Additions and Corrections for USGS Bulletin 1623, Three USGS mafic rock reference samples, W-2, DNC-1, and BIR-1

by

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Abstract

Errors and omissions in USGS Bulletin 1623 are corrected. Data by organizations, where the data were omitted but they were not the six independent determinations necessary to calculate best values, are tabled. A set of six values for eight trace elements were included in the three large tables, but the data were not six independent determinations and best values for these elements have been revised. These revised estimates cause changes in the individual contributions to χ^2 for a comparison of the compositions of W-1 and W-2. The net increase in chi squared for the 46 constituents increased the probability that the compositions of the two samples are about the same from the previous 55 percent to the less desirable probability of 85 percent. The increased probablity is due to the additional contributions to chi squared for revised best values of three more elements having the greatest effect on chi squared. Typographical and rounding errors are tabled.

Introduction

Since the publication of USGS Bulletin 1623 (Flanagan, 1984) in September 1984 and its subsequent distribution, letters have been received noting omissions of data. At least one letter concerned data by instrumental neutron activation analysis where most but not all data for the major and minor oxides were reported as the element, the form in which they were received. After reexamining both the published and the original data, other errors, most of them inconsequential, were found. Several errors and omissions are discussed below.

The reporting of some major and minor oxides as the elements was mentioned in the last two sentences of paragraph 1 under "Tables of Data" (Flanagan, 1984 p.3). Although the sentences are correct, they were not sufficiently explicit and might have been written as follows:

"The determinations of most major and minor oxides by instrumental neutron activation analysis were reported as the elements. I calculated the analysis of variance on a programmable calculator and this served as a check on analyses of variance that were included by some analysts. Means and sample variances for best values were calculated separately, the average serving to confirm the mean obtained by the computer program. Because the mean and sample variance as the elements were converted to oxides by the gravimetric factor and its square, respectively, there was a net saving of four gravimetric conversions and therefore of four possible errors for each set of data."

Analyses of Variance

The analyses of variance were made on the data as published but there were some exceptions. Thus, the data for Ba in W-2 by the University of Toronto (Bulletin, p. 17) contained a value of <200 ppm for the third determination for bottle 2. This lower limit could have been discarded and the calculations made for a design with unequal numbers of observations per cell (bottles), but a later random selection of 6 of the 8 data for calculating best values would have been necessary. The first and second determinations for the three bottles were therefore used for the analysis of variance and for best values. Similarly, data for bottle 3 for Ba in DNC-1 (Bulletin, p. 30) contained lower limits of 200 and 250 ppm, and data for bottles 1 and 2 were used for calculations.

There are trace element data for BIR-1 by spark source mass spectrometry by the Hahn-Meitner Institute and the third observation for bottle 2 was missing for all elements. The third observation for bottle 1 was discarded and analyses of variance were made using the two determinations for each bottle. These four were not used for best values because calculations were restricted to sets of six independent data.

A similar procedure was used for Dy and other rare earth elements in BIR-1 by the University of Geneva. Determination 3 for bottle 1 was missing and the third determinations for bottles 2 and 3 were not used for calculations.

Omitted Data

The data in table 1 by Guy Bologne of the University of Liege consist of three counts by wavelength dispersive X-ray fluoresence spectrometry of two poured discs made from two portions from each bottle of sample. The data for any combination of discs (or pellets) and a bottle of sample are not independent determinations as discussed in section (6) of the ISGRM (International Study Group for Geological Reference Materials) Guide by Steele (1978). When the three data in any cell (a combination of a disc and a bottle of sample) are averaged as indicated in Steele (1978), the data are reduced to a determination in two discs for each bottle - a total of four independent data. Because these four data could not be used for best values, I intended to include the data in a separate table but neglected to do so.

A set of missing data was discovered as a result of a letter questioning how I arrived at a best value of 0.96 ppm Be in DNC-1 for 3 sets of data. There are only two sets of data in table 2 (Bulletin, p.31) for which the mean would be 0.765 ppm, rounded to 0.76 ppm. Inspection of the sheet used for best values indicated that a mean and sample variance of data by two analysts of the British Museum of Natural History (BMNH) were included in the calculations. These data should not have been used (see table 2) and the best value should have been 0.76 ppm Be.

