

GeoPT7 - GBPG-1, Garnet-Biotite Plagiogneiss

Veranstalter: International Association of Geoanalysts and Geostandards Newsletter - GeoPT7

Ringversuchsmaterial: GBPG-1, Garnet-Biotite Plagiogneiss

RV geschlossen: 2000 – 7

Literatur: Proficiency Testing Report GeoPT7 (Laborcode CRB = H4)

Hauptelemente [MA%]

	CRB	RV	1sRV	Z-Score
Na ₂ O	3,54	3,6	0,18	
MgO	2,52	2,6	0,09	
Al ₂ O ₃	15,95	15,9	0,2	
SiO ₂	64,96	64,95	0,71	
P ₂ O ₅	0,08	0,08	0,002	
K ₂ O	2,27	2,2	0,08	
CaO	2,85	2,8	0,05	
TiO ₂	0,712	0,694	0,024	
Fe ₂ O ₃ tot.	6,02	6,03	0,02	
MnO	0,071	0,07	0,003	

Spurenelemente [µg/g]

	CRB	RV	1sRV	Z-Score
Ba	927	908	12	
Ce	90	103	1,2	
Co	20	19,5	0,3	
Cr	192	182	2,6	
Cu	31	30	0,4	
Ga	19	18,6	0,2	
La	49	53	0,8	
Mo	1,8	1,7	0,05	
Nb	8	9,9	0,22	
Ni	61	59,6	0,8	
Pb	16	14,1	0,24	
Rb	60	56	0,65	
Sr	388	363,5	2,6	
Th	12,5	11,3	0,23	
V	90	96,5	1	
Y	17	18	0,32	
Zn	81	80,3	0,7	
Zr	232	231,8	3,3	

Legende

CRB: Ergebnisse CRB – **RV:** Ergebnisse Ringversuch -- **1s-RV:** Standardabweichung Ringversuch

Z-Score: Differenz des Messwertes vom Mittelwert des Ringversuchs -- * Wert nicht zertifiziert

GEOPT7 - AN INTERNATIONAL PROFICIENCY TEST FOR ANALYTICAL GEOCHEMISTRY LABORATORIES - REPORT ON ROUND 7 (GBPG-1 Garnet-biotite plagiogneiss).

Philip J. Potts^{1*}, Michael Thompson², Jean S. Kane³ and Lev L. Petrov⁴

¹Department of Earth Sciences, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK.

²Department of Chemistry, Birkbeck College, Gordon House, London, WC1H 0PP, UK.

³Robert J. Kane Associates Inc., HCR 4, Box 231, Brightwood, VA 22715, USA.

⁴Institute of Geochemistry, Siberian Branch of Russian Academy of Sciences, PO Box 4019, Irkutsk 664033, Russia.

*Corresponding author: e-mail p.j.potts@open.ac.uk

Keywords: Proficiency testing, quality assurance, GeoPT, GeoPT7 round, GBPG-1. analytical geochemistry labs.

Abstract

Results are presented for round seven, GeoPT7, of the international proficiency testing programme for analytical geochemistry laboratories. The sample distributed for this round was GBPG-1 Garnet-biotite plagiogneiss, a candidate reference material prepared by the Institute of Geochemistry, Irkutsk. In this report contributed data are listed, together with an assessment of assigned values, z-scores and charts showing both the distribution of contributed results and the overall performance of participating laboratories.

Introduction

This seventh round of the international proficiency testing programme, GeoPT7, was conducted in a similar manner to earlier rounds. The programme is designed to be part of the standard quality assurance scheme of analytical geochemistry laboratories. 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 analysed result submitted 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 the chosen 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.

Full details of the programme have been included in reports of previous rounds, the current publication status of which is listed in Appendix 1. In this report, therefore, only the features of the present round are included and readers interested in further details are invited to review the previously published reports.

Steering Committee for Round 7: M. Thompson (Chair), P.J. Potts (Secretary), J.S. Kane, L.L. Petrov.

Sample: GBPG-1 Garnet-biotite plagiogneiss was prepared and packaged as a candidate reference material by the Institute of Geochemistry, Irkutsk, Russia. A sub-set of approximately 110 packets were made available to the GeoPT proficiency testing programme. The remaining stock was held at the Institute of Geochemistry pending certification of this sample as a reference material. Ten packets of the sample available for distribution were selected at random and tested for homogeneity using procedures established in previous rounds. Results are listed in Appendix 2.

Timetable for GeoPT7:

Distribution of sample: March 2000

Deadline for submission of analytical results: 15th May 1999

Distribution of preliminary report: July 2000

Submission of results

Results submitted by seventy-six participating laboratories are listed in Table 1. Data from seventy-two of these laboratories was submitted by the cut-off data and contributed to the full assessment of assigned values as well as z-score analysis. Data from the final four laboratories contributed to the z-score assessment only.

Assigned values

Following procedures described in earlier rounds, results submitted before the cut-off data were analysed using robust statistical procedures to derive assigned value concentrations [X_a], these being judged to be the best estimates of the true composition of this sample. Data in Table 2 lists assigned values for 12 major and 37 trace elements. Values were assigned on the basis that: (i) Sufficient laboratories had contributed data for an element. (ii) The statistical assessment gave confidence that the results showed a

central tendency approximating to a normal distribution. Part of this assessment involved examining a bar chart for each element to judge the distribution of results. Bar charts for elements shown in Figure 1 were judged to have satisfactory distributions :

SiO₂, TiO₂, Al₂O₃, Fe₂O₃T, FeO, MnO, MgO, CaO, Na₂O, K₂O, P₂O₅, LOI, Ba, Be, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Li, Lu, Mo, Nb, Nd, Ni, Pb, Pr, Rb, Sc, Sm, Sr, Ta, Tb, Th, Tm, U, V, Y, Yb, Zn, Zr.

Charts in Figure 2 show distribution data for elements that were not judged to be satisfactory in the statistical analysis to assign values. In the present round, values could not be assigned to the following elements:

H₂O⁺, CO₂, Ag, Bi, Cd, F, Ge, Hg, S, Sb, Sn, Tl, W.

The most common reasons for elements failing the assessment of assigned values were as follows:

- (i) Insufficient number of contributed results.
- (ii) A strongly positively skewed frequency distribution of results, sometimes with hints of multimodality.
- (iii) A robust mean clearly different from the mode, which makes the determination of a consensus impracticable.
- (iv) A very wide distribution of results as judged by the sigma value, so that no matter where the consensus were placed most of the participants would receive an 'unsatisfactory' classification if z-scores were calculated.

In the electronic version of this paper, it is planned that element symbols will be linked to the relevant distribution chart via a hypertext link.

Z-score analysis

As in previous rounds, Laboratories were invited to choose one of two performance standards against which their analytical results would be judged:

Data quality 1 for pure geochemistry laboratories, where analytical results are designed for geochemical research and where care is taken to provide data of high accuracy, sometimes at the expense of reduced sample throughput rates.

Data quality 2 for applied geochemistry laboratories, where, although accuracy is still important, the main objective is to provide results on large numbers of samples collected as part of geochemical mapping projects or geochemical exploration programmes.

The target precision [H_a] for each element assessed was calculated from a modified version of the Horwitz function as follows:

$$[H_a] = k \cdot [X_a]^{0.8495}$$

Where X_a is the concentration of the element expressed as a fraction, and the factor $k = 0.01$ for pure geochemistry labs and $k=0.02$ for applied geochemistry labs.

Z-scores were calculated for each elemental result submitted by each laboratory from:

$$z = [X - X_a] / H_a$$

where

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

Z-score results are listed in Table 3 and participating laboratories are invited to assess their performance using the following criterion:

Z-score results in the range $-2 < z < 2$ are considered to be satisfactory. 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.

Participating laboratories

Laboratories that contributed data to this proficiency testing round are listed in Table 4

Overall performance

As a summary of the performance of individual laboratories in this round, a multiple z-score chart is plotted in Figure 3. In this chart, the z-score performance for each element is distinguished by symbols that make it simple to identify whether the results were satisfactory or gave z-score values that were greater or lower than the acceptable z-score limits. These data are designed to help individual laboratories to decide their response to this proficiency testing round.

Participation in future rounds

The benefit from proficiency testing arises from regular participation and laboratories are invited to contribute to the GeoPT8 round, the sample for which will be distributed during September 2000.

Acknowledgments

The authors are very grateful to Liz Lomas (OU) for valued assistance with this work, to John Watson for undertaking the homogeneity testing measurements by XRF and to the Institute for Geochemistry, Irkutsk, for making available the current sample. This program was organised on behalf of the International Association of Geoanalysts.

Appendix 1

Publication status of proficiency testing reports

GeoPT1

Thompson M., Potts P.J., Kane J.S. and Webb P.W. (1996)

GeoPT1. International proficiency test for analytical geochemistry laboratories - Report on round 1. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 20, 295-325.

GeoPT2

Thompson M., Potts P.J., Kane J.S., Webb P.W. and Watson, J.S. (1998)

GeoPT2. International proficiency test for analytical geochemistry laboratories - Report on round 2. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 22 127-156.

GeoPT3

Thompson M., Potts P.J., Kane J.S. and Chappell B.W. (1999a)

GeoPT3. International proficiency test for analytical geochemistry laboratories - Report on round 3. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 23, 87-121.

GeoPT4

Thompson M., Potts P.J., Kane J.S., Webb P.C and Watson J.S. (1999b)

GeoPT4. International proficiency test for analytical geochemistry laboratories - Report on round 4. Submitted for publication to the electronic version of Geostandards Newsletter: The Journal of Geostandards and Geoanalysis (Summer 2000).

GeoPT5

Thompson M., Potts P.J., Kane J.S., and Wilson S. (1999c)

GeoPT5. International proficiency test for analytical geochemistry laboratories - Report on round 5. Submitted for publication to the electronic version of Geostandards Newsletter: The Journal of Geostandards and Geoanalysis (Summer 2000).

GeoPT6

Philip J. Potts, Michael Thompson, Jean S. Kane, Peter C Webb and Jean Carignan (2000)

GEOPT6 - an international proficiency test for analytical geochemistry laboratories - report on round 6 (OU-3: Nanhoron microgranite) and 6A (CAL-S: CRPG limestone). Unpublished report.

Appendix 2

Homogeneity testing

Homogeneity testing was based on analysis of duplicate test samples taken from each of 10 packets, selected at random. These samples were analysed in duplicate by WD-XRF at the Open University for the major elements (SiO₂, Al₂O₃, Fe₂O₃, MnO, MgO, CaO, Na₂O, K₂O, P₂O₅, TiO₂, LOI, Ba, Cr, Ni) on glass discs and the trace elements (As, Ba, Co, Cr, Cu, Ga, Mo, Nb, Ni, Pb, Rb, S, Sc, Sr, Th, U, V, Zn, Zr) on powder pellets, following the procedures described in the GeoPT1 report. Results for 12 major/minor and 19 trace elements were analysed using standard analysis of variance (ANOVA) procedures.

The power of the ANOVA test depends on the inherent precision in measurements of the individual elements determined and is poorest for those elements whose concentrations approach the method detection limit (DL). Among the trace elements for the GeoPT7 homogeneity test, U, Mo, As, and S all occurred at concentrations in the detection limit range (<2DL), and Pb, Th, and Sc occurred at only slightly higher concentrations (2DL to 5DL). Homogeneity conclusions for these elements were not reached because of the unreliability of the test. Homogeneity was demonstrated most reliably for Rb, Sr, Zr, Ba, V, Cr, Ni, Co and Zn, all occurring at concentrations >10 times the detection limit. It is also demonstrated for the following trace elements occurring at concentrations between 5 and 10 times the detection limit: Y, Nb, Cu, and Ga.

Statistically significant differences between packets were detected at the 95% confidence level for Fe₂O₃, CaO, and Ga. The differences noted, however, are not significant at the 99% level. Also the differences are small enough in comparison to the target precision (H_a) such that they would not affect a laboratory's z-score. Statistically significant differences were found between packets for Zr at both the 95% and 99% confidence levels.

Detailed results of the homogeneity tests follow. The probability that the ten packets are the same is tabulated for all oxides/elements whose concentrations are at least 5 times the detection limit. For the three that are possibly heterogeneous, H_a is shown as well for comparison with the standard deviation, which includes both within and between bottle components of variance.

Oxide	Mean % m/m	StdDev	Probability homogeneous	H_a
SiO ₂	65.12	0.17	0.099	
Al ₂ O ₃	15.75	0.035	0.396	
Fe ₂ O ₃	5.92	0.0098	0.043	0.092
MgO	2.57	0.016	0.115	
CaO	2.90	0.013	0.036	0.048
Na ₂ O	3.57	0.023	0.074	
K ₂ O	2.26	0.0089	0.435	
MnO	0.0688	0.0011	0.247	
TiO ₂	0.699	0.0037	0.373	
P ₂ O ₅	0.0834	0.0017	0.121	
	$\mu\text{g g}^{-1}$			
Ba	948.4	8.53	0.262	
Co	21.03	1.12	0.397	
Cr	183.3	1.99	0.269	
Cu	28.09	0.61	0.889	
Ga	17.53	0.68	0.045	1.0
Nb	10.73	0.35	0.698	
Ni	58.99	1.22	0.338	
Rb	56.60	0.51	0.708	
Sr	360.1	1.21	0.616	
V	100.5	2.52	0.977	
Y	19.05	0.48	0.518	
Zn	73.67	1.04	0.849	
Zr	227.4	3.55	0.0072	8.2

Table 1: Results submitted to the GeoPT7 round.

Table 1		Results for sample IGI GBPG-1 (garnet-biotite plagioclase), submitted to the GeoPT7 round														GeoPT7 round technique											
Round identifier	Technique	H1	H2	H3	H4	H5	H6	H7	H8	H9	H9	H10	H10	H11	H12	H13	H14	H14	H15	H16	H16	H17	H18	H19	H19	H20	
codes		X	X	X	X	X,IR, T	MX	A,IR, X	X	X	X	X	X	A,M	G,ISE, X	T,X	X	X	A,I, W	AA,T, X	AA,X	X	X	I	I	X	
Data quality		1	2	1	2	1	1	2	1	2	1	2	2	2	2	2	1	2	2	1	2	2	2	1	2	2	
SiO ₂	% m/m	64.84	65.6	65.93	64.96	64.6	65.03	62.54	63.63	65.0	65.22	64.91	64.96	64.64	65.06	65.06	64.64	65.06	65.06	65.06	63.2	64.64	63.2	64.64	63.2	64.64	64.27
TiO ₂	% m/m	0.707	0.66	0.726	0.712	0.68	0.69	0.679	0.68	0.71	0.67	0.73	0.68	0.69	0.7	0.69	0.69	0.69	0.69	0.69	15.91	16.09	15.91	16.09	15.91	16.09	0.68
Al ₂ O ₃	% m/m	15.82	17.4	16.04	15.95	15.8	16.01	15.15	15.50	15.8	16.12	16.09	15.92	15.83	15.51	15.84	15.92	15.83	15.51	15.84	6.29	6.15	6.29	6.15	6.29	6.15	15.69
Fe ₂ O ₃ T	% m/m	5.93	6.2	6.15	6.02	1.53	5.95	5.746	6.00	6.04	5.89	6.04	5.98	6.21	6.15	5.79	5.98	6.21	6.15	5.79	6.29	6.15	6.29	6.15	6.29	5.96	
Fe(II)O	% m/m	0.07	0.06	0.074	0.071	4.07	0.06	0.067	0.065	0.07	0.073	0.074	0.07	0.07	0.075	4.46	0.07	0.07	0.075	4.46	0.084	0.07	0.084	0.07	0.084	0.06	
MnO	% m/m	2.986	1.88	2.61	2.52	2.61	2.64	2.691	2.50	2.59	2.61	2.75	3.07	2.54	2.63	2.57	2.54	2.63	2.63	2.57	2.49	2.6	2.49	2.6	2.49	2.60	
CaO	% m/m	2.898	2.69	2.84	2.85	2.85	2.84	2.672	3.40	2.86	2.86	2.91	2.87	2.82	2.38	2.8	2.82	2.82	2.38	2.8	2.69	2.9	2.69	2.9	2.71	2.79	
Na ₂ O	% m/m	3.615	2.84	3.67	3.54	3.59	3.55	3.31	3.24	3.54	3.61	3.55	3.66	3.56	3.50	3.68	3.56	3.56	3.50	3.68	3.75	3.54	3.75	3.54	3.73	3.50	
K ₂ O	% m/m	2.261	1.56	2.18	2.27	2.24	2.27	2.218	2.21	2.26	2.23	2.33	2.1	2.24	2.33	2.1	2.24	2.24	2.14	2.27	2.01	2.2	2.01	2.2	2.37	2.29	
P ₂ O ₅	% m/m	0.085	0.17	0.1	0.08	1.03	0.09	0.071	0.07	0.07	0.076	0.06	0.09	0.08	0.105	0.09	0.08	0.08	0.105	0.09	0.084	0.08	0.084	0.08	0.084	0.07	
H ₂ O	% m/m					0.15																					
CO ₂	% m/m	0.78	0.85	0.64	0.83		0.8	0.67	2.60	0.72	0.83	0.77	0.78	0.76	0.73	0.62	0.76	0.73	0.62	0.73	0.84	0.84	0.84	0.84	0.84		
LOI	% m/m																										
Ag	mg kg ⁻¹																										
As	mg kg ⁻¹																										
Au	mg kg ⁻¹																										
B	mg kg ⁻¹	936.4	746	927	927	907	927	965	965	1030	836	885.0	913	642.5	997	820	875	863	997	820	875	863	863	863	863		
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	22.1	20	23	188	207	207	168.9	168.9	102	17	21.0	192	180.2	190	307	181	190	190	307	181	190	181	190	181		
Cr	mg kg ⁻¹	181.4	192	188	3	0.324	207	168.9	168.9	102	166	198.0	192	180.2	190	307	181	190	190	307	181	190	181	190	181		
Cs	mg kg ⁻¹	28.5	25	30	30	3.37	30.5	28.49	28.49	102	33	33.0	30.7	30.7	28.4	34	353	28.4	28.4	34	353	353	353	353	353		
Cu	mg kg ⁻¹																										
Dy	mg kg ⁻¹																										
Er	mg kg ⁻¹																										
Eu	mg kg ⁻¹																										
F	mg kg ⁻¹		19	19	18	18.9	18.9	4.65	4.65	22	4.7	633	18	18.5	3.90	7.02	18.5	3.90	3.90	7.02	7.02	7.02	7.02	7.02	7.02		
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																										

Table 1: Results submitted to the GeoPT7 round.

