



# *Certificate of Analysis*

## NIM-G GRANITE

# SARM 1

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### CERTIFIED REFERENCE MATERIAL

Distributed by  
**SA BUREAU OF STANDARDS**  
P/Bag X191, Pretoria 0001  
Republic of South Africa

Prepared by  
**Council for Mineral Technology (MINTEK)**  
P/Bag X3015, Randburg 2125  
Republic of South Africa

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1. STATUS OF CERTIFICATE

There is no intention of an early revision of this certificate.  
Further data from improved techniques may necessitate a revision in later years.

2. DATE OF ORIGINAL CERTIFICATION

September 1974.

3. DATE OF REVISION

May 1979 and June 1984.

4. AVAILABILITY OF OTHER SIZES OF THE MATERIAL

Only 100 g amounts of the powdered material are available.

5. SOURCE OF THE MATERIAL

The material is from the Bushveld Granite, the acid phase of the Bushveld Complex, in the Transvaal, South Africa. See 18.1.

6. DESCRIPTION OF THE MATERIAL

The material is granitic rock which consists mainly of quartz and K-feldspar with smaller amounts of mica and Na-feldspar; the feldspar, mostly microcline, is highly altered.

7. INTENDED USE

As a reference material (RM) for the calibration of instruments.  
As a control sample in the analysis of rock samples of similar type.  
As a reference material for the development of analytical techniques.

8. STABILITY, TRANSPORT AND STORAGE INSTRUCTIONS

There are no special storage instructions, but care should be taken to avoid undue vibration as this could cause segregation within the bottle.

9. INSTRUCTIONS FOR THE CORRECT USE OF THE REFERENCE MATERIAL

The material should be dried at 105 °C to a constant mass, usually for 2 to 3 hours, before subsamples are taken.

10. METHOD OF PREPARATION OF THE REFERENCE MATERIAL

Approximately 455 kg of rock were collected with sizes from  $0,354 \times 10^4 \text{ cm}^3$  to  $7,08 \times 10^4 \text{ cm}^3$ .  
With the use of various crushing techniques the material was reduced in size until 98 % passed through a sieve with a nominal aperture size of  $75 \mu\text{m}$ .  
For full details of the comminution procedure see 18.1.

11. STATE OF HOMOGENEITY

## 12. CERTIFIED PROPERTY VALUES AND CONFIDENCE LIMITS (where available see 18.5)

Constituent	Certified value %	Constituent	Certified value μg/g	95 % Confidence limits	
				Low	High
SiO <sub>2</sub> .....	75,70	Ce .....	195	190 .....	203
Al <sub>2</sub> O <sub>3</sub> .....	12,08	Cr .....	12		
FeO .....	1,30	Cu .....	12		
CaO .....	0,78	Eu .....	0,35	0,34 .....	0,47
Na <sub>2</sub> O .....	3,36	Ga .....	27		
K <sub>2</sub> O .....	4,99	La .....	109	100 .....	116
F .....	0,42	Mn .....	160		
H <sub>2</sub> O <sup>+</sup> .....	0,49	Nb .....	53		
Total Fe as Fe <sub>2</sub> O <sub>3</sub> .....	2,00	Nd .....	72	67 .....	84
		Pb .....	40		
		Rb .....	325		
		Sm .....	15,8	14,0 .....	18,0
		Sr .....	10		
		Tb .....	3,0	2,4 .....	3,5
		Th .....	51	48 .....	55
		Ti .....	540		
		Y .....	143	120 .....	159
		Yb .....	14,2	12,8 .....	16,0
		Zn .....	50		
		Zr .....	300		

## 13. UNCERTIFIED/APPROXIMATE PROPERTY VALUES

Constituent	Uncertified value %	Constituent	Uncertified value μg/g
Fe <sub>2</sub> O <sub>3</sub> .....	0,6	Ba .....	120
MgO .....	0,06	Dy .....	17
CO <sub>2</sub> .....	0,10	Gd .....	14
		La .....	107
		Li .....	12
		Lu .....	2
		Ni .....	8
		Tm .....	2
		U .....	15
		V .....	2

An order of magnitude can be obtained for the following elements from the analytical results given in NIM Report No. 1945-1978 (see 18.3): Ag, As, Au, B, Be, Bi, Cd, Cl, Co, Cs, Hf, Mo, P, S, Sb, Sc, Ta. Similarly an order of magnitude can be obtained for Er, Ho and Pr from MINTEK Report No. M134(1984). See 18.5.

