GEOPT8 - AN INTERNATIONAL PROFICIENCY TEST FOR ANALYTICAL GEOCHEMISTRY LABORATORIES - REPORT ON ROUND 8 / February 2001 (OU-4 Penmaenmawr microdiorite).

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Abstract

Results are presented for round eight, GeoPT8, of the international proficiency testing programme for analytical geochemistry laboratories. The sample distributed for this round was OU-4 Penmaenmawr microdiorite, a proficiency testing sample collected and prepared by The Open University. 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 eighth round of the international proficiency testing programme, GeoPT8, was conducted in a similar manner to earlier rounds. The programme is designed to be part of the routine 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. These assigned values were estimated by robust statistical analysis of all the contributed data. By examining the magnitude of the z-score, participating laboratories can decide whether the quality of their data is satisfactory in relation to both their 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 8: M. Thompson (Chair), P.J. Potts (Secretary), J.S. Kane, P.C Webb and J.S. Watson.

Sample: OU-4 is a microdiorite which was collected from Graig Llwyd Quarry, Penmaenmawr, North Wales. (UK grid reference SH 715 750). The igneous body which comprises the Penmaenmawr microdiorite is a minor intrusion, oval in shape and 3 x 1.5 km^2 in size. It is thought to be part of the Ordovician-age Llewelyn volcanic group, located near Conway, on the North Wales coast. The rock is fine grained with an average crystal size of 0.2 mm, consisting of plagioclase feldspar, chlorite, clinopyroxene and quartz. A small number of phenocrysts, mainly plagioclase, range up to 2 mm in length. Although this rock was originally chilled rapidly, the igneous mineralogy has been partially over-printed as a result of low-grade greenschist facies metamorphism.

A broken block of fresh rock was selected from the quarry floor. Sample preparation followed procedures at the Open University that have been described in detail in earlier proficiency testing reports (see in particular the GeoPT1 report). The sample was formally tested for homogeneity by selecting at random ten packets of the sample prepared for distribution, and analysing them by WD-XRF at the OU. An analysis of the results is listed in Appendix 2.

Timetable for GeoPT8:

Distribution of sample: September 2000.

Deadline for submission of analytical results: 15th December 2000.

Distribution of preliminary report: February 2001

Submission of results

Results submitted by the seventy-seven laboratories that participated in this round are listed in Table 1. All these data contributed to the full assessment of assigned values as well as the calculation of z-scores.

Assigned values

Following procedures described in earlier rounds, a robust statistical procedure was used 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 39 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 :

SiO_2, TiO_2, Al_2O_3, Fe_2O_3T, FeO, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, LOI, Ba, Be, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Li, Lu, Nb, Nd, Ni, Pb, Pr, Rb, Sb, Sc, Sm, Sn, Sr, Ta, Tb, Th, Tl, 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:

H_2O^+, CO_2, Ag, As, Au, Bi, Br, Cd, Cl, F, Ge, Hg I, In, PGE, Mo, Re, S, Se, Te, W.

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

(i) Insufficient number of contributed results.

(ii) Results showing a strong positive skew in the frequency distribution diagram, 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.

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 precision and accuracy, sometimes at the expense of a reduced sample throughput rates.

Data quality 2 for applied geochemistry laboratories, where, although precision and accuracy are 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:

$[H_a] = k.[X_a]^{0.8495}$

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 overall 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 judge their overall performance in 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 GeoPT9 round, the sample for which will be distributed during March 2001.

Acknowledgments

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Appendix 1

Publication status of proficiency testing reports

GeoPT1

Thompson M., Potts P.J., Kane J.S. and Webb P.C. (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.C. 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

Potts P.J., Thompson M., Kane J.S., Webb P.C. and Carignan J. (2000)
GEOPT6 - an international proficiency test for analytical geochemistry laboratories - report on round 6 (OU-3: Nanhoron microgranite) and 6A (CAL-S: CRPG limestone). International Association of Geoanalysts: Unpublished report.

GeoPT7

Potts P.J., Thompson M., Kane J.S., and Petrov L.L. (2000)
GEOPT7 - an international proficiency test for analytical geochemistry laboratories - report on round 7 (GBPG-1 Garnet-biotite plagiogneiss). International Association of Geoanalysts: Unpublished report.

Appendix 2

GeoPT8 Homogeneity Report

Homogeneity testing was based on analysis of duplicate test portions taken from each of 10 packets. These samples were analysed in duplicate by WD-XRF at the Open University for the major and minor elements (SiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, TiO_2, 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 the major/minor and trace elements were analysed using standard analysis of variance (ANOVA) procedures.

The power of the ANOVA test depends on the inherent measurement precision of the individual elements determined and is poorest for those elements whose concentrations approach the method detection limits. Among the trace elements for the GeoPT8 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-5dl). Homogeneity conclusions for these elements were not reached because measurements could not be made with adequate precision. Homogeneity is demonstrated most reliably for Rb, Sr, Y, Zr, V, Cr, and Zn, all occurring at concentrations >10 times the detection limit. Ba, is also present at a concentration >10dl but gave inconsistent results indicating that there were significant differences between splits when test portions were prepared as powder pellets, but not so when tested in glass discs. Homogeneity is also demonstrated for the trace elements occurring at concentrations between 5 and 10 times the detection limit, Nb, Co, Ni, Cu, and Ga.

As can be seen from the 'probability homogeneous' data listed in the tables below, statistically significant differences between packets were detected at the 95% confidence level for SiO_2, Fe_2O_3, CaO determined in the major oxide package and Ba determined as a trace element. The homogeneity results for Ba as measured in the powder pellets are probably more reliable, because detection limit considerations affect the power of the test for Ba as determined in the glass disc.

The differences noted for Fe_2O_3, CaO and Ba are not significant at the 99% level, while for SiO_2 they are. However, taking account of the mineralogical nature of the sample, any analytical technique, if sufficiently precise, may produce results that show significant differences between packets. In the context of proficiency testing, the important issue is whether these differences are likely to have any significant effect on the analytical results submitted by laboratories and the derived z-scores. As a general rule, if the standard deviation that characterises differences between splits ($s_{sampling}$) is less than 0.4 of the target precision (H_a), the effect on proficiency test results can be considered to be insignificant (Thompson and Lowthian 1996, Analyst, 121, 1593-1596). The results listed in the tables below indicate that this critical ratio is not exceeded by the results of the homogeneity measurements, although the Ni results lie at this limit On this basis, the sample can be considered fit-for-purpose as far as homogeneity for the GeoPT8 round is concerned.

Summary of homogeneity analysis using WD-XRF results for major oxides on glass disks and trace elements on powder pellets.

Oxide	Mean (% *m/m*)	H_a (% *m/m*)* for data quality: 1	2	$s_{sampling}$ (% *m/m*)	Probability homogeneous	$s_{sampling}$ / H_a
SiO_2	63.29	0.678	1.36		0.00009	
Al_2O_3	14.86	0.198	0.395		0.9978	
Fe_2O_3	5.79	0.089	0.179	0.0094	0.0106	0.11
MgO	2.52	0.041	0.081	0.0031	0.146	0.08
CaO	4.52	0.072	0.143	0.0047	0.0345	0.07
Na_2O	3.66	0.060	0.119		0.152	
K_2O	2.71	0.009	0.0178		0.079	
MnO	0.139	0.0038	0.0076		0.806	
TiO_2	0.771	0.0160	0.0320	0.0019	0.0581	0.12
P_2O_5	0.175	0.005	0.010	0.0009	0.524	0.17
Ba	*0.0360*	*0.0012*	*0.0024*	*0.0002*	*0.213*	*0.19*

Element	Mean ($\mu g\ g^{-1}$)	H_a ($\mu g\ g^{-1}$)* for data quality: 1	2	$s_{sampling}$ ($\mu g\ g^{-1}$	Probability homogeneous	$s_{sampling} / H_a$
Rb	100.4	3.9	7.9		0.052	
Sr	99.1	4.0	8.0	0.20	0.150	0.05
Y	49.1	2.1	4.2	0.14	0.355	0.07
Zr	195.5	7.1	14.1		0.312	
Ba	356.2	11.9	23.8	2.62	0.042	0.22
V	79.1	3.4	6.8	0.42	0.598	0.07
Cr	55.4	2.4	4.8		0.344	
Zn	64.4	2.9	5.9		0.276	
Nb	12.8	0.7	1.4	0.16	0.588	0.23
Co	15.0	0.7	1.5		0.077	
Ni	21.1	1.1	2.1	0.43	0.143	0.40
Cu	24.0	1.3	2.7	0.41	0.096	0.31
Ga	16.2	0.9	1.8		0.094	

*H_a data taken from Table 2. Mean is the mean of the XRF homogeneity data.

Probability homogeneous data are representative at 95% confidence.

Figure captions

Figure 1

GeoPT8 - OU-4 Penmaenmawr microdiorite: 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

GeoPT8 - OU-4 Penmaenmawr microdiorite: 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

GeoPT8 - OU-4 Penmaenmawr microdiorite: Multiple z-score charts for laboratories participating in the GeoPT8 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 (▲).

Table 4
Analysts and laboratories participating in the GeoPT8 proficiency testing round.

John Pyke
Australian Geological Survey Organisation, Canberra City,ACT, **Australia.**

Helen Waldron
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Table 1 GeoPT8

OU-4: Penmaenmawr microdiorite - Results submitted to the GeoPT8 round

Round identifier		I1	I2	I3	I3	I4	I5	I5	I6	I7	I7	I8	I8	I9	I10	I11	I11	I12	I13	I14	I15	I16	I17	I18	I19	I20	I20	I21	I22	I23	I23	I24
Technique codes		X	X	X	X	X	M	M	A,M	A,ign, X,T	A,ign, X,T	I	I	A	X,ign	X	X	M,X	X	M,X	M,V, X	M,X	A,M	ign, T,X	X	X	X	IC,M, T,X	X	M	M	AA, A,T,X
Test portion (g)		0.4-5	1	1.2-10	10	0.5	0.1	0.1	0.1	0.2-7.5	0.2-7.5	1.0-10	1.0-10	0.5-1	0.1-2	1.6	1.6	0.28-10	1-6.5	1	0.2-7	0.1-10	0.25	0.3-5.4	0.8-3	0.6-6	0.6-6	0.04-10	5	0.1	0.1	0.01-0.7
Data quality		2	2	1	2	1	1	2	2	1	2	1	2	2	2	1	2	1	1	2	1	1	2	2	2	1	2	1	2	1	2	1
SiO2	% m/m	63.4	65.8	63.22		63.7			61.8	63.46				62.7	62.82	63.48		64.103	63.44	61.66	63.58	63.49	61.27	63.34	63.65	63.63		63.28	57.6			63.54
TiO2	% m/m	0.791	0.82	0.77		0.77			0.78	0.79				0.76	0.7605	0.747		0.766	0.76		0.805	0.76	0.753	0.749	0.7642	0.79		0.79	0.72			0.77
Al2O3	% m/m	14.93	15.1	14.78		14.9			15.5	14.86				14.5	14.72	0.747		14.96	14.80	15.71	14.91	14.85	14.51	14.92	14.92	14.82		14.91	13.2			14.9
Fe2O3	% m/m	5.86	6.17	5.798		5.81			6.2	5.88			5.53	6.1	5.807	0.747		5.817	5.82	6.26	6.033	5.75	5.968	5.77	5.878	5.9		5.87	5.94			5.88
Fe(II)O	% m/m									4.62								4.56			4.52			4.58				4.65				4.58
MnO	% m/m	0.14	0.14	0.14		0.14			0.141	0.149				0.14	0.136	0.146		0.143	0.136	0.11	0.163	0.13	0.142	0.141	0.1450	0.14		0.14	0.127			0.14
MgO	% m/m	2.27	2.25	2.28		2.30			2.47	2.34				2.33	2.315	2.32		2.326	2.28	2.09	2.292	2.28	2.331	2.24	2.275	2.23		2.3	2.56			2.29
CaO	% m/m	4.49	4.62	4.547		4.47			4.8	4.55			4.52	4.6	4.372	2.32		4.507	4.48	4.42	4.414	4.49	4.342	4.51	4.478	4.5		4.44	3.78			4.46
Na2O	% m/m	3.56	3.48	3.654		3.61			3.63	3.61			1.946	3.56	3.512	3.655		3.628	3.56	3.81	3.589	3.61	3.399	3.58	3.527	3.56		3.57	3.38			3.52
K2O	% m/m	2.7	2.75	2.706		2.73			2.7	2.73			2.41	2.65	2.693	2.68		2.691	2.66	2.64	2.752	2.7	2.65	2.7	2.701	2.67		2.72	2.56			2.67
P2O5	% m/m	0.177	0.13	0.175		0.17			0.18	0.174				0.2	0.1654	0.166		0.157	0.177		0.171	0.19	0.17	0.183	0.1794	0.19		0.17				0
H2O+	% m/m		0.14							1.68														2.56								2.14
CO2	% m/m									0.27					0.231									0.23								0.18
LOI	% m/m	1.62	1.7	1.76		1.72			1.7	1.82				1.75	1.697	1.78			1.65		1.67	1.81		1.69	1.688	1.82		1.71				1.73
Ag	mg kg-1													0				0.055		0.94		0.015										
As	mg kg-1				3.9								1.25	19				1.7	2	2.28												
Au	mg kg-1																											0.0013				
B	mg kg-1													33																		0
Ba	mg kg-1	355			359.4		357.3		380	345			378	343		324		349	372	353	542	355	351.4	361		358		362	360	368.6		349
Be	mg kg-1										2			1.5				3		1.68		1.79	1.7					1.64				145
Bi	mg kg-1	2.5												53				0.1		0.05		0.093				13		0.09		0.10		
Br	mg kg-1	1.5											1.79																			
Cd	mg kg-1	0.22												5				0.17		0.29		0.036									0.21	
Ce	mg kg-1	53					55.18		61	55.9		56.75		60		48.5		55.53		49	45.74	56.6	62	61.8		47		51.7		58.1		13
Cl	mg kg-1	148									318						215		290									102				
Co	mg kg-1	16			14.3				12.2	12			13.5	22		12.5				11.6	16	14.1	13.3	13			18	13.2		13.3		23
Cr	mg kg-1	56			54.9				55	50			56	60		43		57	54	44.8	61	60.5	53.25	42.4		54		46.1		53.4		40
Cs	mg kg-1						1.999		1.93				2.13					1.99		1.7		2.12	2.7					2				201
Cu	mg kg-1	26		22.2					25	28				34		25.5		31	27	25	23	25.8	25.22	23.6		23		26.1		25.7		36
Dy	mg kg-1						8.16		7.43	7.9				1.29				7.71		6.33	6.75	8.11	7.78					7.91		8.1		0
Er	mg kg-1						4.99		4.22	4.36				5.57				4.86		3.86	4.09	4.92	5.34					4.87		5.0		9
Eu	mg kg-1						1.658		1.53	1.67		1.68		1.96				1.6		1.51	1.46	1.69	1.72					1.61		1.6		
F	mg kg-1	430									694							640										399				
Ga	mg kg-1	18			15.4					14						18		17.45	17	9.41		16.9	17.09	18.7		17		17.4		18.0		18
Gd	mg kg-1						7.46		6.36	7.26				10.3				7.79		7.35	6.09	7.55	6.77					7.24		7.5		4
Ge	mg kg-1	0.8												1				2.15		3.09											1.9	
Hf	mg kg-1	4.8						5.66	4.89		5.75		5.25					5.25		3.72		5.46	5.43			6		5.05		5.5		25
Hg	mg kg-1																															
Ho	mg kg-1						1.649		1.61	1.53		1.79						1.64		1.27	1.4	1.74	1.83					1.65		1.7		1
I	mg kg-1																															
In	mg kg-1	0.05																														
Ir	mg kg-1																			0.04								2E-05				
La	mg kg-1	32					24.63		22.9	24.5		25.64		26.7		25		24.48		23.9	20.55	26.6	28.8	25.5				22.8		25.6		0
Li	mg kg-1													35														36.3				23

