

O T T A W A

December 27th, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1140.

Experimental Tests on Gold-Silver-Lead-Zinc
Ore from the A and E Group on Carnes
Creek, Revelstoke Mining Division, British Columbia.

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Shipment:

Four bags of ore, total weight 240 pounds, were received on August 26th, 1941, from the A. and E Group on Carnes Creek, in the Revelstoke mining division of British Columbia. This sample was submitted by Andrew Kitson, Revelstoke, B.C.

Characteristics of the Ore:

Six polished sections were prepared and examined under the reflecting microscope for the purpose of determining the character of the ore.

Gangue -

Gangue material forms only a small part of the polished surfaces and occurs as numerous small grains and masses scattered throughout the sulphides. It appears hard and quartzitic and carries abundant, rather finely disseminated carbonate.

Metallic Minerals -

In their approximate order of decreasing abundance, metallic minerals present in the polished sections are: pyrite, arsenopyrite, sphalerite, galena, pyrrhotite, tetrahedrite and chalcopyrite. These minerals are very intimately admixed.

Pyrite and arsenopyrite are usually closely associated as small granular masses and irregular disseminated grains, coarse to fine in size. They contain numerous tiny grains and narrow veinlets of the other sulphides, particularly sphalerite and galena. In general the pyrite and arsenopyrite are coarser-grained than are the other metallic minerals.

Sphalerite and galena are also very closely associated with each other and often form the ground-mass for the other sulphides, particularly for pyrite and arsenopyrite. Pyrrhotite is present in small quantity as medium to fine irregular grains in gangue, pyrite, arsenopyrite, and sphalerite; a practically negligible amount of chalcopyrite has the same mode of occurrence. While most of the tetrahedrite occurs as small grains in galena, it is also

(Metallic Minerals, cont'd) -

visible in a few places as narrow veinlets and tiny inclusions in pyrite and arsenopyrite; its total quantity is very small.

No native gold or silver, nor gold or silver minerals were observed in the polished sections. The silver very probably occurs with the galena. Thus a concentration of galena will likely concentrate a large portion of the silver.

Sampling and Analysis:

The shipment was crushed, ground and sampled by standard methods. Analysis showed the following:

Gold (Au)	-	0.21 ounce per ton.
Silver (Ag)	-	13.75 ounces per ton.
Lead (Pb)	-	10.34 per cent.
Zinc (Zn)	-	10.90 "
Copper (Cu)	-	0.29 "
Iron (Fe)	-	25.20 "
Arsenic (As)	-	8.95 "
Antimony (Sb)	-	0.44 "

Experimental Tests:

The results of the investigation indicate that the ore is amenable to flotation concentrate for the recovery of lead, zinc and part of the silver. Lead concentrates were obtained which assayed from 60 to 65 per cent lead, from about 50 to 72 ounces of silver per ton, 5 to 5.5 per cent zinc, 1.21 to 1.86 per cent arsenic and from 0.17 to 1.54 per cent antimony (Tests Nos. 1, 2 and 4). The zinc concentrates assayed from 44 to 47 per cent zinc, 1.9 to 2.8 per cent lead, 1.65 to 2.46 per cent arsenic and less than 0.2 per cent antimony (Tests Nos. 3, 4 and 5). A zinc concentrate which contained 47.40 per cent zinc assayed 11.85 per cent iron (Test No. 5). About 60 per cent of the lead and 35 to 50 per cent of the silver in the ore were in the lead concentrates.

(Experimental Tests, cont'd) -

The zinc concentrates contained from 44 to 54 per cent of the zinc. The lead cleaner tailings and the scavenger concentrates (middlings) contained from 24 to 37 per cent of the lead, 14 to 27 per cent of the zinc and 30 to 37 per cent of the silver in the ore. In mill practice the scavenger concentrate and first lead cleaner tailing would be returned to the grinding circuit and the second lead cleaner tailing to the first cleaner circuit. This would increase the lead and silver recovery in the lead circuit. The zinc in the lead scavenger concentrate and the lead cleaner tailings would be in the final lead flotation tailing, the latter being the feed to zinc flotation circuit, hence the recovery of zinc would be appreciably higher in mill practice than that obtained by small laboratory tests.

