

# STANDARD BIOGEOCHEMICAL REFERENCE MATERIAL FOR Au-REE DEPOSITS

25 May 2020

UPDEEP\_JUN\_NEED\_ASH

KAVA Reference: 16329, UpDeep, Upscaling deep buried geochemical exploration techniques into European business

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## Content

1. INTRODUCTION .....	3
2. SOURCE MATERIALS.....	3
3. COMMINATION AND HOMOGENISATION PROCEDURES .....	3
4. ANALYTICAL PROGRAM.....	4
5. STATISTICAL ANALYSIS .....	5
6. PARTICIPANT LABORATORIES .....	5
Actlabs, Ancaster, Canada .....	5
ALS, Vancouver, Canada .....	7
Bureau Veritas Acmelabs, Vancouver, Canada .....	9
7. PREPARER AND SUPPLIER.....	12
8. INTENDED USE.....	12
9. STABILITY AND STORAGE INSTRUCTIONS .....	12
10. INSTRUCTIONS FOR CORRECT USE.....	13
11. HANDLING INSTRUCTIONS.....	13
12. TRACEABILITY.....	13
13. LEGAL NOTICE.....	13
14. REFERENCES .....	14

## 1. INTRODUCTION

UpDeep standard reference materials (SRM) are intended to be used in vegetation (i.e. biogeochemical) analysis for providing an affordable method of controlling the quality of plant samples for mineral exploration purposes. SRMs are produced less rigorously compared to e.g. certified reference materials. The UpDeep SRM samples do not follow the ISO standardization and are therefore not certified reference materials (CRM). However, the UpDeep standard reference materials are more affordable and can thus be inserted in the analysis sequence more frequently than CRMs. For the user of the UpDeep SRMs, the purpose is to externally quantify laboratory accuracy and precision.

## 2. SOURCE MATERIALS

UPDEEP\_JUN\_NEED\_ASH SRM is common juniper (*Juniperus communis*) needles collected on top of a Au-REE bearing quartz-hematite vein in the Mäkärä exploration target in year 2017. UPDEEP\_JUN\_NEED\_ASH is one of six reference materials (soil Ah- and B-horizon, common juniper foliage, Scots pine bark, Norway spruce bark and foliage) collected in the UpDeep project on the Mäkärä and Tiira exploration targets in northern Finland.

## 3. COMMINUTION AND HOMOGENISATION PROCEDURES

The UPDEEP\_JUN\_NEED\_ASH SRM was prepared as follows:

- sampling of the common juniper foliage samples in the field
- drying at 40°C for 48 h
- separating the needles and the twigs manually
- milling the needles with Retsch SM 300 mill using heavy metal free steel blades to 1 mm
- ashing of the milled material in 475 °C for 48 h at Labtium Oy (Kuopio, Finland)
- homogenizing the ashed material

- 0.5 g aliquots were taken from the split homogenized material to be sent to commercial analytical laboratories

## 4. ANALYTICAL PROGRAM

UPDEEP\_JUN\_NEED\_ASH SRM samples were analyzed in three geochemical analytical laboratories:

- Activation Laboratories Ltd. (Actlabs, Ancaster, ON, Canada)
- ALS Minerals/ALS Global (ALS, Vancouver, Canada through, ALS, Sodankylä, Finland)
- Bureau Veritas Minerals Acmelabs (BVAcme labs, Shaughnessy St., Vancouver, BC, Canada)

The analytical methods are presented in table 1.

*Table 1. Laboratories, analytical packages and analytical details used to analyse the UPDEEP\_JUN\_NEED\_ASH.*

Laboratory	Analytical package	pretreatment	sample weight (g)	digestion	Instrumentation	# of elements
ALS	ME-VEG41a ME-VEG41a_REE	ashing	0.25	digested in 75% aqua regia using a digestion block operating at 115°C	Agilent 725-ES (ICP-OES) ja Agilent 7900 (ICP-MS) corrected for spectral interferences	53 12
BVAcme labs	VG104-EXT-REE	ashing	0.5	modified aqua regia digestion 1:1:1 HNO <sub>3</sub> :HCl:H <sub>2</sub> O	ICP-MS/ICP-OES	63
Actlabs	2E	ashed	0.25	aqua regia at 95oC for 2 hours	Perkin Elmer Sciex ELAN 6000, 6100 or 9000 ICP/MS	63

Ten UPDEEP\_JUN\_NEED\_ASH SRM aliquots were sent to each laboratory. Tables 2, 3 and 4 present information values for the laboratory results. The RSD% values < 5 are marked as green, the  $5 \leq \text{RSD}\% \leq 15$  are marked with orange and the  $\text{RSD}\% > 15$  are marked with red. Elements having less than four observations between the detection limits are coloured grey.

