GSJ Geochemical Reference Samples

Igneous Rock

Recommended and preferable (asterisked) values (major elements in % and minor and trace elements in ppm, unless otherwise noted)
N. Imai, S. Terashima, S. Itoh and A. Ando (1995):1994 compilation of analytical data for minor and trace elements in seventeen GSJ geochemical reference samples, "Igneous rock series", *Geostandards Newsletter*, 19, 135-213.

Sedimentary Rock

GSJ Geochemical Reference Samples
Recommended and preferable (asterisked) values (major elements in % and minor and trace elements in ppm, unless otherwise noted)
N. Imai, S. Terashima, S. Itoh and A. Ando (1996)
1996 compilation of analytical data on nine GSJ geochemical reference samples, "Sedimentary rock series", *Geostandards Newsletter*, 20,165-216.

For Instrumental analysis

GSJ Geochemical Reference Samples
Recommended and preferable (asterisked) values (% from SiO2 to T-Fe2O3 and μg g^{-1} from Ag to Zr, unless otherwise noted)
N. Imai, S. Terashima, S. Itoh and A. Ando (1995)
1998 compilation of analytical data for five GSJ reference samples: the "instrumental analysis series", *Geostandards Newsletter*, 23, 223-250.

Reference value for environmental analysis -1

Reference values for major, minor and trace elements in five GSJ reference samples, (in % from SiO2 to T-Fe2O3 and ppm from Ag to Zr, unless otherwise noted)
JCFA-1 and JB-1b:. S. Terashima et. al. (1998) *Geostandards Newsletter*, 22, 113-117.
JCp-1: Okai et al., *Geostandards Newsletter*, 25, No.2 (2001), in press.

Reference values for environmental analysis -2

Reference values for GSJ JSO-1, JSO-2, JMS-1 and JMS-2 on dried basis for 2 hours at 110℃
Geostandards Newsletter, in press.
The major constituents are in % m/m and trace elements are in μg g^{-1}. SD standard deviation. n number of analyses. LOI loss on ignition. T total. n. d. not determined. * Obtained by fusion method.

Igneous rocks

1994 recommended or preferable (with asterisks) values for major, minor and trace elements in five GSJ reference samples, (in % from SiO2 to T-Fe2O3 and μg g^{-1} from Ag to Zr, unless otherwise noted)
N. Imai et al. (1995) *Geostandards Newsletter*, 19, 135-213.

Average, Standard deviation and number of measurement (SiO2 to T-Fe2O3, Ag to Zr:JA-1, 2, 3, JB-1, 1a, 2, 3, JF-1,2, JG-1, 1a, 2, 3, JGb-1, JR-1, 2)

	JA-1	JA-2	JA-3	JB-1	JB-1a	JB-2	JB-3	JF-1	JF-2	JG-1	JG-1a	JG-2	JG-3	JGb-1	JP-1	JR-1	JR-2
SiO2	63.97	56.42	62.27	52.37	52.41	53.25	50.96	66.69	65.3	72.3	72.3	76.83	67.29	43.66	42.38	75.45	75.69
TiO2	0.85	0.66	0.7	1	1	1.19	1.44	0.005	0.005	0.26	0.25	0.044	0.48	1.6	0.006*	0.11	0.07
Al2O3	15.22	15.41	15.56	1	1	14.64	17.2	18.08	18.52	14.24	14.3	12.47	15.48	17.49	0.66	12.83	12.72
Fe2O3	2.59	2.16	1.15	2	2	3.33	3.2	0.06	0.06	0.38	0.51	0.33	1.62	4.79	1.98	0.35	0.27
FeO	3.98	3.69	4.83	5	5	9.98	7.85	<0.04*	<0.03*	1.61	1.36	0.57	1.83	9.43	5.99	0.49	0.44
MnO	0.157	0.108	0.104	0	0	0.218	0.177	0.001	0.001	0.063	0.057	0.016	0.071	0.189	0.121	0.099	0.112
MgO	1.57	7.6	3.72	7	7	4.62	5.19	0.006	0.004*	0.74	0.69	0.037	1.79	7.85	44.6	0.12	0.04
CaO	5.7	6.29	6.24	9	9	9.82	9.79	0.93	0.09	2.2	2.13	0.7	3.69	11.9	0.55	0.67	0.5
Na2O	3.84	3.11	3.19	2	2	2.04	2.73	3.37	2.39	3.38	3.39	3.54	3.96	1.2	0.021	4.02	3.99
K2O	0.77	1.81	1.41	1.43	1.4	0.42	0.78	9.99	12.94	3.98	3.96	4.71	2.64	0.24	0.003	4.41	4.45
P2O5	0.165	0.146	0.116	0.255	0.26	0.101	0.294	0.01	0.003*	0.099	0.083	0.002	0.122	0.056	0.002*	0.021	0.012
H2O+	0.72	1.12	0.2	1.02	0.92	0.25	0.18	0.23	0.24	0.54	0.59	0.33	0.67	1.28	2.39	1.16	1.19
H2O-	0.3	1.25	0.11	0.95	0.92	0.13	0.07	0.13	0.18	0.07	0.12	0.12	0.17	0.13	0.44	0.2	0.22
T-Fe2O3	7.07	6.21	6.6	8.99	9.05	14.25	11.82	0.08	0.06	2.18	2	0.97	3.69	15.06	8.37	0.89	0.77

