

THE UNIVERSITY OF BRITISH COLUMBIA

006201

VANCOUVER 8, CANADA

November 28, 1974

DEPARTMENT OF METALLURGY

Mr. P.J. Brown
Chief Metallurgist
Anvil Mining Corp. Ltd.
P.O. Box 1000, Faro, Y.T.

Dear Sir:

Enclosed please find my report on silver rich minerals in your lead concentrate. I must apologize for the amount of time I have taken. At your suggestion, I have sent copies to Mr. R. Fukuhara and Mr. D.A. Blundell.

If I am not mistaken, you are concerned with erratic silver recoveries. If this is the case, it would seem logical to study the tailings rather than the concentrate. I understand that there are floatation techniques available that can nonselectively strip an ore of sulphides and even native metals. A study of these materials stripped from a few kilograms of one of your higher silver tailings may prove very instructive.

If I can be of any further service in this matter please contact me.

Yours truly



R. Butters
Assistant Professor

sdt

cc: Mr. R. Fukuhara, Plant Metallurgist
Mr. D.A. Blundell, Chief Assayer ✓

REPORT ON THE PRESENCE OF SILVER RICH MINERALS
IN ANVIL MINING CORPORATION LEAD CONCENTRATE

In July, 1974, eleven lead concentrate samples and a like number of zinc concentrate samples were received here from the Mine site, Faro, Y.T. These samples were labeled by date and included Jan. to May, 1973, and July to Dec. 1973. In a covering letter dated July 19, 1974, Mr. P. J. Brown, Chief Metallurgist, Anvil Mining Corp. requested that any three of the lead conc. samples be examined for possible Silver rich minerals, using the Electron Beam Microprobe.

Description of the Electron Beam Microprobe

The Electron Beam Microprobe is an instrument capable of yielding quantitative (and qualitative) elemental analysis of very small volumes of materials. The principal of operation is to generate a very small (about 0.5 micron diameter) beam of high energy electrons and to allow this beam to be absorbed at a precisely known location on the surface of a specimen. Characteristic X-Rays are generated by all the elements present in the specimen in a volume of a few cubic microns directly beneath the point of impact of the electrons. Dispersive X-Ray Spectrometers suitably located near the specimen are used to resolve the X-Rays produced by the specimen into the discrete emission lines characteristic of the elements present. By scanning the electron beam in a raster fashion over a small area of the specimen and using the X-Ray intensity signal of any one element to modulate the brightness of a cathode ray tube, it is possible to produce a highly magnified, two dimensional picture of the variations in concentration of that element in the specimen. Since each element tends to absorb electrons

more or less efficiently, depending on its atomic number, it is also possible to produce a "Backscatter Electron Image" on the cathode ray tube. This last technique yields an image of the specimen comparable to that obtained by conventional microscopy but capable of much higher magnification. Quantitative analytical results for a selected area are obtained by comparing the intensities of X-Rays produced by any one element in the sample to that obtained from the pure element. Rather involved corrections due to other elements present must be applied to the raw data in order to obtain truly quantitative analytical results.

Procedure

Three lead concentrate samples, Feb. 1973, May 1973 and Oct. 1973, were selected and mounted separately in epoxy resin. The mounted specimens were ground and polished, finishing with 1 micron diamond paste. A very thin, transparent layer of carbon was then evaporated onto each specimen in order to render the surface electrically conductive. The specimens were then probed for silver and antimony simultaneously using a JOEL model JXA-3A microprobe complete with two spectrometers. The second spectrometer was adjusted for antimony because previous work had indicated that a silver rich mineral present in another sample of Anvil lead concentrate contained antimony. A defocussed electron spot was employed and the specimen was slowly traversed under the beam and continuous recordings of the silver and antimony X-Ray count rate were made. Whenever a slight response was recorded on the silver spectrometer, the specimen was backtracked to that location and the area was scanned manually at high magnification using a finely focussed electron beam. Despite all efforts, no silver rich

grains could be located on any of the three specimens chosen. Each specimen was then repolished to expose new mineral grains and the whole procedure reported. Still, no silver rich areas could be located. In all, about 14 hours of probe time were expended on these three specimens with negative results.

