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Supplementary material

Tellurium in the environment: current knowledge and identification of the gaps

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Table S1. Reviews on tellurium, or reviews that contain a significant part on this element, published in the last 25 years.

Studies are listed in chronological order, starting with the most recent.

Reference	Title	Main topics	No. of pages	No. of references	Comments
Belzile and Chen 2015	Tellurium in the environment: A critical review focused on natural waters, soils, sediments and airborne particles	Uses Biological relevance Tellurium occurrence in natural waters Tellurium occurrence in solid samples	10	72	Acritical compilation of concentration values
Gerhardsson 2015	Tellurium	Physical and chemical properties Methods and problems of analysis Environmental levels and exposure Metabolism Biological monitoring Effects dose-response relationships Carcinogenicity and mutagenicity	12	112	Review on exposure and toxicology; rather old references and approach
Turner et al. 2012	Microbial processing of tellurium as a tool in biotechnology	Generalities on uses and properties of tellurium Toxicity of tellurium Tellurium oxyanions processing in biofilms Tellurium oxyanions processing in planktonic cells	10	140	Interesting text focused on mechanisms at the cellular level

Knockaert 2011	Tellurium and tellurium compounds	Properties Resource and raw materials Production Quality specifications Analysis Tellurium compounds Uses Economic aspects Toxicology and occupational health	11	70	Excellent, concise text focused on production and uses
Ba et al. 2010	Tellurium: an element with great biological potency and potential	Basic chemical features of tellurium Tellurium in biology Potential applications of tellurium in diagnostic and therapy	14	91	Review focused on potential medical applications; weak chemical part
Wallschläger and Feldmann 2010	Formation, occurrence, significance, and analysis of organoselenium and organotellurium compounds in the environment	Methods for the determination of organoselenium species Occurrence of organoselenium species in abiotic compartments Occurrence of organoselenium species in biota Organotellurium compounds in the environment Occurrence in biological samples	46	16[a]	Very short section on Te
Chasteen et al. 2009	Tellurite: history, oxidative stress, and molecular mechanisms of resistance	Historical background The enigma of TeO_3^{2-} toxicity Bacterial mechanisms against oxidative stress and TeO_3^{2-} tolerance Sulfur and cysteine metabolism and TeO_3^{2-} tolerance	13	132	Excellent text on tellurite toxicity and resistance mechanisms

Cunha et al. 2009	A glimpse on biological activities of tellurium compounds	Main classes of tellurium compounds Biological effects of elemental tellurium and its inorganic derivatives Biological effects of organotellurium compounds	15	95	Review on the biological effects of Te compounds, with a special focus on organic ones
Ogra 2009	Toxicometallomics for research on the toxicology of exotic metalloids based on speciation studies	Speciation in relation to metallomics Metabolism of tellurium Metabolism of antimony	7	25[b]	Description of hyphenated techniques and Te metabolism
Zannoni et al. 2008	The bacterial response to the metalloids Se and Te	Chemistry Biological uses of Se and Te Resistance towards Se and Te oxyanions Microbial processing of metalloid chalcogens Chalcogens and bacterial physiology Other chalcogens and metalloids	71	339[c]	Very detailed and comprehensive review. Excellent reading
Kumar and Riyazuddin 2007	Non-chromatographic hydride generation atomic spectrometric techniques for the speciation analysis of arsenic, antimony, selenium, and tellurium in water samples - a review	Previous reviews Arsenic speciation analysis Selenium speciation analysis Antimony speciation analysis Tellurium speciation analysis	32	9[d]	Very short section on Te

Kobayashi 2004	Tellurium	Physical and chemical properties, and analytical methods Sources, production, important compounds, and uses Distribution in the environment and in foods Uptake, absorption, transport and distribution, metabolism, and elimination in humans Effects on plants, animals, and humans Hazard evaluation and limiting concentrations	8	36	Second edition of a book chapter mostly focused on biological aspects; references were probably not updated in this edition
Nogueira et al. 2004	Organoselenium and organotellurium compounds: toxicology and pharmacology	Toxicology Pharmacology	32	276[e]	Most of the article is on Se. Focused on compounds and mechanisms of action
Chasteen and Bentley 2003	Biomethylation of selenium and tellurium: microorganisms and plants	General considerations' Determination of tellurium Nutritional and medical considerations for tellurium compounds Tellurium reduction in microorganisms Tellurium biomethylation Tellurium bioremediation	26	90[f]	Most of the article is on Se. Excellent read
D'Ulivo 1997	Determination of selenium and tellurium in environmental samples	Sample collection and storage Sample treatment Speciation Detection	28	335[e]	Excellent review on the determination on Te; still useful read in spite of being published more than 20 years ago

Taylor 1996	Biochemistry of tellurium	Te physiology Te toxicity Te physiology Te toxicity	9	27	Outdated text

[a]Tellurium only. Total 134 references.

[b]Tellurium only. Total: 57 references

[c]Selenium and tellurium references.

[d]Tellurium only. Total 292 references.

[e]Selenium and tellurium references. Some are multiple references.

[f]Tellurium only. Total: 300 references.

Table S2. Tellurium uses.

Solar cells
Thermoelectric devices
Alloying additive in – steel to improve machining characteristics – copper alloys (minor additive) to improve machinability without reducing conductivity – lead alloys to improve resistance to vibration and fatigue – cast iron to help control the depth of chill – malleable iron as a carbide stabilizer
Vulcanizing agent and accelerator in the processing of rubber
Component of catalysts for the production of plastics, synthetic fibres, nitrogen-based compounds
Pigment in glass and ceramics
Blasting caps

Table S3. Properties of tellurium relevant to understanding its environmental chemistry.

Property (unit)	Value	Reference
General		
Atomic number	52	
Periodic Table group	16	
Periodic Table period	5	
Block	p	
Electronic configuration		
Ground state electron configuration	Kr].$4d^{10}.5s^2.5p^4$	
Shell structure	2.8.18.18.6	
Atomic weight (g)[a]	127.60(3)[b]	Meija et al. 2016
Naturally-occurring isotopes (mol fraction)	^{120}Te: 0.0009(1)[c] ^{122}Te: 0.0255(12) ^{123}Te: 0.0089(3) ^{124}Te: 0.0474(14) ^{125}Te: 0.0707(15) ^{126}Te: 0.1884(25) ^{128}Te: 0.3174(8) ^{130}Te: 0.3408(62)	Berglund and Wieser 2009
Metal		Knockaert 2011
Density at 300 K (g cm^{-3})	6.245	
Melting point (K)	723	
Boiling point (K)	1327	
Thermal conductivity at 293 K (W $m^{-1}K^{-1}$)	0.060	
Electric resistivity (nΩ-m) at 3.3 K	superconducting	
Electric resistivity (Ω-m) at 300 K	9.9×10^{-3}	
Crystal structure	hexagonal lattice with trigonal symmetry	
Empirical atomic radius (pm)	140	Slater 1964
Covalent radius (pm)[d]		
Cordero	138	Cordero et al. 2008
Pyykkö:		Pyykkö 2015
molecular single bond	136	
molecular double bond	128	
molecular triple bond	121	
Crystal radii (pm)[e]		Shanon 1976
Te(-II), 6-coordinate	207	
Te(IV), 3-coordinate	66	
Te(IV), 4-coordinate	80	
Te(IV), 6-coordinate	111	
Te(VI), 4-coordinate	57	
Te(VI), 6-coordinate	70	
Effective ionic radii (pm)[e]		Shanon 1976

Te(-II), 6-coordinate	221	
Te(IV), 3-coordinate	52	
Te(IV), 4-coordinate	66	
Te(IV), 6-coordinate	97	
Te(VI), 4-coordinate	43	
Te(VI), 6-coordinate	56	
Electronegativities (Pauling units)		
Pauling	2.1	Pauling 1960
Allred Rochow	2.01	Allred and Rochow 1958
Electron affinity (eV)[b]	1.970 876(7)	Haeffler et al. 1996
Ionisation energies (eV)[b]		Kramida et al. 2018
$Te \rightarrow Te^{+}$	9.009 66(10)	
$Te^{+} \rightarrow Te^{2+}$	18.6(4)	
$Te^{2+} \rightarrow Te^{3+}$	27.84(4)	
$Te^{3+} \rightarrow Te^{4+}$	37.4155(12)	
$Te^{4+} \rightarrow Te^{5+}$	59.3(9)	
$Te^{5+} \rightarrow Te^{6+}$	69.1(2.0)	
$Te^{6+} \rightarrow Te^{7+}$	124.20(6)	

[a]Using $A_r(^{12}C) = 12$ as a reference, where A_r is the atomic weight and ^{12}C is a neutral atom in its nuclear and electronic ground state.

[b]Uncertainties in parentheses, following the last significant digit to which they are attributed.

[c]Uncertainties (two standard deviations) in parentheses, following the last significant digit to which they are attributed.

[d]Various methods for calculating additive covalent radii exist. Values for three of them are given: Slater (1964) are general-purpose atomic radii covering covalent, ionic and metallic molecules; Cordero et al. (2008) are single-bond radii and Pyykkö considers three types of bonds. Refer to the original publications for details.

[e]See Gibbs et al. (2013) for a discussion of the meaning of these parameters.

Table S4. Published 'dissolved' tellurium concentrations in seawater.[a,b]

Studies are listed in chronological order, starting with the oldest.

System	Dissolved Te[c]	Original units	Dissolved Te / ng L^{-1}	Filtration	Experimental technique	Type of study[d]	Reference
	Te(IV) ONLY			not mentioned	Preconcentration: XAD-2-bismuthiol resin Colorimetry (395 nm) CRM: not mentioned DL: not given	A	Sugimura and Suzuki 1981
Open sea water:							
26°24'N, 151°18'E (34.92 ‰)	0.6	ng L^{-1}	0.6				
23°40'N, 129°22'E (34.83 ‰)	0.3		0.3				
05°50'N, 134°15'E (34.14 ‰)	0.9		0.9				
South China seawater	0.8	ng L^{-1}	0.8	filtration (0.45 µm) after acidification	Preconcentration: sulfhydral cotton fiber Te(VI) reduction: hot acidic HBr treatment Catalytic polarography Accuracy; spiking artificial seawater DL: $9x10^{-11}$ M = 11.5 ng L^{-1}	A	Jingru and Qing 1983
East China seawater	0.4, 0.7		0.4, 0.7				
Seawater	0.06 All Te(VI)	ng mL^{-1}	60	not mentioned	Te(VI) reduction: $TiCl_3$ Preconcentration: "thiol cotton"[e] Te(VI) reduction: $TiCl_3$ HG-AAS CRM: not mentioned DL: 0.008 ng mL^{-1} = 8 ng L^{-1}	A	Yu et al. 1983

Florida Straits:		pmol L^{-1}		not mentioned	Preconcentration:	E	Andreae
surface	4.1 ± 0.8		0.52 ± 0.10		coprecipitation with $Mg(OH)_2$		1984
10 m depth	3.4 ± 0.7		0.43 ± 0.09		Te(VI) reduction: boiling in HCl		
20 m depth	6.8 ± 0.7		0.87 ± 0.09				
30 m depth	3.1 ± 0.6		0.40 ± 0.08				
70 m depth	1.9 ± 0.7		0.24 ± 0.09		HG-GF-AAS		
110 m depth	2.4 ± 0.6		0.31 ± 0.08				
250 m depth	5.6 ± 0.8		0.71 ± 0.10		Accuracy: spiking because of lack of CRMs		
400 m depth	6.2 ± 0.8		0.79 ± 0.10				
N. Gulf of Mexico	3.0 ± 0.5		0.38 ± 0.06		DL: 0.5 pmol L^{-1} = 0.06 ng L^{-1}		
Angola Basin, eastern S Atlantic		pmol kg^{-1}		unfiltered	Preconcentration: alkaline coprecipitation	E	Lee and Edmond 1985
Surface	0.6		0.08				
≈ ≤2500 m	1.3		0.17		Te(VI) reduction: boiling in HCl		
Panama Basin							
Surface	1.7		0.22		HG-GF-AAS		
500-2500 m	≈0.6		≈0.08				
Western N. Atlantic					CRM: not mentioned		
Surface	0.8–1.6		0.10–0.20		DL: 0.02 pM= 0.003 ng L^{-1}		
Below	down to 0.8		down to 0.10				

Scheldt estuary, Oct 1978; salinity (x10^3):		nmol L^{-1}		0.45 µm filter	Preconcentration: adsorption on active C NAA (measurement of the ^{131}I-daughter of ^{131}Te) CRM: not mentioned DL: 0.6 nmol L^{-1} = 76 ng L^{-1}	E	van der Sloot et al. 1985
31.33	0.35		45				
30.37	0.40		51				
30.20	0.15		19				
25.70	0.35		45				
25.50	0.15		19				
25.57	1.00		128				
17.34	0.85		108				
22.43	0.60		77				
9.89	2.2		281				
8.32	1.3		166				
6.87	2.1		268				
5.24	3.0		383				
1.14	1.7		217				
0.98	3.4		434				
0.78	3.1		396				
1982	<0.6						

