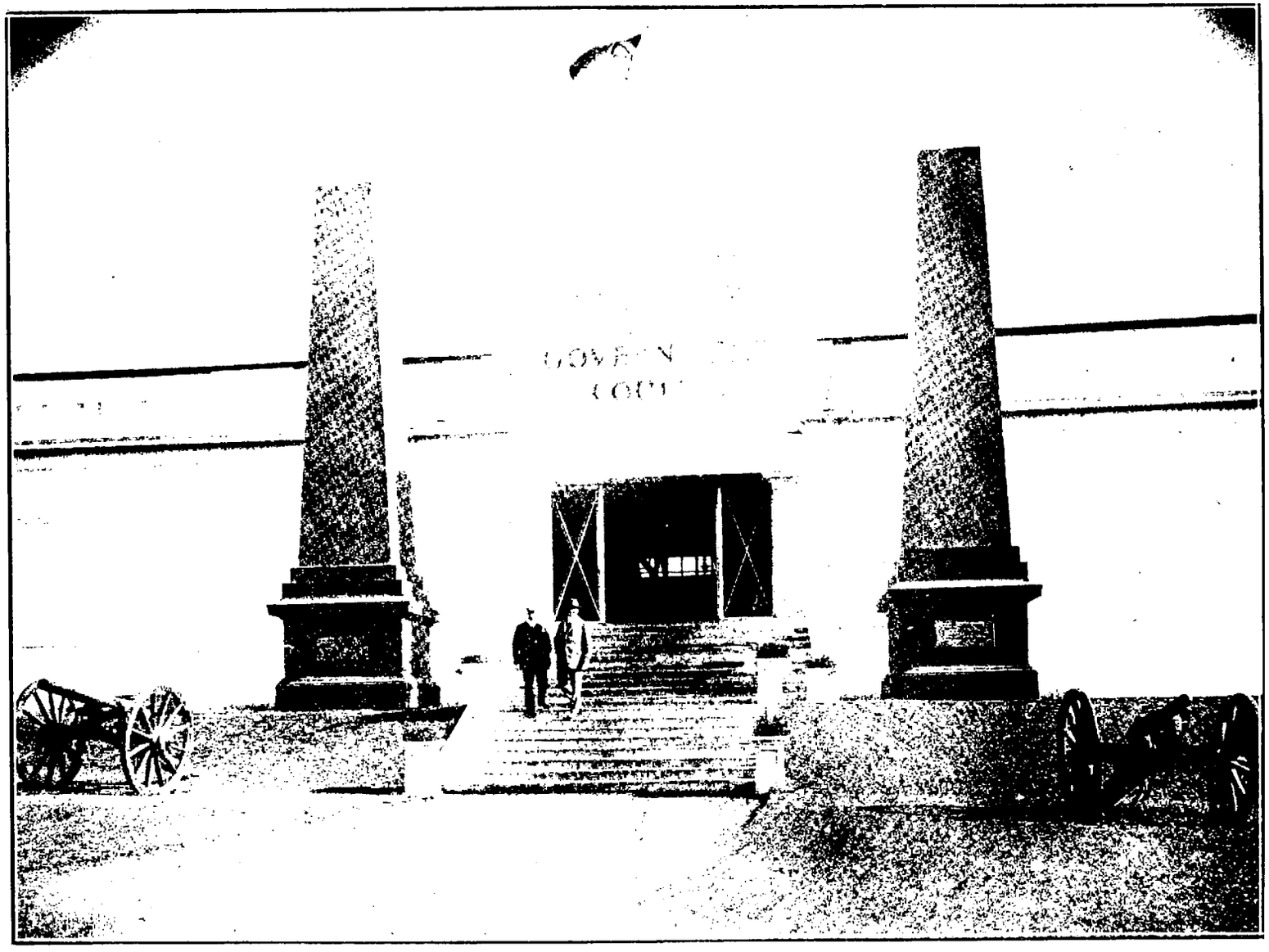


AUCKLAND EXHIBITION, 1913–14.

The entrance to the Government courts, flanked by two golden obelisks, together representing in capacity the gold-production of the Dominion: In value, £82,058,542; in weight, 365 statute tons; in capacity, 1,128 cubic feet.

Frontispiece.

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1914.

NEW ZEALAND.

MINES STATEMENT,

BY THE HON. W. FRASER, MINISTER OF MINES.

MR. SPEAKER,—

I have the honour to present to Parliament the Mines Statement for the year ended the 31st December, 1913.

The value of the mineral output for the year amounted to £3,187,191, as against £3,042,224 during 1912, being an increase of £144,967.

The value of the bullion produced from our gold-mines amounted to £1,563,365, being an increase of £133,495 above that of the previous year.

Kauri-gum continues to be a valuable export, for during 1913 the exports amounted to 8,780 tons, valued at £549,106, which is the highest point reached both as regards tonnage and value during the past seven years. The total production for the year actually amounted to 9,596 tons, which is the highest production for the past ten years.

The value of scheelite concentrates exported amounted to £22,933, being the highest of any year since this (the youngest) branch of our mining industry was established.

Owing to the disastrous strike during November and December nearly all the large collieries were rendered idle, with the result that I regret to record a decrease of 289,610 tons in coal-production, which for the year amounted to 1,888,005 tons, as against 2,177,615 tons during 1912. The loss of wages to colliery employees during those months exceeded £100,000.

The mining industry, if judged by the annual value of exports or production, appears to have arrived at a somewhat settled condition, slight declines in some branches of the industry being compensated by increases in others. As time passes reduction in our gold-output appears probable, but this will be compensated by an increase in coal-output, and probably by the initiation of an iron industry. The kauri-gum industry appears to be established for many years to come.

MINERAL-PRODUCTION.

The following table shows the quantity and value of gold, silver, and other minerals, coal, and kauri-gum, exported during the years 1912 and 1913, also the quantity of native coal consumed in the Dominion during the same periods :—

Product.	Year ending 31st December, 1912. Quantity.	31st December, 1912. Value.	31st December, 1913. Quantity.	31st December, 1913. Value.
		£		£
Gold	343,163 oz.	1,345,131	376,161 oz.	1,459,499
Silver	801,165 "	84,739	975,616 "	103,866
Mixed minerals	1,729 tons	20,571	2,927 tons	31,532
New Zealand coal exported	229,012 "	216,170	211,749 "	205,010
New Zealand coal used in New Zealand	1,948,603 "	974,301	1,676,256 "	838,128
Kauri-gum	7,908 "	401,305	8,780 "	549,106
Coke	4 "	7	28 "	50

	£
Total value of production for 1913	3,187,191
" 1912	3,042,224
Total increase	**£144,967**

AURIFEROUS-QUARTZ MINING.

The value of bullion obtained from our quartz-mines during 1913 amounted to £1,071,813, as a result of treating 464,508 imperial tons of ore, in addition to which scheelite concentrates, value £22,933, was also obtained from such ore.

The dividends distributed by gold-quartz mining companies amounted to £287,088.

The above-recorded output shows an increase when compared with that for 1912.

The following is a statement of the quantity of quartz treated, the value of bullion obtained, and the amount of dividends paid by the most important quartz-mines during 1913 :—

Name of Company.	Quantity of Quartz treated.	Value of Bullion.	Dividends paid by Registered Companies only. 1913.	Dividends paid by Registered Companies only. Total to End of December, 1913.
	Imperial Tons.	£	£	£
Waihi Gold-mining Company (Limited)	164,971	323,345	99,181	4,478,539
Waihi Grand Junction Gold-mining Company (Limited)	87,842	180,020	19,219	57,656
Talisman Consolidated (Limited)	39,780	215,642	133,687	819,041
New Big River Gold-mining Company (Limited)	4,970	28,022	14,400	81,600
Blackwater Mines (Limited)	45,053	82,207	12,500	99,996
Other quartz-mines	121,892	242,577	8,101	*
Totals	**464,508**	**1,071,813**	**287,088**	*

* Unknown.

ALLUVIAL AND DREDGE MINING.

Gold to the approximate value of £295,704 was obtained at sluicing claims during the year. This result is greater than the production by this class of mining for several preceding years. Alluvial-gold mining appears to have arrived at a more permanent condition, owing to the installation by companies of sluicing and elevating plants capable of profitably handling large quantities of low-grade wash. Although no development of importance occurred during 1913, with the addition of new mines now being laid down the future prospects appear to be favourable to the maintenance of the present output.

The value of the production by gold-dredges during 1913 amounted to £195,848, as against £257,333 for 1912. The number of dredges in commission at the end of 1913 was seventy-four, being thirteen less than those at work during the previous year. When this branch of gold-mining was at its zenith—viz., about the year 1902—the number of working dredges was 201. The decline in importance of dredging is now rapid; except for ground inaccessible by other methods it has been found costly, and inefficient in gold-recovery.

The following is a statement regarding the most productive dredges owned by registered companies (the profit from privately owned dredges is not obtainable for publication):—

Name of Dredge.	Production during 1913.	Dividends declared from Dredges owned by Registered Companies.	
		During 1913.	Total to the End of 1913.
West Coast, South Island—	£	£	£
Hessy Cameron	1,856	225	6,480
Worksop	18,244	11,400	35,700
Otago—			
Olrig	1,852	300	4,473
New Golden Run	7,534	400	400
Earnscleugh (three dredges)	9,204	550	26,400
Rising Sun	5,159	800	19,200
Magnum Bonum	3,584	1,000	11,875
Electric (two dredges)	5,985	1,300	130,643
Paterson's Freehold (three dredges)	4,819	600	21,100
Ngapara	4,803	975	1,500
Willowbank	4,084	1,200	3,600
Sixty-three other dredges by registered companies and privately owned	128,724	*	*
Totals	**195,848**	**18,750**	*

* Unrecorded.

SCHEELITE.

The quantity of scheelite concentrates exported during the year amounted to 221 tons, valued at £22,933, the highest annual output yet recorded. This mineral is obtained from the scheelite-gold-quartz mines of Otago and Marlborough in conjunction with gold.

KAURI-GUM.

The most satisfactory feature in connection with our mineral exports during 1913 is the considerable increase in the quantity and value of kauri-gum exported, which amounted to 8,780 tons, valued at £549,106. These results are the highest both in tonnage and value during the past seven years. The total production for the year actually amounted to 9,596 tons, being the highest during ten years. The reason for the improved condition in this old and settled industry is that there is now a steady sale for inferior grades of gum—known in the trade as "dust" and "chips"—hitherto in little demand, but which are now shipped to Germany for linoleum-manufacture.

PETROLEUM.

Drilling operations are still being vigorously carried out by eight companies in the North Island, in the Provincial Districts of Taranaki, Wellington, and Hawke's Bay. The most important development during the year has been the tapping by the Taranaki Oil Lands Company at Moturoa of a flow, which during the first two months of the current year is reported to have yielded over 1,000 barrels of crude oil.

The Taranaki Oil-wells (Limited) commenced operations at their new refinery at Moturoa during the year, and have drilled three additional boreholes, but these have not yet proved productive.

The petroleum industry is not yet permanently established, however. The yield of oil, although of excellent quality, has not been proved in sufficient quantity to be profitable.

For the better control of drilling operations, and protection from influx of water into the oil-bearing beds, regulations based on those in operation in other countries are being prepared.

COAL-MINING.

The output of coal during 1913 amounted to 1,888,005 tons, as against 2,177,615 tons during 1912, being a decrease of 289,610 tons. This decrease is accounted for by the general strike, by which nearly every colliery of importance was closed during the months of November and December. The shortage of coal thus created was made good by importations from foreign parts, which amounted to 468,940 tons—the greatest quantity ever imported—being 104,581 tons in excess of that imported during 1912.

The following is a comparative statement of the coal and lignite raised during the years 1911, 1912, and 1913 :—

Inspection District.	Output for 1912.	Output for 1913.	Decrease, 1913.	Output for 1911.	Increase or Decrease, between Years 1912 and 1911.	
	Tons.	Tons.	Tons.	Tons.		Tons.
Northern	383,847	349,586	34,261	397,872	Decrease	14,025
West Coast	1,301,461	1,057,564	243,897	1,218,693	Increase	82,768
Southern	492,307	480,855	11,452	449,508	,,	42,799
Totals ..	**2,177,615**	**1,888,005**	**289,610**	**2,066,073**	**Increase**	**111,542**

The comparative tonnage of the various classes of coal for the years 1912 and 1913 is summarized as follows :—

Class of Coal.	Output for 1913.	Output for 1912.	Increase or Decrease for 1913.	
	Tons.	Tons.		Tons.
Bituminous and semi-bituminous ..	1,160,274	1,417,608	Decrease	257,334
Pitch-coal	2,397	4,115	,,	1,718
Brown coal	624,852	544,675	Increase	80,177
Lignite	100,482	211,217	Decrease	110,735
Totals	**1,888,005**	**2,177,615**	**Decrease**	**289,610**

The most important development in the coal-mining industry during 1913 has been the entry of the new Liverpool State Colliery near Point Elizabeth into the list of productive collieries, and the approaching completion of the plant and surface arrangements at the new Waipa and Pukemiro Collieries, on the Waikato Coalfield.

PERSONS ENGAGED IN MINING.

The number of persons employed in and about the mines of the Dominion during 1913 is estimated at 9,191, or 376 less than during the previous year. The number employed at metalliferous mines was 4,941, and at coal-mines 4,250. The number of gum-diggers is not known, but exceeds 1,000.

The following table shows the number of miners in each inspection district, and the branch of mining in which they are engaged :—

Classification.	Inspection District.			
	Northern.	West Coast.	Southern.	Totals.
Gold and silver	2,263	1,361	1,125	4,749
Coal	824	2,411	1,015	4,250
Other minerals	6	33	153	192
Totals	**3,093**	**3,805**	**2,293**	**9,191**

MINING ACCIDENTS.

The number of fatalities in connection with mining operations during 1913 was sixteen, and the number of persons reported as seriously injured was twenty-two. The proportion of fatalities per thousand persons employed is as follows: At all mines combined, 1·74; at metal-mines, 2·02; at coal-mines, 1·38: being a slight increase when compared with the proportion of fatalities during 1912.

STATE COLLIERIES.

The output from State collieries during the ten months of 1913 when they were operative amounted to 196,284 tons, as against 261,528 tons during the previous year. The new Liverpool Colliery, near Point Elizabeth, commenced to supply coal towards the end of the year.

At the Point Elizabeth Mine a new development of coal situated to the rise of the old workings will enable the life of this mine to be somewhat prolonged.

The Seddonville Colliery, which has been approaching exhaustion rapidly, was finally closed as a State mine during May of the current year.

Owing largely to the disastrous strike which closed the mines during November and December, from a financial point of view the year's business resulted in considerable loss, as shown upon the balance-sheet appended.

STATE AID TO MINING.

The encouragement of the mining industry by the Government has again been considerable. Subsidies have been granted to miners and prospecting associations, loans have been made for legitimate development of promising mines, and subsidies and direct grants for the construction of roads on goldfields. The free use of Government prospecting-drills has been given when desired. The Government water-races have been maintained and, on the West Coast, considerably extended to supply miners who have proved claims in places where water was not readily obtainable. The following brief details of such State aid during 1913 may prove interesting.

Subsidized Prospecting.

During the year ended the 31st March, 1914, forty-two approved prospecting parties were granted subsidies, amounting to £4,381 8s., of which sum £756 10s. 9d. was expended during that period.

In addition to the above expenditure, £3,439 14s. 2d. granted during previous years was expended during the financial year 1913–14.

Loans for the Development of Mining.

Since 1905, when statutory provision was made for advances by way of loans for mining development, five companies have been assisted by grants of loans aggregating £32,725, of which £20,600 has so far been paid as the mining operations have proceeded, and in accordance with the conditions upon which the loans were granted.

In two cases the developments for which the loan was granted are not yet completed; in another case the loan has been refunded.

Roads and Tracks on Goldfields.

The expenditure on roads and tracks by subsidies and direct grants during the financial year ended the 31st March, 1914, amounted to £24,143 2s., in addition to which, goldfields' local bodies were credited with goldfields revenue amounting to £17,139 7s. 7d. and gold duty amounting to £22,039 11s. 5d. The total amount of State aid thus given on behalf of the mining industry was £63,322 during the past financial year.

DEEP-MINING EXPLORATION.

The crosscutting operations on the 1,000 ft. level at Thames, to connect the Queen of Beauty and Kuranui-Caledonian shafts, a distance of 2,740 ft., have been temporarily suspended at a point 157 ft. distant from the termination at the last-named shaft, owing to an influx of water and gas at great pressure, the crosscut having entered the broken country in the vicinity of the Moanataiari Fault. It is proposed to resume operations in this crosscut when ventilation is restored by means of the Waiotahi shaft, which is now being connected with the crosscut. The quartz-lodes intersected at the 1,000 ft. level have been small and of low value.

The above work has been subsidized by the Government to the extent of £7,000, of which £1,000 was granted during the past year. The operations are controlled by a Board, and the capital necessary to carry on the work is provided by the mining companies whose areas are benefited, assisted by the Government as stated.

No other subsidies for deep-level development were accepted during the past year, but £10,000 has been offered for a considerable time for exploration at depth at the Welcome–Fiery Cross group of mines near Boatman's. An attempt is now being made to float a company to carry out the work upon the conditions specified by the Government—viz., that the applicants for the subsidy shall first expend £14,000 of their own money upon the operations before the subsidy shall be payable.

GOVERNMENT PROSPECTING-DRILLS.

There still continues to be a demand for the Government diamond and Keystone prospecting-drills, although not so great as during the previous year.

The drills have been utilized in prospecting for coal and alluvial gold. During the year 112 holes, aggregating in depth 2,949 ft., were drilled by two Keystone drills in alluvial gravel, and seven holes, aggregating in depth 3,144 ft., were drilled in search of coal. The result of such drilling carries considerable influence with those who finance mining proposals, for by such means may the actual value of mineral deposits be most economically ascertained and mining rendered less speculative. The Government, by providing these modern and economically run prospecting-drills, have done much to assist the mining industry.

GOVERNMENT WATER-RACES.

The Waimea–Kumara and Mount Ida Water-races, which render possible hydraulic mining in the Kumara district, Westland, and the Naseby district in Central Otago, have supplied one hundred miners with water for sluicing during the past year, and enabled them to obtain gold to the value of about £23,226.

For the year ended the 31st March, 1914, the receipts from sales of water from the combined races amounted to £3,305 6s. 9d., the expenditure in upkeep and supervision during the same period being £3,214 19s. 9d., as compared with £2,588 0s. 8d. and £3,273 11s. 3d. respectively during the previous year.

New branch races have been constructed to serve miners in the Waimea–Stafford district, and a race-deviation is now being carried from the Erin-go-Bragh Water-race, purchased by the Government for £2,000 during the past year, to Argus Terrace, Westland, where alluvial-gold deposits are known to exist.

In Central Otago the Mount Ida race has been extended to enable new ground to be worked.

By the maintenance of the Government water-races, mining is rendered possible in the districts served, for without such aid the miners employed would be unable to carry on their occupation in these localities. The races are at present self-maintaining.

When mining ceases to be profitable the Government water-races of Westland and Central Otago may become of value for hydro-electric power and irrigation.

SCHOOLS OF MINES.

The attendance at the subsidized schools of mines at Waihi, Thames, Coromandel, Karangahake, Westport, and Reefton is still small. Only seventy-eight students presented themselves at the annual Government examinations held at all the schools during 1913; of this number a considerable proportion were not *bona fide* mining students, but were scholars of the State schools and others who attended night classes at the school of mines to perfect themselves in some special subject.

The expenditure by the Government upon schools of mines during the year ended the 31st March, 1914, amounted to £3,497 16s. 7d., and during the twenty-nine years since the schools were established it amounted to £31,404 18s. 2d.

GOLD-MINERS' RELIEF FUND.

This fund, which was inaugurated by the passing of the Mining Act Amendment Act, 1910, is still unfinancial, the credit balance on the 31st March last being only £428 4s. 8d., against unpaid claims amounting to over £500. During the year payments from the fund amounted to £4,640 3s., and contributions thereto were £4,730 7s. 5d. To put the fund in a better condition further legislation was passed during last session, and now claims on the fund are restricted to those on account of miners' disease.

GEOLOGICAL SURVEY.

During the past year the survey of the Buller–Mokihinui (Westport) Subdivision has been completed, and a detailed report upon the area, which has been written, will shortly be in the hands of the printer. The survey of the Reefton Subdivision has made good progress, and is now practically completed. In addition to their ordinary field-work, officers of the survey during 1913 and the early part of this year made visits to the Gisborne, East Cape, New Plymouth, Southern Hawke's Bay, Waikaka, Murchison, Motueka, Marlborough, North Canterbury, Waihao, and other districts.

The Palæontological branch of the survey has done good work during the year. At present, however, work is to some extent suspended owing to the transference of Dr. Thomson, who was in charge, to the Dominion Museum.

IRON AND STEEL INDUSTRY.

The question of offering a bonus to assist in the development of the iron-ore resources of the Dominion has been considered, and it has been decided to introduce a Bill during the present session. The Bill is now being prepared, and will be submitted for consideration of honourable members in due course.

TABLES TO ACCOMPANY THE MINES STATEMENT.

No. 1.

TABLE SHOWING COMPARISON IN QUANTITY AND VALUE OF GOLD ENTERED FOR EXPORTATION, ALSO THE QUANTITY AND VALUE OF OTHER MINERALS, FOR THE YEARS ENDED THE 31ST DECEMBER, 1912 AND 1913, AS WELL AS THE TOTAL VALUE SINCE THE 1ST JANUARY, 1853.

Name of Metal or Mineral.	For Year ending the 31st December, 1913.		For Year ending the 31st December, 1912.		Total from the 1st January, 1853, to the 31st December, 1913.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Precious metals—	Oz.	£	Oz.	£	Oz.	£
Gold	376,161	1,459,499	343,163	1,345,131	20,884,312	82,058,543
Silver	975,616	103,866	801,165	84,739	17,783,621	1,938,714
Total gold and silver	1,351,777	1,563,365	1,144,328	1,429,870	38,667,933	83,997,257
Mineral produce, including kauri-gum—	Tons.	£	Tons.	£	Tons.	£
Copper-ore	..	..	..	..	1,495	19,198
Chrome-ore	..	..	..	..	5,869	38,002
Antimony-ore	..	..	..	..	3,768	54,941
Manganese-ore	..	..	..	..	19,364	61,905
Hæmatite ore	..	..	..	..	76	444
Mixed minerals	*2,927	31,532	†*1,729	20,571	41,442	313,597
Coal (New Zealand) exported	211,749	205,010	229,012	216,170	3,536,032	3,254,932
Coke exported	28	50	4	7	16,491	24,975
Coal, output of mines in Dominion (less exports)	1,676,256	838,128	1,948,603	974,301	33,812,787	16,814,583
Shale	..	..	..	..	14,423	7,215
Kauri-gum	8,780	549,106	7,908	401,305	330,775	16,759,563
Total quantity and value of minerals	1,899,740	1,623,826	2,187,256	1,612,354	37,782,522	37,349,355
Value of gold and silver, as above ..		1,563,365	..	1,429,870		83,997,257
Total value of minerals produced, including gold and silver	..	3,187,191	..	3,042,224	..	121,346,612

* Scheelite, 221 tons; greenstone, $6\frac{7}{10}$ tons; pumice, 2,683 tons; stone, 11 tons; unenumerated, 6 tons.
† Stone, 23 tons; greenstone, 7 tons; pumice-stone, 1,562 tons; scheelite-ore, 135 tons; pyrites, 2 tons.

No. 2.

TABLE SHOWING THE QUANTITY AND VALUE OF GOLD ENTERED FOR EXPORTATION FROM NEW ZEALAND FOR THE YEARS ENDED THE 31ST DECEMBER, 1913 AND 1912, AND THE TOTAL QUANTITY AND VALUE FROM 1857 TO THE 31ST DECEMBER, 1913.

District and County or Borough.	Year ending 31st December, 1913.		Year ending 31st December, 1912.		Increase or Decrease for Year ending 31st December, 1913.		Total Quantity and Value from January, 1857, to 31st December, 1913.	
	Quantity.	Value.	Quantity.	Value.	Increase.	Decrease.		
AUCKLAND—	Oz.	£	Oz.	£	Oz.	Oz.	Oz.	£
County of Coromandel ..	3,694	14,607	2,801	11,757	893	..	..	..
County of Thames ..	7,694	28,643	9,297	35,189	..	1,603	..	..
County of Ohinemuri ..	89,090	325,645	36,140	321,595	2,950	..	..	..
County of Piako	52	217	38	159	14	..	..	..
Borough of Thames ..	275	1,146	868	3,603	..	593	..	..
Great Barrier Island ..	2	9	..	..	2	..	..	..
Borough of Waihi ..	116,830	463,661	80,719	321,646	36,111	..	..	..
	217,637	**833,928**	179,863	693,949	39,970	2,196	**5,823,841**	**22,203,539**
WELLINGTON	..	..	..	..	..	..	**188**	**706**

No. 2—*continued.*

TABLE SHOWING THE QUANTITY AND VALUE OF GOLD ENTERED FOR EXPORTATION, ETC.—*continued.*

District and County or Borough.	Year ending 31st December, 1913		Year ending 31st December, 1912.		Increase or Decrease for Year ending 31st December, 1913.		Total Quantity and Value from January, 1857, to 31st December, 1913.	
	Quantity.	Value.	Quantity.	Value.	Increase.	Decrease.		
MARLBOROUGH—	Oz.	£	Oz.	£	Oz.	Oz.	Oz.	£
County of Marlborough ..	**1,533**	**5,944**	439	1,643	1,094	..	**92,484**	**360,189**
NELSON—								
County of Waimea ..	..	..	40	160	..	40	..	..
County of Collingwood ..	624	2,492	3,156	12,599	..	2,532	..	..
County of Takaka ..	..	..	4	16	..	4	..	..
County of Murchison ..	38	150	34	136	4	..	..	..
	662	**2,642**	3,234	12,911	4	2,576	**1,730,402**	**6,860,415**
WEST COAST—								
County of Buller	3,302	12,559	3,457	13,388	..	155	..	..
County of Inangahua ..	59,169	226,963	42,287	166,741	16,882	..	..	..
County of Grey	9,492	37,761	11,576	46,282	..	2,084	..	..
County of Westland ..	9,782	39,484	9,606	38,796	176	..	..	..
Hokitika Borough ..	..	..	..	..	..	..	..	..
Ross Borough	120	479	1,343	5,373	..	1,223	..	..
	81,865	**317,246**	68,269	270,580	17,058	3,462	**5,840,380**	**23,209,639**
CANTERBURY—								
County of Ashburton ..	..	..	..	..	..	..	**99**	**387**
OTAGO—								
County of Taieri	528	2,221	469	1,866	59	..	..	..
County of Tuapeka ..	14,296	57,230	15,409	61,693	..	1,113	..	..
County of Vincent ..	19,409	78,279	25,951	103,966	..	6,542	..	..
County of Maniototo ..	4,952	19,547	6,946	27,399	..	1,994	..	..
County of Waihemo ..	646	2,324	966	3,725	..	320	..	..
County of Waitaki ..	2,326	9,169	2,320	9,115	6	..	..	..
County of Bruce	878	3,515	1,333	5,339	..	455	..	..
County of Lake	2,921	11,800	3,471	13,778	..	550	..	..
County of Wallace ..	2,141	8,596	4,231	16,918	.	2,090	..	..
County of Fiord	18	74	3	12	15	..	..	..
County of Southland ..	24,931	101,286	28,634	115,873	..	3,703	..	..
County of Clutha.. ..	778	3,191	876	3,556	..	98	..	..
	73,824	**297,232**	90,609	363,240	80	16,865	**7,394,776**	**29,415,414**
Unknown	**640**	**2,507**	749	2,808	..	109	**2,142**	**8,254**
Totals	**376,161**	**1,459,499**	343,163	1,345,131	58,206	25,208	**20,884,312**	**82,058,543**

No. 3.

GOLD PRODUCED, 1857 TO 1913

TABLE SHOWING THE TOTAL QUANTITY AND VALUE OF GOLD ENTERED FOR EXPORTATION FROM THE 1ST JANUARY, 1857, TO THE 31ST DECEMBER, 1913. (This Return shows the Output of the various Goldfields. Gold entered at Nelson from Hokitika, Greymouth, and Westport is put under the Head of "West Coast," and Gold from Invercargill and Riverton under the Head of "Otago.")

Year.	Auckland.		Nelson.		Marlborough.		West Coast.		Otago.		Wellington.		Canterbury.		Grand Totals.	
	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.
		£		£		£		£		£		£		£		£
1857 ..	..	..	10,437	40,422	..	..	..	..	..	..	..	..	..	..	10,437	40,422
1858 ..	308	1,192	13,226	51,272	..	..	..	..	..	..	..	..	..	..	13,534	52,464
1859 ..	..	..	7,336	28,427	..	..	..	..	..	..	..	..	..	..	7,336	28,427
1860 ..	..	..	4,538	17,585	..	..	..	..	..	..	..	..	..	..	4,538	17,585
1861 ..	..	..	6,335	24,552	..	..	..	..	187,696	727,321	..	..	..	..	194,031	751,873
1862 ..	1,239	4,098	10,422	40,386	..	..	..	..	399,201	1,546,905	..	..	..	..	410,862	1,591,389
1863 ..	4,483	13,853	9,580	37,120	..	..	..	..	614,387	2,380,750	..	..	..	..	628,450	2,431,723
1864 ..	3,448	10,552	14,410	55,841	24,838	95,231	1,463	5,560	436,012	1,689,653	..	..	..	..	480,171	1,856,837
1865 ..	5,449	17,096	12,137	47,030	7,952	30,814	289,897	1,127,370	259,139	1,004,163	..	..	..	..	574,574	2,226,474
1866 ..	5,814	17,463	7,650	29,643	469	1,818	552,572	2,140,946	168,871	654,647	..	..	..	..	735,376	2,844,517
1867 ..	6,637	18,277	9,123	35,918	501	1,978	511,974	2,018,874	158,670	623,815	..	..	..	..	686,905	2,698,862
1868 ..	53,660	168,874	5,999	38,396	404	1,616	405,762	1,608,844	171,649	686,596	..	..	..	..	637,474	2,504,326
1869 ..	132,451	434,687	10,631	42,524	666	2,664	317,169	1,269,664	153,364	613,456	..	..	..	..	614,281	2,362,995
1870 ..	85,534	319,146	12,244	48,692	1,852	7,408	280,068	1,121,525	165,152	660,694	30	120	..	..	544,880	2,157,585
1871 ..	330,326	1,188,708	10,014	40,056	1,867	7,468	232,882	931,528	154,940	619,760	..	..	..	..	730,029	2,787,520
1872 ..	104,890	369,341	8,175	32,700	2,057	8,228	172,574	690,296	157,574	630,696	..	..	..	..	445,370	1,731,261
1873 ..	119,449	437,123	13,697	54,786	1,274	5,050	188,501	756,442	182,416	734,024	..	..	..	..	505,337	1,987,425
1874 ..	76,910	305,068	5,642	22,158	1,198	4,748	157,531	631,203	135,107	542,154	..	..	..	..	376,388	1,505,331
1875 ..	69,485	262,156	4,577	17,866	1,159	4,636	158,678	635,480	121,423	487,632	..	..	..	..	355,322	1,407,770
1876 ..	56,057	221,905	14,018	55,862	450	1,796	133,014	531,274	118,477	473,491	..	..	..	..	322,016	1,284,328
1877 ..	99,081	403,627	5,367	21,092	870	3,197	153,198	612,823	113,169	455,341	..	..	..	..	371,685	1,496,080
1878 ..	55,982	220,454	4,463	17,223	404	1,617	144,634	578,508	105,003	422,277	..	..	..	..	310,486	1,240,079
1879 ..	37,901	154,295	2,993	11,424	879	3,460	142,822	571,061	102,869	407,868	..	..	..	..	287,464	1,148,108
1880 ..	42,720	176,416	3,222	12,223	1,550	5,650	144,090	575,258	113,666	457,705	..	..	..	..	305,248	1,227,252
1881 ..	35,516	141,326	3,453	13,039	1,378	4,531	127,544	509,971	102,670	411,923	..	..	..	..	270,561	1,080,790
1882 ..	33,059	131,007	3,289	12,494	1,352	5,400	130,048	519,978	83,446	333,804	10	37	..	..	251,204	1,002,720
1883 ..	41,291	163,618	2,064	7,724	636	2,524	116,905	467,152	87,478	352,334	..	..	..	..	248,374	993,352
1884 ..	36,087	143,564	2,159	8,002	1,079	4,306	111,686	446,517	78,810	318,932	101	380	24	96	229,946	921,797
1885 ..	42,989	170,416	2,798	10,337	540	2,160	117,861	471,325	73,183	294,378	..	..	..	..	237,371	948,615
1886 ..	32,271	128,140	2,582	9,979	404	1,451	112,671	446,287	79,104	317,543	47	169	..	..	227,079	903,569
1887 ..	30,697	121,564	2,914	10,829	1,041	3,759	98,774	395,430	70,443	279,518	..	..	..	..	203,869	811,100
1888 ..	35,223	139,556	3,027	11,320	699	2,547	100,139	400,405	62,107	247,142	..	..	24	96	201,219	801,066
1889 ..	28,655	113,191	3,252	12,310	5,189	20,167	101,696	406,451	64,419	256,430	..	..	..	..	203,211	808,549
1890 ..	31,745	125,760	2,856	11,049	6,073	24,285	89,096	356,368	63,423	255,976	..	..	..	..	193,193	773,438
1891 ..	45,392	181,185	4,445	16,896	5,649	22,576	109,268	437,126	87,209	349,573	33	132	..	..	251,996	1,007,488
1892 ..	45,555	183,655	2,535	9,604	3,898	15,429	103,106	412,383	82,933	333,467	52	206	..	..	238,079	954,744
1893 ..	45,714	186,553	2,145	8,187	2,165	8,644	99,127	396,516	77,660	313,238	..	..	..	..	226,811	913,138
1894 ..	52,916	211,974	2,860	10,634	2,536	10,123	86,950	347,464	76,353	307,644	..	..	..	..	221,615	887,839
1895 ..	111,213	430,862	2,460	9,016	2,695	10,771	89,429	357,719	87,694	353,796	..	..	..	..	293,491	1,162,164

No. 3—*continued.*

GOLD PRODUCED, 1857 TO 1913—*continued.*

TABLE SHOWING THE TOTAL QUANTITY AND VALUE OF GOLD ENTERED FOR EXPORTATION FROM THE 1ST JANUARY, 1857, TO THE 31ST DECEMBER, 1913. (This Return shows the Output of the various Goldfields. Gold entered at Nelson from Hokitika, Greymouth, and Westport is put under the Head of "West Coast," and Gold from Invercargill and Riverton under the Head of "Otago")—*continued.*

Year.	Auckland.		Nelson.		Marlborough.		West Coast.		Otago.		Wellington.		Canterbury.		Grand Totals.	
	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.	Oz.	Value.
		£		£		£		£		£		£		£		£
1896 ..	92,346	350,355	2,753	10,333	916	3,588	79,317	317,161	88,362	359,991	..	..	..	..	263,694	1,041,428
1897 ..	105,477	392,337	1,892	7,055	810	3,195	58,817	235,430	84,649	342,187	..	..	..	..	251,645	980,204
1898 ..	142,383	527,786	1,720	6,882	781	3,003	79,948	319,789	55,343	223,231	..	..	..	..	280,175	1,080,691
1899 ..	168,769	624,737	419	1,571	..	..	90,031	360,149	130,311	526,605	..	..	28	111	389,558	1,513,173
1900 ..	166,342	605,398	3,718	14,605	535	2,147	73,923	295,733	129,075	521,629	..	..	23	90	373,616	1,439,602
1901 ..	191,968	695,551	7,212	28,138	133	513	113,286	454,006	142,940	575,492	..	..	22	83	455,561	1,753,783
1902 ..	201,583	721,977	5,947	23,649	601	2,404	118,796	475,272	181,116	728,124	..	..	2	7	508,045	1,951,433
1903 ..	232,681	832,334	7,962	31,710	972	3,845	125,241	501,090	166,458	668,852	..	..	..	..	533,314	2,037,831
1904 ..	223,010	791,529	5,049	20,141	473	1,890	122,310	489,177	169,478	684,764	..	..	..	..	520,320	1,987,501
1905 ..	232,215	935,602	6,469	25,862	..	..	109,704	438,258	172,098	694,214	..	..	..	..	520,486	2,093,936
1906 ..	295,417	1,195,541	2,944	11,746	..	..	104,743	414,292	160,739	649,325	..	..	..	..	563,843	2,270,904
1907 ..	298,101	1,187,079	3,893	15,274	795	3,009	87,069	343,146	118,352	478,982	..	..	..	..	508,210	2,027,490
1908 ..	296,971	1,171,375	3,196	12,783	297	1,145	86,052	335,722	119,907	483,900	..	..	..	..	506,423	2,004,925
1909 ..	288,614	1,142,098	2,572	10,286	39	155	95,014	369,930	120,132	484,431	..	..	..	..	506,371	2,006,900
1910 ..	286,526	1,136,057	117	466	53	212	92,036	358,099	99,556	401,494	..	..	..	..	478,288	1,896,328
1911 ..	263,791	1,049,204	2,149	8,586	229	867	92,403	368,545	96,654	389,580	..	..	..	..	455,226	1,816,782
1912 ..	179,863	693,949	3,234	12,911	439	1,643	68,269	270,580	91,358	366,048	..	..	..	..	343,163	1,345,131
1913 ..	217,637	833,928	662	2,642	1,533	5,944	81,865	317,246	74,464	299,739	..	..	..	..	376,161	1,459,499
Totals ..	5,823,841	22,203,539	310,983	1,229,258	92,350	359,612	7,259,953	28,841,373	7,396,809	29,423,234	273	1,044	123	483	20,884,312	82,058,543

No. 4.

TABLE SHOWING THE TOTAL QUANTITY AND VALUE OF MINERAL ORES OTHER THAN GOLD (THE PRODUCT OF NEW ZEALAND MINES), COAL, COKE, AND KAURI-GUM EXPORTED FROM THE DOMINION UP TO 31ST DECEMBER, 1913.

Year.	Silver.		Copper-ore.		Chrome-ore.		Antimony-ore.		Manganese-ore.		Hæmatite Ore.		Mixed Mineral Ores.*		Coal.		Coke.		Kauri-gum.		Totals.		
	Oz.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Oz.	Tons.	Value.
		£		£		£		£		£		£		£		£		£		£			£
1853 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	830	15,972	..	830	15,972
1854 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,661	28,864	..	1,661	28,864
1855 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	355	4,514	..	355	4,514
1856 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,440	18,591	..	1,440	18,591
1857 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2,522	35,251	..	2,522	35,251
1858 ..	..	..	351	5,000	3	25	..	..	..	..	..	..	..	..	2	4	..	..	1,811	20,037	..	2,167	25,066
1859 ..	..	..	245	2,605	8	120	..	..	..	..	..	..	..	..	..	..	..	..	2,010	20,776	..	2,263	23,501
1860 ..	..	..	137	1,590	116	1,440	..	..	..	..	..	..	..	..	1	2	..	..	1,046	9,851	..	1,300	12,883
1861 ..	..	..	110	1,300	52	520	..	..	..	..	..	..	..	..	..	..	..	..	856	9,888	..	1,018	11,708
1862 ..	..	..	51	1,024	3,843	24,719	..	..	..	..	..	..	..	..	..	..	..	..	1,103	11,107	..	3,997	36,850
1863 ..	..	..	..	..	595	4,318	..	..	..	..	..	..	..	..	..	..	..	..	1,400	27,026	..	1,995	31,344
1864 ..	..	..	..	..	768	4,910	..	..	..	..	..	..	..	..	..	..	..	..	2,228	60,590	..	2,996	65,500
1865 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,867	46,060	..	1,867	46,060
1866 ..	..	..	..	..	281	1,315	..	..	..	..	..	..	..	..	261	400	..	..	2,535	70,572	..	3,077	72,287
1867 ..	..	..	246	2,700	..	..	..	..	..	..	..	..	..	..	973	1,228	..	..	2,685	77,491	..	3,904	81,419
1868 ..	..	..	84	977	..	..	..	..	..	..	..	..	..	..	1,027	1,210	..	..	2,690	72,493	..	3,801	74,680
1869 ..	11,063	2,993	..	..	..	..	..	..	..	..	..	..	..	..	750	800	..	..	2,850	111,307	11,063	3,600	115,100
1870 ..	37,123	11,380	7	120	..	..	..	..	..	..	..	..	..	..	1,672	1,508	..	..	4,391	175,074	37,123	6,070	188,082
1871 ..	80,272	23,145	..	..	..	..	..	..	..	..	..	..	..	..	1,696	1,612	..	..	5,054	167,958	80,272	6,750	192,715
1872 ..	37,064	9,910	..	..	..	..	..	..	..	..	..	..	..	..	990	855	21	50	4,811	154,167	37,064	5,882	164,982
1873 ..	36,187	9,850	..	..	..	..	..	..	..	..	..	..	..	..	724	655	..	..	2,834	85,816	36,187	3,558	96,321
1874 ..	40,566	10,380	..	..	..	..	..	..	..	..	..	..	..	..	1,463	1,363	87	228	2,569	79,986	40,566	4,119	91,957
1875 ..	29,085	7,569	..	..	..	..	..	..	..	..	..	..	..	..	3,385	3,129	15	51	3,231	138,523	29,085	6,631	149,272
1876 ..	12,683	3,171	..	..	..	..	..	..	..	..	..	..	3,180	14,824	1,854	1,954	53	189	2,888	109,234	12,683	7,975	129,372
1877 ..	33,893	7,556	..	..	..	..	..	..	..	..	..	..	2,366	9,664	2,658	2,071	25½	72	3,633	118,348	33,893	8,682½	137,711
1878 ..	23,019	5,755	6	115	..	..	4	102	2,516	10,416	..	..	2	8	6,362	5,139	85	177	3,445	132,975	23,019	12,120	154,687
1879 ..	20,645	4,512	55	1,105	..	..	..	..	2,140	8,338	..	..	..	..	7,144	6,187	154	324	3,229	147,535	20,645	12,722	168,001
1880 ..	20,005	4,500	..	..	..	..	60	612	2,611	10,423	..	..	2,674	11,335	7,020	5,977	87	135	4,725	242,817	20,005	17,177	275,799
1881 ..	18,885	4,236	5	36	..	..	2	24	1,271	3,283	..	..	1,955	4,303	6,621	5,610	223	353	5,461	253,778	18,885	15,538	271,623
1882 ..	5,694	1,286	9	41	..	..	30	900	2,181	6,963	..	..	2,784	8,597	3,207	2,380	275	480	5,533	260,369	5,694	14,019	281,016
1883 ..	16,826	3,785	46	678	..	..	31	804	384	1,155	0½	12	22	110	6,522	4,879	1,430	2,057	6,518	336,606	16,826	14,953½	350,086
1884 ..	24,914	5,125	20	106	..	..	..	..	318	809	..	..	..	..	6,104	4,461	236	372	6,393	342,151	24,914	13,071	353,024
1885 ..	16,624	3,169	..	..	..	..	666	5,289	602	1,716	50½	208	114	993	43,893	51,257	267	385	5,875½	299,762	16,624	51,468¼	362,779
1886 ..	12,108	2,946	20	390	..	..	62	1,784	328½	1,316	..	..	445	1,846	46,136	52,133	497	715	4,920¾	257,653	12,108	52,409¼	318,783
1887 ..	20,809	3,453	..	..	..	..	134	3,989	305	895	..	..	144	4,142	44,129	44,650	183½	266	6,791	362,449	20,809	51,686½	419,844
1888 ..	403	71	2	75	..	..	376	6,246	1,085	2,404	..	..	162	2,955	68,087	64,971	953	1,646	8,482	380,933	403	79,147	459,301
1889 ..	24,105	4,043	..	..	..	..	493	5,319	1,080	2,569	..	..	199	9,985	86,405	84,347	2,132	3,407	7,519	329,590	21,105	97,828	439,260
1890 ..	32,637	6,162	..	..	..	..	515	11,121	482	1,004	1½	5	19	273	69,614	67,003	2,218	3,334	7,438	378 563	32,637	80,287½	467,465
1891 ..	28,023	5,151	0¼	4	..	..	413	4,950	1,153	2,634	..	1	2	6	91,664	91,173	2,544	3,658	8,388	437,056	28,023	104,164¼	544,633
1892 ..	22,053	3,996	..	..	..	..	364	4,900	521	1,239	..	..	84	631	78,911	80,225	4,306	5,691	8,705	517,678	22,053	92,891	614,360
1893 ..	63,076	9,743	..	..	..	..	331	3,467	319	943	..	..	37	650	69,136	72,699	51	53	8,317	510,775	63,076	78,191	598,330
1894 ..	54,177	6,697	..	..	..	..	44	761	534	1,156	..	..	25	353	75,004	73,438	107	160	8,338	404,567	54,177	84,052	487,132
1895 ..	85,024	10,679	..	..	..	..	54	1,486	210	525	..	..	62	880	85,987	83,342	288	715	7,425	418,766	85,024	94,026	516,393
1896 ..	94,307	10,589	..	..	..	..	21	450	65	205	..	..	37	1,335	79,524	71,984	105	263	7,126	431,323	94,307	86,878	516,149
1897 ..	183,892	20,872	..	2	..	..	10	157	180	541	..	..	1,561	5,892	76,073	69,595	..	..	6,641½	398,010	183,892	84,465½	495,069
1898 ..	293,851	33,107	2¼	70	..	..	..	..	217	703	..	..	1,828	4,792	56,332	50,381	9	14	9,905	586,767	293,751	68,253¼	675,834

DIAGRAM showing QUANTITY & VALUE of GOLD exported annually from N.Z.
For the years 1857 to 1913

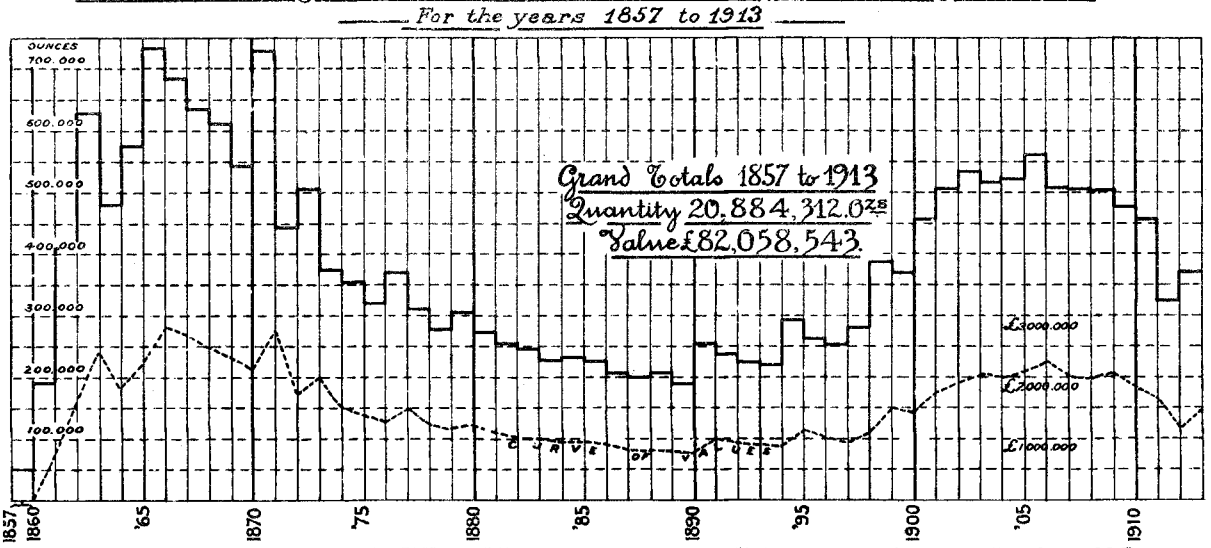


DIAGRAM showing QUANTITY & VALUE of KAURI GUM exported annually from N.Z.
For the years 1853 to 1913

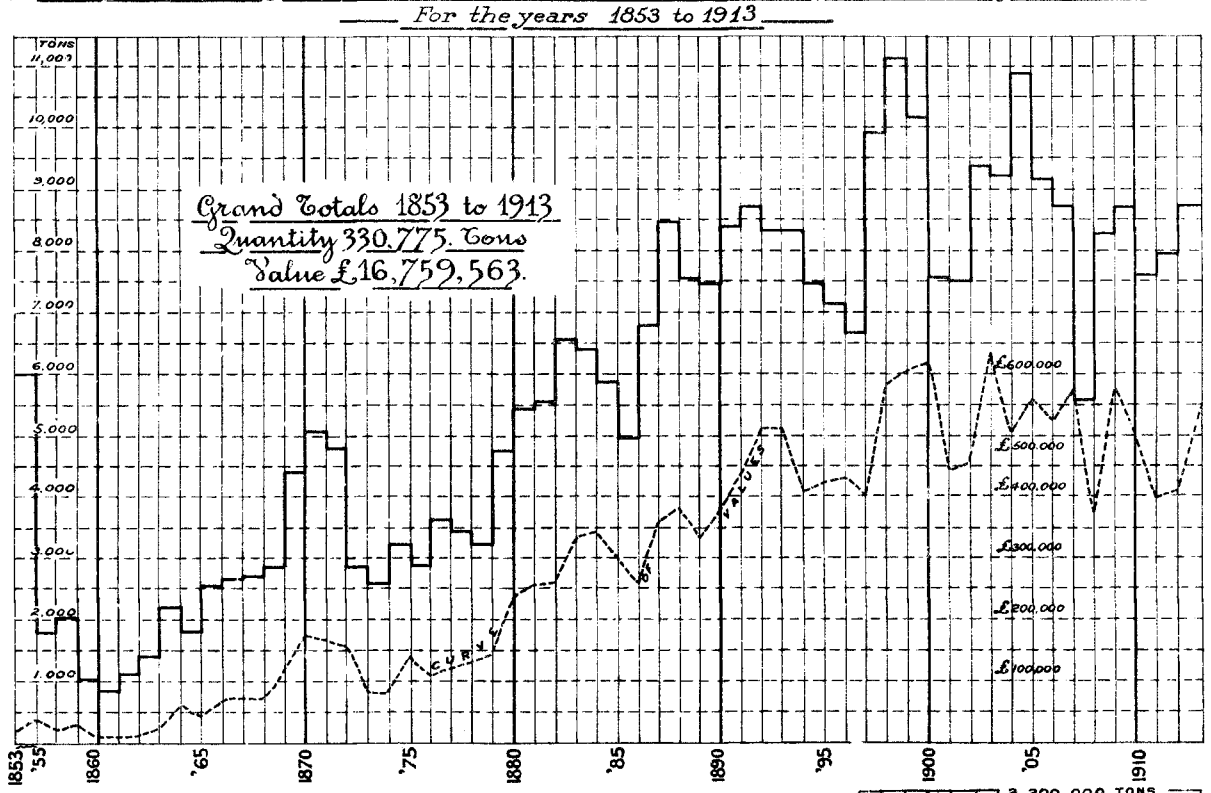
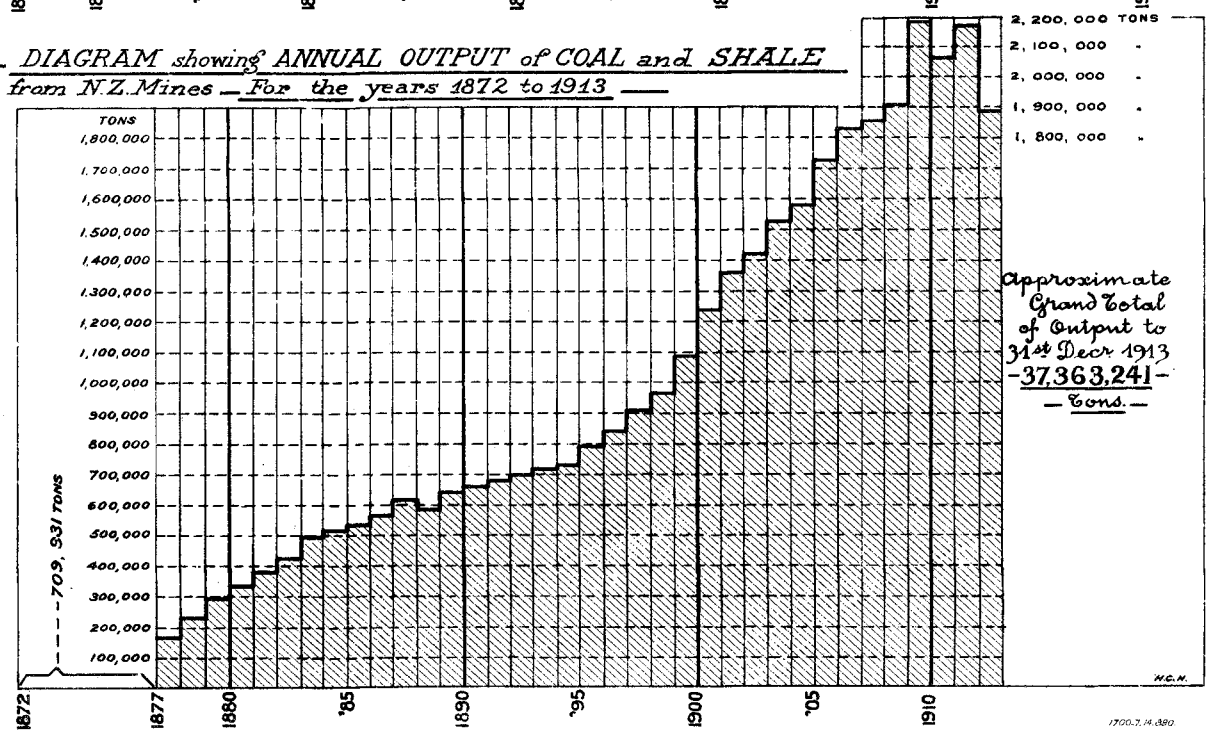


DIAGRAM showing ANNUAL OUTPUT of COAL and SHALE from N.Z. Mines For the years 1872 to 1913



1700-7.14.380

No. 4—*continued.*

TABLE SHOWING THE TOTAL QUANTITY AND VALUE OF MINERAL ORES OTHER THAN GOLD (THE PRODUCT OF NEW ZEALAND MINES), COAL, COKE, AND KAURI-GUM, EXPORTED FROM THE DOMINION UP TO 31ST DECEMBER, 1913—*continued.*

Year.	Silver.		Copper-ore.		Chrome-ore.		Antimony-ore.		Manganese-ore.		Hæmatite Ore.		Mixed Mineral Ores.*		Coal.		Coke.		Kauri-gum.		Total.		
	Oz.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Oz.	Tons.	Value.
		£		£		£		£		£		£		£		£		£		£			£
1899 ..	349,338	40,838	..	..	..	..	..	..	135	407	..	..	1,309	6,591	89,480	83,085	18	9	11,116	607,919	349,338	102,058	738,849
1900 ..	326,457	38,879	12	45	28	110	3	101	166	588	..	..	2,126	12,751	112,707	98,136	..	..	10,159	622,293	326,457	125,201	772,903
1901 ..	571,134	65,258	3	105	..	..	30	136	208	614	..	..	696	7,775	159,643	142,176	..	..	7,541	446,114	571,134	168,121	662,178
1902 ..	674,196	71,975	..	..	175	525	..	..	..	..	17	116	415	4,422	188,677	154,747	..	..	7,430	450,223	674,196	196,714	682,008
1903 ..	911,914	91,497	6	123	..	..	..	..	70	210	..	1	625	7,014	152,332	128,927	..	..	9,357	631,102	911,914	162,390	658,874
1904 ..	1,094,461	112,875	..	..	..	..	..	..	196	570	7	96	1,404	10,168	165,220	139,898	..	..	9,203	501,817	1,094,461	176,030	765,424
1905 ..	1,179,744	120,542	4	17	..	..	..	..	55	165	..	..	632	8,136	122,817	107,062	15	15	10,883	561,444	1,179,744	134,406	797,381
1906 ..	1,390,536	143,572	..	..	..	..	..	..	16	40	..	..	1,297	18,421	141,641	122,614	5	6	9,154	522,486	1,390,536	152,113	807,139
1907 ..	1,562,603	169,484	56	595	..	..	98	2,118	5	26	..	5	1,492	30,448	128,950	114,737	15	15	8,708	579,888	1,562,603	139,324	897,316
1908 ..	1,731,336	175,337	13	275	..	..	5	73	..	..	..	..	1,690	16,179	100,502	85,846	2	4	5,530	372,798	1,731,336	107,742	650,512
1909 ..	1,813,830	180,872	5	100	..	..	2	60	6	29	..	..	1,836	11,709	201,685	183,961	22	23	8,250	552,698	1,813,830	211,806	929,452
1910 ..	1,711,235	171,562	..	..	..	..	..	..	5	15	..	..	2,088	22,202	277,011	259,562	6	10	8,693	465,044	1,711,235	287,803	918,395
1911 ..	1,311,043	131,587	..	..	..	..	20	92	..	4	..	..	3,469	22,104	223,275	204,379	24	41	7,587	395,707	1,311,043	234,375	753,914
1912 ..	801,165	84,739	..	..	..	..	..	..	..	..	..	..	1,729	20,571	229,012	216,170	4	7	7,908	401,305	801,165	238,653	722,792
1913 ..	975,616	103,866	..	..	..	..	..	..	..	..	..	..	2,927	31,532	211,749	205,010	28	50	8,780	549,106	975,616	223,484	889,564
Totals	17,783,621	1,938,714	1,495½	19,198	5,869	38,002	3,768	54,941	19,364½	61,905	76½	444	*41,442	*313,597	3,536,032	3,254,932	16,491	24,975	330,775	16,759,563	17,783,621	3,955 312	22,466,271

* The following are the principal minerals included under this heading:—

Year.	Scheelite-ore.		Auriferous Ore.		Sulphur.		Mixed Minerals.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
		£		£		£		£
1898	..	..	22	380	1,765	4,097	..	315
1899	32	2,788	5	153	1,227	3,483	..	167
1900	54	2,635	219	4,450	1,692	4,824	..	842
1901	2	83	390	6,663	143	360	..	669
1902	39	1,200	231	2,560	100	475	..	187
1903	42	1,439	472	4,449	..	..	..	1,126
1904	17	791	977	8,898	..	..	..	479
1905	28	1,848	535	5,997	..	..	..	291
1906	55	3,407	1,186	13,940	..	..	..	1,074
1907	137	15,486	1,244	14,650	..	..	..	312
1908	68	6,055	654	6,993	..	..	..	3,131
1909	58	4,263	182	2,450	..	..	..	4,996
1910	143	15,070	100	1,538	..	..	..	5,594
1911	138	11,853	138	1,419	..	..	..	8,832
1912	135	13,347	..	..	..	..	..	7,224
1913	221	22,933	6	226	..	..	..	8,373
Totals	1,169	103,198	6,361	74,766	4,927	13,239	..	43,612

No. 5.

TABLE SHOWING THE INCREASE OR DECREASE IN THE ANNUAL PRODUCTION OF COAL AND SHALE IN THE DOMINION, AND THE QUANTITY OF COAL IMPORTED SINCE 1878.

Year.	Coal raised in the Dominion.		Coal imported.		
	Tons.	Yearly Increase or Decrease.	Tons.	Increase over Preceding Year.	Decrease over Preceding Year.
Prior to 1878	709,931	..	..	..	..
1878	162,218	..	174,148	..	..
1879	231,218	69,000	158,076	..	16,072
1880	299,923	68,705	123,298	..	33,778
1881	337,262	37,339	129,962	6,664	..
1882	378,272	41,010	129,582	..	380
1883	421,764	43,492	123,540	..	6,042
1884	480,831	59,069	148,444	24,904	..
1885	511,063	30,232	130,202	..	18,242
1886	534,353	23,290	119,873	..	10,329
1887	558,620	24,267	107,230	..	12,643
1888	613,895	55,275	101,341	..	5,889
1889	586,445	*Dec. 27,450*	128,063	26,722	..
1890	637,397	50,952	110,939	..	17,124
1891	668,794	31,397	125,318	14,379	..
1892	673,315	4,521	125,453	135	..
1893	691,548	18,233	117,444	..	8,009
1894	719,546	27,998	112,961	..	4,483
1895	726,654	7,108	108,198	..	4,763
1896	792,851	66,197	101,756	..	6,442
1897	840,713	47,862	110,907	9,151	..
1898	907,033	66,320	115,427	4,520	..
1899	975,234	68,201	99,655	..	15,772
1900	1,093,990	118,756	124,033	24,378	..
1901	1,239,686	145,696	149,764	25,371	..
1902	1,365,040	125,354	127,853	..	21,911
1903	1,420,229	55,189	163,923	36,070	..
1904	1,537,838	117,609	147,196	..	16,727
1905	1,585,756	47,918	169,046	21,850	..
1906	1,729,536	143,780	207,567	38,521	..
1907	1,831,009	101,473	220,749	13,182	..
1908	1,860,975	29,966	287,808	67,059	..
1909	1,911,247	50,272	258,185	..	29,623
1910	2,197,362	286,115	232,378	..	25,807
1911	2,066,073	*Dec. 131,289*	188,068	..	44,310
1912	2,177,615	111,542	364,359	176,291	..
1913	1,888,005	*Dec 289,610*	468,940	104,581	..

No. 6.

TABLE SHOWING THE OUTPUT OF COAL FROM THE VARIOUS COALFIELDS, AND THE COMPARATIVE INCREASE AND DECREASE, FOR THE YEARS 1912 AND 1913, TOGETHER WITH THE TOTAL APPROXIMATE QUANTITY OF COAL PRODUCED SINCE THE MINES WERE OPENED.

Name of Coalfield.	Output of Coal.		Increase.	Decrease.	Approximate Total Output of Coal up to 31st December, 1913.
	1913.	1912.			
	Tons.	Tons.	Tons.	Tons.	Tons.
North Auckland	102,710	116,147	..	13,437	3,127,113
Waikato	243,316	263,938	..	20,622	3,474,084
Mokau	3,560	3,762	..	202	85,120
Nelson	14,717	29,071	..	14,354	239,321
Buller	679,283	826,105	..	146,822	12,157,911
Inangahua	13,708	11,046	2,662	..	229,594
Grey	349,856	435,239	..	85,383	7,132,072
Canterbury	14,430	16,764	..	2,334	671,471
Otago	306,647	294,063	12,584	..	7,965,296
Southland	159,778	181,480	..	21,702	2,266,837
Totals	**1,888,005**	2,177,615	..	289,610	**37,348,819**

No. 7.

TABLE SHOWING THE DIFFERENT CLASSES OF COAL FROM THE MINES IN THE DOMINION.

Name of Coal.	Output of Coal.		Increase.	Decrease.	Approximate Total Output of Coal up to the 31st December, 1913.
	1913.	1912.			
	Tons.	Tons.	Tons.	Tons.	Tons.
Bituminous and semi-bituminous	1,160,274	1,417,608	..	257,334	22,486,327
Pitch	2,397	4,115	..	1,718	1,993,594
Brown	624,852	544,675	80,177	..	11,074,944
Lignite	100,482	211,217	..	110,735	1,793,954
Totals	**1,888,005**	2,177,615	..	289,610	**37,348,819**

No. 8.

RETURN SHOWING THE TOTAL QUANTITY AND VALUE OF COAL IMPORTED INTO AND EXPORTED FROM NEW ZEALAND DURING THE YEAR ENDED THE 31ST DECEMBER, 1913.

Imported.			Exported.		
Countries whence imported.	Quantity.	Value.	Countries to which exported.	Quantity.	Value.
	Tons.	£		Tons.	£
New South Wales	468,935	466,280	United Kingdom	141,540	143,413
Victoria	5	6	Victoria	8,539	6,547
			New South Wales ..	20,895	18,248
			South Australia	350	174
			Western Australia ..	1,095	828
			Tasmania	2,306	2,362
			Fiji	13,781	13,116
			Canada	1,760	1,760
			U.S.A. (West Coast) ..	3,200	2,972
			Bismarck Archipelago ..	3,846	2,751
			Caroline Islands	2,210	1,602
			Friendly Islands	1,315	1,261
			Gilbert Islands	877	636
			Marshall Islands	894	648
			Navigator Islands ..	2,711	2,142
			French New Guinea ..	3,013	3,090
			Society Islands	2,117	2,043
			Chile	1,300	1,417
Totals	**468,940**	**466,286**	Totals	**211,749**	**205,010**

* The export figures do not include coal and produce of countries other than New Zealand.

No. 9.

NUMBER OF PERSONS ORDINARILY EMPLOYED IN MINING DURING THE YEAR ENDED 31ST DECEMBER, 1913.

County or Borough.	Number of Persons Ordinarily Employed at				Total.
	Gold Quartz-mines.	Gold Alluvial Mines.	Gold-dredges.	Mines other than Gold and Coal.	
NORTHERN INSPECTION DISTRICT.					
County of Thames	173	..	..	..	173
,, Ohinemuri	615	..	..	..	615
,, Coromandel	117	..	..	..	117
,, Piako	8	..	..	..	8
Borough of Thames	76	..	..	..	76
,, Waihi	1,269	..	..	..	1,269
Puhipuhi district	..	..	..	6	6
Great Barrier Island..	5	..	..	..	5
WEST COAST INSPECTION DISTRICT.					
County of Marlborough	32	8	..	30	70
,, Waimea	..	3	..	..	3
,, Collingwood	13	13	..	3	29
,, Murchison	..	29	..	..	29
,, Buller	6	56	..	..	62
,, Inangahua	658	7	48	..	713
,, Grey	15	110	43	..	168
,, Westland	3	241	19	..	263
Borough of Ross	..	57	..	..	57
SOUTHERN INSPECTION DISTRICT.					
County of Taieri	..	7	..	2	9
,, Tuapeka	..	172	60	..	232
,, Vincent	28	81	210	..	319
,, Maniototo	2	83	20	19	124
,, Waihemo	3	..	..	73	76
,, Waitaki	..	27	..	..	27
,, Lake	8	49	12	39	108
,, Wallace	..	45	..	..	45
,, Bruce	..	..	23	..	23
,, Clutha	..	1	..	..	1
,, Southland	..	108	186	..	294
Stewart Island	..	..	..	20	20
Totals	3,031	1,097	621	192	4,941

SUMMARY OF PERSONS ORDINARILY EMPLOYED IN OR ABOUT NEW ZEALAND MINES DURING 1913

Gold-mines	4,749
Other metalliferous mines	192
Coal-mines	4,250
Total	9,191

APPENDICES TO THE MINES STATEMENT.

APPENDIX A.

REPORTS RELATING TO METALLIFEROUS MINES AND STONE-QUARRIES.

The Inspecting Engineer of Mines to the Under-Secretary of Mines

Sir,— Wellington, 30th June, 1914.

I have the honour to present the annual reports of inspection of mines and stone-quarries, together with extracts from the reports of Wardens and other officers, accompanied by statistical information in regard to the metalliferous mines and stone-quarries of the Dominion, for the year ended 31st December, 1913.

In accordance with the usual practice, the tables showing expenditure through the Mines Department on roads, bridges, tracks, prospecting operations, &c., are for the period covered by the financial year—viz., from the 1st April, 1913, to the 31st March, 1914.

The reports, &c., are divided into the following sections :—

I. Production of Minerals.

II. Persons employed.

III. Accidents.

IV. Gold-mining.
- (1.) Quartz-mining.
- (2.) Dredge Mining.
- (3.) Alluvial Mining.

V. Minerals other than Gold.

VI. Stone-quarries.

VII. State Aid to Mining.
- (1.) Subsidized Prospecting.
- (2.) Loans for Development of Mines.
- (3.) Subsidized Roads on Goldfields.
- (4.) Government Prospecting-drills.
- (5.) Government Water-races.

VIII. Schools of Mines.

Annexures,—

Reports of—
- (*a.*) Inspectors of Mines.
- (*b.*) Wardens.
- (*c.*) Water-race Managers.
- (*d.*) Directors of Schools of Mines.
- (*e.*) Mining Statistics.
- (*f.*) Examinations under the Mining Act, 1908, and Lists of Certificate-holders.

I. PRODUCTION OF MINERALS.

The following statement shows the value of the exports from metal-mines and kauri-gum fields from the 1st January, 1853, to the 31st December, 1913:—

Classification.	1912.	1913.	Increase.	Total from the 1st January, 1853, to the 31st December, 1913.
	£	£	£	£
Gold	1,345,131	1,459,499	114,368	82,058,543
Silver	84,739	103,866	19,127	1,938,714
Other minerals	20,571	31,532	10,961	488,087
Kauri-gum	401,305	549,106	147,801	16,759,563
Totals	1,851,746	**2,144,003**	**292,257**	**101,244,907**

The increase in the production of gold and silver above that of the previous year is due to the fact that during 1912 the majority of the most productive quartz-mines were rendered idle by the Waihi and Reefton strikes, by which they were closed from May to October.

The improvement in the quantity and value of kauri-gum exported is a most satisfactory feature, being evidence that the gum-fields are likely to be productive for many years.

The increase under the heading of "Other Minerals" is due to the production from the new scheelite-mining operations in Marlborough.

II. PERSONS EMPLOYED.

The following statement shows the number of persons ordinarily employed in or about the metalliferous mines of the Dominion during the year:—

Classification.	Inspection District.			Total, 1913.
	Northern.	West Coast.	Southern.	
Gold and silver	2,263	1,361	1,125	4,749
Scheelite	...	30	133	163
Cinnabar	6	...	...	6
Iron	...	3	...	3
Tin	...	...	20	20
Total for 1913	...	...	...	**4,941**
Total for 1912	...	...	...	5,239

The reduction shown above in the number of miners employed during 1913 below those employed during the previous year is probably due to a more accurate method of determining the actual number, recently introduced.

In addition to the foregoing, 120 persons were employed at the oil-prospecting wells and refinery in Taranaki.

The number of gum-diggers is not ascertainable, but there are considerably over 1,000 employed on the North of Auckland peninsula.

III. ACCIDENTS.

I regret to record an increase in the number of fatal accidents at our metal-mines during 1913, ten persons being killed and twelve others seriously injured. The fatalities amount to 2·02 persons per 1,000 employed at metal-mines; at our coal-mines the proportion was 1·38 persons per 1,000, which when compared with the average British collieries is about normal.

The cause and description of these accidents is given in the following tables. It will be seen that in only one case—viz., the accident at the Talisman Mine by which two men lost their lives—did the evidence and verdict at the inquest show negligence upon the part of the management, although in some other cases greater safety precautions appeared to be necessary.

The following is a summary of persons killed or seriously injured in metalliferous mines during 1913:—

Inspection District.	Explosions.		Falls of Ground.		In Shafts.		Miscellaneous Underground.		Surface.		About Dredges.		Total.	
	Killed.	Seriously Injured.	Killed.	Seriously Injured.	Killed.	Seriously Injured.	Killed.	Seriously Injured.	Killed.	Seriously Injured.	Killed.	Seriously Injured.	Killed.	Seriously Injured.
Northern	...	1	4	...	2	...	...	...	...	1	...	...	6	2
West Coast	...	1	1	4	...	2	...	2	1	...	...	...	2	9
Southern	...	...	1	...	...	...	...	...	1	1	...	...	2	1
Totals	...	2	6	4	2	2	...	2	2	2	...	...	10	12

Being at the rate of 2·02 fatalities per 1,000 persons employed.

TABLE SHOWING NUMBER OF DEATHS FROM ACCIDENTS AT NEW ZEALAND METAL-MINES AND DREDGES DURING THE YEARS 1906 TO 1913.

Cause of Accident.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.
Explosion	3	...	3	2	2	1	...	...
Fall of ground	3	2	2	1	1	2	1	5
In shafts	1	...	1	3	5	...	1	3
Miscellaneous: Underground...	...	...	2	1	...	...	2	...
,, On surface ...	1	2	6	5	3	2	...	2
About dredges	6	3	1	2	4	...	1	...
Total killed	14	7	15	14	15	5	5	10
Number of employees ...	8,716	9,389	8,880	7,651	8,121	7,400	5,239	4,941
,, persons killed per 1,000 employed	1·60	0·84	1·69	1·83	1·84	0·67	0·95	2·02

The following is a brief description of fatal accidents at metal-mines during 1913:—

Name of Person killed.	Date of Accident.	Mine or Claim.	Cause of Accident, and Remarks.
Patrick McNannom	2/1/13	Dominion Consolidated (quartz)	While building a trestle bridge on an inclined surface tramway from the mine a falling stringer struck deceased on the head, with fatal results.
Joseph Senior and David Christie	11/1/13	Sylvia (quartz) ..	The two deceased, experienced miners, were working about 70 ft. above the battery level, in a stope timbered with 7 in. legs, 8 in. caps and laths, but with no spreaders. The timber evidently collapsed without warning, and the deceased were immediately killed by the falling quartz. The Coroner's jury, while holding no person blameworthy, added as a rider a recommendation that heavier timber should be used in future, and that the sets be "struddled" top and bottom, also that spreaders be placed between each set.
Thomas McBride and William Hyde	28/3/13	Talisman (quartz) ..	The two deceased, having loaded with tools and explosives at the 8th level in the mine one of the skips used in the shaft (inclined 62°) communicating with the lower levels for a farther depth of 950 ft., they then stood on the skip, when the 3 in. (circumference) crucible-steel winding-rope attached to the skip broke at a distance of 41 ft. above the shackle, precipitating deceased down the shaft, with immediately fatal results. The rope (maker, Scott) had been in use 14½ months; it was composed of a hemp core and six strands of eight large and seven small wires in each strand. The drum and pulley around which the rope passed were 4½ ft. diameter. The total strain upon the rope at the time of the accident did not exceed 2 tons. The Coroner's jury, in their verdict, stated that deterioration was the cause of the rope breaking, and that it had not been properly cared for. This accident was followed by a prosecution of the mine-manager by the Inspector of Mines on two charges, viz.: Failing to comply with the Inspector's written instructions that notices should be posted in all chambers of the mine forbidding men from riding on the skips; and failing to test the winding-rope when first put on, and subsequently every three months. Both offences were admitted, and fines of £10, with costs, were imposed on each charge.

Description of Fatal Accidents at Metal-mines, &c.—continued.

Name of Person killed.	Date of Accident.	Mine or Claim.	Cause of Accident, and Remarks.
Wong Hong ..	10/5/13	Nokomai (sluicing) ..	Deceased was working in a sluicing and elevating claim when by some means his foot became caught in the hydraulic elevator, although there appeared to be no necessity for him to go too close thereto, the paddock being roomy. The sufferer's countrymen prevented Europeans from attending to the deeply lacerated foot, but, after neglectful delay, applied their own remedies. Finally amputation became necessary, fatal results following. The elevator was provided with Adams' Patent Blow-back, for use when a block occurred. The Coroner decided that no person was blameworthy.
Francisco Carmine	2/7/13	Coronation Claim (sluicing)	Deceased, an experienced claimholder, was picking a stone from a sluicing-face of about 12 ft. in height, when a fall of earth occurred without warning, killing him instantly. The Coroner's jury returned a verdict accordingly.
W. H. McKee ..	13/4/12 (died 17/11/13)	Moanataiari (quartz)..	While shovelling after blasting at the 1,000 ft. level a fall of quartz occurred, breaking the back of deceased. The walls being soft and the quartz disjointed, the place was timbered to within 12 ft. of the face, and slabs were driven ahead, but no false sets were used, which precaution was necessary, and if adopted the accident would not have occurred.
Lewis Adams ..	26/11/13	Adams and Weir's Claim (sluicing)	While engaged at work a large stone rolled down from the face, crushing deceased fatally. The Coroner's verdict was "accidentally killed." In contravention of section 269 (*b*) of the Mining Act, the mine-manager failed to notify the Inspector of Mines of this accident, and for such neglect was liable to prosecution and fine.
Alexander Woods ..	11/12/13	New Zealand Crown Mines (quartz)	Deceased and another were working in a leading stope at the No. 6 level, immediately above a drive timbered with stulls, when without warning the loose quartz underfoot gave way owing to the collapse of the stulls underneath, burying the deceased and his companion. When extricated, Woods was dead. It is probable that surface-water percolating through broken country caused the collapse of the stulls. The Coroner's jury returned a verdict to the above effect, adding as a rider a recommendation that set timbers in preference to stulls should be used in the class of country in which the accident occurred.

IV. GOLD-MINES.

The following statement shows the value of the bullion-production, also the dividends declared, number of persons employed, and number of gold-mines and dredges:—

	Production of Bullion, 1913.* (All Mines.)	Dividends paid, 1913. (By Registered Companies only.)	Number of Persons ordinarily employed.	Number of Working Mines, Dredges, and Claims.
	£	£		
Quartz-mining	1,071,813	287,088	3,031	63
Dredge mining †... ...	195,848	18,750	621	74
Alluvial mining ‡ ...	295,704	11,643	1,097	223
Totals, 1913 ...	**1,563,365**	**317,481**	**4,749**	**360**

* In addition to the gold produced from the gold-mines, silver was obtained from them, hence the word "bullion" is used in preference to "gold."

† The bullion-production is from 74 dredges, but the dividends given are only from 11 of these, the property of registered companies. The profits of privately owned dredges and mines are unobtainable, which renders this statement incomplete.

‡ The bullion-production is from 223 alluvial claims, but the dividends are only ascertainable from those few that are the property of registered companies.

(1.) Quartz-mining.

The following is a statement showing the tons of ore treated, the value of bullion produced, and the amount of dividends paid by quartz-mining companies in each of the inspection districts during the years 1912 and 1913:—

Inspection District.	Tons of Ore treated. (2,240 lb.)		Value of Bullion.		Dividends paid. (By Registered Companies only.)	
	1913.	1912.	1913.	1912.	1913.	1912.
			£	£	£	£
Northern	327,590	264,831	865,619	781,716	260,188	299,303
West Coast	126,260	55,098	201,987	116,408	26,900	15,600
Southern	10,658	15,722	4,207	8,065	...	...
Totals	**464,508**	335,651	**1,071,813**	906,189	**287,088**	314,903

The following is a statement of the production, working-cost, dividends declared, and the number of persons employed at the principal quartz-mines during 1913:—

Name of Company.	During 1913.			Dividends paid.		Number of Persons ordinarily employed.
	Quantity of Quartz treated.	Value of Bullion.	Average Value per Ton.	1913.	Total to End of December, 1913.	
	Imperial Tons.	£	£ s. d.	£	£	
Northern District—						
Waihi Gold-mining Company (Ltd.)*	164,971	323,345†	1 19 2	99,181	4,478,539	866
Waihi Grand Junction Gold-mining Company (Ltd.)	87,842	180,020	2 0 11	19,219	57,656	403
New Zealand Crown Mines (Ltd.) ..	15,299	28,885	1 17 9	..	70,000	120
Talisman Consolidated (Ltd.) ..	39,780	215,642	5 8 5	133,687	819,041	360
Komata Reefs (Ltd.)	3,080	27,990	9 1 9	..	33,333	23
New Sylvia Gold-mining Company (Ltd.)	10,103	16,351	1 12	..	..	61
Waihi-Paeroa Gold-extraction Company (Ltd.)	‡	42,300	0 6 0½	6,226	12,476	65
West Coast District—						
Blackwater Mines (Ltd.)	45,053	82,207	1 16 5	12,500	99,996	175
Progress Mines of New Zealand (Ltd.)	34,996	37,042	1 1 2	..	326,562	156
Consolidated Goldfields of New Zealand (Ltd.)	23,661	37,105	1 11 4	..	..	106
New Big River Gold-mining Company (Ltd.)	4,970	28,022	5 12 9	14,400	81,600	65
Other quartz-mines throughout New Zealand	34,753	52,904	1 6 6	1,875	§	631
Totals, 1913	**464,508**	**1,071,813**	**2 5 7**	**287,088**	§	**3,031**

* The total value of the output of this company at the end of the year was £10,454,869. The dividends here given are free of income-tax.

† In the annual report of the directors of this company for 1913 the value of the bullion-production is stated to be £336,652, but the figures given in the table above are the official returns from the company to the Inspector of Mines. The discrepancy occurs owing to the actual value of the bullion not being known until it is refined in England.

‡ 140,100 imperial tons of old tailings from Waihi and Karangahake Mines dredged from Ohinemuri River sludge-channel, crushed during former years and recorded therein, but re-treated during 1913.

§ Unknown.

Northern Inspection District.

Waihi Goldfield.—Underground development by the Waihi Gold-mining Company during 1913 has not disclosed any improvement of the ore-bodies as depth has been attained, and the decline in the value of bullion-production and of dividends continues. During the past four years such decline amounts to two-thirds and nearly four-fifths respectively.

The average value recovered per imperial ton of ore treated has declined from £2 8s. to £1 19s. 2d. during the past year. Underground development at the No. 10 or 1,151 ft. level has proved a reduction in the width of the lodes and in value of their contents. The Martha lode, at upper levels the strongest and most productive in the mine, which gradually became impoverished at a depth of 950 ft. to 1,000 ft., shows no improvement at the 1,151 ft. level, where it is still rubbly and oxidized, but none of the five other lodes developed at that level exhibit the same objectionable feature.

On the occasion of my last inspection of the No. 11 or deepest level the only lode there exposed was the recently discovered Dreadnought, which varied in width up to 10 ft., but did not impress me as a strong lode, it being much split up and lenticular; the value contained appeared extremely variable.

The hydro-electric power-supply transmitted from the Hora Hora Falls, on the Waikato River, is now employed for general purposes at the mine and mill of this company. An interesting feature observed by me during my inspection of the mine was the reduction in the temperature of the mine-air, due no doubt to the cooling of the rock-surfaces by the constantly maintained air-current.

At the Waihi Grand Junction Mine the result of the year's operations constitutes a record both as regards bullion obtained and average value per ton of ore treated, which latter now slightly exceeds that of the adjoining Waihi Mine.

Since my last annual report no development on the lodes at greater depth than the No. 6 or 1,082 ft. level has taken place, but the main shaft has been sunk to a depth of 85 ft. below that level. It is generally understood that development at depth in this mine is controlled by the pumping operations at the Waihi Mine, for without such aid the pumping-installation at the Grand Junction Mine is incapable of dealing with the influx of water.

—PLAN—
—OF—
— THE 1000 FT LEVEL. —
— THAMES. N.Z. —
1913

MOANATAIARI G. M. Co.y

KURANUI-CALEDONIAN. G. M. Co.y

H. I. G. M. Co.y

N. G. M. Co.y

MAY QUEEN G. M. Co.y

WAIOTAHI G. M. Co.y

SAXON G. M. Co.y

VICTORIA. G. M. Co.y

MAY QUEEN N. G. M. Co.y

Originally estimated position of MAIN SLIDE at the 1000 ft Level.

Line of Hanging Wall of Main Slide from Boring results

CALEDONIAN SHAFT

WAIOTAHI SHAFT

QUEEN OF BEAUTY SHAFT

RESERVED AREA

PIAKO SHAFT

Scale

Lks. 100 50 0 1 2 3 4 5 6 7 8 9 10 chs.

feet 100 50 0 100 200 300 400 500 feet

Reference

Quartz lodes intersected are shown thus 2'6" / lin3

H. C. North 15.6.14

During the year development at the deepest level has not proved any feature of much interest, but the assay value of the ore exposed in the George, Royal, and Empire lodes has been satisfactory. No indication of leaching of the ore-body as seen in the Martha lode at the Waihi Mine has been here exposed.

The milling-capacity of the mine has been supplemented by the addition of twenty heavy stamps, and the power plant by a new A.E.G. (German) turbo-generator of 2,680 horse-power. No other mining operations of importance have been carried out during the year.

The Waihi Reefs Consolidated and Waihi Gigantic properties have been amalgamated, a new company having been formed with the object of deepening the present shaft from 735 ft. (the present depth) to 1,200 ft., and from thence crosscutting northward in exploration of the Waihi lode system.

Karangahake Goldfield.—The Talisman Consolidated (Limited) has experienced a decrease in tonnage treated and bullion obtained, but the amount of dividends distributed—viz., £133,687—constituted a record for this mine. The decline in output may to a certain extent be attributed to the colliery strike, which rendered this mine idle during November and December.

Development during 1913 has been somewhat disappointing; a crosscut eastward from No. 12 level south failed to intersect the Welcome lode, and the south drive and crosscuts at No. 13 level proved nothing of value in the Dubbo shoot; in No. 14 level, however, development was more satisfactory, a drive southward proved fair-grade ore in that shoot. The deepest development in the mine is by winze No. 12 in the Bonanza shoot, on the Maria lode, which is now down 135 ft. below the No. 14 level, and within 15 ft. of the random of No. 15 level. The lode, which carried high-grade ore from 110 ft. to 112 ft. down the winze and then showed a decline in value, still remains low grade, but a strong and well-defined ore-body, wider than the winze. It is proposed to carry three winzes to No. 15 level, and from thence drive north and south on the Bonanza shoot. To overcome the water difficulty, which was becoming acute, a horizontal pump of about 1,000 gallons per minute capacity has been installed in the Talisman inclined shaft, about 50 ft. below level No. 14; and the new Cornish pump, with an approximate capacity of 2,000 gallons per minute, raises water in the Woodstock shaft from below the random of level No. 14.

The connection of the Woodstock main shaft with the Talisman Mine workings at level No. 14 is being rapidly advanced from both ends; less than 18 chains remain to be driven. In the connecting crosscut 81 ft. from the Woodstock shaft a lode 7 ft. wide of low value was intersected. When the connection is completed pumping and winding will be concentrated in the Woodstock shaft installations.

The New Zealand Crown Mines have obtained small returns during the year. More capital is now being obtained, and it is proposed to confine future operations to the exploration of the property at greater depth. The Waihi-Paeroa Gold-extraction Company have during 1913 re-treated 140,100 imperial tons of tailing for a return of £42,300, being an average extraction of 6s. per ton, a greater output but lower average return than formerly. As the operations advance downstream the average value of the tailing has declined.

Thames Goldfield.—On this goldfield interest has been centred upon the crosscut to connect the Queen of Beauty and Kuranui-Caledonian Company's shaft at the 1,000 ft. level. The direct crosscut having during 1912 entered broken country in the vicinity of the Moanataiari downthrow fault when only 386 ft. from its termination, an influx of water and gas rendered further advance on that course inadvisable, and it was decided to make the connection with the Kuranui-Caledonian shaft in a direct line from the Waiotahi shaft to a point 50 ft. west of the first-named shaft; thereby it was hoped to avoid the broken country. After 493 ft. of the 650 ft. required to connect had been driven—on 30th September, 1913—water and gas at great pressure burst through the floor of the deviation crosscut; the workmen were compelled to make a hurried exit, and all attempts to resume work have since failed. Unless the ventilation of this crosscut is much improved, owing to the danger from gas, it has been decided to suspend crosscutting until the Waiotahi shaft, now being sunk, connects with the 1,000 ft. level crosscut, a farther depth of 50 ft. of sinking.

Coromandel Goldfield.—Profitable mining on this goldfield has, with one exception, ceased, the only dividend-paying mine being that of the New Waitaia Gold-mining Company at Kuaotunu, which, from stoping operations in a lode varying in thickness from 6 in. to 2 ft., were enabled to distribute £1,875 as dividends.

West Coast Inspection District.

From a commercial standpoint, based upon the amount of profit to capital invested, operations on the West Coast quartz-mining fields during 1913 have been unprofitable, only two mining companies having distributed dividends, and in these cases the sum disbursed was not large.

Inangahua Goldfield.—The New Big River Company has replaced its winding-engine by one of modern type, and, having installed compressed-air rock-drills, will now be able to extend its operations in depth. There has at this mine been a decline in tonnage milled and bullion produced below that of the previous year, but the average value per ton has increased from £4 8s. 7d. to £5 12s. 9d., a very satisfactory feature. The deepest development in the mine—viz., the winze from the No. 10 or 1,575 ft. level—has exposed a strong and profitable quartz lode. This company, whose paid-up capital only amounts to £600, has produced gold to the value of £174,244, and has distributed in dividends £81,600.

At the mines of the Consolidated Goldfields of New Zealand and the Progress Mines of New Zealand operations have been unprofitable, the only interesting development being the intersection of a body of quartz in a prospecting-drive through the fault south of No. 10 or 1,269 ft. level. The value of this discovery has yet to be proved.

In the Blackwater district the Blackwater Mines (Limited) have experienced a successful year, dividends amounting to £12,500 having been distributed. There still continues, however, to be a decline in the value per ton of ore treated, such value being—For 1910, £2 6s. 7d.; for 1911, £2 1s. 10d.; for 1912, £2 6s. 1d.; and for 1913, £1 16s. 5d. The No. 6 or 915 ft. level still remains the deepest level in the mine, but preparations are being made to continue sinking the main shaft.

In the vicinity of this mine are situated the Millerton and Prohibition Mines. Upon the former shaft-sinking is in progress, and upon the latter similar work is proposed.

Other quartz-mining operations, such as the Swastika Mine, on the Mokihinui River, are being carried out, but the amount of work done is insufficient to justify either eulogy or condemnation.

Southern Inspection District.

In the southern inspection district no gold-quartz mining is in operation, although from the gold-scheelite-quartz mines of Otago some gold is obtained in conjunction with scheelite.

(2.) Dredge Mining.

This branch of gold-mining is rapidly declining in importance, the number of productive dredges having decreased from 201 during 1902, when dredge mining was at its zenith, to seventy-four during 1913.

On the west coast of the South Island ten dredges were in commission— viz., two on Nelson Creek and one at each of the following places: Capleston, Cronadun, Antonio's Flat, Moonlight Creek, Waimea Creek, Blue Spur, Grey Valley, and North Beach, Cobden.

In Otago and Southland the fleet of sixty-four dredges in commission was distributed as follows: Waikaia Valley, 15; at or near Alexandra (River Clutha), 9; Waikaia, 6; Miller's Flat, 5; at or above Cromwell, 4; Manuherikia, 4; Nevis, 4; Glencoe, 3; Charlton Creek, 3; Cardrona, 2; and one at each of the following places—Lowburn Ferry, Kawarau River, Clutha Gorge, Roxburgh, Ettrick, Ida Valley, Kyeburn, Hogburn, and Waikaka

Of the foregoing, the following dredges ceased operations during the year: Hessey Cameron (Capleston), totally wrecked; Stafford (Waimea Creek), North Beach (Cobden)—all on the West Coast. In Otago and Southland the following dredges ceased operations: Hartley and Riley (River Clutha), Sandy Point (Alexandra), Golden Beach No. 1 (Alexandra), Surprise (Manuherikia), Gem (Waikaia Valley), and Central Charlton (Charlton Creek).

Only one new dredge has been commissioned—viz., that of the Red Jack's Gold-dredging Company on Red Jack's Creek. West Coast. In Central Otago old dredges have been started at Hogburn and Kyeburn, and at Mataura, in Southland

The Worksop dredge operating at Antonio's Flat, near Reefton, again heads the list of productive dredges. This dredge has during the past three years produced gold to the value of £49,687, of which £29,100 was distributed as dividends. An additional area of 300 acres has been acquired by this company, and it is reported that drilling operations thereon have proved very satisfactory.

The following table shows the result of dredge-mining operations in New Zealand during the past eight years:—

Year.	Total Number of Dredges working.	Value of Production.	Average Production per Dredge.	Dividend-paying Dredges owned by Registered Companies.		Number of Persons employed.
				Number.	Dividends.	
		£	£		£	
1906 ..	167	505,199	3,025	66	103,722	..
1907 ..	128	419,634	3,278	65	89,707	1,150
1908 ..	123	373,818	3,039	47	75,800	1,013
1909 ..	111	327,676	2,952	37	56,788	893
1910 ..	104	315,237	3,031	35	51,918	838
1911 ..	93	297,900	3,203	31	45,318	775
1912 ..	87	257,333	2,958	28	38,841	694
1913 ..	74	195,848	2,646	11	18,750	621

The dividends paid by eleven dredges the property of registered companies amounted to £18,750 during 1913; the profits of privately owned dredges are unobtainable.

The following is a statement regarding the most productive dredges owned by registered companies:—

Name of Dredge.	Production during 1913 of all Dredges.	Dividends paid by Dredges owned by Registered Companies.	
		During 1913.	To 31st December, 1913.
West Coast District—	£	£	£
Hessey Cameron (Limited)	1,856	225	6,480
Worksop	18,244	11,400	35,700
Southern District—			
Olrig	1,852	300	4,473
New Golden Run	7,534	400	400
Earnscleugh (3)	9,204	550	26,400
Rising Sun	5,159	800	19,200
Magnum Bonum	3,584	1,000	11,875
Electric (2)	5,985	1,300	130,643
Paterson's Freehold (2)	4,819	600	21,100
Ngapara	4,803	975	1,500
Willowbank	4,084	1,200	3,600
63 other working-dredges (registered or privately owned)	128,724	*	*
Totals	**195,848**	**18,760**	*

* Unrecorded.

The greatest weekly output by a gold-dredge was attained by the "Lady Ranfurly," on the 4th November, 1904. This dredge, operating on the River Molyneux (Clutha), obtained 1,273 oz. of gold in six consecutive days; it was owned by the Electric Gold-dredging Company, who at the end of 1913 had obtained gold to the value of £222,155 by dredging, of which £130,643 was distributed as dividends.

(3.) Alluvial Mining.

The value of the gold-production from sluicing claims amounted approximately to £295,704, being considerably more than that obtained by dredging. About 1,097 persons are engaged upon the alluvial mines.

Although no developments of importance occurred in this branch of the gold-mining industry during 1913, with the addition of the new mines being laid down the future prospects are favourable to an increased annual gold-production.

The following is a brief account of the most interesting alluvial-mining operations during 1913:—

West Coast, South Island.

The Lake Hochstetter Goldfields (Limited), a new company, have been engaged upon the construction of a water-race to carry eighty sluice-heads from that lake to the company's claims at Riverview, near Ahaura, there to work alluvial terraces which are believed to contain a large quantity of low-grade wash.

The evergreen Mont D'Or Gold-mining Company at Ross still remains on the dividend-paying list, although the sum distributed—£1,200—amounts only to one-half of that paid during the previous year.

The Ross Goldfields (Reconstructed) (Limited) have experienced a somewhat eventful year. During the early part of the year pumping was suspended during the installation of a Diesel engine of 250 horse-power as a stand-by in the event of stoppage of the electrical power by which pumping and winding at the mine is operated. A prospecting-drive was projected at No. 6 (315 ft.) level from near the shaft to a point about 20 ft. below the nearest and deepest workings of the old Cassius Mine; and from this drive such old workings were, at the end of June, unwatered through vertical boreholes, after two months continuous pumping by one stationary and one sinking three-stage Worthington turbine-pumps. The volume of water dealt with amounted to 2,000 gallons per minute. At times this quantity was exceeded. Upon subsequent inspection of the old Cassius Mine, which had been inundated and inaccessible since 1872, it was found that the value of the wash in sight did not justify optimistic estimates. The only payable wash left in sight by Cassius was contained in a small block near to his shaft; he had picked his mine clean before the historical inundation took place.

After unwatering the ground the Ross Company have pursued a vigorous and efficient policy in prospecting from the No. 6 level, but with the exception of one small patch of payable wash nothing of importance has yet been developed. During the year the company obtained from low-grade wash gold to the value of £1,918, and employed, on an average, fifty men.

That there remains profitable areas of wash within the Ross Company's ground there can be no reason to doubt, but the water difficulty, and the fact that the main bottom has never yet been reached in this mine, renders problematical the undertaking from a commercial point of view.

Otago and Southland.

During the early part of the year severe floods considerably retarded alluvial-mining operations.

The Golden Crescent have opened up a cement face exceeding 120 ft. in height without reaching the rock bottom, which dips towards Weatherstone's Creek. Much of the most payable wash was blocked out in the early days, but the company is able to pay dividends from the ground remaining. Nine heads of water are used, under a pressure due to 700 ft. of fall.

The Nokomai Sluicing Company again heads the list of dividend-paying alluvial mines, £6,600 being so distributed during 1913; the total dividends paid—viz., £40,284—amount to six times the paid-up capital. Three claims are worked on the sluicing and elevating principle by this company, who employ fifty men.

The Havelock Sluicing Company, operating at Waitahuna, again appear on the list of dividend-paying. This company uses twelve sluice-heads of water, under a pressure due to 700 ft., for sluicing and elevating from a face ranging from 10 ft. to 70 ft. in height.

Near Waikaia the Muddy Terrace Gold-mining Company has produced during the year gold to the value of £4,004, which is £3,500 less than during 1912. During March the company's timber dam, a badly built and unnecessary structure, which diverted the water from Dome Creek into the main race, was carried away by flood. The company then extended their main race 30 chains up the creek and now lift the water directly therefrom, which should have been done at the beginning. To the loss of time by this misfortune may be attributed the considerable reduction in gold-output. Three faces, varying in height between 10 ft. and 50 ft., are worked on the sluicing and elevating principle, about thirty men being constantly employed.

V. MINERALS OTHER THAN GOLD.

Scheelite.

The quantity of scheelite exported during the year amounted to 221 tons, valued at £22,933, as compared with 135 tons, valued at £13,347, in 1912. The following statement shows the quantity and value of scheelite exported since the year 1899 :—

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Tons.	£		Tons.	£
1899	32	2,788	1908	68	6,055
1900	54	2,635	1909	58	4,263
1901	2	83	1910	143	15,070
1902	39	1,200	1911	138	11,853
1903	42	1,439	1912	135	13,347
1904	17	791	1913	221	22,933
1905	28	1,848			
1906	55	3,407	Totals ..	**1,169**	**103,198**
1907	137	15,486			

In the following table is shown the quantity of quartz crushed, and scheelite (tungstic trioxide) concentrates, and gold obtained by the seventeen companies and parties of miners engaged in this industry, together with the value, during the year 1913 :—

Name of Mine or Company.	Locality	Quartz crushed.	Scheelite (Tungstic Trioxide) Concentrates obtained.	Value.
		Tons.	Tons cwt.	£ s. d.
Dominion Consolidated Development Company	Marlborough – Wakamarina Valley	8,180*	60 0	6,491 13 5
Glenorchy Scheelite Syndicate Nine parties of miners ..	Lake County, Glenorchy	533	83 5	8,158 10 10
Fraser and Smith	Waihemo County, Macrae's	40	..	230 5 6
Deep Dell	Ditto	660	12 0	1,220 0 0
Maritana Mining Company ..	,, ...	1,297†	6 6	506 3 2
Stoneburn	,, ...	..	10 17	1,017 0 0
Berry Syndicate..	,, ...	14	0 16	57 5 8
Golden Point	,, ...	4,428‡	28 15	2,191 4 2
Buckland and Ewart	Taieri County, Barewood	..	..	100 0 0
Gold and Tungsten	Maniototo County ..	2,377§	8 10	784 4 6
Total scheelite	..	17,529	210 9	20,756 7 3
Total gold	..	..	..	7,670 3 6
Grand total				28,426 10 9

* Also produced gold to the value of £5,428 5s. 3d. † Also produced gold to the value of £63. ‡ Also produced gold to the value of £1,817 12s. 10d. § Also produced gold to the value of £361 5s. 5d.

It is improbable that the scheelite-mining industry in New Zealand will ever attain great importance, but the increased prosperity as shown above is very satisfactory.

Kauri-gum.

The most satisfactory feature in connection with our mineral exports during 1913 is the considerable increase in the quantity and value of kauri-gum exported, which amounted to 8,780 tons, valued at £549,106, the highest both in tonnage and value during the past seven years. The total production actually amounted to 9,596 tons, the highest since 1904. The average value of the gum marketed during that year was, however, considerably greater than for 1913, this being due to the fact that there is now a steady sale for the grades known in the trade as "chips" and "dust," which are therefore sent forward in large quantities, and are understood to go mostly to Germany for the manufacture of linoleums. The market price of gum varies greatly, according to quality. The best-grade gum, which is very scarce, sells as high as £300 per ton. For single pieces of specimen gum but little larger than a man's fist, transparent, in colour varying from that of brandy to a light amber, collectors have paid as much as £25. A collection of transparent and highly polished specimen gum of varied shades of brown and yellow makes a very beautiful and valuable exhibit. The Mitchelson collection, recently presented to the Auckland Museum, was valued at over £2,000.

The following are the grades of commercial gum as sold in the London market: Pale amber—ordinary three-quarter scraped; half scraped; brown; fair half and three-quarter scraped; fair half scraped; pickings; chips; and dust.

A good market now being available for the low-grade gum, mechanical methods are now employed in obtaining it from swamps. In the Piako district gum is obtained by ground-sluicing and saved in sluice-boxes somewhat similar to the methods of pioneer alluvial-gold mining.

A company with a capital of £30,000 has recently been formed for the purpose of dredging for gum on a swamp at Awanui, in the north of Auckland peninsula. A gold-dredge has been purchased in Otago, which it is proposed to alter to adapt it to gum-dredging. There are many thousands of acres of swamp in the gum-bearing areas of the north, and it is anticipated by the company that the dredge which is about to be placed in commission will be the forerunner of many others. Those who are experienced in gold-dredging know the difficulty in handling buried logs and in separating the gum from the roots, &c., which will be raised by the dredge. The upkeep of a gold-dredge for fuel, wages, and repairs will average approximately £40 per week if working full time.

Iron.

The past year has again been one of inactivity by the Parapara Iron Company. The holders of the Cadman lease have been exempted by the Warden from observance of the labour-conditions of such lease during the past eighteen months. Since the beginning of 1908 this lease has been totally exempted for two years and partially exempted for two years and a half, during which time unsuccessful attempts have been made to obtain capital from abroad to work the deposit. The syndicate who own the Onakaka lease have been more industrious, employing about twenty men in trackmaking and clearing.

As the result of successful experiments in the treatment of Taranaki ironsand at the metallurgical works of the Waihi Gold-mining Company at Waikino, it is proposed to erect an experimental blast furnace near New Plymouth. The process to be adopted consists in the briquetting of 60 per cent. ironsand with 40 per cent. small coal from the Liverpool State Colliery, the coke from which contains only 0·25 per cent. sulphur. The briquettes will then be coked before introduction into the furnace. It is claimed by the patentees that by this process the titanic anhydride in the ironsand, amounting to from 8 to 9·2 per cent., is eliminated in the furnace. If this process proves successful an extensive iron industry may be established on the shores of Taranaki.

Petroleum.

Drilling operations are still being vigorously carried out in the North Island, especially in the Provincial District of Taranaki; but the result of such operations during 1913 has not materially added to the known supply of petroleum. The most interesting development has been the tapping, by the Taranaki Oil Lands Company, of a productive well near Moturoa, at a distance of about 12 or 13 chains east of the No. 5 or most productive well of the Taranaki Oil-wells (Limited). In the new well, at a depth of 2,170 ft., the flow of oil commenced, and during January and February of the current year over 1,000 barrels are reported to have been produced; at 2,232 ft. the well-drilling was temporarily suspended owing to influx of water. This well is lined with 10 in. casing to the bottom.

The Taranaki Oil-wells (Limited) commenced operations at their new refinery during the year, but have experienced some difficulty in eliminating an aromatic substance from the kerosene. The two prospecting-boreholes drilled by this company at Waitara failed to find oil, and were discontinued at depths of 2,970 ft. and 3,821 ft. respectively. This company is now drilling by rotary plant a new hole at Moturoa; a depth of 2,513 ft. has already been attained.

Drilling is also being carried on by the Bonithon Freehold Oil Company near New Plymouth, the United Oil Company at Waitara, the Phœnix Oil Company at Moturoa, the Consolidated Oilfields of Taranaki at Huiroa, and the Mangaone Oilfields (Limited) near Eketahuna.

The following is a list of oil-wells and prospecting-boreholes recently drilled, together with their depths and the results* attained :—

Name of Company.	Name or Number of Well.	Locality.	Total Depth, in Feet, 31/7/14.	Result, 20/5/14.
Taranaki Oil-wells	1	Moturoa	3,030	Drilling.
,, ...	2	,, ...	3,030	Feebly productive.
,, ...	3	,, ...	4,040	,,
,, ...	4	,, ...	850	Unproductive.
,, ...	5	,, ...	2,655	Productive.
,, ...	6 (rotary)	,, ...	2,600†	Drilling, feebly productive.
,, ...	1	Bell Block, Waitara ..	3,821	Unproductive; abandoned.
,, ...	2	,, ,, ..	2,970	,, ,,
Taranaki Oil Lands, &c. ..	Blenheim	Moturoa	2,426‡	Productive at 2,171 ft. and 2,211 ft.
Phœnix Oil	..	,, ...	2,203‡	Drilling.
Consolidated Oilfields of Taranaki	..	Huiroa	2,586‡	,,
Bonithon Freehold Oil	..	Near New Plymouth ..	2,505	Drilling suspended.
United Oil	..	Tikorangi, Waitara River	700‡	Drilling.
Kotuku Oilfields	..	Near Lake Brunner ..	952	Abandoned (in primary rock).
,, ...	1	Oparae, Hawke's Bay ..	1,660	Abandoned or suspended.
,, ...	2	,, ,, ..	1,322	,,
New Zealand Oilfields	1	Totangi, Gisborne ..	511	,,
,, ...	2	Waihirere	1,375	,,
Mangaone Oilfields	1	Mangaone Valley, near Eketahuna	3,000†	,,
,, ...	2	Near Eketahuna ..	114†	Drilling.

* The depths and results here given are from the best evidence obtainable by the Mines Department, but information in some cases is difficult to obtain, and the depths are not guaranteed as correct.

† The rotary system of drilling is employed.

‡ The Canadian-Galician percussion system of drilling is employed.

For the better control of drilling operations, regulations based upon those in operation in other countries are now being prepared; by these provisions risks from influx of water into the oil-bearing beds will be avoided.

Sulphur.

At White Island, in area about 590 acres, situated in the Bay of Plenty, about thirty miles from Whakatane on the mainland and 190 miles by sea from Auckland, the recently formed New Zealand Sulphur Company has laid down a steaming plant and constructed a ditch from Crater Bay to drain the crater lake situated near the centre of the island. The island consists of the summit of a volcano projecting above the sea, and thereon thermal activity is unusually pronounced; from one large vent known as the "Blowhole" there is a remarkable display of solfataric and fumarolic action, unrivalled in New Zealand, so-called smoke and steam being ejected to a height of about 300 ft. Around the fumaroles there are conical mounds of almost pure sulphur, varying from 4 ft. to 6 ft. high, and the floors and sides of the crater are covered to an unknown depth with alternating layers of siliceous mud ash-beds, flowers of sulphur (averaging 7 ft. in thickness), and gypsum. By systematic prospecting a reserve of sulphur has been exposed, and a considerable quantity has been obtained and stacked for treatment. Previous attempts to profitably work the sulphur-deposits have been somewhat hindered by shortage of water-supply, but the present company have constructed a dam which they believe will be adequate to supply their boilers. The steaming plant consists of a retort-house, containing three retorts each of 4 tons capacity, to which steam for fusing the sulphur is supplied by a boiler. I regret to report that one of the retorts recently burst shortly after operations were commenced, and one of the employees was killed. Retorting is now suspended pending the installation of non-corrodible retorts.

