

Certificate of Analysis

Reference Material SI15

Recommended Values and 95% Confidence Intervals

Gold Concentration: 1.805 (+/- 0.028) µg/g

Silver concentration: 19.68 (+/- 0.46) µg/g

The above values apply only to product in jars or sachets which have an identification number within the following range: *The number range is not published on the website*

Prepared and Certified By:

Malcolm Smith BSc, FNZIC
Malcolm Smith Reference Materials Ltd
2 Moriggia Place
Auckland 10
NEW ZEALAND
Telephone: +64 9 444 3534
Telefax: +64 9 444 7739
Email: mgs@xtra.co.nz

Date of Certification:

26 September 2003

Certificate Status:

Original

Available Packaging:

This reference material has been packed in wide-mouthed jars that contain 2.5kg of product. The contents of some jars may be subsequently repacked into sealed polyethylene sachets.

Origin of Reference Material:

Feldspars and iron pyrites with minor quantities of finely divided gold and silver-containing minerals that have been screened to ensure there is no gold nugget effect.

Supplier of Reference Material:

ROCKLABS Ltd
P O Box 18 142
Auckland
NEW ZEALAND
Email: rocklabs@clear.net.nz
Telephone: +64 9 634 7696

Description:

The component minerals have been well mixed and a homogeneity test carried out after the entire batch was packaged into wide-mouthed jars to ascertain that the gold is evenly distributed throughout the reference material. There is no soil component. The product contains crystalline quartz and therefore dust from it should not be inhaled.

The approximate chemical composition is:
(Uncertified Values)

	%
SiO ₂	64.33
Al ₂ O ₃	17.83
Na ₂ O	10.15
K ₂ O	0.25
CaO	0.48
MgO	0.09
TiO ₂	0.06
MnO	0.01
P ₂ O ₅	0.14
Fe	3.2
S	2.9

Intended Use:

This reference material is designed to be included with every batch of samples analysed and the results plotted for quality monitoring purposes.

Stability:

The container (jar or sachet) and its contents should not be heated to temperatures higher than 50 °C. Iron pyrites are likely to oxidize in the air but preliminary tests have shown that the increase in weight of an exposed reference material of similar matrix, in the Auckland climate, is less than 0.1% per year.

Instructions for Use:

Weigh out quantity usually used for analysis and analyze by normal procedure. Homogeneity testing has shown that consistent results are obtainable for gold when 30g portions are taken for analysis. 1g portions should be sufficient to obtain reasonable repeatability for silver analysis.

Method of Preparation:

Pulverized feldspar minerals and barren iron pyrites were blended with finely pulverized and screened, gold and silver-containing minerals. Once the powders were uniformly mixed the composite was placed into 748 wide-mouthed jars, each bearing a unique number. 30 jars were randomly selected from the packaging run and material from these jars was used for both homogeneity and consensus testing.

Homogeneity Assessment for Gold:

An independent laboratory carried out all gold analyses by fire assay of 30g portions, using a gravimetric finish with a balance capable of reading to one microgram. Steps were taken to minimize laboratory method variation in order to better detect any variation in the reference material.

Homogeneity Assessment Prior to Packaging

30 samples were removed at regular intervals from the prepared candidate reference material prior to packaging into 2.5 kg jars. The results of analysis of the 30 samples produced a coefficient of variation of 0.8%.

Homogeneity Assessment After Packaging

The contents of three randomly selected jars were compacted by vibration (to simulate the effect of freighting) and five samples removed successively from top to bottom from each of the three jars. In addition, five samples were removed from the last jar in the series. 30 samples were removed from the top of 30 jars randomly selected from the 748 jars in the batch. The results of analysis of the 50 samples produced a coefficient of variation of 1.0%.

As the homogeneity testing was carried out using 30g analytical portions, the same degree of homogeneity cannot be guaranteed if smaller weights are taken for analysis.

Homogeneity Assessment for Silver:

Ten x 1g portions, taken from ten different jars, produced a coefficient of variation of 1.6 % when analysed together in the one batch by an independent laboratory. The method used was an aqua regia digest followed by AAS.

Analytical Methodology:

Once homogeneity had been established, two sub-samples were submitted to a number of well-recognized laboratories in order to assign gold and silver values by consensus testing. The sub-samples were drawn from the 30 randomly selected jars and each laboratory received samples from two different jars. Indicative concentration ranges were given. Two laboratories used neutron activation and the remainder used fire assay for gold analysis. Most laboratories used an acid digest/instrumental detection procedure for silver.

