

treatment, more especially as the owners could not afford the expense of such a test. The parcel yielded 15dwt. of melted gold, or about 10dwt. per ton. A concentration-test of this ore would have been useful, but we have no concentrator—not even a straight buddle.

“No. 13.—As far as value of ore is concerned, this was the most important test made at the experimental battery. It was also of great interest on account of the complex nature of the ore, which contains chloride, bromide, iodide, selenide, and sulphide of silver, native silver, and free gold. The ore was very rich, containing 32oz. 10dwt. 17gr. of gold and 822oz. 5dwt. of silver per ton. The weight of ore treated was 1,938lb. I was very doubtful as to what was the best treatment for this ore. No doubt such stuff ought to be smelted; but we have no appliances for trying this process. As lixiviation with hyposulphite of soda extracts 75 to 80 per cent. of the silver from this ore when treated on a laboratory scale, it might be desirable to lixiviate it, and then treat by roasting and amalgamation. As the ore is very soft and friable it could be lixiviated without much crushing. However, I finally decided to give a thorough amalgamation-test. The ore was very carefully crushed wet, the escape from the tailings-pits being almost imperceptible, and then amalgamated hot for from six to seven hours, sulphate of copper and salt being liberally used, though, as it turned out afterwards, even more ought to have been used. Owing to the richness of the ore it was necessary from time to time to draw off the quicksilver from the pan and squeeze it through canvas to separate amalgam, and then put it back into the pan. After the whole of the ore had been treated, all the heavy tailings from the settler were again put through, and finally the whole of the tailings were again subjected to a second amalgamation in the pan. This, however, yielded very little more amalgam—hardly enough to pay for the extra expense. So it may be assumed that all that raw amalgamation would extract had been extracted. Still, the tailings contain 4oz. 12dwt. of gold and 189oz. silver per ton. The saving of gold amounted to 85·8 per cent., and of silver to 77 per cent., or 81·5 per cent. of the total assay-value. All the tailings have been carefully saved, and at the first opportunity I intend to have them subjected to a chloridising roasting, and again amalgamate them. In this test there was a very heavy loss of quicksilver, due to the formation of chloride of mercury. The bullion was almost free from copper, and this, taken with the formation of mercury-chloride, shows that more sulphate of copper was required. In melting the retorted bullion a rather peculiar fact was noted—viz., the formation of chloride of silver. This, too, notwithstanding that the amalgam was very thoroughly cleaned, and appeared quite free from any impurities. It came from the retort quite black, and on melting a scum of chloride of silver rose to the top. I ascribe this to chloride of mercury (calomel) being enclosed in the amalgam, and on heating giving off chlorine to the silver. The formation of chlorine in this way tends to refine the bullion, as in the Miller process. Some gold from the Woodstock Mine, Karangahake, gave, when melted at the Bank of New Zealand, Paeroa, quite a thick scum of a mixture of chloride, bromide, and iodide of silver, formed in exactly the same way.

“No. 14.—After finishing the main large parcel of Marototo ore (No. 13) the mine-manager wished me to test another small parcel of 86lb., representing samples taken by him from some thirty or forty tons from time to time. The ore assayed 5oz. 14dwt. 14gr. of gold and 164oz. 15½dwt. of silver per ton. The same treatment as No. 13 yielded 90·3 per cent. of the gold, and 76·6 per cent. of the silver, or 82·9 per cent. of the total assay-value. The percentage of extraction was almost the same as in the former test, though the value of the parcel was much lower. The test shows that raw amalgamation is not capable of completely extracting the gold and silver. What can be done with the aid of a chloridising roasting remains to be seen. I do not think that with very rich ore such as that treated in test No. 13 chloridising roasting should be resorted to until as much gold as possible has been extracted, as recent researches show that very heavy losses of gold by volatilisation frequently occur when roasting in this way. Muffle-tests show 50 or 60 per cent. loss of gold by roasting this Marototo ore with salt. The silver is less liable to loss. Professor Christy has recently shown, in a paper read before the American Institute of Mining Engineers, that the cause of loss is chlorine, and not tellurium, antimony, and arsenic, as has been often imagined. Some experiments of my own, made and published before the publication of Professor Christy's paper, quite bear out his conclusions.

“Since the beginning of this year we have not been able to do anything with the experimental plant. My classes take all my time in the mornings and give me a great deal of preparatory work in the afternoons, while the evenings again are taken up with classes. A certain amount of expense must always be provided for in making these tests, more particularly the wages of a reliable amalgamator. Roasting-tests require money for fuel and salt as well. The Committee have no funds for carrying on experiments unless the owners of mines will pay for having them made, and lately no one has come forward to do so. All the above tests were paid for by the owners. The Committee have made £5 per ton the minimum charge for having tests made, and if the cost of the test comes to more the amount must be made good by the owner. When the value of the information gained by a few tests is taken into account, the fees seem to me to be very low, but many persons here appear to think them far too high. I have given the above detailed account of the tests in the hope of showing how much can be learned by a series of experiments on a working scale, and I have not the least hesitation in saying that the expenditure of £1,000 in experimenting on the ores would give results which would lead to the saving of over twice that amount in a year or two. As I have frequently said before on this subject, the miners here are quite ignorant of how to treat silver-ores, and do not know any other process than the ordinary battery one, and until they see something better actually in operation will never take any steps towards introducing anything new. I must also say that the men who will come forward and have experiments made to benefit others as well as themselves are unfortunately very rare, every one rather waiting to let his neighbour buy his experience, and then himself profit by it. This being the state of things, I think it would be money well spent if the Government would take the lead in this matter, and give a small sum annually for the purpose of carrying on experiments. A sum of £200 a year, which would enable us to employ an amalgamator constantly, would, I believe, be sufficient to do a great deal of good; but we should