

SESS. II.—1887.
NEW ZEALAND.

GOLDFIELDS AND MINES COMMITTEE

(REPORT OF), ON THE WORKING OF THE SCHOOLS OF MINES; TOGETHER WITH
MINUTES OF EVIDENCE AND APPENDIX.

Report brought up 20th December, 1887, and ordered to be printed.

ORDER OF REFERENCE.

Extract from the Journals of the House of Representatives.

WEDNESDAY, THE 23RD DAY OF NOVEMBER, 1887.

Ordered, "That the Goldfields and Mines Committee be authorised to inquire into and report on the working of the Schools of Mines now established in various parts of the colony; also to report generally on the best means whereby the gold- and silver-mining industry of the colony may be fostered and encouraged."—(Mr. SEDDON.)

REPORT.

YOUR Committee have the honour to report that they have taken evidence on the several matters above referred to.

That, in consequence of the evidence not being completed, and the shortness of the time at the disposal of the Committee to consider such an important question, they are not in a position to make a full report this session, but recommend that a similar order of reference be asked for next session, when the matter can be more fully dealt with, and further evidence procured, and an exhaustive and complete report can be made.

That, pending such report, the Committee consider it inimical to the mining industry for the Government to seriously interfere with the present arrangements relative to the schools of mines now established.

That during the recess the Committee recommend the Government to obtain, from America and elsewhere, full information as to the best and most effective methods of dealing with refractory ores.

20th December, 1887.

R. J. SEDDON,
Chairman.

MINUTES OF EVIDENCE.

TUESDAY, 29TH NOVEMBER, 1887. (Mr. R. J. SEDDON, Chairman.)

Mr. H. A. GORDON, Inspecting Engineer, Mines Department, in attendance, and examined.

1. *The Chairman.*] With respect to the order of reference, under which the Committee has to inquire into matters intended to foster the mining industry of the colony, we propose first to examine you in regard to the school of mines. We therefore wish you to give us such information as you possess on that subject.—I would, of course, prefer that the Committee should ask me such questions as they might think fit.

2. *Mr. Allen.*] I would ask one question before the witness proceeds further—it is this: What do you think is the object of this school of mines?—The object, I think, is to impart to miners better knowledge than they now possess on that subject; to give them an opportunity of becoming acquainted with the different ores they come in contact with while following their occupation.

3. Do you think that a school of mines is intended to train miners, and not managers?—Miners: a man should be a miner, I think, before he is a mine-manager. A manager must be a trained miner to all intents and purposes.

4. *The Chairman.*] How many such schools are established in the colony, and at what cost?—There have been twenty-four schools of mines established. The total expenditure on the whole of them has been £5,864.

5. For what period?—Three years.

6. That is less than £2,000 a year?—Yes.

7. What is your impression as to the result of their establishment so far?—I think they have done a great deal of good. When you travel over the North Island now and compare your observation with what was the case three years ago you find that everybody is now acquainted with silver ore, or ore containing silver, when they see it. Before that time miners were simply throwing away ore rich in silver as mere rubbish, because they had no knowledge that it existed in the ore, neither did they know its value; but this state of things is entirely altered now. The school of mines has been the means of prospecting being carried on to a much greater extent for the purpose of finding silver ore.

8. *Mr. Valentine.*] Do you think that by the establishment of these schools there has been less waste?—Yes; a greater amount of waste would have gone on but for the establishment of those schools of mines, as it would have continued to go on year after year.

9. Then you say that the establishment of the schools of mines has helped to save to the miners the amount of loss that would have been caused if they had not been established?—I think so.

10. *Mr. O'Connor.*] Can you give us instances, or can you state the extent of the saving?—As I look on it, you do not get the benefit of these schools the first year or two. It is some considerable time after their first establishment that you begin to see the benefits that result from them.

11. I understood you to say that such results would be obtained from them as might ordinarily be expected from technical education?—I may state that in the North Island they have been the means of directing the attention of miners and others to the fact of gold and silver existing in ores that were hitherto looked on as containing none of these metals. They have been the means of assays being made of every class of ore that is met with. Since their establishment Mr. Fraser, of Auckland, has been directing his attention more to the extraction of gold and silver from the ores met with in the Auckland District, whereby a larger percentage of the metals are now saved.

12. *Mr. Valentine.*] There was a saving of money; but might not that saving have been effected otherwise if the schools had not been established?—There has been less loss; and silver has been obtained where the miners never thought of it existing.

13. Was there a saving that would not have occurred but for the establishment of the schools?—I think so.

14. *The Chairman.*] Following that up, are you aware of any valuable result on the Southern Goldfield; did the establishment of these schools have any effect upon the method of treating plates?—Dr. Black was the means of teaching the battery-managers the use of sodium amalgam in silvering the plates, and also taught them how to manufacture it. Instead of using cyanide of potassium for this purpose, in some instances muriatic acid was used to clean the copper-plates, and care not being taken to wash off all traces of the acid before the silvering process commenced, the result was that the silver would not adhere to the plates for any length of time.

15. *Mr. Allen.*] Do you not think that any man who takes charge of a battery should have these things at his fingers' ends?—Unfortunately some of them have not.

16. Do you not think it would be better if we had less schools and more of a superior class of trained men who knew all these details?—The only difficulty is that the majority of the men following mining as an occupation belong to a class whose parents have not money sufficient to send their children from home to be educated; they must be educated near home for that reason. There is a large number of people of that class living on goldfields.

17. Would you not consider that the practical miner getting this technical education at a large school, thoroughly acquainted with all the details of ores and the best method of extracting what they contain, would be a superior man to the man who obtains his knowledge at one of these local schools?—There is no doubt about it; but men with theoretical training only are not altogether suited to take charge of batteries. They require experience in the details of working of batteries before their training is of much use.

18. *The Chairman.*] On the whole, I understand you to say, from all that has come within your own knowledge, that beneficial results have followed from the establishment of these schools of mines?—Yes.

19. *Mr. M. J. S. Mackenzie.*] Do you mean that the advantage of these schools would be of the theoretical sort?—A man having practical experience, and also possessing theoretical knowledge, knows how much of that knowledge is applicable to each particular case. I look on these schools of mines as having been established mainly for men following the occupation of mining.

20. Do you think that, to any appreciable extent, there is likely to be a reduction in the cost of the production of gold as the result of the establishment of these schools?—There may not have been such a reduction so far; but the question was the prevention of serious loss in the course of production, which had not been previously thought of. The attention which the schools of mines caused to be given to that subject has done a great deal of good.

Mr. M. J. S. Mackenzie. Well, it amounts nearly to the same thing.

21. *Mr. Allen.*] Could not the same result have been obtained, or rather, could not that loss have been provided against, by some less expensive means? If a thoroughly scientific person gave all the information required as to the preferable methods of treating ores, would not that be a more economical way of doing what was wanted rather than establish schools of mines for the teaching of science and chemical analysis; or is it the object to make professors for these schools all over the country?—When I called them twenty-four schools of mines, I do not think that any of them could be termed in the fullest sense schools of mines; they can only be called so in the sense that

they are meant chiefly for the purpose of making men who are for the most part miners acquainted with the ores they meet with in carrying on their occupation. The teachers go at different periods, and give a course of lectures, and show by demonstration the method of testing the various ores and what metals they contain. By this means the miners become acquainted with the process, and are in a better position to prospect and develop the mines.

22. *Mr. M. J. S. Mackenzie.*] Might not the same results be shown equally well by an ordinary assay, or suppose by a descriptive letter in a newspaper?—As a rule miners look on newspapers with suspicion as not always to be relied on.

23. *Mr. O'Connor.*] Miners are prejudiced in such matters against newspaper information; but supposing experts were sent round the goldfields?

The Chairman: That is what is done now.

Mr. O'Connor: That is to say, the miners could be got together, and they could get all this information relating to their pursuits. The whole purpose, as I understand, is to give them not only the best information, but the knowledge that will enable them to demonstrate the existence of the precious or other metals in particular ore.

24. *Mr. Valentine.*] Do you not give them practical demonstration in the school which will enable them to eliminate the gold or silver that may be in the ores?—The miners are made to test the ores themselves after the teacher has shown them the method; but it was never intended or expected from the present schools on the goldfields to produce scientific experts in metallurgy and all its branches.

25. *Mr. Allen.*] How long, I want to know, does that course of demonstration last?—It depends on the locality. In a large place like Reefton, for instance, it might be a considerable time; in some small places it might be not over a month.

26. Do you mean that you can tell them in that period how to deal with ores and to apply the methods for the extraction of gold?—Miners are a very intelligent class of men. Once give them an inkling of anything they do not know, or show them where they are wrong, it causes their attention to be drawn to the matter at once. I do not say that you will teach them to deal with ores or to apply the methods of gold-extraction within a month; but you will cause them to read up the subject, to prepare their minds for the practical treatment of it in any way that is available to them.

27. Is it the object of these schools to teach each miner the way to extract the ores; or is it the object to teach managers to become metallurgical or mineralogical mining experts?—You cannot set up such a difference between the mine-manager and the miner. The miner, although he is a miner to-day, may be a mine-manager to-morrow. The schools were established with the intention of being able to get a better class of men to manage and take charge of mines, they also give every one an opportunity of qualifying themselves to become mine-managers; but the great object is to make every one following mining pursuits to become familiar with the classes of ore that are met with.

28. Is it to teach each individual miner to become expert, or is it to teach particular individuals; your idea appears to be that it is to teach each miner to become expert?—I do not mean "experts;" a man cannot be regarded as an expert unless he has gone through a regular system of metallurgical training. These schools of mines were intended simply to give any one who liked to attend them the opportunity of testing the various ores he was likely to come in contact with and to be able to distinguish them.

29. *The Chairman.*] Is it the case that the majority of persons attending these schools are miners?—Yes; miners generally.

30. *Mr. Valentine:* You would say that a person coming from attendance upon a course of these lectures would be better able to take the position of a manager than he would otherwise have been?—Decidedly.

31. *The Chairman.*] Can you give any information as to the number of persons, that is, miners, who have attended these schools?—I could not exactly tell the number; I should have to refer for it to Dr. Black's report.

32. *Mr. Valentine.*] Do you not keep a record of attendance?—No.

33. *Mr. Allen.*] Is there the remotest prospect of this teaching making the extraction of gold or silver payable where it was not payable before?—I think there is no doubt of it.

34. You think there is a prospect?—Yes.

35. *Mr. Cadman.*] I think there is no doubt of it; you say so?—Yes.

36. *Mr. Allen.*] What makes you think so?—Throughout the North Island some of the ores are very refractory, and this subject is causing considerable attention owing to so many being able to make assays; that the result, I think, will be that you will be able to make poorer mines pay, as the by-products will be utilised.

37. Have you had any experience of the establishment of schools of mines in the other colonies?—Yes; I am acquainted with the method of working the schools of mines at Ballarat and Sandhurst. The only school at one time was that at the Melbourne University; but the class of people they wanted to attend there could not be got. The first school of mines upon a goldfield was at Ballarat, which is a very large goldfield centre. After that there was a school established at Sandhurst for technical instruction.

38. Do you know that Ballarat is anxious to reassociate itself with Melbourne University?—Yes.

39. Do you know anything of the schools of mining in England?—No.

40. Or in America?—No; only from reading about them.

41. *Mr. Valentine.*] In the other colonies do they go to the outlying districts to teach?—In New South Wales they do, but not in Victoria.

42. *Mr. Guinness.*] What number of lecturers or professors have you engaged?—There are six altogether.

43. What do they cost?—£1,600 a year.

44. That is without travelling expenses?—Yes.

45. *Mr. Duncan.*] Suppose a number of young gentlemen passed through these schools of mines, and suppose they understood what they were taught there thoroughly, and even be expert, would they be of much use in the practical working of a mine?—Not unless they had been accustomed to that.

46. *Mr. Cadman.*] Do you think Mr. Montgomery is capable of undertaking the management of mines?—No, certainly not.

47. *Mr. Allen.*] Can you tell us what becomes of most of the students that pass through the London schools of mines?—No, I cannot.

Mr. M. J. S. Mackenzie. They become, I suppose, members of Parliament in the colonies.

Mr. Allen. I may state that the men who pass through the London schools go all over the world, and eventually take charge of batteries and mines.

Mr. Cadman. We have not one of them here that I know of.

Mr. Allen. The more ashamed I am that we should have to say so.

The Chairman. They would not necessarily know the treatment here.

Mr. Allen. They would know every detail.

48. *Mr. O'Connor.*] Does that £1,600 a year include subsidies for buildings?—No; the expenditure on teaching and subsidies has averaged nearly £2,000 per annum since the schools were established.

49. *Mr. Larnach.*] Is it not the fact that the miners gave an equal amount to what the colony gave?—More, in some instances, with regard to buildings and chemicals.

50. Not less?—Not less.

51. That is to say, miners have given an amount beyond that which the Government gave?—They have not given anything towards the teaching. I do not know how much they gave beyond the amount given by the Government towards buildings and chemicals.

52. But towards the erection of buildings?—They have given more than the Government has given for that purpose and procuring chemicals.

53. What is your opinion of what is called the ordinary miner? Is he not a man of more than ordinary intelligence—more than the mere man about town, in reality?—You will find the miners a most intelligent class of men.

54. *Mr. Valentine.*] Is it your opinion that this £2,000 odd expended yearly on these schools of mines have been recouped by the extra benefit derived from them?—I do not think the benefit from them is quite felt yet; we are only beginning to feel the benefit to be derived from them.

55. You think they will recoup the money expended on them eventually in the increased amount of precious metal that will be obtained?—They will be the means of more of the ores being worked, and also more of the metals saved. I must say, with reference to schools of mines, that more may be expected from them as more is taught in them.

