ROCKLABS

WORLD LEADERS IN SAMPLE PREPARATION EQUIPMENT AND REFERENCE MATERIALS FOR USE IN GOLD ASSAYING

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Certificate of Analysis

Reference Material SP37

Recommended Gold Concentration: 18.14 µg/g
95% Confidence Interval: +/- 0.15 µg/g

The above values apply only to product in jars or sachets which have an identification number within the following range: ***139 592 – 141 116.***

Prepared and Certified By:

Malcolm Smith BSc, FNZIC
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Date of Certification: 23 October 2007

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 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
Auckland
NEW ZEALAND
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Website: www.rocklabs.com
Telephone: +64 9 634 7696

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	62.65
Al_2O_3	17.73
Na_2O	7.51
K_2O	3.59
CaO	0.26
MgO	0.32
TiO_2	0.04
MnO	0.00
P_2O_5	0.08
Fe_2O_3	0.1
Fe	3.5
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 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 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 1525 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 all gold analyses 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 Assessment After Packaging

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, 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 1525 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 coefficient of variation 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.

Calculation of Certified Value:

Results for gold were returned from 31 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, three 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 = 28 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.

Summary of Results Used to Calculate Gold Value

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

Gold (ppm)		
Sample 1	**Sample 2**	**Average**
17.174	17.176	17.1750
17.057	17.760	17.4085
17.35	17.85	17.600
17.7	17.6	17.65
17.6	17.7	17.65
17.815	17.975	17.8950
18.4	17.5	17.95
18.017	18.052	18.0345
18.0	18.1	18.05
18.2	18.0	18.10
18.15	18.1	18.125
18.24	18.03	18.135
17.897	18.412	18.1545
18.45	17.90	18.175
18.20	18.20	18.200
18.2	18.2	18.20
18.20	18.30	18.250
18.305	18.200	18.2525
18.314	18.251	18.2825
18.221	18.437	18.3290
18.30	18.41	18.355
18.40	18.50	18.450
18.771	18.203	18.4870
18.6	18.5	18.55
18.550	18.550	18.5500
18.6	18.6	18.60
18.43	18.78	18.605
18.76	18.69	18.725

Average of 28 sets = 18.14 ppm
Standard deviation of 28 sets = 0.38 ppm

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

Coefficient of variation = 2.1 %
95% Confidence interval for average = 0.15 ppm

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

Participating Laboratories

Australia
ALS Chemex, Perth
Amdel Ltd, Adelaide
Amdel Laboratories Ltd, Perth
Amdel Laboratories Ltd, Kalgoorlie
Genalysis Laboratory Services Pty Ltd, Perth
SGS Welshpool Minerals, Perth
SGS Townsville Minerals, Townsville
Standard and Reference Laboratories, Perth
Ultra Trace Analytical Laboratories, Perth

Canada
ALS Chemex, British Columbia
ALS Chemex, Quebec
Assayers Canada, British Columbia
Bourlamaque Assay Laboratories Ltd, Quebec
International Plasma Labs Ltd, British Columbia
Loring Laboratories, Alberta
SGS Minerals Services, Ontario
TSL Laboratories Inc, Saskatchewan

Chile
ACME Analytical Laboratories Ltda

Kyrgyzstan
Alex Stewart Assay and Environmental Laboratories Ltd

New Zealand
SGS Minerals, Waihi

Peru
Minera Yanacocha SRL – Newmont

Russia
Irgiredmet, Irkutsk
Russian Academy of Science, Karelia

South Africa
Anglo Research
MINTEK: Analytical Services Division
SGS Lakefield Research Africa

United States of America
ALS Chemex, Nevada
Barrick Goldstrike Mines Inc, Nevada
Newmont Mining Corporation, Carlin Laboratory
Newmont Mining Corporation, Lone Tree Laboratory
Newmont Mining Corporation, Twin Creeks Laboratory

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, 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.

References:

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

Certifying Officer

M. G. Smith

M G Smith BSc, FNZIC

Independent Statistician

Tim Ball

Tim Ball BSc (Hons)