

G-probe 19 Summary Report
April 2018
Stephen Wilson

A total of twenty five labs submitted final results during this stage of the G-probe 19 study. Technique breakdown was, sixteen labs used LA-ICP-MS, three used SEM, nine used EPMA and one provided information using miro-XRF. Four labs reported results using multiple techniques or provided multiple datasets. The starting material used in glass preparation was the Ardnamurchan gabbro OU-7 kindly supplied by the International Association of Geoanalysts.

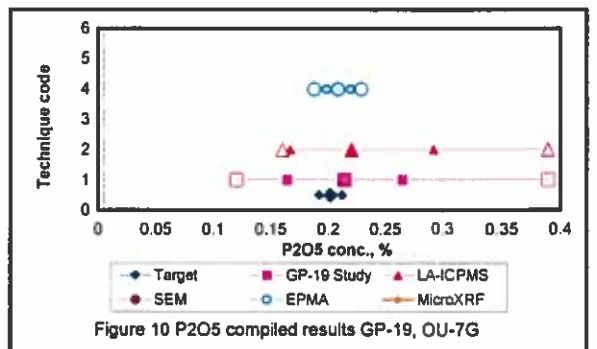
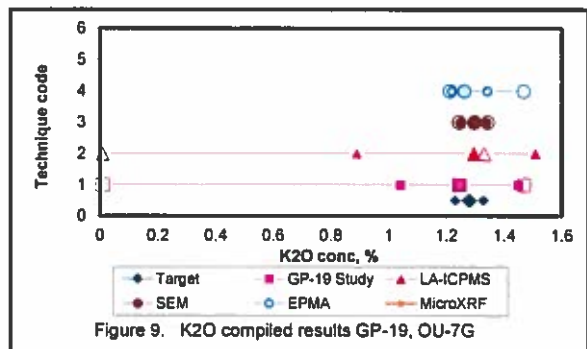
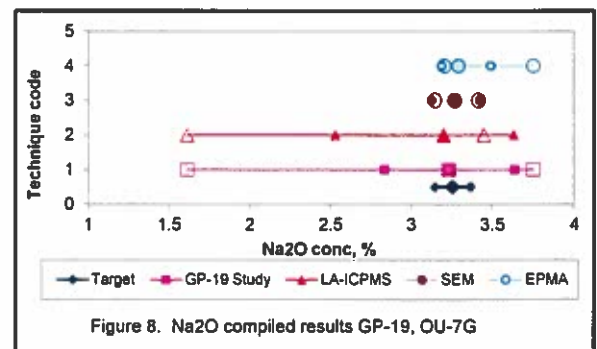
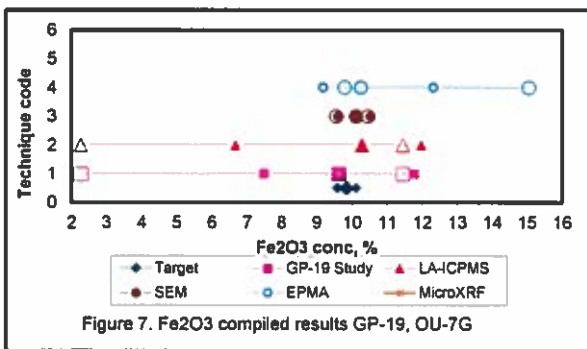
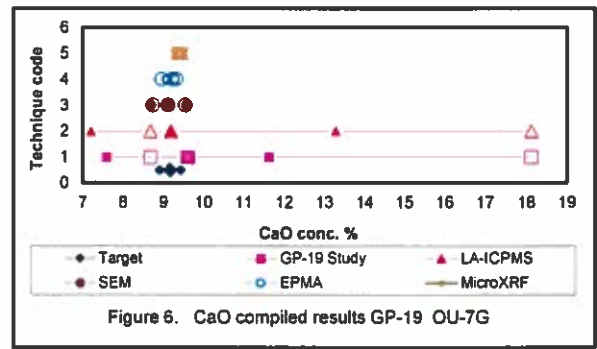
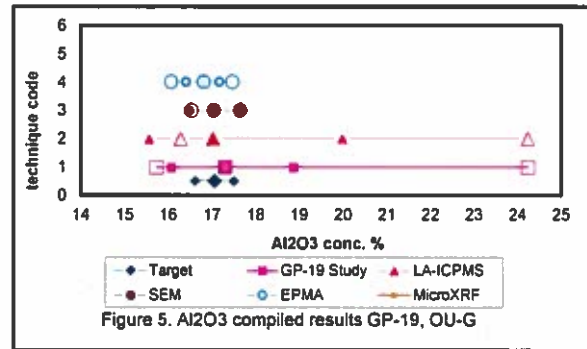
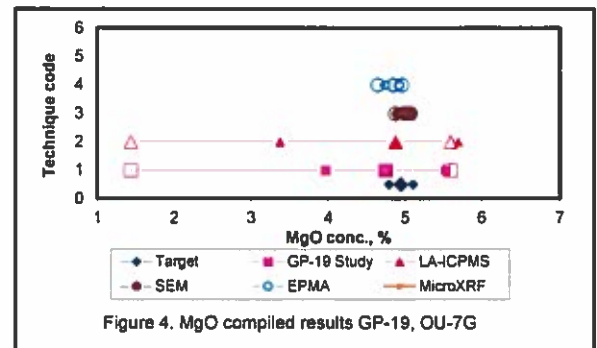
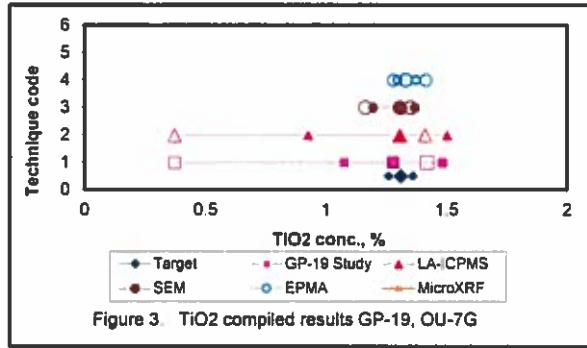
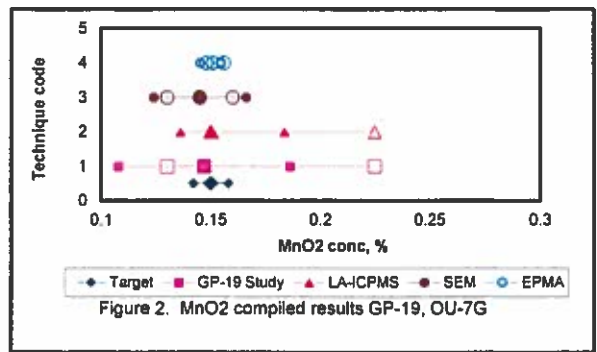
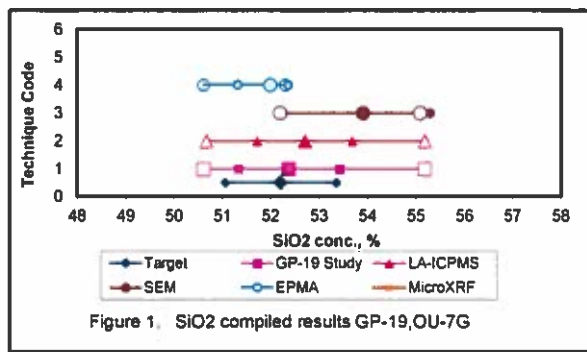
Conversion of contributed gabbro material to a glass was accomplished at the USGS by melting 300 g of the gabbro in a one liter platinum bowl at 1325° C over a period of six hours. At the end of the melting period the molten material was poured into a platinum boat and rapidly lowered into a water bath for quenching. Twenty grams of random fragments were selected, ground and then split into representative aliquots for bulk analysis testing. Samples were analyzed for their total element content using techniques at the USGS and Agat Laboratories, Canada. If you have any questions or comments about this study please forward them to me at your earliest convenience.

