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MINES BRANCH INVESTIGATION REPORT IR 58-43

CYANIDATION TESTS ON A SAMPLE OF GOLD ORE SUBMITTED BY UNITED KENO HILL MINES LIMITED, ELSA, YUKON TERRITORY.

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MINERAL DRESSING AND PROCESS METALLURGY DIVISION

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SHIPMENT

A shipment of 21 lb of ore was received on December 27, 1957 from Mr. W. A. Wall, Mill Superintendent, United Keno Hill Mines Limited, Elsa, Yukon Territory.

PURPOSE OF INVESTIGATION

In his letter, dated December 12, 1957, Mr. Wall stated that his company had done some test work on the ore which indicated that cyanidation of the ore could be carried out. However, he stated, the reagent consumption was excessive, being approximately 15.0 lb of sodium cyanide and 40.0 lb of lime per ton of ore. It was his desire that a few tests be carried out with a view to reducing the reagent consumption and to improving the extraction of gold.

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SUMMARY OF RESULTS

Best results were obtained in one test with a recovery of 93.0% of the gold and a reagent consumption of 1.3 lb of sodium cyanide and 5.6 lb of lime per ton of ore. To obtain these results it was necessary to first roast the ore.

Straight cyanidation of the ore without any pretreatment gave results similar to those obtained by Mr. Wall. Recovery of the gold was 82.7% and the consumption of sodium cyanide was 15.2 lb and of lime was 36.3 lb per ton of feed.

SAMPLING AND ASSAYING

After removing specimens for microscopic examination, the sample was crushed and sampled according to standard procedures and the following analysis was obtained:

Gold	-	0.49 oz/ton
Silver	-	0.39 "
Arsenic	-	5.70 %
Copper	-	0.09 "
Iron	-	39.63 "
Sulphur	-	26.65 "
Zinc	-	0.18 "
Lead	-	0.02 "

CHARACTERISTICS OF THE ORE*

Four polished sections of -10 mesh material taken from the sample, were prepared and examined microscopically to identify the ore minerals.

General Description

In each of the four polished surfaces, particles of metallic minerals, ranging in size from about 1.5 mm across the longest direction to one just visible with unaided eyes, are abundantly embedded in the mounting medium (bakelite). Under a microscope they are seen to consist of pyrrhotite, pyrite, arsenopyrite, chalcopyrite, goethite, sphalerite and galena, listed in approximate order of decreasing abundance. Particles of the first three minerals named are quite common and those of the last four are comparatively scarce. This is particularly true of galena, as not more than three or four grains of this mineral were observed in the four polished sections. The metallic mineral particles are predominantly irregular in shape and are largely free in bakelite. A few, however, are associated with each other and/or with gangue. The latter constituent is subordinate to metallic mineral particles in the four polished surfaces and is represented by translucent clear to white quartz.

Although each of the four sections was carefully traversed under a high-power objective, no gold was found and, therefore, nothing was learned as to how this metal occurs in the ore.

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* From Mineragraphic Laboratory Report No. M-1558-E, by Wm. E. White, January 13, 1958.

CONCLUSIONS

The best recovery and lowest reagent consumption were obtained in one test in which 93.0% of the gold was extracted and the reagent consumption was 1.3 lb of sodium cyanide and 5.6 lb of lime per ton of ore. To obtain these results it was necessary to roast the ground ore by the Beattie Short Roast method.

Straight cyanidation of the ore gave results similar to those reported by the company. Recovery of gold was 82.7% and the consumption of sodium cyanide and lime was respectively 15.2 and 36.3 lb per ton of feed.

The use of litharge had only a slightly beneficial effect, reducing the consumption of sodium cyanide to 11.0 lb and that of lime to 25.2 lb per ton of feed. Gold recovery was 82.9%.

Increasing the period of cyanidation from 48 to 72 hr did not increase the recovery but did increase the consumption of reagents.

With the furnace used for roasting it was not possible to keep the temperature as constant as desired, this factor appeared to cause minor variations in the results obtained.

Flotation of the ore did not appear to be practical. The total amount of sulphides was greater than 72% and the cost of floating the ore did not seem to justify the possible rejection of 28% of the material with an accompanying loss of some of the gold.

DETAILS OF TEST WORK

Test No. 1

One thousand grams of ore was ground with 1.0 lb of NaCN and 1.0 lb of CaO per ton of feed to 91.6% -200 mesh and agitated at a dilution of 2:1 for 48 hr. At the end of the agitation period the tailing was filtered, washed and assayed.

Assay of feed - 0.49 oz Au per ton

Assay of tailing - 0.085 " " "

Extraction of gold - 82.7 %

The consumption of reagents was 15.2 lb of NaCN and 36.3 lb of CaO per ton of feed. The reducing power of the solution in terms of $\frac{N}{10}$ $KMnO_4$, was 3420 cm^3 per liter of solution.

Test No. 2

One thousand grams of ore was ground with 1.0 lb of NaCN, 1 lb of CaO and 1.0 lb of PbO per ton of feed to 91.6% -200 mesh and agitated at a dilution of 2:1 for 48 hr. At the end of the agitation period the tailing was filtered, washed and assayed.

Assay of feed - 0.49 oz Au per ton

Assay of tailing - 0.084 " " "

Extraction of gold - 82.9 %

The consumption of reagents was 11.0 lb of NaCN and 25.2 lb of CaO per ton of feed. The reducing power of the solution in terms of $\frac{N}{10}$ $KMnO_4$, was 1860 cm^3 per liter of solution.

Test No. 3

One thousand grams of ore was ground, dried and roasted according to the Beattie Short Roast procedure. The calcine was ground for 5 min, and filtered and washed twice with hot water. The residue was then repulped and cyanided at approximately 2.5:1 dilution with 1.0 lb of NaCN and 1.0 lb of CaO per ton of solution for 48 hr. At the end of the agitation period the tailing was filtered, washed and assayed.

Calculated assay of calcine - 0.605 oz Au per ton

Assay of tailing - 0.0425 " " "

Extraction of gold - 93.0 %

A screen test of the calcine tailing showed that it had been ground to 92.4% -200 mesh. The reagent consumption was 1.3 lb of NaCN and 5.6 lb of CaO per ton of original feed. The reducing power of the solution in terms of $\frac{N}{10}$ $KMnO_4$, was 300 cm^3 per liter of solution.

Test No. 4

Test No. 4 was a repetition of Test No. 3 except that the agitation was continued for 72 hr.

Calculated assay of calcine - 0.588 oz Au per ton

Assay of tailing - 0.045 " " "

Extraction of gold - 92.3 %

The reagent consumption was 1.9 lb of NaCN and 6.2 lb of CaO per ton of original feed. The reducing power of the solution in terms of $\frac{N}{10}$ $KMnO_4$, was 420 cm^3 per liter of solution.