

QOTHO REFERENCE MATERIAL (QRM)

QRM-7-118

PGM CONCENTRATE

QOTHO REFERENCE MATERIAL REPORT

ASSIGNED VALUES			
ANALYTES	UNITS	CONCENTRATIONS	EXPANDED UNCERTAINTY
Au	g/t	0.23	±0.05
Co	%	0.017	±0.008
Cr ₂ O ₃	%	3.43	±0.11
Cu	%	0.084	±0.015
FeO	%	7.32	±0.20
Ir	g/t	5.02	±0.47
Ni	%	0.13	±0.04
Pd	g/t	25.2	±4.0
PGM+Au (Grav)	g/t	121.3	±4.1
Pt	g/t	75	±11
Rh	g/t	10.8	±1.4
Ru	g/t	14.8	±1.8

1. Use:

QRM-7-118 is a reference material which is suitable for use as random control samples in routine analytical laboratory quality control, when inserted within a batch of samples and measured in parallel to the unknown. The QRM can also be used as a control sample in the analysis of samples of a similar type and verification of analytical methods for PGM Concentrate.

This document was amended to correct a typing error and to amend Cr₂O₃ and PGM + Au (Grav) data, as it was identified that a laboratory had, during the PT program, inadvertently swapped the results for two samples. This has been corrected.

2. Origin of Material:

This material was sponsored by Eland Mine, in the North West Province of South Africa.

3. Mineral and Chemical Composition:

This ore body is situated on the extreme eastern edge of the western limb of the Bushveld Complex. UG2 chromite ore consists of fine to medium size cumulus chromite grains with substantial amounts of post-cumulus orthopyroxene crystals. The Platinum Group Minerals identified in the UG2 are Cooperite, Laurite, Braggite, Pt-Fe Alloy and Sperrylite. This concentrate is the product of the chemical flotation of UG2 ore.

4. Date of Initial Issue:

28 October 2022.

5. Packaging & Handling instructions:

The material was packaged as 100g unit sizes, placed in geo-envelopes, within a vacuum sealed aluminium foil bag. Open the seal of the foil with care and shake or otherwise agitate prior to use. Normal safety precautions for handling fine particulate matter are recommended, such as the use of safety glasses, breathing protection, gloves, and a laboratory coat. Once opened, material must be stored in a cool, dry environment. Results on page 1 is presented on dry basis. Analysis should therefore be done on dry basis, after drying to constant mass, at 105 degrees Celsius.

6. Method of Preparation:

The material was sieved through a 75-micron screen and the oversize was re-milled to ensure 100% passing through the screen. It was then blended, systematically divided, and packaged into 100-gram zip-lock bags. Randomly selected samples, from the bags, were tested in-house via XRF, to confirm homogeneity. Once confirmed and certification completed, the items were placed in geo-envelopes and vacuum sealed in aluminium foil bags.

7. Methods of Analysis used:

- Base and ferrous metals by Peroxide Fusion and ICP-OES finish
- Base and ferrous metals by pressed pellet and XRF finish
- Chrome and Iron by Peroxide fusion and potentiometric titration
- PGM+Au (grav) by Lead collection fire assay and gravimetric finish
- Ag and base metals by multi-acid digestion and ICP-OES finish
- PGM's by Nickel Sulphide collection and ICP-MS or ICP-OES finish
- PGM's by Lead collection and AAS or ICP-OES finish
- PGM's by aqua regia digestion and ICP-MS finish
- Sulphur by combustion analysis.

8. Analysis required:

An instruction letter was sent to all participants. The analysis required was noted in the instruction letter and reporting template, including but not limited to Ag, Au, Co, Cr₂O₃, Cu, FeO, Ir, Ni, Pd, PGM+Au, Pt, Rh and Ru.

9. Participating Laboratories:

No	LABORATORY	COUNTRY
1.	AHK North West	South Africa
2.	AHK Steelpoort	South Africa
3.	ALS Geochemistry Kempton Park	South Africa
4.	ALS Inspection UK	United Kingdom
5.	Anglo Mogalakwena	South Africa
6.	Barplats Mine	South Africa
7.	Metchem (Rustenburg)	South Africa
8.	Metchem (Steelpoort)	South Africa
9.	Mimosa Mine	Zimbabwe
10.	Northam Booyesdal (North)	South Africa
11.	Northam Booyesdal (South)	South Africa
12.	Pilanesberg Platinum Mine	South Africa
13.	Quality Laboratory Services (Rustenburg)	South Africa
14.	SGS Randfontein	South Africa
15.	SGS Canada Inc. Lakefield	Canada
16.	Suntech	South Africa
17.	Tharisa Minerals	South Africa
18.	UIS Analytical Services	South Africa

