

1885.
NEW ZEALAND.

GOLDFIELDS CLASSES AND SCHOOLS OF MINES.

(REPORTS ON).

Presented to both Houses of the General Assembly by Command of His Excellency.

No. 1.

Professor J. G. BLACK, M.A., D.Sc., to the Hon. the MINISTER of MINES.

SIR,—

University Laboratory, Dunedin, 24th May, 1886.

I have the honour to forward my report on the work done in the goldfields classes and schools of mines for the session 1st November, 1885, to 30th April, 1886.

These classes were conducted in accordance with a programme or scheme drawn up by me at your request, and submitted to and approved by you.

In carrying out the programme with my colleague, Mr. Montgomery, I had the assistance of Messrs. Fenton, McLymont, and Goodlet.

In the scheme for the period under report provision was made, in accordance with your instructions, for a full and fair share of the time and work of the staff to all the goldfields of the colony. The scheme was carried out fairly on the whole; but, owing partly to the necessity of leaving Mr. Montgomery at the Thames, and partly to my prolonged tour through the Haast Pass and on that part of the West Coast between Jackson's Bay and Ross, the West Coast Goldfields did not get their fair share of attention from the teaching staff; and I found myself altogether unable to visit the Nelson and Collingwood Districts. This I very much regret, not only on account of the intelligent interest taken by the Coast miners in the whole scheme, and the large number of schools of mines established there, but also on account of the very important and promising mineral character of the country, and the variety of valuable ores that are known to occur there.

In the programme for next session, which will be forwarded for your consideration in a few days, I am keeping this in view, and trying to make up to these districts for the unavoidable neglect with which they have been treated during last session.

The whole work of the session under report is shown in the tables A and B; Table A showing the place at which each member of the staff was engaged in the discharge of his duties on every day of the session; and Table B showing the number of lectures and the number of days on which classes were held, as well as the average attendance for each place visited by the teaching staff.

Table A.

TABULAR VIEW of PLACES VISITED by STAFF of GOLDFIELDS SCHOOL of MINES, with DATES, from 10th November, 1885, to 30th April, 1886.

Date.	Black.	Montgomery.	Fenton.	Goodlet.	McLymont.
1885.					
Nov. 17	Auckland ..	Auckland ..	Auckland ..	Auckland ..	Auckland.
" 18	Thames ..	Thames ..	Thames ..	Thames ..	Thames.
" 19	" ..	" ..	" ..	" ..	"
" 20	" ..	" ..	" ..	" ..	"
" 21	" ..	" ..	" ..	" ..	"
" 22	" ..	" ..	" ..	" ..	"
" 23	Karangahake ..	" ..	Karangahake ..	Karangahake ..	"
" 24	" ..	" ..	" ..	" ..	"
" 25	" ..	" ..	" ..	" ..	"
" 26	Thames ..	Karangahake ..	Thames ..	Thames ..	"
" 27	" ..	" ..	" ..	" ..	"
" 28	" ..	" ..	" ..	" ..	"
" 29	" ..	" ..	" ..	" ..	"
" 30	" ..	Te Aroha ..	" ..	" ..	Te Aroha.
Dec. 1	" ..	" ..	" ..	" ..	"
" 2	" ..	Waiorongomai ..	" ..	" ..	Waiorongomai.
" 3	Waiorongomai ..	" ..	Waiorongomai ..	Waiorongomai ..	"
" 4	" ..	" ..	" ..	" ..	"
" 5	Te Aroha ..	Te Aroha ..	Te Aroha ..	Te Aroha ..	Te Aroha.
" 6	" ..	" ..	" ..	" ..	"
" 7	Thames ..	Thames ..	Thames ..	Thames ..	Thames.
" 8	Tapu ..	" ..	" ..	Tapu ..	"
" 9	Thames ..	" ..	" ..	Thames ..	"
" 10	" ..	" ..	" ..	" ..	"
" 11	" ..	" ..	" ..	" ..	"
" 12	Coromandel ..	Coromandel ..	Coromandel ..	Coromandel ..	Coromandel.
" 13	" ..	" ..	" ..	" ..	"
" 14	" ..	" ..	" ..	" ..	"
" 15	" ..	" ..	" ..	" ..	"
" 16	Auckland ..	" ..	Auckland ..	Auckland ..	Auckland.
" 17	" ..	" ..	" ..	" ..	"
" 18	" ..	" ..	" ..	" ..	"

TABLE A—continued.

Date.	Black.	Montgomery.	Fenton.	Goodlet.	McLymont.
1885.					
Dec. 19	Cambridge ..	Coromandel ..			
" 20					
" 21	Visited Hot Lakes				
" 22	District, Rotorua,				
" 23	Rotomahana,				
" 24	Taupo, thence by				
" 25	coach to Napier,				
" 26	and steamer to				
" 27	Dunedin				
" 28				Ret'd by steamer	
" 29	Dunedin			to Dunedin.	Ret'd by steamer
" 30				Preparing for	to Dunedin.
" 31				the Otago Gold-	Preparing for
1886.				fields classes	the West Coast
Jan. 1	Preparing and pack-				Goldfields
" 2	ing chemicals				classes
" 3	and apparatus for				
" 4	the Otago Gold-				
" 5	fields course of				
" 6	classes				
" 7					
" 8	Clinton			Clinton	
" 9	Orepuki			Orepuki	
" 10	Roundhill and Waiau			"	
" 11	Orepuki			"	
" 12	"			"	
" 13	Riverton	Coromandel, Penin-		Riverton	
" 14	Invercargill ..	sula, and Thames		Invercargill ..	
" 15	Queenstown ..	School of Mines		Queenstown ..	Steamer to Hoki-
" 16	"			"	tika.
" 17	"			"	
" 18	Glenorchy ..			Glenorchy ..	
" 19	Dart River ..			Dart	
" 20	"Invincible" and			"Invincible" ..	Hokitika.
" 21	"Duke of Corn-			Glenorchy ..	"
" 22	wall"				
" 23	Glenorchy ..			Queenstown ..	"
" 24	Queenstown ..			"	"
" 25	"			"	"
" 26	Skipper's			Skipper's ..	"
" 27	"			"	"
" 28	"			"	"
" 29	Skipper's Point ..		Engagement closed	Skipper's Point ..	"
" 30	Arrowtown ..		till 10th March,	Arrowtown ..	"
" 31	"		1886	"	"
Feb. 1	"			"	"
" 2	Macetown ..			Macetown ..	"
" 3	Pembroke ..			Pembroke ..	"
" 4	Criffel			Criffel	"
" 5	Cromwell ..			Cromwell ..	"
" 6	"			"	Rimu.
" 7	"			"	"
" 8	Nevis			Bannockburn ..	"
" 9	Bannockburn ..			"	"
" 10	"			"	"
" 11	Clyde			Clyde	"
" 12	Alexandra ..			Alexandra ..	"
" 13	Black's			Black's	"
" 14	Tinker's			Tinker's	Kanieri.
" 15	Black's			Black's	Ross.
" 16	St. Bathans ..			St. Bathans ..	"
" 17	Naseby			Naseby	Rangitoto.
" 18	"			"	"
" 19	"			"	"
" 20	Dunedin			Dunedin	"
" 21	"			"	Ross.
" 22	"			"	Hokitika.
" 23	"			"	Coach to Christ-
" 24	Opening up thirty	Thames School of		"	church, returning
" 25	cases of chemi-	Mines		"	to Dunedin.
" 26	cals and appa-			Assisting in un-	Dunedin.
" 27	ratus, distribut-			packing, repack-	
" 28	ing, and forward-			ing, and forward-	
Mar. 1	ing same to the			ing appliances	Assisting in repack-
" 2	goldfields			to the goldfields	ing appliances,
" 3	schools of mines			schools of mines	and forwarding
" 4					same to the gold-
" 5					fields.
" 6					
" 7					
" 8	Lawrence ..			Lawrence ..	"
" 9	Bluespur ..			Bluespur ..	Lawrence.
" 10	"			"	Waitahuna.
" 11	Lawrence ..			Lawrence ..	"

TABLE A—continued.

Date.	Black.	Montgomery.	Fenton.	Goodlet.	McLymont.
1886.					
Mar. 12	Lawrence ..		..	Lawrence ..	Waitahuna.
" 13	Waipori ..		..	Waipori ..	"
" 14	Lawrence ..		..	Lawrence ..	"
" 15	Roxburgh ..		..	Roxburgh ..	Lawrence.
" 16	" ..		..	" ..	"
" 17	Dunedin ..		..	Dunedin ..	"
" 18	" ..		..	" ..	"
" 19	" ..		..	" ..	"
" 20	" ..		..	" ..	"
" 21	" ..		..	" ..	"
" 22	Preparing chemi-		..	Assisting in pre-	Lawrence and
" 23	cals and apparatus		..	paring appliances	Bluespur. Con-
" 24	for the West Coast		..	for West Coast	ducting classes
" 25	classes		..	Steamer.. ..	in both places.
" 26	" ..		..	" ..	"
" 27	" ..		..	" ..	"
" 28	" ..		..	Voyage to West	"
" 29	Lawrence ..		..	Coast	"
" 30	Clyde ..		..	" ..	"
" 31	Pembroke ..		..	" ..	"
April 1	Makarora ..		..	Greymouth ..	Teviot.
" 2	Clarke River ..		..	Kumara.. ..	Bannockburn.
" 3	Haast ..		Haast ..	Hokitika ..	"
" 4	" ..		" ..	" ..	"
" 5	Jackson's Bay ..	Thames School of	Jackson's Bay ..	Ross ..	"
" 6	" ..	Mines	" ..	" ..	"
" 7	Haast ..		Haast ..	" ..	"
" 8	Paringa ..		Paringa ..	" ..	"
" 9	Bruce Bay ..		Bruce Bay ..	" ..	"
" 10	Gillespie's ..		Gillespie's ..	" ..	"
" 11	Okarito ..		Okarito ..	" ..	Conducting classes
" 12	Mapourika ..		Mapourika ..	" ..	at Bannockburn
" 13	Ross ..		Ross ..	" ..	and visit to Crif-
" 14	" ..		" ..	" ..	fel and Queens-
" 15	Rimu ..		Rimu ..	Rimu ..	town.
" 16	Kanieri ..		Kanieri ..	Kanieri ..	"
" 17	Stafford ..		Stafford ..	Stafford ..	"
" 18	Hokitika ..		Hokitika ..	Hokitika ..	"
" 19	" ..		" ..	" ..	"
" 20	Kumara ..		Kumara ..	Kumara.. ..	Bendigo Creek.
" 21	Greymouth ..		Greymouth ..	Greymouth ..	"
" 22	" ..		" ..	" ..	Bannockburn.
" 23	Reefton ..		Reefton ..	Reefton ..	Black's.
" 24	" ..		" ..	" ..	"
" 25	Westport ..		Westport ..	Westport ..	"
" 26	" & Denniston		Denniston ..	" ..	St. Bathans's.
" 27	Boatman's ..		Boatman's ..	Boatman's ..	Naseby.
" 28	Reefton ..		Reefton ..	Reefton ..	"
" 29	Kumara ..		Kumara ..	Kumara.. ..	"
" 30	Bealy ..		Bealy ..	Bealy ..	Dunedin.
May 1	Christchurch ..		Christchurch ..	Christchurch ..	..
" 2	" ..		" ..	" ..	..
" 3	Dunedin ..		Dunedin ..	Dunedin ..	..

Table B.

TABULAR VIEW OF PLACES where LECTURES were DELIVERED and TESTING and ASSAYING CLASSES HELD, showing NUMBER of LECTURES and of DAYS on which CLASSES MET, and APPROXIMATE ATTENDANCE.

Locality.	Lectures: Black.		Testing Class: Black, McLymont, and Goodlet.		Testing and Blow-pipe: Montgomery.		Assaying: Fenton.		Lectures: Montgomery.	
	No.	Attend.	No.	Attend.	No.	Attend.	No.	Attend.	No.	Average Attend.
Thames ..	12	150	15	120 to 150	15	20 to 60	15	30 to 60	6	90 to 150
Karangahake ..	3	200	3	150 to 220	3	30 to 60	3	90 to 150	3	
Waiorongomai ..	2	150	2	120 to 150	1	30 to 60	2	30 to 90	1	
Te Aroha ..	1	120	1	150	2	30 to 60	1	30 to 100	2	
Tapu ..	1	80	1	80		..		..		..
Coromandel ..	3	180	3	150 to 200	7	50 to 100	3	50 to 120	4	
Auckland ..	1	..		..		..		..		
Cambridge ..	1	150		..		..		..		..
	24	1,030	25	750 to 950	27	160 to 340	24	230 to 520	16	550

TABLE B—continued.

