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U. S. DEPARTMENT OF MINES  
BUREAU OF METALS

REPORT  
OF  
METALLURGICAL TESTS ON  
DOS CABEZAS MINE  
Mexico

By  
THE WESTERN RESEARCH  
CORP.  
Denver  
Colorado

October 8, 1924.

Mr. E. L. Prentise,  
Denver, Colorado.

Dear Sir:

We have completed the preliminary flotation tests on your ore from Mexico as per instructions from Mr. Wm. E. Ellis of -Boulder, Colorado

SAMPLES:

Three samples were received for testing as follows:

Samples No. 1 and No. 2 East Extension, estimated as 20 oz. silver ore. These were combined for testing. The crude ran .12 gold, 21.4 silver, 1.5% iron, 1.0% silver chloride.

Sample No. 3, tailings. Assayed .20 gold, 24.5 silver, 0.8 iron, 1.1 silver chloride.

Sample No. 4, North extension, estimated 50 oz. silver. Assayed .22 gold, 67 oz. silver, 3.1 iron, 4.6 silver chloride.

The samples were crushed to 80 mesh and treated by flotation using standard methods for oils and reagents as follows:

TEST NO. 1: - Ore No. 1 and No. 2 combined.

<u>Product</u>	<u>%</u>	<u>Gold</u>	<u>Silver</u>
Heads	100.	.13	21.4
Flot. Concls.	5.	3.20	310.8
Flot. Tails	95.	.06	6.0

Rate of concentration, 20 to 1.

Recovery, - Gold, - 65% Silver, - 75%

Remarks: Gold and silver recovery too low but this can be improved by experimentation with flotation reagents

TEST NO. 1: - No. 3 sample mill tailings.

<u>Product</u>	<u>%</u>	<u>Gold</u>	<u>Silver</u>
Heads	100.	.148	24.4
Flot. Concls.	2.6	3.44	495.8
Flot. Tails	97.4	.06	11.8

Rate of concentration, 38 to 1.

Recovery, - Gold, - 60% Silver, - 52%

Remarks: Recovery low on account of mill tailings being weathered or partly oxidized. This can be overcome to some extent by use of reagents with the oils.

TEST NO. 1: - No. 4. North Extension.

<u>Product</u>	<u>%</u>	<u>Gold</u>	<u>Silver</u>
Heads	100.	.17	87.3
Flot. Concls.	5.8	2.30	910.7
" Tails	94.2	.04	11.0

Rate of concentration, 17 to 1.

Recovery, - Gold, - 77% Silver, - 83%

Remarks: Improvement over test No. 1 on account of oils and reagents used and in handling the froth.

CYANIDE TESTS

Using the improved method of cyaniding silver ores by first treating the ore with sodium sulphide to react on antimony if present, then adding sodium hyposulphide to react on manganese. After 36 hours agitation the cyanide is added.

Crude ore crushed to minus 80 mesh.

TEST A: - No. 1 and No. 2 East Extension.

24 hrs. air agitation with 2 lbs. sodium sulphide.		
24 " " " " 2 " " hyposulphide.		
24 " " " " 3 " " cyanide.		
Heads	Gold, - .12 oz.	Silver, - 21.4 oz.
Tails	" - .06 "	" - 5.1 "
Recovery	" - 50.4	" - 76%

Cyanide consumption.....1.4 lbs. per ton.

TEST B: - Mill tailings.

24 hrs. air agitation with 3 lbs. sodium sulphide.  
24 " " " " 3 " " hyposulphide.  
24 " " " " 3 " " cyanide.

Heads	Gold, -	.20 oz.	Silver, -	24.5 oz.
Tails	" -	.04 "	" -	7.6 "
Recovery	" -	80%	" -	69%

Cyanide consumption.....2.2 lbs. per ton.

TEST C: - North Extension.

24 hrs. air agitation with 3 lbs. sodium sulphide.  
24 " " " " 2 " " hyposulphide.  
24 " " " " 3 " " cyanide.

Heads	Gold, -	.22 oz.	Silver, -	67. oz.
Tails	" -	.04 "	" -	27.6 "
Recovery	" -	33.0%	" -	59%

Cyanide consumption.....3.4 lbs. per ton.

COMPARATIVE CYANIDE TESTS.

Using standard method of cyaniding, and making comparative tests on ore crushed to minus 80 mesh and minus 150 mesh.

TEST D: - Ore crushed to 80 mesh. Samples No. 1 & No. 2. East extension. 72 hours air agitation.

Heads	Gold, -	.12 oz.	Silver, -	24.5 oz.
Tails	" -	.04 "	" -	7.6 "
Recovery	" -	50.0%	" -	76.6%

Cyanide consumption.....1½ lbs. per ton.

TEST E: - Ore crushed to 80 mesh. Sample No. 3 mill tailings 72 hrs. air agitation.

