

CERTIFIED REFERENCE MATERIAL RRM Au029

PRODUCT: HIGH GRADE GOLD ORE CERTIFICATE OF ANALYSIS

Certificate Number: CRM Au029 Rev000

Date: 18 October 2016

Table 1 Au029 – Summary of Results

etermination	Unit	Assigned Value	SD between labs	2 SD between labs
Au	ppm	322	14	28

			95% Confidence Limit	
Avg SD within lab	No. data sets	Med no. analysis/ lab	Low	High
10	21	8	318	327

Prepared and Supplied:

Certified Reference Material Au029 has been prepared, certified and is supplied by;

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Certified Reference Materials (CRMs) are used by laboratories to prove the value of their service offerings and for clients of laboratories to evaluate and monitor laboratory performance. CRMs must comply with high metrological requirements and ensuring traceability of measurement results.

Since most techniques employing analytical instrumentation are comparative, these techniques require a sample of known composition (CRM) for accurate calibration. Grade and Matrix matched CRM's are thus vital to the core of the analytical chemistry industry.

Intended Use:

The Certified Reference Material RRM Au029 is intended to be used in analytical laboratories that analyse samples of similar grades (as presented in this certificate of analysis) and matrix (silicate; low carbon, low iron, low sulphur).

- Monitoring of routine laboratory performance (both internal and external)
- Method development and method validation
- Instrument calibration

Origin of Material:

RRM Au029 was prepared from a range of siliceous gold bearing samples combined to provide the desired high grade gold value achieved and within a Silicate; low Carbon, low Iron, low Sulphur matrix.

Country of Origin: South Africa.

Preparation of Material:

The material constituting RRM Au029 has been prepared as follows:

- Drying to constant mass
- Crushing and dry milling to nominal 53µm particle size
- Homogenization
- Systematic rotary division of the entire lot
- Packaging
 - 400g sealed tubs
 - 30g and 50g geochem pouches, vacuum sealed in barrier foil

Homogeneity Testing:

The homogeneity of the stock was evaluated for both 'batch' and 'within unit' homogeneity. Samples were systematically selected to represent the batch for 'batch' homogeneity tests and one unit was selected at random for 'within unit' homogeneity tests. 40 samples were analysed for 'batch' homogeneity with a relative standard deviation of 1.1% and 20 samples were analysed for 'unit' homogeneity with a relative standard deviation of 2.6%. A one-way analysis of variance technique (ANOVA) was used to assess the homogeneity of these elements. No significant variation was observed for both 'batch' and 'within unit' exercises.

Methods of Analysis:

The analysis of the test samples has been conducted according to routine analytical procedures at each of the participating laboratories. The 'industry standard' Fire assay procedure was employed by the participating laboratories, as well as one laboratory reporting results using high energy dispersive XRF.

Participating Laboratories:

A list of the participating laboratories (not in the same order as the results on the data tables) is presented in the table below:

Table 2 Au029 – Participating Laboratories

Activation Laboratories, Ancaster (Canada)
Activation Laboratories, Kamloops (Canada)
Activation Laboratories, Thunder bay (Canada)
ALS Geochemistry, Johannesburg (South Africa)
ALS Geochemistry, Lima (Peru)
ALS Geochemistry, Loughrea (Ireland)
ALS Geochemistry, Vancouver (Canada)
Anglogold Ashanti, Vaal River (South Africa)
Anglogold Ashanti, West Wits (South Africa)
Bureau Veritas Minerals, Swakopmund (Namibia)
Bureau Veritas Minerals, Thebarton (Australia)
Chromatech Services, Roodepoort (South Africa)
MinAnalytical, Perth (Australia)
SGS, Barberton (South Africa)
SGS, Randfontein (South Africa)
Sibanye Gold, Beatrix (South Africa)
Sibanye Gold, Driefontein (South Africa)
SuperLabs, Klerksdorp (South Africa)
SuperLabs, Springs (South Africa)

Statistical Evaluation:

Results received from the inter-laboratory study have been subjected to statistical evaluation. Statistically invalid outliers were excluded from the final evaluation. Values are classified as Certified if the Relative Standard Deviations (standard deviations expressed as a percentage of the mean) is less than 5%. The within laboratory relative standard deviation of 3.14% and the between laboratory relative standard deviation of 4.38% for RRM Au029 achieved in this particular study is regarded as acceptable.