## 5. STATISTICAL ANALYSIS

Analysed elements, units, lower (LDL) and upper detection limits (UDL), percentage of <LDL, >UDL and discretized values, mean, median, standard deviation (SD), relative standard deviation (RSD%) and median absolute deviation (MAD) are presented in Chapter 6. Original data, quality control monitoring results and statistical measures are available upon request.

## 6. PARTICIPANT LABORATORIES

### 6.1. Actlabs, Ancaster, Canada

Table 2. Statistics for UPDEEP\_JUN\_NEED\_ASH\_Actlabs based on 10 aliquots. LDL = lower detection limit, pct\_LDL = percent of samples under lower detection limit, UDL = upper detection limit, pct\_UDL = percent of samples over upper detection limit, pct\_discr = percent of discretized values, SD = standard deviation, RSD% = relative standard deviation percent and MAD= median absolute deviation. The RSD% values < 5 are marked as green, the  $5 \leq \text{RSD}\% \leq 15$  are marked with orange and the  $\text{RSD}\% > 15$  are marked with red. Elements having less than four observations between the detection limits are coloured grey.

element	unit	LDL_ppm	pct_LDL	UDL	pct_UDL	pct_discr	MEAN	MEDIAN	SD	RSD %	MAD
Ag	ppm	0.2	100	NA	0	100	0.15	0.15	0	0	0
Al	ppm	2	0	NA	0	0	366.8	359	33.0414	9.008	6.6717
As	ppm	3	100	NA	0	100	2.25	2.25	0	0	0
Au	ppb	5	100	NA	0	100	3.75	3.75	0	0	0
B	ppm	5	0	NA	0	0	180.6	180.5	5.1683	2.8617	7.413

Ba	ppm	3	0	NA	0	0	838.7	841	16.7998	2.0031	13.3434
Be	ppm	0.08	0	NA	0	30	0.177	0.18	0.02	11.3151	0.0222
Bi	ppm	0.05	100	NA	0	100	0.0375	0.0375	0	0	0
Ca	%	0.1	0	NA	0	30	28.03	28.1	0.5122	1.8273	0.5189
Cd	ppm	0.01	0	NA	0	70	0.384	0.385	0.0097	2.5159	0.0074
Ce	ppm	0.01	0	NA	0	0	2.972	2.97	0.0512	1.7215	0.0667
Co	ppm	0.01	0	NA	0	0	5.126	5.145	0.0912	1.779	0.126
Cr	ppm	10	100	NA	0	100	7.5	7.5	0	0	0
Cs	ppm	0.001	0	NA	0	0	0.1383	0.1415	0.007	5.0448	0.003
Cu	ppm	0.2	0	NA	0	0	47.13	47.25	0.5078	1.0775	0.3706
Dy	ppm	0.001	0	NA	0	0	0.1927	0.1925	0.0055	2.8534	0.0052
Er	ppm	0.001	0	NA	0	0	0.101	0.102	0.0052	5.1553	0.0067
Eu	ppm	0.001	0	NA	0	0	0.1454	0.145	0.0027	1.8681	0.0022
Fe	%	0.01	0	NA	0	70	0.109	0.11	0.0057	5.2078	0
Ga	ppm	0.1	100	NA	0	100	0.075	0.075	0	0	0
Gd	ppm	0.01	0	NA	0	70	0.292	0.29	0.0114	3.888	0.0148
Ge	ppm	0.1	100	NA	0	100	0.075	0.075	0	0	0
Hf	ppm	0.01	100	NA	0	100	0.0075	0.0075	0	0	0
Ho	ppm	0.001	0	NA	0	30	0.0412	0.0415	0.0017	4.0936	0.0022
In	ppb	0.2	0	NA	0	0	2.36	2.3	1.1374	48.1968	1.1861
K	%	0.01	0	NA	0	0	7.608	7.65	0.1175	1.5451	0.1112
La	ppm	0.002	0	NA	0	0	4.003	4.015	0.0673	1.6822	0.0815
Li	ppm	0.5	0	NA	0	40	9.28	9.3	0.1398	1.5069	0.1483
Lu	ppm	0.001	0	NA	0	80	0.0087	0.0085	0.0008	9.4629	0.0007
Mg	%	0.01	0	NA	0	70	1.644	1.65	0.0178	1.0805	0.0148
Mn	ppm	0.1	0	NA	0	80	11150	11150	84.9837	0.7622	74.13
Mo	ppm	0.1	0	NA	0	100	0.34	0.3	0.0516	15.1882	0
Na	%	0.01	0	NA	0	90	0.059	0.06	0.0032	5.3598	0
Nb	ppm	0.005	0	NA	0	0	0.0863	0.086	0.0055	6.3714	0.0059
Nd	ppm	0.002	0	NA	0	0	1.602	1.59	0.0529	3.3004	0.0519
Ni	ppm	5	0	NA	0	40	112.5	113	1.2693	1.1283	1.4826
Pb	ppm	0.1	0	NA	0	80	3.03	3.05	0.0823	2.7171	0.0741
Pd	ppb	3	0	NA	0	0	338	336.5	5.6174	1.662	5.1891
Pr	ppm	0.002	0	NA	0	0	0.4769	0.475	0.0128	2.6861	0.0059
Pt	ppb	2	100	NA	0	100	1.5	1.5	0	0	0
Rb	ppm	0.01	0	NA	0	0	164.4	164	3.2728	1.9907	4.4478
Re	ppb	0.1	0	NA	0	70	0.66	0.65	0.0966	14.6378	0.0741