Pacific Ocean (7°00’N, 78°40’W)		pmol L^{-1}		only hydrothermal water filtered (0.4 µm)	Preconcentration: precipitation with 6 M NaOH (not clear for total concentrations) Te(VI) reduction: HCl boiling HG-AAS CRM: not used DL: 2-4 pg	A	Yoon et al. 1990
0-300 m	1.39 ± 0.19 (n = 7		0.177				
301-1000 m	1.01 ± 0.10 (n = 7		0.129				
1001-2000 m	0.67 ± 0.12 (n = 4		0.085				
2001-4000 m	0.46 ± 0.08 (n = 6		0.059				
Atlantic Ocean (14° 59’S, 1°00’E)							
0-1000 m	1.03 ± 0.12 (n = 10)		0.131				
1001-2000 m	0.74 ± 0.03 (n = 5)		0.094				
2001-3000 m	0.64 ± 0.05 (n = 4)		0.082				
3001-5000 m	0.56 ± 0.04 (n = 7)		0.071				
Saanich Inlet, Canada							
0-70 m	2.50 ± 0.45 (n = 8)		0.319				
80-135 m	10.8 ± 5.79 (n = 9)		1.38				
136-180 m	4.95 ± 0.86 (n = 3)		0.632				
Submarine hydrothermal water:							
13°N EPR	< 40 ± 20 (n = 12)		<5.1				
21°N EPR	1310 ± 90 (n = 5)		167.2				
Guamas	< 20 ± 10 (n = 3)		<2.6				
Dalian, CN	32.0 ± 1.7 (n = 3)	ng L^{-1}	32.0 ± 1.7	0.45 µm	Preconcentration: MSPE with (γ-MPTMS modified silica-coated nanoparticles) Te(VI) reduction: L-cysteine ICP-MS (^{128}Te) CRM: GBW(E)080548 (Te(IV) only: 100 µg mL^{-1}) DL: 0.079 ng L^{-1}	A	Huang and Hu 2008
Zhuhai, CN	10.3 ± 0.7 (n = 3)		10.3 ± 0.7				
Fuzhou, CN	30.1 ± 2.7 (n = 3)		30.1 ± 2.7				

Caspian sea water	0.028 ± 0.003 (n = 3)	ng mL^{-1}	28 ± 3	centrifugation (2000 rpm, 10 min) + filtration (0.45 µm cellulose membrane filter)	Removal organic Te: active C + LLE (CH_2Cl_2) Te(VI) reduction: HCl boiling DLLME (Te(IV) APDC complex, pH 1, extraction CCl_4) ETAAS CRM: NIST 1643e (1 µg L^{-1}) DL: 0.004 ng mL^{-1} = 4 ng L^{-1}	A	Najafi et al. 2010
Dalian, CN Fujian, CN Zhuhai, CN	39 ± 3.8 (n = 3) 47± 4.1 (n = 3) 37± 3.4 (n = 3)	ng L^{-1}	39 ± 3.8 47± 4.1 37± 3.4	0.45 µm	Reduction: HCl and thiourea HG-headspace Pd(II)-coated GBME, ETV–ICP-MS CRM: hair (hair also analysed in this study) DL: 2.6 ng L^{-1}	A	Xiong and Hu 2010
Changjiang River estuary, CN, May 09, 44 sampling stations, profiles Surface water Bottom water	 0.05 (mean) 0.12 (mean)	nmol L^{-1}	 6 15	0.45 µm	Preconcentration: Fe hydroxide Te(VI) reduction: HCl boiling HG-AFS CRM: GSB 04-1756-2004 DL: 0.02 nmol L^{-1} = 2.5 ng L^{-1}	E	Wu et al. 2014
English Channel, off the Belgian coast	39 ± 5 (n=5)	ng L^{-1}	39	unfiltered	Te(VI) reduction: $TiCl_3$ CSV CRM: no DL: 5 ng L^{-1}	A	Biver et al. 2015

Laptev Sea (Arctic Ocean) Aug-Sep 08 (n = 40)	29 ± 21	ng L^{-1}	29	unfiltered	Dilution 5-fold 0.2 M HCl Column separation of saline matrix SF-ICP-MS (^{126}Te) CRM: SLRS-4, SLEW2, SLEW3, NASS-4, NASS-6, CASS-5 DL: 3 ng L^{-1}	A	Rodushkin et al. 2018

[a]Analytical-oriented papers where all samples BDL are not included in the table. Neither studies with concentration values many orders of magnitude higher than expected ones. Predatory journals were not considered.

[b]Abbreviations in the corresponding list.

[c]Values, as published, in original units (given in next column).

[d]Type of study: E, environmental oriented study; A, analytical method development study where Te concentrations have been measured.

[e]"thiol cotton": cotton impregnated with thioglycollic acid.

Table S5. Published 'dissolved' tellurium concentrations in freshwater systems, including groundwater.[a,b]

Studies are listed in chronological order, starting with the oldest.

System	Dissolved Te[c]	Original units	Dissolved Te / ng L^{-1}	Filtration	Experimental technique	Type of study[d]	Reference
Ming River, CN Fuzhou running water, CN	2.8 2.3	ng L^{-1}	2.8 2.3	filtration (0.45 µm) after acidification	Preconcentration: sulfhydral cotton fiber Te(VI) reduction: acidic HBr treatment Catalytic polarography CRM: not mentioned DL: $9x10^{-11}$ M = 11.5 ng L^{-1}	A	Jingru and Qing 1983
Natural river water Polluted river water	<0.01 0.50 0.27 Te(IV), 0.23 Te(VI)	ng mL^{-1}	< 10 500	not mentioned	Te(VI) reduction: $TiCl_3$ Preconcentration: "thiol cotton"[e] HG-AAS CRM: not mentioned DL: 0.008 ng mL^{-1} = 8 ng L^{-1}	A	Yu et al. 1983
River 1 River 2 Lake	0.07 0.05 0.03	ng mL^{-1}	70 50 30	not mentioned	Te(IV) reduction: 80°C HCl HG-AAS (graphite furnace coated with Pd) CRM: GBW 0734, 0735, 0736 DL: not given	A	Zhang et al. 1989

Orinoco, 1984 Mississippi, Jan 1984 Amazon, Dec 1982	2.22 4.17 1.03	pmol L^{-1}	0.131 0.283 0.532	not mentioned	Preconcentration: precipitation with 6 M NaOH (not clear for total concentrations) Te(VI) reduction: HCl boiling HG-AAS CRM: not used DL: 2-4 pg	A	Yoon et al. 1990
Springs in Nevada, US Hiko Crystal Ash	 5 ± 5 (n = 3) 4 ± 4 (n = 3) 5 ± 3 (n = 6)	ng L^{-1}	 5 4 5	0.45 µm	ICP-MS (^{125}Te) CRM: not for Te DL: 9 ng L^{-1}	A	Stetzenbach et al. 1994
145 Norwegian hard rock groundwater samples (n = 145) Oslo subset (n = 89) Bergen subset (n = 56)	0.009 (median) 0.012 (median) 0.008 (median)	µg L^{-1}	9 12 8	unfiltered	ICP-MS (^{126}Te) CRM: not mentioned DL: 0.001 µg L^{-1} = 1 ng L^{-1}	R	Reimann et al. 1996
Lake Biwa, JP	0.040 ± 0.004 (n = 3)	ppb	40	?	Preconcentration: $Fe(OH)_3$ precipitation ICP-MS CRM: in Japanese DL: in Japanese	A	Fujino et al. 1997
European bottled mineral water (n = 56)	0.01 (median) <0.005–0.067	µg L^{-1}	10 <5–67	unfiltered	ICP-MS (^{126}Te) CRM: NIST 1640, 1643d DL: 0.005 µg L^{-1} = 5 ng L^{-1}	E	Misund et al. 1999

Norwegian crystalline bedrock groundwater (n = 476)	<0.005 (median) max: 0.075	µg L^{-1}	<5	unfiltered	ICP-MS (isotope not given) CRM: not mentioned DL: 0.005 µg L^{-1} = 5 ng L^{-1}	R	Frengstad et al. 2000
Global mean Te content in rivers	20	ng L^{-1}	20	-	Estimation from Se river concentrations; the value agrees with estimates from residence time considerations	E	Hein et al. 2003
Rift Valley, ET (n = 138)	<0.005 (median) <0.005–0.019	µg L^{-1}	<5 <5–19	unfiltered	ICP-MS (^{126}Te) CRM: NIST 1640, 1643d, SLRS-4 DL: 0.005 µg L^{-1} = 5 ng L^{-1}	R	Reimann et al. 2003
Groundwater in the Duero Cenozoic Basin, ES (n = 514)	0.027 ± 0.048 (mean) BDL–0.30 (number of samples BDL not given)	µg L^{-1}	27	not mentioned	ICP-MS (isotope not given) CRM: not mentioned DL: not given	E	Gómez et al. 2006
Streams in Europe (n = 807)	<0.005 (median) <0.005-0.032 **60% BDL**	µg L^{-1}	<5	0.45 µm	ICP-MS (^{126}Te) DL: 0.005 µg L^{-1} = 5 ng $L^{-1\ f}$	R	Salminen et al. 2005
Mono Lake, US: Spring 2009 Summer 1996 (archived water)	 13 13	nM	 1659 1659	0.2 µm	Oxidation all Te to Te(VI) by $HNO_3/HClO_4$ digestion Te(VI) reduction: conc HCl HG-AAS CRM: not mentioned DL: not given	E	Baesman et al. 2009

132 brands of bottled water from 28 countries	0.004 (median) 0.0006–0.18	μg L^{-1}	4 0.6–180	not mentioned	SF-ICP-MS (isotope not given) CRM: SLRS-4 NRCC DL: not mentioned	E	Krachler and Shotyk 2009
Haraz river, IR Tajan river, IR Waste water Tap water, IR Drinking wate, IRr	0.029 ± 0.002 (n = 3) 0.036 ± 0.004 (n = 3) 4.1 ± 0.014 (n = 3) < DL < DL	ng mL^{-1}	29 ± 2 36 ± 4 4100 ±14 <4 <4	centrifugation (2000 rpm, 10 min) + filtration (0.45 µm cellulose membrane filter)	Removal organic Te: active C + LLE (CH_2Cl_2) Te(VI) reduction: HCl boiling DLLME (Te(IV) APDC complex, pH 1, extraction CCl_4) ETAAS CRM: NIST 1643e (1 μg L^{-1}) DL: 0.004 ng mL^{-1} = 4 ng L^{-1}	A	Najafi et al. 2010
European bottled water (n = 1785)	<0.03 (median) <0.03–0.316 (a well in Hungary) **90% BDL**	μg L^{-1}	<30 <30–316	unfiltered	No acidification ICP-MS (^{126}Te) DL: 0.03 μg L^{-1} = 30 ng L^{-1}	R	Reimann and Birke 2010
Mineral water: Viva (Luxembourg) Contrex (France) St Yorre (France) Hepar (France) Evian (France) Vittel (France) River Wiltz, LU River Wiltz, LU	 20 ± 3 (n=6) 43 ± 4 (n=5) 40 ± 7 (n=4) 44 ± 1 (n=4) 15 ± 2 (n=3) 10 ± 2 (n=6) 30 ± 9 (n=8) 16 ± 6 (n=5)	ng L^{-1}	 20 43 40 44 15 10 30 16	unfiltered	Te(VI) reduction: $TiCl_3$ Differential pulse cathodic strippingvoltammetry CRM: no DL: 5 ng L^{-1}	A	Biver et al. 2015

2nd and 3rd order streams, Oppdal/Berkåk, NO (n = 168)	0.015 (median) <0.001–0.050) 1 sample BDL	μg L^{-1}	15 <1–50	filtration (0.45 μm)	ICP-MS (isotope not given) CRM: SLSR-5, TM-23.4, TMDA-51.4, TMDA-52.3 DL: 0.001 μg L^{-1} = 1 ng L^{-1}	R	Reimann et al. 2018
Tap water, Lulea, SE (n=10)	0.9 ± 0.4	ng L^{-1}	0.9	unfiltered	Preconcentration: evaporation (sub-boiling conditions) SF-ICP-MS (^{126}Te) CRM: SLRS-4, SLEW2, SLEW3, NASS-4, NASS-6, CASS-5 DL: 0.07 ng L^{-1} (with preconcentration)	A	Rodushkin et al. 2018

[a]Analytical-oriented papers where all samples BDL are not included in the table. Neither studies with concentration values many orders higher than expected ones. Predatory journals were not considered.

[b]Abbreviations in the corresponding list.

[c]Values, as published, in original units (given in next column).

[d]Type of study: A, analytical method development study where Te concentrations have been measured; E, environmental oriented study; R, regional study.

[e]thiol cotton": cotton impregnated with thioglycollic acid.

[f]"Different information is given in the FOREGS website. Values in table come from the report. The map gives a DL of 2 ng L^{-1} and a median value of 2.5 ng L^{-1}.

Table S6. Published 'dissolved' tellurium concentrations in rainwater and snow.