Round identifier	H1	H2	H3	H4	H5	H6	H7	H8	H9	H9	H10	H10	H10	H11	H12	H13	H14	H15	H16	H16	H17	H18	H19	H19	H20
Mo	mg kg ⁻¹	1.2		1.8	1.55									1.7				6							
N	mg kg ⁻¹																								
Nb	mg kg ⁻¹	10.8		8	9.71						0			8.7		12	10.2	8.2				9			
Nd	mg kg ⁻¹	59.3		29	43.9						59			42.5		35		41.76					54.5		
Ni	mg kg ⁻¹			61	70				92					65.0		64	61.7	59		59					
Os	mg kg ⁻¹																								
Pb	mg kg ⁻¹	12.8		26	14	12.9					29			14.0		16	14.1	26							
Pd	mg kg ⁻¹																								
Pr	mg kg ⁻¹				12.23									12.0				11.42							
Pt	mg kg ⁻¹																								
Rb	mg kg ⁻¹	56.1		60	58				55		56			54.0		59	55.6	50		53	50	51	72.1		
Re	mg kg ⁻¹																								
Rh	mg kg ⁻¹																								
Ru	mg kg ⁻¹																								
S	mg kg ⁻¹						73.71						90		1139										
Sb	mg kg ⁻¹			4.5	0.02									0.06											
Sc	mg kg ⁻¹				15.4									15.0			12.6						14.4		
Se	mg kg ⁻¹																								
Sm	mg kg ⁻¹				7.39									6.75				7.29							
Sn	mg kg ⁻¹				0.56									0.2				1.7							
Sr	mg kg ⁻¹	360.5		388	369						360			357.0		368	376.7	322		407	310	337	474		
Ta	mg kg ⁻¹													0.37				3.5							
Tb	mg kg ⁻¹													0.58				0.79							
Te	mg kg ⁻¹																								
Th	mg kg ⁻¹	9.5		12.5	7	12.2								10.4		15	9.3					10	11.4		
Ti	mg kg ⁻¹				0.27																				
Tm	mg kg ⁻¹													0.30				0.33							
U	mg kg ⁻¹			2	0.92									0.8											
V	mg kg ⁻¹			90	100	104.7	79.84				97			100.0		97	95.9	79		88					
W	mg kg ⁻¹													0.45				0.0							
Y	mg kg ⁻¹	19		17	15	17								18.0		20	18.3	20.14				16			
Yb	mg kg ⁻¹													1.93				1.98							
Zn	mg kg ⁻¹	73.6		81	82	79.8	76.1				78			82.0		81	78.3	80.7							
Zr	mg kg ⁻¹	225.3		232	231	242	93.28	236			242			257.0		251	226.6	214			230	210	290		

H73-H76 were submitted too late to contribute to the analysis of assigned values.

Technique codes: A=ICP-AES, AA=atomic absorption, E=emission spectrometry, G=gravimetric, I=INAA, IR=infra red detection, ISE=ion selective electrodes, M=ICP-MS.

T=titrimetry, W=wet chemistry, X=XRF

Table 1: Results submitted to the GeoPT7 round.

Round	H21	H22	H23	H24	H25	H26	H27	H28	H29	H30	H31	H32	H32	H33	H34	H35	H36	H36	H37	H38	H39	H40	H41	H42	H43	H43	H44	
Technic	X	AA	AA.M	A.I.R.	X	M	AA.M	M.X	A.I.R.	AA.A.	A.X	M	M	T.X	A.M	X	X	X	AA.E.	A.M.	X	AA.A.	X	X	G.A.T	G.A.T	A.M	
Data.q1	1	2	2	1	1	1	2	1	ISE.M.	IR.ISE	2	1	2	1	2	2	1	2	2	2	2	1	1	1	1	2	2	
SiO ₂	65.5	65.2	65.3	65.65	64.82		66.04	65.3	65.5	65.05	64.92			64.94	60.63	65.25	64.99		66.42	64.95	64.7	65.2	65.97	64.8	64.63		64.5	
TiO ₂	0.70	0.7	0.684	0.731	0.73		0.68	0.68	0.71	0.725	0.695			0.689	0.632	0.69	0.694		0.641	0.7	0.69	0.69	0.73	0.687	0.666		0.71	
Al ₂ O ₃	15.95	16.10	15.8	15.38	15.99		16.69	15.8	16.00	15.71	15.97			15.99	14.98	15.83	15.84		15.35	15.95	15.9	15.9	15.96	15.80	15.89		15.43	
Fe ₂ O ₃ T	6.04	3.54	6.03	6.13	6.2		4.93	5.9	6.00	6.02	6.093			6.068	6.227	6.1	6.025		5.87	6.1	6.34	5.95	6.19	6.0	6.14		6.21	
Fe(II)O		2.75	3.61						4.35	3.99				4.23						4.52				4.39				
MnO	0.07	0.09	0.066	0.07	0.08		0.056	0.07	0.071	0.069	0.07			0.07	0.067	0.068	0.066		0.06	0.07	0.068	0.069	0.07	0.07	0.073		0.078	
MgO	2.65	2.45	2.55	2.52	2.59		2.42	2.56	2.6	2.57	2.564			2.589	2.503	2.58	2.615		2.55	2.6	2.52	2.59	2.60	2.6	2.62		2.655	
CaO	2.86	1.57	2.76	2.84	2.81		2.1	2.77	2.9	3.07	2.827			2.892	3.216	2.91	2.871		2.7	2.86	2.82	2.84	2.84	2.84	2.91		2.89	
Na ₂ O	3.62	3.91	3.64	3.67	3.82		3.45	3.61	3.6	3.58	3.532			3.625	3.457	3.54	3.604		3.44	3.26	3.45	3.41	3.56	3.6	3.59		3.73	
K ₂ O	2.23	2.02	2.19	2.33	2.3		2.2	2.25	2.3	2.28	2.256			2.257	2.081	2.25	2.269		2.15	2.2	2.26	2.23	2.26	2.24	2.23		2.285	
P ₂ O ₅	0.08		0.078	0.075	0.08		0.08	0.08	0.08	0.065	0.087			0.083	0.064	0.081	0.081		0.066	0.086	0.07	0.078	0.086	0.08	0.078		0.07	
H ₂ O*										1.18															1.16			
CO ₂				0.15						0.02										0.2					0.24			
LOI	0.77		0.741	0.6	0.52		0.93	0.93	0.82	0.78	0.668			0.6		0.71	0.694		0.82	0.82		0.71	0.68		0.77		0.82	
Ag							0.8	0.1																				
As																												
Au																												
B																												
Ba	895			889	976	880.2	941	861	910	833	921	935		901.2	836		952.3		10	884	975	980	826	854	911		920	
Be								0.4	0.7	2	0.8				1				1			0.78				0.6		
Bi													0.04															
Br																												
Cd							0.22	0.1											0.09									
Ce	95			98.9		108	84		112	105.8		108		71.5	99.96						34	0.07			114		98	
Cl																												
Co	190			19.3	22		16.8		20.5	18		19.7																
Cr		2		188	275		155	158	186	178		182		211.6	181.9		207.6		17.1	21	17	18.9		20	25	20.4		
Cs				0.29			0.24	0.4	0.3											144	179	195	197	180	179	183		
Cu		2		29	26		19.9		30	30		26		28.3	23.81		30.51		35	33	30	31.6		27	29	32		
Dy				2.74			2.45		3.3	3.42		3.3			3.08											3.8		
Er				1.85			1.73		1.95	1.53		2.2		2.02												2.15		
Eu				1.61			1.69		1.8	1.68		1.8		1.98												2.05		
F									520	655																		
Ga	18			19.5	17		15.2		19.8			18.4															20.7	
Gd				4.72			5.7		4.3	5.04		4.5		4.67													5	
Ge							3.6		1.5																		7	
Hf				5.35			4.3		5.9			6.7																
Hg							0.24	0.1	0.01																			
Ho				0.62			0.652	0.54	0.63	0.82		0.89		0.76								0.63					0.85	
I									0.05																			
In																												
Ir																												
La				49.3			53	45.4	53	51.8		54		36.8	50.54										69		48.25	
Li									19.5	18.6															20		22	
Lu				0.28			0.307	0.24	0.26	0.35		0.33		0.28													0.5	

Table 1: Results submitted to the GeoPT7 round.

Round	H21	H21	H22	H23	H24	H25	H26	H27	H28	J	H30	H31	H32	H32	H33	H34	H35	H36	H36	H37	H38	H39	H40	H41	H42	H43	H43	H44
Mo					1.88	1	1.31	2		1.5																		1.7
N		10			9.31	10	9.21	7.5		10.8		11			10.2	7.42		9.53		10		12		10		8.2	10	
Nd		37			40	45.11	33.6	42	46	42	46	45			41.68			59.55		35	10	44		61		46	43.75	
Ni	55		2		58.2	55	51.5	23.7		60	79	62			57.4			12.12		42.5	60	55		55		54	60.3	
Os		15			13.6	14	14.6	13.14	13.4	15	22	13.6			17.4			12.12		15.27	40	14		16			14.25	
Pd					4E-04		0.8																					
Pr		16			10.6		11.94	10.61		11.2	10.8	12			11.12					10	10	12				13	11.05	
Pt					7E-04													56.53		60.93	46	70	56	67	57			55.2
Rb	64				58	54	50.3	41.49		55.5	59	57.1			54.8	51.85												
Re																												
Rh							0.04																					
Ru																												
S			1							60																123		
Sb					0.05	16	0.04	0.1		14	13.13				12.6			15.1		16.8	7	14.4		14	15			
Se					13.6		4.1	1		6.7	8.66	7			6.49					2	5	6.7			7.5		6.9	
Sm					6.22		6.83	5.5		0.5																		
Sn					385	364	312.6	356	375	360	364	376			358.7	342.4		357.3		364	324	344	360	400	360	365		350.5
Sr	360				0.37		0.4	0.25		0.46					0.37					0.4								
Ta					0.6		0.596	0.52		0.55	0.84	0.56			0.69					0.5		0.58						0.8
Tb							0.46																					0.85
Te					10.8	12	13.05	27.8	10.2	11.1		11.9			12.23			11.24		10.5	8.4	12						10.5
Th		10			0.27		0.34	0.3	0.29	0.25	0.46	0.35										0.3						
Ti					0.286		0.24					0.31										0.33						0.4
Tm					0.9	1.6	0.818	7.55	0.6	0.82		0.9								1.6	0.7	0.74						0.45
U		99			95.8	101	80.2	57.8	102	109	102	102			103.9			114.2		72	95	98		99		98		97.5
V							0.28	0.3	0.2																			
W		16			17.4	20	14.5	12.2	17	18.6	17.46	18.8		1	18.3	18.18		18.31		20.27	13	22	20	20	19			17
Y					1.87		1.85	1.7		2.1	2.21	2.2			1.92							2.0						2.35
Yb					91	75	75	68.4	80	76	86.2	84.5			79.9	69.7		82.27		85	85	81	75	80	80	2.2		75
Zn	74				268	242	198	3		224	251	280			231.5	202.2		230.4		237.4	214	210		246	227			229.5
Zr	250																											
H73-HT																												
Technic																												

Table 1: Results submitted to the GeoPT7 round.

Round	H45	H46	H47	H48	H49	H49	H49	H49	H50	H51	H52	H53	H54	H55	H56	H57	H58	H59	H60	H61	H62	H63	H63	H64	H64	H65	H66	H66	H67	H68				
Technic	I	AA	A,W	A,X	AA,A	AA,A	AA,A	AA,A	AA,A	AA,W	AAA	X	T,X	M,X	X	X	I	AA,M	X	A	A,ISE	A,IR	A,IR	M	M	M	M	M	G,X					
Data qt	1	2	1	2	1	2	1	2	1	1	2	1	2	1	1	2	2	1	1	1	2	1	2	1	2	1	2	1	1					
SiO ₂		64.46	64.22	64.3	64.92					65.23	64.85	65.6	64.89	65.2	65.73	64.91				64.44	65.2	64.58									64.82			
TiO ₂			0.70	0.69	0.713					0.71	0.686	0.68	0.678	0.69	0.69	0.7				0.73	0.68	0.682	0.69							0.701				
Al ₂ O ₃		15.66	15.73	16	16					16.05	16.15	15.7	15.85	15.84	15.97	15.91				15.54	15.76	15.86								15.89				
Fe ₂ O ₃ T	5.84	6.13	6.22	5.99	6.09					1.23	6.08	5.92	5.998	5.88	6.12	5.94				6.03	5.89	6.07								6.12				
Fe(II)O					3.77					4.38	4.25	3.7									4.2	4.19												
MnO		0.069	0.05	0.069						0.063	0.069	0.067	0.069	0.07	0.068	0.078				0.07	0.07	0.06								0.068				
MgO		2.21	2.80	2.63	2.675					2.44	2.66	2.54	2.449	2.54	2.63	2.5				2.57	2.70	2.6								2.63				
CaO		2.53	2.69	2.86	2.914					2.74	2.81	2.84	2.817	2.88	2.81					2.69	2.74	2.99	2.9							2.84				
Na ₂ O	3.6	3.32	4.14	3.69	3.51					3.35	3.75	3.21	3.477	3.61	3.34	3.41				3.47	3.65	3.62								3.56				
K ₂ O		2.02	2.44	2.22	2.19					2.17	2.17	2.28	2.282	2.25	2.27	2.26				2.21	2.19	2.35								2.18				
P ₂ O ₅				0.081						0.10	0.1	0.083	0.072	0.08	0.085	0.07				0.08	0.07	0.07								0.064				
H ₂ O*										0.91	0.19										1.2	0.78								0.103				
CO ₂										0.10	0.65	0.85	0.735	0.75	0.83	0.86					0.01	0.05								0.98				
LOI		0.505	0.73	0.29						0.89											0.65	0.71												
Ag	0.045																																	
As	0.16																																	
Au																																		
B																																		
Ba	909																																	
Be																																		
Bi	0.15																																	
Br																																		
Cd	106.8																																	
Ce																																		
Cl																																		
Co	19.9	20																																
Cr	190	208																																
Cs	0.31																																	
Cu		32																																
Dy																																		
Er																																		
Eu	1.8																																	
F																																		
Ga																																		
Gd																																		
Ge																																		
Hf	6.68																																	
Hg																																		
Ho																																		
I																																		
In																																		
Ir																																		
La	50																																	
Li																																		
Lu																																		

Table 1: Results submitted to the GeoPT7 round.

Round	H45	H46	H47	H48	H49	H49	H50	H51	H52	H54	H55	H56	H57	H58	H59	H60	H61	H62	H63	H64	H64	H65	H66	H66	H67	H68
Mo	1.7					1.6	0.9											1.7					1.68			H68
N																										
Nb						7				10.92	9.86	10														10
Nd	46			35					40.5	24.1	28.2	40.3		45.3			45	44.6	10.76				10.2		8.81	
Ni	60			61		73	61		52	57.47	57.2	58	77	76		46.8	58	66	43.51	43.4			43.4		43.3	
Os																										60
Pb				14		10	5		12.4	16.12	13.3	13.55	15	16	15.5	19.4		15					12.6			15
Pd							0.08	0.017																		
Pr				9					10.1		10.68					10.9	11.2	12.26					11.9			
Pt																										
Rb	55.2			59			55.2		58	56.7	55.3	55	48	53	17.1	54.3	58	60.38					57.7			71
Re																										
Rh																										
Ru																										
S									0.01																	
Sb	0.020																									
Sc	13.5			12.51		13	14			13.7	13.4	15.8	13	14.14			13	1.7	14				14.3			14
Se																										
Sm	6.65			5.9		7.16			6.3	3.5	7.16			6.79			7.1	7.7	6.72	6.75			7.25			
Sr	367			352		365	350		1.2	0.21							357	362	389.9	365			387		366	
Ta	0.4								353	364.8	365.5	356	423	0.4	242.2	388.6	0.27	0.27					365.7		366	
Tb	0.52								0.59		0.42	0.66		0.61			0.7	0.6	0.6	0.539			0.61		0.54	
Te																										
Th	12.1					17.4			11.3	10.73	9.6	12.1	11	13.58			11.4	11.4	12.14	11.6			12.1		11.7	
Ti									0.35		1.3															11
Tm	0.92																							0.47		
U									1.33		0.89	1.4		0.99	0.67			0.3	0.86	0.258			0.29			
V									96	94	93.9	101	94	220	95			0.88		0.808			0.91			
W	0.35																									87
Y									17	18.52	15.7	20	13					0.4					0.78			
Yb	2.2								1.93		2.08			2.2	16.6				19.27	16.6			17.6			18
Zn	82								82	78.15	80.9	75	81	80	83.6	83.9			1.98	1.90			2.02		2.05	
Zr	250								235	236.5	229.4	239	225	200												81
H73-H77																										265
Technic																										

Table 1: Results submitted to the GeoPT7 round.

Round	H69 Technic M/W	H70 AA, AA M/W	H71 I	H71 I	H71 I	H72 X	H73 X	H74 AA, M ISE	H75 A	H76 A, T, X
Data qt.	1	1	1	1	2	1	1	2	2	2
SiO ₂	64.38	65.53				64.51	65.25	64.94	65.00	65.15
TiO ₂	0.71	0.71				0.79	0.72	0.696	0.67	0.689
Al ₂ O ₃	16.11	15.84				16.01	15.66	15.98	15.60	15.75
Fe ₂ O ₃ T	6.47	6.08			5.93	6.87		6.174	6.32	5.896
Fe(II)O	4.08						5.38		4.02	
MnO	0.06	0.07				0.07	0.067	0.064	0.07	0.067
MgO	2.60	2.61				2.89	2.76	2.518	2.52	2.557
CaO	2.94	2.86			3.05	3.02	2.94	2.895	2.97	2.843
Na ₂ O	3.49	3.64			3.42	3.42	3.76	3.645	3.10	3.592
K ₂ O	2.22	2.26			2.16	2.26	2.40	2.253	2.35	2.295
P ₂ O ₅	0.10	0.10				0.11	0.115	0.084	0.01	0.072
H ₂ O ⁺	1.14						0.91			
CO ₂	0.13						0.80	0.735	1.09	0.572
LOI	0.87	0.75								
Ag	0.05								0.8	
As						3		1	14.8	2
Au										
B									13.3	
Ba	921	918			954	986		860	983.0	945
Be									1.3	
Bi									38.4	16.5
Br										
Cd	107			100.6		65			7.9	3
Ce									142.0	101.5
Cl										
Co	19.6	25			18.9		47	22	24.8	16
Cr	186	167			173	150	170	170	209.0	188
Cs	0.42									
Cu	30.8				35	35		39	36.8	24
Dy	3.37									
Er	1.87									
Eu	1.98			1.643					1.5	
F	570							228		
Ga	20					26		23		27
Gd	4.4									12.5
Ge	1.09							4	16.1	
Hf	6.13				6.35					3
Hg										
Ho	0.62			0.84						
I										
In										0.5
Ir										
La	54.4			52.83		31			52.7	46.5
Li	22							20	14.5	14.5
Lu	0.31			0.31						

Table 1: Results submitted to the GeoPT7 round.