Heads	Gold, -	.20 oz.	Silver, -	24.5 oz.
Tails	" -	.04 "	" -	7.6 "
Extraction	" -	80.0%	" -	67.3%

Cyanide consumption.....1½ lbs. per ton.

TEST F: - Ore crushed to 80 mesh. Sample No. 4, North Extension, 72 hrs. air agitation.

Heads	Gold, - .22 oz.	Silver, - 67.0 oz.
Cyanide tails	" -0 .04 "	" - 27.6 "
Extraction	" -81.8%	" - 58.3%

Cyanide consumption.....2½ lbs. per ton.

The above results indicate that 80 mesh grinding will not make a good recovery and that finer grinding will be necessary.

TEST G: - Ore crushed to 150 mesh. Samples No. 1 and 3. East extension. 72 hrs. air agitation.

Heads	Gold, - .12 oz.	Silver, - 21.4 oz.
Cyanide tails	" -0 .01 "	" - 3.8 "
Extraction	" -91.6%	" -82.3%

Cyanide consumption.....1½ lbs. per ton.

TEST H: - Ore crushed to 150 mesh. Sample Nos. 1 and 3. East extension. Combined flotation and cyanide.

**FLOTATION:**

	<i>g</i>	Gold	Silver
Heads	100.	.12 oz.	21.4 oz.
Flot. Concs.	4.4	.56 "	350.4 "
Flot. Mids.	8.8	.08 "	32.6 "
Flot. Tails.	86.8	.02 "	4.0 "

Rate of concentration, 23 to 1.

Recovery by concentration:	Gold	Silver
Flotation concentrates	68%	70.9%
Flotation middlings	15.4%	12.4%

**CYANIDE TREATMENT ON TAILS WITH 72 hrs. air agitation:**

Flotation tails	Gold, - .02 oz.	Silver, - 4.0 oz.
Cyanide "	" - .01 "	" - 1.2 "

**COMBINED RECOVERY:**

Flotation concentrates	Gold, - 68%	Silver, - 70.9%
Flotation middlings	" - 15.4%	" - 12.4%
Cyanide extraction	" - 8.3%	" - 11.1%
	" - 91.7%	" - 94.4%

TEST H: (Contd.)

REMARKS: While this recovery is good the process is complicated and you would have to market the flotation concentrates, which would be expensive on account of the distance from smelter.

TEST I: - Ore crushed to 150 mesh, Samples No. 1 and 2. East extension. Combined flotation and cyanide, and combining middlings with froth concentrates.

FLOTATION:

	%	Gold	Silver
Heads	100.	.13	21.4
Flot. Concts.	5.8	.44	263.2
Flot. Tails	94.3	.02	5.4

Rate of concentration, 17 to 1.

Recovery, - Gold, - 83.3 Silver, 74.8

CYANIDE TREATMENT ON FLOTATION TAILS WITH 72 hrs. agitation:

Flotation tails	Gold, - .02	Silver, - 5.4
Cyanide tails	" - .01	" - 1.3

Cyanide consumption..... $\frac{3}{4}$  lbs. per ton.

TOTAL EXTRACTION:

Flotation concentrates	Gold, - 83.3	Silver, - 74.8
By cyanide	" - 8.3	" - 19.1
	" - 91.6	" - 93.9

TEST J: - Ore crushed to 80 mesh. Samples No. 1 and 2. East extension. Cyanide on flotation concentrates.

FLOTATION:

	%	Gold	Silver
Heads	100.	.13	21.4
Flot. Concts.	13.5	.30	130.1
Tails	87.5	.02	4.8

Rate of concentration, 8 to 1.

Recovery, - Gold, - 83.3% Silver, - 77.5%

THE flotation concentrates were then reground to 300 mesh and treated with cyanide for 62 hrs.

(TEST J. Contd.)

Flot. Concts - Heads	Gold, -	.30	Silver, 130.1
Cyanide tails	" -	.10	" - 61.3
Extraction	" -	66.6%	" - 52.9%

Cyanide consumption.....6½ lbs. per ton.

REMARKS: This test indicates that it would be necessary to roast the flotation concentrates to secure a good recovery by this method and this would not be practical as it is very difficult to roast a flotation concentrate without excessive loss.

TEST K: - Ore crushed to 80 mesh. Sample No. 3. Mill tails. Cyanide on flotation concentrates.

FLOTATION:

	%	Gold	Silver
Heads	100.	.30 oz.	.34.5 oz.
Flot. Concts.	4.9	.37 "	344.9 "
Tails	95.1	.02 "	8.0 "

Rate of concentration, 20.4 to 1.

Recovery, - Gold, 90% Silver, - 67.4%

The flotation concentrates were then crushed to 200 mesh and treated with cyanide for 72 hrs.

