

Certificate of Analysis for

Certified Reference Material (CRM) – SP148

Analyte	Unit	Certified value	Expanded uncertainty (U)	k
Au	ppm	18.25	+/- 0.15	2

Note 1.

- SI units equivalent: 1 ppm (parts per million) = 1 mg/kg = 1 µg/g = 1 g/t.
- The expanded uncertainty (U) is reported at an approximate 95% level of confidence and was calculated in accordance with ISO 33405:2024, using coverage factor k = 2.

The above values apply only to product in jars or sachets which have an identification number within the following range: **599965–600262**.

Prepared and Certified By

Sadaf Sadaf

Rocklabs Reference Materials

Scott Technology Ltd

P.O. Box 18-142, Glen Innes, Auckland 1743, NEW ZEALAND

Email: s.sadaf@scottautomation.com | Telephone: +64 9 6347696

Date of Certification: 27 May 2026

Certificate Version: 1

Available Packaging

This reference material has been packed in wide-mouth jars containing 2.5 kg of material. Some jars may subsequently be repacked into sealed polyethylene sachets.

Origin of Reference Material

The CRM consists of basalt, feldspar minerals and Iron Pyrite with minor quantities of finely divided gold-containing minerals, screened to minimise gold nugget effects.

Supplier

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 homogenised. Homogeneity test was carried out after the entire batch was packaged into wide-mouth jars. The product contains crystalline quartz and therefore dust from it should not be inhaled.

The approximate chemical composition is:

Method used: Borate Fusion XRF - (Uncertified Values)

Constituent	wt. %
SiO ₂	56.53
Al ₂ O ₃	15.23
Na ₂ O	2.71
K ₂ O	7.10
CaO	3.10
MgO	2.97
TiO ₂	0.91
MnO	0.07
P ₂ O ₅	0.24
Fe ₂ O ₃	4.40
Fe	3.06
S	3.50

Handling Instructions

Fine powders present potential hazards to both the eyes and lungs. Therefore, it is recommended to take standard precautions, including the use of safety glasses and dust masks.

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 and Storage instructions

The material must be kept in a cool, dry environment to maintain the integrity of the CRM. Unopened, the reference material has a shelf life of ten years from the certification date. Stability will be regularly assessed, and any observed changes will be promptly communicated to purchasers. The material should be retained in its original packaging, and the jars must be securely re-closed after each use.

Method of Preparation

This reference material was produced under quality management systems certified to ISO 9001:2015. Finely pulverised feldspar minerals, basalt rock, iron pyrite, and gold-containing mineral concentrate were blended using a controlled preparation process. The total batch was prepared in a single blending iteration using controlled formulation and preparation conditions. Following blending, the material was transferred into a storage tank prior to packaging. The material was subsequently packaged into 298 wide-mouth jars, each assigned a unique identification number. A random selection of 21 jars from the packaging run was used for homogeneity and characterisation testing.

Homogeneity Assessment

Duplicate samples were collected from the top and middle of each of the 21 jars, resulting in 42 samples being analysed. These samples were randomly ordered, then numbered consecutively before being sent to the laboratory for testing. Gold analysis was performed by an independent laboratory using fire assay on 30 g portions followed by an ICP-AES finish. Measures were implemented to minimize methodological variations within the laboratory, thereby improving the sensitivity for detecting potential inhomogeneity.

One outlier was observed in a unit during the homogeneity assessment. Statistical evaluation demonstrated that inclusion or exclusion of this result did not affect the outcome of the homogeneity assessment. On this basis, no further investigation was considered necessary. ANOVA results showed that variability between jars (SD = 0.017 ppm; RSD = 0.095%) and within jars (SD = 0.136 ppm; RSD = 0.742%) was less than 1%, confirming that the between jars and within jars variability were not significant sources of inhomogeneity.

Analytical Methodology

Once homogeneity was verified, two subsamples were distributed to a number of laboratories in a round-robin initiative for consensus testing to establish a certified gold value. The selection of participating laboratories was based on their continued good performance in prior inter-laboratory programs facilitated by Rocklabs. The subsamples were derived from a selection of 21 randomly chosen jars, with each laboratory receiving samples from two distinct jars.