No longer available

No longer available

。。	JA-1	JA-2	JA-3	JB-1	JB-1a	JB-2	JB-3	JF-1	JF-2	JG-1	JG-1a	JG-2	JG-3	JGb-1	JP-1	JR-1	JR-2
Ag	0.033 *	0.043 *	0.084	0.049	0.041 *	0.072 *	0.075	0.017 *	0.019 *	0.034	0.023 *	0.019 *	0.029 *	0.024 *	1.5 *	0.031 *	0.028 *
Al (%)	8.06	8.16	8.23	7.69	7.65	7.75	9.1	9.57	9.8	7.54	7.57	6.6	8.19	9.26	0.35	6.79	6.73
As	2.78	0.85 *	4.68 *	2.33	2.3	2.87	1.84	0.92 *	0.28*	0.33	0.43 *	0.68 *	0.37 *	1.09	0.34	16.3	19.2
Au (ppb)	0.16	0.26	0.95 *	0.79	0.71	5.64	1.99	0.11 *	0.12 *	0.11	0.21	0.059 *	0.17	1.02	0.23 *	0.25	0.13
B	21	20.7	24.8	9.35 *	7.88	30.2	18	1.8 *	1.6 *	6.87	3.95	1.78 *	2.15 *	4.03	1.4 *	117	145
Ba	311	321	323	493	504	222	245	1750	298	466	470	81	466	64.3	19.5	50.3	39.5
Be	0.5	2.05	0.8	1.33	1.44	0.26 *	0.81	1.3 *	0.77 *	3.15	3.16	3.26	1.60 *	0.34 *	<0.1 *	3.34	3.75
Bi	0.0091 *	0.07 *	0.05 *	0.033		0.033 *	0.023 *			0.5	0.43 *	0.64 *	0.05 *	0.014 *		0.56	0.62
Br				0.58 *						0.068 *						6 *	。。
C	271 *	141 *	61 *	470 *	312 *	218 *	120 *	<20 *	38 *	216 *	295 *	35 *	120 *	300 *	764 *	70.8	63 *
Ca (%)	4.07	4.5	4.46	6.61	6.65	7.02	7	0.66	0.06	1.57	1.52	0.5	2.64	8.5	0.39	0.48	0.36
Cd	0.11	0.078 *	0.089*	0.11	0.1	0.14	0.081	0.003 *	0.003 *	0.04	0.026 *	0.004 *	0.054 *	0.087	0.011 *	0.026	0.023
Ce	13.3	32.7	22.8	67.8	65.9	6.76	21.5	4.19	0.84	45.8	45	48.3	40.3	8.17	0.19 *	47.2	38.8
Cl	43			176	171 *	281	259 *			58.1	65 *		156 *	81 *	97 *	920	736 *
Co	12.3	29.5	21.1	38.2	38.6	38	34.3	0.12	0.68	4.06	5.9	3.62	11.7	60.1	116	0.83	0.46
Cr	7.83	436	66.2	425	392	28.1	58.1	5.48	2.47 *	53.2	17.6	6.37	22.4	57.8	2807	2.83	3.1
Cs	0.62	4.63	2.08	1.23	1.31	0.85	0.94	2.09	1.06	10.1	10.6	6.79	1.78	0.26	0.15 *	20.8	25
Cu	43	29.7	43.4	55.1	56.7	225	194	0.82	0.78	2.52	1.67	0.49	6.81	85.7	6.72	2.68	1.36
Dy	4.55	2.8	3.01	4.14	3.99	3.73	4.54	0.39	0.036 *	4.14	4.44	10.5	2.59	1.56	0.022 *	5.69	6.63
Er	3.04	1.48	1.57	2.27	2.18	2.6	2.49	0.31	0.034 *	2.16	2.57	6.04	1.52	1.04	0.016 *	3.61	4.36
Eu	1.2	0.93	0.82	1.49	1.46	0.86	1.32	0.87	0.59	0.73	0.7	0.1	0.9	0.62	0.004 *	0.3	0.14
F	161	223 *	286*	385	357	98.5	253	78 *	16 *	498	439	972 *	317 *	133	14 *	991	1109
Fe (%)	4.95	4.34	4.62	6.29	6.33	9.97	8.27	0.06	0.04	1.52	1.4	0.68	2.58	10.53	5.85	0.62	0.54
Ga	16.7	16.9	16.3	17.9	17.9	17	19.8	17.4	17.9	17.8	16.5	18.6	17.1	17.9	0.70 *	16.1	17.9
Gd	4.36	3.06	2.96	4.9	4.67	3.28	4.67	0.93	0.072 *	4.28	4.08	8.01	2.92	1.61	0.015 *	5.06	5.83
Ge	1.33	1.05 *		0.9	1.02 *	1.35	1.12			1.44	1.5 *	1.70 *	1.06 *	1.01	0.49 *	1.88	1.88 *
Hf	2.42	2.86	3.42	3.31	3.41	1.49	2.67	1.18	0.19	3.56	3.59	4.73	4.29	0.88	0.2	4.51	5.14
Hg (ppb)	11.7 *	1.8 *	1.9 *	29.9	6.65 *	4.78	2.4 *	1.6 *	1.7 *	16.5	4.1 *	3.3 *	2.4 *	4.2 *	5.3 *	3.4 *	0.9 *
Ho	0.95	0.5	0.51	0.79	0.71	0.75	0.8	0.11	0.021 *	0.81	0.82	1.67	0.38	0.33	0.018 *	1.11	1.39
I	0.015 *	0.005 *		0.030 *	0.021 *	0.049 *	0.028 *			0.012 *						0.080 *	0.067 *
In	0.0494 *			0.058*	0.057 *	0.094	0.069 *			0.044 *	0.025 *	0.021 *				0.028 *	。。
Ir (ppb)	0.0028 *	0.013 *	0.014 *		0.023 *		0.037 *					0.0040 *	0.0016 *		2.0 *		0.0022 *
K (%)	0.64	1.5	1.17	1.19	1.16	0.35	0.65	8.29	10.74	3.3	3.29	3.91	2.19	0.2	0.002	3.66	3.69
La	5.24	15.8	9.33	38.6	37.6	2.35	8.81	2.8	0.63	22.4	21.3	19.9	20.6	3.6	0.084	19.7	16.3
Li	10.8	27.3	14.5	11.5	10.9	7.78	7.21	9.81	2.19	86.6	79.5	42.2	20.9	4.59	1.79 *	61.4	79.2
Lu	0.47	0.27	0.32	0.31	0.33	0.4	0.39	0.053	0.02	0.39	0.44	1.22	0.26	0.15	0.0044 *	0.71	0.88
