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Experiments on a telluride ore and design of plant for treating same

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T H E S I S

FOR THE

Degree of Bachelor of Science

IN

MINE ENGINEERING.

C. L. KING AND J. S. SCHROEDER.

Class of 1904.

Experiments on a Telluride Ore and Design of Plant
for Treating Same.

The ore used in these experiments was a double telluride of gold and silver, coming from La Plata, Colorado.

The tellurides occur in thin seams of iron oxide deposited between two walls of very hard quartz. The quartz appeared to be agatized in several of the samples. The veins range in thickness from one to two inches. The original state of the iron was in the form of either pyrite or marcasite which is plainly proved by the presence of pseudomorph crystals of these minerals.

About fifteen pounds of the ore was crushed down to ten mesh. It was well mixed and sampled down to one half. The sample was again well mixed and sampled down one half. This sample was crushed to forty mesh and sampled down to three quarters of a pound which was crushed to one hundred mesh and assayed by both wet and fire assay methods.

The fire assay was made by four methods:

By using an excess of Litharge.

By using an excess of Soda.

By nail method

By scorification.

The following charges were used in the different methods.

Excess Litharge

One half assay ton ore
 Thirty grams soda
 Ten grams borax
 Two and one half grams argol
 Forty grams litharge
 Salt cover

Results:

Au 3.82 oz	Ag .78
Au 3.80 oz	Ag .80

Excess Soda

One half assay ton ore
 Thirty five grams soda
 Four grams argol
 Twenty grams litharge
 Salt cover

Result

Au 3.52 oz	Ag .77
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The check was rescorified with test lead before cupelling

Au 3.45 oz	Ag .78
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Nail Method

One half assay ton ore
 Thirty five grams soda
 Ten grams borax
 Three nails
 Twenty grams litharge
 Salt cover.

Results

Au 3.74 oz Ag .51 oz

The check was rescorified

Au 3.73 oz Ag .47 oz

Scorification assay

One fifth assay ton ore

Seventy grams test lead

Ten grams litharge (used as a cover)

Borax

Results

Au 3.42 oz Ag .64 oz

Au 3.40 oz Ag .70 oz

The ore was then assayed by wet methods for gold, silver and tellurium.

Results

Au 3.90 oz, ~~###~~ Ag .80, Tel. 9.7

Au 3.90 oz Ag .78 Tel. 9.7

9.7 oz Tellurium equals .00033%

Laboratory tests made were chlorination, amalgamation and cyanide on both raw and roasted ore.

It was found that a combination of amalgamation and cyanide methods on the roasted ore gave the best extraction.

The amalgamation and cyanide tests were carried on in the following manner:

Some of the ore was crushed to forty mesh. About six assay tons were weighed into a mortar, enough water was added to make a thick mud. About twenty five grams of mercury were added and the mixture well stirred. The mercury was then panned out and the tailings saved. The mercury was strained but no amalgam was found.

The tailings were then placed in a large funnel arranged with a stop cock below so as to regulate the flow of cyanide solution. 400 cc of a .5% cyanide solution was then poured on the tailings and allowed to percolate through very slowly. This operation was continued for twenty four hours. The tailings were then washed out and assayed.

Au
Ag
~~Silver~~ 2.94 ~~Gold~~ .57

Giving an extraction of 25% gold and 29% ag.

The consumption of cyanide was .017%

Six assay tons of forty mesh ore were then taken and roasted beginning at a low temperature and finishing at a high temperature. The roasting was carried on for an hour and a half. The loss in weight by roasting was about .4 grams

Roasted ore assayed:

Au 3.63 oz Ag .69 oz

Loss by roasting Au .17 oz, Ag .11 oz.

The roasted ore was then amalgamated in the same manner as the raw ore and the tailings saved. The amalgam obtained by straining was retorted and the residue wrapped in lead and cupelled.

Extraction was

Au 1.93 oz or 53%

Ag .37 oz or 53%

The tailings were treated with .5% cyanide solution for twenty four hours and assayed.