Since one other specimen, Jan. 1974 Pbl.O., had already been mounted and had displayed one silver rich grain in a previous study, it was repolished and submitted to the same procedure outlined above. Almost immediately two more silver rich grains were detected in this specimen. Backscatter electron images and X-Ray emission images for all the elements considered relevant were made of the areas around each grain (see figs. 1 and 2). In each case the mineral grains containing silver were very small (about 2 microns in diameter) and in each case the silver rich grain contained significant amounts of antimony and copper, possibly some lead, and no detectable zinc. Antimony rich but silver free grains (one such grain is shown in fig. 2) were detectable throughout all of the samples.

An attempt was made to quantitatively analyse the silver rich grain shown in fig. 2. The following point counts (corrected for background) for silver, antimony, and copper were obtained:

Element	Mineral grain	Pure Metal Standard
Ag	6,250/10sec	27,000/10sec
Sb	4,060	29,000
Cu	6,380	105,300

Since the grain was so small, it is not advisable to place too much significance on these results but some conclusions can be reached. Since both silver and antimony are of about the same atomic number, it is expected that they would both respond in about the same way to the electron beam,

even if the mineral grain were so small and thin that the beam were not completely captured. For this reason, and since the silver and antimony standards gave essentially the same count rate, it is believed that the silver to antimony molar ratio is between 1.5:1 and 2:1. The copper content is quite small and may well be substitutional. Dana's "Textbook of Mineralogy" lists a great number of silver-antimony sulphides, many of which contain lesser amounts of copper and other elements, and many of which are found in association with Galena-Sphalerite deposits.

Conclusions

- 1) No silver rich particles were detected in any of the three lead concentrate samples, Feb. May, or Oct. 1973.
- 2) Two silver rich particles were easily found in the Jan. 1974 lead concentrate sample after repolishing.
- 3) Each of the silver rich particles found in the Jan. 1974 sample contained predominantly Silver, Antimony, and Copper.
- 4) Quantitative analysis was not possible on such a small particle but it is believed that silver to antimony molar ratio is between 1.5:1 and 2:1, while the copper content is quite small.

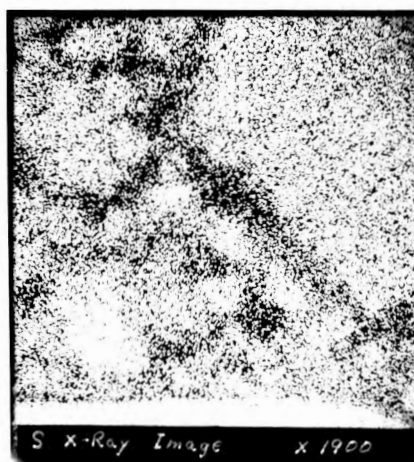
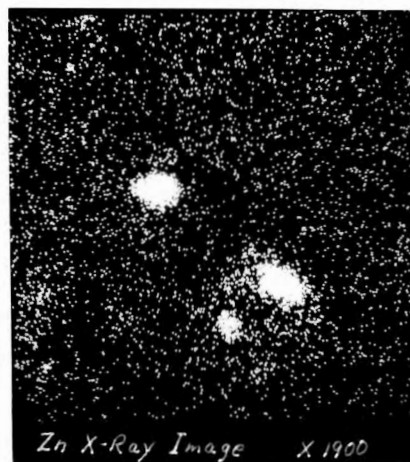
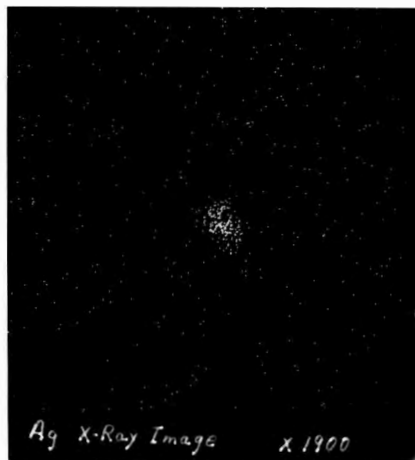
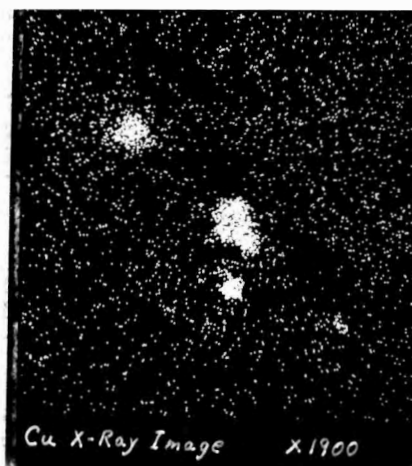