Round	H69	H70	H71	H71	H72	H73	H74	H75	H76
Mo	1.71							16.8	
N	9.01				9			24.4	23.5
Nb	46.6								33
Nd	60.6	54	41.11		74	245	58	60.6	
Ni	14.1				15			62.9	4
Os	12.4								0.5
Pb	60.3		64.8		76				
Pd									
Pr									
Rb									
Re									
Rh									
RU									52
S	110							0.0	10
Sb								0.0	
Sc	0.08		13.8					8.1	
Se	7.17		6.55					15.6	1
Sm	0.64							333.0	440
Sn	351	362			355			1.6	
Sr	0.41								
Ta	0.57		0.69						
Tb									
Te									
Th	12.8		11.6		11		21		
Tl									
Tm	0.3								
U	0.92				3		100		
V	95.3	102			95	40			72.5
W	0.19							10.9	
Y	17.7	20			12	35	13	10.8	17.5
Yb	2.28		2.07						
Zn	82.2	84			88		84	96.6	43
Zr	237	255			233	118		6.3	267
H73-H7									
Technik									

Table 2

Table 2 GeoPT7											
Assigned values and robust statistical analysis of contributed data											
		Xa	Ha	Robust s	Ratio s/Ha			Xa	Ha	Robust s	Ratio s/Ha
SiO ₂	% m/m	64.946	0.693	0.071	0.103	Hf	mg kg ⁻¹	6.07	0.37	0.20	0.53
TiO ₂	% m/m	0.6941	0.015	0.0024	0.1667	Ho	mg kg ⁻¹	0.69	0.06	0.02	0.34
Al ₂ O ₃	% m/m	15.90	0.210	0.020	0.10	La	mg kg ⁻¹	52.95	2.33	0.77	0.33
Fe ₂ O ₃ T	% m/m	6.028	0.092	0.020	0.217	Li	mg kg ⁻¹	20.97	1.06	0.72	0.68
Fe(II)O	% m/m	4.195	0.068	0.066	0.982	Lu	mg kg ⁻¹	0.31	0.03	0.01	0.25
MnO	% m/m	0.070	0.002	0.0003	0.177	Mo	mg kg ⁻¹	1.70	0.13	0.05	0.43
MgO	% m/m	2.60	0.045	0.009	0.20	Nb	mg kg ⁻¹	9.93	0.56	0.22	0.38
CaO	% m/m	2.80	0.048	0.014	0.30	Nd	mg kg ⁻¹	43.30	1.96	0.68	0.34
Na ₂ O	% m/m	3.60	0.059	0.018	0.30	Ni	mg kg ⁻¹	59.6	2.6	0.8	0.3
K ₂ O	% m/m	2.20	0.039	0.008	0.20	Pb	mg kg ⁻¹	14.10	0.76	0.24	0.31
P ₂ O ₅	% m/m	0.0799	0.0023	0.0015	0.6559	Pr	mg kg ⁻¹	11.45	0.63	0.21	0.33
LOI	% m/m	0.751	0.016	0.015	0.936	Rb	mg kg ⁻¹	56.24	2.45	0.65	0.27
						Sc	mg kg ⁻¹	13.93	0.75	0.21	0.28
Ba	mg kg ⁻¹	908.0	26.1	7.0	0.3	Sm	mg kg ⁻¹	6.79	0.41	0.10	0.25
Be	mg kg ⁻¹	0.90	0.07	0.06	0.85	Sr	mg kg ⁻¹	363.5	12.0	2.3	0.2
Ce	mg kg ⁻¹	103.2	4.1	1.2	0.3	Ta	mg kg ⁻¹	0.40	0.04	0.01	0.29
Co	mg kg ⁻¹	19.5	1.0	0.3	0.3	Tb	mg kg ⁻¹	0.60	0.05	0.02	0.33
Cr	mg kg ⁻¹	181.4	6.6	2.6	0.4	Th	mg kg ⁻¹	11.23	0.62	0.23	0.37
Cs	mg kg ⁻¹	0.32	0.03	0.01	0.26	Tm	mg kg ⁻¹	0.30	0.03	0.01	0.35
Cu	mg kg ⁻¹	30.0	1.4	0.4	0.3	U	mg kg ⁻¹	0.90	0.07	0.03	0.39
Dy	mg kg ⁻¹	3.26	0.22	0.07	0.33	V	mg kg ⁻¹	96.5	3.9	1.0	0.3
Er	mg kg ⁻¹	2.01	0.14	0.05	0.35	Y	mg kg ⁻¹	18.00	0.93	0.32	0.34
Eu	mg kg ⁻¹	1.79	0.13	0.03	0.23	Yb	mg kg ⁻¹	2.03	0.15	0.04	0.24
Ga	mg kg ⁻¹	18.6	1.0	0.2	0.2	Zn	mg kg ⁻¹	80.3	3.3	0.7	0.2
Gd	mg kg ⁻¹	4.74	0.30	0.09	0.30	Zr	mg kg ⁻¹	231.8	8.2	3.3	0.4

Xa = assigned value, s = standard deviation of submitted results calculated using robust statistics,
Ha = target precision calculated using a modified version of the Horwitz function.

Table 3 GeoPT7 z-scores

Table 3																
Z-scores for data submitted to the GeoPT7 round (IGI GBPG-1 garnet-biotite plagiogneiss).																
Round Identifier	H1	H1	H2	H3	H4	H5	H6	H7	H8	H9	H9	H10	H10	H11	H12	H13
Technique code	X	X	X	X	X	X,IR	M,X	A,IR	X	X	X	X	X	A,M	G,ISE	T,X
Data quality	1	1	2	1	2	1	1	2	1	1	2	1	2	2	2	2
SiO ₂ % m/m	-0.16		0.47	1.42	0.01	-0.50	0.12	-1.74	-1.90	0.08		0.40		-0.25	-0.03	0.01
TiO ₂ % m/m	0.88		-1.16	2.17	0.81	-0.96	-0.28	-0.50	-0.96	1.08		-1.64		1.22	-0.48	-0.14
Al ₂ O ₃ % m/m	-0.37		3.58	0.67	0.12	-0.48	0.52	-1.79	-1.91	-0.48		1.05		0.00	0.45	0.05
Fe ₂ O ₃ T % m/m	-1.07		0.93	1.32	-0.05	-48.90	-0.85	-1.53	-0.31	0.13		-1.50		1.48	0.06	-0.26
Fe(II)O % m/m						-1.85										0.41
MnO % m/m	0.00		-2.39	1.81	0.24	0.00	-4.79	-0.69	-2.39	0.00		1.44		0.96		0.00
MgO % m/m	-0.31		-7.99	0.22	-0.89	0.22	0.89	1.01	-2.22	-0.22		0.22		1.67	5.22	0.33
CaO % m/m	2.04		-1.15	0.83	0.52	1.04	0.83	-1.33	12.51	1.25		1.25		1.15	0.73	0.52
Na ₂ O % m/m	0.25		-6.40	1.18	-0.51	-0.17	-0.84	-2.44	-6.06	-1.01		0.17		-0.42	0.51	-0.34
K ₂ O % m/m	1.56		-8.19	-0.51	0.90	1.02	1.79	0.23	0.26	1.54		0.77		1.68	-1.28	0.64
P ₂ O ₅ % m/m	2.18		19.27	8.60	0.02	0.04	4.32	-1.84	-4.24	-4.24		-1.67		-4.26		2.16
LOI % m/m	1.85		3.16	-7.08	2.52		3.12	-2.58	117.92	-1.98		5.04		0.61	0.92	0.61
Ba mg kg ⁻¹	1.09			-6.22	0.36	-0.04	0.73		2.19		2.34	-2.76		-0.44		0.10
Be mg kg ⁻¹							1.09									
Ce mg kg ⁻¹					-6.96		0.38					-0.30		-0.51		-1.61
Co mg kg ⁻¹		2.65			0.27	3.56	1.25					-2.47		0.77		0.27
Cr mg kg ⁻¹	0.00				0.80	0.99	3.86	-0.94				-2.32		1.25		0.80
Cs mg kg ⁻¹					44.10		0.13							-1.97		
Cu mg kg ⁻¹	-1.04				-1.74	0.00	0.35	-0.52				2.09		1.04		
Dy mg kg ⁻¹							0.49							-0.60		
Er mg kg ⁻¹							0.33							-0.28		
Eu mg kg ⁻¹							0.83							-0.54		
Ga mg kg ⁻¹		-0.38		0.45	0.23	-0.59	0.35					3.59				-0.30
Gd mg kg ⁻¹							-0.29							-0.06		
Hf mg kg ⁻¹						-0.18	0.28							-0.49		
Ho mg kg ⁻¹							0.08							-0.30		
La mg kg ⁻¹					-0.85		0.15					1.74		-0.42		12.03
Li mg kg ⁻¹							2.39									
Lu mg kg ⁻¹							0.07							-0.55		
Mo mg kg ⁻¹		-3.98			0.40		-1.19							0.00		
Nb mg kg ⁻¹	1.55			1.90	-1.72	0.12	-0.39					-17.66		-1.09		1.84
Nd mg kg ⁻¹					-3.64		0.31							-0.20		-2.11
Ni mg kg ⁻¹	-0.11			0.93	0.27	4.04	-0.42		12.58			-0.23		1.05		0.86
Pb mg kg ⁻¹	-1.72			3.83	7.86	-0.13	-1.58					19.68		-0.07		1.25
Pr mg kg ⁻¹							1.23							0.43		
Rb mg kg ⁻¹	-0.06			-1.32	0.77	0.72	-0.10		-0.50			-0.10		-0.46		0.58
Sc mg kg ⁻¹		1.83				0.09	1.96							0.71		
Sm mg kg ⁻¹							1.47							-0.05		
Sr mg kg ⁻¹	-0.25			0.96	1.02	0.46	0.63		1.05		2.49	-0.29		-0.27		0.19
Ta mg kg ⁻¹							1.09							-0.41		
Tb mg kg ⁻¹							0.77							-0.19		
Th mg kg ⁻¹	-2.77			-9.98	1.02	-6.78	1.55							-0.67		3.02
Tm mg kg ⁻¹														0.00		
U mg kg ⁻¹		25.98			7.52		0.27							-0.68		
V mg kg ⁻¹		0.80			-0.84	0.91	2.12	-2.15				0.13		0.45		0.07
Y mg kg ⁻¹	1.07			2.15	-0.54	-3.22	-1.07		1.61			2.15		0.00		1.07
Yb mg kg ⁻¹							-0.15							-0.35		
Zn mg kg ⁻¹	-2.01			4.44	0.11	0.52	-0.14	-0.63				-0.68		0.26		0.11
Zr mg kg ⁻¹	-0.79			-0.34	0.02	-0.09	1.25	-8.48	0.52			1.25		1.55		1.18

Table 3 GeoPT7 z-scores

Table 3																	
Round	H14	H14	H15	H16	H16	H17	H18	H19	H19	H20	H21	H21	H22	H23	H24	H25	H26
Techniqu	X	X	A,I,W	AA,T	AA,X	M,X	X	I	I	X	X	X	AA	AA,M	A,IR	X	M
code			X											W	M,X		
Data qua	1	2	2	1	2	2	2	1	2	2	1	2	2	2	1	1	1
SiO ₂	-0.44		0.73	0.16		-1.26	-0.22			-0.49	0.80		0.18	0.26	1.02	-0.18	
TiO ₂	0.40		-0.14	-0.28			-0.14	-2.33		-0.48	0.40		0.20	-0.35	2.51	2.45	
Al ₂ O ₃	-0.33		-0.93	-0.29		0.02	0.45	0.95		-0.50	0.24		0.48	-0.24	-2.48	0.43	
Fe ₂ O ₃ T	1.97		0.66	-2.59		1.42	0.66	-1.07		-0.37	0.13		-13.52	0.01	1.10	1.87	
Fe(II)O			-2.03	3.92									-10.69	-4.33			
MnO	0.00		1.20	0.00		3.35	0.00	-1.91		-2.39	0.00		4.79	-0.96	0.00	4.79	
MgO	-1.33		0.33	-0.67		-1.22	0.00	5.55		0.00	1.11		-1.67	-0.56	-1.78	-0.22	
CaO	0.42		-4.38	0.00		-1.15	1.04	-1.88		-0.10	1.25		-12.82	-0.42	0.83	0.21	
Na ₂ O	-0.67		-0.84	1.35		1.26	-0.51	2.19		-0.84	0.34		2.61	0.34	1.18	3.71	
K ₂ O	1.02		-0.77	1.79		-2.43	0.00	4.35		1.15	0.77		-2.30	-0.13	3.33	2.56	
P ₂ O ₅	0.04		5.37	4.32			0.02			-2.12	0.04			-0.41	-2.10	0.04	
LOI	0.57		-0.67	-8.35			2.84				1.21			-0.32	-9.63	-14.73	
Ba	-2.51		1.71			-1.69	-0.63	-1.73			-0.50				-0.73	2.61	-1.07
Be																	
Ce		0.07	0.38					0.92			-2.00				-1.05		1.17
Co	-2.97		-0.23					0.04			-0.73				-0.16	2.55	
Cr	-0.18		0.65		9.47			-0.06			1.29		-13.52		0.99	14.11	
Cs		77.02													-0.99		-0.33
Cu	0.49		-0.56		1.39						-1.74	-9.73			-0.70	-2.78	
Dy			-0.28					1.22							-2.39		0.76
Er			0.03												-1.12		-1.12
Eu			-0.69					1.52							-1.38		0.22
Ga	-0.07										-0.59				0.97	-1.64	
Gd			-1.40												-0.06		0.04
Hf		0.18						2.58				1.26			-1.93		
Ho			1.25												-1.12		-0.57
La		0.20	0.77					0.32				7.95			-1.57		0.02
Li			1.52														
Lu			-0.22					-0.44							-1.11		-0.20
Mo			17.13												1.43	-5.58	
Nb	0.48		-1.54				-0.83				0.06				-1.10	0.12	-1.28
Nd			-0.39					5.70			-1.60				-1.68		0.92
Ni	0.82		-0.12		-0.12						-1.78		-11.18		-0.54	-1.78	
Pb		0.00	7.86									0.59			-0.66	-0.13	0.66
Pr			-0.02									3.58			-1.34		0.77
Rb	-0.26		-1.27		-0.66	-1.27	-1.07	6.47			3.16				0.72	-0.91	-2.42
Sc	-1.78							0.62							-0.44	2.76	
Sm			0.61					1.42							-1.40		0.10
Sr	1.10		-1.73		1.82	-2.23	-1.11		4.62		-0.29				1.80	0.04	-4.25
Ta			42.21						0.82						-0.82		0.00
Tb			1.83					-0.77							0.00		-0.08
Th		-1.55					-0.99	0.27				-0.99			-0.69	1.23	2.91
Tm			0.52												-1.04		-0.49
U															0.00	9.57	-1.12
V	-0.15		-2.25		-1.09			0.62			0.65				-0.18	1.16	
Y	0.32		1.15				-1.07					-1.07			-0.64	2.15	
Yb			-0.18					-0.08							-1.11		-1.25
Zn		-0.30	0.07		-6.22						-1.89				3.24	-1.59	
Zr	-0.63		-1.09			-0.11	-1.33		3.57		2.23				4.44	1.25	

