



**WAGENINGEN EVALUATING PROGRAMS  
FOR ANALYTICAL LABORATORIES**

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**Certificate of Analysis**



**International Soil-Analytical Exchange**

**REFERENCE MATERIAL**

**ISE sample 936**

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## General Information

In this report an overview is given of analytical data for this sample collected in our proficiency testing program. The consensus values are calculated using a robust statistical model. With this NDA model mean and standard deviation are calculated using all reported data when at least 8 results are left after removal of reported 'lower than' (<) and 0 (= zero) values. No outliers are removed.

This report is divided into three sections: Consensus Values, Indicative Values and Values for Information. The division is made on the reliability of the data. Consensus Values are based on at least 16 results while the coefficient of variation is smaller than 25 %. Indicative Values are based on at least 8 and less than 16 results or a coefficient of variation between 25 % and 50 %. Other values, based on more than 2 and less than 8 results or a coefficient of variation higher than 50 %, are given for information only.

In the sections with Consensus Values and Indicative Values the following parameters are given: mean, standard deviation, coefficient of variation, number of results, median and MAD (Median of Absolute Deviation) and the uncertainty in the consensus values. The confidence limits (at 95 % probability) are calculated for these determinands.

In the section with Information Values the following parameters are given: median, MAD and number of results. For determinands which have at least 5 results reported as smaller than (<) the median of these 'smaller than results' is calculated. In some cases this median of '<' values is much smaller than median and mean of the indicative values. This may be caused by a too optimistic (too low) value for the detection limit reported by a (small) majority of participating laboratories who report '<' -values.

All values, expressed on a weight basis (kg or %), are reported in oven dry (105 °C) material. Moisture is reported in the material as received.

## Sample information

WEPAL reference materials are from natural sources only. There is no spiking, mixing or other alterations of the samples. For sample preparation the ISE samples are dried at 40 °C and milled to pass a 0.5 mm sieve.

This ISE sample 936 of Organic Clay Soil from Germany is prepared for the WEPAL proficiency programs. The sample is used in 1 period (or round). The results on which the values in this report are based were taken from the period given in the following table.

Year	Round	Number
1993	3	3



## Consensus Values ISE 936



### Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
Al	g/kg	3.82	0.786	20.6	40	3.91	0.565	0.155	3.57	- 4.07
As	mg/kg	2.21	0.535	24.2	39	2.27	0.370	0.107	2.04	- 2.39
Ba	mg/kg	27.3	6.68	24.5	22	29.3	4.85	1.78	24.3	- 30.2
Co	mg/kg	2.47	0.484	19.6	36	2.50	0.330	0.101	2.30	- 2.63
Cu	mg/kg	5.32	0.873	16.4	86	5.40	0.600	0.118	5.14	- 5.51
Fe	g/kg	5.04	0.735	14.6	63	5.10	0.500	0.116	4.85	- 5.22
Mg	mg/kg	763	150.6	19.7	56	795	106.5	25.2	723	- 803
Mn	mg/kg	324	25.5	7.9	65	324	17.0	3.9	318	- 330
N	g/kg	0.380	0.0817	21.5	64	0.400	0.0600	0.0128	0.359	- 0.400
P	mg/kg	325	43.0	13.2	57	330	30.0	7.1	314	- 336
Pb	mg/kg	13.6	1.76	12.9	72	13.9	1.15	0.26	13.2	- 14.0
Zn	mg/kg	33.4	3.96	11.9	91	33.6	2.70	0.52	32.6	- 34.2

### Method: Extraction with boiling 2M HNO3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
Co	mg/kg	2.15	0.184	8.6	27	2.10	0.120	0.044	2.07	- 2.22
Cr	mg/kg	5.47	0.534	9.7	31	5.50	0.380	0.120	5.28	- 5.67
Cu	mg/kg	4.65	0.498	10.7	34	4.50	0.355	0.107	4.48	- 4.82
Ni	mg/kg	2.93	0.411	14.0	31	2.90	0.300	0.092	2.78	- 3.08
Pb	mg/kg	12.9	1.16	9.0	33	13.0	0.80	0.25	12.5	- 13.3
Zn	mg/kg	30.1	2.05	6.8	33	30.1	1.40	0.45	29.4	- 30.8

### Method: Extraction with 0.1M NaNO3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
Zn	µg/kg	606	125.1	20.6	18	616	84.0	36.8	545	- 668

### Method: Extraction with 0.01M CaCl2 1:10

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
K	mg/kg	47.8	5.20	10.9	20	48.9	3.50	1.45	45.4	- 50.2

### Method: Soil characteristics

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
pH - CaCl2	...	5.55	0.302	5.4	38	5.56	0.210	0.061	5.46	- 5.65
pH - H2O	...	6.07	0.272	4.5	69	6.10	0.190	0.041	6.00	- 6.13
pH - KCl	...	5.52	0.429	7.8	38	5.59	0.300	0.087	5.38	- 5.66



### Consensus Values ISE 936

Method: Phosphorus and related analysis

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
P - Bray (as P)	mg/kg	102	21.6	21.2	17	100	14.0	6.5	90.7	-	113



## Indicative Values ISE 936



### Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Ca	g/kg	2.78	0.448	16.1	8	2.96	0.335	0.198	2.42	-	3.15
Fe	g/kg	6.77	0.244	3.6	10	6.81	0.190	0.096	6.60	-	6.94
K	mg/kg	11800	1110	9.4	11	12100	760	420	11070	-	12540
Mg	mg/kg	1380	250	18.1	8	1440	187	111	1177	-	1585
Mn	mg/kg	366	39.4	10.8	9	364	28.7	16.4	336	-	396
Na	mg/kg	4750	580	12.2	9	4640	410	242	4313	-	5188
Zn	mg/kg	44.2	4.23	9.6	10	44.1	2.82	1.67	41.2	-	47.1

### Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Ca	g/kg	0.855	0.3344	39.1	51	0.930	0.2400	0.0585	0.761	-	0.949
Cr	mg/kg	8.45	2.465	29.2	74	8.84	1.735	0.358	7.88	-	9.02
Hg	µg/kg	38.1	13.48	35.3	32	40.0	10.00	2.98	33.3	-	43.0
K	mg/kg	856	294.5	34.4	49	890	210.0	52.6	772	-	941
Ni	mg/kg	3.88	1.352	34.9	60	3.97	0.990	0.218	3.53	-	4.23
S	mg/kg	77.5	22.43	29.0	16	78.9	16.10	7.01	65.6	-	89.4
Sr	mg/kg	9.73	1.599	16.4	9	10.00	1.000	0.666	8.52	-	10.9

### Method: Extraction with boiling 2M HNO<sub>3</sub>

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Cd	mg/kg	0.117	0.0354	30.1	28	0.115	0.0250	0.0084	0.104	-	0.131
Hg	µg/kg	25.8	12.49	48.5	19	30.0	10.00	3.58	19.8	-	31.7
Mo	mg/kg	0.141	0.0431	30.6	11	0.150	0.0300	0.0162	0.112	-	0.170
Tl	mg/kg	0.0612	0.0135	22.1	10	0.0600	0.0100	0.0053	0.0517	-	0.0707

### Method: Extraction with 0.1M NaNO<sub>3</sub>

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Cd	µg/kg	3.14	1.220	38.9	16	3.00	0.900	0.381	2.49	-	3.79
Cu	µg/kg	26.6	12.88	48.4	18	27.0	9.50	3.80	20.3	-	33.0

### Method: Extraction with 0.01M CaCl<sub>2</sub> 1:10

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Mg	mg/kg	22.1	5.77	26.1	20	23.7	3.92	1.61	19.4	-	24.8
N - NO <sub>3</sub> (as N)	mg/kg	22.3	4.70	21.0	13	21.2	3.20	1.63	19.5	-	25.2
P	mg/kg	3.20	0.923	28.8	16	3.24	0.605	0.288	2.71	-	3.69
Zn	µg/kg	3040	1205	39.7	10	3170	806	476	2190	-	3880



## Indicative Values ISE 936

### Method: Soil characteristics

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Org.matter (L.O.I.)	%	1.08	0.428	39.5	15	1.10	0.300	0.138	0.848	-	1.32
Fraction < 2 µm	%	5.43	1.930	35.6	13	6.00	1.300	0.669	4.27	-	6.58

### Method: Fluoride (Swiss standard procedure)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
F - Total	mg/kg	89.7	7.13	7.9	12	90.5	4.50	2.57	85.2	-	94.2

### Method: Water soluble 1:10 (w/v) (EN-12457-4)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
F	mg/kg	9.04	1.745	19.3	8	9.05	1.100	0.771	7.62	-	10.5

### Method: Phosphorus and related analysis

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
P - Olsen (as P)	mg/kg	38.3	10.54	27.5	30	38.5	7.50	2.40	34.4	-	42.2



## Informative Values ISE 936



### Method: Real totals

Element	Unit	Median	MAD	N
Al	g/kg	21.9	0.15	6
Ba	mg/kg	334	37.5	4
Co	mg/kg	16.1	12.90	3
Cr	mg/kg	25.2	1.20	5
Cu	mg/kg	27.0	18.00	7
Hg	µg/kg	30.0	5.00	4
Ni	mg/kg	29.6	20.50	4
P	mg/kg	382	33.0	7
Pb	mg/kg	28.0	1.00	3
Rb	mg/kg	63.0	6.00	3
Si	g/kg	422	11.5	4
Sr	mg/kg	80.6	38.05	4
Zr	mg/kg	248	38.0	3

### Method: Acid extractable (So-called totals)

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
B	mg/kg	8.00	5.750	16		
Cd	mg/kg	0.190	0.0700	43	0.315	32
Mo	mg/kg	0.290	0.1050	6	1.000	13
Na	mg/kg	52.2	26.80	41		
Sb	mg/kg	0.485	0.3050	6		
Se	mg/kg	0.0900	0.0200	4		
Sn	mg/kg	2.00	1.550	5	5.00	10
V	mg/kg	14.0	0.60	6		
Y	mg/kg	11.1	7.63	3		

### Method: Extraction with 0.1M NaNO3

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
Ni	µg/kg	16.0	6.00	15		
Pb	µg/kg	1.000	-	4	10.000	16

### Method: Extraction with 0.01M CaCl2 1:10

Element	Unit	Median	MAD	N
B	µg/kg	0.420	0.3500	3



**Informative Values ISE 936**



Cu	µg/kg	100.0	10.00	6
Fe	mg/kg	0.500	0.2000	5
Mn	mg/kg	22.4	7.68	10

**Method: Extraction with 0.01M CaCl2 1:10** (cont.)

Element	Unit	Median	MAD	N
N - NH4 (as N)	mg/kg	3.80	1.845	10
Na	mg/kg	8.74	6.140	13

**Method: Soil characteristics**

Element	Unit	Median	MAD	N
TIC=Tot.Inorg C(as CaCO3)	%	1.51	1.050	10
EC-SC (ISO 11265)	mS/m	10.10	3.900	27

**Results smaller than (<)**

Median of <	N
0.500	6

**Method: Other determinations**

Element	Unit	Median	MAD	N
CN - Total	mg/kg	0.680	0.4800	3

**Results smaller than (<)**

Median of <	N
1.000	8