A review of similar sheets for W-2 and BIR-1 showed a mean was used for W-2 but not for BIR-1. Further, there were no Be data by BMNH in tables 1 or 3 of the Bulletin. Because of the requirement of 6 independent determinations, it is fortunate that both the mean and sample variance of the BMNH data for W-2 were discarded as not belonging to the population, and no harm has been done in spite of my error of trying to use the estimates for W-2. The best values for W-2 and BIR-1 remain unchanged and that for DNC-1 should be 0.76 ppm Be.

The original set of data by BMNH was examined and, except for partial sets of data for K_2O in DNC-1 and BIR-1 and of MnO in DNC-1, none of the data by atomic absorption spectroscopy (AAS) for oxides or trace elements was included in large tables 1, 2, and 3. The data by AAS are given in table 2 where each analyst determined an oxide or an element in his single portion from each bottle of the samples. These were not six independent data by each analyst and because of the differences in the data by analysts, I had intended to table the data separately as they should not be used for best values.

Some data from the BMNH by X-ray fluorescence spectroscopy were omitted from the Bulletin. The data, preceded by the page number in the Bulletin on which they should have been listed, are given in the tabulation below in the form used in the Bulletin. The data for MnO by BMNH in the Bulletin (p. 29) were, in fact, data for P_2O_5 that were accidently repeated. The data for K_2O and Cr had been omitted. The correct data in the tabulation had been used for best values.

XRF data by BMNH omitted

Page		Bottle				Standard Deviation		F
		1	2	3	Mean	Bottle	Error	ratio
29	MnO	0.15 .15	0.15 .16	0.15 .15	0.152	0.001	0.004	1.18 NS
	MnO	.150 .150	.154 .151	.150 .151	.151	.001	.001	2.06 NS
40	K_2O	-	-	-	<.05	-	-	-
	K_2O	.031 .025	.026 .029	.018 .032	.027	Neg.	.006	<1
43	Cr	341 336	338 338	343 345	340.2	8.7	2.2	4.61 NS

Data inadvertantly included in Tables 1-3

The data in table 3 are triplicate measurements by energy-dispersive x-ray flourescence spectroscopy on a single pressed powder pellet from each bottle of a reference sample. The triplicate measurements should have been averaged as indicated in Steele (1978), thereby resulting in a single datum for each bottle. The analysis of variance had been calculated because of my oversight for each set of data in table 3 and these data, together with the estimates, were entered in tables 1, 2, and 3 of the Bulletin. Because there were two rather than the 6 independent data required, best values were recalculated without the means and variances of the trace elements in table 3 and the revised values in table 4 also include the original estimates in parentheses for ease of comparison.

There are no errors in the Zr data for BIR-1 in table 3 (p. 48) but there is a revised estimate in table 4. Best values were calculated in the order in which the constituents are listed in table 9 of the Bulletin, and in the order of the samples, W-2, DNC-1, and BIR-1. A value of 16.7 ppm Zr obtained from 2 sets of data was the last estimate to be calculated.

This low Zr content (16.7 ppm) of BIR-1 yields a Zr/Hf ratio of 26.1 using the best value for Hf, and the ratio leaves much to be desired in view of the ratios for W-1 (39.3), W-2 (38.5) and DNC-1 (38.1). Because of the low Zr value, I decided to determine the effect on the ratio of using the critical value of the Studentized range for probability, p = 0.01, when calculating the estimate. The new value, 18.4 ppm obtained from 3 sets of data, yielded a ratio of 28.8, which is only slightly better than the previous ratio of 26.1. The new value, 18.4 ppm, was entered accidently into the rough table of values to be typed. It may be noted that the grand mean, 24.84 ppm, of the six averages of Zr data for BIR-1 in the Bulletin yields a Zr/Hf ratio of 38.8 that agrees well with the ratios for W-1, W-2, and DNC-1.

Changes in contributions to χ^2 for comparing W-1 and W-2

The revised estimates in table 4 for best values for the 8 trace elements in W-2 cause changes in the contributions to chi squared in table 11 (Bulletin p. 8). The original and revised contributions, and the differences between each pair, are given in table 5. The algebraic sum of the positive and negative differences (+ 10.025 - 0.161 = + 9.864) is added to the sum, 46.472, in table 11 to give a revised sum of 56.338. This revised sum is about midway between a chi squared of 53.8 for 80 percent probability and of 58.6 for 90 percent probability for 46 degrees of freedom (df) in table 5 of Hald (1952). I conclude that the compositions of W-1 and W-2 for the 46 constituents are about the same at not greater than the 85 percent probability for chi squared.