The lead and the zinc concentrates contained a very small portion of the gold. In Test No. 1 the zinc flotation tailing assayed 0.23 ounce gold per ton and contained 74.2 per cent of the gold in the ore. Cyanidation of the zinc flotation tailing ground to 98 per cent minus 325 mesh gave a gold extraction of 9.1 per cent; the cyanide tailing assayed 0.20 ounce gold per ton. Roasting the zinc flotation tailing and cyaniding for 48 hours the gold extraction was 57.3 per cent, the cyanide tailing assayed 0.115 ounce gold per ton of calcine (0.086 ounce gold per ton of zinc flotation tailing).

DETAILS OF TESTS:

FLOTATION:

Test No. 1.

The ore, ground to 68 per cent minus 200 mesh in water, was conditioned with reagents and a rougher lead concentrate was removed. This concentrate was cleaned twice by re-floating. A scavenger concentrate, called lead middling, was also taken.

The lead flotation tailing was conditioned with lime and flotation reagents and a rougher zinc concentrate was removed. This concentrate was cleaned twice.

Reagents.

<u>To Lead Conditioner -</u>	<u>Lb./ton</u>
Soda ash	- 0.75
Sodium cyanide	- 0.05
Lime	- 0.10
Oil mixture	- 0.15
Potassium ethyl xanthate	- 0.10
Conditioning time	- 10 minutes.
<u>To Lead Circuit -</u>	
Cresylic acid	- 0.10
Flotation time	- 10 minutes.
<u>To Scavenger Cell -</u>	
Potassium ethyl xanthate	- 0.05
Oil mixture	- 0.09
Cresylic acid	- 0.06
Flotation time	- 5 minutes.
<u>To First Lead Cleaner -</u>	
Potassium ethyl xanthate	- 0.01
Oil mixture	- 0.03
<u>To Second Lead Cleaner -</u>	
Potassium ethyl xanthate	- 0.005

(Continued on next page)

Oil mixture	(Water gas tar	-- 65 per cent.
	(Coal tar creosote	- 25 "
	(Cresylic acid	- 10 "

(Test No. 1, cont'd) -

To Zinc Conditioner - Lb./ton

Lime - 0.5
 Copper sulphate - 0.5
 Potassium ethyl xanthate - 0.05

Conditioning time - 10 minutes.

To First Zinc Cleaner -

Lime - 0.10
 Cresylic acid - 0.03

To Second Zinc Cleaner -

Lime - 0.10
 Cresylic acid - 0.03

pH of the rougher lead circuit solution = 7.7.
 pH " " " zinc " " = 8.0.

Results:

Product	Weight, :				A s s a y s,				Distribution,				
	per	oz./ton		per	per cent		per cent		per cent		per cent		
	cent	Au	Ag	Pb	Zn	Au	Ag	Pb	Zn	Au	Ag	Pb	Zn
Feed	100.00	0.20	13.98	10.74	11.47	100.0	100.0	100.0	100.0				
Lead concentrate	10.08	0.10	56.80	65.16	5.52	5.0	40.9	61.2	4.8				
Lead middling	4.80	0.24	34.34	13.55	12.35	5.7	11.8	6.0	5.2				
1st lead cleaner tailing	4.08	0.20	24.43	17.67	14.51	4.0	7.1	6.7	5.2				
2nd lead cleaner tailing	4.15	0.20	35.05	30.82	11.35	4.1	10.4	11.9	4.1				
Zinc concentrate	8.04	0.10	8.62	1.91	39.33	3.9	5.0	1.4	27.6				
1st zinc cleaner tailing	1.81	0.20	12.92	5.07	17.36	1.8	1.7	0.9	2.7				
2nd zinc cleaner tailing	1.35	0.20	15.64	6.13	18.70	1.3	1.5	0.8	2.2				
Flotation tailing	65.69	0.23	4.60	1.81	8.41	74.2	21.6	11.1	48.2				

The final lead concentrate contained 40.9 per cent of the silver. 29.3 per cent of the silver and 24.6 per cent of the lead were in the middlings and the cleaner tailings; in mill practice these products would be returned to the lead

(Test No. 1, cont'd) -

circuit, thus increasing the lead recovery and the amount of silver in the lead concentrate. Zinc recovery and the grade of concentrate was low. The flotation tailing contained 74.2 per cent of the gold; this would indicate that the gold is associated mostly with pyrite and arsenopyrite.