56. *The Chairman.*] Outside of these teachers, lecturers, and professors, are you aware of any parts of the country where there are persons competent to give this kind of instruction locally?—Yes; there are several places where you could get people who are capable of giving the same instruction as that imparted in the present schools.

57. Will you name the places or localities where persons capable of giving this instruction reside?—Dr. Gage, in Westport, is a capable man; Mr. Purkiss, in Hokitika, is another; then, at the Thames, Dr. Davey: there is a chemist at Kumara; and at Stafford the schoolmaster is capable of imparting instruction.

58. All persons competent to give this instruction?—Yes.

59. *Mr. Allen.*] What do you mean by competent?—Men who can give the information that is sought in the schools of mines.

60. Are they acquainted with all the processes of gold-extraction?—No; I question whether there is any man in the colony acquainted with all the recent processes of gold-extraction.

61. Do you not think it would be advisable to get such a person to come to this colony?—I know that it would be very difficult to get such a man; and if you had him he might not be able to do what you required of him, for this reason: a man who is brought up in one particular locality is acquainted, perhaps, with the variety of ores to be found in that locality. But these ores might be altogether different from what he would find here. If he went into another locality than the one he was brought up to study he might have to experiment upon a whole system of ores before he could be of much use in giving any information.

62. On what grounds do you say that?—You might, for instance, get a man that was accustomed to smelting and treating galena ores, and be altogether astray in regard to the treatment of tellurides and selenides.

63. Do you mean to tell me that a person acquainted with all the processes of gold-extraction would not be equally familiar with tellurides, selenides, or galena ores?—I know this, that a company in Nelson sent to America to get a competent man, the best that could be got. They paid him £1,000 a year. When he came here he was found to be totally astray as to the mode of treating the ores here, as they were different from that which he had been dealing with in America.

64. Do you know where he came from?—No; I cannot tell.

65. Did you say tellurium ore?—No, copper principally, in the form of carbonates and sulphides.

66. Was he working gold with copper?—No.

67. *The Chairman.*] You are aware that the colony is paying £500 a year to Professor Ulrich of the Otago University: Can you tell us whether there is no possibility of the colony getting some more value for that money than it gets at the present time?—He is one of the best mineralogists we have.

68. Could not Professor Ulrich's services be utilized? Has he not such knowledge on these subjects as would make the information he possesses capable of benefiting the colony? What I want to know is whether you have any idea if we could get a little more profit from the money we are paying, or do you think that the colony has got all the advantage it could get from Professor Ulrich's appointment?—I cannot say.

Mr. Larnach: The colony, I believe, is entitled to the services of Professor Ulrich from his position at the University. But he is unable to travel in parts of the colony where the ground is rough. Whether it is from being unable to travel through illness in his family on some occasions, or from other causes, that the colony has not been able to get the use of Professor Ulrich's services, I cannot tell. But I believe these are the reasons that he cannot, or does not, travel far from the University.

69. *Mr. Cadman.*] Has he been on the Northern Goldfields?—I cannot tell.

70. *The Chairman.*] Do you think that, from the means of inter-communication which exists in Otago by roads and railways, there would be any difficulty in attending to a mining community within Otago so as to give a course of instruction?—No, I should think not.

71. *Mr. O'Connor.*] Or put it the other way: if Mahomet does not go to the mountain suppose the mountain goes to Mahomet. Could not he be utilized by sending him ores for analysis, or otherwise might not greater facilities be made for consulting him?—That could be done, but I am not aware that Professor Ulrich makes analyses of ores to tell the exact percentage of metals they contain.

72. *The Chairman.*] What suggestion would you make as to whether the colony could get other service from Professor Ulrich at the present time?—That is a policy question; it is not a question for me to answer; the only thing I can say is, that Professor Ulrich could give a lot of information if he went round the different localities. I have no doubt about that.

73. Do you think he is capable of going to Reefton? Are you aware of the nature of the treatment of quartz at Reefton for the extraction of gold?—There would be a difficulty in Professor Ulrich travelling about Reefton.

74. *Mr. Allen.*] Do you think if Dr. Black were on the spot it would be a benefit?—Yes.

75. Do you not think it would be better for them to train a good man, and send him through?—They have a man.

76. But has that man had a metallurgical training?

77. *Mr. Guinness.*] Who is there?—Mr. Fenton.

78. Has he been working there long?—I think he was assaying at first, and has been a long time taken in hand by Dr. Black.

Mr. Allen: Assaying is not sufficient by itself.

79. *Mr. Cadman.*] How many years has Professor Ulrich been in the employment of the Government?—I cannot tell exactly.

The Chairman: The Victorian Press is always complaining of our taking away their best men. Here we have him.

80. *Mr. Allen.*] Do you think that the colony has derived benefit from the knowledge obtained from Mr. Fenton and Mr. Montgomery?—Yes; I think Mr. Montgomery is a very capable man.

81. *Mr. Larnach.*] He is a pupil of Dr. Black?—I think that he was a pupil both of Dr. Black and Professor Ulrich, but he might have been longer with Dr. Black.

82. *Mr. Allen.*] What was he learning from Dr. Black?—Chemistry and metallurgy from Dr. Black, and mineralogy and mining from Professor Ulrich.

83. *Mr. Cadman.*] Is it true that Professor Ulrich has been in the employment of the colony for the last fifteen or twenty years?

Mr. Larnach: No; twelve years.

84. *Mr. Valentine.*] In answer to a question put by Mr. Allen you made me understand that the reason for having so many schools was in consequence of the miners getting away into the country; you said in the same answer, as I understood, that later on, in your opinion, fewer schools would work to greater advantage?—The reason for that is that, in starting the thing at first, I think it was better to have the lecturers spread over the colony, so as to draw the attention of the whole mining population to the subject, and to the necessity of knowing the material which the various ores contained. After their attention in this way had been properly drawn to the subject so as to show the miners the necessity of having more knowledge concerning the ores that they meet with, you might get them to go a greater distance to attend the school, when they came to know the importance of the knowledge they would obtain by so attending.

85. *Mr. Allen.*] Do you think it would be advisable for the Government to aid miners to get the instruction they require by granting scholarships to enable them to go to a central school where they could be thoroughly taught?—I understand that scholarships are granted now: I think the principle of scholarships is a good one.

86. *The Chairman.*] Now, as to the question of policy; coming back to that, do you think that an advantage might be gained where there are persons to be found fully capable of giving instruction to miners; do you think it would be impolitic, or otherwise, to enable miners to take advantage of such instruction; and that, in the case of such teaching being found, it would be a good policy that the colony should assist the miners with that view in such places as Reefton and Kumara? You can tell us, at the same time, whether or not you think it would be good policy to close those schools?—Where there are competent and capable instructors it would be an advantage to keep them open.

87. *Mr. Larnach.*] Where there has been an amount of money given by the Government there has been an equal amount given by the public?—Yes.

88. Would there be anything like a commensurate benefit to the public for the money subscribed and the plant supplied by subscription if you were to close these schools?—I think not.

89. Supposing pound for pound to be given by the public, do you think the colony, in giving another pound for pound, was acting wisely?—I should think it would be money well spent.

90. *Mr. Allen.*] Do you mean to establish small plants?—I did not understand Mr. Larnach's question to be put in that point of view.

91. *Mr. Larnach.*] The miners established plants; do you think it would be too much to assist them by giving them sets of ores or other aid?—No.

92. *The Chairman.*] Each set of ores costs £12; there is, however, apparatus to be found, which costs money. Suppose the colony pays half the sum requisite, would it benefit to the extent of that half? I ask you, then, whether it would be a benefit to close the schools so as to relieve the colony from the expenditure?—That is a question of policy, which I am not in a position to answer.

93. *Mr. Larnach.*] Is it within your knowledge that, apart from the instruction given to the miners in the several localities where these schools have been established, there is a number of youths who are attending the State schools and receive instruction several times a week with great benefit?—Yes; in every school that is opened you will get a number of pupils of this sort.

94. And they receive a benefit not only from the teaching but from the experiments and demonstration which the appliances afford?—Yes.

95. *Mr. Allen.*] Do you think that a few days of teaching of chemistry is of any use whatever?—It has a value in this way: it opens the eyes of the pupil to facts which he had never dreamt of before; it makes him reflect on a great variety of surrounding circumstances; it induces him to inquire further; it leads him to read up the subject, which he would never have done but for the opportunity afforded of attending similar lectures. It does a deal of good in this way.

96. Is not a little learning a dangerous thing, especially with regard to chemistry?—A little learning is a dangerous thing in regard to anything.

97. *Mr. Larnach.*] Does this instruction go on throughout the year?—In some localities it does; at the Thames, for instance, the school of mines is open every day.

98. *Mr. Cadman.*] Could you tell us the average attendance of scholars for the year?—No, I cannot tell you the average for the year.

99. *Mr. Larnach.*] Now, bearing in mind the small amount of money expended altogether on these schools, the benefits of which extend all over the colony, is it your opinion that it would be prudent to discontinue giving assistance to them?—I think it would be a bad thing to stop this assistance altogether.

100. *Mr. Valentine.*] In your opinion would it be desirable that any present assistance should be taken away from these schools?—I should not like to go into that question. That is for the Government to determine if they should think it desirable.

101. Then, as I understand, you think it desirable that some of this expenditure should be cut down?—It might be cut down, that is to say if on these goldfields they have people among themselves able and competent to give the requisite instruction and to take charge of the schools that are in existence; but it would be desirable to have a few central schools where you might get anything tested that would be referred to them.

102. But, apart from that, is it your opinion that some portion of this expenditure should be cut down?—I think if the miners had the competent persons I refer to among themselves you might attain the same object.

103. But without them?—Not altogether.

104. But attaining the object in view on the establishment of these schools is a matter of time?—Yes.

105. *Mr. Allen.*] But do you not think, if we want to train men who shall be of service to the colony as mining experts, that the schools of mines should be attached to some other teaching body like a University, where those attending could get the requisite training, not only in chemistry but in mechanics, electricity, metallurgy, mineralogy, &c.?—I do; but I do not think that in any of the principal towns of New Zealand, such as Wellington, Auckland, Christchurch, or Dunedin, which are not situated near or in mining localities, you would get the miners to attend. As a matter of fact they are not in a position to attend schools at such a distance. That the schools should be associated with some teaching body I agree, but they should be situate in some mining centre.

106. But the teaching body at Ballarat found they were wrong, and they are now trying to associate themselves with the Melbourne University.

107. *The Chairman.*] Now as to the second paragraph or clause in the order of reference?—I should be glad to answer any questions put to me on that, for it opens up subjects which one might take days to dilate upon and explain.

Mr. Valentine.] I think it would be better to have the witness's opinion before beginning to ask him any questions. He can give his opinion shortly.

108. *The Chairman.*] I think so. Will you be good enough to give the Committee your opinion upon this second clause in the order of reference?—That is, if I understand you rightly, my opinion with regard to getting more information than we have at present in reference to the treatment of ores, and not only the treatment of ore, but likewise the various processes of gold-extraction.

109. I would ask you to confine yourself just at present to two points: first, to hydraulic workings; second, to quartz-mining and the treatment of ores: you can take either of these in the order you please, but to finish one branch of the subject first, so as to enable the Committee to ask you questions upon it as a whole: you can then go to the other?—With regard to auriferous drifts, of which this colony affords a great scope of country, there is no doubt, in my mind, that we are far behind America in the processes of working them.

110. *Mr. Allen.*] Have you been to America?—I have never been in America; but I get all the

periodicals and publications upon the subject from friends who send them to me. They can make auriferous drift there, in some places where the value of the gold is a little over a pennyweight per cubic yard, pay dividend; besides, they have a much easier way of getting clear of the great difficulty which we have to contend with—namely, stones; they have all the machinery requisite for lifting stones, so that they can do by machinery what we can only do by manual labour: that is a great difference in their favour. I believe they have got a real insight into almost everything connected with gold-mining in America, which might be expected from the fact that America presents a much larger field for operations, as far as the extraction of silver and gold is concerned, than any other country in the world. In 1885 the total produce of the silver- and gold-mines in America was thirty-one millions and a half.

111. *Mr. Guinness.*] Dollars or pounds?—Pounds. In Germany, Austria, and Hungary the produce was two millions and three-quarters; in the Australian Colonies it was six millions and a half; in Russia, five millions and a half, that is, in round numbers. The yield in America is twelve times the quantity produced in Germany, Austria, and Hungary; six times the quantity produced by Russia; and five times greater than the produce of the whole of the Australasian Colonies. I think the best way of getting what would be the most valuable and reliable information would be to send from here some one well acquainted with the New Zealand goldfields, their requirements, the nature of the auriferous drifts, and the methods adopted for working them. The person or persons to go there for such a purpose as getting information upon everything connected with gold-mining in America should be well acquainted with the nature of the auriferous drifts and also the auriferous and argentiferous ores that are met with here. If he were an experienced man as well as being practically acquainted with the goldfields and the processes adopted in this colony he could obtain a great deal of information upon a variety of subjects connected with mining. He could see, for instance, the class of machinery used in America, and how everything is carried out in working mines upon a large scale. He would know exactly what would suit each particular mining locality in New Zealand. I am certain this would be most valuable information for the colony to obtain.

112. *The Chairman.*] And as to gold-saving apparatus, what is your opinion with regard to that? Do you think that much saving could be effected?—I think there is no doubt that a saving could be effected by means of the knowledge we would get from America. They get a much larger percentage of gold than we get. There is one thing I should remark as regards the method of sluicing in America. They adopt methods for saving gold in sluices which we do not use here, for the reason, it is said, that the water is too cold to use quicksilver. In America they use quicksilver in their sluice-boxes, and where these sluices are a great length as many as seventy flasks of quicksilver are used in one sluice. They have also different methods of paving their sluices and breaking up cemented gravel from that which is in use here.