Locality.	Lectures: Black.		Testing Exhibition: Black and Goodlet.		Assaying Class: Fenton.		Testing Class: McLymont.		Testing Class: Goodlet.	
	No.	Attend.	No.	Attend.	No.	Attend.	No.	Attend.	No.	Attend.
Gillespie's ..	1	100	..	..	..	..	..	..	..	..
Mapourika ..	1	25	..	..	..	..	..	..	..	..
Ross ..	1	180	1	180	1	20 to 40	..	..	7	70
Rimu ..	1	120	1	120	1	30 to 50	1 week	150	..	..
Kanieri ..	1	80	1	80	1	30 to 50	1 attend.	100	..	..
Hokitika ..	1	160	1	160	1	30 to 50	2 weeks	60	..	..
Stafford ..	1	80	1	80	1	40 to 50	..	..	..	..
Kumara ..	1	140	1	140	1	40 to 60	..	..	..	..
Greymouth ..	1	140	1	140	1	40 to 50	..	..	..	..
Reefton ..	1	70	1	70	2	40 to 50	..	..	..	..
Boatman's ..	1	60	1	60	1	30 to 50	..	..	..	..
	11	1,155	9	1,030	10	290 to 450	10	310	7	70

Locality.	Lectures: Black.		Testing Exhibition: Black and Goodlet.		Testing Class: McLymont.	
	No. of Lectures.	No. of Attendances.	No. of Exhibitions.	No. of Attendances.	No. of Class-meetings.	No. of Attendances.
Orepuki ..	3	90	3	90	..	..
Riverton ..	1	120	1	120	..	..
Invercargill ..	1	150	..	..	..	..
Queenstown ..	3	60	3	60	..	..
Skipper's, Phoenix ..	2	80	2	80	..	..
Skipper's Point ..	1	70	1	70	..	..
Arrowtown ..	3	50	3	50	..	..
Macetown ..	1	45	1	45	..	..
Pembroke ..	1	40	..	..	..	..
Cromwell ..	2	50	2	50	..	..
Bannockburn ..	2	90	2	90	2 weeks	20 to 40
Clyde ..	1	60	1	60	2 "	..
Alexandra ..	1	60	1	60	..	..
Totals ..	22	965	20	775	2 weeks	20 to 40

Black's ..	1	50	1	50	..	..
Tinker's ..	1	70	1	70	..	..
St. Bathans ..	1	90	1	90	..	..
Naseby ..	2	70	2	70	5	25*
Lawrence ..	2	150	2	150	1 week	50
Bluespur ..	2	80	2	80	1 "	80
Waitahuna Gully ..	..	..	..	..	1	120
Waitahuna ..	..	..	..	..	1	180
Waipori ..	1	90	1	90	..	..
Teviot ..	1	120	1	120	..	..
Totals ..	11	720	11	720	15	455

* Class only.

From Table B above it is seen that the total number that attended the lectures was, for the whole colony, 3,870: being for the North Island, 1,030; Otago, 1,685; West Coast, 1,155: total, 3,870.

The number for the West Coast would have been very much larger had I had time, as in the previous year, to visit the important mining communities of Lyell, Nelson Creek, Brunner, Paroa, Charlestown, Westport, and Waimangaroa. It would have been doubled had I also visited Denniston, and the Nelson and Collingwood District.

I left Dunedin by steamer with Messrs. Montgomery, McLymont, and Goodlet on the 9th November. We arrived at Auckland on the 17th, and on the following day proceeded to the Thames. I had telegraphed from Wellington to Colonel Fraser, M.H.R., and Warden Kenrick, at the Thames, and on my arrival there found that all necessary arrangements had been made to enable me to commence work at once. The Academy of Music, the largest hall at the Thames, was placed at my disposal during my stay. In the opening lecture, delivered to a very large and appreciative audience on the 18th November, I explained the objects of my mission and the nature and scope of the various classes and courses of lectures which my colleagues and myself were prepared to carry on during our stay.

At the close of the lecture I opened a roll of membership for the classes at a fee of 10s. for each member, entitling to the privilege of attending all the classes and lectures. The large number that joined and paid the fee enabled me to dispense with fees at the other centres subsequently visited, provided the local authorities placed at my disposal a hall, schoolroom, or other building suitable for the accommodation of the classes.

The work carried on in the classes at the Thames was of the following nature:—

I. Mr. Montgomery opened his blowpipe class every morning at 8 o'clock, taking the students in two relays, up to 11 or 12 o'clock, and again another relay from 6 to 7 in the evening. In these blowpipe classes, which I regard as an important feature of the programme, Mr. Montgomery seated his students along each side of a table about 25ft. in length. He provided each student

with a stout candle, a piece of wood-charcoal, a small and inexpensive assortment of chemicals in the form of dry salts and other reagents, and a blowpipe. The supply of blowpipes, however, ran short, owing to the large number that joined the class; but the students very soon provided themselves with that requisite from various sources.

Furnished with these appliances Mr. Montgomery took his students through a preliminary course of blowing; practising them in the different kinds of flame—oxidizing flame, reducing flame, &c.—and here he was greatly aided by the efficiency of many of his students, who were adepts in the art. He then guided them through a long course of blowing beads in the loop of a platinum wire, from the powdered ores of different metals, showing them how to identify the metal from the colour of the bead with the various fluxes. Mr. Montgomery also instructed and exercised his class in the art of heating metallic compounds, with and without oxidizing and reducing agents, and fluxes in dry glass tubes and on charcoal, and showed them how to distinguish the substance under trial by the results obtained. The energy and success with which the students entered into these blowpipe experiments were quite in keeping with their enthusiasm and perseverance in the other classes.

II. Mr. Fenton, who joined the teaching staff as assayer in Auckland, opened his class for assaying metallic ores every morning at 9 o'clock, and conducted, with his students, assays every day from 9 a.m. to 5 p.m., on the ores of gold, silver, lead, and tin. Being in some difficulty about necessary furnaces, Mr. Dunlop, of the Golden Crown battery, built a melting- and assay-furnace in the battery, and gave the use of it, free of charge, to the class, supplying them, as well, with various other appliances required for carrying on the fire-assays.

The Board of Governors of the Thames High School also, with the hearty concurrence of Mr. Adams, the Rector, placed their laboratory at our disposal, supplying us with one of their gas-assaying furnaces, with the necessary connections, as well as with crucibles, muffles, cupels, &c. When I visited this school with the Chairman, Mr. Brodie, I was greatly surprised at the character of the work done by the more advanced boys in the subjects of chemistry and assaying. At the time of my visit—quite unannounced—some of the boys were busy assaying gold- and silver-bearing stone; and they were doing so with their simple and inexpensive, but well-selected, appliances in a manner that showed they had been trained in a sound practical knowledge of chemistry and the principles and practice of assaying. Indeed, I had not been aware, till I saw it here, that work of so advanced and practical a character in these subjects was attempted in any school in the colony outside of the university colleges. Boys have far more aptitude for such practical studies than they are credited with; and you yourself, Sir, saw, while passing through Ross, with what interest and success boys of from ten to fourteen years of age will take up such subjects.

I look on that kind of work in the schools in mining districts as deserving every encouragement and support at the hands of the Government and the community. It is amazing how utterly such kind of education, direct, practical, and scientific, has in the past been neglected in England and her colonies. It is to be hoped that we in New Zealand will, in our mining centres at least, modify the old courses of study so as to find room in the upper classes of our schools for practical instruction in the elements of chemistry, geology, mineralogy, and assaying, instead of causing our brightest boys to spend their best energies, at the most receptive period of their lives, in the old-world cram of Latin and Greek, to the utter neglect of the practical, everyday, and productive sciences of the present and the future.

In Mr. Fenton's classes, as in all the others, the men themselves took a practical part in the work. He had them engaged in grinding and sifting the ores, weighing them, weighing out the proper fluxes for the different kinds of ore, mixing the fluxes with the ground ore, charging the crucibles, heating them in the melting-furnace to the required temperature and for the proper time, pouring out the molten metal into the ingot-moulds, detaching the slag, hammering and cupelling the resultant buttons of metal, weighing the bullion, and finally separating the silver from the gold, washing, drying, and weighing the latter, and calculating the results.

In all these operations the men took a most intelligent interest, and worked at them with such success that a very large number of men on the Thames can now assay their own ores with quite sufficient accuracy for their own purposes.

The direct advantage to the miners of being able to do this will be seen when it is stated that the silver in the silver-bearing stone of Waihi and Karangahake does not exist in the stone in the state of metallic silver, but chiefly as the grayish-black sulphide and variously-coloured chloride, and in these states of combination is not visible at all as silver. Most of the gold also in the silver-bearing ore exists as a blackish sulphide of gold, probably in combination with the sulphide of silver, and thus escapes the notice of the miner who is prospecting on the old lines. It is only when the gold and silver are brought out either by the fire-assay process or by the wet chemical processes that the value of the stone is known. Much stone on the Waihi and Karangahake, containing gold and silver worth from £10 to £100 per ton of stone, has been overlooked for years for want of a little of this kind of knowledge. I have heard, since my visit to the Thames, of several instances of large quantities of stone, showing to the eye neither gold nor silver, being taken up by members of Mr. Fenton's assaying class, and turned rapidly to their own advantage. A practical acquaintance with the methods of testing stone puts the mining prospector in a position to profit directly by his own discoveries, instead of having to get sample after sample tested by the professional assayer for a fee which he can, in many cases, ill afford, besides subjecting himself to tedious delays, long journeys, loss of time, and the risk of having some one else, better informed, in the meantime jumping his claim.

I look on a practical knowledge of the process for assaying silver- and gold-bearing stone as an incalculable boon to the miners on the Coromandel Peninsula, and a boon that, in the interests of the colony, the Government would do well to provide.

III. My own testing classes were held in the morning from 9 to 12 o'clock, and again in the

evening from 7 to 9. In these classes I was very efficiently assisted by Messrs. McLymont and Goodlet, and, when he was not otherwise engaged, by Mr. Montgomery. In these classes also the students themselves carried on the various operations. The students were arranged round several large working tables, provided with stands of test-tubes, filtering appliances, spirit lamps, solutions of metallic salts, and the various acids, alkalies, and other chemicals required in the testing processes. In the first part of the course they applied the proper tests under my guidance to solutions containing only one metal at a time. In this way we dealt with solutions of gold, platinum, silver, lead, mercury, copper, cadmium, arsenic, antimony, and tin; iron, nickel, cobalt, manganese, and zinc; also, in some cases, barium, magnesium, and calcium. Having mastered the tests for the metals in solution, one at a time, we proceeded some distance with the processes for identifying the metals when several are present in the same solution. The time at our disposal, however, at one place, did not admit of a thorough study of this branch of analysis, and we had to leave it to the more leisurely attention of the permanent staff in the schools of mines.

We then entered on a very fascinating and important branch of analysis, in which we dealt with the ores themselves, grinding them in the mortar, treating the powder with the proper acid (nitric, muriatic, or sulphuric), or mixture of acids (generally aqua regia, a mixture of strong nitric acid and strong muriatic acid), boiling to dryness or otherwise, stirring up the residue with water so as to get a water solution of the metal, and then applying to this solution the proper tests in the proper order till the metal was discovered.

When the stone contained, as was generally the case, more than one metal the processes for identifying these in each other's presence were gone through, thus bringing to bear all the knowledge, practical and theoretical, acquired in the earlier parts of the course. In this way we analysed minerals containing the following metals: Gold, silver, lead, mercury, antimony, platinum, zinc, copper, iron, nickel, and manganese. We also tested in the same way scheelite, worth from £20 to £25 per ton, and occurring in various parts of Otago from Naseby to the head of Lake Wakatipu, limestone, wolfram, and various silicates. We also extracted tin from tinstone by fusing it out with the proper fluxes, and afterwards subjected it in solution to the various tests for that metal. In some of the classes we also examined ores, containing the metals named above, quantitatively to determine the percentage of metal they contained; also coal of various kinds, to determine the percentage of water, ash, gas, and fixed carbon.

During our prolonged stay at the Thames we had time to go through pretty nearly all the work described above; but at the other centres visited it was quite impossible, in the time at our disposal, to go through more than the simplest part of so large a programme. At every place I visited during the session under report, as well as on my tour round the southern goldfields the year before, the attendance was almost invariably increasing during my stay, and my feeling was, on the eve of leaving many a goldfield, that I could well stay there for a couple of years and find plenty to do among the mining classes all the time. The men are not only most intelligent and very well-informed—in many cases, on subjects altogether outside their own pursuits—but are, as a rule, to which I have not found any exceptions, of a genial, straightforward, and kindly disposition, which makes it a positive pleasure to have any dealings with them. I know I am going out of my way in making these observations in a formal report, but I must be allowed to state my experience of the mining community in my own way.

IV. My own lecture was delivered usually from 9 to 11 or 11.30 p.m., and always closed the day's proceedings. The subject of lecture was one or other of the following course:—

1. How quartz reefs were formed.
2. How gold came into the reefs.
3. How other metals came into the reefs.
4. The chemistry of gold.
5. The methods of testing gold-bearing stone.
6. The chlorination process for extracting gold from iron pyrites.
7. The conditions to be observed in the roasting of metallic sulphides.
8. The La Monte furnace.
9. The ores of silver and the processes for the extraction of silver from its ores.
10. The processes for assaying and testing silver-bearing stone.
11. Copper and its ores.
12. The extraction of copper from its ores.
13. Tin: its occurrence and extraction from tinstone.
14. Lead and antimony: their ores and metallurgy.
15. Iron and its ores.
16. The smelting of iron ores.
17. Mercury: its occurrence and the methods of extracting it from its ores.
18. Sodium amalgam: its manufacture, properties, and uses as a gold-saving appliance.
19. Nitric acid and muriatic acid: their manufacture, tests of their strength and purity, and their properties and uses for testing ores, and on the goldfields generally.

I have been often astonished at the patience with which the miners would sit for three or four or sometimes five hours listening to a lecture on some of the above subjects. They were always freely illustrated by experiments; but it was not evidently these, but their intelligent interest in the subject of lecture, and their ability to follow it clearly in all its essential details, that kept the men on their seats to its close.