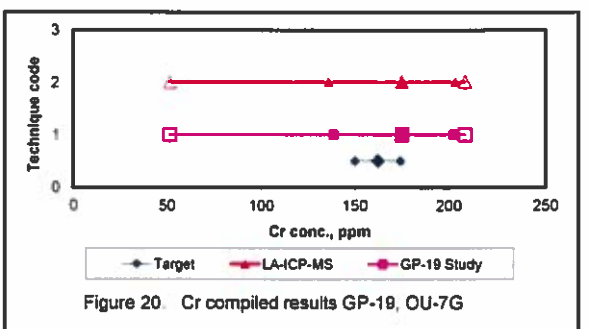
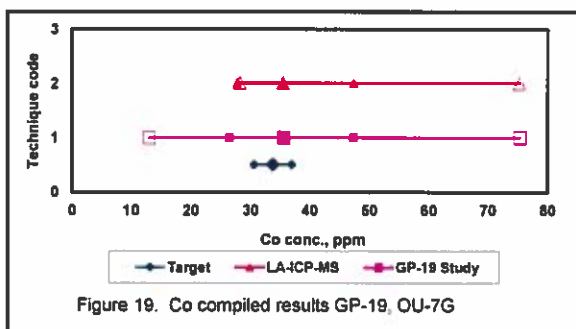
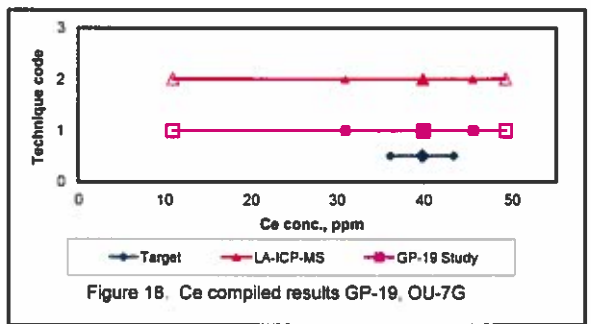
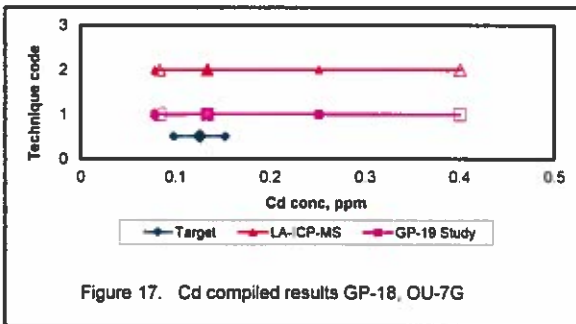
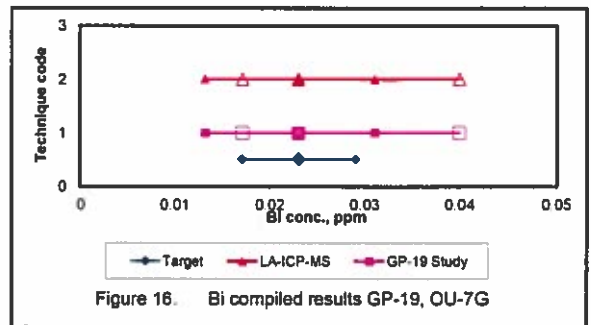
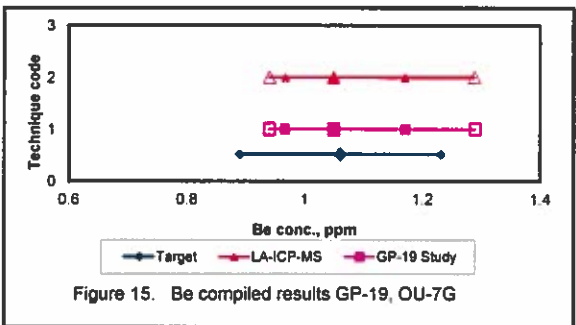
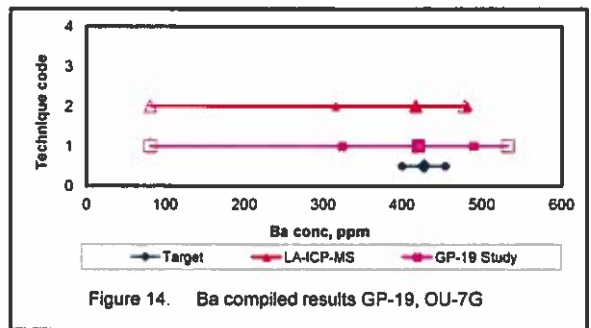
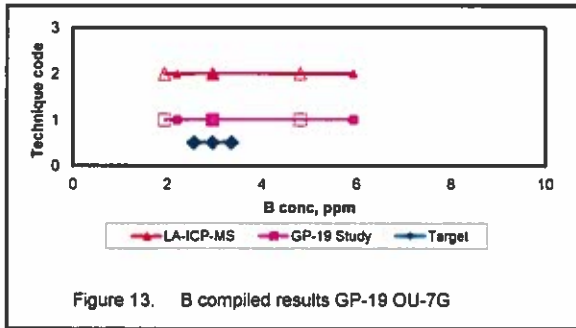
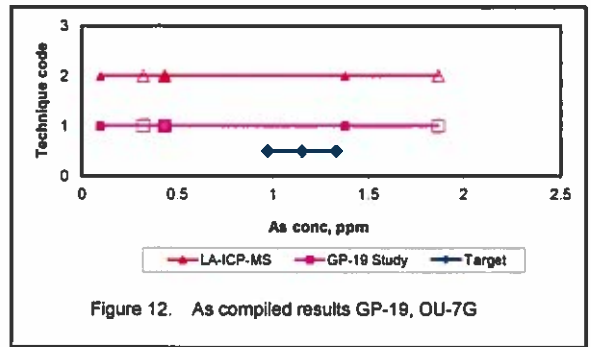
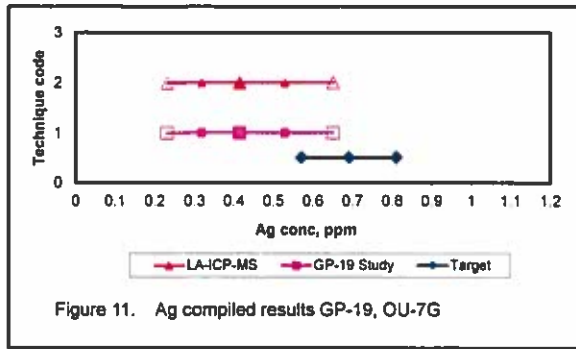
Below you will find summary results for each element studied in this test. In the element diagrams you will find information for each technique providing a value. Also included is the target value (◆) and calculated precision ($X \pm Ha$) (♦) based on the Horowitz equation. A figure is also presented representing the data compilation for the entire study when more that one technique reported values. The study average is represented by ■, the standard deviation of the average by ■ and the maximum and minimum values by □. This study average is calculated primarily for the analysis of the major elements where multiple techniques provided data. For each technique an average value is presented (ex. LA-ICP-MS, ▲) as well as \pm one standard deviation (ex. LA-ICP-MS, ▲), and the maximum and minimum values reported (ex. LA-ICP-MS, △).