113. Then you think that quicksilver might be used to greater advantage than it is at present?—Yes; I think more gold would be saved. Reliable information, as well as plans showing the different methods of working auriferous drifts, would be valuable to the colony and tend to further the development of the mining industry.

114. *Mr. Valentine.*] Have any experiments been made?—Not that I am aware of.

115. Do you know the working of the Kumara Sludge-channel? You do know, I presume, that it is a Government work? From any information you possess, do you think there has been a considerable amount of gold-loss in consequence of partial or imperfect sluicing?—I know that there is tremendous loss in sluicing, for there is a lot of gold in the stuff after it comes into the channel from private parties' sluice-boxes who are using the channel to get clear of their tailings.

116. What is the length of it?—About three-quarters of a mile.

117. That was not formerly thought to be the case; it is only recently that was discovered?—Only recently; the value of the gold saved in this channel averages about £80 per month.

118. Has that discovery been one of the effects of the school of mines?—No.

119. *The Chairman.*] Is it possible to test the apparatus used called "grizzlies" in connection with quicksilver at the Kumara Sludge-channel?—I am not sure that there is sufficient fall. You require fall to use the "grizzly;" unless there is sufficient fall the water and tailings cannot be led back into the sluices.

120. Will you explain what you mean by the term "grizzly"?—It means that there are iron bars forming a grating in the boxes of the main sluice. Underneath this grating there is an under-current box placed about 18in. beneath the bottom of the main sluice. This under-current box is placed at right angles to the main sluice, and conveys the water and fine material that falls through the grating on to large tables, which are from 20ft. to 30ft. in width and about 40ft. in length. The object of these tables is to spread out the sluiced material and allow it to go over the tables in a thin sheet, for it is well known that when there is a great depth of sand and gravel in a sluice-box there is a great loss in gold. After the material leaves the tables it is conveyed by a box into the main sluice again, and passes over a series of grizzlies and under-currents before it is finally deposited on the ground. The effect of the grizzlies being placed in the main sluice is to separate the boulders and coarse material from the fine, and allow the gold to have a better chance of being saved on the tables.

121. *Mr. Duncan.*] Is there anything on the table?—Some of them have great wooden bars, some iron rails, and some are pitched with stones.

122. *The Chairman.*] Do they use quicksilver?—Yes; they use quicksilver.

123. *Mr. Valentine.*] Have you any knowledge of the Switzer country?—Yes.

124. What do you call the deposits there?—Alluvial drifts.

125. Do you know whether there are any of these drifts in the banks going up the left side: are they auriferous; if so, could they be made payable? I am told they could be made to pay: that traces of gold are found there?—It is possible: that is a matter that can only be determined by prospecting. Very little will pay if you have a good face and plenty of water.

Mr. Valentine : They tell me that all these would pay well if they only had the water. At present they have to carry water seven miles across the valley.

126. *The Chairman.*] Is there any other way that you think of which might be adopted to improve the position of the colony with respect to these auriferous drifts—first, in regard to saving gold; second, in regard to water-supply; and third, in regard to appliances, such as the Ball-dredger, which might be introduced, but which are not used here at the present time?—I am in communication with a gentleman in America on the subject of the Ball-dredger. He is making inquiry as to its suitability to our beaches and auriferous drifts, and with the view of introducing his machine, which, from what I can learn, is something after the principle of the Ball-dredger. But I believe this dredge is not in general use in America.

127. Do you know whether there has been any rule laid down for rendering assistance by the Government in working these drifts by means of water-supply?—No; there is no rule laid down. I think that the question of water-supply is one for the Government to consider. Once you begin on that you never know where to stop. That is a question of policy.

128. But could there not be an increase in the yield of gold in the colony if that assistance were given?—There is no doubt about that.

129. *Mr. Guinness* : Could the Government give assistance to a syndicate by means of a land-grant system?—There is the question of policy again.

130. *The Chairman.*] Then, I understand you to say that, with increased water-supply, in your opinion there would be a considerable increase in the yield?—Yes.

131. *Mr. Allen.*] Would it pay?—That has to be tested; no doubt in some places it would pay, not in others.

132. *The Chairman.*] Do you not think there has been a great loss of capital through no record being kept of the directions of drifts, of deep sinkings, &c.; for instance, suppose that a proper record had been kept of the various lodes about the Lamplough District, would not such a record have enabled the miner to follow up these leads, and in this way have had the best possible effect: could it not be done?—The new Mining Act provides for a good deal of that; it provides for systematic mining surveys and other things to be done, and in every case they have to keep a record.

133. Do you mean the Mining Act or the Bill to amend the Mining Act?—The Mining Act.

134. But that only refers to companies; do you not think that where there are no companies, where only small parties of men have to work, in cases of that kind, it would be a great advantage if the Survey Department were to send men to take levels, to note the direction of strata and other appearances that would serve to guide the work in mines?—I question very much whether the expense would not be found to be too great.

135. Would it be expensive?—It would entail great expense.

136. But there would be a great advantage in it?—I think the main advantage would be in deep workings rather than in open workings; you can see the direction in open workings.

137. The colony has been spending a lot of money lately in aiding prospecting, has it not?—Yes.

138. In the Mines Department, then, if any one came to ask you what grounds had been prospected, where it is located, what has been the result of the prospecting, and, generally, what has been done, have you any details of that expenditure?—Yes; we have details of all such expenditure.

139. Have you any details of results?—No; not of results.

140. Have you any plans?—We know the money that has been expended in certain localities.

141. Is there no information given by the local bodies?—We know the amounts that have been paid, we know the men's names to whom payment was made, and we know the localities.

142. Do you not think that if this detailed information were furnished everybody might know the exact position of these prospects?—I think it would be a very useful thing to have.

143. *Mr. Duncan.*] Could it not be got if prospectors were called upon to furnish their reports to the local bodies, and the local bodies might forward these reports to the department?—It might, perhaps be done that way.

144. *The Chairman.*] Are you aware of the system that obtains in Victoria, where they have records of the borings, samples of the strata passed through, and drawings of the same: can you not get every detail connected with matters of this kind, the same as that obtained by the Mining Department in Victoria every month?

Mr. Larnach : That only applies to the chief mining localities.

Mr. Valentine : In Sandhurst all deep sinkings are recorded.

145. *Mr. Duncan.*] There are no deep sinkings in Sandhurst; perhaps, Mr. Gordon, you could tell us?—They are down 2,040ft. in Sandhurst.

146. *The Chairman.*] Have you information of the borings?—I have information of all the different borings.

Mr. Larnach : I think Victoria spends £80,000 a year in boring.

147. *The Chairman.*] Is not the colony entitled to all the detailed information that can be got from any parts of the colony receiving aid from the Government?—I think it would not cost the local bodies much to supply it. It would certainly be a good thing to have.

148. *Mr. Allen.*] You have suggested that it would be a proper thing to send a man to America to bring to New Zealand all the information he could get there: would it not be better to get a man from America?—It would be hard to get a man that has been over all the mining districts of America; and, even if you could, when he came here he might find that the ores here were different; that the system applicable in America could not be applied here. He would have to study the whole subject when he got here, and would probably be of very little good to us.

149. You were speaking only of auriferous drifts?—Of auriferous drifts.

150. Do you think that a man could go over the huge continent of America and obtain complete information of all their hydraulic and other processes in a reasonable time?—He could travel over the principal fields in a reasonable time. The facilities for travelling in America are very great.

151. Do you not think you could get what you want from books, pamphlets, and drawings?—I belong to the American Institute of Mining Engineers, and get all their transactions, and also endeavour to obtain all books and periodicals on the subject; but I find that this information, so far as it is applicable to the colony, is very scant—that is to say, it is information that cannot be utilized to any great extent.

152. Do you not know that there is no country in the world where the details relating to all matters of mining are so complete?—I meant, when I said of the information I obtained from books and periodicals that it was scant, in regard to the mode of applying it. The same system that is laid down there and applicable to their circumstances is such that in many instances could not be applied here with the same success; and books, although valuable in imparting information, do not convey such clear and lucid ideas as actual realities.

153. *The Chairman.*] It is the practical working that you want to see?—Yes.

154. *Mr. Valentine.*] By seeing the practical working you would be in a better position to work up your information?—You might read up a subject, without seeing the practical working of it, and not be able to apply it. But, having seen the thing in detail, you can thoroughly master the subject, so that the whole thing becomes matured in your mind.

155. *Mr. Allen.*] Can a practical knowledge of all these details be got from a cursory visit to America?—Not unless the person sent has a practical knowledge of the subject he has gone to make inquiries about. But any one who has a practical knowledge of the subject which he has gone to make inquiry about is in a different position. He sees different systems at work, he takes notes of his observations on the spot, he brings back plans of all he sees, so as not to trust anything to his memory. That such a visit by a practical man to America would be very valuable to this colony I have no doubt whatever.

WEDNESDAY, 30TH NOVEMBER, 1887.

Mr. H. A. GORDON, Inspecting-Engineer, Mines Department, in attendance, and further examined.

156. *The Chairman.*] Yesterday we considered the best means of encouraging the mining industry, more particularly in reference to auriferous drifts; to day we propose to consider the second part of the subject, in regard to the extraction of gold from refractory ores. Can you give us any information on this part of the subject?—I think the colony wants information upon the following subjects: The best methods of treating the various classes of auriferous and argentiferous ores, their reduction by machinery, the best kinds of amalgamating machinery, the mode of working the lixiviation process, and with respect to the chemicals generally used in amalgamating pans, the various modes of working lodes; also information relative to hauling and pumping machinery, and on the ventilation of mines. First, with reference to the treatment of auriferous and argentiferous ores, the chief subject that will have to be considered is some cheap, simple, and effective method of treating such ores. We have large lodes of ores in New Zealand of low grade, but at the present time they are valueless, because the mode of treatment is too costly and they will not pay for the working. Not only is the treatment too costly, but we do not get anything like a fair percentage of metal from the ores. This applies in a greater degree to the Thames District, also to Te Aroha and Coromandel Districts, rather than to the southern goldfields. On the southern goldfields the gold is in a more free state, and not so much combined with other metals. But in the Thames, Te Aroha, and Waihi Districts a good many ores are very refractory, containing sulphides, selenides, tellurides, and chlorides; there are also cinnabar, galena, sulphur, and arsenic, all in the same lode. It is well known that these sulphides ores are also in many instances arsenious, and working these by the ordinary battery process has an injurious effect upon the quicksilver, as sulphur and arsenic destroys its affinity for the precious metals. So long as gold and silver are associated with sulphur or arsenic, the sulphur being so light carries off the gold with it; even after running through a series of settling-pits, you will find the sulphur carry away the gold. The character of the gold at the Thames, likewise, is different from that found in any other part of the Australasian Colonies; it is so finely divided, combined with silver, and so thickly disseminated through the stone, that there is not in the Australasian Colonies, so far as I am aware, anything to be compared to it. I am thoroughly convinced, from what I have seen of the modes of treatment on the Northern Goldfields, that, by the ordinary stamper process which is now in existence, if an average yield were to be taken, they do not get over 33 per cent. of the metal that the ore contains.

157. *Mr. R. H. J. Reeves.*] So that there is an absolute loss of 67 per cent.?—Yes: I am sure there is. I will give an instance in proof of it. They found at Te Aroha that, when the stone from the New Find Claim, when it was first opened, was crushed by the stampers, it contained about 2oz. to the ton. The tailings were subsequently treated in berdans, and they gave close on a similar amount; and finally they were put through berdans a third time, and found sufficient gold in them to pay: so that in many instances, I feel certain, they do not get anything like 33 per cent.

