O T T A W A November 3rd, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1525.

Concentration Tests on a Sample of Gold-Bismuth-Cobalt-Nickel Ore from the Bico Mines Limited, at Thessalon, Ontario.

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Shipment:

One bag containing 150 pounds of ore was received on April 9th, 1943. The sample was submitted by D. S. Baird, Mining Geologist, Suite 403, Atlas Building, 350 Bay Street, Toronto, Ontario.

Location of Property:

This ore was taken from a property located near the town of Thessalon, in the Sault Ste. Marie mining division, of Ontario.

Sampling and Assaying:

The ore was sampled, and assayed. Assay results were as follows:

Gold	--	0.96	oz./ton.
Silver	-	0.38	"
Nickel	-	1.01	per cent.
Cobalt	-	1.41	"
Bismuth	-	4.18	"
Iron	-	7.54	"
Sulphur	-	3.38	"
Arsenic	-	1.24	"

Conclusions:

The results of tests conducted on this sample of ore have been unsatisfactory because it has not been found possible to separate the bismuth from the cobalt and nickel, or to obtain a satisfactory recovery of any of the metals.

Failure to separate the minerals appears to be due to their very intimate association. The low recovery is due to the fact that no satisfactory method of flotation has been developed and they require such fine grinding that tailing losses are high in gravity concentration methods.

Best results are likely to be obtained by a combination of flotation and table concentration, the two processes being complementary, and each of them, to some extent at least, compensating for the inefficiency of the other.

The ore should be ground with the flotation reagents and the flotation concentrate should be taken off first. The flotation tailing should then be prepared for table concentration, by classification or sizing.

While this ore has not been treated as a gold ore, some preliminary cyanidation tests were conducted on samples of table tailing to see how much of the gold could be extracted. It has been found that roughly half of the gold in the table tailing will dissolve fairly readily in cyanide solution.

(Continued on next page)

(Conclusions, cont'd) -

This means that about 20 per cent of the total gold is lost in the cyanide tailing.

If at any time in the future it should be desirable to treat this ore as a gold ore it will be necessary to conduct further tests with this end in view.

Character of the Ore:

Six polished sections were prepared and examined microscopically for the purpose of determining the character of the sample.

Gangue -

In the polished sections gangue material is a mixture of translucent grey quartz and white carbonate. It is somewhat fractured and transected by narrow sinuous cracks.

Metallic Minerals -

Metallic mineralization is rather strong in the polished sections and is represented by smaltite-chloanthite, native bismuth, niccolite, and erythrite (cobalt bloom), named in order of decreasing abundance. No gold or silver minerals were observed.

Smaltite-chloanthite is present as small masses, coarse to fine irregular grains, and tiny stringers in gangue. In one section it is very intimately associated with niccolite as narrow borders and veinlets which traverse the nickel arsenide. In general its surface presents a discontinuous, lacy appearance due to numerous inclusions of gangue, many of which are too fine to be released by grinding.

Native bismuth exhibits the same modes of occurrence as smaltite-chloanthite. Its surface, however, is comparatively homogeneous, although it does contain a few small inclusions of gangue and smaltite-chloanthite.

Niccolite is visible in only one section, largely

(Character of the Ore, cont'd) -

as small irregular masses in gangue; a small quantity also occurs as medium to fine disseminated grains and tiny stringers transecting gangue. It contains rather numerous small inclusions of gangue and, in places, is intimately intergrown with smaltite-chloanthite which appears to have replaced it.

Erythrite is represented in two or three sections by small, local, red to pink stains in gangue.

Conclusions from Microscopic Examination -

The microscopic examination of six polished sections indicates that while the bulk of the ore minerals should be freed at moderately fine grinds, some will require exceedingly fine grinding, and a small percentage may be too small to be so released. Also, since some of them, especially the smaltite-chloanthite, are extensively impregnated with gangue much of which is too finely divided to be eliminated, it will be found impossible to make a clean cobalt-nickel concentrate.

DETAILS OF INVESTIGATION:

Test No. 1.

A sample of the ore was ground practically all through 65 mesh, 60 per cent through 200 mesh, and floated as follows:

Charge to Ball Mill -

Ore	-	2,000 grams at -14 mesh.
Water	-	1,500 grams.
Coal Tar Creosote No. 634	-	0.06 lb./ton.
Caustic soda	-	1.00 "
Potassium amyl xanthate	-	0.20 "
Grinding time	-	15 minutes.

(Continued on next page)

(Test No. 1, cont'd) -

Reagents to Cell -

Potassium amyl xanthate	-	0.10 lb./ton.
Pine oil	-	0.05 "
Pentasol xanthate	-	0.20 "

A concentrate was floated off and the flotation tailing was treated on a table without sizing or classification.

Summary of Results, Test No. 1.