Ru	ppb	10	100	NA	0	100	7.5	7.5	0	0	0
Sb	ppm	0.02	0	NA	0	80	0.132	0.13	0.0079	5.9758	0.0148
Sc	ppm	0.5	70	NA	0	100	0.4125	0.375	0.0604	14.6378	0
Se	ppm	10	100	NA	0	100	7.5	7.5	0	0	0
Si	%	0.2	100	NA	0	100	0.15	0.15	0	0	0
Sm	ppm	0.001	0	NA	0	0	0.2391	0.2365	0.0176	7.3491	0.0156
Sn	ppm	1	100	NA	0	100	0.75	0.75	0	0	0
Sr	ppm	0.1	0	NA	0	0	834.3	835.5	6.5668	0.7871	5.1891
Ta	ppm	0.001	0	NA	0	100	0.0027	0.003	0.0005	17.8906	0
Tb	ppm	0.001	0	NA	0	60	0.0345	0.0345	0.0014	4.1557	0.0007
Te	ppm	0.01	10	NA	0	0	8.4147	4.405	9.5401	113.3735	5.0557
Th	ppm	0.001	0	NA	0	0	0.0596	0.0605	0.0039	6.5319	0.003
Ti	ppm	1	0	NA	0	60	26.4	26	2.7568	10.4425	0
Tl	ppm	0.001	90	NA	0	90	0.0008	0.0008	0.0001	10.2009	0
Tm	ppm	0.001	0	NA	0	80	0.0126	0.013	0.0008	6.6927	0.0007
U	ppm	0.001	0	NA	0	30	0.0202	0.02	0.0016	8.0165	0.0015
V	ppm	10	100	NA	0	100	7.5	7.5	0	0	0
W	ppm	0.5	0	NA	0	80	1	1	0.0471	4.714	0
Y	ppm	0.001	0	NA	0	0	1.823	1.835	0.0452	2.481	0.0371
Yb	ppm	0.001	0	NA	0	0	0.0615	0.0615	0.0033	5.4336	0.0037
Zn	ppm	1	0	NA	0	0	419	420.5	4.2164	1.0063	5.1891
Zr	ppm	0.5	100	NA	0	100	0.375	0.375	0	0	0