158. That applies only to refractory ores in those districts, and not all round the colony?—It applies to refractory ores; but I say that the ores are more refractory in the northern than on the southern goldfields. On the southern goldfields the metal is in a more free state. I am thoroughly satisfied that, unless roasting and chloridizing are resorted to—where sulphides are present—on some cheap scale, it will be impossible to treat sulphides advantageously. The main fact we have

to contend with in New Zealand is having a small field in comparison to the Australian Colonies, and much more so in comparison with America, which turns out about six times as much gold and silver as the whole of the Australasian Colonies put together. We have not sufficient capital to experimentalize on the treatment of our ores as they have on those large goldfields, or to erect plants suitable for the treatment of ores. Although we may now and then, by testing small samples, be able to extract the gold from its matrix; still, when the metal comes out, it is found at times that the cost of the treatment is more than the ore itself is worth. What we want is some effective way of treating low-grade ores. I believe that the best way of dealing with the difficulty, and the way most beneficial to the colony, will be by obtaining the best information that can be got on all these questions. And the best way of obtaining that information, in my opinion, is to send some one thoroughly acquainted with New Zealand and its ores to visit America, where mining is carried on on such an extensive scale, so that he may see the principles adopted there. He would be able to see whether such processes as are adopted there could be carried on in New Zealand with advantage. There is no doubt there are plenty of systems in use there that would not be applicable to New Zealand, such as the smelting process in Denver. We had the same thing introduced here by La Monte, but it was not a success. The simple reason was this: that there was too much silica in the ore. This process is successful at Sunny Corner, in New South Wales, where I saw it at work; but the reason of this was that the ores there contain large percentages of copper, galena, iron, &c., combined with gold and silver, and lime was almost close at hand, so that the ore contained within itself the fluxes required for making the smelting process effective. Here we have no ores of this description, with the exception of the Champion Lode at Tui Creek, Te Aroha, that I have seen in New Zealand, suitable for treatment by the smelting process, and it is questionable if even that lode I have referred to does not contain too large a percentage of silica. The result is that the cost of fluxes will be too much to allow of the smelting of low-grade ores. Moreover, the reason why I say that America would be the best country to get information from is this: that the most useful machinery we have got is really of American invention. We have one of the best water-motors in the colony in the Pelton hurdy-gurdy wheel, which is an American invention. It would not have been introduced into this colony had not a gentleman at the Thames seen a description of it published in one of the American papers, together with the experiments made with the other water-motors by the Idaho Gold-mining Company. He was so struck by its novelty that he got one constructed at his own expense to test its capabilities. It has been since almost universally adopted in the Thames District and other parts of the colony where there is water-power. I may mention here that the Newberry-Vautin process, referred to by Mr. Reeves, is not a new process. It is a process which was worked in North Carolina many years ago, known as the "Mears" process. There was a description of it given in a paper read by Mr. R. P. Rothwell on the 20th October, 1883—including the filtration through charcoal—before the Institute of Mining Engineers at New York. Any one reading that paper and the pamphlet published by Messrs. Newberry and Vautin must admit that the process is one and the same. If the Newberry-Vautin process is a success, it is an American invention, and it has taken all these years for us to become acquainted with. It was simply enterprising men who brought it to the Australian Colonies, and used it there for the first time. The treatment of our ores is the chief thing and the subject to which the largest amount of attention will have to be paid. What we are really suffering from is not being able to ascertain the most effective method of treating our ores so as to get the largest possible percentage of metals from them. But the question as to the reduction of the ores is also a matter which enters largely into the cost of obtaining the metals from them. There are several systems, more or less effective, in America, of reducing the ores, and we want to know whether any of those systems can be applied effectively here. The method of reducing by means of the Huntingdon crusher and by steel rolls is described in the American papers as a most effective means of crushing the ore; and I have no doubt in time machinery will be found to supersede stampers almost entirely. We have an instance of that in New Zealand, eighteen months or two years ago. The people of the Blue Spur had a battery, twenty-head of stamps, for crushing cement. They found that the quantity they could put through the stampers was too little to make working of this cement remunerative. After a long time, Mr. McQueen, of Kincaid and McQueen, of Dunedin, undertook to put up a set of large rolls. I learnt that this set of rolls not only dispensed with a great deal of manual labour that was employed at the battery breaking up the large blocks and feeding the stampers, but they pulverize two and a half times more than the quantity crushed by the twenty-head of stampers formerly employed, and does not require near the same amount of power to work them. This, by itself, shows that some other method cheaper and more effective can be employed than the stampers ordinarily used; for, if the cement could be reduced in the way described, ores could also be reduced in the same manner. We want, likewise, information—as much information as we can get—concerning the different systems of amalgamating; for it has become a question, in the treatment of our ores, whether, in respect of these refractory ores, the roasting, chlorodizing, and amalgamating system will have the best effect, or whether the roasting or lixiviation process would be more suitable. Both systems are largely used in America. The lixiviation process is spoken highly of in the American papers. The Russell process is also largely in use there, and is said to give good results. We want also as much information as we can possibly obtain respecting the chemicals used for the purposes of amalgamation, together with the different classes of ores to which they are most suitable. Then, if roasting-furnaces are required, there are several different descriptions of these furnaces used in America—the reverberatory furnace, the Stetefeldt, Howell, Bruckner, White, O'Hara, and other furnaces. It is just the question which is the most economical and best adapted for roasting our ores at a cheap rate. Then, in addition to the treatment and reduction of ores, I think it would be a very good thing to see the different systems of working the mines in America—the modes of timbering, stoping-out, and conducting mining opera-

tions generally in that country. There is no doubt that a person living in one locality gets into a particular groove of working. I think that a person who has travelled and seen the various modes in which different classes of mining is carried on, if he is a practical man, will be likely to form a sound judgment, and will probably be able to discover improved methods of working our leads to better advantage than we work them at present. I think also that, along with this, he would be likely to observe the improved methods of haulage and pumping that are adopted, and the best means of ventilation in mines. He would not only see all these things on the spot where they are in full work, but he would be able to bring back plans carefully made of the improvements he had observed in America, which could be adapted to mining-work in New Zealand. He would be able to give the fullest description of the systems in use at the places he visited, and also be able to utilize the information obtained there from the most reliable persons, and from observations made by himself. I think this information, and these descriptions of what is being done in mining in America, would be most beneficial when thoroughly known in this colony, and would help the mining industry of New Zealand very much.

159. You were in Victoria some time since?—Yes.

160. Was McNeil's concentrator at work in the places you visited? I believe it had been patented before you went to Victoria, and was working at the Walhalla?—No; I did not see it.

161. It is a simple process, believed to be of great advantage when applied to some claims?—It separates the free gold from the pyrites.

162. In Melbourne they have an establishment for treating pyrites?—Not that I am aware of. There are places of that description at Sandhurst. There are two public companies there for treating pyrites. But a great many companies have pyrites works of their own. With reference to concentrating machinery, we do not pay sufficient attention to this subject. All the principal companies in Victoria use concentrating machinery, which is the means of making mines pay that otherwise would not do so. We also work the ores in too haphazard a manner. One good thing that the school of mines has done is the teaching of assaying. Every mine ought to have an assayer to test the ore and tailings, for without that you cannot tell the value of the ore nor the quantity of bullion it contains. In California and other parts of America each mine has an assayer. The manager of a mine there is supposed to bring up his return of gold to within a certain percentage of the assay. The assays generally made here are taken from picked stone or ore, and therefore of little use in determining the value of the lode. In America, where assays are made of the ore as each truck-load comes out of the mine, a sample is taken out and laid aside, and finally, when assays are to be made, the stuff is carefully mixed up. By this method the average value of the ore is ascertained. But we take a stone or two, have them crushed and assayed, and judge of the mine by that result. That is a haphazard manner of dealing with the subject, and leads to great mistakes.

163. *Mr. Cadman.*] You have been over the different parts of the Thames, Coromandel, and Ohinemuri Districts: do you think that any one method of treating the ores would do over the whole of these goldfields?—No.

164. How many different modes of treatment do you think would be required: give us the names of places?—In some places the Thames gold is in a more free state than in others. I think that on these goldfields you require two or three methods of treatment. The ores in the Waihi District and Karangahake require different treatment to the generality of the ores about Coromandel. There are some ores which you can crush wet; but where there is a large amount of sulphides present wet-crushing means simply wasting the precious metals, as the sulphur being a very light substance it floats in the water, carrying away both gold and silver with it, and where this description of ore has to be treated we will have to establish dry-crushing, roasting, and chloridizing. It then becomes a question whether it is not better to treat them by the lixiviation process or by amalgamation. This is a question which cannot be determined except by a person working on the different ores and judging for himself. I am certain that you could not with advantage adopt one method all over that large district. In some of the mines, especially at Coromandel, there is a large amount of antimony, which sickens mercury, and renders it unfit for amalgamating purposes. Some of these mines also contain metallic arsenic, having gold disseminated through it, which in its raw state is not suitable ore to be treated by amalgamation.

165. *Mr. Allen.*] You say that at the Thames three different processes will have to be used?—I think it probable you would have to use two or three different processes.

166. You have told us that some of the ores there consisted of alloys of gold and silver?—Yes.

167. Have you had any experience of galena workings in gold and silver alloys?—Yes; I know the system of extraction.

168. Do you know that the chlorination system, or a modification of it, has been successful at Mount Morgan?—As far as gold is concerned; but this system is not, in its present form, suitable for the extraction of silver.

169. How much silver is there in the Mount Morgan Mine?—There is no silver; the gold is almost pure.

170. Is it not the purest gold that has ever been discovered?—Yes.

171. Do you consider chlorination works are always a success upon alloys of gold and silver?—It depends upon what they are associated with.

172. Would it, without modification, be successful?—I do not think it would be always a success.

173. As a general rule would it be a success?—Yes, I think so.

174. If the gold were not specially fine, would it be a success?—It requires gold in a fine state to make it a success. The finer the gold the more rapidly it is dissolved by the chlorine.

175. You speak of various other methods of treating ores, such as roasting; and you say it is

necessary to send some one to the United States to know all about these roasting processes?—Yes; a person would have a better opportunity of seeing them carried out there upon a much larger scale than in any other place in the world. I think there are many different systems employed in America.

176. Do you not think that any man well acquainted with metallurgy would be acquainted with all the details of them?—I question that, for there are plenty of men who know metallurgy pretty well, yet, when they come here, are of little use; their theory may be all right, but they do not always put it successfully into practice.

177. That may be so, but I should not call such men metallurgists. You have told us about the reverberatory furnace, Bruckner cylinder, and other furnaces: do you not think that all the details of these are known to competent metallurgists?—Yes; every man has his own opinion, but you will scarcely find two men that have the same opinion on this subject. You may perhaps find two opinions which coincide, but you will not get every one to agree to which is best; each claim advantages for the particular furnace he has been accustomed to.

178. Can you give us any idea what the experience has been in America in reference to the various methods of roasting, or to what it tends?—Roasting is carried out there upon a very large scale; furnaces are largely used throughout America. It is found that they get better results more cheaply by the use of the Stetefeldt furnace; it is found to work more cheaply than the reverberatory furnace, for this reason: that there is less manual labour connected with the Stetefeldt; the stuff goes into a hopper at the top, and it is chloridized when it gets to the bottom. The reverberatory furnace, on the other hand, requires an amount of manual labour; and not only that, but it requires a certain amount of skilled labour in attendance upon it to know when the sulphides are properly roasted, and ready to go on to the next stage that is to convert the sulphides into sulphates and oxides of the metals.

179. Then you say that the Stetefeldt, and not the reverberatory, furnace is the most likely to succeed?—I do not give any opinion on that. I have never seen the Stetefeldt at work; I only state, from what I have read in the American papers, that the Stetefeldt is the most economical to work on a large scale, and cheaper than the reverberatory furnace.

180. *The Chairman.*] Why cheaper?—Because there is less manual labour required.

181. *Mr. Allen.*] Is it more costly to build?—Yes, it is more costly to build.

182. Then with regard to the Bruckner cylinder?—That is more expensive to work than any of the others.

183. Has it succeeded?—Not well: it is too costly: it is a very effective furnace, but it is too costly to work, and keep in proper repair.

184. Now, with regard to smelting processes, do you think that a man going to America would make himself acquainted with all the latest and best methods?—I say that a man who knew his business would come back with a very large amount of valuable information. But, if the man had no practical knowledge on these subjects, he would bring back very little.

185. Do you think that a man going to America would be allowed to see the latest processes at work?—I am certain of it. I find from correspondence from persons there that they are only too happy to show all they can to any one that comes there from a distance for the purpose of getting information. They perhaps would not show the people of the place, lest it should subject them at times to inconvenience. They might have particular reasons for objecting to persons going through the works. When I visited Sandhurst I was told that objection would be made to my seeing some of the mines. I was told when I wanted to visit Lansell's 180 Claim, Sandhurst, that there was not the slightest chance of my getting down. But I drove up to the manager's house, told him who I was, and the reasons for which I came there. He told me that he would be glad to show me anything that I wished to see. He said that he had been obliged to make the rule against visiting the mine to prevent people coming there who were sent round to get information for stock-exchange purposes.

186. Do you think that he would be allowed to go to a place where they were working tellurides; where they were working with copper ores?—There might be particular reasons in certain places why they would not allow you to see their work. There are secret works in every country, but, as a general rule, no objection is made, according to what I hear from my friends there; they are glad to give information to any person visiting their mines for the purpose of obtaining information.

187. Do you think that a man going there would get all the information that is to be got about the amalgamation processes in use there?—I think he would be able to gain a very large amount of knowledge about them.

188. Would he be able to see their electric processes at work?—I do not know whether the electric process is worked in America or not; but I have seen it in Melbourne.

189. Was it a success?—It was not tried on a large scale. I would like to see it tried on a larger scale before giving an opinion on that point.

190. Do you know that it has been tried on a large scale in Hungary?—I know it has been tried in Hungary; but I do not know whether it has been a great success. They speak highly of it. I know that it is one of the best methods of cleansing quicksilver. When examining this process in Melbourne I asked the agent about it, and he stated that I might put anything I liked into the quicksilver and this process would cleanse it. As an illustration, we got a handbasin and mixed up a lot of quicksilver with antimony and anti-friction grease. After this mixture had been thoroughly beaten together into a pulp the mercury had lost all affinity for gold; but, after placing the negative pole into quicksilver and the positive pole in the water directly above the surface of the quicksilver, you could see the black scum come boiling out, and the quicksilver became perfectly clean in a very short time.

191. I can tell you that it has been tried in Hungary with success?—As far as theoretical

process is concerned, it is an absolute success. Nothing will clean quicksilver like electricity. But I am told that it is not a financial success; but I do not know that.

192. Then, as to the lixiviation process, do you think that a man going from here, unless he possesses a very large amount of chemical knowledge and very large experience as well, would gain any good from seeing that process in America?—I think he would gain a knowledge of the principles adopted in the lixiviation process. Of course, a man would have to understand chemistry; but a person need not know every branch of it. I do not think a knowledge of organic chemistry is required.

193. With regard to pan-amalgamation that is used in America, do you think it would succeed at the Thames?—I question it very much; at any rate, it would be so much gained to see the application of using chemicals in amalgamating in America, and whether any others are used besides sulphate of copper, salt, and iron. They use these in the amalgamating process according to the class of ores they have to deal with.