Round identifier		I1	I2	I3	I3	I4	I5	I5	I6	I7	I7	I8	I8	I9	I10	I11	I11	I12	I13	I14	I15	I16	I17	I18	I19	I20	I20	I21	I22	I23	I23	I24
Technique codes		X	X	X	X	X	M	M	A,M	A,ign, X,T	A,ign, X,T	I	I	A	X,ign	X	X	M,X	X	M,X	M,V, X	M,X	A,M	ign, T,X	X	X	X	IC,M, T,X	X	M	M	AA, A,T,X
Test portion (g)		0.4-5	1	1.2-10	10	0.5	0.1	0.1	0.1	0.2-7.5	0.2-7.5	1.0-10	1.0-10	0.5-1	0.1-2	1.6	1.6	0.26-10	1-6.5	1	0.2-7	0.1-10	0.25	0.3-5.4	0.8-3	0.6-6	0.6-6	0.04-10	5	0.1	0.1	0.01-0.7
Data quality		2	2	1	2	1	1	2	2	1	2	1	2	2	2	1	2	1	1	2	1	1	2	2	2	1	2	1	2	1	2	1
Lu	mg kg-1						0.694		0.68	0.69		0.67		0.43				0.72		0.51	0.57	0.72	0.78					0.66		0.7		
Mo	mg kg-1	2.2							1.15					21				1.65	2	1.03		0.88										5
N	mg kg-1																															
Nb	mg kg-1	11		12.6				12.5	10.8	14				23		3		13.4	15	13.45	12	12.6	12.15	10.3		14		12.7		11.5		19
Nd	mg kg-1	27					28.23		26.4	26.2		29.33		25.3				27.89		24.9	23.87	29.5	31.66	24		32		26.3		29.1		53
Ni	mg kg-1	25		21.9					20	24				26		14.5		15.6	22	18.39	20	20.2	24.7	22			20	20.1			19.2	12
Os	mg kg-1																															
Pb	mg kg-1	18		11.3			13.32		12.8	14				41		24.5		12.1	12	14.07	14	14						12.1		13.1		14
Pd	mg kg-1																			1.71								0.0003				
Pr	mg kg-1	9					6.87		6.4									6.84		6.76	6.17	7.11	8.27					6.48		7.1		0
Pt	mg kg-1																											0.0004				
Rb	mg kg-1	102		100.4			98.6		94.6	94			100			101.5		103.2	100.3	107	90	96.6	104.7	102	101.7	103		105	92	100.3		103
Re	mg kg-1																															
Rh	mg kg-1																											1E-05				
Ru	mg kg-1																			0.08								4E-05				
S	mg kg-1				35						68						75	180	44													
Sb	mg kg-1	2.1							0.27				0.21	1				0.3		0.37		0.22								0.3		
Sc	mg kg-1				17.7				19.8	18.4			19.6					19				20.1	19.3	25		19		17.5				18
Se	mg kg-1													2																		
Sm	mg kg-1	4.2					6.89		6.52	7.36		6.82		8.36				6.59		6.02	5.71	7.23	7.64					6.41		6.9		9
Sn	mg kg-1	2							1.86					3				2.6		2.47		2.25									2.4	0
Sr	mg kg-1	106		98.3			100.3		85	111				89.9		100.5		99.2	99.8	102	107	100	111.1	91	102.2	104		90.2		104.4		79
Ta	mg kg-1	1.7							0.94					4.64				1		0.6		1.11	1.02					1.12		0.7		5
Tb	mg kg-1						1.238		1.17	1.3		1.21						1.4		1.08	1.01	1.37	1.29					1.2		1.3		
Te	mg kg-1																			0.32												
Th	mg kg-1	9			9		8.33		7.6	9			8.35					7.9	8	2.9	13	8.43	9.14					8.07		9.0		8
Tl	mg kg-1	0.4																		0.44		0.47						0.48		0.2		
Tm	mg kg-1						0.706		0.68											0.58	0.56							0.71		0.7		
U	mg kg-1	0.9			1.3		2.165		1.9									2.16	3	0.89		2.1	2.31					2.16		2.2		5
V	mg kg-1	79			84.8				83	81				128		74.5		79	82	68	86	79.6	91.5	73.3		79		82.3			85.7	87
W	mg kg-1	5.5						1.35	1.48					1						0.78												
Y	mg kg-1	47		49.7			45.00		45	47.3				42		44.5		48	49	51	43	44.2	48.3	52		47		38.8		48.4		56
Yb	mg kg-1						4.752		4.2	4.44		4.61		0.04				4.69		3.83	4.19	4.81		25				4.56		4.6		5
Zn	mg kg-1	71		66.4					70	60				76		67.5		69	72	62	80	65.5		67.5		66		78		75.7		63
Zr	mg kg-1	197		196.3				214	180	189						189		198	199	216	195	195.3	178.9	201	205.9	194		166	180	209.4		186

Technique codes: A: ICP-AES; AAA: AAS; E=emission spectrometry; G=gravimetric; I=INAA;
ign=ignition; IR= infra red detection; ISE=ion selective electrodes; M=ICP-MS; O=other;
T=titrimetry; W= wet chemistry; X=X-ray fluorescence.

Round identifier		I25	I26	I26	I27	I27	I28	I29	I30	I31	I32	I33	I34	I35	I36	I37	I38	I38	I39	I40	I41	I42	I43	I44	I45	I46	I47	I48	I49	I50	I51	I52
Technique codes		E,ISE, T,X	AA,M, T,X	AA,M, T,X	T,X	T,X	X	AA,A, ISE,T	T,X	ign, M,X	X	I	A,M, O,X	M	AA,X	M	X	X	X	X	AA, IR,T	A	X	X	X	AA, ign,V	X	A	AA, ISE,X	X	A,O	A,X
Test portion (g)		0.15-10	0.1-0.75	0.1-0.75	0.25-6	0.25-6	0.7-5	0.2-1	0.1-0.8	0.2-7	1.2	1.9	1.0-2.0	0.1	0.25-5	0.1	1.0-10	1.0-10	1	0.4-6	0.1-1	0.25	1.0-5	0.7	0.4	0.004-2	0.174	0.2	1	1.0-5	0.3-0.5	1.0-6
Data quality		2	1	2	1	2	2	1	2	2	1	1	2	2	2	1	1	2	1	1	1	1	2	1	2	1	1	2	2	2	2	2
SiO2	% m/m	63.2	63.495		63.48		63.25	63.5	63.4	63.33	63.87		63.9		62.7		60.71		63.13	63.16		64.61	62.88	63.5	63.5	63.23	62.84	63.11	64.28	66.09	63.25	61.15
TiO2	% m/m	0.59	0.77		0.763		0.79	0.836	0.77	0.814	0.77		0.78		0.75	0.77	0.81		0.73	0.81		0.81	0.77	0.768	0.77	0.82	0.81	0.74	0.78	0.78	0.76	0.76
Al2O3	% m/m	14.35	14.883		14.91		14.7	14.69	14.84	14.48	14.92	15.12	14.6		15.2		14.19		15	14.7	14.34		15.14	14.8	14.8	15.18	15.08	14.93	13.62	13.99	14.67	14.3
Fe2O3	% m/m	5.63	5.738		5.782		5.87	5.71	5.78	5.81	5.91	5.49	5.9		6.12		6.36		5.74	6.27	5.81	5.76	5.95	5.8	5.80	5.60	6.04	5.77	6.06	4.94	5.801	5.67
Fe(II)O	% m/m		4.6		4.26			4.34					4.47								3.98					4.69			-			
MnO	% m/m	0.144	0.142		0.1414		0.139	0.137	0.143	0.139	0.141	0.14	0.14		0.16	0.13	0.16		0.14	0.14	0.13	0.138	0.14	0.141	0.14	0.11	0.144	0.14	0.13	0.13		0.136
MgO	% m/m	2.11	2.325		2.300		2.22	2.37	2.31	2.25	2.32		2.4		2.93		2.22		2.22	2.31	2.24	2.28	2.26	2.27	2.32	2.25	2.64	2.27	1.97	2.14	2.368	2.3
CaO	% m/m	4.96	4.414		4.470		4.4	4.22	4.5	4.42	4.47		4.5		4.1		4.93		4.33	4.53	4.59	4.56	4.38	4.49	4.43	4.76	4.90	4.42	4.74	4.48	4.242	4.42
Na2O	% m/m	3.42	3.66		3.746		3.53	3.49	3.57	3.66	3.72	3.61	3		3.33		3.86		3.67	3.73	3.61	3.57	3.57	3.64	3.62	3.42	3.12	3.43	3.3	4.07	3.74	3.65
K2O	% m/m	2.59	2.753		2.691		2.76	2.65	2.71	2.67	2.77		2.55		2.77		3.02		2.82	2.9	2.53	2.80	2.92	2.7	2.76	2.68	2.73	2.61	2.85	2.8	2.767	2.6
P2O5	% m/m	0.154	0.18		0.177		0.17	0.166	0.19	0.167	0.18		0.18		0.17		0.18		0.18	0.17			0.18	0.174	0.17	0.17	0.145	0.15	0.09	0.18		0.17
H2O+	% m/m							2.13		2.17											2.18					1.66						
CO2	% m/m							0.145		0.18			0.19								0.17					0.06						
LOI	% m/m	2.1	1.46		1.60		1.75	1.75	1.7	1.8	1.71		1.67		1.78		1.69		2	1.62	1.72	1.72	1.73			1.62	1.62		1.78		1.796	1.75
Ag	mg kg-1	0.06													6.6																	
As	mg kg-1							1.17		1.26		1.1			2	5.58																
Au	mg kg-1																									0.025						
B	mg kg-1	25											42																			
Ba	mg kg-1	350		312.8	355		376	385	351	356	389	352	334	361.7	392	366			385	368	385		337	357				358		360		429
Be	mg kg-1	3						2.5		1.84																						
Bi	mg kg-1															0.062																
Br	mg kg-1																															
Cd	mg kg-1														2.4	0.142													3.23			
Ce	mg kg-1	60		48.9		56		56.5	61	57.5	71	64.6	60	51.46		57.1														66		53.3
Cl	mg kg-1									224		190	310					153														
Co	mg kg-1	15		13			12	14	17	13.5		12.6	15		10.4	14.7	25		12	18.7				14				13	35.9			13
Cr	mg kg-1	80		63	70.4		49	67.5	54	60	57	80.5	57		37.2	56.7	68		59	59.6	54			56				53	42.7	64		54
Cs	mg kg-1			1.8						2.09		1.89	3	2.091		2.13																
Cu	mg kg-1	35		30	27.1		29	31		29.1			30		26	29.8	29			22.4	26			27				29				28
Dy	mg kg-1			7.7				8.27		8.06		7.1	9.3	7.669		8.34																7.8
Er	mg kg-1			4.7				4.23		5.06			5.5	4.53		5.12																5.4
Eu	mg kg-1			1.5				1.57		1.61		1.6	2	1.533		1.64																1.54
F	mg kg-1	521						590					470					163											623			
Ga	mg kg-1	18		17.7					19	19	21		18		17	18.8	16			17				17								17
Gd	mg kg-1			7.1				8.09		8.55			8.9	6.831		7.41																7.2
Ge	mg kg-1									1.64			2			1.88																
Hf	mg kg-1			5.7						6.06		5.38	5.4			6.08																5
Hg	mg kg-1																															
Ho	mg kg-1			1.6				1.36		1.78			1.9	1.56		1.79																1.5
I	mg kg-1																															
In	mg kg-1															0.058																
Ir	mg kg-1																															
La	mg kg-1	40		21.7		30		23.7		26.1		25.2	27	22.91		25.6				23												24.3
Li	mg kg-1	33						33					31			37.8					30							39				

Round identifier		I25	I26	I26	I27	I27	I28	I29	I30	I31	I32	I33	I34	I35	I36	I37	I38	I38	I39	I40	I41	I42	I43	I44	I45	I46	I47	I48	I49	I50	I51	I52
Technique codes		E,ISE,	AA,M,	AA,M,	T,X	T,X	X	AA,A,	T,X	ign,	X	I	A,M,	M	AA,X	M	X	X	X	X	AA,	A	X	X	X	AA,	X	A	AA,	X	A,O	A,X
		T,X	T,X	T,X				ISE,T		M,X			O,X								IR,T					ign,V			ISE,X			
Test portion (g)		0.15-10	0.1-0.75	0.1-0.75	0.25-6	0.25-6	0.7-5	0.2-1	0.1-0.8	0.2-7	1.2	1.9	1.0-2.0	0.1	0.25-5	0.1	1.0-10	1.0-10	1	0.4-6	0.1-1	0.25	1.0-5	0.7	0.4	0.004-2	0.174	0.2	1	1.0-5	0.3-0.5	1.0-6
Data quality		2	1	2	1	2	2	1	2	2	1	1	2	2	2	1	1	2	1	1	1	1	2	1	2	1	1	2	2	2	2	2
Lu	mg kg-1			0.7				0.751		0.71		0.74	0.8	0.675		0.71																
Mo	mg kg-1	1								2.19			0.7		2	1.11	2															0.8
N	mg kg-1																															
Nb	mg kg-1	12		10.3	13.2				14	12.8	21		10	11.45	12	13.7	13			13.6			13	15					13		11
Nd	mg kg-1			25.2				29.7	27	28.3		29.2	31	26.25		28.6				26.8									30		26.6
Ni	mg kg-1	50		19.9	22.7		28	18	20	19.7	24	41	32		22.2	22.6	23		26	19.8	12			21				21	40.5	24		23
Os	mg kg-1																															
Pb	mg kg-1	10		13.3	12.7		13	17	16	14.9				14.93	15	13.9	4			12.6	10			13					36.6			15
Pd	mg kg-1																															
Pr	mg kg-1			6.2				8.06		7.12			7.2	6.369		6.79										0.021						
Pt	mg kg-1																															6.3
Rb	mg kg-1	99		101.3	99.9		80	95.1	106	102	116	96	90	89.3	104.3	102	90		107	97.2	83		91	102						97		96
Re	mg kg-1																															
Rh	mg kg-1																															
Ru	mg kg-1																															
S	mg kg-1	184						55							59.8			100														
Sb	mg kg-1							0.09				0.25				0.37																
Sc	mg kg-1	25		16.4						21.8		20		18.49		20.8	19			20				20				19		17		18.27
Se	mg kg-1																															
Sm	mg kg-1			6.2				5.52		7.19		6.68	7.9	6.425		7.28																
Sn	mg kg-1	3.2								1.69			3			2.31																6.9
Sr	mg kg-1	99		108.6	99.8		192	101	103	103	115		100	104.4	103	109	93		86	99.3	102		97	101				99				91
Ta	mg kg-1			0.8						0.9		0.8	0.6			0.96																
Tb	mg kg-1			1.2				1.11		1.38		1.25	1.5	1.213		1.31																
Te	mg kg-1																															1.4
Th	mg kg-1	8		9			9			8.24		8.8	10	7.097	8	8.43				10.4			7									7.3
Tl	mg kg-1															0.53																
Tm	mg kg-1			0.7				0.831		0.77			0.8	0.663		0.76																
U	mg kg-1			2.2			1.5			2.08		2.07	2.7	1.858	2.5	2.23				2.2									2		3	
V	mg kg-1	100		88	83.1			70.5	82	84.8		86	85		101	83.3	79			72.9				82				74		87		74
W	mg kg-1															3.37																
Y	mg kg-1	49		48.5	45.8		42	44.1	48	52.5	53		46	40.73	44	47.2	48		45	51.7			42	48				51		50		44
Yb	mg kg-1	5		4.6				4.93		5.14		4.98	5.4	4.555		4.96																4.62
Zn	mg kg-1	69		64	70.9		72	78.1	73	76	67		74		79.4	68.5	64			70.2	68			70				69	79.6	67		68
Zr	mg kg-1	213		203	191.2				194	203	211		176		203.2	195	199		187	202.7			167	192						200		193

Round identifier		I53	I54	I55	I55	I56	I57	I58	I58	I59	I60	I61	I61	I62	I63	I64	I65	I66	I67	I68	I69	I70	I71	I72	I73	I74	I75	I76	I77
Technique codes		AA	I	A,M,	A,M,	A	M,X	X	X	A,M,	X	AA,A,E	AA,A,E	AA,ign,	A,M	M	I	X	X	X	AA	X	A,I,	A,I,	M,X	AA,A	XRF	AA,	A,O,
				O,T,X	O,T,X					X		M,O,X	M,O,X	T,M									M,T,X	M,X				A,M,X	X
Test portion (g)		0.1	0.15	0.2-4	0.2-4	0.25	0.2-1	1.2-9	1.2-9	0.1-12	4	0.1-1.2	0.1-1.2	0.1-0.5	0.2-0.5	0.25	0.2	4	0.4-8	1.5	0.1	1.0-7	0.2-3	0.1-0.8	0.125-3.5	0.5	1.5	0.3-0.5	0.01-5
Data quality		1	1	1	2	1	1	1	2	2	2	1	2	2	2	1	1	2	2	2	1	1	2	1	1	1	1	2	2
SiO2	% m/m	66.7		63.22		62.89	63.52	63.580		63.24	63.19	63.35		63.4	63.5			63	63.47	63.46	62.01	64.79	63.5	63.2	64.393		63.42	63.13	63.23
TiO2	% m/m	0.84		0.76		0.79	0.775	0.776		0.76	0.763	0.798		0.765	0.75		0.78	0.72	0.77	0.783		0.78	0.766	0.77	0.7849	0.8	0.78	0.769	0.743
Al2O3	% m/m	14.68		14.93		14.87	15.05	14.92		14.52	14.12	15.06		14.83	14.19		15.89	15.1	14.62	14.65	14.37	14.85	14.8	14.8	15.121	14.8	14.69	14.84	14.73
Fe2O3	% m/m	4.96	5.56	5.82		5.92	5.89	5.886		5.8	6.735	5.92		5.78	5.74		5.73	5.71	5.83	5.93		5.87	5.82	5.78	5.989	5.9	5.79	5.711	5.82
Fe(II)O	% m/m													4.21									4.4				4.36		4.51
MnO	% m/m	0.1		0.14		0.14	0.14	0.139		0.14	0.15		0.139	0.138	0.14		0.14	0.13	0.14	0.143	0.41	0.17	0.14	0.108	0.1433	0.16	0.15	0.134	0.132
MgO	% m/m	2.57		2.29		2.36	2.3	2.307		2.23	2.88		2.288	2.37	2.32		2.82	2.94	2.22	2.26	2.24	2.29	2.42	2.29	2.278	2.34	2.24	2.194	2.3
CaO	% m/m	4.36		4.52		4.54	4.53	4.485		4.45	4.48	4.482		4.52	4.39		4.31	3.98	4.39	4.55	6.65	4.52	4.67	4.47	4.586	4.45	4.47	4.607	4.56
Na2O	% m/m	4.41	3.73	3.71			3.61	3.666		3.65	3.461	3.66		3.74	3.62		3.81	3.92	3.49	3.67	2.6	3.56	3.65	3.53	3.661	3.3	3.59	3.657	3.49
K2O	% m/m	2.87		2.82			2.73	2.705		2.66	2.86	2.66		2.69	2.6		2.75	2.69	2.70	2.72	2.8	2.7	2.59	2.7	2.746	2.45	2.76	2.719	2.84
P2O5	% m/m			0.16		0.19	0.18	0.179		0.17	0.158		0.176	0.173	0.14			0.18	0.26	0.174		1.078	0.17	0.23	0.1761	0.14	0.17	0.179	0.176
H2O+	% m/m	7.808			1.9																	0.13	2.2						0.24
CO2	% m/m				0.18																		0.1	0.1			0.26		0.075
LOI	% m/m			1.77		10.49		1.70		1.68	1.855		1.79	1.69						1.64		1.64	1.65	1.77			1.64	1.700	1.74
Ag	mg kg-1										4		0.048										2.9						
As	mg kg-1		1.4										109		1.3				3					1.13					
Au	mg kg-1																						4						
B	mg kg-1												61										47					46	41
Ba	mg kg-1		356		343	354	374	340.1		333.2	377		325		351	388	404	407	408				364	365	365.4	350	290	330	363
Be	mg kg-1									1.5			1.75										2.2	1.91				1.6	1.65
Bi	mg kg-1																						0.16						
Br	mg kg-1		2.2							1.8													1.4						
Cd	mg kg-1												0.15											0.09		0.28			
Ce	mg kg-1		58.2	56.84			57.5		47	52.9	48	61.2			53.5	55.8	58.5		58				56.75	53.7	54.367			53.1	56
Cl	mg kg-1																316						225						
Co	mg kg-1		13.1			20				11	13		14		13	11.4	13.5		11				14	14		18	20		13.5
Cr	mg kg-1		52			54	52	56.0		57.5	59		52		37		54.2		51				55	59.7	50.7		35		55
Cs	mg kg-1		2.0	2.26			1.97				8	2				1.58	2.15						2.2	2.05	2.707	0.5			
Cu	mg kg-1				29	23	25.4	28.6		28.1	66	33			25				24				26	27.4	25.9	35	20	24	30
Dy	mg kg-1			7.94			8.56			7.78		8.26			6.8	7.94	8.31						7.7	8.33	9.114			7.79	7.35
Er	mg kg-1			5.09			4.82			4.72		4.77			4	4.68							4.83	4.72	5.333			4.44	5.04
Eu	mg kg-1		1.68	1.66			1.67			1.63		1.79			1.3	1.77	1.75						1.667	1.6	1.814			1.67	1.65
F	mg kg-1												380						1				493						
Ga	mg kg-1				17.25	18		17.9		16.7	11		16.3		18	16.6							19	16.63	18.9				16.5
Gd	mg kg-1			7.37			7.77			7.12	7	8.21			6.3	7.27							7.4	7.64	7.802			6.99	8.15
Ge	mg kg-1									1.2			1.17										4.4	1.41					
Hf	mg kg-1		5.55	5.64			5.86			5.67	6	5.97				5.59	5.76						5.6	5.15	5.563				
Hg	mg kg-1												0.013																0.008
Ho	mg kg-1			1.75			1.79			1.59		1.84			1.4	1.59							1.63		1.887			1.54	1.63
I	mg kg-1																												
In	mg kg-1																							0.31					
Ir	mg kg-1																												
La	mg kg-1		24.9	26.13			25.6		20.9	22.9	28	27.86			24	24.6	25.3		20				25.4	24.3	26.112			23.9	27
Li	mg kg-1				36.72					34.3		35											36	35.2		36			32