The flotation tailing contained 7.20 per cent insoluble.

Test No. 2.

In this test, sodium sulphide was added to the scavenger circuit in order to sulphidize oxidized lead minerals which may be present.

The ore was ground to 68 per cent minus 200 mesh in water. The following reagents were used:

<u>To Lead Conditioner -</u>		<u>Lb./ton</u>
Soda ash	-	0.75
Sodium cyanide	-	0.20
Zinc sulphate	-	0.50
Oil mixture	-	0.15
Potassium amyl xanthate	-	0.10

Conditioning time - 10 minutes.

To Lead Circuit -

Cresylic acid	-	0.16
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To Scavenger Cell -

Sodium sulphide	-	0.40
Potassium amyl xanthate	-	0.05
Oil mixture	-	0.09
Cresylic acid	-	0.06

To First Lead Cleaner -

Potassium amyl xanthate	-	0.01
Oil mixture	-	0.03
Cresylic acid	-	0.03

(Continued on next page)

(Test No. 2, cont'd) -

To Second Lead Cleaner -

No reagents added.

To Zinc Conditioner -

Lb./ton

Lime - 12.0
Copper sulphate - 1.5
Potassium amyl xanthate - 0.20

Conditioning time - 10 minutes.

To Zinc Circuit -

Cresylic acid - 0.10

Flotation time - 12 minutes.

To First Zinc Cleaner -

Lime - 0.20
Cresylic acid - 0.03

To Second Zinc Cleaner -

Lime - 0.20
Cresylic acid - 0.03

Results:

Product	Results:									
	Weight, per cent	Assays,				Distribution, per cent				
		oz./ton	per cent	per cent	per cent	Au	Ag	Pb	Zn	
	Au	Ag	Pb	Zn	Au	Ag	Pb	Zn		
Feed	100.00	0.20	13.97	10.29	10.58	100.0	100.0	100.0	100.0	
Lead concentrate	9.41	0.17	72.23	60.74	5.01	7.9	48.7	55.5	4.5	
Lead middling	9.21	0.27	13.55	6.33	11.18	12.3	8.9	5.7	9.7	
1st lead cleaner tailing	2.36	0.22	14.47	13.10	13.66	2.6	2.4	3.0	3.0	
2nd lead cleaner tailing	13.88	0.24	26.58	21.28	10.76	16.5	26.4	28.7	14.1	
Zinc concentrate	15.26	0.15	3.30	1.05	41.59	11.3	3.6	1.6	60.0	
1st zinc cleaner tailing	9.42	0.29	3.90	1.61	3.41	13.5	2.6	1.5	3.0	
2nd zinc cleaner tailing	7.03	0.37	3.92	1.20	5.30	12.8	2.0	0.8	3.5	
Flotation tailing	33.43	0.14	2.24	1.00	0.68	23.1	5.4	3.2	2.2	

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(Test No. 2, cont'd) -

The lead concentrate contained 1.86 per cent arsenic, 1.54 per cent antimony.

The zinc concentrate contained 6.18 per cent arsenic, 0.16 per cent antimony. High lime in the zinc circuit did not improve the grade of zinc concentrate.

Ratios of concentration were 10.6:1 for lead and 6.6:1 for zinc. In mill practice, the cleaner tailings and the middling would be returned to their respective circuits; this would lower the ratios of concentration.

Addition of sodium sulphide to the scavenger circuit showed no marked improvement on flotation of lead.

Test No. 3.