Participating laboratories were instructed to determine gold concentrations by fire assay using validated finish methods routinely employed within their laboratories. Indicative concentration ranges were provided to aid with the selection of appropriate analytical procedures.

Gold analysis was conducted by all participating laboratories using fire assay followed by either gravimetric or instrument finish, including Atomic Absorption Spectroscopy (AAS) or Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES). The quantity of sample mass used in the analyses varied among laboratories, ranging from 30–50 g.

Calculation of Certified Value

Each of the 32 participating laboratories returned replicate gold results using the same analytical finish method for both samples. The identification of outliers was carried out using the principles detailed in sections 7.3.2–7.3.4, ISO 5725-2:2025. The evaluation of each laboratory's performance relied on z-scores, partly based on the concept described in ISO/IEC 17043:2023. Criteria details for these assessments are available on request. Following the statistical analyses, five sets of results were excluded in the process of determining gold concentration value for this reference material.

Consequently, a certified value was evaluated in accordance with ISO 33405:2024 and incorporates contributions from characterisation, between- and within-unit homogeneity, transport stability, and long-term stability. The combined standard uncertainty was expanded using a coverage factor $k = 2$ to obtain the expanded uncertainty (U), corresponding to an approximate 95% level of confidence.

$$u_{CRM} = \sqrt{u_{char}^2 + u_{homo}^2 + u_{trns}^2 + u_{lts}^2}$$

Where u_{char} is uncertainty due to characterisation, u_{homo} is uncertainty due to inhomogeneity, u_{trns} is uncertainty due to transport instability and u_{lts} is uncertainty due to long-term storage instability.

The certified value is provided at the beginning of the certificate in $\mu\text{g/g}$ (ppm). A summary of the results used to calculate the certified value is listed below 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 an independent statistician, Dr Daniel Walsh.

Summary of Results Used to Calculate Gold Value
(Listed in increasing order of individual laboratory averages)

Gold ppm		
Sample 1	Sample 2	Set average
17.50	17.50	17.50
17.75	17.40	17.58
17.60	17.70	17.65
17.70	17.70	17.70
17.60	17.95	17.78
18.20	18.00	18.10
18.15	18.10	18.13
18.20	18.20	18.20
18.40	18.00	18.20
18.20	18.20	18.20
18.24	18.20	18.22
18.17	18.28	18.23
18.24	18.26	18.25
18.20	18.30	18.25
18.30	18.26	18.28
18.50	18.15	18.33
18.50	18.15	18.33
18.35	18.30	18.33
18.25	18.50	18.38
18.35	18.45	18.40
18.50	18.40	18.45
18.50	18.40	18.45
18.60	18.40	18.50
18.60	18.60	18.60
18.79	18.45	18.62
18.90	19.05	18.98
19.09	19.29	19.19
Average of the 27 sets		18.25 ppm
SD of the 27 sets		0.38 ppm
RSD		2.1%

Participating Laboratories

Australia	ALS Geochemistry, Perth, Australia ALS Geochemistry, Townsville, Australia Genalysis Laboratory Services, Perth, Australia
Burkina Faso	ALS Geochemistry, Ouagadougou, Burkina Faso
Canada	Bureau Veritas Commodities Canada Ltd (Vancouver) ALS Geochemistry, Vancouver, Canada ALS Geochemistry, Val d'Or, Canada Actlabs Thunder Bay, Canada Actlabs Val d'Or, Canada Bourlamaque Assay Laboratories, Canada MSALABS INC, Canada SGS Lakefield, Ontario, Canada
Chile	ALS Geochemistry, Santiago, Chile
China	Fujian Zijin Mining, China
Côte d'Ivoire	Bureau Veritas, Cote d'Ivoire
Ghana	ALS Geochemistry, Kumasi, Ghana Intertek Minreals Limited, Tarkwa, Ghana
Guyana	MSALABS GUYANA INC
Ireland	ALS Geochemistry, Loughrea, Ireland
Ivory Coast	ENVAL Laboratoire D'analyses Minières, Ivory Coast
Kyrgyz Republic	Stewart Assay, Kyrgyz Republic
Laos	ALS Geochemistry, Vientiane, Laos
Mali	Bureau Veritas, Mali
Mexico	BV Minerals, Hermosillo, Mexico
Mongolia	ALS Geochemistry, Ulaanbaatar, Mongolia
Morocco	LABOMINE, Morocco
Peru	Inspectorate Services, Peru Minera Yanacocha, Peru
Turkey	ALS Geochemistry, Izmir, Turkey
USA	ALS Geochemistry, Reno, USA Bureau Veritas Commodities and Trade, Sparks, USA McClelland Laboratories, Inc., USA

