STATE OF ALASKA
Department of Natural Resources
DIVISION OF MINES AND GEOLOGY

LABORATORY NOTES NO. 1

Precision and Accuracy of the Au-Ag Analysis By AAS on a Quartz Type Rock

By

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November 1968

PRECISION AND ACCURACY OF THE Au-Ag ANALYSIS BY AAS ON A QUARTZ TYPE ROCK

E X P E R I M E N T

A sample of several pounds was selected to study the precision and accuracy of the AAS method on gold and silver determinations.

A P P R O A C H

The sample was crushed, pulverized, and then mixed very carefully by rolling. The powder was coned and then the cone flattoned to a 1/2" deep layer of powder. A 75 gram specimen was taken by removing thin strips of powder across the layer at about 1" intervals. This should provide as representative a sample as is possible to acquire.

The remaining powder was then poured into a sample bag as a stock sample. Fifty grams of the split-out 75 gram sample was run as one sample. This is five times the size of our normal 10-gram samples and should provide an accurate specimen of the larger gold-quartz sample. In addition five 10-gram samples were taken by simply scooping powder from the top of the sample bag and would therefore represent analytically the variations in our normal method of taking a sample.

The samples were all digested by our conventional aqua regia method, except the 50 gram sample was digested at five-times volumes. From the five-times volume sample five separate gold extractions were made which will allow a test of the variation of the gold extraction into methyl iso-butyl ketone.

Gold and silver were determined on each of the five 10-gram samples and on each of the five portions of the 50-gram sample. The samples were randomized and each analyzed by AAS in duplicate which will allow a test of the variation in the AAS readings.

R E S U L T S

GOLD

The five 10-gram samples showed the following gold values in duplicate readings:

SAMPLE	PPM GOLD IN SAMPLES	
	Reading I	Reading II
F_1	23.20	23.00
F_2	27.24	26.80
F_3	30.40	29.48
F_4	26.00	26.00
F_5	30.40	30.40

The mean value is 27.30 ppm in the sample. The maximum deviation is 4.4 ppm and the standard deviation is 3.01 ppm. This gives a coefficient of variation of 11 percent of the value.

From the five specimens of the 50-gram sample the following results were obtained:

SAMPLE	PPM GOLD IN SAMPLE	
	Reading I	Reading II
F_a	27.08	27.68
F_b	26.16	27.20
F_c	26.16	27.40
F_d	26.80	27.68
F_e	26.80	26.80

The mean value is 26.98 ppm gold in the sample. The maximum deviation was 1.52 ppm and the standard deviation is 0.32 ppm. This gives a coefficient of variation of 1.2 percent.

The standard deviation of the reading error is 0.72 ppm which yields a coefficient of variation of 2.3 percent.

The difference between the means of the five portions of the 50-gram sample and the five 10-gram samples is only 27.30 - 26.98 = 0.32 ppm.

Because the reading error is larger than the error from the five separate extractions of the one digestion (50-gram sample), I have demonstrated no detectable error in the extraction process. The reading error comprised about 1/5 (11 percent vs. 2.3 percent) of the total error.

It appears then that the AAS procedure is highly reproducible for gold. The sampling error is also small. The analysis gave a value on this sample of 0.791 ± 0.087 troy ounces per ton.

SILVER

The five 10-gram samples showed the following silver values in duplicate:

SAMPLE	PPM SILVER IN THE SAMPLE	
	Reading I	Reading II
F_1	7.63	7.55
F_2	7.96	8.19
F_3	8.78	9.00
F_4	7.83	8.05
F_5	8.85	9.27

The mean value is 8.11 ppm in the sample. The maximum deviation was 1.64 ppm and the standard deviation was 0.47 ppm which gives a coefficient of variation of 5.8 percent of the value.

From the five specimens of the 50-gram sample the following results were obtained:

SAMPLE	PPM SILVER IN THE SAMPLE	
	Reading I	Reading II
F_a	7.48	8.05
F_b	7.82	7.96
F_c	7.96	8.11
F_d	7.96	8.11
F_e	8.05	7.96

The mean value is 7.94 ppm, maximum deviation 0.63 ppm, standard deviation 0.13 ppm, and the coefficient of variation of 1.6 percent of the value.

The difference between the mean of the five portions of the 50-gram sample and the five 10-gram sample was only 8.11 - 7.94 = 0.17 ppm.

The coefficient of variation of the replicate readings was 3.6 percent of the value. The 3.6 percent is about 1/3 of the total error obtained on the five 10-gram specimens.

It appears that the AAS procedure for silver on this type of sample is very good, yielding a total error (analytical and sampling) of 5.8 percent of the value. The silver value obtained on this sample is 0.234 $\pm$ 0.058 troy ounces per ton.

This sample will be sent out for referee analyses for gold and silver for a closer check on accuracy.