Table 3 Au029 – Statistical Evaluation

Assigned value	Au 322 ppm	Median of number of analyses	8
Number of Data Sets	21	Standard Uncertainty	2.32
Number of Analyses	194	Relative Standard Uncertainty	0.72%
Outliers	8	Lower confidence limit	Au 318 ppm
Between Laboratory Standard Deviation	14	Upper confidence limit	Au 327 ppm
Within Laboratory Standard Deviation	10	Lower limit of tolerance	Au 294 ppm
Between Laboratory Relative Standard Deviation	4.38%	Upper limit of tolerance	Au 351 ppm
Within Laboratory Relative Standard Deviation	3.14%		

Table 4 Au029 – Data Table

Lab	Au ppm	Lab	Au ppm	Lab	Au ppm	Lab	Au ppm	Lab	Au ppm
A	382	E	330	I	317	K	320	Q	326
A	376	E	318	I	332	L	294	Q	337
A	373	E	330	J	308	L	304	Q	317
A	387	E	329	J	331	L	303	Q	325
A	375	E	329	J	303	L	307	Q	302
A	370	F	338	J	325	L	320	Q	305
A	376	F	342	J	313	L	306	R	328
A	385	F	341	J	325	L	323	R	337
B	337	F	326	J	312	L	321	R	320
B	338	F	338	J	319	M	310	R	319
B	338	F	345	J	320	M	306	R	336
B	339	F	291	J	312	M	317	R	325
B	340	F	330	J	321	M	304	R	326
B	339	F	320	J	291	N	303	R	335
B	338	F	329	J	322	N	284	S	327
B	337	F	326	J	287	N	306	S	324
C	329	F	299	J	326	N	300	S	326
C	343	G	374	J	315	N	286	S	321
C	327	G	333	J	327	N	295	S	301
C	339	G	348	J	315	N	304	S	329
C	320	G	338	J	321	N	292	S	324
C	332	G	356	K	293	O	330	S	321
C	313	G	324	K	329	O	335	T	326
C	319	G	347	K	315	O	322	T	327
D	330	G	324	K	333	O	323	T	316
D	326	H	342	K	315	O	325	T	319
D	321	H	340	K	294	O	330	T	316
D	320	H	344	K	318	O	331	T	321
D	322	H	340	K	322	O	334	T	325
D	320	H	336	K	330	P	322	T	325
D	323	H	338	K	301	P	319	U	326
D	325	H	338	K	315	P	325	U	323
E	322	H	334	K	307	P	321	U	333
E	316	I	335	K	327	P	320	U	330
E	319	I	327	K	325	P	318	U	335
E	327	I	295	K	322	P	319	U	328
E	326	I	332	K	329	P	315	U	338
E	335	I	302	K	313	Q	310	U	332
E	318	I	312	K	297	Q	312		

Analysis Validity:

The property value for RRM Au029 Certified Reference Material remains valid provided that good laboratory practice is observed during handling and storage.

The material is in fine powder form and may be hygroscopic in nature. The material may be required to be dried at 105°C until constant mass is achieved.

Instructions before Use:

Safety precautions (in-line with safe laboratory practices) for handling fine particulate matter are advised; such as the use of safety glasses, dust masks, gloves and a laboratory coats.

Minimum Sample Size:

Based on an the results of the homogeneity assessment and evaluation of results submitted by the laboratories contributing certification data, the minimum size of a test portion is recommended to be 5g.

Revisions:

This certificate is version 0.00 for the material RRM-Au008; and is intended to be a 'live document' intended to reflect progress in analytical chemistry. In that, any significant new data and information could be added at any time to ensure the currency and relevance of the certification. Any revisions to this Certificate of Analysis will be made available via the company website www.resourcereferencematerials.com

Traceability:

The characterization of this material has been achieved by inter-laboratory study, each laboratory using an appropriate analytical method. These methods are calibrated against traceable standard solutions and analysed against appropriate Certified Reference Materials.

Acknowledgements:

We would like to gratefully acknowledge the participating laboratories and the staff at RRM for their contributions to this certification exercise.

Legal Notice:

This material has been meticulously prepared and a comprehensive statistical evaluation conducted to assign the property value. The Purchaser, by receipt of this material and certificate, indemnifies and releases Resource Reference Materials (Pty) Ltd from and against any and all liability and costs arising from the use of this material and certificate and any actions taken thereupon.

Approval:

This Certificate of Analysis was approved on behalf of Resource Reference Materials (Pty) Ltd:



18th October 2016

Name
Position

C.S. van der Linde
Managing Director

References:

ISO 17034:2016 General requirements for the competence of reference material producers
DRAFT ISO GUIDE 35:2016 Reference materials — Guidance for the characterization and the assessment of the homogeneity and stability of the material
ISO 5725-2:1994 Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method
ISO 13528:2015 Statistical methods for use in proficiency testing by interlaboratory comparison
ISO 17025:2005 General requirements for the competence of testing and calibration laboratories