Since 1902 there has been no sulphur exported from New Zealand, but during the five years preceding 4,927 tons, value £13,239, were exported from White Island.

Conditions of life in this weird island are not salubrious, nor in the opinion of the Inspector of Mines are they quite safe, the workmen's camp and steaming plant being placed in proximity to the "Blowhole."

Phosphate Rock.

The Ewing Phosphate Company, operating at Clarendon, Otago, produced 11,000 tons during 1913, a slight increase above that of the previous year. Recently made analyses of the higher-grade rock show from 30 to 36·7 per cent. of phosphoric anhydride, equivalent to from 65·3 to 80·2 per cent. tricalcic phosphate. Oxides of iron and alumina together total from 1·4 to 9 per cent.

VI. STONE-QUARRIES.

The following is a table showing for each inspection district the number of quarries, persons ordinarily employed thereat, also the number of certificated quarry-managers or foremen, together with the nature of the material quarried during 1913 :—

Inspection District.	Number of Quarries.	Number of Persons ordinarily employed.	Total Number of Permits granted during 1913. Managers or Foremen.	Total Number of Permits granted. Managers or Foremen.	Material quarried, and Purpose.
Arthur's Pass Tunnel	2	196	4	12	Government railway-tunnel (greywacke).
Hobson, Otamatea, Rodney, Waitemata, Eden	38	228	47	106	Scoria and basalt.
Buller	2	136	7	12	Rock, harbour-works and railway-construction.
Mount Herbert, Akaroa, Malvern, Paparua, Heathcote, Halswell, Springs, Ellesmere, Waimairi, Selwyn, Wairewa	6	62	9	17	Scoria, basalt, and rubble.
Collingwood, Waimea, Takaka	3	25	..	5	
Cook, Waiapu	2	31	2	5	Road-metal.
Grey	4	33	3	8	Limestone, blue and brown rock.
Coromandel, Piako, Ohinemuri, Matamata	8	63	17	39	Road-metal and ballast.
Patangata, Waipukurau, Waipawa, Hawke's Bay, East part East Taupo	10	85	3	20	Limestone.
Hutt, Makara	12	28	3	46	Bluestone.
Inangahua, Murchison, Westland ..	2	5	1	6	Road-metal and limestone.
Marlborough, Kaikoura, Sounds.. ..	2	28	..	8	Rock.
Southern District (Ashburton to Stewart Island)	33	486	39	194	Limestone, phosphate, basalt, and schist.
Rotorua, East Taupo	2	5	2	3	Road-metal.
Tauranga	1	21	..	2	Stone.
Thames	8	21	1	21	Road-metal.
Waikohu	2	27	2	8	Sandstone.
Featherston, Wairarapa South, Masterton, Mauriceville, Eketahuna, Castlepoint	2	11	..	4	Limestone.
Waimarino	8	65	5	12	Road-metal and papa cuttings.
Waitotara	..	..	..	2	
Hawera, Waimate West, Patea, Eltham ..	2	8	1	4	Gravel.
Whangarei	4	176	8	20	Limestone.
Woodville, Dannevirke, Weber	5	38	4	11	Papa and limestone.
Mangonui, Bay of Islands, Whangaroa ..	7	30	..	12	Road-metal.
Pahiatua, Akitio	..	..	..	..	
Whangamomona, Stratford	..	..	..	..	
Waitotara	..	..	..	..	
Awakino North	..	..	..	..	
Oroua, Pohangina, Kiwitea, Rangitikei ..	..	..	..	..	
Totals	165	1,808	158	577	

The following is a summary of persons killed or seriously injured during 1913 at stone-quarries and places within the operation of the Stone-quarries Act (being in proportion of 1·9 persons killed per 1,000 employed) :—

Cause of Accident.	Number of Accidents.		Number of Sufferers.	
	Fatal.	Serious.	Killed.	Seriously Injured.
Explosives	2	..		..
Falls of ground	..	11	..	11
Machinery	..	6	..	6
Haulage	..	14	..	14
Miscellaneous	..	24	..	24
Totals	2	55	2	55

VII. STATE AID TO MINING.

(1.) Subsidized Prospecting.

During the year ended the 31st March, 1914, forty-two approved prospecting parties were granted subsidies amounting to £4,381 8s., of which £756 10s. 9d. was expended during that year. In addition to which £3,439 14s. 2d., granted during previous years, was expended by thirty-two parties during the past financial year.

The results obtained by subsidized prospectors is contained in the Reports of Inspectors of Mines (Annexure A hereto), but it is to be regretted that, as in former years, no discoveries of importance have been made, and the mining industry has not benefited. In a few cases small parties have found fair prospects in known goldfields.

The principal grant was that made to the Hauraki Prospecting and Miners' Association of £1,000, on a basis of a £2 subsidy for every £3 expended in prospecting. Three parties have recently been equipped and sent respectively to the Mahikirau, Waihi-Whangamata, and Thames-Tairua districts of the Hauraki Goldfields to prospect ground considered favourable by the officers of the Geological Survey of New Zealand.

The following statement shows the total expenditure during the year ended 31st March, 1914, on authorities issued previous to that date, in subsidies to prospecting associations and parties of miners in the different counties :—

Name of County, &c.	Expenditure. £ s. d.
Whangarei County	70 0 0
Coromandel County	193 16 0
Thames County	197 15 0
Ohinemuri County	420 14 4
Takaka County	14 0 0
Inangahua County	547 3 6
Murchison County	34 13 4
Grey County	176 0 0
Westland County	1,684 16 1
Ross Borough	50 12 6
Southland County	29 9 9
Prospecting Associations, &c.	777 4 5
	£4,196 4 11

(2.) Loans for the Development of Mining.

Since 1905, when statutory provision was made for advances by way of loans for mining development, five companies have been assisted by grants of loans aggregating £32,725, of which £20,600 has been paid by the Government as the mining operations have proceeded and in accordance with the conditions upon which such loans were granted.

A considerable proportion of the forty-six applications for loans have been refused on the grounds of inadequate prospects of success.

It cannot be stated that there is any evidence that the mining industry has yet benefited by these loans, there may have been collateral benefits, but no company so assisted has paid a dividend. In two cases—initialled "D" and "E" in the statement hereunder—however, the developments for which the loan was granted are not yet completed, and it is premature to pronounce thereon; but in case "A" the company has failed to pay some interest due on the loan or the rent on its lease; in case "C" the loan was refunded without the venture proving successful; and in the remaining case "B," the company, having failed to pay some interest due on its loan, was fortunate in having the same capitalized and added to the original loan.

The provision regarding mining loans is taken advantage of by mining promoters who are unable to obtain subscribers for their shares, to make up shortage of capital on the extremely favourable terms—viz., bearing interest of 4½ per cent.—which the Government offers. It is perhaps unnecessary to state that such speculations, to which the investing public are not responsive, have frequently very remote prospects of success.

The granting of mining loans in New South Wales and Victoria generally proved a failure.

Statement regarding Mining Companies who have borrowed Money for Development of Mining under Part X of the Mining Act.

Initial to represent Name of Company.	Amount of Loan granted.	Amount of Loan paid, 20/5/14.	Amount of Loan refunded to Government.	Subscribed Capital.	Amount of Capital actually Paid up.	Value of Scrip given to Shareholders on on which no Cash paid.	Total Expenditure since Registration.	Total Amount of Dividends paid.	Amount of Debts owing by Company.
	£	£	£	£	£	£	£	£	£
A	10,000	10,000	3,000	14,400	14,400	5,550	60,964	..	15,850*
B	5,225	5,225	..	172,289	7,539	164,750	14,232	..	6,532†
C	500	500	500	6,000	5,353	5,000	6,342	..	675‡
D	10,000	6,491	..	30,000	16,798	10,000	17,132	..	7,250§
E	7,000	3,385	..	70,000	24,379	43,750	15,341	..	208‖

* Company in arrears for interest £348 9s. 1d. and for rent. This company has experienced considerable ill luck.
† Company being in arrears £225 for interest were fortunate in having same capitalized; prospects indifferent.
‡ Refunded loan, although property has not paid a dividend hitherto.
§ Plant and works being laid down, but cost considerably exceeds company's original estimate; prospects fair.
‖ Company are prospecting deep levels thoroughly with the money; results hitherto not encouraging, but the exploration is necessary from a national point of view. The loan in this case has not been included in the last column.

(3.) Subsidized Roads on Goldfields

The following schedule shows the amounts expended by subsidies and direct grants out of the Public Works Fund—vote, "Roads on Goldfields"—in the different counties, &c., during the year ended 31st March, 1914:—

—	Subsidies.	Direct Grants.
	£ s. d.	£ s. d.
Thames County	415 5 0	2,810 17 0
Thames Borough	..	50 0 0
Coromandel County	..	1,622 4 10
Ohinemuri County	130 10 0	1,756 6 0
Pelorus Road Board	..	205 17 0
Collingwood County	..	376 8 3
Takaka County	..	81 15 6
Waimea County	..	90 0 0
Buller County	..	4,284 13 8
Murchison County	..	90 11 11
Inangahua County	71 2 6	2,702 6 11
Grey County	458 16 2	2,529 1 5
Westland County	..	1,316 12 8
Ross Borough	..	100 0 0
Brunner Borough	..	100 0 0
Tuapeka County	160 0 0	..
Vincent County	..	50 0 0
Lake County	..	387 14 0
Southland County	512 13 0	350 0 0
Wallace County	..	574 15 1
Public Works Department	..	2,915 11 1
	£1,748 6 8	£22,394 15 4

In addition to the foregoing, the goldfields' local bodies were credited with goldfields revenue amounting to £17,139 7s. 7d., and gold duty amounting to £22,039 11s. 5d. The total amount of State aid thus given to local bodies on behalf of the mining industry during the past financial year was therefore £63,322.

(4.) Government Prospecting-drills.

There still continues to be a demand for the Government Keystone and diamond drills for prospecting purposes, although not so pressing as during previous years.

During the past year 112 holes, aggregating in depth 2,949 ft., were drilled by means of two Keystone drills in Westland and Otago in search for alluvial gold; and seven holes, aggregating in depth 3,144 ft., were drilled on the west coast of the South Island in search of coal.

The use of these drills, which are lent free of charge, is strongly recommended to those who propose to finance mining operations, for by such means may the actual value of mineral deposits be most economically proved, and mining rendered less speculative. It may be safely stated that in scores of cases here in New Zealand many thousands of pounds would have been saved by preliminary boring at comparatively insignificant cost. To embark in a mining enterprise upon the unverified word of an interested person or optimistic expert is to court disaster. The Government, by providing these modern and cheaply run drills, have done much to protect the over-enthusiastic speculator.

The following is a table showing the result of boring done by Government prospecting-drills during 1913:—

PARTICULARS OF BORING BY GOVERNMENT PROSPECTING-DRILLS.

Type of Drill.	Name of Superintendent.	To whom lent.	Minerals sought for.	Number of Holes drilled.	Approximate Depth drilled.	Diameter of Hole.	Character of Country penetrated.	Average Cost per Foot, including Transport.	Result of Drilling.
					Ft.	In.		s. d.	
Percussion cable ..	W. H. Warburton	Point Elizabeth State Colliery	Nil ..	1	400	9	Mudstone, sandstone, shale ..	6 8½	Hole drilled above mine for pump-delivery column.
Sullivan CN diamond	,,	,,	Coal ..	1	945	2½	Mudstone, sandstone, shale, grit	2 11½	No coal found.
,,	,,	Blackball Colliery (Roa Road)	,, ..	1	650	2½	Mudstone, sandstone, shale ..	2 11½	No coal proved.
,,	,,	Blackball Colliery (Hughes' Track)	,, ..	1	750	2½	,, ,, ,, ..	4 10	17 ft. coal proved at 723 ft.
Schram-Harker diamond	T. F. Smith ..	Westport Harbour Board ..	,, ..	1	79	10	Gravel, running sand, boulders	*	Drill proved unsuitable; hole abandoned.
Ditto	,, ..	,, ..	,, ..	1	80	8	,, ,, ,,	*	Ditto.
Sullivan CN diamond	W. Carter ..	Nelson Coalfields (Limited) (Stoke)	,, ..	1	239	6	River drift, clay, gravel, sand, boulders	38 6	Hole failed to reach bed-rock, and was abandoned owing to high cost.
No. 1 Keystone ..	T. McMath ..	Waikaia Gold-mining Company	Alluvial gold	13	339	6	Gravel and sand	*	Successfully tested the claim.
,, ..	,, ..	J. C. Ellis (Upper Nevis) ..	,,	31	688	6	,, ...	*	,,
No. 2 Keystone ..	G. E. D. Seale ..	Frosty Creek Prospecting Association (Rimu)	,,	1	54	8 to 6	Cemented gravel	15 0	Ground very poor.
,, ..	,, ..	A. Cederman (Rimu Flat) ..	,,	5	200	6	Rough, tight, river-bed gravel	4 10	Very satisfactory; ground averaged 2s. per yard.
,, ..	,, ..	Stafford Dredging Company (Stafford)	,,	18	684	6	Pug and river-bed gravel ..	2 1	Fairly satisfactory, but pug and logs excessive.
,, ..	,, ..	G. Linklater, Auckland lead (Awatuna)	,,	9	236	6	Sand and beach-gravel ..	3 10	Very poor.
,, ..	,, ..	Donnelly's Creek Prospecting Syndicate (Ross)	,,	5	164	6	Very rough river-bed gravel ..	8 2	,,
,, ..	,, ..	Saltwater and Maori Creek Prospecting Association	,,	12	158	6	Fairly rough river-bed gravel ..	8 0	,,
,, ..	,, ..	Murray and Tindale (Marsden)	,,	5	110	6	,, ..	3 8	Fairly satisfactory.
,, ..	,, ..	Golconda Prospecting Syndicate (Cameron's)	,,	7	156	6	Sand and gravel	6 3	Very poor.
,, ..	,, ..	Marsden Prospecting Syndicate	,,	6	160	6	Fairly rough river-bed gravel ..	5 8	,,

* Private operations, cost not available.

(5.) Government Water-races.

The Waimea–Kumara and Mount Ida Water-races, which render possible hydraulic mining in the Kumara district, Westland, and the Naseby district, Central Otago, have supplied 100 miners with water for sluicing during 1913, by which they obtained gold to the value of about £23,226.

For the year ended the 31st March, 1914, the receipts for sales of water from the combined races amounted to £3,305 6s. 9d., the expenditure in upkeep and supervision during the same period being £3,214 19s. 9d., as compared with £2,588 0s. 8d. and £3,273 11s. 3d. respectively during the previous year.

New branch races have been constructed to serve miners in the Waimea–Stafford districts, and a race-deviation is now being constructed from the Erin-go-bragh Water-race, recently purchased by the Government, to Argus Terrace, near Maori Point, Westland, where alluvial gold has been intermittently mined for many years.

The Kumara Water-race extension, which carries by inverted siphon a large supply of water across the valley of the River Taramakau to the northern terraces at Westbrook, has been very badly supported by the miners of the district, who strongly urged the Government to construct this costly extension, and loudly proclaimed the richness and extent of the country which would be served. Independently of mining, this siphon is of considerable value for hydro-electric power, the water-supply being considerable and the pressure adequate.

In Central Otago the Mount Ida Race has been extended for nearly a mile towards its proposed terminus to enable new ground to be worked.

VIII. SCHOOLS OF MINES.

At the last Government examinations the following students won scholarships (value £50 per annum, with free class fees tenable for four years at the Otago University School of Mines)—viz., Messrs. L. Grange, of the Waihi School; and L. Stevenson, of the Thames School.

The following is a summary of the results of the Government examinations at the schools of mines during 1913 by senior students:—

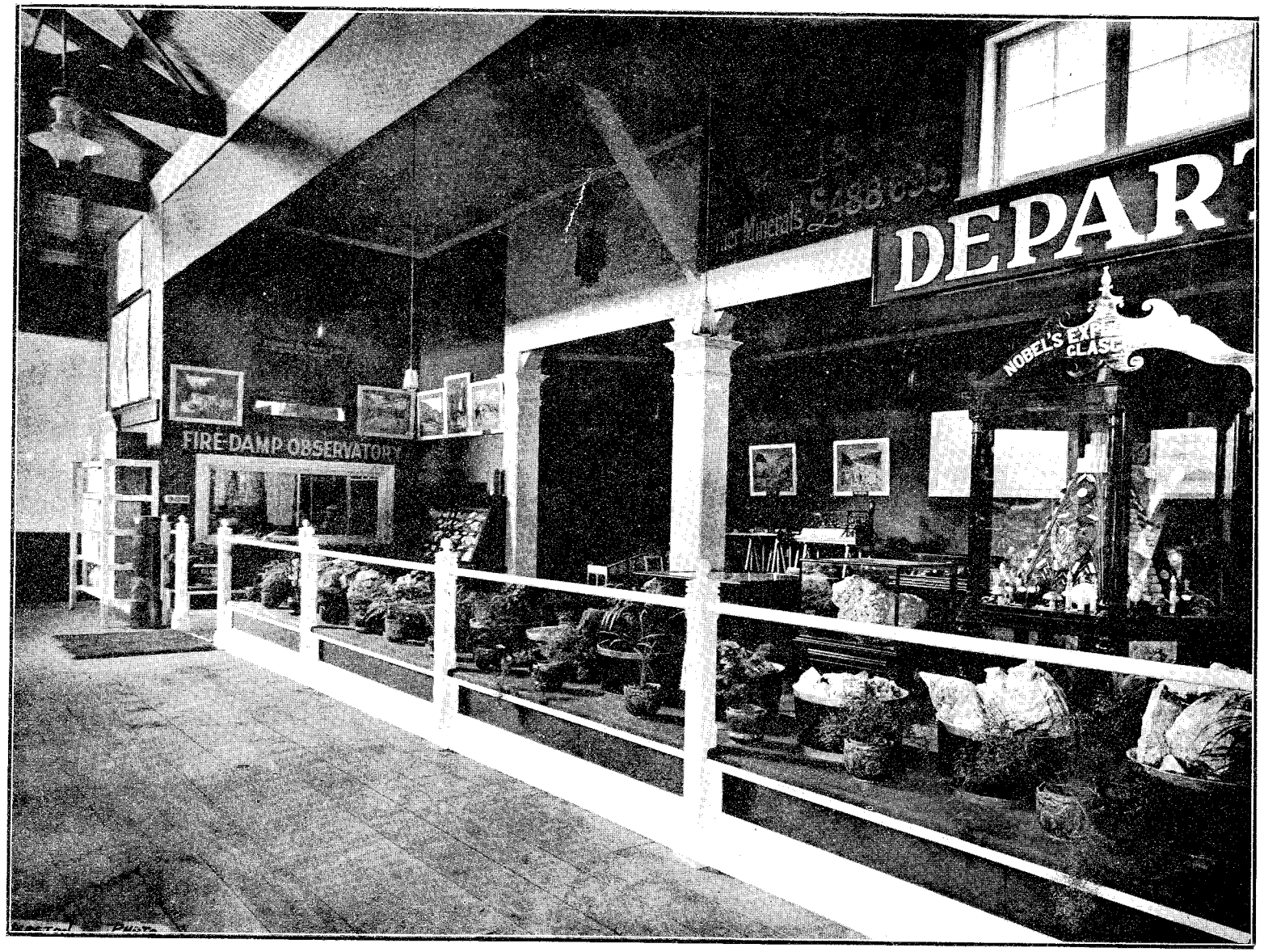
Position.	Locality of School of Mines.	Average Number of Marks awarded per Paper submitted.	Number of Students examined.	Number of Papers submitted.	Total Marks awarded.
		Per Cent.			
1	Thames	60·83	16	24	1,459
2	Waihi	57·20	18	34	1,945
3	Karangahake ..	56·47	11	30	1,694
4	Reefton	49·66	14	27	1,341
5	Coromandel	39·23	7	13	510
6	Westport	38·43	12	23	884
	Totals, 1913 ..	51·87	78	151	7,833
	,, 1912 ..	62·00	66	123	7,629

Upon comparison with the results obtained at the examination for the previous year, it will be seen that the average number of marks per paper has decreased, but the number of students submitting themselves for examination has increased.

The following table shows the expenditure by the Government on schools of mines since their inception, exclusive of subsidies paid to the University of Otago towards the School of Mines in connection with that institution :—

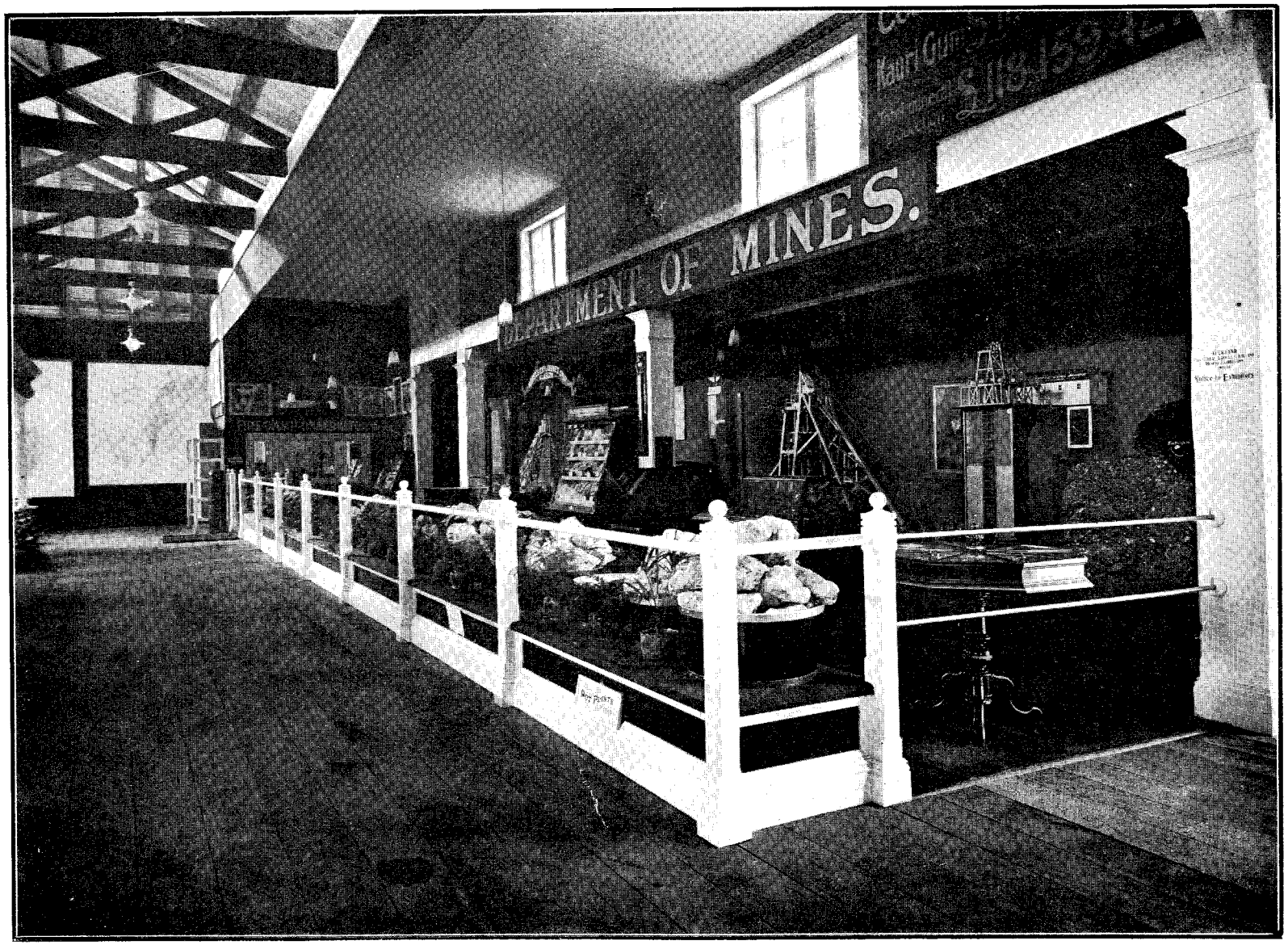
Financial Years.	Subsidies towards the Erection of Schools of Mines, and Maintenance.			Chemicals and Apparatus, also Mineralogical Specimens supplied to Schools of Mines.			Scholarships.	Salaries of Teachers, and Travelling-expenses, &c.			Total Sum paid by the Department towards the Schools of Mines.		
	£	s.	d.	£	s.	d.	£	£	s.	d.	£	s.	d.
1885–86 ...	...			36	19	9	...	1,223	9	10	1,260	9	7
1886–87 ...	257	16	6	409	1	4	...	2,716	9	3	3,383	7	1
1887–88 ...	253	15	9	253	14	1	...	1,714	9	6	2,221	19	4
1888–89 ...	42	10	0	6	12	9	...	1,139	4	1	1,188	6	10
1889–90 ...	142	2	0	181	14	10	...	716	3	10	1,040	0	8
1890–91 ...	217	6	6	54	8	0	...	620	9	9	892	4	3
1891–92 ...	181	14	0	...			...	689	5	9	870	19	9
1892–93 ...	312	3	4	...			...	670	1	0	982	4	4
1893–94 ...	197	0	5	...			...	858	19	4	1,055	19	9
1894–95 ...	390	0	0	45	10	10	...	773	17	8	1,209	8	6
1895–96 ...	820	0	0	...			50	849	3	0	1,719	3	0
1896–97 ...	352	14	11	58	18	6	100	834	12	8	1,346	6	1
1897–98 ...	1,089	18	6	29	19	9	100	780	19	0	2,000	17	3
1898–99 ...	740	15	2	32	19	7	50	729	10	11	1,553	5	8
1899–1900 ...	990	3	4	24	3	8	50	52	16	3	1,117	3	3
1900–1901 ...	866	10	11	56	3	4	98	77	7	10	1,098	2	1
1901–1902 ...	1,155	12	3	63	5	1	49	69	16	4	1,337	13	8
1902–1903 ...	1,379	15	6	134	18	8	158	111	0	0	1,783	14	2
1903–1904 ...	1,575	15	3	88	18	8	92	109	15	10	1,866	9	9
1904–1905 ...	1,401	2	11	17	3	0	100	362	19	6	1,881	5	5
1905–1906 ...	1,806	19	5	87	2	1	49	440	9	4	2,383	10	10
1906–1907 ...	1,836	6	6	11	15	8	100	388	18	5	2,337	0	7
1907–1908 ...	2,428	19	3	94	6	2	150	345	15	11	3,019	1	4
1908–1909 ...	2,738	11	1	328	9	3	100	642	9	4	3,809	9	8
1909–1910 ...	1,882	2	6	692	2	8	100	587	3	2	3,261	8	4
1910–1911 ...	2,813	0	10	44	5	8	108	1,130	7	3	4,095	13	9
1911–1912 ...	1,852	19	11	38	9	9	92	1,138	6	7	3,121	16	3
1912–1913 ...	1,769	6	10	182	18	4	100	1,227	2	2	3,279	7	4
1913–1914 ...	1,909	14	7	70	4	2	250	1,267	17	10	3,497	16	7
Totals ...	31,404	18	2	3,044	5	7	1,896	22,269	1	4	58,614	5	1

I have, &c.,
FRANK REED, M.I.M.M., L.S.,
Inspecting Engineer of Mines.



AUCKLAND EXHIBITION, 1913–14.—A PORTION OF THE COURT OF THE MINES DEPARTMENT.

Face p. 32.



Auckland Exhibition, 1913–14.—The Court of the Mines Department, Recipient of the First Award.

ANNEXURE A.

EXTRACTS FROM THE REPORTS OF INSPECTORS OF MINES.

NORTHERN DISTRICT.

Mr. Matthew Paul, Inspector of Mines, Waihi.

Waihi Gold-mining Company (Limited).—No. 11 level (1,301 ft. from collar of No. 5 shaft): No. 5 shaft north crosscut—This level was started from No. 5 shaft at the beginning of August, and was driven northward a total of 373 ft. At 26 ft. the Royal lode was met, and is 5½ ft. wide. At 70 ft., quartz 9 in. wide; course, 92° (true), vertical. At 172 ft., quartz 3 in. wide; course, 60° (true), dip 1 in 6 south. At 215 ft., quartz 3 in. wide; course, 45° (true), dip 1 in 1 south-west. At 280 ft. three stringers of quartz, making a total width of 12 in.; course, 40° (true), dip 1 in 2½ north-west. At 357 ft. the Dreadnought lode was met, and its width is about 10 ft.; course, 33° (true), dip 1 in 3 north.

No. 10 level (1,151 ft. from collar of No. 5 shaft): The water was pumped down to this level at the end of February, and development was then resumed. Royal lode—East of No. 5 shaft south crosscut the level has been extended from 186 ft. to 744 ft. From 300 ft. to 737 ft. the lode averages 19½ ft. wide. West of No. 5 shaft south crosscut the level has been extended from 174 ft. to 735 ft., and varies greatly in width between 6½ ft. and 20 ft. Dreadnought lode—This payable lode was discovered when sinking No. 4 shaft in April at 88 ft. below No. 10 level. Since then a good deal of development has been done at No. 10 level. It was found that a 12 in. lode at 120 ft. south of No. 4 shaft in the No. 5 shaft crosscut (north) corresponded with the course and dip of the Dreadnought lode, which was driven on east and west. Eastward the level was driven a total of 730 ft. when the main branch of lode junctioned with Empire lode. At 526 ft. east a south offshoot of the lode branched off, and has been followed 111 ft. At 737 ft. the level on the Empire lode was connected. The lode is pinched in very hard country, and further work was suspended. Bath south-east crosscut was started from Empire lode at Bath pass, and was driven a total of 645 ft. in a good class of country. Another 70 ft. will reach Royal lode. Empire lode—East of No. 5 shaft north crosscut the level was advanced from 395 ft. to 552 ft. the lode varying in width between 8 ft. and 14 ft. West of No. 5 shaft north crosscut the level has been advanced to 791 ft. It is found the payable ore extends from the 350 ft. west crosscut to 671 ft., a length of 321 ft., the lode varying from 10½ ft. to 18 ft. in width. At 444 ft. a crosscut was run north 13 ft., when north part of Empire lode was met 12 ft. wide. No. 2 shaft south-west crosscut was driven 56 ft. when Welcome lode was met. The level was then turned on course of Welcome lode, and followed to 240 ft. west from No. 2 shaft, where Welcome lode nominally junctions with Edward lode at Trout pass. Edward lode south—The level has been advanced from 240 ft. point to 435 ft. south of No. 2 shaft, which is a length of 195 ft. opened up on Edward lode; the lode here varies in width between 40 ft. to 75 ft. Martha lode, south section, west of No. 5 shaft north crosscut—The level has been extended from 376 ft. to 584 ft. At 400 ft. the lode has been crosscut; the north and south sections together are 50 ft. wide, and are separated from the Regina section of lode by 5 ft. of country; the Regina section is 15 ft. wide. Regina section of Martha lode—This section starts at about 390 ft. west of No. 5 shaft north crosscut, and was followed to 481 ft. west of same. At 400 ft. the lode is 15 ft. wide, and at 480 ft. the lode is 15 ft. wide.

No. 9 level: Dreadnought lode—At 444 ft. east of No. 5 shaft north crosscut, along the course of Empire lode, a crosscut was run south-east 14 ft. when the main part of the Dreadnought lode was intersected. It is 6½ ft. wide. Westward, 213 ft. was driven. Eastward, 8 ft. was driven where the lode is mixed with country. In No. 5 shaft north crosscut, 54 ft. from the shaft west crosscut, a leader that would correspond with the Dreadnought lode is showing, and it was driven on eastward 106 ft. Prospecting crosscuts—Sole south-east crosscut was extended from 92 ft. to 117 ft. from Edward lode. At 94 ft. the Royal lode, 3 ft. wide, was met.

No. 8 level: Dreadnought lode—At 550 ft. east of No. 4 shaft north crosscut, along the Empire lode, there is a quartz vein 12 in. wide branching off the Empire lode with a course of 225° (true), dip 3 in 5 north. This is believed to be the Dreadnought lode. It has been driven on west 34 ft.

Shafts: No. 2 shaft was sunk from 100 ft. below No. 9 level to 148½ ft., or a total of 1,227½ ft. from the surface. No. 4 shaft was sunk from 66½ ft. below No. 10 level to 108½ ft., or 1,256½ ft. from the surface. No. 5 shaft—Sinking in this shaft was resumed in June at a point 117 ft. below No. 10 level, and sunk to 167½ ft. below same, or to a total depth of 1,319 ft. No. 11 level was opened out at 1,301 ft. in a good class of country.

General: No fatal accidents and only one that could be classed as serious occurred during the year. Two sets of Draeger's mine-rescue apparatus have been obtained, and the shift-bosses are being trained in their use.

Waihi Grand Junction Gold-mining Company.—The Waihi miners' strike of 1912 retarded progress in this mine at least a year. A large number of the most competent miners left to obtain work in Australia and elsewhere. It was well into February before work was properly organized and the bottom level (No. 6) unwatered. The company was fortunate in having ordered an Ingersoll Rand compressor (2,000 cubic feet per minute) prior to the strike. This was installed as rapidly as possible, and to a certain extent overcame the shortage of miners.

The following is a summary of development-work done: Main and intermediate drives on lodes, 2,747 ft.; crosscutting lodes from drives, winzes, and rises, 511 ft.; rises on lodes and through country, 662 ft.; winzes on lodes and through country, 575½ ft.; driving and crosscutting through country, 1,327½ ft.; shaft-sinking, 86½ ft.: total, 5,909½ ft.

No. 6 level: George lode—The drive west advanced to 263 ft. from the south-east crosscut, at which point the lode junctioned with the Royal lode. From south-east crosscut to 186 ft. west the assays averaged £1 15s. 2d. for an average width of 55¾ in. From 185 ft. to 200 ft. the lode is narrow, and mixed with country. From 200 ft. to 235 ft., £1 3s. 6d.; width of lode, 44 in. From 235 ft. to 263 ft., 13s. 2d.; width of lode, 51 in. No. 1 rise (at 40 ft. west of the south-east crosscut) was advanced 90 ft. and holed to No. 1 winze from No. 5 level, at which point the lode is 11 ft. wide, assaying 19s. The first 24 ft. of rise assayed £1 15s. 4d. for 47 in., only the hanging-wall being exposed. From 24 ft. to 90 ft. the value was £2 9s. 10d. for 51 in., the foot-wall not being exposed. No. 2 rise (at 160 ft. west of south-east crosscut) advanced 31 ft. The reef was 38 in. wide, and assayed £1 1s. 6d. The drive east was advanced to 182 ft. east of south-east crosscut. The first 22 ft. assayed £1 11s. 3d. for 76 in. (width of lode); from 22 ft. to 86 ft., £1 0s. 11d. for 72 in. (width of lode). At 50 ft. east the lode and country rock were disturbed by a fault striking north, and values became low. At 86 ft. east the lode was 24 in. wide. From 86 ft. to 184 ft. the lode became narrow and low grade. A crosscut was thrown out at 155 ft. east, and advanced through solid country 18 ft. to the north (hanging-wall side) and 30 ft. into the foot-wall country. No quartz was found. Royal lode—Driving on east drive from 29 ft. to 90 ft. the value was erratic, and averaged £3 9s. 5d. for the width of drive. At No. 1 crosscut (at 90 ft. east) the lode consisted of quartz, calcite, and country rock 25 ft. wide, worth 4s. 8d. From 90 ft. to 182 ft. the drive followed a fissure filled with loose quartz and country of no value. No. 2 crosscut (at 170 ft. east) was projected to the south-east, and advanced 85 ft. through disturbed country. At 72 ft. in this crosscut 60 in. of quartz was passed through, which assayed £3 per ton. The main drive was then directed more to the east, and advanced through disturbed country to 300 ft., where a broken reef formation was cut, assaying 7s. 10d. per ton. Beyond 620 ft. the country rock became free from disturbance. At 750 ft. intersected 33 in. of quartz; value, 7s. 5d. This was followed to 780 ft., at which point a cross-lode striking north was cut. This lode was followed 33 ft. north-west; it was 33 in. wide; value, 10s. 5d.: also 33 ft. south-east for a width of 46 in.; value, 12s. 5d. per ton. A main crosscut to the Empire lode was started at 780 ft. east, and advanced 177 ft. through solid country. In this crosscut the following lodes were intersected: At 70 ft. north-west a lode 60 in. wide, assaying £1 6s.; at 105 ft. north-west a lode 18 in. wide, assaying 10s. 11d.; at 145 ft. north-west a lode 30 in. wide, assaying 3s. 2d. No. 9 rise was put up 54 ft., and holed into the crosscut at the bottom of No. 9 winze from No. 5 level. From No. 6 level to 45 ft. up, the rise passed through a mixture of stringers and country, the assay average being 12s. 3d. for the width of the rise. From 45 ft. up to the winze crosscut the rise was in ore assaying £3 3s., the hanging-wall being exposed, but not the foot-wall. West drive—Advanced 640 ft.; total, 691 ft. From 50 ft. to 114 ft. the reef consisted of loose quartz and rubble, and assays averaged £1 4s. for width of 74 in. The walls were irregular. No. 2 crosscut, at 290 ft. west, exposed lode 12 ft. wide, assaying 2s. 6d.; No. 3 crosscut, at 370 ft. west, exposed lode 11 ft. wide, assaying 2s. 5d.; No. 4 crosscut, at 465 ft. west, exposed lode 13 ft. wide, assaying 5s. 9d.; No. 5 crosscut, at 575 ft. west, exposed lode 26 ft. wide, assaying £1 12s. 6d.; No. 6 crosscut, at 630 ft. west, exposed lode 34 ft. wide, assaying £1 18s. 3d. No. 8 rise (at 30 ft. west of south-east crosscut) was sunk 60 ft. The lode was 36 in. wide, and the assays averaged £1 16s. At 60 ft. down the width of the lode was 45 in., assaying £1 7s. 3d. Empire foot-wall branch lode—The drive on the smaller branch of the foot-wall leader running into the south wall at 255 ft. west was advanced 175 ft., making total of 425 ft. Assays averaged—From 270 ft. to 293 ft., £7 1s. 5d.; width of lode, 35 in.: from 293 ft. to 364 ft., £6 9s. 1d.; width of lode, 44 in. At 345 ft. the lode again divided, another vein branching into the south wall. This vein for the first 10 ft. assayed £19 1s. 3d. for width of lode 37 in. After 17 ft. of driving the lode split into stringers, and died out. Driving on the north branch of the lode (west of the 345 ft. split) was continued. Values became low after 365 ft., being 12s. 3d. for 25 in. of lode. At 420 ft. west a crosscut was thrown out 28 ft. to the south and 87 ft. to the north connecting with the Empire lode. This crosscut was in country rock, and did not disclose anything of value. A branch lode connecting the foot-wall lode and the main Empire lode was located 260 ft. west. This had a length of 50 ft., was 12 ft. wide, and assays averaged £13 12s. 6d. This branch consists of a network of country and rich veins of quartz. No. 6 rise (at 115 ft. west) advanced 25 ft.; total, 116 ft. Assays from 90 ft. to 110 ft. averaged £4 7s. 3d., for width of rise of 32 in. The rise holed into the Empire lode No. 6 winze from No. 5 level. No. 3 winze is down 67 ft.; assays averaging, from level to 15 ft. down, for a width of 48 in., £21 11s. per ton; from 15 ft. to 50 ft. down, for a width of 45 in., £10 11s. 1d. per ton; from 50 ft. to 67 ft. down, for a width of 38 in., £2 1s. 9d. per ton. A crosscut at 50 ft. down exposes both walls, the lode being 8 ft. wide; value averaged £3 13s. 9d. per ton. No. 4 winze is down 37 ft.; assays averaged—Up to 7 ft., for a width of 42 in., £2 15s. 6d. per ton; from 7 ft. to 12 ft., for a width of 46 in., £4 4s. per ton; from 12 ft. to 30 ft., for a width of 42 in., £5 2s. 4d. per ton; from 30 ft. to 37 ft., for a width of 45 in., £13 10s. 5d. per ton: the walls are not exposed. No. 5 winze is down 26 ft.; assays averaged per ton—Up to 11 ft., for a width of 42 in., £4 9s. 6d.; from 11 ft. to 21 ft., for a width of 39 in., £3 9s. 9d.; from 21 ft. to 25 ft., for a width of 38 in., £2 1s. 4d.: walls not exposed. No. 7 winze is down 3 ft. Empire lode—East drive advanced to 973 ft. This drive is close to the foot-wall of the lode for the full distance. The following gives the values: From 244 ft. to 300 ft., £2 13s. 5d. per ton, for width of 62 in.; from 300 ft. to 414 ft., £3 18s. 6d. per ton, for width of 59 in.; from 414 ft. to 506 ft., £2 6s. 8d. per ton, for width of 58 in.; from 506 ft. to 581 ft., £1 18s. 6d. per ton, for width of 54 in.; from 581 ft. to 668 ft., £1 5s. 3d.

per ton, for width of 56 in.; from 668 ft. to 740 ft., 10s. 3d. per ton for width of 60 in.; from 740 ft. to 764 ft., £5 9s. 4d. per ton, for a width of 55 in.; from 764 ft. to 786 ft., £6 5s. 3d. per ton for a width of 51 in. At 786 ft. the reef is cut off by the main fault. The following crosscuts exposed the full width of the lode: No. 3 crosscut (at 280 ft. east of main crosscut), 22 ft. wide; value, 10s. 1d.: No. 4 crosscut (at 370 ft. east of main crosscut), 18 ft. wide; value, 9s.: No. 5 crosscut at (470 ft. east of main crosscut), 15 ft. wide; value, £1 8s. 9d.: No. 6 crosscut (at 565 ft. east of main crosscut), 12½ ft. wide; value, 11s. 6d.: No. 7 crosscut (at 680 ft. east of main crosscut), 21 ft. wide; value, 1s. Continuing the drive beyond the fault, the next 16 ft. is broken country. From 802 ft. to 809 ft. is disturbed quartz, assaying £3 2s. 6d. From 809 ft. to 856 ft. is disturbed country; from 856 ft. to 866 ft. is reef, assaying £1 15s. 9d.; from 866 ft. to 871 ft. is country rock; from 871 ft. to 874 ft. is reef, assaying £1 5s.; from 874 ft. to 880 ft. is country rock. Drives on the 856–866 vein and the 871–874 vein then advanced east to 920 ft., and also west until the fault was met. The two veins were broken out as one body a total length of 110 ft., the average width being 8 ft. and the average value £3 4s. 6d. per ton. From 920 ft. to 973 ft. east the main lode is disturbed, and low grade. At 920 ft. east a main crosscut to the Grace lode was started, and has advanced 165 ft. At 8 ft. cut 20 in. of quartz, assaying £1 10s.; at 15 ft., 36 in. of quartz, assaying £1 4s. 4d. The crosscut is in disturbed country to 70 ft. From 78 ft. to 124 ft. passed through a solid body of mixed quartz and country of low value. From 124 ft. to 165 ft. the country is disturbed. At 920 ft. east a main crosscut to the Royal lode was started, and has advanced through solid country to 213 ft. At 145 ft. it passed through a 42 in. seam of quartz of low value. No. 8 rise advanced 37 ft., making total 87 ft., and holed to winze from No. 5 level; the foot-wall was exposed, and the assays averaged £3 18s. 8d. for width of rise. No. 13 rise was put up 56 ft., and holed to winze from No. 5 level; the first 34 ft. assayed 18s. 11d. for 48 in. wide; the ore is narrow, and cuts out at 45 ft. above the level; foot-wall is exposed. No. 18 rise was put up 54 ft., and holed to winze from No. 5 level; the width of lode in rise is 41 in., and assays averaged £6 2s. 1d. per ton. No. 8 winze was sunk 50 ft.; assays averaged—From level to 14 ft., £1 17s., for width of 45 in.; from 14 ft. to 45 ft., £3 16s., for width of 35 in.; from 45 ft. to 50 ft., £1 11s., for width of 66 in. A crosscut at 50 ft. down exposed both walls. The reef was 25 ft. wide, and assays averaged £2 13s. 1d. No. 9 winze was sunk 37 ft.; assays averaged—From level to 26 ft., £2 8s. 6d., for a width of 38 in.; from 26 ft. to 30 ft., 8s. 11d., for a width of 39 in.: only the foot-wall being exposed. No. 11 winze was sunk 56 ft.; assays averaged—From level to 17 ft. down, no value; from 17 ft. to 48 ft. down, £1 3s. 4d. from width of 48 in.; from 48 ft. to 56 ft. down, £3 3s. 8d. from width of 40 in. The crosscut at 50 ft. down exposed lode of quartz, stringers, and country 10 ft. wide, which assayed £2 8s. per ton. At the west drive (west of south-east crosscut) the main drive advanced 128 ft., and reached the western boundary at 441 ft.; assays averaged—From 313 ft. to 365 ft., £2 7s. 7d., for 64 in. width; from 365 ft. to 441 ft., £1 10s. 7d., for 58 in. width. No. 4 crosscut (at 345 ft. west) proved the lode to be 10½ ft. wide, and assays averaged £1 2s. 10d. per ton. At No. 5 crosscut (at 420 ft. west) the lode proved to be 9 ft. wide, and assays averaged £2 6s. 6d. This crosscut was continued 26 ft. into the hanging-wall country, but did not disclose any further quartz. At 10 ft. west of No. 3 rise a crosscut was driven 21 ft. into the foot-wall country; no quartz was discovered. No. 4 rise was put up 35½ ft., and holed to the winze from No. 5 level. The walls were not exposed, and assays averaged 6s. 6d. for 48 in. width of rise. No. 4 winze was sunk 15 ft. in low-grade quartz; the walls were not exposed. No. 5 winze was sunk 12 ft. close to the foot-wall lode; from level to 7 ft. down assays averaged £2 19s. 4d. for 32 in.; and from 7 ft. to 12 ft., £1 18s. 8d. for 30 in. width. To effect a direct communication between the south-east crosscut and the Empire main lode west, 66 ft. was driven along the foot-wall of the lode. The average of assays along this drive was £1 1s. 5d. for a width of 77 in. Republic lode—No. 1 winze (60 ft. east of the south-east crosscut) was sunk 4 ft..

No. 5 level: Royal lode—No. 1 winze was sunk 73 ft.; assays averaged—From level to 32 ft., £2 1s. 6d., for 48 in. of width; from 32 ft. to 58 ft., 19s. 1d., for 47 in. of width; from 58 ft. to 73 ft., 15s., for 52 in. of width: the walls are not exposed. No. 8 winze was sunk 67½ ft.; assays averaged—From level to 21 ft., 9s., for 32 in. of width; from 21 ft. to 65 ft., £1 18s. 4d., for 40 in. of width: at 50 ft. down the lode is 5 ft. wide, with both walls exposed. Mary lode—No. 1 rise was started from the shrinkage stope at 70 ft. above No. 5 level. After 66 ft. of rising it holed to No. 1 winze from No. 4 level. Assays averaged, from stope to 15 ft. up, £1 7s. 6d., for 40 in. of width; 15 ft. to 66 ft. up, £1 12s. 8d., for 42 in. of width: the walls are not exposed.

No. 4 level: Mary lode—No. 1 winze was sunk 19 ft., and connected with No. 1 rise from No. 5 level; assays averaged £2 12s., for 40 in. of width: walls not exposed. No. 1 shaft (main) was sunk 77½ ft., making total of 1,167 ft. below the surface, and 85½ ft. below No. 6 level. Crossing the centre of the pump shaft is a reef striking north-east, and almost vertical. Assays taken 25 ft. below No. 6 level gave 8s. per ton, for 66 in. width; at 52 ft. down, 2 ft. on north-west side, gave a value of 13s. 7d.; the next 5 ft., 7s. 9d.; and next 6 ft. were valueless. At 55 ft. down, 5 ft. on south-east side assayed 7s. 9d. per ton; at 68 ft. down the reef was 10 ft. wide, and assayed £1 12s. 6d. across the centre of shaft and 18s. 8d. across the south end. At 73 ft. down the reef is worth 14s. for 9 ft. of width; and at 80 ft., 12s. 9d., for 8 ft. of width.

Milling results: 98,383 tons, of 2,000 lb. each, the average value of which was £2 1s. 7d. per ton, gave a gross value of £204,765 2s. 5d. Total value of bullion actually recovered, £180,019 19s. 9d. Extension of mill: Work in connection with the erection of another twenty head of heavy stamps was commenced in September. There is also included an ore-bin of 800 tons capacity, installation of a 150 horse-power motor with rope-drive, vanners, and other necessary appliances. Good progress is being made with this work, and it is anticipated that everything will be running by the end of April next.

Power plant: 6,588,708 units of power were generated, at a cost of slightly over ¼d. per horse-power hour. The new A.E.G. (Allegemeine Elektricitats Gezellschaft, Berlin) 2,680 horse-power turbo-generator, with switchboards and new boilers of 600 horse-power each, were completed and put into commission; also a new Ingersoll Rand air-compressor of 2,000 cubic feet capacity, driven by a 400 horse-power synchronous motor, added to the air-compressing plant.

Mine-rescue apparatus has been obtained, and the men are being trained in its use.

Waihi Standard Gold-mining Company.—The only work done in this mine during the year was confined to cleaning up the debris which found its way into the main shaft from the old workings during the strike.

Waihi Extended and *Pride of Waihi.*—Both these claims have been held under protection during the year.

Waihi Reefs Consolidated.—A new company has taken up this claim. It is proposed to sink the shaft a farther 286 ft., with the object of exploration at a depth of 1,200 ft. level.

Owharoa.

Rising Sun Gold-mining Company.—The low level has been extended a total distance of 2,200 ft., and four lodes intersected, varying from 6 in. to 30 in. in width, all of which gave payable assay values. A rise has also been put up and a connection made with the winze from the upper level. Ventilation is now all that could be desired.

Waikino-Waiomoko Syndicate.—This claim has been held under protection during the year.

Waitekauri.

Maoriland Gold-mining Company.—The principal work carried out in this mine during the year has been the extension of the low level, which is now in a total distance of 1,384 ft. The following lodes were passed: At 1,047 ft., a lode 2 ft. in width, assaying 11s. per ton; at 1,137 ft., a large body of quartz of low grade; at 1,304 ft., a reef 2 ft. 6 in. in width. A trial parcel of 20 tons was put through the mill; assay value from lip of boxes, £1 5s. per ton. The results at this level are considered satisfactory, and it is anticipated that when the No. 4 lode (worked in the upper levels with good results) is found it will be satisfactory. 1,192 tons from the stopes above the intermediate level produced bullion to the value of £2,286 2s. 9d.

Golden Cross Gold-mining Company.—At No. 1 level, the lowest available without pumping (865 ft. northward of the main crosséut), 121 ft. has been driven, and crosscuts put in at various points, exposing large bodies of low-grade ore. The drive is now in the payable zone, and several blocks have been located, which it is expected will be profitable. Recently an outcrop was located 110 ft. north of the main crosscut, and a trial crushing averaged £1 10s. per ton for a width of 8 ft. This appears to be a loop from the main lode, and as a considerable tonnage can be obtained at a low cost the discovery is important.

May Bell Syndicate.—One man has been employed prospecting this claim, and has discovered several small lodes giving fair assay values. An attempt is now being made to raise capital to further develop this property.

Karangahake.

Talisman Consolidated (Limited).—During the year a crosscut driven eastward from No. 12 level south intersected the Welcome reef; the lode where intersected being low grade nothing further was done on same. The south drive at No. 13 level has been advanced considerably beyond the boundary of the Dubbo ore-shoot, without finding anything of value. From the south drive crosscuts were put out east and west in search of parallel ore-bodies, but without success. The south drive at No. 14 level has disclosed considerable fair-grade ore in the Dubbo section. No. 6 winze, No. 14 level, has been sunk 40 ft., at which point water was reached; the width and value of the lode is well maintained. The Woodstock shaft was sunk to the random of No. 14 level (490 ft. from collar). The chamber for No. 14 level is cut, and crosscut for the Maria reef has been started. Talisman shaft (depth, 560 ft. below Waitawheta (or river) level): A large chamber was cut out and a horizontal pump 50,000 gallons per hour capacity has been installed. This pump is doing excellent work raising water to the river-level. Owing to the coal strike at Huntly this mine was closed from the 7th November until early in January, resulting in a reduction in the value of the bullion-production of £30,927.

New Zealand Crown Mines (Limited).—Below is a summary of the mining and mine-development work done in this mine for the past year: Crown lode—Driving, 695 ft.; sinking, 111 ft.; rising, 157 ft.; tons mined, 878; total gross value, £1,640. Welcome lode—Driving, 640 ft.; croscutting, 286 ft.; sinking, 452 ft.; rising, 548 ft.; tons mined, 11,589; total gross value, £24,910. Maria lode—Driving, 542 ft.; crosscutting, 39 ft.; sinking, 54 ft.; rising, 234 ft., tons mined, 2,832; total gross value, £5,952. Ore treated: Number of imperial tons treated, 15,299; ounces of gold recovered, 6,625; ounces of silver recovered, 10,600; value of bullion recovered, £28,884 16s. 4d.; average value recovered per ton of ore, £1 17s. 9d.; gross value of ore treated, £31,662; average value per ton (gross), £2 1s. 5d.; average cost per ton (exclusive of development), 34·28s. During the past year the following improvements have been carried out: Nos. 4 and 7 levels on the Maria lode have been connected by aerial tram-line, with hoppers erected at both ends. In the Crown section the change-house has been improved, and considerable additions made to the rock-drilling plant. A high-pressure pump has been installed for supplying water to rock-drills above the main adit level, and air and water services have been extended in that direction. Five slime-vats have been equipped with mechanical agitators, and conse-

quently a considerable improvement has been effected in the percentage of bullion-recovery. Towards the end of the year the company was reconstructed, and with the capital now available it is expected that a vigorous policy of development will be pursued.

Dominion Gold-mining Company.—During the year work has been confined to the extension of the eastern low level, which has been somewhat retarded by a heavy flow of water and the disturbed nature of the ground. A good class of country is now being penetrated, and, according to the mine-plan, No. 1 reef should be intersected shortly.

Paeroa.

Waihi-Paeroa Gold-extraction Company.—Owing to a protracted drought causing an exceptionally low river to the end of May, great difficulty was experienced in obtaining sufficient tailing to keep the works employed. To prevent a recurrence in any similar dry season, a permanent bridge has been constructed across the river in front of the works, and a high flume erected to convey the treated sands to a point nearly a mile downstream from the works. A good deal of trouble has been caused by buried logs, for the removal of which a Priestman dredge has since been employed. A tramway has been constructed for transport of coal and supplies from the railway-station. During the year 140,100 tons of sand treated produced bullion valued at £42,300.

Komata.

Komata Reefs Gold-mining Company.—Early in the year the drive south on Lavington's lode in the old Komata reefs section of the property was retimbered, and driving south resumed. The lode pinched from 4 ft. in width at the face to a few inches at 472 ft. therefrom. Towards the end of the year some work was done (D reef) in a crosscut on Smithy, or No. 1, level, Te Ao Marama section. After driving 38½ ft. north and 40 ft. south work was stopped, and protection has been granted. No work is being done in the mine. During the year 3,080 tons of ore was crushed and treated at the battery, for a return of bullion valued at £6,964 11s. 10d., in addition to which £21,024 18s. 8d. was obtained by a general final cleaning-up of the whole plant. During 1913 an average of twenty-two men were employed.

Maratoto.

Silver Stream Mines (Limited).—Operations in this mine have been chiefly confined to stoping on the Julia and Queen reefs above the low level. Thirty-one tons of selected ore shipped to Australia for treatment produced bullion valued at £1,115.

Tellurides Proprietary (Limited).—Owing to the extremely dry weather which prevailed during the year it was found necessary to construct another water-race. Work in the mine is still confined to extending the Gordon low level to 250 ft. to intersect the Julia, and 280 ft. to intersect the Queen lodes.

Te Aroha.

Hardy's Mines.—This property has been under protection during the year. The company, however, erected on the flat a small but complete cyanide plant to treat about 3,000 tons of tailing accumulated in the early days.

Waitawheta Gold-prospecting Syndicate.—A new ten-stamp mill, with cyanide plant, has been erected on the site of the old mill, which was burnt down early in January, 1912. No mining was carried out.

Coromandel.

Four-in-Hand.—Work has been confined during the year to prospecting; 120 lb. of picked ore treated produced gold valued at £83 6s. 6d.

Royal Oak Gold-mining Company.—This mine has been let on tribute. Four men obtained gold valued at £655 from the surface.

Venture Claim.—Owned and worked by Regan Bros., who received a Government subsidy to assist them in putting in a low level. Several small leaders were intersected, and 3 tons treated produced bullion valued at £43 10s.

Mount Welcome Gold-mining Company.—Work in this mine has been confined to driving a low level to intersect lodes satisfactorily worked in the upper levels, but which could not be followed down on account of the great amount of water. A Government subsidy of 5s. per foot was authorized for 600 ft. After driving 415 ft. a small lode was intersected, the ore showing gold freely, and 16 lb. of fair picked stone was selected. The lode is now being driven upon.

Exault and Ringleader Syndicate.—Prospecting operations were carried out upon different lodes outcropping on the surface. About 50 tons of ore have been selected for treatment.

Gallant Syndicate.—During the year a new shaft was sunk to a depth of 50 ft. and crosscuts started east and west from the bottom to intersect Scotty's and the Kapanga lodes immediately under where it is reported rich ore was obtained in the early days.

Old Hauraki Gold-mining Company.—This mine was worked by wages-men up to the end of August. The lodes, however, became poor, and owing to financial difficulties protection was applied for and granted, subject to the mine being let on tribute. During the year this mine produced bullion in value £2,158 3s. 10d., of which £1,112 was obtained by tributers.

Hauraki Reefs Gold-mining Company.—Operations have been principally confined to the Golconda reef at No. 1 level. Several stoping-blocks were opened up, gold being freely distributed through the ore. This work was carried on uninterruptedly until the adjoining Old Hauraki Mine ceased pumping, when this company was faced with the question of dealing with the water formerly raised by the Old Hauraki pumping plant. To deal with this water new pumping machinery was erected on the Hauraki north shaft 1,000 ft. nearer the present working-faces, and a solid concrete dam built in the main crosscut.

Armstrong Dredging Company.—At the beginning of the year the disintegrator mentioned in my last report was erected, but, owing to the low grade of the deposit and the difficulties experienced in dealing with it, operations were suspended, and the dredge and beach claim sold to Mr. H. H. Adams.

Bremner's Freehold Gold-mining Company.—Four men have been constantly employed at No. 1 and low level on Bremner's lode, which varies from 3 in. to 3 ft. in width. Four tons of general ore and 250 lb. of picked stone treated produced bullion in value £216 10s.

New Waitaia Gold-mining Company.—A stoping-block 300 ft. in length is now in progress over the back of the low level (No. 6). The lode varies in width from 6 in. to 3 ft. of ore. To the northward the value improves. Rises are being put up to secure better ventilation.

Mountain King Gold-mining Company.—The development-work carried out in this mine during the year consisted of driving north at No. 5 level for 225 ft., and crosscutting for several known reefs. The country proved unfavourable. Funds becoming exhausted, protection was applied for and granted. Gold valued at £1,726 7s. 2d. was obtained from small blocks left in the upper levels.

Handsworth United Gold-mining Company.—This mine was abandoned and sold to Mr. W. J. McLean in September, and is now under protection. 36 tons treated produced gold valued at £388 12s. 9d.

Barrier Reefs, Great Barrier Island.—This mine is owned by Mr. H. Brett. Operations are still confined to driving the low level. Very hard country is being penetrated, consequently progress has been somewhat slow.

PETROLEUM.

New Zealand Oil-wells (Limited), Taranaki.—The refinery was completed and commenced operations early in August. During the year it is stated that 179,750 gallons of crude oil has been obtained. The boreholes at Bell Block reached a depth of 3,710 ft. and 2,820 ft. respectively, without success. At Moturoa Nos. 3 and 5 wells were still flowing, and a rotary drilling plant has been erected and operations commenced to drill a new well about 6 chains from No. 2, which at the end of the year had attained a depth of 2,210 ft. The average number of men employed at the refinery and boreholes was seventy-one.

Taranaki Oil Lands Acquisition and Development Company (Limited).—This company started operations in the Moturoa district on a section of the Whitely Township in March. The plant installed is of Canadian Galician type. Boring was commenced on the 19th April with 17 ft. sheet-iron piping. The superficial water has been cut off by 12 in. casing at a depth of 973 ft. with cement. In the early part of November 10 in. casing was set in cement at a depth of over 2,000 ft., in order to isolate the salt-water flowing from the stratum situated between 1,700 ft. and 1,895 ft. On the 31st December an oil-flow was obtained which was reported to average fifty barrels a day. This company employs about fifteen persons. It is claimed that this well is the first in the district to reach a depth of 2,000 ft. with 10 in. casing and the oil-strata with 9 in. casing.

Phœnix Oil Company (Limited).—This company commenced drilling on a section marked (E) on the South Road in the Moturoa district last May. On the 22nd July, after the extraction of the 12 in. casing which was carried down 1,723 ft., the well on the 31st December had reached a depth of 1,836 ft., with 10 in. casing in movement. The work of drilling has proceeded regularly, and it is anticipated that the oil-strata will be reached in a few months. Ten persons are employed. The plant is identical with that installed at the Taranaki Oil Lands Acquisition and Development Company (Limited).

Consolidated Oilfields of Taranaki (Limited).—A start was made to erect a plant at Huiroa on Section 4, Block XII, in May. Boring was commenced on the 23rd July; 12 in. casing has been lowered to a depth of 885 ft., and there cemented in. On the 31st December this bore had reached a depth of 1,170 ft., with 10 in. casing in movement. Thirteen persons are employed. Plant similar to that already described.

United Oil Company (Limited).—This bore was the last to start on a site chosen on Section 29, Tikorangi district, on the bank of the Waitara River. Drilling was commenced on the 11th December, but, owing to the difficult nature of the surface country, only a depth of 31 ft. had been reached at the end of the year. This plant is in type similar to the foregoing, with the exception of the derrick, which is of iron. Twelve persons are employed. The two last-mentioned bores are for exploration, being started in unproven districts.

Bonithon Freehold Oil Company (Limited).—During the year a borehole was put down to a depth of 2,505 ft. Traces of gas and oil are said to have been encountered, but, unfortunately, some of the boring-tools were lost just before Christmas. Every effort was made to recover them, without success, casing now being withdrawn.

ACCIDENTS AND FATALITIES.

Fatal.

Talisman Consolidated Gold-mining Company, Karangahake.—On the 28th March, 1913, William Hyde and Thomas McBride were killed by falling down the Talisman shaft, due to the winding-rope breaking while these men were illegally riding on the skip. Action was taken against the mine-manager, Mr. Rickard, under section 254, subsection (24), and also under section 261 of the Mining Act, 1908. He pleaded guilty, and was fined £10 and costs on each charge.

New Zealand Crown Mines, Karangahake.—On the 11th December, 1913, Alexander Woods was killed by a fall of quartz in a leading stope above No. 6 level, Hauraki section, caused by a stull in the level below carrying away.

Non-fatal.

Waihi Mine.—On the 2nd September, 1913, blasting accident. Robert Glasgow received serious injuries to his skull and spine, but is now almost recovered.

Waihi Company's Electrical-power Station, Horahora.—On the 10th October, 1913, F. C. Smale was severely burnt on both legs and hand by coming in contact with live wire.

There have been numerous minor accidents, but those quoted are the most serious.

MR. BOYD BENNIE, INSPECTOR OF MINES, THAMES.

May Queen Mine.—The year's work has been confined to the No. 10 (1,000 ft.) level. On the Exchange reef, east and west of the main crosscut, about 300 ft. has been driven. A crosscut has also been advanced a distance of 270 ft. to intersect the Vanguard reef, which should be met with after another 30 ft. of driving. As the main crosscut at the 1,000 ft. level encountered the Moanataiari Slide, and a shortage of coal occurred owing to the strike, the Thames-Hauraki pump stopped and the mine was flooded. On several occasions during the year I inspected the mine, and always found it in good order. No ore was crushed. An average of ten men has been employed.

Thames Deep Levels.—The Victoria crosscut has been extended a further 70 ft. to a total length of 500 ft. seaward from the main crosscut. It having been found that the main crosscut face was dangerously near to the Moanataiari main slide it was agreed that a deviation should be driven, the point of commencement to be at the point where the Waiotahi shaft would meet the main crosscut at the 1,000 ft. level. At the time it was considered that the drive would be sufficiently distant from the slide to avoid all danger, but unfortunately this did not prove correct. On the 30th September last, the deviation being advanced a distance of 493 ft., water and gas at great pressure burst through the floor of the deviation crosscut at a distance of about 25 ft. from the face. So great was the inflow that the workmen were compelled to make a hurried exit, and all attempts to resume work have since failed. According to the known position of the slide it is safe to assume that the water forced its way through 100 ft. to 120 ft. of country. It is most unfortunate that the present delay has occurred, for a further 157 ft. of driving would have completed the connection with the Kuranui-Caledonian shaft which the Deep Levels Mining Board was formed to accomplish. The quartz veins met with during the year have been very few and small, varying in width from 2 in. to 4 in., containing mostly crystallized limestone and calcite. During the year I inspected the mine on several occasions, and found it in good order. The ventilation, which has been well maintained, was always much above the standard required by the Act. An average of ten men has been employed throughout the year.

Thames-Hauraki Pump.—The year just closed has been full of incident as far as pumping operations have been concerned, but with the exception of two accidents to the draw-lifts, the plant has run remarkably well. On the 5th January, 1913, the pump stopped for about eight days to allow of the annual overhaul, the most important piece of work being the fitting of a new pinion-wheel, imported from England, on the crank-shaft of the pumping-engine to replace the old one, which had several broken teeth. In the shaft the new steel girders carrying the bottom plungers were stiffened and supported by heavy timbers. A staging was constructed at No. 5 level to facilitate the operation of bucket-changing. The stoppage caused the water to rise 140 ft. in the shaft, but on the 13th January the pumps were again in commission, and on the 24th of the same month the shaft was clear of water. On the 15th February, water having been again tapped at the 100 ft. level, the pumps were taxed to their utmost; but on the 19th February the bore-hole was closed, and the speed of the pumping-engine was reduced to normal. On the 21st February a hoop on one of the draw-lift buckets burst, and not only caused the bucket to become jammed, but bent three and broke one of the draw-lift rods. Both steel and wrought iron have been tried in the construction of these rods, but with the same result. In order to prevent a recurrence of such an accident a hoop of a different construction was successfully introduced and the bucket altered to suit. On the 7th June, without warning, the two prongs at the fork at the top end of one set of draw-lift rods broke clean off, and allowed the draw-lift rods to fall away and jam the bucket in the working-barrel. Considerable difficulty was experienced in effecting repairs. On the 30th September a large flow of water, accompanied with much gas, was met with at the 1,000 ft. level deviation crosscut. This necessitated the speed of the pumps being increased from seven to seventeen revolutions per minute to cope with it. Since that date and up to the 13th December last, when the pump stopped for the annual overhaul, the speed of the engine has been gradually decreasing, on which date the number of revolutions per minute was seventeen. The air-compressor and Roots blower gave entire satisfaction throughout the year, but on the 24th October, owing to the scarcity of fuel on account of industrial troubles, the former was stopped and the latter was run at a reduced speed, it being necessary to ventilate the shaft to permit of the pumps being attended to. I examined the plant on several occasions during the year, and found it in good order.

Saxon Mine.—The north crosscut at the No. 7 (552 ft.) level was extended a total distance of 135 ft., when the No. 3 reef was intersected, but owing to an influx of gas (CO_2) and the inadequate means of ventilation work was suspended. In June last the Sirocco single inlet fan of 55 in. diameter, driven by a Pelton water-wheel, was installed, thus allowing work to be resumed at the No. 7 level. A crosscut has now been driven about 500 ft., with the object of cutting the Cardigan Nos. 1 and 2 reefs, which should be intersected after another 50 ft. of driving. The mine was inspected on several occasions during the year, and found to be in good order. Nine men have been employed. No crushings were made.

Waiotahi Mine.—During the early part of the year work was confined to driving east on the main reef and stoping on the new and cross reefs at the No. 7 (528 ft.) level. On the 3rd March

this work was suspended, and a start made to put down a borehole from the bottom of the shaft, which is 602 ft. from the surface, to the 1,000 ft. level. The object of this was to drain the water and permit of the shaft-sinking being proceeded with, but unfortunately, after boring 320 ft., the boring-rods broke off at the core-barrel. All attempts to recover the core-barrel and the diamond-crown failed, but the attempt to drain the shaft was successful. Sinking was resumed, and a further 134 ft. has been sunk. From the 1,000 ft. level an uprise has been constructed for a height of 93 ft. During the year 536 ft. has been driven at the 1,000 ft. level in the Waiotahi ground. I inspected the mine during the year, and found it in good order. 62 tons of ore was crushed, for a yield of 41 oz. 7 dwt. of gold, valued at £114 4s. 6d.

Moanataiari Mine.—Work at this mine was at a standstill during the year up till May, since when an average of six men have been employed. A drive has been constructed through the main slide at the No. 3 (300 ft.) level, with a view to picking up the lost portions of the Caledonian reefs Nos. 1 and 2, and also the Moanataiari No. 4 reef, hillward (south-east) of the slide. In the early days of mining on the field these reefs were very productive, and the recovery of them may extend the life of this mine. In driving through the slide a small quantity of what appeared to be carburetted hydrogen-gas was found, but it soon was cleared away I examined the mine during the year, and found ventilation dull. No ore was crushed.

Kuranui-Caledonian Mine.—Owing to the delay in completing the Deep Levels crosscut this company has done very little development during the year, and as their capital was practically exhausted it was found necessary to reconstruct the company. This mine was under protection up till June last, since when two men have been employed. Upon inspection, I found the mine in good order.

Kuranui Mine.—Operations have been principally of a prospecting nature. At the Battery level, Section 2, short drives failed to intersect profitable quartz leaders. The Magazine level was extended a further distance of 460 ft., making its length a total of 890 ft., and during its later extension several quartz leaders varying from 2 in. to 30 in. in width were cut through, and a few pounds of picked stone secured from one of them. This low level is through previously unexplored country. This claim was one of the first gold-producers of the early days. I examined the mine on several occasions during the year, and found the conditions fair. Five men have been employed.

Waitangi Mine.—During the year the following amount of development has been carried out: Driving, 300 ft.; crosscutting, 56 ft.; rising, 86 ft.; sinking, 41 ft.; stoping, 120 ft. The intermediate drive, east of the winze sunk from No. 3 level, has been extended a further distance of 29 ft., making a total distance of 49 ft. from the winze. About 5 ft. of the hanging-wall portion of the reef was broken out and 60 tons of this ore saved for treatment. A crosscut was advanced a distance of 30 ft. through the foot-wall of the main reef to intersect No. 1 and No. 2 leaders, the latter being driven on for a distance of 45 ft., where the leaders junctioned with the Siam reef. The leader was stoped out for a height of 25 ft. above the drive, and 60 tons of ore and 80 lb. of picked stone saved for treatment. No. 1 leader was driven on for a distance of 51 ft., and a drive put up for a height of 24 ft. to intersect the No. 1 winze which was sunk in No. 3 level. 6 tons of ore and 20 lb. of picked stone were selected from this leader for treatment. A drive was put in from No. 4 Beach level to drive south on a 2 ft. 6 in. reef, which was cut through in the main level, but after driving a distance of 77 ft. there was very little encouragement, and the work was stopped. A No. 2 intermediate level was put in east of the rise and 50 ft. below No. 1 intermediate level. A total distance of 39 ft. was driven on the reef, but no gold was seen. A crosscut has extended 15 ft. through the foot-wall of the reef to pick up Nos. 1 and 2 leaders. Rising in the low level east of the fault has been in progress and a height of 62 ft. reached. A drive was also started in the No. 4 level on the main reef west from the north crosscut, and is now in a total distance of 59 ft. About 2 ft. of the foot-wall portion of the reef was broken out, and assayed £2 1s. per ton. I examined the mine during the year, and found conditions very satisfactory. An average of seven men has been employed.

Watchman Mine.—For a short period at the beginning of the year attention was directed to the development and opening-up of the several ore-bodies, from which assay samples gave satisfactory results. As a practical test of the ore, a bulk sample of 750 tons was treated at a local milling plant for a return of £2,241 16s. 9d. The company subsequently decided to purchase the milling plant of the New Day Dawn and Norfolk Company, and also that company's property. Pending the reconstruction of the milling plant, and also the erecting of an aerial tram-line which connects the mine with the mill, all underground development has been suspended. At No. 1 level (Middle Parallel reef) a connection has been made with No. 4 rise—distance driven 220 ft. on an ore-body 3 ft. to 9 ft. wide. A crosscut 26 ft. in length has connected the Parallel and Middle Parallel reefs. No. 5 rise on the Middle Parallel reef was risen to a height of 100 ft. on an ore-body 4 ft. wide. No. 6 rise, 365 ft. south of No. 1 rise, was put up to a height of 62 ft., and crosscutted at various points, proving the reef to be about 10 ft. wide. No. 4 rise was risen to a height of 100 ft., the values being encouraging. With a view to improving the Sunbeam Creek tunnel for horse-haulage and to providing a more direct connection with the mine-working on the reefs, a deviation crosscut 300 ft. in length was constructed, and the tram-line relaid. The mine was examined during the year, and found to be in a satisfactory condition. Ventilation good. An average of fifteen men has been employed.

Dixon's Consolidated Mine.—In the early part of the year a little prospecting was done on the reef outcrop, but owing to the discouraging value of the ore, work was suspended, and later the company went into liquidation.

New Sylvia Mine.—This mine has again proved the most productive mine in the Thames district. 10,103 tons of ore was crushed, for a return of £16,351 4s. The principal development

was as follows: The reef of the No. 2 level was driven on for a distance of 120 ft., where a break was met with and the reef cut off. A drive was advanced in the No. 3 level on the reef, which was composed of fair ore. At present a block is being stoped out for a distance of 300 ft. in length. In the intermediate level a drive was constructed south for a distance of 242 ft. on a reef 4 ft. wide. On the No. 1 reef, a heavily mineralized ore-body, stoping is being carried out for a distance of 150 ft. The Battery level drive was extended a further distance of 220 ft., the reef maintaining its size. Here a block of ore 110 ft. long is being stoped. In the low level the crosscut was extended a further distance of 878 ft., and when in a total distance of 2,645 ft. the No. 2 reef was cut, and proved to be 9 ft. wide. Here in July last, a big flow of water having been struck, the water from the Battery level was drained. On the surface a new lode was located and the ground pegged off and applied for. Owing to the heavy swelling nature of the country, repairs are constantly being carried out. I examined the mine during the year, and found it in good order. An average of sixty-one men has been employed. I regret to state that on the 11th January, 1913, two men were killed by a fall of earth and rock in the stopes.

Worksop Claim.—This claim was formerly known as the Tararu Mines (Limited). The present owners are cleaning up and timbering an old drive, with a view to working a branch reef, from which the former company procured some highly payable ore. There are two men employed.

Monowai Mine.—The principal work in this mine was carried out at No. 1 level, where a large reef was intersected and driven on right and left for some distance, and subsequently stoped. On the outcrop of the reef a landslip occurred, carrying portion of the reef matter with it. From this slip a quantity of rich ore was picked.

Later in the year work was recommenced at No. 3 level, and the reef cut into at a point not previously tested. At this level an air-compressor was installed for rock-drills. I examined the mine during the year, and found it in good order. From 1,122 tons of ore gold to the value of £2,134 5s. 4d. was won. An average of twelve men has been employed throughout the year.

Portia Special Quartz Claim.—Operations consisted chiefly of stoping on a small quartz leader about 3 in. wide, from which 11 tons of general ore was obtained, and returned £362 10s. As further mining would necessitate the driving of a new low level, the claim was abandoned and the lease surrendered. During the early part of the year two men were employed. I examined the mine during the year, and found it in fair condition.

Nonpariel Mine.—For the year the chief work has been stoping, rising, and sinking. On the Wade reef a small block of ore was stoped out, stoping and rising were carried out on the Branch reef, and sinking on the Liverpool Boy's reef. 20 tons of ore was treated, for a return of £1,131 19s., which may be considered as very satisfactory considering that only four men have been employed. I examined the mine during the year, and found it safe. Ventilation dull.

Ballarat Claim.—This claim, 1 acre in extent, which has been worked by the present manager and owner for some years, still continues to yield highly payable ore. For the year, 6 tons of ore and 80 lb. of picked stone was crushed, for a return of £382. For a short period of the year two men were employed. It is the intention of the owner to drive into a small quartz leader known as McCurdie's, from which he expects payable ore.

Golden Drop Mine.—The owner alone works this claim, and has done a little prospecting during the year, but failed to locate anything of importance. No ore was crushed.

Gladstone Claim.—This claim is a small one of 3 acres, and was part of an area held by a mining company who put in several drives and located and worked a reef formation with varying results. The present owner and manager has cleaned up one of those old drives, and after extending it a short distance, located an ore-body from which 23 tons of general ore with 563 lb. of picked stone was selected and treated, returning 537 oz. 7 dwt. of bullion, in value £1,344 13s. 6d. Considering the results, and that only two men are employed, more vigorous methods of mining might be employed.

Little Nell Mine.—The present owner and manager has recently taken up this claim, which has an area of 5 acres, and which was formerly part of a claim worked by a mining company some years ago, when several levels were driven on the then known line of reefs. The present owner opened up one of those old drives, and has located a reef of about 2 ft. in thickness. To transport the ore from the mine to the county road a wire tram (or flying-fox) has been erected, and with a short tram-line easy access is established to and from the mine. During the year 80 tons of general ore and 180 lb. of picked stone was treated, for a yield of bullion in value £561 4s.

Karaka Mine (Limited).—This company has gone into liquidation, and the fine winding-engines, air-compressor, and milling plant, &c., are being offered for sale. It is very regrettable to think that of a capital of £20,000 so much should have been spent on mining machinery, and less than one-fifth of the amount on mine-development. This property still remains unproven as to its mineral resources. During the two years the company has driven 1,600 ft. and sunk 230 ft., and cleared and retimbered 200 ft. of old drives. Several small leaders have been located, from which some stone showing free gold has been secured. However, nothing of a payable nature was located. I examined the mine during the year, and found it in good order. An average of twenty men was employed.

Occidental Mine.—At No. 4 (adit) level a crosscut was driven eastward from the old workings for a distance of 130 ft. to intersect the No. 2 reef. The drive was then continued northward on the line of reef for a distance of 50 ft. At the intersection of the reef and the crosscut a chamber has been excavated and a main shaft is being sunk, and has now reached a depth of 85 ft. It is proposed to install an electric hoist at No. 4 level, and sink the shaft to a depth of 120 ft., and drive on that level. Stoping, with satisfactory results, has been carried on between Nos. 4 and 5 levels on the No. 2 reef. On No. 2 reef a winze was sunk to a depth of

50 ft. at the No. 5 level, and a drive was extended northward on the reef for a distance of 50 ft. A little stoping was done over this drive, with fairly satisfactory results. At the present time work is confined to stoping on the No. 5 level and sinking the shaft. I examined the mine during the year, and found conditions fair. 100 tons of ore and 590 lb. of picked stone was crushed, for a return of £2,710 2s. 8d., and an average of eleven men was employed.

New Cambria Mine.—To develop the property the owner has been endeavouring to raise capital. The principal work was done by tributers, who located nothing of payable value. 18 tons of ore was treated, for a return of £44 15s. I visited the mine during the year, and found it safe.

Golden Belt Mine.—Work has been confined principally to the low level, where the reef has been driven on for some distance from an intermediate level of the main (No. 2) rise. The ore is of fair quality. At the No. 1 (adit) level a reef has been located and driven on for some length, and the ore averaged £3 5s. per ton. Since October 215 tons of ore was treated, for a return of £665 17s. 3d., and as this ore came from three different levels in the mine, the future prospects of the Golden Belt are promising. I examined the mine during the year, and found it in good order. Ventilation fair.

Tairua Golden Hills Mine.—Operations have been confined to stoping over the No. 3 level, and 600 tons of general ore was treated during the year, for a return of £920 16s. 5d. Eight men have been employed.

Tairua Mines.—Early in the year this claim was purchased by Mr. H. H. Adams, who is now making preparations to work the property, especially a section which is believed to be capable of giving satisfactory returns. As mining in the Tairua district is dormant it is hoped that something payable will be located. Two men have been employed.

Daisy Claim.—The owner drove an adit for a distance of about 60 ft., when a small reef was cut into, and the drive was then continued for a distance of 20 ft. During the year 40 tons of ore was mined, for a return of £162 19s., a very satisfactory return. I examined the mine during the year, and found it safe. One man has been employed.

West Coast Claim.—Operations on this claim during the past year have been carried on by two men, who have been solely engaged in prospecting. I regret to state that, owing to nothing of payable quality having been discovered, the owner has sought protection. A ton of ore was crushed, and yielded gold to the value of £9 2s.

Thames Foreshore Dredging-works.—The dredge has been working only at intervals during the year. As the alluvial deposit at times contained stiff clay, alterations in the mode of treatment were necessary, and a Huntington mill was consequently installed on the dredge. The value of gold obtained during the year was £290 5s. 5d., a sum which would hardly pay working-expenses.

AID TO PROSPECTING.

Whenuroroa Prospecting Association.—This association received aid to prospecting from the Mines Department, in order to prospect on the Puhipuhi Goldfield for cinnabar. A drive of 200 ft. was constructed, but no lode was met with, although the surface of the drive was covered with cinnabar. An effort is now being made to raise capital to develop the property. I examined the drive during the year, and found it safe. Two men were employed.

Waiparera Gold-mining Syndicate.—This syndicate received £20 from the Mines Department for the purpose of prospecting for gold at Puhipuhi. Two winzes were sunk on a large lode formation, and were connected by a drive 70 ft. in length. I regret to report that the results of several assays of the ore were very discouraging.

Whangarei Cinnabar Company.—A number of prospecting-shafts were sunk to depths varying from 40 ft. to 60 ft., and a surface tram-line connecting one of the shafts with a smelter recently erected was constructed. As this company has spent a considerable sum in the development of their property it is to be hoped that the quality of the cinnabar (of which some assays have been made) will be maintained.

Tui Special Quartz Claim.—William Hollis, owner of this claim, received £75 assistance in the driving of a low level to cut a lode which is reported to contain payable ore. This level has now been put in to a distance of 300 ft., and after another 50 ft. of driving it is stated that the lode should be intersected.

General Prospecting.—Hughes and Conole, Lee and O'Brien, and Bentham and George received aid to prospect in the Thames County, but the results were most disappointing, nothing being located.

PROTECTION.

The following mines have been protected during the year: Victoria, Reliance, Thames, Alburnia, Bonanza, Dixon's Consolidated, Kapowai, Good Hope, New Magnet, Lord Nelson, Otanui-Mascotte, Champion, and Tairua Monarch.

ACCIDENTS AND FATALITIES.

Fatal.

An accident resulting in the loss of two lives occurred on the 11th January, 1913, at the New Sylvia Mine, David Christie and Joseph Senior being killed by a fall of rock and earth in the stope in which they were working.

Non-fatal.

Several minor accidents occurred during the year, but none were of a serious nature.

WEST COAST INSPECTION DISTRICT.

MR. T. O. BISHOP, INSPECTOR OF MINES.

QUARTZ-MINING.

Marlborough.

Dominion Consolidated Developing Company. — Operations were carried on continuously during the year, and developments in the mine have been satisfactory. The yield of scheelite for the year was 59 tons 19 cwt., value £6,491 13s. 5d.; and of gold, 1,421 oz. 6 dwt., value £5,428 5s. 3d.

Jubilee Top Valley Mine.—Work was entirely suspended for a time, but has been resumed, and two men are again employed in driving, in the hope of striking a reef in the low level.

There is nothing new to report. No other quartz-mining is being carried on in Marlborough.

Nelson.

Golden Blocks Mine.—This mine was closed down at the end of June, all the developed ore-bodies having become exhausted. I am informed that further development-work will be undertaken in the coming year.

The Johnstone's United Mine.—No work has been carried on during the year, but there has been an attempt made to obtain capital for further development-work in this property, but so far it has not been successful. During the years 1893, 1894, 1895 this mine treated some 12,000 tons of ore, the yield of gold being a little under 4 dwt. per ton, and the Inspector's reports for those years are not at all encouraging for future work.

Mount Arthur.—No further prospecting for reefs has been carried on during the year, and nothing of value has been discovered.

Murchison.

The Murchison County Council had some prospectors out in the Maruia and Matakitaki Valleys searching for reefs, but nothing of any value was discovered.

Lyell.

New Alpine Mine.—No work has been carried on during the year, and it appears that this mine will now be finally abandoned.

Victory Mine.—Nothing has been done during the year.

Westport.

Swastika Mines.—Development has been carried on throughout the year, six men being employed. 22 tons of quartz from this work yielded 7 oz. 19 dwt. of gold, valued at £31 2s. 6d. A company has now been floated to develop the mine more fully.

No other quartz-mining has been carried on during the year.

Capleston.

Just-in-Time Mine.—Prospecting by driving on the line of reef has been carried on during the whole year, but without any profitable result. It is probable that work will cease early in the new year.

Welcome and Fiery Cross Mines.—This property is still idle, and occasionally forms the subject of a suit in the Warden's Court. It does not appear likely that any work will be undertaken on the property at present.

Victoria Range Syndicate.—This party is still pushing on the low-level crosscut, which has now been driven 1,400 ft. in solid country. The present intention is to drive it 3,000 ft., and thoroughly prospect the country beneath the old Kirwan's Reward workings.

Big River.

New Big River Mine.—The new winding-plant and air-compressor have been completed, and this is the most modern plant on the field. The boiler is a Babcock and Wilcox of ample horse-power. The winding-engine by Robey is capable of winding from a depth of 3,000 ft., and is fitted with modern automatic overwind-prevention gear, and the air-compressor is capable of more than will be required of it in the present stage of development of the mine. Ore has been mined from the stopes above No. 10 (or 1,575 ft.) level during the whole year, and the 4,970 tons crushed have yielded at the very satisfactory rate of £5 12s. per ton. The winze below No. 10 level has been sunk 70 ft. in a strong reef all the way, and gold is freely showing in the stone. A new block of ore has also been struck in No. 10 level north, and is opening up well; so that ore-development is being kept well in advance of requirements. The working-conditions of the mine have been improved by the installation of compressed air, and water-sprays and a roomy and well-designed change-house have been provided for the workers.

Reefton District.

St. George Gold-mining Company.—Development-work was carried on till the end of April, and then discontinued, the drive having reached the point where it was expected to strike a reef. It is proposed to carry on further work early in 1914.

Cumberland Group of Mines, Merrijigs.—The Consolidated Goldfields Company is carrying on some further prospecting in the old Scotia and Cumberland Mines, and have bailed out and repaired the Scotia shaft, with the object of driving at the 300 ft. level. The Merrijigs reefs have been rich on the surface, but have never been mined to any depth, and the present operations should therefore give some valuable information about this portion of the field.

Progress Mines.—Work has been carried on continuously throughout the year, but the ore mined has been of very low grade. The surface deposit of conglomerate referred to in last year's report proved on trial to be of very low average value, although in places it gave very good prospects. Early in December a prospecting-drive in the main south fault of No. 10 level struck a body of ore of good value, and, although it is yet too early to say much about this find, it appears at present to be a very solid body of ore. Should this prove to be the case it will give a fresh lease of life to a mine which for some years now has been steadily declining.

Bonanza Claim.—No work has been done during the year.

New Discovery.—No further development-work has been done. A small crushing of 20 tons gave 2 oz. 4 dwt. of gold. Work has now been abandoned.

Keep-it-Dark Mines.—Mining and treatment of very low-grade ore has been carried on throughout the year. The main shaft has been sunk for a further distance of 150 ft., making the total depth 1,385 ft. The reef has been struck in the No. 9 level, and an uprise connected from No. 9 to No. 8. Between these levels there is a strong body of ore, and so far is of good average value.

Wealth of Nations Mine.—Mining operations have been continuous throughout the year, 23,661 tons having been treated. A small mullocky reef was struck in a crosscut west at No. 9 level, and was driven on both north and south. No further development-work has been started from the bottom of the shaft, and nothing of great importance has been added to the ore-reserves.

Golden Fleece Mine (Consolidated Goldfields).—No work has been done during the year, but a drive has been started from the Wealth of Nations to connect the two properties.

Bolitho Bros.—This party has been working steadily during the year, and has treated 868 tons of cement, with payable results.

Murray Creek Mines.—The development-work in this mine resulted in the discovery of a fine body of ore, but this was found to be right on the boundary of the Golden Fleece Claim. Negotiations with the Consolidated Goldfields Company have been in progress for some months, and in the meantime work at the mine has been suspended. The battery has been put into repair, and is now ready for crushing.

Anderson's Reef.—An option on this reef was taken by the Consolidated Goldfields Company, who have employed four men in driving and crosscutting during the year. Some quartz has been obtained, but so far no solid reef has been struck.

New Ulster.—No work has been done for the year.

Pride of Reefton.—This is the old Sir Charles Russell line of reef under a new name. One of the drives put in many years ago has been reopened and cleaned out and the reef tested at various places. Although good values were obtained at one or two points, I am informed that the average was very poor, and work has been suspended for the present, while an attempt is being made to raise capital for further work.

Blackwater District.

Blackwater Mines.—This company have had a fairly successful year's work, having produced £82,224 worth of gold from 45,053 tons of ore. One dividend, absorbing £12,499 12s., was paid during the year. Nos. 5 and 6 levels are now being driven north and south, and in both the reef is being followed, but is of small average width. Preparations are being made to continue sinking the main shaft.

Millerton Mine.—Development of this property is in progress, and during the year the shaft has been sunk 70 ft., and plant has been installed for sinking a further 250 ft. A good deal of necessary surface work has been completed, and the opening-up of the mine should now proceed more rapidly. Nothing more is known as to the value of the reef than was known a year ago, the future of the mine depending entirely on the result of the present sinking operations.

Prohibition Mine.—This property adjoins the Blackwater Mines to the north, and that company had it under option for a time and did considerable prospecting-work upon it, both from the surface and from the No. 2 level of their own mine. This option lapsed, and a new company has been formed to work the mine. Preparations are being made to sink a main shaft 2,000 ft. to catch the northerly pitch of the Blackwater reef.

Blackwater South (Absolom and party).—This claim adjoins the Blackwater Mines on the south. It was supposed that the Blackwater reef would run through it, and considerable work was done on a track which appeared to be about in the line of that reef. In driving on this track a few boulders of quartz were met with, but nothing encouraging, and it is most probable that this is only a fault-line carrying a little dragged stone. There are two other small outcrops on the lease, but not enough work has been done to enable them to be judged. About the best that can be said of this claim is that it is worth prospecting on account of its location, but that the work done so far has given very disappointing results.

Several other areas have been prospected in the Blackwater district during the year, and numerous reefs are known to exist, but no discoveries of any value have been made, and the number of men engaged in prospecting is steadily diminishing.

Paparoa Ranges.

This once-promising quartz-field has been almost entirely neglected during the year, but Messrs. Hargreaves and party have continued driving a crosscut at the head of Moonlight Creek. A reef carrying gold was found at the surface, and was also intersected in one tunnel. This led to the commencement of a second tunnel at a lower level, but in this one the country has been flattened very much, and so far the reef has not been struck. Work is being continued.

Poerua.

Poerua Gold-mining Company.—The result of the trial crushings from this mine having been disappointing, work was suspended during the year. Some further prospecting is now being carried on by means of a winze.

Wilberforce Reefs.—No work has been done during the year.

Ross.

Mr. H. J. Turner, of Wanganui, reports a payable reef at Cedar Creek, and is proposing to erect a battery right away. Outcrops have been known in this locality for many years, and two different batteries have been erected, and after working for a time were abandoned. Samples taken by Mr. P. G. Morgan, Director of the Geological Survey of New Zealand, and assayed at the Dominion Laboratory, gave only 1 dwt. 6 gr. of gold, value 5s. 1d. per ton. These reefs are certainly worth a little further prospecting by means of driving or sinking, but it would be very unwise to expend money on erecting a battery at the present stage.

QUARTZ REEFS CONTAINING MINERALS OTHER THAN GOLD.

Wangapeka.

Blue Creek Company.—The Blue Creek Company, of Christchurch, still continues desultory prospecting about the reefs in the Nuggety Creek Valley, but very slow progress is made, and no further knowledge has been gained as the result of the year's work. Several reefs are known, and they contain galena, pyrite, chalcopyrite, zincblende, siderite, and probably traces of other minerals, but no body of ore has as yet been discovered which could be regarded as profitable to work. It is possible that pockets of ore may exist somewhere on the line of these reefs, or associated with them, but the fact that no payable pockets have been found on the surface is not at all encouraging where surface outcrops are so numerous. To thoroughly test these reefs would involve a heavy expenditure, and without more attractive showing at the outset it is doubtful whether this work will ever be undertaken.

Van Belle, Balting, and Grace.—A Nelson syndicate has also been prospecting in this locality, but so far I have never seen anything payable on their areas.

Mount Owen District.

Mount Owen Rising Sun Mineral Company.—This company is now in process of liquidation.

Silverstream Syndicate.—No work has been done during the year to further test the cupriferous quartz reefs in this locality. On my last visit some ore of very good quality was being obtained, but it was only occurring in small and irregular lenses in the granite, and unless a large tonnage could be obtained this would be of no commercial value. The largest body, known as the New Anaconda, is now being tested by means of a drive, and this appears to be a better show than any of the others, but in a low-grade copper proposition situated in such difficult country as this is the available tonnage would require to be enormous, and the existence of such tonnage has yet to be proved.

Parapara Iron Leases.

The *Cadman Lease* has been under protection for the whole year, and no work has been done.

The *Onakaka Syndicate* has had some twenty men employed in clearing the surface and in making tracks.

Scheelite.

This mineral is found with gold in the Dominion Mine, Wakamarina. About 60 tons was obtained during the year; value, £6,491.

ALLUVIAL-GOLD MINING.

Marlborough.

Brothers Claim (Larkin and party).—This party is still endeavouring to work with an inadequate supply of water. Very little has been done for the year, and only £25 worth of gold has been obtained.

Wakamarina Darkie's Terrace Sluicing Company.—Now in liquidation. Work was carried on during part of the year, but the results were so poor that the company has been wound up.

New King Solomon Mines, Mahakipawa.—Work has been carried on intermittently during the year, the pumping plant having given considerable trouble through breakages. No work has yet been done underground.

Reardon and party have taken up a claim adjoining the King Solomon, on the upstream side. They have also started pumping, but have nothing else to report.

Collingwood District.

Parapara Hydraulic Sluicing and Elevating Company.—Work has been carried on continuously during the year, with about the usual average results. There is nothing fresh to report.

Aorere Hydraulic Sluicing Company, Slate River.—Very little work has been done during the year, three men having been employed portion of the time, for a return of 80 oz.

Maruia District.

Walker's Maruia Sluicing Company.—The water-race has been completed and sluicing operations commenced, but the race has given considerable trouble, and the gold-return for the year is given as nil.

The history of alluvial-mining companies in the Murchison County can so far be written in the one word "failure," and it now appears the Thompson Maruia Claim is not going to prove an exception.

Matakitaki.

Richardson and party continue to make a success of the Horse Terrace Claim, and this is a further example of the fact that a claim which is no good to a company is often a good thing for a working party of miners.

Hunter's Claim, Horse Terrace, formerly leased by Chinamen, has now been resumed by the owners, and is now being equipped on a bigger scale.

Mammoth Claim.—A little prospecting-work has been done during the year, but this company does not seem inclined to again attempt sluicing operations.

Buller Valley.

One or two small claims still exist along the Buller Valley, but nothing worthy of note is being done.

Fairdown.

Carthage Gold-mining Company.—This company is still carrying on work on the black-sand deposit at Fairdown, but, according to the returns furnished, can only be paying working-expenses.

Addison's Flat.

Shamrock Claim (Westland Gold-mining Syndicate).—Having completed the plant, this company has now commenced actual mining, but the results so far must have proved very disappointing.

Milliken and party during the year suspended their cement-crushing operations and began sluicing on another portion of the claim, with fair results.

Carmody and party have sold out to a syndicate, and a new water-race is being constructed, and more extensive plant installed, to work the ground on a bigger scale.

Other claims at Addison's have continued working as during the previous year, there being no interesting developments to report.

Grey Valley.

Lake Hochstetter Goldfields Company (Limited) has started operations during the year, and is now engaged in constructing a water-race from Lake Hochstetter down the south side of the Ahaura River along the route surveyed many years ago for the Mines Department by the late Mr. John Gow. This work will take about twelve months yet to complete, so that sluicing operations will not commence till some time early in 1915. There is a very large area of alluvial terraces commanded by this water-supply, and they are very favourably situated for mining as regards fall, and also in the character of the wash, which does not contain very heavy stones. It is the present intention of the management to employ the whole of the water-supply, eighty sluice-heads, in working the company's own claims, so that it should soon be proved whether there is truth in the opinion held by many who know the West Coast—that the large low-grade alluvial deposits can be made profitable if only worked on a sufficiently large scale.

The various tributary gullies along the Grey Valley—viz., Blackwater, Noble's, Duffer's Creek, Callaghan's, Nelson Creek, Notown, Moonlight, and Blackball—still continue to support a few small parties of Europeans and Chinamen, but these are becoming fewer every year, and there is now no work going on which calls for any comment in this report.

DREDGING.

Hessey, Cameron, Tacon Dredge, Capleston.—This machine, after paying very well for several years, was sunk and became a total wreck in June, and the attempts made to refloat her having failed, all work on the claim is suspended pending the building of a new machine.

Cameron Hessey's No. 7 Dredge, Frying-pan Gully.—This machine has been worked continuously during the year, and kept in good repair. Returns, though not large, have been payable.

Slab Hut Creek.—For a few months this claim was worked by Butler and party on tribute, but proved unpayable, and all work has now ceased.

Worksop Gold-dredging Company.—This claim has had another very successful year, and will again head the list as the most productive in New Zealand for the twelve months. A fresh area, 300 acres, has been acquired by the company, and, I am informed by the manager, has given very good prospects by boring, so that the future of the claim seems to be assured for some years to come.

Blackwater River Gold-dredging Company.—This dredge ceased operations during the year, owing to the ground having become unpayable. I am informed that a new start will be made in 1914, and it is expected that better results will be obtained from ground a short distance ahead.

Nelson Creek.

Pactolus Gold Dredge has worked steadily and made a small profit during the year, but the claim has become very nearly worked out.

New Trafalgar Dredge.—The company is in liquidation, but dredging has been carried out by a party of tributers, with poor results.

Notown Creek.—This company has gone into liquidation.

Red Jack's Gold-dredging Company.—This company has built a new machine, and commenced dredging in Red Jack's Creek. It is expected to prove profitable when the claim is properly opened out.

The *Stafford Dredge* was worked for a portion of the year by a small syndicate, but has now ceased operations, though whether finally or temporarily I do not know.

The *Success Dredge* has worked continuously throughout the year, and has obtained a fair average return of between 20 oz. and 30 oz. per week. No dividends have been paid to shareholders.

The *North Beach Dredge*, after yielding payable returns for many years, has now exhausted the claim, and has ceased work.

South Westland.

In this district there are still a few men working on the beaches, and at Oemoeroa there are two men engaged in terrace-sluicing.

Okarito.

It is reported that a dredge is now being built in Greymouth to be used in working the five-mile beaches. Apart from this, there is no mining activity of any kind in the district.

Ross.

The Mont D'Or Gold-mining Company has continued work during the year, but some delay in actual sluicing was caused by the removal of the plant to a new face. Dividends amounting to £1,200 were paid during the year.

Ross Goldfields (Limited).—The Cassius workings were successfully reopened and prospected, and it was found that the only payable wash left by the former owners was a small block close to the shaft. This was taken out in conjunction with wash from No. 6 level, and while it lasted the returns were fairly good. It was, however, soon exhausted, and efforts are now being made by driving and sinking at No. 6 level to open up a new layer of wash. The mine at present can only be regarded as a prospecting proposition, and the future depends entirely upon the discovery of payable ground outside the boundaries of the present workings. Great credit is due to the management for the care taken in reopening the old workings, which contained a large volume of water under a pressure of nearly 90 lb. per square inch. This was tapped by boreholes, and slowly drained off to the pumps, the whole work being accomplished without risk to those employed.

No other mining is being carried out at Ross, although two parties are engaged in prospecting.

Rimu, Seddon's Terrace, and Back Creek.

This is perhaps the most profitable alluvial district in Westland, and still finds employment for about 100 men. No sensational returns are reported, but the average earnings of the miners employed amounts to more than wages, and there is a large extent of ground yet unworked. Shortage of water for sluicing is the great drawback to this field.

Kanieri.

A company has been formed to work a portion of Tucker Flat by means of a Kershaw pump, and results will be watched with great interest, as this method of handling tailings has never yet been properly demonstrated in Westland.

A few private parties are still at work, but no good results are reported.

Hokitika.

The *Montezuma Claim* is being given a still further trial by a reconstructed company. The ground is reported to have given satisfactory results on a trial run, and a Kershaw pump is now being fitted on a floating pontoon to work the claim. This experiment is also being watched with interest, as it is generally supposed that many of the West Coast beaches would be payable if they could be cheaply worked on a large scale.

Blue Spur, Hauhau, and Humphrey's Gully.

These districts still employ a few miners, but the output of gold is small.

Stafford and Waimea.

In this district mining is fairly active still, and some good returns are reported.

Kumara District.

Callaghan's, Dillman's, Cape Terrace, and Westbrook find employment for about sixty men, but the average returns are very small, and it is evident that mining is declining fast throughout this field.

Barrytown.

McKay and party continue working, with profitable results. No other work of any magnitude is being done.

GENERAL REMARKS.

Quartz-mining.

The quartz-mining industry has been carried on under much the same conditions and with about the same results as last year. In the Collingwood district the output from the Golden Blocks Mine has ceased, while in Marlborough an improved return has been obtained from the Dominion Consolidated.

In Lyell and Buller districts there is no activity except some prospecting-work at the old Red Queen Mine, Mohikinui, now known as the Swastika.

Boatman's field is practically dead, and in the Reefton and Blackwater districts the number of miners employed is about 100 less than in 1911. The year 1912 cannot be taken for purposes of comparison, as the mines were idle for eight months on account of labour disputes.

Accidents.

Fatal.—On the 2nd January, P. McMamone was killed at the Dominion Consolidated Mine while helping to build a trestle bridge, through a stringer falling upon him.

Gold-miners' Relief Fund.

One hundred and eight applications in respect of accidents were dealt with, and the sum of £305 6s. 4d. was paid out, while nine claims for total incapacity from miners' complaint were recognized, and a payment of £50 made in each case.

Alluvial and Dredging.

The returns from alluvial and dredge mining have fallen off slightly during the year, but the number of men employed remains practically the same. A large sluicing proposition is being developed in the Ahaura district—viz., the Lake Hochstetter Goldfields Company's property—and if it proves successful it will no doubt lead to other equally large undertakings being commenced in other parts of the West Coast. The fate of the deep-level mining at Ross is hanging in the balance, and on the result, no doubt, depends the opening or otherwise of other similar claims.

Accidents in Alluvial Mines.

Fatal.—F. Carmini, fractured skull, owing to fall of gravel at his Coronation Claim, Goldsborough, on the 2nd July, 1913.

Non-fatal Accidents in the Inspection District.

4/4/13.—G. Stott, Progress Mine: Right leg broken by fall of quartz.
24/4/13.—F. Griffen, Progress Mine: Left hand blown off by explosion of detonators.
27/5/13.—J. McCarthy, Blackwater Mine: Broken leg, through fall of stone.
10/7/13.—A. Hepburn, Progress Mine: Right ankle broken by fall of timber.
14/8/13.—J. Douglas, Shamrock Claim: Broken ribs, through fall of stone.
22/8/13.—W. Beckman, Blackwater Mine: Broken leg, through fall of timber.
2/9/13.—W. Morgan, Progress Mine: Leg broken by timber falling out of cage.
31/10/13.—J. W. Butler, own claim: Fractured ribs, through fall of gravel.
25/11/13.—C. Cooke, Progress Mine: Left leg broken. W. Sullivan, Progress Mine: Wounds on head and neck. W. Thoms, Progress Mine: Severe shock. Above three men injured through being thrown out of cage in overwinding accident.
3/12/13.—T. Robbins, Energetic Mine: Crushed and bruised by fall of stone.

SOUTHERN INSPECTION DISTRICT.

MR. T. THOMSON, INSPECTOR OF MINES.

QUARTZ-MINES.

A. C. Buckland and Ewart, Barewood.—A level 100 ft. below the outcrop was driven in at an angle, and picked up the reef. Driving was continued some distance along the strike, but prospects were not sufficiently encouraging to work being continued.

Mount Highlay Gold and Scheelite Mining Company, Hyde.—Several months' prospecting-work was done on this property during the year. A large amount of driving and rising was done, the quartz being stacked at the surface. A trial crushing was made of this ore, and it is understood that the company propose removing the mill, which is three miles distant from the mine, up to the original battery-site close to the mine.

Highlay Tungsten Mine, Mount Highlay (the Gold and Scheelite Proprietary Company, Limited, owners).—All work has been stopped on this property. During the greater part of the year the mine was worked by a tribute party. This party worked on what is known as Gilmour's reef. Results were payable while operating on the surface stone, but as the cost became greater the tribute was abandoned.

Macrae's.

Maritana Mining Company (gold and scheelite).—The battery, after some alterations early in the year, resumed crushing. A large loss is undoubtedly made in the recovery of the scheelite values. The ore, having to be finely crushed to save the gold values, sets up considerable sliming of the scheelite-contents. For some time the battery supply was obtained from stopes in No. 1 and No. 3 levels. These are now considered unpayable, and attention is being directed to the ground adjoining the Deep Dell property. Several small leaders exist in this area, and the grade, from a scheelite point of view, is high in some of them. Eleven men are employed.

Golden Point Gold-mining Company (the Gold and Scheelite Proprietary Company, Limited, owners).—The battery at this mine has undergone a complete overhaul. A new frame has been put in. The magnetic separator recently installed has been employed on large heaps of accumulated concentrates from years of work. These concentrates were unmarketable, as the percentage, WO_3, was too low. By magnetic separation a percentage of the iron pyrites is removed and the tungstic trioxide raised to a commercial standard. The concentrates are roasted to render the pyrites magnetic. The intention is to ship the pyrites to Australia, as they are worth several ounces in gold for treatment at the smelters. Development of the Round Hill section is being pushed on, and a tramway has been constructed to connect it with the battery. Twenty men are employed.

