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Certificate of Analysis ISO 17034

Certified Reference Material (CRM)

ISO 17034:2016 | ISO/IEC 17025:2017 | ISO 9001:2015

Product ID: MBH-BAS-MC-22-P
Product Name: Merriam Crater Basalt, CRM

Description: MBH-BAS-MC-22 is a vesicular basalt collected from a quarry on the side of the Merriam Crater cinder cone volcano in the San Francisco Volcanic Field in northern Arizona. Rock from the same locale has previously been used to create a lunar simulant material. Major element concentrations are typical basalt concentrations, however, the material is enriched in many trace elements, possible associated with the occasional zeolites filling the vesicles. This ISO 17034 accredited CRM is supplied as a homogenous powder with particle size 95% < 200 mesh (74 um).

Intended Use: This material is intended for use as an elemental CRM for the calibration of instruments as well as the validation of analytical methods. Appropriate use of this material will fulfill the CRM and traceability requirements for use in ISO 17025 accredited laboratories.

Certified Values: Consensus values considered to be of highest quality and fit-for-purpose.

Major Elements (wt%)						
Element	Certified Value	Uncertainty	Oxide	Certified Value	Uncertainty	n*
Al	8.84	0.05	Al_2O_3	16.7	0.1	26
Ca	7.05	0.06	CaO	9.87	0.09	25
Fe	8.6	0.1	Fe_2O_3T**	12.3	0.2	27
K	0.69	0.01	K_2O	0.83	0.01	25
Mg	4.80	0.04	MgO	7.96	0.07	26
Mn	0.145	0.002	MnO	0.187	0.002	30
Na	2.49	0.03	Na_2O	3.36	0.04	24
P	0.315	0.003	P_2O_5	0.722	0.007	20
Si	21.8	0.1	SiO_2	46.6	0.2	13
Ti	1.12	0.01	TiO_2	1.86	0.01	23

* Number of observations

** Total iron expressed as ferric iron Fe_2O_3

Minor and Trace Elements (mg/kg)												
Element	Certified Value	Uncertainty	n	Element	Certified Value	Uncertainty	n	Element	Certified Value	Uncertainty	n
Ba	836	20	32	Ho	0.90	0.04	16	Sr	978	20	31
Ce	104	2	28	La	53.5	0.7	21	Ta	2.13	0.08	19
Co	50	1	27	Mo	1.6	0.2	15	Tb	0.85	0.06	16
Cr	86	5	20	Nb	42	2	23	Th	6.0	0.2	22
Cs	0.22	0.02	19	Nd	47	2	21	U	1.40	0.05	21
Cu	55	2	18	Ni	91	3	26	V	247	7	25
Dy	4.8	0.2	17	Pb	5.7	0.2	15	Y	24.4	0.6	23
Er	2.3	0.1	15	Pr	12.0	0.3	14	Yb	2.00	0.07	16
Eu	2.4	0.2	20	Rb	9.1	0.3	23	Zn	102	3	22
Ga	20	1	21	Sc	27.1	0.7	19	Zr	158	5	21
Hf	3.6	0.1	20	Sm	7.8	0.2	18				

Indicative Values: Values listed when insufficient data was available to provide suitable statistical agreement, typically due to lab or method limitations.

Indicative Values (mg/kg)																				
As	3.6		Be	1.2		Cd	0.09		Gd	6.2		Ge	0.6		In	0.075		Li	7.6		Lu	0.31
S	140		Sb	0.08		Sn	1.3		Tm	0.31		W	0.32									

- Loss on Ignition (LOI) 110 °C to 1000 °C: 0.6 wt%

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Uncertainty and Homogeneity: The uncertainty associated with the certified concentration represents the expanded uncertainty at the 95% confidence level using a coverage factor of k=2. The uncertainty includes the combined effects of method imprecision, material inhomogeneity, and any bias between methods. This material was determined to be homogeneous by procedures consistent with the requirements of ISO 17034 and ISO Guide 35. Replicate samples were selected by a stratified random sampling scheme and analyzed to confirm its homogeneity, in accordance with internal procedures for the assessment of homogeneity and stability. To ensure homogeneity, users should not take a smaller sub-sample than specified in the Instructions for Use, as doing so will invalidate the certified values and uncertainties.

Certification and Traceability: This CRM is processed under the scope of accreditation to ISO 17034 by LGC Standards - Manchester, NH. The certified values of this CRM are determined from the final weighted average results of a comprehensive interlaboratory study. It is an implicit requirement for ISO 17025 accreditation that analytical work be performed with due traceability, via an unbroken chain of comparisons, each with stated uncertainty, to primary standards such as the mole, or to nationally or internationally recognized reference materials. Traceability of the certified value includes, but is not limited to, the following: the mole via primary analytical methods, substances of known stoichiometry, ISO 17034 commercial solutions, appropriate NIST SRMs, and as part of the analytical calibration or process control of the laboratory.

Certification Laboratories: Analytical work performed to assess this material was carried out by laboratories with proven competence, typically indicated by ISO 17025 accreditation. The laboratories involved in the certification of this material used a combination of techniques, including but not limited to: ICP-OES, ICP-MS, IR-Combustion, WD-XRF, and neutron activation.

- Acts Labs - Ontario, CA
- Agat Labs - Ontario, CA
- ALS - Reno, NV
- American Assay Laboratories - Sparks, NV
- Bureau Veritas - Sparks, NV
- LGC Standards - Manchester, NH
- SRC Geoanalytical Laboratories - Saskatchewan, CA
- University of Missouri Research Reactor - Columbia, MO
- Washington State University - Pullman, WA

Quality Certifications: This CRM was prepared under a quality management system that is accredited to the following:

- ISO 17034:2016 Accredited: Reference Materials Producer, A2LA Certificate No. 2848.02 – General Requirements for the Competence of Reference Material Producers
- ISO 17034 references additional requirements specified in ISO Guide 31 and ISO Guide 35
- ISO/IEC 17025:2017 Accredited: Chemical Testing, A2LA Certificate No. 2848.01 – General Requirements for the Competence of Testing and Calibration Laboratories
- ISO 9001:2015 Certified: Quality Management Systems, Registrar: TUV NORD Certificate Registration No. 56 100 19560101

Instructions for Use: The powder should be thoroughly mixed and dried at 110°C for 2 hours before analysis. The recommended minimum sample size is 200 mg. This material should be stored tightly capped in a cool dry location when not in use. Minimize exposure to moisture or high humidity.

Period of Validity: The certification of this material is valid indefinitely, within the uncertainty specified, provided the material is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the material is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

Health and Safety Information: Refer to the **Safety Data Sheet** (SDS), which can be obtained at **lgcstandards.com**

Chuck Goudreau

Chuck Goudreau, Certifying Officer

23 January 2023
Certification Date

Revision No: 000
Revision Date: 23 January 2023

ACCREDITED

ISO 17034 Accredited: Reference Materials Producer, Certificate # 2848.02
ISO/IEC 17025 Accredited: Chemical Testing, Certificate # 2848.01

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