Studies are listed in chronological order, starting with the oldest.

System[a]	Dissolved Te[b]	Original units	Dissolved Te / ng L^{-1}	Filtration	Experimental technique[c]	Reference
Rainwater, Tallahassee, FL 26-28 Feb 1984 6-7 Mar 1984	 26 ± 3 (n = 2) 4.0 ± 0.6 (n = 2) all Te(IV); no Te(VI) detected	pmol L^{-1}	 3.32 ± 0.38 0.51 ± 0.08	not mentioned	Preconcentration: coprecipitation with $Mg(OH)_2$ Te(VI) reduction: boiling in HCl HG-GF-AAS Accuracy: spiking because of lack of CRMs DL: 0.5 pmol L^{-1} = 0.06 ng L^{-1}	Andreae 1984
Snow Rolla, US, 10 Feb-13 March 1986 (6 sampling sites) (n = 16)	4.2	ng L^{-1}	4.2	filtration (size not given)	Acidification HNO_3 Preconcentration: pmping off water wapor at 60C Te(VI) reduction: near dryness with HCl Cation-exchange column GF-AAS CRM: not mentioned	Chiou and Manuel 1988

Rainwater		pmol L^{-1}		not mentioned	Preconcentration: precipitation with 6 M NaOH (not clear for total concentrations) Te(VI) reduction: HCl boiling HG-AAS CRM: not used DL: 2–4 pg	Yoon et al. 1990
Bermuda Island, 4 dates 1983	7.68, 0.67, 0.70, 0.58		0.98, 0.085, 0.089,0.074			
Cambridge, US, 2 dates 1984	6.11, 2.62		0.78, 0.33			
Tropical Western Pacific	2.64		0.34			
Seoul, KR, 2 dates 1984	189, 205		24, 26			
Cloud water, Whiteface Mountain, NY, US, 23 Jul 95	0.43 (mean)[a] 0.21–0.58	µg L^{-1}		passive collector	Preconcentration: slow hotplate evaporation PN-ICP-MS	Yang et al. 2009
Snow Lulea, SW, Feb-Mar 2017		ng L^{-1}		unfiltered	Preconcentration: evaporation (sub-boiling conditions) SF-ICP-MS (^{126}Te) CRM: SLRS-4, SLEW2, SLEW3, NASS-4, NASS-6, CASS-5 DL: 0.07 ng L^{-1} (with preconcentration)	Rodushkin et al. 2018
Fresh snow	1.5 ± 0.8 (n = 14)		1.5			
Snow column	1.9 (n = 4)		1.9			
Roadside snow	2.1 (n = 8)		2.1			

[a]Not clear whether this value corresponds to the concentration in the clouds or in the 20-fold concentrated solution.

Table S7. Published tellurium concentrations in air samples.

Studies are listed in chronological order, starting with the oldest.

System[a]	Tellurium	Original units	Sampling	Measurement technique	Reference
Sutton, UK in 1969	0.14 ± 0.10	ng kg^{-1}	0.45 µm filters but sampling not described	Spark-source mass spectrometry	Hamilton 1974
NASN, US (898 composite samples, 248 sites), 1970	0.16 (mean calculated with values above DL only; samples above DL: 0.22%)	ng m^{-3}	high-volume sampler + fibre glass filters (24 h, 100 m^3 h^{-1})	Filters ashed, digestion: HNO_3-HCl Spark excited ES DL: 3.0 µg mL^{-1}	Scott et al. 1976
University of Missouri, Rolla, US, 1983, 4 different dates	0.298 ± 0.003 (n = 4) 0.231 ± 0.002 (n = 3) 0.261 ± 0.003 (n = 2) 0.209 ± 0.003 (n = 4)	ng m^{-3}	high-volume sampler + fibre glass filters (> 0.01 µm) (1000-1500 m^3 air filtered)	Digestion: HNO_3-$HClO_4$-HCl Reduction Te(VI): HCl (1-2 mL) Separation Se-Te: cation-exchange column GF-AAS Accuracy: sample spiking	Chiou and Manuel 1984
University of Missouri, Rolla, US		ng m^{-3}		As in Chiou et al. 1984	Chiou and Manuel 1986
bulk samples: Jul-Oct 1983 (n = 12)	0.45 ± 0.13 (mean)		high-volume sampler		
sized samples: Oct 1983-July 1984	75% <2 µm		high-volume cascade impactor		

Rolla, Missouri, US, Jan-Mar 86 (n = 5)	0.23 ± 0.11 **gaseous Te**	ng m^{-3}	flow rate: 10 L min^{-1}	Adsorption on charcoal, thermal desorption Separation Se-Te: cation-exchange column GF-AAS Accuracy: spiking DL: 0.1 ng m^{-3}	Muangnoicharoen et al. 1986
Rolla, Missouri, US: Indoor air laboratory (n = 3) Outdoor air (n = 4)	 0.78 (mean) 0.24 (mean) **gaseous Te**	ng m^{-3}	air-flow rate: 7 L min^{-1}	Adsorption on Au-coated beads, mild desorption Separation Se-Te: cation-exchange column GF-AAS Accuracy: spiking DL: 0.03 ng m^{-3}	Muangnoicharoen et al. 1988
Yokohama, JP, Jul 86-Jun 87 Seoul, KR	1.82 (mean) (0.06-0.19) 0.1–1.8	ng m^{-3}	quartz fiber filter	Digestion: HNO_3-HF- $HClO_4$ Coprecipitation with As GF-AAS Accuracy and precision: not given	Hashimoto et al. 1989
Keihin zone, JP, Feb 87 Industrial zone Resident zone Seashore Suburbs	 0.512 (n = 6) 0.908 (n = 6) 0.652 (n = 6) 0.122 (n = 6)	ng m^{-3}	high-volume sampler	As in Hashimoto et al. 1989 but HG-AFS	Watanabe et al. 1989

Bermuda Apr 1974 May 1974 Jul 1974 Aug 1974 Sep 1974	 15.1 ± 2.95 (n = 2) 12.2 ± 13.2 (n = 3) 1.82 ± 1.37 (n = 12) 2.64 ± 2.28 (n = 5) 0.64 ± 0.20 (n = 2)	ng m^{-3}	200 m^3 air filtered	Digestion: HNO_3, $HClO_4$, HCl-HF Te(VI) reduction: HCl boiling HG-GFAAS Accuracy: CRMs DL: 2–4 pg	Yoon et al. 1990
Matsue, JP Summer 1989 (n = 7) Winter 1990 (n = 7)	 0.068 (mean) (0.051–0.094) 0.092 (mean) (0.058–0.16)	ng m^{-3}	high-volume sampler	As in Watanake et al. 1989	Sekine and Hashimoto 1991
Beijing, CN, Dec 88-Feb 90 (n=14)	0.115 (median) 0.070–0.26	ng m^{-3}	high-volume sampler (24 h, 500 L min^{-1})	As in Watanake et al. 1989	Sekine et al. 1992
Mauna Loa, US, 79-85 All Dust season (20 weeks) Non-dust season (31 weeks)	 161 ± 158 281 ± 15 59 ± 48	pg m^{-3}	filter packs	INAA	Zieman et al. 1995
Smog dust from Wuhan, CN	3.92 ± 0.19 (3.62–4.19)	µg g^{-1}	not described	Digestion: HCl-HNO_3-H_2SO_4 Linear sweep polarography in H_2SO_4 solutions containing methylene blue DL: $2x10^{-9}$ g mL^{-1} CRM: comparison with "standard value"	Zhou et al. 1997

Table S8. Detection limit (DL) and tellurium median and maximum concentrations as reported from a number of low density regional geochemical soil surveys in Europe. All values in mg kg^{-1}.[a]

Project a	Soil	median	maximum	method	DL	% BDL	Reference
Kola	B horizon	0.009	0.221	AR GF AAS (+ preconcentration)	0.003	15	Reimann et al. 1998
	C horizon	0.008	0.271	AR, GF AAS (+ preconcentration)	0.003	23	
BSS	TOP (0–25 cm)	0.008	0.07	AR, AAS	0.005	30	Reimann et al. 2003
	BOT (50–75 cm)	0.008	0.12	AR, AAS	0.005	30	
FOREGS	TOP (cm)	0.03	0.93	MA, ICP-MS	0.02	16	Salminen et al. 2005
	SUB (cm)	0.03	1.63	MA, ICP-MS	0.02	21	
GEMAS	Ap (0.20 cm)	<0.02	0.27	AR, ICP-MS	0.02	56	Reimann et al. 2014
	Gr (0–10 cm)	0.02	0.95	AR, ICP-MS	0.02	50	

[a]BSS: Baltic Soil Survey; FOREGS: Forum of European Geological Surveys; GEMAS: Geochemical mapping of agricultural and grazing land soil, TOP: topsoil, BOT: bottom soil, SUP: subsoil; AR: *aqua regia* extraction, MA: multi acid (total) digestion. Other abbreviations in the corresponding list.

Table S9. Tellurium in recent urban geochemistry studies. All values in mg kg^{-1}.

Location		median	minimum	maximum	method	DL	
Prague inner city, CZ	topsoil 0–10 cm n = 194	0.02	<0.02	0.1	*aqua regia*, ICP-MS	0.02	Poňavič et al. 2018
Sisak, HR	topsoil 0–10 cm n = 143,	0.03	<0.02	0.27	*aqua regia*, ICP-MS	0.02	Šorša et al. 2018
Karlstad, SE	topsoil 0–10 cm n = 306	<0.02	<0.02	0.22	*aqua regia*, ICP-MS	0.02	Tarvainen et al. 2018
Hämeenlinna, FI		<0.02	<0.02	0.12	*aqua regia*, ICP-MS	0.02	Tarvainen et al. 2018
London Earth Project, GB	topsoil 0–20 cm n = 7189	<0.5	<0.5	1.9	ED-XRF	0.5	BGS 2011 Ferreira et al. 2017

Table S10. Tellurium concentrations in dated sediment cores.

System	Remote?	Period	Analytical details	Observations	Reference
Chesapeake Bay, US	Direct influence from Baltimore	2 cores 1904–1978.6 (1 core) 1944.5–1997.8 (1 core) Datation method unclear	LA-ICP-MS	Enrichment after 1920 and slight decrease after 1980	Dolor et al. 2009
Two subalpine lakes, Uinta Mountains, Utah, US	Mining districts west of the Uinta Mountains	2 cores 1870–2000 (1 core) 1820–2000 (1 core) Datation: $^{239+240}$Pb and radiocarbon	"multiacid" digestion ICP-MS (isotope not given)	Increase beginning in middle to late 1800s, abrupt increase in late 1930s continuing into 1940s and 1950s	Reynolds et al. 2010
East China Sea	Receives Changjiang River, adjacent to Shangai and Nigbo; massive agricultural, municipal and industrial waste input	1 core 1849–2009 Datation: ^{210}Pb	*Aqua regia* digestion HCl boiling prereduction HG-AFS	Higher values <1960 (attributed to biological activity; peaks in 1970, 1989, 2009 (attributed to anthropogenic activities)	Duan et al. 2014
Lakes in eight locations in Canada	Lakes close to base metal smelting, coal mining and burning, oil sands, rural regions and remote areas	22 cores 1860–2010 Datation: ^{210}Pb	*Aqua regia* digestion CRC-ICP-MS (Xe mode, ^{128}Te)	Most sediments follow local and regional Te sources	Wirklund et al. 2018

Table S11. Biological samples analysed at the ALS Luleå laboratory.