Round identifier		I53	I54	I55	I55	I56	I57	I58	I58	I59	I60	I61	I61	I62	I63	I64	I65	I66	I67	I68	I69	I70	I71	I72	I73	I74	I75	I76	I77
Technique codes		AA	I	A,M,	A,M,	A	M,X	X	X	A,M,	X	AA,A,E	AA,A,E	AA,ign,	A,M	M	I	X	X	X	AA	X	A,I,	A,I,	M,X	AA,A	XRF	AA,	A,O,
				O,T,X	O,T,X					X		M,O,X	M,O,X	T,M									M,T,X	M,X				A,M,X	X
Test portion (g)		0.1	0.15	0.2-4	0.2-4	0.25	0.2-1	1.2-9	1.2-9	0.1-12	4	0.1-1.2	0.1-1.2	0.1-0.5	0.2-0.5	0.25	0.2	4	0.4-8	1.5	0.1	1.0-7	0.2-3	0.1-0.8	0.125-3.5	0.5	1.5	0.3-0.5	0.01-5
Data quality		1	1	1	2	1	1	1	2	2	2	1	2	2	2	1	1	2	2	2	1	1	2	1	1	1	1	2	2
Lu	mg kg-1			0.76			0.726			0.654		0.76				0.7	0.714						0.768	0.68	0.745			0.666	0.775
Mo	mg kg-1		1.54								3		1.27		0.9								1.9			3			
N	mg kg-1																												
Nb	mg kg-1			13.19		12.5	12.7	13.6		13.4	12	13.83				12.7							15	12.7	12.86				12
Nd	mg kg-1			30.94			29.2		20.1	26.5	30	33.17			24	28	29.6						27.5	27.1	27.258			26.7	28.5
Ni	mg kg-1		20		26	21		18.3		20.8	30		19.92		22.6				19			20.6	34	20.8	21.9	22	15	120	19
Os	mg kg-1																												
Pb	mg kg-1				14.54		13.7	16.6		12.3	13		18		9			11.3	30				19	15.2	15.184	14			12.6
Pd	mg kg-1																												
Pr	mg kg-1			7.35			7.06			6.47		7.06			5.8	6.9			12				6.89	7.12	6.364			6.52	7.25
Pt	mg kg-1																												
Rb	mg kg-1		97	103.2			108	98.6		97.6	84	98			98	79.5	95.5	96.7	69			95	95	102.7	101.15	102			102
Re	mg kg-1																												
Rh	mg kg-1																												
Ru	mg kg-1																												
S	mg kg-1																					160							
Sb	mg kg-1		0.28														0.34						0.34	0.24					
Sc	mg kg-1		18.3		18	20	17.3	17.4		16.4		20.2			4.7		19.6						18	20	23.16		20		19.5
Se	mg kg-1																		6										
Sm	mg kg-1		7.13	7.36			7.23			6.5		7.62			5.5	6.84	7.67						7.75	7.5	7.312			6.7	6.8
Sn	mg kg-1												2.7										2.8	2.66					2.1
Sr	mg kg-1		99	110.2		96	104	98.0		100.4	81	102			95.4	86.9		99.7	86			90.4	106	100.4	97	110	75	405	103
Ta	mg kg-1		1.01	0.96			0.94			0.947			1.81			0.999	0.98						1.5	1.03	0.999				
Tb	mg kg-1		1.16	1.26			1.31			1.21		1.3			1.1	1.32	1.27						1.16	1.16	1.441				1.01
Te	mg kg-1																												
Th	mg kg-1		8.37	8.5			8.86	7.8		8.06	1	9.18				9.04	8.86	8.9	20				8.2	8.12	8.085				7.6
Tl	mg kg-1				0.47								0.4										0.45	0.47					
Tm	mg kg-1			0.75			0.746			0.686		0.8				0.695							0.733	0.74	0.769			0.660	0.68
U	mg kg-1		2.13	2.21			2.24			2.09	3	2.4			0.9	2.28							2.3	2.25	2.099				5
V	mg kg-1				90	83		88.2		69.4	71		90		100		89.5		80				95	81.6	84.6	92	65		74
W	mg kg-1		1.2		1.49						6		1.35						6				3						
Y	mg kg-1			49.78		50	45.3	46.2		40.7	51	51.98			43.5	45.9		48	50				50	49.3	51.201		40	38	45.8
Yb	mg kg-1		4.9	4.95			4.88			4.52		4.8			3.8	4.98	5.24						4.21	4.48	4.803			4.50	4.65
Zn	mg kg-1		62		81	72		69.9		71.8	69	61			64				68		0.07		65	68.67	70.6	86	55	69	71
Zr	mg kg-1		200	199.8		192	164	204.8		193.8	197		200		167	176	190	197	178				194	197	190.9	230	210		209

Table 2 GeoPT 8

Assigned values and robust statistical analysis of contributed data

	X_a	H_a	s	s/H_a			X_a	H_a	s	s/H_a
	% m/m	% m/m	% m/m	ratio			mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	ratio
SiO_2	63.34	0.679	0.057	0.08		Ho	1.63	0.12	0.03	0.28
TiO_2	0.77	0.016	0.002	0.11		La	24.96	1.23	0.35	0.28
Al_2O_3	14.83	0.198	0.025	0.13		Li	35.0	1.6	0.7	0.42
Fe_2O_3	5.82	0.089	0.014	0.16		Lu	0.71	0.06	0.01	0.16
FeO	4.52	0.072	0.041	0.57		Nb	12.8	0.70	0.22	0.31
MnO	0.14	0.004	0.001	0.19		Nd	27.9	1.35	0.40	0.30
MgO	2.30	0.041	0.008	0.20		Ni	21.0	1.06	0.40	0.38
CaO	4.48	0.072	0.013	0.19		Pb	14.1	0.76	0.40	0.53
Na_2O	3.61	0.060	0.011	0.18		Pr	6.85	0.41	0.11	0.26
K_2O	2.70	0.047	0.009	0.19		Rb	98.5	3.9	0.8	0.20
P_2O_5	0.173	0.005	0.002	0.34		Sb	0.30	0.029	0.024	0.83
LOI	1.72	0.03	0.01	0.33		Sc	19.1	0.98	0.26	0.27
	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}			Sm	6.94	0.41	0.12	0.30
Ba	360.8	11.9	2.7	0.22		Sn	2.42	0.17	0.14	0.80
Be	1.79	0.13	0.07	0.52		Sr	99.9	4.0	1.0	0.26
Ce	55.7	2.4	0.8	0.32		Ta	1.00	0.08	0.03	0.37
Co	13.5	0.73	0.27	0.37		Tb	1.25	0.10	0.02	0.22
Cr	54.7	2.4	1.0	0.41		Th	8.42	0.49	0.12	0.25
Cs	2.07	0.15	0.03	0.23		Tl	0.46	0.04	0.01	0.23
Cu	27.3	1.3	0.51	0.38		Tm	0.72	0.06	0.01	0.21
Dy	7.81	0.46	0.11	0.23		U	2.19	0.16	0.07	0.47
Er	4.83	0.30	0.09	0.30		V	82.7	3.4	1.2	0.35
Eu	1.64	0.12	0.02	0.15		Y	47.1	2.1	0.5	0.25
Ga	17.4	0.91	0.19	0.21		Yb	4.70	0.30	0.06	0.21
Gd	7.39	0.44	0.12	0.28		Zn	69.5	2.9	0.8	0.28
Hf	5.54	0.34	0.08	0.22		Zr	195.1	7.1	1.7	0.24

Xa=assigned value

s=standard deviation of submitted results calculated using 'robust' statistics

Ha=target precision calculated using a modified version of the Horwitz equation

	Table 3 - GeoPT8														
	Z-scores for data submitted to the GeoPT8 round (OU-4 Penmaenmawr microdiorite).														
Round identifier	I1	I2	I3	I3	I4	I5	I5	I6	I7	I7	I8	I8	I9	I10	I11
Technique	X	X	X	X	X	M	M	A,M	A,ign,	A,ign,	I	I	A	X,ign	X
codes									X,T	X,T					
Test portion (g)	0.4-5	1.00	1.2-10	10.00	0.50	0.10	0.10	0.10	0.2-7.5	0.2-7.5	1.0-10	1.0-10	0.5-1	0.1-2	1.60
Data quality	2	2	1	2	1	1	2	2	1	2	1	2	2	2	1
SiO2	0.04	1.81	-0.19	*	0.53	*	*	-1.14	0.17	*	*	*	-0.47	-0.38	0.20
TiO2	0.66	1.56	0.00	*	0.00	*	*	0.31	1.25	*	*	*	-0.31	-0.30	-1.44
Al2O3	0.25	0.68	-0.26	*	0.35	*	*	1.70	0.15	*	*	*	-0.83	-0.29	-71.25
Fe2O3	0.22	1.96	-0.25	*	-0.11	*	*	2.13	0.67	*	*	-1.62	1.57	-0.07	-56.82
Fe(II)O	*	*	*	*	*	*	*	*	1.46	*	*	*	*	*	*
MnO	0.04	0.04	0.08	*	0.08	*	*	0.17	2.48	*	*	*	0.04	-0.49	1.55
MgO	-0.34	-0.59	-0.44	*	0.05	*	*	2.12	1.04	*	*	*	0.40	0.21	0.54
CaO	0.05	0.96	0.90	*	-0.18	*	*	2.22	0.94	*	*	0.26	0.82	-0.77	-30.23
Na2O	-0.42	-1.09	0.74	*	0.00	*	*	0.17	0.00	*	*	-13.98	-0.42	-0.82	0.76
K2O	0.00	0.54	0.13	*	0.65	*	*	0.00	0.65	*	*	-3.12	-0.54	-0.08	-0.43
P2O5	0.42	-4.79	0.40	*	-0.71	*	*	0.76	0.18	*	*	*	2.97	-0.86	-1.71
LOI	-1.59	-0.33	1.24	*	-0.03	*	*	-0.33	3.13	*	*	*	0.46	-0.38	1.87
Ba	-0.24	*	*	-0.06	*	-0.29	*	0.81	-1.32	*	*	0.73	-0.75	*	-3.09
Be	*	*	*	*	*	*	*	*	*	0.80	*	*	-1.11	*	*
Ce	-0.56	*	*	*	*	-0.22	*	1.08	0.07	*	0.42	*	0.88	*	-2.97
Co	1.71	*	*	0.55	*	*	*	-0.89	-2.06	*	*	0.00	5.82	*	-1.37
Cr	0.27	*	*	0.04	*	*	*	0.06	-1.97	*	*	0.27	1.10	*	-4.89
Cs	*	*	*	*	*	-0.48	*	-0.47	*	*	*	0.20	*	*	*
Cu	-0.48	*	-3.82	*	*	*	*	-0.86	0.55	*	*	*	2.54	*	-1.34
Dy	*	*	*	*	*	0.76	*	-0.41	0.20	*	*	*	-7.11	*	*
Er	*	*	*	*	*	0.52	*	-1.00	-1.55	*	*	*	1.21	*	*
Eu	*	*	*	*	*	0.14	*	-0.46	0.24	*	0.32	*	1.31	*	*
Ga	0.31	*	*	-1.12	*	*	*	*	-3.79	*	*	*	*	*	0.62
Gd	*	*	*	*	*	0.17	*	-1.17	-0.29	*	*	*	3.33	*	*
Hf	-1.08	*	*	*	*	*	0.17	-0.95	*	0.30	*	-0.43	*	*	*
Ho	*	*	*	*	*	0.12	*	-0.10	-0.86	*	1.28	*	*	*	*
La	2.86	*	*	*	*	-0.27	*	-0.84	-0.38	*	0.55	*	0.71	*	0.03
Li	*	*	*	*	*	*	*	*	*	*	*	*	0.00	*	*
Lu	*	*	*	*	*	-0.27	*	-0.25	-0.34	*	-0.67	*	-2.34	*	*
Nb	-1.30	*	-0.31	*	*	*	-0.22	-1.44	1.70	*	*	*	7.30	*	-14.06
Nd	-0.33	*	*	*	*	0.26	*	-0.55	-1.24	*	1.07	*	-0.95	*	*
Ni	1.88	*	0.85	*	*	*	*	-0.47	2.82	*	*	*	2.35	*	-6.12
Pb	2.60	*	-3.67	*	*	-0.99	*	-0.84	-0.09	*	*	*	17.81	*	13.80
Pr	2.62	*	*	*	*	0.04	*	-0.55	*	*	*	*	*	*	*
Rb	0.45	*	0.49	*	*	0.03	*	-0.49	-1.13	*	*	0.19	*	*	0.77
Sb	31.04	*	*	*	*	*	*	-0.56	*	*	*	-1.60	12.05	*	*
Sc	*	*	*	-0.69	*	*	*	0.38	-0.67	*	*	0.28	*	*	*
Sm	-3.30	*	*	*	*	-0.11	*	-0.50	1.02	*	-0.28	*	1.72	*	*
Sn	-1.23	*	*	*	*	*	*	-1.64	*	*	*	*	1.73	*	*
Sr	0.77	*	-0.39	*	*	0.11	*	-1.86	2.78	*	*	*	-1.25	*	0.16
Ta	4.39	*	*	*	*	*	*	-0.37	*	*	*	*	22.78	*	*
Tb	*	*	*	*	*	-0.09	*	-0.40	0.55	*	-0.38	*	*	*	*
Th	0.60	*	*	0.60	*	-0.18	*	-0.84	1.19	*	*	-0.07	*	*	*
Tl	-0.73	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tm	*	*	*	*	*	-0.21	*	-0.32	*	*	*	*	*	*	*
U	-4.15	*	*	-2.87	*	-0.18	*	-0.94	*	*	*	*	*	*	*
V	-0.54	*	*	0.31	*	*	*	0.04	-0.50	*	*	*	6.65	*	-2.41
Yb	-0.01	*	1.26	*	*	-0.97	*	-0.49	0.12	*	*	*	-1.20	*	-1.21
Yb	*	*	*	*	*	0.18	*	-0.84	-0.87	*	-0.30	*	-7.82	*	*
Zn	0.26	*	-1.05	*	*	*	*	0.09	-3.23	*	*	*	1.11	*	-0.68
Zr	0.14	*	0.17	*	*	*	1.34	-1.07	-0.86	*	*	*	*	*	-0.86