10. Assay Data:
 Data used for Assigning Values.

LABORATORY	Ag	Au	Co	Cr ₂ O ₃	Cu	FeO	Ir	Ni	Os	Pd	PGM+Au (Grav)	Pt	Rh	Ru	S
UNIT	g/t	g/t	%	%	%	%	g/t	%	g/t	g/t	g/t	g/t	g/t	g/t	%
LAB001		0.195								17.783		62.534			
LAB002				3.325		7.375					124.5				
LAB003		0.15								23.575		78.575	8.83		
LAB004		0.205					2.213		0.399	23.387		44.767	4.468	4.86	
LAB005		0.186		3.7	0.082		4.865	0.099		26.334	116.01	84.217	11.148	14.971	
LAB006			0.015	3.482	0.075	8.068									0.561
LAB007		0.43	0.077	3.18	0.096			0.179		31.315	116.3	72.14	12.27		
LAB008				3.48							116.18				
LAB009				3.46							124.955				
LAB010				3.45							119.85				
LAB011	< 1.000	0.33	0.02	3.575	0.085	7.395		0.135		28.8		81.85			0.538
LAB012		< 0.200		3.24		7.175				25.9		70.4	10.3		
LAB013	3	0.34	0.02	3.455	0.095	7.305	5	0.12		26		88	11	15.5	0.474
LAB014		0.215					5.181			23.835		77.04	11.04	14.13	
LAB015							>5.000		>1.000	>15.000		>15.000	>5.000	>5.000	
LAB016				3.39		7.325					125.5				
LAB017			0.013		0.069			0.107			127.007				
LAB018		0.19	0.015	3.46	0.09		5.045	0.125		24.12		77.725	10.762	14.508	

11. Method of Assigning Values:

QM is a SANAS Accredited Proficiency Testing Scheme Provider, No. PTS0012

This material was distributed as test items, in the Qotho PGM PT Round 4 of 2022. The participating laboratories were each given 1 randomly selected sample from the batch, to analyse and report on in duplicate. Some laboratories reported results via more than one analytical method. Obvious blunders were resolved with the laboratories (if any), after which the data was processed using Robust Statistics, through PROLab Plus.

Where analytes could not be certified, as is the case for this report, estimate concentrations were assigned (using Robust Statistics), using all the data in the dataset.

12. Measurement of Uncertainty:

Standard uncertainty, u_{QRM} , was calculated according to ISO 13528:2022 (equation 6), and it includes the effects of uncertainty due to inhomogeneity, transport, potential instability, and laboratory uncertainty. Because of all the uncertainties under consideration, QM further applies an expanded uncertainty, for value assignment purposes. The measurement uncertainty of the assigned or certified value is therefore calculated as follows: $U_{QRM} = k \cdot u_{QRM}$, where k is a coverage factor, which is determined from the Student's t -distribution, based on the degrees of freedom, per analyte. This presents an assigned value, as follows: $x_{QRM} \pm U_{QRM}$.

Laboratories which prefer to use the 95% measurement uncertainty, rather than the expanded uncertainty, all available information relating to measurement uncertainty of the certified/assigned values, are given below:

Analyte	Unit of measure	s (Standard Deviation of Dataset)	ν (Degrees of Freedom)	k (Coverage Factor)	u (Standard Uncertainty)	95% Measurement Uncertainty	Expanded Uncertainty
Au	g/t	0.055	8	2.306	0.021	± 0.04	± 0.05
Co	%	0.006	5	2.571	0.003	± 0.006	± 0.008
Cr ₂ O ₃	%	0.162	11	2.201	0.048	± 0.10	± 0.11
Cu	%	0.012	6	2.447	0.006	± 0.012	± 0.015
FeO	%	0.095	5	2.571	0.075	± 0.15	± 0.20
Ir	g/t	0.223	4	2.776	0.168	± 0.34	± 0.47
Ni	%	0.025	5	2.571	0.015	± 0.03	± 0.04
Pd	g/t	4.006	9	2.262	1.771	± 3.5	± 4.0
PGM+Au (Grav)	g/t	5.193	7	2.365	1.745	± 3.5	± 4.1
Pt	g/t	12.383	9	2.262	4.937	± 10	± 11
Rh	g/t	1.333	7	2.365	0.57	± 1.1	± 1.4
Ru	g/t	1.173	4	2.776	0.656	± 1.3	± 1.8

13. Minimum sample size:

The recommended minimum sample size for the use of this material is as per the participants method validation criteria.

14. Period of validity:

The assigned values are valid for this product, while still sealed in its original packaging, for a minimum period of 5 years from date of initial issue of this report. Stability monitoring of inventory will be done at regular intervals. Any concerns regarding potential instability of the material, will immediately be communicated to all consumers.

15. Legal:

This document and the reference material described in it were prepared with due care and attention. The requirements of ISO Guide 31, ISO 17043 and ISO 17034 were followed in the preparation of this reference material and its documentation.

Qotho Minerals, however, accepts no liability for any decisions or actions taken following the use of the reference material. The company has a complaints procedure, which will be made available upon request, should there be any dissatisfaction with either the product or the Report.

Technical Signatories	
Managing Director	Technical Manager
28 October 2022	

This Reference Material Report has been electronically signed using an Advanced Electronic Signature (AES) in terms of the Electronic Communications and Transactions Act No. 15, 2002 (ECT Act). Any amendments to the Report can be detected by reference to the Signature Panel displayed in the electronic pdf version of the Report.

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