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G-Probe-1 - An International Proficiency Test for Microprobe Laboratories - Report on Round 1 : February 2002 (TB-1 Basaltic Glass)

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Results are presented for round one of a new international proficiency testing programme designed for microprobe laboratories involved in the routine analysis of silicate minerals. The sample used for this round was TB-1, a basaltic glass fused and prepared by the USGS. Thirty nine laboratories contributed data to this round, the majority of major element results being undertaken by EPMA and the majority of trace elements by LA-ICP-MS. Assigned values were derived from the median of results produced by nine selected laboratories that analysed powdered material by conventional ICP-MS, INAA and XRF techniques using bulk powders of the sample. Submitted microprobe results were evaluated using a target precision calculated using the Horwitz function, adopting the same criteria as those used for "applied" geochemistry laboratories in the companion Geo*PT* proficiency testing programme for laboratories involved in the routine bulk analysis of silicate rocks. An evaluation of results from participating microprobe laboratories indicated that overall, data were compatible with this precision function. A comparison between the performance of bulk and microprobe techniques used in the analysis of the basaltic glass showed remarkably good agreement, with significant bias only observed for the major oxide MgO.

Keywords: proficiency testing, quality assurance, G-Probe, TB-1, basaltic glass, microprobe laboratories.

On présente ici les résultats de la première session du GeoPT-Min. Il s'agit du nouveau programme international de test de compétence conçu spécialement pour les laboratoires impliqués dans l'analyse in situ de routine de silicates. L'échantillon utilisé dans ce test était TB-1, un verre basaltique fondu et préparé par l'USGS. Trente neuf laboratoires ont participé à cette session. Les données d'éléments majeurs ont été fournies majoritairement par analyse par EPMA et la majorité des données d'éléments en trace par LA-ICP-MS. Les valeurs assignées ont été extraites à partir de la médiane des résultats produits par neuf laboratoires sélectionnés qui ont analysé le même matériel, sous forme de poudre, par ICP-MS conventionnel, INAA et par XRF. Les résultats par microsonde soumis ont été évalués en utilisant une précision cible calculée avec la fonction d'Horwitz. Les mêmes critères que ceux utilisés dans GeoPT: le test de compétence jumeau destiné aux laboratoires spécialisés dans l'analyse de routine de roches silicatées, ont été adoptés. Une évaluation des résultats des laboratoires d'analyse par microsonde a indiqué que, en général, les données étaient compatibles avec la fonction de précision d'Horwitz. Une comparaison entre les performances de l'analyse globale et celles de l'analyse par microsonde, appliquées à l'analyse du verre basaltique, montre un accord remarquable général, le seul biais significatif étant observé pour l'oxyde majeur MgO.

Mots-clés : test de compétence, assurance qualité, sonde, première session de G-sonde, TB-1, verre basaltique, laboratoire d'analyse par microsonde.

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In assessing the performance of laboratories involved in the routine bulk analysis of silicate rocks, the *GeoPT* proficiency testing programme has proven to be very effective (Thompson *et al.* 1996, 1998, 1999, 2000a, b, Potts *et al.* 2000a, b, 2001a, b, 2002). At the time of writing, ten rounds have been completed, with up to eighty laboratories from over twenty countries participating in each round. However, to date, there has never been an attempt to organise an equivalent proficiency testing round for microprobe laboratories. In some respects, this is not surprising, because of the additional difficulties involved. In particular, microprobe laboratories usually analyse a range of different mineral types, and there are many difficulties in selecting a material with a proven homogeneity that is available in sufficient quantities for distribution to participating laboratories. There are additional difficulties in the assessment of results, especially in deriving the assigned value (the best estimate of the true composition of the sample) and in deciding the target precision against which analytical results should be judged.

This paper presents the results of the first proficiency test for microprobe laboratories. As with all proficiency testing schemes, the overall aim was to present results that will permit participating laboratories to evaluate the quality of their data and, if relevant, identify determinations that may be affected by unsuspected analytical bias. However, in addition, the results have been evaluated to develop procedures relevant to this type of proficiency testing scheme and an opportunity has been taken to comment on the overall performance of microprobe laboratories.

Aims of proficiency testing

Proficiency testing is designed to be part of the routine quality assurance scheme of all analytical laboratories. In general, the trial involves distributing a sample of established homogeneity to participating laboratories, which are required to analyse the sample using a well-characterised technique or techniques operated under routine analytical conditions. Results are then tabulated by the organisers and z-scores calculated by comparing each submitted analysis with the value assigned to be the best estimate of the true composition. By examining the magnitude of the z-score, participating laboratories can decide whether the quality of their data is satisfactory in relation to both relevant fitness-for-purpose criteria and results submitted by all the other laboratories contributing to the round, and choose to take corrective action if this appears justified.

Since this is the first attempt to undertake a proficiency testing round for mineralogical microprobe laboratories, one of the aims of this work was to develop conventions for conducting this proficiency test that can be adopted as the standard procedure for future rounds.

Experimental procedures

Steering committee for Round 1

M. Thompson (Chair), P.J. Potts (Secretary) and S. Wilson.

Sample

Although consideration was given to the selection and distribution of a natural mineral, this approach was rejected for a number of reasons. One was the difficulty of finding a mineral with the confidence that it was homogeneous and free of inclusions over the quantity required for distribution to participating laboratories. The second was that to ensure participation by the widest number of microprobe laboratories, a silicate mineral was required and further, one which contained as many major elements as possible, together with a range of trace elements at levels analysable by the LA-ICP-MS and ion probe techniques. These considerations led to the selection of a basaltic glass, synthesised by fusing and quenching a natural basalt, where homogeneity would be attained by adequate crushing and mixing of the source material, together with the beneficial effects of the fusion process. The G-Probe-1 sample was a fused basalt, designated TB-1, prepared at the USGS by well established procedures. After preparation, the resultant glass was crushed into fragments. The coarse fragments were set aside for microprobe analysis, the finely divided material, produced at the same time, was reserved for bulk analysis (see below).

Objectives of the G-Probe-1 proficiency test and instructions to analysts

Microprobe analyses are undertaken for a number of reasons. In many studies, samples are prepared as polished thin sections, which are mounted in the microprobe to determine the compositions of various mineral assemblages, to characterise alteration or

Table 1.
G-Probe-1 instructions to analysts

The G-Probe trial is designed to be an evaluation of the routine analytical capability of microprobe laboratories and to ensure that all laboratories operate to the same criteria, the task is to measure and report the average composition of the basaltic glass chip supplied for this study using a routine microprobe technique.

Please, therefore, follow the following procedure:

For each microprobe technique for which data are reported:

(1) Mount (and if appropriate polish) TWO glass chips in a form suitable for microprobe analysis. Avoid mounting for analysis any surface with an amorphous appearance as this surface may have been in contact with the platinum dish into which the molten sample was poured and chilled during the sample preparation process. Inhomogeneity effects have not been fully assessed for this contact layer.

(2) Analyse the mounted sample using routine microprobe conditions ("spot" mode is preferred) by averaging an appropriate number of individual measurements made over the surface of each sample. The number of individual measurements required is left to the discretion of the analysts, noting that the glass is expected to have excellent homogeneity.

(3) For each of the two samples analysed, report the average concentration of all elements that can be reliably determined together with the standard deviation on the enclosed form. Please, if possible, complete and submit results on the electronic version of this form, a copy of which can be obtained from "e.j.lomas@open.ac.uk" quoting "PLEASE SEND GeoPT-PROBE FORM".

(4) Also provide on this form details of the analytical technique used, including the number of individual determinations that contributed to the average, excitation conditions including probe diameter and any other relevant details.

(5) The preferred method of data submission is by returning the form as an attached file by e-mail to "p.j.potts@open.ac.uk". However, if this is not possible, copies of the form sent by post or by fax will be accepted.

(6) The deadline for the submission of results is 15th March 2001.

(7) Please return results to
by e-mail: p.j.potts@open.ac.uk
by fax: +44 1908 655151
by post P.J. Potts, Department of Earth Sciences, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK.
If results are sent by fax, please also post a copy by air mail as there are often problems with the quality of faxed information.

(8) Please check data carefully before transmission, as errors on the form cannot be corrected after submission (these are considered to be part of the analytical process).

(9) There is no charge for participation in this experimental round.

(10) Please check carefully all results before submission as transcription errors or use of incorrect units by the participating laboratory cannot be corrected by the organisers.

(11) Results reported as "not detected" or "less than" will be disregarded. DO NOT REPORT DETECTION LIMIT DATA.

zoning or to locate and analyse minor phases. In the G-Probe programme, the selected objective was to determine the average composition of two fragments of TB-1 supplied to participating laboratories. Laboratories were asked to mount and polish these fragments using their routine sample preparation procedures, and to select the most appropriate analytical strategy in terms of instrumental conditions and the number of individual determinations required to cover the surface of an individual fragment from which to determine the average composition. Laboratories were asked to report the average composition of each fragment, with standard deviation and number of individual determinations. Specific details of the "Instructions to Analysts" are listed in Table 1.

Timetable for G-Probe-1

Distribution of sample: Autumn 2000.
Deadline for submission of analytical results: 15th March 2001.
Distribution of preliminary report: March 2002.

Results

Submission of results

Results submitted by the thirty nine laboratories that participated in this round are listed in Table 2. Results listed include mean and standard deviations of determinations undertaken on individual fragments and the

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Table 2.
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**1A**					**2A**				
Technique		**EPMA (15 kV, 20 nA, 15 μm)**					**EPMA (15 kV, 20 nA, 20 μm)**				
Number of points		**Fragment 1 12**		**Fragment 2 12**		**Mean of 1+2**	**Fragment 1 6**		**Fragment 2 6**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.1	0.6	54.2	0.5	54.15	53.7	0.3	53.7	0.2	53.7
TiO_2	% m/m	0.82	0.17	0.8	0.17	0.81	0.841	0.037	0.857	0.029	0.849
Al_2O_3	% m/m	16.5	0.2	16.4	0.2	16.45	17.1	0.1	17	0.1	17.05
Fe_2O_3T	% m/m	9.36	0.33	9.17	0.41	9.265	9.26	0.09	9.38	0.08	9.32
Fe(II)O	% m/m	-	-	-	-	-	-	-	-	-	-
MnO	% m/m	0.19	0.07	0.18	0.07	0.185	0.181	0.026	0.171	0.01	0.176
MgO	% m/m	3.58	0.12	3.58	0.08	3.58	3.58	0.03	3.61	0.04	3.595
CaO	% m/m	6.78	0.14	6.75	0.13	6.765	7.03	0.06	7.06	0.05	7.045
Na_2O	% m/m	3.34	0.11	3.34	0.11	3.34	3.37	0.05	3.36	0.04	3.365
K_2O	% m/m	4.47	0.12	4.44	0.1	4.455	4.51	0.04	4.49	0.07	4.5
P_2O_5	% m/m	0.57	0.08	0.56	0.07	0.565	0.568	0.031	0.597	0.042	0.5825
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
As	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Au	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
B	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ba	mg kg^{-1}	-	-	-	-	-	0.042	0.018	0.065	0.021	0.0535
Be	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Bi	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Br	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ce	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cl	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Co	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cr	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cs	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cu	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Dy	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Er	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Eu	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
F	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ga	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Gd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ge	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Hf	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Hg	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ho	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
I	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
In	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ir	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
La	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Li	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Lu	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Mo	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
N	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Nb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Nd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ni	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Os	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pr	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pt	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Re	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rh	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ru	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
S	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sc	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Se	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sm	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sn	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sr	mg kg^{-1}	-	-	-	-	-	0.125	0.007	0.12	0.02	0.1225
Ta	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Tb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Te	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Th	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Tl	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Tm	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
U	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
V	mg kg^{-1}	-	-	-	-	-	0.022	0.012	0.019	0.006	0.0205
W	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Y	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Yb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Zn	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Zr	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**3A**					**4A**				
Technique		**EPMA (20 kV, 20 nA, 25 μm)**					**EPMA (15 kV, 20 nA, 20 μm)**				
Number of points		**Fragment 1**		**Fragment 2**		**Mean of 1+2**	**Fragment 1 24**		**Fragment 2 42**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	53.46	0.177	53.62	0.201	53.54	54.22	0.46	54.49	0.39	54.355
TiO_2	% m/m	0.86	0.023	0.84	0.021	0.85	0.78	0.05	0.74	0.03	0.76
Al_2O_3	% m/m	16.39	0.087	16.42	0.091	16.405	16.63	0.18	16.28	0.2	16.455
Fe_2O_3T	% m/m	-	-	-	-	-	-	-	-	-	-
Fe(II)O	% m/m	8.45	0.037	8.45	0.053	8.45	8.18	0.16	7.93	0.13	8.055
MnO	% m/m	0.18	0.008	0.18	0.008	0.18	0.15	0.02	0.16	0.02	0.155
MgO	% m/m	3.47	0.025	3.48	0.031	3.475	3.56	0.06	3.54	0.06	3.55
CaO	% m/m	6.8	0.04	6.79	0.047	6.795	6.65	0.19	6.59	0.14	6.62
Na_2O	% m/m	3.24	0.035	3.23	0.037	3.235	3.77	0.09	3.73	0.07	3.75
K_2O	% m/m	4.42	0.041	4.4	0.027	4.41	4.43	0.05	4.41	0.06	4.42
P_2O_5	% m/m	0.58	0.02	0.58	0.018	0.58	0.6	0.05	0.6	0.05	0.6
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}										
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}										
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
Eu	mg kg^{-1}										
F	mg kg^{-1}										
Ga	mg kg^{-1}										
Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
Hg	mg kg^{-1}										
Ho	mg kg^{-1}										
I	mg kg^{-1}										
In	mg kg^{-1}										
Ir	mg kg^{-1}										
La	mg kg^{-1}										
Li	mg kg^{-1}										
Lu	mg kg^{-1}										
Mo	mg kg^{-1}										
N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}										
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**5A**					**6A**				
Technique		**ED-EPMA (15 kV, 5 nA, 2 µm)**					**EPMA (15 kV, 20 nA, 30 µm)**				
Number of points		**Fragment 1 40**		**Fragment 2 40**		**Mean of 1+2**	**Fragment 1 10**		**Fragment 2 10**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.98	0.214	54.19	0.241	54.585	54	0.46	53.98	0.29	53.99
TiO_2	% m/m	0.98	0.059	0.97	0.054	0.975	0.89	0.06	0.91	0.03	0.9
Al_2O_3	% m/m	16.45	0.104	16.24	0.122	16.345	16.33	0.17	16.39	0.09	16.36
Fe_2O_3T	% m/m	-	-	-	-	-	-	-	-	-	-
Fe(II)O	% m/m	8.4	0.147	8.3	0.144	8.35	8.18	0.24	8.3	0.19	8.24
MnO	% m/m	0.14	0.069	0.14	0.06	0.14	0.17	0.04	0.17	0.06	0.17
MgO	% m/m	3.46	0.083	3.42	0.076	3.44	3.54	0.06	3.48	0.06	3.51
CaO	% m/m	6.84	0.085	6.77	0.075	6.805	6.81	0.11	6.87	0.12	6.84
Na_2O	% m/m	2.56	0.064	2.56	0.05	2.56	3.05	0.09	3.11	0.06	3.08
K_2O	% m/m	4.34	0.054	4.3	0.068	4.32	4.3	0.07	4.28	0.08	4.29
P_2O_5	% m/m	0.54	0.069	0.54	0.074	0.54	-	-	-	-	-
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}										
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}										
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
Eu	mg kg^{-1}										
F	mg kg^{-1}										
Ga	mg kg^{-1}										
Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
Hg	mg kg^{-1}										
Ho	mg kg^{-1}										
I	mg kg^{-1}										
In	mg kg^{-1}										
Ir	mg kg^{-1}										
La	mg kg^{-1}										
Li	mg kg^{-1}										
Lu	mg kg^{-1}										
Mo	mg kg^{-1}										
N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}										
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**7A**					**8A**				
Technique		**LA-HR-ICP-MS (0.5 mJ/pulse, 10 Hz, 50 µm)**					**EPMA (15 kV, 20 nA, 10 µm)**				
Number of points		**Fragment 1 4**		**Fragment 2 3**		**Mean of 1+2**	**Fragment 1 30**		**Fragment 2 30**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	-	-	-	-	-	54.26	0.18	54.08	0.17	54.17
TiO_2	% m/m	0.939	0.018	0.95	0.01	0.9445	0.86	0.02	0.84	0.02	0.85
Al_2O_3	% m/m	-	-	-	-	-	16.77	0.07	16.75	0.08	16.76
Fe_2O_3T	% m/m	8.77	0.22	8.75	0.095	8.76	9.33	0.17	9.22	0.1	9.275
Fe(II)O	% m/m	-	-	-	-	-	-	-	-	-	-
MnO	% m/m	0.1822	0.0003	0.1839	0.0009	0.18305	0.17	0.02	0.18	0.02	0.175
MgO	% m/m	4.039	0.013	3.976	0.053	4.0075	3.48	0.03	3.61	0.04	3.545
CaO	% m/m	7.941	0.29	7.51	0.037	7.7255	6.81	0.05	6.8	0.04	6.805
Na_2O	% m/m	-	-	-	-		3.36	0.04	3.36	0.05	3.36
K_2O	% m/m	4.59	0.052	4.604	0.062	4.597	4.46	0.04	4.41	0.05	4.435
P_2O_5	% m/m	-	-	-	-	-	0.57	0.03	0.58	0.03	0.575
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}	-	-	-	-	-					
As	mg kg^{-1}	-	-	-	-	-					
Au	mg kg^{-1}	-	-	-	-	-					
B	mg kg^{-1}	-	-	-	-	-					
Ba	mg kg^{-1}	1068	4.9	1077	4.6	1072.5					
Be	mg kg^{-1}	3.392	0.088	2.926	0.061	3.159					
Bi	mg kg^{-1}	-	-	-	-	-					
Br	mg kg^{-1}	-	-	-	-	-					
Cd	mg kg^{-1}	-	-	-	-	-					
Ce	mg kg^{-1}	105.8	0.55	106.7	0.54	106.25					
Cl	mg kg^{-1}	-	-	-	-	-					
Co	mg kg^{-1}	22.59	0.27	22.61	0.036	22.6					
Cr	mg kg^{-1}	62.69	1.8	63.43	0.77	63.06					
Cs	mg kg^{-1}	-	-	-	-	-					
Cu	mg kg^{-1}	61.02	1.05	58.65	0.76	59.835					
Dy	mg kg^{-1}	5.035	0.025	4.613	0.0068	4.824					
Er	mg kg^{-1}	2.696	0.022	2.495	0.0029	2.5955					
Eu	mg kg^{-1}	2.009	0.0053	1.953	0.0088	1.981					
F	mg kg^{-1}	-	-	-	-	-					
Ga	mg kg^{-1}	-	-	-	-	-					
Gd	mg kg^{-1}	6.097	0.048	5.704	0.056	5.9005					
Ge	mg kg^{-1}	1.644	0.016	1.645	0.017	1.6445					
Hf	mg kg^{-1}	5.714	0.046	5.135	0.047	5.4245					
Hg	mg kg^{-1}	-	-	-	-	-					
Ho	mg kg^{-1}	0.9503	0.0054	0.8704	0.0056	0.91035					
I	mg kg^{-1}	-	-	-	-	-					
In	mg kg^{-1}	-	-	-	-	-					
Ir	mg kg^{-1}	-	-	-	-	-					
La	mg kg^{-1}	52.25	0.29	50.65	0.27	51.45					
Li	mg kg^{-1}	23.47	0.27	22.76	0.18	23.115					
Lu	mg kg^{-1}	0.4049	0.0043	0.3696	0.0042	0.38725					
Mo	mg kg^{-1}	-	-	-	-	-					
N	mg kg^{-1}	-	-	-	-	-					
Nb	mg kg^{-1}	32.58	0.15	33.05	0.25	32.815					
Nd	mg kg^{-1}	44.88	0.21	43.37	0.2	44.125					
Ni	mg kg^{-1}	15.52	0.2	15.54	0.099	15.53					
Os	mg kg^{-1}	-	-	-	-	-					
Pb	mg kg^{-1}	-	-	-	-	-					
Pd	mg kg^{-1}	-	-	-	-	-					
Pr	mg kg^{-1}	11.64	0.041	11.55	0.09	11.595					
Pt	mg kg^{-1}	-	-	-	-	-					
Rb	mg kg^{-1}	145.3	1.5	147	1.8	146.15					
Re	mg kg^{-1}	-	-	-	-	-					
Rh	mg kg^{-1}	-	-	-	-	-					
Ru	mg kg^{-1}	-	-	-	-	-					
S	mg kg^{-1}	-	-	-	-	-					
Sb	mg kg^{-1}	0.71	0.0055	0.6947	0.0066	0.70235					
Sc	mg kg^{-1}	23.92	0.15	22.77	0.28	23.345					
Se	mg kg^{-1}	-	-	-	-	-					
Sm	mg kg^{-1}	8.075	0.035	7.711	0.055	7.893					
Sn	mg kg^{-1}	1.577	0.0038	1.59	0.0097	1.5835					
Sr	mg kg^{-1}	1660	5.4	1676	13	1668					
Ta	mg kg^{-1}	1.646	0.012	1.589	0.0065	1.6175					
Tb	mg kg^{-1}	0.8216	0.0033	0.7534	0.0077	0.7875					
Te	mg kg^{-1}	-	-	-	-	-					
Th	mg kg^{-1}	16.13	0.15	15.1	0.095	15.615					
Tl	mg kg^{-1}	-	-	-	-	-					
Tm	mg kg^{-1}	0.3999	0.0016	0.3676	0.0034	0.38375					
U	mg kg^{-1}	4.306	0.024	4.298	0.035	4.302					
V	mg kg^{-1}	177.1	4	182.6	1.5	179.85					
W	mg kg^{-1}	1.375	0.0041	1.386	0.0029	1.3805					
Y	mg kg^{-1}	26.71	0.17	24.86	0.18	25.785					
Yb	mg kg^{-1}	2.859	0.013	2.69	0.025	2.7745					
Zn	mg kg^{-1}	106.3	1.3	112.7	1.6	109.5					
Zr	mg kg^{-1}	246	2.1	226.9	1.4	236.45					

