

レーザーアブレーション用標準物質

米国NIST Trace Element in Glass

米国USGS Microanalytical Reference Materials

西進商事株式会社

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米国NIST製 ガラス標準物質

112.4 – Trace Elements In Glass (wafer form)

These SRMs are for calibrating instruments and evaluating analytical techniques used to determine trace elements in inorganic matrices. NOTE: The nominal glass composition of SRMs 610 through 617 is 72% SiO₂, 12% CaO, 14% Na₂O, and 2% Al₂O₃.

PLEASE NOTE: The tables are presented to facilitate comparisons among a family of materials to help customers select the best SRM for their needs. For specific values and uncertainties, the certificate is the only official source.

Status Unit of Issue >>	611 Now Selling 6 wafers	613 Now Selling 6 wafers	615 Now Selling 6 wafers	616 Now Selling 6 wafers	617 Now Selling 6 wafers
Element (in mg/kg) Wafer Thickness (in mm) 3 and 1					
Zinc	(433)				
Antimony			(1.06)	(0.078)	(0.078)
Barium		(41)			
Boron	(351)	(32)	(1.30)	(0.20)	(0.20)
Cadmium			(0.55)		
Cerium		(39)			
Cobalt	(390)	(35.5)	(0.73)		
Copper	(444)	(37.7)	1.37	(0.80)	(0.80)
Dysprosium		(35)			
Erbium		(39)			
Europium		(36)	(0.99)		
Gadolinium		(39)			
Gallium			(1.3)	(0.23)	(0.23)
Gold	(25)	(5)	(0.5)	(0.18)	(0.18)
Iron	458	51	(13.3)	(11)	(11)
Lanthanum		(36)	(0.83)	(0.034)	(0.034)
Lead	426	38.57	2.32	1.85	1.85
Manganese	485	(39.6)			
Neodymium		(36)			
Nickel	458.7	38.8	(0.95)		
Potassium	(461)	(64)	30	29	29
Rubidium	425.7	31.4	0.855	(0.100)	(0.100)
Samarium		(39)			
Scandium			(0.59)	(0.026)	(0.026)
Silver	(254)	22.0	0.42		
Strontium	515.5	78.4	45.8	41.72	41.72
Thallium	(61.8)	(15.7)	(0.269)	(0.0082)	(0.0082)
Thorium	457.2	37.79	0.748	0.0252	0.0252
Titanium	(437)	(50.1)	(3.1)	(2.5)	(2.5)
Uranium	461.5	37.38	0.823	0.0721	0.0721
Ytterbium		(42)			

In addition to the elements listed above, the glass SRMs contain the following 25 elements: As, Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, Se, S, Te, Tb, Tm, Sn, W, V, Y, and Zr.



The USGS Microanalytical Reference Materials (MRMs) are designed for use in the quantitative analysis of geologic samples using direct solid sampling techniques such as Laser Ablation ICP-MS. Recommended and informational total element concentrations were obtained through international round robin analysis using both bulk and microanalytical data.

Samples are distributed in polished epoxy mounts and ready for immediate use.

These MRMs are supplied as individual samples or as sets contained within a plastic holder.

Accessories are also available which integrate the USGS MRM holder with standard sample chamber mounts for CETAC® and New Wave® laser ablation systems.

Microanalytical Reference Materials(mounted)

Identifier /Order No.	Material Type	Form	Comments	Mount Color
BCR-2G	Basalt Glass	Epoxy Mount	Melted BCR-2	Colorless
BHVO-2G	Basalt Glass	Epoxy Mount	Melted BHVO-2	Magenta
BIR-1G	Basalt Glass	Epoxy Mount	Melted BIR-1	Yellow
NKT-1G	Nephelinite Glass	Epoxy Mount	Melted NKT-1	Magenta
TB-1G	Basalt Glass	Epoxy Mount	Melted TB-1	Orange
GSC-1G	Synthetic Basalt Glass	Epoxy Mount	Traces ~ 3 ppm	Light Blue
GSD-1G	Synthetic Basalt Glass	Epoxy Mount	Traces ~ 30 ppm	Medium Blue
GSE-1G	Synthetic Basalt Glass	Epoxy Mount	Traces ~ 300 ppm	Dark Blue


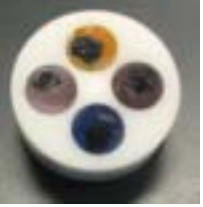
Microanalytical Reference Materials (Pressed Powders)

