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Certificate of Analysis

Reference Material SP59

Recommended Gold Concentration: 18.12 µg/g
95% Confidence Interval: +/- 0.12 µg/g

The above values apply only to product in jars or sachets which have an identification number within the following range: ***236 195 – 237 946.***

Prepared and Certified By:

Malcolm Smith BSc, FNZIC
Rocklabs Reference Materials
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Date of Certification: 19 August 2011

Certificate Status: Original

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

Origin of Reference Material: Feldspar minerals, basalt and iron pyrites with minor quantities of finely divided gold-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
Glen Innes
Auckland 1743
NEW ZEALAND
Email: sales@rocklabs.com
Website: www.rocklabs.com

World Leaders in Sample Preparation Equipment,
Automated Systems and Certified Reference Materials

Description: The reference material is a light grey powder that has been well mixed and a homogeneity test carried out after the entire batch was packaged into wide-mouthed jars. 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	54.51
Al_2O_3	15.95
Na_2O	4.04
K_2O	5.36
CaO	3.53
MgO	3.33
TiO_2	0.93
MnO	0.07
P_2O_5	0.24
Fe_2O_3	4.80
Fe	3.0
S	3.3

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

Method of Preparation: Pulverized feldspar minerals, basalt rock and barren iron pyrites were blended with finely pulverized and screened gold-containing minerals. Once the powders were uniformly mixed the composite was placed into 1752 wide-mouthed jars, each bearing a unique number. 48 jars were randomly selected from the packaging run and material from these jars was used for both homogeneity and consensus testing.

Homogeneity Assessment:

An independent laboratory carried out gold analysis by fire assay of 30 g portions, using a gravimetric finish. Steps were taken to minimize laboratory method variation in order to better detect any variation in the candidate reference material.
The contents of six randomly selected jars were compacted by vibration (to simulate the effect of freighting) and five samples removed successively from top to bottom from each jar. In addition, five samples were removed from the last jar in the series. A sample was also removed from the top of each of the 48 jars randomly selected from the 1752 jars in the batch. The results of analysis of the 83 samples (randomly ordered and then consecutively numbered before being sent to the laboratory) produced a relative standard deviation of 0.4 %.

Analytical Methodology:

Once homogeneity had been established, two sub-samples were submitted to a number of well-recognized laboratories in order to assign a gold value by consensus testing. The sub-samples were drawn from the 48 randomly selected jars and each laboratory received samples from two different jars. Indicative concentration ranges were given. All laboratories used fire assay for the gold analysis, with some using an instrument finish and 21 using a gravimetric finish.

Calculation of Certified Value:

Results for gold were returned from 44 laboratories. 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, four sets of results were excluded for the purpose of assigning a gold concentration value to this reference material. A recommended value was thus calculated from the average of the remaining n = 40 sets of replicate results. The 95 % confidence interval was estimated using the formula:-

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

(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 value is provided at the beginning of the certificate in µg/g (ppm) units. A summary of the results used to calculate the recommended value is listed on page 4 and the names of the laboratories that submitted results are listed on page 5. The results are listed in increasing order of the individual laboratory averages.

Statistical analysis of the consensus test results has been carried out by independent statistician, Tim Ball.

Summary of Results Used to Calculate Gold Value

(Listed in increasing order of individual laboratory averages)

Gold (ppm)		
Sample 1	**Sample 2**	**Average**
17.182	17.281	17.232
17.0	17.5	17.25
17.40	17.30	17.350
17.7	17.6	17.65
17.79	17.74	17.765
17.74	17.84	17.790
17.700	18.030	17.865
18.15	17.60	17.875
18.5	17.3	17.90
17.9	17.9	17.90
17.742	18.063	17.903
17.869	18.012	17.941
18.02	17.92	17.970
18.1	18.0	18.05
18.25	17.85	18.050
17.977	18.137	18.057
18.00	18.15	18.075
18.1	18.1	18.10
18.1	18.1	18.10
18.1	18.2	18.15
18.20	18.15	18.175
18.20	18.16	18.180
18.22	18.22	18.220
18.10	18.35	18.225
17.6	18.9	18.25
18.259	18.248	18.254
17.85	18.7	18.275
18.3	18.3	18.30
18.15	18.50	18.325
18.25	18.40	18.325
18.343	18.309	18.326
17.85	18.9	18.375
18.393	18.557	18.475
18.500	18.484	18.492
18.5	18.5	18.50
18.630	18.490	18.560
18.30	18.90	18.600
18.605	18.620	18.613
18.696	18.704	18.700
18.800	18.700	18.750

Average of 40 sets = 18.12 ppm

Standard deviation of 40 sets = 0.36 ppm

Note: this standard deviation should not be used as a basis to set control limits when plotting results from an individual laboratory.