A look at the above list of subjects of experimental lectures will show how well they are suited to an intelligent mining audience; and it is to such subjects as these that I wish the attention of the teaching staff of the chemistry department of the goldfields schools of mines to be directed.

V. When Mr. Montgomery was lecturing, during my absence at some other centre, he took for his subject some geological or mineralogical subject, or some subject connected with gold- or silver-

saving processes. His wealth of information, gleaned from many authorities, and from prolonged study under Professor Ulrich and myself, in all the departments of mineralogy, mining, petrography, physics, chemistry, metallurgy, and assaying, has stood him in good stead before many a practical, well-informed, very particular, and very critical audience. His youth and native modesty are somewhat against him, but his real worth and thorough all-round competence for his present duties, will win for him the leading place in the first school of mines in the colony.

After spending four days at the Thames, lecturing and conducting classes, I proceeded with Mr. Fenton and Mr. Goodlet to Karangahake, about fifteen miles inland, leaving Messrs. Montgomery and McLymont in charge of the Thames classes. Warden Kenrick, who, as usual, had made all necessary arrangements, accompanied me to Karangahake and presided at the first meeting, which was attended by 150 miners. As there was no room at Karangahake large enough to accommodate such a crowd, Mr. R. K. Davis put his La Monte furnace at our disposal. This building was in course of erection and nearly finished, and through the efforts of Mr. Hazlett, the foreman, it was soon put in a condition suited to the purposes of the classes.

Next day about thirty of the miners took a half-holiday to go through the assaying processes with Mr. Fenton. Mr. Smith, the professional assayer at Karangahake, very kindly put his plant at our disposal for that purpose. This was really a kindness, as we were utterly destitute of balances and crucibles, and it is an unheard-of thing for an assayer to expose his delicate balance and fine crucibles and weights to the rough handling of outsiders; but in the keenness of the interest taken by both Mr. Davis and Mr. Smith this was quite forgotten for the moment.

About 180 miners turned up at the second lecture, and on the third day from 70 to 90 of the miners were engaged in relays all the afternoon assaying with Mr. Fenton, many of them taking an active part in all the processes except the weighing of the fine metals, in which they could not participate owing to the small size of the balance-room.

In the evening at 7 o'clock we found about 220 men assembled for the testing class and lecture, and we found the furnace-room far too small to accommodate them in the usual way. Steps were immediately taken, however, to plank the rafters, and in this way 70 or 80 men had accommodation overhead, and there they remained in perfect silence, looking down on the proceedings at the testing table for four hours.

At this meeting Mr. McLaren, Mining Inspector, presided, and, by his geniality and enthusiasm and knowledge of the men, did good service in explaining from the chair the object of the classes, and urging all to avail themselves of the facilities for technical instruction in their own industry now placed at their disposal.

The meeting here was opened about 7 p.m. and it was after midnight before it broke up. It was indeed, without exception, the most enthusiastic meeting I have ever had on the goldfields. Most of the men had come with paper and pencil, and those who were not themselves taking part in the processes were taking, as well as they could, notes of the proceedings. I was never so impressed as I was that night at Karangahake with the intelligence, perseverance, and energy which the miners can bring to bear on any subject in which they are intensely interested. Here we had many of them analysing and assaying silver ores, with quite sufficient accuracy, by the usual laboratory and furnace processes, while three days before very few of them could identify silver ore when they saw it, much less could they form any idea of the proportion of silver which it contained.

While staying at Karangahake I visited, with Warden Kenrick, Messrs. Gavin, Davis, Fenton, and others, the principal mines in the district—the Woodstock, Diamond, Adeline, Golden Crown, &c. In these visits, as indeed everywhere on the goldfields, the mine managers gave, in the frankest manner, all information about their mines and operations, and thus put me in a position to compare with each other the processes employed in all parts of the colony.

I had at Karangahake also the advantage of Mr. Gavin's experience as manager of many a mine. He, like Mr. Fenton, knew every mine and miner from Coromandel to Waiorongomai, and, as the result of years of close observation, could show the outcrop and underlie of every known reef in that rough country.

I devoted a day also to the gold- and silver-bearing reefs of the Waihi and Owaharoa Districts, with Messrs. Walker, Fenton, John Moore, Humphrey, and Welsh, and visited the Martha, Silverton, Rosemount, Walker's, and other most interesting mines. The quartz here has a structural peculiarity, which leads me to think that most of the silver bearing stone in this district is of hot-water origin.

From Karangahake I returned, with Mr. Fenton and Goodlet, to take the place of Messrs. Montgomery and McLymont at the Thames, while Mr. Montgomery succeeded me at Karangahake. During my second visit to the Thames I continued, with Mr. McLymont, the testing classes and course of lectures already described for six days, Mr. Fenton being engaged with his assaying class with his usual success.

From the Thames I proceeded, with Mr. Fenton and Mr. Goodlet, to Waiorongomai and Te Aroha, where Messrs. Montgomery and McLymont had been conducting testing and blowpipe classes for three days before our arrival.

At Waiorongomai I delivered two lectures to an audience of about 150 men; and with Messrs. Montgomery and McLymont conducted a testing class for two hours each evening, Mr. Fenton meantime carrying on his assaying operations on the blacksmith's forge during the day.

At Te Aroha I delivered one lecture, and showed for two hours in the evening the process for testing metallic ores. The attendance was large and, as usual, eagerly attentive; but it is needless to say that little could be done with so large a subject in the course of one day. The majority of the audience at Te Aroha had come in from Waiorongomai, chiefly of course to attend the classes, but also to concert with the Te Aroha men measures, and to elect a local joint committee to co-operate with the Thames central committee in their efforts to form a strong comprehensive school of mines for the Hauraki.

While staying in this district I visited, with Messrs. Ferguson, Mackay, Cornes, Cameron, Fenton, and others, the principal mines in the neighbourhood, including the New Find, the New Era, the Galena, at Waiorongomai; and the Champion lode, at the head of the Tui Creek, and about 2,000 feet above sea-level, just then being opened by Messrs. Cornes and Banks, associated I believe, with Messrs. Saunders and Chambers, of Auckland. In the Champion Mine I saw stone carrying gold, silver, mercury, copper, lead, iron, and zinc, the gold chiefly in the free state, the other metals being all combined with sulphur, as sulphides, with part of the lead also as sulphate. The mercury sulphide was in this lode a little apart from the other metallic sulphides, and was of a light porous texture and mixed with a good deal of oxide of iron, and had the appearance of having been formed by the agency of water, probably at a high temperature, and carrying up sulphuretted hydrogen, which, acting on mercury in any form, would convert that metal into the cinnabar which we here saw.

Mr. Cornes and the other members of the party were of course intensely interested in the simple tests by which these metals can be distinguished side by side in such complex ores. It is the abundance of such complex minerals on the whole of the Coromandel Peninsula that makes the establishment of a thorough-going and properly-equipped school of mines so great a necessity on the Thames. Without some technical instruction in the methods of testing these minerals, and of extracting the useful metals from them, the miners and prospectors are working in the dark, as the metals cannot be seen by the naked eye and cannot be saved by the usual battery processes. Every variety and mixture of ore requires to be treated according to its composition, and a process that is well enough suited for extracting gold from clean-milling quartz, will not reach the gold or silver, bound up as we found them here and at Karangahake.

We also visited the plant which Messrs. Mackay and Ferguson were erecting for the extraction of the gold and silver of the metallic sulphides of the district. This plant is on an American principle for dealing with silver ores, similar to those to be operated on here. The stone is to be crushed by Fraser and Tinne's (of Auckland) patent rollers. The crushed materials are then admitted into Mackay's patent cast-iron pans, where, after undergoing various grinding, rubbing, separating, and concentrating operations with hot water, mercury, common salt, and other inexpensive chemicals, the silver and gold are found in the form of an amalgam with the mercury, which is retorted in the usual way. The process is a modification of one that, with several others, has been successfully at work for years in Nevada. It deserves every encouragement, and, being in the hands of enterprising men, one of whom has had large experience in similar operations, it will doubtless get a fair trial.

At Waiorongomai Mr. H. Adams took me through what is undoubtedly the best quartz-crushing battery and tailings plant I have seen in the colony. It is a splendidly-housed forty-head stamper battery furnished, in all its details, with the most approved appliances for quartz-crushing and gold-saving of the present day. It is a self-feeding battery. When the stone is low in the boxes the disc affixed to the stamper-rod, in its descent, gives a blow to the top of an upright, that in its turn communicates motion to the board that shuts off the stuff, and thus admits more material into the battery-boxes. The machinery is driven by a splendid supply of water, and the stampers are, by special mechanical contrivances, which I have not seen elsewhere, kept under easy and perfect control throughout their whole extent. There are about twenty berdans at work in the battery itself, besides thirty-two others at a lower level in the tailings plant, situated about five chains from the battery.

The tailings plant being conveniently situated at a level lower than that of the battery, there is no difficulty in conveying the tailings by water down an open sluice to the lower berdans.

The self-feeding contrivances, as seen in operation at the Waiorongomai battery, were such that one boy could manage the whole of this part of the work, which otherwise would require the constant attention of several men. The stone is broken up and passed through screens before being admitted into the feeders so as to reduce it to a suitable size.

This battery, like all of its kind, is admirably suited for extracting the gold from clean-milling quartz comparatively free from complex metallic sulphides. It is, however, in my opinion, not capable of extracting all the gold or much of the silver of the rich gold- and silver-bearing stone of some parts of the Waihi, Karangahake, and Te Aroha; and hence the necessity of importing into the colony processes for dealing with these minerals which have been found efficient in treating similar minerals in other countries—Nevada, Mexico, Spain, Saxony, New South Wales, &c.

It would be one of the chief functions of a colonial school of mines to investigate the character and composition of our gold- and silver-bearing stone and other valuable minerals; to procure and disseminate among those concerned the most recent information about their treatment elsewhere; and to guide the miner in the application of sound and scientific principles in their development and metallurgy. There will thus be saved to the colony the useless expenditure of much money and a great deal of energy in hopeless directions, and the country will be in a position to profit by whatever mineral wealth our mountains contain.

We all returned to the Thames on the 7th December, and continued the classes there for another week, Mr. Fenton having charge, as usual, of the assaying classes, Mr. Montgomery of the blowpipe class, and myself, with Messrs. McLymont and Goodlet, of the testing classes.

On Tuesday Warden Kenrick accompanied me to Tapu, where he had made arrangements for a lecture on gold-saving appliances. The miners all attended, some coming in from a long distance, and we had an audience of about 120, including in this case persons of all ages. The meeting was a very enthusiastic one, and, as in every other place visited, I had only to regret that I could not make a longer stay.

At the Thames Mr. Montgomery delivered during the week three of his lectures on gold-saving appliances; and I closed the classes there by two lectures on the treatment of silver ore and gold-bearing tailings on Thursday and Friday evenings before audiences larger, stronger, more enthusiastic, and more keenly interested in the subject of lecture than even they had been before.

Indeed, my experience everywhere was that the longer we stayed the interest was intensifying; the more the miners knew, the more they wished to know. So much was this the case at the Thames, Karangahake, Te Aroha, Waiorongomai, and Coromandel, as well as on the West Coast and southern goldfields, that it was quite depressing to have to leave such crowds of intelligent men in place after place, all eager to get further information and practice in the methods of testing the ores.

From the Thames we all proceeded by steamer, with Warden Kenrick, to Coromandel on Saturday, the 12th December, and lectured there the same evening. Mr. Cadman, M.H.R., had been for weeks before our arrival in constant communication with Mr. Kenrick and myself about our visit, had spread among the miners information about our doings on the Thames and elsewhere, and had made all necessary arrangements for the success of the classes. The result of all this preparation was that we found on the night of our arrival a crowd of about 180—nearly all miners—awaiting us in the schoolroom. The large room was crowded to overflowing, and many could not even get standing room within the building. The testing class was at once formed, and continued under my own direction and that of Messrs. Montgomery and McLymont for two hours and a half, when at 9.30 p.m. Mr. Cadman took the chair, and I lectured till 11.30 p.m. on the formation of quartz reefs and the introduction of gold into them. Messrs. Montgomery and Fenton opened their blowpipe and assaying classes on Monday morning at 8 o'clock, and continued all day with several relays of students, the men themselves, as usual, taking a direct and active part in all the operations. Mr. McLymont had during Monday and Tuesday full charge of the testing classes until 7 p.m., when I took charge and continued for two hours with the metallic ores, following each evening with a lecture till 11.30 p.m. on some subject connected with gold-saving processes. The work done in the classes here was just a repetition of that done at Karangahake and Te Aroha, and resulted, as at these centres, in the formation of a committee to co-operate with the Thames committee.