194. It is about these chemicals that I wish to ask you. Do you think he would gain any knowledge of chemical reactions in America?—I do not know that he would gain any knowledge about the reactions, for any one that knows chemistry would have considerable knowledge of chemical reactions. What is wanted by sending a man to America is to get a knowledge of how certain things are done on a large scale. We may be right in the method of extracting gold from ores upon a small scale, but it would be so costly to apply these methods on a large scale that the result would be utterly valueless. We want to know how to apply methods on a large scale, which in America are found to pay.

195. What is the result of your reading in regard to pan-amalgamation—as to the use of chemicals in that process: does it affect the amount of extract at all?—In some cases it does.

196. Do you think there is a consensus of opinion in America upon the subject?—Yes, I think it is very general. According to the American papers which I have read on the subject there is great discussion as to whether these chemicals are not used too extensively; that is to say, whether the employment of less chemicals might not have a more beneficial effect.

197. Have you read the Transactions of the American Institute of Mining Engineers?—Yes; I belong to that institution.

198. Have you read of the hyposulphite process?—Yes; the leaching process both with sodium hyposulphite and with calcium hyposulphite.

199. The chlorination process?—Yes.

200. The double hyposulphite process?—Yes.

201. Then you really think that a man going from here would pick up some useful information which we have not, and more than a man coming from there would bring us?—Yes; because a man may be educated as an engineer, and yet, after finishing his education, he is only beginning to learn his business. We might get a man from there who had plenty of theory but not sufficient practice.

202. What is meant, then, is a man who should be well established both in theory and in practice?—Even then a man might have practice in dealing with a certain class of ores, but when he came here he would find a totally different class. We want information, not merely on ores or classes of ores, we want a good deal of other information as well on other subjects connected with mining.

203. *Mr. Larnach.*] I think that, some years ago, you went to Australia on an errand of this kind?—Yes.

204. How long were you there?—Nearly four months.

205. You saw most of the mining districts?—Yes; I went through nearly all the mining districts of Victoria and New South Wales. I did not go to Queensland.

206. Did your visit do any good?—I think it was effective towards some good.

207. From ocular demonstration, did you educate yourself in anything practical?—As far as I was concerned I got a good deal of information. I had to open my eyes when I found that I was rather in a groove about things that I did not believe in before.

208. You made a valuable report?—Yes, I made a report.

209. Do I understand that, in your opinion, you cannot master a subject by seeing a description of it without any practical acquaintance with it so well as you could having a practical knowledge, and then seeing it for yourself?—You can understand any subject far better by witnessing a practical demonstration of it. You can master a description of it, but not so well as seeing the thing itself. If you have a practical knowledge of the subject, you can master its application more fully by seeing the process in actual operation. There may be many details which you cannot see if you only have a description of a thing.

210. Why do you think that a man coming from America with full knowledge of the various processes would not give as good information as a practical man sent from here to that country?—If you get a man acquainted with all the different systems he could give you that information; but the great difficulty is to get a man of that description.

211. My drift in asking the question is to ascertain from you whether, in your opinion, a man coming here, even with experience of the various processes resorted to in America, would be as useful in affording information as the man similarly educated in this colony, and acquainted with the various processes adopted here, who would go to America for the purpose of seeing what information he could get of the American processes that might be made available in New Zealand; or, putting it briefly, which would be the most use, the practical man who went from here to America for his knowledge or the practical man who came from America to this colony to show us what they were doing there?—If you get a man acquainted with all the various processes of treating ores in America, and a man with a similar knowledge of the ores going from here to America, these two men would, as far as the treatment of the ores are concerned, be on the same basis; but I

think a man going from here with that knowledge, and also a knowledge of the various classes of mining in this country, would obtain more valuable information respecting mining generally. We not only want information as to the proper treatment of our ores, but also to be fully conversant with every class of mining that is carried on here, to see if an improved system cannot be introduced whereby the working of our auriferous drifts and metalliferous lodes can be made to give larger returns.

212. Do you not think that a practical miner with a knowledge of engineering, and having a knowledge of chemistry, going to America, and understanding the systems in operation there, acquainting himself with all the systems in vogue in America, would be of use in giving information here?—If you send a capable man from this colony, a man acquainted with the various processes and treatment of ores, the systems in mining, and with mining-machinery, I think the colony would derive more benefit from sending such a man there than if you were to get a man from America to come here.

213. If a man came from America here he would have to acquaint himself with the different classes of ores and methods of mining in this colony before he could be of any use?—Yes.

214. I presume it would be desirable, if the colony resolved to send a man to America, he should also have a practical knowledge of machinery?—Yes; a man must also have a certain knowledge of chemistry, and he must know how to apply it, or else it would be of no use for him to go. He must have a knowledge of what mining is and the modes of carrying on mining-works; likewise a knowledge of New Zealand auriferous and argentiferous ores and drifts, and the methods of working here. It would be no use to send a man unless he possessed a knowledge of these things.

215. You are aware that there are large smelting works in Saxony and Freiburg: do you think a good knowledge could be acquired by a man going there, or do you think it would be desirable to send a man to both these places?—I am afraid, from what I have seen, that we have very few ores in New Zealand fit for smelting. In Freiburg they get ores from all parts of the world and mix them together, so that the one class of ore acts as fluxes to the other. It is only by mixing these ores up together that they can be economically treated by the smelting process. We have very few ores fit for smelting in the colony.

216. I suppose that five months would be ample time for a man to see all that was required?—A man would see a great deal in five months.

217. *Mr. Allen.*] It would be a nice trip?—Well, I do not know about that. I know that when I was travelling over the Australian goldfields I had to spend, in some instances, night and day in travelling, and I began to think, towards the latter end, it was not altogether a nice trip. Any one going from here to America to gain such information as we require must make the most of the time at his disposal, and be prepared to work hard to make his visit of value to the colony.

218. *Mr. Duncan.*] You said that you got a good deal of knowledge in your trip to Victoria; has that knowledge been applied to any mines with official result; and, if so, what mines?—I must say it is very hard to tell, and for this reason: that the mining class are about the most conservative class in the world. They say, "My father did this;" or "This is what my father did, and I will do the same thing." It is not in a day or a year that you will accomplish anything with them. It is only by time and discussion that these things are brought about. It is hard to say what result may have been obtained; but I think that it has been the means, in reference to the working of pyrites ores, of convincing them that it is necessary to put up roasting-furnaces.

219. *Mr. Allen.*] Have any pyrites works been started here?—I believe there was one at the head of Lake Wakatipu, but it was not a success.

220. *The Chairman.*] Do you think it would be of any benefit for the person going to America to take with him samples of different ores—say of the three classes of ores from the Thames District—to have them treated and tested, so that it might be known what percentage of metal they yield?—I think it would; they would be valuable for the means of comparison, if nothing else.

221. Your evidence is subdivided into two parts: do you think it is possible to get a man well up in chemistry, with a thorough knowledge of smelting processes and the extraction of metals, and a practical knowledge of the means adapted to working auriferous drifts?—They are two different branches. One branch scarcely follows upon the other.

222. Then, in that case, taking into consideration the tenour of Mr. Allen's questions, you would require two men, one in respect of smelting works, the other with a knowledge of workings?—Not necessarily; there might be a man who knows both; but it is essential to have a knowledge of chemistry and also mining machinery and mining in all its branches.

223. *Mr. Allen.*] I do not admit that was the tenour of my questions; but do you mean, Mr. Gordon, to say that a man like Eaglesim does not know both processes?—I question whether a man like Eaglesim would be of much use to us, except as a professor to lecture on the subject; but this is not altogether what we want. I do not think he could show us how to get clear of boulders and carry on hydraulic sluicing operations. I think you could hardly get one man to take up the treatment of ores and go at the same time into all the details of hydraulic sluicing.

224. Is there a possibility of getting one man in New Zealand that has a thorough knowledge of the practical processes and methods of extracting metals from ores?—It would be a very hard thing to get one in New Zealand.

225. With regard to the school of mines, do you think that in the present position of the colony, gold and silver extraction is the only thing that ought to be taught in a school of mines?—That is not the only thing taught there; they are taught a knowledge of other metals; of copper and iron, &c.

226. A knowledge of copper in the school of mines?—That is, knowing copper-ores when they find them, and a knowledge of the modes of extracting the metal.

227. Do you mean to say that the extraction of metals is taught there?—I say it is to a certain extent.

228. To what good is that?—I say that the schools of mines have done a great deal of good in this way; they have, for instance, enabled mining communities to know zinc-blend, copper-ore, cinabar, and other ores when they see them; if they see an ore now, they are in a position to say, "This contains tin," or "This contains copper," or "This contains iron," as the case may be; you can find many of the students to tell you a great deal about minerals as well as gold.

229. That is mineralogy; but I want to know whether the treatment of copper-ore for the extraction of the copper, which is metallurgy, is taught there?—No.

230. Or can it be?—No. There are no metallurgical works here.

231. Do you not think a school of mines, to be of any use, should teach the comparative methods of extracting metals?—These schools were established for the purpose of giving mining communities a knowledge of the ores which they find on their goldfields, which knowledge they could not otherwise have had.

232. Do you not think that it was the school of mines that has revolutionized the whole history of England?—There is no doubt that in great centres, such as London, and in other places, you can get up large schools of mines, where everything is taught. But here it would be an utter impossibility to get up such schools. We have neither the people to attend them nor the funds to carry them on.

233. There are no very large schools of mines in London, and there are not a great many who attend the schools there; but do you not think that the work done by the school of mines in London has revolutionized the iron industry of England?—I do.

234. No question about it: why, then, should we not establish a central school attached to a teaching body, such as a university, which might revolutionize the methods of treating ores here the same as has been done in England?—My answer to that is, that it is a question of policy.

235. *Mr. Cadman.*] Can you tell me under whose control is Professor Ulrich?—Under the Otago University, I believe.

Mr. Larnach: The Minister of Mines has the right to ask him, during the six months that the University is not in session, to do work for the Mines Department. I have before stated that Professor Ulrich is not able to travel in consequence of some injury he has sustained. For that reason, the Mines Department, I believe, has never got much of his services.

Mr. Cadman: You say that, to a certain extent, Professor Ulrich is under the Mines Department.

Mr. Larnach: We can send to him things to be tested or for analysis when they are required. We can send him specimens of mineralogy to be named.

236. *The Chairman.*] How long, Mr. Gordon, have you been in connection with the Mining Department?—Five years.

237. During that five years have services been rendered by Professor Ulrich to the department?—Yes; on several occasions. He has reported on several things during that time.

238. What do you mean by several things?—He has reported on the auriferous nature of the country in the vicinity of Ross on the ground that would be commanded by the Miconui Water-race, if it were ever constructed. I think he has reported on the Mount Benger District, and Green's Reef, in Otago; also on Mount Ida and Longwood Districts.

239. Then you had five reports for £500 a year during the last five years?—I cannot exactly tell the number of reports we have had.

240. Then the amount paid by the colony to Professor Ulrich would be £2,500?

Mr. Larnach: I am not sure; but I think this £500 a year was only paid within the last two years.

241. *Mr. Allen.*] Was it paid last year?—Yes.

Mr. Larnach: It has been paid.

Mr. Allen: It was put on the estimates.

Mr. Larnach: The money has been paid.

242. *The Chairman.*] Then what you term "schools of mines" have taught assaying to miners throughout the colony?—Yes.

Mr. Allen: Thoroughly, I understood Mr. Gordon to say.

Mr. Larnach: Sufficiently for their purpose.

243. *The Chairman.*] Do you think the teaching the miners have received in that direction is in itself sufficient to warrant the establishment of the schools?—Yes; I think it has been a great boon to the miners and a benefit to the colony that the schools of mines have been established. We do not see the results as yet, but there is no doubt they will be the means of producing good fruit.

244. *Mr. Allen.*] How long do you think it would take to teach assaying thoroughly of gold-ore alone, working six hours a day?—In the American schools they have there one session devoted to this.

245. There is one question I would ask you about Professor Ulrich. Do you think that the gain to the colony of his teaching results only from his visits to particular parts of it: is there no gain to the colony from the students he has turned out?—There is no doubt of it. We have one of his students at the Thames, who is a credit to the colony.

246. Do you think that the students turned out from the school of mines in Dunedin are sufficiently trained in the metallurgical extraction from ores?—I question it very much; I do not think they have had sufficient opportunity.

247. Are they well tried in mining?—Yes, I understand so; that is, the principles of mining, but not in the practical working of mines.

248. Are they well trained in mineralogy?—Yes, in mineralogy.

249. But not in metallurgical extraction from ores?—I question it, except so far as the testing of small samples.

250. That is not my question. Are they in metallurgical extraction from ores?—I do not think that in metallurgical extraction from ores they are.

251. *The Chairman.*] Have you any idea what number of these students are following up their profession in the colony?—I could not tell; we employed Mr. Buteman for a very short time, and there is Mr. Montgomery at the Thames, Mr. Fenton at Reefton; but I cannot say whether he was a student of Professor Ulrich or not.

252. *Mr. Larnach.*] Do you know whether Professor Ulrich has a large number of students?—I do not know how many he had last year; I think he had two or three the year before.

253. *Mr. Duncan.*] How many schools are there at present?—Twenty-four.

254. Do you not think it would be just as well if there were fewer?—I hold that the system was a good one in order to get the mining community to take an interest in the subject, but now fewer schools and more taught in them would be better. They have, however, done good work so far by enabling the miners to become acquainted with the various ores when they see them, and also to be able to test their value. It was never contemplated to carry on these schools in every part of the colony. The intention was to educate the miners so that they could carry them on themselves, so that by having a laboratory in every little mining centre they would be able to test all the ores they met with. After the importance of these schools become generally known I believe it was the intention that they would be carried on without teachers paid by Government.