Identifier / Order No.	Material Type	Form	Mount
MASS-1	Synthetic Polymetal Sulfide	Pressed Pellet	Pellet in 19 mm ring
MACS-3	Synthetic Calcium Carbonate	Pressed Pellet	Pellet in 19 mm ring





Microanalytical RM Accessories for Laser Ablation

Identifier / Order No.	Material Type	Comments	Photo
SH-V1	Sample Holder	Plastic, will hold 4 RM plugs	
CM-V1	Cetac Laser Ablation system sample mount	Mount for sample holder to fit Cetac Laser Ablation chambers	
NWM-V1	New Wave Laser Ablation system sample mount	Mount for sample holder to fit New Wave Laser Ablation chambers	
RM KIT-1	MRM Starter Kit	Contains 1 each of GSD-1G, BCR-2G, BHVO-2G, BIR-1G, and sample holder (SH-V-1)	

PRELIMINARY

United States Geological Survey

Certificate of Analysis

Microanalytical reference material BCR-2G

Material used in the preparation of BCR-2G was obtained from a randomly selected set of bottles of BCR-2 powder. The powder was melted at 1645°C in a platinum bowl and quenched in water bath. Random fragments of the resulting glass material were selected and sent to a select group of international laboratories as both ground powder and glass fragments.

The information presented below was obtained from the USGS certificate for BIR-1 and the GEOREM database. GEOREM information is representative of a limited data compilation from a select group of international laboratories using both bulk and microanalytical method of analysis. Users are encouraged to review the data compilation in the GEOREM database <http://georem.mpch-mainz.gwdg.de> before use.

BCR-2			GEOREM		
Oxide	Wt %	+/-	Oxide	Wt %	+/-
Al ₂ O ₃	13.5	0.2	Al ₂ O ₃	13.4	0.4
CaO	7.12	0.11	CaO	7.06	0.11
Fe ₂ O ₃ TOT	13.8	0.2	Fe ₂ O ₃ TOT	13.9	0.1
K ₂ O	1.79	0.05	K ₂ O	1.74	0.04
MgO	3.59	0.05	MgO	3.56	0.09
Na ₂ O	3.16	0.11	Na ₂ O	3.23	0.07
P ₂ O ₅	0.35	0.02	P ₂ O ₅	0.37	0.01
SiO ₂	54.1	0.8	SiO ₂	54.4	0.4
TiO ₂	2.26	0.05	TiO ₂	2.27	0.04

BCR-2			GEOREM		
Element	ug/g	+/-	Element	ug/g	+/-
Ba	683	28	Ba	683	7
Ce	53	2	Ce	53.3	0.5
Co	37	3	Co	38	2
Cr	18	2	Cr	17	2
Eu	2.0	0.1	Eu	1.97	0.02
Ga	23	2	Ga	23	1
Gd	6.8	0.3	Gd	6.71	0.07
La	25	1	La	24.7	0.3
Mn	1520	60	Mn	1550	70
Mo	248	17	Mo	270	30
Nd	28	2	Nd	28.9	0.3
Rb	48	2	Rb	47	0.5

BCR-2			GEOREM		
<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Sc	33	2	Sc	33	2
Sr	346	14	Sr	342	4
Th	6.2	0.7	Th	5.9	0.3
U	1.69	0.19	U	1.69	0.12
V	416	14	V	425	18
Y	37	2	Y	35	3
Yb	3.5	0.2	Yb	3.39	0.03
Zn	127	9	Zn	125	5
Zr	188	16	Zr	184	15

Glossary

Wt%	Weight percent
$\mu\text{g/g}$	Microgram per gram of solid
\pm	One Standard Deviation
FeO_{TOT}	Total iron expressed as FeO

Samples may be obtained from the U.S. Geological Survey through the reference materials task, Stephen Wilson coordinator, Request for reference materials should be forwarded to the following address, swilson@usgs.gov

Stephen Wilson
U.S. Geological Survey
Reference Materials Project
MS 964
Denver, CO 80225
USA

United States Geological Survey

Certificate of Analysis

Microanalytical reference material, BIR-1G

Material used in the preparation of BIR-1G was obtained from a randomly selected set of bottles of BIR-1 powder. The powder was melted at 1645°C in a platinum bowl and quenched in water bath. Random fragments of the resulting glass material were selected and sent to a select group of international laboratories as both ground powder and glass fragments.

The information presented below was obtained from the USGS certificate for BIR-1 and the GEOREM database. GEOREM information is representative of a limited data compilation from a select group of international laboratories using both bulk and microanalytical method of analysis. Users are encouraged to review the data compilation in the GEOREM database <http://georem.mpch-mainz.gwdg.de> before use.