Table 3 GeoPT7 z-scores

Table 3																	
Round	H27	H28	H29	H30	H31	H32	H32	H33	H34	H35	H36	H36	H37	H38	H39	H40	H41
Technique	AA,M	M,X	A,IR	AA,A	A,X	M	M	T,X	A,M	X	X	X	AA,E	A,M	X	AA,A	X
code			ISE,M,V	IR,ISE									ISE,X	W,X		M,T,X	
Data	qua	2	1	2	1	2	1	2	1	2	1	2	2	2	2	1	1
SiO ₂	0.79	0.51	0.40	0.15	-0.02			-0.01	-3.11	0.22	0.07		1.06	0.00	-0.18	0.37	1.48
TiO ₂		-0.96	0.54	2.11	0.03			-0.35	-2.12	-0.14	0.00		-1.81	0.20	-0.14	-0.28	2.45
Al ₂ O ₃	1.88	-0.48	0.24	-0.91	0.15			0.41	-2.19	-0.17	-0.31		-1.31	0.12	0.00	0.00	0.29
Fe ₂ O ₃ T	-5.97	-1.40	-0.15	-0.09	0.35			0.43	1.08	0.39	-0.04		-0.86	0.39	1.69	-0.85	1.76
Fe(II)O			1.15	-3.03				0.52					2.40				
MnO	-3.35	0.00	0.24	-0.48	-0.12			0.14	-0.72	-0.48	-2.06		-2.39	0.00	-0.48	-0.48	0.00
MgO	-2.00	-0.89	0.00	-0.67	-0.40			-0.24	-1.08	-0.22	0.33		-0.56	0.00	-0.89	-0.22	0.00
CaO	-7.30	-0.63	1.04	5.63	0.28			1.92	4.34	1.15	1.48		-1.04	0.63	0.21	0.83	0.83
Na ₂ O	-1.26	0.17	0.00	-0.34	-0.57			0.42	-1.20	-0.51	0.07		-1.35	-2.86	-1.26	-3.20	-0.87
K ₂ O	0.00	1.28	1.28	2.05	0.72			1.46	-1.52	0.64	1.77		-0.64	0.00	0.77	0.77	1.54
P ₂ O ₅		0.04	0.02	-6.37	1.60			1.33	-3.40	0.24	0.30		-2.97	1.30	-2.12	-0.81	2.61
LOI		11.42	2.20	1.85	-2.65			-9.63		-1.31	-3.64		2.20			-2.61	-4.53
Ba	0.63	-1.80	0.04	-2.88	0.25	1.04		-0.26	-1.38		1.70		-0.98	-0.46	1.29	2.76	-3.15
Be		-6.84	-1.37	15.04	-0.68				0.68				0.68				-1.64
Ce	-2.34		1.07	0.63		1.16		-7.72	-0.40			-2.29		-0.64	-8.42	0.19	
Co	-1.34		0.52	-1.47		0.24							-1.19	0.77	-1.24	-0.56	
Cr	-1.99	-3.53	0.35	-0.51		0.09		4.55	0.04		3.95		-2.82	-0.18	-0.86	2.05	2.35
Cs	-1.32	2.63	-0.33			-1.32											0.33
Cu	-3.51		0.00	0.00		-2.78		-1.18	-2.15		0.35		1.74	1.04	0.00	1.11	
Dy	-1.86		0.08	0.72		0.17			-0.42					-3.12		0.63	
Er	-0.98		-0.22	-3.33		1.29			0.03					-4.18		-0.09	
Eu	-0.38		0.03	-0.84		0.07			0.72					-0.73		-0.46	
Ga	-1.76		0.64			-0.18			-0.36		-0.09		-1.13	0.23		-0.59	
Gd	1.61		-0.73	1.01		-0.79			-0.11					-1.23		0.21	
Hf	-2.39		-0.22			1.72			-2.21					-7.79			
Ho	-1.25		-0.48	2.32		0.08			0.65					-3.32		-0.95	
La	-1.62		0.01	-0.49		0.45		-6.93	-0.52			-2.54	0.87	-1.06	-9.22	0.45	
Li		-0.44	-0.69	-2.23										-2.34		-0.35	
Lu	-1.22		-0.89	1.24		0.57			-0.55					-3.57			
Mo	-1.55	2.39	-0.80														
Nb	-2.16		0.77			1.90		0.48	-2.23		-0.71			0.06		3.68	
Nd	-2.47		-0.33	1.37		0.87			-0.41					-2.11	-8.48	0.36	
Ni	-1.57	-13.93	0.08	7.53			0.47	-0.85			-0.02		-3.32	1.44	0.08	-1.78	-1.78
Pb	-0.63	-0.92	0.59	10.43		-0.66		4.36			-2.61		0.77	-2.71	17.10	-0.13	
Pr	-0.66		-0.20	-1.02		0.87			-0.26					-1.14	-1.14	0.87	
Rb	-3.01		-0.15	1.13		0.35		-0.59	-0.89		0.12		0.96	-2.09	2.81	-0.10	4.39
Sc		-0.58	0.05		-0.53				-0.89		1.56		1.91	-4.62		0.62	
Sm	-1.58		-0.11	4.59		0.52			-0.37					-1.71		-0.22	
Sr	-0.31	0.96	-0.15	0.04	0.23	1.05		-0.40	-0.88		-0.52		0.02	-1.65	-0.81	-0.29	3.05
Ta	-2.04		0.82						-0.41					0.00			
Tb	-0.77		-0.48	4.63		-0.77			0.87					-0.96		-0.39	
Th	13.27	-1.65	-0.11			1.07			0.80		0.01		-0.59	-2.27		1.23	
Tm	-1.04		-0.87	5.56		0.35								-3.48		1.04	
U	45.46	-4.10	-0.55			0.00							4.79	-1.37		-2.19	
V	-2.10	-9.97	0.71	3.23		1.42		1.91			4.57		-3.16	-0.19	0.45	0.39	
Y	-1.88	-6.22	-0.54	0.64	-0.29	0.86		0.32	0.10		0.33		1.22	-2.68	-4.29	4.29	
Yb	-1.14		0.23	1.22		1.15			-0.38					-4.90		-0.22	
Zn	-0.79	-3.58	-0.04	-1.29	0.89	1.28		-0.11	-1.59		0.60		0.71	0.71	-0.04	0.22	-1.59
Zr	-2.07	-28.01	-0.47		1.18	5.91		-0.03	-1.81		-0.17		0.35	-1.09	-1.33		

Table 3 GeoPT7 z-scores

Table 3																	
Round	H42	H43	H43	H44	H45	H46	H47	H48	H49	H49	H50	H51	H52	H53	H54	H55	H56
Technique	X	G,A,T	G,A,T	A,M	I	AA	A,W	A,X	AA,A	AA,A	AA,AF	AA,W	AA,A	X	T,X	M,X	X
code	ISE,M,X ISE,M,X A X																
Data qua	1	1	2	2	1	2	1	2	1	2	1	1	2	1	2	1	1
SiO ₂	-0.21	-0.46		-0.32		-0.35	-1.05	-0.47	-0.04			0.41	-0.07	0.94	-0.04	0.37	1.13
TiO ₂	-0.49	-1.92		0.54			0.40	-0.14	1.29		0.40	1.08	-0.28	-0.96	-0.55	-0.28	-0.28
Al ₂ O ₃	-0.48	-0.05		-1.13		-0.57	-0.81	0.24	0.48		-0.24	0.72	0.60	-0.95	-0.12	-0.29	0.33
Fe ₂ O ₃ T	-0.31	1.21		0.99	-2.05	0.55	2.08	-0.21	0.67		-2.37	-52.16	0.28	-1.18	-0.17	-1.61	1.00
Fe(II)O		2.88							-6.29			2.74	0.41			-3.66	
MnO	0.00	1.44		1.91		-0.24	-9.57	-0.24		-1.68	311.17	-3.35	-0.24	-1.44	-0.24	0.00	-0.96
MgO	0.00	0.44		0.61		-4.33	4.44	0.33		0.83	-1.11	-3.55	0.67	-1.33	-1.68	-1.33	0.67
CaO	0.83	2.29		0.94		-2.81	-2.29	0.63	2.38		-1.25	-3.13	1.15	0.83	0.18	1.67	1.67
Na ₂ O	0.00	-0.17		1.09	0.00	-2.36	9.10	0.76	-1.52		-4.21	2.02	1.26	-6.57	-1.04	0.17	-1.18
K ₂ O	1.02	0.77		1.09		-2.30	6.14	0.26	-0.26			3.33	-0.77	-0.38	2.05	1.05	1.28
P ₂ O ₅	0.04	-0.81		-2.12				0.24		-3.40		8.60	4.30	1.33	-1.69	0.04	2.18
LOI		1.21		2.20		-7.84	-1.34	-14.70		-1.31		8.86	-3.22	6.31	-0.51	-0.06	5.04
Ba	-0.54	0.11		0.23	0.04			0.04		0.94			0.46	-0.04	-0.32	0.15	-0.42
Be			-2.05										-1.16				
Ce		2.62		-0.64	0.87			-2.47	1.65				0.22		-3.99	-1.25	-5.65
Co	0.54	5.56		0.47	0.44	0.27		-1.24		0.77	-1.47		-0.23		-1.49		4.56
Cr	-0.21	-0.36		0.12	1.29	2.00		1.93		-2.90	-3.08		-0.86	0.13	0.66	-2.47	2.05
Cs				0.49	-0.33				1.32								0.33
Cu	-2.09	-0.70		0.70		0.70		0.00		1.04	0.70		0.35	-1.50	0.31	-2.09	
Dy		2.00		1.23				-2.20	-0.06				-0.17			1.95	
Er		4.05		0.47				-1.77	1.29				1.20			1.16	
Eu		1.59		0.99	0.07			-1.11	1.06				-0.65			0.91	
Ga	-0.59			1.11				0.23					-0.40	0.35	0.07	0.45	0.45
Gd				0.44				-1.56	0.41				0.22			1.08	
Hf				1.26	1.66			2.62	-1.53				-0.09		-1.44	0.82	
Ho			0.13	1.42					0.26				-0.48			1.29	
La		6.89		-1.01	-1.27			-2.46	0.97				1.30	-3.47	-3.83	-0.15	
Li		-0.91		0.49		-0.93			0.97		-3.74		-2.34				
Lu			1.46	3.14					-0.44				0.29			0.91	
Mo				0.00	0.00					-0.40	-6.37						
Nb	0.12		-1.54	0.06				-0.83		-2.61			-1.72	1.76	0.06	-0.12	0.12
Nd		1.37		0.11	1.37			-2.11	0.87				-0.71	-9.77	-3.84	-1.53	
Ni	0.55	-2.17		0.14	0.16	0.27		0.27		2.60	0.55		-1.47	-0.82	-0.46	-0.62	1.71
Pb	2.51			0.10				-0.07		-2.71	-12.02		-1.12	2.67	-0.53	-0.73	1.19
Pr		2.44		-0.32				-1.93	2.28				-1.06			-1.21	
Rb	0.31			-0.21	-0.42			0.56	-0.91		-0.42		0.36	0.19	-0.19	-0.50	-3.36
Sc	0.09	1.43			-0.58			-0.95		-0.62	0.09			-0.31	-0.35	2.49	-1.24
Sm		1.74		0.14	-0.34			-1.09	0.91				-0.60		-4.04	0.91	
Sr	-0.29	0.13		-0.54	0.29			-0.48	0.13		-1.13		-0.44	0.11	0.08	-0.62	-0.37
Ta					0.00					2.18							0.54
Tb			1.93	2.41	-1.54				0.77				-0.10			1.16	
Th				-0.59	1.39			-1.95		4.94			0.05	-0.80	-1.31	1.39	-0.37
Tm			1.74	2.61					1.39				0.87			1.04	
U					0.27					-0.41				5.88		-0.14	6.84
V	0.65	0.39		0.13		0.20		0.71		0.45	-0.36		-0.06	-0.64	-0.33	1.16	-0.64
Y	2.15	1.07		-0.54				-3.54		4.29	-10.73		-0.54	0.56	-1.23	2.15	-5.37
Yb			0.58	1.09	1.15			-2.20	0.12				-0.35			0.33	
Zn	-0.08	-0.08		-0.79	0.52	5.69		-0.49	2.03	8.85	0.22		0.26	-0.64	0.10	-1.59	0.22
Zr	1.74	-0.58		-0.14	2.23			0.14		0.69	-26.91		0.20	0.58	-0.14	0.89	-0.83

Table 3 GeoPT7 z-scores

Table 3																	
Round	H57	H58	H59	H60	H61	H62	H63	H63	H64	H64	H65	H66	H66	H67	H68	H69	H70
Techniqu	X	I	AA,M	X	A	A,ISE	A,IR	A,IR	M	M	A,ISE	M	M	M	G, X	AA, A	AA, A
code						M,X	M,T,X	M,T,X			X					M,W	
Data qua	2	2	1	1	1	2	1	2	1	2	2	1	2	1	1	1	1
SiO ₂	-0.03				-0.73	0.18	-0.53				-2.64				-0.18	-0.82	0.84
TiO ₂	0.20			2.45	-0.96	-0.41	-0.28				-0.35		-0.82		0.47	1.08	1.08
Al ₂ O ₃	0.02		14.78		-1.72	-0.33	-0.19				-0.14				-0.05	1.00	-0.29
Fe ₂ O ₃ T	-0.48	-0.64		-15.74	0.02	-0.75	0.45				0.25				1.00	4.80	0.56
Fe(II)O						0.04		-0.04									-1.70
MnO	1.91		-4.79	4.79	0.00	0.00	-4.79				-0.48		-0.96		-0.96	-4.79	0.00
MgO	-1.11		-33.75		-0.67	1.11	0.00				-0.34				0.67	0.00	0.22
CaO	0.10			-2.29	-1.25	1.98	2.09				0.83				0.83	2.92	1.25
Na ₂ O	-1.68	-1.60			-2.19	0.42	0.34				-0.06				-0.67	-1.85	0.67
K ₂ O	0.77			-5.37	0.26	-0.13	3.84				0.35				-0.51	0.51	1.54
P ₂ O ₅	-2.12				0.04	-2.12	-4.24				-0.83				-6.80	8.60	8.60
LOI	3.48					-3.22	-2.61								14.60	7.59	-0.06
Ba	1.48	1.61	-12.27		-0.88	0.44		0.21	0.08		0.42	0.31		-2.49	-2.00	0.50	0.38
Be			-1.09			8.20											
Ce					1.28	1.51	0.00		0.67		2.07	1.40		0.43	-3.71	0.92	
Co	0.77	-0.53	-0.26		-2.47	-1.24		-0.37			-0.22	1.65		-2.07	4.56	0.14	5.56
Cr	-2.37	-0.22	-1.21	-0.21	-0.36	1.10		0.04			2.12	1.60			-2.93	0.69	-2.17
Cs		-0.16	-0.66			-0.33	0.00		-0.30			0.66				3.29	
Cu	0.00		0.00	5.77	0.00	1.74		-0.76			0.60	0.28			3.48	0.56	
Dy					0.17	0.08	1.31		-0.98		0.21		-1.30			0.49	
Er					0.60	0.65	0.33		-1.12		-0.22		0.05		-0.98		
Eu		0.34			0.22	-0.19	-0.08		-0.31		-0.54		-0.16			1.44	
Ga			0.24	-2.16		-0.82		0.07			1.60		-0.70	-0.59	1.50		
Gd					-1.79	1.77	0.01		-0.59		0.28		0.61		-1.12		
Hf		0.64				2.21				-5.09		-5.29		-0.96		0.18	
Ho		0.13			1.29	0.56	-0.09		-1.28		-0.78		-0.78		-1.12		
La		0.14			0.92	0.50	0.45		-0.02		0.32				-8.13	0.62	
Li			0.69		4.74	-0.46		0.63					0.06			0.97	
Lu		0.67			0.23	0.45	0.23		-1.01		-0.77		-1.44		-0.10		
Mo						0.00					-0.16				0.08		
Nb						0.06	1.48				0.48		-1.99		-1.64		
Nd		0.51			0.87	0.33	0.11		0.05		0.05		0.00		1.68		
Ni	3.38	3.18	-0.27	-4.97	-0.62	1.24		-0.65			-0.22	0.82			0.16	0.39	-2.17
Pb	1.25		1.85	7.00		0.59		-0.16	-0.26			-1.98			1.19	0.00	
Pr					-0.87	-0.20	1.28		0.55		0.71		0.71		1.50		
Rb		-0.66	-15.96	-0.79		0.36	1.69		-0.46		0.60				6.02	1.66	
Sc		0.14			-1.24	-8.16		0.05			0.49				0.09		
Sm		0.00			0.76	1.12	-0.17		-0.10		1.13		-0.12		0.93		
Sr	2.49		-10.13	2.10	-0.54	-0.06	2.21		0.13		0.09	1.97		0.21	0.21	-1.04	-0.12
Ta		0.00				-1.77					-0.54				0.27		
Tb		0.10				0.96	0.00		-1.18		0.19		-1.16		-0.58		
Th	-0.99	1.88				0.13	1.45		0.59		1.39		0.75	-0.37	2.51		
Tm						0.00			-1.46		-0.35				0.00		
U		0.62	-3.14			-0.14	-0.55		-1.26		0.14				0.27		
V	15.92		-0.38		-1.93	1.35		-1.11			0.03	1.42			-2.45	-0.31	1.42
Y				-1.50	-1.07	0.54	1.36		-1.50		-0.43			0.00	-0.32	2.15	
Yb		0.58			-0.90	0.58	-0.36		-0.90				0.12		1.70		
Zn	-0.04		1.01	1.10	-0.98	-0.79		0.77			14.80	-2.07			0.22	0.58	1.13
Zr	8.46	-1.94			-7.44	0.63				-8.40	-12.73	-8.66			4.07	0.64	2.85

Table 3 GeoPT7 z-scores

Table 3							
Round	H71	H71	H72	H73	H74	H75	H76
Technique	1	1	X	X	AA,M	A	A,T
code					ISE		X
Data qua	1	2	1	1	2	2	2
SiO ₂			-0.63	0.44	0.00	0.04	0.15
TiO ₂			6.54	1.76	0.06	-0.82	-0.17
Al ₂ O ₃			0.52	-1.14	0.19	-0.72	-0.36
Fe ₂ O ₃ T		-0.53	9.15		0.79	1.58	-0.72
Fe(II)O				17.53			-1.29
MnO			0.00	-1.44	-1.44	0.00	-0.72
MgO			6.44	3.55	-0.91	-0.89	-0.48
CaO		2.61	4.59	2.92	0.99	1.77	0.45
Na ₂ O		-1.52	-3.03	2.69	0.38	-4.21	-0.07
K ₂ O		-0.51	1.54	5.12	0.68	1.92	1.22
P ₂ O ₅			12.88	15.02	0.88	-14.95	-1.69
LOI				3.12	-0.51	10.81	-5.71
Ba		0.88	2.99		-0.92	1.44	0.71
Be						2.73	
Ce	-0.64		-9.30			4.72	-0.21
Co		-0.28		27.86	1.28	2.68	-1.74
Cr		-0.63	-4.74	-1.72	-0.86	2.08	0.50
Cs							
Cu			3.48		3.13	2.36	-2.09
Dy							
Er							
Eu	-1.13					-1.11	
Ga			7.77		2.32		4.41
Gd							12.95
Hf		0.39					-4.14
Ho	2.67						
La	-0.05		-9.42			-0.05	-1.38
Li					-0.46	-3.05	-3.05
Lu	-0.10						
Mo						60.14	
Nb			-1.65			12.87	
Nd	-1.11						-5.04
Ni			5.59	71.96	-0.31	0.20	-5.16
Pb			1.19			32.22	-6.67
Pr							
Rb		1.75	8.06				
Sc		-0.09					-2.62
Sm	-0.59					1.61	
Sr			-0.71			-1.27	3.20
Ta						16.34	
Tb	1.74						
Th		0.29	-0.37		7.82		
Tm							
U			28.71		677.5		
V			-0.38	-14.56			-3.09
Y			-6.44	18.24	-2.68	-3.86	-0.27
Yb	0.26						
Zn			2.33		0.56	2.46	-5.62
Zr			0.15	-13.93		-13.80	2.16

Table 4

Analysts and laboratories that contributed results to the GeoPT7 proficiency testing round.