During my stay at Coromandel I left Messrs. Montgomery, Fenton, and McLymont in charge of the classes during the day, while I, with Messrs. Cadman, Kenrick, Greenwood, Hutcheson, and Horne, paid a visit to the Tiki District, and inspected Vaughan's, Greenwood's, and Vizard's mines there. With Mr. Hutcheson, manager of Mr. Greenwood's mine, I tried some experiments with sodium amalgam on the copper plates, making the amalgam on the spot. The great trouble in these mines with the usual battery and amalgamated copper-plates system is the presence of much arsenical pyrites in the stone. This causes flouring of the mercury, and consequent loss of both mercury and gold. Our experiments were therefore directed to meet this evil, but I regret to have to say that we did not succeed in lessening the evil to any appreciable extent. I was surprised at this, as I had frequently on other goldfields got very good results from the use of the amalgam, especially when fresh made and used in moderation. Here, however, I found, on further examination, that the mine-water was slightly acid from the presence of free sulphuric acid, and to this, for want of a more probable cause, I attribute the failure of the sodium amalgam. The same mine-water contained a little sulphate of iron in solution, and to this was probably due, in part at least, the trouble with the mercury and the accumulation of green scum on the plates. On Tuesday I visited the Success Mine, on the Tokatea, and was taken through the workings by Mr. P. Reid, the manager. A striking peculiarity of this among paying mines is the narrowness of the reef. The width where I saw it varied from, I should think, a quarter of an inch up to four or five inches. It is also remarkable for the large proportion of carbonate of lime in the stone, the reef in some places being, indeed, nothing else than pure crystallized Iceland spar, of a very clean character, and containing thin plates of gold embedded in the crystals. The formation was such as I had never seen before, and the occurrence of gold in calcspar crystals I had not even heard of. Mr. Reid very kindly presented me with a very good sample of this strange occurrence. He also showed me depressions in the walls of the reef, from which he informed me large plates of gold had been taken. I have down in my note-book that the quantity of quartz from this mine that had been crushed in four or five years was only about seventeen tons, and that all the gold got during that time was got from this small quantity of stone. I also, with Messrs. Cadman, Kenrick, Greenwood, and Horne, visited the Tokatea Mine, about five miles from Coromandel. The tunnel into the mine is about 2,000 feet in length, passing partly through hard slate, to drive through which cost in some places as much as £6 per foot. In the mine—which is in one place about 850 feet under the surface—we saw large patches of splendid sparkling crystals of clear quartz, as well as some fine specimens of crystalized calcspar. All the quartz that I saw in the Coromandel District contains a good deal of arsenic, chiefly combined with iron and sulphur as arsenical pyrites, but occasionally also large pieces of the metal itself weighing several ounces. One piece of metallic arsenicum which I received from a miner weighed about two pounds. In the Thames and Reefton Districts, although there is a good deal of arsenic in the stone, antimony is, I believe, more troublesome. At Reefton the difficulty is met by crushing the stone without the use of mercury in the battery and tables, and catching the gold on the blanket-boxes.

During my whole stay in the Thames Goldfield I was either accompanied through every district by Mr. Kenrick, or moving under arrangements which he had made for my party. These arrangements were in every instance admirable, and, saving me a world of trouble and anxiety, enabled me to devote all my energy and time to my classes. Mr. Kenrick's knowledge of the mines, and of the past history and present condition of the district, and his intimate acquaintance with the miners, were of great service to me. I am under the greatest obligations to him and to Mr. Allom and many other gentlemen on the Thames, who spared no efforts to make such arrangements as would best conduce to the efficient performance of the duties for the discharge of which I had been sent to the Thames.

Leaving Mr. Montgomery alone at Coromandel to carry on the classes on the Thames Goldfield, I proceeded with Messrs. Fenton, McLymont, and Goodlet to Auckland, where, at the request of the Mayor, I delivered a lecture on the mineral wealth of the Thames, and advocated as strongly as I could the formation of a strong school of mines for that district. Mr. Fenton's engagement with

me then terminated for a time. I returned to Dunedin by way of the Hot Lakes and overland to Napier, thence by steamer to Dunedin, where I arrived on the 29th December. From that date till the 7th January, 1886, I was engaged with McLymont and Goodlet packing boxes of apparatus for my Otago and McLymont's West Coast tour. I had previously arranged that Mr. Montgomery should take the Coast in the beginning of January, and had promised the miners there to that effect on my former visit; but the energetic action of the Thames committee, my own recognition of the overwhelming claims and necessity of that district for the services of a resident member of the staff—the best available—and your request to do what was best for the whole colony, compelled me, at the cost of dislocating all my arrangements for the West Coast and Otago, to leave Mr. Montgomery at the Thames. To meet the claims of the West Coast as well as I could under the altered circumstances, I sent Mr. McLymont to the Hokitika District on the 11th January, and proceeded myself with Goodlet to revisit the Otago Goldfields. We left Dunedin on the 8th January, and lectured for four hours in Orepuki on the 9th to an audience of about ninety miners. Classes were formed at once, and for three days we carried them on in the same way as already described for Karangahake, except that, owing to the absence of Messrs. Montgomery and Fenton, we had no blowpipe and assaying classes.

During the day I visited the leading claims, all of which are alluvial, and spent the Sunday at Round Hill and the Waiau Beach diggings. At Round Hill all the good claims are in the hands of Chinamen, of whom there are in the district about 300 men, whilst the European miners do not exceed ten or twelve.

From Orepuki, where all the arrangements for my visit had been previously made by Mr. Hirst, M.H.R., I went to Riverton on the 13th, where I showed the tests for the most important metallic ores during all the afternoon, and lectured to an audience of over 120 on quartz reefs and gold till 11 p.m. I then, after half an hour's interval, got into a buggy and accompanied three of the Merrivale miners to see their claims and inspect some quartz at Merrivale, a distance of about thirty-six miles. We reached Merrivale at half-past 6 o'clock in the morning, boiled the billy, spent four hours on the Merrivale diggings among the claims, returned *via* Otautau and Thornbury on horseback, thence to Invercargill, where I arrived at 7.45 p.m., and lectured to an audience of about 150 the same evening.

Next day I proceeded, with Goodlet, to Queenstown, where I delivered three lectures. While staying in this district I visited the Invincible Mine, the Pyrites Company's works, and the Duke of Cornwall reefs on the Rees River, at the head of Lake Wakatipu. The Pyrites Company's plant in process of erection is a new feature in gold-saving processes in New Zealand. The appliances are designed to concentrate the tailings from the Invincible Mine and any other mines that may be opened up in the Rees Valley. I analysed these tailings about three years ago, and reported from eight to twelve ounces of gold per ton in the samples submitted. The gold exists locked up in the pyrites, and will, for its extraction, require either a preliminary process of roasting or long exposure to the oxidizing influence of a damp atmosphere, after which it may be taken out in the berdans, or by the chlorine process, or by simply passing it, after grinding, over the blankets. The company, I believe, owes its origin to my report on the rich character of the pyrites tailings. They do not intend to extract the gold at the works, but merely concentrate the pyrites tailings, and then ship them to Europe for further treatment. In Europe the bye-products have a sufficient commercial value to render there a process profitable which might not, owing to the high price of labour, fuel, and plant, and the absence of a market, pay here. The concentrating operations are, I believe, carried on under the advice of Professor Ulrich, who has, I understand, some interest in the company, and than whom there is not, I should think, a man in the Australian Colonies better qualified to guide such operations. The concentrating process, well enough fitted for concentrating tin ore, will therefore get a fair trial in this case under the best conditions and the most skilled direction. Great hopes are entertained of its success, and great things are expected from it; and, should it be found efficient for the purpose, it will be adopted in other districts where they have similar rich pyrites-bearing stone.

From the Rees I proceeded to Arrowtown, where I delivered three lectures, and thence to Skipper's, where Mr. Fred. Evans, the enterprising manager of the famous Phoenix Mine, had made excellent arrangements for the lectures. Here I was fortunate in having the use of the Bullen Hall, which Mr. Evans hurried to completion for the accommodation of the classes. The hall was brilliantly lighted with the electric light, which, with the telephone connection with Skipper's Point, Mr. Evans had recently introduced. All the men here are in one way or another connected directly with the Phoenix Mine. There are about ninety of them altogether, and nearly all attended the lectures, and showed a considerable degree of interest in the methods of testing the ores. During my stay here I visited the Mount Aurum reef, with Mr. Fred. Evans, jun. From the top of the mountain, some 7,500 feet above sea-level, we could trace the outcrop of many reefs traversing the ranges in the direction of Macetown. They were easily recognizable with a good glass by the yellowish-brown colour they showed on the outcrop. The colour is due to the oxide of iron produced by the weathering and oxidizing action of the atmosphere on the iron pyrites contained in the mullocky quartz. Mr. Bullen, the enterprising proprietor of the Phoenix Mine, has set an example in another direction to the Australian Colonies which is sure to be followed: this is, in the application of electricity generated by water-power to the purpose of driving the crushing machinery. The dynamos were fitted up in a spacious building, on a beautiful and most romantic site, on what is called the left-hand branch (but really the right-hand branch) of Skipper's Creek, at a distance, following the surface up and down over the lofty spur that separates the branches, of, I should say, two or three miles from the Phoenix battery on the "right-hand" branch. The dynamos are worked by two Pelton wheels, driven by a splendid fall of water directed through two strong iron pipes, with a pressure of, at a guess, a hundred and twenty feet. The dynamos had not been started at the time of my visit, but I learn that they are now working splendidly, and capable, in the opinion of Mr. Evans, of driving twenty-five or thirty head of stampers. The success of this

system at the Phoenix Mine opens up new possibilities in the way of driving crushing machinery in situations where steam cannot be raised for want of fuel and where water-power is available. Here the water-power is two or three miles from the battery, and, it may be, at a lower level. The current is carried from the generating dynamos to the battery by a thin copper wire, supported, like an ordinary telegraph-wire, on poles, and at the battery the electric current is reconverted into the moving power which turns the wheel that drives the stampers. The dynamo plant and all the connections were supplied and erected by Mr. Prince, and are, I understand, giving great satisfaction.

On leaving the Phoenix I visited Mr. Aspinall's and Mr. Johnstone's claims at Skipper's Point, and lectured in the Athenæum Hall there to a most attentive audience of about seventy miners. Many of the men had come some distance and by very precipitous tracks. I opened the lecture on reefs and the chemistry of gold at 7 p.m., and brought it to a close about half-past 12. The night being moonless, many of the men had resolved to remain at the Point all night. There was, therefore, no necessity for shortening the lecture, as great interest was taken in the subject, and it was the only opportunity I had of renewing my acquaintance with the intelligent diggers of this most romantic, precipitous, and out-of-the-way diggings.

After visiting the Criffel diggings, at an altitude of over 4,000 feet, and Pembroke, at the foot of Lake Wanaka, where my assistant Goodlet, and Hawkins, one of Professor Bickerton's assistants, showed and explained the tests for the most important ores, I proceeded to Cromwell and Bannockburn, at each of which places I conducted classes and lectured for two days to most attentive audiences, numbering at Bannockburn over ninety miners. At Bannockburn all the arrangements for the lectures had been made by a very energetic committee of the local school of mines. The school had been formed during my previous visit, and had forwarded an order to London for an assortment of crucibles, chemicals, and other appliances for the purposes of the school. The teaching at Cromwell and Bannockburn was of the same general character as on the North Island, but somewhat more advanced in some particulars owing to the progress made by some of the students during the previous course. While staying at Bannockburn I took occasion to cross over the Carrick range, with Mr. McKersie and another gentleman, to the Nevis diggings, where, after visiting some of the claims, we had an important discussion on the force of the discharge of water from the nozzles and its dependence on the vertical height of the water in the hose or feeding-pipe. I found about two-fifths of the miners sound on this question, but the remaining three-fifths considered my views on the subject absurdly unsound; and after four hours' discussion of the subject I felt that I did not succeed in convincing one of the majority that their theory was bad. Their contention was that they could, by the use of wide pipes and 80ft. vertical height of water in the pipes, get as much pressure from a 3in. nozzle as they could get from the same nozzle when fixed to a narrower pipe, but with, say, 200ft. vertical height of water—it being understood, of course, that the pipes are kept quite full of water, and that the narrower pipe is still wide enough, say a foot in diameter, to carry efficiently the quantity of water required for size of nozzle indicated. I fruitlessly tried to convince them that the pressure of water issuing from the nozzle depends only on the vertical height of the column, and not on the width of the column. I brought every argument I could think of, with diagrams and every other available consideration, to bear, but had to leave them in the same state of mind on the subject as that in which I found them. I am satisfied, however, that the question will be discussed on the Nevis till the correct theory will be apprehended by all concerned. In the meantime it is lamentable to see, in a party of five men working a claim, that three of them, the majority, are able to override the sound convictions of the other two who are better informed, and to put the whole party to the needless expense of procuring pipes much wider than they require, and for the purpose of getting a pressure which no pipe however wide will give them in the absence of the necessary fall.

From Bannockburn I visited and delivered one lecture at each of the following places: Clyde, Alexandra, Black's, Tinker's, and St. Bathans, in each case to a most attentive audience, many of whom had come a long distance to see the tests.

I also, while in this district, visited White's reef on the Old Man, where the proprietors were erecting a five-stamper battery. The stone here is very mullocky, and did not quite realize the very sanguine expectations entertained of it, although it is, I believe, sufficiently encouraging to justify the owners in proceeding energetically with the work. I also saw Green's reef at Black's, and paid a visit to the old deep-lead workings in the Ida Valley, but was not able to form any definite opinion as to the paying prospects of either. From St. Bathans, where a local chemistry club has been formed, I proceeded to Naseby, where I delivered two lectures and showed the tests for the more important ores.

Since my visit to Naseby a local school of mines has been formed, and a laboratory is being fitted up for the use of the classes. Before leaving the Naseby District I visited the Otago Central reef at the Rough Ridge, and found the five-head battery in good order and the mine very fairly opened up, and giving encouraging prospects to the shareholders. Owing to the urgent demands of other districts I was not only unable to prolong my stay in any one of these localities, but was compelled to pass over altogether Cambrian's, Vinegar Hill, Serpentine, the Burster, Kyeburn, Hamilton's, Hyde, and other centres which I had promised to include in the programme. My inability to carry out the whole programme was due, as already explained, to the absence of Mr. Montgomery, and the consequent necessity of sending Mr. McLymont to the Coast, instead of retaining him, as I had intended, to co-operate with myself on the Otago Goldfields.

