Tellus Geochemistry Survey
Analytes

Dermot Smyth

Analyte	*Unit*	*Detection Limit*	*Methodology*	*Capability*
Na_2O	%	0.3	WD-XRF	
MgO	%	0.3	WD-XRF	
Al_2O_3	%	0.2	WD-XRF	
SiO_2	%	0.1	WD-XRF	
P_2O_5	%	0.05	WD-XRF	
SO_3	%	0.5	WD-XRF	
Cl	%	0.05	WD-XRF	
K_2O	%	0.1	WD-XRF	
CaO	%	0.3	WD-XRF	
TiO_2	%	0.02	WD-XRF	
MnO	%	0.01	WD-XRF	
Fe_2O_3	%	0.05	WD-XRF	
Sc	ppm	2.7	WD-XRF	
V	ppm	5.0	WD-XRF	
Cr	ppm	3.0	WD-XRF	
Co	ppm	1.5	WD-XRF	
Ni	ppm	1.4	WD-XRF	
Cu	ppm	1.3	WD-XRF	
Zn	ppm	1.2	WD-XRF	
Ga	ppm	1.0	WD-XRF	
Ge	ppm	0.9	WD-XRF	
As	ppm	1.0	WD-XRF	
Se	ppm	0.2	WD-XRF	
Br	ppm	1.0	WD-XRF	
Rb	ppm	1.5	WD-XRF	
Sr	ppm	1.6	WD-XRF	
Y	ppm	1.6	WD-XRF	
Zr	ppm	5.0	WD-XRF	
Nb	ppm	0.9	WD-XRF	
Mo	ppm	0.2	WD-XRF	
Ag	ppm	0.5	ED-XRF	
Cd	ppm	0.5	ED-XRF	
In	ppm	0.5	ED-XRF	
Sn	ppm	0.5	ED-XRF	
Sb	ppm	0.5	ED-XRF	
Te	ppm	0.5	ED-XRF	
I	ppm	0.5	ED-XRF	
Cs	ppm	4.1	WD-XRF	
Ba	ppm	15.0	WD-XRF	
La	ppm	6.1	WD-XRF	
Ce	ppm	6.2	WD-XRF	
Nd	ppm	3.6	WD-XRF	
Sm	ppm	3.0	WD-XRF	
Yb	ppm	1.4	WD-XRF	
Hf	ppm	1.1	WD-XRF	
Ta	ppm	1.1	WD-XRF	
W	ppm	0.6	WD-XRF	
Tl	ppm	0.5	WD-XRF	
Pb	ppm	1.3	WD-XRF	

Bi	ppm	0.3	WD-XRF	
Th	ppm	0.7	WD-XRF	
U	ppm	0.5	WD-XRF	

XRF of Stream Sediments

Element	*Guide Detection Level*	*Capability*
Au	1ppb	
Pt	0.1ppb	
Pd	0.5ppb	
Rh	0.05ppb	

PGE in stream sediments

Element	*Guide Detection Level*	*Capability*
B	3ppm	

B in stream sediments

Analyte	*Note*	*GUIDE Detection Level*	*Capability*
Bromide	IC	0.02 mg/l	
Chloride	IC	0.05 mg/l	
Fluoride	IC	0.01 mg/l	
Nitrite -NO_2	IC	0.01 mg/l	
Nitrate -NO_3	IC	0.02 mg/l	
Sulphate -SO_4	IC	0.05 mg/l	
HPO_4	IC	0.10 mg/l	
NPOC	TIC/TOC	0.50 mg/l	

Anions in waters

Element	*GUIDE Detection Level*	*Capability*	*Element*	*GUIDE Detection Level*	*Capability*
Ag	0.05 µg/l		Mn	0.10 µg/l	
Al	0.50 µg/l		Na	0.08 mg/l	
As	0.50 µg/l		Ni	0.20 µg/l	
Au	0.10 µg/l		P	0.07 mg/l	
B	0.04 mg/l		Pb	0.05 µg/l	
Ba	0.05 mg/l		Pd	0.30 µg/l	
Be	0.03 µg/l		Pt	0.02 µg/l	
Bi	0.05 µg/l		Rb	0.03 µg/l	
Ca	0.03 mg/l		Rh	0.02 µg/l	
Cd	0.02 µg/l		SO_4	0.12 mg/l	
Co	0.02 µg/l		Sb	0.02 µg/l	
Cr	0.20 µg/l		Se	0.70 µg/l	
Cs	0.02 µg/l		Si	0.08 mg/l	
Cu	0.30 µg/l		Sr	1.00 µg/l	
Fe	0.01 mg/l		Sn	0.05 µg/l	

Hg	0.20 μg/l		Th	0.02 μg/l	
Ho	0.01 μg/l		Tl	0.01 μg/l	
K	0.10 mg/l		U	0.01 μg/l	
La	0.01 μg/l		V	0.10 μg/l	
Mg	0.06.1 mg/l		Y	0.01 μg/l	
Li	0.05 μg/l		Zn	0.50 μg/l	
Mo	0.05 μg/l		Zr	0.01 μg/l	