Calculation of Certified Value:

30 sets of results were returned for gold and 22 sets for silver. Statistical analysis to identify outliers was carried out using the principles detailed in sections 7.3.2 – 7.3.4, ISO 5725-2: 1994. Assessment of each laboratory's performance was carried out on the basis of z-scores, partly based on the concept described in ISO/IEC Guide 43-1. Details of the criteria used in these examinations are available on request. As a result of these statistical analyses, five sets of gold results and one set of silver results were excluded for the purpose of assigning gold and silver concentration values to this reference material. Recommended values were thus calculated from the average of the remaining n = 25 sets of replicate results for gold and n = 21 sets of replicate results for silver.

The 95% confidence interval for each average was estimated using the formula:-

$$X \pm ts/\sqrt{n}$$

Calculation of Certified Value (continued):

(where X is the estimated average, s is the estimated standard deviation of the laboratory averages, and t is the 0.025 tail-value from Student's t-distribution with n-1 degrees of freedom). The recommended values are provided at the beginning of the certificate in µg/g (ppm) units. A summary of the results used to calculate the recommended values are listed below and the names of the laboratories that submitted results are listed on page 5.

Legal Notice:

This certificate and the reference material described in it have been prepared with due care and attention. However ROCKLABS Ltd, Malcolm Smith Reference Materials Ltd and Tim Ball Ltd accept no liability for any decisions or actions taken following the use of the reference material.

Summary of Results Used to Calculate Gold and Silver Values

(not related to order of laboratories listed on page 5)

Gold (ppm)		
Sample 1	Sample 2	Average
1.695	1.674	1.685
1.75	1.67	1.710
1.75	1.68	1.715
1.73	1.73	1.730
1.74	1.74	1.740
1.73	1.78	1.755
1.78	1.74	1.760
1.745	1.776	1.761
1.74	1.80	1.770
1.73	1.82	1.775
1.76	1.80	1.780
1.79	1.78	1.785
1.81	1.78	1.795
1.800	1.819	1.810
1.810	1.825	1.818
1.83	1.83	1.830
1.85	1.83	1.840
1.85	1.85	1.850
1.86	1.88	1.870
1.87	1.87	1.870
1.87	1.88	1.875
1.871	1.902	1.887
1.860	1.915	1.888
1.92	1.88	1.900
1.93	1.93	1.930
Average of 25 sets = 1.805 ppm Standard deviation of 25 sets = 0.067 ppm Coefficient of variation = 3.7 % 95% Confidence interval for average = 0.028 ppm		

Silver (ppm)		
Sample 1	Sample 2	Average
18.5	17.0	17.75
18.1	18.0	18.05
18.3	18.7	18.50
18.9	19.0	18.95
19	19	19.0
19.1	19.1	19.10
19.1	19.2	19.15
19.25	19.20	19.225
19.3	19.4	19.35
20	19	19.5
19	20	19.5
19.88	19.73	19.805
20.1	19.8	19.95
20	20	20.0
20	20	20.0
20.2	20.1	20.15
20.6	20.1	20.35
22	20	21.0
21.8	20.3	21.05
22.7	20.0	21.35
21.8	21.4	21.60
Average of 21 sets = 19.68 ppm Standard deviation of 21 sets = 1.02 ppm Coefficient of variation = 5.2 % 95% Confidence interval for average = 0.46 ppm		

Statistical analysis of both homogeneity and consensus test results has been carried out by an independent statistician.

Participating Laboratories

Australia

Amdel, Adelaide
Amdel, Perth
Amdel, Kalgoorlie
Becquerel Laboratories, Lucas Heights
Genalysis Laboratory Services Pty Ltd, Perth
SGS Analabs, Perth
SGS Analabs, Townsville
Standard and Reference Laboratories, Perth

Brazil

Lakefield Geosol Limitada

Canada

Acme Analytical Laboratories Ltd, British Columbia
Activation Laboratories Ltd, Ontario
ALS Chemex, British Columbia
ALS Chemex Chimitec, Quebec
Bourlamaque Assay Laboratories Ltd, Quebec
SGS Lakefield Research Limited, Ontario
SGS XRAL Laboratories, Ontario

Ireland

OMAC Laboratories Ltd

New Zealand

Amdel New Zealand Ltd, Otago
SGS New Zealand Ltd, Waihi

Russia

Irgiredmet, Irkutsk
Magadangeologia, Magadan
Tsnigri, Moscow

South Africa

Anglo American Research Laboratories (Pty) Ltd
AngloGold, Vaal River
AngloGold, West Wits
Mintek, Analytical Services Division
SGS Lakefield Research Africa (Pty) Ltd

United States of America

ALS Chemex, Nevada
Barrick Goldstrike Mines Inc, Nevada
Newmont Mining Corporation, Nevada

References:

For further information on the preparation and validation of this reference material please contact Malcolm Smith.

Certifying Officer

M G Smith BSc, FNZIC

Independent Statistician



Tim Ball BSc (Hons)