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**9A**					**10A**				
Technique		**Ion Probe (25 nA oxygen at 10 kV, 30 μm)**					**EPMA (15 kV, 20 nA, 20 μm)**				
Number of points		**Fragment 1 11**		**Fragment 2 6**		**Mean of 1+2**	**Fragment 1 15**		**Fragment 2 15**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.7	0.37	53.8	0.32	54.25	53.0492	0.512223	53.54747	0.56036	53.29833
TiO_2	% m/m	0.85	0.08	0.84	0.06	0.845	0.831467	0.056009	0.8532	0.032392	0.842333
Al_2O_3	% m/m	16.53	0.19	16.45	0.18	16.49	16.3466	0.140649	16.42807	0.148869	16.38733
Fe_2O_3T	% m/m	-	-	-	-	-	9.163191	0.181086	9.164672	0.178157	9.163932
Fe(II)O	% m/m	-	-	-	-	-	-	-	-	-	-
MnO	% m/m	0.16	0.05	0.17	0.09	0.165	0.157333	0.034861	0.154867	0.035652	0.1561
MgO	% m/m	3.58	0.09	3.59	0.11	3.585	3.4904	0.057412	3.479667	0.047538	3.485033
CaO	% m/m	6.77	0.1	6.79	0.14	6.78	6.8726	0.090161	6.896	0.07116	6.8843
Na_2O	% m/m	3.29	0.09	3.3	0.13	3.295	3.264667	0.067598	3.3088	0.050143	3.286733
K_2O	% m/m	4.41	0.08	4.44	0.11	4.425	4.377333	0.056489	4.4552	0.06882	4.416267
P_2O_5	% m/m	-	-	-	-	-	0.765733	0.093303	0.790533	0.077269	0.778133
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}	-	-	-	-	-					
As	mg kg^{-1}	-	-	-	-	-					
Au	mg kg^{-1}	-	-	-	-	-					
B	mg kg^{-1}	-	-	-	-	-					
Ba	mg kg^{-1}	-	-	-	-	-					
Be	mg kg^{-1}	-	-	-	-	-					
Bi	mg kg^{-1}	-	-	-	-	-					
Br	mg kg^{-1}	-	-	-	-	-					
Cd	mg kg^{-1}	-	-	-	-	-					
Ce	mg kg^{-1}	90.3	1.75	88.94	3.53	89.62					
Cl	mg kg^{-1}	-	-	-	-	-					
Co	mg kg^{-1}	-	-	-	-	-					
Cr	mg kg^{-1}	-	-	-	-	-					
Cs	mg kg^{-1}	-	-	-	-	-					
Cu	mg kg^{-1}	-	-	-	-	-					
Dy	mg kg^{-1}	3.84	0.46	3.36	0.64	3.6					
Er	mg kg^{-1}	2.88	0.15	2.75	0.13	2.815					
Eu	mg kg^{-1}	1.42	0.18	1.86	0.08	1.64					
F	mg kg^{-1}	-	-	-	-	-					
Ga	mg kg^{-1}	-	-	-	-	-					
Gd	mg kg^{-1}	5.24	0.67	4.47	0.74	4.855					
Ge	mg kg^{-1}	-	-	-	-	-					
Hf	mg kg^{-1}	-	-	-	-	-					
Hg	mg kg^{-1}	-	-	-	-	-					
Ho	mg kg^{-1}	-	-	-	-	-					
I	mg kg^{-1}	-	-	-	-	-					
In	mg kg^{-1}	-	-	-	-	-					
Ir	mg kg^{-1}	-	-	-	-	-					
La	mg kg^{-1}	43.17	0.83	43.33	0.57	43.25					
Li	mg kg^{-1}	-	-	-	-	-					
Lu	mg kg^{-1}	0.35	0.02	0.34	0.03	0.345					
Mo	mg kg^{-1}	-	-	-	-	-					
N	mg kg^{-1}	-	-	-	-	-					
Nb	mg kg^{-1}	31.24	1.18	31.14	0.4	31.19					
Nd	mg kg^{-1}	39.3	0.8	38.74	0.48	39.02					
Ni	mg kg^{-1}	-	-	-	-	-					
Os	mg kg^{-1}	-	-	-	-	-					
Pb	mg kg^{-1}	-	-	-	-	-					
Pd	mg kg^{-1}	-	-	-	-	-					
Pr	mg kg^{-1}	10.31	0.22	10.19	0.31	10.25					
Pt	mg kg^{-1}	-	-	-	-	-					
Rb	mg kg^{-1}	-	-	-	-	-					
Re	mg kg^{-1}	-	-	-	-	-					
Rh	mg kg^{-1}	-	-	-	-	-					
Ru	mg kg^{-1}	-	-	-	-	-					
S	mg kg^{-1}	-	-	-	-	-					
Sb	mg kg^{-1}	-	-	-	-	-					
Sc	mg kg^{-1}	26.84	0.88	27.05	0.64	26.945					
Se	mg kg^{-1}	-	-	-	-	-					
Sm	mg kg^{-1}	7.39	0.43	7.53	0.25	7.46					
Sn	mg kg^{-1}	-	-	-	-	-					
Sr	mg kg^{-1}	1398.34	74.65	1386.66	80.55	1392.5					
Ta	mg kg^{-1}	-	-	-	-	-					
Tb	mg kg^{-1}	-	-	-	-	-					
Te	mg kg^{-1}	-	-	-	-	-					
Th	mg kg^{-1}	-	-	-	-	-					
Tl	mg kg^{-1}	-	-	-	-	-					
Tm	mg kg^{-1}	-	-	-	-	-					
U	mg kg^{-1}	-	-	-	-	-					
V	mg kg^{-1}	180.59	5.23	180.2	4.67	180.395					
W	mg kg^{-1}	-	-	-	-	-					
Y	mg kg^{-1}	24.41	0.56	23.85	0.72	24.13					
Yb	mg kg^{-1}	2.96	0.35	3.01	0.29	2.985					
Zn	mg kg^{-1}	-	-	-	-	-					
Zr	mg kg^{-1}	239.53	3.84	235.63	5.66	237.58					

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**11A**					**12A**				
Technique		**ED-SEM (15 kV, 0.6 nA (specimen), 0.1 µm)**					**EPMA (15 kV, 10 nA, 20 µm)**				
Number of points		**Fragment 1 10**		**Fragment 2 10**		**Mean of 1+2**	**Fragment 1 10**		**Fragment 2 10**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	55.63	0.22	55.45	0.3	55.54	53.82	0.099	54.32	0.067	54.07
TiO_2	% m/m	0.77	0.05	0.85	0.06	0.81	0.839	0.025	0.839	0.0144	0.839
Al_2O_3	% m/m	16.91	0.27	16.59	0.16	16.75	16.32	0.097	16.53	0.0404	16.425
Fe_2O_3T	% m/m	7.7	0.27	7.87	0.13	7.785	-	-	-	-	-
Fe(II)O	% m/m	-	-	-	-	-	8.303	0.106	8.463	0.102	8.383
MnO	% m/m	-	-	-	-	-	0.193	0.0132	0.164	0.0184	0.1785
MgO	% m/m	3.66	0.12	3.45	0.21	3.555	3.64	0.044	3.57	0.059	3.605
CaO	% m/m	6.75	0.13	6.94	0.07	6.845	6.821	0.049	6.825	0.101	6.823
Na_2O	% m/m	-					3.34	0.135	3.32	0.104	3.33
K_2O	% m/m	4.96	0.09	4.84	0.05	4.9	4.29	0.199	4.32	0.0744	4.305
P_2O_5	% m/m	-	-	-	-	-	0.651	0.0217	0.651	0.0452	0.651
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}	-	-	-	-	-	50.9	6.5	50.5	8.3	50.7
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}										
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
Eu	mg kg^{-1}										
F	mg kg^{-1}										
Ga	mg kg^{-1}										
Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
Hg	mg kg^{-1}										
Ho	mg kg^{-1}										
I	mg kg^{-1}										
In	mg kg^{-1}										
Ir	mg kg^{-1}										
La	mg kg^{-1}										
Li	mg kg^{-1}										
Lu	mg kg^{-1}										
Mo	mg kg^{-1}										
N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}										
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**13A**					**14A**				
Technique		**EPMA (15 kV, 40 nA, 10 μm)**					**ED-SEM (20 kV, 2 nA, 10 μm)**				
Number of points		**Fragment 1 20**		**Fragment 2 20**		**Mean of 1+2**	**Fragment 1 4**		**Fragment 2 4**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.09	0.2	54.2	0.29	54.145	53.78	0.2	54.11	0.2	53.945
TiO_2	% m/m	0.92	0.02	0.91	0.02	0.915	0.83	5	0.86	5	0.845
Al_2O_3	% m/m	17.15	0.13	17.15	0.16	17.15	16.42	0.8	16.29	0.8	16.355
Fe_2O_3T	% m/m	-	-	-	-	-	9.32	1	9.31	1	9.315
Fe(II)O	% m/m	8.36	0.13	8.37	0.11	8.365	-	-	-	-	-
MnO	% m/m	0.18	0.03	0.18	0.02	0.18	0.16	25	0.15	25	0.155
MgO	% m/m	3.71	0.06	3.7	0.06	3.705	3.55	2	3.64	2	3.595
CaO	% m/m	6.7	0.06	6.69	0.09	6.695	6.81	0.9	6.82	0.9	6.815
Na_2O	% m/m	3.33	0.06	3.33	0.05	3.33	3.32	3	3.31	3	3.315
K_2O	% m/m	4.51	0.05	4.56	0.03	4.535	4.62	2	4.61	2	4.615
P_2O_5	% m/m	0.66	0.06	0.68	0.04	0.67	0.49	1.7	0.46	1.7	0.475
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}	-	-	-	-	-					
As	mg kg^{-1}	-	-	-	-	-					
Au	mg kg^{-1}	-	-	-	-	-					
B	mg kg^{-1}	-	-	-	-	-					
Ba	mg kg^{-1}	842	13.8	826	13.6	834					
Be	mg kg^{-1}	-	-	-	-	-					
Bi	mg kg^{-1}	-	-	-	-	-					
Br	mg kg^{-1}	-	-	-	-	-					
Cd	mg kg^{-1}	-	-	-	-	-					
Ce	mg kg^{-1}	83.7	1.81	80.7	1.65	82.2					
Cl	mg kg^{-1}	-	-	-	-	-					
Co	mg kg^{-1}	-	-	-	-	-					
Cr	mg kg^{-1}	-	-	-	-	-					
Cs	mg kg^{-1}	-	-	-	-	-					
Cu	mg kg^{-1}	-	-	-	-	-					
Dy	mg kg^{-1}	4.4	0.21	4.22	0.19	4.31					
Er	mg kg^{-1}	2.47	0.16	2.37	0.16	2.42					
Eu	mg kg^{-1}	1.82	0.08	1.78	0.07	1.8					
F	mg kg^{-1}	-	-	-	-	-					
Ga	mg kg^{-1}	-	-	-	-	-					
Gd	mg kg^{-1}	5.46	0.23	5.25	0.18	5.355					
Ge	mg kg^{-1}	-	-	-	-	-					
Hf	mg kg^{-1}	5.62	0.22	5.45	0.19	5.535					
Hg	mg kg^{-1}	-	-	-	-	-					
Ho	mg kg^{-1}	0.92	0.05	0.88	0.04	0.9					
I	mg kg^{-1}	-	-	-	-	-					
In	mg kg^{-1}	-	-	-	-	-					
Ir	mg kg^{-1}	-	-	-	-	-					
La	mg kg^{-1}	45.8	1.38	44.2	0.77	45					
Li	mg kg^{-1}	-	-	-	-	-					
Lu	mg kg^{-1}	0.35	0.03	0.34	0.04	0.345					
Mo	mg kg^{-1}	-	-	-	-	-					
N	mg kg^{-1}	-	-	-	-	-					
Nb	mg kg^{-1}	24	0.44	22.8	0.48	23.4					
Nd	mg kg^{-1}	38.6	0.75	36.9	0.59	37.75					
Ni	mg kg^{-1}	13.7	1.12	13.41	1.15	13.555					
Os	mg kg^{-1}	-	-	-	-	-					
Pb	mg kg^{-1}	13.5	0.41	12.6	0.34	13.05					
Pd	mg kg^{-1}	-	-	-	-	-					
Pr	mg kg^{-1}	9.52	0.24	9.09	0.15	9.305					
Pt	mg kg^{-1}	-	-	-	-	-					
Rb	mg kg^{-1}	130	2.83	123	2.35	126.5					
Re	mg kg^{-1}	-	-	-	-	-					
Rh	mg kg^{-1}	-	-	-	-	-					
Ru	mg kg^{-1}	-	-	-	-	-					
S	mg kg^{-1}	-	-	-	-	-					
Sb	mg kg^{-1}	-	-	-	-	-					
Sc	mg kg^{-1}	19.5	0.67	19	0.45	19.25					
Se	mg kg^{-1}	-	-	-	-	-					
Sm	mg kg^{-1}	7.24	0.27	6.87	0.19	7.055					
Sn	mg kg^{-1}	-	-	-	-	-					
Sr	mg kg^{-1}	1301	22.3	1247	19.2	1274					
Ta	mg kg^{-1}	1.15	0.05	1.14	0.05	1.145					
Tb	mg kg^{-1}	0.78	0.04	0.73	0.05	0.755					
Te	mg kg^{-1}	-	-	-	-	-					
Th	mg kg^{-1}	14.5	0.4	14	0.24	14.25					
Tl	mg kg^{-1}	-	-	-	-	-					
Tm	mg kg^{-1}	0.36	0.03	0.35	0.03	0.355					
U	mg kg^{-1}	3.95	0.17	3.75	0.1	3.85					
V	mg kg^{-1}	-	-	-	-	-					
W	mg kg^{-1}	-	-	-	-	-					
Y	mg kg^{-1}	23.5	0.92	23	0.5	23.25					
Yb	mg kg^{-1}	2.56	0.16	2.62	0.13	2.59					
Zn	mg kg^{-1}	-	-	-	-	-					
Zr	mg kg^{-1}	232	7.72	225	4.18	228.5					

