



## Reference Material Data Sheet

# IAG OU-4 Penmaenmawr Microdiorite

### International Association of Geoanalysts

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### Description of the reference material

*IAG OU-4 is a microdiorite which was collected from Graig Llwyd Quarry, Penmaenmawr, North Wales. (UK grid reference SH 715 750). The igneous body which comprises the Penmaenmawr microdiorite is a minor intrusion, oval in shape and 3 x 5 km<sup>2</sup> in size. It is thought to be part of the Ordovician-age Llewelyn volcanic group, located near Conway, on the North Wales coast. The rock is fine grained with an average crystal size of 0.2 mm, consisting of plagioclase feldspar, chlorite, clinopyroxene and quartz. A small number of phenocrysts, mainly plagioclase, range up to 2 mm in length. Although this rock was originally chilled rapidly, the igneous mineralogy has been partially over-printed as a result of low-grade greenschist facies metamorphism. A broken block of fresh rock was selected from the quarry floor. Sample preparation followed procedures at the Open University that have been described in detail in earlier GeoPT proficiency testing reports (see in particular the GeoPT 01 report - <http://www.geoanalyst.org/index.php/proficiency-testing-proficiency-testing/geopt-programme/previous-rounds>). The sample was formally tested for homogeneity by selecting at random ten packets of the sample prepared for distribution, and analysing them by WD-XRF at the OU. A detailed analysis of the homogeneity data may be found in the GeoPT08-2001 report, the overall conclusion from which was that the sample can be considered fit-for-purpose as far as use in the GeoPT08 round is concerned.*

### Characterisation as a reference material

*This material is characterised as a reference material using results from GeoPT08/2001 round of the International Association of Geoanalysts' GeoPT proficiency testing scheme. The Proficiency Testing Steering Committee for this round was Prof. M. Thompson (statistician), Prof. P.J. Potts (results coordinator) Jean S. Kane, Dr P.C. Webb and J.S. Watson. The GeoPT08 report was published at: <http://www.geoanalyst.org/geopt/GeoPT08Report.pdf>.*

### Intended use

*This reference material is designed for use by laboratories undertaking the determination of the major and trace element mass concentration fractions of silicate rocks and similar materials for the calibration of a measurement system, the assessment of a measurement procedure, assigning values to other materials, and quality control. Note that the material may be used only for a single purpose in the same measurement process. For example, it must not be used for calibration and method validation at the same time.*

### Minimum sample size

*On the basis of the homogeneity results and an assessment of the methods used to contribute results to the GeoPT08-2001 round, the minimum sample size recommended for use as a test portion is 0.2 g.*

IAG OU-4 Penmaenmawr Microdiorite								
Reference values								
Measurand	Reference value	Uncertainty (expanded)	n		Measurand	Reference value	Uncertainty (expanded)	n
	<i>g/100 g</i>	<i>g/100 g</i>				<i>mg/kg</i>	<i>mg/kg</i>	
SiO <sub>2</sub>	63.40	0.08	66		Ho	1.63	0.07	29
TiO <sub>2</sub>	0.770	0.004	67		La	25.1	0.7	42
Al <sub>2</sub> O <sub>3</sub>	14.83	0.05	69		Li	35.0	1.4	16
Fe <sub>2</sub> O <sub>3</sub> T	5.84	0.04	71		Lu	0.71	0.02	31
MnO	0.140	0.002	70		Nb	12.8	0.5	46
MgO	2.29	0.02	69		Nd	27.9	0.8	41
CaO	4.48	0.03	70		Ni	21.0	0.8	55
Na <sub>2</sub> O	3.61	0.03	71		Pb	14.0	0.6	45
K <sub>2</sub> O	2.71	0.02	69		Pr	6.88	0.20	29
P <sub>2</sub> O <sub>5</sub>	0.174	0.003	60		Rb	99	2	59
LOI	1.72	0.02	52		Sc	19.0	0.5	37
	<i>mg/kg</i>	<i>mg/kg</i>			Sm	6.94	0.24	35
Ba	358	4	61		Sr	100	2	59
Ce	56.3	1.4	46		Ta	1.00	0.06	25
Co	13.5	0.6	47		Tb	1.25	0.05	31
Cr	54.8	1.9	54		Th	8.42	0.24	42
Cs	2.07	0.07	26		Tm	0.72	0.03	22
Cu	27.0	0.9	48		U	2.19	0.13	35
Dy	7.86	0.19	31		V	83	2	48
Er	4.83	0.18	30		Y	47.3	1.1	55
Eu	1.64	0.04	33		Yb	4.70	0.13	35
Ga	17.4	0.4	38		Zn	69.5	1.6	52
Gd	7.39	0.24	31		Zr	196	3	54
Hf	5.58	0.13	30					

*Reference values* are the GeoPT assigned values obtained from a re-assessment using robust statistical analysis of results originally submitted to the GeoPT08 round. This reassessment took into account more recent experience of GeoPT data evaluation, together with the opportunity to select median values as the reference value, when justified by the data distribution. Values are reported on a dried basis.