Deep Dell Mining Company.—A five-stamp battery has been erected on this property, with concentrating-tables and cyanide plant complete. The mine-development is principally a few surface holes and shallow drives on a number of leaders. So far as can be seen, they do not appear to live to any depth, and if they did, it is a question, owing to their smallness and the necessary amount of stripping of hard rock, whether they would pay to work. A large body of low-grade ore exists on the property. The values are gold and scheelite. Men, twelve.

Golden Ridge Mining Company.—The drive has been extended 430 ft., and a rise put up to the surface for ventilating purposes. The depth from the surface at this point is 60 ft. No ore-body has yet been met with. Work has been temporarily suspended.

Golden Bar Quartz-mine.—This mine has been closed down, but the probabilities are that it will be reopened again soon.

Keep-it-Dark Syndicate (Berry and party).—The prospecting-drive has been driven 220 ft. The reef is not yet to hand.

Forbes Mining Syndicate.—Prospecting-work is still being carried on by this syndicate.

Nenthorn.

Wealth of Nations (Stanley and party).—A crosscut was put in and the reef cut, and driving continued along the strike. The company are now erecting a small experimental plant to test the quartz.

Bald Hill Flat.

Advance Mine, Obelisk Range (R. T. Symes, owner).—Work is still being pushed on at this mine, although nothing of a solid character has yet been disclosed. Surface-prospecting with water-power when available is continued.

Symes and Party.—A syndicate has been formed to test Grey's reef, from which a considerable amount of gold was obtained from comparatively shallow workings. It is hoped to pick up the continuation of this reef into the slip country, and sluicing is the method to be adopted.

Bannockburn.

Carrick Gold-mining Company.—The battery has been intermittently worked; the stone produced taken from a stope in the White Horse reef at the intermediate level, and a small quantity from the Royal Standard surface level. The low level has been advanced a little at different periods. This level will provide 200 ft. of back should the reef prove of a payable nature.

Star of the East Gold-mining Company.—This mine is worked only during a short season of the year, owing to the high elevation at which it is located on the Carrick Range. The quartz to keep the five-stamp battery going was obtained from an opencut on the outcrop of the reef.

Evans and Ledingham's Quartz-mine.—A considerable amount of driving was done during the winter by this party. The mine is now closed down.

Cromwell.

Alta Mining Syndicate.—This syndicate holds the mineral rights of the original Alta Company, and also that of the old Come-in-Time Company. The battery has been refitted, and work is commenced on the outcrop of the Come-in-Time reef. Some prospecting has been done on the Alta section, and a trial crushing of stone was taken out.

Macetown.

United Goldfields Mining Company.—Homeward Bound section: The block of stone in the new low level pinched completely out a few feet above and below the level. A winze was continued down several feet in the hope of the stone making again, as it appears to occur in this mine in shoots at irregular intervals, and also much displaced in strike. The results were disappointing. Garibaldi section: This section was not worked during the year. All Nations section: A quantity of stone was mined on this reef, and a rope erected to lower it to the flat below, from where it is carted a mile to the battery. The carting can only be carried out in the summer months.

Glenorchy.

Glenorchy Scheelite-mining Company (Limited).—The main levels have been advanced during the year, and various blocks of stone extracted. This company have reconstructed the treatment plant of the Bonnie Jean Mine, and active operations are being carried on in this property. All ore brought in from the Mount Alaska and Larkin Ranges by private parties is treated at these works.

The various parties operating on Mount McIntosh have continued as usual with their surface work. The long winter and heavy snowfall prevented them getting to the high tops as early this season as has been possible for some years previously.

Preservation Inlet.

Morning Star Gold-mining Company.—The low-level tunnel was continued for 150 ft. The mine is to be sold.

HYDRAULIC SLUICING AND ELEVATING.

Owing to the disastrous floods in the early part of the year this branch of mining has lost a considerable part of the available sluicing period. Almost every plant in the district was disorganized by slips or breaks in the races. The companies and private parties managed, however, to survive their difficulties, and got into full operations again. The following brief reports are of the most extensive mines :—

Tuapeka.

Blue Spur and Gabriel's Gully Sluicing Company.—Work was carried on for a time in the cement face operated on by the late Blue Spur Company, but was discontinued, and operations directed to the large deposits of tailings—accumulations of many years' work—lying on the property. Two elevators are worked, and discharge into the old cement paddock. These tailings are upwards of 70 ft. deep, and cover several acres of ground. Twenty-one men are employed.

This company also works a claim in the main gully. Three men are employed, and the face is 20 ft. deep. The ground has all previously been worked by means of low-level tail-races.

Golden Rise Sluicing Company, Weatherstones.—Ground-sluicing is continued on this property, the auriferous wash being worked to the cement bottom. The large overburden of clay immediately over the wash makes the claim difficult to work.

Golden Crescent Sluicing Company, Weatherstones.—This company's operations are now assuming large dimensions. Work is confined to the west wall of the cement-deposit, a depth having been attained of upwards of 120 ft. without reaching the gutter-bottom. A large amount of old mining timbers have to be dealt with. This timber was used in the old days, when the rich layers of cement were driven out. Seven men are employed.

Kitto and Party.—This party's claim adjoins the Gabriel's Gully Sluicing Company's property, and operations are carried on in the east wall of the cement. The face is 70 ft. deep, and the cement is very hard. Progress is slow, as the available water-pressure is low, and the material requires blasting before it can be removed.

Waipori.

Bakery Flat Gold-mining Company.—Operations have been carried out at the lower end of the claim. All necessary additions to plant were made to enable work to be done at this point. The ground has been bottomed, and proved to be shallower than was expected. The depth was about 90 ft. An adequate water-supply has enabled the mine to work good average sluicing time. Men employed, ten.

Lammerlaw Flat Hydraulic Mining Company.—This company still work their claim on the Waipori Flat. The ground is about 20 ft. deep, and the gold is obtained from a false bottom. A fair area being treated annually, the claim is rapidly becoming exhausted.

Post-office Creek, Waipori.—Eleven men find employment in this branch of the Waipori River. Elevating and ground-sluicing are both employed, and the faces average from 15 ft. to 100 ft. deep. The most extensive operations are carried on by Munro and George. This claim is worked to the rock bottom, a depth at this point of 100 ft. 310 ft. of water-pressure is available.

Waitahuna.

Five sluicing and elevating plants are at work in this district, and employ twenty-one men. Three plants are sluicing in the gravel terraces, and the other two are operating on the cement-deposit.

The *Norwegian Sluicing party* are working on the west wall of the deposit, and the Sailor's Gully Company's workings are on the eastern wall.

The *Sailor's Gully Claim* is located about a mile south of the Norwegian Claim. The horizontal width of the cement at the surface appears to be considerable, and a depth upwards of 300 ft. or 400 ft. will have to be reached before the gutter-bottom will be to hand.

Island Block.

Island Block Dredging and Sluicing Company.—Sluicing operations have been at a standstill during the year, and the whole of the company's plant is used by the New Golden Run Dredging Company for pumping purposes, and elevating the soil and clay deposit into a race discharged into the Molyneux River. The New Golden Run Company work the ground on a royalty-basis agreement with the Island Block Company.

Roxburgh.

Work, as usual, has been carried on by the Roxburgh Amalgamated, Ladysmith, and Commissioners' Flat Gold-mining Companies. The Roxburgh Amalgamated has suffered a considerable loss of time by breaks in the water-race, and also the Commissioners' Flat party by the continued high state of the river throughout the winter.

Teviot Molyneux Gold-mining Company.—Race-construction has been carried on during the year, and 2 miles 18 chains of ditching completed. There being 2 miles 10 chains of piping (siphons) the earthwork is therefore completed to the 4-mile 28-chain peg, and within 23 chains of the penstock to operate White's Flat Claim, and 1 mile 23 chains from the terminal point. The dimensions of the race are 7 ft. bottom and 10 ft. top, 3 ft. deep, with a fall of 16 ft. to the mile, and the carrying-capacity is sixty-five heads. The diameter of the siphon-pipes is 3 ft. Several short flood-water races have been completed to carry the by-wash water into gullies, where it cannot do any damage to property and roads on the flat below.

Alexandra.

Doctor's Point Sluicing Company.—This party was formed to test a high level run of gold at Doctor's Point, about nine miles down the gorge below Alexandra. The prospects are good, but the ground is rough and difficult to work. Machinery to deal with the huge rocks will have to be erected. The claim is located on a level probably 600 ft. above the present level of the Molyneux River. Should satisfactory results be obtained, other parties may turn their attention to these higher levels along the bank of the Molyneux.

Cromwell.

Ballingall and Patton.—A claim situated in the bed of the Roaring Meg Creek at Plank Creek Junction is being developed by this party. A water-race, three miles in length, consisting of surface ditching 2 ft. by 1½ ft., with a fall of 13 ft. to the mile, a siphon 2,000 ft. long of 13 in. pipes, 250 ft. of iron fluming, and 1½ chains of tunnelling, is in course of construction to bring water on to the claim. The available pressure at the point of delivery will be 320 ft., and the anticipated depth of ground 35 ft. The capital involved in the undertaking is about £2,000.

Luggate.

The *Galtee More Mining Syndicate* still carry on operations, employing six men.

Arrow River.

Arrow Falls Sluicing Company.—This company operated for the most part of the year in the bed of the Soho Creek, a tributary of the Arrow River. Results have been disappointing, and work in the meantime discontinued.

Shamrock Sluicing Company.—A bad run has been experienced by the company this season, and work has been suspended. It is, however, probable that a tribute party will recommence shortly.

Shotover.

The various claims in the banks and bed of the river have been carried on as usual.

A new development is the commencement made by the *Staircase Sluicing Syndicate* to operate in the bed of the Shotover River at the junction of Staircase Creek. Plant has been installed and the ground opened up.

The *Sandhills Syndicate*, in the Upper Shotover, is carrying out a large scheme to divert a portion of the river from its present bed. The deviation, if successful, will enable the company to work several chains of the present river-bed.

Mining-work generally has been much impeded by the series of floods that have occurred this year.

Cardrona.

Criffel Lead Sluicing Company.—Efforts are still made to work this ground, but owing to the slipping-in of the back reef country the task is difficult.

Matakanui.

Undaunted Gold-mining Company (Limited).—Over the greater portion of the claim the shallow ground to the false bottom has been worked, and attention will have to be directed to the deeper ground commencing at the foot-hills on the back reef. Seven men are employed.

Tinker's Gold-mining Company (Limited).—Progress on this property is slow, due to the slippy nature of the back reef and great overburden. Great care has to be taken in working to avoid accident. Eight men are employed.

Mount Morgan Sluicing Company.—Men, three. Depth, 20 ft. Sluicing and elevating.

St. Bathan's.

Scandinavian Water-race Company (Limited).—Overburden has been extensively removed on this property, permitting the main Kildare lead to be worked. Safety conditions are improved. The Surprise Hill section of the property has also been worked. This latter is a ground-sluicing proposition. Fifteen men are employed.

United Mining and Elevating Water-race Company (Limited).—Work has been done in the deep levels during a portion of the year. The early part of the year was devoted to working a portion of the claim with a free outflow into the channel, dispensing with elevating for that period.

Golden Terrace Gold-mining Company (Limited).—This property has been tested in several places, and work is still being continued.

Livingstone.

Three claims, employing eight men, are working in this district. They are all ground-sluicing propositions, and the faces vary from 10 ft. to 40 ft. in height.

Maerewhenua.

Mining in this district shows no expansion, ten parties being at work. Thirty-three men are engaged in the various mines, the faces varying from 20 ft. to 40 ft. in height. They are all ground-sluicing. A large area of auriferous drift yet remains to be worked, and this number of men will find employment for many years. The grade of the material treated is low, but very uniform.

Naseby.

There are no new developments in this district. About forty men still find profitable employment in the claims. The average number employed in each claim is two, and the depth worked to averages 30 ft.

Hamilton's.

Hamilton's Sluicing Company.—The nature of the ground will not permit of a rapid treatment of the bottom auriferous wash. The face is 100 ft. in height, and the large slip from the back wall makes the work slow and expensive.

Patearoa.

Seven miners work here in three claims, and there are no apparent prospects of any new developments.

Nevis.

The past winter has been more severe than the former one, inasmuch as there has been an increased fall of snow, consequently the miners were later in getting to work. The claims are consistent yielders, and most of them have considerable lives. Elevating is carried on to a depth of 40 ft., and terraces of a considerable height are operated on.

Waikaia.

Muddy Terrace Gold-mining Company (Limited).—The disastrous flood of March last completely washed away the dam in Dome Creek, at the head of the race. Instead of reconstructing it, the race was carried another 30 chains up creek to lift the water directly therefrom. Owing to the water not being on the claim for the greater part of the year, the return from this company's operations will be considerably below that of the previous one. Sluicing has now been commenced on the Freshford side of the terraces. Thirty-five men have been employed.

Argyle Sluicing Company.—Operations have been conducted in the shallower portions of the claim nearer the Waikaia River.

Winding Creek Claim (Round Hill Mining Company, owners).—Three men only have been employed, and a paddock sunk to the bottom in the top corner of the stripped ground has been the principal work. The company propose to prospect the remaining ground by sinking several shafts.

Nokomai.

Nokomai Sluicing Company (Limited).—The two upper claims were worked as usual, but the lower No. 3 plant was removed a considerable distance down the creek, having broken into the old ground worked by the No. 2 claim.

Chasland's.

Long Beach Gold-mining Company.—Results have been disappointing to the owners, mainly due to a difficulty to save the gold, which is supposed to be present in the sand in payable quantities. An amalgamating-machine is installed, from which much is expected.

Wallace Beach.—This company's operations have been suspended.

DREDGING.

This branch of the mining industry is declining.

During the year eleven dredges have ceased operations, and several others have changed owners.

The dredge on the Mataura has been restarted again by Cook and Excell. A bucket-belt arrangement has been adopted, which enables a greater number of buckets to be put on, and the output dealt with increased.

A dredge on the Hogburn has been started, and also one on the Kyeburn.

The Rise and Shine No. 2 dredge has commenced dredging.

The dredge on Adam's Flat, in the Glenore district, has not yet been completed.

Continual rises in the Molyneux River have prevented the gorge dredges below Alexandra from making a start at all this year.

The "1911" dredge broke loose from her moorings and sank during the flood in March last, and is a total wreck.

Earnscleugh No. 3 dredge sank in the paddock, due to suddenly springing a leak from some cause not so far known. The machinery was removed from the sunken pontoons, and they were refloated, docked, and repaired. Machinery is now being placed in position, and the dredge will soon be in commission again.

The industry has been free from serious accident, the regulations being reasonably complied with.

MINERALS OTHER THAN GOLD.

Scheelite.

Prospecting for this mineral is as keen as ever, although the industry shows no marked advance in Otago. Operations are mainly carried on in the Glenorchy and Macrae's districts.

Copper.

No activity has been shown in developing the lode on which some work was done last year in Wet Jacket Arm, Dusky Sound.

Tin.

The Stewart Island Tin and Wolfram Company, incorporated last year, have pushed on work with the tramway leading from Pegasus Harbour to the mine. A jetty has been built, and about two miles of the three miles of tramway required completed. The company intend to work the alluvial flats and also the lode formation.

Limestone.

The Milburn Lime and Cement Company produced 39,137 tons of limestone from the works at Milburn and Dunback.

Marl.

The output of marl from the Milburn Lime and Cement Company's pits at Burnside amounted to 7,843 tons.

Phosphates.

The Ewing Phosphate Company treated 11,000 tons during the year.

ACCIDENTS.

Hydraulic Sluicing.

Fatal.

10/5/13.—A Chinaman named Wong Hong, working in the Nokomai Sluicing Claim, got his foot caught in the suction of the elevator. The man died six days after from blood-poisoning.

26/11/13.—Charles Adams, employed on Adams and Weir's Claim, Maerewhenua, was killed by a stone rolling away from the working-face.

Serious.

17/5/13.—S. B. Carpenter broke his leg, caused by slipping when carrying a casting in the claim.

ANNEXURE B.

REPORTS OF WARDENS.

Mr. Warden DYER, Tauranga, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Warden's Office, Tauranga, 31st January, 1914.

I have the honour to report that there has been very little mining activity in this district during the year ended 31st December, 1913. Some prospecting for gold has been carried on at the eastern extremity of the Bay of Plenty, between Cape Runaway and Port Awanui, but nothing of any importance has been discovered. Seven miners' rights have been issued to prospectors in that locality.

Nothing has been done at the Te Puke reefs, but five miners' rights have been issued to miners there.

I have, &c.,
J. W. DYER, Warden.

Mr. Warden PAGE, Whangarei, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Warden's Court, Whangarei, 6th April, 1914.

I have the honour to present my annual report on the Puhipuhi Mining District for the year ended the 31st December, 1913.

During the year in question some development-work has been carried out at Puhipuhi, and the extent of the cinnabar-deposits has been proved over an area of about 1,500 acres.

A six-retort furnace for treating and testing the cinnabar-ore has been completed by the Whangarei Cinnabar Company (Limited), and out of the first charge of ore, about 15 cwt., between 35 lb. and 40 lb. of metallic mercury was obtained. The ore treated had been exposed to the atmosphere for at least eighteen months, and was of much lower grade than that in sight in the drive at the present time.

Mitchell and party have continued prospecting with a view to further testing the value of the large ore-deposit on their claim. Mr. Robert M. Green, metallurgist, was engaged to examine and report on the cinnabar-deposits. Mr. Green has given a lengthy and interesting report under date the 8th November, 1913.

It is reported that towards the north-east of the cinnabar-deposits a good-looking gold-bearing reef has been discovered, and prospecting-work on this reef has been carried out, but nothing is known to me as to the value or extent of the reef.

The deposits of silver-ore in the same locality have received some attention during the year, and an attempt was being made in Australia to float a company for the purpose of erecting machinery to extract the silver from the ore. The holders of the claims, covering some 300 acres, have been granted six months' protection to enable them to obtain the necessary capital to profitably work the claims.

Coal-mining has been actively carried on at Hikurangi by the Northern and Hikurangi Coal Companies.

During the year ended the 31st December, 1913, there has been a considerable increase in the business in the Warden's Court for the district, fifty-five applications being received for mining privileges (as against fifteen applications in 1912), and licenses were granted covering an area of 1,517 acres. Applications covering 960 acres were adjourned, at the request of the Commissioner of Crown Lands, Auckland, to enable surveys of the locality to be completed.

I have, &c.,
E. PAGE, Warden.

Mr. Warden BURGESS, Thames, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Warden's Office, Thames, 20th April, 1914.

I beg to forward herewith my report on the Hauraki Mining District for period ended 31st December, 1913.

On the whole, the mining industry cannot be said to have progressed in this district. No fresh developments have taken place tending to its extension. The gold produced during the past twelve months has been obtained from mines in operation for some years. Except for the work carried on by the owners of these claims, mining has ceased—only temporarily I hope—to be prosecuted with any vigour throughout the district. Many of the smaller claims in which work of a prospecting nature has been carried on for some years have had to suspend operations and obtain protection from the Court, because it has been found impossible to induce the shareholders to continue their contributions. Calls made by many of the companies have resulted in large numbers of shares being forfeited. Some of these claims appeared to promise success if operations could have been continued, but unless public interest is soon revived in the gold-mining industry most of these claims will be abandoned by their owners.

Mining in this district began to show a decided decline soon after the falling-off in the Waihi Company's returns. The strike that occurred not long afterwards had a very depressing influence,

and the industrial disturbance of last year happened at a time when confidence in the goldfield was being slowly re-established. Several promising ventures in different parts of the district had been taken in hand, and seemed likely to result in mining operations being resumed on these properties; but on the occurrence of the general strike at the end of last year all promises of support were withdrawn, and in most cases the project lapsed. The continued absence of any success in the Thames Low Levels crosscut has had a depressing effect upon mining at Thames generally. Some little prospecting is being done in the Thames and Coromandel districts, but nothing of any importance has been discovered.

The total yield of gold for the whole of the district during the past year (compiled from official returns) amounts to £865,617.

There has been an increase over last year's production in the following places: Waihi Borough, £111,971; Piako County (Te Aroha), £54; Coromandel County, £2,437: and a decrease at Thames of £5,821, and at Ohinemuri County of £24,739. The decrease in the Ohinemuri County is accounted for by the fact that the Talisman Company was compelled to suspend operations for two months owing to the strike at the Huntly coal-mines.

These figures give in the aggregate an increase of £73,902 in the value of gold and bullion produced in the whole district as compared with last year; but it must be borne in mind that for several months during the strike of 1912 work in the Waihi mines was suspended, and the returns for that year consequently decreased much below the average.

The following companies have paid dividends to their shareholders during the year: Waihi Company, £99,181; Waihi Grand Junction Company, £19,219; Talisman Consolidated Company, £133,687; Waihi-Paeroa Extraction Company, £6,226; New Waitaia Company, £1,875: total, £260,188.

The Waihi Company's mine still retains its position as the premier mine in New Zealand. 164,971 tons of ore was treated, for the return of £323,345 worth of bullion. This exceeds last year's return by £6,622. There are no fresh developments to record in the mine. Work is being carried on to a depth of 1,300 ft., and a large output of payable ore is still being obtained. Prospecting-work is being carried on by means of the Scorpion south-east crosscut, the Sole, a south-east crosscut from the Edward lode, and by the Reptile drive, which is being driven by the diamond drill working horizontally.

Profitable work has been carried on in the Waihi Grand Junction Company's mine adjoining. The company treated 87,842 tons of ore, for a total yield of £180,020 worth of bullion. High-grade ore has been obtained from the Empire reef east. Additional stamps are being added to the battery to cope with the increased output of ore from the mine.

The Waihi Extended Company have suspended operations owing to shortness of capital. The Pride of Waihi are in the same position.

The Waihi Reefs Consolidated has been taken over by a new company floated in the Dominion, and active operations are being made to resume work in the mine. The intention is to sink the shaft, which is now down 900 ft., to a further depth of 1,250 ft. or 1,300 ft.

Work at Owharoa is confined to the Rising Sun Claim, the owners of which during the past year have been driving a low-level tunnel.

At Waitekauri the Maoriland Company are carrying in an extension of their low-level tunnel which is now in a distance of 1,384 ft. The prospects met with are encouraging. £2,286 worth of gold was obtained for the year. The Golden Cross Company has kept steadily at work driving the main tunnel, and putting in crosscuts therefrom. Large bodies of low-grade ore have been met with, and present developments point to profitable operations during the coming year.

Talisman Mine.—This well-known mine still maintains its reputation as a steady gold-producer. Last year, however, the returns were unfortunately somewhat reduced owing to the company being compelled to suspend operations in consequence of the strike in the coal-mines at Huntly. The gold produced for the year suffered a reduction of £30,927 compared with the previous year's return. During the year the Woodstock shaft was sunk to the random of the 14th level, and active development-work has been carried out in No. 14 level. The south drive on this level proved the existence of a fair-grade ore in the Dubbo section. The south drive in No. 13 level showed no payable ore, but the south drive in No. 14 revealed payable ore under the section of No. 13 where only low values were obtained. The results of lower developments in the mine show that the high-grade ore is going down, and is becoming more extensive in the deeper level.

New Zealand Crown Mine.—During the year considerable improvements have been effected by the erection of a tram-line from No. 4 to No. 7 levels, by the erection of hoppers, and by the alterations to machinery and plant. No great amount of development-work has been carried out, but the company having been reconstructed, more capital is now available for expenditure in the mine, and, as a consequence, development of the lower levels of the mine will be undertaken.

There are several small claims at work in and near to Karangahake, but none of them have progressed beyond the prospecting stage.

Waihi-Paeroa Extraction Company's Works, Ohinemuri River.—The work of the company has during the past year been much hampered by the low river making it difficult for the treated material to be carried away. A bridge has now been erected over the river, and a flume constructed to carry away the treated tailings nearly a mile farther down the river. A Priestman dredge has been obtained, and has proved most useful in removing old timber from the river-bed. The works have now been connected with the Government railway by a steel tramway, by which all coal and goods are taken to the mill at a greatly reduced expense.

At Komata no work is at present in progress. The Komata Company's claim is at present under protection, having decided to suspend operations owing to the falling-off in the value

of the returns, the reefs being apparently worked out. £6,964 worth of gold was obtained during the year. In cleaning up the battery and scaling the amalgamating-plates £21,024 worth of gold was obtained.

In the Maratoto district only two companies are at work—viz., the Silver Stream and the Tellurides. In the former claim the chief work has been stoping in the Julia and Queen reefs. The ore is occasionally very rich, but is of a refractory nature (chiefly sulphides), and cannot be treated by any process in operation in this district. 31 tons of ore was sent to Australia for treatment, and yielded £1,115 worth of bullion. In the Tellurides claims the chief work has been driving a low-level tunnel to cut the Julia and the Queen lodes now being worked in the Silver Stream. No returns have been obtained.

At the Te Aroha end of the district very little mining has been done throughout the year. Work in the Hardy Mines has been suspended owing to want of capital to carry out the scheme of development decided on. The claims are at present protected, pending the raising of the necessary capital to continue operations. In the meantime the company has erected a small cyanide plant on the flat for the purpose of treating the deposit of tailings which have been accumulating for many years.

Waitawheta Syndicate's Claim.—About two years ago, just when the mine appeared to be on the road to success, the whole of the crushing machinery and plant was destroyed by a fire which burnt down the battery-house. Operations in the mine were suspended beyond what was necessary to keep the drives and working-ways of the mine in order. The owners have since been employing a number of men in the erection of a new ten-stamp mill and cyanide plant, which is now completed, and the company will soon be in a position to resume active work in the mine.

Deep Levels Crosscut.—This work is still in hand, though recent progress has been slow. To avoid the danger of contact with the Moanataiari main slide, which was being approached, a deviation was decided on from a point under the Waiotahi shaft. This it was expected would avoid all danger, but at a distance of 490 ft. a strong volume of water burst through the floor of the drive, and the men at work were compelled by the water and gas to cease operations and hurriedly leave their work. At the end of the year operations had not been resumed. So far no veins or lodes have been met with. The crosscut will, however, assist the operations of such mines as the Saxon, Waiotahi, and Victoria, as it will now be possible to work these mines to a depth of 1,000 ft., with good ventilation and freedom from water.

In the Saxon Mine a crosscut has been driven 500 ft. from No. 7 level, with the object of intersecting the Cardigan reefs. Progress was somewhat delayed by a hard bar unexpectedly met with at this level. The crosscut is now in 500 ft., and the work is progressing favourably.

The Waiotahi Company has been employed in driving and crosscutting, and the shaft is being sunk to meet the crosscut driven from the main Deep Levels crosscut, from which an uprise to a height of 92 ft. has been constructed from the 1,000 ft. level. In furtherance of the project for sinking the shaft to the main crosscut at the 1,000 ft. level, boring with a Government diamond drill was started from the bottom of the shaft for the purpose of draining off the water. When the bore had gone down 320 ft. the boring-rods broke off, and it was found impossible to recover the lost parts. The water was, however, drained off, and the shaft has been sunk about 740 ft. from the surface.

In the Moanataiari Claim a drive has been constructed through the main slide at 300 ft. level, with the object of prospecting on the hillward side for a continuation of the old Caledonian and Moanataiari No. 4 reefs, which on the seaward side were remarkable for their rich yields.

Kuranui-Caledonian Claim.—No work of any importance has been done in this mine, operations being suspended until the work in the Deep Levels crosscut has advanced sufficiently to enable the company to take advantage of the opportunity to prospect their mine at a deeper level.

Kuranui Claim.—The principal work for the year has been the continuation of the Magazine tunnel, which passes practically through previously untried country. The tunnel is now in a distance of 890 ft.

Victoria Claim.—No work is at present being carried on upon this claim. The owners are acting in conjunction with the Waiotahi Company in sinking the latter company's shaft, from which it is intended eventually to work both mines.

May Queen Claim.—During the earlier part of the year operations were carried on at the 1,000 ft. level, but the eruption of water and gas which followed the cutting of the main slide in the main crosscut made it impossible for men to continue longer to work there.

Waitangi Claim.—Development-work is being energetically carried on in this mine, and a large amount of driving, stoping, and rising has been done, and a quantity of ore broken out. The directors have in contemplation the purchase of a battery for the treatment of their quartz.

Watchman Claim.—The company owning this claim is conspicuous for the energy it has displayed in the development of the mine, and in procuring and erecting plant and machinery. A trial parcel of quartz of 750 tons gave a return of £2,241. Encouraged by the proved value of the ore, the company purchased the battery and plant of an English company known as the New Day Dawn and Norfolk Company, situated at Tararu Creek, together with the water rights and races. The battery has been renovated, and more modern appliances erected, and will shortly be in a condition to commence operations. A ground and aerial tram-line has been constructed to connect the mine with the battery. The mine is well opened up, and as soon as the battery is in working-order there will be an adequate supply of ore to keep the battery constantly employed.

New Sylvia.—Work has been maintained throughout the year with a staff of about sixty men. 10,103 tons of ore was treated, for a yield of £16,351. A large amount of work of a developmental and prospecting nature has been done. The ore from the mine is treated at the company's own battery, situated near the claim.

Karaka Mines.—This claim, situated at the head of the Karaka Creek, was taken up by an English company. Over £20,000 was spent in plant and machinery. Very little work in proportion was done underground. No reef of any importance was met with, and the proprietors being dissatisfied with the prospects have closed down the mine, and are disposing of the plant and machinery.

Occidental.—Work has been continuously carried on upon this mine. 100 tons of ore and 590 lb. of picked stone was crushed during the year, and yielded £2,710 2s. 8d. A main shaft is being sunk to a depth of 120 ft., and it is proposed to drive from that level.

At Neavesville (Tairua) the only mine at work is the Golden Belt. Work has been carried on in this claim for several years without any remunerative results. Recent developments have proved more encouraging. 215 tons of ore was a short time ago crushed, for a return of bullion worth £665 17s. 3d., and the shareholders, after patient waiting, are looking forward to a prosperous future.

The Tairua Mines, better known as the Broken Hills Claim, is not at present at work. After several ineffectual attempts to restore the claim to its former position as a dividend-paying mine, the company went into liquidation and sold the property. This was purchased by Mr. H. H. Adams, of Auckland, whose intention is to resume work under a new scheme of operations which he anticipates will enable the claim to be profitably worked. There is a complete crushing battery and all necessary plant on the ground.

The Tairua Golden Hill Claim, which a few years ago was regarded as one of the most promising mines in the Hauraki District, has proved a great disappointment. The company has gone into liquidation, and most of the machinery has been sold for removal off the ground. The claim has been purchased by Mr. Agnew, of Thames, who has been engaged for some months in cleaning up the drives and testing the reefs in the claim. The work done has convinced him that the property is worth another trial, and he is now making arrangements to raise sufficient capital to enable him to recommence operations on a moderate scale.

Waiomio.—The only claim at work in this locality is the Monowai. A large amount of work has been done in driving and stoping. 1,123 tons of ore was treated, for a return of £2,134 worth of bullion. The company owns a complete crushing battery and plant, and has done a large amount of work in the construction of tramways and water-races.

Tapu Creek.—Very little mining of any kind is being done at Tapu. The Portia Claim, owned by Moorcraft and party, carried on operations during the greater part of the year. A small quartz leader was worked for a total return of £362. The claim has since been abandoned

Mining operations in this portion of the Hauraki District have fallen off very considerably, more particularly towards the end of the year.

The old Hauraki Mine suspended operations in August. The ore becoming poorer, the returns fell off, and the company, finding it impossible to raise money by calls on the shareholders, ceased operations. The cost of pumping the water from the shaft adds very largely to the cost of working the mine. Contemplated arrangements between this company and the Hauraki Reefs Company, holding the adjoining property, for sharing the cost of pumping both mines unfortunately fell through owing to a disagreement as to terms.

Operations in the Hauraki Reefs Mine were continued, and profitable returns appeared to be in view, when the company was compelled to cease working owing to the influx of water consequent upon the cessation of pumping on the adjoining claim.

Work of a more or less intermittent character has been carried on in the Four-in-Hand, Royal Oak, Venture, and Exalt Claims, but the returns have been small. The largest yield was £655 worth of gold, being obtained from the Royal Oak Claim.

In the Mount Welcome the principal work has been driving the low-level tunnel which is being put in to cut at a lower depth the lode which was profitably worked in the upper levels, but which could not be sunk upon owing to the large quantity of water met with.

Gallant Claim.—A syndicate has lately been formed for the purpose of working this claim. A shaft has been sunk and crosscuts driven to intersect at a greater depth the Scotty's and Kapanga lodes, which in former years are said to have produced rich ores.

On Bremner's Freehold work on the claim has been carried on with a small number of men, but the total returns have only amounted to less than £300.

In this locality the only claim to maintain continuous work throughout the year has been the New Waitaia. The lodes worked on have proved payable. Gold to the value of £5,955 was obtained during the past twelve months. There is every indication of increased returns being obtained during the ensuing year.

The Mountain King Company worked their claim during a portion of the year, and obtained gold to the value of £1,730, but failing to obtain any fresh payable ore, operations were suspended for want of funds, and the claim is now under protection.

The mines at Great Barrier Island continue to employ a few men, but there are practically no returns of gold, the work in progress being mostly of a prospecting nature. 5 tons of ore from the White Cliffs Claim sent to Cockles Creek, New South Wales, for treatment gave a return of £12 per ton. The ore is refractory in character, and cannot be profitably treated in this Dominion.

I have, &c.,

FRED. J. BURGESS, Warden.

Mr. Warden LOUGHNAN, Blenheim, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Warden's Office, Blenheim, 1st May, 1914.

I have the honour to present a general report on the mining industry in the Marlborough Mining District for 1913.

Wakamarina River, Deep Creek.—The principal mining-work in the district is being done by the Dominion Consolidated Gold-mining Company, which employs an average of eighty-five men at their gold-scheelite mine. A battery of twenty-five stamps is at work.

Wakamarina River, near Mountain Camp Creek.—The Darkie's Terrace Hydraulic Sluicing Company is prospecting and repairing their water-race. One wash-up only took place in the last twelve months. Two further areas of 4 and 6 acres respectively—special claims—have been taken up by P. J. McLean and the Wakamarina Darkie's Terrace Hydraulic Sluicing Company, but only prospecting-work has been done.

Mahakipawa.—Two claims are working at Cullen's Creek: the Redwing Gold-mining Company and the New King Solomon's Gold-mining Syndicate. Both have experienced difficulty with water. Prospecting and installing pumping machinery is being carried out.

Wairau Valley.—The Wairau Gold-mining Company is the only company at work. Its operations consist of development only. There are also a few parties prospecting.

I have, &c.,
F. O'B. Loughnan, Warden.

Mr. Warden Evans, Nelson, to the Under-Secretary of Mines, Wellington.

The Warden's Office, Nelson, 1st June, 1914.

Sir,—

I have the honour to report on the mining industry in the Nelson-Collingwood portion of the Karamea Mining District for the year 1913.

Mining, on the whole, in this district is not in a very flourishing state.

Nelson.

Periodical sittings of the Warden's Court are held at Nelson as occasion requires, and practically all the grants applied for or made are for prospecting licenses for metals and minerals in and about Wangapeka. Messrs. A. A. Grace, Van Bell, and Balting have reported to me from time to time on the results of their prospecting as required by the Mining Act, including a report from Mr. Leslie H. Reynolds, Civil Engineer. From these reports it appears that galena-bearing lodes have been found in the prospecting-areas of sufficient value to warrant further expenditure.

Prospecting-work is being carried on, but the prospecting-areas have not been converted into special claims.

The prospect of a revival of mining in this locality appears to be fairly good.

Motueka.

Practically no grants have been made in this Court, and there does not appear to be any mining carried on in this part of the district.

Takaka.

This part of the district is in the same condition as Motueka.

Collingwood.

The established claims in this part of the district are still working, and one old abandoned claim, known as "Johnston's," has recently been taken up, but nothing of any importance has been done.

The Parapara Iron Company are in the same position as last year. A large amount of capital is required to develop this industry, and up to the present this has not been forthcoming. The property is still under protection, but the company has now reached the limit of protection allowable under the Act.

The Onekaka Iron Company (Turnbull's) has taken up special claims over its prospecting-area, and is now endeavouring to raise the necessary capital to develop the property. These rights are also under protection.

On the whole, the mining industry in the part of the Karamea district under my jurisdiction is not in a flourishing condition.

I have, &c.,
J. S. Evans, Warden.

Mr. Warden Wilson, Westport, to the Under-Secretary of Mines, Wellington.

Warden's Court, Westport, 20th April, 1914.

Sir,—

I have the honour to report to you upon the mining industry in the Westport District during the year ended on the 31st December last.

Westport.

The gradual decrease in mining which has been taking place steadily during the last few years has continued throughout 1913, with the result that almost all the returns of business done in the Warden's Court show a shrinkage. During the past year eight beach claims and three special claims were granted. There has been a corresponding decrease in the subsidiary rights granted for water, &c. The only active operations being engaged in are sluicing at Fairdown and Addison's and beach-combing on the North Beach, and they are in much the same state as during the preceding year.

Charleston.

Messrs. Powell are still working at Rahui Beach, and, I understand, with payable result. This is practically the only mining in the district. The only business transacted in the Court has been the acceptance of surrenders of old rights.

Seddonville.

The Swastika Company continues to develop its property, and has a fair number of men employed there. One special claim has been granted at the Rough and Tumble during the year.

Karamea.

Four prospecting licenses at Anaconda have been converted into special claims. A few men are now employed there and at Mount Radiant. Hopes are entertained as to the value of the molybdenite ores at Mount Radiant.

Murchison.

There was little change in the state of the mining industry around Murchison during 1913. The diminution in business of the Warden's Court noted by me during 1912 has continued. Alluvial sluicing is still carried on at Rappahannock, Maruia, Upper Matakitaki, and Newton Flat, but not more than from thirty to forty men in the whole district have at any time during the year been engaged in the industry. The Mount Owen Rising Sun Mineral Company has ceased prospecting operations at Mount Owen, and is now in course of being wound up. A few prospecting rights were taken up at Lyell Creek, but no *bona fide* prospecting was undertaken.

Throughout this district a change appears to be gradually taking place. The community is paying each year less and less attention to mining, and concentrating its energy on the more certain advantages derivable from farming pursuits; especially is this the case in the Murchison and Karamea districts.

I have, &c.,
Wyvern Wilson, Warden.

Mr. Warden Hewitt, Greymouth, to the Under-Secretary of Mines, Wellington.

Sir,— Greymouth, 26th May, 1914.

I beg to present my annual report on the mining industry in Westland and subdistricts for the year 1913.

Greymouth Subdistrict.

The only mining on an extensive scale in this district is the elevated hydraulic and sluicing claim at Barrytown worked by Mrs. McKay. This claim has been in existence for seventeen years, and is still paying its way. Seventeen men have been employed on an average during the year. A new set of tables has been erected, and the usual hydraulic connections made. The freehold ground has been practically worked out, and the leasehold area, containing about 150 acres, is now being taken in hand.

Stafford Subdistrict.

Most of the alluvial claims are worked by hydraulic sluicing, and appear to be making a profit. A few miners working single-handed seem to make a fair wage.

The Stafford dredge has now ceased operations after having been in use for six months.

The claims taken up in 1912 on the higher levels have not yet begun working.

Hokitika Subdistrict.

There is little to report in connection with this subdistrict. At the time of my last report hopes were entertained that the necessary capital to bring sufficient water from the Toaroha River to work the extensive Rimu Flat on a large scale would be forthcoming. These hopes have, however, not been realized, and many of the rights to ground on the flat have been surrendered or allowed to lapse. Mining operations have proceeded steadily at Seddon's Terrace, where several rich claims are being worked.

The Golden Flat Gold-mining Company (Limited) has acquired a large area of ground at Kanieri, and machinery to be put on their claims is now being constructed. The ground held by the company is very deep, and the surface workings carried on years ago proved highly profitable. Prospecting operations to a considerable depth, by means of shafts and the keystone drill, showed encouraging results, and upon completion and erection of the machinery the company's mining operations will be watched with interest.

Some attention has been turned to the sea-beach deposits. Prospecting operations have been carried on over several miles of the beach south of Hokitika, and I expect to see much of the ground taken up under claim license as a result of these operations.

Ross Subdistrict.

A considerable amount of development-work has been done by the Ross Goldfields Reconstructed (Limited) at their deep mine at Ross. The old Cassius workings, which were reported to be so rich at the time of their abandonment years ago owing to the incapacity of the machinery to deal with the large volume of water met with in the mine, were driven into; but the returns from that portion of the mine have proved disappointing. Development-work is still being carried on in the mine, and a number of men are engaged in sinking a winze from the No. 6 level.

The Mont D'Or Gold-mining Company has proceeded steadily with sluicing operations, and the results have again proved satisfactory to the shareholders. A new face has been opened out, and the results therefrom have been good.

Information received by me indicates that the miners engaged at Donoghue's, Squatter's Terrace, and Redman's Gully are obtaining satisfactory results from their respective claims.

The reefs in the vicinity of Cedar Creek and Mount Greenland have received some attention A quantity of quartz has been treated, and the results have led to the formation of a company. Operations in the future will be watched with keen interest.

Okarito Subdistrict.

Mining operations in this district have been practically at a standstill. Prospecting operations have been continued at the One-mile and Five-mile Beaches, and efforts are now being made to provide the necessary capital to work the existing claims.

Reefton Subdistrict.

During the year 1912 mining in this district was set back considerably owing to labour troubles, and, though during the past year conditions have greatly improved, it cannot be said that the industry has as yet regained its normal state.

In the Wealth of Nations Mine developments have been considerably restricted owing to the limited supply of labour, which is totally inadequate and for the most part of inefficient quality. Stoping has been carried out on all levels from Nos. 7 to 11 inclusive.

In the Blackwater Mines developments have been carried out on Nos. 4 to 6 levels, and stoping has been carried out on Nos. 1 to 5 levels. A dividend of 1s. per share was declared, payable on 31st December, 1913.

With regard to the Progress Mines of New Zealand (Limited), the labour shortage has been very pronounced during the past year, and necessitated the hanging-up of twenty-five stamps throughout the year. A reef in No. 35 east crosscut, No. 10 level, was struck during the latter part of the year, showing good value, but its full extent and nature will not be known until further development is carried out.

The New Big River Company has had another prosperous year, and the payment of monthly dividends has been maintained. A large sum was spent during the year on new winding plant, compressed-air hoists, and rock drills, and also in providing some thousands of feet of piping for conveying compressed air from the surface to all parts of the underground workings.

The Keep-it-Dark Mine employed about sixty men during the year. The shaft was sunk 150 ft., and an intermediate is now being opened up for the block of stone the shaft was sunk for. The quartz opened up is 26 ft. wide, but the length is unknown.

The operations of the Murray Creek Gold-mining Company have been held up owing to the reef being located on the boundary of the claim and dipping away into the adjoining Golden Fleece Claim held by the Consolidated Goldfields of New Zealand (Limited).

The Millerton Gold-mining Company had fourteen men employed during the year, and much useful work was done.

Perotti Bros. have finished sinking their shaft at Golden Point, and have completed a drive of about 500 ft. to the west. An alteration in their plans has been necessary owing to an abrupt change in the nature of the ground. They are now opening up old workings with a view to having a survey made to ascertain the best course to take to pick up the reef.

Other parties operating are the Just-in-Time Gold-mining Company at Capleston, St. George Gold-mining Company at Big River, Pettigrew and party and the Luck-at-Last Syndicate at Victoria Range, Bolitho Bros. at Lankey's Creek, Bierwirth and party at Maori Gully, Saraty's Syndicate at Blackwater, D. Absalom and McEwin and party at Waiutu, L. and F. S. Willis at Black's Point, and Kenning and Knight at Reefton.

The Blackwater Extended Gold-mining Company has been carrying on operations during the year on its claim situate to the north of the properties held by the Blackwater Mines (Limited). A main-shaft site has been selected and surveyed, and water is now being brought on to this site. A dray-road and incline tram are being laid off to give access from Waiuta. It is estimated that the main shaft will require to be sunk from 1,500 ft. to 2,000 ft. in order to cut the Blackwater line of reef.

One new find is that of Avery and party in the Painkiller district, and a syndicate has been formed to work the ground.

Many prospecting licenses were granted during the year, and in a number of cases vigorous prospecting has been carried on. The Consolidated Goldfields are pursuing prospecting operations at the old Scotia Mine, and intend this year to sink the shaft 300 ft., and cut two chambers. The same company has also been prospecting at the Anderson's Tunnel and Perseverance properties.

Very little alluvial mining has been carried on in the district, although a few new claims were granted during the year. The prospects for the coming year are much better, however, as it is intended to carry out sluicing operations on a large scale at Waitahu.

The only dredge now successfully operating in the district is that of the Worksop Company at Hinau. This dredge continues to win remarkably good returns. Messrs. Hessey and Cameron's dredge at Capleston was working during the early part of the year, but sank later. The Blackwater dredge has sunk, but attempts are about to be made to raise it. The Slab Hut Creek dredge at Tawhai was worked for a while without result, and has now ceased operations.

The Frying-pan dredge at Cronadun was working during the year, but the returns were not sufficiently satisfactory, and it also has ceased operations.

During the year 145 applications were lodged, a third of which were for prospecting licenses. This shows a decrease of twenty-eight on the previous year's total. The sum of £1,427 4s. 6d. was collected in revenue, an increase of £95 6s. 8d. on the previous year.

To sum up, the prospects of the quartz-mining field are excellent, the chief difficulty being the shortness of labour.

Ahaura Subdistrict.

The chief interest in this district has centred round the operations of the Lake Hochstetter Gold-mining Company. The construction of the water-race has given a great deal of employment during the year, and fair progress has been made. It is anticipated that the construction of the race will be completed towards the end of the present year, when everything will be in readiness to commence active mining operations. A large number of men will be employed in connection with this company's claim.

At Half-ounce and Noble's district there has been nothing new opened during the past year; the higher levels could be worked were water available. The population is stationary.

At Orwell Creek the population has dwindled down to a few. There have been no new discoveries. Recently a water-race from Clark River was projected in order to carry water for working Napoleon Hill, Red Hill, and Specs Terrace. Should this mature and sufficient water be obtained the district would have a new life.

Moonlight District.—This will at some time be a very important one. There is no doubt the northern parts of Brunnerton Riding, covering Moonlight, Baxter's, Caledonia, and Shellback Creeks, carry a large number of reefs which in time will be developed. Messrs. Hargreaves, Mitchell, and party are still prospecting for quartz at right-hand branch of Moonlight Creek, and are in hopes of making a find during the present year. The population is stationary.

Nelson Creek.—There is still a fairly large number of miners in this district, mostly employed in sluicing. There has been nothing new done during the past year.

Notown.—There is very few miners in this district. Like many other places, water to work the higher levels on the terraces is all that is required to give new life to the district.

During the year 202 mining applications were received and dealt with in the Warden's Court.

Kumara Subdistrict.

Alluvial Mining.

There was quite a revival in this class of mining during the year, which is the principal in this district, so much so that no less than 142 applications were dealt with, the greatest number since the dredging-boom days, which was in the year 1900, and the amount of £1,304 18s. 4d. was collected, as against £799 0s. 10d. for the year 1912; while 183 miners' rights were issued and 296 general registrations were recorded, this increase of business transacted being chiefly due to a new goldfield being discovered, about the middle of the year, at Argus Terrace, Greenstone, quite a small rush taking place, resulting in a number of both special and extended claims being taken up; but, owing to the shortage of water, the only operations carried on up to the present has been in the nature of prospecting and preparing tail-races for which a number of licenses have been granted, awaiting a water-supply which is being brought in by the Government by means of a branch race, a distance of one mile and a quarter from the Government dam at the head of the old Erin-go-bragh Water-race, also known as the Long Drive Water-race. The construction of this branch race was taken in hand by the Government several months ago, and is now nearly completed. There is, I am informed, a considerable quantity of unworked ground in the same locality of a somewhat low grade, but with a copious water-supply could be worked by means of hydraulic sluicing. All parties concerned are confident of success. One of the claim-holders, Kean and party, who have done the most prospecting, found a nugget a few months ago, which upon being weighed proved to be only 7 dwt. short of an ounce.

Mining operations have been carried on steadily during the year at other alluvial claims, which have been working for years past, both at Cape Terrace and Westbrook portion of this district, and have obtained fair results, more so to advantage at the latter place since the completion of the Westbrook–Greenstone Road deviation, which now gives claim-holders ample deposit-room for tailings on; and across the old road claim-holders in this part of the district have also been greatly hampered by the Erin-go-bragh water-race being in their way. This trouble is also relieved, the Government having purchased the race from Mrs. Dixon (the licensee) in the month of June last for the large sum of £2,000, £1,800 being paid by the Government and the balance (£200) by the claim-holders in the district. Four Chinese parties are still working extended and special claims in this part of the district.

Operations at Dillmanstown and Kumara portion of the district: The Kumara Long Tunnel Company ceased operations over a year ago, owing to the very heavy expenditure involved in maintaining the No. 3 channel, there being no other party at that time sluicing into it but the company, but Shannon and party have now finished the boxing and blocking of their tail-race and are now ready to commence sluicing. The Long Tunnel Company may now give their ground another trial, as the maintenance of the channel will not be so heavy, divided between the two parties. McGrath and party commenced sluicing in their special claim at Larrikins, but was compelled to cease operations to put in a new low-level tail-race to enable the ground to be worked, the wash having dipped below the level of their top race, which took years to construct, at a cost of about £3,000. The low-level race is now nearly completed, and the party expect to commence sluicing operations very shortly. Tomasi and party, known as Garner's Claim, at Dillman's: Very little work has been carried on at this special claim during the year, chiefly owing to the scarcity of miners in the district. This party also hold a special claim at Cape Terrace, and the most of the miners obtainable were employed at that claim.

Dredging.

The only dredge in this district, and which is privately owned, has been working in the bed of the Greenstone Creek during the year in a special claim of 20 acres, but the licensee at the end of the year surrendered that claim, and the dredge is now being worked on tribute in an ordinary claim of 1 acre.

Eastern Hohonu Water-race Company.

I am advised that this company now propose to develop and utilize the Eastern Hohonu water-supply for mining purposes on both the New River and Greenstone water-sheds. The survey of the Hohonu – Diamond Terrace branch race, to carry forty heads, is completed, at a cost of about £500, and the company are now raising the necessary capital to carry on the construction-work, at an estimated cost of about £7,000, for the delivery of the forty heads, at a pressure of over 200 ft., on the 100 acres recently taken up between Irishman's Gully and Big Fuchsia Creek. At first the race referred to will take water direct from the Eastern Hohonu, but later, when the high-level race to the New River district is constructed, the low-level race to Diamond Terrace will be supplied by an extensive system of storage dams, into which the surplus water in wet weather will be diverted. It is the company's intention to start mining operations first on the Greenstone Terraces, and develop the high-level supply to the New River Terraces as rapidly as the company's resources will permit.

Ordinary Prospecting.

A considerable amount of interest has been taken in prospecting in this subdistrict during the year, no less than twelve applicants being dealt with, comprising an area of 979 acres, nearly all of which were in the vicinity of the Taipo and Kelly's Range, where prospecting operations have been vigorously carried on during the year with highly encouraging results, so much so that Messrs. Hopkins and party anticipate that they will, by the time their prospecting licenses (four) expire, have sufficient inducement to warrant them turning some of their areas (380 acres) into special claims. One tunnel has been advanced through schist country, containing some nice gold-bearing leaders, a distance of 200 ft. At this point rock exceptionally hard was met with. The quartz found has so far been of a very friable nature, but, still, some nice prospects of free gold of a ragged unworn character was found. The most of the stone is highly mineralized and very rusty.

With reference to the New Zealand Greenstone Company (Limited), the manager reports as follows:—

The company was floated in April, 1912, with a capital of £60,000, of which £32,000 in fully paid shares went to the vendors and underwriters, and of the balance £21,000 has been called up as working capital.

During the period under review the work of development has been actively prosecuted, and the road from its intersection with the Hokitika-Christchurch Road to the machinery-site of the property, a distance of one mile and three-quarters, has been constructed, and a ferro-concrete bridge has been thrown across Lynch's Creek, enabling all the material and machinery to be carted from Kumara Junction to the foot of the aerial by the two company's steam-tractors, which have been in commission since May last. A tractor-shed and hut for the tractor staff has been erected at Kumara Junction, where a site is leased from the Railway Department. An engineer's house, workshop, stores-shed, five huts, and stable have been erected on the company's property at the foot of the aerial, and another hut has been constructed on the summit of Griffen Range, the whole of the material for which had to be packed up on the men's backs.

The heavy cuttings, some five in number, on the line of aerial as well as excavations at machinery-site, have been completed, and the sites for the trestles and breakhead have been levelled. The trestles for the temporary aerial line are almost finished, and the rope is about to be hauled in position, five winches for this work having been carried up piecemeal to the various sites.

A heavy retaining-sill has been constructed at the machinery-site to shore up the deep cutting and keep the formation for the line of rails to the stores-shed in place.

A Babcock and Wilcox boiler to supply the necessary power is now in course of erection and almost completed. Contracts have been let for the erection of the power-house, and so soon as this is finished the Lindley-Browett engine, which is assembled on the site, will be erected.

During the year the vast deposits of nephrite and serpentine on the McArthur's Craggs property have been thoroughly prospected and proved to be of greater mass than originally estimated.

A telephone from the property, to be connected up with Government lines at Wainihinihi, is in course of erection, and should be shortly complete.

One of the difficulties to be faced has been the necessity of erecting a temporary ropeway to haul the larger ironwork to the trestle-stations for the permanent ropeway. Owing to the rugged precipitous nature of the country it was not possible, in view of the stability of the permanent trestles, to carry this up by man-power, as originally designed, nor was it practicable without enormous cost to make a track to the several scarps whereon the trestles are to be erected. This has delayed the work considerably, but now that the initial difficulties have been surmounted the rest is easy, and it is only a matter of a few months before the main aerial will be in running order.

All the material for the permanent roadway is either on the property or at Kumara Junction, so that nothing will hinder the rapid completion of all contemplated work.

I have, &c.,

J. G. L. Hewitt, Warden

Mr. Warden BARTHOLOMEW, Dunedin, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Warden's Office, Dunedin, 2nd March, 1914.

I have the honour to present my report for the year ended the 31st December, 1913, for the mining district under my charge.

LAWRENCE, WAIPORI, WAITAHUNA.

At the Warden's Court, Lawrence, the following business was transacted during the year: Miners' rights issued, 133; applications received, 65; registrations effected, 91; suits entered, 6. During the year eighteen claims were surrendered and sixteen new claims granted, but no new localities were included in the latter. In this subdistrict there are but three dredges working —two at Glenore, and one at Adams Flat—on ground which has been wholly or partly worked for many years. The water-supply for sluicing has been plentiful, and in April some damage was done by flood, especially at Waipori. At this place a claim of 400 acres of worked ground was applied for on the flat, to be worked by a new type of dredge driven by power from the Dunedin City Corporation electrical works at Waipori Falls. There were local objections to the large area applied for, as it would monopolize ground commanded by present water rights, and, after an inspection had been made by the Warden, an area of 100 acres was recommended to be granted to the applicants.

ROXBURGH.

During the year mining in this subdistrict shared in the general decline of the industry in Otago. The dredges still working were hampered to an unusual extent during the twelve months by the flooded state of the Molyneux. The dredges are now almost all held by private parties, who alone can make things pay where the ground has been worked before. The sluicing claims have had a fair year, but were also hampered by the floods. No new areas have been taken up, and all workings are confined to the Molyneux River and the neighbourhood of the river itself. The great development of the fruit industry is diverting attention from mining, and the great success which the widespread orchard-planting has met with shows up in still greater degree the barren waste of good lands caused in many instances by unrestricted mining operations in the past.

The destruction of valuable land by mining operations is still proceeding in a most marked manner at Island Block. This is a fine area of flat land which grows splendid crops, and the huge heaps of tailings adjacent thereto—the barren corpse of mining—form an arresting spectacle of the destruction caused by the present methods of mining.

Attention may be directed to the manner Victoria deals with the problem. There the rich agricultural overburden is removed and is replaced on the gravel—the tailings—after the same is levelled. This is, no doubt, a matter of increased cost to the miner; but might it not be laid down as a sound maxim that if the land is not sufficiently rich in auriferous deposits to bear the increased cost of the more expensive method of mining, it should not be mined at all. I should add, however, that I have recently read that the Victorian regulations have not proved effective to achieve their object.

The land above referred to is freehold, which presents difficulties. But are these insuperable if, as a matter of policy, interference is deemed desirable? The law is stated in Aitken *v.* Swindley (15 N.Z. L.R. 517): "A Crown grant of land does not of itself convey to the grantee the royal metals in the land, or prevent the Crown from working or authorizing others to work them. Yet the effect of the mining legislation of the colony is that the Crown has given up the prerogative right to mine for gold on Crown-granted land."

So far as I am aware, the Crown has not hitherto interfered with mining on private lands. It has been my desire in the above report, without exceeding my functions as Warden, to direct attention to a particular aspect of mining. I have, &c.,

J. R. BARTHOLOMEW, Warden.

Mr. Warden YOUNG, Gore, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Warden's Office, Gore, 28th March, 1914.

I have the honour to present my report for the year ended the 31st December, 1913, on that portion of the Otago Mining District under my charge.

QUEENSTOWN, ARROWTOWN, CARDRONA.

The mining industry in this portion of the district is in very much the same condition as it was at the end of last year. Most of the privileges granted were to be used in connection with existing claims.

Prospecting and development work in connection with the scheelite lodes at the head of Lake Wakatipu continues to be carried on actively, and seven new mineral licenses and twelve prospecting licenses were granted.

The Melbourne syndicate that acquired several privileges with the intention of working the old Invincible Quartz-mines, in the Richardson Range, went into liquidation before undertaking any development-work, but others have since applied for the ground.

A syndicate has acquired and registered options over several claims and water rights in the Shotover River district. The intention is to use existing races for the purpose of generating electricity, which will be conveyed by wires laid on the ground to different parts of the river. The wash will be raised by means of large suction pumps, electrically driven. The plant necessary to give the system a trial has been ordered. Those interested have had considerable mining experience, and they are confident that their proposed system of working will revolutionize mining on the Shotover. It is likely that an amendment in the Mining Act will be asked for giving the right to lay wires and prevent interference with them.

Waikaia.

One dredge ceased operations during the year, leaving five still at work. No new dredging claims were taken up.

There has been a decrease in the number of sluicing claims worked. The Nokomai Hydraulic Sluicing Company and the Muddy Terrace Company continue to carry on operations on a large scale, and pay between them about £8,000 a year in wages. Considerable damage was done to mining properties by the unprecedented flood in the early part of the year, the Muddy Terrace Company especially having lost heavily through this cause.

Gore.

Dredging continues to be the only form of mining carried on in this portion of the district. There has been no development worthy of note during the year. Two dredges are at work in the Charlton Valley, being one less than last year. There are still thirteen at work in the Waikaka Valley.

I have, &c.,

H. A. Young, Warden.

ANNEXURE C.

EXTRACTS FROM THE REPORTS OF GOVERNMENT WATER-RACE MANAGERS.

WAIMEA–KUMARA WATER-RACES.—Mr. JAMES ROCHFORD, Manager.

Waimea Race.

THE cash received for sales of water from this race for the year ended 31st March, 1914, was £873 5s. 4d., and the expenditure on management, gauging, maintenance, and repairs amounted to £609 10s. 4d., showing a credit balance of £263 15s. on the year's transactions.

The average number of miners supplied with water during the year was 28·5, a decrease of 3·58 on the previous year; and the approximate quantity of gold obtained by them was 1,625 oz., having a value of £6,337 10s.

The sales of water amounted to £843 18s. 9d., an increase of £77 17s. 2d. on the previous year. The sales of water would have shown a much larger increase but for the repairs being carried out to the flumings and tunnels on the race.

The cash received for sales of water showed an improvement of £125 19s. 10d., and the expenditure an increase of £18 16s. 3d., as compared with the previous year. The approximate quantity of gold obtained by the miners was 22 oz. greater than during the previous year, representing an increase in value of £85 16s.

During the last seven months of the year there were only four parties using water at Tunnel Terrace, but their returns were quite up to former years, and there is still a large area of payable ground in the locality, and no indication of a falling-off in the demand for water.

The repairs to the Waimea Water-race were completed to Tunnel Terrace in June, and, as the work cost £300 less than the original estimate, I recommended the Department to grant an additional £300 and carry out the repairs to Ballarat Hill. This work was completed early in November, and the sales of water from the Stafford section during the last five months of the year showed an increase of over £28 per month.

The whole of the Waimea Water-race from the outlet end of the Waimea siphon to the terminus at Ballarat Hill, including Branch B, a total length of about twelve miles, is now in excellent order, and the cost of maintaining this section, bar accidents, should be small for years to come. Linklater and Morgan have started the formation of their pipe-line from the old original terminus of Branch B across the Waimea Creek to Scandinavian Hill. The siphon will be 73 chains in length, and composed of wrought-iron pipes 22 in. and 18 in. in diameter. The contract for making the pipes has been let to Mr. James Brayshaw, and the whole work should be completed in four months.

Authorized free water to the value of £32 16s. 3d. was supplied from this race during the year.

The following is a summary of the revenue and expenditure of the Waimea Race for the year ended 31st March, 1914: Sales of water, £843 18s. 9d.; cash received, £873 5s. 4d.; expenditure, £609 10s. 4d.; approximate quantity of gold obtained, £6,337 10s.; average number of miners employed, 28·5.

Branch Race to Callaghan's and Middle Branch Flat.

The cash received for sales of water from this race for the year ended 31st March, 1914, was £535 2s., and the expenditure on management, gauging, maintenance, and repairs amounted to £500 10s., showing a credit balance of £34 12s. on the year's transactions.

The average number of miners supplied with water from this race during the year was 17·83, an increase of 4·25 on the previous year; and the approximate quantity of gold obtained by them was 1,098 oz., having a value of £4,282 4s.

The sales of water amounted to £550, an increase of £115 15s. 10d. on the previous year; and the approximate quantity of gold obtained by the miners was 79 oz. less, representing a decrease in value of £308 2s.

After the repairs to the Waimea Water-race were completed it was found that a number of the flumings on the Callaghan's Race were in a most dangerous condition, and Mr. McConnon and a small staff of men have been engaged for some months past in effecting urgent repairs.

Three parties were engaged sluicing into the Waimea Main Tail-race during the year, the ground operated on being that auriferous area at Middle Branch Flat which was thrown open for mining by the deviation of the Hokitika–Kumara Road through the old workings some eighteen months ago.

Although the sales of water from this race showed a considerable increase on the previous year, I see no reason why they should not show a further improvement for the ensuing year.

Authorized free water to the value of £10 was supplied from this race during the year, and the usual quantity of flushing-water was allowed to parties sluicing into the Waimea Tail-race free of charge.

The following is a summary of the revenue and expenditure of the Callaghan's Race for the year ended 31st March, 1914: Sales of water, £550; expenditure, £500 10s.; approximate value of gold obtained, £4,282 4s.; average number of miners employed, 17·83.

Kumara Race.

The cash received for sales of water from this race for the year ended 31st March, 1914, was £17 14s. 4d.; and the expenditure on management, gauging, maintenance, and repairs amounted to £260 12s. 6d., showing a debit balance of £242 18s. 2d. on the year's transactions.

The average number of miners supplied with water was 4·58, a decrease of 1·83 on the previous year; and the approximate quantity of gold obtained by them was 253 oz., of the value of £986 14s.

The sales of water amounted to £23 8s. 1d., a decrease of £155 19s. 5d. on the previous year; and the cash received shows a decrease of £104 18s. 10d.

The expenditure was £140 19s. 10d. less than during the previous year, and the main and branch races and siphons are in good repair.

The head-race tunnel, which is the only supply race from the Kapitea watershed, and consequently the key of the Kumara and Kumara–Taramakau water-system, is in fair order, but requires constant supervision, so that new intermediate sets and lathing and lining may be immediately placed in position wherever indications of excessive weight are found on the old timbers, as the ground is very difficult and expensive to pick up once a break occurs.

Authorized free water to the value of £159 16s. 10d. was supplied from this race during the year.

The usual quantity of flushing-water was supplied when the No. 3 deviation was working, and water was also supplied to the Borough of Kumara for fire-brigade and other purposes free of charge.

The following is a summary showing the revenue and expenditure of the Kumara Race for the year ended 31st March, 1914: Sales of water, £23 8s. 1d.; cash received, £17 14s. 4d.; expenditure, £260 12s. 6d.; approximate value of gold obtained, £986 14s.; average number of miners employed, 4·58.

Kumara–Taramakau Race.

The cash received for sales of water from this race for the year ended 31st March, 1914, was £428 12s. 3d., and the expenditure on management, gauging, and maintenance was £211 15s. 3d., showing a credit balance of £216 17s.

The average number of miners supplied with water was 10·91, and the approximate quantity of gold obtained by them was 982 oz., of the value of £3,829 16s.

The total sales of water amounted to £473 8s. 3d., an increase of £347 15s. on the previous year; and the cash received shows an increase of £307 8s. 3d.

The water was turned off and the miners were idle for nine weeeks during the year, owing to two breaks which took place in the old cast-iron pipes at McGrath's deviation, on the Kumara–Taramakau siphon. These breaks, of course, materially reduced the revenue of the Kumara–Taramakau Race, but, even after making due allowance for these adverse conditions, the sales were disappointing, and the ensuing year should show a decided improvement.

Authorized free water to the value of £119 8s. 6d. was supplied from this race during the year to parties opening out new claims.

The following is a summary showing the revenue and expenditure of the Kumara–Taramakau Race for the year ended 31st March, 1914: Sales of water, £473 8s. 3d.; cash received, £428 12s. 3d.; expenditure, £211 15s. 3d.; approximate value of gold obtained, £3,829 16s.; average number of miners employed, 10·91.

Erin-go-Bragh Race.

This property was purchased by the Government from Mrs. Sarah Dixon, of Hokitika, on the 24th June, and since that time until the 31st March, 1914, the sales of water amounted to £211 10s. 6d.

The cash received for sales of water was £202 16s. 6d., and the expenditure on management, gauging, and repairs amounted to £220 19s. 3d., showing a debit balance of £18 2s. 9d.

The average number of miners supplied with water was 11·16, and the approximate quantity of gold obtained by them was 421 oz., of a value of £1,641 18s.

The expenditure for the nine months was slightly in excess of the revenue, but this was due to certain works that had to be carried out in order to meet the altered conditions of working the Kumara–Taramakau and Erin-go-Bragh water-races under one management, and by a rather serious break which took place in the tunnel near the head of the Long Drive Race. The maintenance of this tunnel is of the utmost importance, because it is the key to the high-level supply which, although limited, is the only water available that commands the auriferous terraces in the vicinity of the Greenstone.

During the year several claims were pegged out on these terraces, and a deviation of the Long Drive Race was constructed from the reservoir at Maori Point to Argus Terrace to convey water to work the ground.

The parties holding these claims applied for more water than is at present available from the Long Drive Race, and, as there is every possibility of an extensive sluicing field being opened up, the deviation was cut with the object of selling the whole of the water in this locality, and provision has already been made to supply the parties taking water from the lower end of the Erin-go-Bragh Race near Westbrook from the Kumara–Taramakau Race. This arrangement, besides creating a market for all available water at Argus Terrace, obviates the necessity of repairing and maintaining the Erin-go-Bragh Race from the Greenstone to Westbrook, which would be very expensive, as it includes a number of tunnels that are liable to collapse at any moment.

The following is a summary of the revenue and expenditure of the Erin-go-Bragh Race for the year ended 31st March, 1914: Sales of water, £211 10s. 6d.; cash received, £202 16s. 6d.; expenditure, £220 19s. 3d.; approximate value of gold obtained, £1,641 18s.; average number of men employed, 11·16.

Wainihinihi Water-race.

There was an excellent supply of water from this race, and, together with the Kawhaka supply, the Waimea siphon was kept practically full all the year. No breaks occurred, and the race is now in good order.

Waimea-Kumara Water-races.

The following is a summary of the revenue and expenditure of these races for the financial year ended 31st March, 1914: Sales of water, £2,102 5s. 7d.; cash received, £2,057 10s. 5d.; expenditure, £1,803 7s. 4d.; approximate value of gold obtained, £17,078 2s.; average number of miners employed, 73.

It will be seen by the above summary that the value of the sales of water from the combined races was £2,102 5s. 7d., as against £1,505 6s. 6d. for the previous year, thus showing an increase of £596 19s. 1d. In addition to the above sales, authorized free water to the value of £322 1s. 7d. was supplied to parties opening up new claims.

The total expenditure was £1,803 7s. 4d., as against £1,446 19s. 6d. for the previous year, an increase in the cost of maintenance of £356 7s. 10d., which was mainly caused by the upkeep of the Erin-go-Bragh Race for the last nine months of the year.

The cash received was £2,057 10s. 5d., as against £1,440 1s. 5d. for the previous year, showing an increase of revenue of £617 9s.

Comparing the sales of water with the expenditure, the combined races show a profit of £298 18s. 3d., and the ensuing year should show a very considerable increase on this amount.

Mount Ida Water-race, Central Otago.—Mr. J. C. Buchanan, Manager.

The total sales of water from the Mount Ida Water-race during the year amounted to £1,247 16s. 4d., an increase on that of last year of £160 4s. 11d.

The expenditure on maintenance and repairs for the same period amounted to £1,411 12s. 5d., an increase on that of last year of £26 7s. 9d.

The total cash received was £1,247 16s. 4d.

On account of payment in advance, free water was supplied to the value of £24 18s. 1d., and free water for washing up was supplied to the value of £89 7s. 8d.

The total value of water supplied from this race amounted to £1,362 2s. 1d., an increase on that of last year of £189 4s.

The approximate quantity of gold obtained by parties using water from this race during the year was 1,597 oz., valued at £6,148 9s., an increase on that of last year of £192 10s.

The average number of men employed was 26·25.

From the 1st April until hard frost set in at the beginning of July there was a full supply of water; from the 1st to the 18th July, owing to the severity of the frost, most of the claims were closed down. A thaw set in, and the water was on again on the 20th. From then until the 13th September, when the water was turned out for cleaning and repairs, there was a full supply of water.

The season has been a good one for water-supply. From the end of October until the 5th February the season was an exceptionally wet one; from then until the end of year it was fairly dry, but there was plenty of water in the reservoir to keep up a full supply.

Owing, no doubt, to the excessive wet season there occurred numerous large slips of clay along the line of main race, which meant considerable expense in repairing the damage caused by them coming into the race or carrying the outer embankment of race away, the worst places being Wedderburn, West Eweburn, and Coal-pit Gully. There were also several breaks during the year, most of them no doubt caused through the ground becoming so saturated with the continuous rains.

During the year, to enable two parties to start hydraulic elevating in Spec Gully, I had to clean out 70 chains of race that had not been in use for many years, also construct 68 chains of new race to connect Finger-post dam with the branch race leading to Lower Spec Gully. In this locality, no doubt, lies a large belt of payable ground, and I consider ere long much improvements will be necessary to supply all parties requiring water at this point, which is the terminus of the race.

During the year, to cope with the shingle at creek-crossings, I have placed in position at Idaburn and Hills Creek boxes to carry the shingle over the race. I have also material on the ground to do likewise to East Marionburn and Ten-chain Creeks, and will have same in position when the creeks become sufficiently low to enable the work to be carried out. At Pearce's Gorge I have also placed in position a shoot to carry debris across the race, which otherwise, at time of heavy rain or thunderstorms, filled in the race, and also caused a break which meant much expense to repair.

ANNEXURE D.

REPORTS OF DIRECTORS OF SCHOOLS OF MINES.

Professor JAMES PARK, M.I.M.M.E. (London), F.G.S., Director of Otago University School of Mines, to UNDER-SECRETARY, Mines Department, Wellington.

SIR,— Dunedin, 15th April, 1914.

I have the honour to present my report on the work done at the Otago School of Mines during the year ended 31st December, 1913.

The School of Mines for the session of 1913 showed an attendance of eighteen registered students, of whom sixteen were entered for the full associate courses, one for surveying, and one for applied mechanics. Altogether there was an accession of nine new students for the full course. The current session (1914) started with the satisfactory registration of eleven new students, and we now have twenty-eight students taking the full associate course, exclusive of those attending lectures in geology and dental metallurgy. This is the largest attendance since the year 1901. Of these, twenty have entered for the associate course in mining engineering, five for the associate course in geology, and three for the course in land and mine surveying.

The results of the annual examinations in October, 1913, were as high as in previous years, only three failures being recorded—namely, one in mathematics, one in mechanics, and one in practical chemistry.

In September, 1913, Mr. John Mackay, A.O.S.M., passed the examinations of the New Zealand Board of Examiners, and obtained his diploma as a licensed surveyor. In the same year E. Fletcher Roberts and R. S. Thompson succeeded in passing the examinations of the Institution of Civil Engineers, entitling them to the associateship (A.M.I.C.E.) of that institution. The first named was bracketed with another Otago University student as taking the first place among all the candidates from Great Britain and the oversea dominions, and both received honourable mention from the Council in London.

Our old students continue to secure a good share of the lucrative appointments that fall to the lot of mining engineers, both at Home and abroad. Among the more important places obtained by them in 1913 are the following :—

(1.) D. M. Tomlinson, B.E., A.O.S.M., General Manager, Kapsan Mines (Limited), Korea.
(2.) E. Fletcher Roberts, Assistant Engineer, London Port Authority, London.
(3.) Alex. Fyfe, Chief Metallurgist, Ventanas Mining Company, Mexico.
(4.) F. W. Thomas, A.O.S.M., Assistant Manager, Bomba Tin-mines, Northern Nigeria.
(5.) Herbert Black, A.O.S.M., Chief Metallurgist, Aaquah Gold-mining Company (Limited), Gold Coast, West Africa.
(6.) Philip MacDouall, B.E., A.O.S.M., Assistant Manager, Bombassie Gold-mines, West Africa.
(7.) A. R. Andrew, D.Sc., A.O.S.M., Chief Mining Geologist, the Anglo-Saxon Petroleum Company, Sarawak.
(8.) Gerhardt Ulrich, B.E., A.O.S.M., Mining Captain, Prestea Block A Mining Company, Gold Coast, West Africa.
(9.) H. C. Boydell, A.O.S.M., Assistant Manager, Kapsan Mines, Korea.

Revision of Class-work.—The lectures and class-work in mathematics, mechanics, chemistry, and physics for the associateship of the School of Mines are at present the same as for the B.A. degree. The B.A. courses of study as defined for mathematics and chemistry cover the requirements of a professional mining or metallurgical course satisfactorily; but the B.A. courses in mechanics and physics contain much matter that has little or no bearing on the subsequent professional work of our graduates. Radical amendment is required, especially in respect of the course in mechanics. The brilliant scholar has doubtless no difficulty with mechanics as at present prescribed. He is a peculiar type of brain—finer, softer, and more receptive than that of the average professional student, whose reasoning is always associated with the doing of things rather than abstract ideas. The doer is the man who builds our harbours, railways, ships, and bridges, and who produces the coal and metals required for our great industrial activities. He is rarely brilliant, but has, nevertheless, succeeded in supplying us with all the conveniences of our complex modern civilization. To produce an annual output of 1,000 tons of copper is as worthy as teaching men for the mathematical tripos.

In all our work we should aim at making the course of study fit the object in view.

A Forward Move.—The days of the small mine are nearly past. In the last two decades the mineral industry has made prodigious strides, and mining operations are now conducted on a scale of magnitude undreamt of thirty years ago. The mining and metallurgical plant and accessories at many mines represent a value of many hundreds of thousands of pounds; and every day mining engineering is becoming more and more allied to civil engineering. The mining engineer is now required to construct roads, tramways, and railways; design and erect dams, bridges, and complicated metallurgical plant; harness rivers for the generation of hydraulic and electrical power. In order to meet the demand for more specialized knowledge in structural engineering it will be necessary for us, if we mean to keep in the front rank of

engineering-schools, to extend the scope of our instruction, more especially in the departments of applied mechanics, practical electricity, and surveying. This advance will necessitate the appointment of two instructors and the better equipment of our laboratories.

It has been stated by some that many of our graduates go abroad to find profitable employment. This is doubtless true, nor do we regret it. We do not pledge our medical graduates to practice in New Zealand. Why exact more from mining graduates? We must learn to view higher education from a broader outlook than the parochial or provincial. For many generations the universities of Britain have been proud to send their *alumni* to all parts of the Empire. Should we not reciprocate? Mining engineering is not one of the softer professions, but it offers a splendid field for men of grit and enterprise, and we must see to it that their equipment is the right kind before we send them out. The mining-school is the only faculty of the University of Otago representing a wealth-producing industry, and therefore deserves the most sympathetic assistance that can be given it.

The Mineral Industry.—The two basal wealth-producing industries are mining and agriculture, and of these mining is still by far the most important. From the mineral statistics of the British Empire for 1912, just published, we find that the value of the mineral production for that year, including coal, gold, copper, tin, gems, &c., amounted to £237,000,000. In the same year the value of agricultural products, including wheat and all cereals, cotton, butter, cheese, &c., amounted to £149,000,000.

Institution of Mining and Metallurgy, London.—This is the supreme body governing mining procedure and standardizing technological methods throughout the Empire. It is gratifying to say that the associate membership of this institution is now open to our graduates without examination or further academic qualification.

Laboratory.—During 1913 assays were made at schedule rates, most of the determinations being for gold and scheelite.

I have, &c.,
JAMES PARK, Director.

Mr. W. H. BAKER, B.Sc., Director of the Thames School of Mines, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Thames, 27th May, 1914.

I have the honour to present my report on the work done at the Thames School of Mines during the year 1913.

Attendance.—The average number of individual students was seventy-five, of whom twenty-seven were registered students, with a class attendance of forty-four, thirty-five elementary science students, and thirteen members of the teachers' science class.

Examinations.—Twenty students presented themselves for the Government annual examination, and obtained six first-class, twelve second-class, and seven third-class certificates. L. Stevenson, with an average of 66·8 per cent. in seven subjects, gained a Government School of Mines Scholarship, and will continue his studies at the University of Otago. This student also gained the president's medal, presented by G. Warne, Esq. In the Saturday science class F. Grigg won the school prize, with 73 per cent. marks. In this class the students W. Warne, R. Keoghan, R. Judd, S. Judd, R. Wylie, L. Hague Smith, W. Donnelly, T. Cartwright, A. Ellis, and F. Grigg were awarded prizes for regular attendance. J. P. Clark qualified for the bullion-assayer's certificate.

Battery and Experimental Plant.—During the year eleven parcels have been treated by amalgamation, concentration, and cyanidation, and useful information for future treatment of the various ores has been obtained.

Museum.—Various samples have been added to the museum, whose value is gradually enhancing. The thanks of the school are due to Messrs. Kingsford, S. G. Baker, J. T. Caisley, and others for donations of exhibits.

Library.—The lending library instituted by the Mines Department is of very great benefit to the students and staff, and as the books are all standard works, this library is a valuable asset to the school.

In conclusion, I wish to express my appreciation of the work of the staff and of the interest taken by the president and Council in progress of the school.

I have, &c.,
W. H. BAKER, Director.

Mr. J. F. MCPADDEN, A.O.S.M., Director of the Reefton School of Mines, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Reefton, 26th May, 1914.

I have the honour to present my report on the work of the Reefton School of Mines for the year ended 31st December, 1913.

Attendance.—First term, 21 students; second term, 21; third term, 22; fourth term, 18

Waiuta School.—Attendance at this school averaged seven for the year.

Examinations.—At the examination for Government certificates under the Mining Act, held in March, four students presented themselves, one gaining a first-class mine-manager's certificate, while two gained a complete pass and one a partial pass as battery superintendents.

I have to acknowledge with thanks the receipt of mineral specimens from various gentlemen, and also desire to place on record the lively interest taken in the school by the Council.

I have, &c.,
J. F. MCPADDEN, Director.

Mr. U. B. Inglis, A.O.S.M., Director of the Coromandel School of Mines, to the Under-Secretary of Mines, Wellington.

Sir,— Coromandel, 19th March, 1914.

I have the honour to present my report on the work done at the Coromandel School of Mines during the year 1913.

Attendance.—Although mining has been very quiet in Coromandel since the early part of 1913, the number of students attending the school was the largest for some years past, and included men who came from places fourteen miles distant once or twice a week. The actual numbers attending were: First term, 34; second term, 30; third term, 22, the decrease towards the end of the year being almost entirely due to departures from the district, which cost the school some of its most promising students. The number of class-subjects taken was fourteen, including commercial book-keeping, shorthand, and agricultural chemistry, which were added to the regular syllabus by the Council to meet a strong local demand.

Annual Examinations.—At the annual written examinations thirteen students presented themselves for the regular Government papers, eight other students for the extra subjects taught at the school, and seven did the practical examinations. Nineteen pass certificates were secured by eighteen students, there being nine first-, six second-, and four third-class certificates awarded. Five students passed the practical examinations.

Several teachers from the local and surrounding public schools availed themselves of the classes in chemistry, geology, and other subjects in order to sit for the Education Department's B and C certificate examinations held in January, at which some were successful.

Museum.—The mineralogical collection in the school has been augmented by the presentation of a set of New Zealand fossils from the Geological Survey Branch of your Department, and by twenty-five specimens of different rocks from the Antarctic regions collected by Mr. R. E. Priestley, Geologist to the Shackleton and Scott Expeditions, and sent to me by him; also a number of mineral and other specimens have been received from various persons, to whom the thanks of the school are due.

Library.—I have to thank the Department and Mr. T. W. Rhodes, M.P., for forwarding books and copies of Acts affecting mining, agriculture, &c., and for the Geological Survey Bulletins and pamphlets. The school now subscribes to two valuable and instructive magazines—the *Engineering and Mining Journal* and *Popular Mechanics*—which are eagerly read and borrowed by the students.

In conclusion, I wish to express my hearty appreciation of the interest taken in the school by the members of the Council and others, as showing that it is valued as an asset by the community of Coromandel.

I have, &c.,
Urquhart B. Inglis, Director.

Mr. A. H. V. Morgan, M.A., Director of the Waihi School of Mines, to the Under-Secretary of Mines, Wellington.

Sir,— Waihi, 16th March, 1914.

I have the honour to present my annual report upon the work done at the Waihi School of Mines during 1913.

The average attendance of students during the year was forty-eight, with an average class attendance of 101. These figures are almost the same as for the previous year, and seem to indicate that the attendance at the school tends to bear a fixed proportion to the population of the town.

Examinations.—Twenty-two candidates presented themselves for the written examinations, and seven for the practical examinations, with the result that twelve first-class, eleven second-class, and eight third-class certificates were secured, and six passes were obtained in the practical tests. I have much pleasure in stating that again one of our students has been successful in gaining a Government scholarship, of the annual value of £50, tenable for three years at the Otago University, this distinction having been won by Leslie Grange. Another student, H. A. Ellis, has passed the first section of the same examination in three subjects.

The gold medal (value £2 2s.) presented by the president (Mr. Thomas Gilmour) for the highest aggregate in any four subjects has this year been won by H. A. Ellis, with an average of over 76 per cent. Mr. Haszard's gold medal for surveying (value £2 2s.) was won by L. Grange with 76 marks.

Government Certificates.—At the 1913 examination for Government certificates two candidates from this school sat, and both were successful, Mr. A. J. Walker securing a first-class metal-mine manager's certificate, and Mr. E. J. Scoble a first-class coal-mine manager's certificate. These were the only successful candidates from the North Island. Altogether thirty-four students of this school have obtained certificates as first-class metal-mine managers, three as first-class coal-mine managers, forty-two as battery superintendents, and twenty-three as assayers of bullion under the Customs Act.

In conclusion, I have again much pleasure in acknowledging the zeal and ability with which the members of the staff carried out their duties, and also the co-operation and assistance of the Council. In particular I wish to place on record my appreciation of the valuable services rendered by the secretary (Mr. C. F. Sims), who has been untiring in his efforts to forward the interests of the school, and has, during the year, dealt with a large amount of correspondence entailed by conferences and various other matters, in a most able manner.

I have, &c.,
A. H. V. Morgan, Director.

Mr. W. GIBSON, B.E., A.O.S.M., Director of the Karangahake School of Mines, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Karangahake, 12th March, 1914.

I have the honour to present my report of work done at Karangahake School of Mines during the year 1913.

The average number of students for each term was thirty-four, and the class attendance was sixty-eight. The Waikino branch did not show any increase, and as prospects are not in any way improved the expense of maintaining the school does not warrant the retaining of the Assistant Director's services on full time.

Examinations.—At the annual December examinations thirteen students presented themselves, and sent in thirty-four papers in the written work, obtaining eleven first-class passes, eight second-class passes, and six third-class, a very satisfactory result considering the broken attendance occasioned by the Huntly strike during the third term. One student, F. E. Smale, qualified for four subjects of the scholarship, and E. D. White, another student, is now entitled to the bullion-assayer's certificate issued by the Department of Trade and Customs. In the practical examinations there was only one failure, and passes were three in senior chemistry, one in junior chemistry, one in senior wet assaying, and one in junior dry assaying. The president's medal was won by F. E. Smale, and the Council's prizes by E. D. White for chemistry, J. C. H. McDonald for mathematics and drawing, and S. Shore for junior subjects. All the candidates presented for the winder's electrical examination were successful.

Equipment.—Early in the year the electrical laboratory was enlarged and new apparatus added. These changes have been much appreciated by the lecturer and students, the latter having now increased room and apparatus for carrying on their practical work. More apparatus is on order, and should be to hand at any time.

Conference.—In September, by the courtesy of the Hon. the Minister of Mines, a conference with the Board of Examiners was held at Wellington. The proposals by which it was hoped the status of schools of mines would be raised were, unfortunately, not agreed to by the majority of the delegates.

Library.—The thanks of the staff and the students are due to the Mines Department for the further provision to the lending library of up-to-date works in mining subjects. Additions have also been kindly made by the Council.

I have to acknowledge with thanks the receipt of twenty typical New Zealand fossils from the Geological Survey, and also some splendid representative specimens of Broken Hill district from Mr. H. Marshall, of Karangahake. I wish to express also my hearty appreciation of the zeal and enthusiasm displayed by the members of the staff, and also of the co-operation of the Council in all matters pertaining to the progress of the school.

I have, &c.,
WM. GIBSON, Director.

Mr. W. F. WORLEY, Director of the Nelson School of Mines, to the UNDER-SECRETARY OF MINES, Wellington.

SIR,— Nelson, 17th February, 1914.

I have the honour to present my report on the Nelson School of Mines for the year ended 31st December, 1913.

A blowpipe analysis class for boys attending the State school was in session from the 24th April till the 4th December. There were thirteen boys in this class, and the average attendance was ten. With one exception all were quite new to the work; but, nevertheless, good progress was made before the end of the year. Several of these boys are anxious to join the class again this year, and by its close will probably be ready for the examination which is held for those who have been through a two-years course.

Though only a few of the boys who have passed through this class in past years have ultimately taken up mining as a profession, very many of them have become teachers of science. Dr. Worley, who was recently made Professor of Chemistry at the Auckland University, received his first lessons in science in the blowpipe analysis class. Many of the boys, too, acquire a love for collecting rocks and minerals. Clifford Knapp, who belonged to this class during 1912, carried off at the end of last year at the Nelson Boys' College a substantial prize for the best collection of rocks and minerals.

Though the work of teaching this class is done gratuitously, the enthusiasm for the work shown by the lads, and the good progress which most of them make, are sufficient inducements to warrant a continuance of the work.

During the winter months three lantern lectures on geological subjects were given to the Sixth Standard pupils of the Nelson Boys' School.

Geology.—In Bulletin No. 12 frequent mention is made of fault scarps in the rocks near Richmond. Having examined these with some care I fail to see that these scarps are of themselves evidence of faulting. The rock which forms the scarp is an igneous rock, and when viewed in thin sections under the microscope appears to be either a tuff or a lava with fragmental matter embedded in it. This rock is much harder than the rocks by which it is flanked; it is also less susceptible to weathering than they are, and consequently, as the result of unequal weathering, stands out as a conspicuous ridge. In some places the rock lying to the eastward of it is a soft sandstone belonging probably to the Jenkin's Hill beds. This rock has weathered much more

rapidly than the igneous one, and, as the rocks there dip at high angles to the eastward, the igneous rock stands up almost like a wall. This condition is best seen in Hodgson Creek. It would be hard to prove that no differential movement has taken place here along the planes of stratification; but neither is it necessary to assume the existence of a fault to explain the rock scarp, which in all probability has been produced by ordinary weathering processes.

While engaged in studying these supposed fault scarps a rock was discovered which hitherto has not been described. An outcrop of it occurs in one of the small tributaries of the Reservoir Creek. The rock itself is an igneous one; it is of a very dark colour, and when fairly fresh clear crystals of feldspar and distinct crystals of augite may be easily seen in hand specimens. When viewed in thin section under the microscope this rock becomes an intensely interesting one, as it is so unlike anything hitherto seen in this district. The feldspar crystals are remarkably fresh, showing scarcely a trace of decomposition, and under crossed nicols are easily recognized as plagioclase of rather basic composition. The groundmass consists chiefly of densely felted, very minute, crystal laths. Here and there a few large crystal laths may be seen, some magnetite, some augite, and probably some glass. Some fragments of the groundmass are enclosed in the clear feldspar phrenocrysts. Some augite crystals larger than those seen in the groundmass have crystallized in contact with the feldspar, but they are not a conspicuous feature of the rock. Until a more exhaustive analysis of the rock has been made it may reasonably be classed as an andesite.

The Brook Street igneous rocks are being systematically studied, but the work has not yet proceeded far enough for a report thereon.

I have, &c.,
W. F. Worley Director.

Mr. H. Lovell, Director of the Westport School of Mines, to the Under-Secretary of Mines, Wellington.

Sir,— Westport, 31st March, 1914.

I have the honour to present my report upon the work of the Westport School of Mines and the branch schools at Ngakawau, Millerton, and Denniston for the year ended 31st December, 1913.

The average number of students for the year was forty-three, with an average class attendance of eighty-seven. The students were distributed over the school and its branches as follows: Westport, 12; Ngakawau, 9; Denniston, 12; Millerton, 10.

At the annual examinations twenty students presented themselves for examination, and seventeen passes were secured. Candidates sat in mathematics, chemistry, mechanical drawing, mining, ventilation, and surveying. Ten students were prepared for the deputies' and under-viewers' examination, and three candidates—two for first class and one for second class—sat for the mine-manager's examination.

I have to acknowledge with thanks the donation of a number of standard works to the school library by the Mines Department; also the receipt of a set of type fossils from the Geological Department.

The facilities for teaching at the branch schools have not improved during the year. A great demand exists there for instruction in chemistry and engineering subjects which, owing to the lack of accommodation and teaching apparatus, cannot be supplied. An effort is being made, however, to establish in connection with the Westport School a properly equipped central school at Granity calculated to serve the districts of Ngakawau and Millerton, where the demand for technical and mining training is most pronounced.

I have, &c.,
H. Lovell, Director.

ANNEXURE E.

MINING STATISTICS.

Table 1.

STATEMENT SHOWING THE REVENUE OF THE GOLDFIELDS COLLECTED IN THE SEVERAL DISTRICTS OF THE DOMINION OF NEW ZEALAND FOR THE PERIOD FROM 1ST JANUARY TO 31ST DECEMBER, 1913.

District.	Miners' Rights.	Business Licenses, Machine and Residence Sites.	Water-races, Sluices, &c.	Gold-mining Leases, Rents, and Royalties.	Registration.	Fees and Fines, Wardens' Courts.	Miscellaneous.	Totals.
AUCKLAND.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Coromandel ..	38 0 0	0 17 0	0 5 0	394 17 5	6 11 0	17 17 0	22 1 3	480 8 8
Te Aroha ..	27 10 0	575 16 6	20 0 0	317 5 0	1 9 0	5 12 0	0 16 0	948 8 6
Paeroa ..	45 0 0	132 7 5	0 10 0	1,159 7 5	7 16 0	4 15 0	13 1 6	1,362 17 4
Thames ..	78 5 0	..	..	947 7 1	5 11 0	..	38 9 10	1,069 12 11
Pubipubi ..	12 15 0	..	0 5 0	148 15 0	1 19 0	13 3 0	..	176 17 0
Tauranga ..	2 15 0	..	..	..	..	..	1 10 0	4 5 0
Waihi ..	71 15 0	786 14 9	..	946 2 3	7 17 0	35 7 0	103 2 1	1,950 18 1
Totals ..	276 0 0	1,495 15 8	21 0 0	3,913 14 2	31 3 0	76 14 0	179 0 8	5,993 7 6
NELSON.								
Wangapeka ..	2 15 0	..	..	27 0 0	0 7 0	0 16 0	..	30 18 0
Collingwood and Takaka	8 5 0	1 15 0	0 15 0	339 14 11	1 7 0	2 14 0	4 14 0	359 4 11
Westport, Seddonville, and Granity	89 10 0	51 4 0	..	674 3 5	16 18 6	71 1 6	86 5 0	989 2 5
Charleston ..	17 15 0	..	0 5 0	22 0 4	0 11 0	0 15 0	0 10 0	41 16 4
Ahaura ..	33 5 0	34 14 9	1 10 0	267 1 9	3 14 0	24 18 0	0 8 0	365 11 6
Reefton ..	55 10 0	0 8 0	..	1,171 17 6	1 8 0	41 6 0	198 1 0	1,468 10 6
Lyell and Murchison	10 5 0	1 5 0	4 15 0	94 19 8	2 3 0	8 2 0	68 6 0	189 15 8
Totals ..	217 5 0	89 6 9	7 5 0	2,596 17 7	26 8 6	149 12 6	358 4 0	3,444 19 4
MARLBOROUGH.								
Havelock ..	3 0 0	..	0 10 0	20 13 9	0 18 0	2 8 0	0 18 0	28 7 9
Blenheim ..	6 0 0	..	..	77 1 6	0 3 0	0 4 0	1 0 0	84 8 6
Totals ..	9 0 0	..	0 10 0	97 15 3	1 1 0	2 12 0	1 18 0	112 16 3
WESTLAND.								
Hokitika ..	40 15 0	..	1 5 0	277 15 9	16 13 0	40 18 6	81 2 6	458 9 9
Greymouth ..	205 10 0	4 14 7	3 0 0	253 14 5	2 16 0	23 15 0	23 17 0	517 7 0
Ross	12 0 0	0 5 0	1 15 0	293 8 9	8 5 6	13 11 0	6 5 0	335 10 3
Stafford and Goldsborough	13 15 0	..	..	197 12 9	4 19 0	9 0 0	1 1 0	226 7 9
Okarito ..	6 0 0	0 10 0	0 10 0	182 15 0	1 2 0	4 18 0	6 15 0	202 10 0
Kumara ..	45 15 0	10 0 0	3 5 0	1,267 8 4	14 16 0	15 18 0	48 14 0	1,405 16 4
Totals ..	323 15 0	15 9 7	9 15 0	2,472 15 0	48 11 6	108 0 6	167 14 6	3,146 1 1
CANTERBURY.								
Ashburton ..	0 15 0	..	..	..	..	..	..	0 15 0
OTAGO AND SOUTHLAND.								
Middlemarch ..	1 15 0	..	..	18 6 5	..	..	..	20 1 5
Hindon ..	14 15 0	..	..	52 10 0	0 1 0	0 16 0	0 19 0	69 1 0
Naseby ..	24 5 0	13 2 0	0 5 0	479 17 8	4 5 0	18 16 0	17 13 0	558 3 8
Black's, Alexandra, Clyde, Roxburgh, Cromwell	60 10 0	45 8 0	0 10 0	1,721 18 11	0 12 0	73 12 0	45 5 0	1,947 15 11
Tapanui ..	..	..	..	..	..	..	..	..
Arrowtown ..	6 15 0	2 5 0	..	203 12 2	..	3 17 0	..	216 9 2
Queenstown ..	35 15 0	2 9 0	0 15 0	250 7 0	..	26 10 0	2 11 0	318 7 0
Lawrence ..	33 0 0	9 5 0	..	554 1 0	0 6 0	35 12 0	9 0 0	641 4 0
Orepuki ..	..	..	..	21 15 2	0 13 0	3 8 0	..	25 16 2
Riverton ..	23 5 0	9 0 0	1 5 0	151 19 9	2 4 0	4 5 0	24 10 0	216 8 9
Pembroke ..	4 0 0	..	1 6 0	..	0 17 0	7 10 0	..	13 13 0
Waikaia ..	17 0 0	..	0 10 0	219 9 9	0 6 0	9 6 0	4 3 0	250 14 9
Wyndham ..	1 0 0	..	0 10 0	13 6 6	0 5 0	..	..	15 1 6
Gore	4 0 0	..	..	140 17 1	..	2 14 0	1 1 0	148 12 1
Totals ..	226 0 0	81 9 0	5 1 0	3,828 1 5	9 9 0	186 6 0	105 2 0	4,441 8 5
Grand totals ..	1,052 15 0	1,682 1 0	43 11 0	12,909 3 5	116 13 0	523 5 0	811 19 2	17,139 7 7

Table 2.

STATEMENT SHOWING THE REVENUE OF THE GOLDFIELDS COLLECTED IN THE SEVERAL DISTRICTS OF THE DOMINION OF NEW ZEALAND FOR THE PERIOD FROM 1ST JANUARY TO 31ST MARCH, 1914.

District.	Miners' Rights.	Business Licenses, Machine and Residence Sites.	Water-races, Sluices, &c.	Gold-mining Leases, Rents, and Royalties.	Registration.	Fees and Fines, Wardens' Courts.	Miscellaneous.	Totals.
AUCKLAND.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Coromandel ..	15 15 0	0 10 0	..	128 9 6	1 18 0	4 17 0	4 18 6	156 8 0
Thames ..	14 5 0	..	..	329 10 9	11 16 6	..	5 6 0	360 18 3
Te Aroha ..	3 0 0	72 14 6	19 10 0	16 2 9	2 18 0	1 5 0	1 19 0	117 9 3
Paeroa	33 5 0	50 15 10	..	311 16 1	0 17 0	10 6 0	6 5 0	413 4 11
Puhipuhi ..	3 5 0	1 10 0	..	39 14 0	0 4 0	0 15 0	..	45 8 0
Tauranga ..	0 15 0	..	..	..	..	..	..	0 15 0
Waihi	13 15 0	114 2 7	..	440 12 6	5 7 0	2 12 0	16 3 11	592 13 0
Totals ..	84 0 0	239 12 11	19 10 0	1,266 5 7	23 0 6	19 15 0	34 12 5	1,686 16 5
NELSON.								
Wangapeka ..	1 5 0	..	..	..	..	0 8 0	..	1 13 0
Collingwood and Takaka	0 15 0	0 10 0	0 5 0	162 7 11	0 18 0	0 10 0	2 17 0	168 2 11
Westport, Seddonville, and Granity	34 10 0	11 11 6	..	53 15 6	4 10 6	10 11 6	4 12 0	119 11 0
Charleston ..	7 15 0	..	..	9 16 0	..	..	..	17 11 0
Ahaura	15 15 0	2 15 0	0 5 0	53 19 3	0 17 0	5 5 0	..	78 16 3
Reefton.. ..	92 10 0	0 9 0	..	405 12 3	1 12 0	11 6 0	80 14 4	592 3 7
Lyell and Murchison	14 0 0	0 10 0	..	60 1 8	0 4 0	3 0 0	10 0 0	87 15 8
Totals ..	166 10 0	15 15 6	0 10 0	745 12 7	8 1 6	31 0 6	98 3 4	1,065 13 5
MARLBOROUGH.								
Havelock ..	0 15 0	..	..	17 13 4	0 2 0	0 8 0	1 0 0	19 18 4
Blenheim ..	0 15 0	..	..	7 2 6	..	..	..	7 17 6
Totals ..	1 10 0	..	..	24 15 10	0 2 0	0 8 0	1 0 0	27 15 10
WESTLAND.								
Hokitika ..	7 5 0	..	..	73 9 6	4 7 0	2 6 0	28 17 6	116 5 0
Greymouth ..	42 0 0	..	..	12 2 0	0 14 0	4 12 0	11 1 0	70 9 0
Ross	3 0 0	..	0 10 0	91 14 1	1 5 6	4 9 0	1 16 0	102 14 7
Stafford and Goldsborough	3 15 0	..	..	28 5 0	1 14 0	5 18 0	..	39 12 0
Kumara ..	12 15 0	3 15 0	..	38 10 0	3 9 0	2 0 0	58 10 3	118 19 3
Okarito	3 0 0	0 5 0	0 5 0	12 10 0	0 6 0	0 2 0	0 5 0	16 13 0
Totals ..	71 15 0	4 0 0	0 15 0	256 10 7	11 15 6	19 7 0	100 9 9	464 12 10
CANTERBURY.								
Ashburton ..	0 10 0	..	..	..	..	..	..	0 10 0
OTAGO AND SOUTHLAND.								
Hindon	5 0 0	..	..	..	0 3 0	0 4 0	1 12 0	6 19 0
Naseby	6 5 0	0 1 0	0 10 0	241 12 8	2 5 0	2 0 0	0 13 0	253 6 8
Roxburgh Alexandra Clyde .. Black's .. Cromwell	17 0 0	18 11 0	0 5 0	540 11 7	..	20 0 0	14 12 2	610 19 9
Arrowtown ..	3 10 0	2 0 0	..	25 16 1	..	1 18 0	3 14 2	36 18 3
Pembroke ..	1 0 0	..	0 7 0	..	0 1 0	0 8 0	..	1 16 0
Queenstown ..	16 5 0	0 12 0	..	91 2 1	..	3 18 0	1 1 0	112 18 1
Lawrence ..	21 5 0	0 15 0	..	295 16 3	..	6 13 6	5 3 9	329 13 6
Waikaia ..	4 15 0	..	..	30 5 0	..	1 19 0	..	36 19 0
Orepuki ..	..	..	1 10 0	9 3 5	1 14 0	0 10 0	1 17 0	14 14 5
Riverton ..	7 0 0	4 10 0	0 5 0	43 16 3	0 8 0	1 2 0	15 5 0	72 6 3
Wyndham ..	0 10 0	..	..	4 15 7	0 1 0	..	2 5 0	7 11 7
Middlemarch ..	0 10 0	..	..	3 10 0	0 2 0	..	..	4 2 0
Gore	..	..	..	..	..	..	..	..
Totals ..	83 0 0	26 9 0	2 17 0	1,286 8 11	4 14 0	38 12 6	46 3 1	1,488 4 6
Grand totals ..	407 5 0	285 17 5	23 12 0	3,579 13 6	47 13 6	109 3 0	280 8 7	4,733 13 0

Table 3.

STATEMENT SHOWING THE QUANTITY OF QUARTZ CRUSHED AND GOLD OBTAINED IN THE HAURAKI MINING DISTRICT FOR THE YEAR ENDED 31ST DECEMBER, 1913.

Locality and Name of Mine.	Average Number of Men employed.	Quartz crushed.	Gold obtained.		Estimated Value.
			Amalgamation.	Cyanide.	
WAIHI BOROUGH.					
Waihi—		Tons cwt. qr. lb.	Oz. dwt.	Oz. dwt.	£ s. d.
Waihi	866	*164,971 0 0 0	32,068 17	503,475 3	323,345 10 0
Grand Junction	403	87,842 0 0 0	..	226,974 17	180,019 19 9
Totals	1,269	252,813 0 0 0	32,068 17	730,450 0	503,365 9 9
OHINEMURI COUNTY.					
Waitekauri—					
Maoriland	14	1,192 0 0 0	396 18	388 19	2,286 2 9
Golden Cross	8	891 0 0 0	219 14	194 8	626 8 2
	22	2,083 0 0 0	616 12	583 7	2,912 10 11
Karangahake—					
Talisman	360	39,780 0 0 0	27,526 5	151,465 7	215,641 18 0
New Zealand Crown	120	15,299 0 0 0	..	20,723 12	28,884 16 4
	480	55,079 0 0 0	27,526 5	172,188 19	244,526 14 4
Paeroa—					
Waihi - Paeroa Gold - extraction Company	65	†	..	101,749 2	42,300 0 0
Komata—					
Komata Reefs	23	3,080 0 0 0	10,489 5	4,748 4	27,989 10 6
Maratoto—					
Silver Stream	8	31 0 0 0	7,374 0	..	1,115 0 0
Totals	598	60,273 0 0 0	46,006 2	279,269 12	318,843 15 9
PIAKO COUNTY.					
Waiorongomai—					
Hardys' Mines	2	‡40 0 0 0	..	55 3	46 8 3
Waitawheta Gold prospecting Company	6	200 0 0 0	..	119 0	251 15 11
Totals	8	240 0 0 0	..	174 3	298 4 2
COROMANDEL COUNTY.					
Waikoromiko—					
Four-in-Hand	2	0 1 0 8	29 4	..	83 6 6
Tokatea—					
Royal Oak	5	8 14 1 9	239 17	..	655 0 0
Venture Claim	2	3 0 0 0	15 16	..	43 10 0
	7	11 14 1 9	255 13	..	698 10 0
Hauraki Block—					
Old Hauraki	16	56 2 3 19	729 8	..	2,158 3 10
Hauraki Reefs	15	78 3 0 12	785 5	..	2,241 0 0
Armstrong Dredging Company	4	§	23 12	..	64 18 0
	35	134 6 0 3	1,538 5	..	4,464 1 10
Bremner's Freehold—					
Bremner's Freehold	4	11 2 0 26	78 4	..	216 10 0
Kuaotunu—					
Handsworth United	4	36 0 0 0	169 5	..	388 12 9
New Waitaia	20	589 0 0 0	2,080 17	..	5,955 17 2
Mountain King	14	313 0 0 0	..	624 12	1,726 7 2
	38	938 0 0 0	2,250 2	624 12	8,070 17 1
Prospectors	10	17 0 0 23	33 0	..	96 0 0
Totals	96	1,112 3 3 13	4,184 8	624 12	13,629 5 5

* In addition, 4,291 tons of old tailing was re-treated. † 140,100 tons of tailing recovered from the Ohinemuri River (sludge-channel) and re-treated; this tonnage is not included in the total, having been recorded when the ore was originally milled. ‡ Tailings. § Wash-dirt.