From Naseby I returned by coach and train to Dunedin on the 19th February, and was there engaged unpacking and rearranging, allotting and re-packing and forwarding thirty cases of chemicals and apparatus to the various goldfields centres, where local schools of mines were established and funds collected for the purposes of the schools.

On the 8th March I proceeded, with McLymont and Goodlet, to Lawrence, where I delivered

two lectures to most attentive audiences of about 150. At the request of several of my old Bluespur students I held meetings there, which were attended by about ninety, nearly all miners. Mr. Brown, M.H.R., had meantime been organizing visits to Waipori and the Teviot, and kindly accompanied me to both these centres, where we inspected several of the leading claims, and had most enthusiastic meetings. A strong desire was widely expressed in these districts to share in the advantages of a school of mines, and Mr. Brown promised, on behalf of the Lawrence Athenæum and Mining Institute, of which he is president, that that institution would establish branches of its school of mines at each of these centres, and work the classes through whatever staff would be appointed to the Lawrence central school. The Lawrence school will, under these arrangements, bear to the Bluespur, Waitahuna, Waipori, and Teviot schools the same relation which the Thames central school now bears to the branch schools at Coromandel, Karangahake, Te Aroha, and Waiorongomai. The system will, I believe, work well. The Lawrence Athenæum and Mining Institute is a strong body, well endowed, under excellent management, and thoroughly representative of the mining industry of the district, and with a very enlightened view of the responsibility that rests upon it of promoting in every legitimate way and in the most liberal spirit the mining interests of a most important mining district. It has, besides, provided itself, at a cost of about £40, with a very efficient collection of chemicals and apparatus for the use of its classes. It has, besides, a fine library, housed in its own building, which, however, is not at all suited for the accommodation of the classes of a thorough-going school of mines, as this institution is, in the most laudable manner, aspiring to create. No public money could, in my opinion, be spent that would ultimately, and in many cases immediately, be more profitable to the State and more beneficial to a mining community than the money expended in creating and fostering all over the goldfields such institutions as are here contemplated.

A similar central school at Naseby, another at Bannockburn, and a fourth at some centre in the Lakes District would pretty well, with their branches, cover the whole of the Otago Goldfields. Four central schools on the West Coast, carried on in the same way, would, with their numerous branch schools and mining and chemistry clubs, provide for the Coast, whilst the present admirable system, devised and already in operation at the Thames, meets, when more liberally officered and equipped, with the requirements of the North Island.

Leaving Mr. McLymont in charge of the classes in the Lawrence District, and appointing him to visit in succession the Bannockburn school and the schools which were being formed at Bendigo, St. Bathans, and Naseby, I myself returned to Dunedin, to prepare materials for my lecturing tour on the West Coast. I had recalled Mr. McLymont from the Coast on the 19th February for the double purpose of helping me in the allocation to the mining schools of the appliances that had been received from London and of establishing laboratories in the Otago districts just named. From the reports which I received both from the West Coast and Otago, Mr. McLymont amply justified his appointment to these duties. Glowing accounts were received from Hokitika, Rimu, and Kanieri of the attractive character of his classes in these towns, and many and strong representations were made to me to the effect that a better appointment could not be made to the West Coast than Mr. McLymont, in the event of arrangements being completed for a permanent and resident instructor.

At Waitahuna and Waitahuna Gully Mr. McLymont reports audience of 180 and 120 respectively, and at Lawrence, Bluespur, Bannockburn, and Naseby classes ranging from 20 to 80. In some cases, as at Bannockburn and Naseby, I believe members of the local schools only were admitted. I was not consulted in this arrangement, but it will be easy to make for the future such arrangements as will admit, at a nominal charge, all who care to avail themselves of the instruction provided at Government expense. It can, at the same time, be easily provided that subscribing members have privileges in connection with the classes, assays, &c., that will be more than equivalent to their payments.

At Hokitika, where Mr. McLymont conducted classes for two weeks, he reports an attendance of 60; at Rimu, one week, average attendance 120 to 150; and at Kanieri, where he delivered only one lecture, he reports an enthusiastic audience of about 100.

I regret very much that Mr. McLymont was not able to conduct classes at Ross, Stafford, and Kumara, where very energetic schools of mines now exist, and where a large amount of valuable work has been already done by Dr. Davy and Messrs. Purkiss, McJannet, Olden, and Soutter, greatly aided by the wise counsel and experience of Dr. Giles, R.M.

WEST COAST TOUR.

I had long been desirous, for various reasons, of seeing the ranges, beaches, and river-beds of the West Coast between Ross and Martin's Bay; and this desire was increased since my appointment as Lecturer to the Goldfields. It was with great pleasure, therefore, that I received your permission to accompany you overland from Dunedin on your recent tour to that part of the colony.

I would have regretted occupying so much time away from my proper duties in connection with my goldfields classes, had I not succeeded in so placing my colleagues and assistants as for the time to fairly occupy the schools in the most important districts. Mr. Montgomery was in full charge of the Coromandel Peninsula; Mr. McLymont was fully occupied organizing the local schools and arranging the details of the laboratories on the Otago field; Mr. Fenton was making himself acquainted with the alluvial diggings between Greymouth and Ross, and showing the processes for assaying gold- and silver-bearing stone and bullion at Hokitika, where he was also awaiting instructions to join me at the mouth of the Haast on my arrival on the Coast; Goodlet was in the meantime on his way by sea to Ross, where he had instructions to unpack the chemicals, fit up a laboratory, and conduct testing classes till my arrival. Feeling, besides, that I should, by my overland journey, glean information which would be useful to my classes, and guide my recom-

mendations to prospectors who might be making inquiries as to the most promising districts from a mineralogical point of view, I deemed the time so occupied by no means lost either to myself or the community.

We left Dunedin on the 29th March, and proceeded *via* Lawrence, Teviot, Dunstan, Cromwell, and Clutha Valley to Pembroke, at the foot of Lake Wanaka, which we reached on the 31st. On the following day we took the steamer up the lake, and on the same evening reached Mr. Stewart's station in the Makarora Valley, eight miles from the head of the lake. Procuring horses from Mr. Stewart, and accompanied by himself as a most efficient, very pleasant, and well-informed travelling companion and guide, we resumed our journey next day, and reached Stewart's hut, where we camped very comfortably for the night. The hut is situated on the left bank of the united Clarke and Landsborough Rivers—here called the Haast—and about a mile above the junction of the Burke with the Haast, in a well-sheltered corner, just outside a piece of bush, in the middle of a fairly-grassed plain of very considerable area. About midway between Stewart's station on the Makarora and his hut on the Haast we crossed the saddle known as the Haast Pass, whose altitude, you, by consulting your aneroid, calculated as 1,730 feet above sea-level, if I have it noted correctly, but which is returned as 1,716 feet by the Survey Department. This is the highest point on the track between Lake Wanaka and the mouth of the Haast. The grade up the Makarora Valley to within a very short distance of the summit of the pass is a wonderfully easy one. It is for all purposes nearly as good as level, and one is astonished after travelling to the saddle to find that an ascent of something like 800 feet has been made since leaving the head of the lake. There is a very considerable area of level and undulating and gently-sloping country, mostly covered with bush, in the long Makarora and Upper Haast Valley, which will be very available for settlement when railway-communication will be opened with Pembroke. I did not in all the Makarora or Upper Haast, or in any of their tributaries, see among the river-gravels any indication of minerals of any value. I might, however, being on horseback, and without much leisure to examine the river-beds minutely, easily miss scheelite, on account of its general resemblance to quartz. There was a good deal of vein-quartz seen in the upper parts of the Makarora as well as in the Upper Haast, but it was generally of a very clean well-crystallized variety, and was not, so far as I could judge, of a promising appearance to the prospector for gold. There was also, except in occasional patches, an absence of the bluish-black oxide of manganese colours on the rocks *in situ* exposed to view; and this also I take as an unfavourable indication.

We resumed our journey next morning, 2nd April, crossing the Upper Haast (in the map called "the Burke") about a mile from the hut, and following the Haast (now the Burke, Haast, Clarke, and Landsborough all united) on the left bank down to the Haast Settlement at the mouth of that river, which we reached the same evening. All down the river-bed the boulders and shingle were mica schists, chlorite schists, a hard greenish-grey maitai-looking slate, fragments of a coarse impure jade or Maori greenstone, pieces of red-brown jasperoids, a considerable proportion of grey and greenish felspathic and hornblende dyke-stones, with occasional fragments of pure white and yellowish-white crystallized limestone and a fair proportion of vein-quartz. Much of the hard slate was traversed by narrow veins of pure white quartz. We did not see in the river-bed any granite all that day; but as it was getting dark, and we were hurrying to get to the settlement over the last ten miles, we might easily overlook fragments of granite among the river *débris*. In crossing the river at its mouth, moreover, on leaving the Haast Settlement a few days afterwards, we saw in the river-bed a fair sprinkling of granite, and Mr. Stewart, through whose cattle-run we had been riding for the last two days, and who was evidently well informed in the rough geological as well as pastoral features of the country, pointed out to us at various places high spurs, from four to ten miles away, on the right bank of the river, which he said were granite.

The presence of so much dyke-stone, chlorite-slate, vein-quartz, and slates intersected by quartz-veins impressed me as a favourable indication of gold-bearing country. At the same time I have not, on inquiry, heard of gold having ever been found there, and I am aware that the same kind of stones are the chief contents of the river-beds in some parts of Canterbury on the east of the great water-shed, where gold in payable quantities has not been found.

The mountain-ranges through which the Haast Valley has been cut are everywhere densely covered with bush to the altitude of about 2,500ft., above which they show but scanty vegetation with, at the time of our visit, occasional patches of last year's snow still lying on the southern flanks of the highest spurs.

There are in some parts of the valley large areas of flat bush-covered country at an altitude of from 200ft. to 600ft. above sea-level. The character of the bush, the large size of the ferns, and the vigorous condition and luxuriant growth of the underscrub and other vegetation, as well as the appearance of the soil itself where exposed, all point to a high degree of fertility. These favourable indications were more abundant as we neared the Haast Settlement at the mouth of the river, where the land, as shown by the fine paddocks of English grass and the high-fed condition of the bullocks, is of very good quality indeed.

At Marks's accommodation-house, which is a large house and well found in every way, we enjoyed all the comforts of a good hotel, where we passed Sunday, the 4th April. On Monday, the weather deceiving us, we procured fresh horses from Mr. Marks, and started about 11 o'clock, under the guidance of Warden McFarlane, for Jackson's Bay, which we reached about 10 o'clock the same evening. The track from Haast to the Bay lies along the beach, and is interrupted by four unfordable rivers, provided with ferries subsidized by the Government or the county.

The first two rivers about nine miles from the Haast are the Okuru and the Turnbull, which enter the sea together, and which we crossed at Collier's Ferry, we rowing across, and swimming our horses alongside the boat. Nine miles farther we crossed the Waitoto, in the same way, at Hyndley's Ferry. Other five miles along a beautiful hard beach, skirted by a lovely bush, brought us to the Arawata, then rapidly rising to a state of high flood by the heavy rain which

had been incessantly falling during the preceding two days, and was still coming down in torrents. It was here that, after being ferried over the main stream, in swimming your horse in advance of the party to within half a chain of the southern bank of one of the branches you had a very narrow escape from either being overwhelmed by the river or being carried out to sea by the force of the current, which was then running at the rate of ten or twelve miles an hour. Most of the party were at last, with much difficulty and at some risk, ferried over the three wide channels in which the flooded river was now flowing. It was nearly pitch dark when the farther bank was reached. Burmeister, the ferryman, had to remain all night on the southern bank, prostrated by the heavy and protracted labour of effecting the passage, and confounded at the insanity of any one attempting to cross the river in such a state of flood and darkness. After travelling three miles farther along a very narrow and, in the dark, a very precarious track, we reached Jackson's Bay. The Warden, Mr. McFarlane, has had for many years very sanguine views of the future greatness of Jackson's Bay. He is able to give a great deal of information, gleaned from many sources, about the geographical and geological features of the whole coast from Martin's Bay on the south to Hokitika on the north, a distance of something more than 200 miles. He has come in contact with probably all the prospectors who have been for years exploring among the mountains, up the river-beds above the level of the bush, and among the glaciers of the interior ranges that run parallel with the coast. From these and from others he has received specimens of various kinds of ore and of rocks that throw light on the geological formation of the region. Many of these specimens he has from time to time sent for analysis to various authorities, others he has given away to friends and museums, and a few he still retains as a small collection illustrating the mineral character of the district. Among his specimens Mr. Fenton, who joined our party at the Haast, and myself tested and identified: (1.) Chrome ore. (2.) Galena, or sulphide of lead, which Mr. Fenton, on assaying, found to contain about 60 per cent. of lead and about twenty ounces of silver to the ton. (3.) Stibnite, or sulphide of antimony, containing on assay about 35 per cent. of antimony. (4.) and (5.) Two samples of tin ore, the one apparently broken off a piece of vein-tin stone of some size, the other evidently stream-tin ore, and both of very good quality; both also said to be got in the granite country to the south-east of Jackson's Bay. (6.) Various samples of yellow copper pyrites, containing about 24 per cent. of copper. (7.) Black sulphide of copper, containing about 55 per cent. of the metal. (8.) A very interesting specimen of fine river-sand, containing a small proportion of white malleable and highly-magnetic flattened particles of an alloy of nickel and iron. (9.) A sample of black oxide of manganese, of which there is a wide lode some twenty or thirty miles to the southward. (10.) A good specimen of well-crystallized grey hornblende, closely resembling in colour and lustre zincblende, but of no commercial value. (11.) A few specimens of green talcose serpentine, in which were visible some white metallic specks which were pointed out to me by Mr. McFarlane, and which, on examination in the laboratory of the Hokitika Chemistry Club, we found to be the nickel-iron alloy. This last was an important discovery, as it seems to reveal the matrix in which the alloy exists, and from the *débris* of which the nickeliferous river-sands had their origin.