Matrix category	Matrix	Range All units ng g^{-1} except when indicated otherwise	Reference
Human biomarkers	Fingernails	<0.07–1.9 (median: 0.62, n = 96)	Rodushkin and Axelsson 2000b
	Scalp hair	<0.07–1 (median: 0.33, n = 114)	Rodushkin and Axelsson 2000b
	Urine	<0.013–0.26 ng mL^{-1} (n = 12) 0.020–0.045 ng mL^{-1} (n = 10)	Rodushkin et al. 2001 Rodushkin et al. 2018
	Serum	<0.013 ng mL^{-1} (n = 12) 0.007–0.014 ng mL^{-1} (n = 4)	Rodushkin et al. 2001 Rodushkin et al. 2018
	Whole blood	<0.02–0.03 ng mL^{-1} (n = 12) 0.020–0.050 ng mL^{-1} (n = 8)	Rodushkin et al. 2001 Rodushkin et al. 2018
Biofluid	Calf whole blood	0.019–0.055 ng mL^{-1} (n = 3)	Rodushkin et al. 2000
Soft tissues	Human liver	2.2 (SD = 0.2, n = 3)	Engström et al. 2004
	Human kidney	1.9 (SD = 0.4, n = 3)	
	Porcine muscle	0.12 (SD = 0.07, n = 11)	
	Fish muscle	0.15 (SD = 0.04, n = 11)	
	Fish liver	1.1 (SD = 0.1, n = 11)	
	Rabbit liver	0.83 (SD = 0.09, n = 11)	
	Rabbit lung	0.25 (SD = 0.06, n = 11)	
	Rabbit kidney	1.1 (SD = 0.1, n = 11)	

	Rabbit brain	0.19 (SD = 0.04, n = 11)	
Soft tissues	Vole kidney	0.6–29 (n = 64)	Pallavicini et al. 2013
	Vole liver	<0.2–2.8 (n = 64)	
	Vole lung	<0.2–1.5 (n = 64)	
	Vole melt	<0.2–3.6 (n = 64)	
	Vole muscle	0.3–2 (n = 64)	
Nuts and seeds	Hazelnuts	0.24 (SD = 0.21, n = 6)	Rodushkin et al. 2007
	Walnuts	0.19 (SD = 0.12, n = 6)	
	Almonds	0.16 (SD = 0.14, n = 4)	
	Bitter almonds	0.09 (SD = 0.04, n = 2)	
	Pecans	0.18 (SD = 0.12, n = 3)	
	Cashews	0.14 (SD = 0.09, n = 3)	
	Brazil nuts	1.4 (SD = 0.3, n = 2)	
	Pistachios	0.15 (SD = 0.04, n = 2)	
	Pine nuts	0.18 (SD = 0.15, n = 3)	
	Peanuts	0.05 (SD = 0.01, n = 3)	
	Coconuts	0.09 (SD = 0.04, n = 3)	
	Pumpkin seeds	<0.02 (n = 3)	
	Sunflower seeds	0.06 (SD = 0.04, n = 4)	
Plants	Lingonberries and blueberries	0.073–0.14 (35 sites in northern Sweden)	Rodushkin et al. 1999
Food	Caviar (Sweden, Finland, USA)	0.41–2.6	Rodushkin et al. 2007
Food	Sugars	<0.03-0.60 (n = 12)	Rodushkin et al. 2011.

Table S12. Published tellurium (redox) speciation in surface water, air and soils.

Studies are listed in chronological order, starting with the oldest.

System	Results	Units	% Te(IV)	Method	Reference
Polluted river water	Te(IV): 0.27 Te(VI): 0.23	ng mL^{-1}	54	HG-AAS, preconcentration: "thiol cotton", reduction: ??	Yu et al. 1983
Seawater	Te(IV): <0.01 Te(VI): 0.06	ng mL^{-1}	100	HG-AAS; coprecipitation with $Mg(OH)_2$; reduction: boiling in HCl; Te(VI) by difference	Andreae 1984
Angola Basin	Total: 0.6–1.3 Te(IV): 0.12–0.36 Te(VI): 0.43–0.98	pmol kg^{-1}	25	HG-AAS; alkaline coprecipitation; reduction: boiling in HCl	Lee and Edmon 1985
Panama Basin	Total: 0.5–1.4 Te(IV): 0.1–0.55 Te(VI): 0.5–1.14 8		68		
Air Rolla, Missouri, US:		ng m^{-3}		GF-AAS; resin separation	Muangnoicharoen et al. 1988
Indoor air laboratory (n = 3)	Total: 0.78 Te(0): 0.39 Te(IV): 019 Te(VI): 0.20		25		
Outdoor air (n = 4)	Total: 0.24 Te(0): 0.0625 Te(IV): 0.055 Te(VI): 0.125		23		

Pacific	Total: 0.46–1.39 Te(IV): 0.12–0.37 Te(VI): 0.37–1.04	pmol L^{-1}	26	HG-AAS; precipitation with 6M NaOH; reduction: boiling in HCl	Yoon et al. 1990
Atlantic	Total: 0.56–1.03 Te(IV): 0.17–0.20 Te(VI): 0.39–0.84		17		
Canada	Total: 2.5–10.8 Te(IV): 0.72–2.01 Te(VI): 0.57–3.77		20		
Soil NIST SRM 2709	Te(IV): 0.09 ± 0.01 Te(VI): 0.10, 0.14	mg kg^{-1}	≈50	CSV; HF-HNO_3 digestion; preconcentration: chelating resin Fe(III) loaded; separation: ion-exchange	Ferri et al. 1998
Sediment NIST SRM 1649e	Te(IV): <0.005 Te(VI): <0.005				
Seawater, CN	Total: 32.0 ± 1.7 Te(IV): 6.9 ± 0.5 Te(VI): 25.1 ± 1.5	ng L^{-1}	22	HG-AAS; preconcentration: resin; reduction: L-cysteine	Huang and Hu 2008
	Total: 10.3 ± 0.7 Te(IV): 3.1 ± 0.3 Te(VI): 7.2 ± 0.3		30		
	Total: 30.1 ± 2.7 Te(IV): 3.9 ± 0.3 Te(VI): 26.2 ± 2.2		13		

Caspian Sea	Total: 0.028 ± 0.003 Te(IV): 0.012 ± 0.001 Te(VI): 0.016 ± 0.002	ng mL^{-1}	43	HG-AAS; preconcentration: resin; reduction: boiling in HCl	Najafi et al. 2010
Harz River	Total: 0.029 ± 0.003 Te(IV): 0.017 ± 0.001 Te(VI): 0.012 ± 0.001		59		
Tajan River	Total: 0.036 ± 0.004 Te(IV): 0.022 ± 0.002 Te(VI): 0.014 ± 0.001		61		
Waste water	Total: 4.1 ± 0.14 Te(IV): 2.8 ± 0.11 Te(VI): 1.3 ± 0.06		68		
Changjiang River estuary, CN		nmol L^{-1}		HG-AAS; preconcentration: Fe hydroxide; reduction: boiling in HCl	Wu et al. 2014
Surface water	Total: 0.05 (mean) Te(IV): 0.02 (mean) Te(VI): 0.03 (mean)		40		
Bottom water	Total: 0.12 (mean) Te(IV): 0.01 (mean) Te(VI): 0.11 (mean)		8		

Mineral water Viva (Luxembourg)	Total: 20 ± 3 Te(IV): 10 ± 3	ng L^{-1}	51	Catalytic CSV; reduction: $TiCl_3$	Biver and Filella 2015
Mineral water Contrex (France)	Total: 43 ± 4 Te(IV): 31 ± 6		71		
Mineral water St Yorre (France)	Total: 40 ± 7 Te(IV): 28 ± 6		71		
Mineral water Hepar (France)	Total: 44 ± 1 Te(IV): 15 ± 3		34		
Mineral water Evian (France)	Total: 15 ± 2 Te(IV): 5 ± 1		33		
Mineral water Vittel (France)	Total: 10 ± 2 Te(IV): 10 ± 1		1		
River water Luxembourg	Total: 30 ± 9 Te(IV): 13 ± 2		45		
River water Luxembourg	Total: 16 ± 6 Te(IV): 5 ± 1		32		
Sea water Belgium coast	Total: 39 ± 5 Te(IV): 12 ± 2		30		

Table S13. Published values of tellurium concentrations in Certified Reference Materials.

Matrix	CRM	Certified values	Recommended/ Information values	Measured value	Reference
Manganese nodule	GSJ JMn-1	-	-	4489 ± 227 ng g^{-1} 4.15 ± 0.03 μg g^{-1}	Terashima 2001 Schirmer et al. 2014
Ferromanganese nodule	USGS NOD-A1	-	-	30.9 ± 0.1 μg g^{-1}	Axelsson et al. 2002
Ferromanganese nodule	USGS NOD-P1	-	-	4.80 ± 0.20 μg g^{-1} 4.95 ± 0.2 μg g^{-1}	Axelsson et al. 2002 Schirmer et al. 2014
St Joaquin Soil	NIST SRM 2709	-	-	0.10, 0.14 mg kg^{-1} 0.61 mg kg^{-1}	Ferri et al. 1998 Mleczek et al. 2017
Soil	USGS GXR-2	-	-	0.51 ± 0.06 μg g^{-1} 0.69 μg g^{-1} 0.50 ± 0.08 mg kg^{-1} 750 ± 41 ng g^{-1}	Donaldson and Leaver 1990 Govindaraju 1994 Ferri et al. 1998 Terashima 2001
Soil	USGS GXR-5	-	-	0.041 ± 0.015 μg g^{-1} 0.1 μg g^{-1} 0.085 ± 0.017 mg kg^{-1} 87 ± 6 ng g^{-1}	Donaldson and Leaver 1990 Govindaraju 1994 Ferri et al. 1998 Terashima 2001
Soil	USGS GXR-6	-	-	0.046 ± 0.013 μg g^{-1} 0.018 μg g^{-1} 0.052 ± 0.005 mg kg^{-1} 43 ± 2 ng g^{-1}	Donaldson and Leaver 1990 Govindaraju 1994 Ferri et al. 1998 Terashima 2001
Soil	IAEA Soil 5	-	-	0.43 ± 0.06 mg kg^{-1}	Ivanova et al. 2001
Soil	IAEA Soil 7	-	-	0.060 ± 0.003 mg kg^{-1}	Ivanova et al. 2001
Soil	GBW07401/IGGE GSS-1	-	-	0.051 μg g^{-1}	Govindaraju, 1994

Soil	GBW07402/IGGE GSS-2	-	-	0.035 μg g^{-1} 0.033 μg g^{-1}	Govindaraju 1994 Wang et al. 2013
Soil	GBW07403/IGGE GSS-3	-	-	0.04 μg g^{-1} 0.039 ± 0.013 μg g^{-1}	Govindaraju 1994 Wang et al. 2013
Soil	GBW07404/IGGIE GSS-4	0.16 ± 0.02 μg g^{-1}	-	0.15 μg g^{-1} 0.16 ± 0.02 μg g^{-1} 0.16 ± 0.06 μg g^{-1}	Govindaraju 1994 Xi et al. 2010 Wang et al. 2013
Soil	GBW07405/IGGE GSS-5	-	-	4 μg g^{-1} 5 μg g^{-1}	Govindaraju 1994 Wang et al. 2013
Soil	GBW07406/IGGE GSS-6	-	-	0.42 μg g^{-1}	Govindaraju 1994
Soil	GBW0708/IGGE GSS-8	-	-	0.046 μg g^{-1}	Govindaraju 1994
Soil	GBW07409/ESSM-1	-	-	0.024 μg g^{-1}	Wang et al. 2013
Soil	GBW07410/ESSM-2	-	-	0.035 μg g^{-1}	Wang et al. 2013
Soil	GBW07411/ESSM-3	-	-	0.055 μg g^{-1}	Wang et al. 2013
Soil	GBW07418/ESSM-9	-	-	0.033 ± 0.007 μg g^{-1}	Wang et al. 2013
Soil	GBW07420/ESSM-11	-	-	0.036 μg g^{-1}	Wang et al. 2013
Soil	GBW07421/ESSM-12	-	-	0.046 μg g^{-1}	Wang et al. 2013
Soil	GBW07422/ESSM-13	-	-	0.053 μg g^{-1}	Wang et al. 2013
Soil	GBW 07429		0.17 μg g^{-1}	0.16 ± 0.01 μg g^{-1}	Xi et al. 2010
Soil	GBW07431/GSS-31	-	-	0.02 μg g^{-1}	Wang et al. 2013
Soil	GBW07432/GSS-32	-	-	0.05 μg g^{-1}	Wang et al. 2013
Soil	GBW07448/GSS-19	-	-	0.04 μg g^{-1}	Wang et al. 2013
Soil	GBW07450/GSS-21	-	-	0.05 μg g^{-1}	Wang et al. 2013
Soil	GBW07454/GSS-25	-	-	0.05 μg g^{-1}	Wang et al. 2013

Soil	CCRMP SO-1	-	-	0.04 µg g^{-1} 25 ± 6 ng g^{-1}	Govindaraju 1994 Hall and Pelchat 1997
Soil	CCRMP SO-2	-	-	12 ± 1 ng g^{-1}	Hall and Pelchat 1997
Soil	CCRMP SO-3	-	-	10 ± 1 ng g^{-1} 11.8 ng g^{-1}	Hall and Pelchat 1997 Wang and Becker 2014
Soil	CCRMP SO-4	-	-	0.03 µg g^{-1} 35 ± 1 ng g^{-1} 0.01 ± 0.008 µg g^{-1}	Govindaraju 1994 Hall and Pelchat 1997 Perkins 2011
Soil	GSJ JSO-1	-	0.085 ± 0.00425 µg g^{-1} (Geological Survey of Japan 1997)	78 ± 4 ng g^{-1} 0.085 ± 0.004 ppm	Terashima 2001 Terashima et al. 2002
Polluted farmland soil	GBW 08303	-	-	0.069 ± 0.003 mg kg^{-1}	Ivanova et al. 2001
Loess soil	CRM S-1	-	-	0.66 mg kg^{-1} 0.60 mg kg^{-1}	Mleczek et al. 2017 Siwulski et al. 2017
Estuarine sediment	NIST 1646	-	0.5 µg g^{-1} (NIST 1982)	0.037 ± 0.002 µg g^{-1} 0.5 µg g^{-1}	Donaldson and Leaver 1990 Govindaraju 1994
Lake sediment	CCRPM LKSD-1	-	-	35 ± 2 ng g^{-1}	Hall et al 1997; Hall and Pelchat 1997
Lake sediment	CCRPM LKSD-2	-	-	88 ± 4 ng g^{-1}	Hall and Pelchat 1997
Lake sediment	CCRPM LKSD-3	-	-	66 ± 1 ng g^{-1}	Hall and Pelchat 1997
Lake sediment	CCRPM LKSD-4	-	-	188 ± 9 ng g^{-1} 0.11 ± 0.010 mg kg^{-1} 0.14 µg g^{-1}	Hall et al 1997; Hall and Pelchat 1997 Reimann et al. 2007 Schirmer et al. 2014
Lake sediment	GSJ JLK-1	-	-	113 ng g^{-1} 109 ± 7 ng g^{-1}	Imai et al. 1996 Terashima 2001
Lake sediment	IAEA SL-1	-		0.13 ± 0.07 mg kg^{-1}	Ivanova et al. 2001