Table 3—*continued.*

STATEMENT SHOWING THE QUANTITY OF QUARTZ CRUSHED AND GOLD OBTAINED IN THE HAURAKI MINING DISTRICT FOR THE YEAR ENDED 31ST DECEMBER, 1913—*continued.*

Locality and Name of Mine.	Average Number of Men employed.	Quartz crushed.	Gold obtained.		Estimated Value.
			Amalgamation.	Cyanide.	
THAMES COUNTY AND BOROUGH.					
		Tons cwt. qr. lb.	Oz. dwt.	Oz. dwt.	£ s. d.
Tapu—					
Portia..	2	11 0 0 0	121 17	..	362 10 0
Waiomo—					
Monowai	12	1,122 0 0 0	1,562 0	..	2,134 5 4
Tararu—					
New Sylvia	61	10,103 0 0 0	..	19,028 0	16,351 4 0
Watchman	15	750 0 0 0	..	976 2	2,241 16 9
Waitangi	7	0 1 0 18	17 2	..	54 10 1
	83	10,853 1 0 18	17 2	20,004 2	18,647 10 10
Moanataiari—					
Foreshore Tailing Dredge ..	6	*	..	396 15	290 5 5
Waiotahi—					
Waiotahi	15	62 0 0 0	..	41 7	114 4 4
Ballarat	2	6 0 2 24	169 10	..	382 0 0
Nonpariel	4	20 0 0 0	395 11	..	1,131 19 0
West Coast	2	1 0 0 0	3 10	..	9 2 0
	23	89 0 2 24	568 11	41 7	1,637 5 4
Karaka—					
Gladstone	2	23 5 0 0	537 7	..	1,344 13 6
Little Nell	2	80 1 2 2	238 19	..	561 4 0
Occidental	11	100 5 1 2	1,063 11	..	2,710 2 8
	15	203 11 3 4	1,839 17	..	4,616 0 2
Hape Creek—					
Cambria	6	18 0 0 0	17 0	..	44 15 0
Daisy	1	40 0 0 0	67 13	..	162 19 0
	7	58 0 0 0	84 13	..	207 14 0
Tairua—					
Golden Belt	9	215 0 0 0	..	348 10	665 17 3
Tairua Golden Hills	8	600 0 0 0	..	667 0	920 16 5
	17	815 0 0 0	..	1,015 10	1,586 13 8
Totals	165	13,151 13 2 18	4,194 0	21,457 14	29,482 4 9
SUMMARY.					
Waihi Borough	1,269	252,813 0 0 0	32,068 17	730,450 0	503,365 9 9
Ohinemuri County	598	60,273 0 0 0	46,006 2	279,269 12	318,843 15 9
Piako County	8	240 0 0 0	..	174 3	298 4 2
Coromandel County	96	1,112 3 3 13	4,184 8	624 12	13,629 5 5
Thames County and Borough ..	165	13,151 13 2 18	4,194 0	21,457 14	29,482 4 9
Totals, 1913	†2,136	327,589 17 2 3	86,453 7	1,031,976 1	865,618 19 10
Totals, 1912	2,506	264,830 13 0 9	169,152 2	846,043 5	781,716 1 4
Increase	..	62,759 4 1 22	..	185,932 16	83,902 18 6
Decrease	370	..	82,698 15	..	..

* 2,781 tons of tailing recovered from Thames foreshore, and re-treated, but tonnage not here included having been recorded when the ore was originally milled. † During the year 127 men were employed at unproductive mining operations not included in this table.

Table 3—*continued.*

STATEMENT SHOWING QUANTITY OF QUARTZ CRUSHED AND GOLD OBTAINED IN THE MARLBOROUGH, KARAMEA, AND WESTLAND MINING DISTRICTS FOR THE YEAR ENDED 31ST DECEMBER, 1913.

Locality and Name of Mine.	Average Number of Men employed.	Quartz crushed.	Gold obtained.		Estimated Value.
			Amalgamation.	Cyanide.	
		Tons.	Oz. dwt. gr.	Oz. dwt. gr.	£ s. d.
Collingwood County—					
Golden Blocks	13	645	559 0 0	..	2,139 0 0
Marlborough County—					
Dominion Consolidated ..	30	8,180	1,421 6 0	..	5,428 5 3
Buller County—					
New Swastika	6	22	7 19 0	..	31 2 6
Inangahua County—					
Wealth-of-Nations	106	23,661	6,890 3 0	2,599 5 0	37,104 16 8
Keep-it-Dark	60	7,245	1,646 7 0	792 10 0	9,035 4 6
Bolitho Bros. .. .	4	868	223 12 9	..	880 17 3
New Discovery	1	20	2 0 4	..	7 1 11
Progress	156	34,996	6,524 17 0	3,164 10 0	37,042 5 9
New Big River	65	4,970	5,799 4 0	1,195 11 0	28,022 9 11
Blackwater	175	45,053	18,564 4 0	2,376 6 0	82,207 7 4
Grey County—					
Poerua Reefs	15	600	23 11 5	..	88 19 6
Totals	631	126,260	41,662 3 18	10,128 2 0	201,987 10 7

SUMMARY.

Collingwood County	13	645	559 0 0	..	2,139 0 0
Marlborough County	30	8,180	1,421 6 0	..	5,428 5 3
Buller County	6	22	7 19 0	..	31 2 6
Inangahua County	567	116,813	39,650 7 13	10,128 2 0	194,300 3 4
Grey County	15	600	23 11 5	..	88 19 6
Totals, 1913 ..	631*	126,260	41,662 3 18	10,128 2 0	201,987 10 7
Totals, 1912 ..	459	55,098	24,574 12 20	5,867 13 0	116,407 14 10
Increase, 1913 ..	172	71,172	17,087 10 22	4,260 9 0	85,579 15 9

* This total does not include ninety-six men employed in unproductive mining operations not included in this table.

STATEMENT SHOWING THE QUANTITY OF QUARTZ CRUSHED AND GOLD OBTAINED IN THE OTAGO MINING DISTRICT FOR THE YEAR ENDED 31ST DECEMBER, 1913.

Locality and Name of Mine.	Average Number of Men employed.	Quartz crushed.	Gold obtained.	Estimated Value.
LAKE COUNTY.				
		Tons.	Oz. dwt. gr.	£ s. d.
Macetown—				
United Goldfields	8	73	20 5 12	77 16 1
Totals	8	73	20 5 12	77 16 1
VINCENT COUNTY.				
Carrick—				
Carrick Gold-mining Company	12	800	226 4 0	881 8 0
Star of the East	6	400	105 0 0	420 0 0
Bendigo—				
Alto Syndicate	4	27	18 8 0	64 0 0
Come-in-Time	3	463	34 0 0	100 19 4
Bald Hill Flat—				
Advance	1	85	75 0 0	288 5 0
Totals	26	1,775	458 12 0	1,754 12 4

Table 3—*continued.*

STATEMENT SHOWING THE QUANTITY OF QUARTZ CRUSHED AND GOLD OBTAINED IN THE OTAGO MINING DISTRICT FOR THE YEAR ENDED 31ST DECEMBER, 1913—*continued.*

Locality and Name of Mine.	Average Number of Men employed.	Quartz crushed.	Gold obtained.	Estimated Value.
MANIOTOTO COUNTY.				
		Tons.	Oz. dwt. gr.	£ s. d
Hyde—				
Ophir Reef	2	8	8 3 19	31 17 6
Gold and Tungsten	*	2,377	94 2 3	361 5 5
Totals	2	2,385	102 5 22	393 2 11
WAIHEMO COUNTY.				
Macrae's—				
Golden Point	*	4,428	540 8 9	1,817 12 10
Maritana	*	1,297	18 5 12	63 4 10
Deep Dell	*	660	24 16 0	93 0 0
Morning Star	3	40	2 0 0	7 10 0
Totals	3	6,425	585 9 21	1,981 7 8
SUMMARY.				
Lake County	8	73	20 5 12	77 16 1
Vincent County	26	1,775	458 12 0	1,754 12 4
Maniototo County	2	2,385	102 5 22	393 2 11
Waihemo County	3	6,425	585 9 21	1,981 7 8
Totals, 1913	39†	10,658	1,166 13 7	4,206 19 0
Totals, 1912	63†	15,722	2,105 4 0	8,065 1 2
Decrease	24	5,064	938 10 17	3,858 2 2

* As the sixty-eight men employed at these four mines are mostly employed mining and treating scheelite-ore, they are classified as scheelite-miners elsewhere. † During the year two men were employed at unproductive mining operations not included in this table.

STATEMENT OF VALUE OF BULLION WON FROM QUARTZ CRUSHED FOR ALL DISTRICTS FOR THE YEARS ENDED 31ST DECEMBER, 1912 AND 1913.

Mining District.	Year ended 31st December, 1912.	Year ended 31st December, 1913.
	£ s. d.	£ s. d.
Hauraki	781,716 1 4	865,618 19 10
Marlborough, Nelson, and West Coast	116,407 14 10	201,987 10 7
Otago and Southland...	8,065 1 2	4,206 19 0
Totals	906,188 17 4	1,071,813 9 5

Table 4.

GROSS TOTALS AND VALUE OF BULLION PURCHASED BY BANKS FOR THE YEAR ENDED 31ST DECEMBER, 1913.

Bank.	Bullion purchased.	Value.
Hauraki Mining District (Northern Inspection District).		
	Oz. dwt. gr.	£ s. d.
Bank of New Zealand	298,970 13 0	242,766 14 2
Bank of New South Wales	3,336 19 8	7,715 0 4
National Bank of New Zealand	104,352 1 8	43,683 2 1
	406,659 13 16	294,164 16 7
Marlborough, Karamea, and Westland Mining Districts (West Coast Inspection District).		
Bank of New Zealand	24,488 15 13	94,095 5 4
National Bank of New Zealand	13,296 4 13	51,148 10 3
Bank of New South Wales	1,405 19 7	5,521 14 6
Union Bank of Australia	972 11 13	3,797 19 1
	40,163 10 22	154,563 9 2
Otago Mining District (Southern Inspection District).		
Bank of New Zealand	44,419 10 12	170,610 10 3
Bank of New South Wales	6,324 3 3	24,650 14 4
National Bank of New Zealand	18,955 14 2	73,290 3 7
Union Bank of Australia	586 6 1	2,257 5 11
Bank of Australasia	1,785 3 13	6,901 16 3
Private buyers	51 12 14	198 2 5
	72,122 9 21	277,908 12 9
Totals	518,945 14 11	726,636 18 6
Totals, 1912	367,226 12 2	840,579 14 4

Table 5.

RETURN OF GOLD DUTY CREDITED TO LOCAL BODIES FOR THE YEAR ENDED 31ST DECEMBER, 1913, AND THE QUARTER ENDED 31ST MARCH, 1914.

Local Body.	For the Year ended 31st December, 1913.	For the Quarter ended 31st March, 1914.
COUNTIES—	£ s. d.	£ s. d.
Coromandel	369 8 0	..
Great Barrier Island	0 4 7	..
Ohinemuri	8,908 19 8	652 12 2
Piako	5 4 0	..
Thames	1,003 19 10	68 9 6
BOROUGHS—		
Thames	68 15 3	..
Waihi	11,683 0 1	3,594 14 6
Totals	22,039 11 5	4,315 16 2

NOTE.—This statement does not allow for the transfer of £280 from the Waihi Borough Council to credit of Ohinemuri County Council during the year ended 31st December, 1913, also similar transfer of £170 during March quarter, 1914. Transfer was made in accordance with Order in Council dated 31st July, 1913.

Statement of Affairs of Mining Companies, as published in accordance with the Companies Act, 1908.

Name of Company.	Date of Registration.	Subscribed Capital.	Amount of Capital actually paid up.	Value of Scrip given to Shareholders on which no Cash paid.	Number of Shares allotted.	Amount paid per Share.	Arrears of Calls.	Number of Shareholders at present.	Number of Men employed.	Quantity and Value of Gold and Silver produced since Registration.		Total Expenditure since Registration.	Total Amount of Dividends paid.	Amount of Debts owing by Company.
										Quantity.	Value.			
AUCKLAND DISTRICT.														
		£	£	£		£ s. d.	£			Oz.	£	£	£	£
Alburnia Gold-mining Company (Limited) ..	2/9/10	7,800	1,901	..	155,994	3½d., 3d., 2½d., 2d.	10	98	2	..	..	2,014	..	25
Bonanza Gold-mining Company (No Liability) ..	22/10/06	10,000	3,797	..	100,000	0 0 11	..	59	..	..	..	3,897	..	44
Bremner's Freehold Gold-mining Company (Ltd.)	5/8/10	10,000	1,864	..	100,000	1d., 2d., 3½d., 4½d., 5½d.	136	44	4	541	1,499	3,337	..	136
Dominion Gold-mining Company (No Liability)..	8/9/11	18,760	2,345	..	187,600	3d.	..	135	5	..	..	2,355	..	13
Golden Belt Gold-mining Company (Limited) ..	22/12/11	24,856	3,929	17,027	122,982	4/, 2/, 1/10	118	118	9	348	666	3,878	..	1,422
Golden Cross Consolidated Company (Limited) ..	13/8/12	5,435	2,803	..	108,700	7d., 6d., 3d., 2/6	359	39	10	715	826	3,343	..	520
Good Hope Gold-mining Company (No Liability)	10/11/10	12,975	1,982	1,622	129,746	0 0 7	..	72	..	78	228	2,014	..	32
Hare-Ratjen Copper Company (Limited) ..	5/4/07	7,600	1,000	6,600	7,600	1 0 0	..	20	..	..	..	1,412	..	50
Hauraki Reefs (Limited)	28/4/10	17,500	8,530	5,083	175,000	1/5, 1/1, 2/	241	300	11	1,585	4,605	12,627	..	504
Kaipara Copper-developing Company (Limited)..	25/6/08	1,470	1,010	460	1,470	1 0 0	..	99	1	..	..	1,294	..	95
Kuranui Gold-mining Company (Limited) ..	3/9/95	22,394	18,369	3,450	89,575	4/11, 4/10, 4/8, 4/7, & 2/7	144	83	6	..	1,899	19,690	..	231
Luck-at-Last Gold-mining Company (Limited) ..	23/8/09	2,710	2,673	..	83,260	0 0 7⅓	..	18	..	..	..	2,670	..	701
May Queen Gold-mining Company (Limited) ..	15/5/07	64,000	31,504	26,767	256,000	2/7, 2/4, 2/, 1/10	..	367	2	5,198	14,586	55,640	..	468
Moanataiari Gold-mining Company (Limited) ..	7/12/09	22,450	11,013	..	179,596	3d., 8d., 9½d. 1/0½, 1/3½, 1/4½	432	159	7	..	..	11,008	..	717
Monowai Gold-mining Company (Limited) ..	21/9/09	25,000	15,752	..	100,000	3/2, 2/8	86	43	30	6,716	3,925	27,207	..	1,530
Mountain King Gold-mining Company (Limited)	12/2/08	12,000	9,000	2,000	120,000	0 1 10	..	137	..	3,548	9,989	19,328	..	..
Mount Welcome Gold-mining Company (Limited)	8/7/09	5,000	2,745	458	100,000	8½d., 4½d., 3½d.	507	58	6	92	267	4,137	..	..
New Comstock Gold-mining Company (Limited)	23/11/09	28,465	1,207	3,746	113,860	3/, 2/5, 2/5½	..	65	..	..	..	1,408	..	..
New Sylvia Gold-mining Company (Limited) ..	2/10/05	30,000	23,792	1,208	300,000	0 1 8	..	348	56	66,575	42,259	..	..	190
New Waitaia Gold-mining Company (Limited) ..	25/2/09	15,000	7,500	2,500	150,000	0 1 4	..	142	25	1,861	5,386	14,877	1,875	15
North Prince of Wales Consolidated Gold-mining Company (No Liability)	23/3/12	4,405	3,957	1,250	35,240	0 2 0	..	24	..	..	..	3,462	..	499
Occidental Consolidated Gold-mining Company (No Liability)	3/8/09	5,397	3,583	..	107,938	5d. & 10d.	197	131	9	3,447	8,977	11,459	1,348	..
Old Hauraki Gold-mines (Limited)	3/8/07	17,903	13,125	..	179,030	0 1 3	..	271	..	6,823	20,296	28,394	2,625	89
Rising Sun Gold-mining Company (Limited) ..	1/10/08	16,500	7,615	2,229	110,000	0 1 4	240	148	2	..	..	7,436	..	..
Saxon Gold-mining Company (Limited) ..	2–12/07	35,000	15,579	13,333	200,000	1/7½, 1/6½	671	240	12	38	109	15,516	..	395
Silver Stream Mines (Limited)	7/7/09	44,350	8,553	35,600	44,350	13/, 9/6, & £1	187	70	8	10,374	1,545	7,890	..	194
Tauri Consolidated Company (Limited) ..	13/12/12	2,850	950	..	19,000	0 1 0	..	28	19	..	..	105	..	..
Tellurides Proprietary (Limited)	2/11/09	21,288	12,815	1,550	212,880	0 1 10	552	217	4	..	..	13,885	..	..

Te Puke Gold Reefs (Limited)	4–5/98	12,865	12,865	..	101,478	0 2 6	..	102	..	..	..	13,150	..	3
Thames Foreshore Dredging Company (Limited)	16/5/08	11,000	7,400	..	22,000	10/, 4/	..	14	5	3,977	4,194	13,081	..	9,395
Victoria Gold-mining Company (No Liability) ..	8/12/06	29,523	11,415	..	147,615	0 1 6	272	259	1	1,031	2,886	11,739	..	369
Waihi Extended Gold-mining Company (Limited)	29/5/95	149,967	50,427	5,498	149,967	7/5½ & 6/5½	..	397	2	2	4	51,535	..	71
Waihi-Paeroa Gold-extraction Company (Limited)	4/3/10	125,000	65,000	60,000	125,000	1 0 0	..	153	72	168,149	76,111	145,433	12,481	2,682
Waihi Reefs Consolidated (Limited)	26/10/09	172,289	7,539	164,750	172,289	1 0 0	..	246	1	..	..	14,232	..	6,532
Waihi Standard Gold-mining Company (No Liability)	20/11/11	19,891	2,496	5,000	198,305	0 0 3	..	15	..	1,526	601	2,629	..	2
Waitangi Consolidated Gold-mining Company (No Liability)	23/10/08	146,833	13,445	..	169,800	1/8 & 1/3	..	245	8	452	1,442	22,185	..	..
Waitawheta Gold-prospecting Company (No Liability)	21/12/07	7,250	5,769	750	145,000	0 0 11	654	136	9	119	252	7,062	..	381
Waiotahi Gold-mining Company (Limited) ..	28/7/71	18,000	15,000	..	240,000	0 1 3	..	646	17	224,930	674,790	274,706	400,786	155
Watchman Gold-mining Company (Limited) ..	4/12/11	37,500	11,345	10,625	150,000	0 1 6	..	178	17	1,625	4,015	14,655	..	437
Zeehan Consolidated (Limited)	23/10/10	11,300	..	3,700	150,000	0 0 6	13	50	..	..	..	2,822	..	15
Totals	..	1,232,526	421,594	375,206	5,261,275	..	4,819	5,974	360	509,750	881,357	853,512	419,115	27,912

NELSON DISTRICT (INCLUDING WEST COAST).

		£	£	£		£ s. d.	£			Oz.	£	£	£	£
Blackwater River Gold-dredging Company (Ltd.).	27/4/00	9,475	5,892	3,000	9,475	0 18 0	..	91	12	14,136	55,575	47,807	12,755	168
Blue Creek Gold, Silver, and Lead Development Company (Limited)	14/11/10	24,065	3,360	15,000	24,065	1 0 0	272	212	5	..	..	3,634	..	129
Dominion Consolidated Developing Company (Ltd.)	18/1/11	15,000	7,000	8,000	15,000	1 0 0	..	47	80	2,288	18,470	23,877	..	647
Five-mile Beach Gold-extraction Company (Ltd.)	16/6/13	15,015	2,480	7,000	15,015	0 8 0	726	61	..	..	..	1,348	..	80
Just-in-Time Gold-mining Company (Limited) ..	6/8/10	6,425	5,425	1,000	12,850	10/ & 2/6	..	62	5	..	..	6,387	..	18
Keep-it-Dark Mines (Limited)	8/2/11	10,000	4,250	..	20,000	0 4 3	..	47	75	7,707	28,884	40,572	..	6,915
Mahinapua Gold-mining Company (Limited) ..	11/1/09	5,385	4,485	900	5,385	1 0 0	..	77	2	310	1,184	11,110	..	4,657
Millerton Gold-mining Company (Limited) ..	19/11/12	50,125	13,063	24,000	50,125	0 10 0	123	.. 201	14	..	..	6,827	..	..
Mont d'Or Gold-mining and Water-race Company (Limited)	25/7/82	12,000	10,800	..	12,000	0 18 0	..	42	7	37,616	144,730	103,598	55,200	121
Montezuma (Limited)	20/12/12	6,000	5,353	500	6,000	1 0 0	..	73	1	86	327	6,342	..	675
Mount Radiant Prospecting Company (New Zealand)	11/1/13	17,000	5,043	7,000	24	296 13 4	..	13	16	..	..	2,553	..	108
Murray Creek Gold-mining Company (Limited) ..	30/5/11	24,000	14,426	2,000	24,000	£1 & 9/	974	101	7	..	..	15,568	..	2,278
New Swastika Gold-mines (Limited)	4/12/13	38,000	750	32,000	38,000	£1 & 2/6	750	85	9	..	..	481	..	166
New Ulster Quartz-mining Company (Limited) ..	11/3/08	5,125	3,905	1,250	9,126	0 8 2	16	22	2	241	882	5,000	..	..
Parapara Hydraulic Sluicing and Mining Company (Limited)	18/6/92	50,600	26,210	20,000	40,600	£1, 12/, & 5/	150	60	10	13,209	50,796	73,836	..	..
Poerua Gold-mining Company (Limited) ..	20/10/10	19,788	16,664	28,000	19,788	0 17 0	812	181	115	24	89	16,720	..	617
Ross Goldfields Reconstructed (Limited) ..	7/2/11	70,000	24,397	43,750	70,000	6/6, 7/, 7/6	123	276	63	491	1,918	15,341	..	208
Stafford Gold-dredging Company (Limited) ..	17/5/05	289	289	1,734	2,023	1 0 0	1	7	7	7,481	29,066	24,992	4,046	401
St. George Gold-mining Company (Limited) ..	9/10/09	12,150	7,320	3,000	24,300	10/ & 8/	..	44	..	..	..	7,445	..	2
Swastika Gold-mines (Limited)	19/10/12	4,000	2,200	1,250	16,000	0 4 0	..	66	..	..	54	2,200	..	..
Swastika North Gold-mines (Limited)	16/5/13	1,440	418	720	1,440	12/ & 10/	88	28	2	..	..	453	..	104
Worksop Gold-dredging Company (Limited) ..	20/3/07	4,500	4,500	1,500	6,000	1 0 0	..	88	18	17,881	69,307	36,945	35,700	432
Totals	..	400,382	168,230	201,604	421,216	..	4,035	1,884	450	101,464	401,282	453,036	107,701	17,726

STATEMENT OF AFFAIRS OF MINING COMPANIES, AS PUBLISHED IN ACCORDANCE WITH THE COMPANIES ACT, 1908—*continued.*

Name of Company.	Date of Registration.	Subscribed Capital.	Amount of Capital actually paid up.	Value of Scrip given to Shareholders on which no Cash paid.	Number of Shares allotted.	Amount paid per Share.	Arrears of Calls.	Number of Shareholders at present.	Number of Men employed.	Quantity and Value of Gold and Silver produced since Registration.		Total Expenditure since Registration.	Total Amount of Dividends paid.	Amount of Debts owing by Company.
										Quantity.	Value.			
OTAGO DISTRICT (INCLUDING SOUTHLAND).														
		£	£	£		£ s. d.	£			Oz.	£	£	£	£
Arrow River Mining Company (Limited) ..	28/11/11	975	975	..	975	1 0 0	..	13	1	199	772	1,311	..	144
Carrick Gold-mining Company (Limited) ..	22/2/10	27,726	17,307	10,000	27,726	1 0 0	419	204	9	638	2,174	20,977	..	1,792
Crewe Gold-dredging Company (Limited) ..	7/9/02	2,000	2,000	3,000	5,000	1 0 0	..	20	14	11,484	44,200	37,746	8,625	208
Deep Dell Scheelite and Gold Mining Company (Limited)	2/12/12	3,000	2,938	3,000	5,975	1 0 0	38	44	16	25	1,386*	1,430	..	160
Deep Stream Gold-mining Company (Limited) ..	19/11/06	2,500	500	2,000	2,500	1 0 0	..	7	5	1,765	6,794	6,566	1,563	27
Earnscleugh Gold-dredging Company (Limited) ..	15/7/01	8	8	10,992	11,000	1 0 0	..	16	30	44,893	172,088	148,378	26,400	511
Electric Gold-dredging Company (Limited) ..	2/9/99	26,000	..	26,000	26,000	1 0 0	..	281	20	57,225	221,280	98,436	130,643	242
Gabriel's Gully Sluicing Company (Limited) ..	2/5/07	600	180	..	600	0 6 0	..	8	24	3,189	12,277	15,372	1,605	2,759
Golden Crescent Sluicing Company (Limited) ..	26/11/98	3,500	3,500	..	3,500	1 0 0	..	23	7	7,660	29,820	22,197	9,625	32
Good Chance Dredging Company (Limited) ..	24/3/09	1,250	779	..	1,250	1 0 0	..	54	8	2,714	10,563	11,311	625	60
Havelock Sluicing Company (Limited) ..	3/3/08	4,000	3,400	600	4,000	1 0 0	..	12	6	4,166	15,983	14,999	4,600	75
Island Block Gold-dredging and Sluicing Company (Limited)	26/2/00	24,030	12,030	12,000	25,000	1 0 0	..	106	8	8,092	31,540	39,565	2,403	1,339
Karaunui Dredging Company (Limited) ..	12/10/09	5,115	2,765	2,350	5,115	1 0 0	..	95	11	4,119	15,055	21,538	..	1,929
Kia-Ora Victoria Gold-dredging Company (Ltd.)	10/8/01	9,100	5,915	..	9,100	0 13 0	..	35	10	27,291	110,461	78,915	37,759	..
Ladysmith Gold-dredging Company (Limited) ..	19/4/00	12,000	3,964	3,000	14,500	0 10 0	..	80	9	9,418	36,305	30,383	10,421	75
Lammermoor Mining Company (Limited) ..	6/7/08	4,950	4,950	1,000	5,950	1 0 0	..	27	3	456	1,801	6,724	..	479
Lower Nevis Dredging Company (Limited) ..	29/9/06	600	600	600	1,200	1 0 0	..	7	7	3,870	14,876	14,723	1,260	284
Magnum Bonum Gold-dredging Company (Limited)	1/3/06	2,500	2,500	..	2,500	1 0 0	..	9	8	8,423	33,362	22,794	11,875	..
Manuherikia Gold-dredging Company (Limited)..	1/8/99	12,000	6,000	6,000	12,000	1 0 0	..	166	9	18,936	72,606	43,068	34,176	36
Mount Morgan Sluicing Company (Limited) ..	2/7/02	800	800	2,000	2,800	1 0 0	..	11	3	1,850	7,131	7,001	210	..
Muddy Terrace Sluicing Company (Limited) ..	4/10/06	14,400	14,400	5,550	19,950	1 0 0	..	126	30	6,895	27,164	60,964	..	15,850
Naseby Dredging and Hydraulic Sluicing Company (Limited)	16/10/97	5,000	2,288	2,000	5,000	0 15 3	..	24	4	4,542	17,491	17,269	4,125	32
New Golden Run Dredging Company (Limited)..	21/11/07	8,000	8,000	..	8,000	1 0 0	..	20	13	2,988	11,371	16,835	400	1,567
Ngapara Gold-dredging Company (Limited) ..	9/9/11	..	..	2,400	3,000	0 16 0	..	10	9	2,559	9,819	8,420	1,500	178
Nokomai Hydraulic Sluicing Company (Limited)	26/3/98	24,000	7,000	17,000	24,000	1 0 0	..	63	50	35,537	133,193	97,883	40,284	475
Olrig Dredging Company (Limited)	13/3/99	9,955	8,955	1,000	9,955	1 0 0	..	70	8	9,199	35,171	36,600	4,473	356
Ourawera Gold-mining Company (Limited) ..	23/5/95	3,000	3,000	..	3,000	1 0 0	..	16	9	11,969	47,722	38,984	13,615	500
Paterson's Freehold Gold-mining Company (Ltd.)	15/7/99	12,000	8,000	4,000	12,000	1 0 0	..	32	17	19,676	78,707	86,307	21,100	250
Phœnix Water-race Company (Limited) (Regd.)	12/10/67	1,500	1,500	..	1,000	1 10 0	..	19	1	..	..	1,282	8,780	12
Red Jack's Gold-dredging Company (Limited) ..	1/7/12	4,500	3,750	750	4,500	1 0 0	..	47	9	..	..	4,567	..	1,327
Rise and Shine Gold-dredging Company (Limited)	24/2/00	10,000	9,746	2,000	12,000	1 0 0	254	157	22	34,047	132,323	108,799	35,100	2,157
Rising Sun Gold-dredging Company (Limited) ..	16/2/01	8,000	5,500	2,500	8,000	1 0 0	..	80	10	17,888	69,194	52,220	19,200	840
Round Hill Mining Company (Limited) ..	30/7/02	28,245	6,753	21,492	5,649	5 0 0	..	180	38	39,506	157,947	154,191	8,474	170
Roxburgh Amalgamated Mining and Sluicing Company (Limited)	2/3/89	29,153	13,121	15,000	29,153	0 18 6	..	162	11	29,209	109,466	90,489	32,430	114
Sailor's Bend Gold-dredging Company (Limited)	1/9/99	8,000	6,500	1,500	8,000	1 0 0	..	160	8	5,345	20,627	25,028	3,587	176
Sailor's Gully (Waitahuna) Gold-mining Company (Limited)	3/6/96	2,000	200	1,800	2,000	1 0 0	..	10	5	4,323	16,408	12,308	4,750	150

Scandinavian Water-race Company (Limited) ..	10/12/07	7	7	9,750	9,757	1 9 0	..	18	15	6,134	23,376	25,264	..	4,583
Skipper's Sluicing Company (Limited)	20/11/11	3,450	345	3,105	3,450	1 0 0	..	27	4	455	1,748	1,992	..	226
Stewart Island Tin and Wolfram Lodes (Limited)	5/12/12	5,170	3,827	3,000	8,170	0 15 0	50	82	20	..	..	3,464	..	513
Success Gold-dredging Company (Limited) ..	25/5/10	10,000	8,000	2,000	10,000	1 0 0	..	136	11	3,707	14,609	24,648	..	418
Tallaburn Hydraulic Sluicing Company (Limited)	3/12/04	1,200	1,200	..	12	100 0 0	..	9	4	1,277	4,914	6,244	1,380	220
Teviot-Molyneux Gold-mining Company (Ltd.) ..	24/12/09	30,000	16,798	10,000	30,000	16,250 £1 ea.	..	23	50	..	..	17,132†	..	7,250
						3,750 5/ea.								
Tinker's Gold-mining Company (Limited) ..	29/10/10	11,500	11,500	11,500	11,500	1 0 0	..	21	9	1,319	5,126	5,849	467	586
Undaunted Gold-mining Company (Limited) ..	1/3/98	15,000	15,000	..	1,500	10 0 0	..	35	8	11,732	46,041	30,397	14,437	138
United M. and E. Water-race Company (Regd.) {	8/5/72 23/5/72 }	7,600	7,600	..	152	50 0 0	..	8	5	15,995	61,644	68,541	3,078	893
Vinegar Hill Hydraulic Sluicing Company (Ltd.)	23/9/00	..	6,000	..	6,000	1 0 0	..	13	5	..	13,456	12,285	1,050	112
Waikaia Gold-dredging Company (Limited) ..	20/10/03	3,500	1,750	1,750	3,500	1 0 0	..	46	9	11,130	43,989	33,603	14,700	230
Waitahuna Hydraulic Sluicing Company (Limited)	10/11/04	2,000	1,400	..	2,000	0 14 0	..	8	..	3,786	14,730	13,010	3,950	..
Totals	..	399,834	243,251	200,639	407,939	..	761	2,820	592	495,631	1,936,710	1,698,009	518,670	49,475
Grand totals	..	2,032,742	833,075	777,449	6,090,430	..	9,615	10,678	1,402	1,106,845	3,219,349	3,004,557	1,045,486	95,113

* Including 9 tons scheelite. † Approximate.

STATEMENT OF AFFAIRS OF MINING COMPANIES, AS PUBLISHED IN ACCORDANCE WITH THE COMPANIES ACT, 1908—*continued.*

Foreign Company.

Name of Company.	Date of Registration of Office in Dominion.	Subscribed Capital.	Amount of Capital actually paid up in Dominion.	Value of Scrip given to Share-holders on which no Cash paid.	Number of Shares on Dominion Register.	Amount paid up per Share, Dominion Register.	Arrears of Calls, Dominion Register.	Number of Share-holders on Dominion Register.	Number of Men employed in Dominion.	Quantity and Value of Gold and Silver produced since Registration.		Total Expenditure since Registration.	Total Amount of Dividends paid in Dominion.	Amount of Liabilities of Company in New Zealand.
										Quantity.	Value.			
		£	£	£		£ s. d.	£			Oz.	£	£	£	£
Komata Reefs Gold-mining Company (Limited)..	16/10/00	200,000	..	..	231,800	0 5 0	..	441	37	77,510	371,118	328,382	7,467	..

ANNEXURE F.

QUESTIONS ASKED AT THE 1914 EXAMINATION FOR FIRST- AND SECOND-CLASS CERTIFICATES OF COMPETENCY AS MINE-MANAGERS UNDER THE MINING ACT.

SUBJECT I.—*Mining.*

1. A shaft is to be sunk to a depth of 500 ft. to work to best advantage a series of quartz reefs from 1 ft. to 7 ft. wide striking north-east and underlying 10° off the vertical to south-east; quantity of water to be met with unknown.
   - (*a.*) Draw a plan showing (1) size of shaft, (2) style of timbering, (3) class of timber you would use, (4) the relative size of each compartment, and the situation of shaft to lodes.
   - (*b.*) State the distance between each level you would open chambers in shafts and the convenient height of each.
   - (*c.*) Show by sketch how you would put cage chairs or clips in at surface and each chamber in winding-compartments, to be easily manipulated when required.
   - (*d.*) State what are the advantages and also the disadvantages in the Rill system of stoping compared with the flat-back system.
2. Describe how you would drive through loose rubble or old filled-up stopes a level 7 ft. high and 5½ ft. wide in the clear.
3. If a 4-ft.-square cribbed pass is 80 ft. in depth and empty of ore, how would you proceed to fill it to top so that the ore would not pack too tight and allow you to keep the ore from hanging up when it is being trucked out as stoping proceeds?
4. Give a correct estimate of the quantity of ore in tons (2,240 lb. each) in a block 200 ft. long, 150 ft. in depth, average width 7 ft.; also estimated value at £2 7s. per ton, allowing 14 cubic feet to ton of solid ore.
5. Describe in detail how you would organize a gang of miners and allot their respective work, and place the drilling-machines so that you could manage to drive a medium hard heading at the rate of about 50 ft. per week of six days.
6. Taking blasting-powder as a unit, give the relative strength of other explosives generally used in mines.
7. Describe how electric delay fuses are made, and what is the advantage in using them.
8. What precaution would you use in approaching old workings full of water? What provision would you make to prevent the mine being flooded by the water breaking away in greater volume than you anticipate?
9. Show by sketch how you would construct a dam in a drive 5½ ft. wide by 7 ft. in height in ordinary rock to keep water safely back for 200 ft. in height, the dam to have a door and opening large enough to permit trucking through when dam is empty. (*a*) Describe the material you would use; (*b*) how you would construct the door so that, if necessary, it could be closed from the surface; (*c*) what provision you would make for drawing the water off in emptying the dam; (*d*) give the total pressure in tons when the dam is full.

SUBJECT II.—*Mechanics.*

1. Describe briefly the different classes of steel-wire rope used for hauling and winding. Show by calculation the size of rope you would employ for hoisting a load of 35 cwt. (cage, truck, and ore) in a vertical shaft from a depth of 1,200 ft. Specify which class of rope you would recommend for this work.
2. The height of a shaft-head frame is 60 ft.; rope used for winding, 1¼ in. diameter: give a side-view sketch of frame, showing position and diameter of head-pulley, diameter of drum, position of drum-shaft, and back-stay.
3. Describe a safety appliance for holding a truck in skip on an incline in case of accident to controlling-gear or breakage of rope.
4. State how you would test and examine a steam boiler—(*a*) Cornish, (*b*) tubular.
5. A mine-pumping plant is to consist of a suction-gas plant operating an electric generator, from which the electricity is to be conveyed a distance of 1,200 ft. to the pump-motor; quantity of water to be lifted is 6,000 gallons per hour against a head of 400 ft. State class of pump you would employ, and the respective horse-powers of the electric motor, electric generator, and gas-engine.
6. Give a working sketch of bailing-tank, to carry 250 gallons of water, in a vertical shaft, the overall size of compartment being 4 ft. 6 in. by 3 ft. 6 in.
7. What terms are employed for the unit of electro-motive force, current, and power, in electricity?
8. What are the regulations prescribed in the Mining Act in regard to the installation and use of electrical machinery underground?

SUBJECT III.—*Ventilation.*

1. What is understood by the expression "diffusion of gases"? Given four gases whose comparative densities are as 1, 4, 9, and 16, at what relative rates will each of the three last diffuse into the first when brought into contact with it separately, and under such conditions that there is no mechanical movement in either of them, and that the lighter gas is uppermost?
2. What do you understand by the term "vapour density"? Explain how it is that an increase of moisture in the atmospheric air causes the barometer to go down.
3. What is the object of splitting the air in mines? To what general result is it conducive, and how is it effected?
4. Describe and sketch the most efficient ventilating-fan, also the most efficient blower for mine-ventilation with which you are acquainted. State the conditions for which each is adapted.
5. The quantity of air passing through the downcast shaft of a mine is 100,000 cubic feet per minute at a temperature of 40° F.; the quantity in the upcast is 106,000 cubic feet per minute at a temperature of 65° F.: find the amount of gas being given off in the mine-workings.
6. Explain the general principles upon which self-contained breathing-appliances work. Describe, with simple sketch, any type of such apparatus with which you are familiar.
7. A fan running at a speed of 100 revolutions per minute produces 125,000 cubic feet of air under a water-gauge of 2 in.: what would be the required speed of the fan and the water-gauge to produce a circulation of 150,000 cubic feet of air per minute in the same mine?

SUBJECT IV.—*Arithmetic, First Aid, and Law.*

Arithmetic.

1. If 9 men and 6 boys can do in 2 days what 5 men and 7 boys could do in 3 days, in what time could 2 men and 5 boys do the same?
2. An engine working steadily day and night consumes a hundredweight of coal in $7\frac{1}{2}$ hours: how many tons will be used in 150 days?
3. Standard gold consists of 11 parts by weight of pure gold and 1 part of copper. If a sovereign weighs 123 grains, find how many can be coined from a bar of standard gold containing 1 lb. advoirdupois of pure gold.
4. Miners earn on the average 10s. 5d. each per day, and 234 men are employed: find the total sum paid in wages for a week of 6 days.
5. Extract the square root of 50,085,018,863,929 and the cube root of 26,463,502.
6. Make up a pay-sheet in proper form for 4 weeks' wages in connection with a mine, a day being reckoned as 8 hours—116 men at 1s. $1\frac{1}{2}$d. per hour; 47 men at $11\frac{3}{4}$d. per hour; 540 men at 1s. $4\frac{1}{2}$d. per hour; 87 boys at $5\frac{3}{4}$d. per hour.

First Aid.

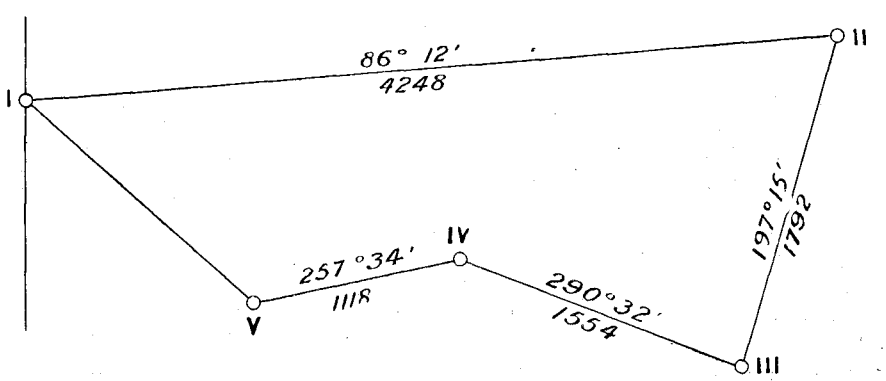
7. Describe Sylvester's method of treating the apparently drowned.
8. Explain the terms "abrasions," "incised wounds," "contused wounds," "lacerated wounds," and "punctured wounds."
9. Give a diagram of and name the arteries of the lower limbs.
10. What are the symptoms of and treatment for a case of cyanide poisoning?

Law.

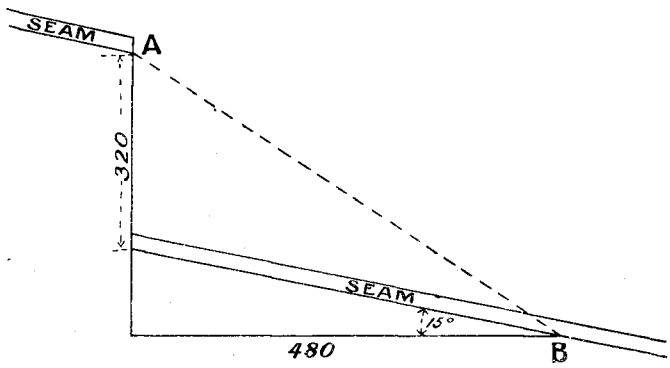
11. What are the provisions of the Act relating to the employment of manual labour in mines on Sundays?
12. State the uniform code of signals to be used at each mine.
13. What are the conditions as to the ventilation of mines?
14. State generally the procedure to be followed in connection with accidents in a mine.

SUBJECT V.—*Surveying.*

1. The accompanying diagram shows a traverse in the underground workings of a mine: compute the bearing and distance of the line V–I.



2. A seam of coal dipping 15 degrees is thrown down 320 ft. by a vertical fault. A slope is started from the top of the downthrow, and cuts the seam 480 ft. horizontally from the fault. Required, the length and dip of the slope AB.



3. The area of a rectangular mining lease is 140 acres, and its width is 33 chains 18 links: find its length.

SUBJECT VI.—*General and Applied Geology.*

1. Carefully describe the action of running water and ice as geological agents.
2. State how water, ice, and other geological agents, assist, or have assisted, the miner (*a*) by exposing metalliferous lodes, (*b*) by forming workable alluvial deposits of gold, stream tin, &c.

[NOTE.—The candidate, if he likes, may combine his answer to this question with his answer to question 1.]

3. Give a table showing the sequence of the principal geological formations in New Zealand, *or* in Great Britain.
4. Define the terms—"Sedimentary rock," "igneous rock," "fossil," "strike," "dip." How do you in practice ascertain the strike and dip of an outcropping stratum?
5. Give a sketch of the geology of any mining district in New Zealand with which you have a personal acquaintance.
6. Give as full an account as you can of the part water is supposed to play in the formation of quartz lodes. Whence do you consider this water is derived?
7. What changes (if any) are likely to take place in the course of time in the contents of a quartz lode originally containing gold and silver associated with sulphides of iron, copper, and other metals (*a*) near the surface, (*b*) at a moderate depth, (*c*) at great depth?
8. Where, in New Zealand, are found asbestos, antimony ores, copper ores, stream tin, phosphate rock?
9. Define the terms—"normal fault," "reversed fault"; and give illustrative sketches. If in drifting or driving you came across a polished surface striking north and south, and dipping at, say, 70° to the west, but having upon it parallel scratches or grooves inclined southward from the direction of dip, what inference concerning the direction of movement of the country would you make?
10. In a district containing numerous quartz lodes, faulting has taken place both prior to and subsequent to the formation of the lodes: explain how you would distinguish the earlier faults from the later faults. Give a figure or figures to illustrate your answer.
11. A quartz lode striking north 45° east, and dipping at 65° to the south-east, is cut off by a strong fault striking north and south, and dipping at 70° to the west: where would you look for the faulted portion of the lode, and why? Give illustrative diagram. If the fault-plane showed scratches or grooves inclined southward from the direction of dip (as in question 9), how would your method of search be affected?
12. Why do mines get hotter with depth? Is the rate of increase of temperature the same in all mining districts, or not? State as fully as you can any figures or other data referring to the rate of increase of temperature in the earth's crust in any part of the world.

QUESTIONS ASKED AT THE 1914 EXAMINATION FOR BATTERY SUPERINTENDENTS' CERTIFICATES OF COMPETENCY.

SUBJECT A.—*The Different Modes of reducing and pulverizing Ores.*

1. Give an intelligent sketch of a crushing-battery capable of reducing 100 tons of hard auriferous quartz ore per day of twenty-four hours to a sufficient degree of fineness so that the gold can be extracted by means of the cyanide process, with all appliances to convert the bullion into a marketable commodity. (*a*) Show by figures the relative levels of the different appliances; (*b*) give a detailed estimate of the cost of such a crushing plant and a description of the different appliances.
2. In lighting battery-buildings 100 lamps of 16 candle-power and 10 lamps of 20 candle-power are required: how many kilowatts would a dynamo have to produce to give the required power? Also give the pressure and volume you would use, and give reasons for same.
3. Describe a Huntingdon mill of 5 ft. diameter, giving its speed and capacity with suitable rock-breakers to pulverize the ore, so that it will pass through a screen of 25-mesh; also give the horse-power required to drive it.
4. If the gold in the ore was in a very finely divided state, what appliances would you use to pulverize it to sufficient fineness to enable it to be attacked by cyanide solutions?

SUBJECT B.—*Amalgamating-machines.*

1. What is meant by "amalgamating-machines"? Why are they required? Describe the class of ore most suitable for treatment by these machines.
2. Describe the different amalgamating-machines used in the Dominion of New Zealand. State their capacity, the speed they are worked at, and the quantity of quicksilver used in each machine.
3. Describe what is meant by "settlers." How are they constructed, and under what circumstances are they used?

SUBJECT C.—*The Use of Quicksilver, and Methods of using it in connection with the Extraction of Gold and Silver from Ores.*

1. How do you ascertain whether the quicksilver is in a fit state to use in the amalgamation of gold-and-silver ores?
2. Is there any advantage in using common salt and sulphate of copper in amalgamating-machines? Describe how they are used, and the class of machine suitable for their use.
3. How are copper plates coated with quicksilver? How is the amalgamated bullion taken off, and how is the plate kept in a fit state for amalgamation?
4. If the quicksilver contained base metals such as lead, antimony, and zinc, how would you purify the quicksilver so as to make it in a fit state for the amalgamation of gold and silver?
5. Describe how bullion is extracted from quicksilver and made into a marketable commodity.

SUBJECT D.—*Cyanide, Chlorination, and other Chemical Processes of recovering Gold and Silver from Ores.*

1. Describe the class of auriferous ore most suitable for treatment by the chlorination process, and state how it is prepared for treatment.
2. What is meant by chlorination? How is it produced? Describe the process fully, and state by what means the gold is extracted.
3. Give a neat sketch of a modern plant where ores are treated with KCN solutions; also describe the class of ore most suitable for treatment by this process.
4. How is KCN solution prepared?
5. How is the strength of KCN solution ascertained?
6. How would you ascertain the most suitable strength of KCN solution to use for the class of ore required to be treated?
7. In making up 40 tons of a sump solution containing 0·013 per cent. of KCN to a 0·2-per-cent. solution, how many pounds of crude cyanide containing 78 per cent. KCN would be required?
8. In using 50 tons of sump solution containing 0·1 per cent. of KCN to make up a 0·23-per-cent. solution, how many tons of a 2-per-cent. solution of KCN would be required?
9. How many tons of a 0·18-per-cent. KCN solution would be obtained from 7 tons of a 6-per-cent. KCN solution?
10. Give the solubility of lead, antimony, copper, and zinc in relation to the solubility of gold, and state the effect that these metals have on the treatment of auriferous ores by KCN solutions.
11. How is bullion extracted from KCN solutions and made into a marketable commodity? Describe fully.
12. If any of the workmen suffered from hydrocyanic poisoning, what remedy would you apply?

SUBJECT E.—*The Sampling and Testing of Ores.*

1. Sketch a combined coke-fusion-furnace and sampling drying-furnace, the fusion-furnace to be capable of taking six H size Battersea round crucibles at one time. Give all dimensions.
2. What is a "grading test," how is it carried out, and why is it used?
3. Define the term "standard" gold? A bar of bullion weighs 242 oz. 12 dwt. 16 gr. and assays 9234: what is its "standard" weight?
4. In a "sands" residue sample as taken from a vat, state how you would determine the following: (*a*) Total gold, (*b*) dissolved gold, (*c*) undissolved gold. Give only outline of processes used.
5. How is the amount of sulphur in pyritic concentrates determined?
6. State how the amounts of gold and silver respectively in a sample of zinc-gold slime are determined? Give outline only of process.
7. An ore consists of 80 per cent. quartz, the balance being alumina, lime, and pyrite. Taking 2 assay tons of ore for assay, what fusion charge would you employ? And state why you select the different ingredients in the proportions given.

SUBJECT F.—*A Knowledge of Arithmetic and the Method of keeping Battery Accounts.*

1. The value of bullion containing gold and silver amounted to £4,977 10s. 6d.; 12½ per cent. of the weight of the bullion was gold. Taking gold to be £4 1s. per ounce, and silver 2s. 3d. per ounce, what would be the weight of the gold and silver in the bullion?
2. Taking the specific gravity of silver to be 10·5: required, the weight of a sphere of silver 4 ft. in diameter in pounds troy.
3. How many cubic feet of water would a nozzle 2¼ in. in diameter discharge per minute, the head of water being 300 ft.?
4. The wages of a crushing-battery, in which 54 men were employed, amounted to £280 per week. These men were in three equal divisions. A division got 63 per cent. of the wages, B division got 80 per cent. of the wages of A division, and the balance was equally divided among the men in C division. How much did each man receive?
5. Extract arithmetically the cube root of 0·0000312.

LIST OF MINE-MANAGERS, BATTERY SUPERINTENDENTS, AND DREDGE-MASTERS WHO HAVE OBTAINED CERTIFICATES UNDER THE MINING ACTS.

First-class Mine-managers' Certificates.

Certificates of Service issued under the Mining Act, 1886, without Examination.

Adams, H. H., Waiorongomai.
*Anderson, P., Thames.
*Andrews, R., Coromandel.
Andrews, T., Thames.
Barclay, T. H., Thames.
Bennett, J., Alexandra.
*Benney, J., Coromandel.
Black, T., Waiomio.
*Bollersley, N., Boatman's.
*Bradbury, M., Reefton.
*Bray, John, Lyell.
Burch, W. H., Thames.
*Byrne, J. F., Stafford.
Cameron, A., Macetown.
*Cameron, E., Te Aroha.
Chapman, J. A., Dunedin.
*Clarke, G. S., Thames.
*Comer, R., Thames.
Conradson, M., Lyell.
*Corin, W., Thames.
*Cornes, C. A., Karangahake.
*Coutts, J., Thames.
*Crawford, T. H., Thames.
*Crowley, C., Reefton.
*Cummings, W., Reefton.
Davis, J. E., Queenstown.
*Davey, C., Ross.
*Donald, J., Cromwell.
*Dryden, S., Thames.
*Dunlop, T. A., Thames.
Edwards, J., Skipper's.
Elliott, J., Macetown.
*Evans, F., Skipper's.
Evans, J. H., Skipper's.
*Fitzmaurice, R., Reefton.
Frewen, J. B., Queenstown.
*Gavin, T., Te Aroha.
*Gilbert, J., Reefton.
Gilmour, T., Thames.
*Giles, G. F., West Wanganui.
Glass, W. M., Naseby.
*Goldsworthy, J., Waiorongomai.
*Greenish, J., Reefton.
*Greenville, W., Ohinemuri.
*Hall, J. P.
*Hansen, P. C., Thames.
*Harris, J., Owen's Reefs.
Harrison, R. H., Coromandel.
*Hicks, T. B., Thames.
*Hilton, G. P., Bendigo.
*Hodge, F., Coromandel.
Hollis, W., Thames.
Hunter, R., Thames.
James, F., Thames.
Jamieson, A., Coromandel.
Jenkins, M., Wakatipu.
Johnstone, H., Bluespur.
*Julian, J., Boatman's.
Kelly, J., Lyell.
Kerr, J., Thames.
*Lawn, E., Black's Point.
*Lawn, H., Boatman's.
*Lawn, J., Reefton.
*Littlejohn, W., Karangahake.
*Lowe, E. W., Thames.
*Malfroy, J. M. C., Ross.
*Martin, W. G., Thames.
*McCallum, J., Reefton.
McCullough, R., Thames.
McGruer, G. N., Karangahake.
*McIlhaney, J., Thames.
McIntosh, D., Bluespur.
*McKay, J., Ross.
*McKenney, J., Reefton.
*McKenzie, W., Thames.
*McLeod, G., Coromandel.
*McLiver, F., Thames.
*McLiver, H., Thames.
McMaster, J., Reefton.
Moore, H. W., Thames.
*Moore, J. H., Thames.
*Morgan, R., Otago.
Morrisby, A. A., Glenorchy.
*Nasmyth, T., Reefton.
Newman, W., Naseby.
*Northey, J., Thames.
*O'Sullivan, D. E., Thames.
Polton, A., Karangahake.
Porter, J., Waipori.
*Purvis, G., Ross.
Quinn, E., Te Aroha.
*Radford, T., Thames.
Ralph, J. G., Thames.
*Ranger, J., Reefton.
*Rasmussen, C. L., Mokihinui.
Rasmussen, C. P., Mokihinui.
Reid, P., Coromandel.
Resta, L., Macetown.
*Roberts, E., Ross.
Rooney, F., Reefton.
Scott, T., Waiorongomai.
*Searight, A., Reefton.
*Senior, J., Thames.
Smith, J. E., Thames.
Stone, F., Karangahake.
*Steedman, J. B., Thames.
Sturm, A., Waipori.
Taylor N., Thames.
Todd, C., Heriot.
Treloer, J. S., Reefton.
Tripp, R. S., Arrowtown.
*Vivian, J. G., Thames.
*Vivian, S., Reefton.
*Waite, C. D., Thames.
*Waite, E., Thames.
Walker, J. W., Thames.
Watson, T., Reefton.
*Wearne, J. E., Endeavour Inlet.
Wearne, T., Endeavour Inlet.
*Wilcox, J., Thames.
Williams, J., Skipper's.
*Wright, G., Boatman's.
Wylie, W., Ross.
Young, G., Skipper's.

Issued after Examination under the Mining Act, 1886, and Amendment Acts.

Adams, B., Thames.
Baker, W., Thames.
Black, G., Reefton.
*Caples, P. Q., Reefton.
*Carter, J., Thames.
*Casley, G., Reefton.
Cochrane, D. L., Reefton.
Colebrook, J. D., Coromandel.
Coombe, J., Reefton.
Crawford, J. J., Thames.
*Cummings, W., Reefton.
Donaldson, W., Otago.
Fleming, M., Thames.
*Gardner, W. P., Reefton.
Harris, W., Thames.
Horn, G. W., Thames.
Horne, W., Coromandel.
Hornick, M., Thames.
Hosking, G. F., Auckland.
Kruizenza, W., Reefton.
*Lawn, T., Reefton.
Logan, H. F., Wellington.
Mangan, T., Thames.
Mouat, W. G., Dunedin.
*Truscott, G., Thames.
Watkins, W. E., Reefton.
*Wilkie, J., Reefton.

Issued on Production of Certificate from a Recognized Authority outside the Dominion under the Mining Acts, 1886, 1891, 1898, 1905, 1908, and 1913.

Argall, W. H., Coromandel.
Beckwith, L. H., Wellington.
Brook, R. H. T., Reefton.
†Cock, J., jun., Ross.
Cock, W., Waiomio.
Datson, J., Manaia.
Dodd, William, Milton.
Evans, A. W., Reefton.
Griffiths, A. P., Auckland.
Griffiths, H. P., Auckland.
Hailey, R. C., Dunedin.
Hall, E. K., Reefton.
McKenna, Thomas, Dunedin.
Molineaux, H. S., Gore.
Rich, F. A., Auckland.
Williams, W. H., Auckland.

Issued after Examination under the Mining Act, 1891.

Agnew, J. A., Thames.
Annear, William, Reefton.
Arcott, R., Waihi.
Bennett, E. P., Thames.
Boydell, H. C., Coromandel.
Bradley, R. J. H., Te Puke.
*Bray, E., Reefton.
*Bruce, Malcolm, Thames.
Carroll, J., Lyell.
Cartwright, E., Thames.
Crabb, J., Reefton.
*Dobson, J. A., Auckland.
Evans, H. A., Wellington.
*Fahey, P., Reefton.
*Flannigan, Francis, Reefton.
Gilmour, J. L., Thames.
Hodge, J. H., Thames.
*Hughes, D., Thames.
*James, T., Thames.
Keam, P. E., Thames.
*Lane, J., Reefton.
Lawn, C. H., Capleston.
Linck, F. W., Thames.
*Marshall, F., Reefton.
Morrison, R., Thames.
McDermott, J., Thames.
McDermott, G., Thames.
McDermott, W., Thames.
McGregor, W. T., Thames.
McKenzie, H. J., Coromandel.
McPeake, J., Thames.
O'Keeffe, M. D., Thames.
Paul, Matthew, Thames.
Paltridge, Henry, Thames.
*Prince, F. H., Reefton.
Robertson, D. B., Stafford.
Ross, Richard, Thames.
Russell, Murray, Dunedin.
Shepherd, H. F., Thames.
Stanford, W. J., Macetown.
*Steedman, J. G., Thames.
Sutherland, Benjamin, Reefton.
Tierney, R., Thames.
Vialoux, F., Coromandel.
Warne, George, Thames.
Waters, D. B., Skipper's.
Watt, J., Thames.
White, G. H., Thames.
Whitley, A., Thames.
Williams, C., Capleston.

* Deceased since issue of certificate. † Alluvial.

FIRST-CLASS MINE-MANAGERS' CERTIFICATES—*continued.*

Issued after Examination under the Mining Acts, 1898, 1905, and 1908.

Allen, Henry, Waihi.
Autridge, L. E., Thames.
Baker, S. G., Thames.
Barker, B., Thames.
Barrance, K. M., Karangahake.
Bell, O., Waihi.
Bennie, Boyd, Waihi.
Bishop, Thomas Otto, Skipper's, Otago.
Blenkhorn, C., Coromandel.
Bolitho, Joseph, Reefton.
Bower, J. W., Coromandel.
Broad, R., Waihi.
Buddle, Frank, Coromandel.
Bull, C. W., Waihi.
Caisley, John, Karangahake.
Carroll, A. M., Reefton.
Carroll, John, Kuaotunu.
Carter, R. P., Waihi.
Clouston, R. E., Kaitangata.
Cooper, J. H., Thames.
Cooper, Thornhill, Waihi.
Cordes, F. M., Karangahake.
Cornes, J. G., Waihi.
*Daley, John William, Waihi.
Docherty, W. H., Coromandel.
Downey, J. T., Reefton.
Dutton, W. F., Waihi.
Ellery, John, Reefton.
Fry, S., Waimangaroa.
Evered, N. J., Waihi.
Geórge, M. T., Waihi.
Goldsworthy, C., Karangahake.
Goldsworthy, W., Coromandel.
Gordon, J. A., Thames.
Grayden, P., Thames.
Greening, W., Karangahake.
Gudgeon, C. W., Macrae's.
Hitchcock, W. E., Barewood.
Hooker, John, Coromandel.
Irwin, Samuel, Waihi.
Jackson, G. T., Waihi.
Johnson, J. H., Coromandel.
Katz, C. A., Waihi.
Langdon, H., Waihi.
Langford, G. S., Waihi.
Lautour, H. A. de, Waihi.
Lawn, Nicholas, Reefton.
Lewis, Ralph Reginald, Waihi.
Mackie, Portland George A., Waihi.
McConachie, W., jun., Waihi.
McDonald, R. M., Table Hill.
MacDuff, R. B., Thames.
McGruer, A., Karangahake.
MacLaren, J. A. J., Coromandel.
McMahon, J. H., Reefton.
McMahon, T., Reefton.
Mitchell, William J., Barewood.
Moore, L. O., Waihi.
Morgan, William, Waihi.
Morrison, William, Waihi.
Moye, Michael, Reefton.
Oats, John, Black's Point, Reefton.
O'Sullivan, J. W., Thames.
*Rabe, John, Thames.
Rimmer, J. C., Helensville.
Rodden, John, Reefton.
Ruffin, R. C., Reefton.
Saunders, W. H., Reefton.
Scoble, E. J. Waihi.
Sheehan, D., Karangahake.
Smith, Walter, Karangahake.
Spearing, J. R., Waihi.
Stewart, F., Waihi.
Stewart, R. A., Reefton.
Sullivan, T., Reefton.
Thomson, J. R., Waihi.
Thomson, Thomas, Waihi.
Thorne, G. M., Waihi.
Tucker, E. S., Coromandel.
Turner, G. W. E., Reefton.
Turnbull, E. V., Coromandel.
Turner, C. E., Murchison.
Ulrich, G. A. C., Waihi.
Walker, A. J., Waihi.
Watson, J. L., Thames.
Webber, J. H. A., Reefton.
*Weir, Thomas, Waihi.
*Whyte, N. McG. H., Waihi.
Williams, C., Thames.
Wilson, Allan, Thames.
Wood, P. H., Reefton.
Wotherspoon, James, Waihi.

Issued under Section 313 of the Mining Act, 1891.

*Edwards, George, Westport.
Hornibrooke, H. P., Coromandel.
Martin, James, Reefton.
Rickard, John, Thames.
Snow, Thomas, Huntly.
Thomas, James, Thames.
Trelease, J. H., Thames.
Williams, John, Kuaotunu.
White, John S., Karangahake.

Certificates of Competency granted to Holders of Provisional Warrants under Section 32 of the Mining Act Amendment Act, 1896.

Alexander, Thomas, Deep Creek.
Argall, A. E., Coromandel.
Battens, H., Coromandel.
*Begley, Thomas, Reefton.
Bennett, Charles Henry, Kuaotunu.
Bunney, Joseph, Waihi.
Campbell, Alexander, Cullensville.
Carlyon, Samuel, Coromandel.
Cornes, C. A., jun., Karangahake.
Daldy, Edward Arthur, Coromandel.
Draffin, Samuel, Waitekauri.
Farmer, C. S., Waitekauri.
*Goldsworthy, Thomas, Tokatea.
Goldsworthy, William, Karangahake.
Govan, Joseph, Thames.
Harvey, A. G., Coromandel.
*Howard, Samuel, Karangahake.
James, Robert, Thames.
Jamieson, John, Reefton.
Johns, Thomas, Waihi.
Kennerley, W. H., Thames.
*Langford, James, Coromandel.
McCombie, John, Karangahake.
MacDonald, H., Coromandel.
McEnteer, James, Tararu.
McFarlane, Charles M., Tokatea.
McLean, Benjamin J., Waitekauri.
McLean, Charles, Thames.
*McLean, James, Tararu, Thames.
Meehan, James, Westport.
Moorecraft, Walter, Coromandel.
Morgan, William, Owharoa.
Moyle, Thomas, Thames.
Patton, William, Macetown.
Pearce, Francis, Reefton.
Potter, William H., Thames.
*Rabe, Henry, Karaka.
Rillstone, Charles, Waipori.
Somervell, John, Thames.
*Stackpole, Robert, jun., Karangahake.
Thomas, Archelaus, Tapu, Thames.
Turnbull, Thomas A., Whangamata.
*Willets, Henry, Thames.
*Wilson, James R. S., Kuaotunu.

Issued to Inspectors of Mines by virtue of Office under the Mining Acts, 1886, 1891, and 1898.

Binns, G. J., Dunedin.
Cochrane, N. D., Westport.
Gordon, H. A., Wellington.
*Gow, J., Dunedin.
Green, E. R., Dunedin.
Hayes, J., Dunedin.
McLaren, J. M., Thames.
Tennent, R., Westport.
*Wilson, G., Thames.

SECOND-CLASS MINE-MANAGERS' CERTIFICATES.

Certificates of Service issued under the Mining Act, 1891.

Adams, W. J., Thames.
Agnew, J. A., Coromandel.
*Allen, Richard, Reefton.
Argall, A. E., Coromandel.
*Beard, W. T., Reefton.
*Begley, Thomas, Reefton.
Bennett, C. H., Coromandel.
Blair, Thomas, Kuaotunu.
Bolitho, James, Reefton.
Bone, William, Reefton.
*Borlase, J. H., Capleston.
*Bowler, John, Thames.
*Bray, Edwin, Reefton.
Bremner, John, Coromandel.
Brokenshire, James, Thames.
Brown, John, Macrae's.
Brownlee, Thomas James, Thames.
Bunny, Joseph, Thames.
Byrne, John, Karangahake.
*Caird, Alexander McNeil, Reefton.
*Campbell, J., Kuaotunu.
*Climo, Noah, Coromandel.
Comer, W. W., Thames.
Comer, George, Thames.
Corbett, T., Paeroa.
*Cowan, Hugh, Kuaotunu.
Crabb, Thomas, Reefton.
Daniel, P. F., Greymouth.
Dobson, John Allen, Kuaotunu.
Edwards, George, Westport.
Ellery, John, Reefton.
*Flannigan, Francis, Reefton.
Foster, Thomas, Wellington.
*Gale, C. W., Coromandel.
Gemmings, Charles, Thames.
Gill, George, Thames.
*Glasgow, T. M., Thames.
Goldsworthy, Henry, Thames.
Goldsworthy, William, Mauku, Auckland.
Govan, Joseph, Thames.
Gribble, James, Norsewood.
*Griffin, Patrick, Thames.
Grimmond, Joseph, Ross.
Guthrie, John, Wellington.
*Guy, Robert, Kuaotunu.
Hardman, James Edward, Thames.
*Harris, R., Thames.
*Harvey, William, Reefton.
Hetherington, William, Thames.
*Hicks, W., Thames.
Hill, Alexander Grey, Waikakaho.
Hollis, Frederick J., Waihi.
Hore, John, Wellington.
Hornibrooke, H. P., Kuaotunu.
Jamieson, John, Reefton.
Jobe, James, Thames.
Johns, Thomas, Thames.
Johnstone, William, Collingwood.
*Kendall, Henry, Thames.
Kerr, George, Kamo.
Kirker, Thomas, Thames.
Laughlin, David, Thames.
Law, John, Thames.
*Lough, H., Thames.
Loughlin, S., Thames.
Mackay, William, Nenthorn.
Martin, David, Black's Point.
Martin, James, Reefton.
Mayn, John, Coromandel.
McCombie, John, Karangahake.
*McCormick, Charles, Coromandel.

*Deceased since issue of certificate.

SECOND-CLASS MINE-MANAGERS' CERTIFICATES—*continued.*

Certificates of Service issued under the Mining Act, 1891—continued.

*McEwen, James, Reefton.
*McLean, James, Thames.
McLean, Alexander, Coromandel.
McLean, Charles, Thames.
*McNeill, Daniel, Thames.
McNeill, George, Upper Kuaotunu.
McLoghry, Archibald, Karangahake.
*McQuillan, John, Reefton.
Meagher, John, Karangahake.
*Mills, George, Thames.
*Milne, John, Thames.
Morgan, William, Upper Thames.
*Moorecroft, Thomas, Thames.
Moyle, Thomas, Thames.
*Naysmith, James, Reefton.
Newdick, Alfred, Thames.
*Notman, Alexander, Reefton.
O'Keefe, M. W. D., Thames.
Page, John, Lyell.
*Parkiss, Joseph W., Reefton.
Peebles, Alexander, Kuaotunu.
Pettigrew, Robert, Sydney.
*Phillips, W. H., Thames.
*Pollock, John, Thames.
Potts, W. H., Thames.
Primrose, J., Kuaotunu.
*Rabe, Henry, Thames.
*Radford, Thomas, Thames.
Reid, Thomas Groat, Thames.
Rickard, John, Thames.
Richards, A. H., Kuaotunu.
*Rogers, Charles Henry, Reefton.
Rogers, William Henry, Kumara.
*Ross, J., Thames.
*Rowe, James, Thames.
Shaw, James, Karangahake.
Sligo, Alexander, Nenthorn.
Thomas, James, Thames.
Thomas, A., Thames.
Thomson, John, Dunedin.
*Tregellas, James, Reefton.
*Tregoweth, William, Thames.
*Wells, Charles Lewis, Thames.
*Willets, Henry, Thames.
Williams, James, Thames.
Williams, John, Thames.
*Wilson, James R. S., Kuaotunu.
Wilson, J. G., Thames.
Whisker, Charles, Thames.
White, John S., Karangahake.
Woodcock, James, Thames.
Worth, Robert, Waihi.

Issued after Examination under the Mining Acts, 1891 and 1898.

Benney, J., jun., Paeroa.
Bennie, Boyd, Coromandel.
Cahill, T. M., Upper Kuaotunu.
Carroll, John, Upper Kuaotunu.
Christie, William, Waitekauri.
Draffin, S., Waitekauri.
Dunkin, T., Coromandel.
Evans, H. A., Skipper's.
*Gatland, V. Y., Coromandel.
Mathewson, A., Hyde.
McNeil, A. H., Coromandel.
White, F. H., Kuaotunu.
White, G. H., Thames.

Issued under Section 313 of the Mining Act, 1891.

Connon, William, Thames.
*Coran, Henry, Thames.
Edwards, E., Coromandel.
*Kelso, Archibald, Coromandel.
McCormick, W. J., Waitekauri.

Certificates of Competency granted to Holders of Provisional Warrants under Section 32 of the Mining Act Amendment Act, 1896.

Allen, W. J., Coromandel.
Barney, Montague T., Waitekauri.
Brownlee, Henry, Thames.
Collins, Charles, Waitekauri.
Curtis, Charles, Taylorville.
Davis, James, Coromandel.
Gardner, James, Waimangaroa.
Howe, Albion S., Waitekauri.
Johnson, Frank H., Collingwood.
Kirwan, William, Reefton.
*McDonald, John, Tairua.
McInnes, John, Puriri.
Martin, William, Tararu, Thames.
Murphy, Joseph, Coromandel.
O'Brien, John, Westport.
Prescott, Arthur J., Coromandel.
*Radford, Samuel, Waihi.
Ruffin, Richard, Manaia, Coromandel.

Certificates of Service issued under the Mining Amendment Act, 1910.

Adams, Albert Augustine, Thames.
Adams, R. W., Thames.
Barker, J. W., Coromandel.
Brabyn, John, Clarendon.
Butcher, F. J., Waitekauri.
Donaldson, George, Macrae's Flat.
Gillan, Thomas, Thames.
Grace, Pierce, Waitekauri.
Hansen, Charles Hans, Puketui.
Hayes, James, Thames.
Hill, Harrold Alexander, Thames.
Hyde, Henry John, Karangahake.
Iles, E. J., Bannockburn.
Inglis, Robert, Kuaotunu.
Kell, Arthur, Karangahake.
McKenzie, D., Georgetown.
Reid, George, Glenorchy.
Reynolds, Edmond Francis, Coromandel.
Sheehan, James, Thames.
Tallentire, John, Waiorongomai.
Williams, John Paul, Puriri.

BATTERY SUPERINTENDENTS' CERTIFICATES.

Issued under the Mining Act 1891 Amendment Act, 1894, without undergoing Examination.

Adams, H. H., Waihi.
Aitken, R. M., Reefton.
Banks, Edwin Gripper, Waihi.
Barry, Hubert Percy, Waihi.
Goldsworthy, Henry, Kuaotunu.
Goldsworthy, John, Kuaotunu.
Greenway, H. Howard, Auckland.
*Heard, G. St. Clair, Waihi.
Hope, John S., Waitekauri.
Hutchison, William, Karangahake.
Margetts, Frederick Ernest, Kuaotunu.
McKenna, T. N., Tararu.
McLellan, William, Waitekauri.
*Mellett, Richard Sheridan, Waitekauri.
*Napier, James, Karangahake.
Noble, James R., Karangahake.
Park, James, Thames.
Shepherd, Henry Franklin, Waihi.
Sims, C. F., Tararu.
Walker, James A., Kuaotunu.
Wilson, Arthur E., Waihi.
Wilson, James Kitchener, Auckland.

Issued after Examination under the Mining Act 1891 Amendment Act, 1894.

Adams, A. A., Thames.
Allen, F. B., Thames.
Allom, H. O., Thames.
Ansley, Comyn, Paeroa.
Ansley, Walter, Thames.
Banks, J. H., Waihi.
Bowers, W., Thames.
Brown, A. E., Thames.
*Carter, Samuel, Thames.
Clarke, J. L., Thames.
Clarke, R., Waitekauri.
Clarke, W. J., Waihi.
Day, A. T., Thames.
Dixon, Clement, Waihi.
Doveton, G. D., Thames.
Fleming, G. C. S., Thames.
Fuller, J. P., Kuaotunu.
Gray, J. W., Waihi.
Hayward, F. W., Komata.
Horn, G. W., Kuaotunu.
Jackson, J. H., Paeroa.
Jones, Achison, Waihi.
Kidd, F. D., Thames.
Laurie, D. B., Karangahake.
Lee, J. W., Reefton.
Macdonald, W., Waihi.
McKenzie, H. J., Thames.
McMicken, S. D., Thames.
Morgan, P. G., Thames.
Morrin, W. S., Thames.
Noakes, H. L., Waihi.
Raithby, R. W., Reefton.
Robinson, J. R., Waitekauri.
Stafford, B. H., Waihi.
Taylor, C. H., Tararu.
Thorpe, A. H., Thames.
Vercoe, R. B., Thames.
Wingate, H. M., Maratoto.
Winslow, G., Thames.
Williams, A. G. R., Thames.

Issued after Examination under the Mining Acts, 1898, 1905, and 1908.

Adams, J. H., Coromandel.
Adams, Richard W., Tararu, Thames.
Adams, J. H., Thames.
Airey, Hubert, Karangahake.
Aitken, Alexander Hugh, Waihi.
Allen, D. V., Thames.
Allen, H. E., Wellington.
Anderson, David, Waihi.
Andrews, T. T., Waihi.
Auld, J. B., Crushington.
Baker, W. H., Thames.
Banks, C. A., Waihi.
Banks, E. J., Thames.
Barrance, K. McK., Karangahake.
Barrett, J. J., Karangahake.
Barron, William E., Waikino.
Baskett, E. G., Karangahake.
Bell, L. M., Waihi.
Bidlake, A. E., Waiomo.
Bird, A. W., Thames.
Bishop, T. O., Reefton.
Blackadder, William, Crushington.
Bradley, R. J. H., Karangahake.
Browne, E., Waitekauri.
Brown, F. M., Karangahake.
Brown, J. E., Komata.
Brown, W. E., Reefton.
Burns, William, Waiomio.
Bush, E. F., Parawai.
Bush, George Arthur, Karangahake.
Bush, H. R., Thames.
Campbell, Colin, Thames.
Carpenter, W. E., Karangahake.
Carless, Noel, Waihi.
Carter, S., Waihi.
Carroll, John, Kuaotunu.

* Deceased since issue of certificate.

BATTERY SUPERINTENDENTS' CERTIFICATES—*continued.*

Issued after Examination under the Mining Acts, 1898, 1905, and 1908—continued.

Chappell, G. A., Karangahake.
Clark, John L., Waihi.
Clarke, Thomas, Waihi.
Coote, J. M., Thames.
Corbett, G. L., Waitekauri.
Couper, J., Thames.
Cowles, R. K., Crushington.
Crawford, H., Macrae's.
Crompton, H., Maratoto.
Croucher, Herbert, Waihi.
Dawson, B., Ellerslie.
Donnelly, Thomas, Waihi.
Donovan, Willie, Waikino.
Draffin, Eugene, Kuaotunu.
Eaton-Turner, Geoffrey William, Waihi.
Ellis, L. L., Waitekauri.
Empson, J. B., Karangahake.
Evans, G. C., Waihi.
Evans, J., Waihi.
Evans, W. B., Reefton.
Ewen, H. F., Auckland.
Fletcher, H. T., Katikati.
*Fraser, J. M., Reefton.
Fry, Sidney, Westport.
Fuller, John P., Kuaotunu.
Fyfe, A., Dunedin.
Gardner, E. A., Reefton.
Gibson, William, Waihi.
Gilpin, J., Waihi.
Gow, E. A., Crushington.
Grayden, J., Waitekauri.
Grayden, Peter, Thames.
Grumitt, P. H., Thames.
Gwilliam, Benjamin, Karangahake.
Halliwell, L. V., Karangahake.
Hargraves, E. P., Waihi.
Hay, Adam, Karangahake.
Harsant, C., Puketui.
Hazard, T. R. C., Waitekauri.
Hindmarsh, R., Reefton.
Hitchcock, W. E., Barewood.
Hogg, B., Karangahake.
Hogg, T. R., Karangahake.
Horn, G. W., Kuaotunu.
Gillooly, T., Roxburgh.
Gillstrom, Carl A., Berlin's.
Hutchison, R. M., Karangahake.
Johnson, Edward, Waihi.
Jones, R. D., Karangahake.
Kidd, R. B., Waitekauri.
Kingsford, A., Karangahake.
Kingsford, C., Waihi.
Langford, G. S., Waikino.
Launder, G. H., Waitekauri.
Lawless, L. J., Paeroa.
Lawn, H., Reefton.
Littlejohn, W. D., Karangahake.
Lovelock, J. E., Crushington.
Mackay, John, Crushington.
Maltman, A., Reefton.
Mann, C., Westport.
Matheson, A. M., Barewood.
Maxwell, W. L., Waihi.
McDonall, P. H., Waihi.
McEwin, J. A., Reefton.
McKinlay, John, Waihi.
McNeil, A. R., Karangahake.
McPadden, J., Coromandel.
Melrose, P., Waihi.
Montgomery, A. E., Opitonui.
Morgan, Robert James, Waihi.
Motherwell, William, Waihi.
Moyle, W. T., Upper Tairua.
Orbell, G. S., Waikouaiti.
Orr, F. S., Waiuta.
Paltridge, F., Thames.
Pond, H. C., Auckland.
Porteous, J., Crushington.
Quick, J. N., Thames.
Reid, J. E., Great Barrier.
Reynolds, E. A., Auckland.
Roberts, H. C., Waihi.
Rodden, William, Lyell.
Rosewarne, R. H., Thames.
Royse, W. G., Reefton.
Sanford, A. G., Waihi.
Shaw, D. S., Waikino.
Shaw, L. J., Waikino.
Stephens, H., Dunedin.
Sutherland, J. A., Reefton.
Thomson, G. W., Bendigo.
Thurlow, J. R., Coromandel.
Tomlinson, A., Karangahake.
Tomlinson, David Mitchell, Barewood.
Tomlinson, W. F., Dunedin.
Turnbull, E. V., Waihi.
Ulrich, G. A. C., Komata.
Ulrich, Herstall, Whangapoua.
Walker, Alfred James Dickson, Waihi.
Waters, D. B., Waihi.
Watson, A. B., Waitekauri.
Watson, A. P., Crushington.
Watson, J. R., Reefton.
Watson, J. P., Reefton.
Watson, W. A., Crushington.
Wearne, W., Reefton.
White, A. S. H., Karangahake.
Williams, A. C., Waihi.
Williams, James, Reefton.
Williams, William Eustace, Waihi.
Wilson, A. P., Crushington.

DREDGEMASTERS' CERTIFICATES.

Issued without Examination under the Mining Act, 1898, and Amendment Acts, 1901 and 1902.

Allen, Charles, Alexandra.
Anderson, L. C., Alexandra.
Andrews, Ralph, Canvastown.
Baker, J. R., Alexandra.
Ballantyne, D., Miller's Flat.
Barnes, T. J., Beaumont.
Barry, Thomas, Clyde.
Bradley, Neil, Alexandra.
Bennett, George, Gore.
Bennett, James, Kumara.
Blue, G. P., Alexandra.
Brand, Peter, Waikaka.
Brennan, Philip, Palmerston S.
Bremner, A. P., Lower Shotover.
Brice, William H., Cromwell.
Bringans, D., Alexandra.
Brown, T. G., Ahaura.
Bunting, James, Murchison.
Busbridge, P., Gore.
Butler, Ewen, Roxburgh.
Butler, M. J., Kanieri.
Cameron, Samuel, Alexandra.
Clarke, Edward, Port Chalmers.
Compton, Albert, Dobson.
Cormack, W., Greymouth.
Cornish, J. T., Miller's Flat.
Coutts, Henry, Miller's Flat.
Cowan, Alexander, Stillwater.
Cowan, James, Nelson Creek.
*Crookston, W. L., Three-channel Flat.
Crowley, J. B., Edendale.
*Cumming, J. C., Beaumont.
Cunningham, George, Kanieri.
Curtis, Charles, Stillwater.
Cutten, W. H., Dunedin.
Deniston, R. A., Cromwell.
Dewar, John, Alexandra.
Donaldson, J. G. A., Greenstone.
*Edmonds, A. R., Nelson Creek.
Faithful, William, Greymouth.
Foohy, J. M., Alexandra.
Gibb, William, Croydon Siding.
Gibson, A., Island Block.
Goodger, G. W., Waenga.
Graham, J. M., Gore.
Grogan, William A., Miller's Flat.
Hansen, William, Alexandra.
Hay, James, Dunedin.
Hedley, A., Cromwell.
Herbert, J., Beaumont.
Hewitt, James, Clyde.
Hogg, Thomas, Cromwell.
Hoskins, Thomas, Maori Point.
Hoy, Samuel, Alexandra.
Inwood, W. J., Rocklands Beach.
Johnston, E. A., Alexandra.
Johnstone, Alexander, Cromwell.
Keen, Thomas, Clyde.
Kennedy, Angus, Alexandra.
Kitto, Edward T., Miller's Flat.
Kitto, Francis, Lowburn.
Kitto, John F., Miller's Flat.
Kitto, W. H., Cromwell.
Kloogh, N. P., Lowburn Ferry.
Lawson, Edward, Dunedin.
Ledingham, J., Bannockburn.
Lee, George, Collingwood.
Lidicoat, R. H., Fern Flat.
Louden, Alexander, Clyde.
Luke, S. J., Alexandra.
Magnus, A., Roxburgh.
Magnus, Olaf, Box 130A, Christchurch.
Mailer, John, Stillwater.
Maitland, A. E., Miller's Flat.
*Maxwell, John, Dunedin.
McClure, F. C., Rongahere.
McConnell, J., Cromwell.
McCormack, D., Kanieri.
McDonald, E. A., Waitiri.
McDonald, J., Sofala.
McDonald, John, Cromwell.
McGeorge, J., Dunedin.
McGeorge, Alexander, Dunedin.
McGregor, D., Kanieri.
McGregor, G. R., Alexandra.
McIntosh, D. J., Lowburn Ferry.
*McLay, George, Cromwell.
McLean, D., Waitiri.
McMath, D. C., Ross.
McMath, Thomas, Alexandra.
*McVicar, Peter, Roxburgh.
Mills, Edward, Murchison.
Mitchell, D. A., Dunedin.
Morel, C. G., Inangahua Junction.
Morris, G. S., Cromwell.
Murray, D., Clyde.
Murray, Madget, Cromwell.
Neilson, S., Miller's Flat.
Nicholson, W. E., Alexandra.
O'Leary, D., Waiau.
Olsen, Charles, Roxburgh.
Parsons, J. D., jun., Clyde.
Percy, John, Clyde.
Perkins, A. C., Dunedin.
Pettigrew, George, Nelson Creek.
Poulter, G. W., Alexandra.
Pringle, John, Miller's Flat.
Ray, J. C., Totara Flat.
Reeder, Philip, Bald Hill Flat.
Rennie, Andrew, Roxburgh.
Ross, Alexander, Cromwell.
Ross, Robert, Alexandra.
Richmond, J., Gibbston.
Ritchie, J. S., Waitiri.
Sanders, H. P., Clyde.
Sanders, John, Cromwell.
Sanders, Thomas, Alexandra.
Schaumann, H., Alexandra.
Scott, M. G., Alexandra.
Scott, Robert, Capleston.
Shore, T. M., Queenstown.
Shore, William, Gore.
Simonsen, Charles, Alexandra.
Skilton, A. G., Old Diggings.
Sligo, N. K., Ahaura.
Smeaton, S. H., Inangahua Junction.
Smith, Alfred, Inangahua Junction.
Steel, Archibald, Kawarau Gorge.
Steel, Thomas, Dunedin.
Templeton, Ivie, Rongahere.
*Thompson, J., Alexandra.
Thompson, T., Miller's Flat.
Tough, John, Miller's Flat.
Troy, G. C., Cromwell.
Turnbull, W. D., Canvastown.
Tyson, John, Rongahere.
Von Haast, J. H., Clyde.
Wallace, John A., Miller's Flat.
Watt, John, Cromwell.
Weaver, Charles, Alexandra.
Williamson, R., Miller's Flat.
Williamson, Walter, Miller's Flat.
Wilson, S. W., Waikaka Valley.
Wood, R. M., Cromwell.
Woodhouse, W. S., Roxburgh.
Young, Andrew, jun., Roxburgh.

* Deceased since issue of certificate.

DREDGEMASTERS' CERTIFICATES—*continued.*

Issued after Examination under the Mining Acts, 1898, 1901, 1902, 1905, and 1908.

Anderson, Andrew, Alexandra South.
Anderson, Bertram, Maori Point.
Anderson, G. B., Roxburgh.
Archer, D. J., Ngakawau.
Baird, William G., Clyde.
Bardsley, John James, Cromwell.
Bate, H. T. G., Greymouth.
Bishop, Hugh Arthur, Collingwood.
Blair, G., Abbotsford.
Borthwick, Robert, Alexandra.
Bourke, John, Clyde.
Brent, C. D., Cromwell.
Briggans, Thomas, Alexandra.
Briggans, William, Alexandra.
Broderick, T., Lyell.
Bruce, J. A., Kawarau Gorge.
Burley, J. P., Westport.
Burnside, Walter, Alexandra.
Burton, A. P., Miller's Flat.
Callaghan, E., Three-channel Flat.
Campbell, G. W. T., Alexandra.
Carnegy, A., Three-channel Flat.
Carr, W., Alexandra.
Carter, W. W., Sandy Point.
Chapman, Robert, Maori Point.
Clark, D., Callaghan's Creek.
Clarke, R. S. B., Alexandra S.
Coup, George, Albertown.
Cox, R. D., Alexandra.
Craig, D. A., Shag Point.
Croawell, James, Three-channel Flat.
Curno, C. B., Alexandra.
Dalton, J. R., Three-channel Flat.
Dalzell, T. L., Cromwell.
Donaldson, John, Lawrence.
Downie, Henry, Totara Flat.
Eaton, Edgar W., Alexandra.
Elder, D. D., Roxburgh.
Fache, S. C., Gore.
Faithful, Alfred, Bannockburn.
Farmer, Nathan C., Miller's Flat.
Farquharson, George, Alexandra.
Findley, David, Dunedin.
Fisher, Hurtle, Miller's Flat.
Filippi, S. de, Westport.
Foley, S., Lowburn Ferry.
Forno, D., Inangahua Junction.
Fraser, W. J., Roxburgh.
French, T. E. K., Three-channel Flat.
Gibson, William H., Cromwell.
Graham, Thomas Arthur, Gore.
Gunion, R. A., Alexandra.
Gunn, W. E., Beaumont.
Guy, Donald, Cobden.
Guyton, James, Dunedin.
Hanning, C. J., Clyde.
Hansen, H. C., Three-channel Flat.
Harden, J., Stafford.
Harliwick, Matthew, Roxburgh.
Hewetson, Sydney, Nelson Creek.
Hogg, J., Nevis.
Holden, Charles, jun., Cromwell.
Holden, John, Cromwell.
Hepburn, D. O., Alexandra.
Hughes, John L., Miller's Flat.
Johnston, John, Maori Gully.
Johnston, Louis, Beaumont.
Jones, David Rowland, Island Block.
Jones, T. R., Miller's Flat.
Junker, Frank J., Berlin's.
Kane, William, Clyde.
Kean, F. F., Waikaka.
Kellett, C. H., Dunedin.
Kennedy, A., Ophir.
Kitto, Henry, Alexandra South.
Kitto, John, Clyde.
Linney, William, Island Block.
Livingstone, D., Alexandra.
Lloyd, Arthur, Inangahua Junction.
Lloyd, Hubert, Lyell.
MacDonald, C. J., Cromwell.
MacGinnis, J. A., Cromwell.
MacGinnis, M. P., Alexandra.
MacLaren, John, Alexandra.
Marklund, C. O., Lowburn Ferry.
Mathews, James Halbert, Miller's Flat.
Matthews, A. A., Three-channel Flat.
Mayne, W. C., Nelson Creek.
McDonald, C. J., Waitere.
McDonald, G., Alexandra.
McCallum, W. S., Alexandra.
McGregor, Dougald S., Alexandra.
McKenzie, John, Roxburgh.
McKinnon, John, Alexandra.
McLean, John. Roxburgh.
Mélvin, J. R., Roxburgh.
Merchant, Isaiah, Clyde.
Milne, John A., Roxburgh.
Moffitt, R. W., Miller's Flat.
Mollison, William, Stillwater.
Moncrieff, Henry, Miller's Flat.
Monson, C. H., Miller's Flat.
Morel, A. E., Noble's.
Morel, L. H., Inangahua Junction.
Morgan, Harold, Roxburgh.
Morgan, John, Alexandra.
Morris, V., Cromwell.
Mouat, W. G., Greymouth.
Munro, C. T., Waitiri.
Munro, Hugh, Alexandra South.
Munro, R. F., Ross.
Murray, H. B., Cromwell.
Murray, Robert John, Canvastown.
Nelson, Edgar, Brunnerton.
Nelson, George L., Brunnerton.
Newick, Albion Edgar Charles, Bannockburn.
Nicholson, Charles S. G., Mataura.
Noble, William, Alexandra.
Olsen, Hans, Alexandra.
Omond, Thomas, Nevis.
Orkney, H. E., Cromwell.
Orr, H. T., Cromwell.
Orr, William W., Cromwell.
Parker, P. R., Roxburgh.
Paterson, J. B., Miller's Flat.
Patterson, J., Clyde.
Plumb, E. H., Maori Point.
Poppelwell, William, Alexandra.
Rait, Hume, Albertown.
Ray, J. F., Bannockburn.
Ray, Robert Marshall, Bannockburn.
Reiderer, Edward, Cromwell.
Reynolds, T., Greymouth.
Ritchie, William John, Cromwell.
Roberts, G., Three-channel Flat.
Robertson, D. J., Alexandra.
Robertson, W. R., Alexandra.
Rooney, J. B., Roxburgh.
Rumble, Charles, Ngahere.
Rumble, Joseph, Miller's Flat.
Sanders, W. J., Ahaura.
Saunders, C. E., Cromwell.
Sawle, J., Cromwell.
Sawyer, J. F., Alexandra.
Sherwood, T. W., Greymouth.
Simpson, Edward Robert, Cromwell
Sparrow, J. A., Upper Nevis.
Spooner, A. E., Alexandra.
Steele, Thomas, Alexandra.
Steele, W. H., Miller's Flat.
Taylor, Alexander, Alexandra.
Taylor, J. T., Dunedin.
Theyers, C., Alexandra.
Theyers, J. W., Alexandra.
Turner, T. F., Moonlight.
Vickerman, E. M., Cromwell.
Walker, J. J., Alexandra South.
Wasserbrenner, M., Alexandra.
Wathen, James, Miller's Flat.
Watson, E. H., Collingwood.
Weaver, P., Alexandra.
Weir, R., Gore.
Weir, T. R., Cromwell.
Weir, W., Nevis.
Wescombe, Alfred L., Island Block.
Westcott, P. A., Miller's Flat.
Williams, Frederick, Alexandra.
Wilson, George, Marsden.
Wilson, Stephen L., Inangahua Junction.
Wood, W. W., Cromwell.
Woodhouse, F., Bannockburn.
Woodhouse, G. G., Waitiri.
Wylde, G. R., Inangahua Junction.

APPENDIX B.

REPORTS RELATING TO THE INSPECTION OF COAL-MINES.

The INSPECTING ENGINEER OF MINES to the UNDER-SECRETARY OF MINES.

SIR,— Wellington, 21st May, 1914.

I have the honour to present the annual reports of inspection, together with statistical information, in regard to the coal-mines of the Dominion, for the year ended 31st December, 1913

The reports are divided into the following sections :—

I. Output of Mineral.
II. Persons employed.
III. Accidents.
IV. General Remarks.

Annexures—

(*a.*) Inspectors' Reports, Extracts from.
(*b.*) Mine Officials' Examinations, and List of Certificate-holders.
(*c.*) Statistics of Working Collieries.

SECTION I.—OUTPUT OF MINERAL.

The output of the several classes of coal mined in each inspection district is summarized as follows :—

Class of Coal, &c.	Output of Coal during 1913.				Total Output to the End of 1913.
	Northern District.	West Coast District.	Southern District.	Total.	
	Tons.	Tons.	Tons.	Tons.	Tons.
Bituminous and semi-bituminous coal	102,710	1,057,564	...	**1,160,274**	22,486,327
Pitch-coal	...	...	2,397	**2,397**	1,993,594
Brown coal	246,876	...	377,976	**624,852**	11,074,944
Lignite	...	...	100,482	**100,482**	1,793,954
Totals for 1913 ...	**349,586**	**1,057,564**	**480,855**	**1,888,005**	**37,348,819**
Totals for 1912 ...	383,847	1,301,461	492,307	2,177,615	35,460,814

During the whole of November and December nearly all the most productive collieries were rendered idle by the general strike, the result of which is that the coal-output for 1913 is 289,610 tons less than during the previous year.

The following is a statement showing output of coal from each coalfield :—

Coalfield.	Output during 1913.	Total Output to End of 1913.
	Tons.	Tons.
North Auckland	102,710	3,127,113
Waikato	243,316	3,474,084
Mokau	3,560	85,120
Nelson	14,717	239,321
Buller	679,283	12,157,911
Inangahua	13,708	229,594
Grey	349,856	7,132,072
Canterbury	14,430	671,471
Otago	306,647	7,965,296
Southland	159,778	2,266,837
Totals	**1,888,005**	**37,348,819**

The production from, and the number of persons employed at, the principal collieries of the Dominion are shown in the following table :—

Name of Colliery.	Locality.	Class of Coal.	Output for 1913.	Total Output to 31st December, 1913.	Total Number of Persons ordinarily employed.
Northern District.			Tons.	Tons.	
Hikurangi	Hikurangi...	Semi-bituminous	46,515	868,582	85
Taupiri	Huntly ...	Brown ...	218,128	2,713,391	508
Northern	Hikurangi...	Semi-bituminous	50,853	502,965	136
West Coast District.					
Coalbrookdale	Millerton ...	Bituminous	292,576	4,053,999	587
	Denniston	"	241,375	6,585,810	559
Westport-Stockton	Mangatini	"	93,315	550,475	180
	Seddonville	"	51,894	524,691	88
State Coal-mines	Point Elizabeth	"	135,276	1,737,574	238
	Liverpool ...	"	9,114	...	53
Blackball	Blackball ...	"	143,836	1,816,660	350
Southern District.					
Kaitangata	Kaitangata	Brown ...	145,904	2,987,846	405
Nightcaps	Nightcaps...	" ...	79,645	958,094	134
Other collieries, in all districts ...	...	Various ...	379,574	14,048,732	927
Totals	...	...	**1,888,005**	**37,348,819**	**4,250**

SECTION II.—PERSONS EMPLOYED.

Inspection District.	Average Number of Persons employed during 1913.		
	Above Ground.	Below Ground.	Total.
Northern	189	635	824
West Coast	557	1,854	2,411
Southern	307	708	1,015
Totals, 1913	**1,053**	**3,197**	**4,250**
Totals, 1912	1,130	3,198	4,328

It will be observed that the decrease in the number of persons employed during 1913 is entirely confined to those employed above ground; this decrease is due to the completion of the surface arrangements at some of the new collieries in the Grey Coalfield.

SECTION III.—ACCIDENTS.

The following is a summary of coal-mining accidents during 1913, with their causes:—

	Fatal Accidents.		Serious Non-fatal Accidents.	
	Number of Separate Fatal Accidents.	Number of Deaths.	Number of Separate Non-fatal Accidents.	Number of Persons injured, including those injured by Accidents which proved Fatal to their Companions.
Falls in mine	4	4	7	7
In shafts	...	...	1	1
Miscellaneous—Underground...	2	2	5	5
On surface ...	...	...	...	...
Totals	**6**	**6***	**13**	**13**

* Being in the proportion of 1·38 deaths per 1,000 persons employed.

The proportion of fatal accidents to persons employed at collieries continues to decline in a very satisfactory manner. During 1913 this amounted to 1·38 per 1,000 persons employed, the lowest average for ten years. Those officials of the mining companies and of the State whose duty it is to secure safety conditions in our collieries are deserving of congratulation for the results here recorded, more especially when it is understood that a considerable number of young inexperienced men are now employed in the coal-mines, whereas formerly the colliers were of Home training and greater experience.

Upon examination of the following brief description of the fatal accidents at New Zealand collieries during 1913 it will be noted that in no case was any one held blameworthy, but in the cases of James Hewitt and Bertie Strongman the sufferers respectively lost their lives owing to absent-mindedness and inexperience.

The following is a brief description of the fatal accidents at New Zealand collieries during 1913:—

Name.	Date of Accident.	Colliery.	Cause and Nature of Accident.
A. Derbyshire ..	17/10/12 (died 21/2/13)	Denniston	Deceased, a trucker in the Coalbrookdale section, was fatally injured by a fall of top coal whilst trucking. He died 127 days after the accident.
W. F. Ferguson ..	26/3/13	New Brighton (Nightcaps district)	When cutting coal from a pillar rib, below an unseen parting in the roof, a large piece of coal fell upon deceased. The Coroner's jury held no person blameworthy.
John Jenkins ..	5/4/13	Northern	Deceased and another were extracting pillar coal when a fall of rock occurred without warning, striking him, and breaking his back. The Inspector of Mines found that timber had been carefully set. The Coroner's jury held no person blameworthy.
James Hewitt ..	2/4/13	Nightcaps	Deceased, a miner, working in a heading, drilled, charged, and ignited a shot in the coal-face, retiring for safety into a level near-by, where he met a deputy; and a dispute occurring between them as to the height of the heading, together they returned to the heading where deceased proceeded to measure the height, when the charge previously ignited by him exploded, killing him instantly. The Coroner's jury returned a verdict accordingly. This remarkable accident was evidently due to the absent-mindedness of deceased, who, in the excitement of the moment, forgot that he had ignited the fuse in the place under discussion. The deputy escaped uninjured.
Matthew McKenzie	9/9/13	Nightcaps (No. 2) ..	Deceased and John Price, miners, together with Dillon, a trucker, were working together filling coal after a recently fired shot. Previous to starting they examined the place, remarking that it was safe. A fall of coal occurred, fatally injuring deceased, also breaking the leg of and inflicting other but minor injuries to Price. The Coroner's jury decided that no person was blameworthy.
Bertie Strongman ..	24/12/13	Whangarei	Deceased, a half-caste Maori youth of nineteen, inexperienced as a miner, had been employed trucking for a few weeks during the general strike. In attempting to enter a cage after it had commenced its ascent deceased was fatally crushed between the cage and the shaft side. The Coroner's jury held no other person blameworthy for the accident; which was correct, but the evidence disclosed lamentable non-observance of the Coal-mines Act. At the time of this accident no code of shaft-signals were posted at either the top or bottom of the shaft; neither had the driver of the winding-engine (a youth of nineteen) a certificate as such. As the result of a prosecution for the first offence the mine-manager was fined £10 and costs.

The following statement shows the tons of coal and shale raised, persons employed, lives lost, &c., from 1878 to 1913 :—

Year.	Output.	Persons employed.			Tons raised per each Person employed Underground.	Tons raised per Life lost.	Persons employed per Life lost.	Lives lost per Thousand Persons employed.	Number of Deaths.
		Above.	Below.	Total.					
Prior ...	709,931	...	...	...	...	...	...	...	...
1878 ...	162,218	147	366	513	443	4,771	15	66·27	34†
1879 ...	231,218	...	...	802	...	115,609	401	2·49	2
1880 ...	299,923	...	...	1,038	...	149,961	519	1·92	2
1881 ...	337,262	...	...	963	...	337,262	963	1·04	1
1882 ...	378,272	...	...	1,043	...	189,136	521	1·91	2
1883 ...	421,764	361	888	1,249	475	210,882	624	1·60	2
1884 ...	480,831	393	890	1,283	540	160,277	421	2 34	3
1885 ...	511,063	338	1,145	1,483	456	170,354	494	2·01	3
1886 ...	534,353	392	1,213	1,605	440	*	*	*	0
1887 ...	558,620	388	1,111	1,499	503	139,655	375	2·66	4
1888 ...	613,895	414	1,275	1,689	481	153,474	422	2·36	4
1889 ...	586,445	466	1,251	1,717	468	146,611	313	2·37	4
1890 ...	637,397	512	1,334	1,846	477	79,674	231	4·33	8
1891 ...	668,794	416	1,277	1,693	523	167,198	423	2·36	4
1892 ...	673,315	485	1,196	1,681	563	673,315	1,681	0·66	1
1893 ...	691,548	590	1,298	1,888	533	138,309	377	2 64	5
1894 ...	719,546	506	1,393	1,899	516	119,924	316	3·16	6
1895 ...	726,654	525	1,274	1,799	618	145,331	360	3·33	5
1896 ...	792,851	590	1,347	1,937	588	12,013	29	34·07	66‡
1897 ...	840,713	531	1,381	1,912	609	210,178	478	2·09	4
1898 ...	907,033	556	1,447	2,003	627	907,033	2,003	0·49	1
1899 ...	975,234	554	1,599	2,153	609	325,078	717	1·39	3
1900 ...	1,093,990	617	1,843	2,460	593	273,497	615	1·62	4
1901 ...	1,239,686	688	2,066	2,754	600	413,228	918	1·09	3
1902 ...	1,365,040	803	2,082	2,885	655	682,520	1,443	0·69	2
1903 ...	1,420,229	717	2,135	2,852	665	355,057	713	1·40	4
1904 ...	1,537,838	763	2,525	3,288	609	384,459	822	1·21	4
1905 ...	1,585,756	833	2,436	3,269	651	264,293	546	1·83	6
1906 ...	1,729,536	1,174	2,518	3,692	687	288,256	615	1·62	6
1907 ...	1,831,009	1,143	2,767	3,910	662	152,584	326	3·07	12
1908 ...	1,800,975	992	2,902	3,894	641	372,195	778	1·28	5
1909 ...	1,911,247	1,159	3,032	4,191	633	273,035	599	1·79	7
1910 ...	2,197,362	1,136	3,463	4,599	634	137,335	283	3·55	16
1911 ...	2,066,073	1,365	2,925	4,290	706	147,577	306	3·26	14
1912 ...	2,177,615	1,130	3,198	4,328	681	241,975	355	2·08	9
1913§ ...	1,888,005	1,053	3,197	4,250	590	314,667	708	1·38	6
Totals ...	**37,363,241**	...	...	...	...	...	...	...	**262**

* No life lost. † Year of Kaitangata explosion. ‡ Year of Brunner explosion. § Nearly all the collieries were idle during November and December owing to a strike.

SECTION IV.—GENERAL REMARKS.

Mining Operations.

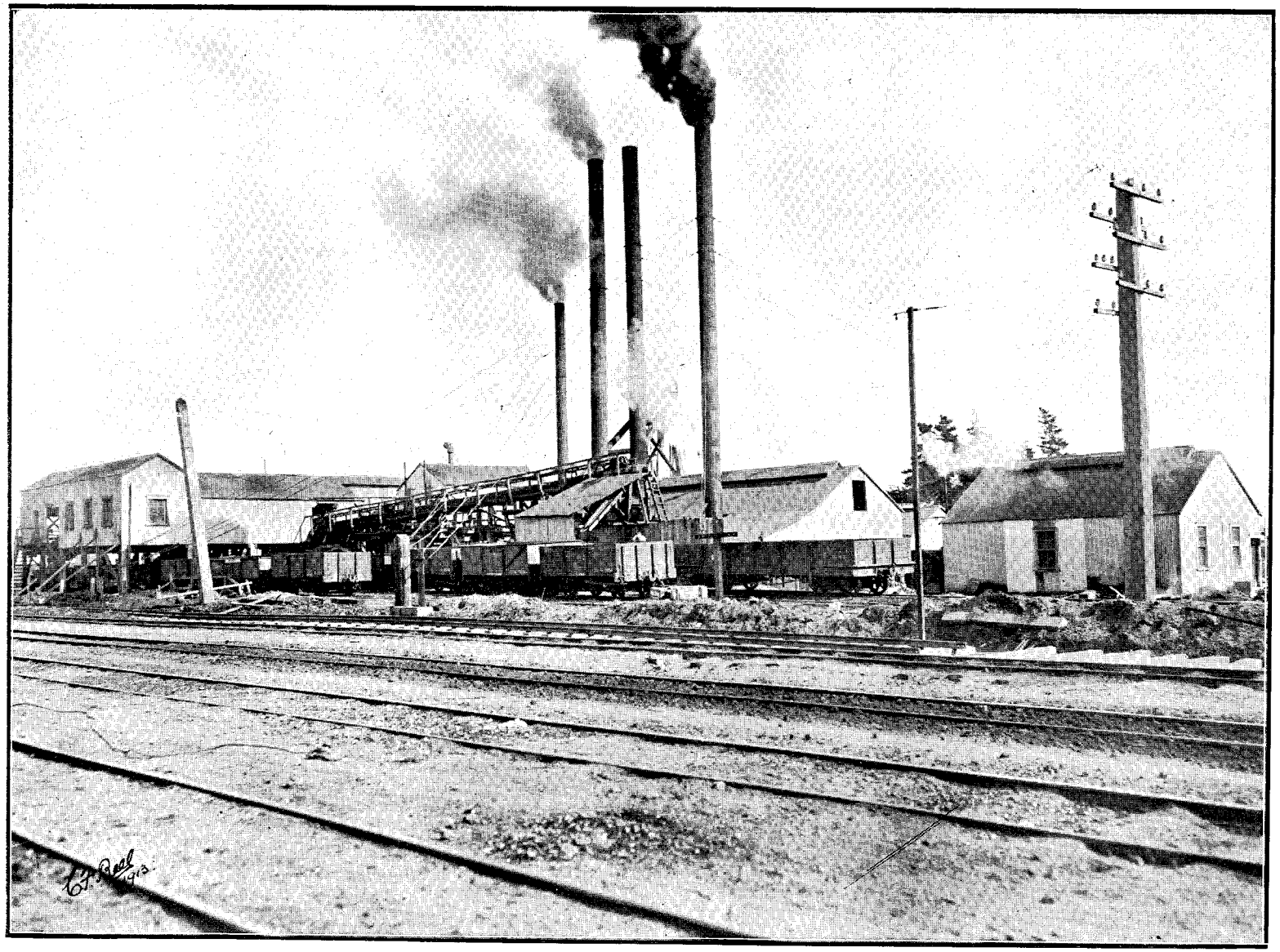
Mining developments at the North Auckland collieries have generally been unimportant. At the Kiripaka Mine work has been suspended. A fire in No. 3 section of the Hikurangi Coal Company's mine destroyed several sheds, and necessitated flooding of the workings, which were subsequently unwatered.