## 6.2. ALS, Vancouver, Canada

Table 3. Statistics for UPDEEP\_JUN\_NEED\_ASH\_ALS based on 10 aliquots. LDL = lower detection limit, pct\_LDL = percent of samples under lower detection limit, UDL = upper detection limit, pct\_UDL = percent of samples over upper detection limit, pct\_discr = percent of discretized values, SD = standard deviation, RSD% = relative standard deviation percent and MAD= median absolute deviation. The RSD% values < 5 are marked as green, the  $5 \leq RSD\% \leq 15$  are marked with orange and the  $RSD\% > 15$  are marked with red. Elements having less than four observations between the detection limits are coloured grey.

element	unit	LDL_ppm	pct_LDL	UDL	pct_UDL	pct_discr	MEAN	MEDIAN	SD	RSD %	MAD
Ag	ppm	NA	0	NA	0	30	0.027	0.0275	0.0018	6.5327	0.0015

Al	%	NA	0	NA	0	100	0.05	0.05	0	0	0
As	ppm	NA	0	NA	0	30	0.301	0.31	0.0436	14.4772	0.0371
Au	ppm	0.0002	20	NA	0	0	0.0011	0.0006	0.0013	113.9185	0.0005
B	ppm	NA	0	NA	0	30	241.3	240.5	3.0203	1.2517	2.9652
Ba	ppm	NA	0	NA	0	30	768.5	767.5	6.1146	0.7957	5.1891
Be	ppm	NA	0	NA	0	90	0.183	0.18	0.0125	6.8397	0.0148
Bi	ppm	NA	0	NA	0	40	0.0292	0.0295	0.0012	4.2098	0.0007
Ca	%	NA	0	NA	0	60	30.34	30.35	0.2271	0.7484	0.2965
Cd	ppm	NA	0	NA	0	0	0.3685	0.367	0.0065	1.7505	0.0037
Ce	ppm	NA	0	NA	0	0	2.794	2.8	0.0493	1.7631	0.0371
Co	ppm	NA	0	NA	0	0	5.323	5.315	0.0845	1.5868	0.0741
Cr	ppm	NA	0	NA	0	0	4.977	5.08	0.1921	3.8603	0.126
Cs	ppm	NA	0	NA	0	0	0.1449	0.1465	0.0083	5.7414	0.0126
Cu	ppm	NA	0	NA	0	0	48.96	49.05	0.6041	1.2338	0.593
Dy	ppm	NA	0	NA	0	0	0.2007	0.2015	0.0069	3.4524	0.0059
Er	ppm	NA	0	NA	0	0	0.1078	0.108	0.0081	7.5464	0.0059
Eu	ppm	NA	0	NA	0	0	0.0447	0.045	0.0039	8.6355	0.003
Fe	ppm	NA	0	NA	0	80	920	900	42.1637	4.583	0
Ga	ppm	NA	0	NA	0	0	0.1135	0.1145	0.0041	3.6268	0.0052
Gd	ppm	NA	0	NA	0	0	0.2466	0.2465	0.013	5.2741	0.0096
Ge	ppm	0.005	100	NA	0	100	0.0038	0.0038	0	0	0
Hf	ppm	NA	0	NA	0	30	0.0084	0.0085	0.002	23.9414	0.0022
Hg	ppm	0.001	60	NA	0	90	0.001	0.0008	0.0004	40.7682	0
Ho	ppm	NA	0	NA	0	30	0.0406	0.04	0.002	4.9534	0.0022
In	ppm	0.005	60	NA	0	60	0.0046	0.0038	0.0013	26.9652	0
K	%	NA	0	NA	0	0	7.629	7.6	0.0695	0.9112	0.0519
La	ppm	NA	0	NA	0	0	3.766	3.765	0.0665	1.7667	0.0741
Li	ppm	NA	0	NA	0	30	9.79	9.8	0.2183	2.2301	0.1483
Lu	ppm	NA	0	NA	0	70	0.0087	0.009	0.0009	10.9044	0.0015
Mg	%	NA	0	NA	0	60	1.778	1.78	0.0162	0.9108	0.0148
Mn	ppm	NA	0	NA	0	30	10595	10600	68.516	0.6467	74.13
Mo	ppm	NA	0	NA	0	60	0.344	0.345	0.0151	4.3766	0.0148
Na	%	NA	0	NA	0	80	0.0718	0.072	0.0008	1.0986	0.0015
Nb	ppm	NA	0	NA	0	0	0.1058	0.104	0.0109	10.2557	0.0082
Nd	ppm	NA	0	NA	0	0	1.6015	1.6175	0.0455	2.8426	0.0297
Ni	ppm	NA	0	NA	0	30	111.65	111.5	1.2921	1.1573	1.4826
P	%	NA	0	NA	0	30	2.42	2.42	0.0211	0.8712	0.0297