In Jackson's Bay, on the sea-beach, we saw, among the boulders, rounded fragments of the following rocks: (1.) Felsphatic and hornblendic dykes (fine-grained diorites). (2.) Serpentine of various colours, from nearly white to greenish-black, many being beautifully variegated. (3.) Greenish talc, white on exposed surfaces. (4.) Large hard and heavy boulders of olivine, covered with an encrustation of reddish-brown oxide of iron. (5.) Mica schists. (6.) Chlorite schists. (7.) Granite. (8.) Saccharoid (coarsely crystallized) limestone. (9.) Coarse nephrite or jade in veins traversing hard siliceous slates. (10.) Quartz (vein-quartz) in boulders and traversing slates. There can be no doubt about the promising mineral character of the district that presents to us, in its river-beds and on its beaches, such a variety of ores and rocks as are enumerated above. Next to the Coromandel Peninsula, which I have visited, and the Nelson and Collingwood District, which I have not yet seen, I believe there is no region in the colony so promising to the prospector for other metals than gold. I am not sanguine about its gold-bearing character—I know nothing of it, however, except from hearsay, and from the detached specimens enumerated above—but it offers great possibilities in other directions—tin, copper, nickel, lead, perhaps silver, antimony, chrome ore, black oxide of manganese, with perhaps others hitherto undiscovered from the lack of knowledge on the part of prospectors of what to look for, and how to know what they are when they have found them. The want of this knowledge on the part of otherwise most intelligent and very industrious and energetic prospectors is greatly to be deplored. Here they are groping among the mountains for valuable minerals with their eyes shut to everything but gold. The gold is in many cases absent, but there may be present plenty of tin, silver, scheelite, nickel, &c., much more valuable than most gold mines, and yet disregarded because unrecognized. It will, in my opinion, be the dawn of a new era for New Zealand, as well as other of the Australian Colonies, when three-fourths of our practical and most intelligent miners and all our prospectors are taught the simple tests for all valuable ores, together with as much of the principles of geology and mineralogy as will enable them in the most direct, easy, and certain manner to follow up the indications which the rocks afford.

Leaving the beautiful and most interesting Jackson's Bay behind us with regret, we returned to the Haast on the 7th. On the 8th, accompanied by Mr. Marks, whose horses we had engaged to Okarito, we made a fresh start northwards, at first along the beach and then, on a very well-engineered and good track over a saddle some 2,000 feet high, to Mr. Stephenson's station on the Paringa, which we reached the same evening. Next day Mr. and Mrs. Stephenson accompanied us on horseback over eight miles of the most execrable track I have seen in New Zealand, and then five miles along the sea-beach to Bruce Bay, where we were detained all night, finding it physically impossible to pass the importunate miners settled there without spending a night with them and hearing what they had to say. At Paringa Mr. Stephenson, who owns a cattle-run and grows and fattens bullocks for the Hokitika market, showed us samples of very coarse alluvial gold and

good samples of copper and iron ore got in the neighbourhood. At Bruce Bay, which is a lingering beach-terrace diggings, worked by about twenty men, I spent a very profitable evening with Mr. Baird, who kindly provided in his house comfortable accommodation for three of the party. Mr. Baird had a small collection of metallic ores representing that and other districts.

From Bruce Bay we made on the 10th a short journey (eighteen or twenty miles) to Gillespie's Beach, where we spent the night, and where I delivered to an audience of about 120 people of all ages (pretty nearly all the population of the place) a lecture on reef and alluvial formations and the occurrence of gold. The miners of Gillespie's, as well as those of Bruce Bay and other settlements along the coast, showed a most intelligent interest in the art of developing the mineral and other resources of the country by means of tracks and roads, of which they are virtually destitute, and increased facilities for bringing water from higher sources to work the claims. The present system that prevails at Gillespie's of running out the washdirt by wheelbarrows, to be worked off in cradles and other similar primitive appliances, ought long ago to have been superseded by the iron pipes and nozzles and sluices of more favoured fields.

On the 11th we reached Okarito, after surmounting various difficulties, such as quicksands, treacherous rivers, tempestuous headlands which had to be rounded in a rather dangerous state of the tide, but of which it must be said that they could be avoided by taking a more circuitous route. Leaving Okarito I proceeded with Messrs. McGoldrich, Butler, and Fenton to the Lake Mapourika Settlement, where I lectured for about three hours to a number of miners, and then at midnight rode ten miles to Mr. Butler's farm, where we arrived at 2 o'clock in the morning and spent the night. From Mapourika there is a fine view of the lower portion of the famous Francis Joseph glacier, at the apparent distance of ten or twelve miles in a straight line, but probably much farther by any practicable track. From Mr. Butler's we rode, on the 13th, into Ross, where I found Goodlet carrying on a large class of miners, schoolboys, and others, who were taking seriously and with very great success to the study of the chemistry of metallic ores and of the processes for testing the same. I delivered one lecture at Ross to a large audience, and was highly gratified at the advanced state in which I found many of the audience (notably several of the younger people) in their knowledge of the details of all my testing experiments. There is now a strong local school of mines established at Ross, with a good working assortment of apparatus and chemicals for carrying on the classes. The funds subscribed amount to something like £30, collected mainly by the efforts of Mr. McJannet, Mr. Grimmond, and other members of the committee.

I left Ross on the 15th, and delivered one lecture in each of the following centres: Rimu, Kanieri, Hokitika, Stafford, Kumara, Greymouth, Reefton, and Boatman's, in each case to a large and most appreciative audience. Mr. Fenton, at each of these places, gathered round him during the day in the nearest blacksmith's forge a crowd of miners interested in the fire processes for assaying the ores of silver-, lead-, tin-, antimony-, and gold-bearing pyrites.

So short a visit to each place did not afford scope for doing much useful work: the passing visit on this occasion served merely to keep alive the interest in the schools that had been created by my previous visit, and to give me an opportunity of conferring with the various committees, and of arranging with them for future operations when an adequate teaching staff will be provided for carrying them on.

I found everywhere, from Kumara to Westport, great disappointment at my inability to carry out fully my last year's promises of more teaching assistance. Of course my long engagement with the whole staff at the Thames, in November and December last, sufficiently explained the matter; but the explanation was not quite satisfactory from a West Coast point of view. It was really a just cause of complaint on the part of these committees that they had raised funds, procured appliances, enrolled members, and had made arrangements for accommodating the classes that were to be taught by myself and Messrs. Montgomery, McLymont, and Goodlet for a period of at least two months; whereas what they really had now offered to them, after all their trouble and preparations, was a flying visit from Mr. Fenton and myself, arriving one day and leaving the next.

A similar grievance arising from the same cause—too much ground to cover by so small a staff—faced me in all parts of the Otago Goldfields. In both cases I succeeded in putting a more cheerful prospect before them by an assurance that a liberal scheme was being considered with the view of fairly meeting their requirements.

I visited Westport and Denniston, but, being able to stay only one day, did not lecture at either. There is a strong committee at Westport, and they are now provided with a well-found collection of appliances for the work of the school. At Denniston, Mr. Brown, the manager of the Westport Coal-mine, informed me that steps would be taken to form chemistry and mining classes there, provided they were assured of a visit from the teaching staff.

There are vigorous schools of mines now at Ross, Rimu, Kanieri, Hokitika, Stafford, Kumara, Greymouth, and Reefton. I regret exceedingly not being able to lecture at Westport, and to visit Lyell, Charleston, and Nelson Creek, at each of which provision must be made for an annual visit of a few weeks from a member of the staff.

Before closing this report, it is desirable, without prejudice to the claims and great requirements of the other goldfields of the colony, to draw attention to some considerations that would make the Thames a peculiarly favourable home for a thorough-going school of mines.

1. The great variety of valuable metals that are found in the Coromandel Peninsula—gold, silver, mercury, lead, copper, antimony, and zinc.

2. The great complexity of the ores containing these metals, all of them being sometimes found together, mostly as sulphides, with the sulphide of iron in the same stone.

3. The state of combination of the silver and sometimes of the gold, both occurring as sulphides, and the silver sometimes as chloride, and occasionally as ruby silver ore, combined with sulphur and antimony, together with antimonial silver ore. In all these states of combination the gold and silver are not seen as such, and are not therefore recognized by the miners unless they

have special knowledge in the methods of testing for the same. The other metals named above are also in a state in which it requires skill and experience to determine them.

4. The remarkable irregularity of the richness of the quartz-reefs on the Thames, as exemplified by the alternating fortunes of the Prince Imperial, Golden Crown, Moanataiari, Caledonia, Cambria, &c. A study of the conditions under which gold is introduced into reefs, together with a study of the character of the mine waters, stalactite formations, and mineral character of the country, would throw a good deal of light on this irregularity in the character of the stone, and bring what now seems to be capricious under the domination of fixed and ascertained laws of nature.

5. The variety of soluble salts and exudations about the walls of the reefs, and the complex and highly acid character of the mine-waters. These features, so strongly marked, offer a fine field for the studies of the school, and are closely connected with the mineral character of the district.

6. The proximity of the Hot Lakes District; the occurrence of mineral springs, some cold, some hot, in the Waihi, Paeroa, and other localities close to the Thames, and at Te Aroha, itself an important mining centre.

7. The peculiar geological features of the country-rock through which the auriferous quartz-reefs run.

8. The curious fact of gold being found in pure crystallized calc-spar, and probably also combined with sulphur in silver-bearing stone.

9. The large accumulations of tailings on the Thames foreshore, necessarily containing a very large quantity of gold, shot into the bay in the earlier days of quartz-crushing operations here. These rich tailings offer a large field for profitable study and scientific treatment to the authorities in charge of the school.

10. The recent discoveries of silver ores previously unsuspected at Waihi, Karangahake, and Waiorongomai, and the necessity of training men in reliable methods of testing the value of these. There is also the most important question of how most efficiently and profitably to extract the silver from such ores under local conditions. This involves a thorough knowledge of some departments of chemistry as well as of mechanical engineering, and a practical acquaintance with the processes in use in Nevada, Saxony, Spain, Mexico, and other countries where similar ores are successfully treated.

11. The great number of experienced mine and battery managers, miners, and assayers on the Thames, that have already taken a most intelligent and practical interest in the subject, resulting as it has done in the creation of a school of mines, now awaiting provision for its adequate support.

12. The central position of the Thames in the Coromandel Peninsula, being nearly equidistant from the important mining districts of Coromandel, Waihi, Karangahake, Te Aroha, and Waiorongomai, with easy communication by water with Auckland.

13. The desirability of encouraging, stimulating, fostering, and supporting the efforts already made by the Thames community, they having raised a sum of over £500 in their determination to provide for technical instruction for themselves in so important an industry as mining, on which the Thames community entirely depends.

Other important circumstances might be stated, strengthening the appeal of the Thames School of Mines Association for liberal government assistance, but enough has been said to justify their claims.

During my visit to Waihi, Karangahake, and Waiorongomai I was strongly impressed with the necessity of getting for the miners of these silver-bearing districts early and reliable information about the details of the various processes now in use in Nevada, Mexico, and the other silver-producing regions of North America.

These processes are well enough known here theoretically, and are described in many recent books and periodicals. This is not, however, what is wanted.

It would be useful to have among ourselves, connected with the Mines Department, and available for giving practical direction in the erection of works and plant, some one who has a practical knowledge of the processes, who has seen them at work, who has acquainted himself with the machinery and appliances, who has, in short, mastered the processes in all their details where they are in full operation.

I do not know of a better way of meeting this great want than by sending a qualified person to the Pacific Slope for a period of several months to collect and bring to New Zealand the information that is so urgently required on the Coromandel Peninsula, as well as at Collingwood and other parts of the colony.

I am preparing, and shall forward for your consideration in the course of the week, a scheme of classes on all the goldfields of the colony for next year.

The Hon. the Minister of Mines.

I have, &c.,
JAMES G. BLACK.

No. 2.

Professor J. G. BLACK, M.A., D.Sc., to the Hon. the MINISTER of MINES.

SIR,—

University Laboratory, Dunedin, 7th June, 1886.