BIR-1			GEOREM		
<u>Oxide</u>	<u>Wt %</u>	<u>+/-</u>	<u>Oxide</u>	<u>Wt %</u>	<u>+/-</u>
Al ₂ O ₃	15.5	0.2	Al ₂ O ₃	15.5	0.2
CaO	13.3	0.11	CaO	13.3	0.2
Fe ₂ O ₃	2.06	0.2	Fe ₂ O ₃		
FeO	8.34	0.10	FeO _{TOT}	10.4	0.1
K ₂ O	0.030	0.003	K ₂ O	0.03	0.005
MgO	9.70	0.05	MgO	9.4	0.1
Na ₂ O	1.82	0.045	Na ₂ O	1.85	0.07
P ₂ O ₅	0.021	0.001	P ₂ O ₅	0.027	0.003
SiO ₂	47.96	0.19	SiO ₂	47.5	0.3
TiO ₂	0.96	0.01	TiO ₂	1.04	0.07

<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Cu	125	4	Cu	119	12
Dy	4	1	Dy	2.55	0.02
Ce	2	0.4	Ce	1.89	0.04
Co	52	2	Co	52	5
Cr	370	8	Cr	392	24
Eu	0.55	0.05	Eu	0.517	0.005
Gd	2	0.4	Gd	1.85	0.02
Hf	0.6	0.08	Hf	0.57	0.03
La	0.63	0.07	La	0.609	0.02
Li	3.6	0.2	Li	3	0.7
Lu	3.6	0.2	Lu	0.248	0.009
Nd	2.5	0.7	Nd	2.37	0.03
Ni	170	6	Ni	178	18
Sc	44	1	Sc	43	3
Sr	110	2	Sr	109	2

BIR-1			GEOREM		
<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Th	0.89	0.7	Th	0.03	0.002
V	310	11	V	326	32
Y	16	1	Y	14.3	1.4
Yb	1.7	0.1	Yb	1.64	0.03
Zn	70	9	Zn	78	17
Zr	18	1	Zr	14	1.2

Glossary

Wt%	Weight percent
$\mu\text{g/g}$	Microgram per gram of solid
\pm	One Standard Deviation
FeO_{TOT}	Total iron expressed as FeO

Samples may be obtained from the U.S. Geological Survey through the reference materials task, Stephen Wilson coordinator, Request for reference materials should be forwarded to the following address, swilson@usgs.gov

Stephen Wilson
U.S. Geological Survey
Reference Materials Project
MS 964
Denver, CO 80225
USA

United States Geological Survey

Certificate of Analysis

Microanalytical reference material BHVO-2G

Material used in the preparation of BHVO-2G represent randomly selected samples of BHVO-2 powder that was melted at 1645°C in a platinum bowl and then quenched in water. Fragments of the resulting glass material were pulverized, homogenized, and split into samples. Aliquots were supplied to a select group of international laboratories for bulk analysis along with a set of glass fragments for microanalytical analysis

Certificate values represent a compilation of laboratory and literature values from selected international laboratories. Recommended values are listed when analytical results provided by independent laboratories using a minimum of three independent analytical procedures are in statistical agreement. Information values with standard deviations are listed when at least two independent laboratories using two independent analytical procedures have provided information. Information values without standard deviations represent information from a single laboratory or analytical procedure.

Recommended Values

<u>Element</u>	<u>Wt. %</u>	<u>±</u>	<u>Oxide</u>	<u>Wt. %</u>	<u>±</u>
Al	7.17	0.12	Al ₂ O ₃	13.5	0.22
Ca	8.18	0.17	CaO	11.4	0.24
Fe _{TOT}	8.37	0.42	Fe ₂ O ₃ _{TOT}	12.0	0.60
K	0.425	0.008	K ₂ O	0.51	0.01
Mg	4.36	0.09	MgO	7.23	0.15
Na	1.62	0.07	Na ₂ O	2.18	0.09
P	0.12	0.01	P ₂ O ₅	0.27	0.02
Si	23.3	0.2	SiO ₂	49.8	0.43
Ti	1.65	0.04	TiO ₂	2.75	0.07