*Uncertainties* are the robust standard deviation of the mean or median of the assigned value expanded by a coverage factor of two, and rounded up.

*Fe<sub>2</sub>O<sub>3</sub>T* is the total iron expressed measured as Fe<sub>2</sub>O<sub>3</sub>. *LOI* is the loss on ignition (nominally 1050 °C for 2 hours).

IAG OU-4 Penmaenmawr Microdiorite								
Information values								
Measurand	Information value	Uncertainty (expanded)	n		Measurand	Information value	Uncertainty (expanded)	n
	<i>g/100 g</i>	<i>g/100 g</i>				<i>mg/kg</i>	<i>mg/kg</i>	
Fe(II)O	4.52	0.09	16		Bi	0.10	0.04	10
	<i>mg/kg</i>	<i>mg/kg</i>			Sb	0.30	0.05	15
B	42	8	7		Sn	2.5	0.3	15
Be	1.8	0.2	17		Tl	0.46	0.02	10

*Information values* are 'provisional' values derived from the GeoPT08 dataset following a re-assessment of source data originally submitted to the GeoPT08 round. This reassessment took into account more recent experience of GeoPT data evaluation, together with the opportunity to select median values as information values, when justified by the data distribution. These data are provided for information purposes only and **not** for the calibration of methods or the assessment of data. Results are reports on a dried basis.

*Uncertainties* are the robust standard deviation of the median expanded by a coverage factor of two, and rounded up.

*Fe(II)O* is the ferrous iron mass fraction.

## **Period of validity**

*Provided the storage and handling conditions are met, this reference material is not expected to deteriorate with time. On exposure to air, the material may absorb moisture, and instructions for handling must be followed.*

## **Storage information**

*Store in a sealed container in a cool dry environment.*

## **Instructions for handling**

*Before any measurements are made, every portion of the test sample must be dried at  $105 \pm 5$  °C for at least 2 hours. Avoid contamination and cross-contamination of the test material.*

## **Assessment of reference values**

*The reference values were determined as a 'consensus', based on the statistical location of the participants' results to the GeoPT08-2001 round. This location was determined as a robust mean if the distribution of results was unimodal and, outliers aside, close to symmetrical. If a slight asymmetry was apparent in a unimodal distribution, the median was chosen as an alternative. In other circumstances, usually when the number of valid results contributing to the location was less than 12 or their dispersion was unusually great, no reference value was assigned, although values may be reported as information values. These judgements were made by the IAG Proficiency Testing Steering Committee.*

## **Metrological traceability**

*Traceability was not formally demonstrated for this reference material. However, traceability could be demonstrated by the use of certified reference materials as calibrators or for performance assessment by the laboratories participating in this round (although this information is not currently recorded by the GeoPT programme). Furthermore, traceability is implied by the overall agreement between datasets for individual elements/oxides submitted by laboratories that contributed to the GeoPT programme.*

## **Reference to reference material characterisation report**

*Further details of the procedures used, the results, their statistical analysis and assessment, on which the property values listed in this certificate are based, can be found in the GeoPT08-2001 report (<http://www.geoanalyst.org/index.php/proficiency-testing-proficiency-testing/geopt-programme/previous-rounds>).*

## **Safety information**

*Silicate powders containing heavy metals can cause harm especially if inhaled or in contact with the skin. User organisations must undertake a health and safety risk assessment and ensure that the appropriate procedures are followed in the handling and use of this material. Further details are available on the relevant Material Safety Data Sheet.*

## **Legal notice – terms and conditions**

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## **Revisions**

*Any revisions to this reference material data sheet will be made available on the IAGeo Ltd web site ([www.iageo.com](http://www.iageo.com)).*

## **Acknowledgements**

*Peter Webb is gratefully acknowledged for undertaking a re-assessment of the GeoPT08 data set and for other contributions to this data sheet.*

## **Approvals**

*This reference material information sheet was approved on behalf of the Certification and Reference Material Committee of the International Association of Geoanalysts.*

**Name** *Philip J. Potts*

**Position** *Chair of IAG Certification  
and Reference Material Committee*

**Date** *29th February 2016*

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