I have the honour, in accordance with your instructions, to forward for your consideration a list of the proposed teaching staff for the goldfields schools of mines classes during the year, 1st November, 1886, to 1st November, 1887; also a detailed account in tabular form of the proposed expenditure in connection with said classes, under the separate headings of salaries, travelling (hotel) expenses, travelling (conveyance) expenses, chemicals and apparatus, and subsidy for text-book—"Black's Chemistry for the Goldfields;" also proposed distribution or allocation of lecturers on the different goldfields of the colony, and a statement of the qualifications of each member of the

proposed staff of instructors. In this scheme of classes for the year there is ampler and more satisfactory provision made for the Coromandel Peninsula than for the other districts of the colony. To this advantage the goldfields on the Hauraki Gulf are entitled from the splendid efforts the miners there made to establish on the Thames a permanent school of mines, conducted by a resident staff. To secure this end a powerful organization was formed, with a strong committee, on which every district from Coromandel to Waiorongomai is represented. They succeeded in raising in three weeks by subscription upwards of £500, which they are devoting to the erection of lecture-rooms, laboratory, and museum, on a site which they have purchased. The membership of the school now reaches the splendid number of 507, at an annual subscription of 10s. each. This school is deserving of every encouragement that the Government can give it. The district under its charge is a wide one, and comprises the important mining centres (gold and silver) of Coromandel, Te Aroha, Waiorongomai, Karangahake, Waihi, as well as the Thames itself.

The Thames proper has 301 members; Coromandel, 66; Te Aroha, 44; Waiorongomai, 43; Karangahake, 38; Waihi, 15: total, 507 members.

With gentlemen so well qualified as Messrs. Montgomery and Henderson, who are amply qualified to cover the subjects of chemistry in all its branches, metallurgy, assaying, mineralogy, mining, geology, mathematics, and surveying, there is good provision made for carrying on the work of a good practical school of mines. Great results may be expected to steadily flow from such an institution, not only in the discovery of new minerals in the district and the best methods of treating minerals which are known to exist there, but also in the important work of instructing the miners and prospectors in the best methods of testing ores with the view of identifying them and ascertaining their value.

It is part of the functions of the Thames School of Mines to provide materials and instruction to the outlying districts from which members are enrolled, and, from the constitution of the central school and the importance to it of these branches, as well as from the promises made to them by the committee, I have every confidence that their reasonable claims in that respect will be fairly met.

There are now at work, with the best means available on the West Coast, mining schools at the following centres, each with its assortment of chemicals and apparatus, partly purchased with their own funds and partly presented to them by Government *pro rata* to their subscriptions: Ross, Rimu, Kanieri, Hokitika, Stafford, Kumara, Greymouth, Reefton, Westport. There are several other centres on the Coast awaiting Government help to furnish their laboratories—Nelson Creek, Charleston, Lyell, Denniston, and Waimangaroa.

In Otago also there are schools now in operation at the following centres:—

1. Lawrence, with a collection of chemicals and apparatus, and other appliances, which cost about £60, £40 of which was provided by the Lawrence Athenæum and Mining Institute. The institute is proposing to build forthwith a lecture-room, laboratory, and museum, and it proposes to take under its patronage and provide materials and means of instruction for the outlying districts of Waipori and Roxburgh, as well as conduct classes in Waitahuna Gully, Waitahuna Flat, Blue-spur, and Weatherstone. The Lawrence Mining Institute will then bear to these districts the same relation as the Thames Central School will do to the whole Coromandel Peninsula, and will in that respect deserve the fullest support of the Government, in view of the wide and varied field it proposes to serve.

2. Bannockburn, with branches at Nevis, Cromwell, Clyde, Alexandra, and Bendigo.

3. Naseby, which will be expected to provide for Hamilton, Hyde, Rough Ridge, and probably Black's and Tinker's.

4. Efforts are being made to form a school at Queenstown, and I believe some funds are already in hand for that purpose, but no effective steps have yet been taken.

5. Riverton and Orepuki. At Riverton £10 have been subscribed, and an assortment of appliances is now being provided. The school is fortunate in possessing Mr. Golding, one of the masters of Riverton school, as its guiding spirit, he having had a training in chemistry and other subjects in Otago University.

Under this scheme for 1886–87 there will be ample provision made for all parts of the colony. Places which were overlooked last year for the want of time and means will be overtaken, and receive a fair share of the attention of the staff in the future.

I shall be able in a few days to forward for your consideration the details of the visits of the proposed staff to each of the districts. This will include provision for Nelson and Collingwood Districts, as well as Charleston, Addison's Flat, Waimangaroa, Denniston, Nelson Creek, No Town, Lyell, and probably Owen's Reefs, all of which were omitted in last year's course.

I have, &c.,

JAMES G. BLACK.

The Hon. the Minister of Mines.

TABLE showing proposed Staff, Salaries, Travelling Allowances and Expenses, and Details of proposed Expenditure, November, 1886, to November, 1887.

Name.	Time engaged.	Salary.	Travelling : Hotel Allowance.	Travelling : Conveyance Expenses.	Total Cost.
		£	£	£	£
James G. Black	6 months ...	450	160	140	750
A. W. Bickerton	2 " ...	150	30	25	205
Alexander Montgomery ...	1 year ...	400	100	50	550
D. Henderson	1 " ...	200	100	50	350
T. Fenton	6 months ...	125	70	60	255
V. McLymont	6 " ...	100	70	50	220
— Hamann	4 " ...	75	40	40	155
— Irvine	6 " ...	50	60	40	150
Thomas Butement	6 " ...	70	70	50	190
W. Goodlet	6 " ...	50	90	110	250
Professor Bickerton's assistant ...	2 " ...	20	20	25	65
		1,690	810	640	3,140
Chemicals and apparatus to be imported for distribution among schools, at rate of £1 for £1					150
Subsidy of 5s. on 480 copies of "Black's Chemistry for the Goldfields," to reduce the price of the book from 10s. to 5s. to subscribers of schools of mines					120
Total sum necessary for year, 1st November, 1886, to 1st November, 1887 ...					3,410

PROPOSED ALLOCATION of TEACHING STAFF to the various Mining Districts in the Colony.

The Thames Goldfields.

Mr. Montgomery	Weeks.
Mr. Henderson	52
Professor Black	52
W. Goodlet	5
	5
	114

West Coast of Middle Island Goldfields and Coalfields.

Mr. McLymont	25
Mr. Butement	25
Mr. Fenton	16
Professor Black	8
W. Goodlet	8
	82

Otago Goldfields.

Professor Bickerton	8
Assistant to Professor Bickerton ...	8
Mr. Hamann	19
Mr. Irvine	25
Mr. Fenton	7
Professor Black	4
W. Goodlet	8
	79

Professor Black will, besides being engaged in conducting and organizing classes during time specified above, spend four weeks in travelling, and probably five weeks prospecting on the West Coast ranges at the head of the Clarke and Landsborough.

QUALIFICATIONS of proposed TEACHING STAFF.

- James G. Black, M.A., D.Sc., Professor of Chemistry, Metallurgy, and Assaying in Otago University and Otago School of Mines.
- A. W. Bickerton, F.C.S., Associate and late Senior Queen's Scholar, Royal School of Mines; Professor of Chemistry and Physics in Canterbury College.
- Alexander Montgomery, M.A., with first-class honours in chemistry and physics (London examination); alumnus of Otago University and Otago School of Mines; ex-assistant to Professor Black for two years in the chemistry classes of Otago University.
- Donald Henderson, fourth year's student in Otago University and School of Mines; licensed surveyor; at present attending the chemistry (senior), assaying, and metallurgy and mining classes in Otago University and School of Mines.

TABLE showing PLACES VISITED and DURATION of VISIT, by Members of the Teaching Staff, on the West Coast, from 1st November, 1886, to 1st May, 1887.

Places to be visited.	Mr. McLymont: Chemistry Analysis and Assaying.	Mr. Butement: Chemistry Analysis and Assaying.	Mr. Fenton: Assaying.	Professor Black and Goodlet: General Subject.	Total Number of Weeks spent by Members of Staff in the different Districts.
Ross	6 weeks ..		1 week ..	1½ weeks	18 weeks.
Rimu	4 " ..	.. ..	.. ..		
Kanieri	3 " ..	.. ..	1 " ..		
Hokitika	2 " ..	.. ..	.. ..		
Stafford	6 " ..		1 " ..	1 " ..	10 "
Kumara	1 " ..	.. ..	.. ..		
Dillmanstown	3 " ..	2 weeks ..	1 " ..	1 " ..	12 "
Paroa .. ..	.. ..	2 " ..	.. ..		
Greymouth .. ..	.. ..	2 " ..	.. ..		
Brunner .. ..	.. ..	1 " ..	.. ..		
Nelson Creek		5 " ..	6 " ..	1 " ..	20 "
Notown .. ..	.. ..	3 " ..			
Ahaura .. ..	.. ..	2 " ..			
Reefton .. ..	.. ..	5 " ..			
Boatman's		2 " ..	2 " ..	1½ " ..	14 "
Lyell .. ..	.. ..	2 " ..	2 " ..		
Westport .. ..	.. ..	2 " ..	.. ..		
Waimangaroa .. ..	.. ..	2 " ..	.. ..		
Denniston				2 " ..	7 "
Addison's Flat .. ..	.. ..	.. ..	.. ..		
Charleston .. ..	.. ..	.. ..	.. ..		
Collingwood .. ..	.. ..	.. ..	3 " ..		
Nelson					

THAMES SCHOOL of MINES.—PROPOSED TIME-TABLE (Approximate).

Thames, 5 Months.	Ohinemuri, 3 Months.	Waiorongomai, 2 Months.	Coromandel, 2 Months.
January 1 to March 15, and July 1 to September 15. (Thames and Tapu, 5 months.)	March 16 to April 30, and Sept. 16 to October 31. (Karangahake and Owha- roa, 1½ months; Waihi, Waitekauri, and Tau- ranga, 1½ months.)	May 1 to May 31, and Nov. 1 to Nov. 30. (Waiorongomai and Te Aroha, 1 month each.)	June 1 to June 30, and Dec. 1 to Dec. 31.

The above time-table was devised and passed by the general committee of the Thames School of Mines Association while Mr. Montgomery's services alone were available. Now, however, that it is proposed to appoint Mr. Henderson as Mr. Montgomery's assistant, the committee will be able to lengthen the session at each centre very considerably. The allocation of the teaching-staff, the apportionment of the time available, and the duration of the session at the different mining centres, can also be more easily dealt with.

SUMMARY showing the Number of WEEKS during which CLASSES will be conducted in the various GOLDFIELDS DISTRICTS in the MIDDLE ISLAND.

West Coast—

Hokitika, Ross	16½ weeks.
Stafford, Kumara, Paroa	9 "
Greymouth, Brunner, Ahaura...	11 "
Reefton, Boatman's, Lyell	19 "
Westport, Denniston, Charleston	12½ "
Nelson, Collingwood	5 "
73 weeks.	

Otago—

Lawrence, Waipori, Roxburgh	13 weeks.
Cromwell, Bannockburn, Nevis	13 "
Queenstown, Skipper's, Macetown, Criffel	11 "
Naseby, Rough Ridge, St. Bathans	15 "
Black's, Alexandra, Clyde	7 "
Riverton, Orepuki	4 "
63 weeks.	

V. McLymont, third year's student in chemistry, first year's student in mining, assaying, metallurgy, and blowpipe, and ex-assistant to Professor Black in the chemistry classes in Otago University and School of Mines; goldfields lecturer on West Coast and in Otago from January to May last.

Thomas F. Fenton, late mine and battery manager, mine and mineral viewer, assayer; first year's student in chemistry, analytical chemistry, metallurgy, assaying, mining, and blowpipe in Otago University and School of Mines.

— Hamann, third year's student in Otago University and School of Mines, third year's student in chemistry, first year's student in metallurgy and assaying; completed course of mining mineralogy and blowpipe in Otago School of Mines.

Thomas Butement, fourth year's student of Otago University and School of Mines. Subjects: chemistry, practical analytical chemistry, metallurgy, assaying, mining, mineralogy, petrography, blowpipe.

— Irvine: Second year's student in chemistry, and first year's student in assaying, metallurgy, mining, and blowpipe, in Otago University and School of Mines.

William Goodlet, laboratory assistant to Professor Black for five years in the chemistry, metallurgy, and assaying classes in University of Otago and School of Mines.

Professor Bickerton's assistant in the chemistry, laboratory, and physics classes in Canterbury College.

No. 3.

Professor J. G. BLACK, M.A., D.Sc., to the Hon. the MINISTER of MINES.

SIR,—

University Laboratory, Dunedin, 21st June, 1886.

I have the honour, in accordance with your instructions, to forward for your consideration a statement, in tabular form, showing,—

1. The centres proposed to be visited next session by the members of the goldfields lectures-staff.
2. The number of weeks during which each instructor will conduct classes at the several centres.
3. The total duration of the teaching-session in each district.

I have, &c.,

JAMES G. BLACK.

The Hon. the Minister of Mines, Wellington.

TABLE showing PLACES VISITED and DURATION of VISIT, by Members of the Teaching Staff, in Otago, from 1st November, 1886, to 30th April, 1887.