The data in table 5 show that the contributions of Ni (4.592), Zn (1.958), and Zr (5.734) are each larger than that of the lowest (Be = 1.927) of the seven constituents in the tabulation under table 11 of the Bulletin. When the sum (12.284) of the contributions for Ni, Zn, and Zr is added to the sum of 35.744 for the 7 constituents, a new chi squared of 48.028 is obtained for the 10 constituents having the greatest effect.

When this revised sum of 48.028 is subtracted from the revised sum, 56.336, for all constituents, we obtain a chi squared of 8.308 for 36 df. Reentering table 5 of Hald (1952) for 36 df, we find that the lowest value of chi squared is 14.4 at 0.05 percent probability. Because the probability that our value of chi squared of 8.308 is less than 14.4 is equal to 0.05 percent for 36 df, the compositions of W-1 and W-2 do not differ for the 36 constituents at probability, p = 0.05 percent.

Errors noted in tables 1 - 3, Bulletin 1623

Errors in the published data are given in table 6. The errors were found by calculating the mean and sample variance for sets of 6 data in the three large tables. If a calculated mean differed from that in the tables, it was recalculated. If the disagreement persisted, the original data were reviewed. Most errors may be attributed to typographical or to rounding errors, but it is frequently difficult to distinguish between them. For any errors or omissions found, the correct averages and sample variances had been used for best values.

The average SiO_2 content for W-2 for the inductively-coupled plasma spectroscopy data by the National Institute for Metallurgy is shown in table 1 (p. 13) as 52.28 percent whereas I calculated 52.585 percent from the 6 data. When a recalculation yielded 52.585 percent, I found that the original data agreed with those in table 1. I conclude that the mean, 52.28, is a typing error and that it should have been 52.58.

A similar error occurred for the mean SiO_2 content of 52.95 percent in W-2 for the XRF data by the USGS. This mean differs from my calculated 52.915 percent that was recalculated because of the difference. If I rounded 52.915 as I normally do, I would have reported 52.92, or, if I failed to round correctly, 52.91. I missed the digit 1 in the second decimal place and I call this a typing error.

Errors of another kind occurred in large tables 1, 2, and 3. For the future publication, I intended to table data in the same format as in USGS Professional Paper 1155 (Flanagan and Gottfried, 1980), using one table for each sample for a technique by an analyst. The number (>100) of such tables became a problem both for publication and for the potential reader, and I decided to use the form of tables 1 - 3. While changing format, I made the errors discussed below.

When recalculating all data in tables 1 - 3, my average for Cr in W-2 for XRF data by BMNH (p. 18) differed from that published. When the difference persisted, I found that I had typed the second determinations of Ni for bottles 2 and 3, rather than the correct data. When the correct Cr data (88 and 91 ppm) are use, the mean is the same as that reported, and the results of variance are correct.

A mean of 9.9533.., rather than the published 9.84, was found for Fe_2O_3T in DNC-1 (p. 30) for data by the Bedford Institute of Oceanography (BIO). A review of the original data showed that I typed the first determinations for MgO (9.90, 9.86, and 10.34) rather than the second determinations for Fe_2O_3T (9.78, 9.72, and 9.89). When these Fe_2O_3T data are used, the published estimates are correct.

I calculated a mean of 3.95 ppm Ce in BIR-1 (p. 42) for XRF data by the Unitversity of Birmingham. For some unknown reason, a mean of 3.6 ppm was entered in table 3. Using the original data, I recalculated a mean of 3.95 ppm and my standard deviations and F ratio agree with those published.

There are two other items that were treated incompletely, or omitted.

1-In table 3 (p. 42) for the Cd data for BIR-1, the heading of Cd and the initials of the contributors are asterisked. The asterisk is explained in a footnote as "* Cd in ppb by BIO and WAIT but in ppm by GCL". Data for Cd in W-2 (p. 18) and in DNC-1 (p. 31) should have been treated similarly.