Mg (%)	0.95	4.58	2.24	4.65	4.72	2.79	3.13	0.004		0.45	0.42	0.02	1.08	4.73	26.9	0.07	0.02
Mn (%)	0.122	0.084	0.081	0.118	0.115	0.169	0.137	0.001	0.001	0.049	0.044	0.012	0.055	0.146	0.094	0.077	0.087
Mo	1.59	0.6	1.89	27.4 *	1.57	1.08	1.09	0.30 *	0.21 *	1.75	0.45	0.37	0.45	0.59	0.087 *	3.25	3.35
Na (%)	2.85	2.31	2.37	2.05	2.03	1.51	2.03	2.5	1.77	2.51	2.51	2.63	2.94	0.89	0.02	2.98	2.96
Nb	1.85	9.47	3.41	33.3	26.9	1.58 *	2.47	0.74	0.7	12.4	11.4	14.7	5.88	3.34	1.48	15.2	18.7
Nd	10.9	13.9	12.3	26.8	26	6.63	15.6	1.46	0.33 *	19.3	20.4	26.4	17.2	5.47	0.072 *	23.3	20.4
Ni	3.49 *	130	32.2	133	139	16.6	36.2	1.36 *	1.38 *	7.47	6.91	4.35 *	14.3	25.4	2460	1.67 *	1.99 *
Os (ppb)															7.9 *		。。
P (%)	0.072	0.064	0.051	0.111	0.11	0.044	0.128	0.004		0.043	0.036	0.001	0.053	0.024		0.009	0.005
Pb	6.55	19.2	7.7	10.0 *	6.76	5.36	5.58	33.4	48.7	25.4	26.4	31.5	11.7	1.92	0.12 *	19.3	21.5
Pd (ppb)	<0.2 *	0.5 *	1.0 *	0.7 *	0.6 *	6.3 *	3.2 *	<0.2 *	<0.2 *	<0.2 *	<0.2 *	<0.2 *	<0.2 *	0.18 *	1.3 *	<0.2 *	<0.2 *
Pr	1.71	3.84	2.4	7.01	7.3	1.01	3.11	0.48	0.088 *	4.83	5.63	6.2	4.7	1.13	0.020 *	5.58	4.75
Pt (ppb)	0.5 *	1.3 *	1.7 *	1.6 *	1.6 *	4.0 *	4.3 *	<0.5 *	<0.5 *	<0.5 *	<0.5 *	<0.5 *	<0.5 *	<0.5 *	4.9 *	<0.5 *	<0.5 *
Ra (ppt)				0.72 *						1.24 *							。。
Rb	12.3	72.9	36.7	41.3	39.2	7.37	15.1	266	218	182	178	301	67.3	6.87	0.80 *	257	303
Re (ppb)	0.45 *	0.063 *	0.65 *		0.18 *	0.38 *	0.24 *			0.098 *	0.015 *	0.016 *	0.033 *	0.27 *	0.015 *	0.046 *	0.023 *
Rh																	。。
Ru (ppb)															6.5 *		。。
S	21.6	8 *	214 *	19.4	10.2 *	17.9	9.86	<5 *	2.8 *	10.9	11 *	7.0 *	54.7 *	1910	26.9 *	13.3	9.6 *
Sb	0.22	0.14 *	0.32 *	0.28	0.25 *	0.25	0.12	0.055 *	0.04 *	0.13	0.048 *	0.057 *	0.08 *	0.085 *	0.034 *	1.19	1.51
Sc	28.5	19.6	22	27.5	27.9	53.5	33.8	0.23	0.089	6.53	6.21	2.42	8.76	35.8	7.24	5.07	5.59
Se	0.0088 *			0.023	0.021 *	0.19 *	0.069 *			0.003				0.15 *		0.006 *	0.0028 *
Si (%)	29.9	26.37	29.11	24.48	24.5	24.89	23.82	31.17	30.52	33.8	33.8	35.91	31.45	20.41	19.81	35.27	35.38
Sm	3.52	3.11	3.05	5.13	5.07	2.31	4.27	0.41	0.11	4.62	4.53	7.78	3.39	1.49	0.019	6.03	5.63
Sn	1.16 *	1.68	0.95 *	1.92	2.24	0.95	0.94	0.3 *	0.13 *	3.6	4.47	3	1.4	0.48	0.05 *	2.86	3.51
Sr	263	248	287	444	442	178	403	172	200	184	187	17.9	379	327	3.32 *	29.1	8.11
Ta	0.13	0.8	0.27	2.93	1.93	0.13	0.15	0.079	0.045 *	1.79	1.9	2.76	0.7	0.18	0.02 *	1.86	2.29
Tb	0.75	0.44	0.52	0.82	0.69	0.6	0.73	0.076	0.009 *	0.78	0.81	1.62	0.46	0.29	0.003 *	1.01	1.1
Te																	。。
Th	0.82	5.03	3.25	9.3	9.03	0.35	1.27	1.17	0.31	13.2	12.8	31.6	8.28	0.48	0.19	26.7	31.4
Ti (%)	0.51	0.4	0.42	0.79	0.77	0.71	0.86	0.003	0.003	0.16	0.15	0.026	0.29	0.96		0.066	0.04
Tl	0.13 *	0.32	0.23*	0.1	0.087 *	0.042 *	0.048	1.18	1.1	1.03	0.98	1.55	0.40 *	0.066 *	0.003 *	1.56	1.85
Tm	0.47	0.28	0.28 *	0.35	0.33	0.41	0.42	0.04 *	0.05 *	0.41	0.38	1.16	0.24	0.16	<0.041 *	0.67	0.74
U	0.34	2.21	1.18	1.67	1.57	0.18	0.48	0.33	0.078 *	3.47	4.69	11.3	2.21	0.13	0.036	8.88	10.9
V	105	126	169	211	205	575	372	5.43	4.86	25.2	22.7	3.78	70.1	635	27.6	7	3
W	0.34*	0.99 *	8.07 *	17.1	1.83 *	0.26 *	1.06 *	0.8 *	4.3 *	1.58 *	12.4	23	14.1 *	0.81 *	0.85 *	1.59	1.8 *
Y	30.6	18.3	21.2	24.3	24	24.9	26.9	2.84	2.67	30.6	32.1	86.5	17.3	10.4	1.54	45.1	51.1
Yb	3.03	1.62	2.16	2.13	2.1	2.62	2.55	0.35	0.045 *	2.47	2.7	6.85	1.77	1.06	0.022	4.55	5.33
Zn	90.9	64.7	67.7	85.2	82.1	108	100	4.41	1.4	41.1	36.5	13.6	46.5	109	41.8	30.6	27.8
Zr	88.3	116	118	141	144	51.2	97.8	38.6	6.73	111	118	97.6	144	32.8	5.92	99.9	96.3