Instructions and Recommendations for Use

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

The certified value is accompanied by an expanded uncertainty (U), which represents total uncertainty associated with the certified gold concentration in the sealed packaging. The expanded uncertainty has been calculated in accordance with ISO 33405:2024 using a coverage factor of $k = 2$, corresponding to an approximate 95% level of confidence.

Drying or mixing of the material is not required before the weighing and analysis. Samples may be drawn multiple times from a jar; however, the container must be securely re-closed after each use to maintain the integrity of the Certified Reference Material.

The expanded uncertainty associated with the certified value shall not be used to establish laboratory control limits. The uncertainty reflects the certification process and interlaboratory characterisation program, rather than the repeatability or reproducibility of individual laboratory measurement systems.

Laboratories are encouraged to establish their own quality control limits by routinely analysing this CRM, recording results over time, and plotting them on an appropriate control chart. This approach enables effective monitoring of laboratory bias and analytical variability based on internally generated data.

Minimum Sample Mass Recommendation

This CRM has been certified using 30-50 g aliquots for fire assay. It is recommended to use a minimum sample size of 30 g when utilizing this CRM. The provided statement on uncertainty and homogeneity is valid only if a sample mass of at least 30 g is used.

Metrological Traceability

The certified values in this report are supported by interlaboratory results traceable to the International System of Units (SI) through measurement of mass. The data presented in the tables represent mass fractions, expressed as weight percent, milligrams per kilogram (mg/kg) or parts per million (ppm), as applicable. Analytical samples were carefully selected to adequately represent the entire batch of the prepared CRM. Each set of analytical data undergoes validation by the assayer, incorporating reference materials and quality control checks during analysis. The selection of laboratories was based on their proven performance in previous inter-laboratory programs conducted by Rocklabs, with many of these laboratories complying with the requirements of ISO/IEC 17025:2017. The certified values provided in the Certificate of Analysis are derived from the means of accepted data following rigorous statistical treatment.

Commutability

This CRM is intended for use in quality control applications involving the determination of analytes in geological materials. The CRM is prepared from natural mineral matrices and has demonstrated suitable performance in interlaboratory analytical programs. All Rocklabs CRMs are produced from natural geological materials to provide analytical behaviour closely aligned with routine field samples in relevant measurement processes.

A formal commutability study has not been performed for this CRM. However, the material is considered suitable for its intended purpose based on its natural mineral composition, method of preparation, and successful use of comparable materials in interlaboratory analytical programs.

The matrix characteristics of this CRM are described in the 'Origin of Reference Material' and 'Description' sections. Users are responsible for determining the suitability of this CRM for their specific analytical procedures and measurement systems.

Legal Notice

This certificate and the reference material described in it have been prepared with due care and attention. However, Scott Technology Ltd and Nano Consulting 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 Sadaf Sadaf.

QMS Accreditation

This CRM has been produced under a quality management system accredited to ISO 17034:2016—General requirements for the competence of reference material producers, under accreditation number 4.

Rocklabs is accredited by IANZ as a reference material producer for the production of certified reference materials. The use of the IANZ/ISO 17034 accreditation symbol applies to the certified reference material activities covered under the Rocklabs scope of accreditation.

All Rocklabs products are manufactured under management systems certified by Telarc to the following standards:

- **ISO 9001:2015** Quality Management System
- **ISO 14001:2015** Environmental Management System
- **ISO 45001:2018** Occupational Health and Safety Management System



Certifying Officer

Sadaf Sadaf

27 May 2026

Sadaf Sadaf (PhD – Earth Science), Technical Chemist - Rocklabs

Independent Statistician

Daniel Walsh

Dr. Daniel Walsh, PhD