<u>Element</u>	<u>μg/g</u>	<u>±</u>	<u>Element</u>	<u>μg/g</u>	<u>±</u>
Ba	125	5	Ni	110	9
Ce	36.6	0.9	Rb	8.9	0.4
Cr	291	36	Sc	34	3
Dy	5.22	0.21	Sm	6.19	0.11
Er	2.53	0.17	Sr	393	9
Eu	2.07	0.07	Th	1.19	0.06
Ga	21.5	0.6	Tm	0.33	0.02
Gd	6.03	0.04	U	0.42	0.06
La	15.2	0.4	V	317	11
Lu	0.28	0.01	Y	26	2
Nb	20	3	Yb	2.09	0.2
Nd	24.9	0.5	Zn	103	6

(Over)

Information values

Element	$\mu\text{g/g}$	\pm	Element	$\mu\text{g/g}$	\pm
Be	1.4	0.5	Mn	1290	71
Co	45	2	Mo	2.9	0.7
Ge	1.3		Pb	1.5	0.2
Ho	1.01		Sb	0.3	
Li	5		Tb	0.9	
			Zr	163	6

Glossary

Wt %	Weight percent
$\mu\text{g/g}$	micrograms/gram
+/-	one standard deviation

Reference

Issued 10-1-06
Dr. Stephen Wilson
U.S. Geological Survey
Denver, Colorado

U.S. Geological Survey

Certificate of analysis

Nephelinite, Knippa, Texas, NKT-1G

Material used in the preparation of this glass material was collected by the U.S. Geological Survey from the XXXX quarry located near the town of Knippa, Texas. The starting material was ground, blended and split at the USGS facility in Denver, Colorado. A two kilogram aliquot of this ground material was then melted at 1645° C in a platinum bowl using a conventional box oven. After two hours of heating the molten material was quenched in a deionized water bath. Glass fragments were removed from the platinum surface, dried, and collected for distribution.

Information presented on this certificate was obtained from an international microanalytical proficiency study (G-probe) organized by the International Association of Geoanalysts (Potts, et al, 2006). Recommended values represent the robust median value of submitted data from sixty four microanalytical laboratories and internal USGS analytical results.

<u>Oxide</u>	<u>Median, %</u>	<u>±</u>	<u>Element</u>	<u>Median, %</u>	<u>±</u>
Al ₂ O ₃	10.20	0.07	Al	5.39	0.021
CaO	13.21	0.04	Ca	9.44	0.028
Fe ₂ O _{3TOT}	13.33	0.05	Fe	9.32	0.035
K ₂ O	1.28	0.007	K	1.06	0.006
MgO	14.33	0.05	Mg	8.64	0.030
Na ₂ O	3.48	0.02	Na	2.58	0.015
P ₂ O ₅	0.967	0.009	P	0.422	0.004
SiO ₂	38.68	0.07	Si	18.08	0.033
TiO ₂	3.95	0.014	Ti	2.37	0.009

<u>Element</u>	<u>Median, mg/kg</u>	<u>±</u>	<u>Element</u>	<u>Median mg/kg</u>	<u>±</u>
Ba	724	31	Nb	87.5	2.5
Be	2.7	0.16	Nd	61.7	2.4
Ce	127	4	Pb	3.01	0.20
Co	61.4	2.4	Pr	15.0	0.6
Cr	443	9	Rb	31.2	0.8
Cs	0.50	0.02	Sc	22.4	0.9
Cu	49.2	2.8	Sr	1203	27
Dy	6.74	0.24	Ta	4.85	0.18
Er	2.64	0.09	Tb	1.31	0.05
Eu	3.85	0.16	Th	7.18	0.16
Gd	10.9	0.4	Tm	0.31	0.01
Hf	6.52	0.26	U	2.18	0.07
Ho	1.13	0.05	V	293	8
La	64.2	2.7	Y	29.7	0.7
Li	17.8	0.6	Yb	1.78	0.05
Lu	0.23	0.01	Zn	132	8
Mo	0.80	0.04	Zr	286	7

Instructions for use: Prior to analysis of this glass reference material, users are encouraged to polish this glass fragment and remove all of the original surface. Users are cautioned against the use of this material for the analysis of platinum or gold, because of these metals were used in the preparation this glass.