D.M. Hill

ANSTO, Menai, NSW 2234, **Australia.**

Helen Waldron

Becquerel Laboratories Pty Ltd., Menaj, NSW 2234, **Australia.**

Phil Robinson

School of Earth Sciences, University of Tasmania, Hobart, Tasmania 7001, **Australia.**

Rob Essers

Genalysis Laboratory Services Pty Ltd., Maddington, WA 6109, **Australia.**

Michael Hart,

Division of Exploration and Mining, CSIRO, Wembley, WA6014, **Australia.**

Franz Bernhard

Institut für Technische Geologie und Angewandte Mineralogie, TU Graz, A-8010 Graz, **Austria.**

Antonella Tajani

IAEA Laboratories, Seibersdorf, A-2444 **Austria.**

Anne-Maria Marion

CRIC, B-1050 Bruxelles, **Belgium.**

Jacinta Enzweiler

Instituto De Geociências, UNICAMP, CP 6152, Campinas, SP, **Brazil.**

Horstpeter H.G.J. Ulbrich

Instituto de Geociências, Universidade de São Paulo, Cidade Universitária, São Paulo, **Brazil.**

Brenda Caughlin

ALS Chemex Labs Limited, North Vancouver, BC, V7J 2C1, **Canada.**

Hugh de Souza

XRAL Laboratories, Don Mills, Ontario, M3B 3J4, **Canada.**

Diane Kelly

Lakefield Research Ltd., Lakefield, Ontario, K0L 2H0, **Canada.**

James Schweyer

Geoscience Laboratories, Sudbury, Ontario, P3E 6B5, **Canada.**

L. Paul Bedard

Université du Quebec à Chicoutimi, Chicoutimi, Quebec G7H 2B1, **Canada.**

Hailin Deng / Liang Qi

Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, Guizhou Province, **PR China.**

Ludmila Dempírová

Czech Geological Survey, Laboratories Barrandov, Prague 5 - Barrandov, **The Czech Republic.**

Sidsel Grundvig

Department of Earth Sciences, Aarhus University, DK-8000 Aarhus C, **Denmark.**

Jørgen Kystol

Geological Survey of Denmark and Greenland, DK-2400 Copenhagen NV, **Denmark.**

GeoPT7 Report

Tarmo Kiipli
Institute of Geology, Tallinn Technical University, 10143, Tallinn, **Estonia**.

Juha Virtasalo
GTK, Kemian Laboratorio, Geological Survey of Finland, FIN-96101 Rovaniemi, **Finland**.

Jean Claude Germanique
CEREGE . CNRS, Université Aix-Marseille III, 13545 Aix en Provence Cedex 04, **France**.

Jean-Louis Joron
Laboratoire Pierre Sûte, CE / Saclay, 91191 Gif sur Yvette Cedex, **France**.

Michel Robert
Centre Commune d'Analyses, Université de la Rochelle, 17000 La Rochelle, **France**.

Jean-Louis Bodinier
Université de Montpellier II, 34095 Montpellier Cedex 05, **France**.

Françoise Augustin
BRGM - service Analyse et Characterisation Minerale, 45060 Orleans Cedex, **France**.

Jean Samuel
Centre de Géochimie de la Surface, CNRS, 67084 Strasbourg Cedex, **France**.

Mireille Polvé / M. Valladon
Laboratoire de Géochimie, Université Toulouse 3, 31400 Toulouse, **France**.

Jean Carignan
SARM, CRPG, 54501 Vandoeuvre-lès-Nancy Cedex, **France**.

Paul Capiez
Université Claude Bernard Lyon 1, UMR 5570, 69622 Villeurbanne Cedex, **France**.

Guenter Matheis
Applied Geochemistry Laboratory, Technical University of Berlin, D-10587, Berlin, **Germany**.

Sven-Oliver Franz
Institute of Geology, Bonn University, 53115 Bonn, **Germany**.

J. Kühnel
Lurgi Umwelt GmbH, 60388 Frankfurt am Main, **Germany**.

Hiltrud Mueller-Sigmund
Institut für Mineralogie, Petrologie und Geochemie, Universität Frieberg, D-79104, **Germany**.

Gerald Hartmann
Universtat Göttingen, Geochemisches Institut, D-37077 Göttingen, **Germany**.

Stefan Pierdzig, Elke Benner, Manfred Böse, Joachim Koppen
CRB Analyse Service GmbH, D-37181 Hardegsen, **Germany**.

U. Rast and A. Andres
Bayerisches Geologisches Landesamt, D-80797 München, **Germany**.

P. Dulski
Geoforschungs Zentrum Potsdam, Telegrafenberg A50, D-14473 Potsdam, **Germany** .

G. Böttcher
Mecklenburg Vorpommern, D-19061 Schwerin, **Germany**.

Friedrich Grüner
Forschungs- und Materialprüfungsanstalt Baden Württemberg, 70569 Stuttgart, **Germany**.

A. Brockmann
Institut Fresenius, Chemische und Biologische Laboratorien GmbH, Taunusstein-Neuhof, **Germany**.

William Kwarteng
HuK Umweltlabor GmbH, 57482 Wenden, **Germany**.

K. Shivkumar
Department of Atomic Energy, Nagpur 440001, **India**.

Byoung Ouk Kim
Hankuk Glass Industries, Research Center, Incheon, 406-130, **Korea**.

Heung Soo Park
Central Research Institute, Korea Chemical Co. Ltd., Kyunggi-do, 449-910, **Korea**.

Sunwong Choi
Samsung Corning Ltd., Suwon, Kyungi-Do, 442 - 390, **Republic of Korea**.

G.K.D. Mazumdar
University Science Instrumentation Centre, Gauhati University, Guwahati 781014, **India**.

Abdelmalek Boussetta
Reminex - Centre de Recherche, Medina, Marrakech, **Maroc**.

Thea G. van Meerten
Interfacultair Reactor Instituut, 2629 JB Delft, **The Netherlands**.

B. van Os
Netherlands Institute of Applied Earth Sciences TNO, Utrecht, **The Netherlands**.

Ewa Popiolek and Piotr Paslawski
Polish Geological Institute, Central Chemical Laboratory, 00-975 Warsaw, **Poland**.

Maria Carlos Figueiredo
Centro Tecnológico da Cerâmica e do Vidro, P-3020 Coimbra, **Portugal**.

Fernando Castro
Tecminho-Laboratório de Análises Químicas, Universidade do Minho, Guimarães, **Portugal**.

Maria Eugénia Moreira
Laboratório do Instituto Geológico e Mineiro, 4465 S. Mamede de Infesta, **Portugal**.

Lev Petrov
Institute of Geochemistry, Siberian Branch RAS, Irkutsk 664033, **Russia**.

Evelina M. Sedykh
Central Analytical Laboratory, Vernadsky Institute of Geochemistry RAS, Moscow, **Russia**.

Galina M. Varshal
Vernadsky Institute of Geochemistry RAS, 117975, Moscow, **Russia**.

Irma A. Rostchina
Central Analytical Laboratory, Vernadsky Institute of Geochemistry RAS, Moscow, **Russia**.

I. Borine
VSEGEI - All Russia Geological Research Institute, 199106 St. Petersburg, **Russia.**

Daniela Mackovych
Geological Survey of Slovak Republic, 05240 Spisská Nová Ves, **Slovakia.**

Maria Fernanda Gazulla Barreda
Instituto de Tecnologia Cerámica, Campus Universitario Riu Sec, 12006 Castellón, **Spain.**

Pongpor Asnachinda
Department of Geological Sciences, Chiang Mai University, Chiang Mai 50200, **Thailand.**

David S. Wray
School of Earth and Environmental Sciences, The University of Greenwich, Kent, **UK.**

Timothy S. Brewer
Department of Geology, University of Leicester, Leicester, LE1 7RH, **UK.**

P.C. Webb / J.S. Watson
Department of Earth Sciences, The Open University, Milton Keynes, MK7 6AA, **UK.**

C.J.B. Gowing
British Geological Survey, Keyworth, Nottingham, NG12 5GG, **UK.**

Graham Oliver
Ceram Research, Penkhull, Stoke-on-Trent, ST4 7LQ, **UK.**

Kym E. Jarvis
NERC ICP-MS Facility, Kingston University, Kingston upon Thames, Surrey, KT1 2EE, **UK.**

J.N. Walsh
Department of Geology, Royal Holloway, University of London, Egham, Surrey, **UK.**

Rick Sanzolone
U.S. Geological Survey, Denver Federal Center, Denver, Colorado 80225-0046, **USA.**

Henry E. Francis
Kentucky Geological Survey, University of Kentucky, Lexington, KY 40506-0107, **USA.**

Jeff Thole
Geology Department, Macalester College, St Paul, Minnesota 55105, **USA.**

R.Michael Kroc
Minerals Technologies, Inc, Easton, PA 18042, **USA.**

Arthur R. Jurgensen
Savannah River Site, Aiken, SC 29808. **USA.**

Prof John Wolff
Department of Geology, Washington State University, Pullman, WA 99164-2812, **USA.**

Trinh Thi Le Thu
Analytical Experimental Center for Geology, Thanh Xuan, Hanoi, **Socialist Republic of Vietnam.**

Figure captions

Figure 1

GBPG-1 Garnet-biotite plagiogneiss: Data distribution charts for elements for which values were assigned. Horizontal lines show the limits for $-2 < z < 2$ for pure geochemistry labs (solid lines) and $-2 < z' < 2$ for applied geochemistry labs (pecked lines).

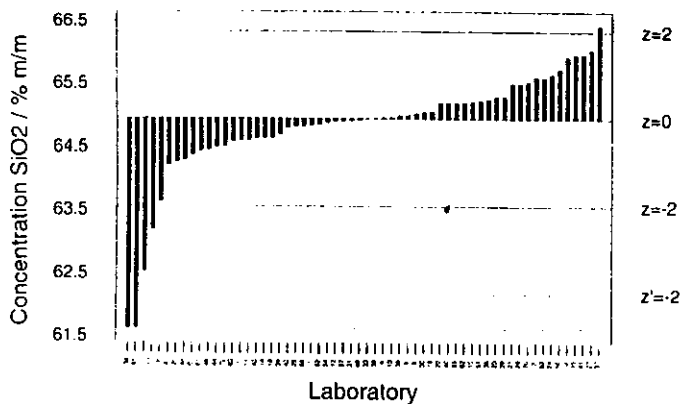
Figure 2

GBPG-1 Garnet-biotite plagiogneiss: Data distribution charts for elements for which values were not assigned. Horizontal lines show the limits for $-2 < z < 2$ for pure geochemistry labs (solid lines) and $-2 < z' < 2$ for applied geochemistry labs (pecked lines).

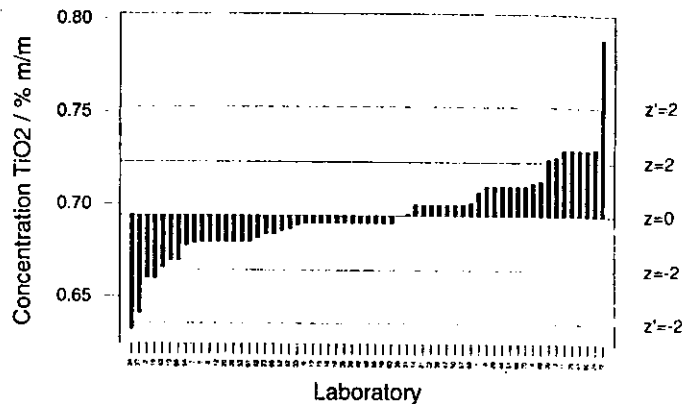
Figure 3

GBPG-1 Garnet-biotite plagiogneiss: Multiple z-score charts for laboratories participating in the GeoPT7 round. Symbols indicate whether or not an elemental result complies with the $-2 < z < +2$ criteria. Satisfactory data are plotted as ' '. Data for other categories are plotted as follows: $z < -3$ (▼), $-3 < z < -2$ (▼), $+2 < z < +3$ (▲), $z > +3$ (▲).

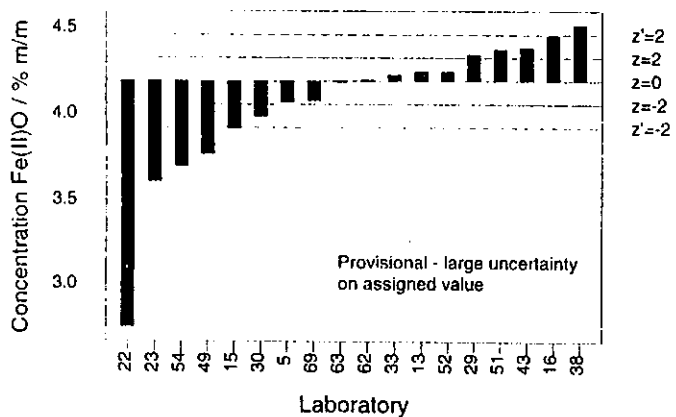
GeoPT7 - Barchart for SiO₂



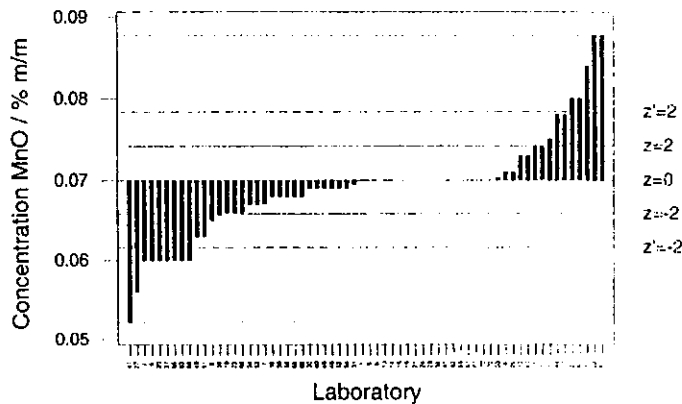
GeoPT7 - Barchart for TiO₂



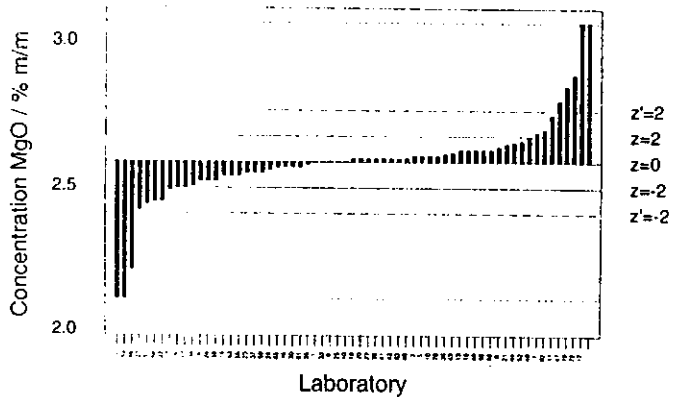
GeoPT7 - Barchart for Fe(II)O



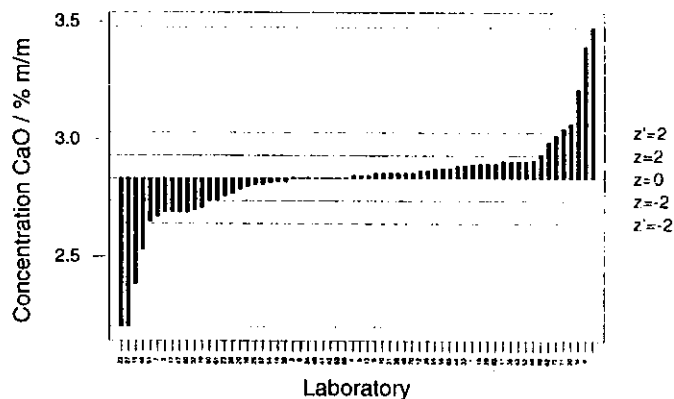
GeoPT7 - Barchart for MnO



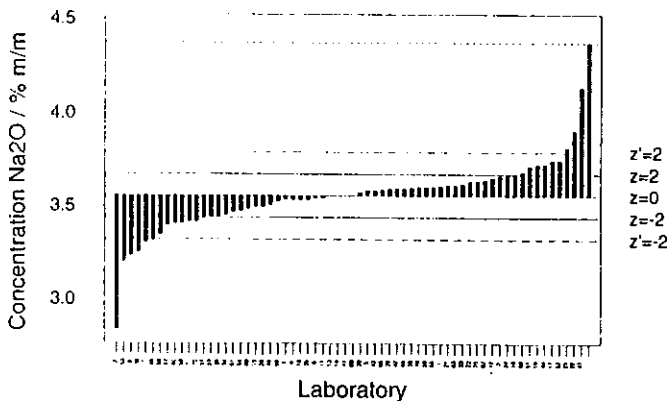
GeoPT7 - Barchart for MgO



GeoPT7 - Barchart for CaO



GeoPT7 - Barchart for Na₂O



GeoPT7 - Barchart for K₂O

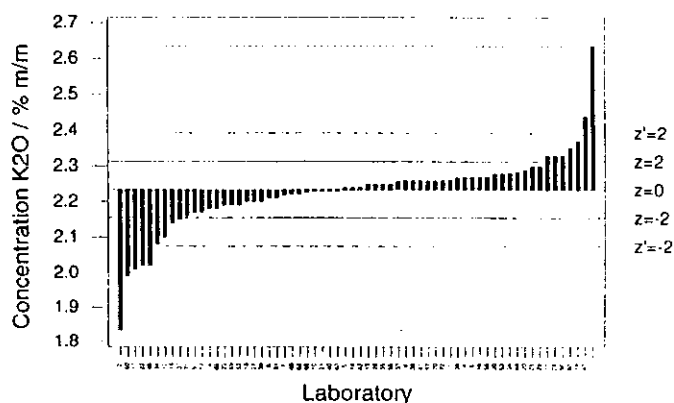
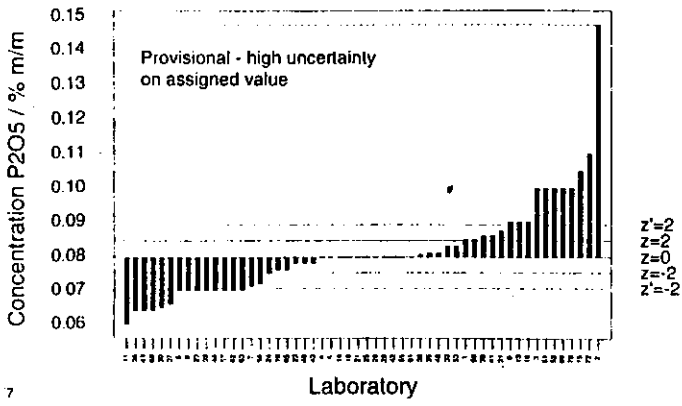
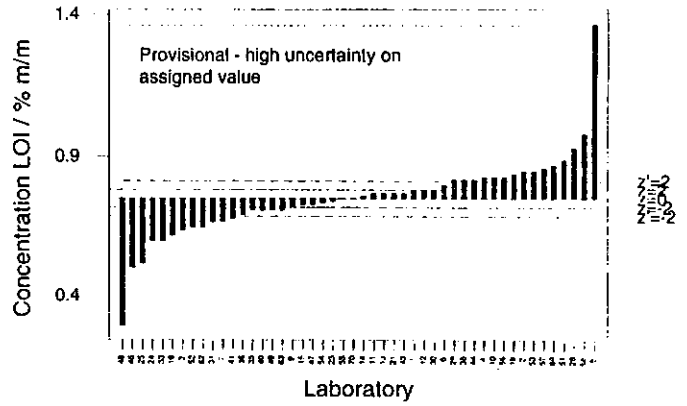