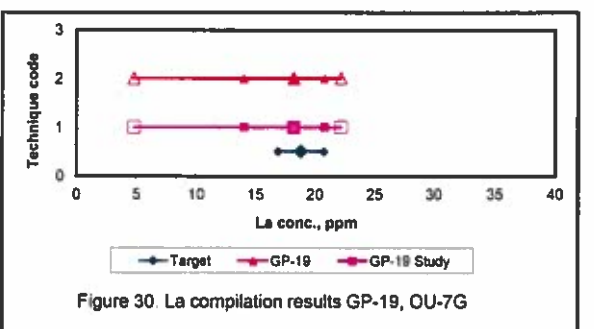
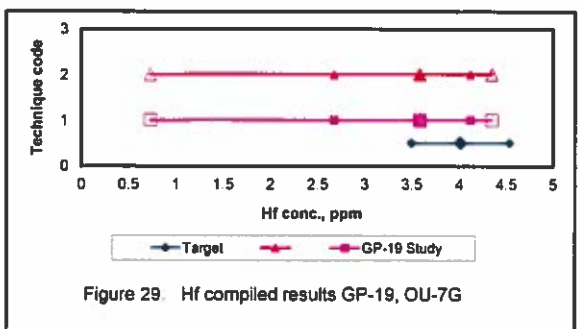
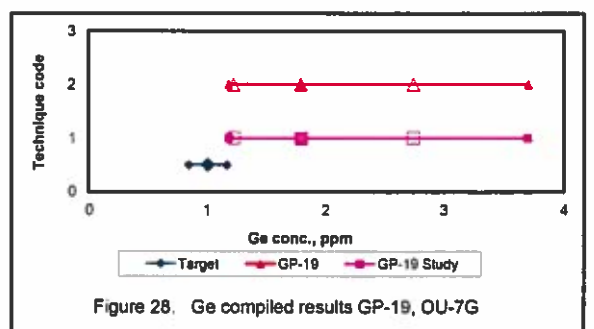
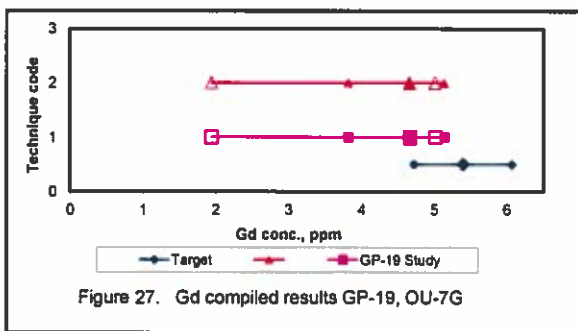
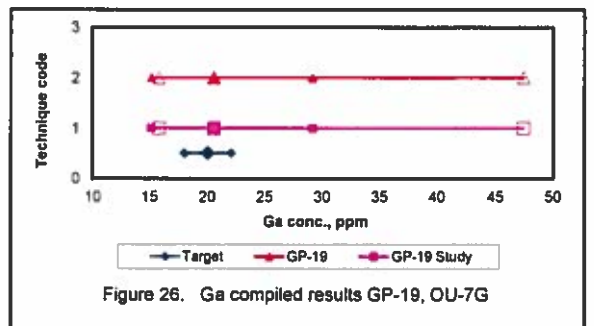
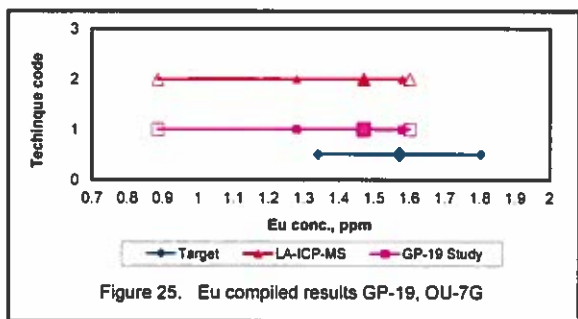
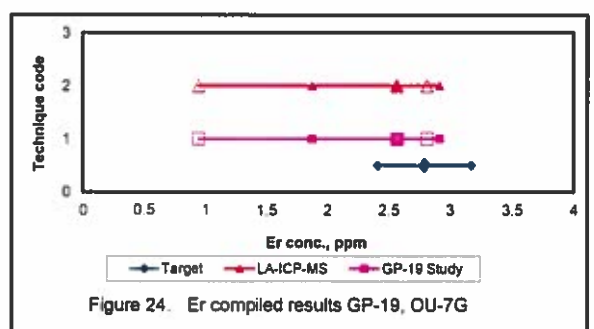
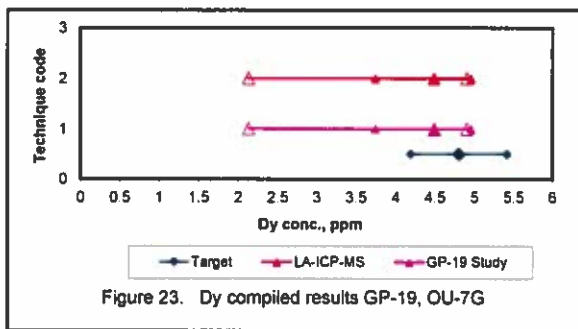
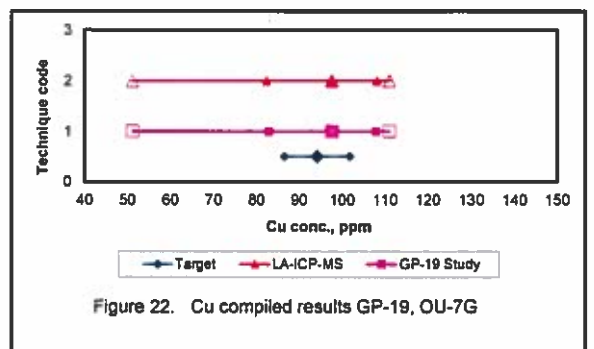
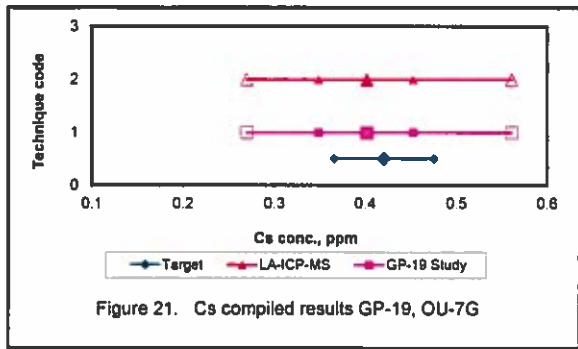
Table 1. Symbols used on figures 1 through 53

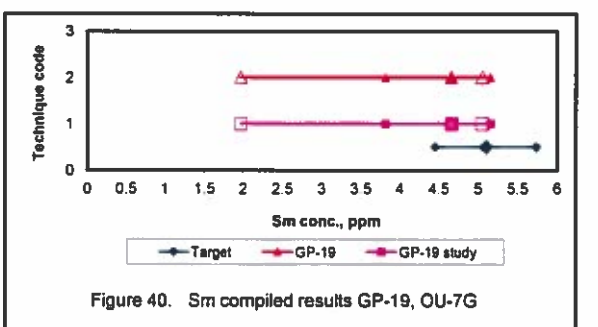
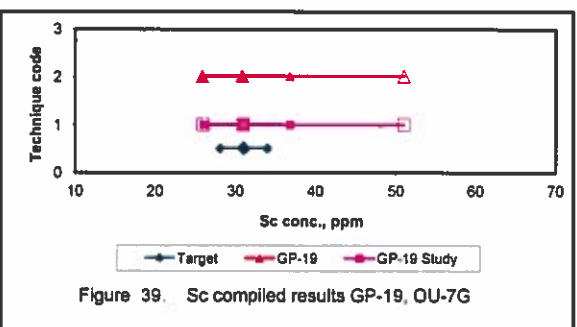
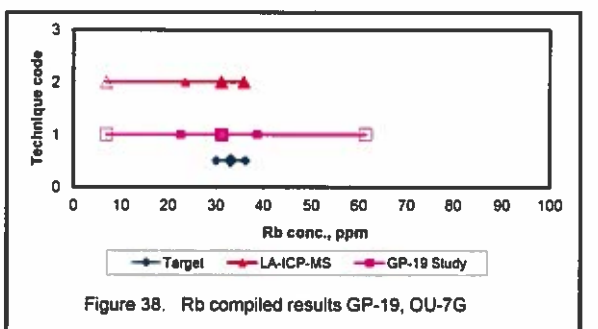
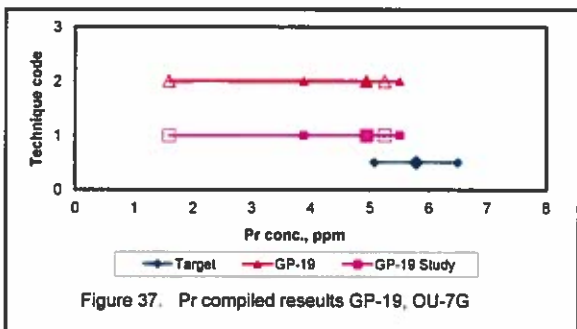
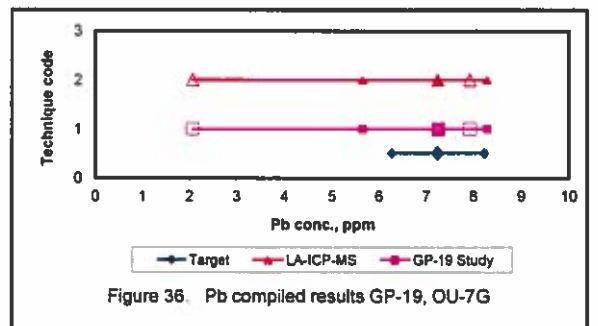
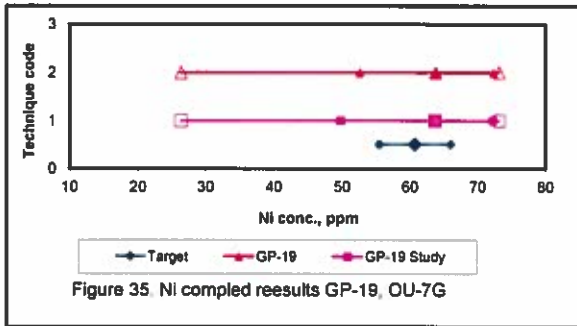
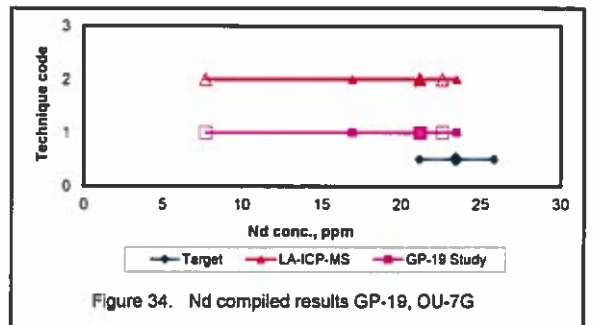
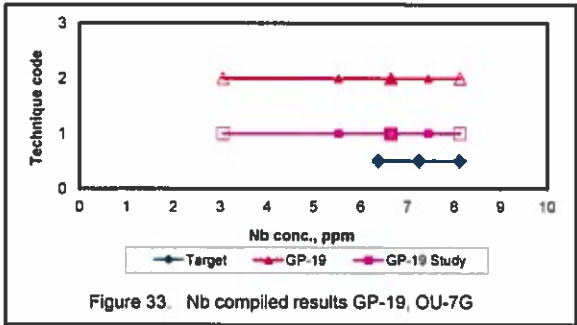
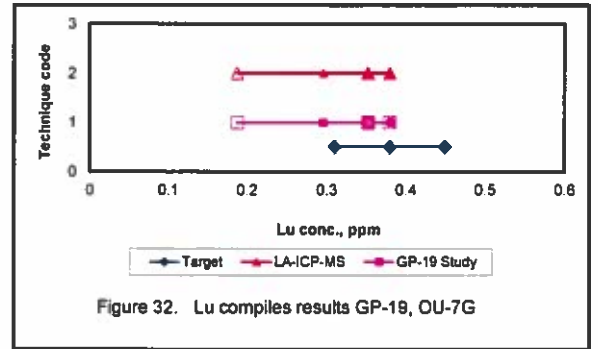
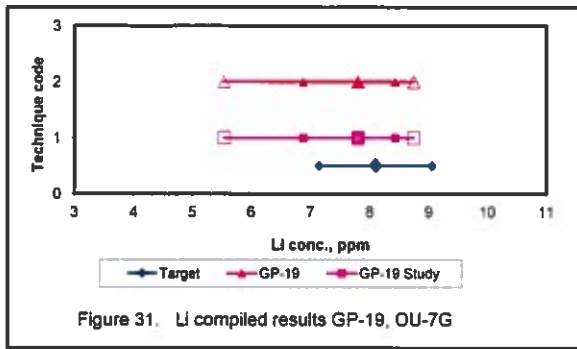
<u>Symbol type</u>		<u>Represents</u>
Large solid symbol,	●	Study or method average
Small solid symbol,	•	Study or method one standard deviation
Large open symbol,	○	Study or method Maximum or Minimum