Glossary

±	One standard deviation
Fe ₂ O _{3TOT}	Total iron oxide concentration
%	Weight percent

References

Potts, P.J., Thompson, M., Wilson, S., Webb, P., 2006, G-Probe-1 – An International Proficiency Test for Microprobe Laboratories – Report on Round 2: May 2005 (NKT-1G Basaltic Glass), Geostandards and Geoanalytical Research, in press

Notes

Samples of this material may be obtained from the U.S. Geological Survey through the Reference Materials Project, Stephen Wilson, Coordinator. Users are encouraged to examine the Reference Materials web site for updated information on this and other USGS microanalytical reference materials (http://minerals.cr.usgs.gov/geo_chem_stand/)

Dr. Stephen Wilson
U.S. Geological Survey
Crustal Imaging and
Characterization Team
Denver, CO 80225
USA

February 2, 2006

United States Geological Survey

Certificate of Analysis

Table Mountain Basalt, Glass TB-1G

Starting material used in the preparation of this glass was collected by the U.S. Geological Survey from Table Mountain located in Golden, Colorado. An aliquot of the powdered material was melted at 1645°C in a platinum bowl using a conventional box oven. The molten glass was quenched in a water bath. Fragments of the glass were removed from the platinum surface, dried, and stored for distribution.

Information presented on this certificate is derived from a laboratory proficiency study conducted by the International Association of Geoanalysts (IAG) in 2002 (Potts et al 2002). The values listed were obtained through the bulk analysis of ground glass fragments which were analyzed by a select group of international laboratories (8). Following a robust statistical analysis the median concentrations and standard deviation were calculated.

<u>Oxide</u>	<u>Median, %</u>	<u>±</u>	<u>Element</u>	<u>Median, %</u>	<u>±</u>
Al ₂ O ₃	16.68	0.44	Al	8.83	0.23
CaO	6.87	0.21	Ca	4.91	0.15
Fe ₂ O _{3TOT}	9.05	0.26	Fe	6.33	0.18
K ₂ O	4.37	0.14	K	3.63	0.12
MgO	3.64	0.12	Mg	2.20	0.07
Na ₂ O	3.20	0.11	Na	2.37	0.08
P ₂ O ₅	0.588	0.025	P	0.26	0.01
SiO ₂	52.22	1.19	Si	24.41	0.56
TiO ₂	0.845	0.035	Ti	0.51	0.02

<u>Element</u>	<u>Median, mg/kg</u>	<u>±</u>	<u>Element</u>	<u>Median mg/kg</u>	<u>±</u>
Ba	924.9	52.9	Ni	19.4	2.0
Ce	89.7	7.3	Pb	16.0	1.7
Co	23.5	2.3	Pr	10.6	1.2
Cr	60.0	5.2	Rb	177.7	10.9
Cs	2.83	0.39	Sc	22.8	2.3
Cu	73.1	6.1	Sm	7.63	0.90
Er	2.76	0.38	Sr	1363	74
Eu	1.91	0.28	Ta	1.51	0.23
Ga	19.8	2.0	Tb	0.84	0.14
Gd	6.20	0.75	Th	15.0	1.6
Hf	5.87	0.72	Tm	0.39	0.07
Ho	0.98	0.16	U	4.20	0.54
La	45.3	4.1	V	189.2	13.7
Lu	0.40	0.07	Y	26.9	2.6
Nb	28.2	2.7	Yb	2.58	0.36
Nd	40.0	3.7	Zn	102.3	8.2
			Zr	250	17

Instructions for use: Users are cautioned against the use of this material for the analysis of platinum or gold, because of these metals were used in the preparation this glass.

Glossary

±	One standard deviation
Fe ₂ O ₃ TOT	Total iron oxide concentration
%,	Weight percent

References

Potts, P.J., Thompson, M., Wilson, S., 2002, G-Probe-1 – An International Proficiency Test for Microprobe Laboratories – Report on Round 1: February 2002 (TB-1 Basaltic Glass), Geostandards Newsletter, 26:197-235

Notes

Samples of this material may be obtained from the U.S. Geological Survey through the Reference Materials Project, Stephen Wilson, Coordinator. Users are encouraged to examine the Reference Materials web site for updated information on this and other USGS microanalytical reference materials (http://minerals.cr.usgs.gov/geo_chem_stand/)

Dr. Stephen Wilson
U.S. Geological Survey
Crustal Imaging and
Characterization Team
Denver, CO 80225
USA

February 2, 2006

PRELIMINARY
United States Geological Survey
Certificate of Analysis

Micro-analytical Reference material GSC-1G

GSC-1G is a synthetic basalt material used for the calibration of micro-analytical methods of analysis. It was prepared using material developed by A.T. Meyers (Meyers, A.T. et al. 1976) and doped with additional trace and major elements to more closely approximate a normal basalt material. The starting powder material was then melted at 1645° C followed by rapid cooling in water.

Element concentrations listed are based on information obtained from the in the GEOREM database. Users are encouraged to examine the database (<http://georem.mpch-mainz.gwdg.de/>) before using this information.