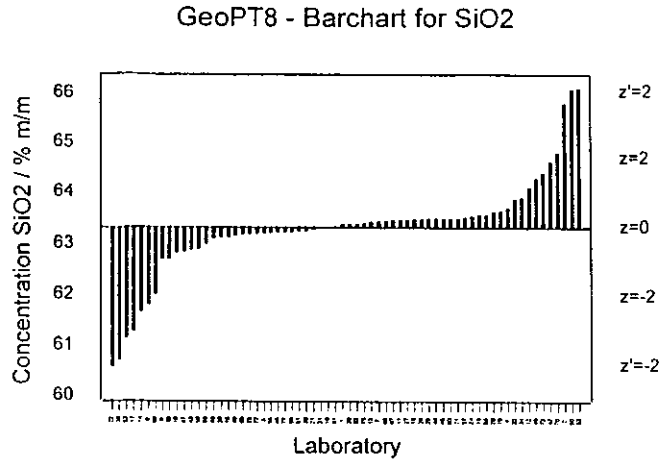
Round identifier	I11	I12	I13	I14	I15	I16	I17	I18	I19	I20	I20	I21	I22	I23	I23
Technique	X	M,X	X	M,X	M,V,	M,X	A,M	ign,	X	X	X	IC,	X	M	M
codes					X			X,V				M,T,X			
Test portion (g)	1.60	0.28-10	1-6.5	1.00	0.2-7	0.1-10	0.25	0.3-5.4	0.8-3	0.6-6	0.6-6	0.04-10	5.00	0.10	0.10
Data quality	2	1	1	2	1	1	2	2	2	1	2	1	2	1	2
SiO2	*	1.12	0.14	-1.24	0.35	0.22	-1.53	0.00	0.23	0.42	*	-0.09	-4.23	*	*
TiO2	*	-0.25	-0.62	*	2.19	-0.62	-0.53	-0.66	-0.18	1.25	*	1.25	-1.56	*	*
Al2O3	*	0.66	-0.15	2.23	0.38	0.10	-0.81	0.23	0.23	-0.05	*	0.40	-4.12	*	*
Fe2O3	*	-0.03	0.00	2.46	2.39	-0.78	0.83	-0.28	0.32	0.90	*	0.56	0.67	*	*
Fe(II)O	*	0.63	*	*	0.07	*	*	0.45	*	*	*	1.88	*	*	*
MnO	*	0.88	-0.98	-3.95	6.20	-2.58	0.31	0.17	0.71	0.08	*	0.08	-1.69	*	*
MgO	*	0.69	-0.44	-2.56	-0.15	-0.44	0.41	-0.71	-0.28	-1.68	*	0.05	3.23	*	*
CaO	*	0.34	-0.04	-0.44	-0.96	0.10	-0.98	0.19	-0.03	0.24	*	-0.60	-4.91	*	*
Na2O	*	0.30	-0.84	1.68	-0.35	0.00	-1.77	-0.25	-0.70	-0.84	*	-0.67	-1.93	*	*
K2O	*	-0.19	-0.86	-0.65	1.12	0.00	-0.54	0.00	0.01	-0.65	*	0.43	-1.51	*	*
P2O5	*	-3.59	0.84	*	-0.49	3.73	-0.35	1.09	0.69	3.73	*	-0.71	*	*	*
LOI	*	*	-2.23	*	-1.60	2.81	*	-0.49	-0.52	3.13	*	-0.34	*	*	*
Ba	*	-0.99	0.95	-0.33	15.24	-0.48	-0.39	0.01	*	-0.23	*	0.11	-0.03	0.66	*
Be	*	9.23	*	-0.42	*	0.00	-0.34	*	*	*	*	-1.14	*	*	*
Ce	*	-0.08	*	-1.38	-4.10	0.36	1.29	1.25	*	-3.59	*	-1.65	*	0.98	*
Co	*	*	*	-1.30	3.43	0.82	-0.14	-0.34	*	*	3.08	-0.41	*	-0.27	*
Cr	*	0.95	-0.30	-2.07	2.62	2.41	-0.31	-2.57	*	-0.30	*	-3.60	*	-0.55	*
Cs	*	-0.54	*	-1.25	*	0.34	2.12	*	*	*	*	-0.47	*	*	*
Cu	*	2.81	-0.21	-0.86	-3.22	-1.11	-0.77	-1.38	*	-3.22	*	-0.88	*	-1.19	*
Dy	*	-0.22	*	-1.61	-2.31	0.65	-0.03	*	*	*	*	0.22	*	0.63	*
Er	*	0.09	*	-1.59	-2.43	0.29	0.83	*	*	*	*	0.13	*	0.55	*
Eu	*	-0.34	*	-0.54	-1.49	0.40	0.32	*	*	*	*	-0.26	*	-0.34	*
Ga	*	0.01	-0.49	-4.43	*	-0.60	-0.19	0.69	*	-0.49	*	-0.04	*	0.62	*
Gd	*	0.93	*	-0.04	-2.96	0.38	-0.70	*	*	*	*	-0.33	*	0.26	*
Hf	*	-0.85	*	-2.66	*	-0.24	-0.16	*	*	1.34	*	-1.43	*	-0.12	*
Ho	*	0.04	*	-1.50	-1.93	0.87	0.80	*	*	*	*	0.13	*	0.54	*
La	*	-0.39	*	-0.43	-3.59	1.33	1.56	0.22	*	*	*	-1.76	*	0.52	*
Li	*	*	*	*	*	*	*	*	*	*	*	0.79	*	*	*
Lu	*	0.16	*	-1.67	-2.35	0.16	0.58	*	*	*	*	-0.84	*	-0.17	*
Nb	*	0.84	3.13	0.46	-1.17	-0.31	-0.48	-1.80	*	1.70	*	-0.16	*	-1.88	*
Nd	*	0.01	*	-1.10	-2.97	1.20	1.40	-1.44	*	3.05	*	-1.17	*	0.90	*
Ni	*	-5.08	0.94	-1.23	-0.94	-0.75	1.74	0.47	*	*	-0.47	-0.85	*	*	-0.85
Pb	*	-2.61	-2.74	0.00	-0.09	-0.09	*	*	*	*	*	-2.61	*	-1.28	*
Pr	*	-0.03	*	-0.11	-1.66	0.63	1.73	*	*	*	*	-0.91	*	0.60	*
Rb	*	1.20	0.46	1.08	-2.15	-0.47	0.79	0.45	0.41	1.15	*	1.65	-0.82	0.46	*
Sb	*	-0.08	*	1.17	*	-2.85	*	*	*	*	*	*	*	-0.08	*
Sc	*	-0.06	*	*	*	1.07	0.12	3.04	*	-0.06	*	-1.59	*	*	*
Sm	*	-0.84	*	-1.11	-2.96	0.71	0.85	*	*	*	*	-1.27	*	-0.09	*
Sn	*	1.09	*	0.16	*	-0.98	*	*	*	*	*	*	*	*	-0.04
Sr	*	-0.17	-0.02	0.27	1.78	0.03	1.40	-1.11	0.29	1.03	*	-2.42	*	1.13	*
Ta	*	0.01	*	-2.50	*	1.39	0.13	*	*	*	*	1.51	*	-3.74	*
Tb	*	1.58	*	-0.87	-2.46	1.27	0.22	*	*	*	*	-0.49	*	0.55	*
Th	*	-1.06	-0.85	-5.65	9.38	0.03	0.74	*	*	*	*	-0.71	*	1.19	*
Tl	*	*	*	-0.24	*	0.24	*	*	*	*	*	0.48	*	-6.29	*
Tm	*	*	*	-1.15	-2.63	*	*	*	*	*	*	-0.15	*	-0.31	*
U	*	-0.21	5.18	-4.18	*	-0.60	0.37	*	*	*	*	-0.21	*	0.04	*
V	*	-1.09	-0.21	-2.16	0.97	-0.91	1.29	-1.38	*	-1.09	*	-0.12	*	*	0.44
Yb	*	0.45	0.92	0.94	-1.92	-1.35	0.30	1.17	*	-0.02	*	-3.91	*	0.64	*
Yb	*	-0.03	*	-1.46	-1.71	0.37	*	34.08	*	*	*	-0.47	*	-0.33	*
Zn	*	-0.17	0.85	-1.28	3.58	-1.36	*	-0.34	*	-1.19	*	2.90	*	2.11	*
Zr	*	0.41	0.55	1.48	-0.01	0.03	-1.15	0.42	0.77	-0.15	*	-4.12	-1.07	2.03	*

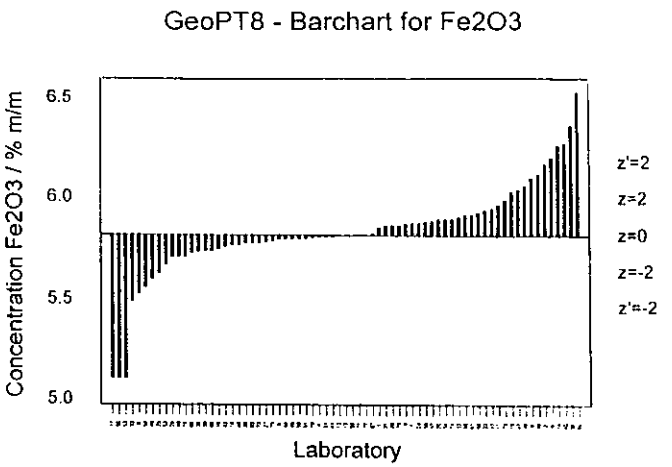
Round identifier	I24	I25	I26	I26	I27	I27	I28	I29	I30	I31	I32	I33	I34	I35	I36
Technique	AA,	E,ISE,	AA,	AA,	T,X	T,X	X	AA,A,	T,X	ign,	X	I	A,M,	M	AA,X
codes	A,T,X	T,X	M,T,X	M,T,X				ISE,T		M,X			O,X		
Test portion (g)	0.01-0.7	0.15-10	0.1-0.75	0.1-0.75	0.25-6	0.25-6	0.7-5	0.2-1	0.1-0.8	0.2-7	1.20	1.90	1.0-2.0	0.10	0.25-5
Data quality	1	2	1	2	1	2	2	1	2	2	1	1	2	2	2
SiO2	0.29	-0.10	0.23	*	0.20	*	-0.07	0.23	0.04	-0.01	0.78	*	0.41	*	-0.47
TiO2	0.00	-5.62	0.00	*	-0.44	*	0.62	4.12	0.00	1.37	0.00	*	0.31	*	-0.62
Al2O3	0.35	-1.21	0.27	*	0.43	*	-0.33	-0.71	0.03	-0.89	0.46	1.47	-0.58	*	0.94
Fe2O3	0.67	-1.06	-0.92	*	-0.43	*	0.28	-1.23	-0.22	-0.06	1.01	-3.70	0.45	*	1.68
Fe(II)O	0.90	*	1.18	*	-3.54	*	*	-2.43	*	*	*	*	-0.31	*	*
MnO	0.08	0.57	0.61	*	0.45	*	-0.09	-0.72	0.44	-0.09	0.35	0.08	0.04	*	2.70
MgO	-0.20	-2.32	0.67	*	0.05	*	-0.96	1.78	0.15	-0.59	0.54	*	1.26	*	7.79
CaO	-0.32	3.34	-0.96	*	-0.18	*	-0.58	-3.67	0.12	-0.44	-0.18	*	0.12	*	-2.67
Na2O	-1.51	-1.60	0.84	*	2.29	*	-0.67	-2.02	-0.34	0.42	1.85	0.00	-5.13	*	-2.35
K2O	-0.65	-1.18	1.14	*	-0.19	*	0.65	-1.08	0.11	-0.32	1.51	*	-1.61	*	0.75
P2O5	-38.41	-2.13	1.51	*	0.84	*	-0.35	-1.60	1.86	-0.69	1.51	*	0.76	*	-0.35
LOI	0.29	5.98	-8.22	*	-3.81	*	0.46	0.92	-0.33	1.25	-0.34	*	-0.80	*	0.93
Ba	-0.99	-0.45	*	-2.02	-0.48	*	0.64	2.04	-0.41	-0.20	2.38	-0.74	-1.13	0.04	1.31
Be	1091.88	4.61	*	*	*	*	*	5.41	*	0.19	*	*	*	*	*
Ce	-17.56	0.88	*	-1.40	*	0.06	*	0.32	1.08	0.36	6.28	3.65	0.88	-0.88	*
Co	13.02	1.03	*	-0.34	*	*	-1.03	0.69	2.40	0.00	*	-1.23	1.03	*	-2.12
Cr	-6.15	5.27	*	1.73	6.54	*	-1.19	5.33	-0.15	1.10	0.95	10.75	0.47	*	-3.66
Cs	1340.55	*	*	-0.91	*	*	*	*	*	0.07	*	-1.21	3.13	0.07	*
Cu	6.58	2.91	*	1.03	-0.13	*	0.65	2.81	*	0.69	*	*	1.03	*	-0.48
Dy	-17.04	*	*	-0.12	*	*	*	1.00	*	0.27	*	-1.55	1.62	-0.15	*
Er	13.67	*	*	-0.22	*	*	*	-1.97	*	0.37	*	*	1.10	-0.49	*
Eu	*	*	*	-0.58	*	*	*	-0.59	*	-0.13	*	-0.34	1.47	-0.44	*
Ga	0.62	0.31	*	0.14	*	*	*	*	0.86	0.86	3.92	*	0.31	*	-0.24
Gd	-7.74	*	*	-0.33	*	*	*	1.61	*	1.33	*	*	1.73	-0.63	*
Hf	56.81	*	*	0.23	*	*	*	*	*	0.76	*	-0.47	-0.21	*	*
Ho	-5.23	*	*	-0.14	*	*	*	-2.26	*	0.60	*	*	1.09	-0.31	*
La	-20.29	6.11	*	-1.33	*	2.05	*	-1.03	*	0.46	*	0.19	0.83	-0.84	*
Li	-7.32	-0.61	*	*	*	*	*	-1.22	*	*	*	*	-1.22	*	*
Lu	*	*	*	-0.09	*	*	*	0.68	*	0.00	*	0.50	0.75	-0.29	*
Nb	8.86	-0.58	*	-1.80	0.55	*	*	*	0.85	-0.01	11.73	*	-2.02	-0.98	-0.58
Nd	18.59	*	*	-0.99	*	*	*	1.35	-0.33	0.16	*	0.98	1.15	-0.60	*
Ni	-8.47	13.65	*	-0.52	1.60	*	3.29	-2.82	-0.47	-0.61	2.82	18.83	5.18	*	0.56
Pb	-0.09	-2.69	*	-0.51	-1.81	*	-0.71	3.87	1.28	0.55	*	*	*	0.57	0.61
Pr	-16.70	*	*	-0.80	*	*	*	2.94	*	0.33	*	*	0.42	-0.59	*
Rb	1.15	0.07	*	0.36	0.36	*	-2.34	-0.85	0.95	0.45	4.44	-0.63	-1.07	-1.16	0.74
Sb	*	*	*	*	*	*	*	-7.34	*	*	*	-1.81	*	*	*
Sc	-1.08	3.04	*	-1.36	*	*	*	*	*	1.40	*	0.97	*	-0.29	*
Sm	4.98	*	*	-0.89	*	*	*	-3.42	*	0.30	*	-0.62	1.16	-0.62	*
Sn	-14.28	2.32	*	*	*	*	*	*	*	-2.14	*	*	1.73	*	*
Sr	-5.22	-0.11	*	1.09	-0.02	*	11.53	0.28	0.39	0.39	3.79	*	0.02	0.57	0.39
Ta	50.07	*	*	-1.25	*	*	*	*	*	-0.62	*	-2.49	-2.50	*	*
Tb	*	*	*	-0.24	*	*	*	-1.42	*	0.69	*	0.03	1.31	-0.18	*
Th	-0.85	-0.43	*	0.60	*	*	0.60	*	*	-0.18	*	0.78	1.62	-1.35	-0.43
Tl	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tm	*	*	*	-0.16	*	*	*	1.86	*	0.42	*	*	0.67	-0.46	*
U	18.01	*	*	0.02	*	*	-2.22	*	*	-0.36	*	-0.79	1.63	-1.08	0.98
V	1.26	2.54	*	0.78	0.12	*	*	-3.58	-0.10	0.31	*	0.97	0.34	*	2.69
Yb	4.25	0.46	*	0.34	-0.59	*	-1.20	-1.40	0.23	1.29	2.82	*	-0.25	-1.50	-0.72
Yb	1.01	0.50	*	-0.17	*	*	*	0.77	*	0.74	*	0.94	1.18	-0.24	*
Zn	-2.21	-0.08	*	-0.94	0.48	*	0.43	2.93	0.60	1.11	-0.85	*	0.77	*	1.69
Zr	-1.29	1.27	*	0.56	-0.55	*	*	*	-0.08	0.56	2.26	*	-1.35	*	0.58