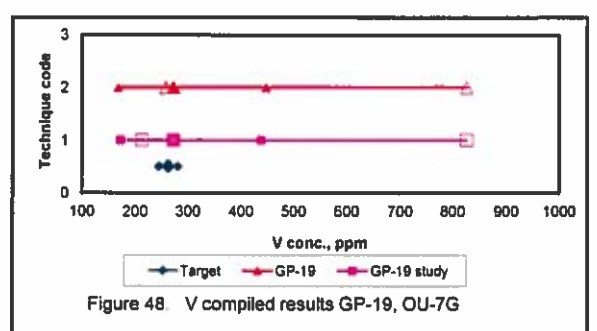
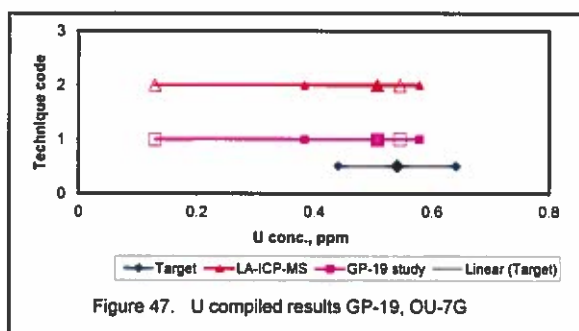
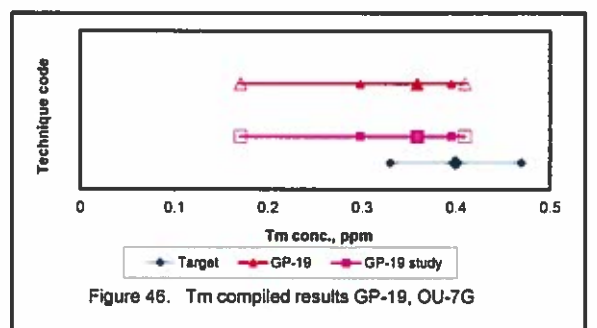
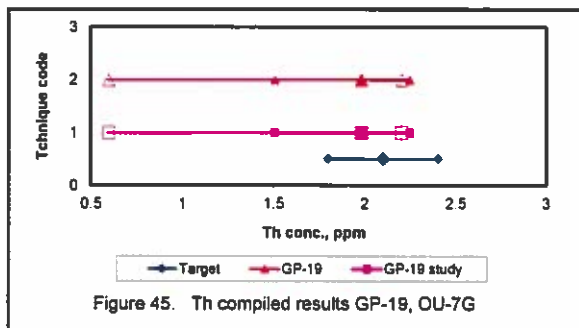
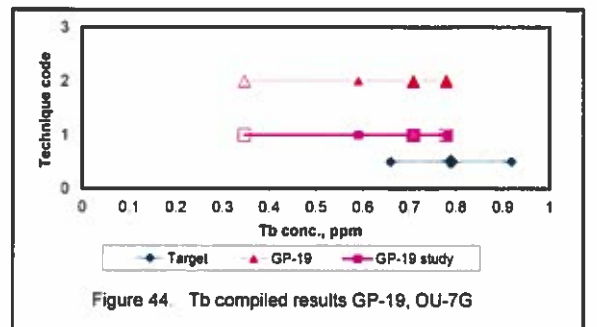
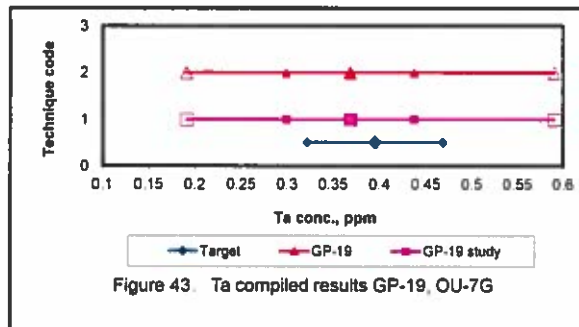
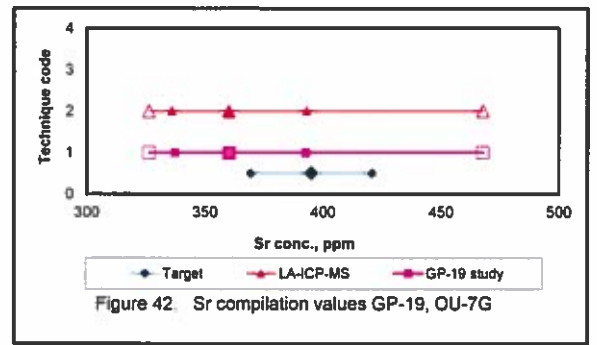
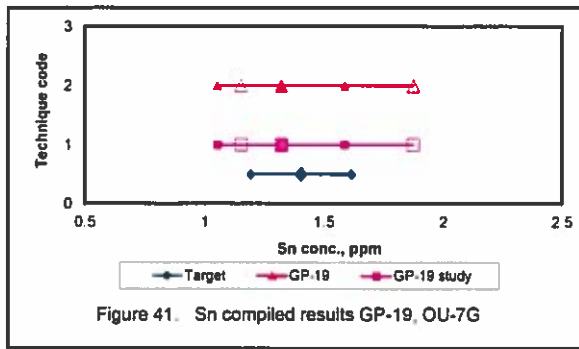
Organizations interested in providing suitable starting materials for future G-probe studies are encouraged to contact Stephen Wilson at the U.S. Geological Survey (swilson@usgs.gov). Contributors of suitable starting materials will receive a complimentary portion of the produced glass.