Pb	ppm	NA	0	NA	0	40	2.724	2.705	0.0508	1.8655	0.0148
Pd	ppm	0.001	70	NA	0	100	0.0008	0.0008	0.0001	14.6378	0
Pr	ppm	NA	0	NA	0	0	0.4757	0.477	0.0201	4.2242	0.0148
Pt	ppm	0.002	40	NA	0	80	0.0021	0.002	0.0008	38.5554	0.0007
Rb	ppm	NA	0	NA	0	0	172.55	172	2.0743	1.2022	1.4826
Re	ppm	0.001	50	NA	0	100	0.0009	0.0009	0.0001	15.0585	0.0002
S	%	NA	0	NA	0	80	0.766	0.765	0.0107	1.4034	0.0074
Sb	ppm	NA	0	NA	0	30	0.137	0.14	0.0149	10.9083	0.0148
Sc	ppm	NA	0	NA	0	40	0.89	0.885	0.0221	2.4844	0.0222
Se	ppm	NA	0	NA	0	30	0.1102	0.109	0.0072	6.4988	0.0067
Sm	ppm	NA	0	NA	0	0	0.237	0.2395	0.0172	7.2566	0.0185
Sn	ppm	NA	0	NA	0	60	0.252	0.255	0.0175	6.9492	0.0222
Sr	ppm	NA	0	NA	0	0	925.4	925	8.9716	0.9695	9.6369
Ta	ppm	0.001	100	NA	0	100	0.0008	0.0008	0	0	0
Tb	ppm	NA	0	NA	0	40	0.0319	0.032	0.0016	5.0004	0.0015
Te	ppm	0.02	60	NA	0	90	0.024	0.015	0.0145	60.3807	0
Th	ppm	NA	0	NA	0	30	0.064	0.063	0.0043	6.7105	0.0022
Ti	%	NA	0	NA	0	100	0.002	0.002	0	0	0
Tl	ppm	NA	0	NA	0	70	0.0054	0.0055	0.001	17.8906	0.0007
Tm	ppm	NA	0	NA	0	70	0.0132	0.013	0.0013	9.9739	0.0015
U	ppm	NA	0	NA	0	60	0.0195	0.0195	0.0011	5.5391	0.0007
V	ppm	NA	0	NA	0	0	1.835	1.835	0.0369	2.0105	0.0445
W	ppm	NA	0	NA	0	60	1.051	1.05	0.039	3.7109	0.0445
Y	ppm	NA	0	NA	0	0	2.085	2.09	0.0506	2.4272	0.0445
Yb	ppm	NA	0	NA	0	0	0.0637	0.0645	0.0054	8.504	0.0059
Zn	ppm	NA	0	NA	0	0	428.3	428.5	3.5917	0.8386	2.9652
Zr	ppm	NA	0	NA	0	30	0.342	0.345	0.0148	4.315	0.0148

### 6.3. Bureau Veritas Acmelabs, Vancouver, Canada

Table 4. Statistics for UPDEEP\_JUN\_NEED\_ASH\_BVAcmelabs based on 10 aliquots. LDL = lower detection limit, pct\_LDL = percent of samples under lower detection limit, UDL = upper detection limit, pct\_UDL = percent of samples over upper detection limit, pct\_discr = percent of discretized values, SD = standard deviation, RSD% = relative standard deviation percent and MAD= median absolute deviation. The RSD% values < 5 are marked as green, the  $5 \leq RSD\% \leq 15$  are marked with

orange and the RSD%>15 are marked with red. Elements having less than four observations between the detection limits are coloured grey.