Information values

<u>Element</u>	<u>Wt %</u>	<u>+/-</u>	<u>Oxide</u>	<u>Wt %</u>	<u>+/-</u>
Al	7.14	0.2	Al ₂ O ₃	13.5	0.4
Ca	5.07	0.07	CaO	7.1	0.1
Fe _{TOT}	10.6	0.08	FeO _{TOT}	13.7	0.1
K	2.57	0.03	K ₂ O	3.10	0.04
Mg	2.17	0.006	MgO	3.6	0.01
Na	2.67	0.15	Na ₂ O	3.6	0.2
Si	24.05	0.28	SiO ₂	53.6	0.6
Ti	0.82	0.04	TiO ₂	1.37	0.06

<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Ag	4.1	0.5	Ho	5.1	0.3
As	3.2	0.8	In	4.5	0.4
B	26	7	La	4.36	0.04
Ba	34.8	0.4	Li	5.9	0.6
Be	4.5	0.4	Lu	5.33	0.05
Bi	3.4	0.2	Mn	176	5
Cd	1.9	0.3	Mo	4.6	0.4
Ce	4.62	0.05	Nb	4.5	0.3
Co	5.9	0.2	Nd	4.72	0.05
Cr	10.3	0.2	Ni	21	1
Cs	3.5	0.2	P	1000	100
Cu	16	4	Pb	14	1
Dy	5.41	0.05	Pr	4.8	0.1
Er	3.72	0.04	Rb	4.92	0.05
Eu	4.4	0.2	Sb	5.3	1.1
Ga	10	1	Sm	5	0.05
Gd	5.29	0.05	Sn	5.3	0.8
Ge	4	1	Sr	32.3	0.03
Hf	4.3	0.4	Ta	4.4	0.6

(over)

Information values

<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Tb	5.1	0.3	V	5.4	0.2
Th	4.2	0.7	W	4.5	0.6
Tl	0.27	0.03	Y	4.8	0.5
Tm	5.2	0.5	Yb	5.29	0.05
U	4.7	0.4	Zn	12.2	0.3
			Zr	6.8	0.7

Glossary

Wt %	Weight percent
<u>ug/g</u>	micrograms/gram
<u>+/-</u>	one standard deviation

References

Meyers, A.T., Havens, R.G., Connor, J.J., Conklin, N.M., Rose, H.J. Jr., 1976, Geological Survey Professional Paper 1013, Glass Reference Standards for the Trace-Element Analysis of Geological Materials-Compilation of Interlaboratory Data, P. 29

PRELIMINARY
United States Geological Survey
Certificate of Analysis

Micro-analytical Reference material GSD-1G

GSD-1G is a synthetic basalt material used for the calibration of micro-analytical methods of analysis. It was prepared using material developed by A.T. Meyers (Meyers, A.T. et al. 1976) and doped with additional trace and major elements to more closely approximate a normal basalt material. The starting powder material was then melted at 1645° C followed by rapid cooling in water.

Element concentrations were determined in a round robin study involving a series of international laboratories. Recommended total element concentrations are reported using bulk methods of analysis and for selected elements ID-TIMS. Recommended element concentrations are reported when at least three independent methods of analysis are in statistical agreement. Information values with standard deviations, are provided when two or more independent laboratories using at least two independent analytical procedures have provided information. Information values without standard deviations represent information from a single laboratory or analytical procedure.

Recommended values

<u>Element</u>	<u>Wt %</u>	<u>+/-</u>	<u>Oxide</u>	<u>Wt %</u>	<u>+/-</u>
Al	7.25	0.04	Al ₂ O ₃	13.7	0.38
Ca	5.06	0.10	CaO	7.08	0.14
Fe _{TOT}	10.1	0.19	Fe ₂ O ₃ _{TOT}	14.4	0.27
K	2.50	0.04	K ₂ O	3.01	0.06
Mg	2.16	0.05	MgO	3.58	0.08
Na	2.66	0.08	Na ₂ O	3.58	0.11
P	0.10	0.007	P ₂ O ₅	0.23	0.02
Si	24.88	0.05	SiO ₂	53.23	0.11
Ti	0.81	0.04	TiO ₂	1.35	0.07