2-Because of the last sentence under Analysis of Variance (Bulletin, p. 3), I intended to enter the following note on p. 48 immediately after "Notes for tables 1 - 3" and before "Critical values of the F ratio .."

For a set of data consisting of k bottles, each with n determinations, the degrees of freedom (df) are :

	df
Bottles	k-1
Error	k(n-1)
Total	kn-1

REFERENCES

Flanagan, F.J., 1984, Three USGS mafic rock reference samples, W-2, DNC-1, and BIR-1: U.S. Geological Survey Bulletin 1623, 54 p.

Flanagan, F.J., and Gottfried, David, 1980, USGS rock standards, III; Manganese-nodule reference samples USGS-Nod-A-1 and USGS-Nod-P-1: U.S. Geological Survey Professional Paper 1155, 39 p.

Hald, Anders, 1952, Statistical tables and formulas: New York, Wiley, 97 p.

Steele, T.W., 1978, A guide to the reporting of analytical results relating to the certification of geological reference materials: Geostandards Newsletter, v. 2, no. 1, p. 31-33.

Table 1. Triplicate measurements by wavelength dispersive X-ray fluorescence on prepared portions from each bottle of reference samples by Guy Bologne, Université de Liège

[In percent. Na_2O by energy dispersive X-ray fluorescence on pressed powders. D, poured disc. P, pressed powder pellet with lucite as the binder.]

		W-2			DNC-1			BIR-1		
		Bottle No.		Mean	Bottle No.		Mean	Bottle No.		Mean
		1117	1140		246	634		165	1230	
SiO_2	D-1	51.65	51.65		45.89	46.07		46.85	47.07	
		51.63	51.93		45.56	46.34		46.87	47.09	
		51.66	51.64		45.63	46.00		47.26	47.09	
	D-2	52.14	52.55		46.37	46.40		47.82	47.77	
		51.97	52.31		46.64	46.34		47.99	47.71	
		52.11	52.53	51.98	46.50	46.27	46.17	48.00	47.73	47.44
Al_2O_3	D-1	15.03	14.94		18.08	18.01		15.23	15.41	
		15.15	15.00		18.07	18.13		15.19	15.39	
		15.11	14.92		17.87	18.08		15.20	15.35	
	D-2	15.25	15.48		18.20	18.14		15.45	15.53	
		15.17	15.37		18.06	18.09		15.66	15.49	
		15.23	15.29	15.16	18.16	18.05	18.09	14.49	15.45	15.40
Fe_2O_3*	D-1	2.16	2.15		2.46	2.51		2.68	2.77	
		2.23	2.22		2.42	2.55		2.67	2.71	
		2.16	2.17		2.48	2.50		2.65	2.68	
	D-2	2.30	2.33		2.72	2.60		2.87	2.82	
		2.25	2.35		2.70	2.59		2.80	2.82	
		2.22	2.34	2.24	2.71	2.60	2.57	2.87	2.82	2.76
MgO	D-1	6.63	6.56		10.41	10.38		9.97	10.17	
		6.65	6.56		10.33	10.47		10.02	9.99	
		6.50	6.43		10.39	10.49		10.14	9.98	
	D-2	6.69	7.14		10.28	10.21		10.86	10.26	
		6.62	7.24		10.23	10.15		10.71	10.71	
		6.68	7.25	6.75	10.19	9.99	10.29	10.71	10.44	10.33
CaO	D-1	11.00	10.95		11.22	11.29		13.31	13.41	
		10.96	10.94		11.24	11.26		13.27	13.41	
		11.02	10.95		11.26	11.32		13.29	13.36	
	D-2	11.00	11.06		11.36	11.45		13.51	13.50	
		11.01	11.05		11.34	11.39		13.57	13.52	
		11.03	11.02	11.00	11.36	11.44	11.33	13.49	13.43	13.42
Na_2O	P-1	2.13	2.14		1.81	1.83		2.01	2.01	
		2.19	2.18		1.98	1.95		2.03	2.05	
		2.21	2.12		1.84	2.00		2.19	2.02	
	P-2	2.23	2.17		1.96	1.93		2.08	2.06	
		2.14	2.21		1.99	2.10		2.13	2.01	
		2.22	2.16	2.18	1.99	1.92	1.94	2.13	2.05	2.06
K_2O	D-1	.61	.60		.21	.21		-	-	
		.61	.59		.21	.21		-	-	
		.61	.60		.21	.22		-	-	
	D-2	.61	.61		.20	.21		-	-	
		.61	.59		.20	.21		-	-	
		.61	.60	.60	.20	.21	.21	-	-	<.03
TiO_2	D-1	1.08	1.09		.48	.50		.99	.98	
		1.07	1.07		.49	.48		.98	.98	
		1.03	1.04		.48	.48		.97	1.00	
	D-2	1.08	1.08		.49	.49		.98	.96	
		1.07	1.06		.48	.48		.99	.99	
		1.07	1.06	1.07	.48	.50	.49	.97	.97	.98
P_2O_5	D-1	.11	.11		.07	.08		-	-	
		.11	.11		.06	.07		-	-	
		.11	.11		.07	.08		-	-	
	D-2	.12	.09		.06	.05		-	-	
		.13	.09		.06	.05		-	-	
		.13	.09	.11	.05	.05	.06	-	-	<.05
MnO	D-1	.17	.17		.15	.15		.18	.18	
		.17	.17		.15	.15		.18	.18	
		.17	.17		.16	.16		.18	.18	
	D-2	.18	.18		.16	.16		.18	.17	
		.18	.18		.16	.16		.18	.18	
		.18	.18	.18	.16	.16	.16	.18	.18	.18