Lake sediment	IAEA SL-3	-	-	0.020 ± 0.001 mg kg^{-1}	Ivanova et al. 2001
Lake sediment	GBW07423/GSS-9	-	-	0.035 μg g^{-1}	Wang et al. 2013
Lake sediment	GBW07435/GSS-35	-	-	0.08 μg g^{-1}	Wang et al. 2013
Marine sediment	NRCC MESS-1	-	-	28 ± 2 ng g^{-1}	Hall et al. 1997; Hall and Pelchat 1997
Marine sediment	NRCC BCSS-1	-	-	30 ± 1 ng g^{-1}	Hall et al. 1997; Hall and Pelchat 1997
Marine sediment	GSJ JMS-1	-	0.132 ± 0.008 μg g^{-1} (Geological Survey of Japan 1999)	126 ± 8 ng g^{-1} 0.132 ± 0.008 μg g^{-1}	Terashima 2001 Terashima et al. 2002
Marine sediment	GSJ JMS-2	-	1.38 ± 0.10 μg g^{-1} (Geological Survey of Japan 2000)	1280 ± 80 ng g^{-1} 1.38 ± 0.09 μg g^{-1}	Terashima 2001 Terashima et al. 2002
Marine sediment	IAEA 356	-	0.54 μg g^{-1} (IAEA, 1994)		
Marine sediment	GBW07357	-	-	0.09 μg g^{-1}	Wang et al. 2013
Marine mud	USGS MAG-1	-	-	0.066 μg g^{-1} 75 ± 3 ng g^{-1} 72.5 ± 0.9 ng g^{-1}	Govindaraju 1994 Hall et al. 1997 Wang and Becker 2014
Stream sediment	CCRMP STSD-1	-	-	85 ± 3 ng g^{-1}	Hall et al. 1997; Hall and Pelchat 1997
Stream sediment	CCRMP STSD-2	-	-	89 ± 2 ng g^{-1}	Hall and Pelchat 1997
Stream sediment	CCRMP STSD-3	-	-	84 ± 4 ng g^{-1}	Hall and Pelchat 1997
Stream sediment	CCRMP STSD-4	-	-	44 ± 1 ng g^{-1}	Hall and Pelchat 1997
Stream sediment	GSJ JSD-1	-	-	0.021 μg g^{-1} 22 ± 3 ng g^{-1}	Imai et al. 1996 Terashima 2001
Stream sediment	GSJ JSD-2	-	-	803 ± 31 ng g^{-1}	Terashima 2001

Stream sediment	GSJ JSD-3	-	-	0.264 µg g^{-1} 307 ± 12 ng g^{-1}	Imai et al. 1996 Terashima 2001
Stream sediment	GBW07301 / IGGE GSD-1	-	-	19 ± 2 ng g^{-1}	Hall and Pelchat 1997
Stream sediment	GBW07302 / IGGE GSD-2	-	-	0.031 µg g^{-1} 0.042 µg g^{-1} 17 ± 1 ng g^{-1} 0.024 µg g^{-1}	Govindaraju 1994 Fadda et al. 1995 Hall and Pelchat 1997 Wang et al. 2013
Stream sediment	GBW07303 / IGGE GSD-3	-	-	0.15 µg g^{-1} 0.019 µg g^{-1} 187 ± 17 ng g^{-1} 0.164 µg g^{-1} 0.16 ± 0.03 µg g^{-1}	Govindaraju 1994 Fadda et al. 1995 Hall et al 1997; Hall and Pelchat 1997 Li G et al. 2010 Wang et al. 2013
Stream sediment	GBW07304 / IGGE GSD-4	-	-	0.08 µg g^{-1} 0.072 µg g^{-1} 58 ± 3 ng g^{-1} 0.064 µg g^{-1} 0.065 ± 0.02 µg g^{-1}	Govindaraju 1994 Fadda et al. 1995 Hall and Pelchat 1997 Li G et al. 2010 Wang et al. 2013
Stream sediment	GBW07305 / IGGE GSD-5	-	-	0.12 µg g^{-1} 0.17 µg g^{-1} 168 ± 13 ng g^{-1} 0.143 µg g^{-1} 0.145 µg g^{-1} 0.14 ± 0.04 µg g^{-1}	Govindaraju 1994 Fadda et al. 1995 Hall and Pelchat 1997 Li G et al. 2010 Li Z et al. 2010 Wang et al. 2013

Stream sediment	GBW07306 / IGGE GSD-6	-	-	0.14 μg g^{-1} 0.16 μg g^{-1} 178 ± 16 ng g^{-1} 0.138 μg g^{-1}	Govindaraju 1994 Fadda et al. 1995 Hall et al 1997; Hall and Pelchat 1997 Li G et al. 2010
Stream sediment	GBW07307 / IGGE GSD-7	-	-	0.065 μg g^{-1} 0.076 μg g^{-1} 94 ± 4 ng g^{-1} 0.072 μg g^{-1} 0.07 ± 0.02 μg g^{-1}	Govindaraju 1994 Fadda et al. 1995 Hall et al 1997 Li G et al. 2010 Wang et al. 2013
Stream sediment	GBW07308 / IGGE GSD-8	-	-	8 ± 1 ng g^{-1} 0.011 μg g^{-1} 0.01 μg g^{-1}	Hall and Pelchat 1997 Li G et al. 2010 Wang et al. 2013
Stream sediment	GBW07309 / IGGE GSD-9	-	-	0.04 μg g^{-1} 41 ± 2 ng g^{-1} 0.043 μg g^{-1} 0.041 ± 0.02 μg g^{-1}	Govindaraju 1994 Hall et al 1997; Hall and Pelcaht 1997 Li G et al. 2010 Wang et al. 2013
Stream sediment	GBW07310 / IGGE GSD-10	-	-	0.09 μg g^{-1} 75 ± 5 ng g^{-1} 0.079 μg g^{-1} 0.08 ± 0.015 μg g^{-1}	Govindaraju 1994 Hall et al 1997; Hall and Pelcaht 1997 Li G et al. 2010 Wang et al. 2013
Stream sediment	GBW07311 / IGGE GSD-11	0.4 ± 0.1 μg g^{-1}	-	0.46 ± 0.01 μg g^{-1} 0.38 μg g^{-1} 445 ± 20 ng g^{-1} 0.35 ± 0.08 μg g^{-1} 0.36 ± 0.02 μg g^{-1} 0.4 ± 0.1 μg g^{-1}	Kontas et al. 1990 Govindaraju 1994 Hall and Pelchat 1997 Yang et al. 2009 Xi et al. 2010 Wang et al. 2013

Stream sediment	GBW07312 / IGGE GSD-12	0.29 µg g^{-1}	-	0.29 µg g^{-1} 350 ± 14 ng g^{-1} 0.3 ± 0.03 µg g^{-1} 0.3 ± 0.07 µg g^{-1}	Govindaraju 1994 Hall et al 1997; Hall and Pelcaht 1997 Maritz et al. 2010 Wang et al. 2013
Stream sediment	GBW07358/GSD-15	-	-	0.05 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07359/GSD-16	-	-	0.02 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07360/GSD-17	-	-	0.05 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07361/GSD-18	-	-	0.03 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07362/GSD-19	-	-	0.05 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07363/GSD-20	-	-	0.05 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07364/GSD-21	-	-	0.25 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07365/GSD-22	-	-	0.05 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07366/GSD-23	-	-	0.05 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07322/GSD-24	-	-	0.03 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07323/GSD-25	-	-	0.03 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07324/GSD-26	-	-	0.05 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07325/GSD-27	-	-	0.21 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07326/GSD-28	-	-	0.03 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07327/GSD-29	-	-	0.1 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07328/GSD-30	-	-	0.07 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07329/GSD-31	-	-	0.03 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07330/GSD-32	-	-	0.04 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07331/GSD-33	-	-	0.15 µg g^{-1}	Wang et al. 2013
Stream sediment	GBW07332/GSD-34	-	-	0.07 µg g^{-1}	Wang et al. 2013

River sediment	BCR 320	-	-	0.025 ± 0.001 mg kg^{-1} 2.1 ± 0.2 ng g^{-1}	Ivanova et al. 2001 Jacimovic et al. 2002
River sediment	NIST SRM 1645	-	-	4.53 ± 0.22 μg g^{-1} 4.13 ± 0.293 μg g^{-1}	Donaldson and Leaver 1990 Schirmer et al. 2014
River sediment	GBW07456/GSS-27	-	-	0.08 μg g^{-1}	Wang et al. 2013
River sediment	GBW07457/GSS-28	-	-	0.1 μg g^{-1}	Wang et al. 2013
River sediment	GBW07433/GSS-33	-	-	0.06 μg g^{-1}	Wang et al. 2013
River sediment	GBW07434/GSS-34	-	-	0.05 μg g^{-1}	Wang et al. 2013
Tidal flat sediment	GBW07451/GSS-22	-	-	0.04 μg g^{-1}	Wang et al. 2013
Tidal flat sediment	GBW07452/GSS-23	-	-	0.06 μg g^{-1}	Wang et al. 2013
Tidal flat sediment	GBW07453/GSS-24	-	-	0.06 μg g^{-1}	Wang et al. 2013
Urban particulate matter	NIST SRM 1648	-	-	0.99 ± 0.13 μg g^{-1}	Yang et al. 2009
Water sample	GBW(E)080548	100 μg mL^{-1} (Te(IV))	-	98 ± 2 μg mL^{-1} (Te(IV)) 97.5 ± 7.9 mg L^{-1} (Te(IV))	Huang and Hu 2008 Liu et al. 2015
Enriched water	NIST 1643c	-	2.7 ng mL^{-1} (NIST 1991)		
Enriched water	NIST 1643d	-	1 μg L^{-1} (NIST 1999)	830 ± 270 ng L^{-1} 0.9 ± 0.1 μg L^{-1} 1.1 ± 0.1 μg L^{-1}	Dressler et al. 2001 Kaplan et al. 2004 Cerutti et al. 2005
Enriched water	NIST 1643e	1.09 ± 0.11 μg L^{-1} (NIST 2004)	-	1.04 ± 0.11 μg L^{-1} 1.05 ± 0.12 ng mL^{-1} 1.02 μg L^{-1} 0.9 ± 0.05 μg L^{-1}	Pedro et al. 2008 Najafi et al. 2010 Perkins 2011 Avigliano et al. 2015
River water	NRCC SLRS-3	-	-	3.23 ± 0.29 ng L^{-1}	Olofsson et al. 2000
River water	NRCC SLRS-4	**-**	**-**	4.0 ± 0.4 pg mL^{-1} 4.4 ± 1.5 ng L^{-1} 3.79 ± 0.12 ng L^{-1}	Rodushkin et al. 2005 Rodushkin et al. 2018 Filella and Rodushkin 2018

Estuarine water	SLEW2	-	-	6 ± 2 pg mL^{-1} 9 ± 3 ng L^{-1}	Rodushkin et al. 2005 Rodushkin et al. 2018
Estuarine water	SLEW3	-	-	11 ± 3 ng L^{-1}	Rodushkin et al. 2018
Open-ocean seawater	NASS-4	-	-	46 ± 5 ng L^{-1}	Rodushkin et al. 2018
Open-ocean seawater	NASS-6	-	-	48 ± 5 ng L^{-1}	Rodushkin et al. 2018
Coastal seawater	CASS-5	-	-	45 ± 6 ng L^{-1}	Rodushkin et al. 2018
Whole milk powder	NIST SRM 8435	-	-	0.010 ± 0.002 μg g^{-1}	Kuo and Jiang 2008
Rice flour	NIST SRM 1568a	-	-	0.0013 ± 0.0004 μg g^{-1} 1.16 ± 0.08 ng g^{-1}	Kuo and Jiang 2008 Yang et al. 2013
Rice	IRMM IMEP-19	-	-	0.78 ± 0.07 ng g^{-1}	Rodushkin et al. 2008
Wheat flour	NIST SRM-1567a	-	-	0.37 ± 0.08 ng g^{-1}	Yang et al. 2013
Citrus leaves	NIST SRM 1572	-	0.02 μg g^{-1} (NIST 1982)	0.020 ± 0.004 mg kg^{-1}	Chéry et al. 2008
Spinach leaves	NIST SRM 1570a	-	-	2.96 ± 0.07 ng g^{-1}	Yang et al. 2013
Tomato leaves	NIST- SRM-1573a	-	-	39.3 ± 0.7 μg kg^{-1} 3.68 ± 0.39 ng g^{-1}	Matos Reyes et al. 2009 Yang et al. 2013
Peach leaves	NIST 1547	-	-	1.0 ± 0.1 ng g^{-1}	Rodushkin et al. 2008
Bush braches and leaves	GBW07602/GSV-1	-	-	42 ± 8 ng g^{-1}	Li G et al. 2010
Bush braches and leaves	GBW07603/GSV-2	-	-	46 ± 5 ng g^{-1}	Li G et al. 2010
Polar tree branches and leaves	GBW07604/GSV-3	-	-	40 ± 4 ng g^{-1}	Li G et al. 2010
Bush branches and Leaves	NACIS NCSDC (73349)	-	-	0.43 mg kg^{-1} 0.40 mg kg^{-1}	Mleczek et al. 2017 Siwulski et al. 2017
Tea	GBW 07605/ GSV-4	-	-	13 ± 1 ng g^{-1}	Rodushkin et al. 2008
Human hair	GBW 07601/ GSH-1	-	-	0.0011 ± 0.0001 μg g^{-1} 0.079 ± 0.005 μg g^{-1}	Rodushkin and Axelsson, 2000a Xiong and Hu 2010