Sedimentary rocks

1996 recommended or preferable (with asterisks) values for major, minor and trace elements in five GSJ reference samples, (in % from SiO2 to T-Fe2O3 and μg g^{-1} from Ag to Zr, unless otherwise noted)
N. Imai et al. (1996) *Geostandards Newsletter, 20,165-216.*

Average, Standard deviation and number of measurement (SiO2 to T-Fe2O3, JLk-1, JLs-1, JDo-1, Sl-1, 2, JSd-1, 2, 3, JCh-1)

	JLk-1	JLs-1	JDo-1	JSl-1	JSl-2	JSd-1	JSd-2	JSd-3	JCh-1
SiO2	57.16	0.12	0.216	59.47	59.45	66.55	60.78	76	97.81
TiO2	0.668	0.0020*	0.00133*	0.725	0.754	0.643	0.614	0.403	0
Al2O3	16.73	0.0207	0.0174	17.6	18.17	14.65	12.31	9.908	0
Fe2O3	4.251	0.0178	0.0222	1.875	0.959	3.526	4.552	3.057	0
FeO	2.191	-	0.071*	4.523	5.048	1.363	5.955	1.161	0
MnO	0.266	0.00209	0.00657	0.0599	0.0818	0.0924	0.12	0.148	0
MgO	1.736	0.606	18.47	2.413	2.385	1.813	2.731	1.17	0
CaO	0.686	55.09	33.96	1.479	1.885	3.034	3.658	0.56	0.0449
Na2O	1.051	0.00194	0.0129	2.184	1.344	2.727	2.438	0.411	0.0305
K2O	2.805	0.00297	0.00232	2.845	3.008	2.183	1.145	1.971	0.221
P2O5	0.208	0.0295	0.0343	0.202	0.164	0.122	0.105	0.0817	0.0167
H2O+	6.372	0.140*	0.395	3.92	4.158	2.301*	2.554	2.838	0.356
H2O-	3.701	0.105	0.145	0.654	0.362	0.836	0.451	0.964	0.152
CO2	-	43.58	46.5	0.769*	1.236*	0.0867*	0.501*	-	0.055*
T-Fe2O3	6.929	0.0168	0.0208	6.764	6.65	5.059	11.65	4.368	0.356
-	-	-	-	-	-	-	-	-	-
Ag	0.198*	0.0013*	0.0019*	0.119*	0.061*	0.036*	1.04*	3.38*	0.0041*
As	26.8	0.145*	0.114*	14.9	11.4	2.42	38.6	252	0.567
Au (ppb)	5.42*	0.0667*	0.09*	0.58*	0.92*	0.64*	54.6*	5.66*	0.17*
B	-	-	-	-	-	-	-	-	-
Ba	574	476	6.14	305	302	520	1199	462	302
Be	3.31*	-	-	2.28	2.68	1.4	1.04*	9.08*	0.373*
Bi	-	-	-	0.53*	-	-	-	23.8*	-
Br	8.7*	-	0.79*			1.65*	-	3.9*	-
C	15030*	119800*	127600*	9213*	11250*	1110*	3160*	6200*	37*
Cd	0.572*	0.159	0.644	0.118*	0.111*	0.146*	3.06*	1.045*	0.006*
Ce	87.9	0.521	2.49	60.6	69.6	34.4	23.4	42	5.21
Cl	-	-	-	21.5*	18.5*	67.5*	28*	39.0*	14*
Co	18	0.0825	0.168	15.5	15.7	11.2	48.4	12.7	15.5
Cr	69	3.37	7.93	60.9	64.7	21.5	108	35.3	7.04
Cs	10.9	0.0201	0.070*	7.6	8.24	1.89	1.07	30.6	0.243
Cu	62.9	0.268	1.41	40.8	44.5	22	1117	426	15.3
Dy	6.57	0.0283	0.814	5.11*	4.71	2.23	2.86	2.22	0.378*
Er	3.59	-	-	1.15*	2.24*	0.906	1.48	1.07	0.233*
Eu	1.27	0.0072	0.176	1.22	1.14	0.925	0.81	0.686	0.0594
F	589	57.5	246	598	678	306	259	3200	134*
Ga	21.4*			20.7*	22.8*	17.2*	15.3*	13.5*	-
Gd	6.02	0.030*	1.3*	4.84*	4.90*	2.71	2.67*	2.63*	1.7*
Ge	-	-	-	-	-	-	-	-	-
Hf	3.78	0.126	0.0897*	4.63	5.54	3.55	2.7	3.21	0.195
Hg (ppb)	142*	5.6*	9.5*	67*	35.3*	15.5*	106*	254*	4.13*
Ho	1.06	-	0.42*	0.688	0.671*	0.318*	0.678*	0.443*	0.112*
I	-	-	-	-	-	-	-	-	-
In	-	-	-	-	-	-	-	-	-
La	40.6	0.153	7.93	29.3	32.7	18.1	11.3	19.8	1.52
Li	51.5*	0.2*	0.4*	50.7*	52.6	22.8	19.2*	151	6.48*
Lu	0.571	0.022	0.0494	0.442	0.404	0.186	0.252	0.196	0.0344
Mo	2.19*	-	0.78*	0.823*	-	0.669*	11.5	-	-
Nb	15.8	1.0*	0.4*	9.53	12.3	11.1	4.56	7.8	1.70*
Nd	35.7	0.136*	5.25	28.8	32	17.6	13.2	15.7	2.05
Ni	35	0.362	2.9	37.6	40.6	7.04	92.8	19.6	8.76
Pb	43.7	0.7*	0.95*	17.4	19.7	12.9	146	82.1	2
Pd (ppb)	3.0*	<0.2*	<0.2*	0.8*	1.3*	0.5*	21.2*	3.2*	0.45*
Pr	8.53	0.032*	0.956	6.07	6.44*	4.05	2.4	3.09	4.25*
Pt (ppb)	1.4*	<0.5*	<0.5*	1.3*	1.5*	<0.5*	16.7*	1.3*	<0.5*
Rb	147	0.18*	1.75*	117	118	67.4	26.9	285	8.61
S	1052	123	90.5*	1467	579*	68*	13100	399*	4*
Sb	1.68*	0.0166*	0.036*	0.933*	0.907*	-	12.5*	2.78*	-
Sc	15.9	0.0307	0.136	16.7	16.8	10.9	17.5	10.5	0.979
Se	0.641*	-	0.0468*	0.588*	0.346*	0.25*	18.8*	1.29*	-
Sm	7.87	0.135	0.788	6.02	5.95	3.48	2.68	3.26	0.359
Sn	5.7*	-	-	2.50*	7.03*	2.77*	32.5*	195*	-
Sr	67.5	295	116	193	230	340	202	58.7	4.2
Ta	1.57	0.014*	0.009*	0.842	1.04	0.893	0.515*	0.687	0.182*
Tb	1.23	0.0041*	0.116	0.717	0.727	0.431	0.44	0.368	0.0385*
Te	-	-	-	-	-	-	-	-	-
Th	19.5	0.0287	0.0429	9.97	11.5	4.44	2.33	7.79	0.735
Tl	1.17	0.003*	0.003*	0.633*	-	0.407*	-	-	-
Tm	0.531*	-	0.059*	0.27*	-	0.13*	0.23*	0.155*	-
U	3.83	1.75	0.858	2.63	2.92	1	1.1	1.66	0.736
V	117	3.59	3.14	131	122	76	125	70.4	10.4
W	3.99*	-	-	2.47*	1.70*	-	-	179*	92.3*
Y	40	0.223	10.3	30	31.3	14.8	17.4	14.9	1.81
Yb	3.99	0.0164	0.323	2.81	3.15	1.18	1.67	1.4	0.182
Zn	152	3.19	35.4	108	101	96.5	2056	136	7.93
Zr	137	4.19*	6.21	174	191	132	111	124	11.5