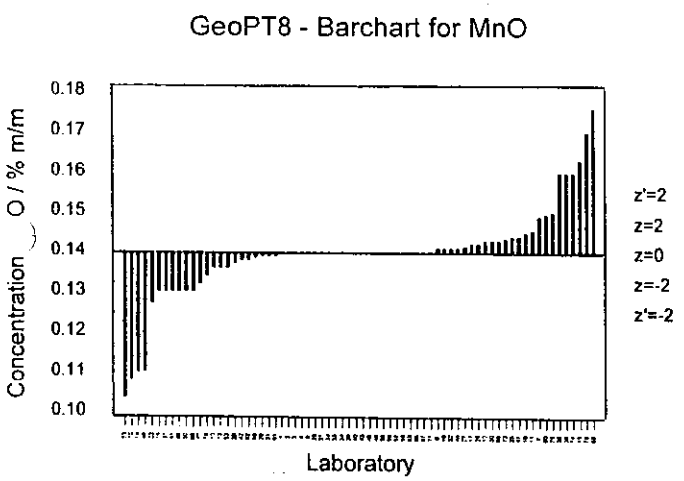
Round identifier	I37	I38	I38	I39	I40	I41	I42	I43	I44	I45	I46	I47	I48	I49	I50
Technique	M	X	X	X	X	AA,	A	X	X	X	AA,	X	A	AA,	X
codes						IR,T					ign,V			ISE,X	
Test portion (g)	0.10	1.0-10	1.0-10	1.00	0.4-6	0.1-1	0.25	1.0-5	0.70	0.40	0.004-2	0.17	0.20	1.00	1.0-5
Data quality	1	1	2	1	1	1	1	2	1	2	1	1	2	2	2
SiO2	*	-3.88	*	-0.31	-0.27	*	1.87	-0.34	0.23	0.12	-0.16	-0.74	-0.17	0.69	2.03
TiO2	0.00	2.50	*	-2.50	2.50	*	2.50	0.00	-0.12	0.00	3.12	2.50	-0.94	0.31	0.31
Al2O3	*	-3.24	*	0.86	-0.66	-2.48	*	0.78	-0.15	-0.08	1.77	1.26	0.25	-3.06	-2.13
Fe2O3	*	6.05	*	-0.90	5.04	-0.11	-0.67	0.73	-0.22	-0.11	-2.46	2.46	-0.28	1.34	-4.93
Fe(II)O	*	*	*	*	*	-7.43	*	*	*	*	2.43	*	*	*	*
MnO	-2.58	5.41	*	0.08	0.08	-2.58	-0.45	0.04	0.35	0.04	-7.90	1.15	0.04	-1.29	-1.29
MgO	*	-1.92	*	-1.92	0.30	-1.43	-0.44	-0.47	-0.69	0.27	-1.18	8.44	-0.34	-4.04	-1.95
CaO	*	6.26	*	-2.13	0.66	1.50	1.08	-0.72	0.10	-0.37	3.88	5.84	-0.44	1.80	-0.02
Na2O	*	4.20	*	1.01	2.02	0.00	-0.67	-0.34	0.50	0.08	-3.19	-8.23	-1.51	-2.60	3.86
K2O	*	6.88	*	2.58	4.30	-3.66	2.15	2.37	0.00	0.65	-0.43	0.65	-0.97	1.61	1.08
P2O5	*	1.51	*	1.51	-0.71	*	*	0.76	0.18	-0.35	-0.71	-6.25	-2.57	-9.22	0.76
LOI	*	-0.97	*	8.80	-3.18	-0.03	-0.03	0.15	*	*	-3.18	-3.18	*	0.93	*
Ba	0.44	*	*	2.04	0.61	2.04	*	-1.00	-0.32	*	*	*	-0.12	*	-0.03
Be	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ce	0.56	*	*	*	*	*	*	*	*	*	*	*	*	*	2.11
Co	1.64	15.76	*	-2.06	7.13	*	*	*	0.69	*	*	*	-0.34	15.35	*
Cr	0.82	5.54	*	1.78	2.03	-0.30	*	*	0.53	*	*	*	-0.36	-2.51	1.93
Cs	0.40	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cu	1.91	1.30	*	*	-3.67	-0.96	*	*	-0.21	*	*	*	0.65	*	*
Dy	1.16	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Er	0.95	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Eu	-0.01	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ga	1.50	-1.59	*	*	-0.49	*	*	*	-0.49	*	*	*	*	*	*
Gd	0.06	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Hf	1.57	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ho	1.28	*	*	*	*	*	*	*	*	*	*	*	*	*	*
La	0.52	*	*	*	-1.60	*	*	*	*	*	*	*	*	*	*
Li	1.71	*	*	*	*	-3.05	*	*	*	*	*	*	1.22	*	*
Lu	0.00	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Nb	1.27	0.27	*	*	1.13	*	*	0.13	3.13	*	*	*	*	*	0.13
Nd	0.53	*	*	*	-0.80	*	*	*	*	*	*	*	*	*	0.78
Ni	1.51	1.88	*	4.71	-1.13	-8.47	*	*	0.00	*	*	*	0.00	9.18	1.41
Pb	-0.23	-13.32	*	*	-1.95	-5.38	*	*	-1.42	*	*	*	*	14.90	*
Pr	-0.15	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Rb	0.89	-2.15	*	2.16	-0.32	-3.92	*	-0.95	0.89	*	*	*	*	*	-0.19
Sb	2.33	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Sc	1.78	-0.06	*	*	0.97	*	*	*	0.97	*	*	*	-0.03	*	-1.05
Sm	0.83	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Sn	-0.62	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Sr	2.28	-1.72	*	-3.47	-0.14	0.53	*	-0.36	0.28	*	*	*	-0.11	*	*
Ta	-0.49	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tb	0.65	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Th	0.03	*	*	*	4.06	*	*	-1.45	*	*	*	*	*	*	*
Tl	1.69	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tm	0.68	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U	0.24	*	*	*	0.04	*	*	*	*	*	*	*	*	*	-0.62
V	0.18	-1.09	*	*	-2.88	*	*	*	-0.21	*	*	*	-1.28	*	0.63
Yb	0.07	0.45	*	-0.97	2.21	*	*	-1.20	0.45	*	*	*	0.94	*	0.70
Yb	0.87	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Zn	-0.34	-1.87	*	*	0.24	-0.51	*	*	0.17	*	*	*	-0.08	1.72	-0.43
Zr	-0.01	0.55	*	-1.15	1.08	*	*	-1.99	-0.44	*	*	*	*	*	0.35

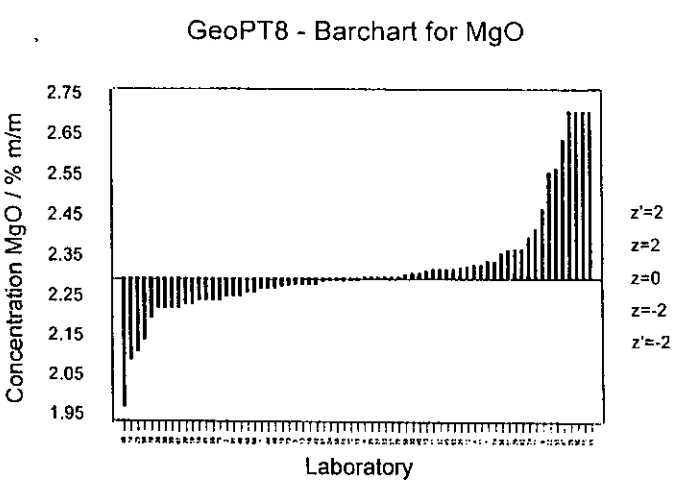
Round identifier	I51	I52	I53	I54	I55	I55	I56	I57	I58	I58	I59	I60	I61	I61	I62
Technique	A,O	A,X	AA	I	A,M,	A,M,	A	M,X	X	X	A,M,X	X	AA,A,E,	AA,A,E,	AA,ign,
codes					O,T,X	O,T,X							M,O,X	M,O,X	T,M
Test portion (g)	0.3-0.5	1.0-6	0.10	0.15	0.2-4	0.2-4	0.25	0.2-1	1.2-9	1.2-9	0.1-12	4.00	0.1-1.2	0.1-1.2	0.1-0.5
Data quality	2	2	1	1	1	2	1	1	1	2	2	2	1	2	2
SiO2	-0.07	-1.62	4.95	*	-0.18	*	-0.67	0.26	0.35	*	-0.08	-0.11	0.01	*	0.04
TiO2	-0.31	-0.31	4.37	*	-0.62	*	1.25	0.31	0.37	*	-0.31	-0.21	1.75	*	-0.16
Al2O3	-0.40	-1.34	-0.76	*	0.51	*	0.20	1.11	0.47	*	-0.78	-1.80	1.16	*	0.00
Fe2O3	-0.11	-0.84	-9.63	-2.91	0.00	*	1.12	0.78	0.74	*	-0.11	5.12	1.12	*	-0.22
Fe(II)O	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-2.12
MnO	*	-0.49	-10.57	*	0.08	*	0.08	0.08	-0.32	*	0.04	1.31	*	-0.09	-0.23
MgO	0.86	0.03	6.71	*	-0.20	*	1.53	0.05	0.22	*	-0.84	7.18	*	-0.12	0.89
CaO	-1.68	-0.44	-1.71	*	0.52	*	0.80	0.66	0.03	*	-0.23	-0.02	-0.01	*	0.26
Na2O	1.09	0.34	13.44	2.02	1.68	*	*	0.00	0.94	*	0.34	-1.25	0.84	*	1.09
K2O	0.72	-1.08	3.66	*	2.58	*	*	0.65	0.11	*	-0.43	1.72	-0.86	*	-0.11
P2O5	*	-0.35	*	*	-2.93	*	3.73	1.51	1.18	*	-0.35	-1.69	*	0.31	-0.02
LOI	1.19	0.46	*	*	1.55	*	276.51	*	-0.66	*	-0.64	2.12	*	1.09	-0.49
Ba	*	2.87	*	-0.40	*	-0.75	-0.57	1.11	-1.74	*	-1.16	0.68	*	-1.50	*
Be	*	*	*	*	*	*	*	*	*	*	-1.11	*	*	-0.15	*
Ce	*	-0.50	*	1.02	0.46	*	*	0.73	*	-1.79	-0.58	-1.59	2.25	*	*
Co	*	-0.34	*	-0.55	*	*	8.91	*	*	*	-1.71	-0.34	*	0.34	*
Cr	*	-0.15	*	-1.14	*	*	-0.30	-1.14	0.53	*	0.58	0.89	*	-0.57	*
Cs	*	*	*	-0.47	1.28	*	*	-0.67	*	*	*	19.98	-0.47	*	*
Cu	*	0.27	*	*	*	0.65	-3.22	-1.41	1.00	*	0.31	14.60	4.32	*	*
Dy	*	-0.01	*	*	0.28	*	*	1.64	*	*	-0.03	*	0.98	*	*
Er	*	0.93	*	*	0.85	*	*	-0.04	*	*	-0.18	*	-0.20	*	*
Eu	*	-0.42	*	0.32	0.15	*	*	0.24	*	*	-0.05	*	1.22	*	*
Ga	*	-0.24	*	*	*	-0.11	0.62	*	0.51	*	-0.41	-3.55	*	-0.63	*
Gd	*	-0.21	*	*	-0.04	*	*	0.88	*	*	-0.30	-0.44	1.89	*	*
Hf	*	-0.79	*	0.03	0.29	*	*	0.93	*	*	0.19	0.67	1.25	*	*
Ho	*	-0.55	*	*	0.95	*	*	1.28	*	*	-0.18	*	1.69	*	*
La	*	-0.27	*	-0.05	0.95	*	*	0.52	*	-1.65	-0.84	1.23	2.35	*	*
Li	*	*	*	*	*	0.52	*	*	*	*	-0.21	*	0.00	*	*
Lu	*	0.75	*	*	0.83	*	*	0.26	*	*	-0.47	*	0.83	*	*
Nb	*	-1.30	*	*	0.54	*	-0.45	-0.16	1.13	*	0.42	-0.58	1.46	*	*
Nd	*	-0.47	*	*	2.26	*	*	0.98	*	-2.88	-0.51	0.78	3.91	*	*
Ni	*	0.94	*	-0.94	*	2.35	0.00	*	-2.54	*	-0.09	4.24	*	-0.51	*
Pb	*	0.61	*	*	*	0.31	*	-0.49	3.35	*	-1.17	-0.71	*	2.60	*
Pr	*	-0.67	*	*	1.21	*	*	0.51	*	*	-0.47	*	0.51	*	*
Rb	*	-0.31	*	-0.37	1.19	*	*	2.41	0.03	*	-0.11	-1.83	-0.12	*	*
Sb	*	*	*	-0.77	*	*	*	*	*	*	*	*	*	*	*
Sc	*	-0.40	*	-0.77	*	-0.54	0.97	-1.80	-1.69	*	-1.36	*	1.17	*	*
Sm	*	-0.05	*	0.46	1.02	*	*	0.71	*	*	-0.53	*	1.65	*	*
Sn	*	*	*	*	*	*	*	*	*	*	*	*	*	0.84	*
Sr	*	-1.11	*	-0.22	2.59	*	-0.97	1.03	-0.47	*	0.07	-2.36	0.53	*	*
Ta	*	*	*	0.14	-0.49	*	*	-0.74	*	*	-0.33	*	*	5.07	*
Tb	*	0.79	*	-0.90	0.13	*	*	0.65	*	*	-0.19	*	0.55	*	*
Th	*	-1.14	*	-0.10	0.17	*	*	0.91	-1.26	*	-0.37	-7.59	1.56	*	*
Tl	*	*	*	*	*	0.12	*	*	*	*	*	*	*	-0.73	*
Tm	*	*	*	*	0.52	*	*	0.45	*	*	-0.27	*	1.34	*	*
U	*	2.59	*	-0.41	0.11	*	*	0.30	*	*	-0.33	2.59	1.33	*	*
V	*	-1.28	*	*	*	1.07	0.09	*	1.62	*	-1.95	-1.72	*	1.07	*
Yb	*	-0.72	*	*	1.29	*	1.40	-0.83	-0.40	*	-1.51	0.94	2.34	*	*
Yb	*	-0.13	*	0.67	0.84	*	*	0.61	*	*	-0.30	*	0.34	*	*
Zn	*	-0.25	*	-2.55	*	1.96	0.85	*	0.14	*	0.39	-0.08	-2.89	*	*
Zr	*	-0.15	*	0.70	0.67	*	-0.44	-4.41	1.38	*	-0.09	0.14	*	0.35	*

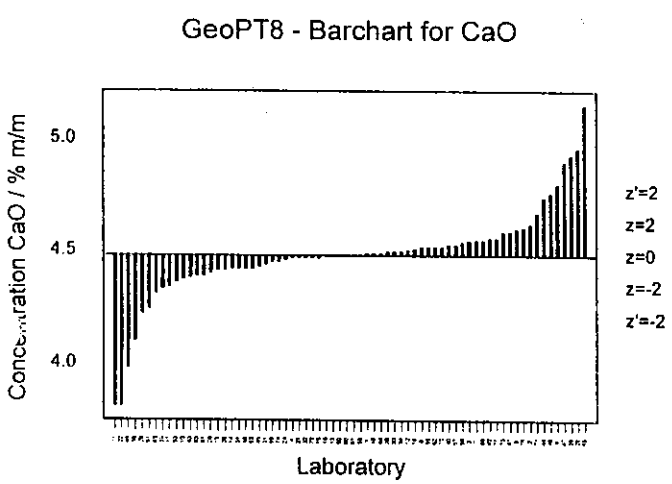
Round identifier	I63	I64	I65	I66	I67	I68	I69	I70	I71	I72	I73	I74	I75	I76	I77
Technique	A,M	M	I	X	X	X	AA	X	A,I,M,	A,I,	M,X	AA,A	XRF	AA,A,	A,O,
codes									T,X	M,X				M,X	X
Test portion (g)	0.2-0.5	0.25	0.20	4.00	0.4-8	1.50	0.10	1.0-7	0.2-3	0.1-0.8	0.125-3.5	0.50	1.50	0.3-0.5	0.01-5
Data quality	2	1	1	2	2	2	1	1	2	1	1	1	1	2	2
SiO2	0.12	*	*	-0.25	0.09	0.09	-1.96	2.13	0.12	-0.21	1.55	*	0.12	-0.16	-0.08
TiO2	-0.62	*	0.62	-1.56	0.00	0.41	*	0.62	-0.12	0.00	0.93	1.87	0.62	-0.03	-0.84
Al2O3	-1.62	*	5.36	0.68	-0.53	-0.46	-2.33	0.10	-0.08	-0.15	1.47	-0.15	-0.71	0.03	-0.25
Fe2O3	-0.45	*	-1.01	-0.62	0.06	0.62	*	0.56	0.00	-0.45	1.89	0.90	-0.34	-0.61	0.00
Fe(II)O	*	*	*	*	*	*	*	*	-0.80	*	*	*	-2.15	*	-0.03
MnO	0.04	*	0.08	-1.29	0.04	0.44	71.95	8.07	0.04	-8.44	0.96	5.41	2.74	-0.76	-1.02
MgO	0.27	*	12.88	7.92	-0.96	-0.47	-1.43	-0.20	1.51	-0.20	-0.49	1.04	-1.43	-1.28	0.03
CaO	-0.65	*	-2.41	-3.51	-0.65	0.47	30.30	0.52	1.31	-0.18	1.45	-0.46	-0.18	0.87	0.54
Na2O	0.08	*	3.36	2.60	-1.01	0.50	-16.97	-0.84	0.34	-1.34	0.86	-5.21	-0.34	0.39	-1.01
K2O	-1.08	*	1.08	-0.11	0.00	0.22	2.15	0.00	-1.18	0.00	0.99	-5.38	1.29	0.20	1.51
P2O5	-3.68	*	*	0.76	9.63	0.09	*	200.64	-0.35	12.60	0.64	-7.36	-0.71	0.64	0.31
LOI	*	*	*	*	*	-1.27	*	-2.55	-1.12	1.55	*	*	-2.55	-0.33	0.30
Ba	-0.41	2.29	3.64	1.94	1.99	*	*	*	0.14	0.36	0.39	-0.90	-5.95	-1.29	0.09
Be	*	*	*	*	*	*	*	*	1.56	0.91	*	*	*	-0.72	-0.53
Ce	-0.46	0.03	1.14	*	0.47	*	*	*	0.21	-0.83	-0.56	*	*	-0.54	0.06
Co	-0.34	-2.88	0.00	*	-1.71	*	*	*	0.34	0.69	*	6.17	8.91	*	*
Cr	-3.70	*	-0.22	*	-0.78	*	*	*	0.06	2.07	-1.68	*	-8.23	*	*
Cs	*	-3.30	0.54	*	*	*	*	*	0.44	-0.13	4.29	-10.58	*	*	*
Cu	-0.86	*	*	*	-1.23	*	*	*	-0.48	0.10	-1.04	5.83	-5.48	-1.23	1.03
Dy	-1.10	0.28	1.09	*	*	*	*	*	-0.12	1.13	2.84	*	*	-0.02	-0.50
Er	-1.36	-0.50	*	*	*	*	*	*	0.00	-0.37	1.64	*	*	-0.64	0.34
Eu	-1.40	1.06	0.89	*	*	*	*	*	0.11	-0.34	1.42	*	*	0.12	0.04
Ga	0.31	-0.93	*	*	*	*	*	*	0.86	-0.89	1.61	*	*	*	*
Gd	-1.24	-0.26	*	*	*	*	*	*	0.02	0.58	0.95	*	*	-0.45	0.87
Hf	*	0.14	0.64	*	*	*	*	*	0.09	-1.14	0.06	*	*	*	*
Ho	-0.97	-0.37	*	*	*	*	*	*	-0.02	*	2.08	*	*	-0.39	-0.02
La	-0.39	-0.30	0.27	*	-2.02	*	*	*	0.18	-0.54	0.93	*	*	-0.43	0.83
Li	*	*	*	*	*	*	*	*	0.31	0.12	*	0.61	*	*	-0.92
Lu	*	-0.17	0.06	*	*	*	*	*	0.48	-0.51	0.58	*	*	-0.37	0.54
Nb	*	-0.16	*	*	*	*	*	*	1.57	-0.16	0.07	*	*	*	-0.58
Nd	-1.44	0.09	1.27	*	*	*	*	*	-0.14	-0.58	-0.46	*	*	-0.44	0.23
Ni	0.75	*	*	*	-0.94	*	*	-0.38	6.12	-0.19	0.85	0.94	-5.65	46.60	-0.94
Pb	-3.35	*	*	-1.83	10.54	*	*	*	3.26	1.49	1.47	-0.09	*	*	-0.97
Pr	-1.28	0.12	*	*	6.27	*	*	*	0.05	0.65	-1.19	*	*	-0.41	0.48
Rb	-0.06	-4.81	-0.75	-0.22	-3.73	*	*	-0.88	-0.44	1.07	0.68	0.89	*	*	0.45
Sb	*	*	1.30	*	*	*	*	*	0.65	-2.16	*	*	*	*	*
Sc	-7.34	*	0.56	*	*	*	*	*	-0.54	0.97	4.20	*	0.97	*	0.23
Sm	-1.73	-0.23	1.77	*	*	*	*	*	0.98	1.36	0.90	*	*	-0.29	-0.17
Sn	*	*	*	*	*	*	*	*	1.14	1.45	*	*	*	*	-0.93
Sr	-0.56	-3.25	*	-0.02	-1.74	*	*	-2.37	0.77	0.13	-0.72	2.53	-6.23	38.19	0.39
Ta	*	0.00	-0.24	*	*	*	*	*	3.13	0.39	0.00	*	*	*	*
Tb	-0.76	0.76	0.24	*	*	*	*	*	-0.45	-0.90	2.01	*	*	*	-1.23
Th	*	1.28	0.91	0.49	11.86	*	*	*	-0.22	-0.61	-0.68	*	*	*	-0.84
Tl	*	*	*	*	*	*	*	*	-0.12	0.24	*	*	*	*	*
Tm	*	-0.39	*	*	*	*	*	*	0.12	0.35	0.83	*	*	-0.49	-0.32
U	-4.15	0.56	*	*	*	*	*	*	0.34	0.36	-0.60	*	*	*	9.00
V	2.54	*	2.00	*	-0.40	*	*	*	1.81	-0.32	0.56	2.73	-5.20	*	-1.28
Yb	-0.84	-0.55	*	0.23	0.70	*	*	*	0.70	1.07	1.97	*	-3.35	-2.15	-0.30
Yb	-1.51	0.94	1.81	*	*	*	*	*	-0.82	-0.74	0.35	*	*	-0.34	-0.08
Zn	-0.94	*	*	*	-0.25	*	-23.65	*	-0.77	-0.28	0.38	5.62	-4.94	-0.08	0.26
Zr	-1.99	-2.71	-0.72	0.14	-1.21	*	*	*	-0.08	0.27	-0.59	4.95	2.11	*	0.99