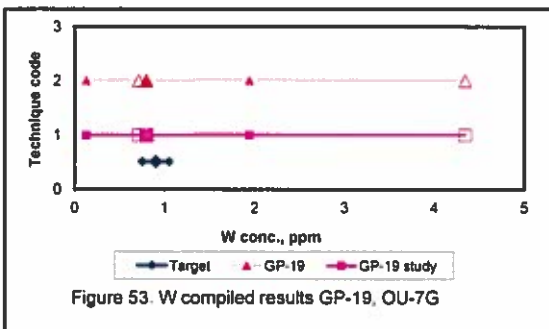
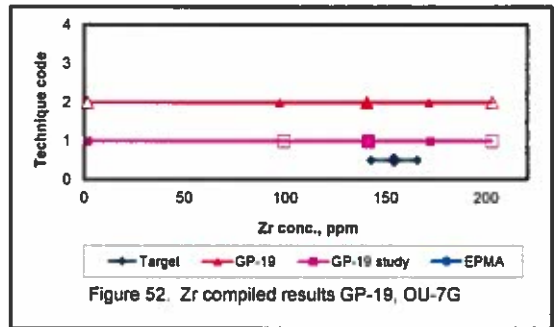
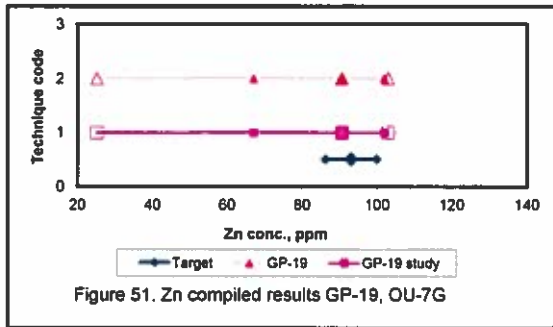
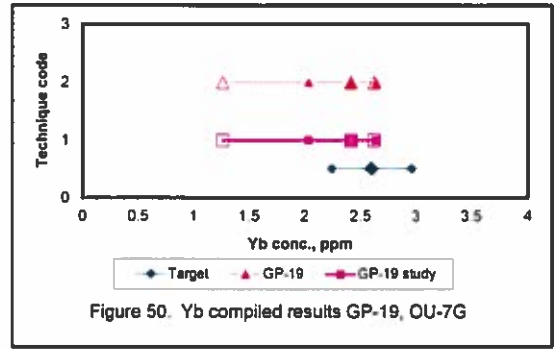
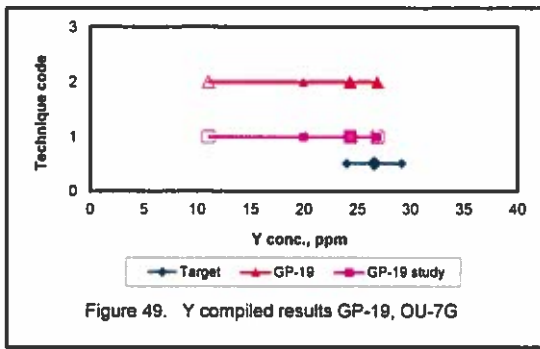


Table 2. Summary results for GP-19, OU-7G

Oxide	Xa %m/m	Ha %m/m	s.d.m. %m/m	GP-19 median	GP-18 median	MAX %m/m	Min %m/m
SiO2	52.20	1.151	1.05	52.24	55.18	50.60	50.60
TiO2	1.31	0.050	0.20	1.31	1.42	0.37	0.37
Al2O3	17.05	0.445	1.57	16.92	24.24	16.06	16.06
Fe2O3	10.47	0.294	2.10	10.29	15.07	2.26	2.26
FeO	9.43	0.269	1.79	9.28	9.70	2.35	2.35
MnO	0.15	0.008	0.02	0.15	0.22	0.13	0.13
MgO	4.95	0.156	0.79	4.88	5.60	1.43	1.43
CaO	9.12	0.262	2.02	9.19	18.14	8.67	8.67
Na2O	3.26	0.109	0.40	3.30	3.75	1.61	1.61
K2O	1.27	0.049	0.21	1.26	1.47	0.01	0.01
P2O5	0.204	0.010	0.05	0.21	0.39	0.12	0.12

Element	Xa mg/kg	Ha mg/kg	s.d.m. mg/kg	GP-18 median	MAX mg/kg	Min mg/kg
Ag	0.69	0.12	0.11	0.41	0.65	0.23
As	1.15	0.18	0.64	0.43	1.87	0.32
Au		0	0.24	0.74	1.11	0.21
B	2.95	0.4	1.30	2.95	5.92	1.93
Ba	428	27.5	83.06	421.1	533.1	80.0
Be	1.06	0.17	0.10	1.05	1.29	0.94
Bi	0.023	0.006	0.01	0.02	0.04	0.01
Br						
Cd	0.125	0.027	0.09	0.13	0.40	0.08
Ce	39.8	3.66	7.36	39.85	49.22	10.86
Cl			6.26		88.99	72.66
Co	33.7	3.18	10.39	35.48	75.15	12.87
Cr	162	12.1	31.92	174.6	208.0	51.1
Cs	0.42	0.054	0.05	0.40	0.56	0.27
Cu	94.1	7.6	12.52	97.54	111.00	50.95
Dy	4.8	0.61	0.61	4.48	4.90	2.13
Er	2.79	0.38	0.52	2.56	2.81	0.94
Eu	1.57	0.23	0.15	1.47	1.60	0.88
F						
Ga	20	2.04	7.04	20.53	47.50	15.75
Gd	5.39	0.67	0.66	4.65	5.00	1.93
Ge	1	0.16	0.78	1.79	3.70	1.22
Hf	4.01	0.52	0.72	3.58	4.34	0.72
Hg			0.00	0.11		
Ho	0.98	0.16	0.48	0.89	2.80	0.44
I						

Element	Xa mg/kg	Ha mg/kg	s.d.m. mg/kg	GP-19 median	MAX mg/kg	Min mg/kg
In	0.07	0.017	0.01	0.07	0.09	0.06
Ir		0	0.07	0.10	0.21	0.06
La	18.8	1.93	3.39	18.19	22.17	4.75
Lj	8.1	0.95	0.78	7.79	8.74	5.53
Lu	0.38	0.07	0.04	0.35	0.38	0.19
Mn	1215	67	177	1181	1742	1071
Mo	0.61	0.105	0.06	0.51	0.63	0.36
Nb	7.25	0.86	0.96	6.63	8.12	3.05
Nd	23.5	2.34	3.31	21.19	22.66	7.69
Ni	60.7	5.23	11.24	63.58	73.10	26.28
Os						
Pb	7.25	0.96	1.32	7.26	7.94	2.06
Pd		0	0.06	0.07	0.11	0.02
Pr	5.78	0.71	0.81	4.93	5.24	1.58
Pt		0	0.21	0.33	0.87	0.22
Rb	33.1	3.13	8.10	31.12	61.38	6.77
Re						
Rh						
Ru			0.01			
S			4.40			
Sb	0.11	0.025	0.14	0.04	0.37	0.00
Sc	31	2.96	5.39	30.91	50.97	25.98
Se	0.7				0.00	0.00
Sm	5.1	0.64	0.67	4.67	5.06	1.97
Sn	1.4	0.21	0.22	1.32	1.87	1.05
Sr	395	25.7	27.87	360.1	467.9	326.0
Ta	0.395	0.073	0.07	0.37	0.59	0.19
Tb	0.79	0.13	0.10	0.71	0.78	0.35
Te	0.02					
Th	2.1	0.3	0.37	1.98	2.20	0.59
Tl	0.13	0.03	0.66	0.17	2.00	0.10
Tm	0.4	0.07	0.05	0.36	0.41	0.17
U	0.54	0.1	0.10	0.51	0.54	0.13
V	262	18.1	133.25	271.3	826.8	211.9
W	0.9	0.15	0.91	0.79	4.35	0.71
Y	26.6	2.6	3.43	24.30	26.88	11.05
Yb	2.6	0.36	0.30	2.41	2.62	1.26
Zn	93.1	6.84	17.45	90.6	103.0	25.2
Zr	154	11.5	36.48	141.2	203.0	1.4

Xa = Target value - USGS bulk analysis of glass fragments
 Ha = Target precision calculated using modified version of Horowitz equation for data quality 2 (Ha = 0.01Xa^{0.6465})
 s.d.m. = Standard deviation of population mean
 GP-19 med. = Median element/oxide concentration for all techniques reporting
 Max. = Maximum element/oxide concentration reported
 Min. = Minimum element/oxide concentration reported

Table 3 cont.