* Total Fe as Fe_2O_3 less the Fe_2O_3 equivalent of FeO.

Table 2. Atomic absorption spectroscopic determinations of several minor oxides and trace elements in W-2, DNC-1, and BIR-1 by two analysts of the British Museum of Natural History

[Units as indicated. A, analyst.]

		W-2				DNC-1				BIR-1			
		Bottle No.				Bottle No.				Bottle No.			
	A	1	2	3	Mean	1	2	3	Mean	1	2	3	Mean
						In percent							
Na_2O	1	2.0	2.0	2.0	2.0	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6
	3	2.11	2.09	2.10	2.10	1.75	1.78	1.76	1.76	1.71	1.67	1.69	1.69
K_2O	3	.60	.60	.60	.60	.218*	.218*	.218*	.218*	.016*	.016*	.016*	.016*
						In parts per million							
MnO	3	1535	1520	1645	1567	1445*	1455*	1365*	1422*	1705	1695	1705	1702
Ba	1	140	170	150	153	140	140	100	127	-	-	-	<100
	3	205	205	205	205	135	135	155	142	-	-	-	<100
Be	1	1	1	2	1.3	2	2	1	1.6	<1	<1	1	-
	3	1.5	1.5	1.4	1.5	.9	1.2	1.0	1.0	.5	.4	.8	.6
Co	1	38	32	33	34	52	57	54	54	40	41	46	42
	3	37	41	44	41	57	50	53	53	55	42	45	47
Cr	1	94	94	96	95	270	276	274	273	380	378	389	382
	3	86	86	85	86	256	255	258	256	349	352	350	350
Cu	1	30	24	24	26	12	12	13	12	90	70	72	77
	3	20	20	20	20	7.7	6.9	7.5	7.4	115	112	114	114
Li	1	9	8	9	9	5	5	5	5	3	3	3	3
	3	8.6	9.2	9.4	9.1	4.3	4.6	4.6	4.5	3.5	3.3	3.0	3.3
Ni	1	58	60	69	62	244	235	224	234	150	150	174	158
	3	72	69	64	68	207	211	209	209	151	147	147	148
Rb	1	18	18	15	17	-	-	-	<5	-	-	-	<5
	3	15	17	17	16	4.2	3.5	3.5	3.7	-	-	-	<3
Sr	1	201	202	194	199	145	142	142	143	111	107	112	110
	3	170	169	169	169	122	120	119	120	93	92	93	93
V	1	280	310	300	297	130	160	160	150	370	350	340	353
	3	257	253	250	253	149	152	149	150	308	294	301	301
Zn	1	74	93	75	81	68	70	64	67	74	72	73	73
	3	82	82	85	83	72	73	69	71	81	78	81	80

* K_2O in table 2 (p. 28) and table 3 (p.40), and MnO, in percent, in table 2 (p. 29) of Bulletin 1623.