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**15A**					**16A**				
Technique		**EPMA (20 kV, 20 nA, 10 µm)**					**EPMA (15 kV, 20 nA, 3 µm)**				
Number of points		**Fragment 1 4**		**Fragment 2 4**		**Mean of 1+2**	**Fragment 1 10**		**Fragment 2 10**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.11	0.29	54.23	0.29	54.17	54.11	0.21	54.22	0.33	54.165
TiO_2	% m/m	0.84	0.57	0.84	0.57	0.84	0.82	0.02	0.84	0.07	0.83
Al_2O_3	% m/m	16.54	0.62	16.62	0.62	16.58	16.53	0.1	16.5	0.11	16.515
Fe_2O_3T	% m/m	8.75	0.6	8.69	0.6	8.72	9.31	0.19	9.29	0.21	9.3
Fe(II)O	% m/m	-	-	-	-	-	-	-	-	-	-
MnO	% m/m	0.09	20.63	0.09	20.63	0.09	0.2	0.05	0.16	0.03	0.18
MgO	% m/m	3.62	0.85	3.58	0.85	3.6	3.49	0.03	3.46	0.05	3.475
CaO	% m/m	6.81	0.26	3.78	0.26	5.295	6.92	0.1	6.95	0.04	6.935
Na_2O	% m/m	3.46	1.39	3.42	1.39	3.44	3.05	0.07	3.02	0.06	3.035
K_2O	% m/m	4.56	0.54	4.55	0.54	4.555	4.5	0.05	4.51	0.1	4.505
P_2O_5	% m/m	0.45	3.91	0.45	3.91	0.45	0.55	0.09	0.58	0.04	0.565
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}										
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}	0	-	0	-	0	-	-	-	-	-
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
Eu	mg kg^{-1}										
F	mg kg^{-1}										
Ga	mg kg^{-1}										
Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
Hg	mg kg^{-1}										
Ho	mg kg^{-1}										
I	mg kg^{-1}										
In	mg kg^{-1}										
Ir	mg kg^{-1}										
La	mg kg^{-1}										
Li	mg kg^{-1}										
Lu	mg kg^{-1}										
Mo	mg kg^{-1}										
N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}										
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**17A**					**18A**				
Technique		**EPMA (15 kV, 25 nA, 8 µm)**					**ED-SEM (15 kV, 3 nA, 1 µm)**				
Number of points		**Fragment 1 12**		**Fragment 2 12**		**Mean of 1+2**	**Fragment 1 98**		**Fragment 2**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.2	0.11	54.21	0.11	54.205	53.5	0.25			53.5
TiO_2	% m/m	0.86	0.04	0.87	0.03	0.865	0.9	0.09			0.9
Al_2O_3	% m/m	17.01	0.09	17	0.06	17.005	16.39	0.12			16.39
Fe_2O_3T	% m/m	9.34	0.13	9.34	0.14	9.34	9.24	0.21			9.24
Fe(II)O	% m/m	-	-	-	-	-	-	-			-
MnO	% m/m	0.19	0.04	0.18	0.04	0.185	0.14	0.07			0.14
MgO	% m/m	3.56	0.05	3.58	0.03	3.57	3.54	0.06			3.54
CaO	% m/m	6.89	0.06	6.92	0.08	6.905	6.62	0.08			6.62
Na_2O	% m/m	3.14	0.05	3.15	0.03	3.145	3.16	0.09			3.16
K_2O	% m/m	4.62	0.08	4.61	0.03	4.615	4.57	0.08			4.57
P_2O_5	% m/m	0.62	0.06	0.57	0.07	0.595	0.52	0.08			0.52
H_2O^+	% m/m	-	-	-	-	-	-	-			-
CO_2	% m/m	-	-	-	-	-	-	-			-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}										
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}										
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
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Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
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N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}										
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**19A**					**20A**				
Technique		**EPMA (15 kV, 6 nA, 1 µm)**					**EPMA (15 kV, 20 nA, 5 µm)**				
Number of points		**Fragment 1 50**		**Fragment 2 50**		**Mean of 1+2**	**Fragment 1 25**		**Fragment 2 25**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	52.98	0.42	53.36	0.59	53.17	53.7	0.25	53.59	0.24	53.645
TiO_2	% m/m	2.28	0.07	2.27	0.07	2.275	0.84	0.04	0.84	0.04	0.84
Al_2O_3	% m/m	13.07	0.14	13.1	0.14	13.085	16.56	0.1	16.61	0.1	16.585
Fe_2O_3T	% m/m	12.42	0.22	12.51	0.29	12.465	9.2	0.16	9.19	0.22	9.195
Fe(II)O	% m/m	-	-	-	-	-	-	-	-	-	-
MnO	% m/m	0.19	0.06	0.2	0.05	0.195	0.18	0.03	0.18	0.04	0.18
MgO	% m/m	3.42	0.07	3.42	0.06	3.42	3.55	0.05	3.52	0.05	3.535
CaO	% m/m	6.99	0.12	6.98	0.12	6.985	6.8	0.08	6.79	0.06	6.795
Na_2O	% m/m	3.05	0.12	3.06	0.09	3.055	3.27	0.05	3.25	0.06	3.26
K_2O	% m/m	1.81	0.05	1.81	0.05	1.81	4.37	0.05	4.34	0.07	4.355
P_2O_5	% m/m	0.38	0.04	0.38	0.04	0.38	0.6	0.06	0.57	0.06	0.585
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg-1										
As	mg kg-1										
Au	mg kg-1										
B	mg kg-1										
Ba	mg kg-1										
Be	mg kg-1										
Bi	mg kg-1										
Br	mg kg-1										
Cd	mg kg-1										
Ce	mg kg-1										
Cl	mg kg-1										
Co	mg kg-1										
Cr	mg kg-1										
Cs	mg kg-1										
Cu	mg kg-1										
Dy	mg kg-1										
Er	mg kg-1										
Eu	mg kg-1										
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Gd	mg kg-1										
Ge	mg kg-1										
Hf	mg kg-1										
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Mo	mg kg-1										
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Nb	mg kg-1										
Nd	mg kg-1										
Ni	mg kg-1										
Os	mg kg-1										
Pb	mg kg-1										
Pd	mg kg-1										
Pr	mg kg-1										
Pt	mg kg-1										
Rb	mg kg-1										
Re	mg kg-1										
Rh	mg kg-1										
Ru	mg kg-1										
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Sb	mg kg-1										
Sc	mg kg-1										
Se	mg kg-1										
Sm	mg kg-1										
Sn	mg kg-1										
Sr	mg kg-1										
Ta	mg kg-1										
Tb	mg kg-1										
Te	mg kg-1										
Th	mg kg-1										
Tl	mg kg-1										
Tm	mg kg-1										
U	mg kg-1										
V	mg kg-1										
W	mg kg-1										
Y	mg kg-1										
Yb	mg kg-1										
Zn	mg kg-1										
Zr	mg kg-1										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**21A**					**22A**				
Technique		**EPMA (15 kV, 20 nA, 10 μm)**					**EPMA (20 kV, 25 nA, 20 μm)**				
Number of points		**Fragment 1 80**		**Fragment 2 80**		**Mean of 1+2**	**Fragment 1 25**		**Fragment 2 25**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	53.94	0.15	53.80	0.16	53.87	53.4	0.56	53.86	0.31	53.63
TiO_2	% m/m	0.83	0.03	0.84	0.03	0.835	0.87	0.03	0.87	0.03	0.87
Al_2O_3	% m/m	16.33	0.09	16.28	0.07	16.305	15.95	0.22	16.12	0.24	16.035
Fe_2O_3T	% m/m	8.86	0.16	8.94	0.14	8.9	9.21	0.12	9.16	0.11	9.185
Fe(II)O	% m/m	-	-	-	-	-	-	-	-	-	-
MnO	% m/m	0.18	0.02	0.18	0.03	0.18	0.19	0.02	0.19	0.02	0.19
MgO	% m/m	3.58	0.03	3.57	0.03	3.575	3.58	0.05	3.53	0.07	3.555
CaO	% m/m	6.71	0.06	6.69	0.06	6.7	6.76	0.04	6.74	0.06	6.75
Na_2O	% m/m	3.25	0.09	3.23	0.04	3.24	3.4	0.04	3.4	0.06	3.4
K_2O	% m/m	4.23	0.05	4.21	0.05	4.22	4.59	0.04	4.58	0.05	4.585
P_2O_5	% m/m	-	-	-	-	-	0.58	0.04	0.58	0.04	0.58
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}										
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}										
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
Eu	mg kg^{-1}										
F	mg kg^{-1}										
Ga	mg kg^{-1}										
Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
Hg	mg kg^{-1}										
Ho	mg kg^{-1}										
I	mg kg^{-1}										
In	mg kg^{-1}										
Ir	mg kg^{-1}										
La	mg kg^{-1}										
Li	mg kg^{-1}										
Lu	mg kg^{-1}										
Mo	mg kg^{-1}										
N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}										
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		23A					24A				
Technique		**EPMA (15 kV, 20 nA, 2-4 μm)**					**LA-ICP-MS (213 nm, 0.25 mJ/p, 10 Hz, 30 μm)**				
Number of points		**Fragment 1 20**		**Fragment 2 20**		**Mean of 1+2**	**Fragment 1 5**		**Fragment 2 5**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.76	0.36	54.63	0.39	54.695					
TiO_2	% m/m	0.84	0.06	0.82	0.04	0.83					
Al_2O_3	% m/m	17.06	0.22	16.87	0.26	16.965					
Fe_2O_3T	% m/m	9.35	0.19	9.12	0.22	9.235					
Fe(II)O	% m/m	-	-	-	-	-					
MnO	% m/m	0.19	0.06	0.2	0.04	0.195					
MgO	% m/m	3.46	0.07	3.45	0.09	3.455					
CaO	% m/m	6.78	0.11	6.75	0.18	6.765					
Na_2O	% m/m	2.99	0.17	2.98	0.16	2.985					
K_2O	% m/m	4.32	0.07	4.31	0.08	4.315					
P_2O_5	% m/m	-	-	-	-	-					
H_2O^+	% m/m	-	-	-	-	-					
CO_2	% m/m	-	-	-	-	-					
Ag	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
As	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Au	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
B	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ba	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Be	mg kg^{-1}	-	-	-	-	-	3.67	0.42	4.03	0.41	3.85
Bi	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Br	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ce	mg kg^{-1}	-	-	-	-	-	77.86	0.57	78.43	1.38	78.145
Cl	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Co	mg kg^{-1}	-	-	-	-	-	18.39	0.26	19.03	1.08	18.71
Cr	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cs	mg kg^{-1}	-	-	-	-	-	2.32	0.03	2.37	0.14	2.345
Cu	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Dy	mg kg^{-1}	-	-	-	-	-	4.79	0.16	4.71	0.13	4.75
Er	mg kg^{-1}	-	-	-	-	-	2.67	0.12	2.64	0.11	2.655
Eu	mg kg^{-1}	-	-	-	-	-	1.79	0.03	1.73	0.07	1.76
F	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ga	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Gd	mg kg^{-1}	-	-	-	-	-	5.93	0.26	5.83	0.23	5.88
Ge	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Hf	mg kg^{-1}	-	-	-	-	-	5.79	0.27	5.47	0.17	5.63
Hg	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ho	mg kg^{-1}	-	-	-	-	-	0.94	0.03	0.93	0.04	0.935
I	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
In	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ir	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
La	mg kg^{-1}	-	-	-	-	-	43.32	0.37	42.7	0.93	43.01
Li	mg kg^{-1}	-	-	-	-	-	19.23	0.48	19.03	0.86	19.13
Lu	mg kg^{-1}	-	-	-	-	-	0.42	0.02	0.43	0.04	0.425
Mo	mg kg^{-1}	-	-	-	-	-	1.45	0.09	1.5	0.1	1.475
N	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Nb	mg kg^{-1}	-	-	-	-	-	28.66	0.19	28.97	0.37	28.815
Nd	mg kg^{-1}	-	-	-	-	-	40.18	0.99	39.4	0.38	39.79
Ni	mg kg^{-1}	-	-	-	-	-	13.16	1.1	13.6	1.01	13.38
Os	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pb	mg kg^{-1}	-	-	-	-	-	9.85	0.2	10.35	1.02	10.1
Pd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pr	mg kg^{-1}	-	-	-	-	-	9.73	0.09	9.7	0.18	9.715
Pt	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rb	mg kg^{-1}	-	-	-	-	-	104.06	0.85	108.08	6.98	106.07
Re	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rh	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ru	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
S	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sc	mg kg^{-1}	-	-	-	-	-	23.97	0.58	23.87	0.81	23.92
Se	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sm	mg kg^{-1}	-	-	-	-	-	7.41	0.23	7.02	0.29	7.215
Sn	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sr	mg kg^{-1}	-	-	-	-	-	1272.8	12.4	1280.6	25.3	1276.7
Ta	mg kg^{-1}	-	-	-	-	-	1.58	0.04	1.52	0.05	1.55
Tb	mg kg^{-1}	-	-	-	-	-	0.79	0.02	0.78	0.03	0.785
Te	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Th	mg kg^{-1}	-	-	-	-	-	14.86	0.18	14.12	0.63	14.49
Tl	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Tm	mg kg^{-1}	-	-	-	-	-	0.39	0.03	0.38	0.03	0.385
U	mg kg^{-1}	-	-	-	-	-	3.17	0.05	3.24	0.23	3.205
V	mg kg^{-1}	-	-	-	-	-	155.76	2.45	161.53	7.3	158.645
W	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Y	mg kg^{-1}	-	-	-	-	-	26.2	0.24	25.52	0.74	25.86
Yb	mg kg^{-1}	-	-	-	-	-	2.82	0.13	2.64	0.15	2.73
Zn	mg kg^{-1}	-	-	-	-	-	72.97	1.14	76.62	8.41	74.795
Zr	mg kg^{-1}	-	-	-	-	-	238.33	3.05	233.15	5.77	235.74

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		25A					26A				
Technique		EPMA (15 kV, 10 nA, 2 μm)					LA-ICP-MS (12 J cm^{-2}, 60 μm)				
Number of points		Fragment 1 20		Fragment 2 20		Mean of 1+2	Fragment 1 8		Fragment 2 24		Mean of 1+2
Element	Conc unit	Mean conc	Standard deviation	Mean conc	Standard deviation		Mean conc	Standard deviation	Mean conc	Standard deviation	
SiO_2	% m/m	53.12	0.29	53.12	0.22	53.12	-	-	-	-	-
TiO_2	% m/m	0.82	0.05	0.83	0.04	0.825	0.8	0.01	0.78	0.01	0.79
Al_2O_3	% m/m	16.62	0.12	16.62	0.13	16.62	-	-	-	-	-
Fe_2O_3T	% m/m	-	-	-	-	-	-	-	-	-	-
Fe(II)O	% m/m	8.8	0.17	8.85	0.16	8.825	-	-	-	-	-
MnO	% m/m	0.19	0.05	0.19	0.04	0.19	0.18	0.01	0.18	0.01	0.18
MgO	% m/m	3.44	0.06	3.4	0.07	3.42	3.67	0.1	3.59	0.1	3.63
CaO	% m/m	6.69	0.08	6.68	0.06	6.685	std	-	std	-	-
Na_2O	% m/m	3.3	0.14	3.3	0.09	3.3	3.55	0.1	3.4	0.1	3.475
K_2O	% m/m	4.46	0.12	4.5	0.07	4.48	-	-	-	-	-
P_2O_5	% m/m	0.59	0.08	0.62	0.07	0.605	-	-	-	-	-
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}	-	-	-	-	-	0.46	0.03	0.56	0.06	0.51
As	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Au	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
B	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ba	mg kg^{-1}	-	-	-	-	-	967	7	940	20	953.5
Be	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Bi	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Br	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ce	mg kg^{-1}	-	-	-	-	-	93	1	92	1	92.5
Cl	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Co	mg kg^{-1}	-	-	-	-	-	26	0.6	24	1	25
Cr	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cs	mg kg^{-1}	-	-	-	-	-	3.1	0.1	2.9	0.2	3
Cu	mg kg^{-1}	-	-	-	-	-	83	2	79	3	81
Dy	mg kg^{-1}	-	-	-	-	-	4.1	0.1	4.2	0.3	4.15
Er	mg kg^{-1}	-	-	-	-	-	-	-	2.3	0.1	2.3
Eu	mg kg^{-1}	-	-	-	-	-	1.83	0.1	1.86	0.06	1.845
F	mg kg^{-1}	0.12	0.02	0.12	0.02	0.12	-	-	-	-	-
Ga	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Gd	mg kg^{-1}	-	-	-	-	-	5.2	0.2	5.2	0.3	5.2
Ge	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Hf	mg kg^{-1}	-	-	-	-	-	5.4	0.3	5.6	0.4	5.5
Hg	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ho	mg kg^{-1}	-	-	-	-	-	0.82	0.04	0.85	0.04	0.835
I	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
In	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ir	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
La	mg kg^{-1}	-	-	-	-	-	46	0.6	-	-	46
Li	mg kg^{-1}	-	-	-	-	-	21.4	1.3	19.1	1	20.25
Lu	mg kg^{-1}	-	-	-	-	-	0.34	0.02	0.36	0.02	0.35
Mo	mg kg^{-1}	-	-	-	-	-	-	-	1.9	0.6	1.9
N	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Nb	mg kg^{-1}	-	-	-	-	-	27.2	0.2	29	2	28.1
Nd	mg kg^{-1}	-	-	-	-	-	38.3	0.7	39.4	0.7	38.85
Ni	mg kg^{-1}	-	-	-	-	-	19.5	0.6	18	1	18.75
Os	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pb	mg kg^{-1}	-	-	-	-	-	18.2	0.6	17.6	0.7	17.9
Pd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pr	mg kg^{-1}	-	-	-	-	-	9.97	0.08	10	0.1	9.985
Pt	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rb	mg kg^{-1}	-	-	-	-	-	167	5	160	6	163.5
Re	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rh	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ru	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
S	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sc	mg kg^{-1}	-	-	-	-	-	-	-	20.3	0.3	20.3
Se	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sm	mg kg^{-1}	-	-	-	-	-	7	0.2	7.1	0.2	7.05
Sn	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sr	mg kg^{-1}	-	-	-	-	-	1343	12	1357	18	1350
Ta	mg kg^{-1}	-	-	-	-	-	1.43	0.05	1.46	0.07	1.445
Tb	mg kg^{-1}	-	-	-	-	-	0.71	0.03	0.75	0.04	0.73
Te	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Th	mg kg^{-1}	-	-	-	-	-	13.8	0.4	14.3	0.4	14.05
Tl	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Tm	mg kg^{-1}	-	-	-	-	-	0.32	0.02	0.35	0.03	0.335
U	mg kg^{-1}	-	-	-	-	-	4.5	0.2	-	-	4.5
V	mg kg^{-1}	-	-	-	-	-	201	2.4	188	6	194.5
W	mg kg^{-1}	-	-	-	-	-	1.62	0.14	-	-	1.62
Y	mg kg^{-1}	-	-	-	-	-	22.1	0.3	23.7	0.8	22.9
Yb	mg kg^{-1}	-	-	-	-	-	2.4	0.2	2.4	0.1	2.4
Zn	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Zr	mg kg^{-1}	-	-	-	-	-	237	3	247	7	242