## 14. VALUES OBTAINED BY INDIVIDUAL LABORATORIES / METHODS

More than 80 laboratories throughout the world have contributed towards the analytical data. See 17.

## 15. MEASUREMENT TECHNIQUES USED FOR THE CERTIFICATION

Among the techniques used by the contributing laboratories were the following:

Atomic absorption spectrophotometry

Emission spectroscopy

Neutron activation analysis

Spectrophotometry

X-ray fluorescence

Sample dissolution was mainly by acid digestion or fusion.

For full details of techniques, etc., see 18.3, 18.4 and 18.5.

## 16. TREATMENT OF THE NUMERICAL VALUES

Statistical tests were used to determine outlying results which were then removed from the main population of results. Estimators of central tendency were then used to determine the preferred value. For full details of the statistical treatment of the analytical data see 18.3, 18.4 and 18.5.

**NOTE:** The certified value is an estimate of the "true" value based upon the best available



17. NAMES OF ANALYSTS / INVESTIGATORS / CO-OPERATING LABORATORIES

See attached list.

18. REFERENCES:  
PREPARATION AND CERTIFICATION PROCEDURES USED IN THIS SAMPLE

- 18.1 Russell, B G, et al.: Collection and preparation of standard rock samples — Report No. 332-1968 of the National Institute for Metallurgy.
- 18.2 Russell, B G, et al.: Preliminary report on the analysis of the six NIMROC geochemical standard samples — Report No. 1351-1972 of the National Institute for Metallurgy.
- 18.3 Steele, T W, et al.: Analysis of the NIMROC reference samples for minor and trace elements — Report No. 1945-1978 of the National Institute for Metallurgy.
- 18.4 Steele, T W, et al.: Analysis of the NIMROC reference samples for major elements — Report No. 2016-1979 of the National Institute for Metallurgy.
- 18.5 Hansen, R G and Ring, E J: The NIMROC reference materials: revised values for Thorium, Yttrium, Lanthanum and the rare-earth elements. Randburg, Council for Mineral Technology, Report No. M134-1984.

These reports are available free of charge from the Council for Mineral Technology.

19. SIGNATURE / NAME OF CERTIFYING OFFICER/S

Mr R C Mallett  
ANALYTICAL SCIENCE DIVISION  
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**AUSTRALIA**

Australian Mineral Development Laboratories.....	Frewville
Commonwealth Scientific and Industrial Research Organization.....	North Ryde
Government Chemical Laboratory.....	Brisbane
Mineral Research Laboratories (C.S.I.R.O.).....	North Ryde
University of Melbourne.....	Parkville
Western Australian Institute of Technology, Department of Physics.....	South Bentley

**AUSTRIA**

University of Vienna, Analysis of Nuclear Raw Materials Division.....	Vienna
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**BELGIUM**

Rijksuniversiteit-Gent, Instituut voor Nucleaire Wetenschappen.....	Ghent
Université de Liège, Institut de Géologie.....	Liège

**CANADA**

Department of Natural Resources.....	Quebec
Falconbridge Nickel Mines Ltd.....	Thornhill
Geological Survey of Canada.....	Ottawa
McGill University, Department of Geological Sciences.....	Montreal
McMaster University, Department of Geology.....	Hamilton
Inco Metals Co.....	Copper Cliff, Ontario

**CZECHOSLOVAKIA**

Geological Survey of Czechoslovakia.....	Prague
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**FRANCE**