In this test the amounts of copper sulphate and potassium amyl xanthate added to the zinc circuit were decreased in order to decrease the amounts of pyrite and arsenopyrite which floated with the zinc.

After grinding the ore in water to 68 per cent minus 200 mesh the pulp was conditioned for 10 minutes with 1.0 pound of soda ash, 0.2 pound of lime, 0.2 pound of sodium cyanide, 0.15 pound of oil mixture and 0.08 pound of potassium amyl xanthate per ton. Then 0.13 pound of cresylic acid was added to the cell and a rougher lead concentrate removed which was cleaned twice using 0.01 pound of potassium amyl xanthate and 0.03 pound of oil mixture per ton of ore in the first cleaner circuit and 0.03 pound of cresylic acid in the second cleaner circuit.

In the scavenging circuit, 0.05 pound of potassium amyl xanthate, 0.10 pound of oil mixture and 0.06 pound of

(Test No. 3, cont'd) -

cresylic acid per ton were used.

The lead circuit tailing was conditioned with 3.0 pounds of lime per ton, and the zinc floated with 1.0 pound of copper sulphate, 0.10 pound of potassium amyl xanthate and 0.06 pound of cresylic acid per ton. The rougher zinc concentrate was cleaned twice using 0.2 pound of lime and 0.03 pound of cresylic acid per ton of ore in each cleaning operation.

pH of rougher lead circuit solution	-	8.13
pH " " zinc " "	-	10.35
pH " 1st zinc cleaner circuit solution	-	9.40
pH " 2nd " " " "	-	9.75

Results:

Product	Weight, : per : cent	A S S A Y S,				Distribution,			
		oz./ton : Au :	per cent : Ag :	per cent : Pb :	per cent : Zn :	per cent : Au :	per cent : Ag :	per cent : Pb :	per cent : Zn :
Feed	100.00	0.21	14.19	10.65	10.67	100.0	100.0	100.0	100.0
Lead concentrate	13.87	0.20	62.08	52.41	6.33	13.1	60.7	68.3	8.2
Lead middling	9.51	0.36	14.22	6.38	13.03	16.1	9.5	5.7	11.6
1st lead cleaner tailing	9.70	0.24	16.89	14.53	11.79	11.0	11.6	13.2	10.7
2nd lead cleaner tailing	1.06	0.28	31.26	30.78	9.50	1.4	2.3	3.1	1.0
Zinc concentrate	12.84	0.10	4.34	1.92	44.80	6.0	3.9	2.3	53.9
1st zinc cleaner tailing	3.77	0.20	6.28	4.40	9.08	3.6	1.6	1.5	3.2
2nd zinc cleaner tailing	2.59	0.22	8.05	4.15	11.52	2.7	1.5	1.0	2.8
Flotation tailing	46.66	0.21	2.69	1.11	1.97	46.1	8.9	4.9	8.6

The lead concentrate contained 2.96 per cent arsenic, 0.25 per cent antimony.

The zinc concentrate contained 2.31 per cent arsenic, 0.08 per cent antimony.

(Test No. 3, cont'd) -

The lead concentrate contained 60.7 per cent of the silver and 68.3 per cent of the lead but the grade was low, namely 52.41 per cent lead. The zinc concentrate assayed 44.80 per cent zinc and contained 53.9 per cent of the zinc; the zinc flotation tailing assayed 1.97 per cent zinc.

Test No. 4.

An attempt was made to improve the grades and recoveries of the lead and the zinc by using Aerofloat 25, which is a frother and collector for lead minerals, and sodium aerofloat, which is a collector of zinc minerals.

The ore was ground to 82.7 per cent minus 200 mesh with 1.0 pound of soda ash, 0.20 pound of lime, 0.10 pound of sodium cyanide, 0.10 pound of Aerofloat 25 per ton of ore. To the flotation cell, 0.05 pound of potassium ethyl xanthate and 0.10 pound of cresylic acid were added and a rougher lead concentrate removed. This concentrate was cleaned twice using 0.02 pound of sodium cyanide and 0.01 pound of potassium ethyl xanthate per ton of ore in the first cleaner circuit and 0.01 pound of sodium cyanide in the second cleaner circuit.