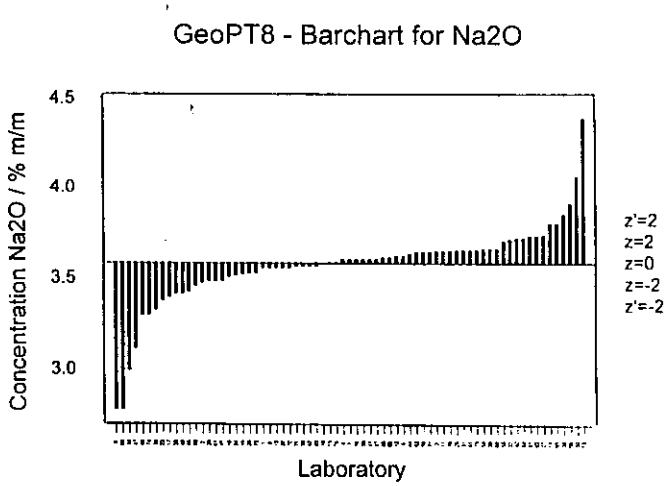


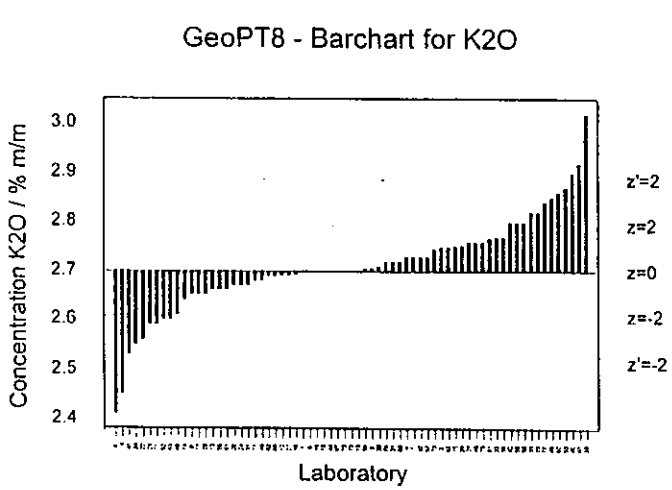












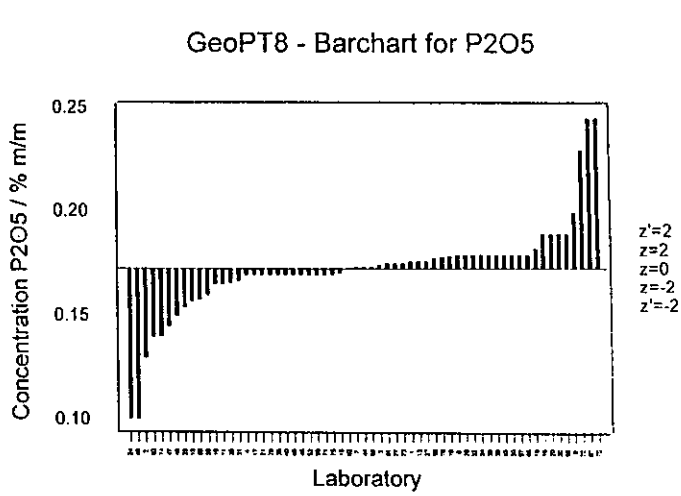


Figure 1 / GeoPT8

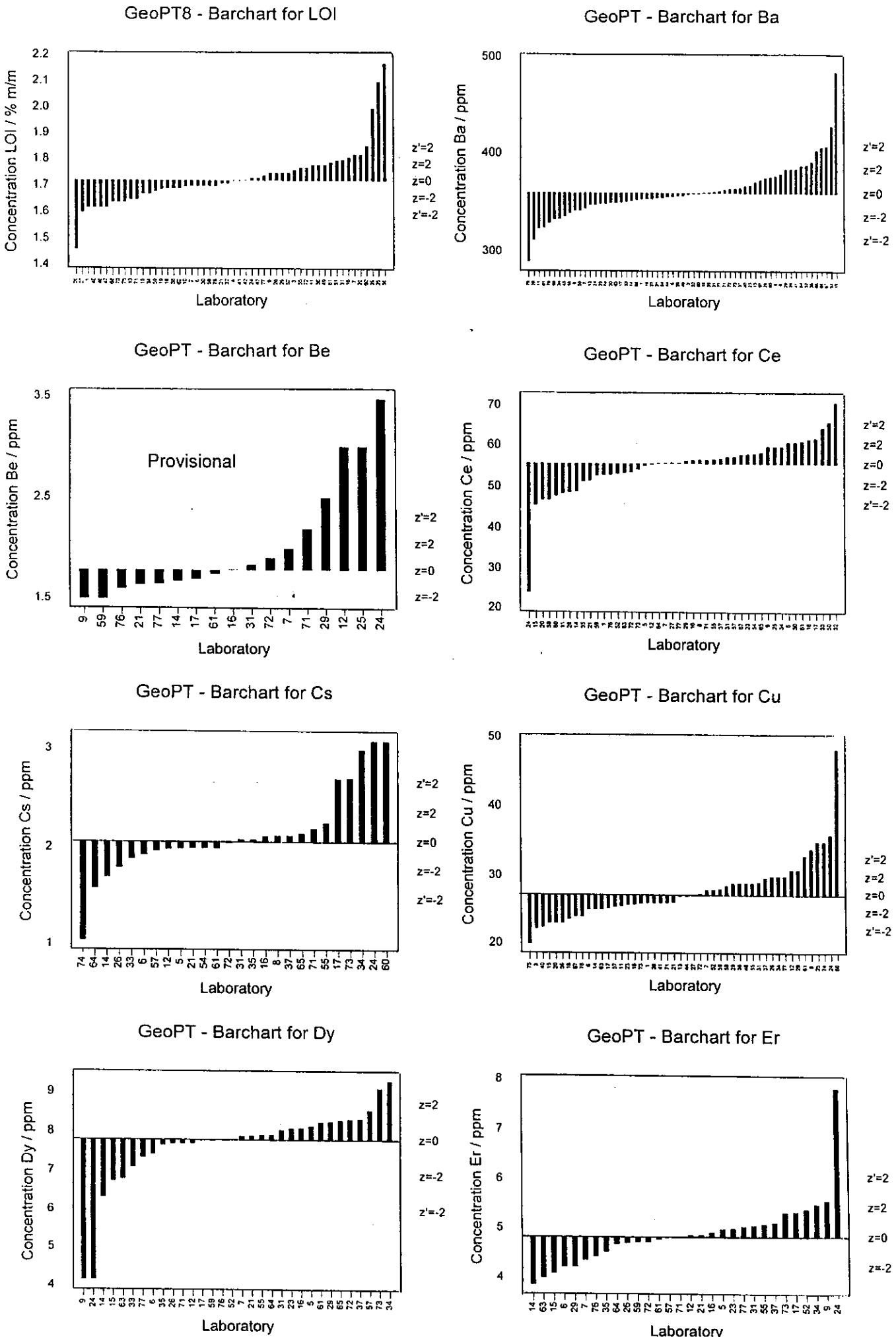


Figure 1 / GeoPT8 (continuation 1)

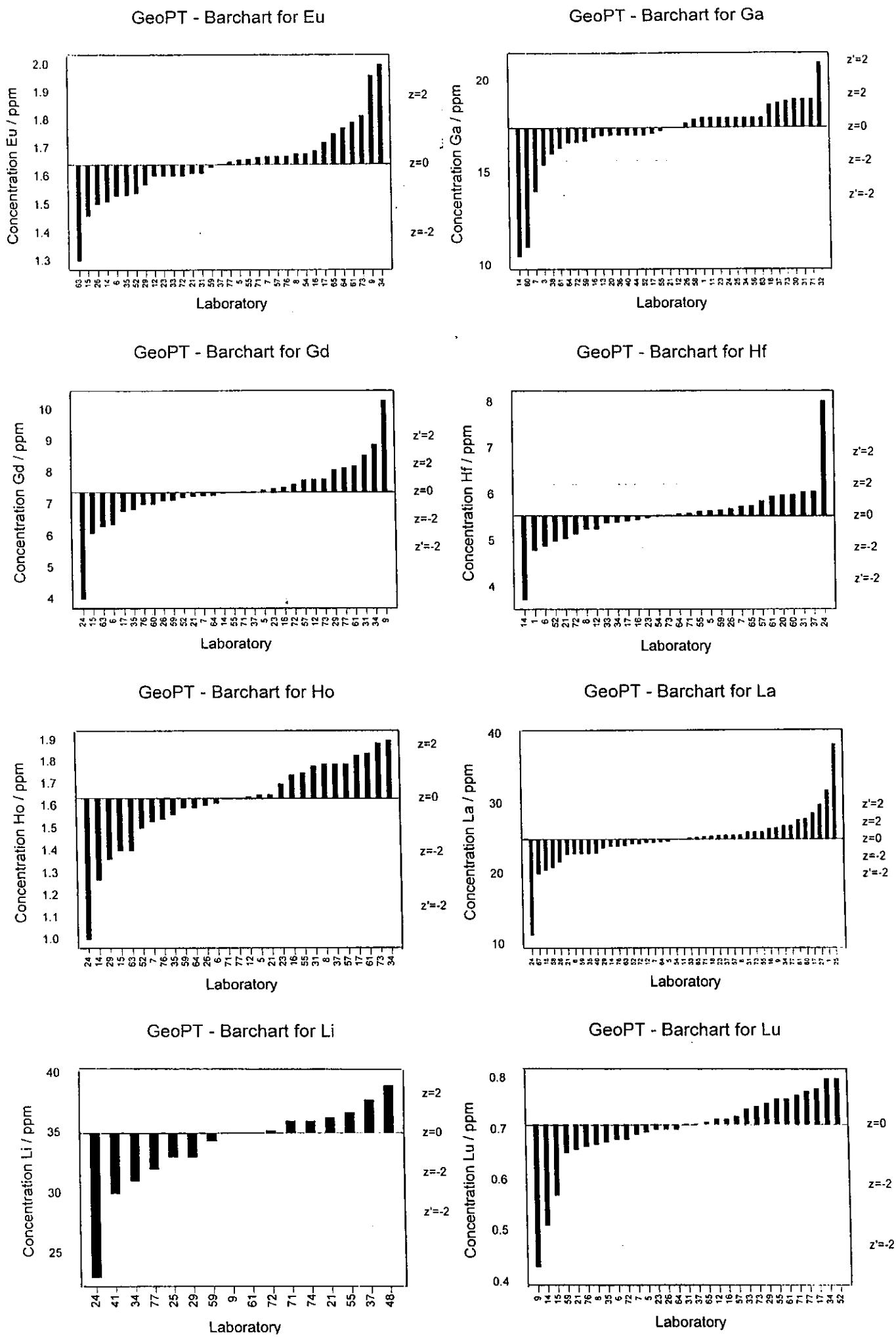
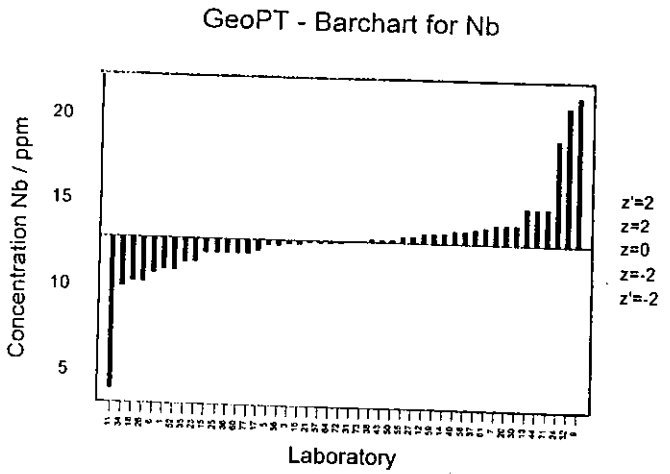
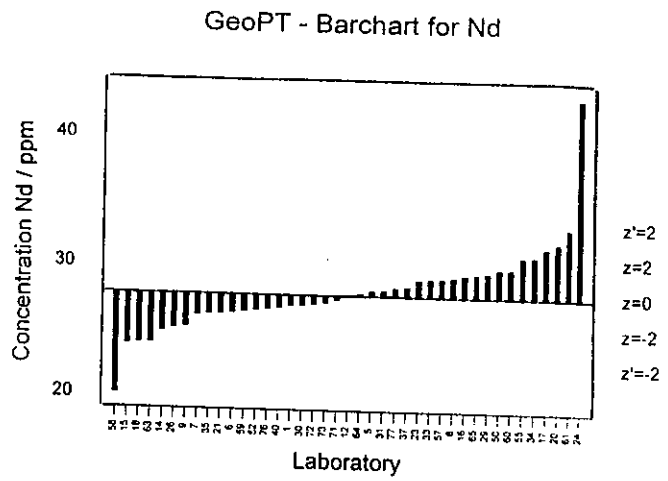
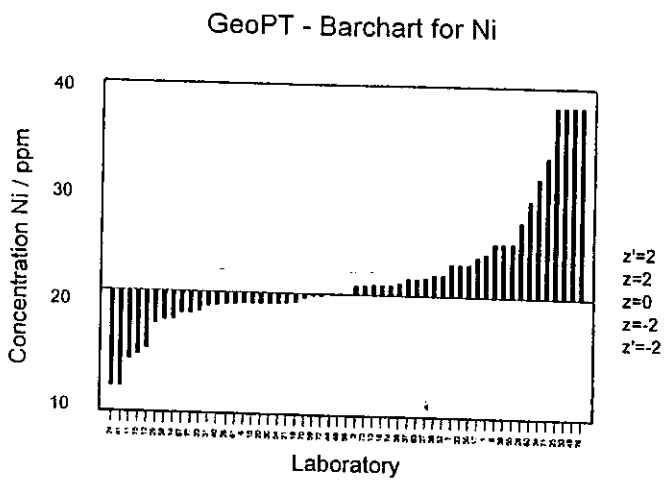
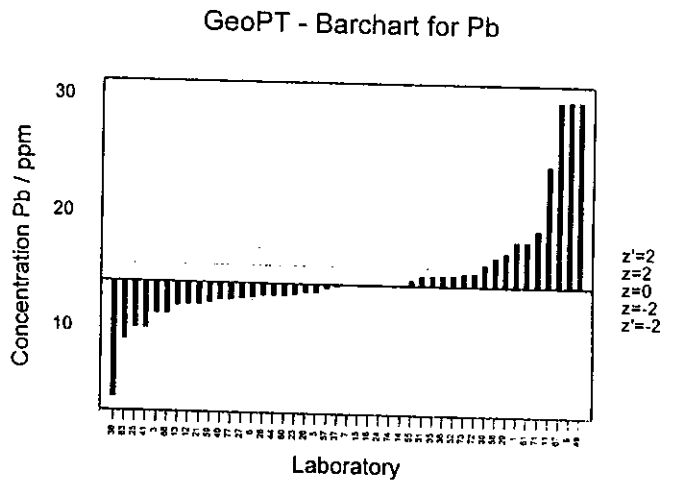