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		27A					28A				
Technique		EPMA (15 kV, 40 nA, 20 µm)					LA-ICP-MS (0.22 mJ/p, 30 µm)				
Number of points		Fragment 1 10		Fragment 2 10		Mean of 1+2	Fragment 1 9		Fragment 2 6		Mean of 1+2
Element	Conc unit	Mean conc	Standard deviation	Mean conc	Standard deviation		Mean conc	Standard deviation	Mean conc	Standard deviation	
SiO_2	% m/m	53.7	0.41	53.7	0.48	53.7					
TiO_2	% m/m	0.85	0.018	0.88	0.011	0.865					
Al_2O_3	% m/m	16.3	0.09	16.4	0.06	16.35					
Fe_2O_3T	% m/m	9.12	0.082	9.12	0.095	9.12					
Fe(II)O	% m/m	-	-	-	-	-					
MnO	% m/m	0.19	0.027	0.17	0.023	0.18					
MgO	% m/m	3.51	0.028	3.53	0.041	3.52					
CaO	% m/m	6.92	0.029	6.9	0.084	6.91					
Na_2O	% m/m	3.26	0.024	3.29	0.023	3.275					
K_2O	% m/m	4.46	0.085	4.46	0.095	4.46					
P_2O_5	% m/m	0.58	0.034	0.61	0.033	0.595					
H_2O^+	% m/m	-	-	-	-	-					
CO_2	% m/m	-	-	-	-	-					
Ag	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
As	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Au	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
B	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Ba	$mg\ kg^{-1}$	1060	87	1130	76	1095	929	29.1	939	27	934
Be	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Bi	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Br	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Cd	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Ce	$mg\ kg^{-1}$	-	-	-	-	-	84.4	2.29	86.1	2.16	85.25
Cl	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Co	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Cr	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Cs	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Cu	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Dy	$mg\ kg^{-1}$	-	-	-	-	-	4.57	0.381	4.95	0.483	4.76
Er	$mg\ kg^{-1}$	-	-	-	-	-	2.73	0.204	2.84	0.166	2.785
Eu	$mg\ kg^{-1}$	-	-	-	-	-	1.92	0.0909	2	0.12	1.96
F	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Ga	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Gd	$mg\ kg^{-1}$	-	-	-	-	-	5.8	0.212	5.81	0.545	5.805
Ge	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Hf	$mg\ kg^{-1}$	-	-	-	-	-	6.1	0.426	6.51	0.215	6.305
Hg	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Ho	$mg\ kg^{-1}$	-	-	-	-	-	0.944	0.0788	1.01	0.0336	0.977
I	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
In	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Ir	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
La	$mg\ kg^{-1}$	-	-	-	-	-	49.7	0.492	50	1.42	49.85
Li	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Lu	$mg\ kg^{-1}$	-	-	-	-	-	0.421	0.0444	0.456	0.0341	0.4385
Mo	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
N	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Nb	$mg\ kg^{-1}$	-	-	-	-	-	23.9	0.45	23.9	0.596	23.9
Nd	$mg\ kg^{-1}$	-	-	-	-	-	42.2	1.48	42.9	1.82	42.55
Ni	$mg\ kg^{-1}$	-	-	-	-	0	-	-	-	-	-
Os	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Pb	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Pd	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Pr	$mg\ kg^{-1}$	-	-	-	-	-	10.6	0.276	10.6	0.455	10.6
Pt	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Rb	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Re	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Rh	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Ru	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
S	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Sb	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Sc	$mg\ kg^{-1}$	-	-	-	-	-	20.8	1.1	20.9	0.979	20.85
Se	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Sm	$mg\ kg^{-1}$	-	-	-	-	-	7.72	0.653	7.89	0.544	7.805
Sn	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Sr	$mg\ kg^{-1}$	1181	156	1188	153	1184.5	1330	15.3	1329	29	1329.5
Ta	$mg\ kg^{-1}$	-	-	-	-	-	1.25	0.0467	1.33	0.0322	1.29
Tb	$mg\ kg^{-1}$	-	-	-	-	-	0.872	0.108	0.886	0.0888	0.879
Te	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Th	$mg\ kg^{-1}$	-	-	-	-	-	15.8	0.68	16.5	0.729	16.15
Tl	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Tm	$mg\ kg^{-1}$	-	-	-	-	-	0.372	0.0531	0.36	0.0133	0.366
U	$mg\ kg^{-1}$	-	-	-	-	-	3.78	0.318	3.64	0.466	3.71
V	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
W	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Y	$mg\ kg^{-1}$	-	-	-	-	-	24.8	0.63	24.4	0.931	24.6
Yb	$mg\ kg^{-1}$	-	-	-	-	-	2.79	0.207	2.85	0.122	2.82
Zn	$mg\ kg^{-1}$	-	-	-	-	-	-	-	-	-	-
Zr	$mg\ kg^{-1}$	124	62	176	63	150	238	4.08	232	7.59	235

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**29A**					**30A**				
Technique		**EPMA (15 kV, 20 nA, 10 µm)**					**ED-SEM (15 kV, 5 nA, 1.3 µm)**				
Number of points		**Fragment 1 30**		**Fragment 2 60**		**Mean of 1+2**	**Fragment 1 8**		**Fragment 2 8**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	53.29	0.18	53.59	0.16	53.44	53.23	0.07	53.41	0.1	53.32
TiO_2	% m/m	0.86	0.03	0.86	0.03	0.86	0.88	0.02	0.87	0.02	0.875
Al_2O_3	% m/m	16.52	0.07	16.51	0.08	16.515	15.99	0.05	16.15	0.05	16.07
Fe_2O_3T	% m/m	-	-	-	-	-	8.88	0.04	8.86	0.04	8.87
Fe(II)O	% m/m	8.29	0.07	8.3	0.07	8.295	-	-	-	-	-
MnO	% m/m	0.18	0.02	0.18	0.02	0.18	0.21	0.01	0.2	0.01	0.205
MgO	% m/m	3.53	0.04	3.53	0.03	3.53	3.75	0.03	3.71	0.05	3.73
CaO	% m/m	6.85	0.08	6.84	0.06	6.845	6.95	0.03	6.97	0.02	6.96
Na_2O	% m/m	3.15	0.04	3.15	0.05	3.15	2.87	0.03	2.87	0.02	2.87
K_2O	% m/m	4.35	0.04	4.36	0.05	4.355	4.32	0.01	4.33	0.01	4.325
P_2O_5	% m/m	0.57	0.03	0.57	0.04	0.57	0.44	0.02	0.47	0.02	0.455
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}										
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}										
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
Eu	mg kg^{-1}										
F	mg kg^{-1}										
Ga	mg kg^{-1}										
Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
Hg	mg kg^{-1}										
Ho	mg kg^{-1}										
I	mg kg^{-1}										
In	mg kg^{-1}										
Ir	mg kg^{-1}										
La	mg kg^{-1}										
Li	mg kg^{-1}										
Lu	mg kg^{-1}										
Mo	mg kg^{-1}										
N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}										
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**31A**					**32A**				
Technique		**ED-SEM (20 kV, 50 nA, 0.5 μm)**					**LA-ICP-MS (15 J cm-2, 10 Hz, 193 nm, 120 μm)**				
Number of points		**Fragment 1 5**		**Fragment 2 5**		**Mean of 1+2**	**Fragment 1 4**		**Fragment 2 4**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	54.3	0.2	54.2	0.2	54.25					
TiO_2	% m/m	0.9	0.1	0.9	0.1	0.9					
Al_2O_3	% m/m	17.5	0.2	17.3	0.1	17.4					
Fe_2O_3T	% m/m	-	-	-	-	-					
Fe(II)O	% m/m	8.1	0.1	8.4	0.2	8.25					
MnO	% m/m	0.1	0	0.1	0.1	0.1					
MgO	% m/m	3.7	0	3.7	0.1	3.7					
CaO	% m/m	6.8	0.1	6.8	0.1	6.8					
Na_2O	% m/m	3.1	0	3	0.1	3.05					
K_2O	% m/m	4.5	0.1	4.5	0.1	4.5					
P_2O_5	% m/m	0.5	0.1	0.5	0	0.5					
H_2O^+	% m/m	-	-	-	-	-					
CO_2	% m/m	-	-	-	-	-					
Ag	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
As	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Au	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
B	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ba	mg kg^{-1}	-	-	-	-	-	899	23	895	20	897
Be	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Bi	mg kg^{-1}	-	-	-	-	-	0.023	0.003	0.019	0.008	0.021
Br	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ce	mg kg^{-1}	-	-	-	-	-	83	2	82	1	82
Cl	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Co	mg kg^{-1}	-	-	-	-	-	23.3	0.3	23.4	0.1	23.3
Cr	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Cs	mg kg^{-1}	-	-	-	-	-	2.40	0.01	2.50	0.08	2.45
Cu	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Dy	mg kg^{-1}	-	-	-	-	-	4.10	0.08	4.07	0.21	4.08
Er	mg kg^{-1}	-	-	-	-	-	2.3	0.1	2.2	0.1	2.2
Eu	mg kg^{-1}	-	-	-	-	-	1.53	0.09	1.53	0.06	1.53
F	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ga	mg kg^{-1}	-	-	-	-	-	19.9	0.5	19.8	0.7	19.8
Gd	mg kg^{-1}	-	-	-	-	-	5.00	0.08	5.03	0.21	5.02
Ge	mg kg^{-1}	-	-	-	-	-	2.3	0.2	2.4	0.1	2.3
Hf	mg kg^{-1}	-	-	-	-	-	4.8	0.1	4.7	0.1	4.75
Hg	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ho	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
I	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
In	mg kg^{-1}	-	-	-	-	-	0.06	0.01	0.07	0.01	0.06
Ir	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
La	mg kg^{-1}	-	-	-	-	-	42	1	41	1	42
Li	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Lu	mg kg^{-1}	-	-	-	-	-	0.33	0.01	0.31	0.03	0.32
Mo	mg kg^{-1}	-	-	-	-	-	1.47	0.04	1.43	0.10	1.45
N	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Nb	mg kg^{-1}	-	-	-	-	-	26.3	0.3	25.8	0.7	26.1
Nd	mg kg^{-1}	-	-	-	-	-	36.3	0.9	35.4	0.7	35.9
Ni	mg kg^{-1}	-	-	-	-	-	16.3	0.8	16.2	0.5	16.2
Os	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pb	mg kg^{-1}	-	-	-	-	-	15.9	0.2	15.5	0.6	15.7
Pd	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Pr	mg kg^{-1}	-	-	-	-	-	9.2	0.2	9.0	0.2	9.1
Pt	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rb	mg kg^{-1}	-	-	-	-	-	137	4	135	2	136
Re	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Rh	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Ru	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
S	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sb	mg kg^{-1}	-	-	-	-	-	0.16	0.01	0.14	0.01	0.15
Sc	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Se	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Sm	mg kg^{-1}	-	-	-	-	-	6.5	0.2	6.4	0.1	6.5
Sn	mg kg^{-1}	-	-	-	-	-	1.6	0.1	1.6	0.1	1.6
Sr	mg kg^{-1}	-	-	-	-	-	1278	16	1255	24	1266
Ta	mg kg^{-1}	-	-	-	-	-	1.31	0.03	1.27	0.06	1.29
Tb	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Te	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Th	mg kg^{-1}	-	-	-	-	-	13.3	0.3	13.3	0.5	13.3
Tl	mg kg^{-1}	-	-	-	-	-	0.09	0.01	0.10	0.02	0.10
Tm	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
U	mg kg^{-1}	-	-	-	-	-	3.5	0.2	3.7	0.1	3.6
V	mg kg^{-1}	-	-	-	-	-	176	1	172	4	174
W	mg kg^{-1}	-	-	-	-	-	1.34	0.04	1.36	0.08	1.35
Y	mg kg^{-1}	-	-	-	-	-	23.5	0.5	23.0	0.8	23.3
Yb	mg kg^{-1}	-	-	-	-	-	2.3	0.2	2.3	0.1	2.3
Zn	mg kg^{-1}	-	-	-	-	-	-	-	-	-	-
Zr	mg kg^{-1}	-	-	-	-	-	223	3	219	6	221

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		33A					34A				
Technique		EPMA (15 kV, 15 nA, 1 μm)					EPMA/LA-ICP-MS (2 mJ/p, 10 Hz, 100 μm)				
Number of points		Fragment 1 15		Fragment 2 15		Mean of 1+2	Fragment 1 85		Fragment 2		Mean of 1+2
Element	Conc unit	Mean conc	Standard deviation	Mean conc	Standard deviation		Mean conc	Standard deviation	Mean conc	Standard deviation	
SiO_2	% m/m	53.5	0.33	53.66	0.25	53.58	45.98	8.11			45.98
TiO_2	% m/m	0.89	0.02	0.9	0.02	0.895	0.84	0.14			0.84
Al_2O_3	% m/m	16.53	0.16	16.5	0.23	16.515	-	-			-
Fe_2O_3T	% m/m	9.11	0.12	9.09	0.1	9.1	8.64	1.68			8.64
Fe(II)O	% m/m	-	-	-	-	-	-	-			-
MnO	% m/m	0.2	0.01	0.2	0.01	0.2	0.17	0.03			0.17
MgO	% m/m	3.53	0.05	3.58	0.05	3.555	3.54	0.27			3.54
CaO	% m/m	6.78	0.05	6.8	0.05	6.79	7.34	1.64			7.34
Na_2O	% m/m	3.35	0.12	3.41	0.08	3.38	2.89	0.52			2.89
K_2O	% m/m	4.42	0.15	4.38	0.22	4.4	4.4	0.51			4.4
P_2O_5	% m/m	0.61	0.01	0.62	0.01	0.615	0.51	0.19			0.51
H_2O^+	% m/m	-	-	-	-	-	-	-			-
CO_2	% m/m	-	-	-	-	-	-	-			-
Ag	mg kg^{-1}	-	-	-	-	-	-	-			-
As	mg kg^{-1}	-	-	-	-	-	-	-			-
Au	mg kg^{-1}	-	-	-	-	-	-	-			-
B	mg kg^{-1}	-	-	-	-	-	-	-			-
Ba	mg kg^{-1}	731	73	775	60	753	990	254			990
Be	mg kg^{-1}	-	-	-	-	-	-	-			-
Bi	mg kg^{-1}	-	-	-	-	-	-	-			-
Br	mg kg^{-1}	-	-	-	-	-	-	-			-
Cd	mg kg^{-1}	-	-	-	-	-	-	-			-
Ce	mg kg^{-1}	-	-	-	-	-	89.4	26.3			89.4
Cl	mg kg^{-1}	-	-	-	-	-	-	-			-
Co	mg kg^{-1}	-	-	-	-	-	21.9	10			21.9
Cr	mg kg^{-1}	-	-	-	-	-	-	-			-
Cs	mg kg^{-1}	-	-	-	-	-	-	-			-
Cu	mg kg^{-1}	-	-	-	-	-	-	-			-
Dy	mg kg^{-1}	-	-	-	-	-	-	-			-
Er	mg kg^{-1}	-	-	-	-	-	-	-			-
Eu	mg kg^{-1}	-	-	-	-	-	-	-			-
F	mg kg^{-1}	393	106	341	87	367	-	-			-
Ga	mg kg^{-1}	-	-	-	-	-	-	-			-
Gd	mg kg^{-1}	-	-	-	-	-	-	-			-
Ge	mg kg^{-1}	-	-	-	-	-	-	-			-
Hf	mg kg^{-1}	-	-	-	-	-	-	-			-
Hg	mg kg^{-1}	-	-	-	-	-	-	-			-
Ho	mg kg^{-1}	-	-	-	-	-	-	-			-
I	mg kg^{-1}	-	-	-	-	-	-	-			-
In	mg kg^{-1}	-	-	-	-	-	-	-			-
Ir	mg kg^{-1}	-	-	-	-	-	-	-			-
La	mg kg^{-1}	-	-	-	-	-	46.4	14.4			46.4
Li	mg kg^{-1}	-	-	-	-	-	-	-			-
Lu	mg kg^{-1}	-	-	-	-	-	-	-			-
Mo	mg kg^{-1}	-	-	-	-	-	-	-			-
N	mg kg^{-1}	-	-	-	-	-	-	-			-
Nb	mg kg^{-1}	-	-	-	-	-	-	-			-
Nd	mg kg^{-1}	-	-	-	-	-	43.2	14.2			43.2
Ni	mg kg^{-1}	-	-	-	-	-	-	-			-
Os	mg kg^{-1}	-	-	-	-	-	-	-			-
Pb	mg kg^{-1}	-	-	-	-	-	15.5	6.3			15.5
Pd	mg kg^{-1}	-	-	-	-	-	-	-			-
Pr	mg kg^{-1}	-	-	-	-	-	10.6	4.2			10.6
Pt	mg kg^{-1}	-	-	-	-	-	-	-			-
Rb	mg kg^{-1}	-	-	-	-	-	148	43			148
Re	mg kg^{-1}	-	-	-	-	-	-	-			-
Rh	mg kg^{-1}	-	-	-	-	-	-	-			-
Ru	mg kg^{-1}	-	-	-	-	-	-	-			-
S	mg kg^{-1}	-	-	-	-	-	-	-			-
Sb	mg kg^{-1}	-	-	-	-	-	-	-			-
Sc	mg kg^{-1}	-	-	-	-	-	22.5	8.9			22.5
Se	mg kg^{-1}	-	-	-	-	-	-	-			-
Sm	mg kg^{-1}	-	-	-	-	-	-	-			-
Sn	mg kg^{-1}	-	-	-	-	-	-	-			-
Sr	mg kg^{-1}	-	-	-	-	-	1424	313			1424
Ta	mg kg^{-1}	-	-	-	-	-	-	-			-
Tb	mg kg^{-1}	-	-	-	-	-	-	-			-
Te	mg kg^{-1}	-	-	-	-	-	-	-			-
Th	mg kg^{-1}	-	-	-	-	-	15.7	7.5			15.7
Tl	mg kg^{-1}	-	-	-	-	-	-	-			-
Tm	mg kg^{-1}	-	-	-	-	-	-	-			-
U	mg kg^{-1}	-	-	-	-	-	3.7	1.8			3.7
V	mg kg^{-1}	-	-	-	-	-	177.7	38.7			177.7
W	mg kg^{-1}	-	-	-	-	-	-	-			-
Y	mg kg^{-1}	-	-	-	-	-	-	-			-
Yb	mg kg^{-1}	-	-	-	-	-	-	-			-
Zn	mg kg^{-1}	77	41	71	26	74	-	-			-
Zr	mg kg^{-1}	-	-	-	-	-	240	54			240