Serum	Seronorm Serum Lot: MI0181	-	-	0.012 ± 0.30 ng mL^{-1} 32 ± 3 ng L^{-1}	Rodushkin et al. 2001 Rodushkin et al. 2004
Serum	Seronorm Serum Lot: JN 3299	-	-	22 ± 1 ng L^{-1}	Rodushkin et al. 2004
Urine	Seronorm Urine Lot: NO2524	-	-	99 ± 17 ng L^{-1}	Rodushkin et al. 2004
Urine	Seronorm Urine Lot: FE1113	-	-	110 ± 16 ng L^{-1}	Rodushkin et al. 2004
Bovine liver	NIST SRM 1577a	-	-	4.2 ± 1.0 ng g^{-1} 3.6 ± 0.5 ng g^{-1}	Engström et al. 2004 Pallavicini et al. 2013
Bovine muscle powder	NIST SRM 8414	-	-	0.40 ± 0.06 ng g^{-1}	Engström et al. 2004
Dog-fish muscle	DORM-2	-	-	1.8 ± 0.1 ng g^{-1}	Engström et al. 2004

Table S14. Unpublished values for reference materials used in QC/QA at Luleå (from control charts).

Values obtained in a single laboratory (ALS Scandinavia, Luleå) using microwave assisted digestion with HNO_3/HF mixture and SF-ICP-MS analysis.

Number of analysis per material varies from 20–400, these values were obtained over several years.

Reference material	Matrix	Mean ± SD
ERM-BD150	Skimmed milk powder	<0.05 ng g^{-1}
ERM-BD151	Skimmed milk powder	<0.05 ng g^{-1}
ERM-BB184	Bovine muscle	0.23 ± 0.05 ng g^{-1}
ERM-BB186	Pig kidney	0.46 ± 0.08 ng g^{-1}
ERM-BB422	Fish muscle	<0.05 ng g^{-1}
ERM-BD512	Dark chocolate	<0.05 ng g^{-1}
ERM-CD281	Rye grass	<0.05 ng g^{-1}
ERM-DB001	Human hair	0.14 ± 0.09 ng g^{-1}
BCR-274	Single cell protein	0.59 ± 0.13 ng g^{-1}
BCR-414	Plankton	5.5 ± 0.9 ng g^{-1}
BCR-482	Lichen	2.48 ± 0.19 ng g^{-1}
NIST SRM 1547	Peach leaves	0.81 ± 0.16 ng g^{-1}
NIST SRM 1549	Whole milk powder	<0.05 ng g^{-1}
NIST SRM 1567	Wheat flour	<0.05 ng g^{-1}

Abbreviations

AAS: atomic absorption spectroscopy

AFS: atomic fluorescence spectroscopy

APDC: ammonium pyrrolidine dithiocarbamate

BDL: below detection limit

CRC: collision/reaction cell

CRM: certified reference material

CSV: cathodic stripping voltametry

DL: detection limit

DLLME: dispersive liquid–liquid microextraction

ES: emission spectroscopy

ETAAS: electrothermal atomic absorption spectroscopy

ETV–ICP-MS: electrothermal vaporisation ICP-MS

GBME: graphite bar microextraction

GF: graphite furnace

HG: hydride generation

ICP-MS: inductively coupled plasma mass spectrometry

INAA: instrumental neutron activation analysis,

LA-ICP-MS: laser ablation ICP-MS

LLE: liquid liquid extraction

MSPE: magnetic solid-phase extraction

NAA: neutron activation analysis

γ-MPTMS: γ-mercaptopropyltrimethoxysilane

PN-ICP-MS: pneumatic nebulizer ICP-MS

SD: standard deviation

SF-ICP-MS: sector field ICP-MS

SRM: standard reference material

XRF: X-ray fluorescence

References

Allred AL, Rochow EG (1958). A scale of electronegativity based on electrostatic force. *Journal of Inorganic and Nuclear Chemistry* **5**, 264–268. doi:10.1016/0022-1902(58)80003-2

Andreae MO (1984). Determination of inorganic tellurium species in natural waters. *Analytical Chemistry* **56**, 2064–2066. doi:10.1021/ac00276a019

Avigliano E, Schenone NF, Volpedo AV, Goessler W, Fernández Cirelli A (2015). Heavy metals and trace elements in muscle of silverside (*Odontesthes bonariensis*) and water from different environments (Argentina): aquatic pollution and consumption effect approach. *Science of the Total Environment* **506-507**, 102–108. doi:10.1016/j.scitotenv.2014.10.119

Axelsson MD, Rodushkin I, Ingria J, Öhlander B (2002). Multielemental analysis of Mn–Fe nodules by ICP-MS: optimisation of analytical method. *Analyst* **127**, 76–82. doi:10.1039/b105706p

Ba LA, Döring M, Jarnier V, Jacob C (2010). Tellurium: an element with great biological potency and potential. *Organic & Biomolecular Chemistry* **8**, 4203–4216. doi:10.1039/C0OB00086H

Baesman SM, Stolz JF, Kulp TR, Oremland RS (2009). Enrichment and isolation of *Bacillus beveridgei* sp. nov., a facultative anaerobic haloalkaliphile from Mono Lake, California, that respires oxyanions of tellurium, selenium, and arsenic. *Extremophiles* **13**, 695–705. doi:10.1007/s00792-009-0257-z

Belzile N, Chen Y-W (2015). Tellurium in the environment: A critical review focused on natural waters, soils, sediments and airborne particles. *Applied Geochemistry* **63**, 83–92. doi:10.1016/j.apgeochem.2015.07.002

Berglund M, Wieser ME (2011). Isotopic compositions of the elements 2009 (IUPAC Technical Report). *Pure & Applied Chemistry* **83**, 397–410. doi:10.1351/PAC-REP-10-06-02

BGS (2011). London Earth Surface Soil G-BASE Dataset (British Geological Survey: Keyworth). Available at: www.bgs.ac.uk/gbase/londonearth.html [verified 17 October 2018]

Biver M, Quentel F, Filella M (2015). Direct determination of tellurium and its redox speciation at the low nanogram level in natural waters by catalytic cathodic stripping voltammetry. *Talanta* **144**, 1007–1013. doi:10.1016/j.talanta.2015.07.010

Cerutti S, Kaplan M, Moyano S, Gásquez JA, Martinez LD (2005). Determination of tellurium by ETAAS with preconcentration by coprecipitation with lanthanum hydroxide. *Atomic Spectroscopy* **26**, 125–129.

Chasteen TG, Bentley R (2003). Biomethylation of selenium and tellurium: microorganisms and plants. *Chemical Reviews* **103**, 1–25. doi:10.1021/cr010210

Chasteen TG, Fuentes DE, Tantaleán JC, Vásquez CC (2009). Tellurite: history, oxidative stress, and molecular mechanisms of resistance. *FEMS Microbiology Reviews* **33**, 820–832. doi:10.1111/j.1574-6976.2009.00177.x

Chéry CC, Herremans S, Van Lierde V, Vanhaecke F, Freitas MC, Jasekera R (2008). Ultra-micro trace element contents in spices from Sri Lanka. *Journal of Radioanalytical and Nuclear Chemistry* **276**, 143–147. doi:10.1007/s10967-007-0423-7

Chiou KY, Manuel OK (1984). Determination of tellurium and selenium in atmospheric aerosol samples by graphite furnace atomic absorption spectrometry. *Analytical Chemistry* **56**, 2721–2723. doi:10.1021/ac00278a021

Chiou KY, Manuel OK (1986). Tellurium and selenium in aerosols. *Environmental Science & Technology* **20**, 987–991. doi:10.1021/es00152a003

Chiou KY, Manuel OK (1988). Chalcogen elements in snow: relation to emission source. *Environmental Science & Technology* **22**, 453–456. doi:10.1021/es00169a014

Cordero B, Gómez V, Platero-Prats AE, Revés M, Echeverría J, Cremades E, Barragán F, Alvarez S (2008). Covalent radii revisited. *Dalton Transactions* 2832–2838. doi:10.1039/B801115J

Cunha RLOR, Gouvea IE, Juliano L (2009). A glimpse on biological activities of tellurium compounds. *Anais da Academia Brasileira de Ciências* **81**, 393–407. doi:10.1590/S0001-37652009000300006

Dolor MK, Helz GR, McDonough WF (2009). Sediment profiles of less commonly determined elements measured by Laser Ablation ICP-MS. *Marine Pollution Bulletin* **59**, 182–192. doi:10.1016/j.marpolbul.2009.03.027

Donaldson EM, Leaver ME (1990). Determination of tellurium in ores, concentrates and related materials by graphite-furnace atomic-absorption spectrometry after separations by iron collection and xanthate extraction. *Talanta* **37**, 173–183. doi:10.1016/0039-9140(90)80020-G

Dressler VL, Pozebon D, Curtius AJ (2001). Determination of Ag, Te, U and Au in waters and in biological samples by FI–ICP-MS following on-line preconcentration. *Analytica Chimica Acta* **438**, 235–244. doi:10.1016/S0003-2670(01)00861-3

Duan L-Q, Song J-M, Yuan H-M, Li X-G, Li N, Ma J (2014). Selenium and tellurium fractionation, enrichment, sources and chronological reconstruction in the East China Sea. *Estuarine, Coastal and Shelf Science* **143**, 48–57. doi:10.1016/j.ecss.2014.03.024

D'Ulivo A (1997). Determination of selenium and tellurium in environmental samples. *Analyst* **122**, 117R–144R. doi:10.1039/A704759B

Engström E, Stenberg A, Senioukh S, Edelbro R, Baxter DC, Rodushkin I (2004). Multi-elemental characterization of soft biological tissues by inductively coupled plasma–sector field mass spectrometry. *Analytica Chimica Acta* **521**, 123–135. doi:10.1016/j.aca.2004.06.030

Fadda S, Rivoldini A, Cau I (1995). ICP-MS determination of 45 trace elements in whole coal using microwave oven acid digestion for sample preparation. *Geostandards Newsletter* **19**, 41–54. doi:10.1111/j.1751-908X.1995.tb00151.x

Ferreira A, Johnson CC, Appleton JD, Flight DMA, Liste, TR, Knights KV, Ander L, Scheib C, Scheib A, Cave M, Wragg J, Fordyce FM, Lawley R (2017). London Region Atlas of Topsoil Geochemistry. (British Geological Survey: Keyworth) Available at: http://nora.nerc.ac.uk/id/eprint/516540/ [verified 21 October 2018]

Ferri T, Rossi S, Sangiorgio P (1998). Simultaneous determination of the speciation of selenium and tellurium in geological matrices by use of an iron(III)-modified chelating resin and cathodic stripping voltammetry. *Analytica Chimica Acta* **361**, 113–123. doi:10.1016/S0003-2670(98)00021-X

Filella M, Rodushkin I (2018). A concise guide for the determination of less-studied technology-critical elements (Nb, Ta, Ga, In, Ge, Te) by inductively coupled plasma mass spectrometry in environmental samples. *Spectrochimica Acta B* **141**, 80–84. doi:10.1016/j.sab.2018.01.004

Frengstad BS, Lax K, Tarvainen T, Jæger Ø, Wigum BJ (2010). The chemistry of bottled mineral and spring waters from Norway, Sweden, Finland and Iceland. *Journal of Geochemical Exploration* **107**, 350–361. doi:10.1016/j.gexplo.2010.07.001

Fujino O, Hara K, Ikejima S, Goda S (1997). Determination of tellurium in lake water by ICP-MS. *Bunseki Kagaku* **46**, 857–862. doi:10.2116/bunsekikagaku.46.857