Places to be visited.	Professor Bickerton and Assistant: General Subject.	Mr. Hamann: General Subject.	Mr. Irvine: General Subject.	Mr. Fenton: Assaying.	Professor Black and Goodlet: General Subject.	Mr. Goodlet: Testing Ores.	Total Number of Weeks spent by Members of Staff in the Districts.
Lawrence ..	6 weeks ..	..	..	1 week ..	1 week ..	2 weeks ..	23 weeks.
Bluespur ..							
Waitahuna ..							
Waipori ..							
Roxburgh ..	1 " ..	2 weeks ..	..	1 " ..	1 " ..	2 " ..	14 "
Cromwell ..	1 " ..						
Bannockburn ..	1 " ..						
Nevis ..	1 " ..						
Queenstown ..	1 " ..	1 " ..	..	3 " ..	1 " ..	..	12 "
Arrow ..	1 " ..						
Skipper's ..	1 " ..						
Skipper's Point ..	1 " ..						
Macetown ..	1 " ..	8 weeks ..	1 " ..	1 " ..	1 " ..	..	15½ "
Criffel ..	1 " ..						
Naseby ..	..						
Hamilton ..	..						
Rough Ridge ..	..	2 " ..	2 " ..	1 " ..	1 " ..	..	9½ "
St. Bathans ..	..						
Cambrian's ..	..						
Tinker's ..	..						
Black's ..	..	2 " ..	2 " ..	..	..	..	4 "
Alexandra ..	..						
Clyde ..	..						
Riverton ..	..						
Orepuke ..	..	2 " ..	2 " ..	..	..	..	..

No. 4.

Mr. A. MONTGOMERY, M.A., to Professor BLACK.

Sir,—

Thames School of Mines, Waiorongomai, 17th May, 1886.

In accordance with the instructions in your telegram of the 11th instant, I have to make the following report of my work since the beginning of the year:—

On the 4th January I went to Tauranga, to inspect the quartz-reefs that had been discovered in various parts of the county. I spent a week in visiting the various localities, and also gave a lecture in Tauranga to about two hundred persons. Specimens of stone from the various finds were assayed by me on my return to the Thames, and the results of these assays, together with my impressions as to the probability of finding gold in the district, were forwarded to the Mayor of Tauranga. I attach a copy of my letter to him.

Returning to the Thames on the 11th January, I had several consultations with the newly-elected committee of the Thames School of Mines Association, at whose disposal my services had been placed. A suitable temporary building was secured, and on the 25th January I began to give a regular course of instruction in practical chemistry, determinative mineralogy, chemistry, and geology. Many difficulties had to be encountered, the principal ones being caused by want of necessary apparatus. I was not able to give instruction in the very important subject of assaying while at the Thames, as I had neither furnace nor assay-balance, both essential requisites. As this branch of chemistry is of all others that which is of the greatest immediate value to the practical miner, the want of instruction in it was very much felt, and a great many men who would have attended classes in assaying put off coming at all to the lectures until such time as the necessary apparatus for that study should be procured. Nevertheless, over forty members entered for the classes. The average attendance at the determinative mineralogy class was about six, at practical chemistry and at lectures on chemistry ten each, and at lectures on geology twelve. The classes at the Thames were held continuously for seven weeks. I am certain that, if there had been provision for work in quantitative chemical analysis and assaying, there would have been a much larger attendance.

Leaving the Thames on the 22nd March, I went to the important mining district of Karangahake, where I remained four weeks, holding classes in practical chemistry and assaying, for a balance and portable furnace were obtained just before I left the Thames. The miners at Karangahake attended very well, many coming long distances in spite of very bad roads and bad weather. The average attendance was from fifteen to sixteen per day. From Karangahake I went to Waihi, and held classes there for a fortnight, the average daily attendance being about fourteen, which was very good considering the small population and the inclemency of the weather. The course of instruction, as at Karangahake, included wet and dry tests for the various metals, and fire-assaying. From Waihi I came on to Waiorongomai, where I am now. The course of instruction here will extend over about ten days, and I shall then go to Te Aroha for about the same time, and thence to Coromandel, where I shall stay three or four weeks, and then return to the Thames.

The Thames School of Mines Association has now bought a building suitable for a laboratory and lecture-room, and an assay-furnace is in course of erection, so that during the winter session I expect a large attendance of students. The secretary of the association has been asked to forward you all particulars as to the number of members of the association in the different centres, and no doubt will do so.

With regard to the results of the work already done I cannot say more than that a beginning has been made which in time will lead to good results if means are taken to continue the instruction. It would be difficult to find a district where scientific knowledge is more necessary than in the goldfields of the Coromandel Peninsula. Till very lately the only gold-saving appliance in use on the field has been the stamping-mill, a machine suitable only for free gold, but quite incapable of dealing with silver ores, such as those common at Karangahake, where the silver is often in the proportion to gold of 50 or 100 to 1. Even for free gold of the very fine character that occurs in many parts of the field the ordinary battery-process is not sufficient, as in an instance which came under my notice where a quantity of very rich stone was crushed in a good well-appointed battery, and then treated twice over in berdans, and yet nevertheless the tailings were worth at the rate of £56 per ton. At Karangahake, at Waihi, and at Whangamata there is a great deal of silver ore—all unfit for battery treatment. Again, at Tararu, Te Aroha, and Waiorongomai there is much galena, zinblend, and copper pyrites, carrying both gold and silver, ores which can only be treated by processes requiring considerable scientific metallurgical knowledge. At Coromandel, too, there is a great deal of ore containing arsenical pyrites and rich in gold, which cannot be satisfactorily saved by the processes in use. The ores are not in unusual or unknown combinations, nor are the difficulties met with new ones. They have been encountered and overcome repeatedly in various parts of the world. But our miners, with few exceptions, do not understand any process but that at present in vogue, and have not the requisite scientific knowledge to adapt foreign processes to their own necessities. A wide field of usefulness is therefore open to the school of mines here.

With regard to the future working of the school I may be permitted to make a few suggestions. The work done by the school of mines here suffers very much on account of its intermittent character. Classes are held for a fortnight or a month or more at a time, as the case may be, at a place, and then there is an interval of perhaps six months before the instructor can come round again. There is no provision for carrying on work during this interval, and till such is made no progress can be effected. If a small building were procured in each centre, and fitted with a portable "Universal" furnace, a balance, and a few chemicals, men might meet together—say, once or twice a week—to carry on work and make experiments. Such a building might also be utilized as a public library. The prime cost of establishing such little laboratories all over the goldfields need not be very great, and the cost of maintenance would be very small, and could doubtless be covered by local subscriptions. The present method of working entails very heavy travelling expenses, as

the instructor must carry his laboratory about with him. My expenses for carriage of chemicals and apparatus from the Thames to Karangahake, Waihi, and Waiorongomai amount to about £14 10s., which would go a long way to cover the cost of the whole of them.

Another matter which I wish to bring before your notice is that one instructor is not enough for such a large district as the Coromandel Peninsula. The time that one man can give to each mining centre is too little to be of much use. Two teachers are urgently required, each having the assistance of a laboratory-boy. In view of the importance of the mining industry in the district, and the necessity for giving it scientific guidance, it is to be hoped that steps will be taken before long to establish a complete and thoroughly-equipped school of mines at the Thames. The teachers of that school might then take turns in visiting the outlying districts, and with small laboratories in these as above suggested work could be carried on without the long breaks which at present hamper it so badly.

Professor Black, M.A., D.Sc.,
University of Otago.

I have, &c.,
A. MONTGOMERY, M.A.

No. 5.

Mr. A. MONTGOMERY, M.A., to Professor BLACK.

SIR,— Thames School of Mines, Waiorongomai, 22nd May, 1886.
I enclose copy of report on Tauranga County finds of quartz for attachment to report sent to you on 17th instant. The original report being at the Thames I could not send you a copy sooner.
Professor Black, University of Otago. I have, &c.,
A. MONTGOMERY.

Mr. A. MONTGOMERY, M.A., to R. C. JORDAN, Esq., Mayor of Tauranga.

SIR,— Thames School of Mines, 9th February, 1886.
I have to report that I have made assays of the samples of quartz forwarded by you from various parts of the Tauranga District. With one exception—a sample (A) of quartz—none of the stone gave a payable result, though traces of gold and a little silver were found in nearly every case. With regard to the quantity of silver shown by the assays, it must be regarded as only approximately correct, as I was unable to procure any litharge quite free from silver to make the tests with. The amount of silver known to exist in the litharge has been deducted from the total silver found, but there might be a little difference in the amount of silver reduced from litharge in different cases. The error due to this cause is not, however, sufficient to affect the question of the payable or unpayable nature of the stone. The following are the results of assays:—

Sample 1.—From Katikati, sent by Mr. S. Earl: Dense quartz, containing a great deal of pyrites. Rusty on outside from weathering of pyrites. Could find no gold nor silver.

Sample 2.—From Katikati: Quartz with some pyrites and a little calcite. Gold, 1dwt. 15gr. Silver, 1oz. 14dwt. 7gr. per ton.

Sample 3.—From Katikati: Quartz, with a good deal of calcite, and some pyrites. No gold or silver.

Sample 4.—From Katikati: No gold or silver.

Sample 5.—From Katikati: Calcite, quartz, and pyrites, all plentiful. Bare trace of gold. Silver, 13dwt. 1gr.

Sample 7.—From Katikati: Quartz, with much calcite, and a good deal of pyrites. Gold, 1dwt. 15gr.; silver, 1oz. 1dwt. 5gr. per ton.

Sample 8.—From Te Puke, Proud's Reef: Mottled, brecciated quartz, with a good deal of pyrites. Gold, 1dwt. 16gr.; silver, 1oz. 1dwt. 4gr. per ton.

Sample 9.—From Te Puke: Similar quartz to Sample 8. This was, unfortunately, lost in the furnace, and I have not had time to repeat the test since.

Sample C.—This was a small sample of quartz in a paper parcel in a small bag, forwarded by Mr. Galbraith. It gave a slight trace of gold.

Sample C.—Cellular quartz, with white dense quartz, showing agate structure in parts. Sent by R. S. Galbraith. Found at Te Puke, top of No. 3 Road. The labels of this sample and the next had got detached, so that I could not tell which was meant. This sample was a very white quartz. Trace of gold. Silver, 9dwt. 19gr.

Sample C.—Brown dense quartz, with a little pyrites. Forwarded by Mr. Galbraith. A small sample of iron pyrites in a match-box, also sent by Mr. Galbraith, was too small for assay. The brown quartz gave a slight trace of gold.

Sample.—From banded reef of quartz and pyrites in the Momitu River, Kaimai District, collected by myself. I could detect neither gold nor silver in it.

Sample A.—This was a sample of rusty cellular quartz, pretty free from pyrites. Locality where found is not stated. This is the only good stone that I examined, giving 1oz. 9dwt. 9gr. of gold, and 2oz. 12dwt. 6gr. of silver per ton of ore.

The quartz found in the Te Puke and Kaimai Districts is in a rhyolitic formation, which has not, I believe, been yet found to contain payable gold and silver ores. As far as I could ascertain from men well acquainted with the country, no gold has ever been found in the creeks and rivers traversing this formation. This absence of gold in the creeks is a very unfavourable sign; for, if there had been gold in the reefs, their destruction by weathering would have liberated the gold which would get washed into the creek-beds. Both at Te Puke and Kaimai there are large reefs of quartz, carrying large quantities of iron pyrites, a mineral without which gold is hardly ever found. I

know no reason why there should not be gold in these reefs, but my assays fail to show more than a trace of its presence. Further prospecting might result in finding better stone; but, looking at the fact that the geological formation has not hitherto been found favourable for gold, I do not think that the present prospects warrant a large expenditure in opening-up the reefs. Some further work, however, is required to set at rest the question of the auriferous character of these reefs.

In the Waitekahi River a little gold is said to have been got from time to time by prospectors, which points to this district as more likely to prove payably auriferous than those previously mentioned. I was not able to find any payable quantities of the precious metals in the samples sent from this district, though most of them gave traces of both gold and silver. The geological formation here is the same as that of the Te Aroha and Waiorongomai Goldfields, being composed of lavas (diorites or propylites probably), with occasional beds of volcanic tufas and breccias. In traversing the bed of the Waitekahi River I was shown a great many small veins of quartz, and several of nearly pure calcite, nearly all heavily charged with iron pyrites. Unfortunately the veins are all very small, and the country is very hard, as a rule. In such hard blue rock as many of the veins are found in, I should not expect to find much gold, for it is now generally agreed that gold finds its way into the reefs from the country rock, and is a result of its decomposition. Where, therefore, we find the country rock hard and undecomposed, any gold it may contain cannot have been washed out into the reefs. The bands of soft tufa country seem to be few and of small extent compared to the hard lava bands, so that, even if gold were found in the tufa (sandstone of the miners), the lava would be continually encountered, and working would consequently be most expensive. There has been very little quartz found in the Waitekahi River, which renders it unlikely that there are any large reefs near it. Looking at the generally hard nature of the country, and the small size of the veins found as yet, I do not look on this district as likely to prove a payable goldfield. Mr. Moon, who has prospected the country for a long time past, informs me that near the head of the Waitekahi River, where I did not go, the country becomes much softer, and a "kindly sandstone" makes its appearance. It is in these bands of soft "sandstone" that the gold is likely to be found, if at all. The upper part of the Waitekahi might be better worth prospecting than the portion I examined. Present appearances do not, however, warrant much expense in opening up the country for prospecting.

I must take this opportunity of thanking you, Sir, and the members of the Tauranga committee for many kindnesses during my short visit to the district. To Captain Turner and to Messrs. Smith and Moon I am especially indebted for the great amount of trouble which they took to show me the different reefs in the Kaimai and Waitekahi Districts, and for a large amount of information.

R. C. Jordan, Esq.,

Mayor of Tauranga.

I have, &c.,

A. MONTGOMERY, M.A.

[*Approximate Cost of Paper.*—Preparation, nil; printing (1,600 copies), £19 8s. 9d.]

By Authority: GEORGE DIDSBURY, Government Printer, Wellington.—1886.