Lab identifier Data Quality Method Elem/Cmpnd	units	7	7	8	8	9	9	10	10	11	11	12	12
		2	2	2	2	2	2	2	2	2	2	2	2
		EPMA	EPMA	EPMA	EPMA	EPMA	EPMA	EPMA	EPMA	EPMA	EPMA	EPMA	EPMA
SiO2	% m/m	52.26	52.28	52.3	52.24	52.249	52.153	51.18	51.18	51.83	51.89	51.83	51.91
TiO2	% m/m	1.31	1.31	1.31	1.28	1.366	1.370	1.41	1.41	1.34	1.35	1.32	1.34
Al2O3	% m/m	17.10	17.03	16.15	16.06	16.884	16.937	17.41	17.46	16.82	16.79	16.66	16.73
Fe2O3T	% m/m	10.28	10.31	10.23	10.15	10.336	10.209	9.79	9.97	10.31	10.32	15.01	15.07
Fe(II)O	% m/m	9.26	9.29	9.22	9.14	9.310	9.270	8.82	8.98	9.29	9.30	9.30	9.34
MnO	% m/m	0.15	0.15			0.152	0.145			0.15	0.15	0.15	0.15
MgO	% m/m	4.87	4.88	4.73	4.65	4.960	4.964	4.87	4.92	4.71	4.83	4.84	4.93
CaO	% m/m	9.28	9.30	9.14	9.24	9.214	9.231	9.02	9.02	9.15	9.19	9.24	9.25
Na2O	% m/m	3.27	3.27	3.75	3.66	3.388	3.376	3.30	3.21	3.23	3.25	3.22	3.30
K2O	% m/m	1.25	1.26	1.47	1.38	1.263	1.255	1.22	1.21	1.27	1.27	1.27	1.26
P2O5	% m/m	0.19	0.20	0.229	0.224					0.20	0.21	0.21	0.21
Ag	mg/kg												
As	mg/kg												
Au	mg/kg												
B	mg/kg												
Ba	mg/kg									533.1	466.6	456.7	451.5
Be	mg/kg												
Bi	mg/kg												
Br	mg/kg												
Cd	mg/kg												
Ce	mg/kg												
Cl	mg/kg									89.0	83.2	72.7	74.9
Co	mg/kg											12.9	36.6
Cr	mg/kg											173.5	160.3
Cs	mg/kg												
Cu	mg/kg												
Dy	mg/kg												
Er	mg/kg												
Eu	mg/kg												
F	mg/kg												
Ga	mg/kg												
Gd	mg/kg												
Ge	mg/kg												
Hf	mg/kg												
Hg	mg/kg												
Ho	mg/kg												
I	mg/kg												
In	mg/kg												
Ir	mg/kg												
La	mg/kg												
Li	mg/kg												
Lu	mg/kg												
Mn	mg/kg												
Mo	mg/kg												
Nb	mg/kg												
Nd	mg/kg												
Ni	mg/kg											39.5	36.1
Os	mg/kg												
Pb	mg/kg												
Pd	mg/kg												
Pr	mg/kg												
Pt	mg/kg												
Rb	mg/kg												
Re	mg/kg												
Rh	mg/kg												
Ru	mg/kg												
S	mg/kg											14.1	20.3
Sb	mg/kg												
Sc	mg/kg												
Se	mg/kg												
Sm	mg/kg												
Sn	mg/kg												
Sr	mg/kg											371.7	374.8
Ta	mg/kg												
Tb	mg/kg												
Te	mg/kg												
Th	mg/kg												
Tl	mg/kg												
Tm	mg/kg												
U	mg/kg												
V	mg/kg												
W	mg/kg											211.9	250.8
Y	mg/kg												
Yb	mg/kg												
Zn	mg/kg												
Zr	mg/kg											162.9	154.2

Table 3 cont.

Lab Identifier Data Quality Method Elem/Cmpnd	units	13		14		15		16		17		18	
		2	2	2	2	2	2	2	2	2	2	2	2
		microXRF	microXRF	LA-ICPMS	LA-ICPMS	LA-ICP-MS	LA-ICP-MS	LA-ICP-MS	LA-ICP-MS	LA-ICP-MS	LA-ICP-MS	LA-ICP-MS	LA-ICP-MS
SiO2	% m/m			52.31	52.72								
TiO2	% m/m			1.26	1.34								
Al2O3	% m/m			16.5	16.76								
Fe2O3T	% m/m			10.44	10.44								
Fe(III)O	% m/m												
MnO	% m/m			0.15	0.15								
MgO	% m/m			4.81	4.9								
CaO	% m/m	9.33	9.46										
Na2O	% m/m			3.17	3.24								
K2O	% m/m			1.23	1.26								
P2O5	% m/m			0.37	0.39								
Ag	mg/kg			0.47	0.26	0.414	0.444	0.42	0.41				
As	mg/kg			0.44	0.42	bdl	bdl	0.36	0.32				
Au	mg/kg			0.91	0.55	0.752	0.839	0.84	0.68				
B	mg/kg					bdl	bdl	2.40	1.93				
Ba	mg/kg			421.75	423.55	383	379	407.73	404.42	426.3	431	398.77	381.08
Be	mg/kg					bdl	bdl	1.17	1.10			1.06	0.94
Bi	mg/kg			0.04	0.02	0.023	0.023	0.02	0.02	0.029	0.0131		
Br	mg/kg												
Cd	mg/kg			0.12	0.13	0.084	0.083	0.10	0.11	0.108	0.136		
Ce	mg/kg			39	39.63	35.9	35.3	40.62	39.61	40.24	40.23	38.32	36.33
Cl	mg/kg												
Co	mg/kg			34.75	34.68	33.7	32.6	35.93	35.78	34.87	33.86	31.04	28.19
Cr	mg/kg			186.1	184.75	164	163	174.92	173.08			171.60	158.75
Cs	mg/kg			0.38	0.56	0.377	0.348	0.41	0.40	0.389	0.365	0.41	0.36
Cu	mg/kg			95.65	93.85	96.5	94.8	97.19	95.72	96.8	82.5	99.58	87.05
Dy	mg/kg			4.63	4.81	4.13	4.12	4.50	4.33	4.32	4.33	4.09	3.89
Er	mg/kg			2.51	2.37	2.4	2.35	2.66	2.56	2.49	2.45	2.42	2.31
Eu	mg/kg			1.47	1.43	1.27	1.27	1.46	1.44	1.45	1.43	1.42	1.37
F	mg/kg												
Ga	mg/kg			18.16	18.22	24	23.1	18.82	18.71			17.49	15.75
Gd	mg/kg			4.89	4.84	4.29	4.26	4.71	4.50	4.36	4.31	4.48	4.26
Ge	mg/kg			1.22	1.3	3.7	3.6	2.62	2.80				
Hf	mg/kg			3.78	3.64	3.33	3.27	3.43	3.34	3.27	3.12	4.34	3.42
Hg	mg/kg												
Ho	mg/kg			0.89	0.9	0.84	0.817	0.89	0.88	0.896	0.875	0.84	0.82
I	mg/kg												
In	mg/kg			0.07	0.06	0.06	0.055			0.089	0.073		
Ir	mg/kg			0.21	0.14			0.07	0.06				
La	mg/kg			18.03	18.25	16.6	16.1	18.32	17.74	18.57	17.34	17.44	16.46
Li	mg/kg					bdl	bdl	7.89	7.91			7.16	7.29
Lu	mg/kg			0.36	0.34	0.307	0.316	0.36	0.34	0.337	0.332	0.32	0.34
Mn	mg/kg					1106	1071	1178.20	1181.93				
Mo	mg/kg			0.48	0.5	0.382	0.356	0.48	0.51	0.55	0.56		
Nb	mg/kg			6.35	6.32	5.92	5.76	6.33	6.38	6.99	6.96	7.18	6.26
Nd	mg/kg			21.05	21.71	18.8	18.3	21.14	20.44	21.37	21.65	20.25	19.32
Ni	mg/kg			63.45	62.75	62.5	63.8	63.35	64.79	66.2	62.8	61.30	58.01
Os	mg/kg												
Pb	mg/kg			7.63	7.93	6.97	6.76	7.09	7.11	7.15	7.09	7.53	6.63
Pd	mg/kg					0.109	0.023						
Pr	mg/kg			4.76	4.8	4.44	4.36	4.93	4.90	4.92	4.96	4.61	4.49
Pt	mg/kg			0.87	0.51	0.219	0.256	0.39	0.30				
Rb	mg/kg			29.87	30.3	31.1	30.4	30.27	30.64	30.6	29.05	29.44	31.80
Re	mg/kg					bdl	bdl						
Rh	mg/kg					bdl	bdl						
Ru	mg/kg					1.762	1.741						
S	mg/kg					bdl	bdl						
Sb	mg/kg			0.07	0.05	bdl	bdl	0.00	0.04				
Sc	mg/kg			32.73	33.48	28.56	27.13	29.99	29.42				
Se	mg/kg					bdl	bdl						
Sm	mg/kg			5.06	4.71	4.26	4.09	4.73	4.52	4.58	4.68	4.34	4.36
Sn	mg/kg			1.1	1.05	1.36	1.42	1.15	1.14	1.87	1.71		
Sr	mg/kg			360.7	366.1	336	326	359.91	356.62	356.5	348.4	352.53	337.63
Ta	mg/kg			0.35	0.32	0.312	0.397	0.34	0.34	0.446	0.365	0.40	0.36
Tb	mg/kg			0.72	0.7	0.635	0.625	0.70	0.67	0.672	0.676	0.76	0.71
Te	mg/kg												
Th	mg/kg			1.7	1.54	1.84	1.83	2.01	1.98	2.08	1.94	1.99	1.86
Ti	mg/kg			0.2	0.16	0.172	0.173	0.19	0.17	0.207	0.148		
Tm	mg/kg			0.36	0.37	0.322	0.32	0.36	0.35	0.362	0.357	0.35	0.34
U	mg/kg			0.49	0.52	0.453	0.45	0.51	0.52	0.541	0.516	0.51	0.46
V	mg/kg			279.7	283.85	259	259	273.62	278.55			281.37	263.45
W	mg/kg			0.86	0.82	0.733	0.713	0.75	0.79	0.83	0.81		
Y	mg/kg			24.23	24.64	22.1	22	23.95	23.46	21.98	21.8	24.34	23.26
Yb	mg/kg			2.62	2.53	2.19	2.12	2.40	2.38	2.39	2.4	2.28	2.15
Zn	mg/kg			88.4	90	92	88.3	90.69	91.13			91.71	74.75
Zr	mg/kg			147.8	148.7	130	127	138.51	133.17	131.6	128.3	142.57	136.28