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**35A**					**36A**				
Technique		**LA-ICP-MS (0.3 mJ/p, 40 µm)**					**EPMA (15 kV, 10 nA, 15 µm)**				
Number of points		**Fragment 1 6**		**Fragment 2 6**		**Mean of 1+2**	**Fragment 1 30**		**Fragment 2 30**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m						53.50	0.71	53.08	0.43	53.29
TiO_2	% m/m						0.87	0.04	0.88	0.03	0.875
Al_2O_3	% m/m						16.09	0.33	15.94	0.22	16.015
Fe_2O_3T	% m/m						9.37	0.21	9.34	0.17	9.355
Fe(II)O	% m/m						-	-	-	-	-
MnO	% m/m						0.19	0.04	0.18	0.03	0.185
MgO	% m/m						3.56	0.09	3.56	0.06	3.56
CaO	% m/m						6.74	0.16	6.67	0.08	6.705
Na_2O	% m/m						3.09	0.10	3.06	0.08	3.075
K_2O	% m/m						4.50	0.09	4.41	0.04	4.455
P_2O_5	% m/m						0.59	0.04	0.56	0.05	0.575
H_2O^+	% m/m						-	-	-	-	-
CO_2	% m/m						-	-	-	-	-
Ag	mg kg^{-1}	-	-	-	-	-					
As	mg kg^{-1}	-	-	-	-	-					
Au	mg kg^{-1}	-	-	-	-	-					
B	mg kg^{-1}	-	-	-	-	-					
Ba	mg kg^{-1}	951.771	77.592	1005.483	44.864	978.627					
Be	mg kg^{-1}	-	-	-	-	-					
Bi	mg kg^{-1}	-	-	-	-	-					
Br	mg kg^{-1}	-	-	-	-	-					
Cd	mg kg^{-1}	-	-	-	-	-					
Ce	mg kg^{-1}	90.599	7.513	95.69	4.879	93.1445					
Cl	mg kg^{-1}	-	-	-	-	-					
Co	mg kg^{-1}	-	-	-	-	-					
Cr	mg kg^{-1}	-	-	-	-	-					
Cs	mg kg^{-1}	-	-	-	-	-					
Cu	mg kg^{-1}	-	-	-	-	-					
Dy	mg kg^{-1}	4.118	0.534	4.179	0.319	4.1485					
Er	mg kg^{-1}	2.41	0.385	2.345	0.216	2.3775					
Eu	mg kg^{-1}	1.774	0.202	1.818	0.085	1.796					
F	mg kg^{-1}	-	-	-	-	-					
Ga	mg kg^{-1}	-	-	-	-	-					
Gd	mg kg^{-1}	5.127	0.5	5.412	0.491	5.2695					
Ge	mg kg^{-1}	-	-	-	-	-					
Hf	mg kg^{-1}	5.236	0.56	5.424	0.51	5.33					
Hg	mg kg^{-1}	-	-	-	-	-					
Ho	mg kg^{-1}	0.815	0.084	0.83	0.057	0.8225					
I	mg kg^{-1}	-	-	-	-	-					
In	mg kg^{-1}	-	-	-	-	-					
Ir	mg kg^{-1}	-	-	-	-	-					
La	mg kg^{-1}	41.936	3.832	43.585	2.453	42.7605					
Li	mg kg^{-1}	-	-	-	-	-					
Lu	mg kg^{-1}	0.336	0.023	0.35	0.026	0.343					
Mo	mg kg^{-1}	-	-	-	-	-					
N	mg kg^{-1}	-	-	-	-	-					
Nb	mg kg^{-1}	29.856	2.063	32.172	0.588	31.014					
Nd	mg kg^{-1}	37.778	3.856	38.578	1.893	38.178					
Ni	mg kg^{-1}	-	-	-	-	-					
Os	mg kg^{-1}	-	-	-	-	-					
Pb	mg kg^{-1}	13.487	1.797	16.092	1.225	14.7895					
Pd	mg kg^{-1}	-	-	-	-	-					
Pr	mg kg^{-1}	10.121	0.974	10.567	0.522	10.344					
Pt	mg kg^{-1}	-	-	-	-	-					
Rb	mg kg^{-1}	-	-	-	-	-					
Re	mg kg^{-1}	-	-	-	-	-					
Rh	mg kg^{-1}	-	-	-	-	-					
Ru	mg kg^{-1}	-	-	-	-	-					
S	mg kg^{-1}	-	-	-	-	-					
Sb	mg kg^{-1}	-	-	-	-	-					
Sc	mg kg^{-1}	-	-	-	-	-					
Se	mg kg^{-1}	-	-	-	-	-					
Sm	mg kg^{-1}	6.998	0.676	7.137	0.213	7.0675					
Sn	mg kg^{-1}	-	-	-	-	-					
Sr	mg kg^{-1}	1324.14	82.754	1371.932	29.657	1348.036					
Ta	mg kg^{-1}	1.381	0.13	1.42	0.092	1.4005					
Tb	mg kg^{-1}	0.708	0.081	0.736	0.056	0.722					
Te	mg kg^{-1}	-	-	-	-	-					
Th	mg kg^{-1}	13.339	1.377	13.75	0.931	13.5445					
Tl	mg kg^{-1}	-	-	-	-	-					
Tm	mg kg^{-1}	0.375	0.042	0.363	0.032	0.369					
U	mg kg^{-1}	4.136	0.302	4.567	0.259	4.3515					
V	mg kg^{-1}	-	-	-	-	-					
W	mg kg^{-1}	-	-	-	-	-					
Y	mg kg^{-1}	21.513	1.668	21.525	1.403	21.519					
Yb	mg kg^{-1}	2.317	0.31	2.324	0.246	2.3205					
Zn	mg kg^{-1}	-	-	-	-	-					
Zr	mg kg^{-1}	220.603	18.304	224.247	11.941	222.425					

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		**37A**					**38A**				
Technique		**EPMA (20 kV, 20 nA, 10 µm)**					**EPMA (15 kV, 20 nA, 10 µm)**				
Number of points		**Fragment 1 31**		**Fragment 2 27**		**Mean of 1+2**	**Fragment 1 10**		**Fragment 2**		**Mean of 1+2**
Element	**Conc unit**	**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**		**Mean conc**	**Standard deviation**	**Mean conc**	**Standard deviation**	
SiO_2	% m/m	53.83	0.81	53.96	0.56	53.895	52.86	0.21	53.07	0.24	52.97
TiO_2	% m/m	0.85	0.062	0.81	0.043	0.83	0.84	0.02	0.83	0.02	0.84
Al_2O_3	% m/m	16.64	0.294	16.68	0.261	16.66	15.99	0.06	16.01	0.06	16.00
Fe_2O_3T	% m/m	-	-	-	-	-	9.37	0.12	9.24	0.1	9.31
Fe(II)O	% m/m	8.45	0.21	8.46	0.209	8.455	-	-	-	-	-
MnO	% m/m	0.2	0.032	0.19	0.034	0.195	0.2	0.03	0.21	0.04	0.2
MgO	% m/m	3.52	0.059	3.59	0.037	3.555	3.32	0.06	3.33	0.04	3.33
CaO	% m/m	6.91	0.131	6.87	0.121	6.89	6.67	0.06	6.67	0.06	6.67
Na_2O	% m/m	3.43	0.056	3.39	0.053	3.41	3.15	0.05	3.12	0.04	3.14
K_2O	% m/m	4.39	0.055	4.35	0.141	4.37	4.49	0.03	4.52	0.03	4.51
P_2O_5	% m/m	0.65	0.069	0.66	0.058	0.655	0.58	0.03	0.55	0.03	0.57
H_2O^+	% m/m	-	-	-	-	-	-	-	-	-	-
CO_2	% m/m	-	-	-	-	-	-	-	-	-	-
Ag	mg kg^{-1}										
As	mg kg^{-1}										
Au	mg kg^{-1}										
B	mg kg^{-1}										
Ba	mg kg^{-1}	-	-	-	-	-	1100	100	1000	200	1050
Be	mg kg^{-1}										
Bi	mg kg^{-1}										
Br	mg kg^{-1}										
Cd	mg kg^{-1}										
Ce	mg kg^{-1}										
Cl	mg kg^{-1}										
Co	mg kg^{-1}										
Cr	mg kg^{-1}										
Cs	mg kg^{-1}										
Cu	mg kg^{-1}										
Dy	mg kg^{-1}										
Er	mg kg^{-1}										
Eu	mg kg^{-1}										
F	mg kg^{-1}										
Ga	mg kg^{-1}										
Gd	mg kg^{-1}										
Ge	mg kg^{-1}										
Hf	mg kg^{-1}										
Hg	mg kg^{-1}										
Ho	mg kg^{-1}										
I	mg kg^{-1}										
In	mg kg^{-1}										
Ir	mg kg^{-1}										
La	mg kg^{-1}										
Li	mg kg^{-1}										
Lu	mg kg^{-1}										
Mo	mg kg^{-1}										
N	mg kg^{-1}										
Nb	mg kg^{-1}										
Nd	mg kg^{-1}										
Ni	mg kg^{-1}										
Os	mg kg^{-1}										
Pb	mg kg^{-1}										
Pd	mg kg^{-1}										
Pr	mg kg^{-1}										
Pt	mg kg^{-1}										
Rb	mg kg^{-1}										
Re	mg kg^{-1}										
Rh	mg kg^{-1}										
Ru	mg kg^{-1}										
S	mg kg^{-1}										
Sb	mg kg^{-1}	-	-	-	-	-	0.08	0.02	0.08	0.02	0.08
Sc	mg kg^{-1}										
Se	mg kg^{-1}										
Sm	mg kg^{-1}										
Sn	mg kg^{-1}										
Sr	mg kg^{-1}										
Ta	mg kg^{-1}										
Tb	mg kg^{-1}										
Te	mg kg^{-1}										
Th	mg kg^{-1}										
Tl	mg kg^{-1}										
Tm	mg kg^{-1}										
U	mg kg^{-1}										
V	mg kg^{-1}										
W	mg kg^{-1}										
Y	mg kg^{-1}										
Yb	mg kg^{-1}										
Zn	mg kg^{-1}										
Zr	mg kg^{-1}										

Table 2 (continued).
G-Probe-1 (TB-1 basaltic glass) - results submitted by participating laboratories

Lab code		39A				
Technique		LA-ICP-MS (266 nm)				
Number of points		Fragment 1 23		Fragment 2		Mean of 1+2
Element	Conc unit	Mean conc	Standard deviation	Mean conc	Standard deviation	
SiO_2	% m/m	-	-			-
TiO_2	% m/m	0.8881	0.0242			0.8881
Al_2O_3	% m/m	-	-			-
Fe_2O_3T	% m/m	-	-			-
Fe(II)O	% m/m	-	-			-
MnO	% m/m	-	-			-
MgO	% m/m	-	-			-
CaO	% m/m	-	-			-
Na_2O	% m/m	-	-			-
K_2O	% m/m	-	-			-
P_2O_5	% m/m	-	-			-
H_2O^+	% m/m	-	-			-
CO_2	% m/m	-	-			-
Ag	mg kg^{-1}	-	-			-
As	mg kg^{-1}	-	-			-
Au	mg kg^{-1}	-	-			-
B	mg kg^{-1}	-	-			-
Ba	mg kg^{-1}	974	28			974
Be	mg kg^{-1}	-	-			-
Bi	mg kg^{-1}	-	-			-
Br	mg kg^{-1}	-	-			-
Cd	mg kg^{-1}	-	-			-
Ce	mg kg^{-1}	92.1	2.9			92.1
Cl	mg kg^{-1}	-	-			-
Co	mg kg^{-1}	24.6	0.9			24.6
Cr	mg kg^{-1}	-	-			-
Cs	mg kg^{-1}	2.9	0.1			2.9
Cu	mg kg^{-1}	-	-			-
Dy	mg kg^{-1}	5.07	0.22			5.07
Er	mg kg^{-1}	2.8	0.13			2.8
Eu	mg kg^{-1}	1.97	0.07			1.97
F	mg kg^{-1}	-	-			-
Ga	mg kg^{-1}	-	-			-
Gd	mg kg^{-1}	6.61	0.26			6.61
Ge	mg kg^{-1}	-	-			-
Hf	mg kg^{-1}	6.36	0.31			6.36
Hg	mg kg^{-1}	-	-			-
Ho	mg kg^{-1}	1.03	0.06			1.03
I	mg kg^{-1}	-	-			-
In	mg kg^{-1}	-	-			-
Ir	mg kg^{-1}	-	-			-
La	mg kg^{-1}	48.8	1.5			48.8
Li	mg kg^{-1}	-	-			-
Lu	mg kg^{-1}	0.43	0.02			0.43
Mo	mg kg^{-1}	-	-			-
N	mg kg^{-1}	-	-			-
Nb	mg kg^{-1}	30.4	1.2			30.4
Nd	mg kg^{-1}	42.2	1.5			42.2
Ni	mg kg^{-1}	19.1	0.8			19.1
Os	mg kg^{-1}	-	-			-
Pb	mg kg^{-1}	18.1	1.6			18.1
Pd	mg kg^{-1}	-	-			-
Pr	mg kg^{-1}	10.2	0.4			10.2
Pt	mg kg^{-1}	-	-			-
Rb	mg kg^{-1}	144	8			144
Re	mg kg^{-1}	-	-			-
Rh	mg kg^{-1}	-	-			-
Ru	mg kg^{-1}	-	-			-
S	mg kg^{-1}	-	-			-
Sb	mg kg^{-1}	-	-			-
Sc	mg kg^{-1}	26.9	1.1			26.9
Se	mg kg^{-1}	-	-			-
Sm	mg kg^{-1}	7.92	0.31			7.92
Sn	mg kg^{-1}	-	-			-
Sr	mg kg^{-1}	1402	48			1402
Ta	mg kg^{-1}	1.67	0.08			1.67
Tb	mg kg^{-1}	-	-			-
Te	mg kg^{-1}	-	-			-
Th	mg kg^{-1}	16.5	0.6			16.5
Tl	mg kg^{-1}	-	-			-
Tm	mg kg^{-1}	-	-			-
U	mg kg^{-1}	4.1	0.2			4.1
V	mg kg^{-1}	172	7			172
W	mg kg^{-1}	-	-			-
Y	mg kg^{-1}	27.4	1.2			27.4
Yb	mg kg^{-1}	2.74	0.11			2.74
Zn	mg kg^{-1}	-	-			-
Zr	mg kg^{-1}	267	10			267

overall mean calculated from the means of each fragment. As can be seen from Table 2, participating laboratories selected a minimum of three and a maximum of ninety eight determinations per fragment of glass to evaluate its average composition. In terms of techniques used, twenty six sets of data were reported by EPMA, eight by ICP-MS, five by ED/WD-SEM and one by ion probe (noting that one laboratory reported combined EPMA/LA-ICP-MS data).

Evaluation of homogeneity

Homogeneity was assessed in two ways: Laboratories that contributed data using bulk analytical techniques were asked to prepare two test portions and to analyse each in duplicate. Agreement in the average compositions of test portions provided data to demonstrate the homogeneity of the sample. As part of the design of the experiment, microprobe laboratories were asked to mount and analyse two separate fragments of the basaltic glass and to report average compositions separately. Agreement between the average composition of these two fragments (Table 2) was again taken as a demonstration of the homogeneity of this sample.

Assigned values

Assigned values are the best estimate of the true composition of the sample and can be evaluated in a number of ways. In the Geo*PT* programme for laboratories involved in the bulk analysis of silicate rocks, the assigned values are derived from a statistical assessment of the results submitted by participating laboratories, usually as the robust mean. In the present G-Probe programme, the basaltic glass was analysed independently of participating microprobe laboratories. The material separated as "fines" after crushing the fused glass (see above) was circulated to a number of laboratories that had already proven their performance in the Geo*PT* programme. These laboratories were asked to analyse two test portions of the powdered glass, taking note of the following analytical requirements:

(a) Analyse two test portions in duplicate.

(b) Use a routine, well-characterised analytical technique of proven reliability (e.g., as judged from participation in the Geo*PT* proficiency testing programme).

(c) Provide evidence of traceability of results (this can normally be achieved by showing that the analytical performance has been assessed by the comparative analysis of suitable (certified) reference materials).

Results, listed in Table 3, were contributed by the following laboratories, using the techniques indicated:

INAA: Becquerel Laboratories (Menai, NSW, Australia)
Interfacultair Reactor Institut (Delft, The Netherlands).

ICP-MS: GeoForschungsZentrum (Potsdam, Germany)
Institute of Geochemistry (Guiyang, PR China)
Université de Toulouse (France)
University of Tasmania (Australia)
Washington State University (WA, USA).

XRF: Open University (Milton Keynes, UK)
University of Tasmania (Australia)
US Geological Survey (Denver, CO, USA).