Table 3. Triplicate measurements by energy dispersive X-ray fluorescence on one pressed powder pellet from each bottle of a sample by Guy Bologne, Université de Liège

[In parts per million. Lucite was used as a binder for pellets. x̄, mean.]

	W-2			DNC-1			BIR-1		
	Bottle No.			Bottle No.			Bottle No.		
	1117	1140	x̄	246	634	x̄	165	1230	x̄
Co	40	38	38*	50	46	49*	43	45	44*
	38	36		48	49		42	43	
	35	39		54	48		44	44	
Ni	80	80	80*	300	290	285*	173	174	177*
	81	84		291	284		181	186	
	78	76		276	270		171	175	
Rb	23	20	22*	-	-	<15	-	-	<15
	21	22		-	-		-	-	
	24	23		-	-		-	-	
Sr	204	203	202*	147	150	149*	116	114	116*
	202	201		148	150		117	117	
	202	202		152	149		117	114	
V	246	241	249*	154	138	145*	294	289	291*
	252	249		152	142		285	300	
	252	254		146	135		283	294	
Y	23	24	21*	18	19	18*	17	16	17*
	20	20		16	19		15	18	
	21	19		18	17		17	16	
Zn	74	78	73*	61	69	66*	67	69	69*
	69	73		69	67		69	69	
	73	68		67	80		72	67	
Zr	67	73	66*	-	-	< 20	-	-	< 20
	61	58		-	-		-	-	
	67	67		-	-		-	-	

* Means, recalculated and rounded to the second decimal, and their sample variances were used erroneously in the calculations of best values. Data for V and Y in DNC-1 were not listed in table 2 of Bulletin 1623.

Table 4. Revised estimates for some trace-element contents in Table 9, USGS Bulletin 1623

[$\bar{\bar{x}}$ and $s_{\bar{x}}$ in parts per million. Original estimates in parentheses.]

	W-2				DNC-1				BIR-1			
	$\bar{\bar{x}}$	n	$s_{\bar{x}}$	df	$\bar{\bar{x}}$	n	$s_{\bar{x}}$	df	$\bar{\bar{x}}$	n	$s_{\bar{x}}$	df
Co	44.82 (43.15)	16 (21)	1.23 (2.11)	75 (40)	56.93 (56.75)	17 (18)	2.21 (2.19)	105 (115)	51.5 (51.58)	16 (18)	1.74 (1.88)	85 (100)
Ni	71.8 (70.4)	4 (10)	.80 (2.46)	25 (50)	246.7 (247.0)	5 (12)	3.60 (11.78)	35 (75)	173.5 (166.4)	4 (9)	3.08 (5.88)	35 (55)
Rb	19.9 (20.9)	9 (11)	.96 (1.06)	45 (55)	-	-	-	-	-	-	-	-
Sr	191.9 (192.0)	9 (8)	3.26 ([1]2.98)	50 (50)	144.5 (144.0)	8 (7)	1.90 (1.77)	45 (45)	106.6 (107.2)	6 (7)	1.50 (1.49)	35 (40)
V	258.8 (259.0)	10 (13)	12.77 (12.27)	60 (70)	-	-	-	-	312.8 (311.6)	9 (12)	9.65 (11.47)	45 (60)
Y	23.4 (23.0)	6 (7)	1.74 (1.63)	40 (40)	-	-	-	-	15.5 (15.8)	3 (4)	.92 (.92)	30 (35)
Zn	78.8 (79.6)	8 (10)	2.10 (2.28)	40 (55)	70.7 (70.1)	4 (10)	1.12 (2.36)	40 (60)	71.2 (69.6)	4 (6)	2.04 (2.02)	40 (45)
Zr	96.2 (100.0)	3 (6)	1.50 ([1]3.74)	25 (40)	-	-	-	-	16.7 (18.4)	2 (3)	1.19 (1.19)	30 (30)

[1] $s_{\bar{x}}$ accepted at $p = 0.01$.

