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Certificate of Analysis

Reference Material HiSilP5

Recommended Gold Concentration: 12.05 µg/g
95% Confidence Interval: +/- 0.064 µg/g

The above values apply only to product in jars or sachets which have an identification number within the following range: ***508593–509397.***

Prepared and Certified By:

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Rocklabs Reference Materials
Scott Technology
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Date of Certification: 13 August 2021

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: A highly siliceous matrix with minor quantities of clay, iron pyrites and finely divided gold-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: rocklabs.sales@scottautomation.com
Website: www.scottautomation.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	90.02
Al_2O_3	3.45
Na_2O	0.20
K_2O	0.41
CaO	0.19
MgO	0.19
TiO_2	0.14
MnO	0.02
P_2O_5	0.03
Fe_2O_3	4.00
Fe	1.75
S	2.0

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, or stored at temperatures higher than 50 °C. Where the container remains unopened, the reference material will remain stable for more than 10 years from the date of certification.

When exposed to atmosphere iron pyrites are likely to oxidize. 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: Following ILAC Guidelines G12:2000 and G13:2000, a highly siliceous matrix containing minor quantities of clay 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 805 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 805 jars in the batch. The results of analysis of the 24 samples (randomly ordered then consecutively numbered before being sent to the laboratory) produced a relative standard deviation of 1.9%. Results from two of the jars were abnormally low. Multiple repeat analyses of samples from these two jars did not replicate the low results, thus indicating laboratory inaccuracy in the initial analyses. If the two low initial results are discounted, a relative standard deviation of 0.8% is obtained on the results from the remaining 22 jars.

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 neither was there a significant difference between the last jar and the other jars.

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 24 randomly selected jars and each laboratory received samples from two different jars.

Each laboratory was instructed to analyse the samples for gold using the method they believed would give the best results. Indicative concentration ranges were given.

The samples were analysed for gold by all participating laboratories using fire assay followed by either gravimetric or instrument finish (AAS or ICP). The amount of sample used in the analyses varied between laboratories, (range 10 - 50g).

Calculation of Certified Value:

Results for gold were returned from 50 laboratories using one finish method for both 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, 9 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 = 36 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**	**Set average**
11.600	11.600	11.6000
11.500	11.800	11.6500
11.600	11.800	11.7000
11.950	11.500	11.7250
11.900	11.550	11.7250
11.950	11.650	11.8000
12.163	11.732	11.9475
11.750	12.200	11.9750
12.050	11.900	11.9750
12.075	11.900	11.9875
12.100	11.950	12.0250
12.000	12.050	12.0250
12.030	12.060	12.0450
12.000	12.100	12.0500
12.100	12.000	12.0500
12.100	12.000	12.0500
12.133	11.996	12.0645
12.010	12.150	12.0800
12.200	12.000	12.1000
12.050	12.150	12.1000
12.190	12.020	12.1050
12.180	12.060	12.1200
12.050	12.200	12.1250
12.150	12.100	12.1250
12.170	12.110	12.1400
12.130	12.160	12.1450
12.137	12.160	12.1485
12.200	12.100	12.1500
12.100	12.300	12.2000
12.350	12.050	12.2000
12.200		12.2000
12.100	12.300	12.2000
12.202	12.213	12.2075
12.350	12.300	12.3250
12.600	12.100	12.3500
12.307	12.504	12.4055

Average of the 36 sets	12.051 ppm
Standard deviation of 36 sets	0.189 ppm
Relative Standard Deviation	1.6%
95% Confidence interval for average	+/- 0.064 ppm

Note: ***Neither the Stand ard 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 6)

Participating Laboratories

Australia	ALS Minerals, Kalgoorlie ALS Minerals, Perth ALS Minerals, Townsville Bureau Veritas Amdel, Adelaide Intertek Genalysis Laboratory Services, Perth SGS Minerals Services, Townsville
Burkina Faso	ALS Minerals, Burkina Faso SEMAFO Burkina Faso S.A.
Canada	ALS Minerals, Val-d'Or ALS Minerals, Vancouver Bourlamaque Assay Laboratories, Quebec Bureau Veritas Commodities Canada Ltd, Ontario Bureau Veritas Commodities Canada Ltd, Vancouver MSALABS Inc., Langley BC SGS Minerals Services, Lakefield, Ontario SGS Minerals Services, Vancouver Techni-Lab S.G.B. Abitibi Inc/Actlabs, Ste-Germaine-Boule Techni-Lab S.G.B. Abitibi Inc.Val d'Or
China	Fujian Zijin Mining and Metallurgical Testing Technology Co., Ltd
Côte d'Ivoire	Bureau Veritas Mineral Laboratories, Abidjan
Ghana	ALS Minerals, Kumasi Intertek Minerals, Samahu
Guyana	A2 Global Inc
Ireland	ALS Minerals, Loughrea
Kyrgyz Republic	Stewart Assay and Environmental Laboratories LLC, Kara-Balta
Laos	ALS Geochemistry, Vientiane
Mexico	Inspectorate de Mexico - Bureau Veritas Group
Mongolia	ALS Minerals. Ulaanbaatar
Morocco	REMINEX Research Center, Casablanca
New Zealand	SGS New Zealand Ltd, Otago 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
South Africa	ALS Minerals, Edenvale - Johannesburg
Turkey	Acme Analitik Laboratuar Hizmetleri Ltd, Sirketi ALS Minerals, Izmir
USA	ALS Minerals, Reno Barrick Goldstrike – Met Services, Nevada Bureau Veritas Commodities and Trade, Sparks Nevada Gold Mines, Carlin Nevada Gold Mines, Lone Tree Nevada Gold Mines, Twin Creeks
Zimbabwe	Performance Laboratories, Ruwa

Instructions and Recommendations for Use:

Weigh out quantity usually used for analysis and analyse for total gold 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 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 have used our consensus testing statistical data to establish control limits for assessing acceptance of laboratory results. Our certification process produces precise statistical data based on the proficiency program and not on an individual laboratory. 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.

Our suggested best practice would be to accumulate a history of the test results obtained, and plot them on a control chart to determine any laboratory bias and variability. The appropriate centre line and control limits for this chart should be based on the average level and variation 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.

Our instructions are recommendations for appropriate use of reference materials. If our statistical data is used for control limits due to practicality and particular circumstances, please consult with us and we will be happy to assist and advise.

Legal Notice:

This certificate and the reference material described in it have been prepared with due care and attention. However, 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 Eoin Foster.

Certifying Officer

Eoin Foster
Manufacturing Manager

Independent Statistician

Tim Ball BSc (Hons)