The new colliery, the property of the Northern Coal Company, recently laid down in the vicinity of the limestone rocks at Waro has been well equipped with pumping, winding, and ventilating machinery; it is probable that in the near future this will be the most productive colliery in the district.

The Taupiri Coal-mines (Limited) again heads the list of productive collieries in the North Island, the output therefrom exceeding all other North Island mines combined. This company possesses a large and comparatively unbroken area of coal, with a coal-seam of great thickness, in places exceeding 60 ft. The two photographs accompanying this report show the pit headgear and surface buildings of this company—Ralphs and Extended Mines respectively.

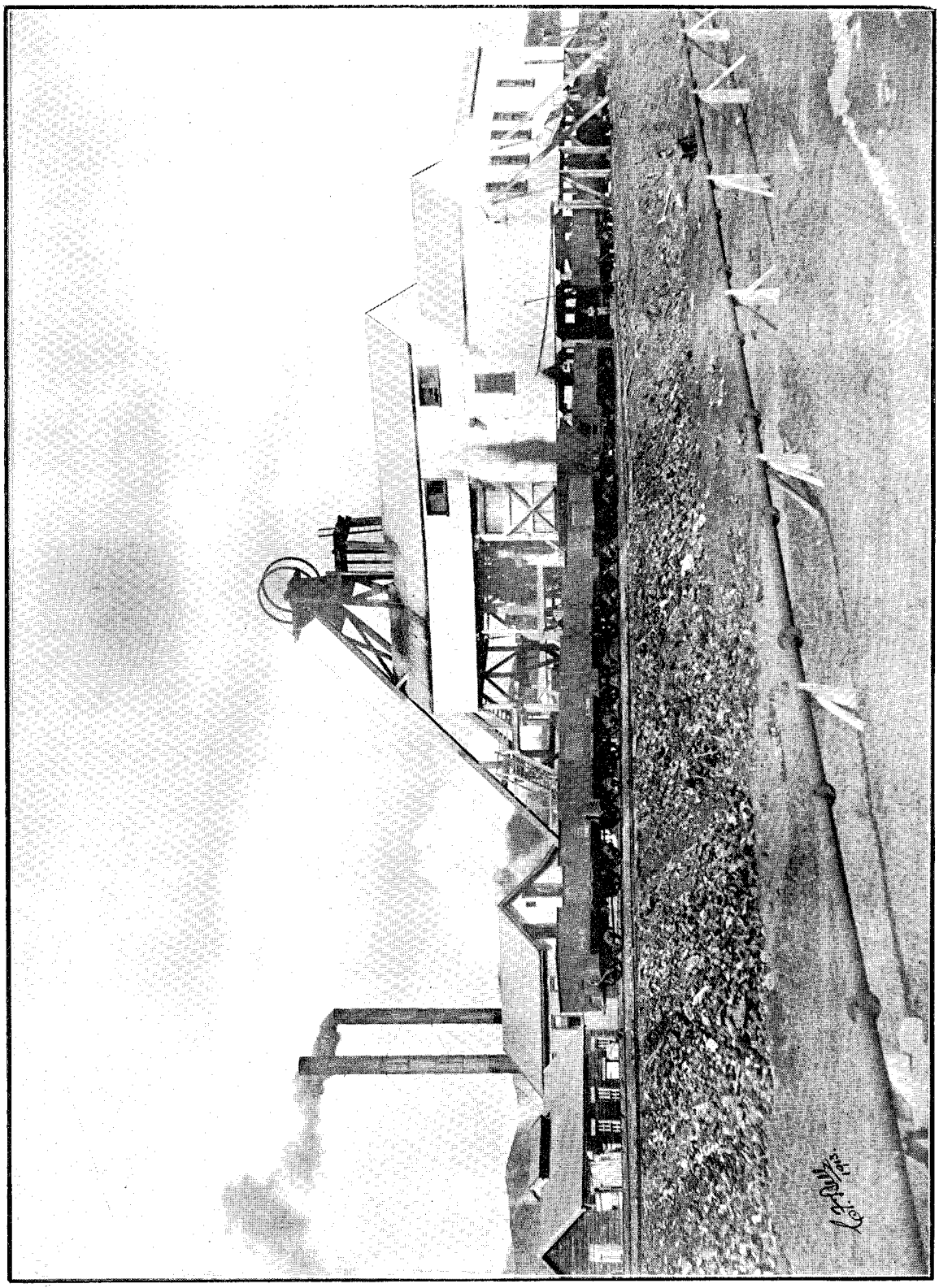
Two new collieries, the property of the Waipa Railway and Collieries (Limited) and Pukemiro Collieries (Limited), having been laid down and fully equipped, will enter the lists of productive collieries upon the completion of some bridges and culverts on the branch railways to connect them with the Main Trunk Railway. The Waikato Coalfield, upon which the three last-named collieries are situated, is the most extensive and unbroken coalfield in the Dominion.

On the West Coast bituminous coalfields the principal mines had, prior to the strike, produced a considerable output. On the Grey Coalfield the most interesting event was the addition of the new Liverpool Mine, one of the Point Elizabeth State Collieries, to the list of productive mines. The equipment of this mine is of considerable magnitude; the bin (capacity, 4,000 tons) and



TAUPIRI COAL-MINES (LIMITED).—RALPH'S MINE, HUNTLY.

Face p. 96



Taupiri Coal-mines (Limited).—Extended No. 1 Mine, Huntly.

screening arrangements are constructed upon the most modern design; the self-acting endless-rope system of haulage installed upon the incline connecting the mines with the new branch railway to Greymouth has been designed to transport an output of 2,000 tons per day. Three separate sections of bord-and-pillar workings are now being developed. No. 1 mine is situated at the upper terminus of the surface haulage incline, a distance of two miles from the coal-storage bin and branch railway, and 1,735 ft. above sea-level. No. 2 mine is situated about a quarter of a mile down the incline from its terminus; and No. 3 mine immediately above the coal-storage bin and branch-railway terminus, the latter being about 800 ft. above sea-level. The coal-seams, of which there are several, are of exceptional quality for steam, gas-production, and for coke-manufacture, but the prevalence of faulting and bands of stone in the coal are unfavourable characteristics.

The old Point Elizabeth State Mine, near Runanga, from which the output has previously been obtained, has received a further short lease of life by the discovery of a small unworked coal-area of excellent quality 10 ft. in thickness, situated in section No. 2, to the rise in a north-east direction.

At the Blackball Colliery the country on the north-west side of the fault has been tested by diamond-drilling. Two holes were drilled, the first, situated on the Roa Road, penetrated the primary slate at a depth of 650 ft. without proving any coal-seam. The second attempt, on Hughes's track, was more successful; at a point 15 chains ahead of the main-haulage level, at a depth of 706 ft., a seam of coal 17 ft. in thickness, containing a 9 in. band of shale, was proved.

At the Denniston Collieries of the Westport Coal Company there has been no new development of magnitude, although small unworked areas of coal detached from the mine have been connected therewith by stone drifts as the workings extend. The greater portion of the output is obtained by pillar-extraction. At the same company's Millerton Colliery favourable developments have been carried out in the Mine Creek section, the Mangatini fault has been passed through, and the coal-seam now being driven upon is found to be superior both in quality and thickness. In the Mangatini section excellent coal is being developed towards the eastern boundary.

The Westport-Stockton Coal Company commenced operations upon their newly developed eastern section during the year, which is now connected to the incline haulage system by an electrical tramway. Headings bearing southward have been driven a short distance in the coal, but, unfortunately, the seam developed has up to the present proved soft and dirty, and is in a faulted belt of country, which will, however, be passed through. As this area was extensively bored prior to mining operations being decided upon, the character of the coal should then have been determined.

The Seddonville State Colliery, formerly the Westport-Cardiff Colliery, has become exhausted of marketable coal, and has terminated its chequered career as a State colliery. The following is a brief history of this mine: The first owners of the property were the New Cardiff Syndicate, who, in 1886, first took up the ground as a coal-prospecting area, and subsequently as a lease. In 1893 the Westport-Cardiff Company was floated in Christchurch to work the ground. This company constructed a storage-bin, screens, and rope-haulage installation at Seddonville, also an inclined surface tramway connecting the mine at Chasm Creek with the railway sidings at Seddonville. After producing 227,441 tons of coal, the greater proportion of which was soft and small coal, therefore not marketable except at a low price, operations ceased in 1899, the company going into liquidation. During the following year the property was taken over by the Government, the Westport-Cardiff lease being determined for non-fulfilment of its conditions. Acting upon a favourable report in 1901 by the Government mining advisers—Messrs. H. A. Gordon, John Hayes, and A. McKay—the ground was prospected and subsequently worked as the Seddonville State Colliery, the output therefrom commencing in 1903. A briquette-manufactory was established at Westport in 1907 for the utilization of the soft and small coal produced in such large proportions at Seddonville, but after a trial extending over four years it was found that the cost of manufacture exceeded the price obtainable for the briquettes, owing chiefly to the high cost of imported pitch. The manufacture of briquettes was then discontinued. The total quantity of briquettes produced amounted to 32,714 tons. Owing to the exhaustion of marketable coal the mine was finally closed during May, 1914. The total output of coal under State control amounted at the end of 1913 to 524,691 tons, mostly small and unprofitable. The loss of capital upon the mine, and briquette-manufactory in connection therewith, to the Westport-Cardiff Company and to the State exceeds £100,000.

The Puponga Colliery, near Collingwood, after experiencing a strike during the early part of the year, went into liquidation, and has since been operated by the liquidator. Owing to bad management, water has been admitted to this mine by the extraction or splitting of coal-pillars under a creek which traverses the surface in a direction parallel to the main dip haulage-road of the mine. This property has never been adequately prospected by boring. If this was done a considerable area of good coal would probably be found.

In Otago and Southland coal-mining development has been uninteresting, no new mines or works of importance having been undertaken during the year.

Coal-miners' Relief Fund.

The following is a statement of account of the Coal-miners' Relief Fund during the two last financial years:—

	Year ended 31st March, 1913.	Year ended 31st March, 1914.
	£ s. d.	£ s. d.
Contributions	2,041 19 3	1,893 14 3
Allowance on account of accidents, &c. ...	1,635 7 6	1,720 8 4
Balance	6,594 19 9	7,034 10 6

I have, &c.,

Frank Reed, M.I.M.M., M.I.M.E., L.S.,
Inspecting Engineer of Mines.

ANNEXURE A.

EXTRACTS FROM REPORTS OF INSPECTORS OF MINES.

NORTHERN INSPECTION DISTRICT.—MR. BOYD BENNIE, INSPECTOR OF MINES, THAMES.

Hikurangi Coal Company (Limited).—No. 3 section (new dip): From this section practically all the year's output has been produced. The extraction of pillars constitutes the principal work, and has been carried on without accident. In July the pillar coal became ignited by spontaneous combustion of the waste coal in the "gob." This fire took a complete hold of the mine, and destroyed the air-shaft, fan-shed, and engine-room. The mine was then flooded, and later, when the water was drained off, the manager reported very little damage to have been done underground. The new north dip section, situated at the northern end of the property, is entered from an inclined stone-drift about 300 ft. in length, dipping 1 ft. in 6 ft. The coal-seam has been opened up, and three shifts were worked daily. Owing to continuous working, the mine-ventilation became very bad, and two air-shafts were sunk. Three other mine adits were opened up on various parts of the property, where small areas of coal were located, and parties of from six to eight men employed. During the year the manager was proceeded against and fined for a breach of the general rules, section 42, which renders compulsory the employment of a certificated underviewer for every mine. During the year 46,515 tons of coal was mined, as against 54,618 tons for the previous year, labour troubles being the chief cause of the decrease. An average of eighty-five men has been employed. I visited the mine several times during the year, and found the conditions as regards safety precautions anything but satisfactory.

Northern Coal Company (Limited).—Hikurangi Northern Mine: Work during the year consisted solely of pillar-extraction, in which considerable progress had been made up to the time of the strike, the output for the ten months being practically equal to that of the previous year. The quality of the coal in No. 3 section has considerably improved, it formerly being split with seams of stone. I have made six inspections during the year, and the Check Inspectors one, and on each occasion the mine was found in good condition generally. Unfortunately, one fatal and one serious accident occurred during the year. 43,242 tons of coal were mined, and an average of sixty-three men employed.

New Mine: Development has been confined principally to the extension of the main dip and its connection with the shaft, for ventilation. This was satisfactorily effected in September last, and all steam-pipes were carried through the return airway. The coal mined is of excellent quality, and is in considerable demand for steam purposes. Steam for hauling is obtained from two multitubular boilers, and a compressor supplies air for the pumps. An endless rope is to be installed, the necessary machinery being now on the property; a loading-station is also to be constructed. There is every reason to believe that in the near future this colliery will be the chief producer in the district. I examined it several times during the year, and found conditions satisfactory. 7,612 tons of coal have been extracted, and an average of seventy-three men employed.

Te Kiripaka Mine: The development-work in connection with the opening of this mine has been suspended, and as the Kiripaka Panapu section became worked out 1,193 tons of coal was obtained from the old Ngunguru section. Eight men were employed for part of the year.

Ruatangata Kamo Mine.—For a few months a little work was done at this mine. Thirty tons of coal were mined, and an average of two men employed. I examined the colliery during the year, and found conditions fair.

Whangarei Colliery.—Operations at this mine have been irregular, owing, in a measure, to the nature of the mine-developments. At present the coal is inferior and the seam much faulted, but from the evidence supplied from boreholes and the workings of the old Kamo Mine an improvement is anticipated some chains ahead of the present workings. During the strike a number of inexperienced men were employed at the colliery, with the result that one fatality occurred. I examined the mine on several occasions during the year, and found the conditions normal; ventilation sometimes dull. 3,880 tons of coal was mined, and eighteen men employed.

United Collieries.—This colliery has been worked almost continuously throughout the year, the coal being principally used at the mines of the Waihi Goldfield. This mine is worked from the main incline dip, but it is proposed to open up an old shaft near the river loading-station, and to erect an up-to-date winding and screening plant, which would effect a considerable saving in the expense of haulage. I examined the mine on several occasions during the year, and found conditions generally in fair order, but the distribution of air was at times faulty. During the year thirty-eight men have been employed, and 21,651 tons of coal was mined.

Taupiri Coal-mines (Limited).—Ralph's Mine: The chief development consisted of the construction of a stone drive, 10 chains in length, to open up the coal existing under Lake Waahi. The face of the coal was reached just prior to the stoppage of work by the strike, and, in consequence, operations in this part of the field have been hindered. During the early part of 1914 this heading will be advanced, and it is expected that the bulk of this mine's output will shortly be won from this area. Attention has also been directed during the year to the Lake Rotoiti lease (Taupiri West section), where the coal has proved to be of excellent quality. I examined the mine on several occasions, and found conditions generally satisfactory. 89,949 tons of coal was mined, and an average of 226 men employed.

Extended Mine: Coal of excellent quality is still being produced. The ventilation was considerably improved by the installation of a new 92 in. diameter double-inlet Sirocco fan, which was erected to replace a smaller fan of similar type. The assembling of all the compressors under

one roof was completed early in the year, and all power necessary for pumps, coal-cutting machines, winches, &c., is here generated for the various mines of this company. I examined this mine several times during the year, and found conditions very favourable. 128,182 tons of coal was extracted. An average of 282 men was employed.

Pukemiro Collieries (Limited).—Practically all the machinery has been erected, and the railway-formation is well advanced, but there still remain several small bridges and culverts to be constructed, together with platelaying and other contingent work. It will therefore be a considerable time before the branch line is opened up. Ten men are employed above ground.

Waipa Railway and Collieries (Limited).—Considerable progress has been made by this company in surface arrangements. The railway-formation from Ngaruawahia to Te Akatea has been completed, and the bridge across the Waipa River finished. A temporary engine-shed and water-supply have been constructed to accommodate a locomotive recently imported. The chief work yet to be completed by the contractors, Messrs. Donald McLean and Co., is a viaduct across Stony Creek, consisting of an imposing ironbark structure resting upon concrete foundations. The formation at the railway-station yard at Te Akatea is finished. The contract for the necessary power plant for haulage in the mine and for driving the ventilating-fan has been let. An extensive workshop and store has been built at the bottom of the incline. The coal will be worked from adits, and the company expects to be able to market coal early in the year 1914. Exclusive of the railway-construction, there are about ten men employed at the mine.

Huntly Coal, Brick, Fireclay, and Tile Works.—This company has taken over the works of Messrs. Coates and Co., and have reconstructed brickworks upon their leasehold near the Huntly Railway-station. A tunnel has been constructed through the hill connecting the company's freehold with the works, and an endless rope is to be installed to haul the coal and fireclay to the works. I have examined the mine on several occasions during the year, and found it in good order. 3,187 tons of coal was mined, and an average of five men employed at the mine.

Mangapapa Colliery.—The output from this colliery continues to be small, due to difficulties in transport. I examined the mine in October, and found it in good order generally. 3,560 tons of coal was extracted, giving employment to ten men.

Kawakawa Colliery.—Practically nothing has been done at this mine during the year. Only four men have been employed, and 239 tons of coal mined. The lease has been surrendered.

ACCIDENTS AND FATALITIES.

Fatal.

John Jenkins, Northern Mine, Hikurangi, on 5th April, 1913: Killed by a fall of rock.

Herbert Strongman, Whangarei Mine, Whangarei, on 24th December, 1913: The deceased, an inexperienced half-caste youth, in attempting to secure his lamp from a cage after it had commenced to ascend, was caught between the cage and the shaft-wall, and dragged to the surface, death resulting about an hour later.

Non-fatal.

John Hardie, Extended Mine, Huntly, on 5th June, 1913: Leg broken by a train of empty mine-trucks.

Henry Brignall, Northern Mine, Hikurangi, on 5th June ,1913: Serious injuries to head and neck, caused by fall of rock.

Arthur O'Neill, Ralph's Mine, Huntly, on 12th August, 1913: Leg broken, through being caught between the buffers on the trucks.

John Hurst, Ralph's Mine, Huntly, on 6th August, 1913: Neck and back injured by fall of coal.

R. Wilson, W. Driver, and W. Campbell, during 1913 at the Taupiri Mines, each lost one eye, being hit by flying coal.

WEST COAST INSPECTION DISTRICT.—MR. JAMES NEWTON, INSPECTOR OF MINES, WESTPORT.

Point Elizabeth State Collieries.—The output from this colliery amounted to 135,276 tons, a decrease compared with last year's winnings of 53,557 tons.

No. 1 section: The only area capable of further development is that known as the crosscut dip, but the winding dip-heading has been standing the whole of the year, and it is very questionable whether it can be profitably extended on account of its great steepness, rendering coal-production costly. Eastward the coal thins to an unworkable thickness. The output from this section has been obtained from pillar-extraction working back homeward from the thin coal, and a considerable output has been obtained therefrom. During the year a Westinghouse compound wound generator, direct current, running at 420 revolutions per minute, and coupled direct to a Belliss Morcam high-speed steam-engine, has been installed, and supplies electrical power to an electric turbine pump. This pump is at present employed in unwatering the extended dip workings, and apparently is capable of easily dealing with the inflow of water. The ventilation of the workings has been well maintained, and, generally speaking, the timbering for the support of the roof, sides, &c., has been well attended to.

No. 2 section: The whole of the output from the top seam, which varies in thickness from 10 ft. to 13 ft., is still being won by pillar-extraction. The area available for working is rapidly decreasing. Underlying this seam at Nos. 1 and 2 levels in the bottom seam a considerable amount of coal still remains, which will not be worked until the top seam pillars have sufficiently advanced homeward to allow the overburden to fall and settle, thereby reducing the crushing-action of the overlying rocks. To the rise coal has been won both by pillar and solid workings from an area lying between two faults in a north-east direction. At the level the distance between these faults is approximately 22 chains, but to the rise of the seam the faults converge to about 3 chains apart, where the western fault dies away and the seam of coal thickens. The coal has been driven

into for several chains, and is showing a good hard seam, approximately 10 ft. thick. There is every probability that a considerable area of coal of good quality will be opened up. Ventilation of the working has been efficiently maintained, and the drivages have generally been kept in safe working-order. Safety-lamps are used in the workings. A medium output will be available for several years from this mine.

Liverpool Mine: The necessary surface arrangements have been sufficiently advanced to enable coal to be marketed, an output of 9,114 tons having been recorded during 1913. Every facility for dealing with a large output has been provided, and should the various seams open out well a very substantial increase in the tonnage ought to be obtained during the incoming year.

No. 1 mine, situated on the east bank of Tararu Creek, has been driven a distance of about 12 chains. After driving approximately 7 chains the coal gave place to dirt bands, &c. The level was then turned to cut the drift situated 2 chains to the northward, and advanced a further 5 chains on the level, the seam becoming dirty and thin. Rise headings have been driven to the outcrop, a distance of approximately 6 chains, in coal of good quality and medium hardness, but the area is small, and only a limited supply of coal can be expected therefrom. Other workings in this mine are situated on both sides of the Seven-mile Creek, and are connected by a stone drive approximately 17 or 18 chains in length. The winning level across the creek has advanced 11 chains, but the coal has been replaced by dirt. The rise heading going north has been driven a distance of approximately 10 chains in coal of medium hardness, and at present is pitching considerably. Evidence of flattening, however, are to be seen in the floor of the seam. On the west side of the Seven-mile Creek a pair of headings have been driven to the rise in good coal. The seam, however, thins considerably going westward.

No. 2 mine, which is situated some 18 or 19 chains to the southward, opens out in coal approximately 12 ft. to 14 ft. thick. The coal appears to be of good quality, but is rather soft and friable. This seam contains three bands of stone, some of which will be hard to separate from the coal owing to its soft nature. The dip of the seam is very steep, probably 38° to 40°, and unless it flattens when driven on will be costly to work.

No. 3 mine is situated above and close to the storage-bins, and is known as Garvey's Creek seam. In the rise heading going north the coal thickens from about 2 ft. 6 in. to between 5 ft. and 6 ft., but at a point about 9 chains in a small downthrow fault is met with. After proceeding a short distance the coal again is thrown up. Going westward the coal improves in thickness and hardness, but between the coal and the main sandstone roof there is a stratum of rotten shaly matter, which varies in thickness up to 2 ft. A good deal of earth-movement is evidenced by the fact that crevices in the roof may be seen which have the appearance of extending considerable distances. Naked lights are used, and the ventilation of the workings have invariably been found excellent. General safety conditions of the workings are satisfactory.

Paparoa Colliery.—During the year 31,869 tons of coal was produced, and eighty-five persons were employed. The mine has been further developed by driving in northerly and easterly directions. Generally speaking, the coal is of good quality, but shows no signs of hardening, and owing to its crushed nature must necessarily produce a considerable percentage of small coal. An improved ventilation of the working-faces has been brought about by the better erection of stoppings and temporary brattice. The mine has been found to be almost entirely free from fire-damp for the last half of the year, and with reasonable care given to the circulation of the air-current very little trouble from this source is probable. Safety-lamps are used in the workings, and the ventilation is produced by a Sirocco fan circulating approximately 60,000 cubic feet of air per minute.

Blackball Colliery.—Operations have been carried on at this colliery for a period of only nine months during the past year owing to strikes, the first of which occurred in August and September, the second commencing in the beginning of November and lasting the remainder of the year. The output of coal was 143,836 tons, a decrease compared with last year's winnings of 59,042 tons. The coal won has, generally speaking, maintained its usual hardness and quality.

No. 1 dip section: The west levels in this section have been driven a considerable distance, and the headings driven therefrom show coal of excellent quality approximately 14 ft. thick. The quantity of water to be pumped has considerably increased, being approximately 350 gallons per minute. No. 2 dip has been driven about 450 yards from the level, and the coal appears to be improving. From this direction the bulk of the output will have to be won in the near future. The levels to the east have opened out coal of fair average quality, and the water has increased from 100 gallons to 6,000 gallons per hour.

No. 17 section: To the rise of the main level a large amount of development has been done, proving the coal to be of medium hardness, and good quality and thickness. The roof in this section is very soft, and requires a good deal of extra attention; there is consequently a liability to spontaneous combustion.

Two boreholes have been drilled to test the area on the north-west side of the fault. No. 1 borehole gave unsatisfactory results; at 650 ft. 6 in. of coal was penetrated, and at 660 ft. the primary slate was entered. No. 2 borehole, in direct line with the main-haulage level, and about 15 chains ahead, proved coal at 706 ft., and two seams were subsequently found, the top seam being 4 ft. thick and the bottom seam 12 ft. thick, with 9 in. of shale between them. By this borehole the fault is proved to be a downthrow of approximately 250 ft. The ventilation has been found to be generally good, but at times attention has been drawn to defective bratticing, causing the current of air to short-circuit. Other working-conditions have been satisfactory, with the exception of the somewhat careless handling and carrying of explosives by the workmen. Notices have, however, been posted to the effect that no explosives will be served from the magazine unless proper canisters are presented for the same. This procedure will, I think, have a remedial effect.

Brunner Mine.—St. Kilda section: During the year 22,624 tons of coal has been produced, a decrease compared with last year's output of 1,716 tons. Early in the year the horse-drive area was won to about 11 chains from the mouth of the drive, and stopped in order to protect the airways leading from the lower workings. To the north of this a small area of solid coal between a fault and the river-bank has been entered, which supplied excellent coal. The workings to the dip have proved disappointing, the area being very much broken and faulted, while the coal is exceedingly dirty and soft. Very little development can be expected in this direction, and most probably the only coal that will be won will be eight or ten pillars of medium quality on the north side of a dip. A small area on the south side will be recoverable when the dip is being abandoned. In the free drainage level pillars are being won.

The life of this mine can only be expected to be of short duration, while the output will be limited. Ventilation is carefully attended to. A small amount of fire-damp is met with occasionally when disarrangement of the ventilation occurs, and every care is, in consequence, taken to guard against the same. General condition of the mine satisfactory.

North Brunner Mine.—Underground operations at this colliery were suspended towards the end of March, and the only work done during the remainder of the year has been to load a quantity of fireclay that had previously been stored on the surface. This property has proved disappointing. Development in the upper portion of the mine has shown the coal to be extremely soft and dirty, besides which in every direction driven the seam pinched and faulted to such an extent that it was found quite impossible to profitably proceed further. Operations were then commenced to extract the pillars. There are two other small areas of coal with a seam about 11 ft. in thickness, situated at a lower elevation, but in both places the coal is extremely soft and friable. A fair amount of excellent fireclay underlies the seam in places.

Loughnan's Mine, Merrijigs.—An output of 1,340 tons of coal has been won during the year, being an increase over last year's winnings of 188 tons. A free drainage level has been driven through the hill, and pillar-extraction has commenced to the rise working from the far end homewards. Four men have been employed intermittently. The workings are holed to the surface, ensuring good ventilation.

Golden Point Mine, Progress Junction.—An output of 327 tons has been won for the year, a decrease of 193 tons compared with 1912. Coal from this mine does not find a ready sale for household purposes. Ventilation of the level and rises good.

Watson and Moyle's Coal-mine, Murray Creek.—A new drive from the surface has been put in at a higher level on the seam, the coal at this point being hard and of good quality. A drive is being constructed to connect with the previous workings to ensure plentiful ventilation and a second outlet, the output of 1,437 tons being an increase of 267 tons above that during last year. Two men are employed underground.

Phœnix and Venus Coal-mine, Murray Creek.—Three men are employed winning coal, but the trade at times is slack. The level has been extended a considerable distance, and the coal has proved variable in hardness. Holings have been made with the level above, ensuring good circulation of air. The output, 2,618 tons, shows an increase over last year's winnings of 1,137 tons. General condition of workings satisfactory.

Lankey's Creek Coal-mine.—No output has been obtained during the year. Operations have been confined to building a surface tramway, now completed.

Lockington's Freehold, Deep Creek.—The output, 450 tons, shows an increase over last year's winnings of 215 tons, obtained partly from opencast and partly from driving. The coal is variable in quality, being in places very stony. Conditions of workings are satisfactory.

Burke's Creek Coal-mine.—The winning level has been extended a considerable distance through very hard coal, and practically free from the usual balls and bands of sandstone; at present, however, it is standing at faulted ground, a distance approximately of 12 chains in from the outcrop. This faulted ground has been met with in all developments to the south-east rise. The bottom level on the south of the creek has been extended, and is now in a distance of approximately 400 ft. A connection has been made to the old workings above, where several pillars of coal are standing intact, which can be won from the present level. The coal is of medium hardness. Adequate ventilation is produced by furnace. Roof and sides satisfactorily propped.

Waitahu Coal-mine.—The output during 1913 was 150 tons. The mine has been idle for a considerable time. When last visited, in company with the owner, I condemned the timbering, and gave instructions to have the whole of the drive retimbered and made secure. On a subsequent visit I found that work in the mine had been suspended, and remained so for the rest of the year.

Reefton Mine.—This mine has proved disappointing to the lessees. After driving a considerable distance into the hill through barren ground the coal was found to be soft and inferior, but changed to good hard coal of limited area as the drive advanced. Subsequently pillar-extraction was commenced. The output amounted to 1,463 tons for the year, an increase of 1,266 tons over last year's production. Ventilation is obtained by holing into old rise workings connected with the surface. General working-conditions are satisfactory.

Merrijigs Mine.—The few small stumps of coal to the rise of the old drive were won early in the year, and a new drive started further north. The coal is exceedingly soft, but suitable for steaming purposes. The output for the year was 763 tons, an increase of 369 tons above that of last year. Three men were employed. Workings safe. Openings are driven from 4 ft. to 6 ft. wide.

Archer's Freehold, Capleston.—No development has been done during the year. The levels are both faulted. The output has been obtained from small pillars to the rise. The two seams connected by a cross-measure stone drive are ventilated by connections to upper levels. An output of 740 tons of coal was obtained during the year, a decrease of 695 tons on last year's output.

Coghlan's Freehold.—This mine has produced very little coal for the year, owing to want of trade. The output, 186 tons, shows a decrease of 598 tons. This has been won from No. 2 level. The quality is only medium, being soft and friable. Ventilation obtained by holings to the rise.

Rocklands Coal-mine, Buller Road.—The only demand for this coal is for small household consumption, confined to the few scattered homesteads in the Buller Gorge. This coal at some future date will no doubt command a ready sale when transport facilities are improved. The output, 81 tons, shows a decrease on last year's production of 118 tons. Working-conditions satisfactory. Ventilation of the workings secured by holings to the surface.

Whitecliffs Coal-mine, Buller Road.—The output from this mine for the year, 42 tons, shows a decreased winning on last year's production of 74 tons. This mine also depends on local household consumption. Conditions of working satisfactory.

Seddonville State Colliery.—The output for the year amounted to 51,894 tons, a decrease of 20,799 tons compared with last year's production. The working-life of this colliery cannot be prolonged for any lengthy period unless an outlet for soft coal can be found. The present workings are solely confined to two limited areas, one at the extreme south end of the main haulage-road, the other being located on the west side of the haulage-road, approximately 13 chains further north. The former area is already approaching exhaustion, and a great deal of the remaining coal is soft and stony. In the latter section (west) by far the greater proportion of the coal is unmarketable, owing to its soft and friable nature, besides which in places it is very stony. A steady decrease in output may be expected from this colliery, owing to the fact that the area available for operations will steadily become less. The ventilation of the workings has been found adequate at all inspections, and a plentiful supply of mining-timber has been provided and used.

Denniston Collieries.—The output won from this colliery for the period under review is 241,375 tons, being a decrease on last year's production of 57,261 tons. A large area of excellent hard coal has been proved by development during the year.

Coalbrookdale Mine: The workings in the Wareatea section are in the solid coal, and are being developed in a south-west direction. To the southward, with an east and west bearing, is a strip of almost barren country from 8 to 10 chains wide, which drive has been driven through, thereby connecting the mine-workings with Smith's drive, 10 chains in from the Cascade escarpment. The result of this connection will be the opening-up of a large area of excellent hard coal, 25 ft. to 30 ft. in thickness. To the westward an upthrow fault has been encountered in all the workings. Starting from the northern end, it rapidly becomes more formidable as it advances southward. The coal, however, has been proved on the high side to be of excellent quality. A large volume of air enters the main drive, but owing to faulty stoppings the ventilation has been found to be indifferent at the working-faces. Too much reliance is placed on poorly constructed brattice stoppings in the cut-throughs. In other respects the condition of the sections were found satisfactory. The dip area is opening up good hard coal, and a reasonable output can be expected for a considerable time from this part of the mine. No. 8 section workings are all in the solid. The main heading has crossed a small fault running north-west, and the coal has somewhat thinned on the further side. The whole of the workings going north and east are proving a considerable thinning of the coal, in places to between 2 ft. and 3 ft. Should this continue, solid work in this area will soon be finished. One pair of colliers are employed in Wallace's section. The same conditions have been found at times in this section with reference to the ventilating-current as those referred to in the Wareatea section. The roof in this section is exceedingly tender, and necessarily demands a good deal of attention. At the beginning of the year, to replace the Hayes fan, a Sirocco fan was installed, capable of producing 200,000 cubic feet of air per minute.

Ironbridge Mine: In the old shaft section pillars are being won. In the new shaft section solid workings are opening up a large area of excellent coal. These workings are being developed in a south-west direction. Kruger's section—These workings are developing in a south-western direction, and are proving the existence of hard coal. An extensive area of coal is available here. To the eastward pillars are being won from the Kiwi No. 1, No. 4, and No. 7 sections. Deep Creek section is opening up well, and excellent hard coal is being won. The workings are being developed north-west, and although faulting has been met with occasionally, it has not been formidable. Beardsmore dip has not been worked for several years, and probably an extensive water drive must be driven to win the coal advantageously. The working-conditions have generally been found satisfactory. An extensive haulage system has been established..

Millerton Colliery.—Operations at this colliery have resulted in the production of 292,576 tons of coal, being a decline on the previous year's winnings of 36,854 tons.

Mine Creek section: Two shifts of colliers are employed, and the largest amount of coal was obtained from this section. The winning-places going south-west are opening up a large area of coal of good quality. The Mangatini fault has been crossed, and the headings, which for a considerable distance were driven in thin coal and shale, are now driven in coal of improved quality and greater thickness. Two sections of pillars are being worked, one on the west and one on the east of the main haulage-road. In the former the roof overlying the coal is exceptionally rotten, in consequence of which a large amount of the pillar coal is being lost. The latter area has a much better and stronger roof generally, and consequently a greater percentage of the pillar coal is won.

Mangatini section: Excellent hard coal is being proved towards the eastern boundary. On the west two sections of pillars are being worked, with satisfactory results, considering the thickness of the seam, which in places is probably 40 ft. The south headings have been standing almost all the year, the coal having given place to shale.

Lower section: This section is being won out south-west, and all coal won has been from solid workings. Faults running east and west have been met with, and at present the most southerly places are skirting a fault which will need to be crossed before further development in this

direction can be done. At present a large area is standing on pillars, besides which a very large area known to be coal-bearing awaits exploitation. The various sections are ventilated by means of centrifugal fans, and the workings have invariably been found to be well supplied with a current of air. The old workings have been inspected, and no impure air or heating has been observed. The general safety of the workings has been found satisfactory.

Westport-Stockton Colliery.—The output from this colliery amounted to 93,315 tons, a decrease of 31,685 tons compared with that during the previous year.

B tunnel section: The coal extending to the western boundary of the lease in this section has been cut into pillars, and the extraction of the same has commenced at the southern outcrop. The coal, from 12 ft. to 16 ft. in thickness, is generally good and of medium hardness. Going eastward in this section the seam thins to 4 ft. rapidly, but still remains of medium hardness and good quality.

C tunnel section: The whole of the coal in this section, with the exception of a small area situated across a creek and skirting the western boundary of the lease, has been cut into pillars.

D tunnel section: A few pairs of colliers have been employed in this area during the year, and a patch of good coal has been opened up across the creek skirting the western boundary. Development can be carried out in this section in a southerly direction along the western boundary of the lease, and in all probability will not extend very far.

New area east: To the end of the year this area has been developed by a pair of winning headings going south for about 3 chains, together with one or two drivages going west, and up to the present has proved disappointing, the coal being soft and somewhat dirty. The prospects for this area are not promising, unless good coal can be found to the south and west of the area. Ventilation excellent, and the conditions of the workings generally satisfactory.

Puponga Mine.—The year's output, 8,084 tons, shows a decline on last year's operations of 16,321 tons. This is accounted for by the fact that for several months of the year the mine has been idle owing to strikes, together with a decreased number of coal-winners employed. The only development has been in a south-easterly direction in No. 14 level, which proved a small area of coal of good quality, although in places the seam is divided with several bands of hard stone. At the beginning of the strike in November operations ceased, and the pumps were shifted higher up the dip and the water allowed to rise. This portion will need to be unwatered again before the mine can restart, and will probably occupy several weeks. Prospecting towards the western boundary proved a seam of hard coal varying from 4 ft. to 7 ft. thick. This will no doubt be driven into shortly to ascertain its extent. The general safety of the mine has been found satisfactory, and the ventilation of the workings adequate.

Marble Creek Coal-mine.—This mine has not yet reached the output stage, and the necessary preparations have been slow. A seam of coal 8 ft. to 10 ft. thick, apparently good and hard, has been met with, and has opened out for about 2 chains. The seam is pitching almost vertical, and is situated at a lower level than the seam referred to in former reports. Most of the work done during the year has been on the surface railway.

North Cape Coal-mine, Puponga.—The output for the period under review totals 6,633 tons, an increase on last year's winnings of 1,963 tons. The whole of the output has been won from solid workings towards the outcrop in a southerly direction. This area is small, and all solid places will soon be finished. Preparations are well in hand for prospecting the seam to the dip. The jetty across the mud-flat is finished, and a main and tail haulage system is being installed to convey the output from the storage-bins to the loading-stage. When inspected the general safety of the workings has been found satisfactory, and the natural ventilation of the mine has been adequate up to the present. Should, however, the seam prove workable to the dip, mechanical ventilation will need to be installed.

Ventilation.

At all the large collieries efficient ventilating appliances are installed, and sufficient quantities of air enter the mines. In some sections, however, stoppings of a permanent character are not always carried sufficiently near to the working-face, with the result that the ventilating-current is so far reduced by leakage that at times it is scarcely possible to detect any circulation in the air even in restricted areas. Too many faultily erected and temporary stoppings composed of brattice-cloth are to be found in the cut-throughs, and these, taking the place of more reliable structures, cause an excessive short-circuiting of the ventilating-current, in consequence of which the reek from the workmen's oil-lamps and the fumes from the blasting operations linger too long in the working-place, and are inhaled by the workmen. This at times causes a feeling of dissatisfaction on the part of those whose lot it is to labour in such atmospheres. There is no reason why conditions such as these should exist. Efficient appliances for producing ventilation are provided at the collieries, but what is required to ensure adequate ventilation at all the working-faces is the erection of strong airtight stoppings to within a reasonable distance of the working-faces, together with carefully erected brattice partitions for temporary purposes.

Accidents.

Fatal.

J. Derbyshire, a trucker, mentioned in last year's report as having received serious spinal injuries, the result of a fall of coal at the working-face in the Coalbrookdale Mine, died in the District Hospital, Westport, on the 21st February, 1913. Derbyshire was injured on the 17th October, 1912, and passed away after 127 days.

Non-fatal; Serious.

W. Tully got seriously injured in the Coalbrookdale Mine on the 7th March, 1913. His injuries consisted of a fracture to the base of the skull, the result of getting struck by a run-away truck down the new dip. From inquiries made I am given to understand that Tully has so far recovered from his injuries that he is now able to do ordinary labouring-work.

SOUTHERN INSPECTION DISTRICT.—MR. E. R. GREEN, INSPECTOR OF MINES, DUNEDIN.

Canterbury.

Broken River Coal-mines (Limited).—Four men prospecting with Calyx drill.

Springfield Colliery, Springfield.—As hitherto, the fireclay-output exceeds that of coal, which latter is obtained from a small seam occurring in conjunction with a seam of fireclay at 80 ft. depth from the surface. 1,014 tons of fireclay and 175 tons of coal was raised during the year.

Sheffield Fireclay-mine, Sheffield.—An output of 293 tons of fireclay was reported for the year.

Homebush Colliery, Glentunnel.—Engine seam: Pillaring outward on balance of pillars left at first working. The "creep" has affected the working-parts of the mine, so that roadways are low in places and air-courses occasionally rather restricted. The rise, second outlet, and airway acted satisfactorily. Fireclay-output, 593 tons for the year.

Bush Gully seam: The 6 ft. seam of coal at this new mine was driven upon for a distance of 250 ft. to the dip at an inclination of 1 in 1. At 350 ft. it is proposed that levels will be broken away to the east and west, and the seam worked longwall. The site for the fan-shaft is situated 2 chains from the mine-mouth.

A new branch line of railway, about four miles in length, has been constructed from Coalgate Railway-station to the mine.

St. Helen's Colliery, Whitecliffs.—Two levels are driven in the 6 ft. seam, and pillars are being drawn outward. Unfortunately, owing to faulting, a considerable proportion of the coal is unsaleable, and consequently left behind.

Tripp's Colliery, Mount Somers.—Pillar and head coal-working on small scale. Ventilation good.

Albury Colliery, Albury.—Ladder-way required in second outlet and upcast air-shaft. Ventilation good.

Dalgety Coal-mine, Hakataramea.—A semi-vertical seam worked for station requirements.

North Otago.

St. Andrew's Colliery, Papakaio.—An average annual output is maintained for district use.

Prince Alfred Colliery, Papakaio.—Working is continued under the usual conditions.

Ngapara Colliery, Ngapara.—Local demand fully supplied.

Broadleaf Colliery, Shag Point.—By prospecting-work the average output from this property is maintained.

Shag Point Colliery, Shag Point.—The excessive wet weather causing ground-slips, this mine became unworkable. Prospecting for a new seam is being carried out.

Allandale Colliery, Shag Point.—Now practically closed down; some prospecting was being carried on in the 3 ft. seam area.

South Otago.

Fernhill Colliery, Abbotsford.—Recent rains have rendered repairs necessary to the upcast air-shaft. Ventilation good. Coal-output at present rather restricted. Output of building-sand, 12,507 tons for the year.

Freeman's Colliery, Abbotsford.—The panel system of working is in operation. Travelling-ways in good order and ventilation generally well conducted to working-faces.

Green Island Colliery, Green Island.—The dip workings being filled with water, an effort was made to enter the seam on the line of strike through some old workings pending the erection of electrical-pumping plant.

Jubilee Colliery, Saddle Hill.—Pillar and head coal-places are being continued outward. Substantial sand stoppings are built on the line of waste workings. Development to the dip is also advancing, but the band of stone met in easterly working is proving troublesome. Ventilation good, and working safely conducted.

Saddle Hill No. 1 Colliery, Saddle Hill.—Pillar and head coal-workings are being conducted in a safe manner, the roof-break being kept close up in working-places. Permanent brick and ash fire-stoppings are kept up to the waste. Under new furnace-ventilation an ample supply of air available for the workmen.

Saddle Hill No. 2 Colliery, Saddle Hill.—The area from whence the coal-output has hitherto been obtained is now exhausted and stopped off. A new drive has been driven for the recovery of pillars and head coal left at first working a number of years ago. When approaching the old workings containing water the requirements of the Act in respect to boring were observed. Roof good and ventilation excellent.

East Taieri Colliery, Mosgiel.—A new opening on the western face of Saddle Hill. Workings in safe condition.

Lauriston Colliery, Brighton.—The remaining coal-pillars are being taken out safely. Ventilation good.

Brighton Colliery, Brighton.—On account of some heating, work had been suspended and the pit was filled with water.

Waronui Colliery, Milton.—Under the system of narrow-drive development-work in vogue, airways and travelling-roads are in a safe and satisfactory condition for working. Roof to pillar-workings well supplied with timber. Fan-ventilation adequate, and use of explosives carefully supervised.

McGilp's Colliery, Milton.—Advancing work partially interrupted by faulting, and prospecting-drives are being extended.

Taratu Colliery, Lovell's Flat.—Main-shaft workings were now pumped free from standing water, and second outlet communication restored. Ladder travelling-way in upcast air-shaft, also main-shaft timbers, in good condition. Ventilation good.

Hawthorn Den Coal-mine, Kaitangata.—A tramway having been laid from the mine to the hilltop, the lessee expects an increased output from this small mine.

Longridge Coal-mine, Kaitangata.—A 3 ft. seam is worked to the fault, and work now consists of coming back with the pillars. Roof good; timber used as required.

Kaitangata Collieries, No. 1 Mine.—Coal-workings on the northern side of main haulage-way are suspended. The horse haulage-way beyond the main rope terminus was being doubled, and an extra communication-way was being driven between No. 1 heading south and the extension, thence to No. 6 dip. Pillar-workings in Oliver's dip section, where heating occurred, were sealed off. The fire heating on No. 3 heading to shaft section was reduced, and the stoppings were reported as being properly attended to. Mundy's dip and No. 6 dip places mainly pillaring outward, the temperature therein being 74° F. (dry bulb). Several pillar-workings in No. 21 dip were finished and closed up. A prospecting-dip was being driven from No. 21 dip westerly, whence it was proposed to drill a borehole to the 18 ft. seam underlying. Generally the air-ways and travelling-ways had been well maintained, and fire-stoppings carefully attended to. Several samples of mine-air were collected for analyses by the Dominion Analyst at the returns from the north side split, from No. 21 dip section, and at the drift to upcast air-shaft. The samples contained 1·06, 0·32, and 0·69 per cent. of methane respectively. The safety-lamp station cabin is maintained at the intake entrance to the two main air splits underground. An abundant supply of timber, brattice, &c., is kept on hand for use as required. A new magazine has been erected at a suitable site on the surface and approved for storage of explosives. Van-ventilation, electrically driven, an average of 30,000 cubic feet of air per minute has been in constant circulation. Plans and report-books kept to date. About thirty-five horses and ponies in work were in good condition as reported by the Inspector for the S.P.C.A. Association.

Kaitangata Collieries, No. 2 Mine, Kaitangata.—Old northerly workings are finished and sealed off. Levels to southward were driven through the fault, where the coal-seam was found to be about 25 ft. in thickness. The Sirocco fan, electrically driven at half-speed, is capable of producing 28,000 cubic feet of air per minute.

Castle Hill Colliery, Kaitangata.—The output was being produced from No. 7 dip workings and Jordan's seam north, where the pillars are being worked outward. Ventilation was good, and several places less warm than formerly. Only safety-lamps were used in the working-places. Travelling-ways and air-ways to upcast air-shaft maintained in good order. Report-books kept to date.

At the three Kaitangata Collieries 450 safety-lamps of bonneted Clanny type are in daily use.

Benhar Colliery, Stirling.—Seam, 30 ft. Roof good, where bringing back pillars and head coal. Ventilation fair. Pipeclay-output, 5,346 tons for the year.

Mainholm Lignite-pit, Waipahi.—Opencast. Output for the year, 2,704 tons.

Central Otago.

Coal Creek Colliery, Roxburgh.—The main seam having become soft and inferior, attention was being paid to prospecting in the vicinity of the former opencast workings.

McPherson's Coal-pit, Roxburgh.—The spontaneous fire from the old workings was still smouldering on the opencast face, but no likelihood of further harm appears to exist. A water-race exists near to the pit, and water therefrom is available for use in the event of the fire spreading. Report-book to date.

Perseverance Coal-mine, Roxburgh.—The old underground spontaneous fire had caused increased warmth at the stoppings which were in good order. Water was laid on and the heating suppressed. Ventilation good. Report-book kept.

Alexandra Colliery, Alexandra.—Only a few more pillars remain to be withdrawn, when this mine will be closed.

Molyneux Colliery, Alexandra.—Recent workings were advancing in the direction of old gold-dredging excavations submerged by the Clutha River, for security against inundation. Centre and flank boreholes kept well ahead, while boreholes in roof were put up 7 ft. at intervals of about 12 ft. Wet backs continue, and water inflow has increased. The management exercises care and watchfulness.

Cambrian Coal-pit, Cambrian's.—Open working, face stripped and well battered where coal is obtained.

Laudervale Coal-pit, Cambrian's.—Opencast; seam 16 ft., stripping 8 ft.

Rough Ridge Pit, Otūrehua.—Open working-face stripped ahead. Preparing for dip-working.

Idaburn Pit, Otūrehua.—Opencast pit flooded. Now preparing to siphon the water, and work toward dip of seam.

Otūrehua Coal-pit, Otūrehua.—Water in drainage heavy, making lower part of seam unprofitable to work.

Gimmerburn Coal-pit, Gimmerburn.—Opencast shallow pit worked for local requirements.

Clyde Collieries, Clyde.—The main haulage-drive having fallen in, work being suspended meanwhile. Openings to surface properly protected.

Shepherd's Creek Coal-mine, Bannockburn.—Advancing No. 3 dip and developing in narrow work, with a view to future pillar-extraction. Workings in good order, and ventilation good, with two exceptions, where a stenton was almost through. The powder-magazine was to be moved to a more suitable site as selected.

Cairnmuir Coal-mine, Bannockburn.—Pillaring outward continued, with a good roof-break close up, and caving sand prevents spontaneous ignition and provides effective stowing.

Ranfurly Coal-mine, Bannockburn.—The prospecting-dip drive has been extended to 240 ft. from surface, where the vertical seam was found faulted. An uprise to the surface, for ventilation, was almost completed.

Gibbston Coal-pit, Gibbston.—An average output continues to be maintained from this high altitude.

Ryder's Coal-mine, Nevis.—A low level has been driven, which facilitates haulage and drainage. Evidence of faulting may be seen in both directions.

Nevis Crossing Coal-pit, Nevis.—Opencast pit. Two men steadily employed during summer months.

The Golden Point, Limited (lately Gold and Scheelite Proprietary Company, Limited), Macrae's.—Worked for own requirements. The workings collapsed during the year.

Dillon's, Blackstone Hill.—A private pit worked for local consumption.

Southland.

Pukerau Coal-mine, Pukerau.—A small output produced for local use.

Heffernan's Coal-mine, East Gore.—The main entrance having collapsed during recent wet weather a new dip has been driven, and the mine is being reopened.

Green's Colliery, Gore.—In usual working-condition, this mine having suffered less from storm and floods than other pits in the district. Fan-ventilation fair. Report-book and plan kept.

Bushy Park Coal-pit, Croydon.—Opencast. Heads stripped well back and in good working-order.

Burnwell Coal-mine, Chatton.—Driving to dip, and southerly. Seam thick (30 ft.) and strong. The communication-way towards old Chatton Mine has now fallen in.

Ramsay's Coal-mine, Chatton.—Driving to dip, and levels broken away southward. Seam thick and strong. Ventilation good. Report-book kept.

Springfield Coal-mine, Waikaka Valley.—A shallow underground working, in fair order. Ventilation good.

Willowbank Colliery, Waikaka Valley.—Recent flood-water made inroads through the fallen ground of older workings, causing the mine to practically collapse around the small pillars left. The fault converging from outcrop tends to narrow the dip-workings.

Glenlee Coal-pit, Waikaka.—Opencast pit, stripping kept well ahead.

Edge's Coal-mine, Waikaka.—Driving to the dip and opening levels in the usual way. Siphon drainage having become unworkable on account of the depth, a steam-pump is now used.

Rossvale Coal-mine, Waikaia.—Bords were being driven toward the boundary of old Waikaia Mine workings. The seam is open-jointed, and the water-level on the floor was being taken as a guide and safeguard against a sudden inburst of water. The mine-manager promised to have a borehole kept ahead in advancing places.

Waikaia Coal-mine, Waikaia.—The former haulage-way to the surface has collapsed beyond repair. A new dip drive is being put down through former workings. Noxious gas has not been observed.

Argyle Coal-pit, Glenavy.—Opencast; worked for local supplies.

Waimea Coal-mine, Kingston Crossing.—New mine on terrace being got ready for output.

Lynch's Coal-mine, Kingston Crossing.—A steady output being maintained for local purposes.

Princhester Creek Coal-pit, The Key.—An output of 130 tons was produced during the year, for local requirements.

Mataura Collieries Company (Limited), Mataura.—After flood inconveniences the mine has been unwatered, and normal conditions now prevail. Some brattice was required for more complete ventilation, which the mine-manager promised should receive attention.

Mataura Lignite-pit, Mataura.—Work was being conducted at two places, the "face" being about 200 yards in length. Stripping was kept well ahead, and explosives apparently carefully handled. As twelve men were employed at one time in and about the pit in contravention of the permit issued by me authorizing the employment of eight men, in accordance with the Coal-mines Act, the holder of such permit, Mr. William Coster, was proceeded against and convicted, with costs amounting to £2 13s.

Waimumu Coal-pit, Waimumu.—Opencast workings, safely conducted.

Heatherlea Coal-pit, Waimumu.—Opencast working for local use.

Ota Creek Coal-pit, Wyndham.—Shallow opencast workings, liable to much flooding by water.

Clarke's Coal-pit, Wyndham.—Opencast workings. Centrifugal pump, steam-driven, now installed.

Robin Hood Coal-pit, Pine Bush.—An opencast pit supplying district requirements.

Nightcaps Colliery, Nightcaps.—No. 1 mine: Permanent ash fire-stoppings are built against the waste in the middle and upper seams. No. 2 mine: The output is chiefly derived from pillar and head coal. The lower seam dip drive has attained 400 ft. from surface, the dip being 1 in 4. A connection for ventilation with new shaft will shortly be made. The opencast section which has yielded so large a proportion of the output will shortly be abandoned, owing chiefly to the stripping becoming too heavy to be profitable. The loading-bank and surface erections which were burned have now been restored in steel and concrete. Close attention is paid to daily examinations and report-books. Plan duly kept. Explosives-magazine approved. An extraordinary fatality occurred on the 2nd April, 1913, when James Hewitt, miner, returned to his working-face having first previously ignited the fuse of a shot without having given the usual warning. Hewitt was killed instantly, and a deputy and another workman accompanying him had a narrow escape. Matthew McKenzie, miner, was fatally injured on the 9th September, 1913, by being thrown against a coal-truck by a fall of coal from the roof, he sustaining fracture of skull and jaw.

New Brighton Coal-mine, Nightcaps.—Pillar and head coal, working back from the boundary. Ventilation good; report-book and plan kept. A fatal accident happened on the 26th February, 1913, whereby William Ferguson, miner, was killed by a fall of coal from the face, which had previously been examined by the mine-manager and others and considered safe.

Wairio Coal-mine, Nightcaps.—Not working. Awaiting completion of new private branch line of railway from Wairio Station.

Beaumont Coal-pit, Nightcaps.—Opencast workings; stripping kept well ahead of working-face.

Mount Linton Coal-mine, Nightcaps.—A small output derived for local consumption.

Diamond Lignite-pit (lately Bush Siding Pit), Seaward Bush.—Opencast pit recently reopened for output of lignite for district use.

Lynwood Coal-pit, Te Anau.—Worked for supply of fuel for the Government steamers on Lakes Te Anau and Manapouri.

Private Pits.

Wellwood Park Lignite-pit, Pukerau.—Small output for own use.
Otikerama Station Lignite-pit, Pukerau.—Output for station requirements.
Riverview Lignite-pit, Gore.—Small output for own use.
Tuach's Lignite-pit, Waimumu.—Small output for local use.

ACCIDENTS.

Three fatal accidents were recorded during the year: two by falls of coal from roof; one killed owing to re-entering his working-place after igniting a shot at the face; and in a fourth case suicide was committed subsequent to a minor accident—this cannot be classed among fatal mining accidents.

Seven persons were incapacitated, each for several weeks, by five ignitions of blasting-powder in or about as many mines in Southland. These accidents were due to the mishandling of powder and naked lights by the sufferers.

Ten eye accidents, mostly non-serious, were reported as being chiefly due to flying coal from miners' picks.

Fatal Accidents.

26/2/13.—New Brighton Colliery, Nightcaps: William Ferguson, twenty-five, miner; fractured skull by fall of coal from roof at working-face which had been previously examined by mine-manager and deputy and considered safe.

2/4/13.—Nightcaps Colliery, Nightcaps: James Hewitt, fifty-five, miner; injuries to chest, struck by flying coal from a shot which deceased had previously ignited, and, unaccountably, re-entered the place without warning his fellow-workmen, two of whom had a narrow escape.

9/9/13.—Nightcaps Colliery, Nightcaps: Matthew McKenzie, thirty-four, miner; fractured skull and jaw; was thrown against a coal-box by a fall of coal from roof of his working-place.

Serious Non-fatal Accidents.

6/1/13.—Kaitangata Colliery, Kaitangata: A. S. Gillanders, mine-manager; fractured leg; fell 550 ft. to the bottom of upcast air-shaft, which he was examining, when the hand-winch slipped out of gear. 108 days off work.

31/1/13.—New Brighton Colliery, Nightcaps: Walter Robinson, forty-five, miner; bruised groin while taking down coal. Ninety-eight days off work.

24/2/13.—Kaitangata Colliery, Kaitangata: William McGhee, thirty-eight, repairer; fractured left wrist; struck by a fall of coal while timbering. 121 days off work.

18/4/13.—Kaitangata Colliery, Kaitangata: Alexander Morrison, forty, miner; fracture of radius; struck by stone falling from roof. Fifty days off work.

22/5/13.—Kaitangata Colliery, Kaitangata: Joseph Hennessy, twenty-one, trucker; compound fracture of right leg, with subsequent amputation above knee. As alleged, playfully and improperly started haulage-winch, and leg became crushed between coal-box and winch-frame.

10/6/13.—Ryder's Coal-mine, Nevis: Walter George, twenty-two, miner; loss of right eye; struck by a "fire" while squaring timber. Thirty-nine days off work.

6/8/13.—Christie's No. 2 Colliery, Saddle Hill: William Scott, forty-two, miner; injured back by full truck of coal overturning on him while trucking. He committed suicide twenty-eight days after the accident owing to depressed mind.

9/9/13.—Nightcaps Colliery, Nightcaps: John Price, forty-four, miner; fracture of left fibula and scalp-wound by fall of coal from roof of working-place, when M. McKenzie was fatally injured. Seventy-four days off work.

10/10/13.—Kaitangata Colliery, Kaitangata: Alexander Morrison, forty-one, miner; fractured rib and sprain of back by fall of coal from roof of working-place. Seventy days off work.

COAL-MINERS' RELIEF FUND.

Payments to the fund for the year 1913, £949 8s. 2d.

FIRECLAY AND PIPECLAY OUTPUT.

Canterbury and Otago, 7,246 tons; building-sand output—Otago, 12,507 tons.

ANNEXURE B.

QUESTIONS ASKED AT THE 1914 EXAMINATION FOR FIRST-CLASS CERTIFICATES OF COMPETENCY AS MINE-MANAGERS UNDER THE COAL-MINES ACT.

SUBJECT 1.—*Prospecting, Opening out a Colliery, Working Coal, and Timbering.*

1. Describe fully how you would sink a shaft, rectangular or circular, through quicksand to a depth of 100 ft.
2. If found necessary to open a roadway through ground recently worked by longwall, how would you secure same?
3. Give sketches and description of pit-bottom roadways and lines of rails therefrom in a seam of coal 8 ft. thick from which an output of 800 tons per eight-hours shift has to be raised.
4. Has the amount of cover overlying a coal-seam any bearing on the system to be adopted in working pillars? And, if so, explain fully in regard to 100 ft. and 500 ft. of cover respectively.
5. Why is coal-dust to be regarded as explosive under certain conditions? And state what these are.
6. Describe and show by sketches the systems of working coal with which you have had practical experience, and state what changes would in your opinion be an improvement on any one of the systems.
7. Show by sketches (*a*) what is meant by systematic timbering, and (*b*) sets of timber good for side and top weight, and (*c*) the application of sprags in the working-faces of a colliery.
8. Give sketches showing how you would lay out a longwall working with the coursing of the air from the downcast shaft through the faces and return to the upcast shaft, and state the conditions in which the longwall system is superior to the bord-and-pillar system.
9. Describe and show by sketches how you would carry drives intended to open up old workings, and all necessary precautions to be observed to prevent accident from (*a*) water and (*b*) noxious gases.

SUBJECT 2.—*Mine-gases, Spontaneous Combustion, and Ventilation.*

1. Name and describe the different gases met with in coal-mines, giving their specific gravity and their effect upon life and health.
2. With a fan developing 30 horse-power at the fan with a water-gauge of 2·3 in., but from which only 50 per cent. of useful effect is obtained, what quantity of air would be produced?
3. If appointed to the management of an important and extensively developed colliery worked with locked safety-lamps, having no previous knowledge of the colliery, how would you proceed to make yourself thoroughly acquainted with it in all departments?
4. Why should the circulation of air in mines be maintained continuously, and not during the day only?
5. What special precautions should be observed in the erection of a ventilating-fan in order that it may not be destroyed by an explosion? And state your experience of work done in mines where explosive gases were generated.
6. Given 50,000 ft. of air passing in two splits, how much circulates in each if one measures 7 ft. by 4 ft. and the other 7 ft. by 8 ft.?
7. If the volume of air be trebled, how much will the friction be increased?
8. State how you would proceed to deal with a fire in the workings of a coal-mine, and what experience you have had in dealing with such conditions?
9. Ventilate a mine-plan [not here reproduced] and show by conventional signs the position of air-crossings, doors, stoppings, &c., having due regard to the haulage-system from the face of working-places to the downcast shaft.

SUBJECT 3.—*General Mining, Steam Boilers and Engines.*

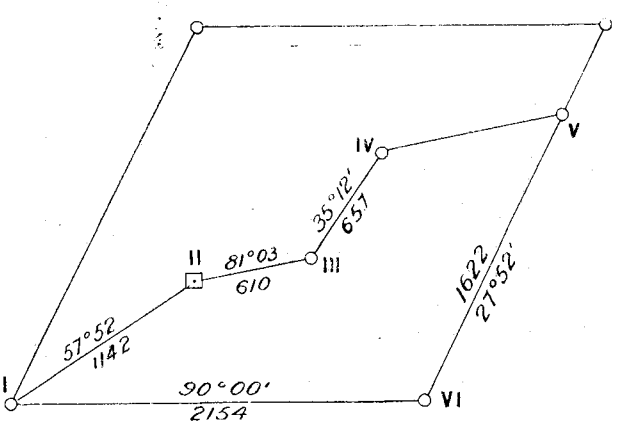
1. Give sketches with the dimensions (figured) of a dam which you would consider effective to resist a pressure of 60 lb. per square inch, and state material preferred to be used and dimensions of site.
2. Give sketches of Lancashire boiler of 200 horse-power, specifying all dimensions and strength of plates suitable for a working-pressure of 120 lb. per square inch.
3. With a mean pressure of 80 lb. and 300 ft. per minute piston-speed, what size cylinder is required to give 150 horse-power?
4. What is the breaking-strain of a 3-in.-circumference steel-wire rope?
5. Explain the meaning of the constant number 0·034 in the formula used in finding the diameter of a plunger to pump a given quantity of water.
6. What is the limit to the length of a single-lift pump, and what causes this?

7. Show by calculation the relative strength of two beams of timber, one being 12 ft. by 10 in. by 10 in., and the other 12 ft. by 12 in. by 8 in., and show breaking-strain of each if loaded in the middle.
8. State briefly the precautions to be observed in connection with blasting in coal-mines, and under what circumstances you would prohibit same.

SUBJECT 4.—*Mine Drainage and Haulage; also Practical Electricity.*

1. Under what conditions should the pump-rods and weight of water in pipes be equal? Give a case where they should be so, and say which should be the heavier, and why.
2. Having to install a 25 horse-power motor, continuous current, one mile from the generating-station, where the voltage is 480 and the line consists of No. 2 standard wire-gauge wire, what should the resistance and voltage drop be, and what voltage should the motor be ordered for?
3. Assuming that you have an incline 50 chains long dipping 1 in 6 against load, up which it is required to haul by direct haulage 25 trucks, the gross load being 25 tons, at a speed of 600 ft. a minute, what power electric motor would you install? Choose what you consider proper size and quality of rope, and make all necessary allowances for friction and other losses.
4. What is meant by the term "factor of safety," and what factor should be allowed in winding-ropes?
5. Give your practical experience in the use of electric plant for (*a*) pumping and (*b*) winding or haulage, and state what precautions should, in your opinion, be observed for its safe use underground.
6. Having to unwater a dip heading of 55 chains dipping at rate of 1 in 5, the inflow of water being 500 gallons per minute, state capacity and class of pump you would adopt, and motive for actuating same. The pump to work only twelve hours daily after dip pumped out. Show by sketch how the pump should be mounted to follow water down the dip.
7. Having regard to the dangers arising from the employment of appliances which may, owing to some defect, ignite fire-damp with air in such proportion as to be explosive, what stringent rules would you adopt to guard against disaster from the use of such appliances?
8. Enumerate the most prolific causes of accidents in coal-mines, and briefly describe precautions which would, in your opinion, tend to reduce the number of accidents.

SUBJECT 5.—(*a.*) *Mine-surveying, Levelling, and Making of Plans.*



1. The above diagram represents a mining claim with a shaft at II, and an underground tunnel from II to III and III to IV: compute the distance that should be driven from IV to the boundary of the claim at V. [NOTE.—The distances are given in links.]
2. The angle of elevation in the tunnel when driven from IV to V is 3° 15′: compute the difference in height from IV to V in feet.
3. The area of the figure I, II, III, IV, V, VI is required: state by what methods it can be obtained, and what is the most accurate method.
4. What timbers may be used for survey pegs?

(*b.*) *Geology—Prospecting for Coal, Origin and Mode of Formation of Coal-seams; Faulting; also a General Knowledge of the Geology of Stratified Rocks, and more particularly of New Zealand Coal-measures.*

1. State fully how you would prospect a hilly bush-clad area of, say, 2,000 to 3,000 acres, in which more than one apparently workable coal-seam outcropped, in order to determine whether it would be advisable to spend, say, £250,000 in making a railway and opening out a mine. What aid could a fairly good geological and topographical map, on the scale of 1 in. to 20 chains, give you in the matter? In the absence of suitable maps, how much geological and topographical mapping would you yourself do, or have done, and on what scale?
2. Give approximate chemical composition of lignite, brown coal, bituminous coal, and anthracite. State the principal New Zealand localities for each of these classes of coal.
3. Define the terms—"strike," "dip," "anticline," "unconformity." Give illustrative diagrams.
4. Give as full an account as your time permits of the geology of any coal-mining district in New Zealand, Australia, Great Britain, or any other country with which you are personally acquainted.

SUBJECT 6.—*Arithmetic, and a Knowledge of the Coal-mines Act and Amendments, also First Aid to the Injured.*

1. If you know the length of the three sides of a triangle, how would you find its area ?
2. Explain what you know of keeping accounts.
3. Assume the annual output of a colliery to be 100,000 tons screened coal, 50,000 unscreened, and 60,000 tons small, the average cost per ton on trucks being 7s., what would the average selling-price have to be in order to provide 5 per cent. depreciation and 10 per cent. dividend on a capital of £300,000 ?
4. How many tons of coal does a pillar 42 ft. by 60 ft. by 9 ft. contain ?
5. How many cubic feet of debris would be produced from a shaft 14 ft. diameter, 500 ft. deep ; and how many gallons of water would such a shaft contain ?
6. Find the depth of a circular cistern, 7 ft. diameter, which contains 2,400 gallons.
7. Are you the holder of a certificate from the St. John's Ambulance Society ?
8. Give a list of what you consider the requisite material and appliances required to be kept at collieries to enable first aid to be speedily rendered, and state where, in your opinion, such should be kept underground and overground respectively.
9. What do you consider the best dressing to be applied to persons suffering from severe burns ; and what is most important to be guarded against in such cases ?
10. In the treatment of persons affected by the inhalation of noxious gases, what are the first steps to be taken ? And state what experience you have had, if any, in the use of rescue apparatus.
11. Give your knowledge of the Coal-mines Act and general and special rules by stating (*a*) the duties devolving on the manager under the Act ; (*b*) the duties and responsibilities of the fireman in making the daily examination of the mine prior to the men entering the mine ; (*c*) under-viewers' duties ; (*d*) provision for refuge-holes on haulage-roads, and the special rules provided for guarding against accidents from fire-damp and the use of explosives.

QUESTIONS ASKED AT THE 1914 EXAMINATION FOR SECOND-CLASS CERTIFICATES OF COMPETENCY AS MANAGERS UNDER THE COAL-MINES ACT.

SUBJECT 1.—*Prospecting, Opening out a Colliery, Working Coal, and Timbering.*

1. Give briefly your experience in prospecting, and what steps are generally taken in connection with this work and what you consider most essential.
2. In sinking a shaft through quicksand to a depth of 100 ft., what means would you adopt ?
3. Having to carry a roadway through old workings very much fallen, what style of timbering would you adopt ? Show by sketches.
4. What are the most necessary safeguards in connection with blasting in coal-mines ?
5. Briefly describe the methods of working coal in any mines with which you have been connected, and show by sketches how you would lay out a pit-bottom where a fairly large output has to be handled.
6. Give a sketch plan of what you understand is meant by the panel system of carrying on the workings of a colliery, and state what you consider the advantages of this method.
7. Having regard to the production of the largest possible yield of lump coal, what method of preparation for blasting would you adopt in bord-and-pillar workings ?

SUBJECT 2.—*Mine-gases, Spontaneous Combustion, and Ventilation.*

1. In a mine where fire-damp is given off freely, what means of limiting the number of men in any one split would you adopt ? And say how many men you consider sufficient to have in any split.
2. Would you think it proper to stop the ventilating-fan when men are not at work ? Give reasons for your opinion for or against.
3. State how you would proceed to deal with a fire in the workings of a coal-mine, and give your experience in connection with such.
4. Give the names, specific gravity, and symbols of gases commonly met with in coal-mines, and their effect on life and health.
5. What do you consider the most suitable material with which to build air-crossings and permanent stoppings, and should these, in your opinion, be so strong as to resist the effect of explosions ?
6. Having 50,000 ft. of air passing in two air-courses, one being 7 ft. by 5 ft. and the other 7 ft. by 7 ft., what quantity would pass in each ?
7. Ventilate a mine-plan [not here shown], and show by conventional signs the position of doors, air-crossings, stoppings, &c., at same time having regard to haulage of coal from face of workings to the shaft.

SUBJECT 3.—*General Mining, Mine-drainage, and Haulage.*

1. Being suddenly apprised of the presence of fire-damp in the workings of a colliery where it had not previously been seen, what steps would you adopt to prevent accidents ?
2. Having to pump 100 gallons a minute from a dip working, what provision would you make for dealing with it (*a*) as regards storage with the object of pumping the day's make of water in eight hours and (*b*) size of pump and means of driving same ?

3. Show by sketches the kind of dam you would erect to resist a pressure of 60 lb. per square inch stating kind of material used and reason for preference.
4. Give your experience in the use of safety explosives, and describe fully the dangers from blown-out shots.
5. If you decide to treble the air passing through an aircourse, how much would the friction be increased ?
6. Show by sketches how you would proceed to carry on drives towards old workings where you expected to tap water under pressure, giving all precautions deemed requisite, including provision against noxious gases.

SUBJECT 4.—*Elementary Electricity, Arithmetic, and Knowledge of Coal-mines Act, also First Aid to the Injured.*

1. If required to transmit power to a long distance underground for haulage purposes, what precautions would you observe in reference to voltage and protection of cables ?
2. What power of motor would you install to haul 10 trucks of coal up an incline grade 1 in 5 against load, trucks and coal being 10 tons, speed 400 ft. per minute ? Give size of rope, and allow for friction and other losses.
3. If you have 100 pairs of miners producing 800 tons per day at a cost of 6s. per ton, and it is required to increase the output by 40 per cent. and to reduce the cost per ton 10 per cent., what additional men would require to be employed, and what would the average cost per ton be ?
4. Having to construct a circular cistern to contain 3,000 gallons, a diameter of 8 ft. having been decided on, what would the depth be ?

First Aid.

1. Are you the holder of a certificate from St. John's Ambulance Society ?
2. Enumerate the most essential kind of material and appliances which should be kept at all collieries for the rendering of first aid.
3. State how you would render first aid to persons suffering from (*a*) burns, (*b*) broken lower limb, (*c*) thigh-fracture, and (*d*) how bandages should be applied to stop profuse bleeding from injured limb.

Knowledge of Coal-mines Act.

1. State your knowledge of the Coal-mines Act with reference to (*a*) duties of underviewer ; (*b*) fireman examining mine before men enter upon their shift ; (*c*) necessary reports and records to be kept in compliance with the Act ; (*d*) the special rules for guarding against accident from fire-damp, and (*e*) from blasting and coal-dust.

LIST OF PERSONS WHO HAVE OBTAINED CERTIFICATES UNDER THE COAL-MINES ACTS.

First-class Mine-managers' Certificates.

Issued under the Coal-mines Acts, 1886 and 1891.

Aitken, T., Wendon.
Alexander, T., Brunnerton.
Austin, J., Sheffield.
Binns, G. J., Dunedin.
Bishop, J., Brunnerton.
*Brown, T., Westport.
Brown, T., Glentunnel.
Cameron, J., Denniston.
Campbell, J. C., Fairfield.
Cochrane, N. D., Dunedin.
Collins, W., Taupiri.
Dando, M., Brunnerton.
*Elliott, R., Wallsend.
*Ferguson, A., White Cliffs.
*Freeman, J., Green Island.
*Geary, J., Kamo.
Gray, J., Abbotsford.
*Harrison, J., Brunnerton.
*Irving, J., Kaitangata.
Jamison, W., Waimangaroa.
*Kenyon, J., Shag Point.
Kerr, G., Kamo.
*Lindsay, W., Otago.
Lloyd, J., Invercargill.
*Louden, J., Green Island.
Love, A., Whangarei.
Mason, J., Nightcaps.
May, J., Greymouth.
Moody, T. P., Kawakawa.
Moore, W. J., Springfield.
*Nelson, J., Green Island.
Ord, J., Huntly.
*Redshaw, W., Whangarei.
Reed, F., Westport.
*Richardson, D., Abbotsford.
Shore, J., Kaitangata.
Shore, T., Orepuki.
*Shore, W. M., Kaitangata.
*Smart, W., Christchurch.
Smith, A. E., Nelson.
Smith, T. F., Nelson.
Sneddon, J., Mosgiel.
Swinbanks, J., Kawakawa.
Taylor, E. B., Huntly.
Thompson, A., White Cliffs.
Walker, J., Collingwood.
Williams, W. H., Shag Point.

Issued under the Coal-mines Acts, 1886, 1891, 1905, and 1908, after Examination.

Armitage, F. W., Auckland.
Armstrong, J., Brunnerton.
Barclay, T., Kaitangata.
Barclay, W., Kaitangata.
Bennie, Boyd, Waihi.
Bishop, T. O., Reefton.
Brown, J. C., Denniston.
Burt, A., Waihi.
Campbell, Peter, Fairfield.
Carruthers, J., Shag Point.
Carson, W., Kaitangata.
Coombe, J., Waihi.
Coulthard, J., Taylorville.
Dixon, C. W., Granity.
Dixon, W., jun., Kaitangata.
Dowgray, R. L., Granity.
Duggan, George, Burnett's Face.
Dunn, Andrew, Denniston.
Dunn, W., Brunnerton.
Dunn, W. R., Thames.
Elliott, R., jun., Denniston.
Fleming, J., Kaitangata.
Fletcher, James, Granity.
Fox, R. A., Denniston.
Fry, Sydney, Waimangaroa.
Gibson, John, Westport.
Gillanders, A., Shag Point.
Gowans, W., Millerton.
Green, E. R., Abbotsford.
Green, J., Brunnerton.
Hamilton, J. S., Burnett's Face.
Herd, J., Brunnerton.
Heycock, C. R., Nightcaps.
Hill, Robert, Abbotsford.
Hosking, G. F., Auckland.
*Hughes, D., Preservation Inlet.
Hughes, Joh., Puponga.
*Jebson, D., Canterbury.
Johnson, W. P., Thames.
Jones, T., Kimihia.
Leitch, J., Blackball.
Leitch, W., Blackball.
Marshall, A. G., Denniston.
McCaffrey, Patrick, Ferntown.
McCormack, W., Denniston.
McEwan, Robert, Coromandel.
McGeachie, J., Mokau.
Milligan, J., Denniston.
Milligan, N., Westport.
Morgan, William, Waihi.
Murray, T., Westport.
*Newsome, F., Denniston.
Newton, James, Brunnerton.
Parsonage, W., Runanga.
Penman, A., Huntly.
Scoble, E. J., Waihi.
Shore, Joseph, Kaitangata.
Smith, George, Fairfield.
Sowerby, H., Denniston.
Tattley, E. W., Huntly
Tattley, F. J., Mercer.
Taylor, A. H., Waikato.
Thomson, Thomas, Denniston.
Turner, G. F., Shag Point.
Westfield, C. H., Fairfield.
Young, James H., Waimangaroa.

Issued under the Coal-mines Act, 1886, on Production of English Certificate.

Binns, G. J., Dunedin.
Black, T. H., Waipori.
Broome, G. H., Ngakawau.
Cater, T., Auckland.
Cochrane, N. D., Dunedin.
*Garrett, J. H., Auckland.
Hayes, J., Kaitangata.
Hodgson, J. W., Ross.
*Lindop, A. B., Springfield.
*Macalister, J., Invercargill.
*Nimmo, J., Oamaru.
*Straw, M., Westport.
Tattley, W., Auckland.

Issued to Inspectors of Mines by virtue of Office, under the Coal-mines Acts of 1886 and 1891.

*Coutts, J., Thames.
Gordon, H. A., Wellington.
*Gow, J., Dunedin.
McLaren, J. M., Thames.
*Wilson, G., Thames.

Issued under the Coal-mines Acts of 1891, 1905, and 1908, on Production of Certificate from a recognize Authority outside the Dominion.

First Class.

Alison, J., Mangatini.
Alison, R., Greymouth.
Bayne, J. A. C., Roa.
Clark, W., Blackball.
Davidson, Gavin, Blackball.
*Dixon, J., Westport.
Fletcher, George, Westport.
Frame, Joseph, Kaitangata.
Gillick, J., Kaitangata.
Goold, A. L., Auckland.
Irvine, James, Dunedin.
*James, Isaac Angelo, Westport.
Jordan, R. S., Kaitangata.
Kane, D., Denniston.
Kirkwood, D., Coromandel.
Lamont, J., Devonport.
Lewis, W., Blackball.
Mark, W. S., Kaitangata.
McAvoy, H., Christchurch.
Nelson, E., Hikurangi.
Paterson, D. S. A., Kawhia.
*Pollock, James, Green Island, Otago.
*Proud, Joseph, Wanganui.
*Scott, Joseph, Ngahere.
Tennent, R., Brunnerton.
Twining, C. E., Dunedin.
Watson, James, Greymouth.
Watson, John, Blackball.
Wight, E. S., Auckland.
Wood, William, Mokihinui.

Second-class Mine-managers' Certificates.

Issued under the Coal-mines Act, 1891.

Carson, M., Kaitangata.
Collier, Levi, Kamo.
Clarke, Edward, Shag Point.
Elliot, Joseph, Coal Creek.
Harris, John, Denniston.
Herd, Joseph, Brunnerton.
Howie, James, Kaitangata.
*Leeming, William, White Cliffs.
Lobb, Joseph, Mokau
*Love, Alexander, Orepuki.
McIntosh, Allan, Shag Point.
McLaren, J. M., Thames.
*Marshall, J., Ngakawau.
Murray, Thomas, Denniston.
*Nimmo, George Stewart, Ngapara.
Radcliffe, William, Reefton.
*Roberts, John, Brunnerton.
*Ross, John, Kawakawa.
Sara, James, Reefton.
Smith, Charles, Whangarei.
Thomas, James, Springfield.
Wallace, William, Huntly.
*Willetts, John, Papakaio.
Willetts, John Morris, Papakaio.
Young, William, Waimangaroa.

* Deceased since issue of certificate.

Issued under the Coal-mines Acts, 1886, 1891, 1905, and 1908, after Examination.

Allan, J., Brunner.
Austin, W. B., Sheffield.
Ball, A., Kimihia.
Barber, John, Shag Point.
Barclay, T., Kaitangata.
Barclay, T., jun., Kaitangata.
Barclay, William, Kaitangata.
Barnes, A. E., Shag Point.
Broome, J., jun., Gore.
Brown, Robert, Kaitangata.
Cadman, J., Hikurangi.
Campbell, Peter, Fairfield.
Carruthers, J., jun., Nightcaps.
*Carson, Joseph, Kaitangata.
Charles, E., Glentunnel.
Cherrie, R. C., Mokau.
Christie, James, Saddle Hill.
Clemo, G., Whangarei.
Craig, John, Coal Creek Flat.
Crocketts, S., Millerton.
Dale, E. G., Kaitangata.
Dixon, W., jun., Kaitangata.
Doel, G., Lovell's Flat.
Duncan, James, Kaitangata.
Duncan, J. E., Kaitangata.
Duncan, John, Lovell's Flat.
Ferguson, A., Kaitangata.
Ferguson, G., Roa.
Fox, R. A., Blackball.
Harris, A., Saddle Hill.
Heyes, T., Kaitangata.
Heycock, C. R., Nightcaps.
Hill, R., Abbotsford.
Hodson, John, Kaitangata.
Holden, J., Drury.
Hughes, Job, Roa.
Hunter, A.. Southland.
Kells, F. H., Denniston.
Kirkland, H. S. S., Nightcaps.
Lewis, David, Puponga.
Lewis, J., Nightcaps.
Lindsay, J. B., Orepuki.
McAllister, Neil, Kaitangata.
McLelland, J., Kaitangata.
McLelland, A. C., Kaitangata.
McNeill, D., Fairfield.
Milligan, J., Denniston.
Mills, Walter, Huntly.
Mosley, J. T., Stirling.
Neilson, J., Runanga.
Neilson, Moffat, Abbotsford.
Newburn, S., Kaitangata.
Ogilvie, W. W., Saddle Hill.
Orr, Hugh, Fairfield.
Parcell, W., jun., Bannockburn.
Penman, C. P., Kaitangata.
Price, F. J., Burnett's Face.
Scoble, E. J., Blackball.
Snow, T., Mercer.
Tattley, F. J., Mercer.
Taylor, Joseph, Collingwood.
Thompson, Joseph, Blackball.
Todd, T., Nightcaps.
Waldie, A. B., Mokau.
Watson, A., Soldier's Creek.
Westfield, C., Fairfield, Otago.
Whittleston, A. W., Shag Point.

Issued under the Coal-mines Acts of 1891, 1905, and 1908, on Production of Certificate from a recognized Authority outside the Dominion.

Arundel, W., Hikurangi.
Baxendale, J., Mine Creek.
Black, J., Granity.
Boyd, J., Hikurangi.
Brownlie, T., Huntly.
Burt, A., Huntly.
Burt, W. Huntly.
Clarkson, S., Kaitangata.
Cross, G., Hikurangi.
Dickinson, W., Gore.
Dodd, W., Granity.
Dowgray, R., Granity.
Eyeington, G., Huntly.
Greenwell, R., Huntly.
Grenall, S., Granity.
Inglis, A., Huntly.
Jones, T., Kimihia.
Kerr, D., Collingwood.
Lennox, W., Springfield.
Little, W., Wellington.
Littlewood, G. G., Denniston.
Longstaff, H. C., Kaitangata.
McCall, John, Wellington.
McGeachie, J., jun., Mokau.
McGuire, P., Mount Somers.
McGuire, William, Seddonville.
McHardy, A. J., Ferntown.
Molony, C. V. P., Auckland.
Parsonage, W., Dunollie.
Penman, A., Huntly.
Robertson, J., Granity.
Robertson, R., Roa.
Sneddon, J., Blackball.
Strachan, J., Dunedin.
Tennant, D., Paparoa.
Talbot, H., Huntly.
Webb, T. E., Huntly.

UNDERVIEWERS' CERTIFICATES.

Issued under the Coal-mines Amendment Act, 1909.

Allan, James, Puponga.
Attrill, Charles Waterford, Mercer.
Berry, A. H., Huntly.
Bond, John, Waikaia.
Boustrage, T. Hubert, Brunnerton.
Broome, James, Gore.
Clough, Henry, Millerton.
Davidson, William, Mine Creek.
Davis, William, Runanga.
Donaldson, James, Kaitangata.
*Falconer, Andrew, Abbotsford.
Flynn, John, Bannockburn.
Green, Richard, Abbotsford.
Hawthorn, James, Puponga.
Hunter, Peter, Ngakawau.
Johnston, William Crowan, Gore.
Johnstone, Thomas, Denniston.
Levick, Harry, White Cliffs.
Mann, William, Granity.
Marsh, Charles George, Glentunnel.
Muncaster, William, Runanga.
McAlister, Robert, Kaitangata.
McGrane, Reginald, Seddonville.
McKenzie, David, Nightcaps.
McNeill, William, Fairfield.
Newlands, George, Brunnerton.
Nimmo, Thomas, Papakaio.
Nimmo, William, Ngapara.
Penman, John, Denniston.
Proctor, William, Kaitangata.
Robertson, William, Mosgiel.
Todd, Thomas, Nightcaps.
Walker, John, Blackball.
Williams, William, Kaitangata.
Wilson, Daniel, Kaitangata.
Winter, John, Denniston.

Issued under the Coal-mines Amendment Act, 1909, after Examination.

Atkinson, John, Puponga.
Berry, A. H., Huntly.
Brown, Charles Henry, Denniston.
Carson, F. Kaitangata.
Clark, W. S., State Collieries.
Dowgray, John, Millerton.
Hewitson, W. E. G., Burnett's Face.
Hunter, Peter, Stockton.
Jack, W., Millerton.
Johnston, C. M., Seddonville.
McDonald, Thomas, Ngakawau.
McLeod, J. G.. Millerton.
Mosley, J. T., Denniston.
O'Brien, D. Q., Mangatini.
Peacock, Thomas, Denniston.
Pearson, William, Burnett's Face.
Strongman, C. J., Cobden.
Sweeney, J. L., State Collieries.
Turner, Alfred, Kiripaka.

Issued under the Coal-mines Amendment Act, 1910.

Baerdsmore, E., Denniston.
Cuthbertson, Robert, Fairfield.
Evans, William, Abbotsford.
Fisher, T., Westport.
Gibson, M., Abbotsford.
Greene, M , Kaitangata.
Hadcroft, J., Runanga.
Hunt, W., Shag Point.
Jones, David, Nightcaps.
Jones, Morris, Nightcaps.
Jones, W., Waikaka Valley.
Kitto, Richard, Kaitangata.
Manderson, P., Runanga.
Mann, D., Granity.
Marshall, J. W., Westport.
Mason, Edward, Kingston Crossing.
Mitchell, Alexander, Runanga.
McCaughern, John, Kaitangata.
Neill, S., Kawakawa.
Newburn, S., Kaitangata.
Statham, Robert, Kaitangata.
Walker, J. R., Brighton.

* Deceased since issue of certificate.

FIREMEN AND DEPUTIES' CERTIFICATES.

Issued under the Coal-mines Amendment Act, 1909.

Aitken, George, Glentunnel.
Allan, A. George, Abbotsford.
Allan, Charles, Brunnerton.
Beardsmore, Edward, Denniston.
Berry, Albert Henry, Huntly.
Blaney, James, sen., Kaitangata.
Boyd, Robert, Waronui.
Bradley, Robert, Denniston.
Buchols, Joseph, Waikaka.
Burgess, William Charles, E. Gore.
Callaghan, Frederick, Kiripaka.
Campbell, Samuel, Millerton.
Chamley, William, Millerton.
Clausen, Emil P., c/o J. Worthington, 33 Hiropi Street, Newtown, Wellington.
Connelly, Michael, Denniston.
Connew, John, Puponga.
Coppersmith, John, Denniston.
Coulthard, Thomas, Brunnerton.
Cowan, Robert Black, Gibbston.
Cuthbertson, Robert, Fairfield.
Darby, James, Huntly.
Davis, Evan, Denniston.
Deeming, William, Hikurangi.
Dellaway, Archibald, Denniston.
Dickson, Richard, Hikurangi.
Dillon, Lawrence M., Nightcaps.
Duncan, Frank, Huntly.
Duncan, Hugh, Kaitangata.
Evans, John, Granity.
Evans, William, Abbotsford,
Findlay, Charles, Denniston.
Foot, Frederick Ernest, Denniston.
*Fullick, George, Runanga.
Gibson, Matthew, Abbotsford.
Gibson, Robert, Millerton.
Gilmour, William, Millerton.
Glover, Richard, Runanga.
Gray, Thomas, Abbotsford.
Gribben, John, Kaitangata.
Headcroft, James, Runanga.
Hamilton, John, Hikurangi.
Hargreaves, Charles, Millerton.
Harris, John, Reefton.
Harris, Joseph T., Saddle Hill.
Hartley, John, Denniston.
Hay, James, Denniston.
Heron, Ralph, Kimihia.
Higgins, Thomas James, Denniston.
Hislop, William, Denniston.
Holden, Samuel, Granity.
Housley, Benjamin, Huntly.
Howe, George Charles, Shag Point.
Jackson, Samuel, Millerton.
Jarvie, William Marshall, Kaitangata.
Jaspers, George F., Denniston.
Jenkins, James, Ngakawau.
Johnston, C. Mountier, Seddonville.
Jones, David, Nightcaps.
Kaye, Charles, Runanga.
Kitto, Richard, Kaitangata.
Leeming, J. T., South Malvern.
Lutton, William, Millerton.
Mann, Duncan, Millerton.
Mason, William, Denniston.
Mears, Andrew David, Runanga.
Moncrieff, Thomas, Nightcaps.
Moore, Thomas, Mangatini.
Morganti, Charles, Ngakawau.
Murdoch, Colin McColl, Stirling.
McCaffrey, James, Seddonville.
McCoughern, John, Kaitangata.
McDonald, John T., Millerton.
McGarry, Isaac, Millerton.
McGhee, William, Kaitangata.
McGill, Douglas Thomas, Waikaka.
McGill, John, Huntly.
McKenzie, James, Nightcaps.
Newburn, Robert, jun., Kaitangata.
Newburn, Samuel, Kaitangata.
Nicholas, William, Kaitangata.
Oliver, William, Kaitangata.
Parcell, Henry Clyde, Bannockburn.
Park, Francis, Stirling.
Peckham, Henry William, Huntly.
Penman, Robert, Kaitangata.
Richards, James, Brunnerton.
Rodgers, Edwin, Kaitangata.
Sanderson, John, Kurow.
Scott, Charles, Nevis.
Scott, John, Runanga.
Skellern, John, Huntly.
Smith, Edwin, Springfield.
Smith, William, Huntly.
Smith, William, Seddonville.
Sneddon, James, Blackball.
Southward, John, Runanga.
Statham, Robert, Kaitangata.
Taylor, David, Roa.
Taylor, James, Springfield.
Thin, William, White Cliffs.
Travis, James, Alexandra South.
Tripp, Albert, Kaitangata.
Wallace, John, Mataura.
Wardrope, Francis, Hikurangi.
Watson, Andrew, Roa.
West, George Thomas, Waronui.
White, James, Roa.
Whorsky, John, Huntly.
Wilson, Walter William, Springfield.
Young, Thomas Gardner, Waikaia.

Issued under the Coal-mines Amendment Act, 1909, after Examination.

Allan, George, Huntly.
Allan, James, Brunnerton.
Anderson, Walter, Blackball.
Armstrong, V., Runanga.
Atkinson, J., Puponga.
Ball, A., Kimihia.
Berry, T., jun., Huntly.
Birchall, J., Burnett's Face.
Blair, Peter, Huntly.
Boddy, Archibald John, Runanga.
Bond, W. T., Huntly.
Broadbent, Samuel, Huntly.
Brown, J., jun., Denniston.
Buchanan, William, Millerton.
Burdon, George, Denniston.
Burt, T., Huntly.
Burt, W., jun., Huntly.
Carson, Frederick.
Chippendale, J., Millerton.
Clark, W. S., Dunollie.
Connolly, John, Runanga.
Connolly, John Joseph, Runanga.
Curran, James, Ngakawau.
Cuthbertson, John, Glentunnel.
Danks, Peter, Millerton.
Darby, W., Huntly.
Davidson, Thomas, Mine Creek.
Davis, Oliver James, Runanga.
Dowgray, John, Millerton.
Downes, William Norbury, Cobden.
Duggan, Francis, Runanga.
Dutton, John, Granity.
Dymond, J., Millerton.
Ferguson, A., Kaitangata.
Forrest, John, Runanga.
Fox, Henry John, Blackball.
Gilligan, H., Runanga.
Griffen, James, Kaitangata.
Hall, R. H., Huntly.
Hannigan, P., Ngakawau.
Hardie, J., Millerton.
Harvey, D., Huntly.
Hawkins, Joseph, Burnett's Face.
Hendry, John, Millerton.
Hicks, J. R., Kiripaka.
Hilton, Thomas, Denniston.
Honey, Archibald John, Denniston.
Hopkinson, Joseph, Seddonville.
Innes, Andrew, Runanga.
Isherwood, T., Runanga.
James, F. T., Seddonville.
Johnson, J. H., Hikurangi.
Johnson, Thomas, Huntly.
Jones, B., Millerton.
Jones, J., Kimihia.
King, Thomas Henry, Granity.
Lauder, Matt Currie, Runanga.
Lowden, W., Millerton.
McAuley, P., Ngakawau.
McAvoy, William, Ngakawau.
McDonald, Thomas, Burnett's Face.
McKenty, H., Denniston.
McKernan, John, Millerton.
McLaughlin, J. W., Huntly.
McMillan, John, Huntly.
McMillan, John, Kaitangata.
Maddison, W., Huntly.
Makepeace, Henry, Runanga.
Mitchell, A., Seddonville.
Morganti, Louis, Millerton.
Moreland, S., Hikurangi.
*Mosley, J. T., Denniston.
Moye, John Patrick, Denniston.
Myers, Richard, Millerton.
Newton, Charles, Runanga.
Nicholson, David, Huntly.
Nicholson, J., State Collieries.
Niven, Peter, Ngakawau.
Nolan, John, Granity.
O'Brien, Denis Quinlan, Millerton.
O'Brien, Martin, Millerton.
Parker, Andrew, Greymouth.
Parr, Joseph, Burnett's Face.
Paul, James, Seddonville.
Pearson, Samuel George, Burnett's Face.
Pearson, William, Burnett's Face.
Phillips, J., Puponga.
Ponton, F., Millerton.
Powell, J., Dunollie.
Reed, W. H., Hikurangi.
Robson, W., State Collieries.
Rodgers, J., Ngakawau.
Rowse, J., Runanga.
Ruston, Edwin Walter, Huntly.
Seddon, William, Huntly.
Smith, J. A., Seddonville.
Smith, Thomas W., Millerton.
Southward, William, Runanga.
Strongman, Charles James, Cobden.
Sutherland, J., Millerton.
Sweeney, John Lewis, Runanga.
Tate, Anthony, Seddonville.
Taylor, Christopher, Millerton.
Thawley, William, Denniston.
Thomson, Thomas, Mine Creek.
Turton, John, Huntly.
Veitch, D., Blackball.
Vurlow, Frederick Alexander, Denniston.
Wallwork, Moses, Runanga.
Wear, Daniel, Huntly.
Webster, Oliver, Huntly.
White, Edward, Granity.
Wilson, J. T., Kamo.
Woods, A., Millerton.
Wood, W., Huntly.
Worthington, T., Millerton.
Young, Joseph, Huntly.
Young, Thomas, Granity.

Issued under the Coal-mines Amendment Act, 1910.

Broadfoot, W., Millerton.
Burgess, R. S., Waikaka.
Cain, Alexander, Waikaia.
Cameron, D., North Chatton.
Churchill, S. G., Alexandra South.
Clasen, Charles, Shag Point.
Crabbe, George, Alexandra South.
Cumming, J. S., Denniston.
Cunningham, Thomas, Kaitangata.
Dixon, A., Nightcaps.
Garrey, W., Kaitangata.
Gray, Hugh, Dunedin.
Halsey, W. J., Saddle Hill.
Hartshorne, W. C., Brunnerton.
Hodgetts, I., Burnett's Face.
Hunt, William, Shag Point.
Junker, F. A., Waikaia.
Kidd, G. C., Albury.
King, J., Granity.
Lee, S., Nightcaps.
Mackie, N., Longridge.
McAuley, John, Kaitangata.
McClimont, John, Mount Somers.
McDowell, R., Nightcaps.
McIntosh, A. S., Shag Point.
McIvor, W., Waikaka.
Nelson, J. H., Pukerau.
Ramsey, George, Waikaka.
Robinson, R., Ngakawau.
Russell, H. C., Bannockburn.
Saunders, W., Denniston.
Stevenson, J., Shag Point.
Thomas, B., Denniston.
Tinker, G., Nightcaps.
Whittlestone, G. F., Abbotsford.

*Deceased since issue of certificate.

ANNEXURE C.

STATISTICS OF WORKINGS IN COAL-MINES, 1913.

