O T T A W A June 4th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 847.

Amalgamation of Jig Middlings
from Provincial Mine School Ore,
Val D'Or, Abitibi, Quebec.

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Shipment:

A 54-pound shipment of jig middlings obtained from Provincial Mine School ore was received on April 10th, 1940.

The shipment was submitted by G. S. Grant, Manager, Initiation Federale-Provinciale de la Jeunesse, Mine Ecole Provinciale, Val D'Or, Quebec.

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Purpose of Investigation:

The sample was submitted for the purpose of conducting amalgamation tests on this material with a view to keeping down the mercury losses. It is reported that in amalgamating this material, difficulty has been encountered in recovering more than 85 per cent of the mercury, the assumption being that the pyrrhotite present in the ore causes excessive flouring of mercury.

Character of Material:

The material consists of a jig middlings product and is reported to be somewhat finer than the concentrates usually subjected to amalgamation.

Sampling and Analysis:

The shipment was ground to minus 14 mesh and a sample cut in the usual way. This sample analysed as follows:

Gold	-	0.16 oz./ton
Sulphur	-	4.30 per cent
Arsenic	-	Nil.
Iron	-	7.05 per cent
Insoluble	-	75.31 "

Screen Analysis:

Mesh		Weight, per cent
+ 20	mesh -	6.8
+ 28	" -	14.3
+ 35	" -	20.8
+ 48	" -	17.7
+ 65	" -	14.5
+100	" -	10.6
+150	" -	7.3
+200	" -	3.6
-200	" -	4.4
		100.0

Experimental Tests:

Preliminary to making pebble mill tests, amalgamating tests in a mortar were made to learn, if possible, the nature of the fouling and the cure by the addition of certain chemicals.

The mortar tests did not show any actual flouring of mercury, but very definitely showed that the mercury became coated with a film of sulphides and that some of the mercury was broken up into droplets, which condition would probably become more pronounced as grinding continued, thereby causing a substantial loss of mercury by fouling.

A. E. Flynn, in a recent paper (Trans. C.I.M.M., 1939, p. 150), has shown that he has found the addition of sodium hydroxide, arsenious oxide and lead carbonate to be more beneficial than most other chemical reagents formerly used or suggested for this purpose.

Following this procedure, some tests were made in the mortar, using small quantities of these reagents, and the results indicated that the fouling tendency could be overcome and clean mercury obtained.

A number of tests were next made on 1,000-gramme lots of the minus 14 mesh material to determine the conditions for a satisfactory mercury recovery.

The middlings at 67 per cent solids was ground in a pebble jar running at 60 r.p.m. with a ball charge of 5 pounds.

Following the grind, water was added to reduce

the pulp density to 57 per cent and the mercury and lime or other reagents added.

The amalgamation was carried on for 2 hours at 33 r.p.m. The amalgamation charge therefore was:

1,000 grammes ground middlings,
750 " water,
50 " mercury, and
5 pounds 1-inch steel balls.

Reagents - varying amount.

The following table shows the results of these tests, numbered 1 to 7 inclusive:

Test No.	Addition agents	Mercury recovered, per cent	Tailing assay, Au oz./ton
1.	2 grammes CaO	63.6	-
2.	5 " CaO	66.9	-
3.	2.5 " CaO	78.7	-
4.	0.5 gm. NaOH 0.65 " As_2O_3 6 gm. lead carbonate	99.6	0.10
5.	1.0 gm. NaOH 1.3 " As_2O_3 12.5 gm. lead carbonate	99.6	0.14
6.	1.5 gm. NaOH 1.95 " As_2O_3 12.5 gm. lead carbonate	99.7	0.09
7.	Duplicate of No. 4.	99.8	0.10

Tests Nos. 1, 2, 4 and 5 were ground 6 hours to give 99.7 per cent minus 325 mesh. Tests Nos. 3 and 7 were ground 3 hours to give 99.3 per cent minus 200 mesh.

In the above tests the mercury was recovered by running the diluted pulp through a laboratory hydraulic

classifier of the glass tube type and finally cleaned up by water washing.

The tests show definitely that amalgamating in lime without addition agents results in a high loss of mercury, while amalgamating with Flynn's reagents corrects the fouling tendencies and gives a satisfactory mercury recovery. The gold extraction, however, is very low.

A second series of tests were run in which the material was ground at 67 per cent solids for 1 hour with 20 pounds of steel balls. The charge was then dewatered by filtration and repulped to 57 per cent solids and amalgamation was carried out as previously described for 2 hours with 5 pounds of steel balls. The results are shown in the following table:

Test No.	Addition agents	Mercury recovered, per cent	Tailing assay, Au oz./ton
8.	None.	98.2	0.05
9.	None.	97.4	0.05
10.	2 grammes CaO	99.3	0.08
11.	0.5 gm. NaOH 0.65 " As_2O_3 6 gm. lead carbonate	99.8	0.05
12.	1.0 gm. NaOH 1.3 " As_2O_3 12.5 " lead carbonate	99.6	0.08
13.	1.5 gm. NaOH 1.95 " As_2O_3 12.5 " lead carbonate	99.6	-
14.	1.0 gm. NaOH 1.3 " As_2O_3	98.6	0.05
15.	12.5 gm. lead carbonate	98.9	0.065

The grind in the above tests was 95 to 98 per cent

minus 200 mesh.

In this series of tests the mercury was recovered as previously described. In all of the tests of this series the mercury was bright and clean.

These tests demonstrate quite clearly the effect of the chemical reactions in grinding. Tests Nos. 8 and 9, where no reagents of any kind were used, and Test No. 10, where lime only was used in amalgamating, show a good recovery of mercury as compared with Tests Nos. 1, 2 and 3, where the pulp was not dewatered. The addition of the Flynn reagents permits an almost perfect recovery of the mercury. Part of the mercury formed droplets, but these droplets were of sufficient size to permit recovery by washing.

It will be observed that the gold recovery in this series of tests is much improved over the tests of the first series.

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Conclusions:

The jig middlings from this ore, as represented by the sample submitted, can not be amalgamated direct without serious fouling and loss of mercury.

Chemical additions of the type suggested by A. E. Flynn (Trans. C.I.M.M., 1939, pp. 150-163) counteract the tendency to fouling and show good recoveries of mercury.

Grinding in water and dewatering prior to amalgamation overcomes the fouling, and the addition of lime or chemicals of the Flynn type to the fresh pulp improves

mercury and gold recoveries.

The quantity of chemicals used will probably vary to some degree with the sulphide content of the material to be treated.

It is suggested that in discharging the barrel into the trap the discharging rate be slowed down as much as possible, so as to obtain a high water washing ratio in the trap. Should fine mercury still escape the trap, the addition of an amalgam plate to the trap overflow might be advantageous in recovering such losses.

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