Relative standard deviation = 2.0 %

95% Confidence interval for average = 0.12 ppm

Participating Laboratories

Australia	ALS Minerals, Kalgoorlie ALS Minerals, Orange ALS Minerals, Perth ALS Minerals, Townsville Amdel – Bureau Veritas, Adelaide Amdel – Bureau Veritas, Kalgoorlie Genalysis Laboratory Services, Perth Independent Assay Laboratories, Perth SGS Minerals Services, Perth Standard and Reference, Perth Ultra Trace – Bureau Veritas, Perth
Burkina Faso	ALS Minerals, Burkina Faso Semafo Burkina Faso S.A.
Canada	Acme Analytical Laboratories, Vancouver ALS Minerals, Val d'Or ALS Minerals, Vancouver Bourlamaque Assay Laboratories, Quebec Loring Laboratories (Alberta) Ltd, Calgary SGS Minerals Services, Vancouver SGS Minerals Services, Lakefield Techni-Lab S.G.B., Québec TSL Laboratories Inc, Saskatoon
Chile	Acme Analytical Laboratories, Santiago ALS Minerals, La Serena
Côte d'Ivoire	Bureau Veritas Mineral Laboratories, Abidjan
Ireland	OMAC Laboratories
Kyrgyz Republic	Stewart Assay and Environmental Laboratories LLC, Kara-Balta
Mali	ALS Minerals, Bamako
New Zealand	SGS Minerals Services, Otago SGS Minerals Services, Waihi
Peru	ALS Minerals, Lima Inspectorate Services Perú S.A.C., Callao Minera Yanacocha SRL – Newmont, Lima
Russia	Irgiredmet Analytical Centre, Irkutsk
South Africa	ALS Minerals, Johannesburg AngloGold Ashanti, Vaal River Chemical Laboratory Goldfields West Wits Analytical Laboratory Performance Laboratories, Randfontein SGS South Africa (Pty) Ltd, Johannesburg
United Kingdom	Inspectorate International, Essex
USA	ALS Minerals, Reno Barrick Goldstrike – Met Services Newmont Mining Corporation, Carlin Laboratory
Zimbabwe	Performance Laboratories, Harare

Instructions and Recommendations for Use:

Weigh out quantity usually used for analysis and analyze for total gold by normal procedure. Homogeneity testing has shown that consistent results are obtainable for gold when 30g portions are taken for analysis.

We quote a 95% confidence interval for our estimate of the declared value. This confidence interval reflects our uncertainty in estimating the true value for the gold content of the reference material. The interval is chosen such that, if the same procedure as used here to estimate the declared value were used again and again, then 95% of the trials would give intervals that contained the true value. It is a reflection of how precise the trial has been in estimating the declared value. It **does not** reflect the variability any particular laboratory will experience in its own repetitive testing.

Some users in the past have misinterpreted this confidence interval as a guide as to how different an individual test result should be from the declared value. Some mistakenly use this interval, or the standard deviation from the consensus test, to set limits for control charts on their own routine test results using the reference material. Such use inevitably leads to many apparent out-of-control points, leading to doubts about the laboratory's testing, or of the reference material itself.
A much better way of determining the laboratory performance when analysing the reference material is to accumulate a history of the test results obtained, and plot them on a control chart. The appropriate centre line and control limits for this chart should be based on the average level and variability exhibited in the laboratory's **own** data. This chart will provide a clear picture of the long-term stability or otherwise of the laboratory testing process, providing good clues as to the causes of any problems. To help our customers do this more simply for themselves, we can provide a free Excel template that will produce sensible graphs, with intelligently chosen limits, from the customer's own data.

Legal Notice:

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

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)