Name of Mine and Locality.	Name of Manager.	Number of Years worked.	Quality of Coal.	Number of Seams worked.	Thickness of Seams.	Thickness worked.	Dip of Seam.	System of Underground Working.	Dimensions of Shafts. Number of Shafts.	Size of Shaft or Adit.	Depth of Shaft or Length of Adit.	Output delivered by	Output for 1913. Coal.	Slack.	Total.	Approximate Total Output to 31st December, 1912.	Approximate Total Output to 31st December, 1913.	Number of Men ordinarily employed. Above.	Below.	Total.	Power used for drawing Mineral.	Pumps. Stroke.	Size of Barrel.	Height of Column.	Means of Ventilation.	Date of Inspector's last Visit.
NORTHERN INSPECTION DISTRICT.																										
North Auckland Coalfields.													Tons.	Tons.	Tons.	Tons.	Tons.									
Kawakawa Colliery	R. Dickson	1½	Semi-bituminous	1	3′ 6″	3′ 6″	1 in 3	Bord and pillar		Dip 6′ x 4′	150′	Dip	239	..	239	278	517	1	3	4	Horse	..	..	..	Natural	4/12/13
Hikurangi Coal Company (Limited)	W. R. Dunn	22	Ditto	1	2′ to 14′	2′ to 12′	1 in 8	Ditto	3	5′ x 5′ 4′ x 4′ 4′ x 4′ 6″ Tunnel	50′	„	46,515	..	46,515	822,067	868,582	20	65	85	Steam	2–10″	1–8″ 1–6″	60′ 60′	Fan	9/12/13
Northern Colliery (Old Mine)	Edwin Nelson	16	„	1	3′ to 12′	3′ to 12′	Varied	„		6′ x 5′ Dip	350′ 462′	„	43,242	..	43,242	452,112	495,354	14	49	63	„	..	..	..	„	9/12/13
„ (Waro Mine)	E. W. Tattley	2	„	1	9′ to 11′	7′	„	„	1	6½′ x 6′ Tunnel 9′ x 6′ 8′ x 8′ Tunnel 9′ x 6½′	1,680′ 191′ 900′	„	7,611	..	7,611	..	7,611	21	52	73	„	1–10″ 2–10″ 1–10″ 2–10″ 1–10″ 1–7″	1–8″ 2–6″ 1–8″ 1–6″ 1–6″ 1–4″	191′ 191′ 45′ 176′ 220′ 42′	„	11/10/13
Kiripaka Colliery	A. Turner	21	„	1	2′ to 20′	2′ to 20′	1 in 10	„	1	5′ x 5′ Dip	25′	„	1,193	..	1,193	290,348	291,541	2	6	8	Manual	..	..	..	Natural	3/6/13
Rautangata-Kamo Mine	F. J. Wilson	2	„	1	3′ to 6′	3′ to 6′	1 in 4	„	1	6′ x 6′ 8′ x 4′ Tunnel	330′ 60′	„	30	..	30	110	140	..	2	2	„	..	..	..	„	6/12/13
Whangarei-Kamo Mine	A. H. Taylor	4	„	1	4′ to 6′	4′ to 6′	1 in 4	„	1	12′ x 6′ 9′ x 6′ Tunnel 12′ x 6′	200′ 100′ 140′	Shaft	3,880	..	3,880	8,453	12,333	3	15	18	Steam	1–24″ 1–5¼″	1–8″ 1–4¾″	160′ 40′	Ex. steam	27/12/13
Waikato Coalfield.																										
United Collieries	F. J. Tattley	2	Brown	1	54′	20′ to 30′	Varied	„	2	9′ x 9′ 4′ x 4′ Tunnel 6′ x 6′	139′ 90′ 300′	Dip	21,651	..	21,651	120,963	142,614	17	21	38	„	1–24″	1–14″	120′	Fan	22/8/13
Taupiri Coal-mines (Limited)— Extended Mine	William Wood	25	„	1	10′ to 34′	20′	1 in 10	„	2	10′ diameter	166′ 207′	Shaft	89,636	38,545	128,181			52	230	282	„	1–12″ 1–20″	2–5″ 1–6″	204′ 400′	„	13/12/13
Ralph's Mine	James Fletcher	22	„	1	10′ to 60′	20′	1 in 10	„	3	2–9′ x 5½′ 1–8½′ diameter	190′ 220′ 140′	„	64,629	25,318	89,947	2,495,263	2,713,391	46	180	226	„	1–12″ 1–18″ 1–12″	2–6″ 1–6″ 2–5″	190′ 380′ 230′	„	21/8/13
Pukemiro Collieries (Limited)	Edward S. Wight	..	„	..	16′ to 18′	..	1 in 25	„	..	Tunnel 10′ x 6½′	75′	Dip	..	..	..	..	..	10	..	10	..	..	..	..	..	..
Waipa Railway and Colliery (Limited)	Thomas Thomson	..	„	..	11′	8′	1 in 6	„	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Huntly Coal Brick Works	R. Greenwell	1	„	1	5′ to 20′	5′ to 11′	Level	„	1	4′ x 3′	8′	„	3,187	350	3,537	600	4,137	1	4	5	Manual	..	..	..	Natural	19/8/13
Mokau Coalfield.																										
Mangapapa Colliery	William Lennox	29	„	1	6′ to 8′	6′ to 8′	1 in 10	„		Tunnel 9′ x 6′	1,752′	Adit	3,560	..	3,560	77,348	80,908	2	8	10	Horse	..	..	..	Fan	29/9/13
Out of mines included in previous statements at which operations are suspended or abandoned																2,069,209	2,069,209									
WEST COAST INSPECTION DISTRICT.																										
Nelson Coalfield.																										
Puponga Colliery	P. McCaffrey	10	Bituminous	1	7′ to 10′	All	1 in 3½	Bord and pillar		10′ x 6′ 6″	41 ch.	Direct haulage	7,469	615	8,084	160,101	168,185	23	37	60	Steam	14″ 8″ 5″ 10″	8″ 4½″ 3½″ 6″	270′	Fan	15/12/13
Mount Burnett (Collingwood) (under development)	..	..	„	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	3	13	..	..	..	..	..	1/9/13
North Cape	Job Hughes	3	„	1	3′ 6″ to 5′ 6″	All	1 in 3	Bord and pillar		7′ x 7′	18 ch.	Horse haulage	6,047	586	6,633	6,366	12,999	12	19	31	Horse	..	..	..	Natural	15/12/13
Buller Coalfield.																										
Seddonville State Colliery	I. A. James	10	„	1	12′	All	Variable	Ditto	1	6′ x 12′ 10′ x 7′	150 ft. 72 ch.	Endless rope	30,137	21,757	51,894	472,797	524,691	17	71	88	Steam	..	..	..	Fan	13/10/13
Westport Stockton Coal Company (Limited)	H. McAvoy	5	„	1	4′ to 20′	12′ to 14′	„	„	1	*B* 8′ x 7′ *C* 13′ x 8′ *D* 13′ x 7′ *E* 10′ x 8′	60 ch. 26 ch. 13 ch. 3 ch.	Endless rope, electric locomotives	66,343	26,972	93,315	457,160	550,475	40	140	180	Electric	..	..	..	„	28/10/13
Westport Coal Company (Ltd.)— Millerton Colliery	W. McCormack	22	„	1	4′ to 40′	12′	„	„	1	10′ x 7′ 11′ x 7′ 12′ x 7′ 10′ x 6′	72 ch. 53 ch. 11 ch. 24 ch.	Endless rope	243,460	49,116	292,576	3,761,423	4,053,999	116	471	587	Gravity	..	..	..	„	23/10/13
Ironbridge Colliery (Denniston)	G. Smith	22	„	2	3′ to 30′	All	„	„	1	10′ x 6′	76 ch.	„	190,736	50,639	241,375	6,344,435	6,585,810	146	413	559	Steam	Two Tangyes 8″ x 4″ x 12″			„	5/12/13
Coalbrookdale Colliery (Denniston)	N. Milligan	32	„	1	4′ to 20′	„	„	„	1	10′ x 6′ 10′ x 6′	44 ch. 25 ch.	„										Cameron 8″ x 4″ x 12″			„	4/12/13
Whitecliffs Colliery, Buller Road	J. H. Burley (P.)	13	„	1	16′ to 20′	9′	1 in 4	„		12′ x 9′	1¼ ch.	Hand haulage	42	..	42	6,966	7,008	..	2	2	Horse	..	..	..	Natural	18/10/13
Rocklands Colliery	J. P. Burley (P.)	12	„	1	16′ to 20′	8′	1 in 4	„		10′ x 8′	2 ch.	„	81	..	81	6,003	6,684	..	2	2	„	..	..	..	„	18/10/13
Inangahua Coalfield.																										
Coghlan's Freehold, Capleston	J. Coghlan (P.)	17	„	1	10′	All	1 in 3	„		6′ x 6′	9 ch.	„	28	158	186	4,917	5,103	..	2	2	„	..	..	..	„	5/11/13
Archer's Freehold	J. W. Archer (P.)	18	„	2	10′	„	1 in 3	„		7′ x 5′	12 ch.	„	740	..	740	16,716	17,456	1	3	4	„	..	..	..	„	5/11/13
Waitahu Coal-mine	I. Rhodes (P.)	11	„	1	14′	8′	1 in 4	„		10′ x 6′ 6″	7 ch.	„	150	..	150	4,268	4,418	2	2	4	„	..	..	..	„	10/11/13
Burke's Creek Coal-mine	J. Harris (P.)	12	„	1	12′ to 15′	8′	1 in 4	„	1	12′ x 8′	10 ch.	„	3,124	1,110	4,234	14,791	19,025	1	6	7	„	..	..	..	„	10/11/13
Lockington's Coal-mine	E. F. Lockington (P.)	12	„	1	12′ to 15′	8′	1 in 4	„		10′ x 8′	6 ch.	„	450	..	450	2,295	2,745	..	2	2	„	..	..	..	„	10/11/13
Phœnix and Venus, Murray Creek	W. Knight (P.)	32	„	1	30′	10′	1 in 2	„		6′ x 4′	5 ch.	„	2,618	..	2,618	29,459	32,077	2	3	5	„	..	..	..	„	7/11/13
Watson and Moyle's	G. Ward (P.)	5	„	1	12′	12′	1 in 4	„		8′ x 6′	7 ch.	„	240	1,197	1,437	3,904	5,341	2	2	4	„	..	..	..	„	7/11/13
Lankey's Creek Coal-mine	F. Knight (P.)	11	„	1	8′	8′	1 in 20	„		7′ x 5′	3½ ch.	„	Nil	..	Nil	17,313	17,313	3	..	3	„	..	..	..	„	20/11/13
Golden Point Coal-mine	R. L. Kearns (P.)	5	„	1	10′	10′	1 in 3	„		6′ x 5′	4½ ch.	„	327	..	327	1,258	1,585	..	2	2	„	..	..	..	„	6/11/13
Loughlan's Coal-mine	R. L. Kearns (P.)	8	„	1	5′	5′	1 in 6	„		10′ x 5′	12½ ch.	„	1,340	..	1,340	9,571	10,911	..	2	2	„	..	..	..	„	6/11/13
Merrijigs Coal-mine	H. Grigg (P.)	3	„	1	8′	8′	Variable	„		6′ x 4′	2 ch.	„	763	..	763	394	1,157	..	3	3	„	..	..	..	„	6/11/13
Reefton Coal-mine	C. A. Svenson (P.)	11	„	1	8′	8′	1 in 4	„		6′ x 5′	10 ch.	„	539	924	1,463	4,112	5,575	1	2	3	„	..	..	..	„	8/11/13
Grey Coalfield.																										
Paparoa Colliery	J. A. C. Bayne	5	„	1	8′ to 16′	12′	Variable	„		10′ x 7′ 6″	49½ ch.	Endless rope	18,692	13,177	31,869	71,360	103,229	25	60	85	Gravity	..	..	..	Fan	1/10/13
Blackball Colliery	J. Watson	23	„	2	15′	15′	1 in 6	„	2	9′ x 6′	18½ ch.	„	93,494	50,342	143,836	1,672,824	1,816,660	50	300	350	Steam and electric	6″ 9″	4″ 9″	90′ 90′ Three turbines	„	24/11/13
North Brunner Colliery	J. Armstrong	4	„	1	6′ to 12′	12′	1 in 3	„	2	9½′ x 6½′	6 ch.	Endless rope, gravity inclines	3,637	3,500	7,137	36,545	43,682	20	50	70	Steam	..	..	..	„	2/4/13
Brunner Colliery	R. Allison	49	„	1	12′	All	1 in 4	„	3	12′ x 10′ 12′ x 10′ 14′ x 6′	4 ch.	Direct haulage	8,410	14,214	22,624	2,321,271	2,343,895	12	40	52	„	11″ 6″	7″ 4″	40′ 25′	„	22/11/13
Point Elizabeth State Collieries— No. 1 Section	J. Coulthard	9½	„	1	8′ to 16′	8′ to 10′	Variable	„		10′ x 7′	11 ch.	Endless and direct haulage	67,638	67,638	135,276	1,602,298	1,737,574	61	177	238	„	2′ 9″ 3′	8″ 12″	380′ 520′	„	25/11/13
No. 2 Section	J. Coulthard	9½	„	2	4′ to 12′	All	1 in 5	„		10′ x 7′	12 ch.	Ditto														
"Liverpool" Section	H. Sowerby	..	„	2	6′ to 20′ 4′ to 6′	8′ to 10′ All	Variable	„		12′ x 7′	35 ch.	„	4,600	4,514	9,114	Nil	9,114	13	40	53	Gravity	..	..	..	„	25/9/13
Output of mines included in previous statements at which operations are abandoned or suspended																1,562,453	1,562,453									
SOUTHERN INSPECTION DISTRICT.																										
Canterbury.																										
Broken River, Broken River	W. J. Cloudesley	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	4	..	..	..	..	..	..
Springfield, Springfield	J. Taylor (P.)	37	Brown and fireclay	2 1	2′ 5′	All	1 in 6	Bord and pillar	1	6′ x 4′	80′	Shaft	132	175	307	91,687	91,994	1	4	5	Steam	..	Direct acting steam	50′	Exhaust steam from pump	9/10/13
Sheffield Fireclay, Sheffield	John Austin	..	Fireclay	1	8′	„	1 in 10	Ditto		..	..	Adit	..	..	..	..	..	2	..	2	..	..	..	..	..	..
Homebush, Glentunnel	James Lamont	41	Brown	1	5′	„	1 in 3	„	1	4′ x 3′ 6′ x 5′	50′ 10 ch.	Adit	8,853	879	9,732	277,546	287,278	12	20	32	Horse and steam	..	Tangye pump	50′	Steam jet	10/10/13
St. Helens, Whitecliffs	William Thin (P.)	32	„	1	6′	„	1 in 3	„		6′ x 5′ 4′ x 3′	5 ch. 80′	Engine plane	1,287	..	1,287	21,113	22,400	1	2	3	Steam	..	Tangye	50′	Exhaust steam from pump	11/10/13
Tripp's, Mount Somers	J. McClimont (P.)	47	„	1	40′	15′	1 in 9	„		7′ x 6′	5 ch.	Adit	2,412	..	2,412	59,969	62,381	..	3	3	Horse	..	..	..	Natural	15/10/13
Albury, Albury	Robert Riddle (P.)	22	„	1	12′	8′	1 in 6	„		6′ x 5′ 4′ x 3′	5 ch. 68′	„	582	..	582	12,726	13,308	1	1	2	„	..	Tangye	30′	„	10/9/13
Dalgety, Hakataramea	C. W. Enson	32	„	1	30′	15′	Semi-vertical	Levels	..	..	..	„	110	..	110	3,257	3,367	..	..	..	..	..	..	..	..	..
North Otago.																										
St. Andrew's, Papakaio	T. Nimmo (P.)	35	Brown	1	7′	6′	1 in 8	Bord and pillar		6′ x 6′ 4′ x 3′	5 ch. 60′	„	1,887	..	1,887	47,998	49,885	1	4	5	Horse	..	..	..	Furnace	..
Prince Alfred, Papakaio	A. Beardsmore (P.)	44	„	1	9′	7′	1 in 9	Ditto	1	5′ x 6′ 4′ x 3′	5 ch. 51′	„	914	..	914	57,039	57,953	1	2	3	„	..	..	..	Natural	..
Ngapara, Ngapara	W. Nimmo (P.)	35	„	1	25′	8′	1 in 7	„	1	6′ x 6′ 4′ x 4′	10 ch. 50′	„	606	..	606	28,463	29,069	1	1	2	„	..	..	..	„	..
Broadleaf, Shag Point	G. W. Brooke (P.)	5	Pitch	1	5′	All	1 in 10	„		6′ x 5′	150′	„	738	195	933	2,282	3,215	1	3	4	„	..	..	..	„	8/10/13
Shag Point, Shag Point	C. Clasen (P.)	5	„	1	3′	„	1 in 6	„	1	6′ x 5′ 4′ x 4′	250′ 25′	„	527	222	749	5,540	6,289	1	3	4	„	..	..	..	„	8/10/13
Allandale, Shag Point	A. McIntosh	26	„	1	7′	„	1 in 4	„		6′ x 5′ 5′ x 4′	350′ 60′	Engine plane	515	200	715	321,105	321,820	1	2	3	Steam	..	Tangye	60′	Furnace	8/10/13

ANNEXURE C—*continued.*

STATISTICS of WORKINGS in COAL-MINES, 1913—*continued.*

Name of Mine and Locality.	Name of Manager.	Number of Years worked.	Quality of Coal.	Number of Seams worked.	Thickness of Seams.	Thickness worked.	Dip of Seam.	System of Underground Working.	Dimensions of Shafts. Number of Shafts.	Size of Shaft or Adit.	Depth of Shaft or Length of Adit.	Output delivered by	Output for 1913. Coal.	Slack.	Total.	Approximate Total Output to 31st December, 1912.	Approximate Total Output to 31st December, 1913.	Number of Men ordinarily employed. Above.	Below.	Total.	Power used for drawing Mineral.	Pumps. Stroke.	Size of Barrel.	Height of Column	Means of Ventilation.	Date of Inspector's last Visit.
SOUTHERN INSPECTION DISTRICT—*continued.*													Tons.	Tons.	Tons.	Tons.	Tons.									
South Otago.																										
Fernhill, Abbotsford	James Gray	36	Brown	1	15′	12′	1 in 10	Bord and pillar	1	6′ x 6′ / 4′ x 4′	5 ch. / 30′	Adit	6	1,093	1,099	151,998	153,097	9	2	11	Self-acting incline	..	..	..	Natural	30/12/13
Freeman's Coal Company, Abbotsford	James Sneddon	33	,,	1	7′ to 14′	All	1 in 7	Ditto	2	6′ x 6′ / 5′ x 4′	1,400′ / 150′	Engine plane	19,792	2,637	22,429	472,316	494,745	12	30	42	Steam and horse	..	..	..	Fan	30/12/13
Green Island, Green Island	Thomas Barclay, jun.	26	,,	1	10′	8′	1 in 10	,,	1	6′ x 5′ / 4′ x 3′	5 ch. / 35′	,,	187	68	255	118,394	118,649	..	1	1	Ditto	..	Tangye		Exhaust steam	29/12/13
Jubilee, Saddle Hill	Thomas Barclay	16	,,	1	18′	12′	1 in 10	,,	1	6′ x 5′ / 4′ x 3′	10 ch. / 40′	,,	19,685	4,051	23,736	236,403	260,139	7	25	32	,,	..	Tangye		Furnace	29/12/13
Saddle Hill (No. 1), Saddle Hill	W. W. Ogilvie	41	,,	1	20′	15′	1 in 10	,,	..	6′ x 5′ / 4′ x 3′	10 ch. / 100′	,,	2,808	4,981	7,789	207,806	215,595	3	11	14	,,	..	..	..	,,	29/12/13
Saddle Hill (No. 2), Saddle Hill	Robert Hill	12	,,	1	22′	15′	1 in 10	,,	1	6′ x 5′ / 4′ x 3′	5 ch. / 30′	,,	4,334	11,295	15,629	168,691	184,320	9	14	23	,,	..	..	..	Fan	29/12/13
Lauriston, Brighton	J. R. Walker (P.)	27	,,	1	7′	6′	1 in 20	,,	..	6′ x 5′	3 ch.	,,	267	18	285	8,224	8,509	1	1	2	Steam	..	Tangye		Natural	7/1/13
East Taieri, Mosgiel	A. G. Rogers (P.)	1	,,	1	10′	7′	1 in 10	,,	..	6′ x 5′	300′	Adit	700	1,209	1,909	..	1,909	1	5	6	Horse	..	..	..	,,	20/6/13
Waronui, Milton	James Carruthers	9	,,	1	18′	8′	1 in 7	,,	..	6′ x 6′	15 ch.	Engine plane	19,570	2,327	21,897	102,686	124,583	19	26	45	Electric tail-rope system	..	Tangye		Fan	24/11/13
McGilp's, Milton	J. J. Cooper (P.)	9	,,	1	22′	15′	1 in 8	,,	..	6′ x 6′	5 ch.	Adit	5,377	..	5,377	14,111	19,488	1	4	5	Hand	..	..	..	Natural	24/11/13
Taratu, Lovell's Flat	Thomas Shore	12	,,	1	20′	12′ to 15′	1 in 10	,,	2	13½′ x 5½′ / 6′ x 4′	200′ / 185′	Shaft and level	11,566	4,581	16,147	158,278	174,425	12	20	32	Steam	..	Tangye		Fan	25/11/13
Hawthorn Den, Kaitangata	John Dahren (P.)	5	,,	1	9′	All	..	,,	..	6′ x 4′	2 ch.	Adit	121	..	121	402	523	1	..	1	Hand	..	..	..	Natural	25/11/13
Wangaloa, Kaitangata	J. Smith	32	,,	1	10′	7′	1 in 6	,,	..	6′ x 5′	1 ch.	,,	20	..	20	2,084	2,104	..	1	1	,,	..	..	..	,,	25/11/13
Longridge, Kaitangata	N. Mackie (P.)	5	,,	1	4′	All	1 in 4	,,	..	5′ x 4′	100′	,,	537	..	537	2,487	3,024	..	3	3	,,	..	..	..	,,	26/11/13
Kaitangata Collieries (2), Kaitangata	A. S. Gillanders	37	,,	3	50′ in aggregate	,,	1 in 1½ to 1 in 30	,,	1	10′ x 7′ / 8′ x 4½′	51 ch. / 580′	Engine plane, endless rope haulage	98,902	47,002	145,904	2,841,942	2,987,846	83	322	405	Steam and compressed air	2′ 6″	6″	280′	Fans (2)	19/12/13
Castle Hill, Kaitangata	W. Carson	19	,,	4	50′ in aggregate	,,	1 in 1½ to 1 in 20	,,	1	11′ x 6½′ / 9′ diameter	45 ch. / 526′	Ditto									Ditto	2′ 6″	6″	500′	Furnace	26/11/13 / 25/11/13
Benhar, Stirling	C. Murdoch (P.)	50	Lignite	1	25′	12′ to 16′	1 in 10	,,	..	6′ x 6′ / 4′ x 4′	5 ch. / 50′	Engine plane	5,334	619	5,953	141,962	147,915	1	6	7	Steam	..	Snow pump		Exhaust steam	26/11/13
Mainholm, Waipahi	J. G. Drummond (P.)	28	,,	1	20′	All	..	Open	..	..	..	Open	2,704	..	2,704	59,853	62,557	3	..	3	Horse	..	..	..	..	..
Central Otago.																										
Coal Creek, Roxburgh	J. Barber	43	Lignite	1	20′ to 50′	10′ to 20′	..	Bord and pillar	..	6′ x 5′	2 ch.	Adit	463	..	463	58,007	58,470	1	1	2	Horse	..	Siphon		Natural	6/12/13
McPherson's, Roxburgh	R. McPherson (P.)	43	,,	1	80′	All	..	Open	..	..	..	Open	3,461	..	3,461	58,764	62,225	4	..	4	,,	..	Drainage tunnel		..	6/12/13
Perseverance, Roxburgh	S. Vernon (P.)	26	,,	1	75′	25′	1 in 3	Bord and pillar	..	7′ x 6′	5 ch.	Engine plane	2,291	..	2,291	53,479	55,770	1	3	4	Pelton wheel	Hydraulic jet-pump			Natural	6/12/13
Alexandra, Alexandra	D. Mathias (P.)	32	,,	1	9′	7′	1 in 7	Ditto	1	6′ x 5′ / 5′ x 3½′	5 ch. / 60′	,,	1,248	..	1,248	80,979	82,227	1	3	4	Steam	..	Snow pump		Exhaust steam	25/9/13
Molyneux, Alexandra	A. W. Whittleston	15	,,	1	28′	9′	1 in 20	,,	1	6′ x 4′	80′	Shaft	5,543	1,508	7,051	115,977	123,028	4	12	16	,,	..	Tangye	100′	,,	5/12/13
									1	5′ x 4′	60′															
Cambrians, Cambrians	M. J. Miller	52	,,	1	30′	All	..	Open	..	..	..	Open	173	..	173	47,938	48,111	1	..	1	Horse	..	..	..	..	24/9/13
Lauder vale, Cambrians	Robert Jones	9	,,	1	20′	,,	..	,,	..	..	..	,,	114	..	114	758	872	1	..	1	,,	..	..	..	..	24/9/13
St. Bathan's, St. Bathan's	J. Enright	16	,,	1	Indefinite	..	..	,,	..	..	..	,,	165	..	165	5,456	5,621	2	..	2	,,	..	..	..	..	24/9/13
Rough Ridge, Otirehua	John Beck (P.)	27	,,	1	35′	All	..	,,	..	..	..	,,	737	..	737	27,280	28,017	2	..	2	,,	..	Drainage tunnel		..	23/9/13
Idaburn, Otirehua	J. White (P.)	43	,,	1	20′	,,	..	,,	..	..	..	,,	647	..	647	42,787	43,434	2	..	2	,,	..	Drainage tunnel		..	23/9/13
Otirehua, Otirehua	R. Thomas (P.)	21	,,	1	7′	,,	..	,,	..	..	..	,,	312	..	312	1,725	2,037	1	..	1	,,	..	Douglas pump		..	23/9/13
Gimmerburn, Gimmerburn	C. Dougherty	57	,,	1	12′	,,	..	,,	..	..	..	,,	24	..	24	3,145	3,169	1	..	1	,,	..	..	..	..	..
Clyde, Clyde	G. F. Turner	41	Brown	2	40′	14′	1 in 2	Bord and pillar	..	6′ x 6′	5 ch.	Engine plane	1,401	..	1,401	60,118	61,519	1	2	3	Steam	..	Tangye		Natural	5/12/13
Shepherd's Creek, Bannockburn	W. R. Parcell	36	,,	1	8′	7′	1 in 6	Ditto	..	6′ x 6′	200′	,,	3,907	..	3,907	74,970	78,877	2	11	13	,,	..	Tangye		Exhaust steam	26/9/13
Excelsior, Bannockburn		18	,,	1	6′	5′	1 in 6	,,	..	6′ x 5′	20 ch.	,,	..	..	..	59,202	59,202	..	..	..	,,	..	Tangye		Natural	..
Cairnmuir, Bannockburn	H. C. Russell (P.)	11	,,	1	12′	10′	1 in 1	,,	..	6′ x 6′	5 ch.	,,	3,277	..	3,277	28,815	32,092	2	8	10	,,	..	Tangye		,,	26/9/13
Ranfurly, Bannockburn	George Crabbe (P.)	3	,,	1	10′	All	1 in 1	,,	..	6′ x 5′	150′	,,	27	..	27	654	681	1	2	3	,,	..	..	..	,,	26/9/13
Cardrona, Cardrona	R. McDougall (P.)	29	,,	1	30′	,,	..	Open	..	..	..	Open	290	..	290	24,928	25,218	3	..	3	Horse	..	..	..	..	..
Gibbston, Gibbston	John Duncan	27	,,	1	15′	10′	1 in 5	Bord and pillar	..	6′ x 5′	20 ch.	Adit	850	103	953	19,729	20,682	1	2	3	Steam	..	..	..	Natural	..
Ryder's, Nevis	A. E. Toms (P.)	13	,,	1	45′	20′	Semi-vertical	Levels	..	..	..	,,	1,427	..	1,427	7,934	9,361	1	2	3	Horse	..	..	..	,,	7/3/13
Nevis Crossing, Nevis	R. Ritchie (P.)	10	,,	1	16′	16′	Open	..	..	..	..	Open	840	..	840	10,132	10,972	2	..	2	,,	..	..	..	..	7/3/13
Gold and Scheelite Proprietary, Macrae's	C. W. Gudgeon	7	Lignite	1	10′	All	..	,,	..	..	..	,,	226	..	226	2,590	2,816	1	..	1	,,	..	..	..	..	..
Dillon's, Blackstone Hill	John Dillon	16	,,	1	12′	..	,,	..	..	..	..	,,	18	..	18	225	243	..	..	..	..	..	..	..	..	..
Southland.																										
Pukerau, Pukerau	F. A. Junker (P.)	33	Lignite	1	16′	9′	1 in 8	Bord and pillar	..	7′ x 6′	10 ch.	Adit	925	..	925	38,151	39,076	..	2	2	Horse	..	..	..	Natura	..
Heffernan's, East Gore	D. McAskill (P.)	35	,,	1	20′	12′	1 in 7	Ditto	..	6′ x 6′	5 ch.	Engine plane	2,963	..	2,963	53,829	56,792	1	2	3	Steam	..	Snow pump		,,	6/11/13
Green's, Gore	W. C. Johnston (P.)	25	,,	1	17′	12′	1 in 20	,,	..	10′ x 8′	10 ch.	,,	14,103	..	14,103	128,135	142,238	1	7	8	,,	..	Tangye		Fan	17/12/13
									1	4′ x 3′	50′															
Bushy Park, Croydon	George Flett (P.)	8	,,	1	20′	All	..	Open	..	..	..	Open	1,553	..	1,553	17,651	19,204	2	..	2	Horse	..	Tangye		..	17/12/13
Burnwell, Chatton	D. Cameron (P.)	14	,,	1	20′	12′	1 in 10	Bord and pillar	..	10′ x 8′	5 ch.	Engine plane	4,025	..	4,025	29,475	33,500	1	2	3	Steam	..	Tangye		Natural	6/11/13
Ramsay's, Chatton	J. Buchols (P.)	10	,,	1	20′	18′	1 in 10	Ditto	..	8′ x 6′	10 ch.	,,	7,614	..	7,614	49,970	57,584	1	4	5	,,	..	..	..	,,	6/11/13
Springfield, Waikaka Valley	James Travis (P.)	20	,,	1	17′	10′	1 in 10	,,	..	9′ x 8′	5 ch.	,,	5,365	..	5,365	28,505	33,870	1	3	4	,,	..	Steam pump		,,	6/11/13
Willowbank, Waikaka Valley	E. Charles (P.)	17	,,	1	15′	10′	1 in 10	,,	..	9′ x 8′	5 ch.	,,	3,975	..	3,975	63,960	67,935	1	4	5	,,	..	Steam pump		,,	6/11/13
Glenlee, Waikaka	D. T. McGill (P.)	20	,,	1	14′	All	..	Open	..	..	..	Open	437	..	437	12,676	13,113	1	..	1	Horse	..	..	..	..	6/11/13
Edge's, Waikaka	R. Burgess (P.)	14	,,	1	16′	12′	1 in 4	Bord and pillar	..	8′ x 8′	3 ch.	Engine plane	3,784	..	3,784	34,681	38,465	1	2	3	Steam	..	Steam pump		Natural	6/11/13
Rossvale, Waikaia	Robert Craig (P.)	10	,,	1	10′	8′	1 in 12	Ditto	..	6′ x 5′ / 4′ x 3′	10 ch. / 60′	Adit	2,268	..	2,268	27,856	30,124	1	4	5	Horse	..	..	..	,,	7/11/13
Waikaia, Waikaia	T. D. Moffat	6	,,	1	10′	8′	1 in 6	,,	..	6′ x 5′	5 ch.	Engine plane	152	..	152	14,248	14,400	1	1	2	Steam	..	Steam pump		,,	7/11/13
Argyle, Upper Waikaia	C. H. Hutton (P.)	22	,,	1	20′	All	..	Open	..	..	..	Open	169	..	169	3,939	4,108	1	..	1	Horse	..	..	..	..	..
Waimea, Kingston Crossing	J. E. Johnstone (P.)	5	,,	1	6′	,,	..	Bord and pillar	..	6′ x 6′	2 ch.	Adit	100	..	100	2,473	2,573	..	2	2	,,	..	..	..	Natural	..
Lynch's, Kingston Crossing	James Mason, jun. (P.)	3	,,	1	6′	,,	..	Ditto	..	6′ x 6′	3 ch.	,,	1,089	..	1,089	1,982	3,071	1	1	2	,,	..	..	..	,,	..
Princhester Creek, The Key	W. O. Kempthorne (P.)	11	Brown	1	6′	,,	Irregular	Open	..	..	..	Open	130	..	130	1,161	1,291	1	..	1	,,	..	..	..	..	..
Mataura Collieries (Limited), Mataura	James Broome	17	Lignite	1	17′	12′	1 in 10	Bord and pillar	..	8′ x 6′	5 ch.	Engine plane	11,603	..	11,603	149,515	161,118	3	9	12	Steam	..	Steam pump		,,	5/11/13
Mataura Lignite, Mataura	W. Coster (P.)	37	,,	1	18′	All	..	Open	..	..	..	Open	9,371	..	9,371	116,944	126,315	9	..	9	Horse	..	Steam pump		..	5/11/13
Boghead, Mataura	W. Kyle (P.)	15	,,	1	16′	,,	..	,,	..	..	..	,,	1,755	..	1,755	19,822	21,577	3	..	3	,,	..	Steam pump		..	5/11/13
Waimumu, Mataura	G. W. Williams (P.)	14	,,	1	9′	7′	..	,,	..	..	..	,,	208	..	208	30,176	30,384	1	..	1	,,	..	Steam pump		..	..
Heatherlea, Mataura	F. Barber	2	,,	1	..	..	..	,,	..	..	..	,,	97	..	97	44	141	1	..	1	,,	..	..	..	..	..
Ota Creek, Wyndham	E. Genge (P.)	33	,,	1	6′	All	..	,,	..	..	..	,,	710	..	710	16,209	16,919	1	..	1	,,	..	Steam pump		..	..
Clarke's, Wyndham	G. W. Clarke (P.)	7	,,	1	12′	,,	..	,,	..	..	..	,,	1,420	..	1,420	9,761	11,181	2	..	2	,,	..	Steam pump		..	..
Robin Hood, Pine Bush	J. Conser	32	,,	1	14′	,,	..	,,	..	..	..	,,	56	..	56	3,231	3,287	1	..	1	,,	..	..	..	..	..
Graham's, Fairfax	P. S. Graham	35	,,	1	6′	,,	1 in 20	Bord and pillar	..	5′ x 5′	5 ch.	Adit	19	..	19	16,598	16,617	1	..	1	Hand	..	..	..	Natural	..
Nightcaps, Nightcaps	W. Barclay	32	Brown	3	36′ in aggregate	34′	1 in 7	Ditto	..	10′ x 10′ / 9′ x 6′	20 ch. / 20 ch.	,,	79,645	..	79,645	878,449	958,094	38	96	134	Steam, compressed air, and horse	..	Three tangyes		Two fans	18/12/13
New Brighton, Nightcaps	A. Hunter	7	,,	1	12′ to 20′	12′	1 in 7	,,	..	6′ x 6′	5 ch.	,,	3,587	..	3,587	18,067	21,654	2	5	7	Steam	..	..	..	Natural	18/12/13
Wairio, Nightcaps	R. Sheddan	8	,,	1	17′	9′	..	,,	..	8′ x 8′	2 ch.	,,	..	..	..	4,152	4,152	..	..	..	,,	..	..	..	,,	18/12/13
Beaumont, Nightcaps	T. Moss (P.)	5	,,	1	20′	15′	1 in 4	Open	..	..	..	Open	775	..	775	3,357	4,132	3	..	3	,,	..	Steam pump		..	18/12/13
Mount Linton, Nightcaps	Thomas Thomson	19	,,	1	20′	15′	..	,,	..	..	..	,,	746	..	746	2,383	3,129	2	..	2	,,	..	Steam pump		..	..
Diamond Lignite Company (lately Bush Siding), Seaward Bush	A. Dixon (P.)	11	Lignite	1	32′	All	..	,,	..	..	..	,,	936	..	936	6,613	7,549	2	..	2	,,	..	Steam pump		..	..
Lynwood, Te Anau	T. Roberts (New Zealand Tourist Department)	13	,,	1	7′	,,	..	,,	..	..	..	,,	124	..	124	1,765	1,889	1	..	1	..	..	..	..	..	..
PRIVATE PITS.																										
Wellwood Park, Pukerau	A. M. Mason	12	Lignite	1	7′	All	..	Open	..	..	..	Open	24	..	24	248	272	..	..	..	..	..	..	..	..	..
Otikerama Station, Pukerau	W. J. Poight	16	,,	1	7′	,,	..	,,	..	..	..	,,	..	..	..	300	300	..	..	..	..	..	..	..	..	..
Riverview, Gore	J. Nicol	..	..	..	..	..	..	..	..	..	..	..	50	..	50	1,756	1,806	..	..	..	..	..	..	..	..	..
Tuach's, Waimumu	J. Tuach	7	Lignite	..	..	..	..	Open	..	..	..	Open	..	..	..	81	81	..	..	..	..	..	..	..	..	..
Output of mines included in previous statements at which operations are suspended or abandoned													..	..	..	2,044,989	2,044,989	..	..	..	..	..	..	..	..	..
Totals, Southern District, South Island													397,692	83,163	480,855	10,235,106	10,715,961	307	708	1,015						
Totals, West Coast District, South Island													751,105	306,459	1,057,564	18,591,600	19,649,164	557	1,854	2,411						
Totals, North Island													285,373	64,213	349,586	6,336,751	6,686,337	189	635	824						
Grand Totals													1,434,170	453,835	1,888,005	35,163,457	37,051,462	1,053	3,197	4,250						

	Tons.
Output of mines included in statement for 1890, but whose operations were suspended prior to 1890 (less three, which are again included in body of statement—namely, Hill's Creek, 779 tons; Lovell's Flat, 323 tons; Wyndham, 1,988 tons: total, 3,090 tons)	132,732
Output of mines included in former statements, but whose operations were suspended prior to 1889	172,529
Output of Waikaka, Adam's Flat, and Waimea Mines, inserted twice in statement for 1891	6,518
	37,363,241

APPENDIX C.

GEOLOGICAL SURVEY BRANCH

(EIGHTH ANNUAL REPORT (NEW SERIES) OF THE).

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LETTER OF TRANSMITTAL.

SIR,— Geological Survey Office, Wellington, 1st June, 1914.

I have the honour to forward herewith the eighth annual report of the Geological Survey Branch of the Mines Department, dealing with the twelve months ending 31st May, 1914.

I have, &c.,

P. G. MORGAN,

The Hon. the Minister of Mines, Wellington. Director, N.Z. Geological Survey.

REPORT.

SUMMARY OF FIELD OPERATIONS.

DURING the twelve months ending 31st May, 1914, the detailed survey of the Reefton Subdivision was continued by Dr. J. Henderson, Mining Geologist, assisted by Mr. H. S. Whitehorn, Assistant Topographer, and a full field party. The survey was brought to a conclusion, and a detailed report upon the area will be prepared during the coming winter. The Reefton Subdivision, it may be mentioned, consists of the survey districts of Waitahu, Reefton, Inangahua, Mawheraiti, Maimai, Waiwhero, Temiko, Punakaiki, and Brighton. It therefore has an area of over 1,000 square miles, and is thus the largest subdivision that has been geologically surveyed in detail to date.

In order to furnish reports required by the Mines Department, visits occupying from a few days to several weeks were made by members of the staff to a number of localities, including the Warkworth, Woodville, Gisborne–East Cape, southern Hawke's Bay, northern Wairarapa, New Plymouth, and Waikaka districts. In addition, the Director visited Parapara, Seddonville, and Greymouth in connection with matters of a special nature.

PALÆONTOLOGICAL WORK.

Until his transfer to the Museum in January last Dr. J. Allan Thomson continued work on the late Cretaceous and Tertiary fossils, with especial reference to the Tertiary Brachiopoda. Mr. Henry Suter, of Christchurch, was engaged during the greater part of the year in the examination of Tertiary fossils, and in the revision of type specimens. Various specialists in Europe and Australia, including Dr. Newell Arber, Mr. Henry Woods, Mr. T. H. Withers, Professor Otto Wilckens, Mr. W. S. Dun, and Mr. F. Chapman, have gratuitously examined collections selected from the Palæozoic and Mesozoic fossils. A fuller account of the work being done will be found in Dr. Thomson's report on a later page.

A beginning in the work of distributing duplicate fossils has been made, small collections having been forwarded to the various schools of mines throughout the Dominion, and a considerable number of specimens set aside for the museums and University colleges.

OFFICE AND MISCELLANEOUS INDOOR WORK.

The so-called office-work of the Geological Survey is of a varied nature. The total amount of almost purely clerical or routine labour is considerable, but at present this is performed mainly by the professional members of the staff, to the detriment of more technical work. Besides the ordinary correspondence, numerous requests for information in connection with geology, mining, and mineral occurrences have to be answered. In some cases a considerable amount of search through the available literature and lengthy replies are necessary, the most notable instance of this kind being an inquiry concerning New Zealand lakes, to which an answer covering thirty-eight pages of foolscap was given. The care of the library, without which the writing of adequate reports would be impossible, takes much time.

Other indoor work of the staff includes as much indexing as time allows, the preparation of rock sections, examination of mineral and rock specimens, &c. In addition, the Director has special duties as a member of the Boards of Examiners under the Mining and Coal-mines Acts and of the Loan Board constituted by the Mining Amendment Act, 1911.

CHANGES IN STAFF.

In January of this year Dr. J. Allan Thomson, Palæontologist, was transferred to the Dominion Museum as Director. The vacancy thus made has not yet been filled. Work on the fossil collections, however, has not been wholly discontinued, for Mr. Henry Suter has been specially engaged for a period of three years to continue his work on the Tertiary Mollusca. Under the agreement made Mr. Suter is to devote nine months of each year to Geological Survey work.

At the end of January Mr. J. A. Bartrum, Assistant Geologist, resigned in order to take an appointment on the staff of the Auckland University College. His place has been doubly filled by the appointment of Messrs. W. Gibson, B.E., A.O.S.M., and M. Ongley, M.A., as Assistant Geologists.

Publications.

The final proofs of Bulletin No. 16, written by Dr. Henderson, and entitled "The Geology of the Aroha Subdivision, Hauraki," were read in August last, but the bulletin was not issued until nearly the middle of March of this year. It contains a complete account of an area which extends southwards from the Waihi Subdivision to the Tauranga and Matamata districts, and includes the Karangahake and Te Aroha goldfields. Palæontological Bulletin No. 1, by Dr. Allan Thomson, entitled "Materials for the Palæontology of New Zealand," mentioned in my last report as nearly ready for publication, was issued in April of this year.

Towards the end of 1913 a "List of the Minerals of New Zealand," prepared by Mr. J. A. Bartrum and myself, was issued with the "Catalogue and Description of Exhibits of the Mines Department" printed in connection with the Auckland Exhibition, and was also published separately.

Palæontological Bulletins Nos. 2 and 3 are now in the hands of the Government Printer. Other reports, including an account of the Tertiary Brachiopoda of New Zealand and a bulletin dealing with the geology and mineral resources of the Buller-Mokihinui Subdivision, are in an advanced stage of preparation.

Library.

A number of United States Geological Survey bulletins which were missing from the library set, a few standard works, and various other publications have been added to the library by purchase. In addition, various technical journals have been obtained and the usual exchanges received from foreign geological surveys and other scientific institutions. A manuscript catalogue of the books in the library has been prepared, and is brought up to date from time to time. Many of the exchanges and journals received have been bound during the year, but a considerable quantity of unbound material has accumulated, most of which is worth preserving.

OFFICERS' REPORTS.

DR. J. HENDERSON, MINING GEOLOGIST.

Dr. Henderson, Mining Geologist, submits the following summary report on his work during the past twelve months:—

My work for the past year has comprised the final revision of Bulletin No. 16, reports on the coal possibilities of the Warkworth district and on oil prospects in the Warwick district, and field-work in the Reefton Subdivision.

Reefton Subdivision.

Introduction.

The second season's field-work in the Reefton Subdivision was commenced in September, 1913, and was continued without interruption to the end of May, 1914. The writer was assisted throughout by Messrs. H. S. Whitehorn and F. Fulton Wood, topographers, and for a short period by Mr. W. Gibson, geologist. The areas topographically and geologically surveyed include portions of Inangahua, Maimai, Waitahu, Waiwhero, and Temiko survey districts, and the whole of Reefton, Punakaiki, and Brighton survey districts. The 1913–14 season was very favourable for outdoor work, and it was thus found possible to complete the field-work necessary for writing the detailed report on the subdivision.

Physiography and Structure.

The surface of the Reefton Subdivision is exceedingly diversified; mountain-chains with peaks rising over 5,000 ft. traverse the district from end to end; between these lies a great structural valley for the drainage of which the two largest river systems of the West Coast compete. The topography is but the expression of the underlying earth-structure. Great fracture-zones have been traced, which divide the subdivision into earth-blocks, three of which are relatively elevated and form the Victoria, Brunner, and Paparoa ranges, while the Mawheraiti–Inangahua Valley and the limestone plateau between the Paparoas and the coast form the depressed blocks. The evenness of the sky-line of the mountain-ranges suggests that they have been carved from elevated peneplains. Although no glaciers or permanent snowfields now exist within the subdivision, there is abundant evidence that the higher portions of Victoria and Paparoa ranges were at one time glaciated, and that the great piedmont glacier of Westland extended as far north as Merrijigs Hill.

General Geology.

The basement-rocks of the subdivision consist of thick layers of greywacke interbedded with minor bands of argillite. These beds, though entirely devoid of fossils, are believed to be of Silurian and Ordovician age, and in part probably represent the Aorere Series of the Collingwood district. They have been subjected to powerful stresses which have found relief in sharp folding and intense fracturing, and, in addition, have been intruded by vast granite bathyliths and penetrated by a widespread system of basic dykes. Later than, but in close connection with these latter, are quartz veins, which have a great development along the principal zones of fracture.

Quartzites, argillites, and limestones, with fossils proving a Lower Devonian age, form a rock sequence known as the Reefton Series. The area covered by these rocks is very small, and their exact relationship to the preceding series is unknown, but for reasons which cannot be here

detailed there is little doubt but that the Silurian beds underlie the Reefton Series. The quartzites and limestones must be regarded as the remnants of a once widespread sheet preserved from destruction by deep involvment in great fault movements.

Thick beds of conglomerate form the lowest beds of the formation next in age. From their nature these beds vary in thickness and composition in adjoining localities, and are at many places not represented in the sequence of the series of which they form a part. They are succeeded by grits, sandstones, and shales often containing valuable coal-seams.

Overlying with undoubted discordance are Miocene beds represented in the coastal province by grits, sandstones, limestones, and claystones in that order. Within the Inangahua–Mawheraiti Valley the limestones shrink to insignificant bands and sometimes entirely disappear, their places being taken by claystones and sandstones, while the uppermost claystones become soft sandstones and conglomerates. There is evidence that much overlap occurs in connection with this series. Irregular seams of brown coal, sometimes of great thickness, may be intercalated among the basal beds of any locality. An interesting feature of the Miocene rocks of the west coast is the amount of fragmental coal they carry. In the Greymouth and Buller-Mokihinui subdivisions these fragments appear to be almost entirely confined to the lower beds, but in the Reefton Subdivision the higher strata contain them over a considerable area near the mouth of the Punakaiki River.

Quaternary deposits of various ages are widely distributed. They consist of beach gravels up to 450 ft. above present sea-level, moraines, fluvio-glacial and fluviatile gravels.

Economic Geology.

The subdivision contains a variety of minerals of economic value, among which may be mentioned platinum, stibnite, arsenical pyrites, copper-pyrites, molybdenite, stream-tin, and monazite. Of these only stibnite and arsenical pyrites appear to offer economical possibilities. The abundant brick-clays, cement-stones, fireclays, and alum shales are likely at no distant date to be of commercial importance. There is an inexhaustible supply of excellent building-stone in the granite and Miocene limestone of the district, while the Devonian limestone will also furnish a considerable amount. The Devonian limestone has already been utilized as a source of agricultural lime, and there is no reason why the purer beds of the Miocene limestone should not furnish first-class quicklime. At present the prosperity of the inhabitants of the subdivision depends largely upon the exploitation of its gold and coal deposits.

Auriferous Quartz Veins.—Innumerable quartz veins traverse the Aorere rocks. The payably auriferous lodes, which form but a small percentage of the whole, lie chiefly in a belt of country over twenty miles in length stretching from Larry's Creek to Snowy River. The lodes, which occupy fault planes, occur in four well-marked systems, in two of which they strike west of north, and in the other two, east of north. The ore is found in shoots which all pitch to the northward; in the northern portion of the district the dip is to the eastward, but in the central and southern portions it changes to the westward. Several of the shoots have been worked to a vertical depth of over 1,500 ft., and have been found, in a general way, to maintain their size and tenor to that depth. In the Reefton field the problems in mining are in no way connected with the irregular distribution of the pay-ore owing to a secondary concentration, but are confined to the purely mechanical difficulties brought about by fault movements.

Alluvial Gold.—Alluvial deposits of various ages and many forms are found within the subdivision. Cements at the base of the older coal formation are being actively worked at Lankey Creek and Globe Hill, and have in the past received attention at Murray and Boatman creeks. A similar bed of quartz cement occurs at the base of the Miocene in Garden Gully, and, although not itself worked, has yielded, by its degradation, richly auriferous alluvium. That the Old Man Bottom gravels of late Miocene or Pliocene age carry gold has been cogently maintained by McKay, who believes them to be sometimes payably auriferous. The Pleistocene morainic and fluvio-glacial gravels which cover the hills from Merrijigs to Waiuta and again at Nobles are still being worked. River-terraces within the subdivision have in the past yielded large quantities of gold, and the beds of Boatman, Antonio, and Mawheraiti streams are at present being dredged with highly remunerative results. Marine equivalents of the Quaternary terrestrial deposits occur at various places along the coast. These, which in the early days of the Coast were famous for their richness, are now all but exhausted, one claim only being still regularly worked.

Coal.—Although, up to the present, the greater portion of the coal mined in the Reefton district has been for local household and power purposes, nevertheless in the near future the writer anticipates a large external trade.

The coals of the subdivision occur in two series of different geological age. The older series contain the pitch-coals of Reefton, the little-known anthracite of the Fox River, and a small area of bituminous coal on the divide between the Punakaiki and Big rivers. The younger series, of Miocene age, carries the brown coals and lignites of the Inangahua Valley and of the coastal belt from the Waiwhero to Charleston.

The principal area of the older series lies in the vicinity of Reefton, where for a distance of nearly eight miles thick seams of pitch-coal are exposed along the eastern edge of the great rift-valley, upturned by the powerful faults which bound it. That the coal-measures lie beneath the Miocene strata and Quaternary gravels which fill the Inangahua Valley there is no doubt, but in the absence of all data in the way of bores it is impossible to give even the roughest estimate of the amount of coal available, or do more than state that a coalfield of great size and value almost certainly extends beneath the valley-floor. Outliers of the same coalfield lying at a higher level occur in troughs among the hills to the east of Reefton.

The anthracite of the Fox River occurs in faulted strata dipping at high angles, and the proved extent of the field is very small.

Miocene rocks form the whole floor of the rift-valley from Landing Creek northward. Outcrops are found as far south as the Waitahu River on the eastern side, and as Giles Creek on the western. Coal-seams nearly always of good workable thickness occur in every creek on the flanks of the Brunner Range, while on the Paparoa side large seams outcrop in Giles and Fletcher creeks. All the coals are brown coals of somewhat variable composition which are low in ash.

In the Barrytown–Brighton district a 20 ft. seam outcrops in the Waiwhero, a 16 ft. seam in Limestone Creek, and an 8 ft. seam near Brighton. Although these were the only outcrops noted, there is little doubt but that numerous coal-lenses lie beneath the limestone plateau. The strata in this district are generally horizontal, and talus from the great limestone cliffs hides the soft coal-bearing beds at the base of the formation. The coals are utilized to a small extent for household purposes, for which they are admirably adapted.

DR. J. ALLAN THOMSON, PALÆONTOLOGIST.

Dr. Thomson, Palæontologist, left the Geological Survey to assume the position of Director of the Dominion Museum on the 12th January, 1914. Since that time, however, he has dealt with matters arising out of his previous work. He reports on his work as follows:—

Introduction.

My work during the past year may be classed under the following headings:—

(1.) Sorting of collections for specialists, together with correspondence in regard to the collections sent out. This work has continued to occupy a great deal of my time.

(2.) Study of Tertiary Brachiopoda.

(3.) Extraneous reports. In June, 1913, I reported on the "Mineral Prospects of the Maharahara District."

(4.) Field-work. A brief visit was paid during the Christmas holidays to the Pliocene beds of Castlecliff, Wanganui, resulting in the addition of a considerable number of species to the show collection. Some Pliocene fossils were obtained during my visit to Maharahara earlier in the year.

Progress of the Descriptive Palæontology.

Tertiary Mollusca.

Mr. Henry Suter, of Christchurch, was, on the 1st August, 1913, appointed Consulting Palæontologist on Tertiary Mollusca for a period of three years. He has since determined large collections of shells, and has described and named seventy-seven new species. The collections examined were as follows:—

(1.) Collections from the Westport, Inangahua, and Mokihinui districts made by the Director, and earlier collections from the same districts made by Mr. A. McKay.

(2.) Large collections from the Waipara and Weka Pass districts, North Canterbury, and the Waihao district, South Canterbury, recently collected by myself.

(3.) Collections from Blue Cliffs, Kakahu, Pareora, and Sutherlands, in South Canterbury, submitted by Mr. C. Gudex.

(4.) Collections from Target Gully, Oamaru, Wharekauri, Otiake, and Komiti Bluff, Kaipara, submitted by Professor P. Marshall.

(5.) Collections from Waipara, Weka Pass, and Greta Creek, North Canterbury, submitted by Mr. A. Purchas.

(6.) Large collections from various localities near Oamaru, submitted by Mr. G. Uttley.

(7.) A commencement has been made on the very large old collections from South Canterbury and Waitaki Valley localities.

The first and second parts of Mr. Suter's "Revision of the Tertiary Mollusca," &c., are now in the press as Palæontological Bulletins Nos. 2 and 3. The manuscript for a further bulletin dealing with the new species is practically ready for the press. The lists of determinations of the fossils of the Westport, Inangahua, and Mokihinui districts will be included in the ordinary (areal) bulletins dealing with those districts. It is intended to issue the lists from the Oamaru, Waipara, and Weka Pass districts in the contemplated bulletin dealing with the Tertiary brachiopods as descriptions of the chief brachiopod localities will accompany that bulletin. The other lists are reserved for a contemplated bulletin dealing with the correlation of the Tertiary beds.

Tertiary Brachiopoda.

The completion of the revision of this group has been delayed by my promotion, but their study is being pursued whenever opportunity allows. The diagnoses of the majority of the species have been prepared, and the preparation of the plates is also well advanced. Mr. G. Uttley, of Oamaru, has very kindly prepared a detailed account of the brachiopod localities of the Oamaru district, which is the more useful as the majority of the specimens examined were collected by him.

Tertiary Cirripedia.

Mr. T. H. Withers, of the British Museum, has during the year examined and redescribed the giant cirripede from Motutapu Island, and has returned the material on loan from the Survey. He has published the result of his work in a paper entitled "Some Miocene Cirripedes of the Genera Hexelasma and Scalpellum from New Zealand."*

* Proceedings of the Zoological Society of London for 1913.

Other Groups of Tertiary Invertebrates.

Arrangements were made last year with Mr. D. G. Lillie, ship biologist to the British Antarctic Expedition, 1910, that wherever possible the specialists who work up the material of the expedition should also undertake the revision of the New Zealand Tertiary forms of the same groups. During this year large collections (including all the available type specimens) of echinoderms, corals, bryozoans, cirripedes, and fossil crustaceans were sorted out and despatched to Mr. Lillie. At the same time specimens from the Canterbury and Otago museums are also being sent to Mr. Lillie, so that the greater part of the collected material in New Zealand will be made available to the specialists in each group.

Cretaceous Mollusca.

Mr. H. Woods, Demonstrator in Palæontology, Cambridge, has nearly completed the description of the specimens forwarded to him,* and it is probable that this will also be embodied in a memoir of the British Antarctic Expedition, 1910.

Jurassic and Triassic Faunas.

The specimens previously sent to the late Professor G. Boehm have been safely returned to Wellington through the kind offices of Professor Deecke, Director of the Geological Survey of Baden. No further steps have been taken with regard to the description of these fossils.

Mesozoic Floras.

Dr. E. A. N. Arber has finished his work on these fossils, and his description is to be published in a memoir of the British Antarctic Expedition, 1910.

Classification and Correlation of the Tertiary Rocks.

An observation of great importance as affecting all previously proposed classifications of the lower and middle Tertiary rocks was made by Mr. G. Uttley in a letter—viz., that in the Waihao district of South Canterbury the fossils of the Mount Harris beds, which lie above the Waihao limestone, are apparently similar to those of the Waihao greensands, which underlie the same limestone. Later, during a visit to the district I was able to confirm the observation.

The similarity of the fossils of these two sets of beds has been recognized before by Hutton and Park, but as their relative positions in regard to the limestone was not known, the significance of the similarity was overlooked. Hutton† in 1877 examined collections made from both localities by Haast, and correlated the two sets of beds in his Pareora system, which it will be remembered he considered to overlie the Oamaru system unconformably. Haast‡ in 1879, recognizing the inferior position of the greensands as compared to the limestone, pointed out the difficulty that the limestone contained "all the characteristic fossils of the Oamaru formation," but did not follow the matter further. McKay§ in 1882 clearly recognized the inferior and superior positions of the greensands and Mount Harris beds with respect to the limestone, but somewhat strained the palæontological evidence by classifying the greensands as Cretaceo-tertiary and the Mount Harris beds as Lower Miocene. Following this report there ensued a long controversy between Hutton and McKay with regard to the age of the Waihao greensands, Hutton continuing to classify them as belonging to his Pareora system, and supposing that they were laid down on a highly eroded surface of limestone, McKay strongly maintaining their truly inferior position and endeavouring to show that their fauna was Cretaceo-tertiary

It may now be definitely stated that McKay was correct in his reading of the field evidence, and that the greensands do underlie the limestone. That position has not been challenged since 1888, and after a few days' study in the field is, to my mind, self-evident. My field-work in Marlborough, North and South Canterbury, and North Otago has also been sufficient for me to state quite definitely that there is no Cretaceo-tertiary formation in New Zealand in the sense of a set of beds containing mingled Cretaceous and Tertiary fossils. There is apparently in North Canterbury and Marlborough (and I believe there is actually) a Cretaceo-tertiary succession, but the fossiliferous Cretaceous and Tertiary beds are separated by many hundreds of feet of apparently unfossiliferous Amuri limestone. All the beds in the Oamaru and South Canterbury districts classified by Hector and McKay as Cretaceo-tertiary, and notably the Waihao greensands, contain only Tertiary fossils.

In 1905 Park‖ returned to the old difficulty that had confronted Haast, and proposed an entirely new solution of the problem. Recognizing the similarity of the Waihao greensand and Mount Harris fossils, and the inferior position of the greensands, and also the necessity of including the Waihao limestone in the Oamaru system, he concluded that there were two limestones in the Oamaru system, one above and one below beds with "Pareora fauna," and at the same time on palæontological evidence he correlated the Mount Harris beds with the Waihao greensands, remarking that the stratigraphy is not very clear.¶

My own field observations are in agreement with those of McKay that the Mount Harris beds overlie the Waihao limestone. This reading of the field evidence necessitates not two limestones in South Canterbury and North Otago separated by beds with the "Pareora fauna," but

* The specimens from Coverham, mentioned in the annual report of last year as being involved in a fire on the s.s. "Turakina" reached Mr. Woods safely. † Trans. N.Z. Inst., Vol. 9 (1877), p. 594. ‡ Geol. Cant. Westl., p. 310, 1879. § Rep. Geol. Explor. during 1881, Vol. 14 (1882), pp. 64 and 71–75. ‖ Trans. N.Z. Inst., Vol. 37 (1905), pp. 489–551. ¶ The above does not state Professor Park's arguments in full, as much of his evidence was obtained from other districts than Waihao.

one limestone separating two sets of beds with the "Pareora fauna." If this is so, and if the principles of palæontology have any application to our Tertiary rocks, these two apparently similar faunas cannot be identical, but must show some differences. For the present, then, correlations based on the presence of the "Pareora fauna," which was built up by Hutton from the fossils of beds of different ages, can have no value. When we have defined the peculiarities of these upper and lower faunas we shall have made a great step in the classification of the Tertiary rocks. For this purpose all the Tertiary Mollusca from North Otago and South Canterbury have been put in Mr. Suter's hands, and he has also determined various collections from these localities for private collectors. Mr. Suter estimates that he will finish the determinations and the compilation of the fossil lists in about six months, and it will then be necessary to prepare a stratigraphical bulletin dealing with the whole subject fully.

SPECIAL REPORTS.

1. PRELIMINARY REPORT ON THE GISBORNE - EAST CAPE DISTRICT.

(By P. G. Morgan, Director.)

Narrative.

I left Wellington on the 10th January, and arrived in Gisborne next day. On the 12th I went to Matawai, the present terminus of the Gisborne–Opotiki Railway, and next day examined the proposed Motuhora quarry and the country between Matawai and Motu Falls. On the 15th January the Cook County and Gisborne Borough Council's quarries near Patutahi were visited. From the 16th to the 23rd January, in company with Mr. W. E. Akroyd, Government Valuer, I made a hurried and necessarily incomplete reconnaissance of the strip of country between Gisborne and Hicks Bay. On the 24th January the coast-line between Gisborne and Sponge Bay (south of Kaiti) was examined. On the 25th January Totangi Oil-well (New Zealand Oilfields (Limited)) and the Public Works quarry near Patutahi were visited. On the 26th January I inspected the New Zealand Oilfields' Waihirere bore, near Ormond, and on the evening of the same day left Gisborne for Napier, *en route* to Wellington.

Previous Geological Work.

In 1869 a brief report by Captain F. W. Hutton on the East Cape district was published.* In 1874 the coastal belt from Gisborne to near East Cape was examined by Hector and McKay, the latter of whom has since visited the district on two or three occasions, and has embodied his observations in valuable reports. Others who have made geological examinations are S. H. Cox, J. Park, H. Hill, and J. M. Bell. Dr. J. Wanner, of Bonn, and Mr. E. de C. Clarke have also visited the Gisborne - East Cape district, but have not published anything concerning the area. During 1908 and 1909 the survey districts of Mangatu and Waingaromia, with a combined area of 312½ square miles, were surveyed in detail by J. H. Adams. The results of his investigations were published in Bulletin No. 9 (New Series) of the New Zealand Geological Survey, under the title of "The Geology of the Whatatutu Subdivision, Raukumara Division, Poverty Bay." The area thus surveyed in detail covers less than a twelfth of the Raukumara Division, and is not sufficiently large to yield definite results concerning the geology of the division as a whole. Unfortunately also, Mr. Adams and Dr. P. Marshall, who wrote the section on palæontology in Bulletin No. 9, disagreed with Mr. Alex. McKay (and it may be added with Sir James Hector) on a fundamental point in the geology of the district—namely, the presence or absence of Cretaceous rocks. My own brief examination has convinced me of the substantial correctness of the view held by McKay—namely, that Cretaceous rocks are present in the Whatatutu Subdivision as well as elsewhere in the Gisborne - East Cape district.

General Geology.

The oldest rocks of the district are argillites, greywackes, and fine-grained conglomerates, which are probably of Trias-Jura age, but have been placed by McKay in the Maitai Series, which he regards as of Carboniferous age. The Trias-Jura or Maitai rocks are exposed chiefly on the western side of the Waiapu Valley, where they evidently form the greater part of Mounts Hikurangi (5,606 ft.) and Aorangi (4,091 ft.). Near the Gisborne–Opotiki Railway they form Mount Motuhora (3,405 ft.), which is on the western side of the East Coast - Bay of Plenty watershed, and much of the country from here towards Opotiki. According to Hill there is a small

* Rep. G.S. during 1868–69, No. 5, pp. 7–8.

outcrop of "Maitai slates" on the east coast between Port Awanui and Reporua.* McKay, however, states that there are no old Secondary or Palæozoic rocks east of the main range in this part of the North Island.†

Cretaceous rocks, according to McKay, cover a belt of some width which extends from the headwaters of the Waipaoa and Motu rivers almost to Hicks Bay. Between the mouth of the Waiapu River and Waipiro they reach the coast. Cretaceous inliers are found at Waitangi Hill, on the coast-line between Gisborne and Tuahine Point, at Whangara, and some distance north of Gable-end Foreland. Elsewhere Miocene strata form the prevailing surface rocks. There are also comparatively small patches of Pliocene and Pleistocene pumice-sands, &c. Flats of considerable size, covered by alluvial deposits, occur near Gisborne, at Tolago Bay, in the Waiapu Valley, in the Awatere Valley, and west of Te Araroa (Kawakawa).

Geological Structure.

The geological structure of a petroliferous district is all important to those in search of oil, but its elucidation requires careful and detailed mapping, and therefore no adequate account of structure can here be given. Briefly, the Miocene rocks are usually gently, but, on the whole, irregularly folded. The Cretaceous rocks where exposed are much more strongly folded. A number of faults, some of considerable strength, traverse both Miocene and older rocks.

Indications of Petroleum.

The numerous indications of oil in the Gisborne - East Cape district may be classified as mineral springs, gas springs, mud volcanoes, oil-seepages, deposits of ozokerite or allied mineral and magnetic disturbances. In the following paragraphs a rough and incomplete account of these occurrences will be given.

(1.) *Mineral Springs.*

The mineral springs of the Gisborne district are mainly salt springs, which almost invariably contain detectable amounts of iodine, and are accompanied by effusions of inflammable gases. Cold salt springs occur at Hangaroa (about twenty-two miles west-south-west of Gisborne), at Patutahi (now quiescent), at Waihirere (near Ormond), in the Kaiti Block near Gisborne, at Whangara, in the Upper Waimata Valley, and elsewhere. At Te Puia, a few miles from Waipiro, there are numerous saline springs, with a temperature of 150° F. or more. Mineral springs, the water of which contains a little sulphuretted hydrogen, but is not unpleasant in taste, occur on the beach east of Tua Motu (near Gisborne), and on the east side of Waiapu Valley near the main road, not far from the branch road to Tuparoa. A little south of Tuparoa, on the banks of a small stream, a continuous incrustation of sulphates (probably an alum, and a basic ferric sulphate) was observed during the hot and dry weather that prevailed at the time of my visit. The water of a mineral spring that occurs in the Whatatutu Subdivision, at the head of the Waikohuiti Stream, not far from the Te Karaka – Motu Road, contains various sulphates, and is therefore more or less comparable to the Tuparoa incrustations. A description and analysis of this spring is given by Adams.‡ Nearly all the well-water of the Gisborne flats is brackish and unfit for human consumption. Salt water was encountered in the South Pacific No. 9 borehole everywhere below 470 ft.

(2.) *Gas Springs.*

About four miles west-south-west of Patutahi is a gas spring in the valley of Te Aroha Stream, on land formerly belonging to Mr. Peach, but now owned by Messrs. Mather and McInnes (Section 79, Block IV, Patutahi Survey District). Another gas spring is said to occur higher up the valley. A little salt or brackish water accompanies the gas. At Wainui, east of Gisborne, several small gas springs are reported, but these at the present time are probably quiescent. At Roto-o-tahi, a few miles north of Gable End Foreland, are two or more springs. The gas is mainly methane, but, according to Mr. F. A. Rich, contains also a little sulphuretted hydrogen. Near the Te Puia springs, in the neighbourhood of Waipiro, gas-escapes are very numerous. On Te Ahi-o-te-Atua Block (Mata Survey District), near the Maori village of Jerusalem, is a large gas spring, said to yield a constant flame 2 ft. or more in height. To the eastward, in the Waikohu Valley, are several other gas-escapes. There are several gas springs a short distance south of the mouth of the Waiapu River. In the Whatatutu Subdivision are many gas-vents, now no longer active. The positions of three of these are indicated in J. H. Adams's report.§ In Tutamoe and Arowhana survey districts, north of the Whatatutu Subdivision, there are numerous gas springs, two of which are mentioned by Adams.‖ Gas-escapes are especially common in the Huiarau, Hauturu, and Pouturu blocks, and are found in a belt of country extending far down the Waiapu Valley. A small escape of inflammable gas, accompanied by salt water, occurs far north in the Omaika Block, a few miles from Te Araroa. A gas spring with salt water is stated to occur to the westward of the last-mentioned spring in the Wharekahika Block, near the junction of the Oweka Stream with the Wharekahika. Other gas springs are reported at Waiorongomai (between Waipiro and Tuparoa), and at Wairongomai, Block V, Mangaoporo Survey District.

Nearly all the bores drilled in pursuit of oil have encountered gas in some quantity. Various bores made in search of artesian water near Gisborne have struck gas. In one case at Makaraka the gas obtained was utilized for heating and lighting in a dwellinghouse for some years, its use being then discontinued owing to some chemical action corroding the pipes. Recently a shallow bore on Mr. J. C. Field's property, a few miles from Gisborne, encountered gas, the lighting of which resulted in an explosion. The unwary bystanders received a considerable shock and sustained various injuries. A little south-east of Patutahi Township large quantities of gas are said to have been struck in an artesian bore.

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* "Oil-wells and Oil-prospects along the East Coast," Trans. N.Z. Inst., Vol. 39, 1907, p. 511. † "Report on the Petroleum-bearing Rocks of Poverty Bay and East Cape Districts, Auckland, New Zealand," Mines Report, C.–10, 1901, p. 23. ‡ Bull. No. 9, N.Z.G.S., 1910, p. 46. § *Op. cit.*, p. 39; see also map. ‖ *Op. cit.*, p. 39

The natural gas of the Gisborne district appears to contain olefines in small quantity, since it burns with a distinct yellowish or yellowish-red border, which is not wholly (though perhaps partly) due to the presence of sodium. In some cases sulphuretted hydrogen is present, for example, at Roto-o-tahi. The corrosion of iron pipes at Makaraka indicates the presence of objectionable impurities in that locality. At Te Puia the gas used for cooking and lighting in the accommodation-house appears to be nearly free from nitrogen, carbon dioxide, or other diluting impurity, for it burns with a very hot flame.

(3.) *Mud Volcanoes.*

In several parts of the Gisborne district occur mud volcanoes, or, more correctly, mud springs. All emit more or less inflammable gas associated with salt water, and the various localities have therefore already been mentioned in preceding paragraphs. Probably all the mud springs at one time or another have given rise to spasmodic, sometimes violent, eruptions of mud and gas doubtless caused by the local accumulation of gas under great pressure. The most prominent mud volcano in the Gisborne district is on Section 23A, Block VII, Waimata Survey District. Together with smaller mud springs on Sections 22 and 24 in the same block it has been described by J. H. Adams.* Other mud springs occur at Roto-o-tahi, Whangara, Waihirere, and Patutahi. At the two latter places the springs are now extinct or quiescent.

(4.) *Oil-seepages.*

Several distinct oil seepages or springs are known in the Gisborne - East Cape district. The most important of these is a series of seepages at Waitangi Hill, which have been fully described in New Zealand Geological Survey Bulletin No. 9 (pages 36–39). A second oil spring known as Dobbie's, Totangi or Tangihanga oil spring occurs in the Totangi Valley, Tangihanga Block (Waikohu Survey District), about sixteen miles as the crow flies west-north-west from Gisborne. By road the distance may be twenty-four or twenty-five miles. At the present time visible oil is confined to the two bores which have been drilled at the spot. The Rotokautuku Block, Waiapu Valley, is a third locality where oil-seepages are known to occur. A decidedly doubtful seepage of oil occurs in connection with the gas and salt-water spring in the Omaika Block (Matakaoa Survey District), a few miles south of Te Araroa. Oil is said to have been seen more than once floating on the sea at Horoera Point, near East Cape—an occurrence which, if correct, is paralleled by similar phenomena seen near the New Plymouth Sugarloaves.

(5.) *Ozokerite.*

In the Rotokautuku Block, near some of the Southern Cross Company's bores, a considerable deposit of a mineral fat, identified by Skey as dopplerite, was found forty years or more ago. Mr. Akroyd states that some tons of the mineral were mined and exported. Unfortunately up to the present I have not been able to find any full account of this interesting occurrence. The twenty-fourth annual report of the Colonial Museum and Laboratory (1882, pages 56–57) contained a description of mineral grease said to occur in the petroleum country of the Waipara district, North Island. This probably refers either to the Waipaoa Valley or to the Waiapu Valley. Ozokerite is also said to have been found on Kaiti Hill, near Gisborne.

(6.) *Magnetic Disturbances.*

Mr. Akroyd informed me that in the neighbourhood of Tutamoe Trigonometrical Station the magnetic needle is deflected much and irregularly from its usual position. This occurrence may possibly be important as an indication of petroleum.†

OIL-PROSPECTING OPERATIONS.

In 1874 the Poverty Bay Oil and Kerosene Company sank a shaft on Waitangi Hill to a depth of 100 ft., from the bottom of which a borehole was drilled for an additional 110 ft. Between 1880 and 1887 the South Pacific Petroleum Company drilled nine holes, eight of which were near Waitangi Hill, whilst the ninth was a mile and a quarter south of the main oil spring. This last bore, the deepest of the series, had reached a depth of 1,321 ft. in December, 1887, when a "blow-out" of oil and gas took place. The gas and oil became ignited, the derrick was burnt down, and much of the machinery destroyed. After the bore had been cleaned out no more oil was obtained. Another few feet (15 ft., it is said) was drilled, and then the well was abandoned as a "dry hole."

The Minerva Petroleum Company in 1887–88 bored to a depth of 750 ft. on the eastern bank of the Waipaoa River, at a point five miles west-south-west from the main oil spring on Waitangi Hill. Oil said to have been obtained from this well contained by analysis 94·60 per cent. illuminating-oil and 2·95 per cent. paraffin, the remainder being waste or loss. This remarkable composition indicates that the oil may have been the naturally purified material known as "white oil," which itself seldom occurs in quantity, but is considered to be a good indication of ordinary petroleum.

In 1909 the Gisborne Oil Company began boring on Waitangi Hill at a site selected by the Geological Survey. A light flow of oil, equal to three barrels per day, was struck at 655 ft. Drilling was continued to a depth of 1,478 ft. when, principally owing to difficulties with the casing, which was not sufficiently strong to withstand the pressure of the caving ground, the

* "The Eruption of the Waimata Mud Springs," *Mines Record*, Vol. 12, 1907–8, pp. 97–101. † G. F. Becker: Relations between Local Magnetic Disturbances and the Genesis of Petroleum," U.S.G.S. Bull. 401, 1909.

bore was stopped. When the casing was being withdrawn the oil at 655 ft. was again tapped, with the result that a flow estimated at ten barrels per day was obtained. Owing, it is said, to mud blocking the holes in the casing, the flow gradually diminished to less than three barrels per day, at which stage pumping, it would seem, was abandoned.

In 1902–3 two bores were drilled at Totangi (Tangihanga Block) by an English syndicate, in which Mr. R. Brett, of Auckland, was interested. The first of these bores was situated at the oil spring at the height of about 575 ft. above sea-level, and, although started with a diameter of only 3 in., reached a depth of 338 ft. Oil in small quantity and much gas were encountered in this bore. The second bore, situated in the valley about a mile to the south of the oil spring, began as a 4 in. hole, and reached a depth of 505 ft. (also recorded as 525 ft.). A good deal of gas was encountered, but the log contains no mention of oil.

During the years 1911–12 a concern with a large capital, known as "The New Zealand Oilfields (Limited)," drilled a trial bore (initial diameter 5 in.) within a few feet of the English Syndicate's No. 1 Totangi bore to a depth of 273 ft., or 65 ft. less than the earlier bore. A 14 in. well was then begun about 11 chains to the northward. This had reached a depth of 513 ft. when drilling operations were suspended in order that a rotary drill might be substituted for the cable plant in use. A rotary plant having been obtained, it was installed at Waihirere, near Ormond, instead of Totangi. The Waihirere well, which was also a 14 in. bore, started by cable drilling, was continued to a depth of 1,381 ft., when drilling was stopped, partly owing to various difficulties with the bore, and partly owing to lack of capital. In this bore considerable quantities of gas and traces of oil were encountered. The actual boring operations at Totangi and Waihirere appear to have cost nearly £18,000 in addition to the outlay incurred for machinery and plant, or at the rate of over £8 per foot, although none of the bores was deep.

In 1881 the Southern Cross Petroleum Company began drilling on the Rotokautuku Block, situated on the western side of the Waiapu River between the Mangaoporo and Tapuwaeroa branches. In this locality the surface indications of petroleum are oil-seepages, gas springs, and the deposit of dopplerite (ozokerite) previously mentioned. In all seven wells, ranging from 150 ft. to 1,820 ft. in depth, were drilled. Several of these bores were so close to one another that they were included in the circumference of a shaft sunk to a depth of over 400 ft. in order to save the casings. All the bores yielded more or less gas, and in the seventh several small "shows" of oil were obtained.

Results obtained by Past Boring.

Nearly every bore that has been drilled in the Gisborne - East Cape district in search of oil encountered natural gas in some quantity, and not a few found traces of oil. If the doubtful blow-out of oil and gas at the South Pacific No. 7 bore in 1887 be excepted, the only decided flow of oil was that struck at a depth of 655 ft. in the Gisborne Oil Company's bore on Waitangi Hill in 1909. It is perhaps worth noting that this is the only site selected after a geological survey at which a bore has been made.

The chief result obtained by the bores hitherto drilled is a knowledge of the difficulties to be encountered. Of these the chief are soft caving ground and gas-pressure. It is evident that the very best drilling plant and drillers must be employed, that the casing used must be extremely strong, and that holes of large initial diameter (except in the case of prospecting-bores) are necessary. Experienced drillers consider that the best type of boring plant is a rotary drill. This has been to some extent confirmed by the experience of the New Zealand Oilfields at Waihirere, where, however, the pump-valves were quickly destroyed by the fine but sharp grit that formed part of the beds drilled below a depth of 1,000 ft. This wearing of the pump-valves was, indeed, the difficulty that prevented a much greater depth than 1,381 ft. from being attained. The rotary system, in common with other flush-drilling methods, has the further disadvantage that an oil-bearing stratum may be passed without being detected, owing to the pressure of the circulating water and mud preventing oil (if not under greater pressure) from entering the bore. The eccentric percussion drill now being successfully used by several companies in Taranaki presents the advantage that the casing may be kept close to the bottom of the hole all the time, and deserves a trial in the Gisborne district.

Discussion of Methods.

In the past many mistakes have been made by those engaged in the search for oil. Some of these were almost unavoidable, and could be certainly perceived only after the event; others, again, could have been avoided by the exercise of ordinary common-sense. The enthusiasm that actuates the pioneers of a new industry is not always combined with prudence and foresight. Hence arise such mistakes as starting oil-prospecting operations with insufficient capital or a poor drilling plant, ignoring previous experience, and neglecting detailed geological survey as a means of locating bore-sites and obtaining general information. From first to last a very large capital sum has been dissipated in connection with the search for oil in the Gisborne - East Cape district. In most cases, so far as can be learned, the greater part of the money has been spent, if not always wisely, yet in actual boring operations.

Oil Possibilities.

Until a detailed geological survey of the whole area has been made, any opinion concerning the oil prospects of the Gisborne - East Cape district must be tentative. Sir James Hector and Mr. Alex. McKay both refrained from expressing any definite views concerning oil possibilities. Professor James Park in 1889 stated that in his opinion oil would not be found at the places

where boring was then being conducted, though he thought that further exploration might discover localities where the geological conditions were more favourable.* Dr. J. M. Bell, in 1908, was favourably disposed towards boring on Waitangi Hill,† and in 1910 J. H. Adams, after making a detailed survey of the Whatatutu Subdivision, recommended three sites for boreholes, of which Waitangi Hill was one.‡ On the whole it may be said that the geologists who have examined the Poverty Bay district have either refrained from expressing any decided opinion in favour of the presence of oil in large quantity, or have done so in guarded terms. Until a detailed geological survey of a much larger area than the Whatatutu Subdivision has been made it would be folly to give a definite opinion concerning the oil potentialities of the district, for the available data are quite insufficient to justify a decided statement one way or the other.

Future Prospecting.

With regard to the advisability of further prospecting for oil a definite statement may be made. The numerous mineral springs, gas-escapes, and oil-seepages, together with the generally favourable nature of the geological conditions, justify a vigorous prospecting policy, provided that this is prosecuted on sane and well-thought-out lines. The boring already done, in my opinion, counts for very little. No well, unless it was the Southern Cross Petroleum Company's No. 7 bore (which is said to have been abandoned when the prospects were good) has been drilled nearly deep enough. Outside the Whatatutu Subdivision boring must be preceded by detailed geological survey. Until payable oil has actually been struck every bore must be regarded merely as a trial. Past experience seems to render it advisable, in selecting future boring-sites, to avoid the known oil-seepages and mineral springs, most of which are probably on or near faults. The large amount of gas present in the strata makes it not improbable that the main oil-pools, if such exist, in some cases at least are on the slopes rather than the crests of anticlines.

Natural Gas.

Whatever the oil prospects may be, the numerous gas-escapes make it practically certain that the Gisborne - East Cape district is abundantly supplied with gaseous fuel. It is somewhat surprising that more use of the known escapes for heating and lighting purposes has not been made, and that not a single bore has been drilled in search of gas. It would be well worth while to test the Gisborne flats for natural gas, and in doing so there is a possibility that oil may be struck.

Mineral Waters.

Some of the mineral springs, more especially those containing iodine or sulphuretted hydrogen, have medicinal value. In this respect Te Puia hot saline springs, rich in iodine, are pre-eminent. They are of large size, are situated in an elevated position, and will in time doubtless become a health and pleasure resort. The only other springs in New Zealand comparable with Te Puia are those of Morere (northern Hawke's Bay) and the Great Barrier Island.

Water-supply.

In most parts of the Gisborne - East Cape district potable water becomes scarce during the hot dry summer season. There are few places where artesian water is likely to be obtained, and therefore for town supplies the chief hope lies in the conservation of the water of suitable streams by means of reservoirs. Where isolated country houses have to be supplied, or stock watered, a careful search for springs may be recommended. In many places a limited supply of water may be obtained from wells or shallow bores. On the Gisborne flats a moderate amount of water may be obtained by boring, but, as already mentioned, this is brackish and unfit for domestic use, though cattle will drink it.

Conclusion.

Since the possibilities of oil near Gisborne are probably as great as at Whatatutu or in the Waiapu district, a detailed geological survey of the survey districts of Waikohu, Waimata, Whangara, Patutahi, and Turanganui may be regarded as a pressing requirement at the present time. The survey of the Whatatutu Subdivision, made several years ago, requires some revision, owing to the Cretaceous rocks, which are supposed to be the source of the oil and gas, not having been separated from the Miocene rocks. After the completion of the proposed survey near Gisborne it may be advisable to extend detailed work northward from the Whatatutu Subdivision towards Waiapu and East Cape. Not until the general geology of the district has been mastered, can boring-sites be recommended with any confidence. The Cretaceous rocks, since they are apparently associated with most of the oil indications, require special attention. Their structure, owing to masking by the probably unconformable Miocene rocks, will be difficult to unravel, and without doubt numerous trial bores must be made before sufficient information for the oil-driller's requirements can be collected.

There are many localities where natural gas could be utilized for heating, lighting, and power purposes. Not improbably boring for gas on the Gisborne flats would be attended by success.

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* "On the Oil-bearing Strata of the North Island," Trans. N.Z. Inst., Vol. 21, 1889, pp. 489–492. † "Second Annual Report of the New Zealand Geological Survey," 1908, p. 11. ‡ Bull. No. 9, 1910, pp. 40–42.

2. MATERIALS FOR ROADMAKING AND RAILWAY-BALLAST IN THE GISBORNE DISTRICT.

(By P. G. Morgan, Director.)

Owing to the scarcity of material suitable for roadmaking and for ballasting railway-lines in the neighbourhood of Gisborne, I gave some attention to the question of road-metal during my visit to that district in January last. The macadamizing material usually employed is limestone, much of which is soft and porous, and some as quarried is mixed with clay and rubble. Hence the roads made with the poorer material are far from durable, require frequent remetalling, and are never in a satisfactory condition—mud in winter and dust in summer being prevailing conditions. Tarring experiments have not been altogether successful, for the porous limestone absorbs an unusual amount of tar, and the clayey material forms with it a soft coat, which is easily broken by ordinary traffic. Besides limestone the other macadamizing materials available in the Gisborne district are sandstones of varying quality, burnt claystone (papa), fine gravel from the Waipaoa River, and an occasional rare cargo of ballast discharged from vessels visiting the port of Gisborne.

At a distance of fifty miles or more from Gisborne large quantities of greywacke apparently suitable for roadmaking may be found on the western side of the Raukumara Range and its southward continuation, the Huiarau Range. The approaching completion of the Gisborne–Opotiki Railway to the neighbourhood will render it possible to transport the stone to Gisborne and its neighbourhood at a comparatively small cost.

In the course of my investigations the following working or projected quarries were visited: (1) Proposed quarry at Motuhora; (2) Public Works quarry near Matawai; (3) Public Works quarry near Patutahi; (4) Cook County Council quarry near Patutahi; (5) Gisborne Borough Council quarry near Patutahi ("Gentle Annie").

(1.) Proposed Quarry at Motuhora.

Motuhora is a bush-clad peak of the Ruakumara Range, situated about eight miles to the south-west of Motu Township. The mountain, which is 3,405 ft. in height, is composed of greywacke, argillite, and fine conglomerate of probable Jurassic age. The site of the proposed quarry is, roughly, 1,600 ft. or 1,700 ft. above sea-level, and is in the valley of a small tributary of the Motu River near Mr. W. Orr's farm, and about half-way between Matawai, the present terminus of the Gisborne–Opotiki Railway, and Motu. Here, at two points a few chains apart, drifts, each 50 ft. long, have been driven in greywacke,* argillite,* and fine conglomerate. These rocks strike north-north-east and dip 60° east-south-east. In the lower or No. 1 drift the first 35 ft. is nearly all greywacke, whilst the remaining 15 ft. is mainly argillite. One or two small bands of fine conglomerate are also observable. The upper drift passes through about 40 ft. of rather fine greywacke, and the remaining 10 ft. is chiefly argillite.

Of the rocks mentioned the greywacke, if not too fine-grained, will form an excellent road-making-material, equal or superior to the best limestone in the Gisborne district. The argillite is not sufficiently durable to be used by itself, but may be mixed in a small proportion with the harder greywacke. The conglomerate as a rule is somewhat easily disintegrated, and is therefore not suitable as a macadamizing-material. This rock, however, so far as my observation went, occurs only in small bands, and will not interfere with quarrying operations. The interbedding of somewhat wide bands of argillite with the greywacke renders it necessary to exercise caution in selecting a permanent quarry-site, and the bush covering increases the difficulty of doing so. The rock exposures in the minor creek-gullies should be carefully examined with a view to finding a wide band of hard coarse-textured greywacke. Fine-grained greywacke passing into argillite is not so suitable as a rock of coarser grain in which cementation through recrystallization is usually thorough. At the points where the trial drifts have been made the greywacke bands prospected are apparently only 35 ft. to 40 ft. thick. There seem, however, to be thicker bands in close proximity suitably located for opening out.

Without much doubt suitable road-metal in large quantity can be obtained from Motuhora Mountain, but the distance from the Town of Gisborne and the adjoining district renders transportation a serious question. When the present railway-line has been advanced a few miles a branch can easily be constructed to the foot of Motuhora. The haul to the localities where the metal is required will vary from a few miles to over fifty miles. It is proposed to distribute the stone from the railway by means of motor-wagons, which will undoubtedly be more economical than horse-drawn vehicles.

(2.) Public Works Quarry near Matawai.

About two miles north of Matawai Railway-station a high face of light-grey flatly bedded sandstone, on the east side of the railway-line, is now being quarried for use as railway-ballast. At the time of my visit (13th January) several drifts had been driven into the face in preparation for a large blast. The rock, though porous, is hard, and does not disintegrate on exposure to weathering. It should prove very suitable for use as railway-ballast or for road-foundations. It is not a first-class material for the surface layer of a road, but may well be used where better stone is not easily obtainable.

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*Greywacke is a sedimentary rock, usually of a grey colour, composed of grains of quartz, feldspar, and other minerals. It has the texture of sandstone. As the component minerals become finer and finer, greywacke tends to pass into argillite, which may be described as a mudstone, resembling slate, but without slaty cleavage.

(3.) Public Works Quarry near Patutahi.

The Public Works Department is at present opening out a quarry a few miles west-south-west from Patutahi, on Messrs. Mather and McInnes's land, at a point about a mile and a quarter from the Gisborne–Napier Railway now under construction. The rock which is to be quarried consists of a thick limestone band, probably striking about north-east, and dipping 45° or more to the north-west. It is grey in colour, and more or less shattered, but the individual pieces of stone are hard. Somewhere between 5 and 10 per cent. of clay and rubble fills the interstices of the rock. It will make excellent railway-ballast, and, if the rubble is excluded, fair road-metal. According to Mr. C. E. Armstrong, Public Works District Engineer, some 180,000 cubic yards of rock is available. Very little overburden has to be removed, and the quarry can be easily and cheaply worked. Transport to the railway-line will be by means of a short self-acting tram and a branch railway-line about a mile in length.

(4.) Cook County Council Quarry

The Cook County Council quarry is some miles west of Patutahi, and perhaps two miles north of the Public Works quarry last mentioned. The county quarry has been in existence, I was told, about thirty years, and a large quantity of stone has been obtained. It is provided with a complete rock-breaking plant, together with screens, &c., worked by an oil-engine. The broken stone passes into bins, whence it is distributed by carting. The rock quarried is a band of limestone, 50 ft. or more in thickness, which strikes north-north-west (330°) and dips at 20° to the east-north-east. It is underlain by a blue claystone, and stratigraphically overlain by a similar rock, but where quarried has merely an overburden of 12 ft. to 21 ft. of Recent clay, the stripping of which is a somewhat expensive item. The upper part of the limestone as seen in the quarry is brown in colour, and not as solid as the lower portion, which is of a bluish colour, and contains many shells, most of which belong to the genus *Pecten*. Higher up the small gully which passes through the quarry the limestone seems to have less overburden, but, owing to the upward trend of the bedding in this direction, thins out in a short distance. There is, however, sufficient stone in sight to meet the present rate of consumption for a number of years.

The limestone is fairly pure, containing apparently 80 to 90 per cent. carbonate of lime. Some is regularly carted to Nelson Bros.' freezing-works near Gisborne for the purpose of making quicklime.

(5.) Gisborne Borough Council Quarry.

The Gisborne Borough Council quarry, commonly known as the Gentle Annie Quarry, is situated in the valley of Te Aroha Stream, not far from the Public Works Patutahi quarry. The rock quarried is an extremely shattered rubbly limestone, containing fossils similar to those of the Cook County Council quarry, and is probably in the same horizon. It is variable in composition and in general appearance. Although some of it is hard and suitable enough for road-metal, much is very soft, and in addition a large percentage of the quarried material consists of clay and rubble.

The quarry, which was opened in 1910, is provided with a first-class crushing and screening plant, driven by an oil-engine. The broken material is run down a self-acting incline to bins, whence it is discharged into trucks holding about 1 cubic yard. These are conveyed to Gisborne by steam locomotives running on a narrow-gauge railway.

The poor general quality of the Gentle Annie stone renders its use very costly, since roads made with it require frequent repairs, and are never in a satisfactory condition. In addition the interest on the cost of the long transportation line is a heavy item. I have little hesitation in recommending that some other source of roadmaking material should be sought by the Gisborne Borough Council. Mount Motuhora, notwithstanding its distance, seems to be the most promising locality for this purpose in the district. Apparently the only other alternative is to import stone for macadamizing purposes by sea, a course that should certainly have been taken in preference to opening out the Gentle Annie Quarry.

Recommendations.

(1.) The proposed quarry at Motuhora should be developed, provided that further exploration shows that the conditions are suitable and that a practical road test of the greywacke results satisfactorily.

(2.) Experiments should be made to determine the suitability of calcined or burnt claystone (papa), recommended as a roadmaking material in Bulletin No. 9 (pp. 43–44). Some claystones burn much harder than others, and therefore care should be exercised in selecting the material, and in the method of calcining or burning.

(3.) The soft sandstones and impure limestones of the district are not good roadmaking materials, but if used on somewhat wide roads with high crowns and good drainage will probably give fairly satisfactory results where the traffic is not too heavy. In one spot I saw a very good piece of road made with glauconitic sandstone.

(4.) Where macadamizing-material is unobtainable or too expensive, roads should be formed fairly wide and given a high crown. Special attention should be paid to drainage. In some parts of the United States roadmakers claim that by employing a proper method of construction earth roads, fairly good both in summer and in winter, can be made. It seems probable that moderately serviceable earth roads can also be made in the Gisborne district by employing suitable methods.

ANALYSES OF LIMESTONE AND SANDSTONE.

The following analyses of samples of limestone and sandstone obtained during my visit have been made in the Dominion Laboratory:—

	(1.)	(2.)	(3.)	(4.)	(5.)
Insoluble in hydrochloric acid	..	7·93	6·09	13·74	..
Silica (SiO_2)	9·13	..	..	..	74·45
Alumina (Al_2O_3)	2·14	2·27	1·59	2·00	12·73
Iron oxide (Fe_2O_3)	1·16				2·92
Titanium dioxide (TiO_2)	0·18	..	..	..	0·35
Lime (CaO)	46·91	48·72	50·75	43·08	0·64
Magnesia (MgO)	1·05	0·84	0·87	3·59	0·73
Carbonic anhydride (CO_2)	35·82	37·68	39·96	35·49	Nil
Water and organic matter	2·08	2·59	0·68	2·47	2·70
Alkalies (K_2O and Na_2O)	1·18	..	..	..	5·65
	99·65	100·03	99·94	100·37	100·17

(1.) Limestone from County Council quarry, near Patutahi.
(2.) Limestone (sample A) from Public Works quarry, near Patutahi.
(3.) Limestone (sample B) from Public Works quarry, near Patutahi.
(4.) Limestone from Gisborne Borough Council quarry at Gentle Annie.
(5.) Impure sandstone from Public Works quarry, near Matawai, Gisborne–Opotiki Railway.

3. PETROLEUM PROSPECTS IN SOUTHERN HAWKE'S BAY AND EASTERN WELLINGTON.

(By P. G. MORGAN, Director.)

INTRODUCTORY.

In July, 1910, the writer visited portions of the eastern Wairarapa district, principally with a view to examining the petroleum indications of that area. His conclusions were embodied in a parliamentary paper, published under the title of "Petroleum and other Minerals in Eastern Wairarapa District."* Recently, in September, 1913, and January, 1914, visits were made to the Weber, Eketahuna, and Pongaroa districts with a similar object.

CHARACTER OF COUNTRY.

The country examined is now for the most part free from forest, and is a well though not closely settled region, the principal industry of which is sheep-farming. Immediately to the east of the Tararua-Ruahine Range, which forms the western boundary of the district, is the comparatively low-lying country traversed by the Wellington–Masterton–Napier Railway. This part of the area consists largely of broad alluvial plains, in places terraced by stream-action. To the eastward rolling hills of no great height predominate, the most prominent being the "Taipos," near Tenui, and the Puketoi Hills.† The latter south-south-east of Woodville reach a height of 2,634 ft. A well-known point in the northern part of the Puketois is Oparae Hill, which is 2,471 ft. high.

The chief streams of the area under notice are the Ruamahanga with its tributary the Taueru, the Whareama, the Whakataki, the Mataikona, the Aohanga, the Akitio, and the Upper Manawatu rivers. Of these the Ruamahanga flows southward, whilst the Manawatu, breaking through the Tararua-Ruahine Range, reaches the west coast of Wellington. The other streams mentioned have a general easterly course to the Pacific Ocean.

GENERAL GEOLOGY.

The oldest rocks of the area under consideration are the highly-folded slaty greywackes and argillites that form the greater part of the Tararua-Ruahine and Rimutaka ranges, and are probably of Trias-Jura age. Similar rocks occur near Cape Palliser, and are reported to form small patches elsewhere to the east of the main range.‡ Near Eketahuna is an outcrop of fossiliferous limestone or marble, containing imperfect specimens of *Monotis*§ or allied genus.

An important group of rocks consisting of conglomerates, sandstones, dark shales, and other rocks is developed mainly along the east coast. To this rock-group the provisional name of East Coast Series may be given. In several places it contains Cretaceous fossils, but not improbably the lower beds are of Jurassic age. Rocks of the East Coast Series almost certainly form the greater part of the Taipos, and cover a small area near Blairlogie. Similar rocks are found

* C.–16, 1910. There are a few misprints in this paper, for which the author is not responsible, no proofs ever having been submitted to him. † See also "Mineral Prospects of the Maharahara District," by J. Allan Thomson, on later pages of this report. ‡ See also p. 164 of this report. § Alex. McKay "On the Tauherenikau and Waiohine Valleys, Tararua Range," Rep. G.S. during 1887–88, No. 19, 1888, p. 65.

in the Gisborne - East Cape district near Motu, in the Waiapu Valley, at Awanui, Whangara, and elsewhere. In most localities the East Coast rocks are strongly folded and more or less faulted. Since most of the oil indications both of the area under notice and of the Gisborne district are associated with them they possess a possible economic importance.

The East Coast Series is followed, without much doubt unconformably, by marine Tertiary strata, which consist chiefly of calcareous mudstones and sandstones, with shelly limestone in an upper horizon. Though these rocks are mainly of Miocene age, in those districts where little denudation has taken place the uppermost horizon is Pliocene. As a rule they show gentle dips, but in places they are strongly crumpled and more or less faulted.

Although the Miocene claystones form an excellent cover for possible reservoirs of petroleum, yet their great thickness is a drawback, since all bores drilled in them must necessarily be carried to a great depth before there is much chance of striking oil in quantity.

The marine Tertiaries in the main river-valleys are unconformably overlain by Pleistocene and Recent alluvium, generally in the form of a moderately coarse gravel.

Somewhat outside the district examined by the writer are the igneous rocks found at Brancepeth and in the upper Ruamahanga Valley.

Geological Structure.

In view of the possible occurrence of petroleum the geological structure of the area becomes economically important. Viewed very broadly it may be said to have on the whole a tilt from the coast towards the foot of the Tararua-Ruahine Range. Thus the older rocks are in general to the east, and the younger to the west. An anticlinal structure accompanied by faulting appears in the neighbourhood of the Taipos, whilst the Puketoi Range is a well-marked anticline, as yet but little affected by denudation. Various other anticlines with corresponding synclines occur in the district, but not sufficient field-work has been done to enable details to be given. The trend of the anticlinal folds is in general north-north-east.

At the base of the Tararua-Ruahine Range is a great fault which sharply separates the Miocene from the Trias-Jura rocks. Evidence of faulting is well seen at the Woodville entrance to the Manawatu Gorge, where Tertiary rocks are standing on edge. That the range itself has been comparatively recently uplifted is shown by the fact that the Manawatu River, which is of post-Miocene age, has cut through the range, and must therefore be antecedent to it.*

Petroleum Indications.

The petroleum indications of the area under notice consist of gas springs, mineral springs, traces of petroleum, ozokerite or allied mineral, and mud volcanoes, or, more correctly, mud springs.

(1.) *Gas Springs.*

A large number of inflammable gas springs is known to occur in the eastern Wellington and southern Hawke's Bay districts. The most southerly of these is on Hinekura Station, about twelve miles south-east of Martinborough. A gas spring, concerning which no particulars are available, is stated to occur on Mr. Kummer's property, Kaiwhata River, near Flat Point. (See, however, a later page, under the heading of "Mud Volcanoes.")

The well-known Blairlogie gas spring occurs on Mr. H. Morrison's Awatoitoi Estate, between Carswell's and Blairlogie. The spring is on the eastern slope of a ridge known as Kerosene Ridge, at a barometric height of 910 ft. above sea-level. At the time of the writer's visit, which took place during heavy rain, gas was bubbling vigorously through the water in a small hole about 6 in. in diameter, whilst over an area of several square yards there were numerous small escapes. The gas ignited readily, and burnt with a bluish-yellow flame. The water in the hole tasted strongly of kerosene. In dry weather it is said to be quite salt, but, doubtless owing to dilution by rain-water, this feature was not observed by the writer. Southward from Kerosene Ridge small gas-bubbles are said to appear in the water of Middle Division Creek at a spot about a mile south-west of Cameron's Look-out.

On Mr. D. Cameron's land, about a mile and a half to the northward of the Blairlogie gas spring, and about a quarter of a mile south of the Whakataki Road, is a spot where, over an area of several square yards, numerous small jets of inflammable gas escape.

Near Ica, in Boundary Creek, a small tributary of the Whareama River, there was in 1888, according to Professor Park, an escape of carburetted hydrogen. In 1910 what was supposed to be the same spring yielded only a few bubbles of gas, which did not ignite on the application of a lighted match. Park also states that he was informed that during the formation of the road from Aohanga Landing to the homestead the grey shaly clays of the cuttings were found to give off a large amount of gas.

At Spring Hill, about a mile north-west of Mr. Hume's Aohanga homestead, are two gas springs within half a mile of each other. At Glencoe Gorge, about six miles from the mouth of the Aohanga River, is a large gas spring on Mr. Humphries's land. A gas spring occurs on Section 184, east of the Mangahuia Road, and another is reported to exist in the Mangahuia Valley. On Messrs. Toxward and Gray's property, on the south side of the Akitio River, some miles from the mouth, are several fairly strong gas-escapes. There is a gas spring on Mr. Frank Armstrong's land at Esdale, some eight or nine miles from the mouth of the Akitio River. The five springs last mentioned, together with others, lie in a narrow belt ten to twelve miles long, six or seven miles from the coast, and are not far from the boundary-line between pre-Tertiary and Miocene rocks.

At Tea-tree Point, eight or nine miles east of Weber, are one or more fairly vigorous escapes of gas, smelling of petroleum. The springs are situated on or near the crest of a north-and-south-trending anticline.

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* See also "Mineral Prospects of the Maharahara District, Hawke's Bay," on later pages of this report.

Near Waipatiki, on the Oparae Road, about a mile south of its junction with the Weber Road, a powerful gas spring, said to have been discovered about four years ago, occurs in the bed of a small stream. The gas has been piped to the Kotuku Oil Syndicate's No. 1 bore, and was there used to assist in raising steam.

Near Pukehinau, a small settlement about half-way between Weber and Pongoroa, are several gas springs, one of which, on Mr. Frank Giddens's land (Section 24) smells strongly of oil. The other springs are on Mr. A. C. Bishop's land.

A newspaper report of October, 1912, states that while borings in the bed of the Akitio River, near its mouth, were being made in order to ascertain the nature of the foundations for a proposed bridge, a strong flow of gas, which burnt for two or three hours, was struck.

During the boring of the Kotuku Oil Syndicate's No. 1 bore near Waipatiki a good deal of gas was encountered in the upper part of the bore.

Mr. H. Hill states that gas springs are fairly common southward of Cape Kidnappers, between Porangahau and Wainui. He also mentions gas springs between Waikopiro and Wallingford.*

The following analysis of gas from Aohanga, forwarded to the Dominion Laboratory by Mr. D. Laing in 1910, may be quoted† :—

	Per Cent.
Methane as marsh gas (CH_4)	35·3
Ethane (C_2H_6)	17·6
Oxygen	12·0
Nitrogen	35·1
Carbon dioxide	Nil.
	100·0

The oxygen and nitrogen may be wholly or partly due to air having found its way into the rubber bladders used for transmitting the sample.

(2.) *Mineral Springs.*

Mineral springs are common in the east Wellington and southern Hawke's Bay districts. Information has been obtained concerning the following occurrences: On Mr. Morrison's land (Blairlogie), close to Middle Division Creek, is a small spring which smells strongly of sulphuretted hydrogen, and deposits sulphur and other substances. At Langdale, on the eastern side of Morrison's and Elder's Taipos, are eight or ten similar springs, all in a small piece of ground on Mr. French's property. The water of these springs contains common salt, an iodine compound, and sulphuretted hydrogen. At Whakataki Saddle is a small spring known as the "magnesia spring," which deposits a white substance, probably carbonate of lime. The water possesses a somewhat peculiar taste and smell, probably due mainly to carbon dioxide. About three miles and a half up the Okau Stream, which enters the sea three miles north of Whakataki, is a spring the water of which smells of sulphuretted hydrogen. On Mr. R. O. Smith's property, about two miles and a half from Bideford, a small settlement fifteen miles north-east of Masterton, is a strongly saline spring. In the Rongomai district (Mangaone Valley), near Tane, a few miles north-east of Eketahuna, are a number of small brine springs, which are frequented by cattle for the sake of the salt. Most of these are on land belonging to Mr. J. M. Davie. In one instance a few bubbles of inflammable gas issue with the water. Salt springs also occur on Mr. W. R. Godfrey's land, and elsewhere in the neighbourhood. Near Makuri, east-south-east of Pahiatua, is a mineral spring concerning which the only information obtained is that it is situated on Section 7, Block XIII, Makuri Survey District, near the right bank of the Makuri River.

By searching the annual reports of the Dominion Laboratory analyses of water from a number of mineral springs may be obtained. Nearly all these springs are decidedly saline, and contain appreciable amounts of iodine, together with, in a few cases, traces of bromine. In the following list the date refers to the year of publication in the Laboratory Report, and the numbers accompanying the abbreviation "Lab." in brackets refer to the number of the report and the page:—

(1.) "Sulphur-wells," Masterton; 1907 (Lab. 40, p. 26).
(2.) Section 7, Block XV, Mangapakeha Survey District; 1907 (Lab. 40, p. 30). Two moderately saline springs exist here.
(3.) Langdale Station, Whareama; 1889 (Lab. 23, p. 69). On Mr. French's property, as mentioned above.
(4.) Pahaua (Pahaoa) district, Wairarapa East; 1878 (Lab. 12, pp. 45–46). The first water in which free iodine was found (Skey). See also "Transactions of New Zealand Institute," Vol. 10, 1878, pp. 444–46.
(5.) Ihuraua, Masterton; 1911 (Lab. 44, p. 18). Probably in valley of Ihuraua River, a stream rising some distance north of Masterton and flowing towards and past Alfredton.
(6.) Mangapuaka Creek, Dannevirke; 1909 (Lab. 42, p. 38).
(7.) Patangata (forty-three miles south of Napier); 1902 (Lab. 35, pp. 15–16).

* "Oil-wells and Oil-prospects along the East Coast," Trans. N.Z. Inst., Vol. 39, 1907, pp. 512, 519. † Forty-fourth Annual Report of the Dominion Laboratory, 1911, p. 33.

In Vol. 10 of the "Transactions of the New Zealand Institute," published in 1878, a paper by Skey mentions the following additional mineral springs:—

(8.) Wallingford (p. 444).

(9.) Northern boundary of Wellington Province, on Mr. Douglas McLean's run (pp. 446–47).

(10.) Akitio (p. 447). A carbonated water with very little chlorine and no iodine. Lime is the principal base. Is probably similar to the "magnesia spring" on Whakataki Saddle.

(3.) *Petroleum-traces.*

No decided oil-seepage is known to occur in the district under consideration, but many of the gas springs smell more or less strongly of petroleum. Oil films have been reported to occur in a small creek east of the Blairlogie gas spring, but owing to the flooded condition of the stream could not be seen by the writer during his 1910 visit.

At Mr. Maunsell's house near Tenui a smell of petroleum was perceived for weeks after a flood caused by the damming and subsequent breaking away of the neighbouring creek.

A seepage of petroleum has been reported from a gravel-pit in the bed of the Tiraumea River near Mr. Thomas Checkley's farm at Hinemoa, a few miles east or north-east of Tane. When the locality was visited by the writer the pit had been refilled with stream-gravel and no sign of oil was visible. Abundant deposits of iron-oxide on the river-bank justify the belief that films of that substance had been mistaken for oil.

The traces of oil encountered in the various trial bores for oil are mentioned later. A very interesting occurrence is a glauconitic sandstone near Aohanga, which smells strongly of petroleum, and has been shown by analysis to contain nearly ½ per cent. of oil.* The rock retains the smell for months and even years.

In Waipawa Creek, a tributary of the Mataikona River, it is said that a strong smell of petroleum has been frequently noticed.

(4.) *Ozokerite-like Mineral.*

On Mr. Frank Giddens's farm at Pukehinau, close to the gas spring already mentioned, the ground contains a peculiar substance resembling animal fat, which, however, burns only with difficulty.

A similar material comes from the Lansdowne district, near Masterton, which, though identified as having the characters of an animal fat by the Dominion Laboratory, is possibly a natural substance. A sample given to the writer has evidently been subjected to weathering. It is a very light substance, nearly white in colour, but with brownish streaks. It has a greasy feel, possesses a peculiar fatty smell which suggests animal origin, melts readily, and burns without difficulty.

(5.) *Mud Volcanoes.*

Near the mouth of the Kaiwhata River, on Messrs. Kummer's property, according to a newspaper report,† are three mud volcanoes which exude inflammable gas. They are situated at the corners of triangle with a base of about half a mile, and a perpendicular of one mile and a quarter. In July, 1911, two of them were nearly quiescent, but at the third were several active gas-vents.

PROBABLE SOURCES OF PETROLEUM.

The discovery or recognition of possible adequate sources of oil is an important matter, since it would to some extent indicate the probability of oil occurring in quantity, though in this matter the oil geologist is still greatly hampered by want of knowledge concerning the origin of petroleum. As possible sources of oil, bituminous shale, buried vegetable matter, and marine organisms may be mentioned.

The dark shales of the East Coast Series as seen by the writer in various places hardly deserve to be termed bituminous, and are not promising as possible sources of liquid hydrocarbons. Thus in 1888 Professor Park wrote, with respect to Wairarapa North County, "There is an entire absence of shales containing such a proportion of hydrocarbons as to be capable of yielding mineral oil by slow distillation."‡

The rocks of the East Coast Series contain a good deal of vegetable matter, which in places forms small pockets of coal. The minute black grains that occur in some of the sandstones and claystones are frequently if not always "bituminous" (that is, they swell on being heated like bituminous coal), but their origin is obscure. Probably they are altered fragments of buried vegetation, or possibly are derived from eroded coal-seams. If bitumen, as is very unlikely, the occurrence recalls the "tar-sands" of Western Canada and Barbadoes. Mr. Henry Hill, who in a previously cited article makes reference to these black particles comes to the conclusion that they are probably not bitumen.§ A sample of drillings from the Tane bore which was examined by the writer and found to contain a few black shining grains was not sufficiently large to enable positive determination of their nature to be made with the facilities at hand.

The marine beds of the East Coast Series do not appear to be promising as possible oil-sources, but they ought to be further investigated before being positively condemned as non-petroliferous.

Although in the east Wellington and southern Hawke's Bay district the East Coast Series, as in the Gisborne-East Cape district, gives rise to more indications of petroleum than the

* C.–16, 1910, p. 3. † *New Zealand Times*, 15th July, 1911. ‡ "On the Probable Discovery of Oil and Coal in Wairarapa North County," Rep. G.S. during 1887–88, No. 19, 1888, p. 23. § "Oil-wells and Oil-prospects along the East Coast," Trans. N.Z. Inst., Vol. 39, 1907, p. 519.

overlying Miocene rocks, and therefore appears to be the source of the gas and oil encountered, yet it is pertinent to ask whether, after all, the Miocene rocks are not the true source. If marine beds are the source of petroleum, then the Miocene beds are more competent than the underlying East Coast beds to supply oil in large quantity. It is well known that the downward migration of small amounts of petroleum and larger amounts of gas can, under certain conditions, take place. In Galicia, for example, oil has migrated from Miocene to Cretaceous rocks.* An argument tending the same way that will carry weight with many people, though its logical value is small, is that nowhere are Cretaceous rocks known to be abundantly oil-bearing, whereas in a majority of the world's oilfields Tertiary, and more particularly Miocene, rocks are eminently petroliferous. Detailed geological survey would go a long way towards solving the question raised, which has, of course, a most important bearing upon oil-prospecting methods. If a Miocene origin for the East Coast petroleum could be proved the probability of oil being found in profitable quantity would, in the writer's opinion, be appreciably enlarged.

Prospecting Operations.

During the past two years several bores have been drilled in the southern Hawke's Bay and east Wellington district in search of petroleum, but so far without success.

Near Waipatiki the Kotuku Oil Syndicate has drilled two wells to depths of over 2,000 ft. No. 1, situated about three-quarters of a mile south of the junction of the Oparae and Weber roads, encountered a good deal of gas near the surface and a light show of oil at a depth of 1,680 ft. to 1,725 ft.† The site of this well was apparently chosen on account of its proximity to the large gas spring previously mentioned. It is some distance down the flank of an anticline, and therefore not in a good position for a trial bore. No. 2 bore is about a mile and a quarter to the south, and is situated on Mr. A. D. Herrick's land. It is considerably nearer an anticlinal crest than No. 1 well, and therefore in a more promising position, although the top of No. 2 bore is about 180 ft. higher than the top of No. 1. Stratigraphically, however, it is probably quite 1,500 ft. lower. Nevertheless, so far as known to the writer, No. 2 bore met with no indication of petroleum beyond a barely perceptible show of oil in the material being brought up by the mud-pump at the time of the writer's visit from a depth of about 1,900 ft. The strata pierced by these two wells consists almost entirely of the one class of rock, a bluish claystone with occasional sandy bands. No. 1 well passed through a band of deep-green glauconitic sandstone at a depth of about 1,200 ft. What is probably the same band is exposed in Waipatiki Creek, about half a mile to the westward, where it shows a dip of 33° to the north-east.

A company known as Mangaone Oilfields (Limited), financed mainly by Napier capital, has drilled a bore at Tane, about ten miles from Eketahuna, to a depth of some 3,000 ft. The only rocks penetrated were varieties of claystone, with occasional sandy layers. The oil indications encountered were light shows of gas, and possibly an occasional film of oil. The well has lately been abandoned, and it is understood that a second bore is to be drilled on Mr. Thomas Grove's land, near the junction of the Tawataia and Eketahuna–Alfredton roads.

Conclusions.

The various indications of petroleum noted on the foregoing pages—that is, gas and mineral springs, an ozokerite-like mineral, and traces of petroleum itself—are sufficient to prove that mineral oil occurs in the area under notice, but do not lead to any definite opinion either as to the existence of a profitable oilfield or as to where trial borings, if any, ought to be made. If any conclusion is to be drawn from the too-scanty data already collected it must be that the presence of petroleum in quantity is doubtful, and that, although natural gas exists in some abundance, the chances of oil-boring operations being successful are apparently not very great. On the other hand, so much is unknown and the possible prize is so great that further prospecting on careful and sane lines may well be warranted. More data concerning surface indications of petroleum ought to be collected, and in particular settlers ought carefully to note the localities where gas and brine springs occur. Above all, a geological survey of at least part of the district, sufficiently detailed to elucidate the structure, ought to be made before any more oil-boring is done. The area of most promise is perhaps that extending southward from Waipatiki and Weber towards Pongaroa, and thence eastward to the coast; but a careful reconnaissance survey of a much larger area is also advisable.

Although a geological survey may not finally settle the question as to the existence of petroleum in quantity, it will decide some of the accessory problems, and will determine with a fair degree of accuracy the anticlines and domes that form the best sites for trial bores. To drill oil-wells in a new territory without the assistance of a careful geological survey is, in the light of present-day knowledge, sheer folly, yet this has been done in the past, and will doubtless be again done in the future.