Sold out

Provisional certified values of JA-1a

					Analyst B			
	n	X	SD	Method	X	SD	Method	JA-1 ref.
(%)					(n=3-6)			
SiO2	12	63.719	0.055	Grav.+Photom.	63.57	0.04	Grav.+AAS	63.97
TiO2	20	0.8757	0.01	ICP-AES	0.87	0.01	ICP-AES	0.85
Al2O3	20	15.627	0.06	ICP-AES	15.58	0.16	ICP-AES	15.22
Fe2O3		3.08	0.01	Calc.	3.09	0.04	Calc.	2.59
FeO	11	3.77	0.02	Volu.(Titr.)	3.67	0.08	Volu.(Titr.)	3.98
MnO	20	0.16	5E-04	ICP-AES	0.161	0.001	AAS	0.157
MgO	20	1.5647	0.036	ICP-AES	1.57	0.01	AAS	1.57
CaO	20	5.8135	0.023	ICP-AES	5.75	0.03	AAS	5.7
Na2O	20	3.9355	0.028	ICP-AES	3.92	0.02	AAS	3.84
K2O	20	0.7799	0.01	ICP-AES	0.79	0.01	AAS	0.77
P2O5	20	0.17	7E-04	ICP-AES	0.172	0.002	ICP-AES	0.165
H2O+	7	0.33	0.06	Penfield	0.32	0.03	Penfield	0.72
H2O-	7	0.1973	0.007	Grav.	0.24	0.01	Grav.	0.3
Ig.loss	7	0.2855	0.007	Grav.				
T-Fe3O3	20	7.2657	0.033	ICP-AES	7.17	0.04	AAS	7.07
(ppm)								
Ba	20	322.26	1.615	ICP-AES	321	2	ICP-AES	311
Co	5	12.993	0.1	ICP-AES	12.8	0.8	ICP-AES	12.3
Cr	5	<10		ICP-AES	4.1	0.4	ICP-AES	7.83
Cu	3	41.727	0.132	ICP-AES	41.8	0.5	AAS	43
Li	5	11.619	0.08	ICP-AES	11.5	0.1	AAS	10.8
Mo					1.2	0.1	AAS*	1.59
Ni	5	2.7082	0.501	ICP-AES	1.8	0.4	ICP-AES	3.49
Sr	20	268.58	1.797	ICP-AES	267	2	ICP-AES	263
V					107	0.4	ICP-AES	105
Y					31.7	0.5	ICP-AES	30.6
Zn	4	91.258	0.483	ICP-AES	90.7	0.8	ICP-AES	90.9
Zr	5	94.925	2.867	ICP-AES				88.3
(ppb)								
Ag					42	2	AAS*	33
Au					0.21	0.06	AAS*	0.16
Cd					101	5	AAS*	110
Hg					0.2	0.1	AAS**	11.7
Tl					88	5	AAS*	130

AAS*: solvent extraction flameless AAS, AAS**: electrothermal vaporization coldvapor AAS

Reference values for major, minor and trace elements in five GSJ reference samples,
(in % from SiO2 to T-Fe2O3 and ppm from Ag to Zr, unless otherwise noted)
Terashima et. al., Geostandards Newsletter, 22, 113-117 (1998)

	JB-1b		JCFA-1	
	X	SD	X	SD
SiO2	51.11	0.11	50.56	0.12
TiO2	1.26	0.03	1.31	0.02
Al2O3	14.38	0.07	24.25	0.12
Fe2O3	3.29	0.08	4.22	0.10
FeO	5.16	0.10	0.88	0.03
MnO	0.147	0.001	0.068	0.001
MgO	8.14	0.06	2.12	0.03
CaO	9.60	0.06	8.91	0.07
Na2O	2.63	0.02	2.24	0.02
K2O	1.32	0.01	1.27	0.01
P2O5	0.256	0.005	0.586	0.005
H2O+	1.53	0.03	0.37	0.01
H2O-	1.06	0.02	0.18	0.01
T-Fe2O3	9.02	0.07	5.20	0.03
As	1.24	0.03	29.1	0.5
Be	1.30	0.04	4.06	0.11
T-C	419	4	13500	160
Co	40.3	1.1	37.4	0.9
Cr	439	11	75	3
Cs	1.21	0.03	8.6	0.2
Cu	55.5	0.8	122	2
Li	10.8	0.3	91.0	0.9
Ni	148	2	32.2	1.1
Pb	6.8	0.3	47.2	1.7
Rb	39.1	0.6	54.1	0.6
T-S	10	2	1960	41
Sb	0.20	0.01	2.1	0.1
Sr	439	4	1100	10
V	214	3	243	3
Zn	80.0	2.1	63.0	2.6

Reference values for GSJ JSO-1, JMS-1 and JMS-2 on dried basis for 2 hours at 110 deg.
Terashima et al., Geostandards Newsletter, 26, 85 (2002).

	JSO-1			JMS-1			JMS-2		
	Mean	SD	n	Mean	SD	n	Mean	SD	n
SiO2	38.37	0.07	3	53.74	0.22	3	41.78	0.19	3
TiO2	1.23	0.02	3	0.70	0.01	3	1.40	0.02	3
Al2O3	18.06	0.17	3	15.82	0.12	3	14.18	0.10	3
Fe2O3	8.58	0.11	4	4.54	0.11	4	10.96	0.09	4
FeO	2.52	0.07	4	2.12	0.04	4	<0.04		2
MnO	0.197	0.002	20	0.102	0.001	20	2.26	0.02	20
MgO	2.11	0.02	20	2.87	0.03	20	3.24	0.02	20
CaO	2.55	0.07	20	2.13	0.04	20	4.68	0.06	20
Na2O	0.67	0.01	20	4.07	0.02	20	5.79	0.06	20
K2O	0.34	0.01	20	2.24	0.04	20	2.70	0.02	20
P2O5	0.48	0.01	3	0.18	0.01	3	1.26	0.02	3
LOI	24.38	0.06	3	10.40	0.04	3	11.26	0.06	3
H2O+	7.88	0.23	3	6.79	0.09	3	7.13	0.09	3
Cl	n. d.			2.69	0.03	3	4.05	0.02	3
T-C	8.91	0.09	4	1.69	0.02	4	0.39	0.01	4
T-S	0.2	0.01	4	1.32	0.04	4	0.29	0.02	4
T-Fe2O3	11.38	0.11	20	6.90	0.05	20	10.96	0.09	20
As	8.1	0.1	3	18	1	3	35	1	3
B	12.0	0.8	3	81	4	3	106	4	3
Ba	267	4	3	307	3	3	1856	16	3
Be	0.69	0.02	3	1.3	0.1	3	1.8	0.1	3
Co	32	1	3	18.1	0.4	3	226	2	3
Cr	71	2	3	133	2	3	78	1	3
Cs	1.5	0.2	3	5.9	0.2	3	3.0	0.2	3
Cu	169	2	3	88	2	3	447	2	3
In	0.086	0.004	3	0.101	0.004	3	0.178	0.008	4
Li	11.2	0.2	3	62	1	3	43	1	3
Ni	39	2	3	53	2	3	311	3	3
Pb	13	1	3	49	2	3	88	2	3
Rb	14.5	0.3	3	88	2	3	65	1	3
Sb	0.38	0.02	3	1.4	0.1	3	4.5	0.2	3
Sr	196	2	3	154	2	3	454	4	3
Te	0.085	0.004	3	0.132	0.008	3	1.38	0.09	4
V	300	3	3	127	2	3	183	3	3
Y	24.9	0.7	3	24.3	0.8	3	254	4	3
Zn	105	2	4	264	3	4	166	2	4
Zr	96	2	3	132	3	3	220	3	3