APPENDIX.

REPORT of PROFESSOR BLACK.

SIR,—

University Laboratory, Dunedin, 2nd December, 1887.

I have the honour to inform you that I am writing for you a report on the working, present condition, and constitution of the goldfields schools of mines, and, so far as I can obtain them at short notice, the number of members enrolled in the classes of same.

I shall have this report prepared and forwarded to you by the mail that leaves Dunedin on Monday next, reaching Wellington on Wednesday, the 7th instant.

I am writing my report under the following heads:—

1. The expenditure on these schools up to date, and showing Government subsidies and local contributions.
2. The property now possessed by these schools under the particulars of (a) lecture-rooms, (b) assaying-plant, (c) chemicals and chemical appliances, (d) collections of minerals, (e) books relating to their studies.
3. The growth of the schools to their present state.
4. The requirements of the mining districts in the matter of technical education such as these schools afford.
5. The work already done by the schools.
6. The subjects that should be taught in the schools.
7. The plan on which, in the light of three years' experience with them, I wish to recommend that these schools be conducted, officered, and subsidised.
8. The number of members enrolled in the several schools so far as I have the necessary information.

I have, &c.,

The Chairman, Goldfields Committee, Wellington.

JAMES G. BLACK.

SIR,—

The University, Dunedin, 3rd December, 1887.

I have the honour, in compliance with your instructions, to report on the working of the goldfields schools of mines, and on the number of members now enrolled in them.

In doing so, I must first express my regret that my information as to the numbers on the rolls is not quite accurate; and that the figures given in that particular are only the best approximation I can make. I have, for the sake of clearness, arranged in tabular form (Table A) the most important particulars relating to the schools on the West Coast and Otago.

I have not included the Thames School of Mines and its branches in this table, as my information about those is very incomplete.

TABLE A.

	Local Contributions up to November, 1886.	Members now on Roll (Approximate).	Annual Fees now due.	County Councils now due.	Local for Buildings.	Local Total to Date.	Value of Buildings.	Value of Teaching- appliances.
	£ s.		£ s.	£	£	£	£	£
Ross ...	39 10	45	22 10	10	Free	62	Free	30
Rimu ...	25 0	36	18 0	9	20	72	20	25
Kanieri ...	20 0	25	12 10	6	15 ?	53	15	10
Hokitika ...	30 10	40	20 0	10	50 ?	110	Free	120
Stafford ...	17 0	30	15 0	7	Free	39	"	60
Kumara ...	47 0	50	25 0	10	60 ?	142	75 ?	80
Greymouth ...	15 0	50	25 0	?	80	120	150	70
Reefton ...	25 0	50	50 0	?	150	225	300	100
Boatman's ...	...	40	20 0	?	100 ?	120	200	...
Westport ...	14 0	30	15 0	?	75	104	75	60
Denniston ...	25 0	50	25 0	?	50	100	100	25
Lyell ...	...	40	20 0	?	20	40	...	...
Takaka ...	...	40	20 0	...	...	20	...	...
Nelson ...	...	50 ?	25 0	...	35	60	Free	70
Orepuki ...	10 0	40	10 0	?	...	20	...	...
Riverton ...	20 0	20	10 0	?	...	30	...	20
Lawrence ...	70 0	20	10 0	?	...	80	Free	120
Wetherstones ...	Included in Lawrence	60	30 0	...	...	30	...	...
Waitahura ...								
Bluespur ...								
Waipori ...	10 0	60	15 0	...	...	25	...	15
Roxburgh ...	...	40	10 0	...	...	10	...	...
Bendigo ...	3 0	10	5 0	...	...	8	...	5
St. Bathans ...	5 0	20	10 0	...	...	15	...	10
Naseby ...	...	30	15 0	...	...	15	...	60
Bannockburn ...	25 0	50	25 0	...	...	50	...	70
Queenstown ...	...	20	10 0	...	...	10	...	50
Skipper's Point ...	...	20	10 0	...	...	10	...	...
Skipper's ...	...	40	20 0	...	...	20	...	...
Totals for West Coast and Otago	401 0	1,006	493 0	52	655	1,590	935	1,000

This table requires some explanation: (1.) The amounts stated in the second column as "Local contribution up to November, 1886," is virtually correct. (2.) The numbers in the third column, under "Members now on roll," is only approximately correct. The column represents the average number on the rolls since the formation of the schools rather than the members on roll at present, as I have no reliable information as to what the present numbers are. The numbers, however, do not include schoolboys, except, perhaps, in the case of Ross. (3.) The amounts stated in the fourth column as "Fees now due" will not, of course, be paid, as the schools are announced to be abolished. (4.) I am not able to ascertain, without delay, what amounts are voted by County Councils, except for the Westland County schools. (5.) The amounts in the sixth column, "Local for buildings," is a good approximation. (6.) The "Value of buildings," in the eighth column, is also only an approximation. Indeed, I am not sure whether the building at Westport is yet completed. Besides, the buildings at Westport and Boatman's are, I understand, of a superior class, and designed to accommodate not only the schools of mines, but also to serve as a reading-room and athenæum for the general public. (7.) The value of "Teaching-plant," in the last column of the table, includes assaying and chemical appliances and mineral collections and books on the subjects of study.

An inspection of the table for the Middle Island shows—

Total local contributions to date (provided the schools were to be continued, and therefore the fees now due available) ...	£1,590
Total local contributions realised to date ...	£1,108
Total value of assets, including buildings, chemicals, mineral collections. (Of this sum of assets £400 belongs to the Reefton school and £1,535 to the others) ...	£1,935
The total membership on rolls (average). (This does not include about three hundred schoolboys in Nelson and West Coast and Otago who enjoy the benefits of the classes) ...	1,006

Origin and Growth of Schools.—The growth of the schools has been very rapid, and has been going on during the last year much more vigorously on the West Coast than in the previous years. The movement began at Lawrence in November, 1884, just three years ago; and up to the 1st

November, 1885, very little was done, except to form committees to get Government aid for the schools they proposed to form. In November, 1885, I visited the Thames Goldfield with Messrs. Montgomery, Fenton, McLymont, and Goodlet; and the result of our five weeks' visit was the formation of the Thames School of Mines, with a Hauraki Gulf subscription-list of £512, and branch schools at Coromandel, Karangahake, Waiorongomai, and Te Aroha. During the same year, 1885-86, about £150 was collected on the West Coast for the purchase of chemicals and apparatus, and in Otago about £100 for the same purposes. In 1886-87 the Thames increased its contributions by fees and subscriptions for chlorination to I know not what amount; and the West Coast and Nelson schools increased their local contribution by an additional sum of £805, and Otago by £100. This great increase during the year that has just expired proves incontestably the strong hold that these schools have taken of the miners, and shows in a strong light the wrench that will be done to their best aspirations by their extinction, if such should be their fate.

I have written to the secretaries of the West Coast schools for more precise information as to the number of members that will be willing to join the classes on the revised basis shown in Table B of this report. But I am afraid there will not be time to have it ready for forwarding to you until it is too late for your purpose.

To meet the present requirements of the Middle Island, schools would be required at all the places mentioned in Table B. Within the last three months the miners at Takaka, in the Collingwood District, have collected £20 for the purchase of chemicals, the Nelson school has imported seventy pounds' worth of chemical appliances, and the schools at Boatman's, Orepuki, and Waipori have put in claims for appliances as a subsidy on additional local subscriptions for the purpose.

The Requirements of the Miners for Technical Instruction.—The rapid improvements now being made in gold- and silver-saving processes, and the extensive use of chemical substances in these, require special technical skill on the part of miners. The old methods alone will be available to our miners until they learn something about the chemistry of such substances as the following: Chlorine, sodium, sodium amalgam, nitric acid, muriatic acid, sulphuric acid, cyanide of potash, corrosive sublimate, saltpetre, chloride of lime, lime, common salt, carbonate of soda, iodide of soda, hyposulphite of soda, hyposulphate of lime; the action of these on each other, their actions on the metals and on the ores, when to use them, and how.

There has been a great deal of gold lost to the colony already from the want of such knowledge; and a great deal of most valuable ores are now allowed to escape down the creeks for the same reason. I am constantly getting samples of iron-pyrites, copper-pyrites, and antimony sulphide, all containing from 1oz. to 40oz. and 50oz., and sometimes to 100oz., of gold per ton; whilst there is no free gold visible in the stone. Blanketings also, from which the battery-manager has taken all the gold he can, are found to contain as much as 40oz. to 50oz., and in one case 201oz. per ton. Such tailings have, in many mines, been allowed to go down the creeks for many years. There has also been an enormous loss of gold and mercury, due to the sickening of the mercury and the fouling of the copper-plates. This loss is due to an imperfect knowledge of the causes of the flouing, and of the chemical substances that prevent it. There is also a great deal to learn about the removal of gold from old copper, old iron, and from the accumulations of rusty materials that are sometimes found at batteries long in use. Improper methods of roasting gold-bearing stone have also caused a great loss of gold. The introduction of the chlorination processes will require special trained skill in roasting our rich pyrites. This pyrites is a common thing on all our goldfields; and when it exists in sufficient quantity, and of a certain degree of richness, it is suitable for the chlorination process, the first step in which is roasting in a particular way, which the untrained miner is not acquainted with, and which he cannot learn correctly from books or descriptions. These, and all other processes, must be practically carried out in presence of the miners, and, indeed, by the miners themselves, to have any good results.

One of the most important kinds of knowledge for the miners in a country abounding in minerals is, of course, the knowledge how to find out whether a stone does or does not contain such metals as gold, silver, tin, lead, antimony, mercury, copper, zinc, platinum; also, whether it is scheelite, chrome-ore, manganese-ore, &c.; and, secondly, how to find out for himself what proportion of such metals a stone contains. It used to be considered a mysterious operation to find out these things. But in reality there is nothing simpler than to impart this knowledge to our miners. It is well enough known that miners bring a great amount of intelligence and aptitude and enterprise to whatever they engage in; and I know, from my experience among them, that hundreds of them learn very easily and very rapidly the processes of testing stone, both qualitatively and quantitatively, for these valuable constituents. Indeed, if such were not the case, I would have nothing to do with them.

But I am not going to trouble your Committee with details of the many directions in which valuable information is sown broadcast through the mining districts by these schools of mines. The miners in our colony are cut off from much communication with other mining countries; they have been here mostly for a long time without much infusion of new blood, and they cannot be aware of the present state of the mining industry and processes that in America and some parts of Australia make stone pay handsomely which they cannot touch here. The diffusion of accurate and detailed information on all mining matters all over the world will itself be a valuable factor in improving our processes.

The Nature of the Work already done by the Schools of Mines.—The amount of practical information which has been diffused among the miners of the colony cannot, of course, be stated in figures. I can, therefore, only point out what subjects are taught in the classes, and state generally that, in my own presence, something like three thousand individual miners in the colony have been present and have seen the experiments performed whilst these subjects were taught by myself and assistants. Nothing like that number of men are able themselves to apply the tests and repeat the experiments and interpret aright the results of them; but I can say that in the district under Mr.

Fenton's charge, extending from Westport and Denniston to Reefton and Lyell, something like two hundred and fifty men have seen the process for assaying gold- and silver-bearing stone; and probably about one hundred and fifty men in that district could now be intrusted to conduct accurately such assay for themselves. I do not know that more than two hundred men in Mr. McLymont's district—Greymouth to Ross—have seen assaying fairly carried out; and of these probably a hundred miners could do it themselves. I am not in a position to know what has been done in the Thames School of Mines in the way of teaching the process for assaying stone; but I know that on my visit to that district, two years ago, four hundred men had seen Mr. Fenton's process; and, had the schools at Coromandel, Karangahake, Te Aroha, and Waiorongomai, been carried on according to my programme, we should have four hundred men there now who could assay stone for gold and silver, lead, tin, and antimony by the fire process with perfect success. In Otago I should say that four hundred men have seen the process, and, of these, that one hundred and fifty men could carry it out. Much progress has been made in teaching the chemistry of gold-saving agents, such as chlorine, the various acids, sodium amalgam, and several salts; the use of these, and their mode of application; also in the roasting of ores, and the easier methods of testing minerals by the wet processes and the blowpipe.

The schools have now arrived at the stage when more rapid progress would be expected, for the two following reasons: (1.) Their lecture-rooms and laboratories are now rapidly getting fitted up with the necessary teaching-plant. Indeed, it is only within the last few months that the schools at Denniston, Westport, Boatman's, Greymouth, and Kumara got suitable buildings for themselves. (2.) The studies of the classes hitherto have only prepared the miners and older schoolboys for entering on the more important and advanced and practically-useful subjects of testing and assaying complex minerals for the metals they contain. Among the advantages which many hundreds of the miners have derived from these schools I must also mention the practical information they have received on every goldfield about the methods of removing the gold from old copper-plates, and of extracting it from the old iron retorts which have been long used for retorting amalgam; also the cupellation process of cleaning, by means of bone-ash and lead, the dirty gold which is otherwise not saleable. The attention drawn to the fact that at Reefton and other quartz-mining districts much gold goes away in the tailings—often up to 1oz. per ton—is the first step in bringing about improved means of getting better returns, especially when the mine- and battery-managers are themselves becoming experts in the testing of such tailings. The teaching of a thousand miners how to identify such valuable minerals as scheelite, chrome-ore, and the black oxide of manganese must also be placed to the credit of the schools.