Au .34 oz Ag .08

Extraction Au 37% Ag 45%

Consumption of cyanide was .006%

Some of roasted forty mesh ore was amalgamated and treated with .1 .3 .5 and .7% solutions of cyanide and the tailings assayed.

Strength Solution	Assay Value		Percent Extraction		Consumption Cyanide
	Ag	Ag	Au	Ag	
.1	1.54 1.32	.30	4	3	.001
.3	1.32	.24	11	10	.002
.5	.34	.08	38	35	.006
.7	.34	.05	38	35	.009

The .5% solution gave the best extraction with the least consumption.

The next tests were made on sized 20/40/ and 60 mesh. Time twenty four hours. These were roasted, starting at a low temperature and finishing at a high temperature.

Five assay tons were weighed out and each one amalgamated and the tailings of each saved. The amalgam was retorted and cupelled.

Extraction:

20 mesh Au 1.32 or 46%	Ag .31 or 45%
40 mesh Au 1.93 or 53%	Ag .37 or 53%
60 mesh Au 1.98 or 54%	Ag .39 or 56%

Tailings assayed

20 mesh	Au 2.31	Ag .38
40 mesh	Au 1.70	Ag .32
60 mesh	Au 1.65	Ag 30

The tailings were then treated with a .5 % cyanide solution for twenty four hours. The tailings were then carefully washed and assayed.

Size ore	Assay value		Percent Extraction		Consumption
	Au	Ag	Au	Ag	Cyanide
20 mesh	.96	.28	37	10	.007
40 mesh	.34	.08	37	32	.008
60 mesh	.28	.05	38	33	.008

The next test was for time of leaching.

A roasted sixty mesh ore was amalgamated and some of the tailings treated with a .5% cyanide for twenty four, thirty six and forty eight hours. The tailings were then washed and assayed.

Time	Assay value		Percent Extraction		Consumption
	Au	Ag	Au	Ag	Cyanide
24 hours	.28	.05	38	.33	008
36 hours	.12	trace	42	.44	009
48 hours	.07	--	44	.44	.01

The plant is to have a cap 100 T and will consist of a

Crushing Plant

Roasting Furnace

Amalgamation Mill

Cyanide Mill

The ore is brought direct from the mine and dumped on crusher floor. The crushing is done by a Comet crusher number "A" which crushes the ore to one and one half inch. The crushed ore falls direct into a storage bin. From this bin it is fed into a set of rolls which crushes it to three-quarters inch. After passing through these rolls it runs into the boot of an elevator which carries it up to a trommel. The undersize from the trommel passes direct into bin #2 below. The oversize passes through another set of rolls and then into bin #2. The final size being 1/4"

From bin number two it is conveyed by tramway to roaster building where ore is roasted in two Pearce Turret Furnaces. After

being discharged from these furnaces it is wheeled outside of building to cooling floor.

When cooled it is loaded into car and hauled up an incline and emptied into bin number 3.

From bin number three it is conveyed by belt conveyor to stamp feeders. The stamps crush to sixty mesh and discharge into copper amalgamating plates. The tailings from these tables pass into a mercury trap and from there into settling tanks. When settling tanks are full water is drawn off and tailings loaded into cars and hauled to cyanide mill where they are placed in leaching vats. The leaching vats are filled to within a foot of the top and carefully leveled off. Great care being taken not to pack the tailings.

The track is carried on a trestle which is entirely separated from vats so that the vibration will not cause settling. The vats are built on a foundation separate and not connected with building. The leaching solutions and wash water are introduced in the bottom of vat, causing them to flow up through the tailings.

The solution tanks, of which there are two, are placed in the highest level in the building about a foot above the leaching vats.

The solution from the leaching vats is run into a gold solution storage tank. There are two of these tanks, one for strong and one for weak gold solutions. From these storage tanks the solutions are run through the zinc precipitating boxes. The boxes have nine compartments 24" X 18" X 15" . At intervals the precipitates are sluiced into a launder which conveys them to a settling tank. When enough are collected they are filtered^{ed} in a filter press and placed in an acid tank to dissolve excess of zinc. The residuum are then melted down in a furnace. A vacuum pump is used to aid leaching in vats and washing the tailings.