Figure 1

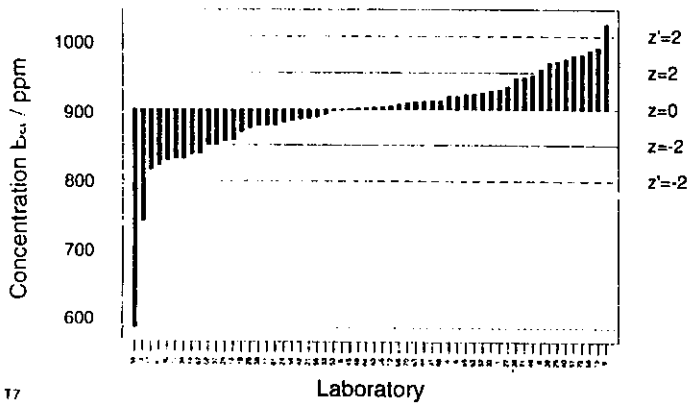
GeoPT7 - Barchart for P2O5



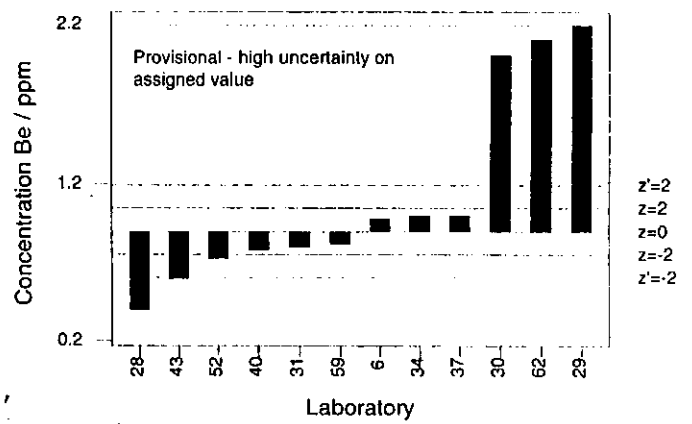
GeoPT7 - Barchart for LOI



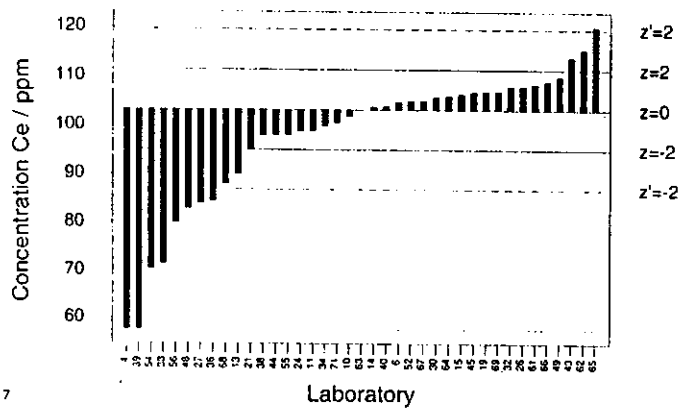
GeoPT7 - Barchart for Ba



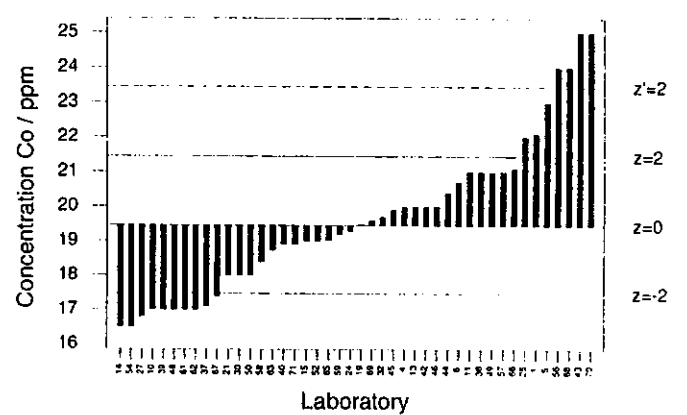
GeoPT7 - Barchart for Be



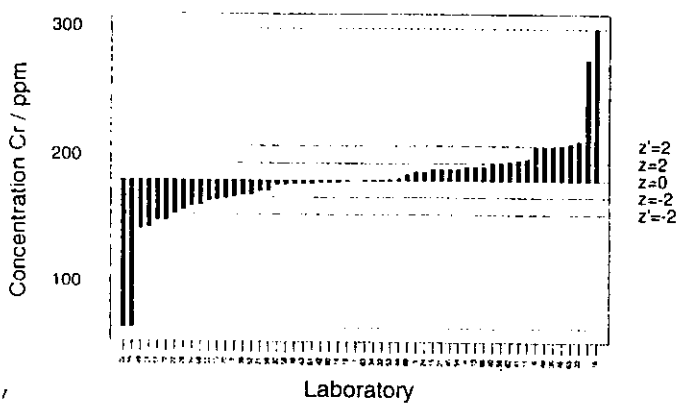
GeoPT7 - Barchart for Ce



GeoPT7 - Barchart for Co



GeoPT7 - Barchart for Cr



GeoPT7 - Barchart for Cs

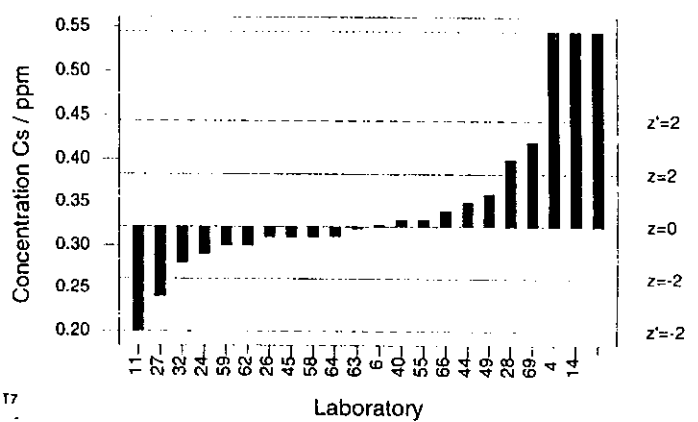
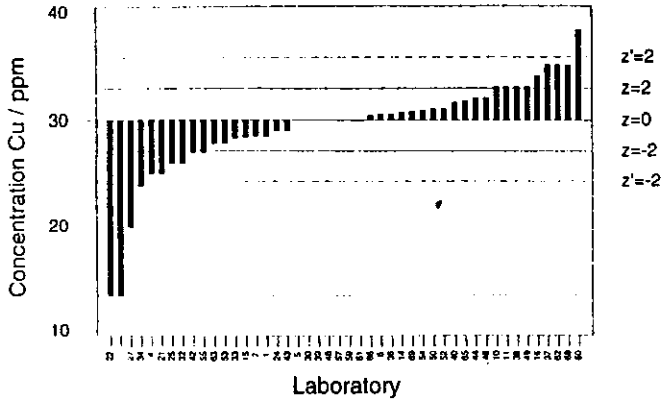
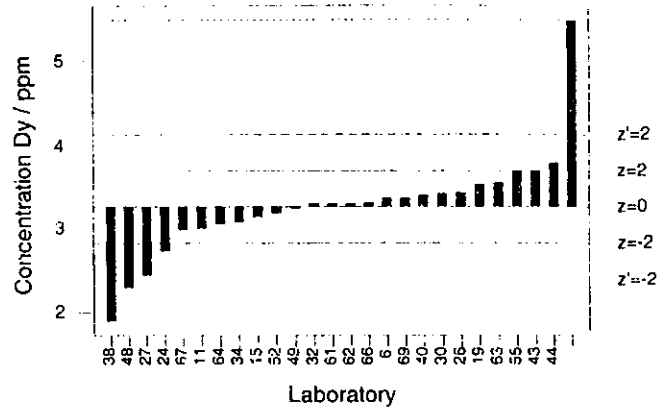


Figure 1 (continued)

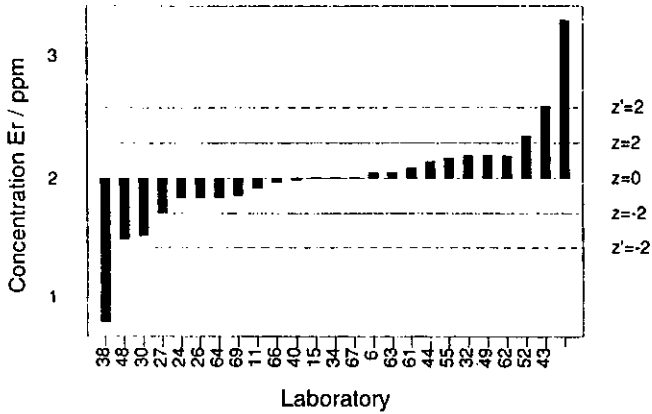
GeoPT7 - Barchart for Cu



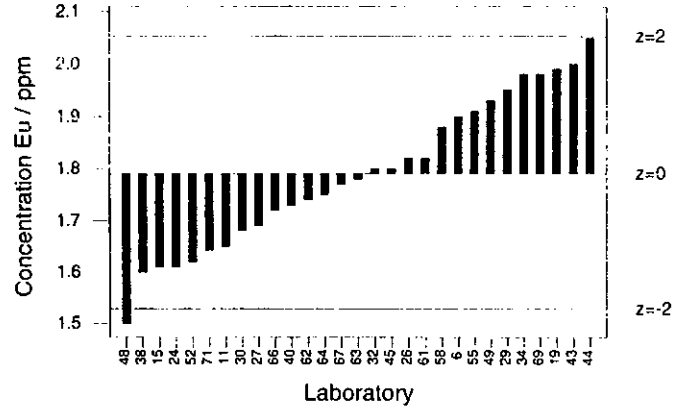
GeoPT7 - Barchart for Dy



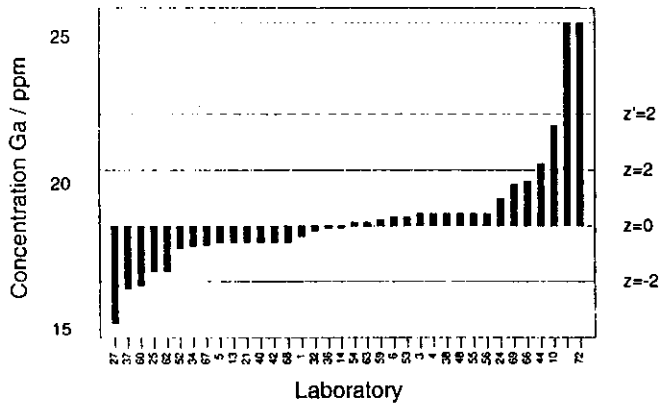
GeoPT7 - Barchart for Er



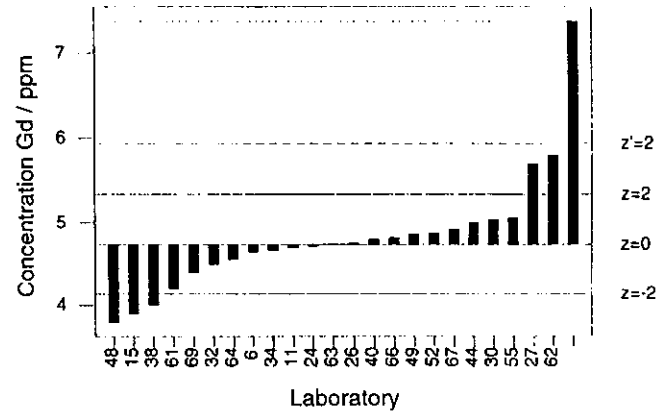
GeoPT7 - Barchart for Eu



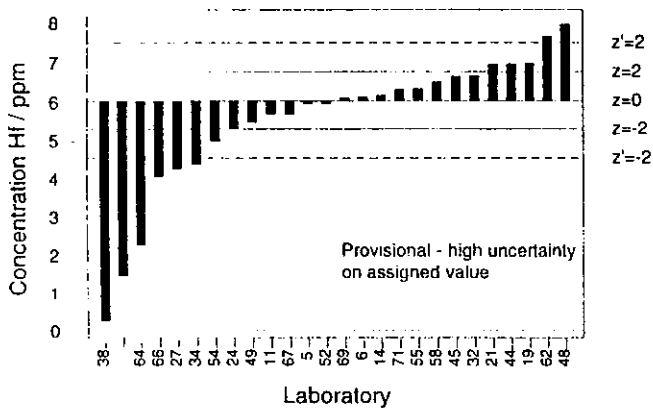
GeoPT7 - Barchart for Ga



GeoPT7 - Barchart for Gd



GeoPT7 - Barchart for Hf



GeoPT7 - Barchart for Ho

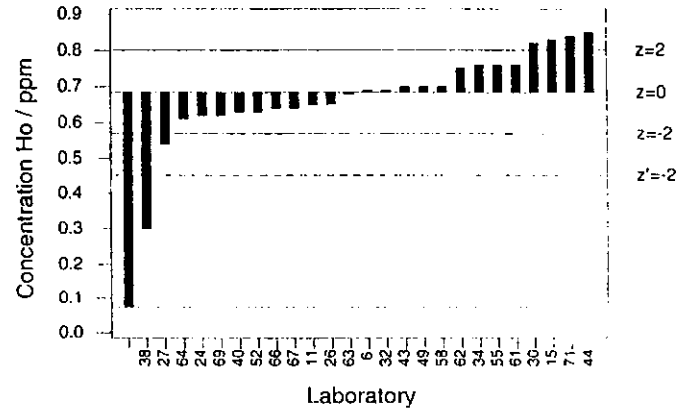
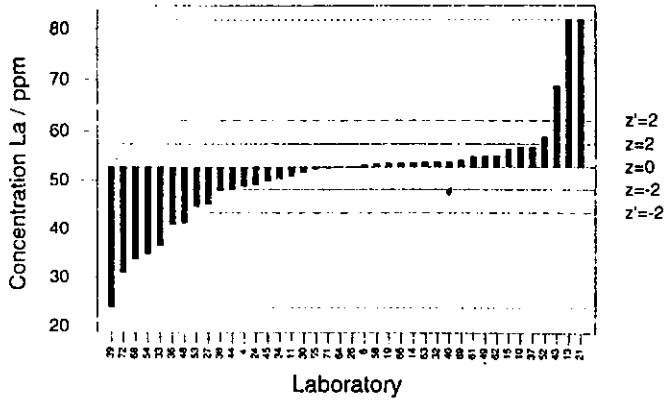
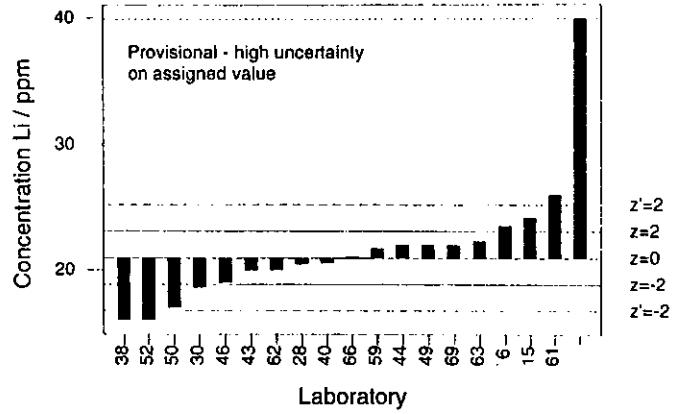


Figure 1 (continued)