Bureau National de Métrologie.....	Paris
Bureau de Recherches Géologiques et Minières.....	Orleans
Centre National d'Etudes et Recherches Céramiques.....	Paris
Centre National de la Recherche Scientifique.....	Nancy
Commissariat à l'Energie Atomique.....	Chatillon-sous-Bagneux
Rhône-Progil.....	Aubervilliers
Société Nationale des Pétroles d'Aquitaine.....	Pau
Université Pierre et Marie Curie, Département de Géologie Appliquée.....	Paris

**GREAT BRITAIN**

British Ceramic Research Association.....	Stoke-on-Trent
Institute of Geological Sciences.....	London
University of London Kings College, Department of Geology.....	London
Macaulay Institute for Soil Research.....	Aberdeen
Open University, Department of Earth Sciences.....	Milton Keynes
Imperial College of Science and Technology, Department of Geology.....	London
University of Bristol, Department of Geology.....	Bristol
University College, Department of Geology.....	London
University of Keele, Department of Geology.....	Staffordshire
University of Leeds, Department of Earth Sciences.....	Leeds
University of Newcastle-upon-Tyne, Department of Geology.....	Newcastle-upon-Tyne
University of Reading, Department of Geology.....	Reading

**ISRAEL**

Geological Survey of Israel.....	Jerusalem
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Kyushu University, Department of Geology.....	Fukuoka

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**NEW ZEALAND**

Department of Scientific and Industrial Research, Soil Bureau.....	Lower Hutt
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## **SOUTH AFRICA**

AECI Ltd., Research Department .....	North Rand
Anglo American Corp. of SA Ltd., Anglo American Research Laboratory .....	Crown Mines
Corner House Laboratories (1968) (Pty) Ltd.....	Emmentaria
Council for Mineral Technology .....	Randburg
Cullinan Refractories Ltd .....	Olifantsfontein
Société Générale de Surveillance (SA) (Pty) Ltd.....	Johannesburg
Johannesburg Consolidated Investment Co. Ltd., Minerals Processing Research Laboratory .....	
McLachlan and Lazar (Pty) Ltd.....	Knights
Nuclear Development Corporation.....	Johannesburg
Palabora Mining Co. Ltd.....	Pretoria
Phosphate Development Corp. Ltd.....	Phalaborwa
Rhodes University, Department of Geology .....	Phalaborwa
	Grahamstown

### **South African Bureau of Standards:**

General Chemistry Division.....	Pretoria
Physical Chemistry Division .....	Pretoria
Metallurgy Division .....	Pretoria

### **Council for Scientific and Industrial Research:**

National Chemical Research Laboratory.....	Pretoria
National Institute for Coal Research.....	Pretoria
National Institute for Materials Research .....	Pretoria
South African Iron and Steel Industrial Corp. Ltd .....	Pretoria

### **University of Cape Town:**

Department of Geochemistry .....	
Department of Physics .....	Rondebosch

### **University of Natal:**

Department of Chemistry .....	Pietermaritzburg
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### **University of the Witwatersrand:**

Nuclear Research Unit.....	Johannesburg
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## **SWEDEN**

National Defence Research Institute .....	Stockholm
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## **SWITZERLAND**

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Université de Genève, Institut de Minéralogie.....	Geneva

## **UNITED STATES OF AMERICA**

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Franklin and Marshall College, Department of Geology.....	Lancaster, Pennsylvania
Pennsylvania State University, Mineral Constitution Laboratories .....	University Park, Pennsylvania
Rice University, Department of Chemistry .....	Houston, Texas
Texas A & M University, Department of Chemistry .....	College Station, Texas
United States Department of the Interior, Geological Survey.....	Reston, Virginia
Woods Hole Oceanographic Institution.....	Woods Hole, Massachusetts
Yale University, Department of Geology and Geophysics .....	New Haven, Connecticut
University of California at San Diego.....	La Jolla, California

## **WEST GERMANY**

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Universität Freiburg, Mineralogisches Institut.....	Freiburg
Universität Tübingen, Mineralogisch-Petrographisches Institut .....	Tübingen
Universität Würzburg, Mineralogisches Institut.....	Würzburg

## **ZAMBIA**

Rhokana Corp. Ltd.....	Kitwe
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## **ZIMBABWE**

Prospecting Ventures Ltd.....	Harare
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