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* Cunningham Craig: "Oil-finding." Second impression, 1914, p. 41. †See Auckland *Weekly News*, 2nd October 1913, p. 56.

4. THE TARANAKI OILFIELD.

(By P. G. Morgan, Director.)

In accordance with instructions given by the Hon. the Minister of Mines on the 16th February, the writer left Wellington on the 18th for the purpose of investigating the present condition of the New Plymouth oilfield, more especially with regard to the occurrence of water in the oil-bearing strata. Besides repeatedly inspecting the oil-wells near New Plymouth, the writer visited the United Company's bore at Tikorangi, eleven or twelve miles east of New Plymouth, and the Consolidated Oilfields of Taranaki Company's bore near Huiroa, about thirteen miles by road north-east of Stratford. On the 27th February he returned to Wellington.

Prospects of Oilfield.

As yet the production of petroleum at New Plymouth has not been sufficiently large to enable any final opinion concerning the future of the oilfield to be formulated. Government bonuses have been paid to Taranaki (New Zealand) Oil-wells (Limited) on a certified production of 500,000 English gallons of petroleum. On a later page the total production of the Taranaki Oil-wells Nos. 2, 3, and 5 bores to the 25th February of this year is shown to be 733,972 gallons. If to this be added the oil produced by other wells, including the Taranaki Oil Lands Acquisition and Development Company's Blenheim bore, the total production of the field to date still falls far short of 1,000,000 gallons.

In 1911 Mr. E. de C. Clarke, discussing the prospects of the field, wrote: "The importance and extent of the Taranaki oilfield still remain to be proved. Considering the time and money which have been spent in oil-prospecting in the district, the amount of evidence for or against the existence, in the area under discussion, of the large oilfield in which so many people firmly believe is small."* From other portions of his report the impression is gained that Mr. Clarke was by no means a disbeliever in the future importance of the field, but was anxious to impress upon the people of Taranaki and others interested the slenderness and inconclusiveness of the positive evidence for the existence of a great oilfield, and the unwisdom of assuming that possibilities were certainties. The present writer must take a somewhat similar attitude, but since additional data of a favourable nature have been obtained since 1911, the opinion may be expressed that the prospects of the New Plymouth field at the present time are more promising than ever before in its history, and that, given proper development, the field will prove profitable. The discovery of considerable oil-pools in neighbouring districts is also by no means unlikely.

Outline of Geology.

The geology of the Paritutu and Waitara survey districts, which include the New Plymouth or Moturoa oilfield, has been described by Mr. E. de C. Clarke in Bulletin No. 14, and therefore needs but brief mention here. It may be as well to remind the reader that the oil-bearing rocks, called by Mr. Clarke the Onairo Series, are nowhere exposed near the proved petroliferous area, owing to their being covered by the rocks of the Pouakai Series, which are composed mainly of fragmental volcanic material usually more or less sorted by water, and near New Plymouth are about 200 ft. in thickness. The Onairo Series is of great but unknown thickness, and consists of a succession of claystones, sandy claystones, and sandstones, with occasional bands of conglomerate. On the whole, these rocks, as exposed east and south of Waitara, have a westerly dip at moderate angles, but in places—for example, near Tikorangi—there are decided evidences of an undulatory structure. Near New Plymouth the Onairo rocks, being masked by the Pouakai rocks, are necessarily known only from the logs of the various bores. The imperfect data so far obtained are not inconsistent with the hypothesis that a gentle anticline, or, at any rate, some structure favouring the accumulation of oil, extends in an easterly or east-south-east direction from the neighbourhood of Moturoa. The present producing wells are on or near the crest of this supposed anticline.

Oil-bearing Horizons.

Mr. Clarke states that "the oil horizons, as disclosed by boring near New Plymouth, lie at approximately 1,000 ft., 2,000 ft., and 3,000 ft. below sea-level, but owing to the variable nature of the strata are ill-defined, and are at varying distances from the surface in neighbouring bores." He considers the 3,000 ft. horizon to be the most productive, and the 1,000 ft. horizon to be probably the least important.

Recent boring shows clearly that the 1,000 ft. horizon is of no great importance, except perhaps near the Sugarloaves. Mr. Clarke's 2,000 ft. horizon is more correctly at 2,100 ft. to 2,300 ft. below sea-level,† and seems actually to consist of several oil-bearing beds, separated from one another by no great thickness of claystone. This horizon has been decidedly productive, and is worthy of careful development. Owing to the fewness of bores deeper than 2,300 ft. the lower oil horizons are not well known. There is oil at approximately 2,600 ft. below sea-level (Taranaki Oil-wells Nos. 3 and 5 bores), at 3,000 ft. (Taranaki Oil-wells Nos. 2 and 3 bores), and at 3,700 ft. (Taranaki Oil-wells No. 3 bore).

Since the oil hitherto obtained is probably not indigenous to the strata in which it is found, but has migrated from greater depths, the opinion may be expressed that the main oil horizon of the New Plymouth field is at a greater depth than that to which any bore has yet penetrated. At Tikorangi oil, if present in quantity, will probably be found at somewhat smaller depths than

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* "The Geology of the New Plymouth Subdivision," N.Z.G.S. Bull. No. 14, 1912, p. 37. † On later pages this horizon will be called the 2,200 ft. horizon.

at New Plymouth (Moturoa). This opinion is in accord with the views expressed by Hector, McKay, and other geologists.

Present Conditions.

Since Mr. E. de C. Clarke reported on the New Plymouth oilfield (in 1911) a considerable amount of drilling has been done. No. 3 well of the old Taranaki Petroleum Company (now incorporated in Taranaki (N.Z.) Oil-wells (Limited) has been deepened from 3,841 ft. to 4,015 ft., and is thus the deepest bore in New Zealand, whilst No. 5 well has been deepened from 1,745 ft. to 2,644 ft., with successful results. During the past year Taranaki Oil-wells has been drilling a well, commonly known as the "rotary bore," a few chains south-eastward from their Nos. 1 and 5 bores. This well was drilled by the rotary process to a depth of about 2,190 ft., and was then "cemented." At the time of the writer's last visit drilling was being continued by a percussion method, and the bore had reached a depth of approximately 2,220 ft. On the evening of the 26th February it was reported to be 2,250 ft. deep.

During 1913 the Bonithon Company bored a second well a few chains east of their first well (No. 21 of Bulletin 14) to a depth of 2,505 ft., but was not successful in finding oil. Towards the end of December the boring tools were lost in the well, and fishing operations have apparently been fruitless, for the casing is now being withdrawn. The Taranaki Oil Lands Acquisition and Development Company has drilled the Blenheim well, situated about 11 chains east of the Taranaki Oil-wells No. 5 bore, to a depth of 2,223 ft., and has struck a good flow of oil. The Phœnix Company is drilling a few chains southward from the Taranaki Oil-wells rotary bore, and at the time of the writer's visit had reached a depth of about 2,100 ft.

A few miles east of New Plymouth, in the Bell Block district, Taranaki Oil-wells has drilled Nos. 1 and 2 bores to depths of 3,820 ft. and 2,710 ft. respectively, but so far without success, though considerable quantities of gas were encountered in both bores. Still farther eastward, near Tikorangi, the United Oil Company has recently commenced drilling. At the time of the writer's last visit the bore was approximately 500 ft. deep, and had met with favourable indications of oil. The Consolidated Oilfields of Taranaki has been boring for some time near Huiroa, thirteen miles north-east of Stratford. When visited by the writer on the 26th February the bore was about 1,750 ft. deep, and a light show of petroleum was being obtained. Similar shows had been encountered from a depth of 1,000 ft.

The position with respect to oil-production at the end of February may be summed up as thus: Taranaki Oil-wells had two producing wells (Nos. 3 and 5), with a total daily production of a little over ten barrels, though in the past production had been at the rate of twenty, thirty, or more barrels per day over short periods. The Taranaki Oil Lands Acquisition and Development Company had one productive well, the Blenheim, which for a few days during January yielded oil at the rate of fifty barrels per day. This production, however, for debatable reasons, has not been maintained. At the time of the writer's visit the well, at a guess, was producing twenty to twenty-five barrels per day.

Quality of Oil.

Few analyses of the Taranaki oil are at present available. Some of these were quoted by Mr. Clarke in Bulletin No. 14. It may suffice here to say that the oil is a valuable one with a paraffin base, and is worth at the well's mouth 10s. or more per barrel of 42 gallons. For special purposes it has brought 15s. to 17s. 6d. per barrel.

Gas.

The gas that is produced in considerable quantity by some of the wells during several years has been used for steam-raising purposes. The analyses given in Bulletin No. 14 (p. 46) show that it is of peculiar composition, containing almost as much ethane as methane, and a very high proportion of carbon dioxide. On account of this latter constituent, which probably varies considerably in amount from time to time, the gas sometimes does not ignite very readily, and the flame is liable to be accidentally extinguished—for example, through the sudden admittance of a body of cold air into the firebox when the door is opened. Partly on this account a small auxiliary coal-fire has to be maintained when gas is being burnt under the steam boilers.

The gas from Petch's farm and other localities a few miles from New Plymouth consists mainly of methane, with no ethane, but with a small percentage of olefines. It corresponds very closely to gas from various oilfields in other parts of the world, and may therefore be regarded as derived from petroliferous strata. In the oilman's phrase it is "petroleum gas." The present writer therefore concurs with Mr. E. de C. Clarke's recommendation that the gas-producing belt of country extending for fifteen miles in an east-south-east direction from the Sugarloaves should be prospected by boring.

In all oilfields with flowing wells the influence of gas-pressure in causing expulsion of the oil is believed to be paramount. Since in the course of a few years the gas-supply and its pressure may diminish almost to zero it is important to conserve gas as far as possible, and to allow no unnecessary waste.

Reference may here be made to the great degree of cooling produced by the sudden expansion of gas which enters a well under pressure. This will cause the deposition of solid paraffin, and may lead to the blocking not only of the well, but also of the oil sand immediately surrounding it.*

Water.

Considerable quantities of water have been encountered at various depths in all the boreholes drilled, but, unfortunately, the details given in all the older bore-logs are extremely

* Cunningham Craig: "Oil-finding." Second impression, 1914, p. 53.

imperfect, and few definite data concerning the water-bearing beds can be obtained. The volcanic beds (Pouakai Series) near the surface are water-logged from sea-level downwards until replaced at about 200 ft. by the claystones and sandstones of the Onairo or petroliferous series. This water is easily shut off, and need not be further considered. From 200 ft. to 1,500 ft. below sea-level fresh artesian or subartesian water is encountered at several horizons in the Onairo rocks, but apparently not in great quantity. One well (Booth's) at 800 ft. encountered a spring of "warm bitter water." The principal artesian-water horizon seems to be about 1,700 ft. below sea-level, at which depth the Onairo Series contains bands of sandstone and pebbly layers. The water is variously reported as fresh and as saline. It is probably everywhere slightly brackish, like the water now escaping outside the inner casings from Taranaki Oil-wells No. 3 bore and from the Blenheim bore. At approximately 2,050 ft. to 2,150 ft. below sea-level water with a salinity approaching that of sea-water is encountered. In Taranaki Oil-wells No. 5 bore salt water is reported from a depth of 2,599 ft. In No. 3 well water more than twice as salt as sea-water reaches the surface with the oil being produced. This water probably comes from a depth of over 3,000 ft. It is remarkable as being highly alkaline, whilst the other salt waters of the field are nearly neutral. Salt water was encountered in Taranaki Oil-wells Bell Block No. 1 bore at a depth of 2,210 ft., and salt or brackish water also occurs in the United Company's bore at Tikorangi, and in the Consolidated Oilfields of Taranaki Company's bore at Huiroa.

The occurrence of saline waters at various horizons in the Taranaki oilfields is an interesting and important fact, the full significance of which is not understood at the present time. It is to be hoped that the various oil companies will keep careful records of all water encountered in their bores, whether salt or fresh, and also that complete analyses of the water from each horizon below 1,600 ft. will be made for every bore.

Salt Water produced with Oil.

In past years more or less salt water has been produced with the oil at every bore. It seems, however, that the present No. 3 bore of Taranaki Oil-wells, when being drilled by the Samuel Syndicate in 1896, for a short period yielded pure oil. Mr. E. de C. Clarke writes: "The water at 1,885 ft. having been shut off and a packer placed at 1,934 ft., oil unmixed with water began to flow at the rate of 270 gallons per twenty-four hours."* Recently the Blenheim well is stated to have produced pure oil when it first began to flow, and towards the end of February nearly pure petroleum was again being bailed.

The amount of salt water ejected with the oil at Nos. 3 and 5 bores of the Taranaki Oil-wells varies, perhaps proportionately with the oil, perhaps not, no exact measurements having ever been made. Probably at least 60 parts of water are produced for every 40 parts of oil. It is possible that salt water occurs so close to the oil-bearing strata hitherto tapped that it cannot be excluded from the oil by cementing or other water-exclusion process. This is maintained by some of the persons interested in the Taranaki Oilfield, but the writer sees no reason for accepting such a statement without clear proof of its truth. Still less can the assertion that the presence of water is desirable, or at least no detriment, be considered a reason for complacently regarding any attempt to alter the present conditions as unnecessary. On the other hand, it is true, A. Beeby Thompson writes: "Many of the oldest boring-masters in the oilfields [of Russia] emphatically insist that a proportion of water with the oil does improve the life and production of the well, and there is without doubt much truth in the assertion, for in most of the best Saboontchy, Romany, and Bibi-Eibat wells the percentage of water raised amounts in the aggregate to from 20 to 40 per cent."† Boverton Redwood similarly, but much more cautiously, says: "The admixture of salt water with the oil in the more compact rocks seems to facilitate the flow of the more viscous varieties."‡ In a later work Beeby Thompson again refers to the supposed favourable influence of a limited quantity of water under the special conditions of compact strata and limited gas-pressure. He writes, "Deprived of gas, the flow in such compact strata is exceedingly slow, especially in the case of heavy viscous oils such as parts of California produce. A limited contamination with water is often the salvation of a field where such conditions pertain, and the productive life of wells is prolonged by the presence of salt water which mingles with the oil, rendering it more fluid and flowing with it towards the points of abstraction."§ Thompson also cites the 1904 report of the West Virginian Geological Survey in support of his views. Notwithstanding what has been quoted, it cannot be doubted that the presence of water with petroleum is both objectionable and dangerous during the early development of an oilfield, though during the last stages it may become a necessary evil. Water produced with petroleum is objectionable because of the expense of separation and of the loss of volatile constituents during the separating process. This loss may doubtless be prevented, but at the present time a very large proportion of the benzene in the New Plymouth petroleum is wasted. Moreover, the passage of salt water up the well increases the liability of the casing to corrosion.

The danger of admitting water to an oil-bearing stratum is now so well known that little need be said concerning the matter. One or two quotations from Beeby Thompson, which leave quite a different impression on the mind from the passages previously cited, may be made: "Time after time oilfields of great promise have been abandoned after the expenditure of fortunes on fruitless attempts to check the apparently almost limitless volumes of water which entered the wells and displaced the petroleum as soon as its extraction was commenced."‖ Again:

* Bull. No. 14, 1912, p. 32. † "The Oilfields of Russia," 2nd ed., 1908, p. 55. ‡ "Petroleum and its Products," 2nd ed., 1906, Vol. 1, p. 107. § "Petroleum-mining," 1910, p. 57. ‖ *Op. cit.*, p. 260.

"When an oil source is struck beneath a water-bearing stratum a moderate production of oil may be maintained for a while if the water is only imperfectly excluded by the casing, on account of the pressure of the oil, but as soon as the gas-pressure diminishes and the natural level of oil falls below the hydrostatic head of the water the latter enters the well and mingles with the oil. For a while an emulsified mixture of oil and water may be raised, but as the water increases in volume and cuts a passage behind the casing the oil is steadily replaced, and an increasing volume of water at length totally excludes the oil from the well, although the gas may continue to escape. As a rule the entrance of water has then proceeded too long to allow any effectual measures for its exclusion, such as might have been undertaken when the well was first completed."*

It has been said that the New Plymouth petroleum occurs naturally mingled with water. Such a statement, entirely at variance with the fundamental facts known to all that oil and water do not mix,† and that oil (except in rare cases) is lighter than water (Taranaki petroleum has an average specific gravity of 0·845), needs no refutation. Certainly, by violent churning a temporary mixture of oil and water could be produced, and it is possible by the addition of clay to produce a more permanent emulsion. If the material from a so-called "mud vein" finds admittance to a producing oil-well, doubtless a mixture such as that recently encountered in the Blenheim well will be produced. Exceptionally "mud veins" containing petroleum in suspension may exist, but of this there is no definite proof.

The orthodox and undoubtedly correct view with regard to petroleum and water is that they do not occur in the same stratum in the same place.‡ A water-bearing stratum may exist a short distance above petroliferous stratum, but in that case the water and the oil must necessarily be separated by an impervious layer. Again, there may be water immediately below an oil-bearing stratum, or in the latter at a lower level than the oil, for example, on the flanks of an anticline. In the former case the oil may be regarded as floating on the water, and it will be imposible to exclude all water from the oil-wells. In the latter case there will be a narrow belt on each side of the anticlinal crest where the wells will produce both oil and water. As the field becomes exhausted more and more wells will "turn to water." In the case of the New Plymouth field there is no conclusive evidence that water occurs in such close proximity to the petroliferous strata that it cannot be excluded from them. The proper course to pursue therefore is to make every effort totally to exclude water from the bores before these reach any oil-bearing stratum.

Summary of Data relating to Principal Bores.

The following particulars are in part supplementary to the data given by Mr. E. de C. Clarke in Bulletin No. 14, which should be consulted for further information:—

Taranaki Oil-wells No. 1 or Birthday Bore.—(No. 16 of Bulletin 14, pp. 33–34, and in tabular comparison of records of bores.) Formerly known as the Birthday well. Depth, 2,340 ft. This well, drilled in the first place by the late Mr. G. C. Fair, struck oil on the 22nd June, 1905, at a depth of 2,230 ft. The original casing being very defective, and water very troublesome, in 1906 the well was recased and deepened to 2,345 ft. with fairly successful results by the Taranaki Petroleum Company. Mr. Clarke states that "the casing, however, is in a very bad state, being much bent and having one or two holes punched right through it."§ In 1907 the well was cleaned out to a depth of 2,269 ft. In 1910 further efforts were made to clean out the well, and 6 in. casing was inserted to a depth of 2,320 ft. Since then, so far as the writer can learn, nothing has been done except to withdraw much of the casing. The present proprietary company, Taranaki (N.Z.) Oil-wells (Limited), has never done any drilling in this well, and all the machinery except the derrick has been removed. It has not yielded any oil for some years, and for all practical purposes is an "abandoned well" in the ordinary oilfield sense of that term.

Taranaki Oil-wells No. 2 or Roy's Well.—(No. 17 of Bulletin 14, p. 34.) Depth, 3,030 ft. Casing, 10 in. and 8 in., inside which is 2,114 ft. of 6 in. casing, with which water is stated to be shut off. The well was cased to a depth of 3,020 ft. with 5 in. casing, but this has been withdrawn for perforation and not yet replaced. This well produced a little oil at 1,872 ft., and at 2,209 ft. a very fair flow of oil, equal for a short time to twelve barrels per day, was obtained. On the 5th January, 1910,‖ a steady flow, reaching ten barrels per day, was struck at a depth of 3,030 ft., and continued for nearly three years until, on the 12th December, 1912, the well, owing, it is said, to silting, ceased to flow. So far this well has been the best on the field. Its total production during the 1,032 days it flowed was 300,499 gallons of oil, equal to 291 gallons, or about seven barrels per day. Since at the present time (February, 1914) no work is going on, though it is understood that the proprietary company intends to resume operations, the well may be regarded as temporarily abandoned.

Taranaki Oil-wells No. 3 or Samuel's Bore.—(No. 9 of Bulletin 14, pp. 32, 34–35.) Depth, 4,015 ft. Casing: 8 in. to 1,800 ft., 6 in. to 2,540 ft., 5 in. to 2,541 ft., 4 in. to 3,980 ft. The water is stated to be shut off with the 5 in. and 6 in. casing. A little water, slightly brackish, and probably derived from the 1,700 ft. horizon, reaches the surface inside the outer casing. It will be noted that water may not be excluded from the 2,200 ft. oil-bearing stratum. Since the 2nd March, 1910, the well has produced oil at the rate of from eight to three barrels daily, except when temporarily blocked by the accumulation of solid paraffin in the casing. When

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* *Op. cit.*, pp. 261–2. † Traces of water may dissolve in oil, and *vice versa*. ‡ See, for example, the monumental work by Hofer, Engler, and others, entitled "Erdols." § Bull. No. 14, 1912, p. 34. ‖ This date is given on page 34 of Bull. No. 14. On page 53 the date "5th June, 1910," is mentioned, but is evidently an error.

this occurs the well is capped for a day or more until a considerable amount of gas has collected in the casing under pressure. On the capping being removed it blows itself clear. The well has produced about 166,855 gallons of petroleum, 49,277 gallons of which flowed in 1913, an average per day of 135 gallons. It may perhaps be as well to explain that the petroleum here and at No. 5 well is not pumped or bailed, but is forced (with salt water) to the top of the casing mainly by gas-pressure, the action being more or less analogous to that of a geyser.

Taranaki Oil-wells No. 4 Bore.—(No. 18, Bulletin 14, p. 35.) Depth, 1,678 ft. This well was drilled by the Taranaki Petroleum Company some distance to the eastward of its other bores, and was abandoned owing to difficulties with quicksand. The present company has not done any work at this bore.

Taranaki Oil-wells No. 5 Bore.—(No. 25, Bulletin 14, p. 35.) Depth, 2,644 ft. Casing: 8 in. to 1,858 ft., 6½ in. to 2,027 ft., 5 in. to 2,045 ft., 4 in. to 2,633 ft.* Water is stated to be shut off with the 5 in. casing. Fresh water occurred in this bore at 20 ft., 285 ft., 390 ft., and 484 ft. Water at 1,700 ft. to 1,800 ft. in sand was reported as fresh, but probably was very slightly brackish. Salt water was encountered at 2,187 ft. and 2,599 ft. It does not appear that the salt water is excluded from the oil-bearing strata.† Gas was obtained at many points from 210 ft. downwards, and oil at 2,187 ft., 2,443 ft., 2,582 ft., and 2,642 ft. Oil began to flow from the bore on the 11th February, 1912, and is still flowing, mixed with a more than equal bulk of salt water. At first the daily flow was probably about thirty barrels, but is now only eight barrels or less. During 1913 the well produced 130,293 gallons of oil, or 357 gallons per day. Its total production (to February, 1914) is 266,618 gallons.

Taranaki Oil-wells Rotary Bore.—Depth (end of February), about 2,250 ft. Casing: 12 in. to 747 ft., 10 in. to 1,778 ft., 8 in. to 2,185 ft., 6 in. to 2,220 ft. This bore was drilled by the rotary system to a depth of about 2,190 ft. At 2,185 ft. water was shut off by cementing, and tests made in the writer's presence on the 20th February showed that not more than two or three gallons of salt water was entering the bore per hour. This result, however, proved little beyond the soundness of the casing, for so far as the writer knows the bottom of the bore had not then been disturbed by a renewal of the drilling. Boring by the percussion method having been resumed, on the 25th February strong traces of gas and oil were encountered, and on the 28th February more oil and gas. On the 4th March, according to a newspaper report, a strong flow of oil, accompanied by great gas-pressure, was struck.

Taranaki Oil Lands Acquisition and Development Company's Blenheim Well.—Present depth (end of February), 2,223 ft. Casing: 12 in., cemented at 973 ft.; 10 in., cemented at 2,024 ft. Artesian water, very slightly saline and with a temperature of 100° F., was encountered at 1,700 ft. Some of this water reaches the surface between the 10 in. and 12 in. casings. Oil was struck in the bore on the 31st December, 1913, at a depth of about 2,170 ft. The flow increased during January until by bailing as much as fifty barrels per day of pure oil are stated to have been obtained. After 19,000 gallons of oil had been won pumping was stopped for a few days on account of want of storage. On the 3rd February bailing was resumed, but instead of petroleum the well was found to be nearly filled with a thick emulsion of oil, mud (clay), and salt water, and it was found difficult to reduce the level of the liquid in the casing below 1,000 ft. It was asserted by the management that the influx of the mud and salt water was due to leakage from No. 5 and, perhaps, other bores of the Taranaki Oil-wells. This matter is discussed elsewhere. At the time of the writer's visits on the 21st and 23rd February the conditions had changed somewhat. The bore had been deepened from 2,180 ft. to 2,223 ft., and a fresh flow of oil struck at 2,211 ft. Nearly pure petroleum at the rate of perhaps twenty to twenty-five barrels per day was being bailed from a depth of 400 ft., but at somewhat greater depth the well still contained oil-mud-salt-water emulsion, a little of which was being bailed with the purer oil.

Phœnix Company's Bore.—This bore, situated 6 or 7 chains south of the Taranaki Oil-wells rotary bore, at the end of February had attained a depth of about 2,100 ft. It was lined with 14 in. casing to 270 ft., and 10 in. casing to near the bottom. It was proposed to cement the well at about 2,200 ft., and then to continue boring. Oil is expected to be struck before the bore reaches 2,300 ft.

Bonithon Freehold Petroleum Extended Company's No. 1 Bore.—(No. 21, Bulletin 14, pp. 36–37.) Depth, 3,005 ft. The log of this bore, as published in Bulletin No. 14,‡ hardly mentions water. Traces of oil and gas were encountered at various depths from 1,480 ft. downwards. At the present time water with a decided taste of carbon dioxide (soda) is issuing from holes bored in the wooden plug which closes the top of the casing. Nothing having been done at this bore for a considerable time, and all the machinery having been removed, it may be considered to be an abandoned well.

Bonithon No. 2 Bore.—This was drilled by the rotary system to a depth of 2,505 ft., when, as previously mentioned, the tools were lost in the well. Casing was inserted to a depth of 1,920 ft, but this at the end of February was being withdrawn, and apparently the well was to be abandoned. Water, seemingly fresh, but with a peculiar taste and smell, was issuing from the top of the bore. During boring a little gas and traces of oil are said to have been encountered.

Other Bores.—The other bores in the neighbourhood of New Plymouth over 2,000 ft. in depth are the New Zealand Standard Oil Company's Carrington Road or Hadley bore, reported to be over 3,200 ft. deep, and the Taranaki Oil-wells' two bores on Bell Block, mentioned on a previous page. These three bores are all several miles from the proved portion of the oilfield.

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* The actual length of pipe inserted was 2,662 ft., but 29 ft. of this represents the approximate overlap of the joints. In other cases no deduction for overlap is known to have been made. † Some little time after the writer's visit the 5 in. casing collapsed, and was withdrawn, together with the 4 in. casing, by the company. The 6 in. casing was then carried to 2,110 ft., and cemented at that depth. ‡ See tabular comparison of record of bores, in pocket at end of bulletin.

The Water Danger.

It is now recognized on every oilfield in the world that the entry of water in quantity into oil-bearing strata, if allowed to continue, results in irremediable damage, and that therefore it is necessary that the State should provide by law for the exclusion of water from bores which enter oil-bearing strata, and for the proper plugging of abandoned wells, which, even if watertight in the first place, will in a year or two became a source of danger through the corrosion or collapse of the casing.

In order to determine what is now taking place in the New Plymouth oilfield it would be necessary to have a complete record made by independent persons of all that has been done or has happened since January, 1905, when the Birthday well (No. 1 of Taranaki Oilwells) reached a depth of 2,100 ft. In addition analyses of water, oil, and gas, as these were encountered in each well, ought to have been made. In the absence of full information it is now impossible, or at least extremely difficult, to arrive at definite conclusions. Hence the writer's opinions, as stated below, vary from possibilities to probabilities, but in no case except (5) represent a certainty. These opinions are—

(1.) That some flooding of oil-bearing strata at New Plymouth has already occurred.

(2.) That up to the present time the flooding is slight, and that no serious or irremediable damage has been done. Reasons for this view are that so far gas-pressure has counteracted water-pressure to a great extent; that the strata are mainly claystone, and therefore tend to close tightly against casing; and that not a great deal of water has been produced with the oil by the various bores. There is no evidence to show that this water, which is as salt as or salter than sea-water, has been diluted by the fresh or nearly fresh water from horizons above 1,800 ft.

(3.) Efforts to shut off water have not always been made, and when made have not, as a rule, been certainly successful. The watertight nature of the strata drilled through, and their packing against the casings, have, however, not improbably saved the situation.

(4.) That the statements made by representatives of the Taranaki Oil Lands Acquisition and Development Company, the United Oil Company (Tikorangi), and the Phœnix Company on the one hand, and by persons interested in the Taranaki Oil-wells (Limited) on the other hand, are made in good faith, but neither side can absolutely prove its assertions.

(5.) That the immediate issue of regulations to ensure the exclusion of water from the oil-bearing strata is necessary.

Discussion of Bores.

The probability or otherwise of water having entered the oil-bearing strata may perhaps best be inferred by discussing a number of the bores separately.

Taranaki Oil-wells No. 1 or Birthday Bore.—The history of this bore from 1905 to the present time shows that it is only too probable that water was allowed by it to enter the 2,200 ft. oil stratum, especially during 1905 and the early part of 1906. The fact that a good flow of oil was obtained in 1906 from this well after it had been deepened to 2,345 ft. indicates that probably not much water had then entered the oil stratum. If, as is likely, the lower part of the bore during recent years has been filled by silting and by the collapse of its walls, then the bore is doubtless safe at the present time. If, however, the collapse is not complete, and the bore is more or less open below 1,700 ft., it may be admitting water to the 2,200 ft. oil stratum.

Taranaki Oil-wells No. 2 Bore.—Concerning this well Mr. E. de C. Clarke states, "According to local report No. 2 bore is not in a very satisfactory state, 250 ft. of casing being, it is asserted, adrift somewhere in the well."* As previously mentioned, this well ceased flowing on the 12th December, 1912. Probably up to this time the well had not admitted any great quantity of water, if any, to the oil-bearing strata. At the present time no definite opinion as to water conditions in the bore can be formed, but it is open to suspicion. In particular, any salt-water stratum there may be between 2,114 ft. and the well-bottom at 3,030 ft. must be in connection with the oil-bearing strata except in so far as silting and caving have caused the blockage of the well.

Taranaki Oil-wells No. 3 Bore.—This well has a long history dating from November, 1895. Since then it has been repeatedly recased and deepened. There is no evidence that water is shut off above 2,540 ft., and therefore there is a possibility that the bore is admitting water to the 2,200 ft. oil stratum. On the other hand, not improbably claystone may be tightly packed against the 6 in. casing below 1,800 ft., and water thus excluded from the oil-bearing strata. Since oil (with salt water) reaches the surface, it is probable that gas-pressure is at present effective in preventing water from entering the oil-bearing strata below 2,500 ft., even if the casing is defective, of which, as a matter of fact, there is no evidence.

Taranaki Oil-wells No. 5 Bore.—It is admitted that at 2,045 ft. a good and probably successful attempt to exclude the water at higher horizons from this bore was made.† It does not appear, however, that the salt water encountered at 2,187 ft. and 2,599 ft. is shut off. There may not be a great quantity of salt water at either horizon, and packing of the claystone country against the casing may be effective in preventing any serious leakage. The production of salt water with the oil cannot, however, be regarded as a satisfactory feature.

Taranaki Oil-wells Rotary Bore.—So far as the writer could judge, this well was satisfactorily cemented at 2,185 ft., but though the test made showed that the casing was tight and in good order, it could not be regarded as proving that all water behind the casing would be prevented from following down and entering the well as this was deepened. It is just possible that while this well was being bored by the rotary system the pressure of the muddy water forced

* Bull. No. 14, p. 34. † See, however, footnote on p. 140.

down the inside of the casing to the bottom of the bore acting along a plane of weakness caused the influx of oil-mud-salt-water emulsion into the Blenheim bore. There is now no means of testing this hypothesis. It is tolerably certain that there was no direct flow from the rotary bore to the Blenheim well, because the water that entered the latter was salt, and not fresh or merely brackish.

Taranaki Oil Lands Acquisition and Development Company's Blenheim Well.—This is the bore supposed to have suffered by the operations of the Taranaki Oil-wells. Whether this was so or not cannot be conclusively proved. The mud-salt-water-oil emulsion which entered the well towards the end of January may have come from Taranaki Oil-wells No. 1 bore, or have been conditioned by the rotary bore, as mentioned above. More probably, the writer thinks, a so-called "mud-vein" or "fissure" broke into the bore. So far as could be ascertained mud-water-oil emulsion had ceased to enter the well before the 20th February.

Bonithon No. 1 Bore.—There is no record of water having been shut off in this bore. Not improbably the soft claystone country has packed against the casing, or, if the deeper casing has been withdrawn, has filled the lower part of the bore by caving and silting. The bore is not far from the prolongation of the narrow belt on which the present producing wells are situated. It may actually have passed through an oil-bearing stratum without oil, owing to the pressure of the water in the bore, being detected. In that case this well is certainly a possible source of danger.

Bonithon No. 2 Bore.—Since this well was not cased below 1,920 ft., and, moreover, the casing is being withdrawn, it is a possible source of danger.

Suggestions.

(1.) *Keeping Bore-logs and other Records.*—In the past, as is well known, very unsatisfactory bore-logs were kept. Much more careful records are now being made, but it may be suggested that the various companies should agree on a co-operative method of keeping the drilling-logs and other data of importance, and for the common benefit should freely communicate these to one another. Samples of the bore rocks should be methodically taken and preserved. Reference may here be made to the remarks of Mr. Clarke on pages 37 and 47 of Bulletin No. 14.

(2.) *Temperature Observations.*—Temperature observations of water and oil as struck in each bore, and also of the strata, are desirable.

(3.) *Analytical Work.*—Complete analyses of water, oil, and gas from the different horizons would be of great value.

(4.) *Pumping Wells.*—Bailing or pumping the wells may be recommended where there is not a good flow of oil. In the past considerable ingenuity has been displayed in inducing reluctant bores to flow freely at psychological moments, the *modus operandi* being to cap the casing until a considerable amount of gas under pressure had accumulated, when, on opening the stop-cock, spectacular results could be obtained. The same method is now employed quite legitimately for cleaning out a well, &c. The writer is of opinion, however, that when the production of a well begins to fall materially pumping or bailing ought to be resorted to rather than attempts to coax a flow by means of gas-pressure. In this connection it may be again observed that the expansion of gas under pressure has a tremendous cooling effect, and this may be the real or main reason why wells become blocked by paraffin. Originally the oil in the 2,200 ft. stratum has a temperature almost certainly over 90° F., and probably over 100° F. It should therefore flow to the bore quite freely without assistance from water, and if cooling from gas-expansion be avoided, remain liquid in the bore.

Recommendations re Regulations.

Whatever may be the actual facts concerning the question of damage done to any part of the oilfield, there can be no dispute regarding the danger of allowing bores to pass through a water-bearing stratum without the water being securely shut off, or of abandoning wells without properly plugging them. It is therefore imperative that regulations be introduced as soon as possible to deal with these and other matters requiring attention. Representatives of the companies interested in the field have concurred in the suggestion that regulations should be made. In order to frame these it is not necessary to ascertain the exact conditions at New Plymouth, or to await future developments, for the experience of foreign oilfields is a clear and sufficient guide. The writer recommends—

(1.) That the oil-bores near New Plymouth be frequently inspected (at least once a quarter) by an Inspector of Mines or other competent person appointed by the Mines Department. As soon as the oil-production warrants it, a special Inspector resident on the field should be appointed.

(2.) That regulations ensuring the proper shutting-off of water in wells now being bored or flowing oil, and the proper plugging of abandoned wells, be gazetted at the earliest possible date.*

(3.) That further regulations be drawn up to provide, *inter alia*, that—

(*a.*) No bore is to be commenced until the Inspector of Mines (or his deputy) be notified.

(*b.*) Plans of the surrounding areas and sections of all bores, drawn to approved scales, are to be supplied periodically and upon request to the Inspector. The plans to show positions of all buildings, machinery, pipe-lines, storage-tanks, &c. The sections to show sizes and lengths of casing, points at which water or oil is encountered, nature of strata, &c.

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* The reader may be referred to "Oil Production Methods," 1913, by Paul M. Paine and B. K. Stroud, for a description of modern methods of excluding water from oil-bearing strata (pp. 130–142).

(*c.*) Careful and correct logs of all bores are to be kept, and copies forwarded regularly to the Inspector.
(*d.*) Samples of rocks bored are to be taken regularly and kept in a suitable core-box at or near the bore.
(*e.*) No casing is to be withdrawn without permission of the Mines Department (to be given through the Inspector).
(*f.*) When a well is to be abandoned notice should be given to the Inspector, who will then order it to be plugged or filled by some approved method.
(*g.*) No water-flush boring system of drilling is to be employed without the permission of the Inspector, and then only to such depth and under such conditions as he may approve. In all cases a non-flush system to be combined with the flush system permitted.
(*h.*) All bores are to be situated approved distances from public roads, from buildings, from the boundaries of adjoining properties, &c.
(*i.*) No well is to be bored within a specified distance (say, 300 ft.) of any other well operating on adjoining property.
(*j.*) Boiler-houses are to be, say, 30 yards from bore, gas-tanks, or oil-storage tanks or reservoirs, and to be completely isolated from derrick, &c.
(*k.*) Only electric lights, suitably protected from accidental breakage, are to be used in or about derrick, gas-tanks, oil-tanks, &c. Wiring connections, switches, to be outside derrick, &c.
(*l.*) Proper precautions against explosions or accidental fires are to be taken where gas or oil is used for firing boilers, &c.
(*m.*) Penalties are to be enforced against smoking or other practices likely to lead to an explosion or fire near bores producing oil or inflammable gas, near oil-storage tanks, &c.
(*n.*) All drillers in charge (head drillers) are to be certificated.

Literature.

Reference may be made to the following literature dealing more or less with matters raised in this report:—

(1.) "Preliminary Report No. 1: Petroleum." By F. McN. Hamilton and R. P. McLaughlin, California State Mining Bureau, 1914. This report gives a vivid picture of the water menace and of problems that have to be solved. It states that "the gathering and patching together of evidence is the prime necessity."

(2.) "The Prevention of Waste of Oil and Gas from Flowing Wells in California." By Ralph Arnold and V. R. Garfias. Technical Paper 42, U.S. Bureau of Mines, 1913.

(3.) "Proposed Regulations for the Drilling of Gas and Oil Wells, with Comments thereon." By O. P. Hood and A. G. Heggem. Technical Paper 53, U.S. Bureau of Mines, 1913.

(4.) "Mining Laws." Bulletin No. 66, California State Mining Bureau, 1914. On page 33 are quoted the provisions of an Act designed to prevent waste of natural gas. On pages 33–35 are quoted the provisions of an Act intended to prevent injury to gas- or petroleum-bearing strata by the penetration of water therein.

(5.) The following articles in the *Petroleum Review* deal with the water problem*:—

"Water the Enemy of the Petroleum Industry." By Dorsey Hager. In issues of 15th and 29th September, 1911.
"The Water Difficulty in the Californian Fields." 4th May, 1912.
"The Menace of Water in the Oilfields." By W. H. Storm and Paul Prutzman. In issues of 7th and 21st September, 19th October, and 2nd November, 1912.
"The Cementing Process of Excluding Water from Oil-wells as practised in California." By Ralph Arnold and V. R. Garfias. In issues of 22nd March and 12th April, 1913.
"Exclusion of Water and the Isolation of Water in Oil-wells." By John Wells. In issue of 19th April, 1913.

Appendices.

(1.) *Extract from Galician Petroleum Mining Regulations.*†

Section 7—Shutting off and extracting Water.—Par. 75: In each borehole the subterranean water should be isolated by casing so that it cannot penetrate to the oil and wax strata. Without the authority of the Mining Department this casing cannot be removed. After each gravel formation encountered is passed the water coming therefrom must be isolated immediately. The art and manner of isolating the water should be shown in proper working plans. If, after shutting off the subterranean water, water is introduced into the borehole under pressure the neighbouring exploiters have the right to control the amount of water so introduced, and in the same way have the right after the shutting-off of the water to control the eventual loss of water by the use of water-flush-drilling systems. If the watering of a borehole is suspected the District Mining Officer (Inspector) should, upon being requested by the neighbouring exploiters, or obtaining the knowledge of it himself from other sources, immediately make a local inspection, accompanied by experts, and should, using the result of this inspection as a basis, give the necessary instructions for dealing with the matter.

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*The writer is indebted to Mr. A. E. Watkins, New Plymouth, for the loan of copies of these articles.
† Translated by Mr. J. R. von Fedorowicz.

Par. 76: If it is a question of withdrawing the casing from the boreholes which are to be abandoned these boreholes should, as the casing is withdrawn, be filled with watertight material. The District Mining Officer should be notified of the intention of blocking a borehole at least a fortnight before operations are started. The District Mining Officer receiving such notice should immediately make a local inspection, requesting the proprietors of the neighbouring exploiting rights to accompany him, in order to determine in what manner the blocking of the borehole shall be carried out so as to prevent the subterranean water from entering the oil and wax strata. The proprietors of the neighbouring boring rights have the right to control the manner of blocking the borehole.

Par. 77: In all producing boreholes where there is not a complete isolation of the water the water should be continually withdrawn in order that its own and neighbouring mining areas may not be flooded. If this is not done the mining authority, at the request of the proprietors of the neighbouring rights, will order the withdrawing of the water or the watertight blocking of this borehole, and if his orders are not carried out during the succeeding fortnight will undertake the work himself, but at the cost of the exploiter who was ordered to do it.

Par. 78: In the event of a borehole being abandoned in which there is not a complete isolation of the water it should be at once filled with watertight material.

(2.) *Law in West Virginia regarding Abandoned Wells.*

The law in West Virginia regarding abandoned wells is shown by the following quotation from the *Mining and Scientific Press* (San Francisco), 29th November, 1913, page 872:—

"*Abandoned Oil-well—Failure to Plug.*—A person who drills an oil-well and then abandons it without plugging it, so that water rises in the well, enters the oil- and gas-bearing sand, and causes the gas-flow from a well on adjacent land to cease, is liable to the owner of the land on which the adjacent well is situated for damages, both on the common-law theory that he has used his own property in such a negligent manner as to injure his neighbour, and upon the further grounds that he has violated a State statute requiring that abandoned wells be plugged.—Atkinson *v.* Virginia Oil and Gas Company (West Virginia): 79 South-eastern, 647, 23rd September, 1913."

(3.) *Extract from Roumanian Water-flush Drilling Law of 1906.**

"Every precaution is to be taken during water-flush drilling to note losses of water. If a loss of water is observed the water-flush drilling must be suspended until the borehole is protected from water-loss by the insertion of casing. Near the oil-bearing stratum water-flush drilling must be suspended. In exceptional cases the Government Engineer may permit the continuing of water-flush drilling into the oil-bearing stratum. In new territories water-flush drilling is prohibited. In exceptional cases it may be allowed where favourable geological and mining conditions exist, but in all cases it must be combined with a non-water-flush system. This special permission can be given only after a commission appointed by the Minister has given its advice."

(4.) *Summary of Portions of Russian Law relating to Petroleum-mining.*†

There appears to be a Central Mining Board, and in addition on each field a District Mining Engineer, whose duties include supervision of the oil industry in order to see that the regulations *re* plans and safety of workers and of oil industry are observed, and the compilation of statistics.

There is a small tax on oil produced.

Owners of prospecting-bores have to notify the mining administration when work is ceased, and withdraw casing as directed. A similar rule applies to producing wells which cease production or are abandoned.

There is a minimum area of about 5 acres (2 dessatines) for plots of land which can be bored.

The erection of plant, buildings, &c., is more or less subject to regulation. Owners of oil lands must, if compensated, allow neighbouring owners access for necessary purposes.

Producers or oil-seekers must conform to regulations *re* prevention of fires and other matters; must keep plans of their plots, entering up on same all drilling-work done, buildings erected, &c.; must allow Government officials to inspect bores, plant, &c.; and on request must supply exact statistics of production, &c.

When drilling operations are started the producer (oil-seeker) must notify the local District Engineer and submit plan and explanation of nature of proposed operations.

The producer must keep a bore-log of the proper description and a section of the formations drilled through. He (or the driller in charge) must supply a copy of the daily log to the Mining Engineer representing the Mines Department (p. 53). He must follow the instructions of the District Engineer with regard to safety of workmen and of bores, &c., and with regard to protection against fires, &c. He must have in readiness protective devices for regulating the flow of oil, &c.; must get these devices into position upon the first indication of a spouter; and must report appearance of a spouter without any delay to the District Engineer, who shall take any steps that may seem to him necessary.

With the view of providing against damage being done to an oilfield in consequence of the influx into the oil-bearing formation of water and heavy oil from the upper levels, such wells as are not in exploitation must, after as much of the casing-tubes as possible has been extracted, be packed with clay right up to the top.

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* Retranslated from Engler and Hofer's "Erdols," by Mr. J. R. von Fedorowicz. † Abridged from "The Russian Oilfields and Petroleum Industry," by John Mitzakis, 1911.

In the event of the producer failing to do as required, with a view to render working operations safe, to provide against fires, and to regulate the flow of oil, the District Engineer is to have the work done at the cost of the producer.

Pipe-lines are not to be laid within 700 ft. (100 sagenes) of buildings without the owner's consent.

Provision is made for the election of local technical councils or committees, which act in an advisory capacity only.

(5.) *Summary of Portions of Galician Petroleum-mining Regulations.*

The regulations in force include the following provisions:—

Re excluding water: See Appendix I, pp. 143–4.

If boring is being done by means of a water-flush system the water used must be measured, and the flush method, if there is serious loss, must be discontinued.

Boring-managers must be certificated. Bores must be 10, or in most cases, 15 metres from roads, buildings, &c. So with pumping-stations, oil-tanks, &c.: these must be 15 metres from roads and buildings. Notice of installation of electrical machinery must be given to the mining office (Mines Department), and the installation must be approved by the electrical authority.

Buildings, &c., must be approved by the Mines Department.

Oil and gas firing are subject to regulations made with a view to prevention of accidental fires or explosions.

Plans and sections of all bores are required on a scale of 1:720 for small plots, 1:1440 for large plots. The plans must show all topographical details, buildings, machinery, &c. The sections must be according to a prescribed scale and give prescribed details.

Plan and section of each bore must be sent to Mines Department within four weeks after the bore is finished. Some exceptions to rules are permitted in special cases.

Re examinations: There is a board of examiners, which has power to make allowances and exemptions. Certificates are given by the vote of a majority of the examiners. A candidate who has passed part of the examination may repeat examination in not less than six months in those subjects in which he has failed, but is not allowed a second chance. The examination is written, oral, and practical (in the field). Mechanical drawing may be a subject of the examination.

(6.) *Exclusion of Water from Oil Sands.*

The following notes form a summary of part of Chapter V of "Oil-production Methods" by Paul M. Paine and B. K. Stroud:—

Where the strata are hard and cave but little, the casing may be set on the bottom of the bore below the lowest water-bearing stratum and above the productive measures. Boring may then be continued with a smaller-sized drill, thus leaving a shoulder upon which the casing may rest and effect a watertight bond with the wall of the bore. The method, however, is far from satisfactory in many cases, and is quite unreliable with soft, loosely cemented strata, and in general a cementing process is necessary.

The simplest method of placing the cement is that known as "bailing" it in. The hole is first filled with water and the casing raised until the shoe is about 60 ft. off bottom. Three joints of casing are then unscrewed and placed to one side in the derrick. The cement, mixed to a thick grout, is then run into the hole in a specially constructed bailer that dumps its contents when it reaches the bottom. When 1 or 2 tons (dry weight) of cement have been inserted in this way the casing previously removed is screwed back into the top of the string, and filled with water. A plug having been screwed into the top coupling, the casing is then lowered until the shoe strikes bottom. Since the casing is full of water which is prevented from escaping by the plug at the top, a large portion of the cement at the bottom is forced between the casing and the wall of the hole and into the adjoining strata. The casing is then driven, in order to seat the shoe into the bottom as far as possible.

Some operators, instead of lowering the cement in a bailer, run it down in a series of long narrow bags tied to the end of the drilling-tools. When the bottom is reached a few strokes of the tool break the bags so that the cement is free to flow when the casing is lowered.

In connection with the bailing-it-in method, the Baker "cement plug" is sometimes used instead of the plug screwed into the top of the casing before it is lowered. This plug is made of light cast iron, and is so constructed that it may be hung from the bailer with a piece of soft rope and lowered inside the casing below the shoe. It is then raised with a slight tension or pull, when a set of slips catches on the shoe, and thus the bottom opening of the casing is effectively closed. The casing is then lowered, and the cement is thus forced up on the outside. The bailer is freed by a strong pull that breaks the soft rope, leaving the plug in the hole. Being of cast iron it is easily drilled.

The bailing-it-in methods are now largely replaced by processes in which the cement is pumped down either through the casing or through an auxiliary smaller string of tubing lowered inside the casing for that purpose. With methods of this class a necessary preliminary step is to secure a "circulation"—*i.e.*, the space between the casing and the wall of the hole must be sufficiently cleared of caved material to allow fluid pumped down inside the casing to come to the surface on the outside, thus ensuring that when cement is pumped to the bottom it will pass readily up on the outside of the casing if prevented from rising inside. In order to obtain proper circulation it may be necessary to raise the casing 100 ft. or more from the bottom, and

to resort to a pump-pressure of several hundred pounds per square inch. The casing is then gradually lowered, and worked up and down until the water or mud circulates readily, when the shoe is only a few feet from the bottom of the bore. An apparent circulation may be secured by reason of a leak in the casing. The presence or absence of leakage is determined by continuing to pump in water, and at same time lowering the casing until the shoe strikes bottom. If the circulation continues after the shoe has reached bottom there must be leakage, but if instead the fluid is held and the pump-pressure increased until it stops the pump the absence of leakage may be assumed.

The pump ordinarily used is the 10 in. by 5 in. by 12 in. duplex mud-pump used in the Californian oilfields for pumping mud in wells being drilled by the rotary or circulator methods. It is connected to the top of the casing by 2½ in. or 3 in. pressure armoured hose.

The Perkins method, said to be of particular value for very deep wells or for those in which the casing tends to "freeze," is also known as the disc or packer method, from the fact that the cement is inserted between two moving packers that have an outside diameter almost as great as the inside diameter of the casing. After a circulation has been obtained the casing is suspended so that the shoe is several feet from the bottom, and enough fresh water is then pumped in to clean the bottom of the hole thoroughly. The packers are made either of wood or of cast iron, with ends consisting of heavy canvas or rubber washers of just the proper size to pass down inside the casing. One packer is about 3 ft. in length, so that when passed down the casing it will fall entirely below the shoe, whilst the other is longer, so that when its lower end reaches the bottom of the hole the upper end still remains in the casing. The casing having been filled with water has the shorter packer inserted in it, and against this is pumped the cement, mixed to a grout just thin enough to be readily pumped. The required amount of cement having been pumped in, the longer packer is placed in the casing above the column of cement, and water is pumped in, pushing down the combination of lower packer, cement, and upper packer. When the lower packer passes the casing-shoe it falls to the bottom of the hole, thus allowing the cement to pass around the shoe and up on the outside of the casing. When the upper packer reaches the bottom it cannot, on account of its length, entirely leave the casing. It stops, therefore, the further flow of water and retards the pump, thus indicating that the cement is out of the pipe. The casing is then landed on the bottom, and after the cement has set the packers are drilled out.

The main objections to the packer method are the danger of the packers sticking inside the casing and the fact that the lower packer may fall to the bottom in such a way as to prevent the casing-shoe from being squarely landed. This may cause the breaking of the cement bond when the packer is drilled. It is possible to dispense with the travelling packers by measuring into a tank connected with the pump the exact amount of water necessary to fill the casing. The cement is pushed ahead of the water, and is known to have passed out of the casing when the tank is drained.

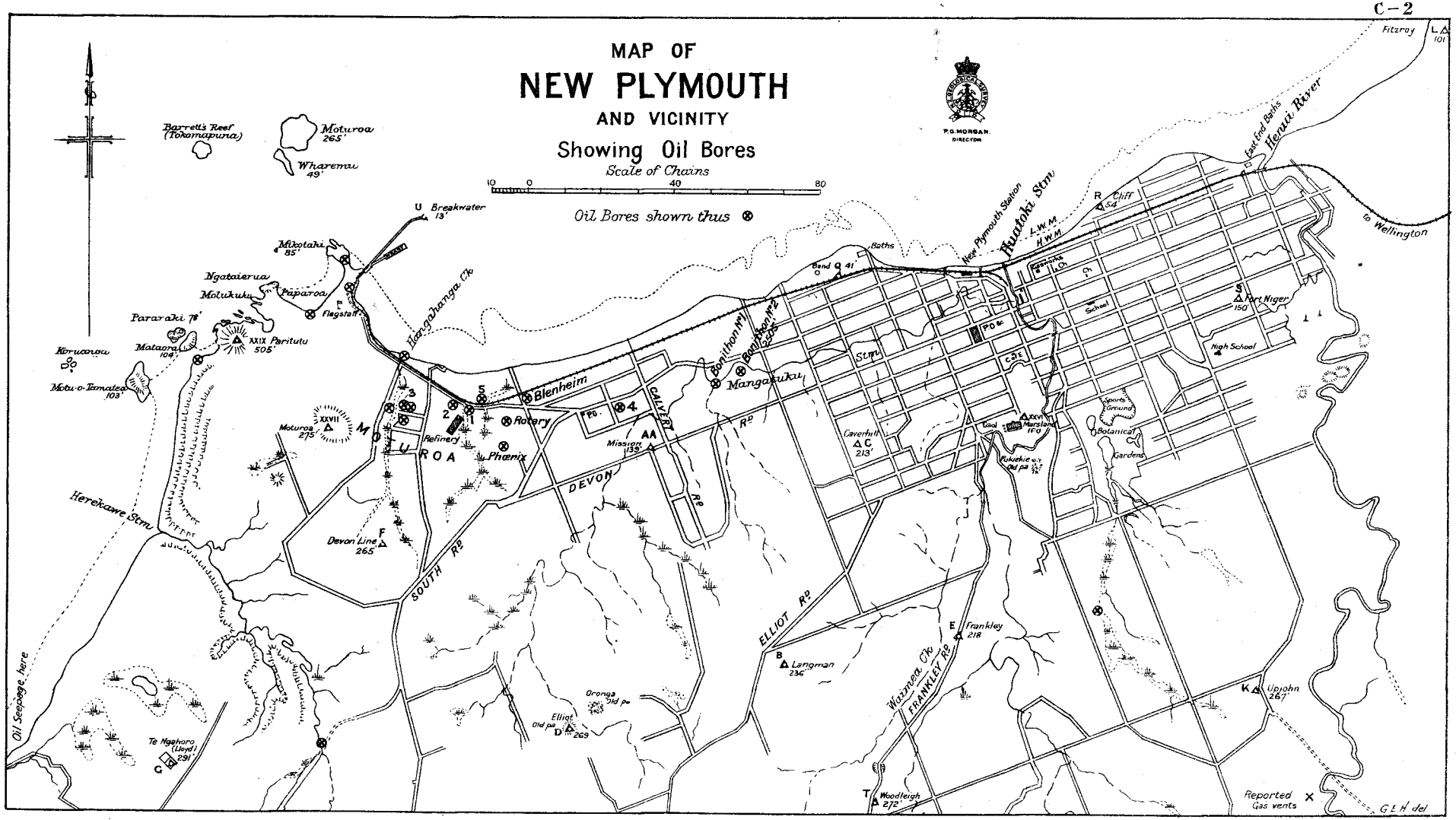
In the "bottom-packer" method cement is pumped down inside a smaller auxiliary string of tubing, to the lower end of which is attached a packer, which may be made from strips of belting confined between two metal plates, or may be of some special design, such as the Larkin wall packer. The function of the packer is to close the annular space between the smaller tubing and the casing, so that the cement pumped down inside the former is forced to pass around the casing-shoe and up on the outside of the casing. The cement having been inserted, the casing is landed squarely on the bottom, the tubing with its packer removed, and the cement remaining at the bottom of the well bailed before it has had time to set.

In all tubing methods it is necessary that the precise instant at which pumping ought to cease (*i.e.*, when all the cement has reached the bottom of the tubing) should be known, lest the cement be forced too far up on the outside of the casing. Provision for this may be made by measuring into a tank before pumping starts sufficient water to fill the tubing, as described above. Another plan is to contract the lower end of the tubing by means of a swage nipple or bushing, which then stops a wooden plug placed on top of the cement and below the water used for forcing the former down.

In actual practice Messrs. Paine and Stroud remark, the "bottom-packer" method has not proved as successful as might be expected, because of various mechanical obstacles which they mention. They describe in detail a "top-packer" method, in which a packer is placed at the top of the casing around the 3 in. tubing which is to convey the cement. The casing being filled with water, the cement when pumped down the inner tubing is forced outside the casing at the bottom. The moment at which to stop pumping is determined by a wooden plug, 1 ft. to 3 ft. long, with canvas washer nailed to its top, placed between the top of the cement and the following water pumped in, and stopped at the bottom of the tubing by a bushing or nipple.

It sometimes happens after a productive oil sand has been reached that if the well is drilled deeper so-called "bottom" water is encountered. The presence of oil and gas in the hole renders the exclusion of such water more difficult than that of the top water, especially when the lower water occurs only a few feet below the oil sand. Under such conditions particular care must be exercised in gauging the amount of cement injected, so that its level does not rise to the oil sand and so interfere with the oil-production. If a streak of hard ground intervenes between the oil sand and the water stratum below it may be possible to exclude water by plugging the bottom of the bore with pieces of stone and brick, together with a few sacks of cement.

If a distance of 2 ft. or more intervenes between the oil sand and the water stratum a so-called "bridge" is formed by driving bricks, stones, &c., tightly into the bottom of the hole, so as to hold back the water temporarily and provide a landing-place for cement pumped down through a string of tubing.


MAP OF
NEW PLYMOUTH
AND VICINITY
Showing Oil Bores
Scale of Chains
10 0 40 80
Oil Bores shown thus
P.G. MORGAN. DIRECTOR
Barrett's Reef (Tokamapuna)
Moturoa 265'
Whareroa 49'
U Breakwater 13'
Mikotahi 85'
Ngataierua
Motukuku
Paparoa
Flagstaff
Hangatianga Cr
Pararaki 78'
Mataora 104'
XXIX Paritutu 505'
Korowaro
Motu-o-Tematea 103'
Herekawe Stm
Moturoa 275'
XXVII
Refinery
Rotary
Phœnix
Blenheim
Bonithon No 1 Bore
Bonithon No 2 Bore 1205
Mangaotuku
Baths
Band
New Plymouth Station
Huatoki Stm
L.W.M.
H.W.M.
R Cliff 54
East End Baths
Henui River
to Wellington
Fitzroy
Fort Niger 150
High School
Sports Ground
Botanical Gardens
Caveriill C 213'
Cool
XXVI Marsland 160
Kuiukiekie
Mt Pā
Mission 139'
CALVERT Rd
DEVON Rd
SOUTH Rd
ELLIOT Rd
FRANKLEY Rd
Devon Line F 265'
Oil Seepage here
Te Ngahoro (Lloyd) 291
Oronga Old Pa
Elliot Old pa D 269
Waimea Cr
B Langman 236'
E Frankley 218
K Upjohn 267'
T Woodleigh 272'
Reported Gas vents
G.E.H. del

5. OIL OCCURRENCE NEAR PARAPARAUMU.*

(By P. G. Morgan, Director.)

On the 13th September, 1911, I visited a supposed occurrence of petroleum on Mr. Murdoch McLean's farm near Paraparaumu, thirty-two or thirty-three miles from Wellington. The circumstances which led to my visit were as follows:—

Some time previously when a ditch was being dug through a small peat bog a strong smell resembling that of kerosene or petroleum was observed. During the summer of 1910–11 the same smell was noticed in one or two places some distance from the drain. When a stick was pushed into the peat on the side of the ditch oily material was seen to rise after the withdrawal of the stick, and to form a film on the surface of the water. A sample of the peat when analysed at the Dominion Laboratory yielded 0·6 per cent. of petroleum.

The peat bog yielding these indications of petroleum is situated west of Mr. McLean's house, which again is between Paraparaumu Railway-station and the sea. The bog in question and similar bogs in the district have been formed through drifting sand blocking the natural drainage, thus giving rise to swamps, in which peaty material has collected. The peat in the locality visited is reddish-brown in colour, and contains much woody matter. Its depth is about 6 ft. Below the peat is a soft brown sandstone, which is also seen on the surface at the margin of the bog. At the time of my visit the water-level was 15 in. to 18 in. below the bog-surface, which owing to the drainage operations is ordinarily quite dry, and now supports a grassy sward.

On pushing a pole into the peat on the east side of the ditch previously mentioned I found that oily matter rose in very small quantity, together with bubbles of gas which burned with a pale-blue flame, and were doubtless marsh-gas or methane (CH_4). The oil formed irridescent films on the surface of the water in the ditch. These, however, were quickly absorbed by the mud and peaty matter also stirred up. The wet peat smelt distinctly of kerosene, and some dry peat had an even stronger smell.

The most probable source of the petroleum and inflammable gas is the peat itself. Marsh-gas has long been known as produced by the decomposition of peaty material, and in a few cases oil has also been observed in peat bogs.† The marine or semi-marine (wind-blown) sand that underlies the peat is a possible though in this case not a likely source of the oil. I am inclined to think that the presence of common salt, derived from sea-water blown inland during heavy gales, has something to do with the production of the oil.

Although at the present time no really satisfactory explanation of the occurrence can be given, yet the presence of undoubted petroleum in the Paraparaumu peat bogs tends to throw light on the important problem of petroleum-genesis, and is therefore well worth recording.

From a strictly commercial point of view no value can be attached to the petroleum-content of the peat. It is, of course, within the bounds of possibility that it may possess some peculiar property which would render its extraction worth while, but this is a matter to be determined by scientific research.

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6. PETROLEUM IN MURCHISON DISTRICT.

During the early part of 1914 the occurrence of petroleum near the head of the Warwick, a tributary of the Maruia, was reported. The locality was visited last April by Dr. Henderson, who states that oil oozes in small quantity at two or more points from a series of Tertiary conglomerates, sandstones, and shales. Apparently the petroleum is associated with a fault plane. In the neighbourhood of the seepages the strata have an almost vertical attitude, owing to the influence of a great fault which runs through the Warwick and Warbeck valleys. Southward, in Station Creek and the Rappahannock Valley, the oil-bearing rocks are not so disturbed, and there is a possibility of an oil reservoir. To determine the structure, however, necessarily requires detailed field-work.

A report upon the occurrence will be prepared at an early date, and published when opportunity offers.

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7. THE WAIKAKA GOLD-MINING FIELD.

(By P. G. Morgan, Director.)

In accordance with instructions given by the Hon. the Minister of Mines, I left Wellington for Waikaka on the evening of the 10th April. After spending two days in Dunedin I arrived in Waikaka on the 14th. On the 17th I left for Wellington, which was reached on the morning of the 19th April.

Nature of Country examined.

The area examined lies in the vicinity of Waikaka Township, which is sixteen miles by rail north of Gore. It consists of gently rolling downs or ridges, separated by alluvial flats, through which flow the Waikaka Stream and its tributary, the Little Waikaka. The Waikaka River flat at its lower end near McNab Railway-station is 259 ft. above sea-level, whilst at Waikaka Railway-station the height is 457 ft. The ridges on an average are about 100 ft. higher. To the northward of Waikaka the country rises somewhat rapidly, the map showing heights of 1,907 ft. and 2,769 ft. (Mount Wendon). The land, except a few acres of old alluvial workings and recently dredged areas, is all being utilized for agricultural purposes.

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* Written in 1911. † See Boverton Redwood; "Petroleum and its Products," 2nd ed., 1906, pp. 33, 34, 121, 123, &c.

General Geology.

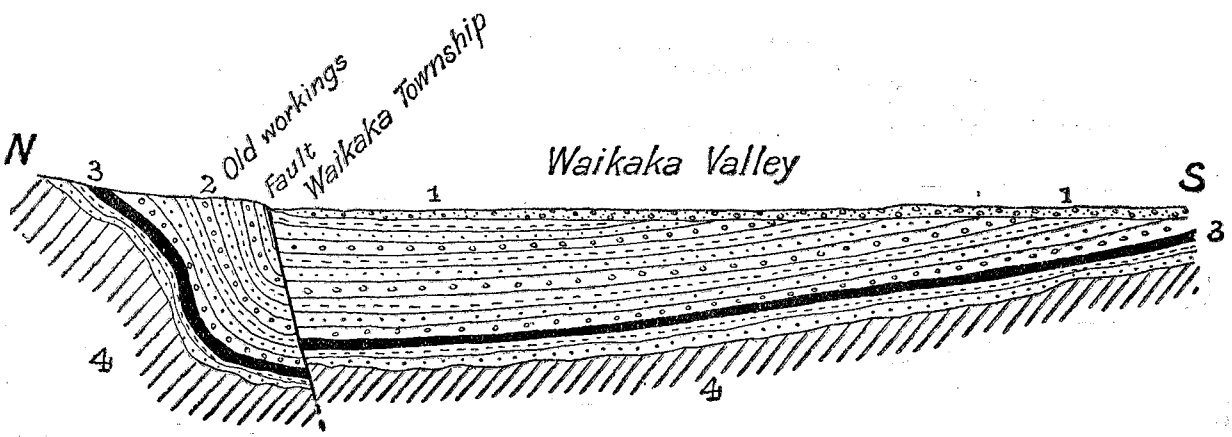
The rocks forming the rising country to the northward of Waikaka are mapped by Hutton as belonging to the Kaikoura formation, of late Palæozoic age. McKay similarly regards them as Carboniferous or Devonian. According to the views held by Marshall, however, these rocks are not older than the Triassic. As judged by the stream detritus they appear to consist mainly of bluish greywacke (sandstone of McKay), with minor amounts of argillite (indurated shale of McKay), and other rocks. Highly folded greywacke, argillite, and chert, probably of Trias-Jura age, form some low hills just to the north-east of Gore, and similar rocks probably underlie the Waikaka Valley.

Resting on the older rocks just mentioned is a series of clays, sands, gravels, and conglomerates, with one or more lignite-seams near the base. These rocks are mapped by McKay as Cretaceo-Tertiary, but as exposed in the Waikaka-Waikaia district are probably of Miocene age, as stated in an old geological report.* They are of great economic importance, both on account of the lignite and on account of their alluvial gold, which is contained in bands of quartzose gravel, hereafter generally referred to as the "older quartz drifts."

Recent gravels and clays occupy the stream-valleys to a moderate depth, seldom exceeding 20 ft. The gravels, like the older quartz drifts, from which they are in great part derived, are auriferous. The rolling ridges and downs are usually covered by a fairly thick coating of clayey or loamy soil and subsoil, so that as a rule the underlying Miocene rocks are exposed only on steep slopes.

Geological Structure.

The supposed Mesozoic rocks near Gore strike north-west and dip at 70° to 80° to the south-east. Near the railway-bridge, however, a dip not exceeding 15° is shown. The period of folding was doubtless pre-Tertiary, but during the Tertiary era movements both of elevation and depression, accompanied by faulting and warping, have taken place. The Miocene rocks in general maintain a nearly horizontal attitude, but close to Waikaka Township are involved in a considerable fault, with approximately east and west strike. As a result the older quartz drifts are here nearly vertical. To the southward the Miocene rocks are seen to be nearly horizontal, but incline to dip northward, so that in the neighbourhood of Willowbank the lignite is at or near the surface. It thus appears that in the Waikaka district the Tertiary rocks lie in a shallow basin, which towards the northern boundary is crossed by the fault just mentioned. The structure, very roughly, may be represented in cross-section as in diagram, which shows an unsymmetrical synclinal fold, broken by a fault with upthrow to the south. Owing to the steep dip of the beds on the northern disturbed limb of the syncline the final result of the various movements is equivalent to a downthrow towards the south, and thus the southward continuation of the vertically dipping quartz drifts will be found by sinking.



1. *Recent.* 2. *Older quartz drifts, &c.* 3. *Lignite.* 4. *Mesozoic and older rocks.*

Diagrammatic Section showing Geological Structure, Waikaka.

Economic Geology.

History of Waikaka Goldfield.

Gold is said to have been found at Waikaka in 1865. During the next twenty or thirty years the modern gravels and the older quartz drifts were extensively worked in various ways by small parties of Europeans and Chinese. The first workings were probably upon the modern stream-gravels near the township. Immediately north of the township a rich layer in the fault-involved older quartz drifts, perhaps 10 ft. or more in width, was worked from the surface downwards until water became too troublesome. This layer is locally known as the "back lead." On or near it a shaft was sunk many years ago to a depth of 90 ft., but was not utilized for driving-out on account of the water trouble. Somewhere about 1880, Smith, Barberry, and others drove an inclined drift from a point to the southward of the back lead for a distance of 254 ft. They then drove horizontally for a short distance, and intersected an auriferous layer of quartz wash, about 10 ft. wide, known as the "front lead." The party worked this

* Appendix to Rep. G.S. during 1890–91, No. 21, 1892, p. 164.

lead for some time by a stoping and filling method, and also drove towards the back lead; but, owing to difficulties with running sand, and the death of Mr. Barberry, an experienced and capable miner, who acted as manager, work in this direction was discontinued. The drift, which had passed through 300 ft. or thereabouts of alternating bands of more or less auriferous quartz gravel and of clay, was then very near the back lead. The quartz drifts were worked by sluicing and by driving-out somewhat to the north-east of the township, and again in the Little Waikaka Valley, at and near a spot called the Sandy Knowes, where they show a gentle southward dip. Some of the early tailings at Sandy Knowes have been reworked, and still give a good prospect, so that the ground here must have been very rich. The older quartz drifts of the Waikaka Valley have also been worked by sluicing some distance below the township.

Gold, as already mentioned, was obtained by the early miners from the modern gravels of the Waikaka Stream near the township, and also from numerous small gullies in the neighbourhood. Some of these are known to have been very rich.

For some years prior to 1896 very little mining was done near Waikaka, but in that year J. R. Perry built a dredge, and by the end of 1897 another dredge was at work. From 1900 onwards dredging has been a prominent and successful industry in the valley, the best years being from 1903 to 1907, when from twenty to twenty-eight dredges were at work. At the present time about a dozen dredges are in commission.

Prior to 1909 the dredges worked only the recent gravels of the Waikaka and Little Waikaka Valleys, but in that year deeper ground about two miles and a half from Waikaka was tested, with satisfactory results. Owing to most of the dredges being privately owned, particulars are not easily ascertained, but it is understood that some very rich wash, belonging to the older quartz drifts, has since been worked.

The Older Quartz Drifts and Associated Beds.

The older quartz drifts and the associated beds are of a considerable thickness, not determinable at present, but certainly exceeding 400 ft. The gold-bearing layers consist almost entirely of quartz pebbles and quartz grit, with a few water-worn fragments of other rocks. The quartz pebbles are usually imperfectly rounded, much honeycombed, and for the most part pure white in colour, but some are stained greenish by a chloritic mineral. They are probably derived mainly from quartz lenticles in mica-schist country, as has been suggested for other localities by McKay. The non-honeycombed quartz pebbles are either very glassy or are flinty. The minor constituents of the quartz drifts are greywacke and argillite of bluish and greenish colours, together with a little mica-schist.

Where McGeorge Bros.' No. 3 dredge is now working, south-east of Pullar Railway-station, the deep auriferous wash, 10 ft. to 15 ft. thick, rests on a hard blue clay. The wash is loose, but is overlain by 2 ft. to 3 ft. of cemented quartz gravel or conglomerate, which naturally is very troublesome to dredge. The conglomerate is succeeded by 10 ft. to 15 ft. of dark clay or pug, containing much partly carbonized wood and other vegetable matter. Although similar material occurs to a small extent in the neighbouring terraces, this pug is probably not part of the older quartz-drift series of Miocene age, but a swamp or lake deposit immediately preceding the modern gravels. Above the pug is 12 ft. to 14 ft. of quartzose gravel (modern wash), surface clay, &c.

The deep dredging in the Little Waikaka Valley shows a very similar section to that just described. In places as much as 24 ft. of dark carbonaceous clay (pug) has been found to overlie the quartz wash and cement.

The Recent Auriferous Deposits.

No information of any consequence concerning the early alluvial workings is available. The shallow ground worked by dredges between Waikaka and McNab is usually from 12 ft. to 16 ft. deep, and consists of a varying depth of clayey soil and subsoil, underlain by 4 ft. to 12 ft. of wash, formed almost entirely of quartz gravel and sand, more rounded than the similar components of the older quartz drifts. A few pebbles of greywacke, argillite, and mica-schist are the other constituents of the wash.

The bottom on which most of the dredges work is a yellow clay, passing into the dark carbonaceous clay previously mentioned. Near Willowbank and lower down some dredges work in places on a lignite bottom.

Character of Gold.

It is said that a 5 dwt. speck was found on the terraces near Waikaka Township, but the great bulk of the gold is fine, and much of it is scaly as well. That now being obtained by the dredges, after being retorted, has a fineness varying from 0·9810 to 0·9835, and sells for about £4 1s. per ounce. It is therefore obvious that the alluvial gold is of great purity.

Minerals associated with Gold.

The concentrates from the sluice-boxes of the dredges consist largely of a heavy grey sand, probably zircon, and to a smaller extent of blacksand, which, as a rule, is not very magnetic. An appreciable amount of cinnabar is present in the form of small red grains, and a little platinum also occurs. The concentrates from the deeper ground (older quartz drifts) contain also a moderate amount of pyrite in the form of small irregular concretions.

Origin of Gold.

The gold in the younger deposits at Waikaka is clearly derived from the older quartz drifts. As McKay says, "All the gold found in the Waikaka has been directly derived from ancient beds

of quartz wash and cement which underlie the recent accumulations of the river-valley."* The source of the gold in the older quartz grits of Otago has also been carefully discussed by McKay, who comes to the conclusion that the gold has come chiefly from quartz folia in the mica-schists, and only in a minor measure from regular quartz lodes.† Though his views have been opposed by some who believe that the alluvial gold of Otago has been derived wholly from auriferous lodes, his main thesis, that the gold has its origin mainly in the schists, remains unaffected. It has been suggested that the alluvial gold has been derived chiefly from the ancient formations which once overlay the schist, but have been very largely destroyed by denudation. This hypothesis may contain some truth, but its proof has yet to be found.

Origin and Mode of Formation of Older Quartz Drifts.

The source of the materials forming the older quartz gritz and the associated sands, clays, &c., has been sufficiently indicated above. It is of some importance to determine whether the quartzose gravels are river or beach deposits, and in the latter case whether they are marine or lacustrine. If they are of fluviatile origin, then they would mark the course of some ancient river, and occur along a continuous but serpentine line. Beach deposits, on the other hand, would indicate the shore of the sea or of some ancient lake, and would lie not on a serpentine or meandering but on a straight or gently curving line or belt. Other differences will suggest themselves, but it is on the present occasion necessary merely to refer the reader to McKay, who has shown that the quartz drifts represent beach deposits, from which soft rocks have been almost completely eliminated by wave-action. That at Waikaka and most other places in Otago they are lacustrine is shown by the complete absence of marine fossils not only from the gravels themselves, but also from the interbedded clays, which would certainly have preserved traces of shells if these had been entombed. Apart from this feature, in most places the physical characters of the beds themselves practically prove their fresh-water origin. It is not intended to maintain that the whole of the Miocene beds are of lacustrine origin. The lignite towards the base may have been a swamp deposit, though it is to be noted that "mussel" shells (probably the fresh-water *Unio*) are stated to occur in the immediately overlying beds. Near Waikaia marine shells of Miocene facies occur in a horizon not yet determined. The upper layers of quartzose gravel seen in the Waikaka Valley below the township appear to be of fluviatile rather than lacustrine origin. These gravels contain gold, and in places would pay for sluicing if a sufficiently abundant supply of water were available, but are not nearly so rich as the undoubted lacustrine deposits in a somewhat lower horizon.

The tracing of the shore-lines of the ancient lakes of Central Otago is an important problem, which could be partly, but probably not completely, solved by a careful and detailed geological survey of the whole area over which the quartz grits occur. Isolated and incomplete surveys of small areas are likely to lead only to inconclusive or misleading results.

Deep Leads.

Although the examination of the district was far from complete in itself, and needs to be supplemented by work in neighbouring localities, the data obtained are sufficient to prove the existence of moderately deep auriferous leads in the neighbourhood of Waikaka. From the section shown in the diagram on page 148 it follows that the older quartz drifts containing auriferous layers extend southward from the east-and-west fault for several miles.

Boring, followed if the results are sufficiently promising by shaft-sinking and driving, is necessary in order to ascertain the number, depth, extent, and value of the auriferous layers. Detailed geological survey is also necessary in order to assist in the interpretation of the data obtained by boring. It has to be remembered that beach deposits of gold occur in a lenticular manner along the shore-lines, and that the lenses will have much greater length than breadth. For instance, the auriferous blacksands of the Charleston and other districts on the west coast of the South Island thus occur. At present, as previously mentioned, there are no data which would enable the ancient lake-margins to be mapped. Such mapping, if possible, would give the approximate direction or trend of the "runs" of gold.

Depth of Deep Leads.—The only data from which the depth of the leads can be ascertained are those afforded by the dredges now at work on the deeper ground of the flats. From the evidence thus obtained it would seem that south-east of Pullar Railway-station the deep lead is about 50 ft. below the surface of the flats. Eastward, in the Little Waikaka Valley, a corresponding but not so rich lead occurs at about the same depth. If the two occurrences are assumed to belong to the same lead, then this lead underlies the intervening higher ground at a depth of, say, 150 ft. Southward the depth will be less, and ultimately the lead, if it continues as such, must reach the surface, though the outcrop will be obscured by the soil and subsoil on the higher ground, and by recent gravels on the river-flats. Northward the depth of the lead will increase to an unknown maximum near Waikaka Township. By deep boring other auriferous leads will probably be found to underlie that outlined above.

Working Deep Ground.—If sufficiently rich ground has been proved by boring, the working of the ground by driving-out will present no great difficulties. Probably water will have to be pumped in fairly large quantity. This will be useful for washing purposes. The lignite of the district furnishes a cheap fuel for steam-raising purposes. If profitable wash should be found to extend over a large area the most economical plan would be to have an electrical power-station near one of the coal-pits, and thence transmit electrical energy to the pumping and other machinery at the various shafts.

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* "Gold Deposits of New Zealand," 1903, pp. 59–60. † *Op. cit.*, p. 68.

Recommendations.

A few trial bores from one to two and a half miles south of Waikaka Township may be recommended as advisable. The selection of the sites may be left to those persons or companies who are prepared to find money for boring. All that is necessary for the first few bores from a geological point of view is that very careful logs be kept and placed on record. When some data have accumulated, plans for systematic boring may be evolved, and ultimately, if the results are favourable, sites for shafts from which the leads will be driven out may be selected. Only over a comparatively small area is it likely that dredging can be employed as a means of recovering the gold now buried in the older quartz drifts. As regards the nearly vertical leads near Waikaka Township, these may be prospected by sinking vertical or inclined shafts.

Literature.

The following list of references to the Waikaka district may be useful. Unfortunately, few publications prior to 1887 are available for consultation :—

1872. Hutton, F. W.: "On the Geology of the District of Southland." Rep. G.S. during 1871–72, No. 7, pp. 96–112. Has no special reference to the geology of the Waikaka district. The lignite of the Mataura district is placed in the alluvial formation (Quaternary). The occurrence of resin in it is mentioned as a noteworthy feature (p. 96).

1875. Hutton, F. W., and Ulrich, G. H. F.: "Report on the Geology and Goldfields of Otago." The only reference to the Waikaka district is on p. 34, where the Te Anau Series is stated to occur in the Upper Waikaka district (which apparently means the Upper Waikaia of present-day maps). Much of the Waikaka district is mapped as Pleistocene.

1887. Galvin, P.: "The Handbook of New Zealand Mines." On p. 28 is a reference to the discovery of gold at Waikaka in 1865 and the decadent state of mining in that locality during 1887.

1892. Rep. G.S. during 1890–91, No. 21. On p. lxviii of the Progress Report, and on pp. 22, 63–64, and 164, Waikaka is mentioned, but the Waikaia or Switzers district is meant.

1897. McKay, Alexander: "Report on the Older Auriferous Drifts of Central Otago." A reprint of C.–4, 1894. Waikaka auriferous drifts are briefly described on pp. 81–82, and again mentioned on p. 99.

1903. McKay, Alexander: "Gold Deposits of New Zealand." (Reprinted from *Mines Record*). On pp. 59–60 is reference to Waikaka diggings.

1906. Galvin, P., and others: "The New Zealand Mining Handbook." On pp. 198, 277–278, 320, and 321 will be found references to dredging and the utilization of dredged land in the Waikaka Valley.

1888–1913. Mines Reports. The following references have been noted :—

1888. C.–6, p. 31. Mention of deep leads is made.

1893. C.–3, Appendix III, p. xii. Reference to lignite.

1894. C.–3A, p. 35. Alluvial gold.
C.–4: "Older Auriferous Drifts of Central Otago," by Alex. McKay Waikaka mentioned on pp. 32, 40. Report reprinted in 1897.

1895. C.–3A, p. 36. Alluvial gold.
C.–3B, p. 15. Lignite-pit mentioned.

1896. C.–3B, p. 15. Lignite-pit mentioned.

1897. C.–3A, p. 21. A dredge has been built at Waikaka by J. R. Perry.
C.–3B, p. 15. Lignite-pits mentioned.

1898. C.–3A, pp. 25, 66. References to dredging.
C.–3B, p. 11. Lignite-pits mentioned.

1899. C.–3, p. 147, and C.–3A, p. 31. References to dredging. Two dredges at work near Waikaka.

1900. C.–3, p. 145. Five dredges at work in Waikaka district.

1901. C.–3, pp. 24, 70, 118. References to dredging. Eleven dredges at work in Waikaka district.
C.–3A, p. 18. Lignite.

1902. C.–3, pp. 76, 120. Dredging.
C.–3A, p. 22. Lignite.

1903. C.–3, p. 168. Sixteen dredges at work.
C.–3A, p. 25. Lignite.

1904. C.–3, pp. 83, 119. Twenty dredges at work.
C.–3A, p. 19. Lignite.

1905. C.–3, pp. 71, 106. Dredging. Twenty-five dredges at work.

1906. C.–3, pp. 77, 114. Dredging. Twenty-five to twenty-eight dredges at work.

1907. C.–3, pp. 44, 57. Dredging. Twenty-four dredges at work.

1908. C.–3, pp. 42, 51. Twenty to twenty-two dredges at work.

1909. C.–3. On p. 39 is reference to proposed working of deep lead near township of Waikaka. P. 52, nineteen dredges at work.

1910. C.–3, p. 54. Twenty-two dredges in Gore-Waikaka district. Good results are being obtained from the deeper ground.

1911. C.–3, p. 49. Fourteen dredges in Waikaka district.

1912. C.–2, pp. 3, 23, 58–59, 66. A revival of dredging at Waikaka, owing to discovery of gold in deep ground. Seventeen dredges in all; fourteen at work.

1913. C.–3, p. 47. Dredging. Thirteen dredges at work in district.

1897–1909. *Mines Record*, Vols. 1 to 12. The following citations nearly all have reference to dredging or allied topics:—
1897–98. Vol. 1, pp. 31, 109, 503.
1899–1901. Vol. 3, pp. 69, 181–182 (Waikaka Sludge-channel), 273–275 (Waikaka Sludge-channel).
1900–1. Vol. 4, pp. 422–423.
1902–3. Vol. 6, pp. 305, 325, 417 *et seq.*
1903–4. Vol. 7, pp. 2–4, 143–144, 507–509.
1904–5. Vol. 8, pp. 461–464.
1906–7. Vol. 10, pp. 9–11 (blacksand, platinum), 76 (blacksand), 357 (restoring dredged land).
1907–8, Vol. 11, pp. 35, 73 (auriferous terraces at Waikaka), 176.
1908–9, Vol. 12, pp. 2, 50, 315 (McGeorge Bros.' No. 3 dredge).

ANALYSES.

The following results obtained in the Dominion Laboratory upon dredge concentrates from Waikaka are of interest:—

(1.) Concentrates from McGeorge Bros.' No. 3 dredge, Waikaka (per Mr. Aikman).

Silica (SiO_2)	84·38
Alumina (Al_2O_3)	2·03
Iron oxide (Fe_2O_3)	5·36
Titanium oxide (TiO_2)	0·87
Lime (CaO)	1·08
Magnesia (MgO)	0·46
Alkalies (K_2O and Na_2O)	1·56
Zirconium dioxide (ZrO_2)	1·20
Sulphur (S)	0·83
Water and organic matter	1·43
Undetermined	0·80
	100·00

Some metallic particles of iron were separated before the analysis was made. The sample also contained 0·05 per cent. of cinnabar, 5 oz. 4 dwt. 13 gr. of gold, 6 dwt. 7 gr. of silver, and 8 dwt. 4 gr. of platinum per ton. No copper, lead, rare earths, or tungstic acid could be detected.

(2.) Concentrates from a dredge at Waikaka (per Mr. James Paterson). This sample contained many metallic particles of iron and lead, which were separated. The residue contained: Cinnabar, 26·75 per cent., equivalent to 23·06 per cent. of metallic mercury; rare earths other than zirconia, 0·07 per cent. Zircons were abundant, and a large percentage of platinum was present, also some gold and magnetite. No tungstic acid could be detected.

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8. THE WAIKAIA DISTRICT, SOUTHLAND.

(By P. G. MORGAN, Director.)

Acting under instructions given by the Hon. the Minister of Mines, I left Wellington on the 29th June for Dunedin, whence on the 1st July I proceeded to Waikaia. Two days and a half were spent in inspecting the district adjoining the township, and on the 4th July I left for Lawrence.

SITUATION.

The township of Waikaia, the chief centre of population in the district drained by the Waikaia River, is situated fourteen miles north of Riversdale, whence it is reached by means of a branch railway opened a few years ago. The railway-station, 522 ft. above sea-level, is known as Switzers, but this name is much more correctly applied to the old mining settlement (now abandoned) two miles or more to the eastward, and will be so used in this report.

TOPOGRAPHIC FEATURES.

The principal drainage-channel, the Waikaia River, a tributary of the Mataura, runs southward through a broad flat valley, which towards Riversdale merges into the Waimea Plains. From the west the Waikaia is joined by the Garvie Burn (Boundary Creek), Dome Burn, Steeple Burn, Gow Burn, and other streams, whilst its principal affluent from the east is the Argyle Burn.

Northward of Waipounamu Railway-station the Waikaia Valley is bordered by terraces of considerable height. As Waikaia Township is approached the country to the eastward rises, the highest point being Round Down, 2,030 ft. in height. To the north-east, north, and west are seen the Umbrella Range, Old Man Range, and Garvie Mountains, which reach heights well over 5,000 ft., and are snow-clad throughout the winter and early spring.

General Geology.

The oldest rocks in the immediate neighbourhood of Waikaia are unfossiliferous argillites and greywackes, which in places are subschistose in character. They are considered by Alex. McKay* to be probably of Devonian age. Some miles north of Waikaia they pass, apparently without stratigraphical break, into the well-known mica-schists of the Central Otago region, regarded by McKay as probably of Silurian age.

The subschistose argillites and greywackes outcrop near the banks of the Waikaia River north and south of the township, in Welshman's Gully, and along the course of Argyle Burn. They form Round Down Hill, and also appear as the bed-rock over a large section of the Muddy Terrace Sluicing Company's claim. The few strikes observed varied from nor.h of west to east of north, and the corresponding dips were from 10° to 50° to the northward or westward.

Overlying the Palæozoic rocks, naturally with a high degree of unconformity, are Miocene rocks consisting of gritty clays, sands, and probably gravels, with a lignite and oil-shale horizon. Near Muddy Terrace there occurs a shelly band containing numerous Mollusca, of which the following species have been identified: *Ostrea wuellerstorfi, Pecten (Patinopecten) marshalli* Suter, and *Venericardia ponderosa* Suter. The Cretaceo-Tertiary rocks mapped by McKay near Waikaia Township are probably not older than Miocene, and may possibly be in part younger, but until detailed surveys are made, certainty of correlation cannot be attained.

The gravels and clays which form the terraces of the Waikaia Valley and flank the higher hills may be considered to range in age from Pliocene to Pleistocene. They vary in thickness from a few feet to over 200 ft., as at the Winding Creek or Break-em-all Claim. Recent gravels cover the Waikaia flood-plain to a moderate depth, and during the past few years have been extensively dredged.

Economic Geology.

Alluvial Gold.

In the early days of the Otago goldfields the Switzers diggings for some time supported a large population. As the easily worked and rich ground became exhausted the miners decreased in numbers and sought other fields or occupations. There remain, however, immense quantities of low-grade gravels, which are being worked by hydraulic sluicing at various points, though the want of a sufficient supply of high-pressure water, as in many other goldfields, prevents the poorer gravels and the deep ground from being worked to advantage. During the past twelve or fourteen years dredging has been an important industry in the district, but the available dredging-ground is nearly exhausted, and only a few dredges are now at work. The land dredged was all river-flat, suitable for agricultural purposes, and it is to be regretted that resoiling, which could have easily been carried out at little expense, was not made a condition of the leases. As it is, hundreds of acres of good land have been rendered almost useless for at least a century to come. The suggestion has been made that the land could be redredged with profit, and in that case the buried soil of some portions would be brought to the surface again, and the land thus greatly improved.

Lignite.

Lignite has been worked at several places in the Waikaia district, but the decrease in the number of working dredges has lessened the demand during the past two or three years. The following analysis indicates the composition of the lignite at the Landslip Mine:—

Fixed carbon	21·06
Volatile matter	37·51
Water	37·11
Ash	4·32
	100·00
Total sulphur	0·23 per cent.

Oil-shale.

At a point about a mile west of north from Freshford Railway-station a shale consisting largely of hydrocarbons was worked opencast for some time in order to furnish fuel for dredges. The following analysis of material from "Goldie's shale-pit" probably represents the shale from this locality:—

Fixed carbon	12·00
Volatile matter	60·25
Water	18·25
Ash	9·50
	100·00
Total sulphur	2·16 per cent.

The shale extends under the Waikaia River flat towards the Landslip Coal-mine, and evidently belongs to the same horizon. Notwithstanding the somewhat high sulphur, there can be no doubt but that the deposit has considerable economic possibilities and deserves careful investigation. The

* "On the Geology of the Lower Waikaka [Waikaia] Valley, and the Auriferous Drifts at Switzers." Rep. G.S. during 1890–91, No. 21, 1892, p. 63. "Waikaka" in this report should be printed "Waikaia."

following extract from the Mines Report of 1912 (C.–2, p. 118) indicates that prospecting the flat to the eastward of the shale-pit has received attention :—

" *Muddy Terrace Coal-mine, Waikaia.* — This property is being prospected by an Invercargill syndicate to prove the shale. Six bores have been put through the shale, and 35 acres proved. The deepest hole, 62 ft., contained 14 ft. of shale ; other holes have proved seams of from 9 ft. to 19 ft. of shale."

Further prospecting by boring, and a series of careful analyses of the shale, together with working tests upon large samples, ought to be undertaken. If the results are satisfactory, the working of the deposit on a large scale will naturally follow.

Clay.

Interbedded with the auriferous gravels east of Waikaia are bands of light-coloured clay. These at some future time may be found useful for the manufacture of various classes of pottery-ware.

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9. THE LAWRENCE–WAIPORI DISTRICT.

(By P. G Morgan, Director.)

On the 4th July I proceeded from Waikaia to Lawrence, and remained there until the 8th, when I left in order to go to Macrae's. During this brief visit I examined most of the mining claims at work near Lawrence and Waitahuna. A day was spent in visiting Waipori, where the O.P.Q. lode and other points of interest were inspected. In the present report justice cannot be done to the geology and mineral resources of the Lawrence district. A moderately detailed survey occupying at least some months is needed before any description of permanent value can be written.

Topography.

The district between Lawrence and Waipori is a hilly unforested country rising to heights of over 2,000 ft. North-west of Waipori is the Lammerlaw Range, over 3,000 ft. high ; and to the eastward is Maungatua, 2,944 ft., which overlooks the low-lying Taieri Plain. The country near Lawrence has been deeply dissected by the Tuapeka and Waitahuna streams, which flow southward to join the Molyneux. The other principal drainage-channel of the district, the Waipori, in its upper course flows through a broad upland valley, which at Waipori Township is nearly 1,300 ft. above the sea. In passing through the Waipori Gorge, a few miles to the eastward, the stream falls almost to sea-level, and thus has afforded the Dunedin City Corporation opportunity for establishing hydro-electric-power works.

A few river-flats, all covered by more or less auriferous gravels, occur in the stream-valleys. Among these may be mentioned Evans and Wetherstones Flats, near Lawrence, Waitahuna Flat, and the high-level Waipori Flat.

General Geology.

The prevailing rock of the Lawrence district is mica-schist, of probable Palæozoic age. In some places this rock is almost free from quartz laminæ, and therefore could be termed phyllite, whilst in others it contains numerous interbedded folia of that mineral, the largest reaching 4 in. or 5 in. in thickness and many feet in length and breadth. As shown by these quartz folia, the bedding of the schists is usually not far from horizontal, but in a few localities fairly steep dips are seen. In the southern part of the Lawrence Borough, especially near the main road to Dunedin, a fine-grained greywacke, only slightly schistose, outcrops in several places. It would therefore appear that the boundary-line between the schists and the less-altered rocks supposed by McKay to be of probable Devonian age ought to be drawn through the town of Lawrence, and not some miles to the westward, as in his map published in 1894 and again in 1897.*

It ought to be mentioned that the ancient bed-rock on which the alluvial gold-bearing beds rest—that is, mica-schist, greywacke, or argillite—is known throughout Otago by the inappropriate names of " the reef " or " the high reef."

The Palæozoic rocks are capped in places by outliers of Tertiary and Quaternary rocks. These in general are conglomerates or gravels containing more or less detrital gold. Of great economic importance is the so-called " cement "—really conglomerate—which occurs at Bluespur, Wetherstones, Forsyth, Waitahuna Gully, and perhaps elsewhere. This conglomerate is interbedded with and overlain by sands and clays, which in places contain layers of lignite. These beds, regarded by McKay as belonging to Hector's Cretaceo-Tertiary system, are probably of Miocene age, but the absence of fossils and of detailed stratigraphic work prevents a definite statement from being made. The " cements " show moderate dips of from 10° to 20° in the various places where they are exposed.

In places there may be patches of Pliocene or " Old Man " gravels. The so-called " granite " bottom of the district—an unfortunate term, for no granite is present—is presumably a bed of quartzose pebbles, on which rest gold-bearing gravels, and may possibly represent a Pliocene horizon. The various stream-flats have a covering of Recent auriferous gravels, which have been extensively worked for their gold-contents. Finally, in many places near Lawrence a somewhat thick coating of clay masks the underlying rocks, both on the flats and on the slopes, thus rendering surface prospecting somewhat difficult.

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* See " Older Auriferous Drifts of Central Otago," C.–4, 1894, opposite page 48, and the 2nd edition, 1897, opposite page 86.

A remarkable fault, called the Tuapeka fault by McKay,* traverses the Lawrence district from north-west to south-east. It is of great economic importance, for it has been the chief agent in preserving from erosion the auriferous conglomerate worked at Bluespur and elsewhere.

Economic Geology.

(1.) *Metalliferous Lodes.*

In all probability much of the alluvial gold of the Tuapeka district originated from definite auriferous veins, and not from the quartz folia of the mica-schists as McKay has very ingeniously argued.† Hence search for such lodes near Lawrence and elsewhere is abundantly justified. As a matter of fact, several quartz lodes are known to exist near Lawrence; and one of these, on the spur between Gabriel's Gully and Wetherstones, was worked for a short period many years ago.‡ Near Waipori the well-known O.P.Q. lode has had a long and chequered career, and still offers considerable possibilities to the miner, for no portion of this well-defined and strong lode has been tested to a greater depth than 280 ft. Other gold-bearing lodes in the same locality are the Canton, Nuggety, Nuggety Gully, Cox's, and the Bella, all of which have been but imperfectly prospected.

In addition to the gold-bearing veins just mentioned, lodes carrying copper-ore, antimony-ore, cinnabar, and scheelite have been found within a few miles of Waipori. The district as a whole therefore seems worthy of the prospector's attention.

(2.) *Alluvial Gold.*

Since 1861 the Tuapeka district has been famous for its rich alluvial deposits, the presence of which was first announced by the public-spirited Gabriel Read, with whose name that of Edward Peters ("Black Peter") ought also to be associated as one of the early discoverers of gold in Otago.

At the present time the chief source of the gold being won in the district is the auriferous conglomerate or "cement" being worked at Bluespur, Wetherstones, and Waitahuna Gully. This conglomerate has been fully described by McKay and others, and therefore little need be said about it on the present occasion. It rests on an uneven floor of mica-schist, whilst at Bluespur and Waitahuna Gully it is also seen to be bounded on the north-east side by a smooth wall of rock having a slope to the south-west of from 35° to 40°. This smooth slope does not represent the actual surface on which the conglomerate (cement) was deposited, but is the exposed face of the Tuapeka fault, which originally cut through a more or less continuous sheet of the Bluespur beds, as well as the underlying mica-schist (so-called "high reef"). The conglomerate on the north-east or upthrow side of the fault has long since been entirely removed by erosion, whilst on the south-west or downthrow side patches of considerable size still remain. Between these patches the "cement," like that on the north-east side of the fault, has been denuded. At Bluespur, though millions of tons of the cement have been sluiced into Munro and Gabriel's gullies, a considerable quantity still remains. At Wetherstones, besides the cement in sight, now being sluiced by the Golden Crescent Sluicing Company, an immense amount lies beneath the Wetherstones Flat.

Though unable to speak definitely, I may at least say that there is a probability of the deep ground in this locality containing one or more rich layers, and therefore a vigorous prospecting policy seems warranted. The beds near Forsyth Railway-station lie between the two productive areas of Wetherstones and Waitahuna, and therefore are perhaps worth prospecting, especially in their deeper portions. At Waitahuna Gully the "cement" in sight will probably furnish good returns for many years to come, provided the various companies are not hampered by an insufficient supply of water.

The modern gravels of the various valleys and stream-flats now appear to be almost exhausted. In places they have been worked twice and even three times over, first by cradling and ground-sluicing, then by dredging or by hydraulic sluicing and elevating. In the Tuapeka Valley above Evans Flat the Tuapeka Sluicing Company is following an old gravel-filled channel of the Tuapeka Stream, which is only a few yards wide, and excavated to a depth of 4 ft. or 5 ft. in quartz-mica schist. Above the gutter is about 6 ft. of quartz and schist gravel, overlain by a similar or greater thickness of clay. This material is being elevated to about 25 ft. above the bottom of the gutter, and profitable returns are apparently being obtained.

(3.) *Lignite.*

Layers of lignite occur in the upper part of the Bluespur cement, and at Wetherstones in a horizon above the cement, but these occurrences are of little value. Near the Lawrence Racecourse lignite was worked many years ago for local consumption, but on the coming of the railway a better class of coal was introduced and the local fuel ceased to be in demand. Lignite occurs also at Evans Flat. So far as can be judged from the scanty data now available, the horizon of the Lawrence and Evans Flat lignite is above that of the Bluespur cement, and therefore may correspond to the lignite at Wetherstones, as seen in the Golden Rise Sluicing Claim.

(4.) *Clay.*

Extensive clay-deposits occur between Lawrence and Beaumont, and in the future will probably be found to be of value for the manufacture of bricks, tiles, drainpipes, and possibly some classes of pottery-ware. The superficial clays of other localities may also prove of some economic importance, especially for brickmaking.

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* "Older Auriferous Drifts of Central Otago," 2nd edition, 1897, p. 110. † *Op. cit.*, 2nd edition, p. 20. See also "Gold Deposits of New Zealand," 1903, p. 68. ‡ See Hutton and Ulrich's "Geology of Otago," 1875, pp. 158, 195.

Conclusion.

Owing to the brevity of my visit, this report cannot be expected to cover all points of interest in the Lawrence–Waipori district, and is likely to contain one or two small errors at least. As already stated, the metalliferous lodes of the district deserve to be prospected afresh, whilst its clays and lignites are not without value. The auriferous "cements" of Wetherstones, Waitahuna, and perhaps other localities offer considerable possibilities, and ought to be carefully prospected at those points where they are not already being worked.

Literature.

The principal accessible references to the Tuapeka district are as follows:—

1875. Hutton, F. W., and Ulrich, G. H. F.: "Geology of Otago." This work contains much valuable information relating to the Tuapeka and Waipori districts. See especially pp. 93 (Bluespur), 158–159 (Gabriel's Gully Reef, O.P.Q. Reef), 181–183 (Older Drift of Bluespur, &c.), 184 (Waipori Copper Lode), 185 (Waipori Antimony Lode), 189 (Brown-coal Mine, near Lawrence), 195–197 (Gabriel's Gully Reef), and 197–199 (O.P.Q. Reef).

1879. Cox, S. H.: "The Tuapeka Cements." Rep. G.S. during 1878–79, No. 12, pp. 42–53.

1881. Rowe, W. E.: "On the Stony Creek Antimony-mine, Waipori, Tuapeka County." Rep. G.S. during 1879–80, No. 13, pp. 155–156.

1881. Rowe, W. E.: "On the Waitahuna Copper Lode, near Waipori, Tuapeka County." Rep. G.S. during 1879–80, No. 13, pp. 156–158.

1892. Hector, James: "Blue Spur, Tuapeka." Part of Progress Report in Rep. G.S. during 1890–91, No. 21, pp. xxii–xxvi.

1893. Rickard, T. A.: "The Goldfields of Otago." Trans. Am. Inst. Min. Eng., Vol. xxi, pp. 411–442. A portion is reprinted in the Mines Report (C.–3), 1893, pp. 109–111. Mr. Rickard's article deals very largely with the Lawrence and Waipori districts.

1893. Rickard, T. A.: "Alluvial Mining in Otago." Trans. Am. Inst. Min. Eng., Vol. xxi, pp. 442–473.

1894. Hector, James: "Blue Spur, Tuapeka." Part of Progress Report in Rep. G.S. during 1892–93, pp. xxxv–xxxix.

1894. McKay, Alexander: "Older Auriferous Drifts of Central Otago." Mines Report, C.–4. Reprinted in 1897.

1903. McKay, Alexander: "Gold Deposits of New Zealand." Reprinted from *New Zealand Mines Record.*

1906. Loughnan, R. A.: "The First Gold Discoveries in New Zealand." Reprinted from *New Zealand Mines Record.*

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10. GOLD-MINING POSSIBILITIES OF THE HUNUA DISTRICT, AUCKLAND.*

(By J. Henderson, Mining Geologist.)

The township of Hunua lies in the basin of Hunua Stream, some thirty miles by rail and road from Auckland. Attention has lately been directed to a number of quartz lodes which are exposed at various points on the farms of Messrs. Wilson, Morrison, and Price, from three to six miles from the township.

Mr. D. E. Morrison has driven two crosscuts about 50 ft. apart vertically, and has intersected a lode over 10 ft. wide in both drifts. Dish prospects may be obtained from portions of the lode. Three small veins have also been exposed by trenching on the same farm.

Close to Morrison's boundary Mr. F. Price has proved by trenching that numerous boulders of quartz occur in the surface clays. A large barren-looking body of quartz outcrops for many chains on his leasehold.

Other quartz lodes occur on Mr. Wilson's farm and in the low range between the Hunua Valley and Hauraki Gulf. The stream alluvia yield at many points dish prospects of an encouraging nature.

The whole district is of low relief, the hills seldom exceeding 1,200 ft., and in general are about 1,000 ft. above sea-level, or approximately 300 ft. above the valley-floor. The land surface is old, and as a consequence surface accumulations are heavy, rock-weathering has proceeded to considerable depths, and outcrops are poor.

Little can be said of the geology of the district. Fresh andesite overlies the lode-containing rock in several localities. The precise nature of the lode country is difficult to determine, as it is little better than a clay, but probably consists of greywacke and argillite of Juro-Triassic age.

The lodes themselves consist of rusty quartz, indicating that iron sulphide was once abundant, and some of the quartz still carries a little pyrite. Manganese oxide is also present.

Eight samples of quartz were taken and assayed at the Dominion Laboratory, but in none of these was gold or silver found to be present.

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*Written in October, 1911.

11. COAL POSSIBILITIES OF THE WARKWORTH DISTRICT.

(By J. Henderson, Mining Geologist.)

Introduction.

The present writer spent only ten days in the Warkworth district, so that the following account of its geology is of necessity mainly compiled from the reports of previous observers. The chief papers dealing with the Warkworth and neighbouring districts are as under:—

1869. Hector, James: "Memorandum to accompany Geological Sketch-map of Kawau." Geological Reports, Vol. 5, pp. 45–48.
1881. Cox, S. H.: "Geology of the Marsden and Rodney Counties." Geol. Rep., Vol. 13, pp. 13–39.
1882. Cox, S. H.: "North Auckland District." Geol. Rep., Vol. 14, pp. 18–32.
1884. McKay, A.: "On the Occurrence of Serpentinous Rocks as Dykes in the Cretaceo-Tertiary Strata near the Wade, Auckland." Geol. Rep., Vol. 16, pp. 99–101.
McKay, A: "On the Relations of the Tertiary and Cretaceo-Tertiary Strata on the Coast-line between Auckland and Mahurangi." *Ibid*, pp. 101–106.
1886. Park, James: "On the Kaipara District." Geol. Rep., Vol. 17, pp. 164–170.
1887. Park, James: "Kaipara and Wade Districts, Auckland." Geol. Rep., Vol. 18, pp. 219–229.

Physiography.

The most remarkable physiographic feature of the district is the wide maturely sculptured depression stretching from Kaipara Flats Station to Warkworth, and known as the Kaipara Flats. North and south the land rises abruptly into extensive assemblages of hills, the remains of deeply dissected plateaux of soft sandstone. Eastward this depression is drained by the Mahurangi and westward by the Kourawhero, a branch of the Kaitoto. The Kaitoto escapes from the depression by a short gorge and joins its parent stream, the Hoteo, itself entangled in a narrow valley. It has been suggested that at one time the Hoteo found its way to the sea through the valleys of the Kourawhero and Mahurangi. On this supposition the Kaipara Flats would be the wide floor of the ancient Hoteo. The topography of the depression, however, is decidedly against this view.

All the streams show entrenchment below their main valley-floors, a fact implying a recent elevation of the land. On the other hand, as pointed out by Hector long ago, the manner in which the sea penetrates into the land by winding estuaries and intricate embayments points to a drowning of former stream-valleys by a recent depression. Possibly the most feasible explanation of the facts is that after considerable depression of the land a relatively slight elevation took place.