The lead flotation tailing was conditioned for 10 minutes with 3.0 pounds of lime and 0.05 pound of sodium cyanide per ton of ore. Then 1.0 pound of copper sulphate, 0.15 pound of sodium aerofloat and 0.10 pound of cresylic acid were added and a rougher zinc concentrate removed. This concentrate was cleaned twice using 0.3 pound of lime, 0.02 pound of sodium cyanide and 0.03 pound of cresylic acid per ton in the first cleaner circuit and 0.3 pound of lime and 0.03 pound of cresylic acid

(Test No. 4, cont'd) -

in the second cleaner circuit.

pH of rougher lead circuit solution - 8.0
 pH " " zinc " " - 9.8
 PH of 1st zinc cleaner circuit solution - 10.2

Results:

Product	Weight, per cent	A s s a y s				Distribution, per cent					
		oz./ton	per cent	Au	Ag	Pb	Zn	Au	Ag	Pb	Zn
Feed	100.00	0.19	13.26	9.97	10.61	100.0	100.0	100.0	100.0		
Lead concentrate	9.22	0.08	51.64	63.20	5.03	3.9	35.9	58.5	4.4		
1st lead cleaner tailing	9.44	0.24	27.91	15.08	10.85	11.8	19.9	14.3	9.7		
2nd lead cleaner tailing	4.47	0.27	45.51	26.72	10.07	6.3	15.3	12.0	4.2		
Zinc concentrate	12.53	0.12	7.90	2.73	44.56	7.9	7.5	3.4	52.6		
1st zinc cleaner tailing	3.55	0.20	11.16	8.60	14.95	3.7	3.0	3.1	5.0		
2nd zinc cleaner tailing	3.43	0.19	12.11	5.31	17.28	3.4	3.1	1.8	5.6		
Flotation tailing	57.36	0.21	3.54	1.21	3.42	63.0	15.3	6.9	18.5		

The lead concentrate assayed 1.21 per cent arsenic and 0.17 per cent antimony. The zinc concentrate assayed 2.46 per cent arsenic and 0.14 per cent antimony.

The zinc flotation tailing was high in zinc indicating that a stronger collector would be necessary.

Test No. 5.

In the lead circuit, caustic soda was used in place of soda ash as the latter has a slight activating action on pyrite. In the zinc circuit the amounts of copper sulphate and potassium ethyl xanthate were kept

(Test No. 5, cont'd) -

quite low in order to keep down the amounts of pyrite and arsenopyrite which floated with the zinc.

A sample of the ore was ground to 82.7 per cent minus 200 mesh with 0.50 pound of caustic soda, 0.20 pound of lime, 0.20 pound of sodium cyanide, 0.50 pound of zinc sulphate and 0.10 pound of Aerofloat 31 per ton of ore. To the rougher lead circuit, 0.05 pound of potassium ethyl xanthate, 0.10 pound of oil mixture and 0.03 pound of cresylic acid were added. The rougher lead concentrate was cleaned twice using 0.02 pound of sodium cyanide, 0.01 pound of potassium ethyl xanthate and 0.03 pound of oil mixture per ton of ore in the first cleaner circuit and 0.01 pound of sodium cyanide in the second cleaner circuit.

To the scavenging circuit, 0.07 pound of potassium ethyl xanthate, 0.10 pound of oil mixture and 0.06 pound of cresylic acid per ton of ore were added.

The tailing from the scavenging circuit was conditioned for 10 minutes with 3.0 pounds of lime per ton of ore. Then 0.70 pound of copper sulphate, 0.08 pound of potassium ethyl xanthate, 0.06 pound of oil mixture and 0.03 pound of cresylic acid were added and the zinc froth removed for 10 minutes. The rougher zinc concentrate was cleaned twice using 0.4 pound of lime in the first cleaner circuit and 0.6 pound of lime and 0.03 pound of oil mixture in the second cleaner circuit.

