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Certificate of Analysis

Reference Material SP89

Recommended Values and 95% Confidence Intervals
Gold Concentration: 18.46 (+/- 0.08) µg/g
Silver Concentration: 84.4 (+/- 1.1) µg/g

The above values apply only to product in jars or sachets which have an identification number within the following range: ***407 686– 408 575*.**

Prepared and Certified By:

Brett Coombridge, M.Phil. Chemistry
Rocklabs Reference Materials
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Date of Certification: 18 December 2014

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 and silver-containing minerals that have been screened to ensure there is no gold nugget effect.

Supplier of Reference Material:

ROCKLABS
P O Box 18 142
Glen Innes
Auckland 1743
NEW ZEALAND
Email: reference-materials@rocklabs.com
Website: www.rocklabs.com

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	54.31
Al_2O_3	15.69
Na_2O	4.37
K_2O	5.01
CaO	3.51
MgO	3.24
TiO_2	0.93
MnO	0.07
P_2O_5	0.24
Fe_2O_3	4.84
Fe	3.1
S	3.5

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 and silver-containing minerals. Once the powders were uniformly mixed the composite was placed into 890 wide-mouthed jars, each bearing a unique number. 24 jars were randomly selected from the packaging run and material from these jars was used for both homogeneity and consensus testing.

Homogeneity Assessment:

Sampling was performed by Rocklabs Reference Materials and 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.

Homogeneity: A sample was removed from the top of each of the 24 jars randomly selected from the 890 jars in the batch. The results of analysis of the 24 samples (randomly ordered then consecutively numbered before being sent to the laboratory) indicated 3 test results were anomalously low. Analysis of the slags and crucibles related to these 3 samples showed excessive gold had been retained, so the results for these samples were discarded from the set. The test results for the remaining 21 samples produced a relative standard deviation of 0.5%.

Settling: The contents of 3 randomly selected jars were compacted by vibration (to simulate the effect of freighting) and 5 samples were removed successively from top to bottom from each jar. In addition, 5 samples were removed from the last jar in the series. No top to bottom gradation in the gold values was observed, although the last jar in the set contained slightly higher levels of gold. Subsequent analysis of the last 9 jars showed this was only evident in the last jar. Taking a conservative approach and ensuring product consistency, the last 5 jars of product were discarded.

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 24 randomly selected jars and each laboratory received samples from two different jars. Each laboratory was instructed to analyse the samples for gold and silver using the method they believed would give the best results. Indicative concentration ranges were provided.

The samples were analysed for gold by all participating laboratories using fire assay followed by either gravimetric or instrument finish (AAS or ICP).

Only laboratories that routinely perform silver analysis were requested to analyse the samples for silver. A range of methods were used between labs, ranging from variations on acid digest/instrument finish, to fire assay/gravimetric finish.

The amount of sample used in the analyses varied between laboratories for both gold (range 15 - 50g) and silver (range 0.1 - 2.0g digest/instrument; and 30g fire assay/gravimetric).

Calculation of Certified Value:

The 53 participating laboratories each returned replicate gold results using one finish method for both samples. In addition, 28 of the 53 laboratories returned replicate sets of silver results for the same samples. 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, 6 sets of results were excluded for the purpose of assigning a gold concentration value and 3 sets were excluded for silver. Recommended values were

thus calculated from the average of the remaining n = 47 sets of replicate results for gold and n = 25 for silver.

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 values are provided at the beginning of the certificate in µg/g (ppm) units.

A summary of the results used to calculate the recommended value for silver and gold are listed on page 4 and page 5 respectively. The names of the laboratories that submitted results are listed on page 6. 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 Silver Value

(Listed in increasing order of individual laboratory averages)

Silver (ppm)		
Sample 1	**Sample 2**	**Set Average**
78.7	78.7	78.70
79.6	80.7	80.15
81.15	80.90	81.025
82.0	81.5	81.75
82	82	82.0
83.09	82.70	82.895
83.00	83.00	83.000
83	83	83.0
84	82	83.0
83.470	83.155	83.313
83	84	83.5
83.657	84.000	83.829
83	85	84.0
84	85	84.5
85	85	85.0
86	85	85.5
86.8	84.9	85.85
85.0	87.7	86.35
88	86	87.0
87.6	86.6	87.10
87.5	87.0	87.25
87.4	87.5	87.45
89.4	86.3	87.85
88	88	88.0
88.348	88.602	88.475

Average of 25 sets	=	84.4 ppm
Standard deviation of 25 sets	=	2.6 ppm
Relative standard deviation	=	3.1 %
95% Confidence interval for average	=	+/- 1.1 ppm

***Note:** Neither the Standard deviation nor the Confidence interval should be used as a basis to set control limits when plotting individual laboratory results. See notes under "Instructions and Recommendations for Use" (pg 7)*

Summary of Results Used to Calculate Gold Value

(Listed in increasing order of individual laboratory averages)