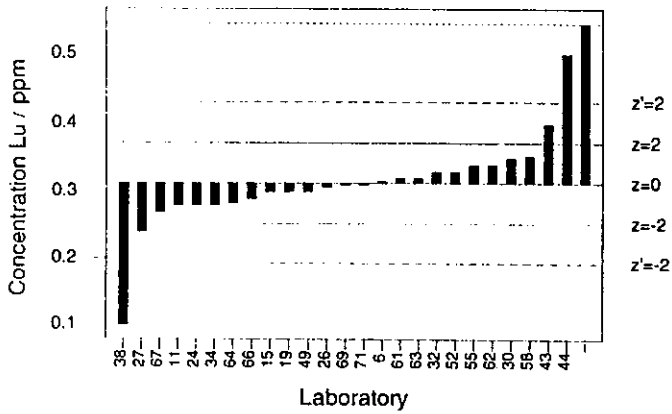
GeoPT7 - Barchart for La



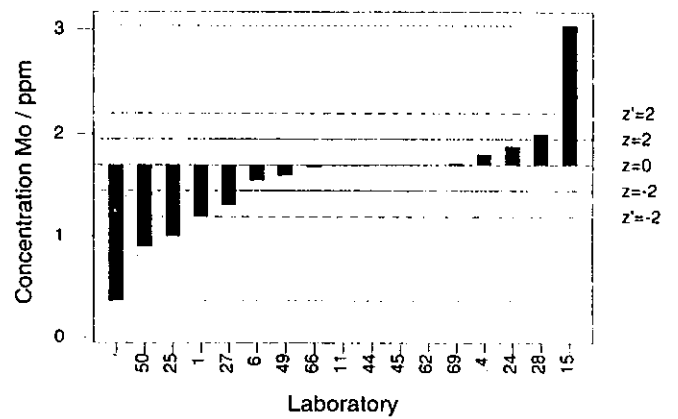
GeoPT7 - Barchart for Li



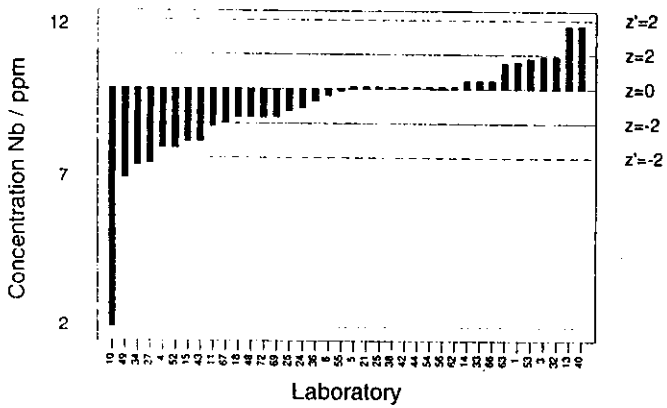
GeoPT7 - Barchart for Lu



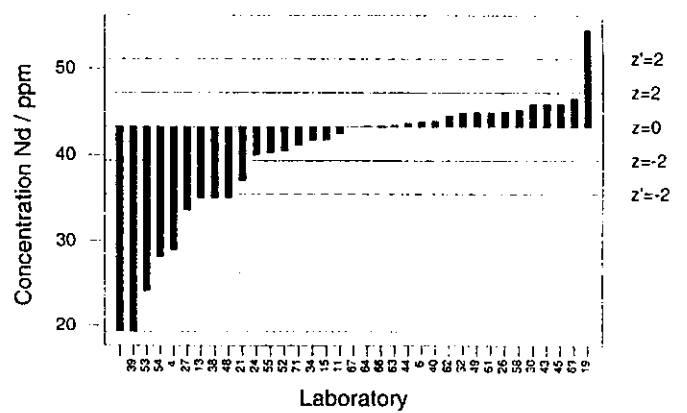
GeoPT7 - Barchart for Mo



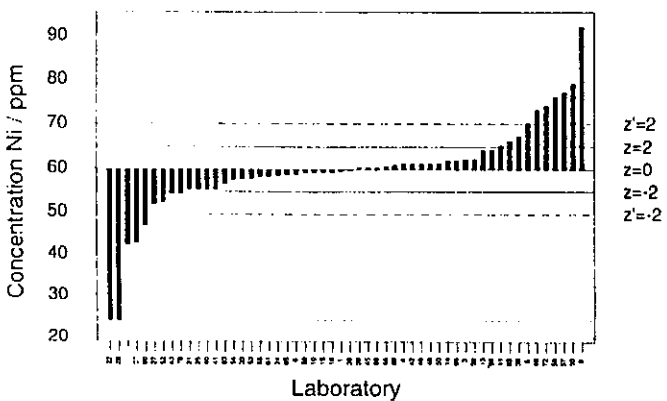
GeoPT7 - Barchart for Nb



GeoPT7 - Barchart for Nd



GeoPT7 - Barchart for Ni



GeoPT7 - Barchart for Pb

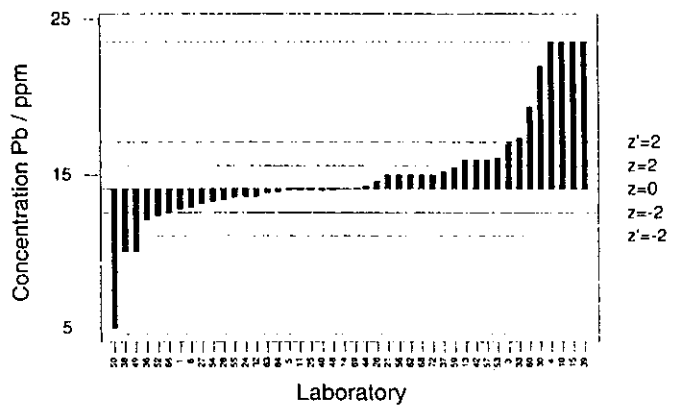
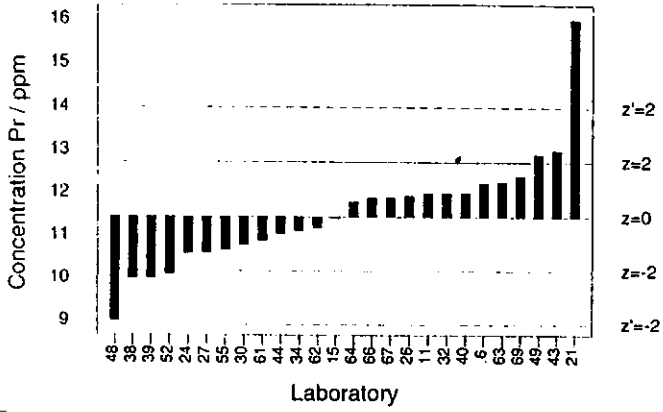
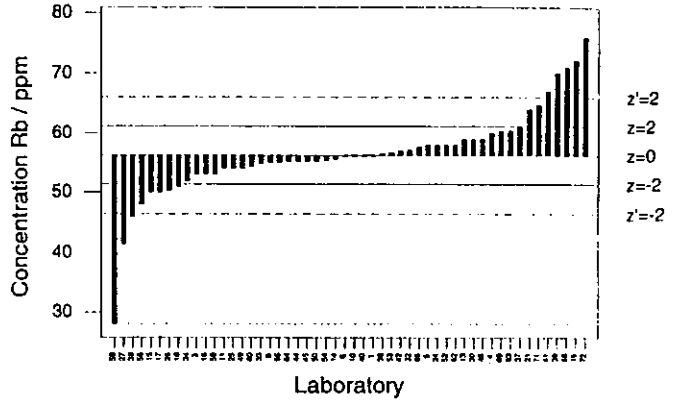


Figure 1 (continued)

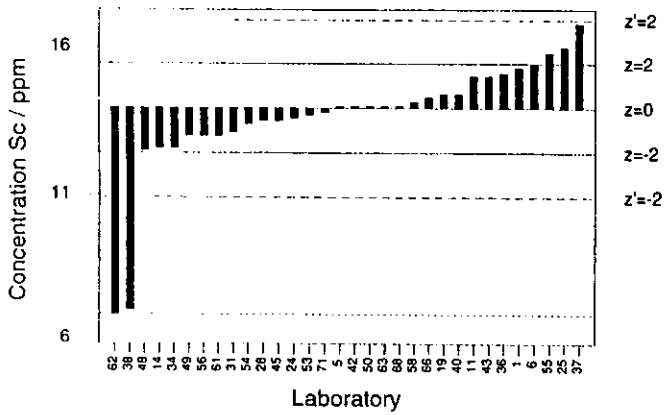
GeoPT7 - Barchart for Pr



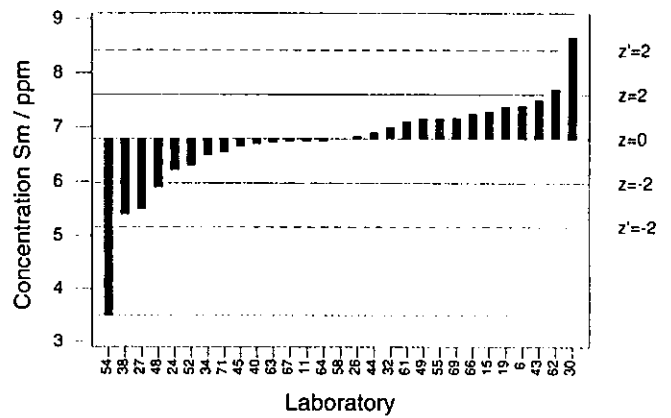
GeoPT7 - Barchart for Rb



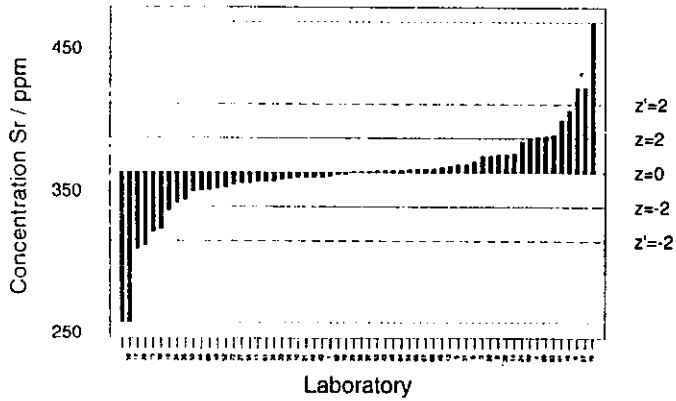
GeoPT7 - Barchart for Sc



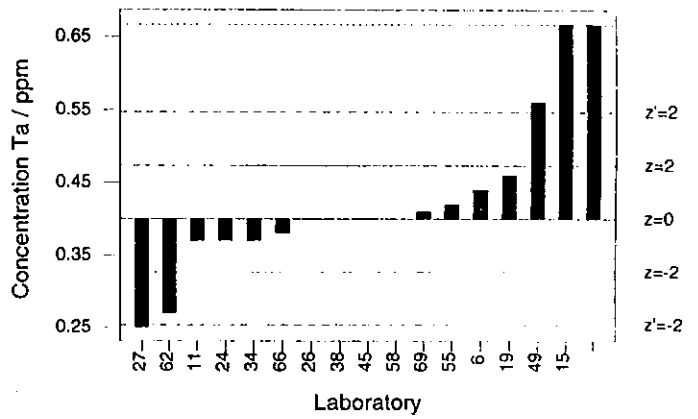
GeoPT7 - Barchart for Sm



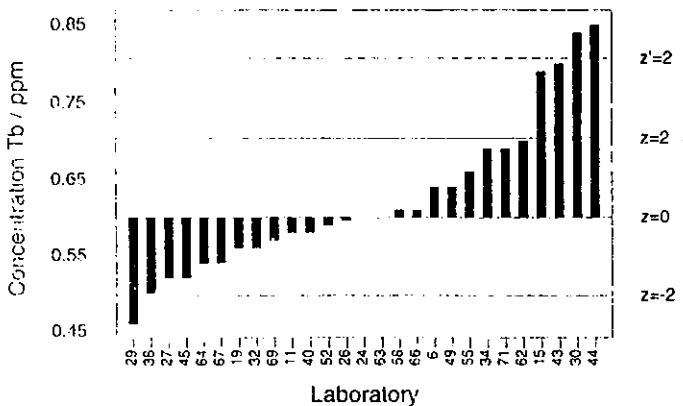
GeoPT7 - Barchart for Sr



GeoPT7 - Barchart for Ta



GeoPT7 - Barchart for Tb



GeoPT7 - Barchart for Th

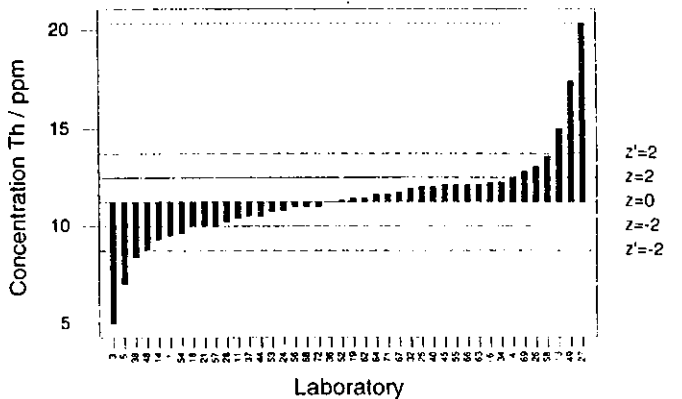
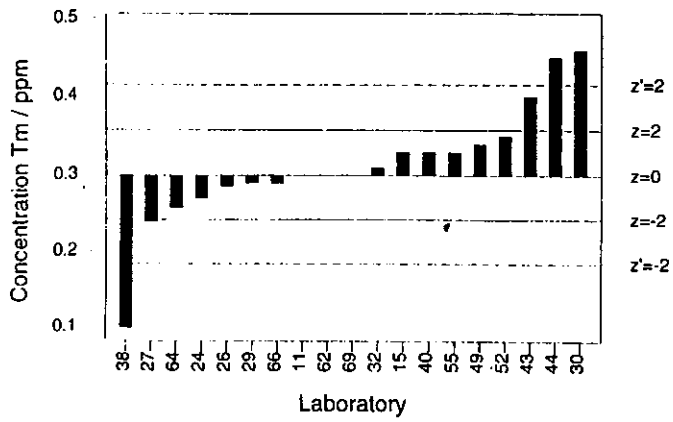
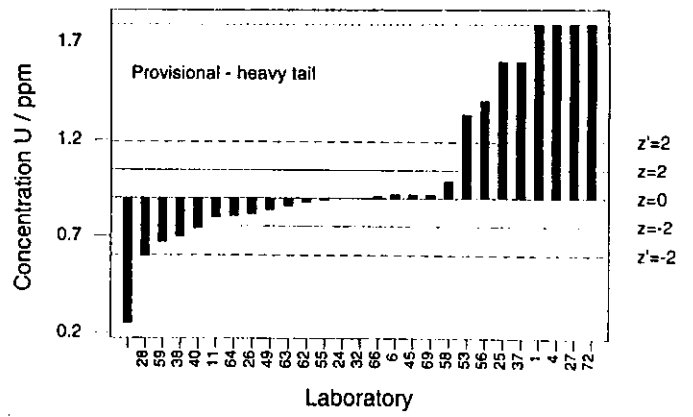


Figure 1 (continued)

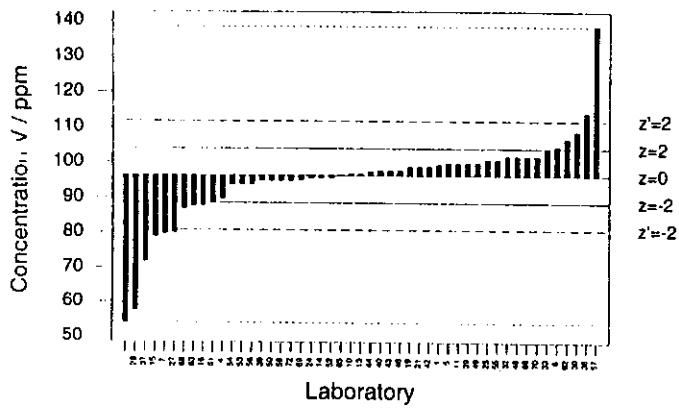
GeoPT7 - Barchart for Tm



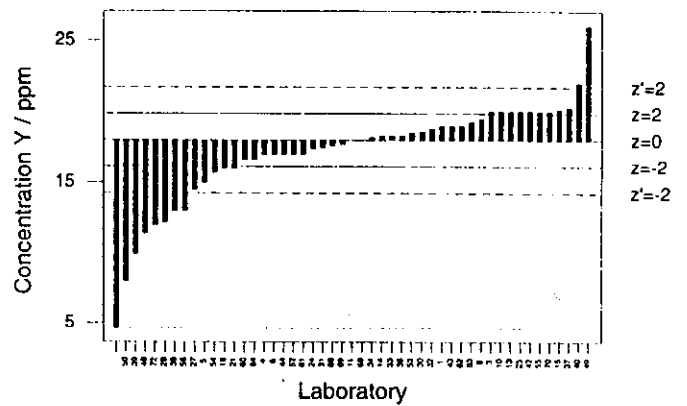
GeoPT7 - Barchart for U



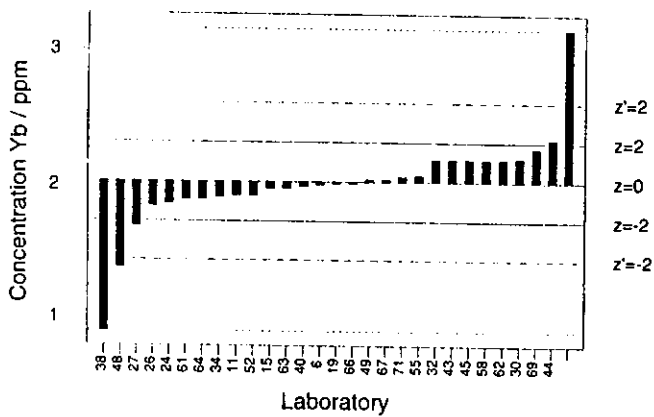
GeoPT7 - Barchart for V



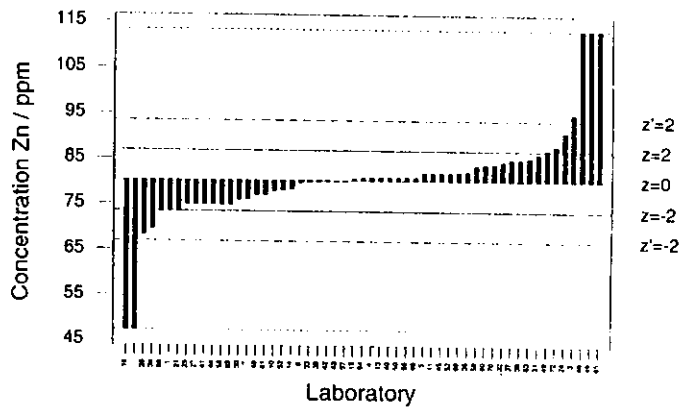
GeoPT7 - Barchart for Y



GeoPT7 - Barchart for Yb



GeoPT7 - Barchart for Zn



GeoPT7 - Barchart for Zr

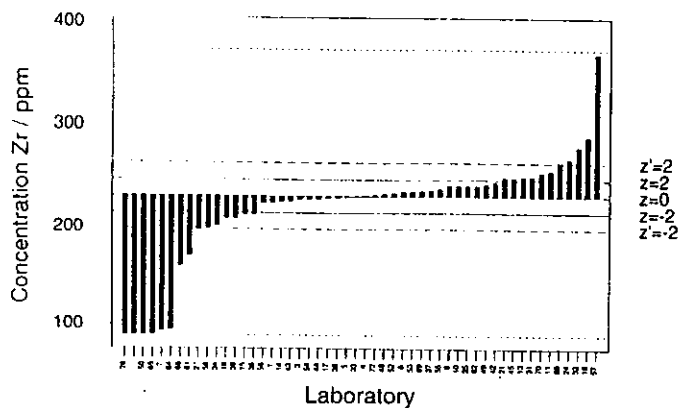
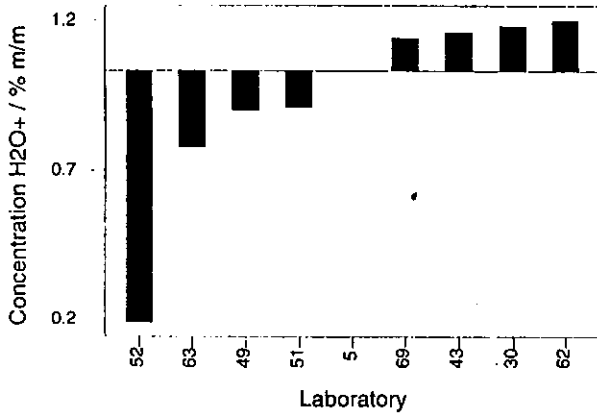
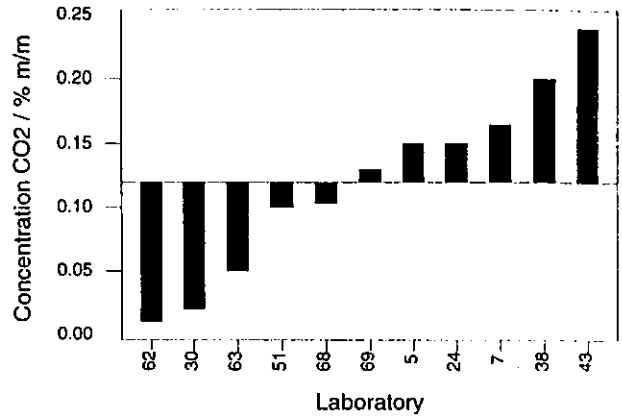