The major constituents are in % m/m and trace elements are in ppm. SD standard deviation.
n number of analyses. LOI loss on ignition. T total. n. d. not determined.
* Obtained by fusion method.

1998 recommended or preferable (with asterisks) values for major, minor and trace elements in five GSJ reference samples,
(in % from SiO2 to T-Fe2O3 and μg g-1 from Ag to Zr, unless otherwise noted)
N. Imai et al. (1999) Geostandards Newsletter, 23, 223-250.

Average, Standard deviation and number of measurement

	JR-3	JGb-2	JH-1	JSy-1	JMn-1
SiO2	72.76	46.47	48.18	60.02	14.11
Al2O3	11.90	23.48	5.66	23.17	4.30
Fe2O3	2.61	0.62	1.39*	-	-
FeO	1.86	5.41	8.09*	-	-
MnO	0.083	0.13	0.19	0.0024	33.09
MgO	0.050	6.18	16.73	0.016	3.12
CaO	0.093	14.10	15.02	0.25	2.91
Na2O	4.69	0.92	0.71	10.74	2.80
K2O	4.29	0.059	0.53	4.82	0.94
TiO2	0.21	0.56	0.67	0.0015*	1.06
P2O5	0.017	0.017	0.099	0.014*	0.54
H2O+	0.72*	1.46*	1.82*	-	7.90*
H2O-	0.24*	0.14	0.18*	-	-
T-Fe2O3	4.72	6.69	10.27	0.084	14.40
Ag	0.036*	-	-	-	-
As	1.1*	0.96*	1.0*	0.90*	75.4
Au (ng g-1)	-	-	-	-	0.95*
B	11.4*	4.9*	10.8*	14.5*	138*
Ba	65.8	36.5	106	15.7	1714
Be	7.6	-	0.43*	0.80*	7.8*
Bi	0.21*	0.022*	0.067*	0.009*	4.3*
C	230*	880*	1630*	340*	905*
Cd	0.064*	-	-	-	15.5*
Ce	327	3.0	17.6	2.6	277
Co	0.98	25.8	51.5	0.16*	1732
Cr	3.5	125	616	2.0	26.6
Cs	1.0	0.51	0.87	0.69	0.60
Cu	2.9	11.4	8.6	1.3	11132
Dy	21.5*	0.60*	2.5	0.37	28.3*
Er	14.0*	0.36*	1.2	0.30	14.6
Eu	0.53	0.59	0.86	0.16	7.6
Ga	36.6	15.9	7.9	23.5	37.1*
Gd	19.7*	0.48*	2.7*	0.27	29.8*
Hf	40.3	0.25	1.4	1.2	6.2*
Hg (ng g-1)	3.4*	1.9*	1.9*	0.5*	-
Ho	4.7*	0.15*	0.53	0.094	5.8
La	179	1.5	7.9	1.2	122
Li	120*	15.7*	12.1*	15.3*	71.7*
Lu	2.8	0.062	0.17	0.076	2.1
Mo	0.49	0.42	0.77	0.048*	318
Nb	510	1.9	4.2	0.51	27.6*
Nd	107	1.8	11.6	1.2	137
Ni	1.6*	13.6	58.2	1.1	12632
Pb	32.8	1.5	2.6	4.9	430
Pr	33.1	0.39*	2.3*	0.32	31.4*
Pt (ng g-1)	-	-	-	-	110*
Rb	453	2.9	14.4	66.3	10.9
S	39*	599*	567*	13*	940*
Sb	0.17*	0.12*	0.067*	0.15	37.5
Sc	0.50	24.7	77.6	-	13.0*
Sm	21.3	0.51	3.1	0.27	30.2
Sn	17.4	0.48*	0.92*	0.17	4.4*
Sr	10.4	438	153	19.3	792
Ta	36.8	0.29	0.23	0.013*	0.64*
Tb	4.29	0.15	0.52	0.057*	4.8
Th	112	0.19	1.4	0.23	11.7
Tl	0.93*	-	-	0.96*	-
Tm	-	0.059*	0.19*	0.053	2.1
U	21.1	0.041*	0.58	0.20	5.0
V	4.2	174	228	2.1	424
W	7.8*	1.6*	-	0.06*	45.3*
Y	166	4.5	13.7	2.6	111
Yb	20.3	0.39	1.2	0.41	13.8
Zn	209	48.5	61.8	3.2	1068
Zr	1494	11.6	48.3	70.2	344

Provisional certified values (%)
Okai, Terashima, Imai: Bunseki Kagaku, 51, 973 (2002)

	JCu-1		JZn-1	
	Mean	SD	Mean	SD
TiO2	0.013	0.001	0.20	0.01
Al2O3	0.29	0.01	6.32	0.02
MnO	0.59	0.01	1.49	0.01
MgO	2.13	0.05	1.94	0.04
CaO	23.5	0.1	18.1	0.1
Na2O	0.052	0.003	0.45	0.01
K2O	0.015	0.001	0.83	0.03
T-Fe2O3	17.5	0.1	11.8	0.1
Cu	3.73	0.05		
Zn	0.0679	0.0015	2.22	0.01
Pb			0.161	0.002

Uncertainty is 95% confidence limits.