Because a relatively small number of individual determinations was available for each element, the median value was taken as the assigned value. Data are listed in Table 4, for the following oxides/elements for which sufficient results were available to evaluate assigned values:

SiO_2, TiO_2, Al_2O_3, Fe_2O_3T, MnO, CaO, MgO, Na_2O, K_2O, P_2O_5, Ba, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Lu, Nb, Nd, Ni, Pb, Pr, Rb, Sc, Sm, Sr, Ta, Tb, Th, Tm, U, V, W, Y, Yb, Zn, Zr.

The quality of these data may be judged from the agreement between data submitted by different laboratories using a number of independent techniques (Table 3 and Figure 1, technique code 1). Note that single gross outliers in data for Co, Cu and V were not included in the calculation of mean data in Table 3, but were included in the full data set from which median values were evaluated in Table 4.

Z-score analysis

In proficiency testing schemes, the z-score is the principle parameter whereby a laboratory can judge the quality of individual analytical results, and is calculated from the expression:

$$z = [X - X_a] / \sigma_p \qquad (1)$$

where:

Table 3.
G-Probe-1 summary data of bulk determinations on TB-1 (basaltic glass)

	Laboratory 1		Laboratory 2		Laboratory 3		Laboratory 4		Laboratory 5		Laboratory 6		Laboratory 7		Laboratory 8		Laboratory 9		
Element	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**GRAND MEAN**
	% m/m		**% m/m**		**% m/m**		**% m/m**		**% m/m**		**% m/m**		**% m/m**		**% m/m**		**% m/m**		
SiO_2	54.42	0.24	-	-	54.03	-	54.41	0.11	-	-	53.62	0.86	-	-	-	-	-	-	54.12
TiO_2	0.845	0.007	-	-	0.850	-	0.867	0.006	-	-	0.846	0.012	-	-	0.780	0.018	0.830	-	0.836
Al_2O_3	16.68	0.02	-	-	16.77	-	16.68	0.03	-	-	16.48	0.20	-	-	17.49	0.78	-	-	16.82
Fe_2O_3T	9.05	0.28	-	-	9.16	-	9.21	0.01	-	-	9.05	0.12	8.95	0.06	8.84	0.05	-	-	9.04
Fe(II)O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
MnO	0.185	0.001	-	-	0.180	-	0.187	0.003	-	-	0.180	0.001	-	-	0.190	0.006	0.169	-	0.18
MgO	3.64	0.02	-	-	3.75	-	3.61	0.01	-	-	3.56	0.06	-	-	3.87	0.20	-	-	3.69
CaO	6.89	0.06	-	-	6.89	-	6.90	0.02	-	-	6.74	0.08	6.85	0.02	6.75	0.28	-	-	6.84
Na_2O	3.19	0.02	-	-	3.35	-	3.22	0.01	-	-	3.00	0.07	3.19	1.96	3.35	0.05	-	-	3.22
K_2O	4.40	0.01	-	-	4.28	-	4.42	0.01	-	-	4.34	0.06	3.60	0.25	4.72	0.23	-	-	4.29
P_2O_5	0.578	0.000	-	-	0.590	-	0.586	0.004	-	-	0.625	0.020	-	-	-	-	-	-	0.59
LOI*	-	-	-	-	-0.08	-	-	-	-	-	1.25	-	-	-	-	-	-	-	-
	mg kg^{-1}		**mg kg^{-1}**		**mg kg^{-1}**		**mg kg^{-1}**		**mg kg^{-1}**		**mg kg^{-1}**		**mg kg^{-1}**		**mg kg^{-1}**		**mg kg^{-1}**		
Ag	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-	-	-	-	-	-
As	-	-	-	-	< 3	-	-	-	-	-	-	-	< 1	-	-	-	-	-	-
Au	-	-	-	-	-	-	-	-	-	-	-	-	0.159	0.00299	0.165	0.007	-	-	0.162
Ba	934.8	7.5	934.8	12.3	911.0	5.4	869.2	26.6	981.1	8.1	-	-	1009.0	51.9	915.0	16.6	849.0	-	925.5
Be	-	-	-	-	3.9	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi	-	-	0.027	0.026	< 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Br	-	-	-	-	-	-	-	-	-	-	-	-	< 1	-	-	-	-	-	-
Cd	-	-	0.29	0.04	-	-	-	-	-	-	-	-	< 10	-	-	-	0.08	-	-
Ce	85.5	0.6	89.7	0.3	89.6	1.8	-	-	91.5	0.6	-	-	86.9	1.2	91.8	1.4	94.8	-	90.0
Co	-	-	22.7	0.9	23.3	0.5	52.7	28.4	-	-	-	-	23.8	0.1	22.6	0.3	24.4	-	23.4
Cr	50.4	0.2	60.0	1.6	65.9	0.8	71.5	2.4	-	-	-	-	59.6	19.1	57.3	0.1	62.2	-	61.0
Cs	3.32	0.02	2.59	0.06	2.95	0.05	-	-	2.80	0.01	-	-	2.56	30.48	2.83	0.05	2.85	-	2.84
Cu	25.7	0.1	64.6	2.2	75.9	0.4	73.1	0.9	-	-	-	-	-	-	-	-	74.1	-	71.9
Dy	5.32	0.03	4.77	0.07	4.65	0.06	-	-	4.86	0.01	-	-	-	-	5.06	0.21	5.04	-	4.95
Er	2.81	0.04	2.73	0.05	2.69	0.02	-	-	2.76	0.02	-	-	-	-	-	-	2.89	-	2.78
Eu	1.980	0.016	1.921	0.108	1.850	0.026	-	-	1.918	0.027	-	-	1.780	0.058	1.900	0.038	1.910	-	1.894
Ga	18.8	0.1	19.8	0.4	20.4	0.1	19.2	0.7	-	-	-	-	-	-	-	-	21.4	-	19.9
Gd	6.35	0.04	6.03	0.05	6.06	0.10	-	-	6.20	0.07	-	-	-	-	-	-	6.35	-	6.20
Ge	-	-	1.68	0.07	-	-	-	-	-	-	-	-	-	-	-	-	1.84	-	-
Hf	5.87	0.04	5.83	0.09	5.68	0.02	-	-	6.25	0.09	-	-	5.66	0.04	6.40	0.09	6.89	-	6.08
Ho	1.040	0.004	0.929	0.027	0.950	0.008	-	-	0.943	0.004	-	-	1.150	0.024	-	-	1.010	-	1.004

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Table 3 (continued).
G-Probe-1 summary data of bulk determinations on TB-1 (basaltic glass)

	Laboratory 1		Laboratory 2		Laboratory 3		Laboratory 4		Laboratory 5		Laboratory 6		Laboratory 7		Laboratory 8		Laboratory 9		
Element	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	GRAND MEAN
	mg kg-1		mg kg-1		mg kg-1		mg kg-1		mg kg-1		mg kg-1		mg kg-1		mg kg-1		mg kg-1		
In	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.039	-	-
Ir	-	-	-	-	-	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-
La	-	-	45.19	0.31	44.70	1.01	-	-	45.81	0.23	-	-	45.40	0.51	43.80	0.51	46.50	-	44.98
Li	-	-	-	-	17.9	-	-	-	-	-	-	-	-	-	-	-	19.1	-	18.5
Lu	0.400	0.005	0.397	0.011	0.390	0.005	-	-	0.403	0.006	-	-	0.390	0.006	0.400	0.026	0.410	-	0.399
Mo	-	-	-	-	1.4	0.0	-	-	-	-	-	-	< 5	-	-	-	1.2	-	-
Nb	27.3	0.2	28.2	0.5	27.4	0.3	28.7	0.6	-	-	-	-	-	-	-	-	28.9	-	28.1
Nd	38.2	0.1	40.0	0.3	39.8	0.4	-	-	41.4	0.3	-	-	39.8	1.1	41.5	3.2	41.6	-	40.3
Ni	21.7	0.1	14.5	1.1	18.2	0.6	19.4	0.6	-	-	-	-	-	-	-	-	21.4	-	19.0
Pb	16.7	0.3	15.4	0.8	16.4	0.7	15.8	2.5	16.2	0.7	-	-	-	-	-	-	15.9	-	16.1
Pr	9.62	0.06	10.47	0.07	10.60	0.10	-	-	10.89	0.04	-	-	-	-	-	-	10.60	-	10.44
Rb	139.5	1.4	143.4	2.8	143.0	0.9	150.1	1.9	142.2	1.4	-	-	148.0	3.3	146.0	6.9	147.0	-	144.9
S	-	-	-	-	-	-	32.8	2.2	-	-	-	-	-	-	-	-	-	-	-
Sb	-	-	-	-	0.15	0.01	-	-	-	-	-	-	< 0.2	-	-	-	0.29	-	0.22
Sc	23.3	0.3	-	-	22.9	1.1	25.6	1.1	-	-	-	-	21.8	0.2	21.4	0.2	22.7	-	23.0
Se	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-	-	-	-	-	-
Sm	7.95	0.03	7.23	0.12	7.48	0.12	-	-	7.63	0.11	-	-	7.34	0.04	7.72	0.19	7.91	-	7.61
Sn	-	-	1.5	0.6	1.6	0.1	-	-	-	-	-	-	< 200	-	-	-	-	-	-
Sr	1342	12	1389	30	1328	1	1363	13	1374	17	-	-	-	-	1417	26	1260	-	1353
Ta	1.57	0.02	1.34	0.41	1.56	0.01	-	-	-	-	-	-	1.36	0.09	1.46	0.09	1.56	-	1.48
Tb	0.930	0.004	0.817	0.014	0.840	0.010	-	-	0.833	0.008	-	-	0.920	0.247	0.740	0.028	0.890	-	0.853
Te	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-	-	-	-	-	-
Th	14.9	0.2	15.4	0.5	15.1	0.2	17.7	1.4	14.5	0.1	-	-	15.0	0.3	14.8	0.1	15.9	-	15.4
Tl	-		0.044	0.013	0.135	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-
Tm	0.410	0.004	0.390	0.008	-	-	-	-	0.389	0.009	-	-	-	-	-	-	0.390	-	0.395
U	-	-	4.42	0.25	4.20	0.17	5.45	0.76	4.11	0.04	-	-	3.45	0.09	3.89	0.34	4.53	-	4.29
V	83.9	0.4	194.1	4.6	188.3	0.8	203.5	6.1	-	-	-	-	-	-	190.0	8.7	188.0	-	192.8
W	-	-	-	-	3.1	1.2	-	-	-	-	-	-	< 2	-	-	-	2.1	-	2.6
Y	27.9	0.2	26.5	0.5	25.3	0.2	28.6	1.3	25.3	0.3	-	-	-	-	-	-	27.3	-	26.8
Yb	2.58	0.02	2.54	0.05	2.54	0.02	-	-	2.65	0.01	-	-	2.54	0.04	2.67	0.06	2.87	-	2.63
Zn	70.1	0.3	95.4	3.7	111.0	0.5	101.6	0.3	-	-	-	-	104.0	54.3	-	-	103.0	-	103.0
Zr	231.8	1.9	261.7	2.4	245.0	0.8	255.8	5.3	272.1	2.0	-	-	294.0	102.9	233.0	15.9	233.0	-	253.3

Participating laboratories. Becquerel Laboratories (Menai, NSW, Australia), GeoForschungsZentrum (Potsdam, Germany), Interfacultair Reactor Institut (Delft, The Netherlands), Institute of Geochemistry (Guiyang, PR China), Open University (Milton Keynes, UK), US Geological Survey (Denver, CO, USA), Université de Toulouse (France), University of Tasmania (Australia), Washington State University (WA, USA). Grand Mean is the average of the mean laboratory results with gross outliers excluded. * Loss on ignition.

Table 4.
G-Probe-1. Assigned values (taken as the median of the bulk determinations on TB-1)

Element	Assigned value	Target precision
	% m/m	precision
SiO_2	54.22	1.19
TiO_2	0.845	0.035
Al_2O_3	16.68	0.44
Fe_2O_3T	9.05	0.26
MnO	0.183	0.009
MgO	3.64	0.12
CaO	6.87	0.21
Na_2O	3.20	0.11
K_2O	4.37	0.14
P_2O_5	0.588	0.025
	$mg\ kg^{-1}$	
Ba	924.9	52.9
Ce	89.7	7.3
Co	23.5	2.3
Cr	60.0	5.2
Cs	2.83	0.39
Cu	73.1	6.1
Dy	4.95	0.62
Er	2.76	0.38
Eu	1.91	0.28
Ga	19.8	2.0
Gd	6.20	0.75
Hf	5.87	0.72
Ho	0.98	0.16
La	45.3	4.1
Lu	0.40	0.07
Nb	28.2	2.7
Nd	40.0	3.7
Ni	19.4	2.0
Pb	16.0	1.7
Pr	10.6	1.2
Rb	144.7	10.9
Sc	22.8	2.3
Sm	7.63	0.90
Sr	1363	74
Ta	1.51	0.23
Tb	0.84	0.14
Th	15.0	1.6
Tm	0.39	0.07
U	4.20	0.54
V	189.2	13.7
Y	26.9	2.6
Yb	2.58	0.36
Zn	102.3	8.2
Zr	250	17

The assigned value is the median of the bulk analytical results listed in Table 3. The target precision is calculated using the Horwitz function (see text).

X is the contributed result, X_a is the assigned value and σ_p is the target precision.

The target precision, σ_p, used in this expression is a value similar in function to a standard deviation that describes the acceptable range of variation among the results. Its value is selected on fitness-for-purpose criteria and represents the maximum acceptable level of uncertainty in the results. Accordingly, a z-score more extreme than ± 3 implies that an unacceptable source of error may be present in the participant's analytical system and that remedial action should be taken. Z-scores more extreme than ± 2 carry the same message to a lesser degree, but will occur by chance with reasonable frequency (about one in twenty results for a participant complying exactly), so isolated values will not signify much. As far as the G-Probe programme is concerned, z-score results in the range $-2 < z < 2$ are considered to be satisfactory. However, if the z-score for any element falls outside this range, contributing laboratories are advised to examine their procedures to ensure that determinations are not subject to unsuspected analytical bias.

In selecting the most appropriate value of σ_p, similar criteria to those used in the Geo*PT* programme have been adopted here. In that (Geo*PT*) programme, the value of σ_p was derived from the Horwitz function (Horwitz *et al.* 1980, Thompson 2000),

$$R_H = 0.02c^{0.8495} \quad (2)$$

where R_H is the reproducibility (between laboratory) standard deviation observed at an analyte concentration c, both being expressed as mass ratios (for example, 1 $mg\ kg^{-1} = 10^{-6}$). The Horwitz function is an empirical observation that applies over a wide range of concentrations, test materials, analytes and physical principles underlying the analytical procedure. Two levels of uncertainty were recognised as fit-for-purpose in Geo*PT*: "Class 1", was considered to be appropriate for high precision analysis for "pure" geological research where

$$\sigma_p = R_H / 2 \quad (3)$$

and "Class 2", more appropriate for "applied geochemistry" where

$$\sigma_p = R_H \quad (4)$$

Participants were required to select the Class against which their data should be judged according to their objective needs.

For the G-Probe-1 programme, the authors are not aware of any universally accepted fitness-for-purpose criteria against which microprobe data should be

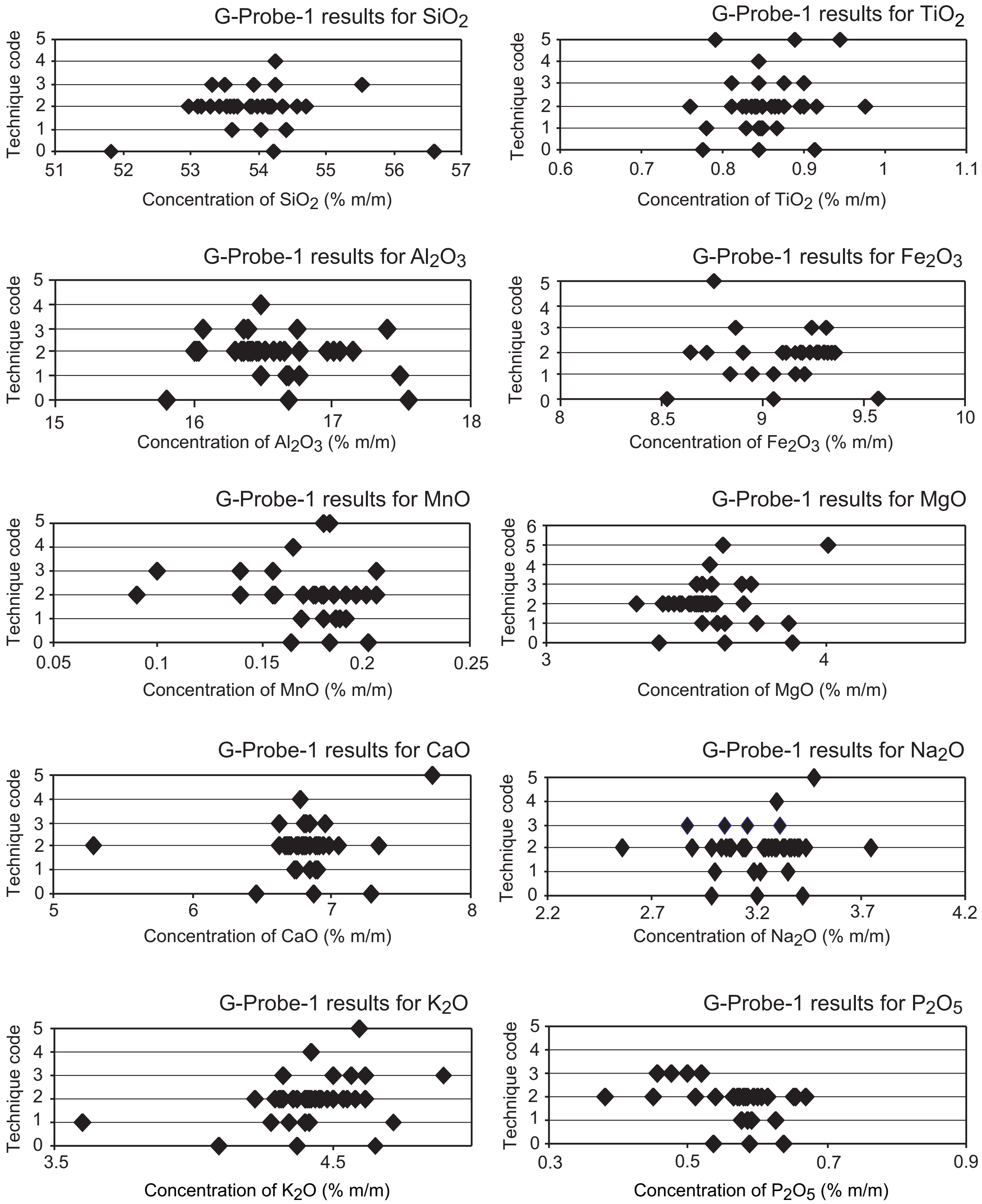

Figure 1. Comparison of analytical results for TB-1 (basaltic glass). ***Technique code (0)*** **represents the median value and the (median-2z) and (median+2z) z-score limits;** ***technique code (1)*** **represents the results of bulk analytical techniques used to analyse independently TB-1 fines;** ***technique code (2)*** **represents electron microprobe results,** ***(3)*** **ED/WD SEM,** ***(4)*** **ion microprobe and** ***(5)*** **LA-ICP-MS.**