Figure 1 (continued)

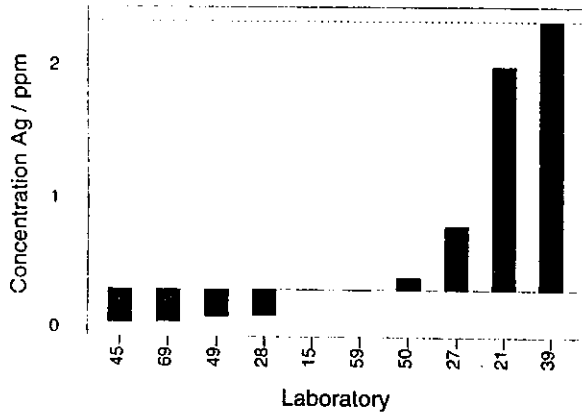
GeoPT7 - Barchart for H2O+



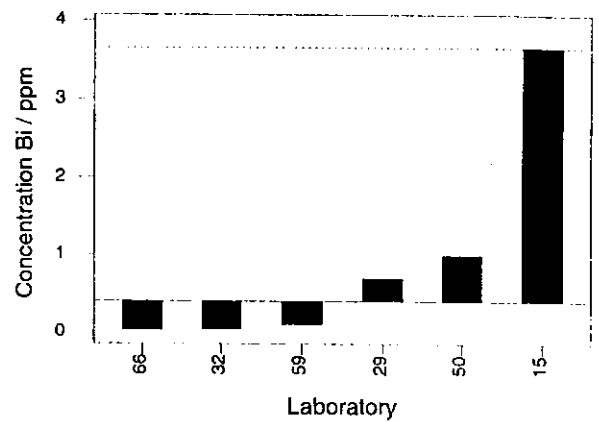
GeoPT7 - Barchart for CO2



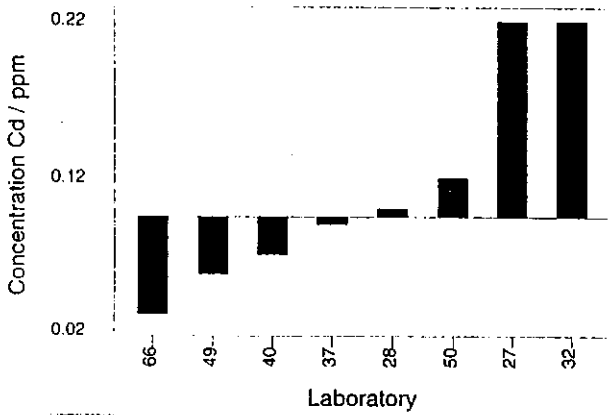
GeoPT7 - Barchart for Ag



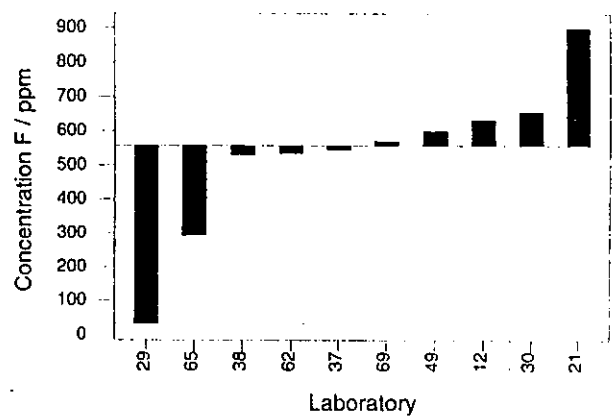
GeoPT7 - Barchart for Bi



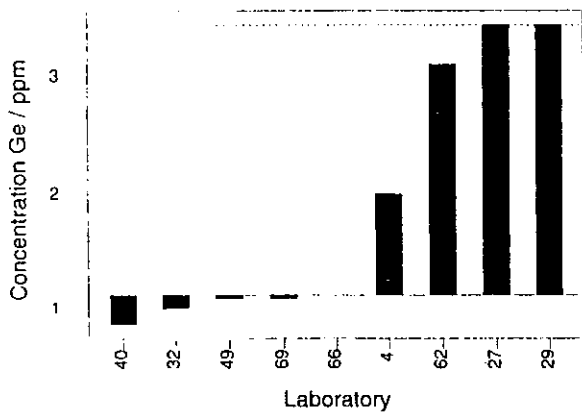
GeoPT7 - Barchart for Cd



GeoPT7 - Barchart for F



GeoPT7 - Barchart for Ge



GeoPT7 - Barchart for Hg

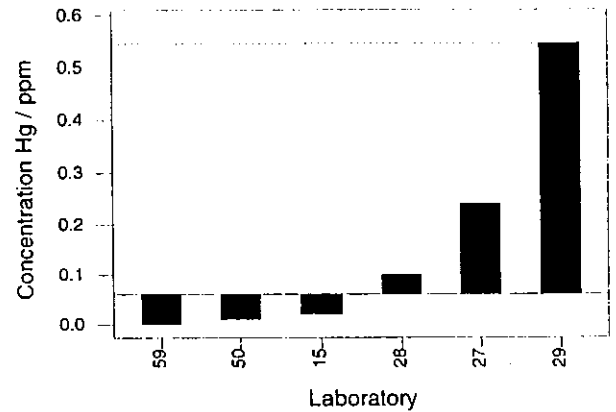
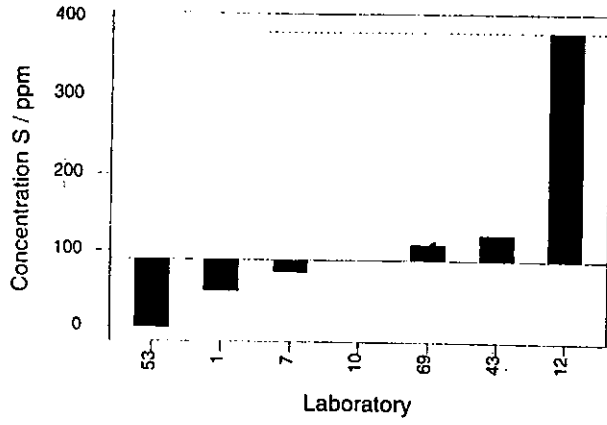
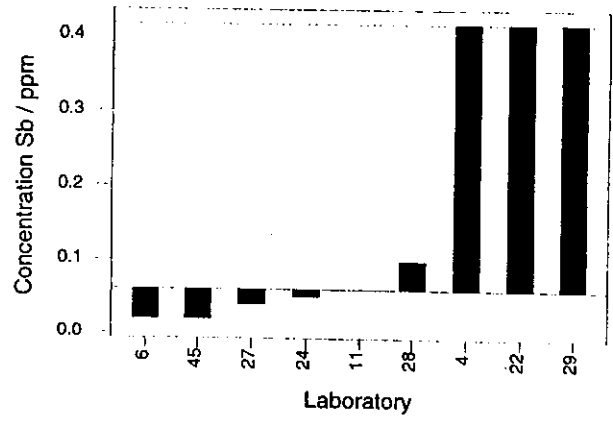


Figure 2

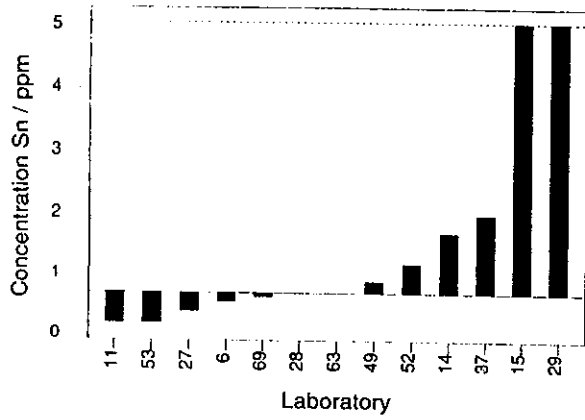
GeoPT7 - Barchart for S



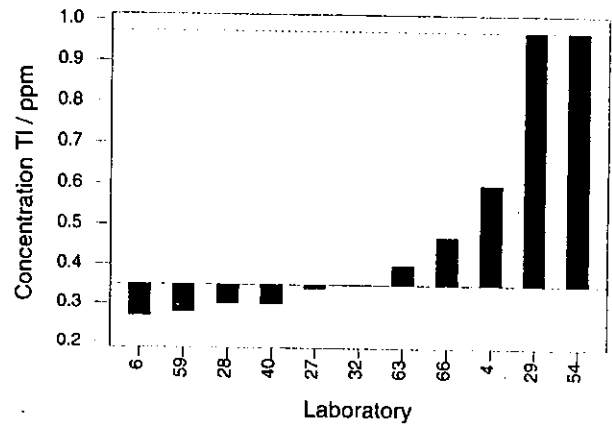
GeoPT7 - Barchart for Sb



GeoPT7 - Barchart for Sn



GeoPT7 - Barchart for Tl



GeoPT7 - Barchart for W

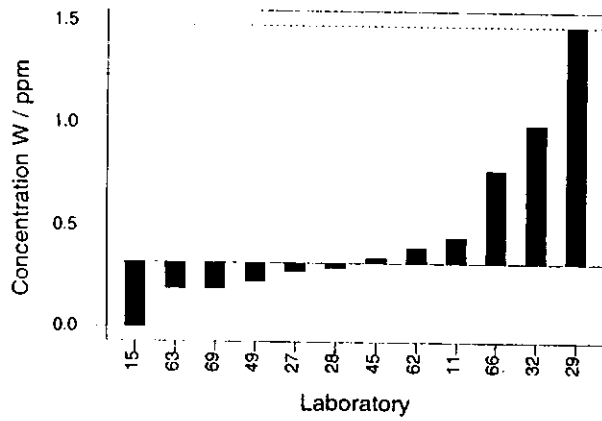
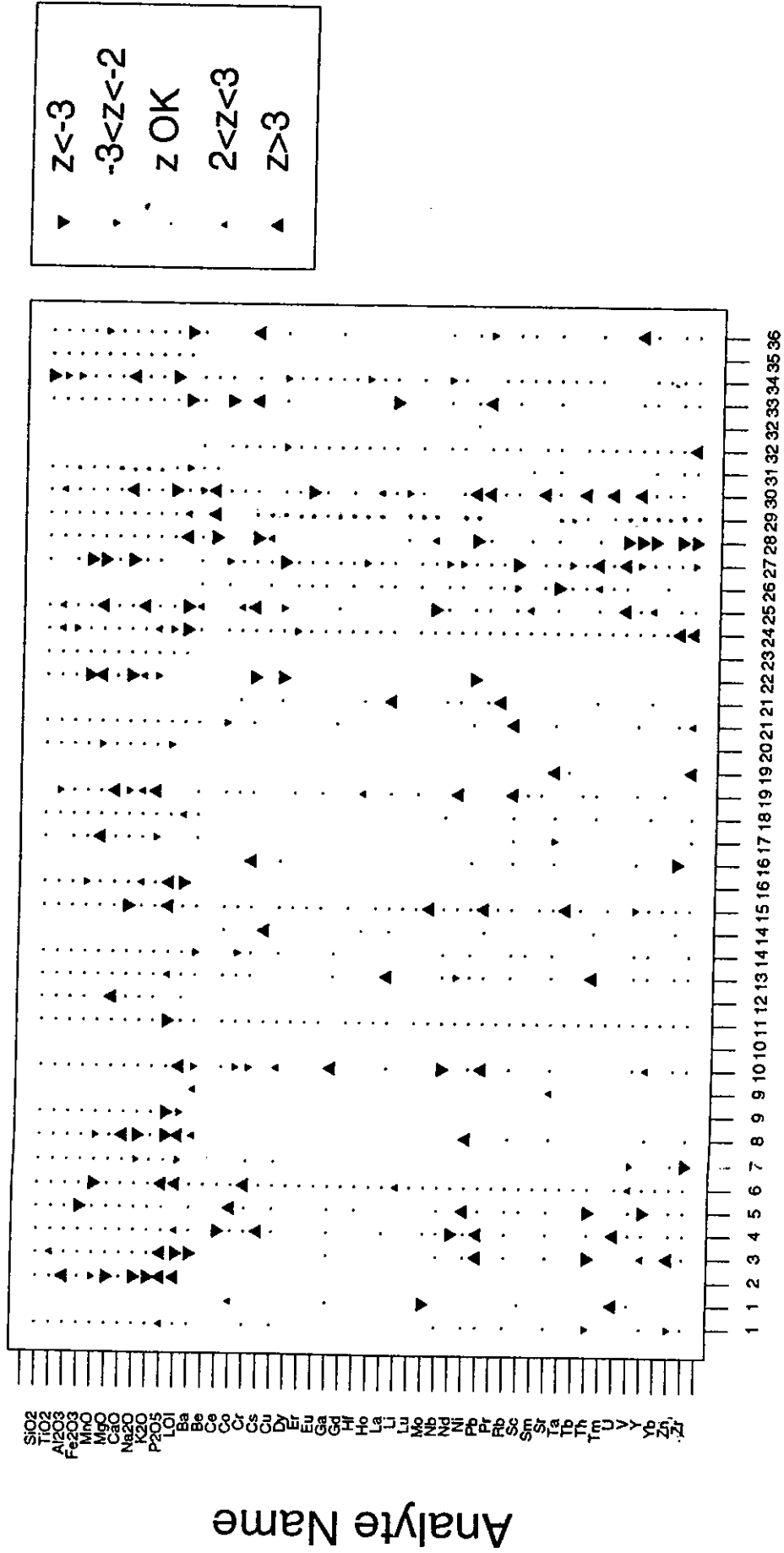


Figure 2 (continued)

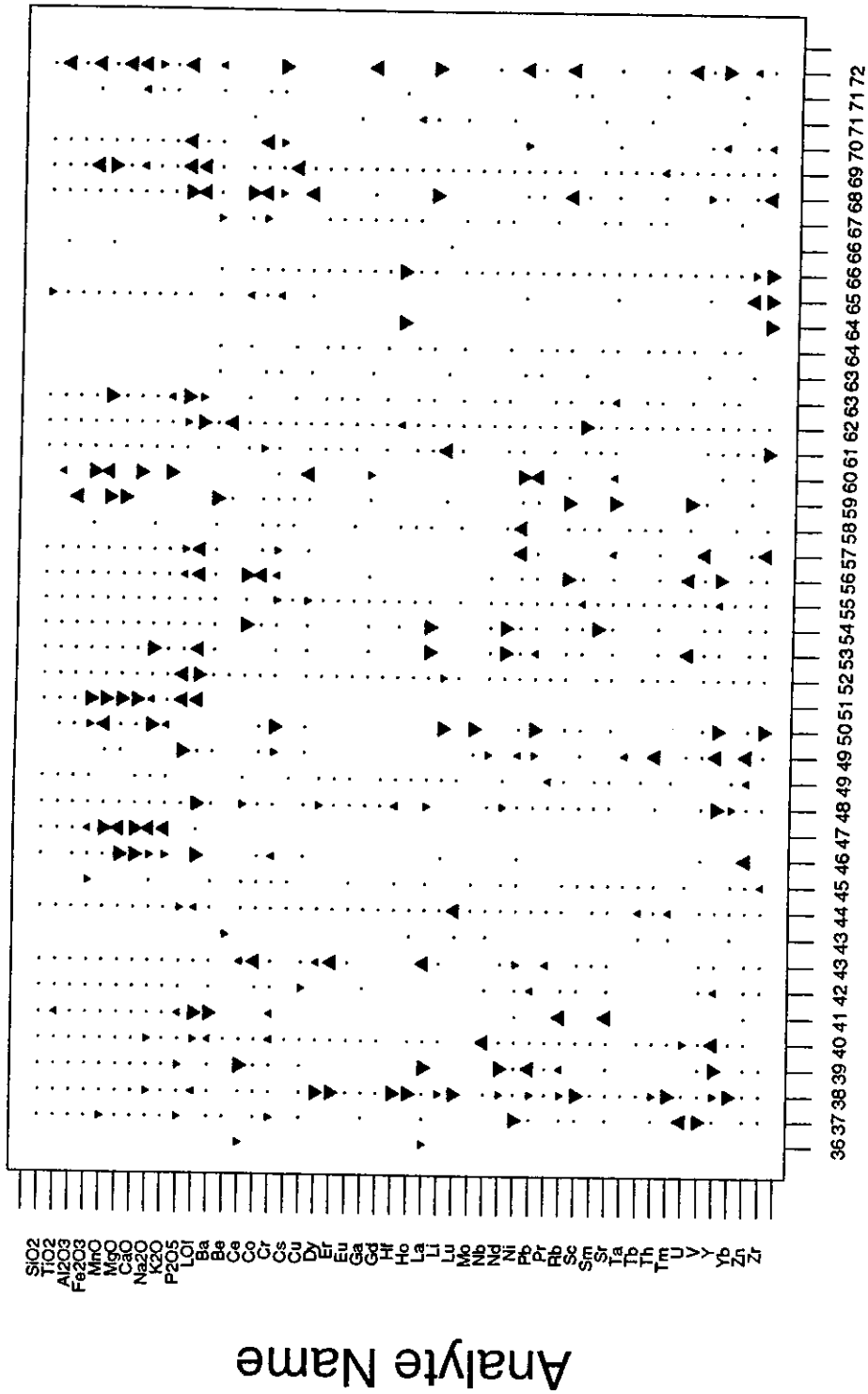
GeoPT - Multiple z-score Chart



Laboratory Identity Code

Figure 3

GeoPT - Multiple z-score Chart



Laboratory Identity Code

Figure 3 (continued)