Table 3 cont.

Lab identifier Data Quality Method Elem/Cmpnd	units	19		20		21		22		23		24	
		2 LAICPMS	2 LAICPMS	2 LAICPMS	2 LAICPMS	2 LA-ICPMS	2 LA-ICPMS	2 LA-ICPMS	2 LA-ICPMS	2 LAICPMS	2 LAICPMS	2 LAICPMS	2 LAICPMS
SiO2	% m/m	51.693	50.654			53.09	52.9	53.32	53.09			53.20	53.17
TiO2	% m/m	1.279	1.273			1.32	1.31	1.29	1.30			1.32	1.31
Al2O3	% m/m	16.277	16.504			16.9	17	17.75	17.82			16.86	16.70
Fe2O3T	% m/m	10.748	10.670					9.65	9.78			10.16	10.41
Fe(II)O	% m/m												
MnO	% m/m	0.152	0.152					0.15	0.15			0.15	0.15
MgO	% m/m	4.861	4.871			5.09	5.07	4.35	4.43			4.80	4.81
CaO	% m/m	9.180	9.180					8.68	8.67			9.06	9.00
Na2O	% m/m	3.168	3.087			3.38	3.37	3.13	3.10			3.43	3.45
K2O	% m/m	1.208	1.179			1.3	1.3	1.27	1.24			1.30	1.30
P2O5	% m/m	0.178	0.177			0.222	0.222	0.21	0.21			0.23	0.22
Ag	mg/kg	0.43	0.33					0.58	0.23			0.30	0.41
As	mg/kg											0.35	0.45
Au	mg/kg							1.11	0.21				
B	mg/kg									3.9	4.03	2.79	3.05
Ba	mg/kg	405.85	407.59	417.4	422.2	425	422	406.3	420.4	444	439	417.4	417.3
Be	mg/kg			1.04	1.00					1.02	1.04	1.23	1.29
Bi	mg/kg											0.02	0.03
Br	mg/kg												
Cd	mg/kg	0.40	0.24									0.16	0.25
Ce	mg/kg	40.45	40.74	39.28	39.44	40.7	40.4	37.0	38.4	40.1	39.2	39.8	39.9
Cl	mg/kg												
Co	mg/kg	35.62	35.63	36.28	35.48	35	34.7	36.2	36.4	38.5	37.8	34.5	34.6
Cr	mg/kg	174.32	173.22	184.40	179.70	208	206	172.8	174.3	185	180	178.7	181.7
Cs	mg/kg	0.39	0.39	0.39	0.42	0.41	0.4			0.436	0.476	0.39	0.40
Cu	mg/kg	92.87	87.01	101.90	94.12	106.6	106	100.3	97.9	111	108	99.2	100.1
Dy	mg/kg	4.37	4.63	4.42	4.60	4.67	4.65	3.9	4.0	4.27	4.37	4.58	4.44
Er	mg/kg	2.60	2.81	2.64	2.65	2.7	2.7	2.2	2.4	2.36	2.42	2.66	2.57
Eu	mg/kg	1.50	1.51	1.47	1.46	1.49	1.49	1.4	1.4	1.42	1.4	1.53	1.48
F	mg/kg												
Ga	mg/kg	19.27	18.96	20.48	20.03			20.2	20.5	47.5	45.5	20.6	20.2
Gd	mg/kg	4.73	5.00	4.38	4.61	4.82	4.83	4.0	4.1	4.38	4.47	4.70	4.75
Ge	mg/kg	1.78	2.36	1.31	1.39							1.34	1.35
Hf	mg/kg	3.44	3.59	3.40	3.61	3.65	3.65	3.0	3.1	3.34	3.48	3.81	3.57
Hg	mg/kg											0.11	0.10
Ho	mg/kg	0.91	0.97	0.88	0.90	0.98	0.97	0.8	0.8	0.821	0.844	0.90	0.88
I	mg/kg												
In	mg/kg	0.07	0.08										
Ir	mg/kg												
La	mg/kg	18.21	18.84	17.96	18.16	18.9	18.8	16.2	16.9	17.5	17.7	18.1	17.9
Li	mg/kg	8.20	7.44	7.80	7.52	8.59	8.46			8.74	8.45	7.53	7.50
Lu	mg/kg	0.35	0.37	0.33	0.35	0.37	0.37	0.3	0.3	0.317	0.319	0.38	0.35
Mn	mg/kg	1179.76	1179.95	1226.00	1211.00	1176	1168	1165.7	1191.6	1237	1221		
Mo	mg/kg	0.56	0.52			0.62	0.57	0.5	0.5			0.51	0.51
Nb	mg/kg	6.49	6.43	6.67	6.61	6.4	6.36	6.8	7.2	6.84	6.73	6.97	6.93
Nd	mg/kg	21.34	21.76	20.62	20.99	21.5	21.23	19.1	19.9	20.9	21	21.3	20.9
Ni	mg/kg	64.07	63.72	65.41	62.69	68.2	68.1	67.5	67.1	73.1	71.4	63.7	63.1
Os	mg/kg												
Pb	mg/kg	7.17	7.34	7.34	7.38	7.15	7.1	7.0	7.3	7.64	7.39	7.94	7.87
Pd	mg/kg												
Pr	mg/kg	4.95	5.00	4.81	4.90	5.24	5.21	4.4	4.6	4.91	4.93	5.04	4.99
Pt	mg/kg												
Rb	mg/kg	29.87	29.43	31.00	31.14	31.8	31.6	32.0	32.0	35.9	35	31.8	31.4
Re	mg/kg												
Rh	mg/kg												
Ru	mg/kg												
S	mg/kg												
Sb	mg/kg											0.04	0.03
Sc	mg/kg	30.10	31.46	31.53	31.22	29.6	29.5	26.0	26.8	27.9	28.5	30.1	29.3
Se	mg/kg												
Sm	mg/kg	4.65	4.73	4.62	4.75	4.75	4.77	4.3	4.4	4.58	4.66	4.84	4.69
Sn	mg/kg	1.45	1.49					1.3	1.4			1.29	1.24
Sr	mg/kg	356.19	358.00	364.40	368.60	358	356	347.2	348.9	365	364	362.7	360.0
Ta	mg/kg	0.35	0.36	0.34	0.35	0.38	0.39	0.3	0.4	0.366	0.376	0.38	0.37
Tb	mg/kg	0.71	0.73	0.69	0.71	0.77	0.77	0.6	0.6	0.661	0.694	0.73	0.73
Te	mg/kg												
Th	mg/kg			1.92	1.98	2.07	2.06	1.9	1.9	1.86	1.89	2.04	2.01
Tl	mg/kg	1.94	2.00					0.2	0.1				
Tm	mg/kg	0.34	0.38	0.35	0.34	0.38	0.38	0.3	0.3	0.324	0.332	0.37	0.38
U	mg/kg	0.52	0.52	0.48	0.49	0.51	0.5	0.5	0.5	0.544	0.523	0.52	0.52
V	mg/kg	276.46	275.88	276.20	274.20	259	257	267.9	268.2	283	274	262.8	263.7
W	mg/kg	0.81	0.79			0.83	0.83	0.8	0.8			0.74	0.72
Y	mg/kg	23.86	25.28	24.19	24.67	25.8	25.7	20.8	20.9	21.6	22.3	25.0	24.3
Yb	mg/kg	2.41	2.62	2.35	2.49	2.46	2.5	2.1	2.2	2.22	2.29	2.52	2.45
Zn	mg/kg	91.33	92.11	95.76	91.38	83.8	83.5	93.2	94.8	99	96.4	91.9	90.4
Zr	mg/kg	137.49	143.55	139.60	141.30	143	142	124.1	124.7	131	135	143.2	140.1

Table 3 cont.