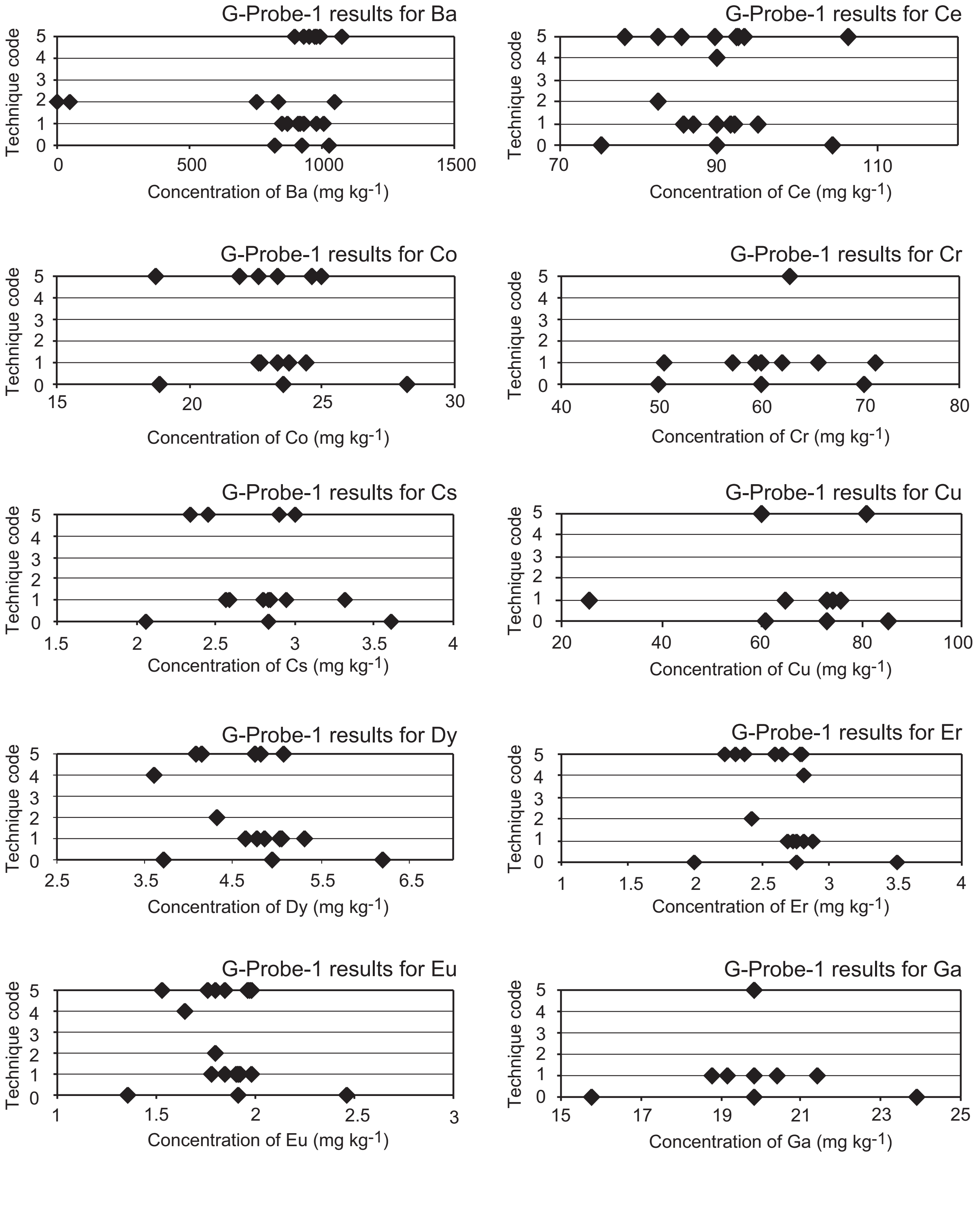

Figure 1 (continued). Comparison of analytical results for TB-1 (basaltic glass). ***Technique code (0)*** **represents the median value and the (median-2z) and (median+2z) z-score limits;** ***technique code (1)*** **represents the results of bulk analytical techniques used to analyse independently TB-1 fines;** ***technique code (2)*** **represents electron microprobe results,** ***(3)*** **ED/WD SEM,** ***(4)*** **ion microprobe and** ***(5)*** **LA-ICP-MS.**

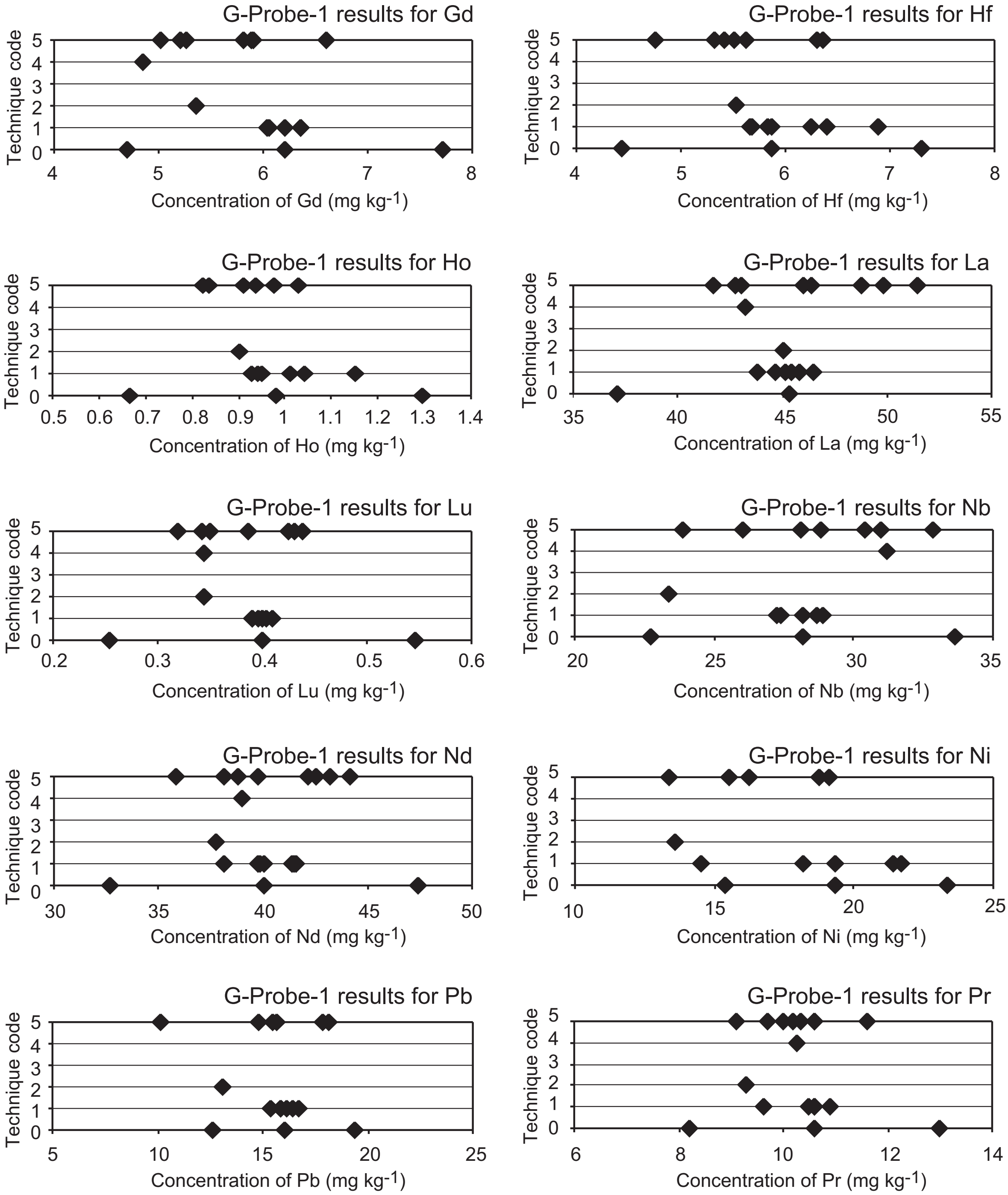

Figure 1 (continued). Comparison of analytical results for TB-1 (basaltic glass). *Technique code (0)* represents the median value and the (median-2z) and (median+2z) z-score limits; *technique code (1)* represents the results of bulk analytical techniques used to analyse independently TB-1 fines; *technique code (2)* represents electron microprobe results, *(3)* ED/WD SEM, *(4)* ion microprobe and *(5)* LA-ICP-MS.

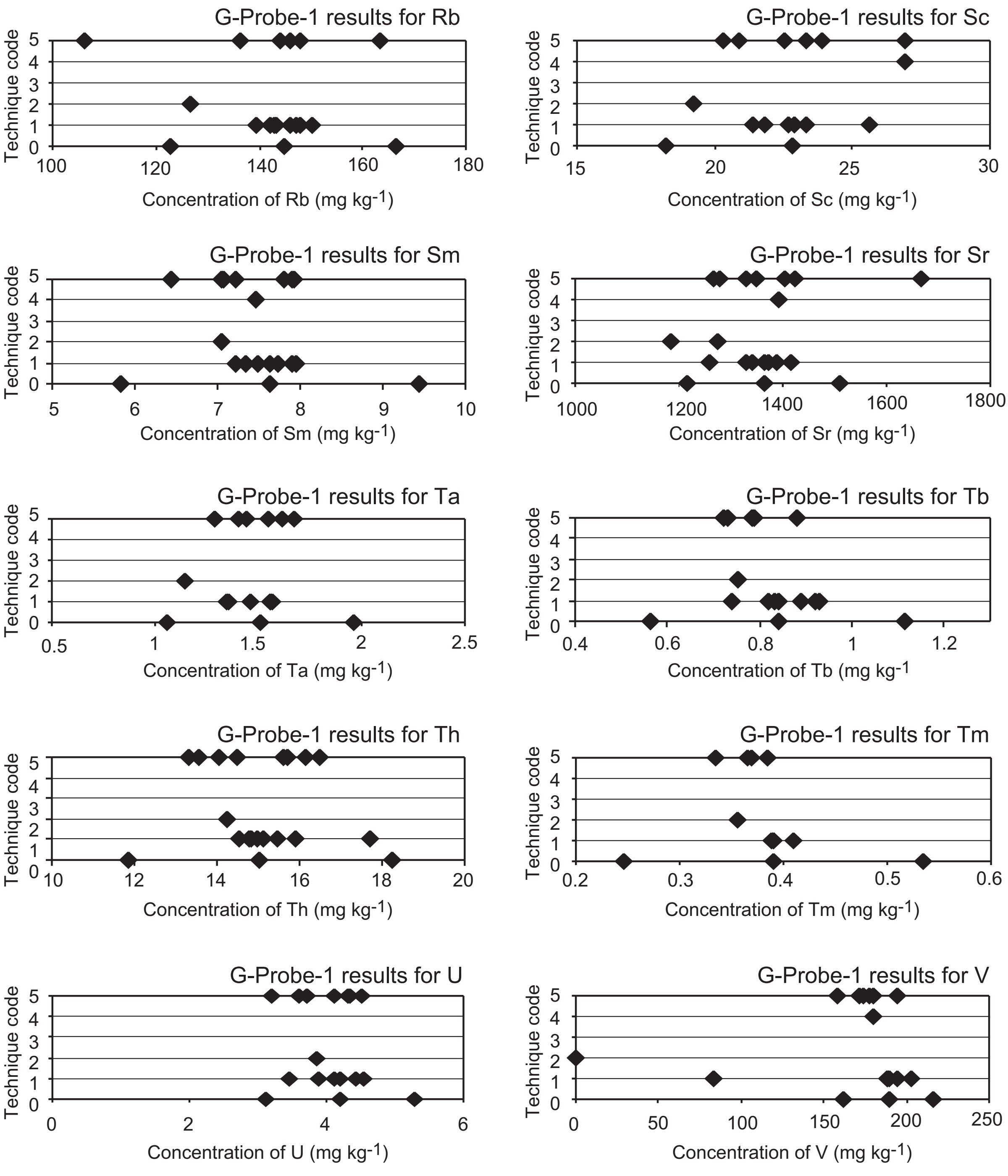

Figure 1 (continued). Comparison of analytical results for TB-1 (basaltic glass). *Technique code (0)* represents the median value and the (median-2z) and (median+2z) z-score limits; *technique code (1)* represents the results of bulk analytical techniques used to analyse independently TB-1 fines; *technique code (2)* represents electron microprobe results, *(3)* ED/WD SEM, *(4)* ion microprobe and *(5)* LA-ICP-MS.

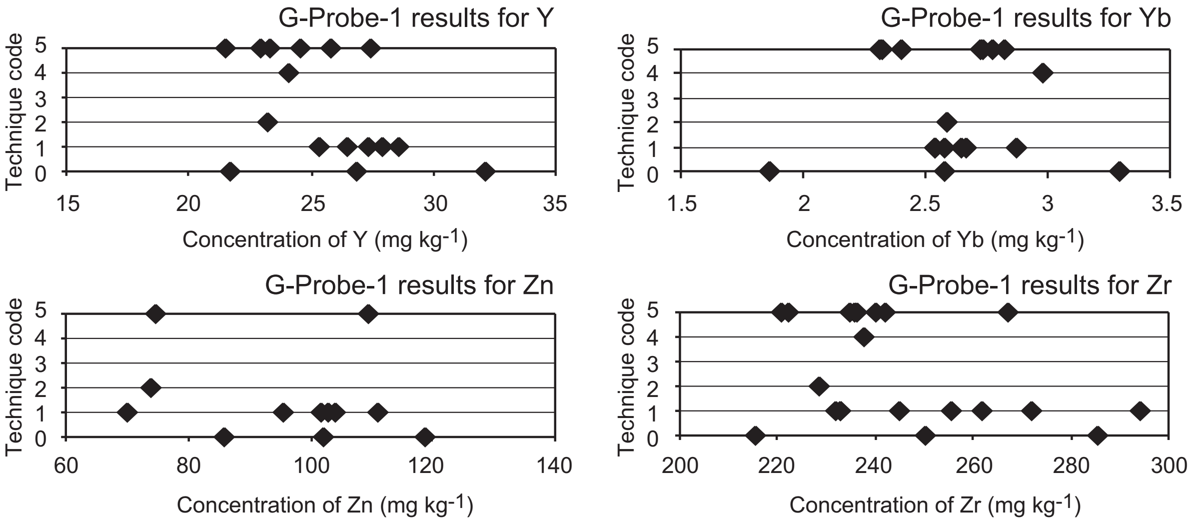

Figure 1 (continued). Comparison of analytical results for TB-1 (basaltic glass). *Technique code (0)* represents the median value and the (median-2z) and (median+2z) z-score limits; *technique code (1)* represents the results of bulk analytical techniques used to analyse independently TB-1 fines; *technique code (2)* represents electron microprobe results, *(3)* ED/WD SEM, *(4)* ion microprobe and *(5)* LA-ICP-MS.

judged. The "Class 2" standard was, therefore, arbitrarily selected, such that the target precision here has been calculated from

$$\sigma_p = R_H = 0.02c^{0.8495} \quad (5)$$

The appropriateness of this assumption is commented on further in the evaluation of results below. As a guide, some values of relative standard deviation based on σ_p, over the normal concentration range for data judged by the "Class 1" and "Class 2" standards are given in Table 5.

Table 5.
Relative standard deviations implied by the target value σ_p

Concentration	% RSD (Class 1)	% RSD (Class 2)
100% m/m	1	2
10% m/m	1.4	2.8
1% m/m	2	4
1000 mg kg^{-1}	2.8	5.7
100 mg kg^{-1}	4	8
10 mg kg^{-1}	5.7	11.3
1 mg kg^{-1}	8	16
0.1 mg kg^{-1}	11.3	22.6
0.01 mg kg^{-1}	16	32

Data in Table 6 lists z-scores for all results submitted by participating laboratories. Z-score data were calculated from the average of the mean compositions of fragment 1 and fragment 2.

Participating laboratories

Laboratories that contributed data to this proficiency testing round are listed in Table 7. Note that to preserve confidentiality, there is no correspondence between the round number in Table 2 and the order in which laboratories are listed in Table 7.

Discussion

Overall performance

In order to simplify an evaluation of the overall performance of laboratories contributing to this round, results for each element that could be assessed are plotted in Figure 1. The diagrams in this Figure show the concentration of each reported determination, segregated according to analytical technique as follows:

Technique code 0: The three data points represent the -2 ‹ z ‹ 2 range against which results have been evaluated. The individual points correspond to (X_a - $2\sigma_p$), X_a and ($X_a + 2\sigma_p$).

