

Annex 1: Trace element quality assurance data

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Recovery and limit of detection

Element	Recovery (%)	LoD (mg/kg)
Lithium	91	0.005
Beryllium	98	0.001
Boron	71	1
Sodium	57	5
Magnesium	100	1
Aluminium	64	0.5
Silicon	98	100
Phosphorus	95	10
Sulfur	90	500
Potassium	78	20
Calcium	81	5
Scandium	77	0.005

Element	Recovery (%)	LoD (mg/kg)
Titanium	55	0.1
Vanadium	67	0.01
Chromium	100	0.05
Manganese	100	0.1
Iron	100	1
Cobalt	100	0.005
Nickel	100	0.05
Copper	100	0.05
Zinc	100	0.2
Gallium	80	0.01
Germanium	80	0.01
Arsenic	110	0.005
Selenium	100	0.01
Rubidium	107	0.02
Strontium	95	0.02
Yttrium	91	0.001
Zirconium	89	0.01
Niobium	85	0.002

Element	Recovery (%)	LoD (mg/kg)
Molybdenum	90	0.02
Ruthenium	93	0.001
Rhodium	91	0.005
Palladium	89	0.005
Silver	75	0.01
Cadmium	90	0.005
Tin	99	0.005
Antimony	101	0.002
Tellurium	129	0.01
Caesium	128	0.001
Barium	109	0.02
Lanthanum	111	0.001
Cerium	105	0.001
Praseodymium	100	0.001
Neodymium	95	0.001
Samarium	95	0.001
Europium	95	0.001
Gadolinium	95	0.001

Element	Recovery (%)	LoD (mg/kg)
Terbium	90	0.001
Dysprosium	88	0.001
Holmium	88	0.001
Erbium	85	0.001
Thulium	87	0.001
Ytterbium	87	0.001
Lutetium	84	0.001
Hafnium	69	0.001
Tantalum	66	0.001
Tungsten	79	0.002
Rhenium	89	0.001
Osmium	90	0.005
Iridium	87	0.001
Platinum	97	0.001
Gold	90	0.002
Mercury	95	0.005
Thallium	96	0.005
Lead	94	0.005

Element	Recovery (%)	LoD (mg/kg)
Bismuth	101	0.001
Thorium	89	0.001
Uranium	94	0.001

Certified reference materials

Element	NIST 1548a (mg/kg)	Reference (mg/kg)	Bias (%)	INCT-OBTL-5 (mg/kg)	Reference (mg/kg)	Bias (%)
Lithium	0.028	None	-	29.1	~19.3	51
Beryllium	<0.001	None	-	0.085	~0.081	5
Boron	4.55	4.16	9	50	33.6	49
Sodium	7470	8130	-8	407	~435	-7
Magnesium	325	580	-44	8810	8530	3
Aluminium	79	72.4	9	3150	1980	59
Silicon	<100	~78.7	-53	2280	None	-
Phosphorus	2920	3490	-16	1720	1700	1
Sulfur	1500	1930	-22	4840	4550	6
Potassium	6360	6970	-9	31500	22700	39
Calcium	1610	1970	-18	51600	40000	29
Scandium	<0.005	~0.0008	-	0.782	0.64	22

Element	NIST 1548a (mg/kg)	Reference (mg/kg)	Bias (%)	INCT-OBTL-5 (mg/kg)	Reference (mg/kg)	Bias (%)
Titanium	5.8	~4.7	23	199	~80.7	146
Vanadium	0.02	None	-	6.41	4.01	60
Chromium	0.05	None	-	6.27	~6.3	0
Manganese	3.5	5.75	-39	191	180	6
Iron	20	35.3	-42	1630	~1490	9
Cobalt	0.01	~0.028	-63	0.919	0.981	-6
Nickel	0.24	0.37	-35	8.21	8.5	-3
Copper	1.43	2.32	-38	9.64	10.1	-5
Zinc	16.7	24.6	-32	51.9	52.4	-1
Gallium	0.01	None	-	0.92	None	-
Germanium	<0.01	None	-	0.17	None	-
Arsenic	0.195	0.2	-3	0.766	0.668	15
Selenium	0.23	0.25	-7	0.18	None	-
Rubidium	3.78	None	-	17.6	19.1	-8
Strontium	2.76	2.93	-6	116	105	11
Yttrium	0.003	None	-	1.31	~0.963	36
Zirconium	0.05	None	-	0.88	None	-
Niobium	0.002	None	-	0.196	None	-

Element	NIST 1548a (mg/kg)	Reference (mg/kg)	Bias (%)	INCT-OBTL-5 (mg/kg)	Reference (mg/kg)	Bias (%)
Molybdenum	0.22	0.26	-16	0.41	0.414	-2
Ruthenium	<0.001	None	-	<0.001	None	-
Rhodium	<0.005	None	-	<0.005	None	-
Palladium	<0.005	None	-	0.058	None	-
Silver	<0.01	None	-	0.05	0.053	-3
Cadmium	0.034	0.035	-4	3.31	2.64	25
Tin	14.7	17.2	-15	0.163	None	-
Antimony	0.0078	~0.009	-14	0.059	0.076	-21
Tellurium	<0.01	None	-	<0.01	None	-
Caesium	0.0087	None	-	0.242	0.288	-16
Barium	1.08	1.1	-2	64.1	67.4	-5
Lanthanum	0.003	None	-	1.48	1.69	-13
Cerium	0.004	0.01	-56	2.82	2.99	-6
Praseodymium	0.001	None	-	0.37	~0.321	15
Neodymium	0.003	None	-	1.47	1.33	10
Samarium	0.001	None	-	0.29	0.264	10
Europium	<0.001	None	-	0.065	0.06	7

Element	NIST 1548a (mg/kg)	Reference (mg/kg)	Bias (%)	INCT-OBTL-5 (mg/kg)	Reference (mg/kg)	Bias (%)
Gadolinium	0.001	None	-	0.268	~0.243	10
Terbium	<0.001	None	-	0.043	0.035	24
Dysprosium	<0.001	None	-	0.246	~0.184	33
Holmium	<0.001	None	-	0.048	~0.035	39
Erbium	<0.001	None	-	0.14	0.101	38
Thulium	<0.001	None	-	0.019	~0.014	39
Ytterbium	<0.001	None	-	0.119	0.115	3
Lutetium	<0.001	None	-	0.018	~0.017	6
Hafnium	0.002	None	-	0.034	0.291	-88
Tantalum	<0.001	None	-	0.01	0.042	-75
Tungsten	0.002	None	-	0.05	None	-
Rhenium	<0.001	None	-	0.01	None	-
Osmium	<0.005	None	-	<0.005	None	-
Iridium	<0.001	None	-	<0.001	None	-
Platinum	<0.001	None	-	<0.001	None	-
Gold	<0.002	None	-	0.003	~0.003	-4
Mercury	<0.005	~0.005	-49	0.018	0.021	-13

Element	NIST 1548a (mg/kg)	Reference (mg/kg)	Bias (%)	INCT-OBTL-5 (mg/kg)	Reference (mg/kg)	Bias (%)
Thallium	<0.005	None	-	0.064	0.051	24
Lead	0.054	0.044	22	2.16	2.01	8
Bismuth	0.001	None	-	0.115	None	-
Thorium	0.001	None	-	0.519	0.503	3
Uranium	0.002	None	-	0.106	~0.113	-6

'-' indicates values where they are issued as a reference value.