element	unit	LDL_ppm	pct_LDL	UDL	pct_UDL	pct_discr	MEAN	MEDIAN	SD	RSD %	MAD
Ag	PPB	2	0	NA	0	30	29.1	29	2.846	9.7802	1.4826
Al	%	0.01	0	NA	0	100	0.05	0.05	0	0	0
As	PPM	0.1	0	NA	0	40	0.5	0.55	0.17	33.9935	0.0741
Au	PPB	0.2	30	NA	0	60	0.525	0.3	0.6138	116.9228	0.2224
B	PPM	20	0	NA	0	0	200.9	199.5	9.3387	4.6484	5.9304
Ba	PPM	0.5	0	NA	0	0	778.6	782.15	11.615	1.4918	7.8578
Be	PPM	0.1	70	NA	0	70	0.0925	0.075	0.0392	42.3519	0
Bi	PPM	0.02	100	NA	0	100	0.015	0.015	0	0	0
Ca	%	0.01	0	NA	0	0	29.717	29.79	0.5792	1.9489	0.3113
Cd	PPM	0.01	0	NA	0	30	0.425	0.425	0.0232	5.4621	0.0148
Ce	PPM	0.1	0	NA	0	70	2.83	2.85	0.1059	3.7433	0.0741
Co	PPM	0.1	0	NA	0	40	5.77	5.9	0.3164	5.4836	0.1483
Cr	PPM	0.5	0	NA	0	0	4.64	4.65	0.3658	7.8827	0.4448
Cs	PPM	0.02	0	NA	0	100	0.134	0.13	0.0052	3.8537	0
Cu	PPM	0.01	0	NA	0	0	47.744	47.97	1.9368	4.0566	2.6761
Dy	PPM	0.02	0	NA	0	0	0.174	0.17	0.0241	13.8674	0.0222
Er	PPM	0.02	0	NA	0	70	0.086	0.085	0.0097	11.2336	0.0074
Eu	PPM	0.02	0	NA	0	30	0.205	0.215	0.0314	15.2967	0.0148
Fe	%	0.01	0	NA	0	80	0.108	0.11	0.0042	3.904	0
Ga	PPM	0.1	0	NA	0	90	0.31	0.3	0.0316	10.2009	0
Gd	PPM	0.02	0	NA	0	0	0.217	0.22	0.0295	13.5751	0.0148
Ge	PPM	0.1	70	NA	0	100	0.0825	0.075	0.0121	14.6378	0
Hf	PPM	0.02	100	NA	0	100	0.015	0.015	0	0	0
Ho	PPM	0.02	0	NA	0	100	0.025	0.025	0.0053	21.0819	0.0074
In	PPM	0.02	100	NA	0	100	0.015	0.015	0	0	0
K	%	0.01	0	NA	0	0	7.006	7.005	0.0818	1.1678	0.0964
La	PPM	0.5	0	NA	0	40	3.79	3.8	0.1729	4.5616	0.1483
Li	PPM	0.1	0	NA	0	0	8.8	8.8	0.3127	3.5533	0.2965
Lu	PPM	0.02	100	NA	0	100	0.015	0.015	0	0	0
Mg	%	0.01	0	NA	0	60	1.848	1.86	0.027	1.4609	0.0148
Mn	PPM	1	0	10000	100	100	12000	12000	0	0	0
Mo	PPM	0.01	0	NA	0	0	0.709	0.71	0.0348	4.9062	0.0445
Na	%	0.001	0	NA	0	60	0.0801	0.08	0.0016	1.9914	0.0015

