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THE MACARTHUR-FORREST CYANIDE PROCESS FOR THE LIXIVIATION OF GOLD AND SILVER ORES.

This process has been introduced by the Cassel Company at Karangahake, Auckland, New Zealand, and as the results obtained have been very good on an ore that has hitherto defied successful treatment by amalgamation, it appears likely to be a commercial success, and worth the attention of mining men. The ore treated was from the Crown mine at Karangahake, which consists of quartz charged with extremely fine metallic gold and sulphide and selenide of silver, with, occasionally, chloride of silver as well. From the difference between the amount of gold visible on the most careful grinding and washing or that can be extracted by amalgamation, and that obtained by assay, there is reason to believe that much of the gold is not in a free state, but exists in combination with the sulphur and selenium present. The ordinary battery treatment is quite a failure with this ore, extracting only from about one-fifth to one-third of the gold value. Amalgamation in pans succeeds much better, but is not altogether satisfactory either. The ore is much too silicious for smelting, and the chlorination treatment requires it to be roasted before it can deal with it, and then is not very successful after all. It is, therefore, a very difficult ore to deal with, and the cyanide process in successfully treating it has scored a victory over many competitors.

The result of a bulk test of a parcel of 263 tons 7 cwts. treated is given in the *Auckland Weekly News* of 14th March, 1891, as follows:—

263 tons 7 cwts. contained, by assay, gold, 425 ounces; silver, 940 ounces.

Recovered and sold to the Bank, gold, 384 ounces; silver, 664 ounces.

Percentage of recovery, gold, 90½ per cent.; silver, 70½ per cent.

The cost of treatment is stated to have been 6s. 6d. per ton for drying and grinding the ore, and 13s. 6d. a ton for the lixiviation treatment. It will be seen that the extraction was very successful, the gold left in the tailings being only at the rate of 3 dwt. 3 grs. to the ton, and silver a little over an ounce to the ton.

The process depends on the fact that a weak solution of cyanide of potassium will dissolve gold, silver, and most compounds of silver very freely. A weak solution acts better than a strong one, and hence solutions containing only from ¼ to 1 per cent of cyanide are employed. No roasting is required, it being claimed for the process that it will extract both gold and silver from metallic sulphides without roasting. I am not aware, however, if this has been proved on a working scale. The ore is ground dry in Lamberton Mills, and put into wooden leaching vats furnished with false bottoms arranged for filtering, as in all other leaching processes. The quantity of solution necessary is about half the weight of the charge of ore, so that from 3 to 8 lbs. of cyanide are used for every ton. It is made to take about 36 hours to pass through

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the ore-bed on the filters, and then runs into a series of wooden precipitating boxes filled with coarse granulated zinc. The gold and silver are precipitated on the zinc. The solution, after passing through these boxes, is assayed to ascertain its loss of strength, and made up to the original condition by the addition of a little more cyanide, and then may be used again. The gold and silver are recovered from the zinc by putting the contents of the precipitating boxes on a sieve and shaking this well in a vat of water. The loose precipitate is thus washed off and the zinc is returned to the boxes again. The muddy sediment of gold and silver is allowed to settle thoroughly, collected, washed with diluted sulphuric acid to remove any zinc left in it, washed well with hot water, filtered through calico filters, dried, and melted into fine bullion.

Part of the above description is taken from the annual volume for 1890 of "Reports on the Mining Industry in New Zealand," wherein Mr. H. A. Gordon gives a fuller description, illustrated by drawings. The following table of results obtained in the preliminary trials of the process at Karangahake is abridged from his report. Each of the tests was made on one ton of ore; consequently, they are working tests, not mere laboratory ones.

Assay Value of Ore per Ton.		Extracted per Ton.		Percentage Extracted.		Percentage of Potassium Cyanide used on Ore treated.
Gold.	Silver.	Gold.	Silver.	Gold.	Silver.	
oz. dwt. grs.	oz. dwt. grs.	oz. dwt. grs.	oz. dwt. grs.	Per cent.	Per cent.	
0 19 4	10 1 17	0 16 14	7 2 0	86.5	70.4	0.50
0 19 14	10 1 17	0 17 23	7 9 1	91.7	73.8	0.50
1 12 16	14 14 0	1 11 1	11 7 0	95.0	77.2	0.50
1 12 16	17 12 0	1 7 9	11 9 3	83.9	62.2	0.40
1 12 16	16 6 16	1 6 4	9 6 1	80.1	56.9	0.25
1 17 13	1 17 13	1 14 7	1 4 12	91.2	65.1	0.50
1 17 13	1 17 13	1 12 16	1 2 21	87.1	60.6	0.50
2 2 4	2 4 2	1 19 18	1 12 16	94.2	74.3	0.25
2 2 11	2 4 2	2 0 20	1 1 6	96.0	47.7	0.25
0 11 10	3 11 20	0 9 10	1 19 4	82.4	54.4	0.25
1 12 16	5 14 8	1 7 19	4 3 8	85.0	72.8	0.25
1 19 4	6 4 3	1 15 22	4 18 0	91.8	79.0	0.40

A. MONTGOMERY, *Geological Surveyor.*

REPORT OF THE MOUNT CAMERON WATER-RACE BOARD TO 30TH JUNE, 1891.

11th August, 1891.

SIR,
This Board has the honor to report as follows.

The Board was constituted by Act of Parliament, 51 Vict. No. 28, on the 20th December, 1887, and consists of the Secretary of Mines, the Commissioner of Mines for the District, the Inspector of Mines, and two members annually appointed by the Governor in Council. It commenced its duties on the 9th February, 1888, and assumed control of twelve miles of main race and nine miles of branches, which, under the authority of the Act quoted, had been purchased by the Government at a cost of £4750.

On the 21st of August last the Board received into its charge the whole work, consisting of 34 miles of main race and 9 miles of branches (including the original portion above referred to), which had been constructed and repaired by the Government at a total cost of £31,460 7s. 3d., including purchase of the old portion of the race.

The receipts during this period, necessarily curtailed by stoppages for repairs and the limited supply of water obtainable, and of ground commanded by the old race, amounted to £687 13s. 11d., whilst the cost of maintenance and management amounted to £631 14s. 5d.

During this period there have been 2330 heads of water sold. Receipts have been £1751 5s. 1d., and the cost of maintenance and management has been £1087 9s.

The total sum paid to Sinking Fund to date has been £719 5s. 7d., being $\frac{3}{4}$ per cent. upon the whole cost; but, at the present rate of receipt and expenditure, the net proceeds for the year 1891 will be $2\frac{1}{2}$ per cent. upon the cost of purchase and construction.

The number of claims supplied since the race has been in full work has averaged, weekly, 10. These, which employ a considerable number of miners and yield a fair quantity of tin ore, could not have been worked but for the construction of this race. Other claims are in course of being opened.

The race has a carrying capacity of 50 Tasmanian heads, discharging 450,000 gallons per hour. The supply of water at the intake is more than sufficient to meet the present demand.