<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Ba	67.8	3.9	Nd	43.6	3.3
Ce	40.0	2.3	Pb	47.8	0.6
Co	38.8	1.2	Pr	43.1	2.9
Cs	31	2	Rb	37.1	2.1
Dy	52.1	1.2	Sc	49.6	2.7
Er	39.6	1.2	Sm	44.7	3.1
Eu	42.4	2.7	Sr	69.3	3.9
Gd	49.4	6.0	Tb	47.5	4.3
Hf	38.9	1.4	Tm	50.6	5.8
Ho	48.9	5.9	U	42.4	4.2
La	39	4	Y	44	4
Lu	53	2	Yb	51.8	4.8

(Over)

PRELIMINARY
United States Geological Survey
Certificate of Analysis

Micro-analytical Reference material GSE-1G

GSE-1G is a synthetic basalt material used for the calibration of micro-analytical methods of analysis. It was prepared using material developed by A.T. Meyers (Meyers, A.T. et al. 1976) and doped with additional trace and major elements to more closely approximate a normal basalt material. The starting powder material was then melted at 1645° C followed by rapid cooling in water.

Element concentrations listed are based on information obtained from the in the GEOREM database. Users are encouraged to examine the database (<http://georem.mpch-mainz.gwdg.de/>) before using this information.

Information values

<u>Element</u>	<u>Wt %</u>	<u>+/-</u>	<u>Oxide</u>	<u>Wt %</u>	<u>+/-</u>
Al	6.88	0.2	Al ₂ O ₃	13.	0.4
Ca	5.3	0.2	CaO	7.4	0.3
Fe _{TOT}	9.87	0.23	FeO _{TOT}	12.7	0.3
K	2.2	0.08	K ₂ O	2.6	0.1
Mg	2.1	0.02	MgO	3.5	0.03
Na	2.9	0.15	Na ₂ O	3.9	0.2
Si	25.1	0.7	SiO ₂	53.7	1.5
Ti	0.045	0.004	TiO ₂	0.075	0.007

<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Ag	200	20	Hf	395	7
As	260	90	Ho	501	8
B	330	120	In	370	60
Ba	427	5	La	392	4
Be	490	80	Li	430	60
Bi	320	30	Lu	518	6
Cd	160	50	Mn	590	20
Ce	414	4	Mo	390	30
Co	380	20	Nb	420	40
Cr	400	80	Nd	453	5
Cs	310	20	Ni	440	30
Cu	380	40	P	70	20
Dy	524	6	Pb	378	12
Er	595	6	Pr	460	10
Eu	410	20	Rb	356	4
Ga	490	70	Sb	450	110
Gd	490	70	Sc	530	20
Ge	320	80	Sm	488	5
Hf	38.9	1.4	Sn	280	50
Ho	48.9	5.9	Sr	447	5

(over)

Information values

<u>Element</u>	<u>ug/g</u>	<u>+/-</u>	<u>Element</u>	<u>ug/g</u>	<u>+/-</u>
Ta	390	40	V	440	20
Tb	480	20	W	430	50
Th	380	20	Y	410	30
Tm	500	20	Yb	520	5
U	420	30	Zn	460	10
			Zr	410	30

Glossary

Wt %	Weight percent
<u>ug/g</u>	micrograms/gram
<u>+/-</u>	one standard deviation

References

Meyers, A.T., Havens, R.G., Connor, J.J., Conklin, N.M., Rose, H.J. Jr., 1976, Geological Survey Professional Paper 1013, Glass Reference Standards for the Trace-Element Analysis of Geological Materials-Compilation of Interlaboratory Data, P. 29

PRELIMINARY

United States Geological Survey

Certificate of Analysis

Microanalytical Carbonate Standard, MACS-3

This reference material is designed primarily for use in the analysis of carbonate samples using techniques such as Laser Ablation ICP-MS. MACS-3 was prepared using a specially designed co-precipitation process in which forty five trace and minor elements are added to the reaction vessel and allowed to mix with the calcium carbonate precipitate. The final slurry was ground to less than 40 micron, dried at 110° C and then pressed into pellets. Recommended values are based on USGS bulk analysis using a variety of analytical techniques and confirmed by one international laboratory. Information values represent results from a single method of analysis.