Nb	PPM	0.02	0	NA	0	90	0.093	0.09	0.0067	7.2575	0.0074
Nd	PPM	0.02	0	NA	0	0	1.482	1.495	0.0702	4.7373	0.0741
Ni	PPM	0.1	0	NA	0	0	117.5	117.75	1.2329	1.0493	1.112
P	%	0.001	0	NA	0	0	2.3841	2.377	0.1197	5.0214	0.0956
Pb	PPM	0.01	0	NA	0	0	2.892	2.87	0.1258	4.3489	0.089
Pd	PPB	10	100	NA	0	100	7.5	7.5	0	0	0
Pr	PPM	0.02	0	NA	0	0	0.473	0.465	0.0279	5.9003	0.0297
Pt	PPB	2	30	NA	0	60	2.65	2.5	1.1797	44.5166	1.112
Rb	PPM	0.1	0	NA	0	0	159.66	158.65	4.9668	3.1109	3.3358
Re	PPB	1	70	NA	0	100	0.825	0.75	0.1208	14.6378	0
S	%	0.02	0	NA	0	50	0.62	0.62	0.0125	2.0116	0.0074
Sb	PPM	0.02	0	NA	0	100	0.12	0.12	0.0082	6.8041	0.0148
Sc	PPM	0.1	0	NA	0	80	0.68	0.7	0.0422	6.2005	0
Se	PPM	0.1	100	NA	0	100	0.075	0.075	0	0	0
Sm	PPM	0.02	0	NA	0	0	0.214	0.215	0.0212	9.9005	0.0222
Sn	PPM	0.1	0	NA	0	80	0.22	0.2	0.0422	19.1653	0
Sr	PPM	0.5	0	NA	0	0	878.29	892.6	34.952	3.9796	29.8744
Ta	PPM	0.05	100	NA	0	100	0.0375	0.0375	0	0	0
Tb	PPM	0.02	0	NA	0	100	0.034	0.03	0.0052	15.1882	0
Te	PPM	0.02	0	NA	0	70	0.043	0.04	0.0095	22.0624	0.0148
Th	PPM	0.1	100	NA	0	100	0.075	0.075	0	0	0
Ti	PPM	10	0	NA	0	0	121.2	121	4.4171	3.6445	4.4478
Tl	PPM	0.02	100	NA	0	100	0.015	0.015	0	0	0
Tm	PPM	0.02	100	NA	0	100	0.015	0.015	0	0	0
U	PPM	0.1	100	NA	0	100	0.075	0.075	0	0	0
V	PPM	2	0	NA	0	100	4	4	0	0	0
W	PPM	0.1	0	NA	0	60	0.9	0.9	0.0667	7.4074	0
Y	PPM	0.01	0	NA	0	0	1.882	1.87	0.0656	3.487	0.0371
Yb	PPM	0.02	0	NA	0	80	0.061	0.06	0.0099	16.3021	0.0148
Zn	PPM	0.1	0	NA	0	0	346.33	339.05	13.8598	4.0019	8.3026
Zr	PPM	0.1	90	NA	0	90	0.0875	0.075	0.0395	45.1754	0

## 7. PREPARER AND SUPPLIER

UPDEEP\_JUN\_NEED\_ASH SRMs are prepared by the Geological Survey of Finland (GTK) in a project Upscaling deep buried geochemical exploration techniques into European business (UpDeep) and supplied by GTK and Scandinavian Geopool.

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This activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation.

## 8. INTENDED USE

UPDEEP\_JUN\_NEED\_ASH SRM is intended to quantify laboratory accuracy and to monitor laboratory precision, drift, periodic concentration shifts, unusual breaks and outliers in analytical results of vegetation samples for mineral exploration.

## 9. STABILITY AND STORAGE INSTRUCTIONS

UPDEEP\_JUN\_NEED\_ASH SRM should be stored in a room temperature unopened in their own plastic containers. Stability of the materials is not tested.

## 10. INSTRUCTIONS FOR CORRECT USE

UPDEEP\_JUN\_NEED\_ASH SRM should be only be used to monitor the quality of ashed biogeochemical samples of the similar matrix and concentration ranges.

## 11. HANDLING INSTRUCTIONS

Keep dry and do not touch with bare hands to avoid SRM contamination.

## 12. TRACEABILITY

The analyzed SRM samples represent the entire batch of prepared SRM. All the analyzed samples have individual names and can be traced back into the original analytical results. The laboratories were chosen on the basis of the availability of the analytical services specific to plants and offered range of elements usable for mineral exploration. The laboratories have ISO/IEC 17025:2005 accreditation (ALS Minerals/ALS Global), Quality ISO9001:2008, Environmental Management: ISO14001, Safety Management OH SAS 18001 and AS4801 certificates (Bureau Veritas Minerals Acmelabs) and ISO/IEC 17025 (Activation Laboratories Ltd).

## 13. LEGAL NOTICE

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## 14. REFERENCES

Reimann, C., Filzmoser, P., Garrett, R. & Dutter, R. 2008. Quality control (QC). In: Statistical data analysis explained: applied environmental statistics with R. John Wiley & Sons Ltd, England, p. 281-299.