Reference: GSJ analytical results for other elements
Okai, Terashima, Imai: Bunseki Kagaku, 51, 973 (2002)

	JCu-1		JZn-1		Method	
(%)						
SiO2	28.68		43.95		GRAV	
P2O5	<0.005		<0.005		COLOR	
H2O+	1.00		1.71		GRAV	
H2O-	0.54		0.61		GRAV	
LOI	15.37		6.61	6.58	GRAV	GRAV
T-C	3.06		1.28		CEA	
T-S	7.00	7.02	1.30	1.27	CEA	ICPES
(ug/g)						
As	173		99		AA	
Ba	3.5	3.9	208	207	ICPES	ICPES
Cd	3.6	3.1	114	121	AA	ICPES
Co	324	324	24	24	AA	ICPES
Cr	10	7	21	20	AA	ICPES
Cu			29	20	AA	ICPES
Li	2.9	3.0	19.5	21.6	AA	ICPES
Ni	425	407	6	11	AA	ICPES
Pb	4				AA	
Rb	1.9		42		FE	
Sb	3.8		31		AA	
Sr	75	78	358	357	ICPES	ICPES
V	9		24		ICPES	

National Institute of Advanced Industrial Science and Technology (AIST)

Geological Survey of Japan

Certified Geochemical Reference Material

GSJ CRM JB-2a Basalt (Oshima volcano)

Geochemical Reference Material Technical Information

Intended uses for this CRM are controll of the precision of analysis or confirmation of the validity of analytical methods or instruments for analysis of main or trace components in basalts or similar samples.

Certified Value

Component	Certified Value (mass fraction %)	Analytical Method (*vide infra*)
SiO_2	53.22 ± 0.21	1
TiO_2	1.18 ± 0.02	2
Al_2O_3	14.67 ± 0.08	2
total Fe_2O_3	14.18 ± 0.07	2, 3, 4
FeO	9.83 ± 0.12	4
MnO	0.214 ± 0.004	2, 3
MgO	4.58 ± 0.04	2, 3
CaO	9.79 ± 0.05	2, 3
Na_2O	2.03 ± 0.02	2, 3
K_2O	0.41 ± 0.01	2, 3
P_2O_5	0.095 ± 0.005	2, 5

after ± value is expanded uncertainty.

Information Value

Component	Information Value (mg/kg)	Analytical Method (*vide infra*)	Component	Information Value (mg/kg)	Analytical Method (*vide infra*)
Ba	219, 225	2, 2	Rb	7.2	6
Co	40, 38.4	2, 2	Sr	179, 179	2, 2
Cr	28, 27.7	2, 2	V	574, 575	2, 2
Cu	274, 269	2, 2	Y	25.4	2
Li	7.9, 7.84	3, 2	Zn	109, 107	2, 2
Ni	14.5, 16.5	2, 2	Zr	61.8	2

The analytical value of other components (including the above-mentioned components) is opened sequentially on the GSJ geochemical reference materials web page.
https://gbank.gsj.jp/geostandards/

Analytical Method

1) Gravimetry and one method of spectrophotometry, ICP-AES and AAS
2) ICP atomic emission spectrometry (ICP-AES)
3) Flame atomic absorption spectrometry (AAS)
4) Potassium dichromate titration
5) Spectrophotometry
6) Flame emission spectrometry

Decomposition Method

The decomposition method mainly used was as follows.
SiO_2 : Sodium carbonate fusion
FeO : Sulfuric acid – hydrofluoric acid decomposition
Others : Nitric acid – perchloric acid – hydrofluoric acid decomposition

Traceability

Traceability of this CRM was ensured by using a balance calibrated according to JCSS (Japan Calibration Service System), and standard solutions prepared accroding to JIS (Japanese Industrial Standard) and JCSS.

Method of Characterization

The values of CRM were determined by interlaboratory testing by 8 collaborating organizations and 2 laboratories in the Geological Survey of Japan/AIST. After some data were rejected by statistical treatments, certified values and uncertainties were obtained from the averages of the analytical results and 95% confidence intervals respectively.

Precautions for Use

From the point of homogeneity, it is recommended to use more than 100 mg at each analysis.

Notes for Storage

The CRM should be stored at room temperature without direct sunshine and high humidity. After unsealed, the CRM should be stored in a bottle with a tightly fixed inner lid.

Preparation Method

Locality : Basalt rock sample was collected in Oshima-machi, Tokyo, Japan.
Sample processing : Sampled rock was roughly crushed with a jaw-crusher, and powdered in a ball-mill. The powder was screened with a 147 μ m sieve, homogenized, and approximately 100 g of the powder were put in each glass bottle.

Homogeneity

Ten bottles were randomly sampled from the products. And each 100mg of 3 samples from each bottle were analyzed by ICP-AES for several chemical components. The results showed good homogeinity.

Expiration of Certification

The expiration date of this sample is not especially provided. However, it notifies the customer when the alteration not anticipated happens, and the change is caused in the certified value.

Measurement Laboratory

Geological Survey of Japan/AIST
Dowa Techno Research Co.,Ltd.
KAWAJU TECHNO SERVICE CORPORATION
Mitsubishi Materials Techno Corporation
Mitsui Chemical Analysis & Consulting Service Inc.
NIPPON STEEL TECHNORESEARCH
Shimadzu Techno-Research Inc.
Sumitomo Metal Technology Inc.
THE GENERAL ENVIRONMENTAL TECHNOS CO.,LTD.

Note : This paper is a translation of the original Japanese certificate and is not an official document.

If you have any questions about this CRM, please contact

National Institute of Advanced Industrial Science and Technology (AIST)
Geological Survey of Japan (GSJ)
Geochemistry Group, Institute of Geology and Geoinformation
AIST Tsukuba Central 7, 1-1-1, Higashi, Tsukuba, Ibaraki 305-8567, Japan

National Institute of Advanced Industrial Science and Technology (AIST)

Geological Survey of Japan

Certified Geochemical Reference Material

GSJ CRM JB-3a Basalt (Fuji volcano)

Geochemical Reference Material Technical Information

Intended uses for this CRM are controll of the precision of analysis or confirmation of the validity of analytical methods or instruments for analysis of main or trace components in basalts or similar samples.

Certified Value

Component	Certified Value (mass fraction %)	Analytical Method (*vide infra*)
SiO_2	50.87 ± 0.18	1
TiO_2	1.44 ± 0.01	2, 3
Al_2O_3	17.16 ± 0.12	2, 3
total Fe_2O_3	11.83 ± 0.06	2, 3, 4
FeO	7.71 ± 0.08	4
MnO	0.179 ± 0.003	2, 3
MgO	5.17 ± 0.03	2, 3
CaO	9.75 ± 0.06	2, 3
Na_2O	2.74 ± 0.03	2, 3
K_2O	0.78 ± 0.01	2, 3
P_2O_5	0.291 ± 0.002	2, 5

after ± value is expanded uncertainty.