Gold (ppm)		
Sample 1	**Sample 2**	**Set Average**
17.950	17.700	17.825
18.05	17.60	17.825
17.9	18.1	18.00
17.99	18.15	18.070
18.05	18.15	18.100
17.869	18.480	18.175
18.123	18.231	18.177
18.35	18.15	18.250
18.075	18.465	18.270
18.30	18.25	18.275
18.680	17.941	18.311
18.30	18.35	18.325
18.372	18.330	18.351
18.40	18.35	18.375
18.626	18.140	18.383
18.207	18.577	18.392
18.2	18.6	18.40
18.55	18.25	18.400
18.675	18.125	18.400
18.51	18.29	18.400
18.4	18.4	18.40
18.3	18.5	18.40
18.423	18.384	18.404
18.350	18.465	18.408
18.538	18.295	18.417
18.5	18.4	18.45
18.535	18.377	18.456
18.075	18.880	18.478
18.494	18.497	18.496
18.18	18.82	18.500
18.413	18.657	18.535
18.55	18.60	18.575
18.725	18.450	18.588
18.5	18.7	18.60
18.600	18.600	18.600
18.64	18.60	18.620
18.595	18.646	18.621
18.6	18.7	18.65
18.55	18.85	18.700
18.75	18.70	18.725
18.55	18.95	18.750
18.70	18.80	18.750
18.645	18.990	18.818
18.65	19.05	18.850
18.9	18.8	18.85
19.325	18.425	18.875
19.540	18.780	19.160

Average of 47 sets	=	18.455 ppm
Standard deviation of 47 sets	=	0.265 ppm
Relative standard deviation	=	1.4 %
95% Confidence interval for average:	=	+/- 0.078 ppm

<u>Note:</u> Neither the Standard deviation nor the Confidence interval should be used as a basis to set control limits when plotting individual laboratory results.
See notes under "Instructions and Recommendations for Use" (pg 7)

Participating Laboratories

Australia		ALS Minerals, Burnie
		ALS Minerals, Kalgoorlie
	†	ALS Minerals, Orange
	†	ALS Minerals, Perth
	†	ALS Minerals, Townsville
		Bureau Veritas Amdel, Adelaide
		Bureau Veritas Amdel, Kalgoorlie
	†	Intertek Genalysis Laboratory Services, 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, Quebec
	†	Loring Laboratories (Alberta) Ltd, Calgary
	†	SGS Minerals Services, Lakefield, Ontario
	†	SGS Minerals Services, Vancouver
		Techni-Lab S.G.B. Abitibi Inc/Actlabs, Val d'Or
	†	Techni-Lab S.G.B. Abitibi Inc/Actlabs, Ste-Germaine-Boule
	†	TSL Laboratories Inc, Saskatoon
Chile	†	Acme Analytical Laboratories, Santiago
Côte d'Ivoire		Bureau Veritas Mineral Laboratories, Abidjan
Ghana		ALS Minerals, Kumasi
		Performance Laboratories, Obuasi AngloGold
Ireland		ALS Minerals, Loughrea
Kyrgyz Republic	†	Stewart Assay and Environmental Laboratories LLC, Kara-Balta
Laos		ALS Geochemistry, Vientiane
Mali		ALS Minerals, Bamako
Mongolia	†	ALS Minerals, Ulaanbaatar
Namibia	†	Bureau Veritas- Mineral Laboratories, Swakopmund
New Zealand		SGS New Zealand Ltd, Otago
		SGS New Zealand Ltd, Reefton
	†	SGS New Zealand Ltd, Waihi
Peru	†	ALS Minerals, Lima
	†	Inspectorate Services Perú S.A.C., Callao
	†	Minera Yanacocha SRL – Newmont, Lima
Romania	†	ALS Minerals, Rosia Montana
Russia	†	Irgiredmet Analytical Centre, Irkutsk
South Africa	†	Acme, Inspectorate M & M, Rustenburg
	†	ALS Minerals, Edenvale
		SibanyeGold, Driefontein Operations
		Performance Laboratories, Allanridge
		Performance Laboratories, Barberton
		Performance Laboratories, Randfontein
Turkey	†	Acme Analitik Laboratuar Hizmetleri Ltd, Sirketi
		ALS Minerals, Izmir
USA	†	ALS Minerals, Reno
	†	Barrick Goldstrike – Met Services, Nevada
	†	Inspectorate, Sparks
		Newmont Mining Corporation, Carlin
		Newmont Mining Corporation, Lone Tree
		Newmont Mining Corporation, Twin Creeks
Zimbabwe		Performance Laboratories, Ruwa

Note: The symbol † identifies laboratories that analysed the samples for both gold and silver.
All laboratories listed above analysed the samples for gold.

Instructions and Recommendations for Use:

Weigh out quantity usually used for analysis and analyse by normal procedure. Do not dry before weighting.

We quote a 95% confidence interval for our estimate of the declared value. This confidence interval reflects our uncertainty in estimating the true values for the gold and silver 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, 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

Brett Coombridge (M.Phil. Chemistry)

Independent Statistician

Tim Ball BSc (Hons)