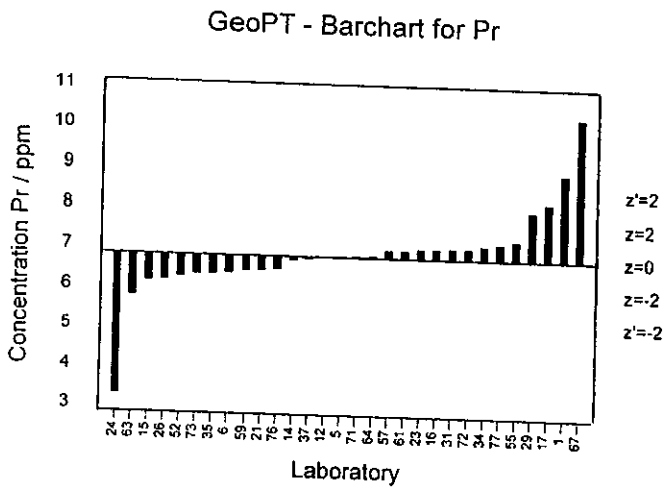
Figure 1 / GeoPT8 (continuation 2)

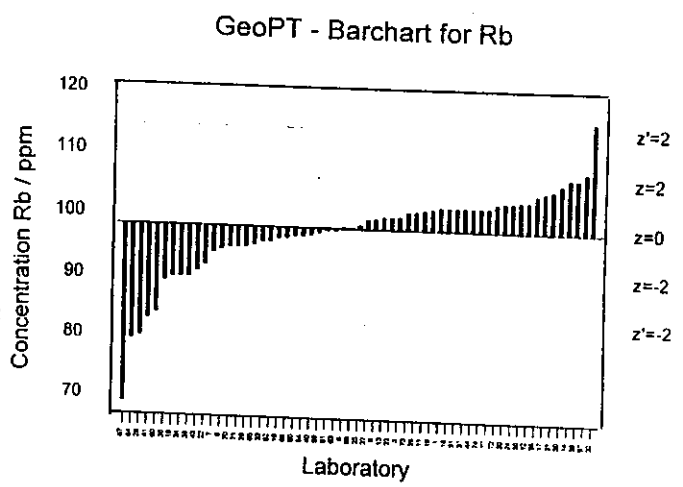


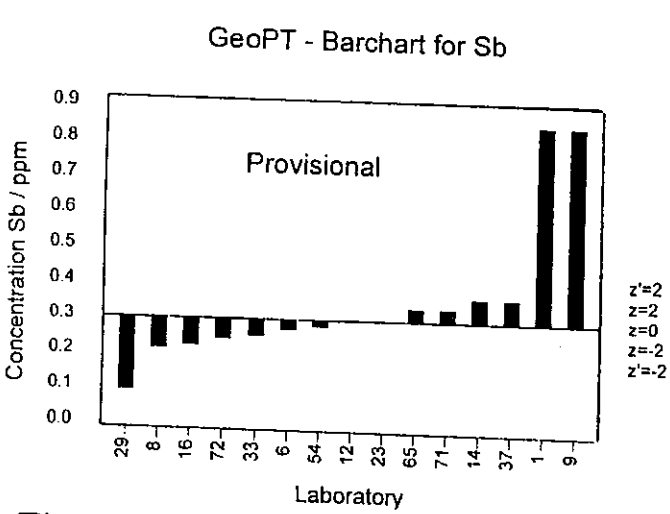












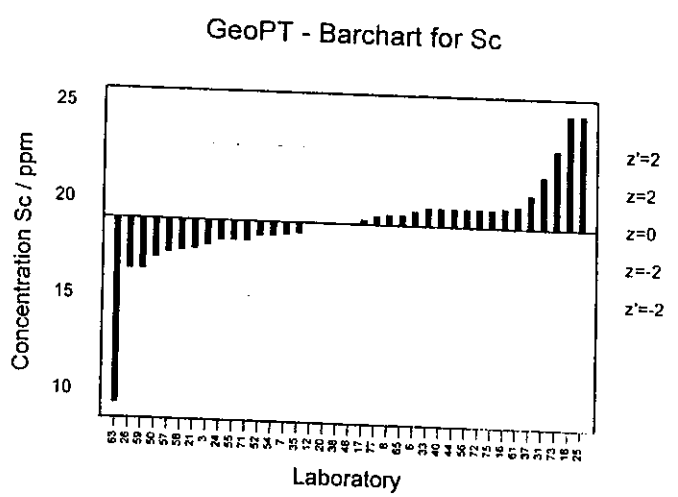


Figure 1 / GeoPT8 (continuation 3)

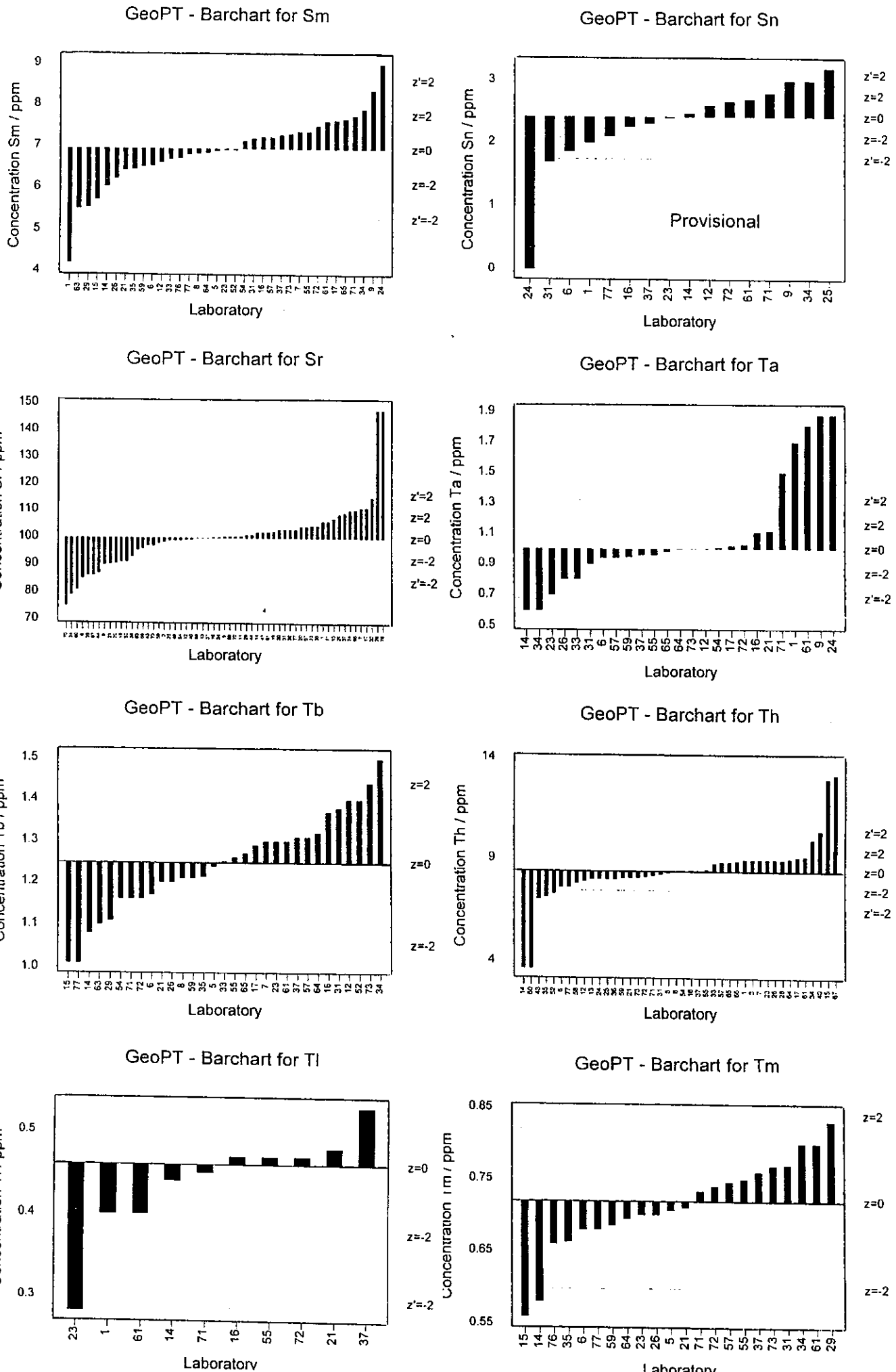
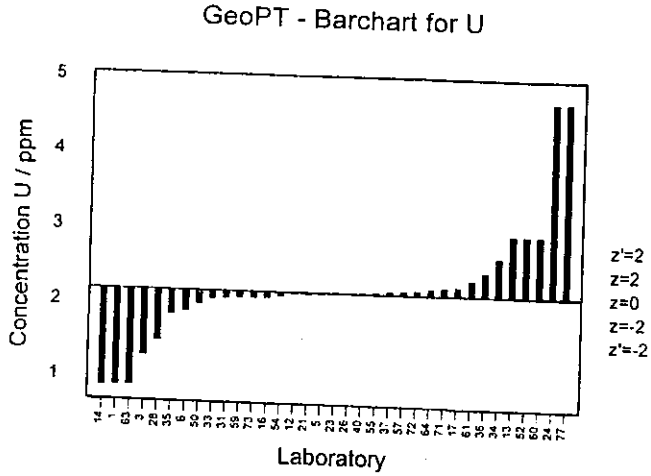
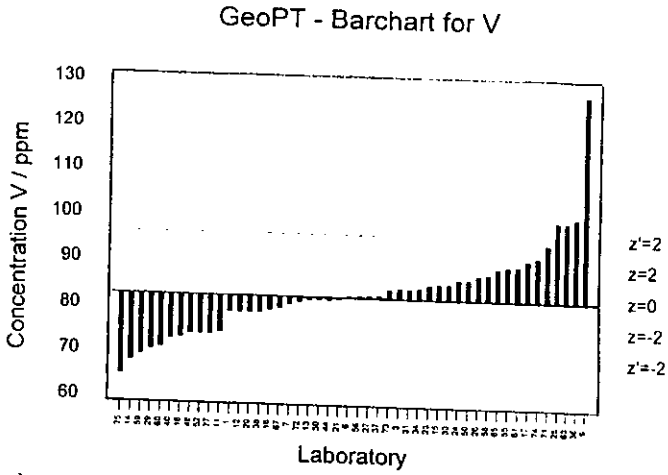
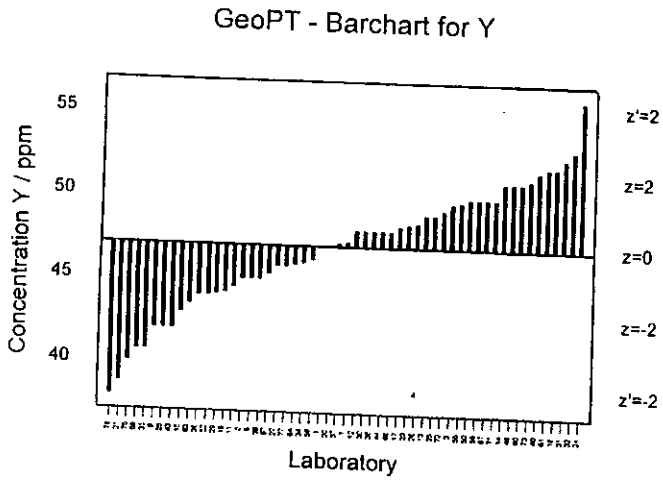
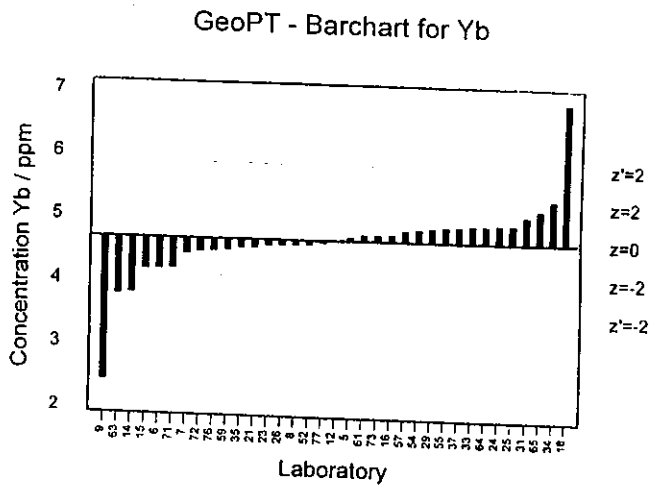


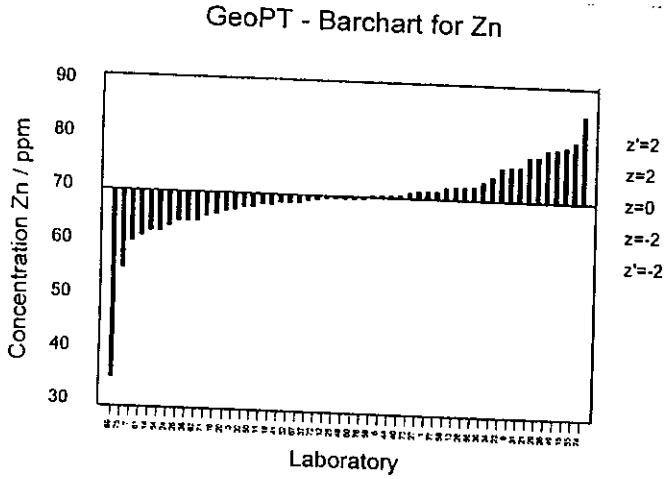
Figure 1 / GeoPT8 (continuation 4)











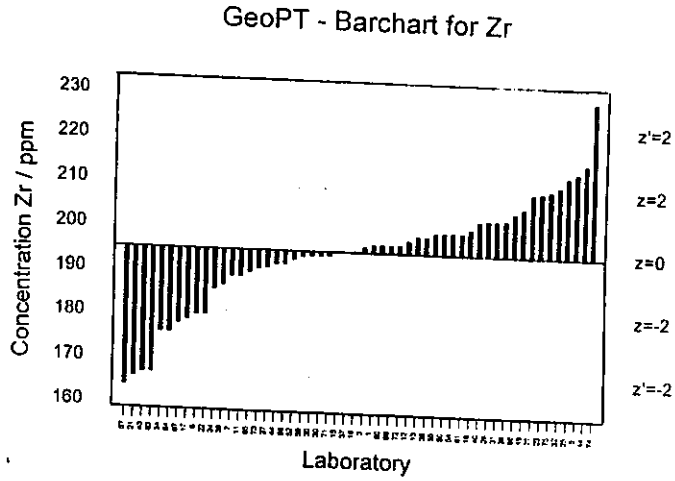
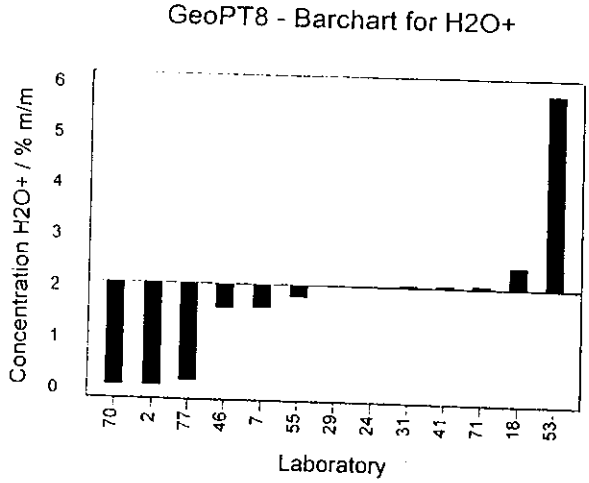
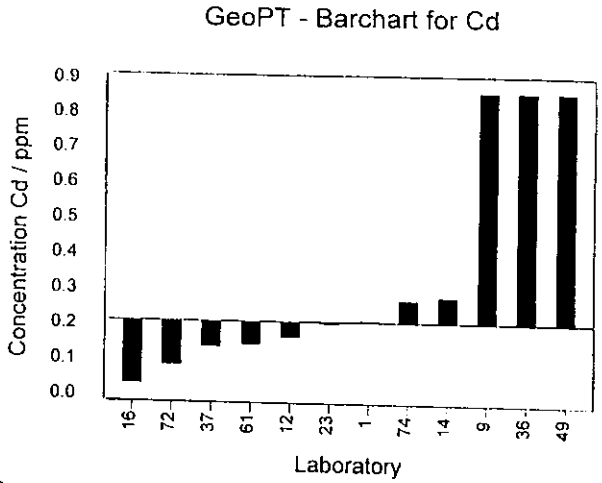
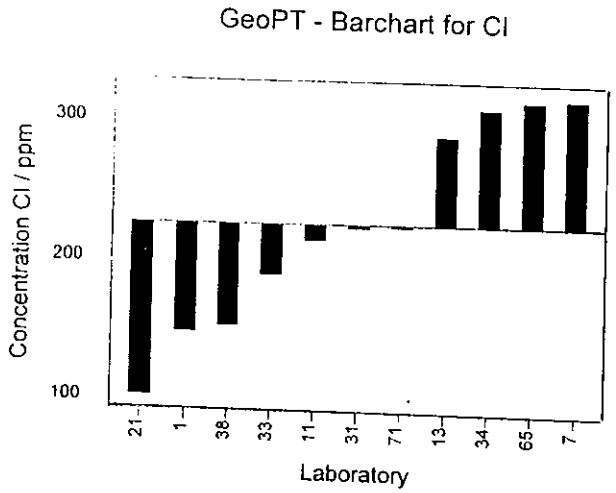
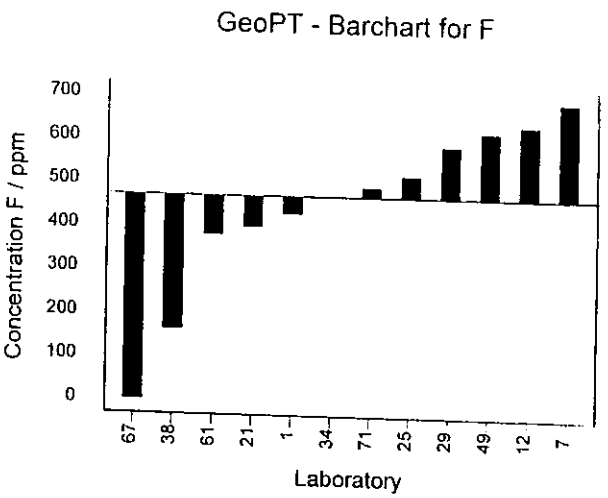


