PAPER NO. 217.

PRECIPITATION OF GOLD AND SILVER IN CYANIDE SOLUTIONS BY CARBON.

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THIS paper is the outcome of experiments carried on and experience gained at the Waihi-Paeroa Gold Extraction Company's tailings plant at Waihi, New Zealand.

The plant was erected to treat accumulated tailings which had been discharged into the Ohinemuri River by the Waihi batteries.

The Ohinemuri River is a common sludge channel for all mining *débris*, tailings, and ashes from the power plants, the last being the cause of occasional high residues, which gave so much trouble to the management.

The tailings were dredged from the bed of the river into barges by means of a Pohle air lift, the power being supplied by a 13 b.h.p. Tangye oil engine driving an air compressor and a centrifugal pump.

The sands were elevated from the barges by bucket-belt elevators over screens, to eliminate large particles and rubbish, into storage hoppers, and from there fed direct into four C. Judd Ltd. tube mills.

The method of treatment was fine grinding in a weak cyanide solution, agitation in B. and M. tanks, filtration with turn-over vacuum filters, and precipitation with zinc shavings.

The comparatively high values of the residues in gold gave a great deal of trouble, and it was not until repeated experiments were carried out that the cause of the trouble was located. While the value of silver residues remained stationary, the gold values

fluctuated very much. To overcome this, finer grinding was resorted to, with poor results, except that more silver was recovered—the gold residues still remaining too high.

It was well known that carbon would precipitate gold and silver, but its selective action was not known.

When fine grinding did not give the desired result other methods had to be sought. Knowing that there was a variable amount of half-burnt coal among the tailings, it was decided to experiment with carbon.

A heavy "fresh" occurring at that time gave the opportunity on a large scale; the fresh bringing down a large amount of half-burnt coal. On these newly-deposited tailings experiments were carried out, and it was found the silver residues, just after grinding, were normal, while the gold was slightly high. Samples were then taken every day from the B. and M. tanks and assayed, with the result that the value of gold residues unmistakably increased, while the value of silver residues decreased until such a time when practically all the gold was precipitated, then the value of the silver residues started to rise, thus showing that the carbon had no apparent effect on the silver until nearly all the gold was precipitated.

The following are the results of a few assays, showing the action of carbon on gold and silver in cyanide solutions.

The samples were first taken from the overflow from the classifier, and then daily from the B. and M. tanks.

Sample.	Gold. oz.	Silver. oz.
No. 1.—From overflow	.088 ..	.908
1st day, B. and M. tanks ..	.098 ..	.658
2nd „ „ „ ..	.102 ..	.634
3rd „ „ „ ..	.108 ..	.628
4th „ „ „ ..	.112 ..	.672
No. 2.—From overflow	.060 ..	.860
1st day, B. and M. tanks ..	.068 ..	.672
2nd „ „ „ ..	.088 ..	.654
3rd „ „ „ ..	.096 ..	.604
4th „ „ „ ..	.096 ..	.684

Sample.	Gold. oz.	Silver. oz.
No. 3.—From overflow	.044 ..	.680
1st day, B. and M. tanks ..	.062 ..	.620
2nd „ „ „ ..	.084 ..	.610
3rd „ „ „ ..	.100 ..	.650
4th „ „ „ ..	.100 ..	.814

No. 4.—Experiments were then made with gold and silver solutions in which ground clinker was placed, the whole being agitated for two days, with the following result:—

	Gold. oz.	Silver. oz.
Before agitation	.046 ..	.642
After „	.013 ..	.504
Precipitated	.033 ..	.138

No. 5.—Unconsumed coal-dust was also placed in a gold and silver solution and agitated for two days, but no precipitation occurred.

No. 6.—A sample of half-burnt coal from the river was assayed, and was found to contain .102 oz. of gold and .604 oz. of silver.

No. 7.—A sample of charcoal (in small lumps) found floating in the lime tank was assayed, and found to contain 1.760 oz. gold and 1.792 oz. silver. This showed that it was imperative to eliminate the charcoal associated with lime used for settling purposes.

By comparing the time of the river-freshes and the residues of slimes of the tailings taken at that time, it was found that the residues were higher than at any other period. From this it was concluded that fresh carbon precipitated gold and silver more freely than when the carbon had become saturated with water.

To eliminate the carbon two 6-ft. Union vanners were installed. Though these were overtaxed, the desired result was at once obtained. Besides removing the carbon, the light river sands were also removed.

The output of the plant was 80 tons per day, and that amount was run over the vanners. The vanners were driven at about 120 revolutions, with a belt travel of 6 ft. per minute and with a fall of 8 in. in the whole length. The distributing box was placed 18 in. further down than is usual, while the pulp discharged from the lower side. The water distributer also was placed lower down the table. The sand was from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. thick as it came comparatively dry over the head, where it was washed off with a series of solution jets into a launder.

The river sand and coal flowed off over a tail into a race.

In the assays Nos. 1, 2, and 3 there was no apparent precipitation of silver until nearly all the gold was precipitated, but in the experiment No. 4 and assays Nos. 6 and 7 silver was shown as being precipitated in equal and greater quantities than gold. From this apparent contradiction it is assumed that, while the silver was being dissolved, a very small amount was being precipitated, showing that the dissolution of silver up to a certain point was quicker than the precipitation.