Product	Weight, per cent	Assays, Per cent Bi	Co	Ni	Au oz./ton	Distribution, per cent Bi	Co	Ni	Au
Flot. conc.	9.30	23.08	8.28	4.50	5.50	53.94	57.61	54.57	48.38
Table conc.	3.07	6.60	10.18	12.76	0.48	5.09	23.38	18.01	15.97
Table tailing	87.63	1.86	0.29	0.24	0.43	40.97	19.01	27.42	35.65
Feed (cal.)	100.00	3.98	1.34	0.77	1.06	100.00	100.00	100.00	100.00

The bismuth appears to float under the same conditions as cobalt and just about as efficiently. Both concentrates are marketable with respect to cobalt, but the problem of separating the cobalt from the bismuth remains.

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Test No. 2.

A sample of the ore was dry-crushed all through 65 mesh and sized on 100-, 150-, and 200-mesh screens. The sized fractions were treated on a table, samples of concentrate and tailing from each size being assayed separately. The remainder of the table tailing was then mixed together and floated with the same reagents as were used in Test No. 1. The reagents were not ground with the ore and flotation results were not so good.

(Continued on next page)

(Test No. 2, cont'd) -

Products of Table Test -

	Weight, per cent	Assays: Au oz./ton	Assays: Per cent Bi	Co	Ni
Table conc., +100 mesh	13.96	3.00	3.85	3.08	1.66
-100+150 "	6.68	3.10	4.73	7.02	4.84
-150+200 "	31.11	2.70	7.38	10.90	10.20
-200 "	48.25	3.14	22.10	10.90	12.98
Average table conc.	100.00	2.98	13.81	9.55	9.99
Table tailing, +100 mesh	4.03	0.56	2.73	0.12	0.04
-100+150 "	11.83	0.635	3.11	0.17	0.05
-150+200 "	18.86	0.62	2.55	0.24	0.12
-200 "	65.28	0.76	3.65	1.01	0.77
Average table tailing	100.00	0.71	3.34	0.73	0.53

These figures indicate the fineness of grinding needed to produce a satisfactory grade of table concentrate and they also show how the table tailing losses increase with finer grinding. In spite of the fact that native bismuth has a much higher specific gravity than smaltite, the tendency of both minerals to concentrate together is also shown here. This is doubtless due to the inclusions of smaltite-chloanthite referred to in the microscopic examination.

Summary of Results, Test No. 2.

Product	Weight, per cent	Assays: Per cent Bi	Co	Ni	Au oz./ton	Distribution, per cent: Bi	Co	Ni	Au
Table conc.	7.03	13.81	9.55	9.99	2.98	24.89	50.47	61.03	24.54
Flot. conc.	27.23	6.27	1.14	0.85	1.40	43.77	23.34	20.11	44.66
Flotation tailing	65.74	1.86	0.53	0.33	0.40	31.34	26.19	18.86	30.80
Feed (cal.)	100.00	3.90	1.33	1.15	0.85	100.00	100.00	100.00	100.00

The flotation concentrate produced in this test is too low-grade in cobalt to be marketable and recoveries in the table concentrate alone are somewhat low, particularly the

(Test No. 2, cont'd) -

bismuth. From these results it would seem to be better practice to grind the ore with flotation reagents to the required size and take off the flotation concentrate, then classifying and tabling the flotation tailing.

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Test No. 3.

A sample of the ore was ground, floated and table concentrated, following the same procedure as in Test No. 1. Samples of the table tailing were agitated in cyanide solution for periods of 24 and 48 hours without further grinding. The cyanide tailings were assayed for gold.

Screen Analysis, 48-hour Cyanide Tailing.

Product	Weight, per cent	Assay, Au oz./ton
+100 mesh	6.67	0.32
-100+150 mesh	21.73	0.27
-150+200 "	16.83	0.26
-200 "	54.77	0.16
Average tailing:	100.00	0.211

A bulk assay on the 24-hour cyanide tailing gave exactly the same answer, 0.21 ounce gold per ton.

Summary of Results of Cyanidation.

Product	Assay, Au oz./ton:	Extraction, per cent Content	Reagents consumed, lb./ton tailing NaCN	CaO
Table tailing	0.39	-	-	-
24-hour cy. tailing	0.21	46.15	1.20	3.52
48- " " "	0.21	46.15	1.46	2.83

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(Test No. 3, cont'd) -

Complete Summary of Results, Test No. 3.

Product	Weight, per cent	Assays, Per cent Bi	Co	Ni	Au oz./ton	Distribution, per cent Bi	Co	Ni	Au
Flot. conc.	9.31	19.71	6.65	3.95	5.88	49.23	41.69	30.89	61.04
Table conc.	5.28	1.38	10.25	11.05	0.31	1.96	36.45	49.02	1.82
Table tailing	85.41	2.13	0.38	0.28	0.39	48.81	21.86	20.09	37.14
Feed (cal.)	100.00	3.73	1.48	1.19	0.90	100.00	100.00	100.00	100.00
Table tailing cyanided	85.41	-	-	-	0.21	-	-	-	20.00
Average conc.	14.59	13.08	7.95	6.52	3.86	51.19	78.14	79.91	62.86
Pregnant solution	-	-	-	-	-	-	-	-	17.14

By regrinding the table tailing 82 per cent finer than 325 mesh and agitating for 48 hours, the cyanide tailing assayed 0.18 ounce per ton and contained 17.58 per cent of the total gold.

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