Information Value

Component	Information Value (mg/kg)	Analytical Method (*vide infra*)	Component	Information Value (mg/kg)	Analytical Method (*vide infra*)
Ba	244, 244	2, 2	Pb	5.7	3
Be	0.69	2	Rb	15.1	6
Co	36.3, 34.7	3, 2	Sr	404, 406	2, 2
Cr	57, 57.3	3, 2	V	379, 375	2, 2
Cu	195, 194	3, 2	Y	27.7	2
Li	7.3	3	Zn	104, 100	3, 2
Ni	39	3	Zr	100	2

The analytical value of other components (including the above-mentioned components) is opened sequentially on the GSJ geochemical reference materials web page.
https://gbank.gsj.jp/geostandards/

Analytical Method

1) Gravimetry and one method of spectrophotometry, ICP-AES and AAS
2) ICP atomic emission spectrometry (ICP-AES)
3) Flame atomic absorption spectrometry (AAS)
4) Potassium dichromate titration
5) Spectrophotometry
6) Flame emission spectrometry

Decomposition Method

The decomposition method mainly used was as follows.
SiO_2 : Sodium carbonate fusion
FeO : Sulfuric acid – hydrofluoric acid decomposition
Others : Nitric acid – perchloric acid – hydrofluoric acid decomposition

Traceability

Traceability of this CRM was ensured by using a balance calibrated according to JCSS (Japan Calibration Service System), and standard solutions prepared accroding to JIS (Japanese Industrial Standard) and JCSS.

Method of Characterization

The values of CRM were determined by interlaboratory testing by 8 collaborating organizations and 2 laboratories in the Geological Survey of Japan/AIST. After some data were rejected by statistical treatments, certified values and uncertainties were obtained from the averages of the analytical results and 95% confidence intervals respectively.

Precautions for Use

From the point of homogeneity, it is recommended to use more than 100 mg at each analysis.

Notes for Storage

The CRM should be stored at room temperature without direct sunshine and high humidity. After unsealed, the CRM should be stored in a bottle with a tightly fixed inner lid.

Preparation Method

Locality : Basalt rock sample was collected in Narusawa-mura, Yamanashi, Japan.
Sample processing : Sampled rock was roughly crushed with a jaw-crusher, and powdered in a ball-mill. The powder was screened with a 147 μ m sieve, homogenized, and approximately 100 g of the powder were put in each glass bottle.

Homogeneity

Ten bottles were randomly sampled from the products. And each 100mg of 3 samples from each bottle were analyzed by ICP-AES for several chemical components. The results showed good homogeinity.

Expiration of Certification

The expiration date of this sample is not especially provided. However, it notifies the customer when the alteration not anticipated happens, and the change is caused in the certified value.

Measurement Laboratory

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National Institute of Advanced Industrial Science and Technology (AIST)

Geological Survey of Japan

Certified Geochemical Reference Material

GSJ CRM JSd-4 Stream Sediment

Geochemical Reference Material Technical Information

Intended uses for this CRM are controll of the precision of analysis or confirmation of the validity of analytical methods or instruments for analysis of main or trace components in stream sediment or similar samples.

Certified Value

Component	Certified Value (mass fraction %)	Analytical Method (*vide infra*)
SiO_2	51.12 ± 0.35	1
TiO_2	0.64 ± 0.02	2
Al_2O_3	13.22 ± 0.20	2
total Fe_2O_3	8.06 ± 0.12	2, 3, 4
MnO	0.107 ± 0.001	2, 3
MgO	4.04 ± 0.06	2, 3
CaO	5.57 ± 0.05	2, 3
Na_2O	2.28 ± 0.03	2, 3
K_2O	1.40 ± 0.03	2, 3
P_2O_5	0.45 ± 0.01	2, 5

after ± value is expanded uncertainty.

Information Value

Component	Information Value (mass fraction %)	Analytical Method (*vide infra*)
FeO	2.08 ± 0.16	4

Component	Information Value (mg/kg)	Analytical Method (*vide infra*)	Component	Information Value (mg/kg)	Analytical Method (*vide infra*)
Ba	892, 883	2, 2	Rb	57	6
Co	21, 21	2, 2	Sc	17	2
Cr	1220, 1210	3, 2	Sr	223, 217	2, 2
Cu	488, 484	3, 2	V	157, 147	2, 2
La	16	2	Y	21	2
Li	32	3	Zn	1480, 1490	3, 2
Ni	118, 110	3, 2	Zr	90	2
Pb	240	3			

The analytical value of other components (including the above-mentioned components) is opened sequentially on the GSJ geochemical reference materials web page.
https://gbank.gsj.jp/geostandards/

Analytical Method

1) Gravimetry and one method of spectrophotometry, ICP-AES and AAS
2) ICP atomic emission spectrometry (ICP-AES)
3) Flame atomic absorption spectrometry (AAS)
4) Potassium dichromate titration
5) Spectrophotometry
6) Flame emission spectrometry

Decomposition Method

The decomposition method mainly used was as follows.
SiO_2 : Sodium carbonate fusion
FeO : Sulfuric acid – hydrofluoric acid decomposition
Others : Nitric acid – perchloric acid – hydrofluoric acid decomposition

Traceability

Traceability of this CRM was ensured by using a balance calibrated according to JCSS (Japan Calibration Service System), and standard solutions prepared accroding to JIS (Japanese Industrial Standard) and JCSS.

Method of Characterization

The values of CRM were determined by interlaboratory testing by 8 collaborating organizations and 2 laboratories in the Geological Survey of Japan/AIST. After some data were rejected by statistical treatments, certified values and uncertainties were obtained from the averages of the analytical results and 95% confidence intervals respectively.

Precautions for Use

As the moisture content of this CRM is relatively high, the CRM should be used after drying at 105–115 ℃ for 2 hours.
From the point of homogeneity, it is recommended to use more than 100 mg at each analysis.

Notes for Storage

The CRM should be stored at room temperature without direct sunshine and high humidity. After unsealed, the CRM should be stored in a bottle with a tightly fixed inner lid.

Preparation Method

Locality : Stream sediment sample was collected in Kanto District, Japan.
Sample processing : Sampled sediment was roughly crushed with a jaw–crusher, and powdered in a ball–mill. The powder was screened with a 246 μ m sieve, homogenized, and approximately 100 g of the powder were put in each glass bottle.

Homogeneity

Ten bottles were randomly sampled from the products. And each 100mg of 2 or 3 samples from each bottle were analyzed by ICP–AES for several chemical components. The results showed good homogeinity.

Expiration of Certification

The expiration date of this sample is not especially provided. However, it notifies the customer when the alteration not anticipated happens, and the change is caused in the certified value.

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