Stratigraphy.

Three unconformable sedimentary formations outcrop within the district. Of these the oldest, probably of Juro-Triassic age, is represented by the slates of Kawau Island, Matakana Point, and Cape Rodney. The rocks have been much folded and contorted, and usually have a north-easterly strike and a steep westerly dip.

Rocks of probable Cretaceous age overlie the last-mentioned strata with great unconformity. Only one member of these beds—the hydraulic limestone—outcrops in the Warkworth district, but a full sequence is developed farther north at Whangarei. According to McKay greensands and black grits with coal-seams underlie the hydraulic limestone in that locality. Several bores, put down to prove the amount of limestone in connection with the cement-works, penetrated a greensandstone, which probably corresponds to the greensands below the limestone at Whangarei. The chalk with flints which Cox maps as covering a large area of country to the west of Wellsford and the flinty rocks exposed at Snell's Beach are part of the same formation. Inconsiderable outcrops of hydraulic limestone occur near Warkworth, and at various places upon the floor of the Kaipara Flats depression.

The next series of beds, called by Cox the "concretionary sandstones," is correlated by him with the Waitemata Series of Auckland Harbour. Where this formation rests on the slates, as at Kawau Island and Cape Rodney, the beds are generally calcareous breccia-conglomerates; but, as a whole, the lower beds are marly sandstones. The upper beds consist of thick greensandstones with occasional marly bands often containing coaly matter. Sometimes also volcanic breccias are interbedded, and to the west of Ahuroa the sandstones are capped by a breccia which may mark the close of the series. Although the relationships of the hydraulic limestone and the greensandstones are nowhere within the district shown clearly in section, the discordance of the formations is proved by the numerous coarser bands which occur in the sandstones containing water-worn pebbles of hydraulic limestone, calcareous marl, and rarely carbonaceous shale derived from the denudation of the hydraulic limestone and associated beds. Readily accessible localities where these pebble-bands may be observed are the railway-cuttings about half-way between Hoteo and Tauhoa, and in a quarry a little off the main road from Warkworth to Kaipara Flats Station, about two miles and a half from Warkworth. Hector long ago noted similar pebbles in the breccia conglomerate of Matakana North Head.*

Structure.

Numerous minor faults occur in the greensandstones, while the outcrops of hydraulic limestone nearly all show signs of severe fracturing. Thus in the railway cutting about 20 chains north of Kaipara Flats Station marly limestone dipping south at an angle of 75° is immediately

* S. H. Cox: "Geography of the Rodney and Marsden Counties," Rep. G.S. No. 13, 1881, p. 29.

succeeded on the north by a zone, several chains in width, of intensely crushed and pugged limestone. Some 15 chains to the east of this occurrence a mineral spring is reported to issue in low-lying ground. Again in a well about three miles west of the railway-station slickenslided marls were reached after pasing through 45 ft. of shattered limestone. At Wilson's cement-works, near Warkworth, the limestone is greatly disturbed and full of slickenslided joints, &c. At Bailey's quarry, about a mile and a half north-west of Warkworth, a serpentine, altered from a basic rock, outcropping in connection with the hydraulic limestone, shows crushing due to earth-movements. At Snell's Beach the flinty "firestones" stand at high angles. These disturbed areas all occur in the wide low-lying depression already described, and their distribution suggests that a broad east-and-west fracture-zone underlies it. Kawau Island is in the direct line of the depression, and Hector in his map shows several east-and-west faults disturbing the strata there. The dyke of basic rock outcropping on the east of the island is also, according to Cox, much crushed. That the whole district has been subjected to forces tending to produce east-and-west fracturing is also suggested by the latitudinal distribution of the volcanic bosses as mapped by Cox.

Coal Possibilities.

In estimating the possibility of finding coal in the Warkworth district by boring, attention should be given not only to the local geology, but also to that of the New Zealand coalfields generally. So far no detailed examination has ever been made of the Warkworth district, and until this has been done any opinion cannot be regarded as more than tentative.

In other parts of New Zealand it is known that coal-seams are found in connection with both the Miocene and Cretaceous rocks. The soft greensandstones of the district, which are probably of Miocene age, stretch as far south as Auckland, and throughout this area coal-seams are unknown, although at many localities thin lenses of coaly matter occur. The foldings and dislocations affecting these rocks expose the full sequence at many points, and it is exceedingly unlikely that workable seams will be found anywhere within them.

In regard to the Cretaceous rocks of the district it is known that workable seams occur beneath similar rocks in the Whangarei district. On the other hand, in East Auckland and North Canterbury, where large areas of similar rocks are found, no workable seams are known. Indeed, it may be said that in New Zealand even in well-known productive areas the greater proportion of the coal-bearing horizon is usually destitute of workable seams.

It has already been noted that pebbles of hydraulic limestone and carbonaceous shale occur in the Miocene sandstone. This implies that after the deposition of the Cretaceous rocks the land was elevated and subject to denudation. The distribution of the various formations suggests that the greater area of Cretaceous rocks removed lay to the eastward of the Warkworth district. Still, the possibility that the greensandstones rest upon the basal slates at points other than at Kawau Island, Matakana Point, and Cape Rodney must not be forgotten.

Bore-sites.

In determining the most suitable sites for bores the following points must be kept in view:—

(1.) The Miocene sandstones as a possible source of coal must be entirely disregarded.
(2.) The only possible coal horizon lies at the base of the series containing the hydraulic limestone.
(3.) This coal horizon may be entirely destitute of coal.
(4.) Denudation has removed at least a portion of this horizon in the Warkworth district.

If coal-seams occur below the hydraulic limestone, to prove their existence may require the drilling of a considerable number of bores. Bores to reach the coal horizon will be the least depth if drilled somewhere within the Kaipara Flats depression. Several known faults, however, traverse this valley and would tend to render boring difficult and the results obtained unreliable. Even if coal were found the faults would greatly add to the cost of mining, and cause the coal to be crushed and of low commercial value. Again, it would be inadvisable to bore eastward of the Warkworth meridian, because in that direction it is known that the limestones have been largely removed by denudation.

The data for the selection of bore-sites are so meagre that any drilling must be regarded as a purely speculative venture. Perhaps the most suitable place for the first bore would be in the Kaitoto Valley, about a mile north of the Woodcocks Railway-station. This position is low-lying, is fairly close to an area of hydraulic limestone, and is at the same time sufficiently far from the known faults. The bore should be drilled until the basal slates are attained. A careful log should be kept, and in addition frequent samples of the strata traversed taken and examined by a competent geologist. No reliable estimate of the depth required to be bored can be given, but the lowest member of the Cretaceous rocks will at this place be probably not more than 500 ft. below the surface. The data given by this bore should be of great value in elucidating the structure of the district and in indicating the position of later bores.

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12. COAL PROSPECTS OF THE WAIMATE DISTRICT, SOUTH CANTERBURY.

(By J. Allan Thomson, Palæontologist.)

(1.) Narrative.

The present report was ordered in response to representations made by a deputation of residents of the Waimate district to the Hon. the Prime Minister. In accordance with my instructions, I proceeded to Waimate on the 21st May, 1913, and communicated with Mr. W. G.

Paul of that town, who explained to me more exactly the nature of the report desired. Waimate had experienced a coal famine during the previous winter so far as Kaitangata or similar household coals were concerned, and consequently it was felt that the discovery, in an easily accessible locality, of a workable seam of coal would be a great boon to residents of that town, even if it were of no better quality than the coal previously mined from the Waihao district. Coal had long been known in the Waihao area, and had been worked from time to time, but all the mines lay too far from the Waihao Downs Railway to allow it to be worked at a profit. A resurvey of the Waihao district was therefore desired. Mr. G. Pitcaithley, headmaster of the Waimate High School, kindly gave me information about previous mining and boring operations near Waihao Forks. I then proceeded to Waihao Downs, and was engaged in the examination of the surrounding country until the 29th May; Mr. E. Richards, of Waihao Downs Station, kindly providing me with means of transport.

(2.) Topography and Physiography.

In the south of Canterbury a strong range diverges from the Southern Alps and extends in a nearly south direction towards the coast near Waimate, thus gradually restricting in this direction the breadth of the area occupied by the coastal downs which replace the Canterbury Plains from Timaru southwards. This range, which near the Alps is known as the Two-Thumb Range, with peaks over 8,000 ft. in height, gradually lessens in elevation towards the coast, being 3,562 ft. in Mount Studholme, the highest point of the Hunters Hills between the upper waters of the Waihao and Pareora Rivers, and 1,275 ft. in the hills two miles west of Waimate. It turns more to the south-east a few miles to the north-west of Waimate, and presents a straight, steep front of about six miles in length facing that town, being broken through only by an old gorge of the Waihao River, through which the railway runs from Waimate to Waihao Downs. These hills extend beyond Waimate nearly to the Waihao River; and, since they have apparently received no name, I propose to designate them in this report the Waimate Hills. From their base to the sea there is an area of low-lying country, practically a coastal plain, through which the Waimate, Hook, and other smaller streams wander in nearly graded channels to the sea. Waimate lies at the foot of the hills, at a height of 175 ft. above sea-level.

The Waihao River rises on the western side of the Hunters Hills, receiving a strong branch at the Forks from a western watershed of over 2,000 ft. in height separating its valley from that of the Hakataramea River, and flows past the south end of the Waimate Hills through the narrow coastal plain to the sea. It is separated from the Waitaki Valley in its lower part by the Waikakahi Downs, which have a breadth of six to nine miles between the two rivers, and rise to heights of 927 ft. in Mount Harris, and 1,072 ft. three miles farther west.

Two miles below the Forks the Waihao Valley is strongly contracted between the southern end of the Waimate Hills and the Waikakahi Downs. Above this point the river runs for several miles in narrow, fairly deep gorges cut through high-level terraces, but as these are not prominent in a distant view, the general appearance of the valley is that of a broad basin, whose regularity is disturbed only by prominent escarpments of limestone. The hills bordering this part of the valley—viz., the Waimate Hills on the east, the Hunters Hills on the north-east, the Hakataramea watershed on the west, Elephant Hill on the south-west, and the north end of the Waikakahi Downs on the south—though deeply scored by narrow ravines, present on the whole very gentle slopes towards the high-level terraces of the Waihao River. The major outlines of this part of the valley were developed at a time when the river flowed through the rock-bound Waimate Gorge. The cutting of this gorge in such hard rocks must have been a relatively slow process, during the progress of which the upper part of the valley attained a mature topography. A broad flood-plain was cut across the softer rocks of the middle of the valley, while the surrounding hills were smoothed and rounded. Meanwhile a smaller stream was working its valley back in the softer rocks to the south of the Waimate Hills, and finally it tapped the waters of the Waihao a little below the Forks, and turned them into the present channel. Finding now only soft rocks in its lower courses, the new river thus formed was able to deepen its bed in these with relative ease, and then to cut deep gorges through the old flood-plain, parts of which are now left as high terraces. The smaller tributaries of the old stream were also given fresh cutting-power, and have developed into the small ravines which modify the old mature slopes of the Hunters Hills and the south-west side of the Waimate Hills.

The very markedly straight front of the north-east side of the Waimate Hills is undoubtedly due to a strong fault, which has let down the soft rocks near the coast against the harder rocks of the Waimate Hills. This fault must be older than the capture of the Waihao, since the grade of the small sluggish stream now draining the Waimate Gorge is not altered in crossing the fault-line. Although the steep slope of the hills suggests a recent fault scarp, it may be equally well explained by the differential erosion of the soft and hard rocks on either side of the fault, and be thus a fault-line scarp.

(3.) General Account of the Geology.

Apart from superficial deposits such as clay and terrace gravels, the rocks of the Waihao and Waimate districts may be divided into two main groups. The older of these consists of greywackes, argillites, and similar rocks, dipping at high angles and striking in a north-west direction. In the absence of fossils their age is uncertain, but there is a very strong break between them and the overlying Tertiary rocks. The older group forms the Waimate Hills, the Hunters Hills, and thence the high ground extending through Pudding Hill to Elephant Hill, with a tongue, as it were, protruding to form Tussock Hill. They also pass under the Tertiary rocks, and form the floor on which they rest.

Lying with strong unconformity on the older rocks is the younger group of Tertiary (probably Lower Tertiary) age. It consists of softer and more incoherent rocks, and may be subdivided as follows: (1) Coal-measures (at the base); (2) greensands; (3) limestone; (4) Mount Harris-beds.*

The coal-measures are reddish-brown in colour, and consist of fine conglomerates, sands, shales with much carbonaceous matter, and seams of coal occupying various horizons. Sandy beds predominate in most exposures, and in consequence of their excessive permeability to water, and of the oxidation to sulphuric acid of the large amount of iron sulphides they contain, the greywacke series immediately underlying the coal-measures is deeply rotted and strongly bleached, as may be well seen in the bed of the Waihao River half a mile above the bridge on the road between Waihao Forks and Waihaorunga. The coal-measures vary in thickness from place to place, and pass gradually by the increase of glauconite into the overlying greensands, but there are from 50 ft. to 150 ft. of non-glauconitic beds which may be claimed as coal-measures. They outcrop in an irregular broad curve on the north side of the area occupied by the Tertiary rocks, but are absent at the surface along certain lines where the younger rocks, greensands or limestones, have been let down by faults against the greywacke series. The coal-measures dip everywhere below the greensands, and thus underlie the area south of their outcrop towards the Waitaki River, at an increasing distance from the surface in this direction.

The greensands are deep-green rocks formed mainly of quartz grains and glauconite, and contain many marine shells which prove their age to be Lower Tertiary. An interesting mineral occasionally found in these rocks is retinite or fossil resin, derived no doubt from the resin of coniferous trees which were growing on the adjacent land. The greensands appear to be upwards of 200 ft. thick. Unlike the coal-measures they are very impervious rocks, as is proved by the numerous springs which issue from under the terrace gravels at the top of the cliffs of greensand in both branches of the Waihao River. The result of this impermeability is that the underlying coal-measures are water-logged, and hold the water under pressure.

The limestone is a highly glauconitic variety, and consists in its lower part of thin beds of hard limestone separating thicker bands of calcareous greensand, which exhibit current bedding in an extremely well-marked degree. A marl rock is stated to underlie the limestone near McCullough's Bridge, a section which the writer did not have the opportunity of examining, but opposite Waihao Downs Station the limestone appears to pass gradually down into the greensand. The Waihao limestone is believed to be strongly phosphatic, but a search for bands of rock phosphate proved unsuccessful. It is quite likely, however, that both the greensand and the limestone everywhere carry a small percentage of phosphorus, which may account for the fertility of the soils lying on them. The beds immediately succeeding the limestone were not seen in any of the exposures visited, but a higher series of loose sands and shell-beds is exposed in Mount Harris. Time did not permit of an examination of the country around Waimate on the north-east side of the Waimate Hills, but it is probable that the Mount Harris beds underlie the gravel plains of this area.

With the exception of McKay, all previous writers on the geology of the Waihao and Waitaki valleys have explained the fact that the Tertiary beds extend into basin-like areas among the mountains by postulating that in these situations inlets of the Tertiary sea indented the coast-line. McKay, however, held that over the whole of the eastern side of the South Island the Tertiary beds occupied a much greater area at the time of their deposition, extending further towards the axis of the island, and that, in consequence of differential uplift or approximately uniform uplift and subsequent down-faulting of certain areas, the more elevated parts were removed by erosion, while those parts lying below the general level of the greywacke floor were preserved from this denudation, and now appear to occupy interior basins. The disposition of the Tertiary beds at Waihao favours McKay's view, for the basal surface of the coal-measures is not plane but gently curved, so that their outcrop is roughly semicircular between Elephant Hill and the Waimate Hills, while a minor basin occurs north of Tussock Hill in such a manner that it cannot be explained by original deposition. Further, the great fault along the north-east side of the Waimate Hills is evidence of differential movement since the deposition of the Tertiary beds.

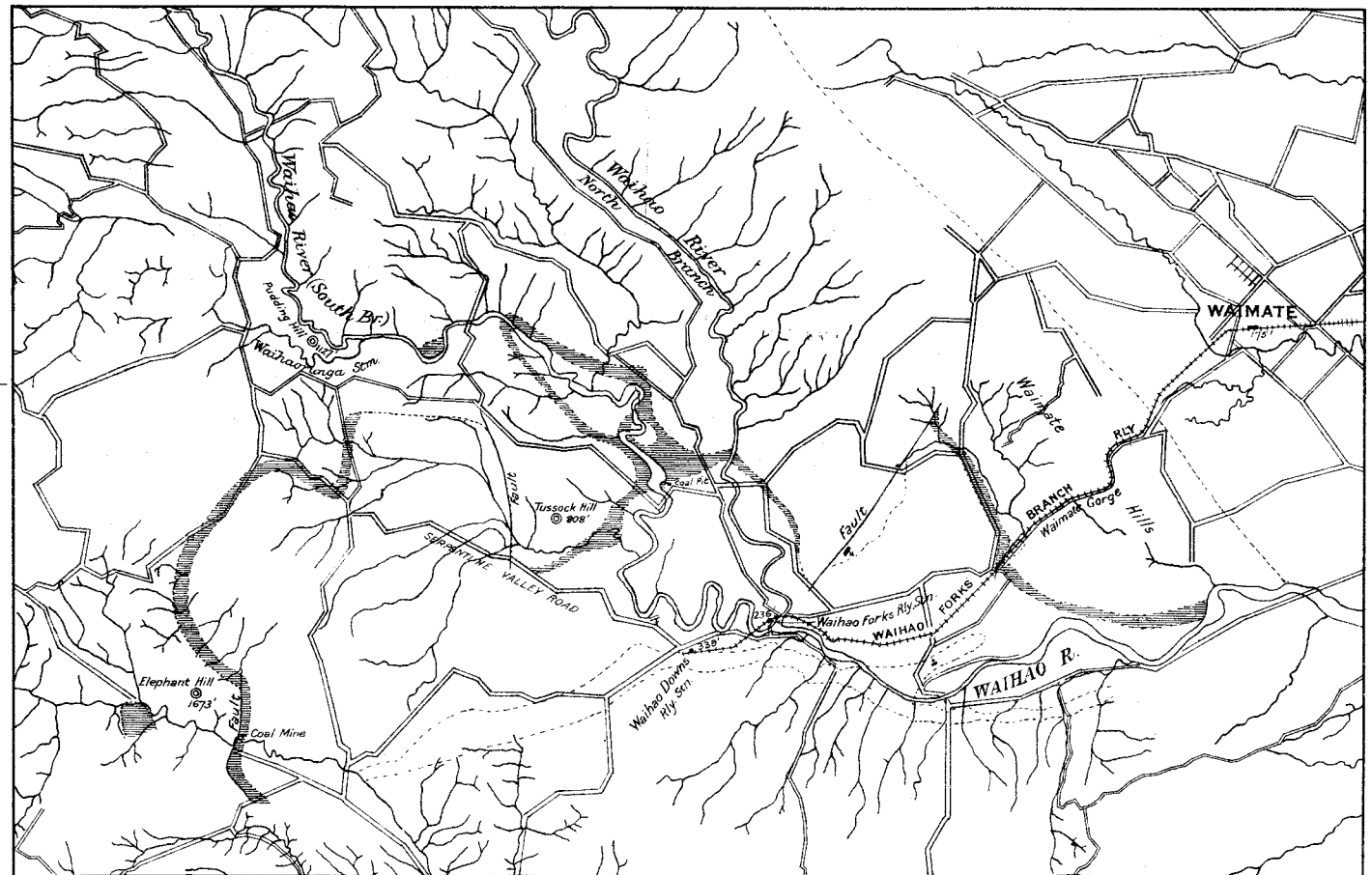
It is probable that the old mature surface exhibited by the hills surrounding the Waihao basin lies only a little distance below the original base of the Tertiary rocks which once covered these hills, for it is only slightly below the projection of base of the existing Tertiary beds. Apparently the Tertiary floor was warped into a gently curved surface, and the river eroded easily those parts of the Tertiary rocks lying above its flood-plain when it flowed through the Waimate Gorge, and also the decomposed greywacke immediately underlying them, but was able to carry out little effective work on the harder undecomposed greywackes at a greater depth. A confirmation of this view of the structure will ensue if outlying patches of the Tertiary rocks are subsequently discovered on portions of this old mature surface.

Geological Map.—The geological sketch-map accompanying this report is the first that has been made of the area, and, being hurriedly made, can only be taken as a first approximation. It has most claim to accuracy in the area west of the north branch of the Waihao River, with the exception of the limestone outcrop between Waihao Downs and Elephant Hill Creek. The outcrop of coal-measures on the south-west side of the Waimate Hills was not examined by the writer, and has been inserted on the strength of McKay's descriptions. Alluvial formations are not shown.

(4.) Coal Prospects in the Waihao Area.

Coal has been mined intermittently in the Waihao area for about forty years. The reasons that have prevented a permanent industry being established are—(i) The poor quality of the coal; (ii) the distance from a market; (iii) the nature of the coal-measures.

* Mr. Marwick, in a written communication, states that there is a bed of greensand between the limestone and the Mount Harris beds, occupying thus a position similar to the Hutchinson Quarry beds in the Oamaru district.



GEOLOGICAL SKETCH MAP OF
WAIHAO COALFIELD

Scale

CHAINS 80 40 0 1 2 3 4 5 MILES

P.G. MORGAN. DIRECTOR.

Reference

Mt. Harris Beds. Limestone. Greensand. Coal Measures. Greywacke &c.

Transpose symbols Limestone and Greensand.

C-2.

(i.) *The Quality of the Coal.*

A large number of analyses of coal from Waihao have been published from time to time, and are collected in the following table, with a new analysis made by the Dominion Analyst of a specimen collected by the writer from the face of the drive in the Elephant Hill Coal-mine.

——	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Fixed carbon	34·72	27·77	35·85	32·83	24·81	27·78	27·97	39·41	38·24	22·0	24·95	24·28	28·37
Hydrocarbon	22·83	31·06	43·02	47·24	54·41	49·84	31·06	28.40	29·53	52·8	36·41	36·16	43·22
Water	28·01	36·18	15·01	16·32	17·58	18·19	36·18	23·96	24·21	15·9	26·09	30·59	23·49
Ash	14·44	4·99	6·12	3·61	3·20	4·19	4·79	8·23	8·02	9·3	12·55	8·97	4·92
Calculated evaporative power (lb.)	4.5	3·6	4·30	3·90	..	..	3·6	..	..	..	..	..	..
Sulphur	..	..	..	..	..	..	..	..	..	..	1·62	1·78	2·98

1. Waihao. Coal water-logged, but dried as powder for forty-eight hours. Average of four samples, 20th Ann. Rep. Col. Lab. (1886), p. 39.
2. Waihao. Ash contains alkaline carbonates. 21st Ann. Rep. Col. Lab. (1887), p. 35.
3–7. Waihao. 27th Ann. Rep. Col. Lab. (1893), pp. 21–22.
8, 9. Waihao Forks. 30th Ann. Rep. Col. Lab. (1897), p. 4.
10. Shale, Waihao Forks Coal-mine. 39th Ann. Rep. Col. Lab. (1906), p. 5.
11. Waihao Coal-mine. Rep. Analyses N.Z. Coal, &c., Mines Dept. (1907), p. 9.
12. Waihao Forks. 44th Ann. Rep. Dom. Lab. (1911), p. 9.
13. Elephant Hill Coal-mine. 1913.

The average composition of Waihao coals calculated from the above table is as follows:—

Fixed carbon	29·92
Hydrocarbons	38·92
Water	23·98
Ash	7·18

It will be seen, therefore, that the Elephant Hill coal corresponds very nearly to the average of all Waihao coals, and is not as good as the best of these. These analyses show that the Waihao coals are of poor quality, being too low in fixed carbon, rather high in ash, and exceedingly high in water. In burning them a great part of the heat must be consumed in evaporating this water. They cannot, therefore, compete successfully with a high-class brown coal such as Kaitangata. Nevertheless, the fact remains that they have found a ready sale in Waimate at a price of about 17s. 6d. per ton.

It will perhaps be as well to correct certain misapprehensions that exist in the district in regard to the quality of the coal in depth. In the first place, the coal-measures do not extend under the higher hills bounding the basin, such as Elephant Hill and Tussock Hill, but rest along their edges. Where the coal-measures are deeply buried they are almost certainly water-logged, and thus no improvement in the percentage of water in the coal is likely to be found. In any case, so far as pressure of overlying rocks is concerned, the coal at the outcrop has once experienced the same pressure as that still covered by the greensand and limestone, and no improvement from pressure is to be expected in depth. Should the coal be found, however, in more impervious measures, there would be some reason to expect an improvement in quality.

(ii.) *The Distance from a Market.*

Coal has been mined chiefly from an inclined drive near the south branch of the Waihao River at the crossing of the road from Waihao Forks to Waihaorunga—*i.e.*, two miles from the Waihao Forks Railway-station, and from an adit on the south-east side of Elephant Hill, distant by road about six miles and a half from Waihao Downs Railway-station. In each case the coal was carted from the mine to the railway-station, and in the case of the Elephant Hill mine the cost of carting prevented the coal being sold at a profit in Waimate. Attempts have been made to discover coal near the south-west end of the Waimate Gorge, where it would be very convenient to the railway and to Waimate, but no good seam was found here. The thickest known seam is that at Elephant Hill (12 ft. or more), that on the South Waihao being 5 ft., and a seam discovered by boring near Waihao Forks being 9 ft. Should the railway be extended from Waihao Downs in the direction of Waihaorunga, as settlers hope will be the case, it will shorten the distance that coal would have to be carted from Elephant Hill, and will render the south-east side of Tussock Hill very acccessible. A suggestion has been made that a deviation towards Elephant Hill of the proposed railway extension would allow the coal there to be used, but in view of the poor quality of the coal a deviation can hardly be recommended on this ground alone. At present the best area for mining, from the point of view of accessibility, appears to be two miles to the north-east of Waihao Forks. The coal is of too poor a quality and the quantity too small to justify the laying of a tramway.

(iii.) *The Nature of the Coal-measures.*

From what has been said above of the permeability of the coal-measures and the impervious character of the greensands, it will be readily understood that the coal-measures in depth must be heavily saturated with water. This was proved by the experience in shaft-sinking and boring near Waihao Forks. In 1886, A. B. Lindop, a mining engineer temporarily engaged by the Geological Survey, recommended that a bore should be put down at this point to cut the coal at

150 ft., in the mistaken hope that the quality of the coal would be improved in depth. Apart from the question of water in the coal-measures this would have been a suitable site for a mine, as it is immediately adjacent to the railway. No action was taken at the time, but a few years ago a shaft was sunk to a depth of 180 ft., when it filled up one night between shifts with water. Presumably the shaft had nearly reached the bottom of the greensands, and the pressure of water in the underlying loose sands broke the remaining band of impervious rock at the bottom of the shaft. The fact that they were sinking into an artesian system did not seem to strike the prospectors, for they then put down a bore of 460 ft. to the greywacke floor, cutting 9 ft. of coal at 380 ft. This bore also gave a flow of water. It follows, therefore, that although coal underlies a large area of country it cannot be profitably mined because of the water difficulty, and only a comparatively small amount of coal can be obtained from those parts of the measures relatively free of water near the outcrop. Even then the nature of the enclosing beds may cause some difficulties in mining. The Elephant Hill coal has a fairly good roof of shale, but in the mine on the South Waihao a fall or flow of loose sand filled the workings and put an end to mining operations.

It follows, therefore, from the poor quality of the coal, its hydrous nature, and the difficulties of mining, that the Waihao area is never likely to become an important coalfield, although a small amount of coal may be mined around the outcrop for household use in Waimate and the surrounding district. When the high-grade coals of New Zealand are becoming exhausted there will probably be a system perfected of burning the poorer coals at the pit-mouth and transforming their heat into electricity, which can be conducted to the adjacent towns by wire. When that time comes the Waihao coalfield will be a valuable asset to the district.

(5.) Coal Prospects in the Waimate District.

Time did not permit of an examination of the geological structure of the country to the north of Waimate. Coals of inferior quality are known from various points between Waimate and the Pareora River, and it appears probable that they underlie Waimate. Before any boring operations to test this hypothesis can be recommended, a geological reconnaissance of the country between Timaru and Waimate will be necessary to ascertain the succession of the beds, their thickness at Waimate, the probable quality of the coal, if any, and whether an artesian system is also likely to occur in this area. Such an examination will necessitate at least a month's field-work.

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13. MINERAL PROSPECTS OF THE MAHARAHARA DISTRICT, HAWKE'S BAY.

(By J. Allan Thomson, Palæontologist.)

Narrative.

The present examination of the Maharahara district was made in response to representations made by the Woodville Chamber of Commerce. I therefore made it my first business, after arriving in Woodville on the 20th June to ascertain from Mr. Horne, President of the Chamber, the nature of the report desired. Mr. Horne explained that, owing to the nearness of the

mountains, the amount of farming land around Woodville was necessarily restricted, and that the business men of that town therefore hoped to provide for expansion by opening up mineral industries in the mountains, and were prepared to form companies for that purpose, provided that the indications were sufficiently favourable. The minerals supposed to exist were coal on Mr. Johnson's farm at Maharahara, oil near Te Rehunga, copper in the ranges behind Maharahara, and gold in the Manawatu Gorge.

From the 20th to the 24th June I was engaged in examining the coal and copper prospects at Maharahara. During this work I was accompanied by Mr. F. Johnson, who kindly acted as guide. On the 25th and 26th June, in company with Messrs. Murray and Foley, of Te Rehunga, I examined the oil indications near Te Rehunga, and also some supposed silver prospects in the ranges behind. On the morning of the 27th I visited the gold lease in the Manawatu Gorge, and in the afternoon of the same day returned to Wellington.

The actual country examined was small in extent, but, owing to the uniformity of geological plan of east Wellington and south Hawke's Bay, a sufficient amount of observation was made to give a general account of the mineral prospects of the whole area.

Topography.

The whole of the country examined lies on the western side of the Manawatu River above the gorge. The dominant topographical feature is the Ruahine Range, which extends from the Manawatu Gorge in a north-north-east direction for sixty miles to the gorge of the Ngaruroro River, beyond which its continuation is known as the Kaweka Range. These ranges form the structural backbone of the North Island, and are the northerly continuation of the Rimutaka and Tararua Ranges. Opposite Maharahara the Ruahines rise to peaks of nearly 3,500 ft., and descend in long steep spurs to the high-level terraces of the tributaries of the Upper Manawatu River. The chief streams draining the mountains are, in order north-east from the Gorge to Dannevirke, the Mangaatua, the Raparapawai, the Orouakeretahi with its tributaries the Otamarahu and the Mangapukakakahu, the Otamaraho, the Tamaki, and the Tapuata streams.

Next in importance to the Ruahine Range comes the Puketoi Range, which bounds the Manawatu River on the south-east side. This range rises to heights of 2,600 ft. behind Kumeroa, but presents a more gradual descent towards the river. Like the Ruahine Range, it is only a part of an elevated mass of country extending for a great distance in a north-north-west to south-south-east direction, in this case from Cape Kidnappers to Cape Palliser.

Between the Ruahine and the Puketoi ranges, the highest points of which are eighteen miles apart on a south-east line drawn through Maharahara, lies the basin-shaped valley of the Upper Manawatu River, through which the Dannevirke–Woodville section of the Napier–Wellington Railway runs at heights between 700 ft. and 300 ft. above sea-level. In a distant aspect the valley seems to slope gently from the foot of the ranges on each side to the river, but actually the Manawatu is incised over 100 ft. below the general level of the plain, while the numerous tributaries have revived their courses through the old flood-plain right back to the ranges, and their valley-sides are submature in development, so that in traversing the valley along its margin from south-west to north-east a constant repetition of flat hill and rounded valley is met with.

The basin of the Upper Manawatu extends south-south-west from Woodville between the eastern and western mountains nearly to Mauriceville, where a low watershed separates it from the valley of the Ruamahanga River, which flows south-south-west through Wairarapa Lake to Palliser Bay, occupying a similar position with regard to the Rimutaka and Tararua Mountains on the west and the Cape Palliser Range and its northerly continuation on the east. There is thus a great longitudinal depression between the eastern and western mountains running practically from Palliser Bay to Hawke's Bay.

Nearly the whole of the country above described was at one time heavily wooded, as the names Forty-mile Bush, Seventy-mile Bush, &c., indicate, but now the forests are practically confined to the mountains and their edges, the better parts of the valleys being at least burned, if not cleared and grassed. A great deal of the burning is of very recent date.

General Account of the Geology.

For the purpose of comparing mineral prospects the rocks of New Zealand, with the exception of those of the Otago Sounds region, may be conveniently divided into five great groups. These are—

(1.) Old more or less metamorphosed, and now mainly schistose or crystalline, sediments occurring chiefly on the west coast of the South Island and in Otago. To these rocks all the productive gold-reefs of the South Island are restricted, and from them all the rich alluvial gold has been derived. These rocks do not occur in the North Island.

(2.) A central group of steeply dipping conglomerates, hard impure sandstones (greywackes), slaty indurated mudstones and shales (argillites), red jasperoid rocks and crystalline limestones. These rocks form the greater part of the high mountains of North Otago, Canterbury, Marlborough, and Wellington. Their age and subdivision is still a matter of controversy, but they are certainly intermediate in age between the rocks of groups one and four. Taken as a whole, they are almost devoid of valuable minerals, the only deposit of any importance now worked in them being the marble of the Blue Mountains, Shag Valley, Otago, which is burned for lime.

As the rocks of the Ruahine and Puketoi ranges belong to this group, their mineral prospects will be reviewed in greater detail below.

(3.) A series of granites, serpentines, and related igneous rocks intruded as bosses and dykes into the rocks of groups 1 and 2. According to modern views of ore-genesis, most ore-deposits owe their introduction into the places they now occupy to solutions given off by igneous intrusions during or after their cooling. Serpentines form the country of copper near Nelson, of nickel-iron in north-west Otago, and probably form the matrix of the semi-precious greenstone of the South Island. Moreover, platinum is found in the neighbourhood of serpentines in Westland. No intrusive rocks have been yet described by geologists from the Tararua-Ruahine ranges, but it is said that a large mass of serpentine occurs in the Ruahines north of Norsewood, while boulders of basic rocks have been found in streams draining the east side of the Tararuas.

(4.) A marginal group of marine sediments occurring on both sides of the central chains in each island. These rocks, which are but little altered from their original composition as gravels, sands, mud, and shell-beds on the sea-bottom, now form conglomerates, sandstones, mudstones (papa), greensands, marls, and limestones usually dipping at quite low angles. In general the series begins with conglomerates and sandstones, followed by greensands or mudstones, on which rest limestones, corresponding to the period of maximum depression; then as the sea shallowed again the order of the beds is reversed, and greensands or mudstones again appear, followed by gravels. By means of the fossils contained in the rocks it is possible to determine that the beds belong to various ages in different parts of the country, ranging from Upper Cretaceous through Lower Tertiary to Upper Tertiary.

It is in this marginal group of rocks that all the workable seams of coal in the Dominion occur, and also most of the limestones suitable for building, cement-making, or burning for lime. Experience has shown that the Cretaceous coals are seldom extensive or of very high grade, while nearly all the good coals occur in the Lower Tertiary. The Upper Tertiary rocks often contain seams of lignite, but never of good brown coal. Further, it is in these marginal rocks that all the oil indications in New Zealand have been obtained, the oil being presumably formed from the immense amount of organic matter in the form of shells and smaller forms of life deposited with the marine sediments. The oil indications are most abundant in the Upper Cretaceous rocks, but the only producing wells as yet lie in the Lower Tertiary mudstones of New Plymouth.

(5.) Finally, there are the extensive fields of lava and volcanic ash (including pumice) of Recent and Tertiary date, which are best developed in the centre of the North Island. In these rocks occur the andesitic goldfields of the Hauraki Peninsula, Waihi, and Karangahake. These rocks, with the exception of beds of transported pumice, do not occur on the east side of the Ruahine Range and its continuations.

Turning now to the district around Maharahara, and, indeed, to the whole of the east coast of the North Island, we find that only the second and fourth of these groups of rocks are represented. The core of the Ruahine Mountains and its northerly and southerly continuations is formed of the central group of greywackes and argillites, with reddish jaspers, which appear at numerous points between Wellington and Norsewood, and may be clearly seen in the Manawatu Gorge. According to McKay, crystalline limestones belonging to this series occur near Eketahuna, and are of sufficiently good quality and colour for architectural marbles if they could be obtained in blocks of sufficient size. The possibility of discovering marbles of similar nature in other parts of the ranges should not be lost sight of. These rocks strike for the most part north-north-east to south-south-west, with steep dips to the west-north-west and east-south-east, but local divergences from these directions are formed by smaller folds, and by faults. Similar rocks have been described in the eastern mountains only at Cape Palliser and for a short distance to the northwards, to the north-east of Alfredton, and on the northern continuation of the Puketoi Range. Between Kumeroa and the Cape Palliser Peninsula the older rocks, which presumably form the core of the eastern mountains, appear, according to earlier reports, to be covered by a mantle of Lower Tertiary rocks, which hardly form a definite range, but in places rise to the semi-isolated peaks known as the Taipos.*

The Upper Manawatu Valley is floored by Upper Tertiary (Pliocene) conglomerates, sandstones, mudstones (papa), and limestones, lying between the ranges and on their margins, and covered in most places by the high-level terrace gravels of the Manawatu River and its tributaries. Limestones or calcareous sandstones are well represented in the top end of the Manawatu Gorge, but are not developed along the front of the Ruahines near Maharahara. Characteristic Pliocene fossils were obtained by the writer in the mudstones of the Mangaatua River close to the range, and nearer the Manawatu River on the saddle of Harding's Road, between Kumeroa and Woodville. Along the edge of the Ruahine Range the basal Pliocene beds are steeply folded against the mountains, being practically vertical in the Mangaatua River. McKay has observed that on the edges of the Wakarara Range, far to the north, the Upper Tertiary (presumably Pliocene) rocks are overfolded, so that the order of succession is reversed, and the beds dip towards instead of away from the ranges. Similarly along the western side of the Puketoi Range, as far as can be judged from distant views, the Pliocene rocks are also folded against the range, but in the centre of the valley the dip is quite small, and the beds are in some places flat. Structurally, therefore, they form a broad syncline, bounded on each side by the ranges, and resting on a floor of the older greywacke-argillite series. A local modification of this structure is found on the right bank of the Manawatu River opposite Kumeroa, where a small island, as it were, of the older rocks appears in the midst of the Tertiary rocks, forming Morgan's Hill above

* Subsequent observations on the Taipos east of Masterton have cast doubt on the Tertiary age of the rocks forming them.

the Hopeland School. It is a part of the old floor, which has been elevated relatively to the surrounding country along fault lines.

From the disposition of the rocks above described it is obvious that earth-faults of some magnitude have affected the district since the Pliocene period. From what we know of similar structures in the Kaikoura Ranges, it may be asserted that the central group of rocks was folded and elevated, and in places completely planed off by processes of erosion before the latter part of the Cretaceous period. Large parts were once more depressed below sea-level, but at different times, for the base of the marginal rocks now covering them is Cretaceous in some places (*e.g.*, East Marlborough and east side of the Puketoi Range), Lower Tertiary in others (*e.g.*, South Canterbury), and Upper Tertiary in others (*e.g.*, Hawke's Bay). After the deposition of the Pliocene beds a second period of compression was instituted, the pressures coming from the east-south-east, with the result that parallel mountain chains, with intervening structural valleys, were formed in north-east to south-west or north-north-east to south-south-west directions. The rocks of the central group, being already tightly folded, appear to have moved up and down, or to have been tilted, as blocks, while the softer and more pliable marginal rocks were folded into broad anticlines over the lower ranges facing the pressure, and synclines between the ranges, while along the edges of the stronger blocks of older rocks on their eastern sides facing the pressure they have been so squeezed as to be steeply folded, and even overfolded in places. The long depression running from Palliser Bay, through the valleys of the Ruamahanga, the Upper Manawatu, and the Tukituki rivers, to Hawke Bay is thus a structural valley, and has not been excavated by these rivers, but only slightly modified by them. The apparently abnormal courses of the Manawatu and Ngaruroro rivers in cutting boldly through the Ruahine Mountains is not due to damming back into lakes, with subsequent escape over low passes in the ranges, as is commonly supposed, but to the fact that these rivers were antecedent—*i.e.*, they were there in those courses before the mountains reached their present elevations, and were able to cut down their gorges as the mountains rose.

The state of our knowledge of the rocks and fossils of east Wellington is not sufficiently advanced to permit of a clear statement of the relationships of the Pliocene rocks of the Upper Manawatu basin to the Older Tertiary rocks of the Ruamahanga and the Taipos and the Cretaceous rocks of the East Coast. Possibly a bar of the older rocks separates the Upper and Lower Tertiaries of the Manawatu and Ruamahanga valleys. In general structure, however, it may be anticipated that little difference will be found between different parts of the great structural valley. Should oil be found in the Wairarapa Valley the determination of the exact relationships of the older Tertiary rocks there to the Younger Tertiaries farther north will become a pressing economic problem.

Mineral Prospects in the Ruahine Ranges.

From what has been said above it will be gathered that the mineral prospects of the greywacke-argillite series of rocks are not very bright. Gold, if it occurred in any quantity, would have long ago revealed its presence to prospectors in the gravels of the streams draining the range. The Hon. J. C. Crawford, at one time Provincial Geologist of Wellington, made a systematic search for gold and other minerals through the Tararua Range, with most unpromising results. A little gold, however, has been found in the Terawhiti and Karori districts, near Wellington, the earliest recorded discovery (alluvial gold) being as far back as 1861,* and mines were started in 1881, but without success. The most promising mineral discovery yet made in these rocks in the Dominion is that of copper at Maharahara, while another small copper lode has been described by W. A. McKay from the head of the right-hand branch of the Makaretu River, near Norsewood.

All the minerals that have been found are restricted to the belts of red jaspers and associated rocks, as has been clearly indicated by A. McKay in the following sentences: "Apart from the grey indurated sandstones, slaty shales, and mudstones that form the greater part of the Rimutaka, Tararua, and Ruahine Mountains, there are frequent outcrops of grey and red or greenish chertose rocks (often strongly charged with pyrites, and not infrequently mistaken for quartz reefs), red jasperoid slates, brecciated green diabasic tuffs (always more or less calcareous), and thick bands of green siliceous slates. These together form a belt of strata of considerable thickness; their characteristics are constant, and their continuity is but rarely interrupted between the shores of Cook Strait and the northern part of the Ruahine Mountains; and, forming part of the great backbone and main watershed of the North Island, they can be followed north-east until, with the other strata belonging to the same system, they terminate on the south and east shores of the Bay of Plenty. . . . Among these chertose, jasperoid, and diabasic rocks, or in their close vicinity, have been found all the indications of mineral wealth yet discovered in connection with the older rocks of the Wellington District."†

The true nature of the red jasperoid rocks and the green rocks accompanying them has never been determined by chemical and petrological study, and it is therefore difficult to give any explanation of why they are at times mineral-bearing. On account of the frequent occurrence of manganese with the red rocks Hutton considered that they were of deep-sea origin, for the red oozes of the ocean-bottoms contain many nodules of manganese oxide. The greywackes and argillites that enclose the reds rocks are essentially terrigenous deposits, formed in no great

* See J. C. Crawford: "On the Geology of the Province of Wellington," Trans. N.Z. Inst., Vol. II, 1870, p. 370. Probably gold was found at a still earlier date in the valley of the Waiariki Stream. † A. McKay: Rep. Geol. Explor., Vol. 19 (1888), pp. 1, 2.

depth of water, so that Hutton's explanation is improbable. It is more probable that McKay is correct in considering the green rocks as of volcanic origin, in which case the source of the precious metals may be looked for in the igneous magma. Since the red and green rocks are cupriferous only in places, it is possible that the copper has been introduced subsequently to their formation by later intrusives in the ranges. However, the matter is obscure at present, and all that can be asserted is that the red and green rocks are mineral-bearing, and are the only rocks in the ranges that have proved so up to the present.

The Maharahara Copper-mine.

In spite of the fact that this mine has been worked by three companies at different times, and has been the subject of five published and several other manuscript reports, little is yet known about the true nature of the deposit. This is partly due to the fact that on three occasions when it was visited by Hector and McKay the mine-workings were blocked by falls of stone, and partly also to the fact that the workings do not reveal much of the supposed reef. The copper indications which led to the discovery consisted of blocks of red jasper, with green stains, found in the Mangaatua River, and a further find of a mass of sulphide farther up the stream. Finally, in the steep bush-clad ranges above, three outcrops of strong bands of jasper were discovered, of which one contained abundant green stains and small amounts of copper sulphides. The prospecting operations have consisted of blasting away part of this outcrop, sinking an irregular shaft 80 ft. deep at this point, driving an adit crosscut (the intermediate drift or drive) for 350 ft. from a point on the hill slope perhaps 150 ft. lower, and another adit crosscut (the low-level drive) just above the creek-level, 290 ft. lower. At the time of the writer's visit the shaft had been filled, the adits were both blocked by slips, and all that could be seen were the dumps and the outcrops. The whole neighbourhood is heavily wooded, and such clearings as were formerly made had become re-forested with dense undergrowth, so in the short time available little could be seen of the relationships of the rocks. The lease is now held by Mr. Norman Gurr, of Dannevirke, whose operations have apparently been confined to clearing the track from the road in the valley below through the bush up to the low-level drive.

The outcrops examined by the writer consist of strong bands of red hematitic jasper, containing abundant green stains along the joint-planes, and occasional small masses of chalcopyrite embedded in the jasper near the joint-planes, and apparently occurring along a cross-vein. The rock is very hard to break with the hammer, and will be costly to drive on. Except for the presence of the copper minerals and the large percentage of hæmatite, the jasper does not differ materially from other specimens of similar rock from Sinclair Head, near Wellington, the Kaikoura Mountains, &c. Hector, however, considered that a distinction could be made between the light-brown or red more siliceous specimens from the creek-bed, which he regarded as derived from a stratified rock, and the dark-brown or purple more hæmatitic specimens from the outcrop, which he considered the proper gangue of a true lode or mineral vein, and of the nature of gossan; for he stated later that in the low-level drive the lode was 7 ft. wide, carrying about 4 ft. of clean copper-ore, with the hæmatite showing signs of disappearing. McKay, however, considered the jasper as a bedded rock in which the copper had been enriched along certain fissures.

Since the jasper, taken as a whole, is much too low-grade to be mined in bulk, the question of whether it is a true lode or not can be left open for the present. What is of importance is the manner of the occurrence within or alongside the jasper. The previous reports are not very clear on this point. Hector considered that the lode was not continuous, but consisted of lenses occupying cavities formed by an oblique movement along the line of fissure, meaning apparently a relative displacement of two walls that were not plane, but presented small rolls. There can be no doubt, from the analyses published by Hector and McKay, that small lenses of rich ore do occur, but the explorations made do not appear sufficient to allow a definite statement of their frequency to be made, and this in spite of an expenditure of something like £30,000 in developing the property. The great fault of former mining was that all the capital was expended on crosscuts, and no driving of any extent along the line of lode was attempted.

The opinion which the writer has formed after inspection of the outcrop, conversations with two men who have worked in the adits at different times, and study of the former reports, is as follows:—

(1.) The mode of occurrence of the copper is unusual, and consequently it would be unwise to condemn the mine without giving it a fair trial. Experience of copper-mines elsewhere does not help much in estimating the probabilities.

(2.) Copper is widespread in the jasper as stains or small masses of chalcopyrite, but the rock as exposed in the outcrop is very low-grade.

(3.) Rich lenses of bornite and other sulphides have been found, and there is a possibility of obtaining larger bonanzas.

(4.) The value of the ore will probably be considerably enhanced by the gold and silver content of the copper-ores.

(5.) To test the property thoroughly by legitimate mining no more crosscuts are necessary, but levels should be driven on each side from the low-level crosscut along the jasper as long as copper indications are found. If the results are satisfactory rises should be made to connect with similar drifts on the intermediate level. The ore blocked off should be thoroughly sampled by modern methods, and no assays of picked samples should be published to mislead the public.

(6.) For such a testing of the property a prospecting syndicate with a working capital of £10,000 is necessary. A small part of the money expended will certainly be recovered from ore won in driving, but the syndicate should be prepared to risk the loss of the greater part of their money.

(7.) More favourable mining ventures demanding the expenditure of £10,000 could be found in New Zealand. In view of the benefits that would accrue to the district, however, the expenditure would be a legitimate venture for residents of the district, since, if successful, it would probably lead to other mines being opened up in the ranges.

Gold in the Manawatu Gorge.

A gold claim near the Woodville end of the Manawatu Gorge has been held by a prospector for some time, and a small amount of auriferous pyrite has been discovered, on the strength of which most of the storekeepers in Woodville and neighbouring towns have been invited to invest money in part shares in the claim. The pyrite occurs in a thin leader traversing a red jasperoid band, but there is no indication of a solid reef. No serious work has been done on the claim, nor are there any indications that warrant the expenditure of any further money in prospecting it.

Silver in the Ruahine Ranges.

From time to time, during shooting expeditions or other excursions in the ranges, settlers light on specimens of stone or minerals which they consider of value as mineral indications, but when afterwards asked to find or describe the spot they are unable to do so owing to the similarity of landmarks in the forest. Mr. Foley, of Te Rehunga, has carefully prospected a locality above that settlement from which some galena shown to him, and found to be argentiferous, was stated to come, but beyond finding a few barren quartz leaders traversing the greywacke he discovered no indications of minerals. It is important that any one finding a supposed valuable mineral on the bush-clad spurs should either blaze the trees around, or erect a small pile of stones over the spot, as otherwise there is little probability that he will be able to locate it in a later visit.

MINERAL PROSPECTS IN THE PLIOCENE ROCKS.

Coal at Maharahara.

The coal indications on Mr. Johnson's farm at Maharahara are found in a small tributary of the most easterly branch of the Mangaatua River, and lie close up to the ranges. The rocks in which the coal occurs are near the base of the Pliocene sequence, and strike at this point north-north-east to south-south-west, with a dip of 45° to the east-south-east. They consist mainly of conglomerates, with numerous intercalations of mudstones and shales, which contain plant-impressions and small masses of coaly matter ranging up to 4 in. in their greatest diameters. A small seam of coal has been found in the highest exposed part of this conglomerate-mudstone series, and it is on this that the hopes of the coal-prospectors have been built. The coal is lustrous and black, and apparently of good quality, but it passes gradually into black carbonaceous shale. Between two strong beds of conglomerate there is a space of 3 ft. occupied by a bed of mudstone and the coal-seam. The latter averages 6 in. in thickness, but in places thins out almost to nothing, though it is said to have swelled to as much as 18 in. in a small drift put in on it. It is thus quite lenticular in character, and even if, as hoped by the prospectors, it were found to exceed this thickness, there is no likelihood that it would maintain the increased size for more than a few feet. The seam in itself is, therefore, of no value as a source of coal. From the point where it occurs an almost continuous section exhibiting similar conglomerates and mudstones can be traced up the stream (but down the sequence of beds) to the underlying greywacke rocks, so that there is no hope of discovering a thicker seam at a lower horizon.

Farther down the stream the rocks overlying the conglomerate immediately above the coal are not exposed, but there is reason to believe that after a short interval of similar conglomerates there is a soft sandstone. The east branch of the Mangaatua River has excavated a broad rounded valley at this point, and along a line fronting the hills just below the last outcrops of conglomerates there is a succession of low passes connecting the various streams flowing from the mountains for a distance of two miles to the north-east, a fact that points to the occurrence of a fairly thick bed of soft rock succeeding the conglomerates. Some light is thrown on this point by a section, a mile and a half to the south-west, exposed in the cuttings of the road along the branch of the Mangaatua leading to the copper-mine, and in the cliffs of the left bank of this river farther down. In a small cutting on the road there is a thin seam of coal enclosed in mudstone, lying between beds of sandstone and sandy conglomerate, all striking north-north-east to south-south-west, and dipping very steeply (over 70°) to the east-south-east. Forty feet higher in the sequence an exposure of a few feet of calcareous sandstone, with marine shell fossils, occurs by the road, and is succeeded, after another obscure interval of about 40 ft., by a thick band of conglomerate. Above this follows hundreds of feet of sands and sandy mudstones, with numerous Pliocene fossils in a horizon commencing about 100 ft. above the conglomerate. This section shows that marine conditions existed during the deposition of at least the upper part of the conglomerates, and makes it probable that the soft rocks overlying the conglomerates in the east branch of the river are sands and sandy mudstones.

While, therefore, it cannot be definitely stated that there are no thicker seams of coal overlying that found on Mr. Johnson's farm, the geological evidence is against this possibility. Further, the general experience of the whole of the Upper Manawatu basin, and also of the Wairarapa, goes to show that if thicker seams of coal should be found they are likely to be of inferior quality. The known coal-seams lie either near the base of the Pliocene rocks, like the two described above, or near the top, in what is known as the pumice sand and lignite series, the coal in the latter being of very poor quality indeed. The following tables bring together all the published analyses of coals from the Upper Manawatu and Wairarapa basins:—

Analyses of Coal from Upper Manawatu and Ruamahanga Valleys.

UPPER MANAWATU VALLEY.

——	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Fixed carbon ..	40·32	27·9	9·04	7·81	35·91	31·4	10·20	42·21	37·82	17·51	39·13	50·78	23·20
Hydrocarbons ..	42·69	28·6	12·40	18·06	22·83	33·4	9·53	29·52	33·87	45·58	22·82	26·81	23·17
Water	14·28	37·7	33·98	19·69	11·14	26·6	20·23	20·04	14·11	30·52	20·41	14·21	10·79
Ash	2·71	5·8	44·58	54·44	30·12	8·6	60·04	8·23	14·20	6·39	17·64	8·20	42·84
Sum	100·00	100·0	100·00	100·00	100·00	100·0	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Evaporative power (lb.)	5·2	..	..	..	4·6	..	..	5·5	4·90	5·7	5·1	7·5	..
Locality	Ruahine Mountains, Wellington	Norse-wood	Mangatewainui Stream, near Norse-wood		Jet coal, Mahara-hara	Eketahuna	Mangahao	Makuri			Tiraumea.		

RUAMAHUNGA VALLEY.

——	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Fixed carbon ..	45·01	29·20	39·90	34·14	39·39	29·89	44·82	40·80	40·18	35·40	10·50	45·15	34·78
Hydrocarbons ..	24·75	25·00	29·70	32·24	33·98	27·53	23·79	26·60	33·15	22·57	6·70	30·99	16·00
Water	25·12	19·30	24·20	29·20	24·02	26·18	1·20	17·40	22·46	23·21	0·80	17·09	20·03
Ash	5·12	26·50	6·20	4·42	2·61	16·40	30·19	15·20	4·21	18·82	82·00	6·77	29·19
Sum	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Evaporative power (lb.)	..	3·8	5·19	4·4	5·10	..	..	5·2	5·2	4·6	..	..	4·5
Locality				Mauriceville				Near Masterton	Opaki, near Masterton	Fernridge, S.W. of Masterton	Matarawa, Carterton	E. side of Rimutaka Mountains, Wairarapa	Morrison's Run, Wairarapa.

References.

In the following list of references to the analyses the abbreviation "Lab." indicates Colonial Museum and Laboratory, or Colonial Laboratory, or Dominion Laboratory Report. The numbers following indicate the number of the report and the page of that report on which the reference will be found. "Rep. G.S." stands for "Reports of Geological Explorations."

UPPER MANAWATU.

1. Lab. 23/47, 1889.
2. Lab. 15/30, 1880.
3–4. S. H. Cox: "The District around Norsewood." Rep. G.S., No. 15, 1883," p. 3.
5. A. McKay: "Deposit of Jet Coal at Maharahara, near Woodville." Parl. Paper C.–11, 1896, p. 47.
6. Lab. 37/6, 1904.
7. A. McKay: "On the Prospects of Coal within the Mangahao Block, Pahiatua County." Rep. G.S., No. 21, 1892, p. 30.
8. Lab. 28/9, 1894.
9. Lab. 27/17, 1893.
10. Lab. 9/13, 1874.
11–12. Lab. 30/5 and 6, 1897. For 11 see also Parl. Paper C.–11, 1896, p. 50.
13. Lab. 18/41, 1883.

RUAMAHANGA VALLEY.

1. A. McKay: "Deposit of Lignite at Mauriceville, Wairarapa North." Parl. Paper C.–11, 1896, p. 51.
2–3. Lab. 35/5 and 6, 1902.
4–6. Lab. 30/4 and 5, 1897.
7. Lab. 32/3, 1899.
8–9. Lab. 23/43, 1889.
10. Lab. 23/52, 1889.
11. Lab. 35/6, 1902.
12. Lab. 10/10, 1875. See also S. H. Cox: "Report on Coal at Wairarapa," Rep. G.S. No. 9, 1877, p. 1.
13. Lab. 19/24, 1890.

Oil at Te Rehunga.

The supposed indications of oil at Te Rehunga all centre around a gravel-pit near the ranges in which a very strong smell of oil was observed last summer. A hole was sunk at that time, and a small amount of oil was found making a pug of the gravel. The pit has since been extended and deepened, and at the time of the writer's visit contained a large pool of water a few yards from the original hole, and at a lower level than its bottom, but no trace of oil occurred on the surface of the water. The original hole was therefore re-excavated until water rose in it, and some doubtful traces of oil were observed. Before the pit was started a steam log-hauler stood on this site for about six months, and it is practically certain that the small amount of oil found was derived from the oil used for lubricating the steam-engine. The other indications in the neighbourhood consisted of scum on the surface of standing water in the partially cleared bush near by, and of brown slime of vegetable origin on the clay banks of a small stream. Such indications are of no value.

With regard to the general question of the occurrence of oil in the Manawatu basin, it may be said that a suitable cover exists in the impervious mudstones of the Pliocene rocks, and that the structure is not unfavourable. The only things that are lacking are definite indications in the form of oil-seepages, gas springs, salt springs, or sulphur springs. Until these are found any expenditure in the way of boring would be quite unjustified. In any case the district will be partly tested by the bore now being put down near Eketahuna. Should this yield oil the prospects further north are quite good.

It may be pointed out, however, that the only producing wells in New Zealand at the present are in Miocene rocks, and that the majority of the oil indications on the east coast of the North Island lie in Upper Cretaceous rocks. Even in these rocks it is far from being proved that oil is of general occurrence, while there is nothing known at present to suggest that it will be found in the Pliocene rocks.

Bibliography.

For further details of the district under consideration the reader may be referred to the following papers and reports, the titles of which are in most cases self-explanatory:—

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1877. Hector, J.: "Masterton and Napier Districts." Rep. Geol. Explor. during 1876–7, pp. x–xi.
1877. McKay, A.: "Report on the Country between Masterton and Napier." *Ibid.*, pp. 67–94. (With maps and sections.)
1877. Cox, S. H.: "Report on Coal at Wairarapa." Rep. Geol. Explor. during 1874–6, p. i.
1883. Cox, S. H.: "The District around Norsewood." Rep. Geol. Explor. during 1882, pp. 1–4.

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1888. McKay, A.: "On Mineral Deposits in the Tararua and Ruahine Mountains." Rep. Geol. Explor., Vol. 19, pp. 1–6.
1888. McKay, A.: "On the Copper-ore at Maharahara, near Woodville." *Ibid.*, pp. 6–8, Appendix, by W. Skey, pp. 8–9.
1888. McKay, A.: "On Certain Calcareous Rocks occurring near Eketahuna, County of Wairarapa North." *Ibid*, pp. 18–20.
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1894. Hector, J.: "Maharahara Copper-lode." Rep. Geol. Explor., Vol. 22, pp. xxxiv–xxxv.
1894. Hector, J.: "Lignites in Wellington District." *Ibid.*, pp. xxxiii–xxxiv.
1894. McKay, A.: "On the Maharahara Copper-mine, Woodville, Hawke's Bay." *Ibid.*, pp. 2–6.
1894. Hill, H.: "Notes on the Geology of the Country between Dannevirke and Wainui, Hawke's Bay." Trans. N.Z. Inst., Vol. 26, pp. 392–6.
1896. McKay, A.: "Deposit of Jet Coal at Maharahara, near Woodville." Parl. Paper C.–11, pp. 47–49.
1896. McKay, A.: "Prospect of finding Coal on the Tiraumea Estate, Upper Tiraumea Valley." *Ibid.*, pp. 49–51. (With map.)
1896. McKay, A.: "Deposit of Lignite at Mauriceville, Wairarapa North." *Ibid.*, p. 51.
1901. McKay, A.: "Copper at Maharahara, near Woodville, Hawke's Bay." Parl. Paper C.–10, p. 3.
1901. McKay, W. A.: "Report on a Copper Lode in the Ruahine Range, near Norsewood." *Ibid.*, pp. 26–28.
1901. McKay, W. A.: "Report on the Geology of Cook Strait from Pencarrow Head to the Ruamahanga River and of the Eastern Slopes of the Ruahine Mountains between the Tamaki and Makaretu Rivers." *Ibid.*, pp. 28–36.
1909. Hill, H.: "The Great Wairarapa: A Lost River." Trans. N.Z. Inst., Vol. 41, pp. 429–37.

APPENDIX D.

STATE COAL-MINES

(REPORT ON THE WORKING OF) FOR THE YEAR ENDED 31ST MARCH, 1914.

Prepared in accordance with the requirements of Section 118 of the Coal-mines Act, 1908.

The GENERAL MANAGER, State Coal-mines, to the UNDER-SECRETARY, Mines Department, Wellington.

SIR,— New Zealand State Coal-mines Office, Wellington, 12th June, 1914.

I beg to submit the annual report and balance-sheet of the New Zealand State Coal-mines for the year ended 31st March, 1914.

The gross output of the mines was 198,279 tons, which, after allowing for mine consumption and waste, left 177,816 tons for disposal, and when compared with the figures of last year shows a decrease of 49,218 tons.

The Point Elizabeth Mine produced 110,401 tons of marketable coal of the following grades: Screened, 32,834 tons; unscreened, 37,776 tons; bunker, 13,950 tons; small, 25,841 tons.

The following table shows the quantity disposed of, after allowing for stocks on hand and afloat:—

To whom.	Screened.	Unscreened.	Bunker.	Small.	Totals.
	Tons.	Tons.	Tons.	Tons.	Tons.
Depots	24,296	20,641	..	5,576	50,513
Railways	1,688	5,746	..	..	7,434
Other Government Departments	663	1,598	821	340	3,422
Private consumers	6,115	9,863	13,043	20,456	49,477
Totals	32,762	37,848	13,864	26,372	110,846

The sales of coal from this mine are therefore 50,498 tons less than last year. This reduction in the output is due partly to the "thinning-out" of the seams, but mainly to the cessation of work on account of the strike of miners and others employed in and about the mine. The demand for coal from Point Elizabeth has for years exceeded the output, and the position has become so acute that it will be necessary to mix it with Liverpool coal for household purposes. This mixture should make a really good and economical fuel.

The Liverpool Mine turned out up to the 31st March of this year 22,170 tons of marketable coal of the following grades: Screened, 3,832 tons; unscreened, 7,102 tons; bunker, 979 tons; small, 10,257 tons. The following table shows the quantity disposed of, after allowing for stocks on hand and afloat:—

To whom.	Screened.	Unscreened.	Bunker.	Small.	Totals.
	Tons.	Tons.	Tons.	Tons.	Tons.
Depots	2,182	1,254	..	472	3,908
Railways	986	159	..	..	1,145
Other Government Departments ..	100	75	217	176	568
Private consumers	152	5,084	762	5,296	11,294
Totals	3,420	6,572	979	5,944	16,915

Owing to the strike above referred to the development of this colliery has been hampered, and will not reach a regular stage of production until June of this year. The coal does not burn so freely as Point Elizabeth, but is denser and consequently more economical; it is a first-class steam and gas article, and the demand is already nearly equal to the estimated output of the mine.

The Seddonville Mine produced 45,245 tons of marketable coal of the following grades: Screened, 17,100 tons; unscreened, 2,409 tons; nuts, 1,526 tons; small, 24,026 tons; bunker, 184 tons.

The following table shows the quantity disposed of, after allowing for coal on hand and afloat:—

To whom.	Screened.	Unscreened.	Bunker.	Nuts.	Small.	Totals.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Depots	4,287	95	..	..	1,104	5,486
Railways	11,772	95	..	1,140	21	13,028
Other Government Departments	624	..	35	..	628	1,287
Private consumers	525	2,375	149	693	22,107	25,849
Totals	17,208	2,565	184	1,833	23,860	45,650

The sales from this mine are less than those of last year by 21,020 tons, which is accounted for by the marketable coal being exhausted and in consequence necessitating the closing of the mine. It is to be regretted that this course was found necessary, but after careful exploration it was found that a sufficiency of hard coal could not be found to justify the expenditure on further operations.

The ways, working plant, &c., in and about all the mines have been maintained in good order.

It gives me pleasure to be able to state that the officers and men connected with the various branches of the State coal-mines have worked well and with the welfare of the Department at heart.

In conclusion, I may say that it is expected, when the labour agreements are finally settled and the conditions become normal, the outlook for the future should be very satisfactory.

Attached are the reports of the Mine-managers, giving detailed information in reference to the working at each mine.

I have, &c.,
W. C. Gasquoine,
General Manager.

The Manager, Point Elizabeth State Coal-mine, to the General Manager, State Coal-mines Department.

Sir,— Greymouth, 6th May, 1914.

I have the honour to submit my annual report on the State collieries under my charge for the year ended 31st March, 1914.

Point Elizabeth Colliery.

Coal-winning.

The gross total output for the year amounted to 124,803 tons 12 cwt., of which the No. 1 Section of the colliery produced 41,248 tons 17 cwt., and from No. 2 there was obtained 83,554 tons 15 cwt., and after deducting mine consumption there remained for disposal 110,401 tons.

The colliery worked 216 days 6 hours, an average of four days 1 hour per week; the balance of the possible working-time—viz., 313 days—being accounted for by time lost on account of the watersiders' strike, fifty-three days; fortnightly pay Saturday, twenty-six days; and by other union holidays and minor stoppages, seventeen days and a quarter.

The average daily output for the days worked was 577 tons 6 cwt., and the gross output since the sales of coal began in 1904 amounts to 1,817,702 tons.

The average numbers of employees during the year were—coal-miners, 82; other adult underground labour, 66, and 2 boys; on the surface there were employed 48 men and 16 boys; the surface labour embraced haulage-road workers, engine-drivers, firemen, and mechanics: in all, underground and overground, 196 men and 18 boys.

The disbursements on wages account were £42,419 18s. 10d.; and the coal-hewers' average daily earnings were, in No. 1 Section, 17s. 4·53d.; and in No. 2, 19s. 3·58d.; or a general average of the two sections of 18s. 7d. per day.

Underground Exploration.

The work done by way of exploration underground has been confined to the workings in the bottom seam of coal, which is separated from the main seam by about 20 ft. of sandstone. In No. 2 Section, where this seam is most extensive, the main headings have been driven across the line of fault (which in the lower levels had cut off the coal and limited the workings), with the result that the workings for an increased area may be extended to the south-west, and, as the coal has thickened considerably, it will provide output from this section of the field for a longer period than was anticipated.

Surface Exploration.

The work under this head has been confined to the putting-down of bores to the south and east of the dip workings in the No. 1 Section, and on the western side of the Seven-mile Creek, but so far nothing of a favourable character has been encountered.

At the date of last annual report (1913), boring done amounted to 8,921 ft.; the additions for the year bring the aggregate to over 10,000 ft. In consequence of the unsatisfactory result of this work it has been suspended, and attention is being directed to further examination of the bluffs adjacent to the Seven-mile and Spring Creeks, the object being to trace, if possible, an extension of the present seams capable of being mined and handled profitably by the present plant.

Additions to Plant.

In the last annual report reference was made to the addition to pumping plant then in course of being installed to enable the then flooded portion of the workings in No. 1 Section to be unwatered. This plant, consisting of 200 kw. electric generator (Westinghouse Company, makers), direct-coupled to Bellis-Morcom compound non-condensing engine, and Rees-Roturbo pump, capable of raising 600 gallons per minute to a vertical height of 600 ft., the pump being direct-coupled to a 160 h.p. Westinghouse motor, speed 1,450 revolutions per minute, was completed on the 26th August, 1913, with the result that the accumulated water was speedily reduced. A large saving in the mine consumption of coal has been effected, and very considerable reduction in the maintenance and running charges in connection with this branch of the mine plant.

Accidents.

There have been no fatal accidents in connection with the operation of this colliery during the year, although there have been a number of minor and some of a more serious character. There is, however, a tendency towards greater care in connection with all branches of the work.

General.

In concluding the report on this colliery it is to be regretted that the workable area of coal in present workings is fast being diminished, and unless some other area is capable of being operated by the present plant the life of the workings is limited.

LIVERPOOL COLLIERY.

The general description of this colliery, together with the topographical features of the field and character of the development-works, were fully dealt with in last annual report (1913). The works then referred to as nearing completion, including coal-storage bins, screens, coal-tubs, hydraulic brakes, and other accessories, are now in complete working-order.

Coal-winning.

The colliery reached the output stage in April, 1913, and first shipment of coal was made during that month, to the 31st March, 1914, the gross quantity raised amounted to 15,690 tons, and after deducting mine consumption there remained for disposal 15,510 tons.*

The disbursements for wages on account of coal-winning were £6,061 12s. 4d. The miners so far employed have been paid on a day-wages rate of 12s. per day of eight hours from time of entering until their return to the tunnel-entrance.

Underground Development.

The colliery is being developed at three points. No. 1 tunnel-entrance is at the upper end of endless-rope-haulage line, at 1,750 ft. above sea-level, and is two miles distant from the railway and coal-bins. The seam being worked in this section varies from 5 ft. to as much as 30 ft. in thickness, and the inclination is from 1 in 5 to 1 in 2.

No. 2 tunnel is 1 mile 40 chains from the railway. The seam is about 14 ft. in thickness, and the inclination from 30° to 75° from the horizontal, and is about 1,550 ft. above sea.

No. 3 tunnel is in close proximity to the railway and storage bins. The seam ranges from 4 ft. to 8 ft. and over, inclination 1 in 5 or 6, and is about 800 ft. above sea-level.

In all cases the workings are producing high-grade bituminous coal, light in ash, sulphur very low, and suitable for producing coke of exceptional quality for smelting purposes.

Additions to Plant.

In order to cope with the output from the several sections of the mine, and deal effectively with the winning of coal from a field where the inclination of the seams is liable to change in direction and degree of dip and rise, it will be necessary to add to the electric-power plant which has already been installed for working the ventilating-fans. Electricity offers the most convenient and economical means of dealing with the varying conditions likely to be met with in the course of the development of this coalfield.

Accommodation for Workmen.

In order to meet the demand soon likely to arise, huts and cottages are now in course of being erected—the huts for single men and cottages for families—and means of transport for those whose homes are established at Runanga, and who may require to travel to work at the Nos. 1 and 2 Sections of the new colliery, are now in course of construction.

* In addition to the above, prospecting-tunnels and development-work produced 6,980 tons 18 cwt.

Baths.

The establishment of baths to permit of men, when leaving their work at the mine, to wash and change their clothes is being considered, and plans have been prepared. Before proceeding with any such erection the matter of position and water-supply has to be very carefully considered, and, as there are three separate sections of the mine, only two of which can be accommodated at one bath establishment, two installations of the kind will eventually be necessary. As regards the benefits to the men there can be no two opinions.

Cottage Hospital.

Plans for provision of this kind have also been prepared. Accidents are inseparable from mining, and in the case of this mine the long distance to be traversed before a patient can be properly attended to, the erection of a building near the mine such as has been projected is a necessity.

General.

As already indicated, the coal-mining work so far done at this colliery has been paid for at day-wages rates; but the Court of Arbitration having been approached to fix an award whereunder contract rates will come into force, it is hoped that the present system will soon be abolished.

Accompanying are plans of the workings of the Point Elizabeth and Liverpool Collieries, and photos of the points of interest at the mines; also table showing the hewers' average daily earnings for the year.

Permit me to add that the officers in all branches of the works have carried out their duties to my satisfaction, and the Inspecting Engineer has rendered valuable assistance.

I have, &c.,
JAMES BISHOP, Manager.

HEWERS' AVERAGE DAILY EARNINGS FOR YEAR ENDED 31ST MARCH, 1914.

Pay ending.	Days.	Amount.	Average.
		£ s. d.	s. d.
1913.			
12th April	882	836 11 2	19 4·72
26th April	982	957 16 11	19 4·54
10th May	906	917 6 7	20 3·00
24th May	987	857 7 2	17 4·31
7th June	938	394 4 5	19 11·03
21st June	913	896 19 7	19 7·56
5th July	924	878 4 9	19 0·11
19th July	839	850 15 9	20 3·26
2nd August	753	750 10 9	19 11·21
16th August	895	808 5 1	18 0·73
30th August	901	821 7 0	18 2·60
13th September	856	779 5 0	18 2·41
27th September	874	796 18 2	18 2·67
11th October	783	726 11 5	18 6·70
25th October	835	787 19 7	18 10·45
8th November	188	213 4 7	22 8·20
1914.			
31st January	801	600 0 11	14 11·78
14th February	798	684 6 9	17 1·73
28th February	857	730 10 11	18 3·59
14th March	840	768 19 0	18 3·59
31st March	856	777 4 5	18 1·72
Totals	17,614	16,368 9 1	18 7·02

The MANAGER, Seddonville State Coal-mine, to the GENERAL MANAGER, State Coal-mines.

Seddonville, 10th April, 1914.

SIR,—

I have the honour to submit my annual report on the Seddonville State Colliery for the year ending 31st March, 1914.

OUTPUT.

The total output won from the mine for the year was 50,705 tons 11 cwt., and after deducting mine consumption and waste there remained for disposal 45,245 tons. The gross output from the mine since its inception amounts to 537,960 tons.

The mine worked 187¼ days, making an average of 3·6 days per week, which is a great reduction when compared with the previous year. This reduction in the number of working-days is the effect of labour troubles, in consequence of which the mine was rendered idle from the 28th October, 1913, to the 12th January, 1914.

The number of men and boys employed in and about the mine throughout the year averaged 88.

The coal-hewers' average daily earnings works out to 19s. 6½d. per shift, which is an increase of 9d. per shift over the previous year.

Accidents.

There were a few minor accidents occurred during the year, but not any of a serious nature.

Plant.

The plant and machinery in and about the mine have been maintained in good working order and condition.

Underground Exploration.

With the exception of a small area in the West Section, which required developing at the beginning of the year, practically the whole of the output was maintained from pillar-extraction, the greater part of which was won from the West Section. It may be stated that the workings in this section are all to the rise, and, as mentioned in my last annual report, great care had to be exercised to avoid damaging the surface over a large portion of these workings, which is of a very swampy nature, and if once broken and allowed to cave in would have had disastrous results. Therefore where pillars could not be taken out entirely the system adopted was to split and rob the pillars to a certain extent, and leave stumps or small pillars of coal sufficiently strong to protect the surface.

The South workings, which form the other part of the mine, have been worked continuously during the year, finding employment on an average for seven pairs of miners. The coal in this part of the mine, although hard and of excellent quality, has the drawback of being difficult to work, owing to the presence of stone bands of very irregular form and thickness. Several attempts were made to extract the pillars from this section in a systematic manner, but owing to the above difficulty it was found that many of the pillars could not be extracted without incurring great expense, consequently pillars thus found were abandoned and attention was paid to extract the pillars free from stone.

Prospecting.

Under this head it may be stated that during the last four years a considerable amount of prospecting has been done in this locality with the object of developing a new colliery. An area comprising 3,821 acres which was attached to the present reserve has been geologically surveyed, also thoroughly tested by boring, and where outcrops of coal were discovered drives were put in to ascertain the thickness and quality of the seams. The results obtained, however, were not sufficient to warrant such an undertaking.

It would not be out of place to state that the Department has done everything possible for the welfare of the district in the manner above described, and it is regrettable to report there is no other area in the vicinity of Seddonville that could be recommended for further prospecting to be done that would be attended with success.

General.

It will be perceived that the past year has not been one of great activity. Although there has been a fair demand for screened coal, the demand for steam coal has been very limited. It was so limited at the early part of the year that in order to keep the mine working to fulfil screened orders upwards of 5,000 tons of small coal was put on to the heap, where at the present time there are approximately 10,000 tons of this class of coal.

As the date has now been decided upon for the closing-down of the mine, a brief explanation is necessary to state why several pillars shown on the accompanying tracing of the mine-plan have not been worked. In the development of this mine at its inception the coal under a large portion of the area was found to be very soft, and could not be disposed of without incurring great loss. To endeavour to utilize this soft coal briquette-works were erected in Westport, but owing to the high cost of pitch it was found they could not be manufactured at a profit. Therefore the pillars shown as not having been worked are pillars containing this class of coal.

In conclusion, permit me to say that all the officers connected with the working of the colliery have carried out their duties in a very satisfactory manner, and the Consulting Engineer has on several occasions rendered valuable assistance in connection with the working of the mine.

I have, &c.,

I. A. James, Manager.

Balance-sheet of the New Zealand State Coal-mines.

Statement of Liabilities and Assets at 31st March, 1914.

Liabilities.	£ s. d.	£ s. d.
Debenture loan	175,000 0 0	
Loan under Appropriation Act, 1912	50,000 0 0	
		225,000 0 0
Debenture sinking fund	13,200 0 0	
Reserve fund	5,884 11 2	
		19,084 11 2
Accrued interest	5,564 16 8	
Sundry creditors	16,747 17 6	
		22,312 14 2

Assets.	£ s. d.	£ s. d.	£ s. d.
Point Elizabeth Colliery and Development Property Account	511 7 1		
Depreciation	511 7 1		
		..	
Machinery, plant, ropes, and rolling-stock—			
Cost at 31st March, 1913	25,245 0 2		
Additional outlay during year	189 11 7		
	25,434 11 9		
Depreciation	8,365 18 5		
		17,068 13 4	
Buildings at mine—			
Cost at 31st March, 1913	2,348 14 7		
Additions during the year	10 18 1		
	2,359 12 8		
Depreciation	476 10 0		
		1,883 2 8	
Cottages—			
Cost at 31st March, 1913	2,196 0 10		
Depreciation	340 11 3		
		1,855 9 7	
Stores (stock on hand)	2,012 15 11		
Timber (stock on hand)	61 8 4		
Coal (stock on hand at mine and wharf)	896 12 8		
Coal (stock on hand, afloat)	622 6 0		
		3,593 2 11	
			24,400 8 6
Point Elizabeth (Liverpool) Colliery and Development Property Account—			
Cost at 31st March, 1913	86,695 19 4		
Additions during the year	9,753 10 2		
	96,449 9 6		
Depreciation	1,205 12 4		
		95,243 17 2	
Machinery, plant, ropes, and rolling-stock—			
Cost at 31st March, 1913	39,753 13 2		
Additions during the year	6,998 5 10		
	46,751 19 0		
Depreciation	584 8 0		
		46,167 11 0	
Buildings at mine—			
Cost at 31st March, 1913	1,523 16 0		
Additions during the year	980 15 5		
	2,504 11 5		
Depreciation	31 6 2		
		2,473 5 3	
Cottages at mine	175 4 11		
Depreciation	2 3 10		
		173 1 1	
Timber Account	..	165 6 5	
Coal (stock on hand at mine and wharf)	1,733 1 5		
Coal (stock on hand, afloat)	63 17 3		
		1,796 18 8	
			146,019 19

BALANCE-SHEET OF THE NEW ZEALAND STATE COAL-MINES—*continued.*

Statement of Liabilities and Assets at 31st March, 1914—continued.

Liabilities.	*Assets.*	£ s. d.	£ s. d.	£ s. d.
	Seddonville Colliery—			
	Machinery, plant, ropes, and rolling-stock—			
	Cost at 31st March, 1913	7,403 4 3		
	Depreciation	3,718 18 9		
			3,684 5 6	
	Buildings at mine—			
	Cost at 31st March, 1913	297 0 9		
	Depreciation	63 15 11		
			233 4 10	
	Cottages—			
	Cost at 31st March, 1913	155 16 11		
	Depreciation	36 0 0		
			119 16 11	
	Stores (stock on hand)	149 4 10		
	Coal (stock on hand at mine and wharf)	286 4 9		
	Coal (stock on hand, afloat)	253 17 6		
			689 7 1	
				4,726 14 4
	Briquette plant—			
	Cost at 31st March, 1913	3,630 15 5		
	Less plant sold	14 11 6		
		3,616 3 11		
	Depreciation	1,613 10 3		
			2,002 13 8	
	Hulks Property Account—			
	Cost at 31st March, 1913	1,255 11 8		
	Additions during the year	1,433 15 5		
		2,689 7 1		
	Depreciation	201 13 9		
			2,487 13 4	
				4,490 7 0
	Wellington Depot Property Account—			
	Cost at 31st March, 1913	1,875 4 9		
	Additions during the year	13 15 6		
		1,889 0 3		
	Depreciation	175 1 5		
			1,713 18 10	
	Stocks on hand	..	3,291 10 2	
				5,005 9 0

BALANCE-SHEET OF THE NEW ZEALAND STATE COAL-MINES — *continued.*

Statement of Liabilities and Assets at 31st March, 1914—continued.

Liabilities.	£ s. d.	*Assets.*	£ s. d.	£ s. d.	£ s. d.
		Christchurch Depot Property Account—			
		Cost at 31st March, 1913	4,949 17 8		
		Additions during the year	120 13 3		
			5,070 10 11		
		Depreciation	348 7 8		
				4,722 3 3	
		Stock on hand	..	1,920 2 4	
					6,642 5 7
		Wanganui Depot Property Account—			
		Cost at 31st March, 1913	1,413 13 1		
		Additions during the year	257 6 6		
			1,670 19 7		
		Depreciation	106 17 11		
				1,564 1 8	
		Stock on hand	..	1,685 8 2	
					3,249 9 10
		Dunedin Depot Property Account—			
		Cost at 31st March, 1913	1,300 0 6		
		Depreciation	100 7 10		
				1,199 12 8	
		Stock on hand	..	919 4 9	
					2,118 17 5
		Wellington Office Furniture Account—			
		Cost at 31st March, 1913	68 12 9		
		Additions during the year	15 0 0		
			83 12 9		
		Depreciation	9 9 8		
				74 3 1	
		Sundry debtors	..	15,641 3 11	
		Suspense Account, premiums, deposits, &c.	..	469 11 9	
					16,184 18 9
		Cash in hand and in Public Account on 31st March, 1914 ..	..	31,217 0 3	
		Less vouchers outstanding	..	966 3 8	
					30,250 16 7
		General Profit and Loss Account—			
		Loss for the year	..	..	23,307 18 9
	£266,397 5 4				£266,397 5 4

State Coal-mines Office, Wellington, 12th June, 1914.
LOUIS H. EILERS, F.R.A., N.Z., Accountant.

W. FRASER,
Minister of Mines.

Examined and found correct.
ROBERT J. COLLINS, Controller and Auditor-General.

Statement of General Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.
To Point Elizabeth Colliery Trade Expenses Account ..	54,436 14 1	
Liverpool Colliery " " ..	14,868 1 3	
Seddonville Colliery " " ..	22,655 18 1	
Wellington Depot " " ..	9,897 14 9	
Christchurch Depot " " ..	6,245 16 3	
Wanganui Depot " " ..	2,794 7 3	
Dunedin Depot " " ..	2,212 18 10	
		113,111 10 6
Wellington office furniture depreciation	9 9 8	
Briquette-works depreciation	1,613 10 3	
		1,622 19 11
		£114,734 10 5
Balance down		£23,307 18 9

Cr.	£ s. d.	£ s. d.
By Point Elizabeth Colliery Working Account—Gross profit ..	44,526 12 2	
Liverpool Colliery " " " ..	7,959 4 0	
Seddonville Colliery " " " ..	19,157 3 3	
Wellington Depot Trading Account—Gross profit " ..	9,685 6 8	
Christchurch Depot " " ..	5,586 0 5	
Wanganui Depot " " ..	2,864 19 6	
Dunedin Depot " " ..	1,528 4 8	
		91,307 10 8
Seddonville Colliery recovery ..	5 0 0	
Point Elizabeth Colliery rents	101 14 0	
Liverpool " " ..	12 7 0	
		119 1 0
Balance: Loss for year	..	23,307 18 9
		£114,734 10 5

Statement of Point Elizabeth Colliery Working Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.
To Stock of coal on hand at 31st March, 1913	1,876 6 1	
Stock of timber on hand at 31st March, 1913	21 11 2	
		1,897 17 3
Coal-winning—		
Wages	40,084 2 1	
Materials used	3,614 4 2	
Stores used	1,909 18 1	
		45,608 4 4
Timber cut	200 0 8	
Stores sold	900 9 6	
		1,100 10 2
Special rate	1,006 8 6	
Royalty	1,712 10 6	
		2,718 19 0
Balance: Gross profit at mine	..	44,526 12 2
		£95,852 2 11

Cr.	£ s. d.	£ s. d.
By Sales of coal	93,022 9 7	
Sales of timber	252 10 11	
Sales of stores	996 15 5	
		94,271 15 11
Stock of coal on hand at 31st March, 1914—		
At mine and wharf	896 12 8	
Afloat	622 6 0	
		1,518 18 8
Stock of timber on hand at 31st March, 1914	..	61 8 4
		£95,852 2 11

Statement of Point Elizabeth Colliery Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.
To Management and office salaries	1,974 16 5	
Interest and exchange	2,816 18 10	
Travelling-expenses	154 19 2	
Printing and stationery	108 0 10	
Repairs and maintenance	1,266 5 7	
Telegrams and postages	98 12 1	
Railway haulage	9,607 16 2	
Insurances	16 5 2	
Compensation for accidents and fund	956 11 2	
Railway freights	485 14 6	
General expenses	101 5 9	
Marine freights	23,726 4 4	
Hulks Working Account (proportion)	2,102 2 11	
Wharfages, &c.	1,245 4 2	
Audit fees	17 5 0	
Bad debts	64 5 3	
Depreciation: Mine, buildings, plant, and machinery	9,694 6 9	
		54,436 14 1
		£54,436 14 1

Cr.	£ s. d.	£ s. d.
By Balance of Working Account—		
Gross profits at mine	44,526 12 2	
Rents	101 14 0	
		44,628 6 2
Balance: Loss		9,808 7 11
		£54,436 14 1

Statement of Point Elizabeth (Liverpool) Colliery Working Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.
To Coal-winning—		
Wages	8,049 10 2	
Materials used	121 9 1	
Stores used	213 3 11	
		8,384 3 2
Special rate		164 19 9
Balance: Gross profit at mine		7,959 4 0
		£16,508 6 11

Cr.	£ s. d.	£ s. d.
By Sales of coal		14,711 8 3
Stock of coal on hand at 31st March, 1914—		
At mine and wharf	1,733 1 5	
Afloat	63 17 3	
		1,796 18 8
		£16,508 6 11

Statement of Point Elizabeth (Liverpool) Colliery Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Management and office salaries	490 0 0		By Gross profits at mine	7,959 4 0	
Interest and exchange	4,123 9 8		Rents	12 7 0	
Travelling-expenses	12 8 6				7,971 11 0
Printing and stationery	16 12 11		Balance: Loss		6,896 10 3
Repairs and maintenance	17 0 0				
Telegrams and postages	13 10 8				
Railway haulage	2 131 4 1				
Compensation for accidents and fund	146 15 11				
Railway freights	715 8 2				
General expenses	29 8 8				
Marine freights	4,645 17 8				
Hulks Working Account (proportion)	502 0 1				
Wharfages, &c.	197 15 11				
Audit fees	2 18 8				
Depreciation: Mine, buildings, plant, and machinery	1,823 10 4				
		14,868 1 3			
		£14,868 1 3			£14,868 1 3

Statement of Seddonville Colliery Working Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Stock of coal on hand at 31st March, 1913		795 5 6	By Sales of coal		33,399 13 1
Coal-winning—			Stock of coal on hand at 31st March, 1914—		
Wages	12,839 18 3		At mine and wharf	286 4 9	
Materials used	550 15 9		Afloat	253 17 6	
Stores used	596 12 7				540 2 3
		13,987 6 7			
Balance: Gross profits at mine		19,157 3 3			
		£33,939 15 4			£33,939 15 4

Statement of Seddonville Colliery Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Management and office salaries	840 4 3		By Balance of Working Account—		
Rents	38 13 0		Gross profits at mine	19,157 3 3	
Interest and exchange	1,093 15 8		Recovery	5 0 0	
Travelling-expenses	82 8 6		Balance: Loss for year	3,493 14 10	
Printing and stationery	22 8 6				
Telegrams and postages	48 6 0				
Repairs and maintenance	107 12 11				
Railway haulage	7,284 4 4				
Insurances	5 0 6				
Compensation for accidents and fund	148 8 1				
General expenses	95 17 3				
Marine freights	8,307 12 10				
Hulks Working Account (proportion)	533 7 7				
Wharfages, &c.	170 14 9				
Railway freights	41 16 3				
Audit fees	16 13 0				
Depreciation: Mine, buildings, plant, and machinery	3,818 14 8				
		22,655 18 1			
		£22,655 18 1			£22,655 18 1

Wellington Depot Trading Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Stocks on hand at 31st March, 1913	..	1,279 6 9	By Sales of coal	32,195 9 2	
Purchases of coal	24,002 17 8		Sales of firewood, coke, &c.	1,292 17 1	
Purchases of firewood, coke, &c.	868 16 1				33,488 6 3
		24,871 13 9	Stocks on hand at 31st March, 1914—		
Cartage to depot	..	943 9 3	Coal	3,211 16 3	
Balance: Gross profits	..	9,685 6 8	Firewood, &c.	79 13 11	
					3,291 10 2
		£36,779 16 5			£36,779 16 5

Wellington Depot Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Wages	3,025 2 8		By Balance of Trading Account	9,685 6 8	
Salaries	894 11 10		Balance: Loss	212 8 1	
Rents	852 0 0				
Rates	139 10 8				
Interest	98 17 5				
Travelling-expenses	24 15 2				
Repairs and maintenance	344 15 5				
Telegrams and postages	20 3 10				
Printing and stationery	124 9 7				
Insurances	85 5 10				
Cartage	3,564 11 5				
Sacks	161 14 2				
Freights, &c.	72 13 1				
General expenses	145 13 9				
Alterations	45 0 0				
Audit fees	47 10 0				
Bad debts written off	72 12 6				
Compensation	3 6 0				
Depreciation	175 1 5				
		9,897 14 9			
		£9,897 14 9			£9,897 14 9

Christchurch Depot Trading Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d
To Stocks on hand, 31st March, 1913		1,292 4 2	By Sales of coal	29,626 4 3	
Purchases of coal	22,652 11 0		Sales of firewood, coke, &c.	757 1 8	
Purchases of firewood, coke, &c.	522 14 10				30,383 5 11
		23,175 5 10	Stocks on hand, 31st March, 1914—		
Haulage to depot		2,249 17 10	Coal	1,669 16 5	
Gross profit		5,586 0 5	Firewood, coke, &c.	250 5 11	
					1,920 2 4
		£32,303 8 3			£32,303 8 3

Christchurch Depot Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Wages	1,667 1 9		By Balance of Trading Account	5,586 0 5	
Salaries	844 11 8		Balance: Loss for year	659 15 10	
Rents	64 0 0				
Interest and exchange	197 2 7				
Repairs and maintenance	282 19 5				
Telegrams and postages	11 5 0				
Printing and stationery	33 4 0				
Insurances	10 8 2				
Travelling-expenses	18 7 8				
Cartage	1,767 18 11				
Sacks	66 14 11				
Freights	835 11 1				
General expenses	51 2 4				
Audit fees	39 6 8				
Bad debts	7 14 5				
Depreciation	548 7 8				
		6,245 16 3			
		£6,245 16 3			£6,245 16 3

Wanganui Depot Trading Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Stocks on hand, 31st March, 1913		1,702 4 10	By Sales of coal	12,467 17 5	
Purchases of coal	9,259 8 6		Sales of firewood, coke, &c.	1,112 14 11	
Purchases of firewood, coke, &c.	597 18 9				13,580 12 4
		9,857 7 3	Stocks on hand, 31st March, 1914—		
Haulage to depot		841 8 11	Coal	1,436 4 0	
Gross profit		2,864 19 6	Firewood, coke, &c.	249 4 2	
					1,685 8 2
		£15,266 0 6			£15,266 0 6

Wanganui Depot Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.
To Wages	730 13 1		By Balance of Trading Account	2,864 19 6
Salaries	445 0 0			
Rents	110 13 4			
Interest and exchange	60 14 10			
Repairs and maintenance	62 6 11			
Telegrams and postages	13 16 2			
Printing and stationery	43 15 11			
Travelling-expenses	7 18 1			
Insurance	6 5 0			
Cartage	925 13 2			
Sacks	81 8 7			
Freights, &c.	137 5 7			
General expenses	45 18 8			
Audit fees	16 0 0			
Depreciation	106 17 11			
		2,794 7 3		
Balance: Net profit		70 12 3		
		£2,864 19 6		£2,864 19 6

Dunedin Depot Trading Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.	£ s. d.
To Stocks on hand, 31st March, 1913		1,565 16 6	By Sales of coal	8,756 13 2	
Purchases of coal	5,919 6 6		Sales of firewood, coke, &c.	85 16 0	
Purchases of firewood, coke, &c.	68 10 8				8,842 9 2
		5,987 17 2	Stocks on hand, 31st March, 1914—		
Wharfages, &c.	469 13 11		Coal	888 15 7	
Cartage to depot	210 1 8		Firewood, coke, &c.	30 9 2	
		679 15 7			919 4 9
Balance: Gross profit		1,528 4 8			
		£9,761 13 11			£9,761 13 11

Dunedin Depot Profit and Loss Account for the Year ended 31st March, 1914.

Dr.	£ s. d.	£ s. d.	*Cr.*	£ s. d.
To Wages	505 16 0		By Balance of Trading Account	1,528 4 8
Salaries	405 0 0		Balance: Loss	684 14 2
Rents	200 0 0			
Rates	25 16 9			
Interest	56 18 8			
Repairs and maintenance	163 7 3			
Telegrams and postages	7 0 4			
Printing and stationery	21 2 4			
Insurances	6 5 0			
Travelling-expenses	2 8 8			
Cartage	625 4 8			
Freights, &c.	5 15 1			
General expenses	40 11 8			
Sacks	40 4 7			
Audit fees	7 0 0			
Depreciation	100 7 10			
		2,212 18 10		
		£2,212 18 10		£2,212 18 10

Statement of the Receipts and Expenditure of the N.Z. State Coal-mines for the Year ended 31st March, 1914.

Receipts.	£ s. d.	£ s. d.
To Cash in hand and in Public Account at 31st March, 1913	..	45,561 10 10
Loan under Appropriation Act (instalment)	15,596 0 0	
Interest on overdue instalment	0 1 8	
Inscribed Stock	2,601 0 7	
	..	18,197 2 3
Proceeds sale of coal	..	161,842 13 4
Recoveries	5,622 16 1	
Refunds, &c.	22 10 7	
	..	5,645 6 8
		£231,246 13 1

Expenditure.	£ s. d.	£ s.
By Point Elizabeth Colliery—		
Property and development	331 7 4	
Machinery, plant, and rolling-stock	1,304 10 8	
Buildings	10 18 1	
Stores and materials	7,922 8 0	
Wages	40,089 9 5	
Timber	395 16 7	
Special rate	1,446 3 0	
Royalty	1,320 0 0	
		52,820 13 1
Liverpool Colliery—		
Property and development	11,652 4 11	
Machinery, plant, and rolling-stock	11,901 19 0	
Buildings	936 7 7	
Stores and materials	95 19 7	
Wages	5,165 1 11	
Timber	225 0 0	
		29,976 13 0
Seddonville Colliery—		
Stores and materials	1,067 18 6	
Wages	12,676 9 2	
Briquette-works sundries	56 14 0	
		13,801 1 8
Hulks, property	1,305 5 9	
" working	2,881 7 5	
Wellington Depot, property	142 15 6	
" " working	9,005 8 11	
Christchurch Depot, property	125 0 0	
" " working	4,673 18 3	
Wanganui Depot, property	257 6 6	
" " working	2,321 5 5	
Dunedin Depot "	1,415 8 5	
		22,127 16 2
Management and office salaries	6,093 0 3	
Rents	1,430 16 8	
Rates	165 7 5	
Interest and exchange	6,226 6 8	
Marine freights	36,111 13 10	
Travelling-expenses	310 1 6	
Printing and stationery	369 13 7	
Telegrams and postages	211 16 9	
Repairs and maintenance	2,161 8 2	
Railway haulage	21,326 16 3	
Insurances	129 9 8	
Compensation for accidents and fund	1,265 13 0	
General expenses	515 8 1	
Wharfages, &c.	2,008 14 2	
Railway freights	1,174 1 4	
Refunds	2 6 4	
Audit fees	130 16 8	
Loan charges	2,601 2 3	
Deposit Contract Account	20 0 0	
Wellington Office furniture	15 0 0	
		82,269 12 7
Cash in hand and in Public Account at 31st March, 1914	31,217 0 3	
Less vouchers passed	966 3 8	
		30,250 16 7
		£231,246 13 1

State Coal-mines Office, Wellington, 12th June, 1914.
LOUIS H. EILERS, F.R.A., N.Z., Accountant.

W. FRASER,
Minister of Mines.

By Authority: JOHN MACKAY, Government Printer, Wellington.—1914.

MINES DEPARTMENT
NEW ZEALAND

NEW ZEALAND STATE COLLIERIES

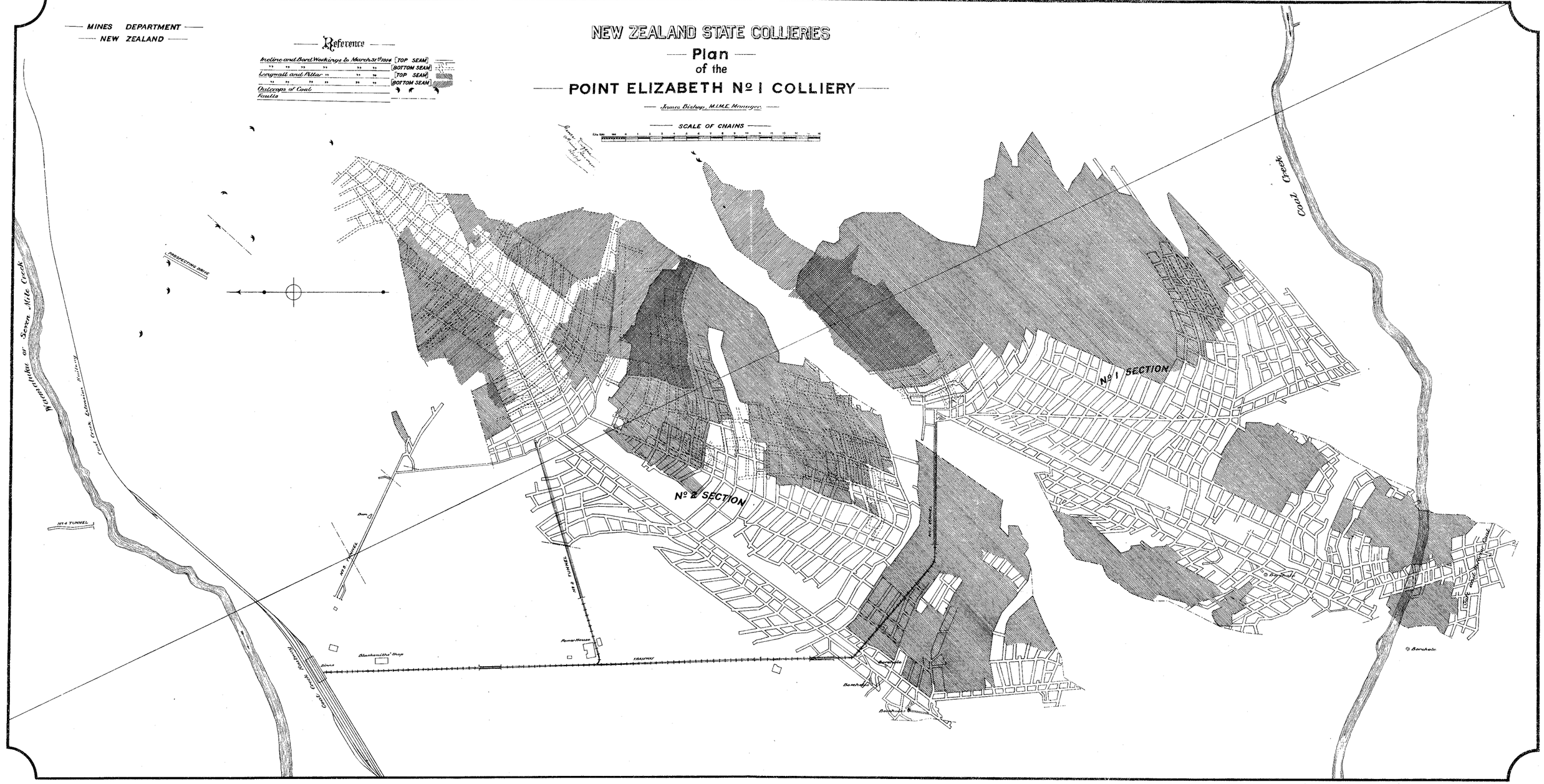
Plan of the POINT ELIZABETH No 1 COLLIERY

James Bishop, M.I.M.E. Manager.

Reference

Incline and Board Workings to March 31st 1914 [TOP SEAM]
" " " " " " [BOTTOM SEAM]
Longwall and Pillar " " " [TOP SEAM]
" " " " " " [BOTTOM SEAM]
Outcrops of Coal
Faults

SCALE OF CHAINS



1750 C. & 381

NEW ZEALAND STATE COLLIERIES

— Plan of the —

— SEDDONVILLE STATE COLLIERY —

(I. A. James, Manager)

— Scale of Chains —

1 Chs. 100 0 5 10 15 Chs.

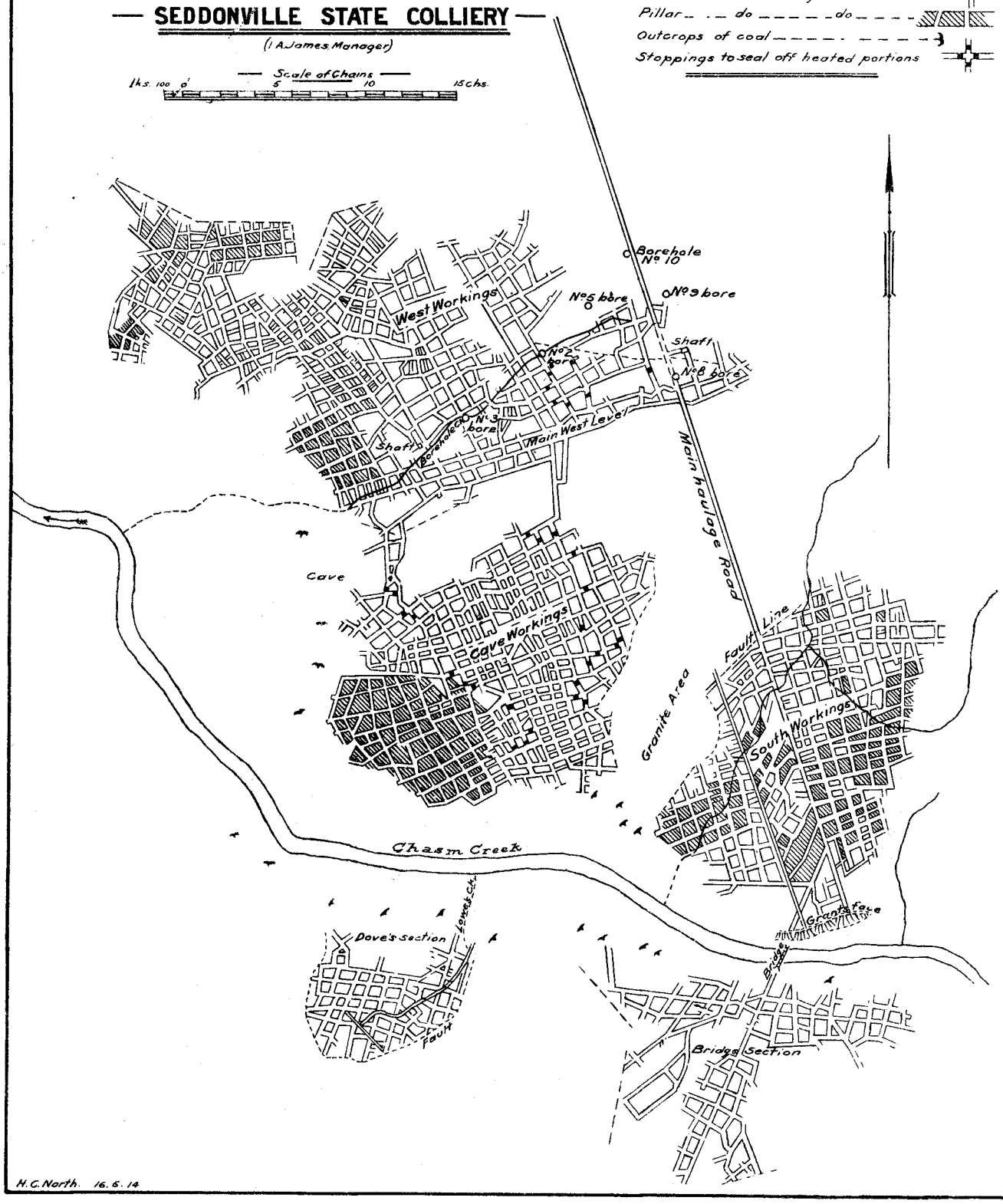
— Reference —

Incline and Bord Workings to March 31st 1914

Pillar — do — do

Outcrops of coal

Stoppings to seal off heated portions



H. C. North. 16. 6. 14

1150. 6. 14. 360

NEW ZEALAND STATE COLLIERIES

Plan of the

LIVERPOOL COLLIERY

James Bishop, M.I.M.E. Manager.

SCALE OF CHAINS.

0 1 2 3 4 5 6 7 8 9 10 15 20 25 30

George Duggan Mining Surveyor. 30/11/14

Mill Ck. Reserve

Building Sites Group 1

No 3 Section

Spring Creek

Office

Railway to Greymouth

Railway Station

Liverpool Ck.

Inclined Cableway for Electric Haul

Brake House

Power House

Manager's Cottage

Building Sites Group 2

Traffic Road from Railway Station

Warmatuku or Seven Mile Creek

Warrington's Hole

High Level Road being Constructed

Service Tramway from Dunmore to Liverpool Colliery

No 2 Section

Building Sites Group 3

Brake House

Tauranui Creek

No 1 Section

Seven Mile Creek

Darby Creek

Paora Creek

1750. 6.14. 382