Gerhardsson L (2015). Tellurium. In 'Handbook on the Toxicology of Metals. Fourth Edition. Volume II. Specific metals'. Chapter 54 (Eds GF Nordberg, BA Fowler, M Nordberg), pp. 1217–1228. (Academic Press: Amsterdam) doi:10.1016/B978-0-444-59453-2.00054-8

Gibbs GV, Ross NL, Cox DF, Rosso KM, Iversen BB, Spackman MA (2013). Bonded radii and the contraction of the electron density of the oxygen atom by bonded interactions. *Journal of Physical Chemistry A* **117**, 1632–1640. doi:10.1021/jp310462g

Gómez JJ, Lillo J, Sahún B (2006). Naturally occurring arsenic in groundwater and identification of the geochemical sources in the Duero Cenozoic Basin, Spain. *Environmental Geology* **50**, 1151–1170. doi:10.1007/s00254-006-0288-z

Govindaraju K (1994). 1994 compilation of working values and sample description for 383 geostandards. *Geostandards Newsletter* **18**, 1–158. doi:10.1046/j.1365-2494.1998.53202081.x-i1

Haeffler G, Klinkmüller AE, Rangell J, Berzinsh U, Hanstorp D (1996). The electron affinity of tellurium. *Zeitschrift für Physik D* **38**, 211–214. doi:10.1007/s004600050085

Hall GEM, MacLaurin AI, Pelchat JC, Gauthier G (1997). Comparison of the techniques of atomic absorption spectrometry and inductively coupled plasma mass spectrometry in the determination of Bi, Se and Te by hydride generation. *Chemical Geology* **137**, 79–89. doi:10.1016/S0009-2541(96)00156-8

Hall GEM, Pelchat J-C (1997). Determination of As, Bi, Sb, Se and Te in fifty five reference materials by hydride generation ICP-MS. *Geostandards Newsletter* **21**, 85–91. doi:10.1111/j.1751-908X.1997.tb00534.x

Hamilton EI (1974). The chemical elements and human morbidity - water, air and places - a study of natural variability. *Science of the Total Environment* **3**, 3–85. doi:10.1016/0048-9697(74)90040-03e85

Hashimoto Y, Watanabe K, Yumoto K, Sekine Y, Kim H-K, Otoshi T (1989). Tellurium as a possible tracer of coal combustion effluent. *Journal of Japan Society of Air Pollution* **24**, 45–51. doi:10.11298/taiki1978.24.45

Hein JR, Koschinsky A, Halliday AN (2003). Global occurrence of tellurium-rich ferromanganese crusts and a model for the enrichment of tellurium. *Geochimica et Cosmochimica Acta* **67**, 1117–1127. doi:10.1016/S0016-7037(02)01279-6

Huang C, Hu B (2008). Speciation of inorganic tellurium from seawater by ICP-MS following magnetic SPE separation and preconcentration. *Journal of Separation Science* **31**, 760–767. doi:10.1002/jssc.200700405

Imai N, Terashima S, Itoh S, Ando A (1996). 1996 compilation of analytical data on nine GSJ geochemical reference samples, "Sedimentary rock series". *Geostandards Newsletter* **20**, 165−216. doi:10.1111/j.1751-908X.1996.tb00184.x

Ivanova J, Djingova R, Korhammer S, Markert B (2001). On the microwave digestion of soils and sediments for the determination of lanthanides and some toxic and essential elements by inductively coupled plasma source mass spectrometry. *Talanta* **54**, 567–574. doi:10.1016/S0039-9140(00)00640-8

Jacimovic R, Lazaru A, Mihajlovic D, Ilic R, Stafilov T (2002). Determination of major and trace elements in some minerals by k0-instrumental neutron activation analysis. *Journal of Radioanalytical and Nuclear Chemistry* **253**, 427−434. doi:10.1023/A:1020421503836

Jingru A, Qing Z (1983). An analytical method of ultra-trace tellurium for samples of sea- and environmental-water. *International Journal of Environmental Analytical Chemistry* **14**, 73–80. doi:10.1080/03067318308071608

Kaplan M, Cerutti S, Moyano S, Olsina RA, Martinez LD, Gásquez JA (2004). On-Line preconcentration system by coprecipitation with lanthanum hydroxide using packed-bed filter for the determination of tellurium in water by ICP-OES with USN. *Instrumentation Science & Technology* **32**, 423−431. doi:10.1081/CI-120037674

Knockaert G (2011). Tellurium and tellurium compounds. In 'Ullmann's Encyclopedia of Industrial Chemistry'. Volume 35. pp. 685–695 (Wiley-VCH: Weinheim)

Kobayashi R (2004). Tellurium. In 'Elements and their Compounds in the Environment. Occurrence, Analysis and Biological Relevance. Volume 3: Nonmetals, particular aspects'. (Ed E Merian, M Anke, M Ihnat, M Stoeppler) pp. 1407–1414 (Wiley: Weinheim)

Kontas E, Niskavaara H, Virtasalo J (1990). Gold, palladium and tellurium in South African, Chinese and Japanese geological reference samples. *Geostandards Newsletter* **14**, 477–478. doi:10.1111/j.1751-908X.1990.tb00083.x

Krachler M, Shotyk W (2009). Trace and ultratrace metals in bottled waters: Survey of sources worldwide and comparison with refillable metal bottles. *Science of the Total Environment* **407**, 1089–1096. doi:10.1016/j.scitotenv.2008.10.014

Kramida A, Ralchenko Yu, Reader J, NIST ASD Team (2018). 'NIST Atomic Spectra Database. Version 5.5.6' (National Institute of Standards and Technology: Gaithersburg, MD) Available at: https://physics.nist.gov/asd [verified 12 July 2018]

Kumar AR, Riyazuddin P (2007). Non-chromatographic hydride generation atomic spectrometric techniques for the speciation analysis of arsenic, antimony, selenium, and tellurium in water samples - a review. *International Journal of Environmental Analytical Chemistry* **87**, 469–500. doi:10.1080/03067310601170415

Kuo C-Y, Jiang S-J (2008). Determination of selenium and tellurium compounds in biological samples by ion chromatography dynamic reaction cell inductively coupled plasma mass spectrometry. *Journal of Chromatography A* **1181**, 60–66. doi:10.1016/j.chroma.2007.12.065

Lee DS, Edmond JM (1985). Tellurium species in seawater. *Nature* **313**, 782–785. doi:10.1038/313782a0

Li Z, Tai Z, Ren W, Gao Z, Li Y (2010). Determination of rare and rare earth elements in Black Shales by inductively coupled plasma-mass spectrometry with microwave digestion [Chinese]. *Rock and Mineral Analysis* **29**, 259–262.

Li G, Wang Y, Sun Y, Dong T, Wang H (2010). Determination of Cr, Ga, In, Te and Tl in geological samples by inductively coupled plasma-mass spectrometry [Chinese]. *Rock and Mineral Analysis* **29**, 255-258.

Liu Y, He M, Chen B, Hu B (2015). Simultaneous speciation of inorganic arsenic, selenium and tellurium in environmental water samples by dispersive liquid-liquid microextraction combined with electrothermal vaporization inductively coupled plasma mass spectrometry. *Talanta* **142**, 213–220. doi:10.1016/j.talanta.2015.04.050

Matos Reyes MN, Cervera ML, de la Guardia M (2009). Determination of total Sb, Se, Te, and Bi and evaluation of their inorganic species in garlic. by hydride-generation–atomic-fluorescence spectrometry. *Analytical and Bioanalytical Chemistry* **394**, 1557–1562. doi:10.1007/s00216-009-2713-0

Meija J, Coplen TB, Berglund M, Brand WA, De Bièvre P, Gröning M, Holden NE, Irrgeher J, Loss RD, Walczyk T, Prohaska T (2016). Atomic weights of the elements 2013 (IUPAC Technical Report). *Pure & Applied Chemistry* **88**, 265–291. doi:10.1515/pac-2015-0305

Misund A, Frengstad B, Siewers U, Reimann C (1999). Variation of 66 elements in European bottled mineral waters. *Science of the Total Environment* **244**, 21–41. doi:10.1016/S0048-9697(99)00307-1

Mleczek M, Siwulski M, Rzymski P, Niedzielski P, Gąsecka M, Jasińska A, Budzyńska S, Budka A (2017). Multi-elemental analysis of *Lentinula edodes* mushrooms available in trade. *Journal of Environmental Science and Healtht B.* **52**, 196–205. doi:10.1080/03601234.2017.1261551

Muangnoicharoen S, Chiou KY, Manuel OK (1986). Determination of selenium and tellurium in the gas phase using specific columns and atomic absorption spectrometry. *Analytical Chemistry* **58**, 2811–2813. doi:10.1021/ac00126a050

Muangnoicharoen S, Chiou K-Y, Manuel OK (1988). Determination of selenium and tellurium in air by atomic-absorption spectrometry. *Talanta* **35**, 679–683. doi:10.1016/0039-9140(88)80160-7

Najafi NM, Tavakoli H, Alizadeh R, Seidi S (2010). Speciation and determination of ultra trace amounts of inorganic tellurium in environmental water samples by dispersive liquid–liquid microextraction and electrothermal atomic absorption spectrometry. *Analytica Chimica Acta* **670**, 18–23. doi:10.1016/j.aca.2010.04.059

Nogueira CW, Zeni G, Rocha JBT (2004). Organoselenium and organotellurium compounds: toxicology and pharmacology. *Chemical Reviews* **104**, 6255–6286. doi:10.1021/cr0406559

Ogra Y (2009). Toxicometallomics for research on the toxicology of exotic metalloids based on speciation studies. *Analytical Sciences* **25**, 1189–1195. doi:10.2116/analsci.25.1189

Olofsson RS, Rodushkin I, Axelsson MD (2000). Performance characteristics of a tandem spray chamber arrangement in double focusing sectorfield ICP-MS. *Journal of Anaytical and. Atomic Spectrometry* **15**, 727−729. doi:10.1039/b002609n

Pallavicini N, Ecke F, Engström E, Baxter DC, Rodushkin I (2013). A high-throughput method for the determination of Os concentrations and isotope ratio measurements in small-size biological samples. *Journal of Anaytical and. Atomic Spectrometry* **28**, 1591−1599. doi:10.1039/c3ja50201e

Pauling L (1961). 'The Nature of the Chemical Bond. An Introduction to Modern Structural Chemistry. Third edition' (Cornell University Press: Ithaca, US)

Pedro J, Stripekis J, Bonivardi A, Tudino M (2008). Determination of tellurium at ultra-trace levels in drinking water by on-line solid phase extraction coupled to graphite furnace atomic absorption spectrometer. *Spectrochimica Acta B* **63**, 86–91. doi:10.1016/j.sab.2007.11.011

Perkins WT (2011). Extreme selenium and tellurium contamination in soils - an eighty year-old industrial legacy surrounding a Ni refinery in the Swansea Valley. *Science of the Total Environment* **412-413**, 162–169. doi: 10.1016/j.scitotenv.2011.09.056

Poňavič M, Wittlingerová Z, Čoupek P, Buda J (2018). Soil geochemical mapping of the central part of Prague, Czech Republic. *Journal of Geochemical Exploration* **187**, 118–130. doi:10.1016/j.gexplo.2017.09.008

Pyykkö P (2015). Additive covalent radii for single-, double-, and triple-bonded molecules and tetrahedrally bonded crystals: A summary. *Journal of Physical Chemistry A* **119**, 2326−2337. doi:10.1021/jp5065819

Reimann C, Arnoldussen A, Englmaier P, Filzmoser P, Finne TE, Garrett RG, Koller F, Nordgulen Ø (2007). Element concentrations and variations along a 120-km transect in southern Norway - Anthropogenic vs. Geogenic vs. Biogenic element sources and cycles. *Applied Geochemistry* **22**, 851−871. doi:10.1016/j.apgeochem.2006.12.019

Reimann C, Äyräs M, Chekushin V, Bogatyrev I, Boyd R, Caritat P de, Dutter R, Finne TE, Halleraker JH, Jæger Ø, Kashulina G, Lehto O, Niskavaara H, Pavlov V, Räisänen ML, Strand T, Volden T (1998). 'Environmental Geochemical Atlas of the Central Barents Region' NGU-GTK-CKE Special Publication (Geological Survey of Norway: Trondheim, Norway) 745 pp.

Reimann C, Birke M (2010). 'Geochemistry of European Bottled Water' (Borntraeger Science Publishers: Stuttgart) 268 pp. + CDrom

Reimann C, Birke M, Demetriades A, Filzmoser P, O'connor P (eds.) (2014). Chemistry of Europe's agricultural soils. Part A: Methodology and interpretation of the GEMAS data set. *Geologisches Jahrbuch, Reihe B, Heft* **102** (Schweizerbart: Stuttgart) 528 pp.