Trace elements in waters

Analyte	Unit	Detection Limit	Methodology
Na_2O	%	0.3	WD-XRF
MgO	%	0.3	WD-XRF
Al_2O_3	%	0.2	WD-XRF
SiO_2	%	0.1	WD-XRF
P_2O_5	%	0.05	WD-XRF
SO_3	%	0.5	WD-XRF
Cl	%	0.05	WD-XRF
K_2O	%	0.1	WD-XRF
CaO	%	0.3	WD-XRF
TiO_2	%	0.02	WD-XRF
MnO	%	0.01	WD-XRF
Fe_2O_3	%	0.05	WD-XRF
Sc	ppm	2.7	WD-XRF
V	ppm	5.0	WD-XRF
Cr	ppm	3.0	WD-XRF
Co	ppm	1.5	WD-XRF
Ni	ppm	1.4	WD-XRF
Cu	ppm	1.3	WD-XRF
Zn	ppm	1.2	WD-XRF
Ga	ppm	1.0	WD-XRF
Ge	ppm	0.9	WD-XRF
As	ppm	1.0	WD-XRF
Se	ppm	0.2	WD-XRF
Br	ppm	1.0	WD-XRF
Rb	ppm	1.5	WD-XRF
Sr	ppm	1.6	WD-XRF
Y	ppm	1.6	WD-XRF
Zr	ppm	5.0	WD-XRF
Nb	ppm	0.9	WD-XRF
Mo	ppm	0.2	WD-XRF
Ag	ppm	0.5	ED-(P)XRF
Cd	ppm	0.5	ED-(P)XRF
In	ppm	0.5	ED-(P)XRF
Sn	ppm	0.5	ED-(P)XRF
Sb	ppm	0.5	ED-(P)XRF
Te	ppm	0.5	ED-(P)XRF
I	ppm	0.5	ED-(P)XRF
Cs	ppm	4.1	WD-XRF
Ba	ppm	15.0	WD-XRF
La	ppm	6.1	WD-XRF
Ce	ppm	6.2	WD-XRF
Nd	ppm	3.6	WD-XRF

Sm	ppm	3.0	WD-XRF
Yb	ppm	1.4	WD-XRF
Hf	ppm	1.1	WD-XRF
Ta	ppm	1.1	WD-XRF
W	ppm	0.6	WD-XRF
Tl	ppm	0.5	WD-XRF
Pb	ppm	1.3	WD-XRF
Bi	ppm	0.3	WD-XRF
Th	ppm	0.7	WD-XRF
U	ppm	0.5	WD-XRF

XRF of soils

Element	Detection Level	Capability	Element	Detection Level	Capability
Au	100 ppb		Ag	2 ppb	
Al	0.01%		As	0.1 ppm	
B	1 ppm		Ba	0.5 ppm	
Be	0.1 ppm		Bi	0.02 ppm	
Ca	0.01%		Cd	0.01 ppm	
Ce	0.15 ppm		Co	0.1 ppm	
Cr	0.5 ppm		Cs	0.02 ppm	
Cu	0.01 ppm		Fe	0.01%	
Ga	0.1 ppm		Ge	0.1 ppm	
Hf	0.02 ppm		Hg	5 ppb	
In	0.02 ppm		K	0.01 %	
La	0.5 ppm		Li	0.1 ppm	
Mg	0.01%		Mn	1 ppm	
Mo	0.01 ppm		Na	0.001%	
Nb	0.02 ppm		Ni	0.1 ppm	
P	0.001%		Pb	0.01 ppm	
Rb	0.1 ppm		Re	1 ppb	
S	0.02%		Sb	0.02 ppm	
Sc	0.1 ppm		Se	0.1 ppm	
Sn	0.05 ppm		Sr	0.5 ppm	
Ta	0.05 ppm		Te	0.02 ppm	
Th	0.1 ppm		Ti	0.001%	
Tl	0.02 ppm		U	0.1 ppm	
V	2 ppm		W	0.1 ppm	
Y	0.01 ppm		Zn	0.1 ppm	
Zr	0.1 ppm				

Aqua regia package for soils (Pt and Pd are in addition)

Element	Detection Levels	Capability	Element	Detection Levels	Capability
Au	1 ppm		Ag	20 ppb	
Al	0.02%		As	0.3 ppm	
Ba	1 ppm		Bi	0.04 ppm	
Ca	0.02%		Cd	0.05 ppm	
Co	0.2 ppm		Cr	1 ppm	
Cu	0.05 ppm		Fe	0.02%	

Ga	0.02 ppm		K	0.02 %	
La	1 ppm		Mg	0.02%	
Mn	2 ppm		Mo	0.05 ppm	
Na	0.002%		Ni	0.2 ppm	
P	0.001%		Pb	0.5 ppm	
S	0.02%		Sb	0.02 ppm	
Sc	0.1 ppm		Sr	1 ppm	
Th	0.1 ppm		Ti	0.001%	
U	0.2 ppm		V	1 ppm	
W	0.1 ppm		Zn	0.5 ppm	
Be	1 ppm		Ce	0.02 ppm	
Cs	0.1 ppm		Hf	0.02 ppm	
Li	0.1 ppm		Nb	0.04 ppm	
Rb	0.1 ppm		Sn	0.2 ppm	
Ta	0.1 ppm		Y	0.1 ppm	
Zr	0.2 ppm		La	0.1 ppm	
Ce	0.02 ppm		Pr	0.1 ppm	
Nd	0.1 ppm		Sm	0.1 ppm	
Eu	0.1 ppm		Gd	0.1 ppm	
Tb	0.1 ppm		Dy	0.1 ppm	
Ho	0.1 ppm		Er	0.1 ppm	
Tm	0.1 ppm		Yb	0.1 ppm	
Lu	0.1 ppm		Se	0.1 ppm	

Multi-acid (HCl, HF, HNO_3, $HClO_4$) digestion ("Near-total") of soils

Parameter	Detection Level	Capability
SO_4	0.05%	

Add-on to soils

Element	Detection Level (ppb)	Capability
Au	1ppb	
Pt	0.5ppb	
Pd	0.5ppb	

PGE in soils