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Certificate of Analysis

Reference Material OxH139

Recommended Gold Concentration: 1.312 µg/g
95% Confidence Interval: +/- 0.007 µg/g

The above values apply only to product in jars or sachets which have an identification number within the following range: *421026– 422998.*

Prepared and Certified By:	Brett Coombridge, M.Phil. Chemistry Rocklabs Reference Materials P.O. Box 316056 Wairau Valley Post Centre Auckland 0760 **NEW ZEALAND** Email: b.coombridge@scott.co.nz Telephone: +64 9 444 3534
Date of Certification:	12 June 2015
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:	Basalt and feldspar minerals 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 P O Box 18 142 Glen Innes Auckland 1743 **NEW ZEALAND** Email: reference-materials@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	58.38
Al_2O_3	17.03
Na_2O	4.90
K_2O	4.99
CaO	3.87
MgO	3.43
TiO_2	1.01
MnO	0.06
P_2O_5	0.26
Fe_2O_3	5.25
L O I	0.38

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) should not be heated to temperatures higher than 50 °C. The reference material is stable, with weight changes of less than 0.5 % at extremes of naturally occurring temperature and humidity conditions.

Method of Preparation:
Pulverized basalt rock and feldspar minerals were blended with finely pulverized and screened gold-containing minerals. Once the powders were uniformly mixed the composite was placed into 1973 wide-mouthed jars, each bearing a unique number. 42 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 an ICP 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 42 jars randomly selected from the 1973 jars in the batch. The results of analysis of the 42 samples (randomly ordered then consecutively numbered before being sent to the laboratory) produced a relative standard deviation of 1.3%.

Settling: The contents of 4 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:
Samples were submitted to a number of well-recognized laboratories in order to assign a gold value by consensus testing. The samples were drawn from 42 randomly selected jars whereby 30 laboratories received duplicate samples from two separate jars, and 24 laboratories received a single sample drawn from the same set of jars[1].

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

Calculation of Certified Value:
From the 54 participating laboratories, 30 labs returned replicate gold results for two samples, and 24 labs returned a single result from 1 sample[1].

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, 7 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 = 47 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.

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[1] Note: The labs that returned a single result had analysed two samples. Owing to a processing error at Rocklabs, only one of the two samples was applicable to OxH139, which was identified after the samples had been analysed. Hence only one valid test result was applicable from those labs.

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
1.255	-	1.255
1.26	1.29	1.275
1.285	1.269	1.277
-	1.278	1.278
-	1.280	1.280
1.282	-	1.282
1.276	1.295	1.286
1.286	-	1.286
1.27	1.31	1.290
1.30	1.28	1.290
1.31	1.27	1.290
1.292	1.290	1.291
1.290	1.295	1.293
1.293	-	1.293
1.31	1.28	1.295
1.296	-	1.296
1.325	1.269	1.297
-	1.30	1.30
-	1.304	1.304
1.300	1.310	1.305
1.29	1.32	1.305
1.300	1.315	1.308
1.31	1.31	1.310
1.29	1.34	1.315
-	1.319	1.319
1.32	1.32	1.320
1.32	-	1.32
1.316	1.327	1.322
-	1.325	1.325
1.325	-	1.325
1.350	1.300	1.325
-	1.33	1.33
-	1.33	1.33
-	1.33	1.33
1.33	-	1.33
1.36	1.30	1.330
1.35	1.31	1.330
1.331	-	1.331
1.335	1.327	1.331
-	1.332	1.332
1.344	1.321	1.333
1.365	1.310	1.338
1.350	1.330	1.340
-	1.345	1.345
1.33	1.36	1.345
1.345	1.360	1.353
1.371	1.344	1.358

Average of 47 sets	=	1.312 ppm
Standard deviation of 47 sets	=	0.024 ppm
Relative standard deviation	=	1.8 %
95% Confidence interval for average:	=	+/- 0.007 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 6)

Participating Laboratories

Australia	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	ALS Minerals, Val-d'Or
	ALS Minerals, Vancouver
	Bourlamaque Assay Laboratories, Quebec
	Bureau Veritas Commodities Canada Ltd, Vancouver
	Loring Laboratories (Alberta) Ltd, Calgary
	Met-Solve Analytical Service Inc., Langley BC
	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
	SGS Ahafo Laboratory, Kenyasi Brong Ahafo
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 - Johannesburg
	SibanyeGold, Driefontein Operations
	Performance Laboratories, Barberton
	Performance Laboratories, Randfontein
	Performance Laboratories, Allanridge
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

Instructions and Recommendations for Use:

Weigh out quantity usually used for analysis, and analyse 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, 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)