(Continued on next page)

(Test No. 5, cont'd) -

Results:

Product	Weight, per cent	A s s a y s,				Distribution, per cent			
		oz./ton Au	Ag	Pb	Zn	Au	Ag	Pb	Zn
Feed	100.00	0.20	13.90	10.29	11.01	100.0	100.0	100.0	100.0
Lead concentrate	11.56	0.16	46.00	51.90	5.40	9.3	38.2	58.5	5.7
Lead middling	12.91	0.28	20.66	9.09	13.50	18.2	19.2	11.4	15.8
1st lead cleaner tailing	6.25	0.25	19.92	12.07	10.02	7.9	9.0	7.3	5.7
2nd lead cleaner tailing	5.27	0.285	32.11	21.70	8.15	7.6	12.2	11.1	3.9
Zinc concentrate	10.23	0.07	6.07	2.63	47.40	3.6	4.5	2.5	44.0
1st zinc cleaner tailing	20.83	0.27	3.97	1.48	2.78	28.3	5.9	3.0	5.3
2nd zinc cleaner tailing	11.66	0.21	6.50	2.10	10.85	12.3	5.4	2.4	11.5
Flotation tailing	21.29	0.12	3.63	1.84	4.21	12.8	5.6	3.8	8.1

The lead concentrate contained 2.48 per cent arsenic and 2.14 per cent antimony. The zinc concentrate contained 1.65 per cent arsenic, 0.16 per cent antimony and 11.85 per cent iron (Fe).

Tests were carried out using Minerec A and Aerofloat 242 as galena collectors and Aerofloat 226 in zinc circuit. The concentrates obtained were low grade and high in iron sulphides.

CYANIDATION OF FLOTATION TAILINGS.

Test No. 6.

Samples of zinc flotation tailing from Test No. 2 were agitated with lime and sodium cyanide for 24 and 48 hours at 3 to 1 dilution (liquid to solid).

Cyanidation of Flotation Tailing.						(Pb, 1.00%, Zn, 0.68%)				
Agitation time, hours	Assay, oz./ton		Tailing, per cent		Extraction, per cent		Titration, lb./ton of solution		Reagents consumed, lb./ton solids	
	Au	Ag	Au	Ag	Au	Ag	NaCN	CaO	NaCN	Lime
24	0.14	2.24	0.13	2.03	7.1	9.4	1.10	0.35	3.7	18.7
48	0.14	2.24	0.12	1.86	14.3	16.9	1.30	0.30	4.1	20.9

Test No. 7.

In this test samples of zinc flotation tailing, reground to 98 per cent minus 325 mesh, were agitated with lime and sodium cyanide for 24 and 48 hours at about 2 to 1 dilution (liquid to solid).

Cyanidation of Reground Flotation Tailing.						(Pb, 0.96%, Zn, 0.70%)				
Agitation time, hours	Assay, oz./ton		Tailing, per cent		Extraction, per cent		Titration, lb./ton of solution		Reagents consumed, lb./ton solids	
	Au	Ag	Au	Ag	Au	Ag	NaCN	CaO	NaCN	Lime
24	0.22	2.81	0.20	1.71	9.1	39.1	0.62	0.04	4.61	19.6
48	0.22	2.81	0.20	1.50	9.1	46.6	0.66	0.07	5.35	21.6

The extraction of gold was very low, showing that the ore is refractory.

Test No. 8.

The zinc flotation tailing from Test No. 3 was roasted in an electric muffle furnace as follows:

(Continued on next page)

(Test No. 8, cont'd) -

Heating stage, door closed - 295-400° C. - 35 minutes.
 Fuming stage, door closed - 400-470° C. - 40 minutes.
 Free oxidation, door opened
 3 inches - 470-650° C. - 180 minutes.