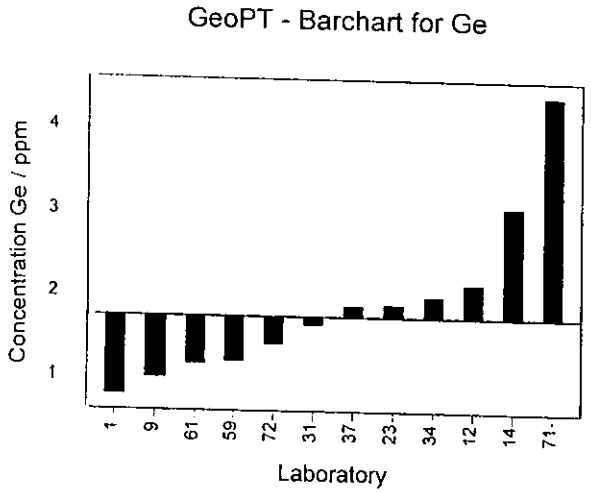
Figure 1 / GeoPT8 (continuation 5)

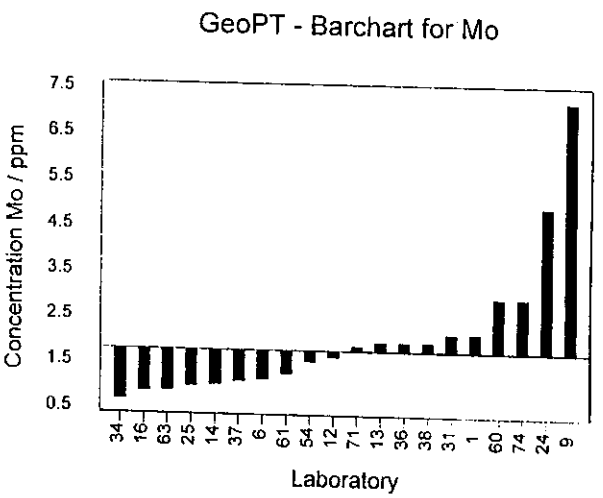


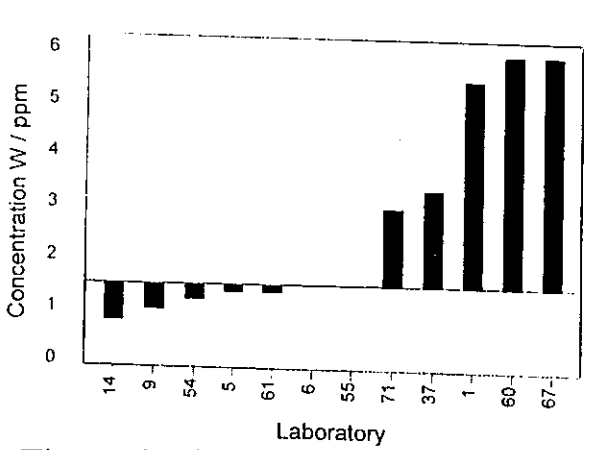












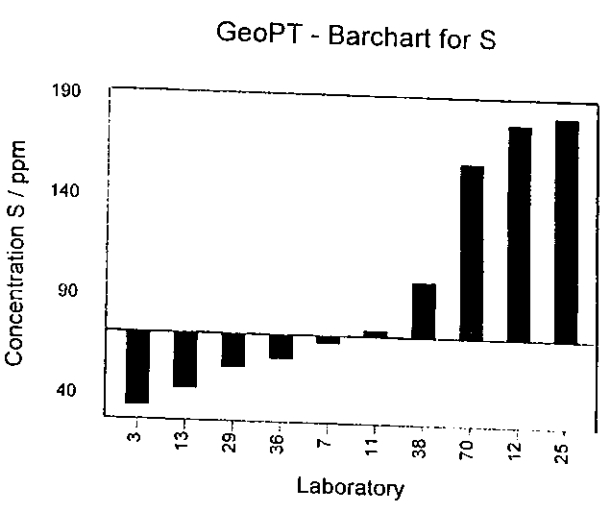
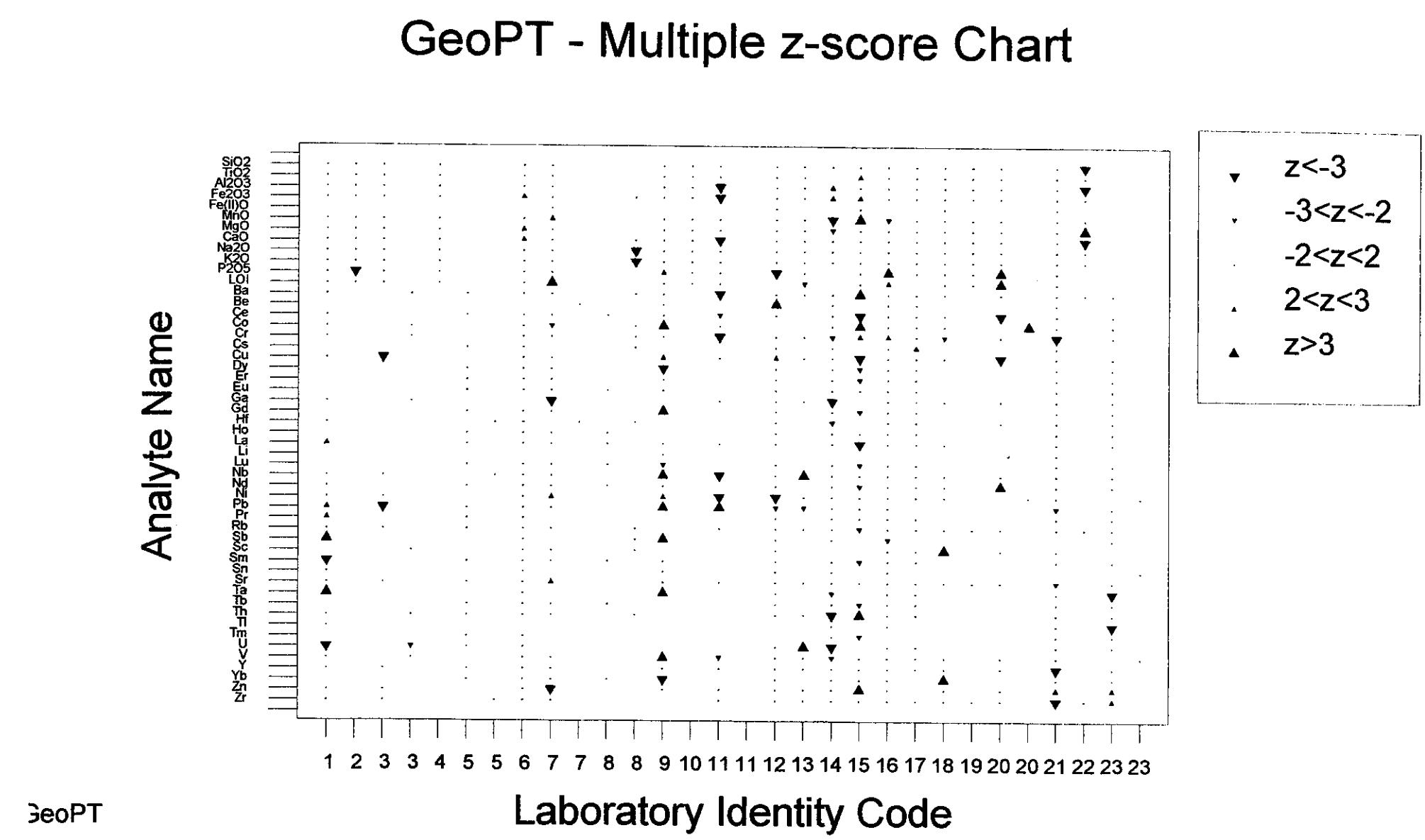


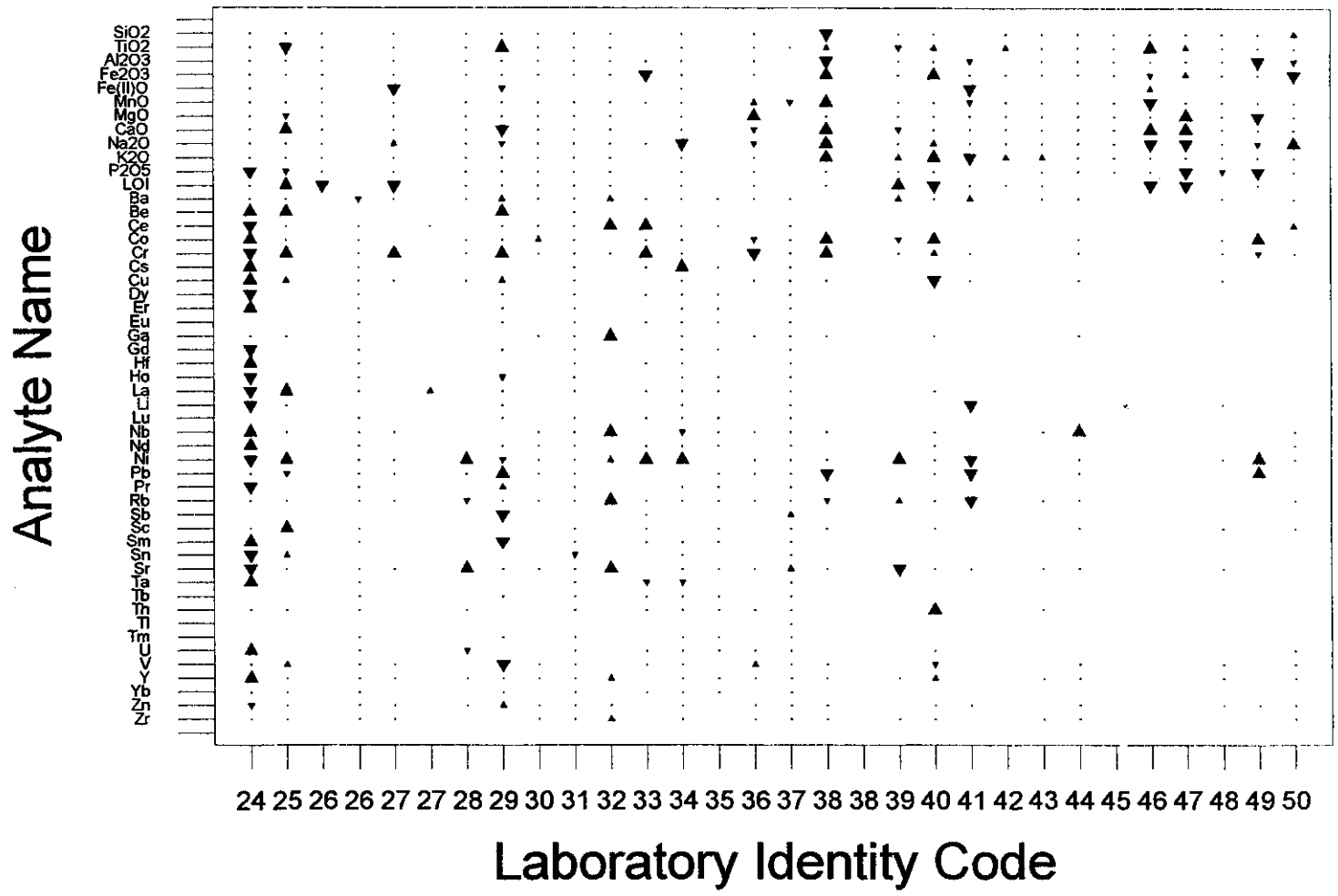
Figure 2 / GeoPT8



GeoPT

19/01/01

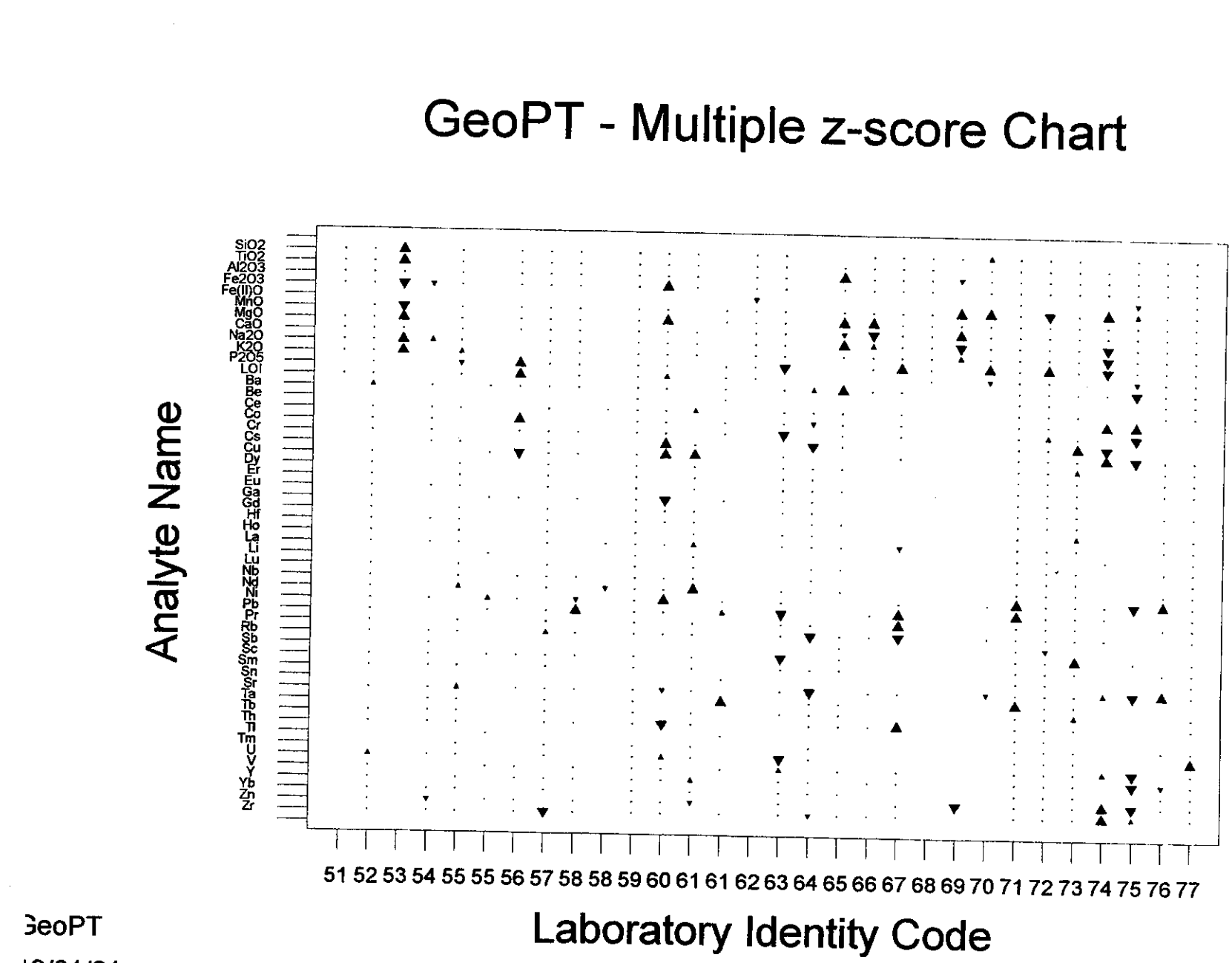
Figure 3 / GeoPT8



GeoPT

19/01/01

Figure 3 / GeoPT8 (continuation 1)



GeoPT

19/01/01

Figure 3 / GeoPT8 (continuation 2)