Heads, flot. concts.	Gold, -	.37	Silver, - 344.9
Cyanide tails	" -	.10	" - 188.
Extraction	" -	73.0%	" - 47.0%

Cyanide consumption,.....9 lbs. per ton.

REMARKS: This confirms results in Test J. with cyaniding flotation concentrates, and proves it would not be practical to cyanide flotation concentrates without roasting.

C O N C L U S I O N S

The preliminary tests with flotation on ore crushed to 80 mesh give an average value of 2.35 oz. gold and 572 oz. silver with an average recovery of 67% of the gold and 69% of the silver.

Flotation tests on ore crushed to 150 mesh making a dirty froth concentrate for treatment by cyanide showed a low average of gold and silver values as follows:

Average of gold	45	oz.
" " silver	247	"
Recovery " gold	78	%
" " silver	74	%

The results of the flotation test are not encouraging as the grade of concentrates and recovery are low. Considerable improvement can be made by commercial practice but the improved results would not warrant the installation of the flotation process if the concentrates have to be hauled a long distance to market.

Cyanide tests on ore crushed to 80 mesh show an average recovery of 70.6% of the gold and 67.3% of the silver. Cyanide test on ore crushed to 150 mesh showed a recovery of 91.6% of the gold and 82.3% of the silver. This can be improved by finer grinding.

The combination of flotation and cyanide making a flotation concentrate and cyaniding the tailings shows the following recovery:

Average of tests H. & I.	Gold	Silver
by flotation into a concentrate	83.3%	77.8%
by cyanide on flotation tails	8.3%	15.7%
Total recovery	91.6%	93.5%

The combination of flotation and cyanide gives the best recovery but makes a low grade concentrate that cannot be marketed.

Tests J. and K. were made by cyaniding the flotation concentrates without roasting and the results were not satisfactory as the cyanide extraction was too low and it would be necessary to roast this product to obtain a high recovery.

#### RECOMMENDATIONS:

On account of distance from transportation we would recommend fine grinding and continuous decantation cyanide on your ore as the tests indicate that with fine grinding to 150 mesh a fairly good recovery can be obtained and by grinding to 200 mesh in a cyanide solution the recovery can be considerably improved.

Very truly yours,

THE WESTERN RESEARCH CORP.

By \_\_\_\_\_

JMMc-NC



TEST NO. E:

Flotation.

Sample No. 3, Mill Tails.

Hercules Pine Oil	1/4	lb. per ton.
#50 G. N. S. Mineral Oil	1/4	lb. " "
Z-1 Reagent	1/4	" " "

REMARKS:

Averaging the results of the flotation tests the following oil combinations will give the best results: -

Forest Products or Hercules Pine Oil	1/4 to 3/4	lbs. per ton.
General Naval Stores No. 50 Mineral Oil	1/4 to 1-	" " "
Sodium silicate	1/4 to 1/2	" " "
Z-1 Sulphidizing reagent	1/4 to 1/2	" " "

OILS AND REAGENTS.

The following oils and reagents were used in the flotation tests:

TEST NO. I:

Flotation.

Samples No. 1 & 2, East extension.

Hercules Pine Oil	$\frac{1}{2}$	lb. per ton.
#50 G. N. S. "	1	" " "
Calcium sulphide	1-	" " "
Sodium silicate	$\frac{1}{2}$	" " "

TEST NO. I:

Flotation.

Sample No. 3, Mill tailings.

Hercules Pine Oil	$\frac{1}{2}$	lb. per ton.
#50 G. N. S. "	1	" " "
Calcium sulphate	1-	" " "
Sodium silicate	$\frac{1}{2}$	" " "

TEST NO. I:

Flotation.

Sample No. 4, North Extension.

Hercules Pine Oil	$\frac{1}{2}$	lb. per ton.
#50 G. N. S. "	1	" " "
Calcium sulphate	1-	" " "
Sodium silicate	$\frac{1}{2}$	" " "

TEST NO. H:

Flotation.

Sample No. 1 & 2, East extension.

Forest Products Pine Oil	1-lb.	per ton.
#50 G. N. S. Mineral "	$\frac{1}{2}$	" " "
Z-1 Reagent	$\frac{1}{2}$	" " "
Hercules Risore "	$\frac{1}{16}$	" " "

TEST NO. I:

Flotation

Sample No. 1 & 2, East extension.

Forest Products Pine Oil	$\frac{1}{2}$	lb. per ton.
#50 G. N. S. Mineral "	$\frac{1}{2}$	" " "
Z-1 Reagent	$\frac{1}{2}$	" " "
Sodium silicate	$\frac{1}{2}$	" " "

TEST NO. J:

Flotation.

Samples No. 1. & 2. past extension.

Forest Products Pine Oil	$\frac{1}{2}$	lb. per ton.
#50 G. N. S. Mineral "	1	" " "
Z-1 Reagent	$\frac{1}{2}$	" " "

M. B. 2. U