The best feature in Mr. Montgomery's last report to the Minister of Mines is that at the Thames School of Mines he has about a hundred and twenty schoolboys attending his chemistry and testing and blow-pipe classes. I know Mr. Fenton has also a considerable number of boys from twelve to sixteen years of age in his assaying and blow-pipe classes, and I can testify that these boys can, as the results of Mr. Fenton's teaching, assay quartz or iron-pyrites with great accuracy. I do not know how far Mr. McLymont carried out my instructions to form classes, wherever he was, of the same kind. In Otago such classes made great progress under Messrs. Harman and Goodlet at Riverton, Waipori, Lawrence, Bannockburn, and Naseby; and I consider these boys' classes an excellent feature of the schools.

Number of Members enrolled in the Classes.—I regret that I am not in possession of full information on this subject. But the benefits of the instruction given at the schools are not confined to the enrolled members, because the classes are, in most cases, open to and attended by some miners who are not on the rolls; and, indeed, during my own visits all my lectures and testing-classes are attended by large crowds of miners, the attendance on these occasions ranging between 60 and 250—giving for the West Coast and Nelson an average of about 120 and for Otago an average of 70 at each meeting. It must, however, be confessed that, although a good deal of useful information, which can in many cases be turned to good account, is given in these lectures of mine, yet their main object is to draw attention to the benefits that can be derived by a course of study in the practical classes that are carried on during the longer periods by my assistants. It is therefore by the attendance at these practical classes that are held during my absence that the success of the schools must be judged, and I regret that I have not got accurate information to give your Committee. I have, however, ventured to state in Table A of this report the average number of the members enrolled in each school on the West Coast and in Otago for the last two years. The numbers fluctuate a good deal from time to time. I have taken them chiefly from reports of the presidents of the schools to myself, and partly from information from the instructors—Messrs. McLymont, Fenton, Harman, and Goodlet; at the same time I must observe that three circumstances have all along militated against large numbers in several of the West Coast schools—namely (1.) The want of lecture- and class-rooms at the important centres of Kumara, Denniston, Greymouth, Boatman's, and Westport. These wants, I am glad to inform your Committee, have now been supplied in a most satisfactory way. (2.) The failure of Mr. McLymont to make himself acceptable to the general body of miners, and especially to the schools of mines committees and members in the important centres of Rimu and Stafford, and only partially in Kumara and Greymouth: he explains his partial failure in the last two cases by the circumstance that they had not in these places any suitable accommodation for classes; and (3.) The uncertainty in the minds of the miners about the continued support of these schools by Government subsidy. I am not sure that there is much in this last reason, although it will go far to annihilate any local efforts now that Government has suddenly withdrawn their support. The year's term in most of these schools is in the present month; and the result of the discontinuance of Government support will simply paralyse all efforts to keep these schools alive. From Table A, above referred to, the number of enrolled members must be taken during the year as 576 for the West Coast schools and 430 for the Otago schools.

This, I suppose, is the proper time to say that I am, on the whole, much disappointed with the number of students enrolled in the various classes of the Thames School of Mines, as shown by Mr. Montgomery's last report to the Minister of Mines. I do not wish to criticize the policy of the committee of the Thames School of Mines Association, because I know it is composed of excellent and shrewd men; but in carrying on their functions they have departed widely from the scheme advocated by me. They have utterly abandoned the schools that I had inaugurated with great success in the important centres of Coromandel, Karangahake, Te Aroha, and Waiorongomai; and the result is that, instead of having classes for testing and assaying the ores attended by from three hundred to four hundred miners on the Hauraki Gulf, they have only a roll of some twenty miners and a hundred and twenty schoolboys.

The schoolboys are the redeeming feature of the Thames School of Mines, as well as a great feature of the West Coast and Otago schools; and I desire to call your attention as emphatically as I can to the fact of so many schoolboys in each Island learning mineral chemistry and the chemistry of gold- and silver-saving agents at these schools. With the lecture-rooms and laboratories now provided and fitted up and supplied with teaching appliances at the West Coast centres, and with a judicious instructor appointed to the Greymouth-Ross District, there is no doubt that there would be immediately a large accession to the membership of these schools.

In taking it on myself to recommend to you the reconstitution of the schools of mines on the basis of Government subsidy of £2 for £1 subscribed locally, such Government subsidy not in any event to exceed £1,870 for the whole colony, I think I am indicating a practical way out of the difficulty which at present confronts us. This basis is shown in Table B of this report. In connection with this new basis I wish to point out that, whilst the Government subsidy would not in any year exceed £1,870 for the whole colony, it might very well happen that it would fall considerably below that amount. If, for example, the local contributions of the supporters and members of the schools were to fall to, say, £600, the Government subsidy would be reduced to £1,200. The Government subsidy would indeed be measured by the success of the schools, and there would thus be a good guarantee that the money was being well spent. Of course, any sum contributed by the members of a school in excess of their quota under this Table B would go to supply chemicals and other appliances for the classes.

In conclusion, you will allow me to say that it will be a most calamitous thing for the goldfields to allow these schools to go down now that they have established themselves in homes of their own. Their property, in the form of teaching appliances, mineral collections, and buildings with their fittings, cost £1,535, without including the Thames and Reefton schools, which are proposed to be retained. These chemicals and collections, and in most cases the lecture-rooms, will represent so much money thrown away—money partly contributed by Government and partly by the miners on the strength of their faith in the assurances given them of Government support. I have not by any means given up the hope that the Government will be advised to continue these schools on some such basis as I have sketched in my proposals embodied in Table B. If it be otherwise determined, I can only protest that the scheme of technical schools has been abandoned, not by myself nor by the miners, but, after a most decided and indeed unparalleled success, by the Government of the colony.

The Chairman, Goldfields Committee, Wellington.

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

TABLE B (referred to in above Report).

TABULAR VIEW of MIDDLE ISLAND SCHOOLS of MINES (embodying proposed new Basis for the Reconstitution of the Goldfields Schools of Mines for the West Coast and Otago).

Name of School.	Annual Contribution.	Single Classes conducted by a Member of Teaching-staff, showing the Number of Weeks each Place will be entitled to.	Group Classes conducted by a Member of the Teaching-staff, showing Length of Teaching-session.	District Classes conducted by a Member of the Teaching-staff.	Visits of Professor Black and W. Goodlet.			
	£	Weeks.	Weeks.	Weeks.	Weeks.			
Nelson	25	} 5	5	5	} 4			
Collingwood	10							
Owen	15		5	5		5		
Lyell	10	3	3	3	} 3			
Denniston	15	5	} 10	} 13				
Westport	15	5						
Charleston	10	3	3	} 29				
Reefton	50	18	} 26					
Boatman's	25	8						
Ahaura	10	3	3	} 25	} 3			
Nelson Creek	10	3	} 14					
Notown	10	3						
Greymouth	25	8	} 14					
Kumara... ..	25	8						
Dunganville	10	3						
Stafford	10	3						

TABLE B—*continued.*

Name of Schools.	Annual Contribution.	Single Classes conducted by a Member of Teaching-staff showing the Number of Weeks each Place will be entitled to.	Group Classes conducted by a Member of the Teaching-staff, showing Length of Teaching-session.	District Classes conducted by a Member of the Teaching-staff.	Visits of Professor Black and W. Goodlet.
	Weeks.	Weeks.	Weeks.	Weeks.	Weeks.
Hokitika	25	3	14	22	2
Kanieri	10	3			
Rimu	10	3			
Ross	15	5			
	£335				
Orepuki	10	3	6	9	4
Riverton	10	3			
Invercargill	10	3			
Lawrence	10	3			
Blue Spur	10	3	9	17	2
Waitahuna	10	3			
Waipori	15	5			
Roxburgh	10	3			
Alexandra	10	3	6	18	2
Clyde	10	3			
Cromwell	10	3			
Bannockburn	20	6			
Nevis	10	3	12	26	2
Black's	10	3			
Tinker's	10	3			
St. Bathans	10	3			
Naseby	25	8	14	11	5
Hamilton	10	3			
Macrae's	10	3			
Queenstown	10	3			
Arrow	10	3	5	...	2
Macetown	10	3			
Skipper's	20	5			
Skipper's Point	10	...			
Oamaru	10				
Timaru	10				
	£300				

This table explains itself. In the first column are given the names of the centres where schools will be established.

The second column shows the annual subscription that each school will have to raise to entitle it to the share of the time of the teaching-staff noted in the third column.

The third column shows the time to be devoted to each school by a member of the teaching-staff.

The fourth column shows the length of the teaching-session in each of the schools. This column requires a little explanation. Looking (for example) at the number 26 in the column opposite Reefton and Boatman's, it means that classes will be held in Reefton for twenty-six weeks continuously, and in Boatman's for twenty-six weeks; but, as these two centres are bracketed together, their classes will be carried on together—say, four days a week at Reefton, and two days a week at Boatman's. In the same way, looking at the number 14 opposite Kumara, Dunganville, and Stafford, it means that classes will be carried on at each of these places for fourteen weeks continuously, the class at Kumara meeting, say, three days a week, and at each of the other places meeting one day a week. In the same way, classes will be conducted at Greymouth, Nelson Creek, Notown, Hokitika, Kanieri, and Rimu for fourteen weeks continuously, the classes at Greymouth and Hokitika meeting three times a week, while those at the other places just named will meet once a week. There is no doubt that, in many cases, the classes that meet once a week under the Government instructor will arrange to meet by themselves more frequently to repeat the experiments shown by the instructor. This is our experience hitherto, and it is wonderful how rapidly these men qualify themselves for working independently.

In the fifth column is shown the number of weeks the instructors will be in the various districts bracketed together. During these periods he will be in easy communication with all his classes within the district.

The sixth column shows the duration of my own visit with Goodlet to the various districts. During these visits my duties will be to inspect the various schools, examine the students, an

deliver lectures on some mining subject, and visit any mines or reefs or localities of exceptional interest. If this system is to be carried out in its entirety (I have no doubt about the miners' part of it), there will be an annual sum of £2,805 available for the payment of an ample and thoroughly qualified teaching-staff and their necessary travelling expenses.

The expenditure in the different districts will, of course, be strictly proportioned to their contributions. Thus, at the Thames and for the branch-schools at Coromandel, Waihi, Karangahake, Te Aroha, and Waiorongomai, the sum of £900 per annum will be available; for the schools at Nelson, Collingwood, and on the West Coast, £1,005 will be provided; and for the schools on the goldfields of Otago, the sum of £900. These sums will provide for the services of two good men on the Thames Goldfield all the year round, and for the services of Professor Brown for part of the year; for two men on the West Coast all the year round, and my own services and those of my assistant (W. Goodlet) for three months in summer; for one man in Otago all the year round, a second man for six summer months, and my own services and those of "Willie" for three summer months. The time-table (appended) for the Middle Island is drawn up on the assumption that that number of instructors will be available. The Thames committee will co-operate with the committees at Coromandel, Waihi, Karangahake, and Te Aroha to organise efficient branch-schools at these centres.

The second column of the above table shows local subscriptions on the West Coast and at Nelson amounting to £335. This will earn a subsidy of £670, making £1,005 available for that part of the colony. The Otago subscriptions show £300, earning a subsidy of £600, making £900 available for Otago. The sum of £300 is suggested for the Thames and outlying districts, earning £600, and thus making a sum of £900 available for the requirements of the northern goldfields.

I have marked these sums as what, from my knowledge of the different districts and my experience of the miners, will be required and will be forthcoming for the support of the schools. If it should turn out that I have been too sanguine in my expectations of what the miners are willing and able to do to help themselves in the matter of these schools, I shall, of course, have to submit to my disappointment; but I have a very firm conviction that the miners will not shirk their part of the compact.

Such is the form the system of technical schools of mines will take if the principle of bringing the instruction within reach of the whole mining population of the colony is to be maintained. By carrying out this system as here outlined, and strengthening the Thames and Reefton schools as well as the Otago University School of Mines with additional and specialised teaching-power, and more liberal State aid, so as to foster them into first-class schools of mines, the colony will have done its duty in the matter of providing a system of technical mining education by which it will benefit a thousandfold. In drawing up this scheme I have followed the lines laid down by the Hon. Mr. Larnach, late Minister of Mines, as most suitable for the requirements of the colony.

The duties of such a teaching-staff would be to teach the miners and miners' growing-up sons in every mining district in the colony such subjects as the following: (1.) The chemistry of nitric acid, muriatic acid, sulphuric acid, aqua regia, common salt, saltpetre, corrosive sublimate, cyanide of potash, sodium, sodium amalgam, caustic soda, carbonate of soda, hyposulphite of soda, iodide of soda, lime. (2.) The properties and uses of these gold- and silver-saving agents (they are all used for these purposes), their action on each other and on copper plates, gold, silver, mercury, lead, tin, antimony, &c. (3.) The action of these chemicals on the ores and in the battery. (4.) The manufacture of sodium amalgam, its use for silvering the plates, preventing the formation of scum on them, preventing the sickening of mercury, and for reviving it when it has been sickened. (5.) The action of air, of water, and of acids on sodium amalgam. (6.) When to use sodium amalgam, how to use it, and how much of it to use for the different purposes and under different circumstances. (7.) The simplest way of testing stone to see whether it contains such metals as gold, silver, tin, antimony, bismuth, lead, copper, platinum, or zinc. (8.) The processes for assaying quartz, pyrites, and other minerals to see how many ounces, pennyweights, and grains of gold, silver, tin, lead, antimony, &c., they contain. (9.) The proper methods and conditions of roasting pyrites and other minerals that require roasting. (10.) The use of the blowpipe for testing minerals. (This is a most important branch of technical education for the miner, because the pipe and the necessary chemicals are so cheap and so easily carried about). (11.) The properties and uses of chlorine as a gold-saving agent, and the manufacture of that most important element from salt, sulphuric acid, and oxide of manganese, or from oxide of manganese and muriatic acid, or from chloride of lime and sulphuric acid. (12.) The different kinds of chlorination-plant in use, and practical experiments on a small scale to show their action. (13.) The different kinds of silver-ore (some fifteen in number), how to identify them and ascertain how much silver they carry per ton. (14.) The different processes now in use for extracting silver from the different kinds of ore, so that we may not—as in the case of the La Monte furnace for the Thames ores—let mining men commit the mistake of applying, at a great cost, a kind of apparatus for the treatment of one kind of ore merely because we know it to be the correct thing for quite a different kind of ore. It is partly from this view of it that I have always advocated the sending for the most recent information from the great silver-mining centres in America. (15.) The rational treatment of such complex ores as we have in abundance at the Thames, Karangahake, and Waiorongomai, in the North Island; as well as at Collingwood, Owen, Reefton, Ross, Waipori, and the Lammerlaws, in the Middle Island, and at D'Urville Island, off Nelson. (17.) The testing of scheelite, coal, clays, limestones, and iron-ores. (18.) The chemistry of the battery, the blankets, and the riffles.