Reimann C, Birke M, Flem B, Eggen OA. Gasser D (2018). Background values of gold, potentially toxic elements and emerging high-tech critical elements in surface water collected in a remote northern European environment. *Geochemistry: Exploration, Environment, Analysis (GEEA)* **18**, 185–195. doi:10.1144/geochem2017-090

Reimann C, Bjorvatn K, Frengstad B, Melaku Z, Tekle-Haimanot R, Siewers U (2003). Drinking water quality in the Ethiopian section of the East African Rift Valley I: Data and health aspects. *Science of the Total Environment* **311**, 65–80. doi:10.1016/S0048-9697(03)00137-2

Reimann C, Hall GEM, Siewers U, Bjorvatn K, Morlan G, Skarphagen H, Strand T (1996). Radon, fluoride and 62 elements as determined by ICP-MS in 145 Norwegian hard rock groundwater samples. *Science of the Total Environment* **192**, 1–19. doi:10.1016/0048-9697(96)05272-2

Reimann C, Siewers U, Tarvainen T, Bityukova L, Eriksson J, Gilucis A, Gregorauskiene V, Lukashev VK, Matinian NN, Pasieczna A (2003). ‘Agricultural soils in Northern Europe: A Geochemical Atlas‘ (Schweizerbart: Stuttgart) 279 pp.

Reynolds RL, Mordecai JS, Rosenbaum JG, Ketterer ME, Walsh MK, Moser KA (2010). Compositional changes in sediments of subalpine lakes, Uinta Mountains (Utah): Evidence for the effects of human activity on atmospheric dust inputs. *Journal of Paleolimnology* **44**, 161–175. doi:10.1007/s10933-009-9394-8

Rodushkin I, Axelsson MD (2000a). Application of double focusing sector field ICP-MS for multielemental characterization of human hair and nails. Part I. Analytical methodology. *Science of the Total Environment* **250**, 83–100. doi:10.1016/S0048-9697(00)00369-7

Rodushkin I, Axelsson MD (2000b). Application of double focusing sector field ICP-MS for multielemental characterization of human hair and nails. Part II. A study of the inhabitants of northern Sweden. *Science of the Total Environment* **262**, 21–36. doi:10.1016/S0048-9697(00)00531-3

Rodushkin I, Bergman T, Douglas G, Engström E, Sörlin D, Baxter DC (2007). Authentication of Kalix (N.E. Sweden) vendace caviar using inductively coupled plasma-based analytical techniques: evaluation of different approaches. *Analytica Chimica Acta* **583**, 310–318. doi:10.1016/j.aca.2006.10.038

Rodushkin I, Engström E, Sörlin D, Baxter D (2008). Levels of inorganic constituents in raw nuts and seeds on the Swedish market. *Science of the Total Environment* **392**, 290–304. doi:10.1016/j.scitotenv.2007.11.024

Rodushkin I, Engström E, Stenberg A, Baxter DC (2004). Determination of low-abundance elements at ultra-trace levels in urine and serum by inductively coupled plasma–sector field mass spectrometry. *Analytical and Bioanalytical Chemistry.* **380**, 247–257. doi:10.1007/s00216-004-2742-7

Rodushkin I, Nordlund P, Engström E, Baxter DC (2005). Improved multi-elemental analyses by inductively coupled plasma-sector field mass spectrometry through methane addition to the plasma. *Journal of Anaytical and Atomic Spectrometry* **20**, 1250–1255. doi:10.1039/b507886e

Rodushkin I, Ödman F, Holmström H (1999). Multi-element analysis of wild berries from northern Sweden by ICP techniques. *Science of the Total Environment* **231**, 53–65. doi:10.1016/S0048-9697(99)00080-7

Rodushkin I, Ödman F, Olofsson R, Axelsson MD (2000). Determination of 60 elements in whole blood by sector field inductively coupled plasma mass spectrometry. *Journal of Anaytical and. Atomic Spectrometry* **15**, 937–944. doi:10.1039/B003561K

Rodushkin I, Ödman F, Olofsson R, Burman E, Axelsson MD (2001). Multi-element analysis of body fluids by double-focusing ICP-MS. *Recent Research Developments in Pure & Applied Analytical Chemistry* **5**, 51–66.

Rodushkin I, Paulukat C, Pontér S, Engström E, Baxter DC, Sörlin D, Pallavicini N, Rodushkina K (2018). Application of double-focusing sector field ICP-MS for determination of ultratrace constituents in samples characterized by complex composition of the matrix. *Science of the Total Environment* **622–623**, 203–213. doi:10.1016/j.scitotenv.2017.11.288

Salminen R, Batista MJ, Bidovec M, Demetriades A, De Vivo B, De Vos W, Duris M, Gilucis A, Gregorauskiene V, Halamic J, Heitzmann P, Lima A, Jordan G, Klaver G, Klein P, Lis J, Locutura J, Marsina K, Mazreku A, O'Connor PJ, Olsson SÅ, Ottesen R-T, Petersell V, Plant JA, Reeder S, Salpeteur I, Sandström H, Siewers U, Steenfelt A, Tarvainen T (2005). 'Geochemical Atlas of Europe'. In 'Part 1: Background Information, Methodology and Maps' (Geological Survey of Finland: Espoo) 526 pp.

Schirmer T, Koschinsky A, Bau M (2014). The ratio of tellurium and selenium in geological material as a possible paleo-redox proxy. *Chemical Geology* **376**, 44–51. doi:10.1016/j.chemgeo.2014.03.005

Scott DR, Loseke WA, Holboke LE, Thompson RJ (1976). Analysis of atmospheric particulates for trace elements by optical emission spectrometry. *Applied Spectroscopy* **30**, 392–405.

Sekine Y, Hashimoto Y (1991). Long-range transport of airborne particulate pollutants in the Eastern Asia area. *Journal of Japan Society of Air Pollution* **26**, 216–226. doi:10.1186/s41021-015-0025-5

Sekine Y, Hashimoto Y, Nakamura T, Chen Z, Mitsuzawa S (1992). Characterization of atmospheric aerosol components at Beijing, China. *Journal of Japan Society of Air Pollution* **27**, 237–245. doi:10.1016/j.atmosenv.2015.11.020

Shannon RD (1976). Revised effective ionic radii and systematic studies of interatomic distances in halides and chalcogenides. *Acta Crystallographica A* **32**, 751–767. doi:10.1107/S0567739476001551

Siwulski M, Mleczek M, Rzymski P, Budka A, Jasińska A, Niedzielski P, Kalač P, Gąsecka M, Budzyńska S, Mikołajczak P (2017). Screening the multi-element content of *Pleurotus* mushroom species using inductively coupled plasma optical emission spectrometer (ICP-OES). *Food Analytical Methods* **10**, 487–496. doi:10.1007/s12161-016-0608-1

Slater JC (1964). Atomic radii in crystals. *Journal of Chemical Physics* **41**, 3199–3204. doi:10.1063/1.1725697 doi:10.1063/1.1725697

Šorša A, Peh Z, Halamić J (2018). Geochemical mapping the urban and industrial legacy of Sisak, Croatia,using discriminant function analysis of topsoil chemical data. *Journal of Geochemical Exploration* **187**, 155–167.

Stetzenbach KJ, Amamo M, Kreamer DK, Hodge VF (1994). Testing the limits of ICP-MS: determination of trace elements in ground water at the part-per-trillion level. *Ground Water* **32**, 976–985. doi:10.1111/j.1745-6584.1994.tb00937.x

Sugimura Y, Suzuki Y (1981). Determination of tellurium in sea water. *Papers in Meteorology and Geophysics* **32**, 163–165. doi:10.2467/mripapers.32.163

Tarvainen T, Ladenberger A, Snöälv J, Jarva J, Andersson M, Eklund M (2018). Urban soil geochemistry of two Nordic towns: Hämeenlinna and Karlstad. *Journal of Geochemical Exploration* **187**, 34–56. doi:10.1016/j.gexplo.2017.07.018

Taylor A (1996). Biochemistry of tellurium. *Biological Trace Element Research* **55**, 231–239. doi:10.1007/BF02785282

Terashima S (2001). Determination of indium and tellurium in fifty nine geological reference materials by solvent extraction and graphite furnace atomic absorption spectrometry. *Geostandards Newsletter* **25**, 127–132. doi:10.1111/j.1751-908X.2001.tb00791.x

Terashima S, Imai N, Taniguchi M, Okai T, Nishimura A (2002). The preparation and preliminary characterisation of four new geological survey of japan geochemical reference materials: Soils, JSO-1 and JSO-2; and marine sediments, JMS-1 and JMS-2. *Geostandards Newsletter* **26**, 85–94. doi:10.1111/j.1751-908X.2002.tb00626.x

Turner RJ, Borghese R, Zannoni D (2012). Microbial processing of tellurium as a tool in biotechnology. *Biotechnology Advances* **30**, 954–963. doi:10.1016/j.biotechadv.2011.08.018

van der Sloot HA, Hoede D, Wijkstra J, Duinker JC, Nolting RF (1985). Anionic species of V, As, Se, Mo, Sb, Te and W in the Scheldt and Rhine estuaries and the Southern Bight (North Sea). *Estuarine, Coastal and Shelf Science* **21**, 633–651. doi:10.1016/0272-7714(85)90063-0

Wallschläger D, Feldmann J (2010). Formation, occurrence, significance, and analysis of organoselenium and organotellurium compounds in the environment. In 'Metal Ions in Life Sciences' (Eds A Sigel, H Sigel, RKO Sigel) pp. 319–364 (Royal Society of Chemistry: Cambridge) doi:10.1039/9781849730822-00319

Wang Z, Becker H (2014). Abundances of sulfur, selenium, tellurium, rhenium and platinum-group elements in eighteen reference materials by Isotope Dilution Sector-Field ICP-MS and Negative TIMS. *Geostandards and Geoanalytical Research* **38**, 189–209.

Wang Y, Gu T, Wang X, Gao Y, Jochum KP, Müller WEG (2013). 'Practical Handbook of Reference Materials for Geoanalysis. Second edition' (Eds Y Wang, T Gu, X Wang, Y Gao, KP Jochum, WEG Müller) (Geological Publishing House: Beijing)

Watanabe K, Yumoto K, Koyama T, Sekine Y, Hashimoto Y (1989). Relationship of tellurium and selenium concentrations in airborne particulates to major emission sources. *Journal of Japan Society of Air Pollution* **24**, 208–213. doi:10.11298/taiki1978.24.208

Wu X, Song J, Li X (2014). Occurrence and distribution of dissolved tellurium in Changjiang River estuary. *Chinese Journal of Oceanology and Limnology* **32**, 444–454. doi:10.1007/s00343-014-3161-z

Xi M, Liu R, Wu P, Xu K, Hou X, Lv Y (2010). Atomic absorption spectrometric determination of trace tellurium after hydride trapping on platinum-coated tungsten coil. *Microchemical Journal* **95**, 320–325. doi:10.1016/j.microc.2010.01.009

Xiong C, Hu B (2010). Headspace trapping of the hydrides on a Pd(II)-coated graphite adsorptive bar as a microextraction method for ETV–ICP-MS determination of Se, Te and Bi in seawater and human hair samples. *Talanta* **81**, 578–585. doi:10.1016/j.talanta.2013.05.015

Yang KX, Swami K, Husain L (2009). Sensitive measurement of Se and Te in cloud water and ambient particular matter. *Spectroscopy Letters* **42**, 458–466. doi:10.1080/00387010903267179

Yang G, Zheng J, Tagami K, Uchida S (2013). Rapid and sensitive determination of tellurium in soil and plant samples by sector-field inductively coupled plasma spectrometry. *Talanta* **116**, 181–187. doi:10.1016/j.talanta.2013.05.015

Yoon BM, Shim SC, Pyun HC, Lee DS (1990). Hydride generation atomic absorption determination of tellurium species in environmental samples with *in situ* concentration in a graphite furnace. *Analytical Sciences* **6**, 561–566. doi:10.2116/analsci.6.561

Yu M-Q, Liu G-Q, Jin Q (1983). Determination of trace arsenic, antimony, selenium and tellurium in various oxidation states in water by hydride generation and atomic-absorption spectrophotometry after enrichment and separation with thiol cotton. *Talanta* **30**, 265–270. doi:10.1016/0039-9140(83)80060-5

Zannoni D, Borsetti F, Harrison JJ, Turner RJ (2008). The bacterial response to the chalcogen metalloids Se and Te. *Advances in Microbial Physiology* **53**, 1–71. doi:10.1016/S0065-2911(07)53001-8

Zhang L, Ni Z-M, Shan X-Q (1989). *In situ* concentration of metallic hydride in a graphite furnace coated with palladium – determination of bismuth, germanium and tellurium. *Spectrochimica Acta B* **44**, 751–758. doi:10.1016/0584-8547(89)80073-4

Zhou X, Lu G, Wang F, Lan Y (1997). A new polarographic adsorptive catalytic wave for the determination of trace tellurium in smog dust and wheat flour. *Microchemical Journal* **57**, 274–282. doi:10.1006/mchj.1996.1470

Zieman JJ, Holmes JL, Connor D, Jensen CR, Zoller WH, Hermann DM, Parrington JR, Gordon GE (1995). Atmospheric aerosol trace element chemistry at Mauna Loa Observatory. 1. 1979–1985. *Journal of Geophysical Research* **100**, 25979–25994. doi:10.1029/93JD03316