Technique code 1: Data points represent determinations by the bulk analytical techniques on the

Table 6.
G-Probe-1 Z-score analysis (TB-1 basaltic glass)

Lab code	**1A**	**2A**	**3A**	**4A**	**5A**	**6A**	**7A**	**8A**	**9A**	**10A**
Element	**EPMA**	**EPMA**	**EPMA**	**EPMA**	**EPMA**	**EPMA**	**LA-HR ICP-MS**	**EPMA**	**Ion Probe**	**EPMA**
SiO_2	-0.06	-0.44	-0.57	0.12	0.31	-0.19	-	-0.04	0.03	-0.77
TiO_2	-1.01	0.11	0.14	-2.45	3.75	1.59	2.87	0.14	0.00	-0.08
Al_2O_3	-0.53	0.85	-0.63	-0.52	-0.77	-0.73	-	0.18	-0.44	-0.67
Fe_2O_3T	0.83	1.04	-	-	-	-	-1.12	0.87	-	0.44
Fe(II)O	-	-	1.31	-0.38	0.88	0.41	-	-	-	-
MnO	0.24	-0.71	-0.29	-2.93	-4.52	-1.35	0.04	-0.82	-1.88	-2.82
MgO	-0.51	-0.39	-1.39	-0.76	-1.68	-1.09	3.06	-0.80	-0.47	-1.30
CaO	-0.51	0.85	-0.36	-1.22	-0.32	-0.15	4.16	-0.32	-0.44	0.07
Na_2O	1.27	1.50	0.29	5.08	-5.99	-1.15	-	1.45	0.85	0.77
K_2O	0.60	0.92	0.28	0.35	-0.37	-0.58	1.61	0.46	0.38	0.32
P_2O_5	-0.89	-0.21	-0.30	0.48	-1.88	-	-	-0.50	-	7.48
Ba	-	-17.47	-	-	-	-	2.79	-	-	-
Ce	-	-	-	-	-	-	2.26	-	-0.02	-
Co	-	-	-	-	-	-	-0.40	-	-	-
Cr	-	-	-	-	-	-	0.58	-	-	-
Cs	-	-	-	-	-	-	-	-	-	-
Cu	-	-	-	-	-	-	-2.17	-	-	-
Dy	-	-	-	-	-	-	-0.20	-	-2.17	-
Er	-	-	-	-	-	-	-0.43	-	0.15	-
Eu	-	-	-	-	-	-	0.26	-	-0.97	-
Ga	-	-	-	-	-	-	-	-	-	-
Gd	-	-	-	-	-	-	-0.40	-	-1.79	-
Hf	-	-	-	-	-	-	-0.62	-	-	-
Ho	-	-	-	-	-	-	-0.44	-	-	-
La	-	-	-	-	-	-	1.51	-	-0.50	-
Lu	-	-	-	-	-	-	-0.17	-	-0.75	-
Nb	-	-	-	-	-	-	1.69	-	1.10	-
Nd	-	-	-	-	-	-	1.12	-	-0.27	-
Ni	-	-	-	-	-	-	-1.93	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-
Pr	-	-	-	-	-	-	0.84	-	-0.29	-
Rb	-	-	-	-	-	-	0.13	-	-	-
Sc	-	-	-	-	-	-	0.24	-	1.82	-
Sm	-	-	-	-	-	-	0.29	-	-0.19	-
Sr	-	-18.52	-	-	-	-	4.14	-	0.40	-
Ta	-	-	-	-	-	-	0.47	-	-	-
Tb	-	-	-	-	-	-	-0.38	-	-	-
Th	-	-	-	-	-	-	0.36	-	-	-
Tl	-	-	-	-	-	-	-	-	-	-
Tm	-	-	-	-	-	-	-0.09	-	-	-
U	-	-	-	-	-	-	0.19	-	-	-
V	-	-13.76	-	-	-	-	-0.68	-	-0.64	-
Y	-	-	-	-	-	-	-0.43	-	-1.06	-
Yb	-	-	-	-	-	-	0.54	-	1.13	-
Zn	-	-	-	-	-	-	0.89	-	-	-
Zr	-	-	-	-	-	-	-0.80	-	-0.73	-

Table 6 (continued).
G-Probe-1 Z-score analysis (TB-1 basaltic glass)

Lab code	11A	12A	13A	14A	15A	16A	17A	18A	19A	20A
Element	**ED SEM**	**EPMA**	**EPMA**	**ED SEM**	**EPMA**	**EPMA**	**EPMA**	**ED SEM**	**EPMA**	**EPMA**
SiO_2	1.11	-0.12	-0.06	-0.23	-0.04	-0.04	-0.01	-0.60	-0.88	-0.48
TiO_2	-1.01	-0.17	2.02	0.00	-0.14	-0.43	0.58	1.59	41.25	-0.14
Al_2O_3	0.16	-0.58	1.08	-0.74	-0.23	-0.38	0.74	-0.66	-8.23	-0.22
Fe_2O_3T	-4.87	-	-	1.02	-1.27	0.96	1.12	0.73	13.14	0.56
Fe(II)O	-	1.02	0.95	-	-	-	-	-	-	-
MnO	-	-0.44	-0.29	-2.93	-9.82	-0.29	0.24	-4.52	1.30	-0.29
MgO	-0.72	-0.30	0.53	-0.39	-0.34	-1.39	-0.59	-0.84	-1.84	-0.89
CaO	-0.12	-0.23	-0.85	-0.27	-7.66	0.32	0.17	-1.22	0.56	-0.36
Na_2O	-	1.17	1.17	1.03	2.20	-1.57	-0.55	-0.41	-1.38	0.52
K_2O	3.78	-0.47	1.17	1.74	1.31	0.96	1.74	1.42	-18.29	-0.12
P_2O_5	-	2.48	3.23	-4.43	-5.41	-0.89	0.28	-2.66	-8.16	-0.11
Ba	-	-	-1.72	-	-	-	-	-	-	-
Ce	-	-	-1.03	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-11.58	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-	-
Cu	-	-	-	-	-	-	-	-	-	-
Dy	-	-	-1.03	-	-	-	-	-	-	-
Er	-	-	-0.89	-	-	-	-	-	-	-
Eu	-	-	-0.40	-	-	-	-	-	-	-
Ga	-	-	-	-	-	-	-	-	-	-
Gd	-	-	-1.12	-	-	-	-	-	-	-
Hf	-	-	-0.47	-	-	-	-	-	-	-
Ho	-	-	-0.51	-	-	-	-	-	-	-
La	-	-	-0.07	-	-	-	-	-	-	-
Lu	-	-	-0.75	-	-	-	-	-	-	-
Nb	-	-	-1.76	-	-	-	-	-	-	-
Nd	-	-	-0.62	-	-	-	-	-	-	-
Ni	-	-	-2.92	-	-	-	-	-	-	-
Pb	-	-	-1.77	-	-	-	-	-	-	-
Pr	-	-	-1.09	-	-	-	-	-	-	-
Rb	-	-	-1.66	-	-	-	-	-	-	-
Sc	-	-	-1.56	-	-	-	-	-	-	-
Sm	-	-	-0.64	-	-	-	-	-	-	-
Sr	-	-	-1.21	-	-	-	-	-	-	-
Ta	-	-	-1.61	-	-	-	-	-	-	-
Tb	-	-	-0.62	-	-	-	-	-	-	-
Th	-	-	-0.50	-	-	-	-	-	-	-
Tl	-	-	-	-	-	-	-	-	-	-
Tm	-	-	-0.49	-	-	-	-	-	-	-
U	-	-	-0.65	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-
Y	-	-	-1.39	-	-	-	-	-	-	-
Yb	-	-	0.03	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
Zr	-	-	-1.25	-	-	-	-	-	-	-

Table 6 (continued).
G-Probe-1 Z-score analysis (TB-1 basaltic glass)

Lab code	21A	22A	23A	24A	25A	26A	27A	28A	29A	30A
Element	**EPMA**	**EPMA**	**EPMA**	**LA ICP-MS**	**EPMA**	**LA ICP-MS**	**EPMA**	**LA ICP-MS**	**EPMA**	**ED/WD SEM**
SiO_2	-0.29	-0.49	0.40	-	-0.92	-	-0.44	-	-0.65	-0.75
TiO_2	-0.29	0.72	-0.43	-	-0.58	-1.59	0.58	-	0.43	0.86
Al_2O_3	-0.86	-1.48	0.65	-	-0.14	-	-0.76	-	-0.38	-1.40
Fe_2O_3T	-0.58	0.52	0.71	-	-	-	0.27	-	-	-0.69
Fe(II)O	-	-	-	-	2.91	-	-	-	0.65	-
MnO	-0.29	0.77	1.30	-	0.77	-0.29	-0.29	-	-0.29	2.36
MgO	-0.55	-0.72	-1.55	-	-1.84	-0.09	-1.01	-	-0.93	0.74
CaO	-0.83	-0.58	-0.51	-	-0.90	-	0.19	-	-0.12	0.44
Na_2O	0.34	1.82	-2.03	-	0.89	2.52	0.66	-	-0.50	-3.10
K_2O	-1.08	1.53	-0.40	-	0.78	-	0.63	-	-0.12	-0.33
P_2O_5	-	-0.30	-	-	0.68	-	0.28	-	-0.70	-5.21
Ba	-	-	-	-	-	0.54	3.21	0.17	-	-
Ce	-	-	-	-1.59	-	0.38	-	-0.62	-	-
Co	-	-	-	-2.07	-	0.62	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-
Cs	-	-	-	-1.25	-	0.44	-	-	-	-
Cu	-	-	-	-	-	1.28	-	-	-	-
Dy	-	-	-	-0.32	-	-1.29	-	-0.31	-	-
Er	-	-	-	-0.27	-	-1.21	-	0.07	-	-
Eu	-	-	-	-0.54	-	-0.23	-	0.18	-	-
Ga	-	-	-	-	-	-	-	-	-	-
Gd	-	-	-	-0.43	-	-1.33	-	-0.53	-	-
Hf	-	-	-	-0.33	-	-0.51	-	0.60	-	-
Ho	-	-	-	-0.29	-	-0.92	-	-0.02	-	-
La	-	-	-	-0.56	-	0.17	-	1.12	-	-
Lu	-	-	-	0.34	-	-0.68	-	0.52	-	-
Nb	-	-	-	0.23	-	-0.03	-	-1.57	-	-
Nd	-	-	-	-0.06	-	-0.32	-	0.69	-	-
Ni	-	-	-	-3.01	-	-0.30	-9.76	-	-	-
Pb	-	-	-	-3.51	-	1.10	-	-	-	-
Pr	-	-	-	-0.74	-	-0.52	-	0.00	-	-
Rb	-	-	-	-3.53	-	-	-	-	-	-
Sc	-	-	-	0.49	-	-1.10	-	-0.86	-	-
Sm	-	-	-	-0.46	-	-0.65	-	0.19	-	-
Sr	-	-	-	-1.17	-	-0.18	-2.43	-0.46	-	-
Ta	-	-	-	0.18	-	-0.29	-	-0.97	-	-
Tb	-	-	-	-0.40	-	-0.80	-	0.28	-	-
Th	-	-	-	-0.35	-	-0.62	-	0.69	-	-
Tl	-	-	-		-	-	-	-	-	-
Tm	-	-	-	-0.07	-	-0.77	-	-0.34	-	-
U	-	-	-	-1.84	-	0.55	-	-0.91	-	-
V	-	-	-	-2.22	-	0.39	-	-	-	-
Y	-	-	-	-0.40	-	-1.53	-	-0.88	-	-
Yb	-	-	-	0.42	-	-0.50	-	0.67	-	-
Zn	-	-	-	-3.37	-	-	-	-	-	-
Zr	-	-	-	-0.84	-	-0.48	-5.75	-0.88	-	-

Table 6 (continued).
G-Probe-1 Z-score analysis (TB-1 basaltic glass)

Lab code	31A	32A	33A	34A	35A	36A	37A	38A	39A
Element	ED SEM	LA ICP-MS	EPMA	EPMA LA-ICP-MS	LA ICP-MS	EPMA	EPMA	EPMA	LA ICP-MS
SiO_2	0.03	-	-0.54	-6.93	-	-0.78	-0.27	-1.05	-
TiO_2	1.59	-	1.44	-0.14	-	0.86	-0.43	-0.29	1.24
Al_2O_3	1.65	-	-0.38	-	-	-1.52	-0.05	-1.56	-
Fe_2O_3T	-	-	0.19	-1.58	-	1.17	-	0.98	-
Fe(II)O	0.46	-	-	-	-	-	1.33	-	-
MnO	-8.76	-	1.83	-1.35	-	0.24	1.30	2.36	-
MgO	0.49	-	-0.72	-0.84	-	-0.68	-0.72	-2.64	-
CaO	-0.34	-	-0.39	2.29	-	-0.80	0.10	-0.97	-
Na_2O	-1.43	-	1.64	-2.92	-	-1.20	1.92	-0.64	-
K_2O	0.92	-	0.21	0.21	-	0.60	-0.01	0.96	-
P_2O_5	-3.45	-	1.07	-3.05	-	-0.50	2.64	-0.89	-
Ba	-	-0.53	-3.25	1.23	1.01	-	-	2.36	0.93
Ce	-	-1.03	-	-0.05	0.47	-	-	-	0.32
Co	-	-0.10	-	-0.70	-	-	-	-	0.45
Cr	-	-	-	-	-	-	-	-	-
Cs	-	-0.98	-	-	-	-	-	-	0.18
Cu	-	-	-	-	-	-	-	-	-
Dy	-	-1.39	-	-	-1.29	-	-	-	0.19
Er	-	-1.42	-	-	-1.01	-	-	-	0.11
Eu	-	-1.36	-	-	-0.41	-	-	-	0.22
Ga	-	0.00	-	-	-	-	-	-	-
Gd	-	-1.57	-	-	-1.24	-	-	-	0.54
Hf	-	-1.56	-	-	-0.75	-	-	-	0.68
Ho	-	-	-	-	-1.00	-	-	-	0.32
La	-	-0.88	-	0.27	-0.62	-	-	-	0.86
Lu	-	-1.10	-	-	-0.78	-	-	-	0.41
Nb	-	-0.78	-	-	1.03	-	-	-	0.81
Nd	-	-1.13	-	0.86	-0.50	-	-	-	0.59
Ni	-	-1.58	-	-	-	-	-	-	-0.13
Pb	-	-0.21	-	-0.32	-0.74	-	-	-	1.22
Pr	-	-1.26	-	0.00	-0.22	-	-	-	-0.34
Rb	-	-0.78	-	0.30	-	-	-	-	-0.06
Sc	-	-	-	-0.13	-	-	-	-	1.80
Sm	-	-1.31	-	-	-0.63	-	-	-	0.32
Sr	-	-1.31	-	0.83	-0.20	-	-	-	0.53
Ta	-	-0.98	-	-	-0.48	-	-	-	0.70
Tb	-	-	-	-	-0.86	-	-	-	-
Th	-	-1.07	-	0.41	-0.94	-	-	-	0.91
Tl	-	-	-	-	-	-	-	-	-
Tm	-	-	-	-	-0.29	-	-	-	-
U	-	-1.12	-	-0.92	0.28	-	-	-	-0.18
V	-	-1.11	-	-0.83	-	-	-	-	-1.25
Y	-	-1.38	-	-	-2.05	-	-	-	0.19
Yb	-	-0.75	-	-	-0.73	-	-	-	0.45
Zn	-	-	-3.47	-	-	-	-	-	-
Zr	-	-1.70	-	-0.60	-1.60	-	-	-	0.95

Table 7.
G-Probe-1. List of participating laboratories

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powdered sample. Note that these points will always centre on the X_a value plotted on the line below, since X_a is the median of these data.

Technique code 2: Data points represent determinations made by electron microprobe analysis. Note that the majority of the microprobe major element data was reported by this technique.

Technique code 3: Data determined by ED/WD scanning electron microscope.

Technique code 4: Data determined by ion probe microanalysis.

Technique code 5: Data determined by laser ablation-inductively coupled plasma-mass spectrometry.

Note that the majority of the microprobe trace element data was reported by this technique.

In the case of iron, some microprobe laboratories reported data as FeO, some as Fe_2O_3. When plotting elemental data in Figure 1, all results were first converted to Fe_2O_3.

In evaluating these results, interest lies in:

(i) Whether there is significant bias between the bulk data (technique code 1) and results contributed by individual microprobe techniques (technique codes 2 to 5).

(ii) The overall spread of data from microprobe techniques compared to bulk analytical methods.

(iii) Whether assumptions about the target precision and derived z-score limits match the contributed microprobe results.

These comparisons are largely based on EPMA and LA-ICP-MS techniques, since these were the methods used to report the majority of the microprobe data.

Bias between microprobe data and bulk analytical results: The only element for which significant bias is observed was magnesium. Although the majority of the electron microprobe results are still within the $-2 < z < 2$ limits, they cluster about a value that is approximately 0.12% m/m below the median of the bulk analytical results. There is also a suggestion that the electron microprobe Fe_2O_3 data plots about 0.2% m/m higher than the median bulk data and that a few trace elements by LA-ICP-MS (e.g., Zr, Tm, Dy, Er plot slightly lower than the median bulk data, an effect that may be influenced by the tight clustering of the bulk results. However, overall, the agreement between microprobe and bulk analytical results is remarkably good.

Overall spread of microprobe data: When evaluating the quality of microprobe data, as judged by the spread of reported results, data by LA-ICP-MS for the elements Ba, Cs, Ni, Sc, Sr, U and a number of REE (e.g., Ho, Tb, Tm) is comparable to the bulk chemical results. Zirconium is also comparable, but largely because the spread of bulk data is wider than for other trace elements, possibly indicating interlaboratory bias in the determination of this element.

In general, the precision of major elements reported by EPMA is not as good as that from the bulk techniques, accepting that laboratories asked to undertake the bulk analysis of the basaltic glass were specially selected. The spread of LA-ICP-MS data for Nb and one or two of the LREE (e.g., La) appears to be significantly wider than for other elements.

Target precision for microprobe techniques: In evaluating the overall performance of microprobe laboratories that contributed data to this round, the majority of the data fit within the $-2 < z < 2$ limits indicating that these laboratories are complying with the "Class 2" precision standard described above. A more detailed evaluation of these data will be required to judge whether a more demanding standard should be adopted for future G-probe proficiency testing rounds, to satisfy fitness-for-purpose requirements relevant to the modern use of microprobe data.

Participation in future rounds

The benefit from proficiency testing arises from regular participation and the organisers hope to run further rounds of this proficiency testing programme in the near future.

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