SUPPLEMENTARY REPORT BY PROFESSOR BLACK.

SIR,—

The University, Dunedin, 9th December, 1887.

I have the honour to inform you that I find, on inquiry, by the telegraphic reports of the secretaries of the West Coast schools of mines and Mr. Fenton, that my estimate of the members

on the rolls of these schools was, in my report to you, only about one-half the real numbers now on the rolls.

I append a statement drawn up with this authentic information at my disposal. I find the membership of the schools between Ross and Nelson about 1,160, with an annual subscription of about £600. Now, this, to me, is overwhelming evidence of the intense interest the practical miners take in these technical classes. And you will see this interest is not only sustained by the present service and system, but it is rapidly increasing. This, contrasted with the small number of miners attending the Thames School of Mines last year, according to Mr. Montgomery's report, speaks loudly in favour of the system that plants schools in all the centres, and not merely in one or so in each Island.

The idea of abandoning these technical schools at their present stage must not be entertained for one moment. I consider myself as well as Government committed to the support of these schools, to some degree at least; and I shall visit them all during the four months, January to April, either with or without Government assistance; but if it is to be without Government assistance, I shall be ashamed of the Government under which we live. There is no other Government of any country under heaven that would let so noble and intensely-useful and practical and successful a system of technical education for so important an industry starve.

I have written a letter to the Minister of Mines on the subject, suggesting that Government pay the necessary travelling expenses of myself (without salary) and of my assistant, W. Goodlet (with £30 salary for him), for the four months, January to April, that we are going to devote to the discharge of this duty. We shall leave Dunedin about the 3rd of January and proceed to Nelson to open the school of mines there, with classes of probably a hundred and fifty members. We shall then visit Picton, Collingwood, Owen, Lyell, Westport, Charleston, Denniston, Reefton, Boatman's, Greymouth, Nelson Creek, Notown, Kumara, Dunganville, Stafford, Hokitika, Kanieri, Rimu, and Ross.

I cannot help thinking, however, that it will be to the deep discredit of the Government of the colony, both at home and abroad, if they allow W. Goodlet and myself to carry on this colonial work at our own expense; for I cannot allow the miners, however willing, to contribute to defray my expenses until they shall have their lecture-rooms completed and supplied with the necessary assaying and testing and teaching appliances. When will Government again find any one, duly qualified, so willing to teach the miners, or when will the Government again find the miners so willing and eager to be taught?

I am forwarding twenty copies of my letter to the *Otago Witness* on the subject of the schools, and I desire to draw your attention to the part defining a new basis which, in my opinion, would work well for the colony. The total cost to the colony for the whole system in both Islands would not exceed £1,870 per annum: and for this you would have twenty schools on the West Coast and Nelson, twenty-six schools in Otago, and five or six on the Thames Goldfield. That the miners will do their share of the work is amply proved; and the completion of such a scheme, and the obtaining for it of legislative recognition as a colonial institution, would be, I consider, a very appropriate work of your Committee.

I have, &c.,

The Chairman, Goldfields Committee, Wellington.

JAMES G. BLACK.

Names of Schools of Mines, Numbers of Members on the Rolls, and Subscriptions (West Coast only).—Ross, 45, £17; Rimu, 50, £25; Kanieri, 20, £10; Hokitika, 50, £25; Stafford, 60, £15; Dunganville, 20, £10; Kumara, 50, £25; Greymouth, 90, £45; Nelson Creek, 20, £10; Notown, 20, £10; Reefton 90, £109; Boatman's, 95, £65; Lyell, 50, £25; Westport, 60, £60; Denniston, 110, £78; Charleston, 40, £20; Owen, 50, £25; Takaka (Collingwood), 50, £25; Nelson, 90, £50; Dobsonville, 50, £25; Brunner, 50, £25: total enrolled members, 1,160; total subscriptions, £699. The numbers for Charleston, Owen, Nelson, Dobsonville, and Brunner are approximate, but under the mark. The amounts subscribed opposite Hokitika, Kumara, and Greymouth do not include building funds; they are therefore under the mark.

P.S.—Sir, I have to explain that the probably unusual strength of some of the language of this report must be attributed to the strength and sincerity of my convictions on the subject of it. I look for reasonable indulgence from your Committee, and trust you will be able to stand up on behalf of these technical schools.—J. G. B.

Enclosure.

[Extract of a letter from Professor Black to the *Otago Witness* on the subject of the schools of mines.]

THE guiding principles for the recognition of the schools of mines for the whole colony are few and simple:—

1. That the annual cost to the colony do not exceed £1,870.
2. That the subsidy be earned in each separate school by a local contribution of £1 for £2 subsidy.
3. That no school be recognised which does not show at least twenty subscribers and an annual subscription of at least £10.
4. That the time devoted to each school by the Government instructor be strictly proportioned to the amount subscribed by its members.
5. That each school provide itself with such an assortment of chemicals and testing and assaying-appliances as will be required for carrying on the work of its classes.
6. That a stock of such appliances be imported by the Minister of Mines for the use of the schools; and that from such stock the schools be supplied at prime cost, duty free.
7. That each school provide suitable accommodation for the classes and proper custody for the teaching appliances.
8. That the teaching-staff be appointed and discharged by the Minister of Mines, and be in every respect under his control.

9. That the members of the teaching-staff be movable by the Minister of Mines from one district to another, so that all parts of the colony may have the benefit of any special qualifications any member of the staff may possess.

10. The Minister of Mines, in allotting their districts to the members of the teaching-staff, will take into consideration the requirements of quartz-mining districts for the services of the quartz-mining experts on the staff.

11. The members of the teaching-staff will co-operate with Education Boards, School Committees, and the headmasters of the Government schools and of Catholic schools, to form classes of upper-form schoolboys for the study of the chemistry and testing and assaying of metallic ores.

12. Professor Black will, once a year, visit every school of mines in the Middle Island, to hold a practical examination of the students, to inspect and report on their accommodation for the classes and on the state of their appliances, to direct them in their further studies, and to lecture and conduct classes so far as the time at his disposal will permit.

13. Each member of the teaching-staff will, on the 31st of March every year, report to Professor Black on the work of the classes in his district during the year, and on any minerals discovered or new localities for valuable minerals. It will be Professor Black's duty then to forward these reports to the Minister of Mines, with his remarks thereon, together with his own report for the year.

14. That each school manage its own affairs, appoint the times for the meetings of the classes, and arrange for the custody of the appliances and property of the school.

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[For "the duties of such a teaching-staff" *vide* remarks at foot of Table B, fifth paragraph, page 22.]

The field, it will be seen, is unbounded, and the trouble will be to get the right men to occupy it. It would be an eternal disgrace to New Zealand if, in the present depressed state of the colony, we were to disregard the present receptive and enthusiastic attitude of the minds of our thousands of miners to the technical instruction afforded by these schools. Why, the battle is more than half won. It only remains to consolidate the separate schools already in existence into a regularly-organised colonial institution.

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[For tabular view of Middle Island schools of mines, and explanation thereof, *vide* Table B, page 20, to the sixth paragraph on page 23 inclusive.]

Some person writing to the *Otago Daily Times* under a *nom de plume* has views on the subject of sending to Nevada and Mexico for information as to silver-ores and their treatment. I am not going to trouble your readers with the reasons which render such a mission very desirable in the interests of the silver-smelting industry that is going to be in the immediate future a great factor in our prosperity. I shall content myself with telling him who are the men that should be sent on such an errand.

1. A report alone is no good. Practical men never learn much which they can make use of from a learned report on any subject. It seems to me that the men (for there should be two of them) sent should, on their return, not merely write a report of what they have seen and learnt and done, but should be prepared and qualified to direct the erection of plant suitable for carrying on the processes.

2. They should be men who are in the Government service, with a good record to their names, and not men who would probably go at the public expense, see and learn what is to be seen and learnt, write a report containing just as much or as little as they choose to put into it, keep back what they like, and make use of it themselves and exclusively for their own advantage.

3. One of them at least should be thoroughly acquainted with the chemistry of all the gold- and silver-saving substances that are known to be in use; and, indeed, since silver-saving process almost wholly, and gold-saving process to a considerable extent, are now chemical operations, he should be well up in the whole subject of mineral and general chemistry.

4. One of the men should be a practical mechanic or a civil engineer specially conversant with gold-saving machinery. Not merely a man who can describe and even draw diagrams of such plant, but a man who can draw up specifications showing the details of all parts of such machinery, and superintend the erection of it; a man who can put his own hand to the work and, if need be, erect the machinery himself.

5. Both men should be well up in all the processes now in use at least in this colony, otherwise they might waste their time in working up the details of something we have already on the Thames, or at Reefton, or Skipper's.

6. It seems to me also to be quite necessary, if our miners are to get any considerable benefit from such a mission, that one at least of the two appointees be qualified and willing to teach, on every goldfield in the colony, what he has seen and learnt on the other side. The information, to be of any use, must be communicated directly to the miners (the parties most interested) by the erection of plant, by practical experiments, and by explanatory conversations and lectures; and, in short, the information got at the cost of the colony for the benefit of the miners must be made a subject of study in all the technical schools of mines.

7. Well, then, such being, as far as I can see, the qualifications of the men, the question arises, Who have these qualifications?

If Mr. Gordon—the well-known Inspector of Mines and of Mining Machinery for the colony—can be spared, there is no doubt that he is just the man in New Zealand who possesses in an eminent degree the qualifications mentioned in No. 4 above. Mr. Gordon is not only familiar with all the appliances in use in New Zealand; he has also made himself well acquainted with the mining and gold- and silver- and tin-saving appliances in Victoria, New South Wales, and Queensland. As an associate with Mr. Gordon on such a mission it seems to me that there are only four

men in the colony fairly qualified—namely, Professor Brown (of Auckland College), myself, and Messrs. Montgomery and Fenton (directors of the Thames and Reefton Schools of Mines respectively). It seems to me that you cannot get the necessary information and also get the greatest good out of it by sending outsiders. Mr. Gordon would have special charge of the mechanical details of all mining-plant, crushing-plant, tailings-plant, hoisting-plant, batteries, hydraulic-plant, pumping and ventilating appliances, and, indeed, of all gold- and silver-saving processes generally. The chemical expert (that name will do for want of a better) would make it his business to ascertain the character and composition of the different ores worked, the general processes in use for their treatment, the chemistry and action of the different agents used, the relation of the ores treated to those we have in New Zealand, and the special modes of treatment of every different kind of ore. It would also be his duty to give reliable information as to which of the chemical agents used in large quantities can be produced here from our own resources. They should also be in a position to give to mining men in America authoritative information as to our own mineral wealth in all particulars. They should be able to give information on such subjects as the extent and richness of the known gold- and silver-bearing stone in the colony, our copper, iron, antimony, and lead-ores, our scheelite, our iron-ores, and our coal.

University Laboratory, 24th November, 1887.

I have, &c.,

JAMES G. BLACK.

REPORT BY PROFESSOR ULRICH.

SIR,—

University, Dunedin, 1st December, 1887.

In answer to the several questions contained in your telegram, I have the honour to report as follows:—

1. Number of students attending lectures in mining and mineralogy during the last five years: 1883, five; 1884, two; 1885, three; 1886, six; 1887, three.
2. Number of students who hold diplomas and certificates: Four.
3. Number of students who are now engaged as mining-managers and mineralogists: Two (Mr. Montgomery at the Thames, and Mr. Fenton at Reefton, in teaching).
4. Number of students now attending lectures: This year's session is over, but for that of next year there are, as far as I know, four students certain, and some new ones may enter.

With regard to the small number of students who have, so far, gained diplomas and certificates, and the poor attendance hitherto of the school in general, I beg to mention that this has been mainly due, no doubt, to the incompleteness of the school according to the curriculum prescribed. This defect has only been rectified during the last two years—namely, by the appointment in 1886 of a lecturer on practical mechanics, and by that of two lecturers in 1887—namely, one for general geology and the other for mine- and land-surveying. Two of the students thus obtained their diplomas and certificates only recently at the end of the session, and, in order to be capable of acting as mining-managers, will have first to pass through a practical course in mines. They are qualified, however, to teach the subjects they have passed in, and have, in fact, already acted as assistants to Professor Black during his goldfields lectures. One student, who gained last year the diploma for the mining and metallurgical divisions and certificates for assayer and surveyor, has, I was informed, gone to Victoria and there found employment, but I do not know in what capacity.

I have, &c.,

R. J. Seddon, Esq., Chairman, Goldfields Committee.

GEORGE H. F. ULRICH.

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