Reference Material Data Sheet

IAG OU-8 Calcareous Sandstone

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Description of the reference material

Calcareous sandstone OU-8, was supplied by Dr J.N. Walsh (Royal Holloway, University of London) and was re-homogenised, divided and packaged at the Open University, UK.

Homogeneity testing

The sample was tested for homogeneity in accordance with the procedures outlined in the GeoPT protocol on the basis of WDXRF determinations on 10 packets selected at random, each of which was analysed in duplicate. For the analytes SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, CaO, Na_2O, K_2O, LOI, Rb, Sr, Y, Zr, Nb, Ba, Pb, Th, U, Sc, V, Cr, Co, Ni, Cu, Zn, Ga, Mo, As, S, no lack of sufficient homogeneity was detected by the Fearn-Thompson test. For one element tested (P) there was insufficient resolution in the data for a valid test to be conducted. It was therefore demonstrated that this material was suitable for use in the GeoPT proficiency testing programme.

Characterisation as a reference material

This material is characterised as a reference material using results from GeoPT17/2005 round of the International Association of Geoanalysts' GeoPT proficiency testing scheme. The Proficiency Testing Steering Committee for this round was Prof M. Thompson (statistician), Dr P.C. Webb (results coordinator), Prof P.J. Potts and Dr J.N. Walsh. The GeoPT17 report is available via the International Association of Geoanalysts web site (http://www.geoanalyst.org/index.php/proficiency-testing-proficiency-testing/geopt-programme/previous-rounds).

Intended use

This reference material is designed for use by laboratories measuring the major and trace element mass fraction concentrations in 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 GeoPT17 round, the minimum sample size recommended for use as a test portion is 0.2 g.

Storage information

Store in a sealed container in a cool dry environment.

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Reference values

Measurand	Reference value	Uncertainty (expanded)	p		Measurand	Reference value	Uncertainty (expanded)	p
	g/100 g	*g/100 g*				*mg/kg*	*mg/kg*	
SiO_2	54.12	0.20	63		**Ho**	0.51	0.02	29
TiO_2	0.244	0.004	66		**La**	13.5	0.4	47
Al_2O_3	6.54	0.05	66		**Li**	10.3	0.7	23
Fe_2O_3T	1.30	0.02	72		**Lu**	0.263	0.013	32
MnO	0.138	0.002	68		**Nd**	12.3	0.4	43
MgO	1.88	0.02	67		**Pb**	9.7	0.5	43
CaO	16.72	0.14	69		**Pr**	3.12	0.13	31
Na_2O	0.68	0.02	67		**Rb**	64.0	0.9	53
K_2O	2.97	0.03	70		**Sb**	0.21	0.02	22
LOI	15.30	0.06	53		**Sm**	2.40	0.12	36
	mg/kg	*mg/kg*			**Sr**	264	5	57
Ba	532	6	61		**Ta**	0.33	0.03	23
Be	1.42	0.10	22		**Tb**	0.368	0.015	32
Ce	41.8	1.6	47		**Th**	9.45	0.30	48
Cs	3.23	0.14	32		**Tl**	1.02	0.04	13
Dy	2.24	0.09	33		**Tm**	0.245	0.009	25
Er	1.58	0.05	32		**U**	0.75	0.05	34
Eu	0.66	0.03	36		**V**	29.8	1.4	50
Ga	6.24	0.30	40		**Y**	16.0	0.5	50
Gd	2.25	0.09	32		**Yb**	1.69	0.06	37

Reference values *are the GeoPT assigned values obtained from a re-assessment using robust statistical analysis of results originally submitted to the GeoPT17 round. This reassessment took into account more recent experience of GeoPT data evaluation. Values are reported on a dried basis.*

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

Fe_2O_3T *is the total iron expressed measured as Fe_2O_3,* ***LOI*** *is the loss on ignition, nominally determined by heating a test portion to 1050 °C for 2 hours;* ***p*** *is the number of independent data sets that contributed to the reference value.*

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.

Assessment of reference values

The reference values were determined as 'consensus' values based on the statistical location of the participants' results in the GeoPT17 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. If a noteworthy skew was apparent and an objective explanation for the outcome was forthcoming, the mode of the results might be used. In other circumstances, usually when the number of valid results contributing to the location was less than 15 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.

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Information values

Measurand	Information value	Uncertainty (expanded)	p		Measurand	Information value	Uncertainty (expanded)	p
	g/100 g	*g/100 g*				*mg/kg*	*mg/kg*	
CO_2	14.9	0.3	17		**Ge**	1.1	0.2	10
	mg/kg	*mg/kg*			**Hf**	4.7	0.5	31
As	1.0	0.1	18		**Nb**	4.3	0.4	44
Bi	0.044	0.011	9		**Ni**	7.5	1.9	45
Co	2.6	0.3	37		**Sc**	3.6	0.4	35
Cr	21	2	51		**Sn**	0.62	0.15	14
Cu	8.2	0.9	49		**Zr**	181	8	52

Information values *are mainly 'provisional' values derived from the GeoPT17 dataset following a re-assessment of the source data originally submitted to the GeoPT17 round. This reassessment took into account more recent experience of GeoPT data evaluation, together with the opportunity to select median or mode 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 reported on a dried basis.*

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

CO_2 *is the mass fraction (g/100g) of total carbon expressed as carbon dioxide;* ***p*** *is the number of independent data sets that contributed to the information value.*

Instructions for handling

Before any measurements are made, every portion of the test sample must be dried at 105 ± 5 °C for at least 2 hours. Avoid contamination of the test material.

Reference material characterisation report

Further details of the procedures used, the results, their original statistical analysis and assessment, on which the property values listed in this certificate are based, can be found in the GeoPT17 report (http://www.geoanalyst.org/index.php/proficiency-testing-proficiency-testing/geopt-programme/previous-rounds).

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 and by the fact that some participating laboratories were formally accredited (although none of this information was recorded during the GeoPT17 round). However, traceability is implied by the overall consensus between datasets for individual elements/oxides submitted by laboratories that contributed to the GeoPT programme.

Safety information

Rock powders containing silicate minerals 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 made available on the IAGeo Limited web site (www.iageo.com).

Acknowledgements

Peter Webb is acknowledged for undertaking a re-assessment of the GeoPT17 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** **4th August 2017**