Lab identifier Data Quality Method	Elem/Cmpnd units	25		26		27		28		29		30	
		2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS	2 LA-ICP-MS
SiO2	% m/m	52.68	52.54	52.33	52.31	52	51.4			55.18	53.88		
TiO2	% m/m	1.31	1.3	1.31	1.31	1.41	1.35			1.26	1.26		
Al2O3	% m/m	17.07	17.12	16.75	16.74	18	17.7			17.70	17.02		
Fe2O3T	% m/m	9.13	9.19	11.41	11.45	8.7	8.4			11.15	11.06		
Fe(II)O	% m/m					9.7	9.3			2.35	2.52		
MnO	% m/m	0.15	0.16	0.15	0.15	0.15	0.15			0.22	0.22	0.16	0.15
MgO	% m/m	4.89	4.91	4.92	4.91	5.5	5.6			1.43	1.46		
CaO	% m/m	9.25	9.3	9.17	9.17	9.1	9.2			17.90	18.14		
Na2O	% m/m	3.45	3.42	3.34	3.34	3.1	3			1.61	1.63		
K2O	% m/m	1.33	1.32	1.30	1.30	1.22	1.33			0.01			
P2O5	% m/m	0.23	0.23	0.22	0.22	0.16	0.19						
Ag	mg/kg			0.39	0.49	0.41	0.41	0.65	0.5525				
As	mg/kg							1.675	1.87				
Au	mg/kg			0.57	0.73								
B	mg/kg			5.38	5.92			2.72	2.85				
Ba	mg/kg	428.95	427.92	413.1	414.2	429	429	79.99	81.63	404.8	413.3	470.97	479.05
Be	mg/kg	0.99	0.94	1.06	1.06								
Bi	mg/kg					0.02	0.02						
Br	mg/kg												
Cd	mg/kg					0.18	0.19						
Ce	mg/kg	40.38	40.66	39.76	39.93	41	41	10.89	10.855	39.71	40.36	45.88	49.22
Cl	mg/kg												
Co	mg/kg	35.02	35.48	35.88	35.94	35	35	73.13	75.15	37.32	36.47		
Cr	mg/kg	177.15	178.41	173.1	172.7	172	172	51.05	51.53	181.2	175.6		
Cs	mg/kg	0.45	0.43	0.41	0.41	0.4	0.4	0.269	0.2725	0.42	0.44		
Cu	mg/kg	100.94	98.67	105.4	105.9	91	91	50.9	53.8	100.5	101.9		
Dy	mg/kg	4.69	4.62	4.76	4.72	4.9	4.9	2.13	2.28	4.47	4.71	4.68	4.78
Er	mg/kg	2.76	2.69	0.94	0.94	2.81	2.72	1.20	1.12	2.71	2.70	2.7	2.81
Eu	mg/kg	1.52	1.5	1.48	1.49	1.53	1.48	0.88	0.92	1.48	1.47	1.58	1.6
F	mg/kg												
Ga	mg/kg	20.98	21.23	20.75	20.71	26.2	26.2	22.08	21.63	21.20	20.85	17.34	17.18
Gd	mg/kg	4.69	4.88	4.96	4.95	5	4.8	2.27	1.93	4.76	4.89	4.46	4.57
Ge	mg/kg					2	1.8	1.32	1.37			2.1	1.88
Hf	mg/kg	3.66	3.68	3.66	3.65	4	4	0.72	0.77	3.48	3.59	3.63	3.85
Hg	mg/kg												
Ho	mg/kg	0.92	0.95	2.80	2.78	0.98	1.01	0.44	0.46	0.91	0.94	0.88	0.89
I	mg/kg												
In	mg/kg					0.07	0.07		0.06				
Ir	mg/kg												
La	mg/kg	18.38	18.4	18.53	18.48	19.1	18.5	4.85	4.745	18.29	18.54	20.71	22.17
Li	mg/kg	7.88	7.84	7.79	7.79	7.5	7.7	5.53	5.725				
Lu	mg/kg	0.36	0.38	0.37	0.36	0.37	0.38	0.187	0.204	0.35	0.35	0.36	0.36
Mn	mg/kg					1166	1158	1742	1737				
Mo	mg/kg	0.51	0.54	0.47	0.47	0.51	0.47	0.51	0.63	0.51	0.57		
Nb	mg/kg	6.87	6.93	6.62	6.65	6.7	6.7	3.05	3.22	6.42	6.48	7.65	8.12
Nd	mg/kg	22.19	22.19	21.59	21.52	22	21.6	7.86	7.69	21.15	21.28	21.9	22.66
Ni	mg/kg	63.12	63.27	65.46	65.97	63	63	26.5	26.28	66.91	65.99		
Os	mg/kg												
Pb	mg/kg	7.28	7.39	7.40	7.33	7.08	7.14	2.06	2.09	7.26	7.51		
Pd	mg/kg												
Pr	mg/kg	4.99	5.12	4.99	5.00	5.23	5	1.58	1.62	4.93	4.99	4.71	4.94
Pt	mg/kg					0.37	0.29						
Rb	mg/kg	31.45	31.31	31.52	31.57	30	28	6.81	6.765	32.12	32.50		
Re	mg/kg												
Rh	mg/kg												
Ru	mg/kg												
S	mg/kg												
Sb	mg/kg							0.32	0.373				
Sc	mg/kg	30.9	30.93	31.01	30.92	31.5	31	48.0	51.0	30.97	30.91		
Se	mg/kg												
Sm	mg/kg	4.96	4.82	4.78	4.76	5	4.8	2	1.97	4.66	4.73	4.48	4.62
Sn	mg/kg			1.29	1.31	1.8	1.8	1.18	1.385	1.24	1.32		
Sr	mg/kg	365.68	370.21	365.2	365.4	376	359	465.0	467.9	356.1	360.2		
Ta	mg/kg	0.38	0.38	0.37	0.37	0.38	0.39	0.209	0.1905	0.34	0.35	0.54	0.59
Tb	mg/kg	0.76	0.77	0.74	0.74	0.78	0.69	0.3465	0.3565	0.72	0.73	0.69	0.71
Te	mg/kg												
Th	mg/kg	1.96	1.98	2.06	2.07	2.2	2.1	0.611	0.5915	2.03	2.17		
Ti	mg/kg							0.098	0.1415				
Tm	mg/kg	0.39	0.41	0.38	0.37			0.17	0.196	0.37	0.37	0.37	0.36
U	mg/kg	0.5	0.49	0.49	0.49	0.54	0.52	0.128	0.1315				
V	mg/kg	265.68	267.31	266.3	266.5	269	265	820.1	826.8	281.4	279.9		
W	mg/kg	0.84	0.8	0.79	0.79	0.77	0.76	4.12	4.35	0.79	0.83	0.71	0.81
Y	mg/kg	25.76	25.76	25.83	25.76	25.3	24.6	11.05	11.76	24.99	25.14	25.84	26.88
Yb	mg/kg	2.4	2.47	2.51	2.52	2.6	2.6	1.31	1.26	2.42	2.48	2.43	2.43
Zn	mg/kg	78.76	80.38	74.5	74.5	103	93	25.18	26.29	82.15	85.67		
Zr	mg/kg	146.43	146.88	146.8	147.2	148	141	1.425	1.445	139.8	142.8	191.08	202.96