Table 5. Changes in contributions to χ^2

[-, decrease. +, increase]

	Table 11	Revised	-	+
Co	0.555	0.523	0.032	-
Ni	.864	4.592	-	3.728
Rb	.002	.219	-	.217
Sr	.075	.056	.019	-
V	.028	.028	0	0
Y	.251	.141	.110	-
Zn	1.314	1.958	-	.644
Zr	.298	5.734	-	5.436
		Sum	.161	10.025
		Net increase		9.864

Table 6. Errors found in tables 1, 2, and 3 of Bulletin 1623

[Const, constituent. Org, organization. Method listed only to distinguish between types of data. R, reported. C, corrected. Errors are typographical (typo) or rounding. sd, standard deviation]

Page	Const	Org./Method		Bottle No. 1	2	3	Mean	Remarks
13	SiO_2	NIM ICPS	R	-	-	-	52.28	Typo
			C	-	-	-	52.58	
	SiO_2	USGS XRF	R	-	-	-	52.95	Typo
			C	-	-	-	52.92	
	Al_2O_3	BIO	R	-	-	-	14.83	Rounding
			C	-	-	-	14.84	
15	Na_2O	HMI INAA-B	R	-	1.75	-	-	Typo
			C	-	1.73	-	-	
	K_2O	NIM XRF	R	-	-	-	.74	Rounding
			C	-	-	-	.75	
	K_2O	HMI INAA-W	R	-	.61	-	-	Typo
			C	-	.60	-	-	
17	Fe_2O_3T	Exxon	R	-	-	-	10.80	Typo
			C	-	-	-	10.81	
18	Ce	Open	R	-	-	-	23.5	Typo
			C	-	-	-	23.4	
	Cr	BMNH XRF	R	-	70	55	-	Line 2 for Ni (p. 21)
			C	-	88	91	-	Line 2 for Cr
21	Mn	NERF	R	-	-	-	1540	Rounded (40 ppm error sd)
			C?	-	-	-	1538	
24	Ti	HMI SSMS	R	3804	-	-	-	Typo
			C	3904	-	-	-	
26	SiO_2	BMNH XRF	R	46.04	-	-	-	Typo
			C	47.04	-	-	-	
	Al_2O_3	BMNH XRF	R	-	18.75	-	-	Typo
			C	-	18.74	-	-	
27	MgO	GSC/G	R	-	10.16	-	-	Typo
			C	-	10.06	-	-	
	MgO	Exxon	R	-	-	-	10.22	Typo
			C	-	-	-	10.21	
	Na_2O	WHOI	R	-	-	-	1.61	Rounding
			C	-	-	-	1.60	
28	Na_2O	HMI INAA-W	R	-	-	-	1.41	Rounding
			C	-	-	-	1.40	
		HMI INAA-B	R	-	-	-	1.41	Rounding
			C	-	-	-	1.40	
30	Fe_2O_3T	BIO	R	9.90	9.86	10.34	-	Line 1 for MgO (p. 27)
			C	9.78	9.72	9.89	-	Line 2 for Fe_2O_3T
	Ba	Nott	R	-	-	-	142.20	Rounding
			C	-	-	-	142.19	
31	Co	NERF	R	-	-	-	57.8	Typo
			C	-	-	-	57.7	
	Co	Open	R	-	-	-	57.23	Typo
			C	-	-	-	57.27	
32	Cr	USGS OES	R	-	-	-	492	Typo
			C	-	-	-	482	
33	Gd	Open	R	-	-	-	2.62	Typo
			C	-	-	-	2.63	
34	Nb	WHOI	R	-	-	-	2.9	Rounding
			C	-	-	-	2.8	
	Ni	Nott	R	-	-	-	241.78	Typo
			C	-	-	-	241.75	
36	V	NIM	R	-	-	-	169	Rounding
			C	-	-	-	168	
38	Al_2O_3	Exxon	R	-	-	-	15.67	Rounding
			C	-	-	-	15.68	
40	TiO_2	GSC/H	R	-	-	-	.92	Typo
			C	-	-	-	.93	
41	Fe_2O_3T	Tohok	R	-	-	-	11.51	Typo
			C	-	-	-	11.53	
42	Ba	Nott	R	-	-	-	33.75	Rounding
			C	-	-	-	33.74	
44	Eu	LASL INAA	R	-	-	-	.83	Rounding
			C	-	-	-	.82	
46	Sc	HMI INAA-8	R	-	-	-	44.1	Rounding
			C	-	-	-	44.0	
47	Yb	HMI INAA-W	R	-	-	-	1.63	Rounding
			C	-	-	-	1.62	
	Yb	NERF	R	-	-	-	1.97	Rounding
			C	-	-	-	1.96	