Recommended values

<u>Element</u>	<u>Wt %</u>	<u>+/-</u>	<u>Oxide</u>	<u>Wt %</u>	<u>+/-</u>
Ca	37.69	0.52	CaO	52.74	0.73
Fe TOT	1.12	0.03	Fe ₂ O ₃ TOT	1.60	0.04
Na	0.59	0.04	Na ₂ O	0.80	0.014
C _{TOT}	11.5	0.06			

<u>Element</u>	<u>µg/g</u>	<u>+/-</u>	<u>Element</u>	<u>µg/g</u>	<u>+/-</u>
Ag	53.3	1.8	Mg	1756	136
As	44.2	1.4	Mn	536	28
Ba	58.7	2.0	Mo	1.21	0.14
Be	56.4	1.7	Nb	35.2	3.1
Bi	19.9	1.6	Nd	11	0.41
Cd	54.6	2.2	Ni	57.4	4.9
Ce	11.2	0.33	Pb	56.5	1.8
Co	57.1	2	Pr	12.1	0.23
Cr	117	5	Sb	20.6	1.1
Cu	120	5	Sc	21	0.8
Dy	10.7	0.5	Sm	11	0.27
Er	11.2	0.22	Sn	58.1	8.8
Eu	11.8	0.13	Sr	6760	350
Ga	16.1	1.1	Ta	20.5	5.3
Gd	10.8	0.3	Th	55.4	1.1
Ge	56.9	4	Ti	54.9	0.18
Hf	4.73	0.21	Tl	14.2	1.7
Hg	10.2	0.4	U	1.52	0.04
Ho	11.3	0.14	V	46.3	1.13
La	10.4	0.5	W	2.16	0.19
Li	62.2	4.2	Zn	111	5.7
Lu	10.8	0.3	Zr	8.67	0.63

(Over)

Information values

Element	ug/g	+/-	Element	ug/g	+/-
Au	7.12		Pd	3.4	
Br	0.44		Pt	17.8	
Cl	61	2	Ru	20.1	
I	20.3				

Isotopic Information

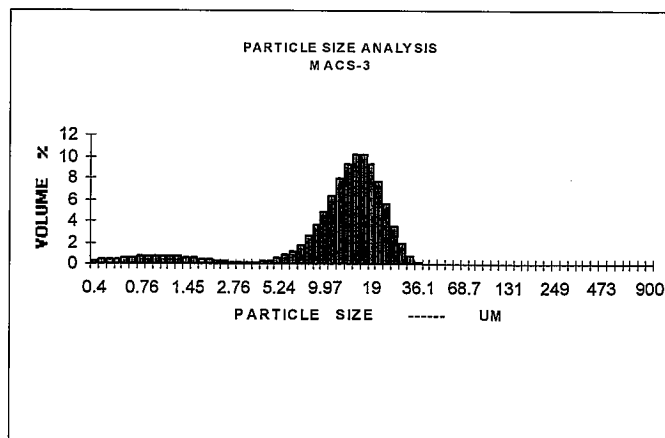
Element	Ratios	+/-	N
Sr 87/86 (Rb corrected)	0.70759	2.5e-5	1
Sr (SRM 987)	0.71025	1.0e-5	1

	Ratio	+/- (2σ)	N
Pb208/204	38.181	0.002	1
207/204	15.619	0.002	1
206/204	18.390	0.01	1

Pb SRM 981	Ratio	+/- (2σ)	N
208/204	36.688	0.004	1
207/204	15.488	0.002	1
206/204	16.935	0.002	1

Glossary

Wt %	Weight percent
ug/g	micrograms/gram
+/-	one standard deviation
N	number of labs reporting



PRELIMINARY

United States Geological Survey

Certificate of Analysis

Polymetal sulfide, MASS-1

MASS-1 was prepared using a specially designed coprecipitation process utilizing Copper, Iron and Zinc solutions in combination with a Sodium Sulfide solution. A total of twenty five trace elements were added to the mixture prior to the precipitation step. The resulting precipitate was washed with deionized water, ground to <50 microns, dried and aliquots of the powder pressed into pellets. Samples of the dried powder were analyzed for its total element composition at the U.S. Geological Survey using a variety of analytical techniques. Micro-homogeneity was assessed using LA-ICPMS.

Preliminary values

<u>Element</u>	<u>Wt. %</u>	<u>±</u>
Cu	13.4	0.05
Fe	15.6	0.1
H ₂ O	13.6	
Na ₂ O	3.3	0.02
S	27.6	0.10
Zn	21.0	0.5

<u>Element</u>	<u>µg/g</u>	<u>±</u>	<u>Element</u>	<u>µg/g</u>	<u>±</u>
Ag	50	5	Mn	280	80
As	65	3	Mo	59	9
Ba	14	5	Ni	97	15
Cd	60	7	Pb	68	7
Co	60	10	Sb	60	9
Cr	65	11	Se	51	4
Ga	64	11	Sn	59	6
Hg	57	3	V	63	10
			W	20	2

Information values

Bi	60	Ir	42
In	50	Te	15
		Tl	50