Fig. 1. Backscatter Electron Image and X-Ray Emission Images from the First Selected Area of Lead Conc. Sample Jan. 1974.

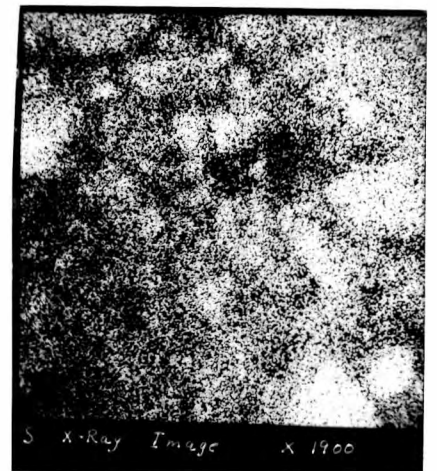
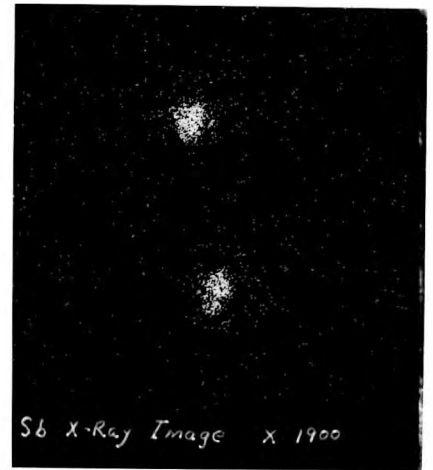
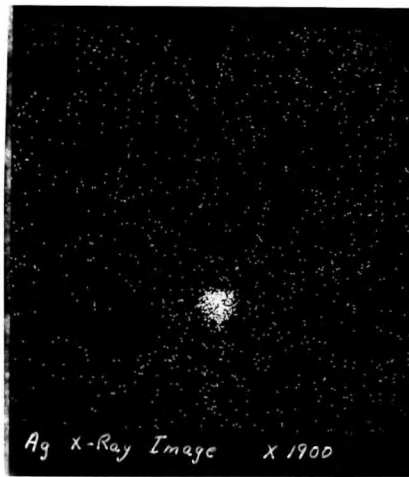
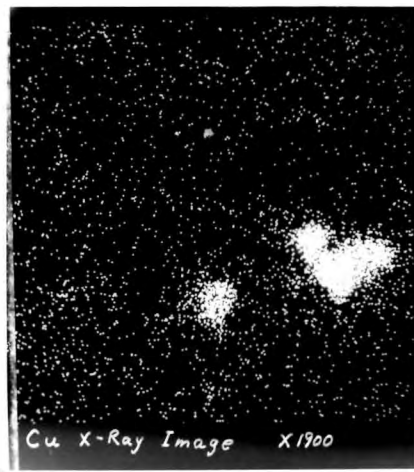


Fig. 2. Backscatter Electron Image and X-Ray Emission Images from the Second Selected Area of Lead Conc. Sample Jan. 1974.