Reduction in weight due to roasting - 25.1 per cent.
 Gold loss due to roasting - 4.4 "
 Silver loss due to roasting - 3.1 "

The calcine assayed as follows:

Gold (Au) - 0.27 ounce per ton.
 Silver (Ag) - 3.48 ounces per ton.
 Sulphate sulphur - 1.84 per cent.
 Sulphide sulphur - 2.57 "
 Arsenic (As) - 0.91 "
 Lead (Pb) - 1.31 "
 Zinc (Zn) - 2.46 "

The calcine was ground in water to 98 per cent minus 325 mesh, filtered and the solids repulped with fresh water for cyanidation.

Cyanidation of Calcine.

Agitation time, hours	Assay,				Extraction,		Titration,		Reagents consumed,	
	oz./ton		per cent		per cent		of solution		lb./ton solids	
	Au	Ag	Au	Ag	Au	Ag	NaCN	CaO	NaCN	Lime
24	0.27	3.48	0.125	-	53.7	-	0.88	0.33	1.84	5.5
48	0.27	3.48	0.115	2.38	57.4	31.6	0.35	0.10	3.00	5.9
96	0.27	3.48	0.110	2.11	59.3	39.4	0.90	0.41	4.89	6.9

The reducing powers of the cyanide solutions were 52, 64 and 90 c.c. of N/10 KMnO₄ per litre for 24, 48 and 96 hours agitation, respectively.

The cyanide tailings were combined and sized by means of an infrasizer. The analysis was as follows:

(Continued on next page)

(Test No. 8, cont'd) -

Infrasizer Analysis.			
Microns	Weight, : per : cent :	G o l d	
		Assay, : oz./ton:	Distribution, per cent
+56	: 0.3)	0.27	10.5
-56+40	: 4.4)		
-40+28	: 12.6)	0.12	26.7
-28+20	: 14.1)		
-20+14	: 11.9)	0.12	22.5
-14+10	: 10.6)		
-10	: 46.1	0.105	40.3
Total	: 100.0	0.12	100.0

Conclusions:

The results of the above investigation show that it is possible to obtain a lead concentrate assaying from 60 to 65 per cent lead, less than 6 per cent zinc (6 per cent allowable without penalty), one to two per cent arsenic and below two per cent antimony. A zinc concentrate can be obtained of about 45 per cent zinc, 1.5 to 2.5 per cent arsenic and less than 0.2 per cent antimony.

As it is practically impossible to show figures on actual recoveries by small laboratory tests, it is quite probable that recoveries of lead, zinc and silver would be better than 80 per cent. As the pyrite and arsenopyrite contain numerous tiny grains and narrow veinlets of galena and sphalerite, it can be expected that the final tailing will be high in lead and zinc.

The gold is associated with pyrite and arsenopyrite and hence would be mainly in the zinc flotation tailing, which would have to be roasted before cyanidation

(Conclusions, cont'd) -

due to it being refractory. About 55 per cent of the gold in the zinc flotation tailing can be extracted by cyanidation of the roasted product. The cyanide feed would have to be ground practically all through 325 mesh in order to attain low gold content in the cyanide tailing.

The following flow-sheet should prove satisfactory, ball mill and classifier discharging a product, ground to about 70 per cent minus 200 mesh, to a lead conditioner where the pulp is agitated with reagents. From the conditioner the pulp would go to a rougher lead flotation circuit where a rougher lead concentrate and a scavenger concentrate (middling) would be taken off. The rougher lead concentrate should be cleaned at least twice; the first cleaner tailing and the scavenger concentrate would be returned to the ball mill-classifier circuit and the second cleaner tailing to the first cleaner circuit. The lead flotation tailing, being feed to the zinc circuit, would be conditioned with sufficient lime to give the solution a pH of about 10. The pulp from the zinc conditioner would go to the zinc rougher flotation circuit. The rougher zinc concentrate should be cleaned at least twice. The cleaner tailings would be reground and returned to the head of the zinc circuit. The zinc flotation tailing could be put over a pilot table on which lead and silver minerals could be removed and returned to the initial grinding circuit.

The zinc flotation tailing would be thickened, filtered and roasted. The calcine would be ground in a ball mill-classifier circuit, the classifier overflow thickened and filtered. The filter cake would be repulped with barren cyanide solution for cyanidation treatment.

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