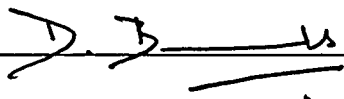


NGU Report 97.106

Soil geochemistry of the Bleikvassli area (Status  
Report No. 3). Detailed investigations of the  
Grasvatnet area.

Report no.: 97.106		ISSN 0800-3416	Grading: Confidential until 01.01.2000	
Title: Soil geochemistry of the Bleikvassli area (Status Report No. 3). Detailed investigations of the Grasvatnet area.				
Authors: Krog, Reidar		Client: NGU and Bleikvassli Gruber		
County: Nordland		Commune: Hemnes		
Map-sheet name (M=1:250.000) Mo i Rana		Map-sheet no. and -name (M=1:50.000) Storakersvatnet 2027 III		
Deposit name and grid-reference:		Number of pages: 44	Price (NOK):	
		Map enclosures:		
Fieldwork carried out: 1993-1996	Date of report: 20.06.97	Project no.: 2543.29	Person responsible: 	
Summary:  A combined geological, geophysical and geochemical exploration project aimed at finding new ore reserves in the vicinity of the Bleikvassli mine, Nordland county was initiated by NGU in 1993. A number of the anomalous areas detected during this regional survey were followed up with more detailed investigations. One of these was the Grasvatnet area where detailed geological mapping revealed sulphide-impregnations with restricted thickness and extent. Deep geophysical anomalies (Transient Field EM) are connected with these mineralisations and this report deals with the results of detailed soil sampling around the mineralisations and geophysical anomalies.				
Emneord: Geochemistry	Till		Massive sulfides	
Exploration	Anomaly		Pb, Zn, Cu, Au	
Soil	Weathered material			

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14	Map of Ca-values in the Grasvatnet area
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## 1 INTRODUCTION

A combined geological, geophysical and geochemical exploration project aimed at finding new ore reserves in the vicinity of the Bleikvassli mine in the county of Nordland was initiated by NGU in 1993. A regional soil sampling survey was carried out as part of this project and is described in NGU Report No. 95.155. (Krog 1995a). One of the anomalous areas discovered during this regional survey, the Grasvatnet area, was followed up in 1994 with the collection of 15 new soil samples. Following this, further investigations were carried out in this area in 1996 in the form of ground geophysics (Dalsegg 1996b), geological studies (Bjerkgård & Larsen 1996) and 205 new soil samples. The results of the soil sampling carried out in 1996 are described in this report. The term «soil» is used by NGU for both organic soil and inorganic overburden, although in this study, soil samples consisted of till and weathered material.

## 2 METHODS

The regional soil samples collected in 1993 and the follow-up samples collected in 1994 were taken with a spade from a depth of 0.4 m or, if the soil was of insufficient thickness, at the base of the soil, as close to the bedrock as possible. The follow-up samples taken in 1996 were collected on 14 traverses; from traverse 1601-1609 to traverse 1764-1805 (the numbers refer to the sample numbers within each traverse as shown in Appendix 2). These samples were taken using a hand auger from the base of the soil or at a maximum depth of 1.3 m. Sample spacing was 25-50 m. Soil samples were taken where possible in the c-horizon. In much of the sampling area, however, a c-horizon is not present and the samples were therefore largely taken from the b-horizon. Only soil consisting of till and weathered material was sampled. Humus, peat, marine deposits, fluvial or glacial-fluvial sediments were not sampled. The sample weight was 1 kg in 1993 - 94 and 0.1 kg when using the auger in 1995-96. Sample bags were made of high wet-strength paper and special waterproof adhesives. The equipment was free from heavy metal contamination.

The samples were dried at about 40°C for 2-3 weeks. The <0.06 mm fraction (dry sieving) of the samples was analysed after having been numbered in a random order. Two analytical methods and laboratories were used:

ICP-AES analysis at NGU's laboratories. Determination of 31 elements. Samples were analysed using a Thermo Jarrel Ash ICP 61 after partial extraction of a 1 gram sample with 7 N HNO<sub>3</sub> according to NS 4770.

### Gold (Au) analysis at ACME Analytical laboratories LTD.

20 gram sample, fire assay and analysis by ICP/graphite furnace. Only the samples collected in 1993 and 1994 were analysed for Au.

## **3 SULPHIDE MINERALISATIONS AND GEOPHYSICAL ANOMALIES**

Sulphide mineralisations (Bjerkgård & Larsen 1996) and deep geophysical anomalies (Transient Field EM) (Dalsegg 1996 b) were found in several places in the Grasvatnet area (Appendices 2 and 3). The northernmost of these mineralisations occurs in thin lenses located very close to the site of the soil sample anomaly from 1993. The mineralisation is of skarn-type with on average 2.2 % Cu, 0.2 % Pb, 0.6 % Zn, 23 ppm Ag and 230 ppb Au. These values are consistent with the soil anomaly values of 400 ppm Cu and 59 ppb Au.

About 1.5 km SSE of this mineralisation is a pyrite-impregnated quartz-sericite schist. This mineralisation is between 30 and 100 m thick and can be followed for about 700 m along strike direction. The content of pyrite varies between 5 and 20 % and the base metal concentrations are very low (maximum 100 ppm).

About 2.5 km further south, at Rabotsbekken, is a mineralised zone (about 10 m thick and 250 m long in the direction of strike) where three different types of mineralisation can be observed. Samples from the mineralised zones indicate an average composition of approximately 0.1 % As, 0.3 % Zn, 0.3 % Cu, 0.3 % Pb and 23 ppm Ag but they all have very low concentrations of Au. This mineralised zone also produces a Transient Field EM (TFEM) geophysical anomaly at the surface in the area of the mineralisation.

Several other TFEM-anomalies were located below the surface (25 - 200 m) in the area between the pyrite and the Rabotsbekken mineralisations (Appendix 2).

## **4 RESULTS**

The analytical results, field numbers and UTM co-ordinates of the 238 samples from the Grasvatnet area are listed in Appendix 35. The minimum, maximum, median, arithmetic average and standard deviation values for the analyses of 746 samples taken from the Bleikvassli region in 1993 are listed for comparison in Appendix 34.

Appendices 3 to 33 contain geochemical maps at a scale of 1:30 000 for the following elements: Pb, Zn, Cu, Au, B, Ba, Be, C, Ca, Cd, Ce, Co, Cr, Fe, K, La, Li, Mg, Mn, Mo, Ni, P, Sc, Sr, Ti, V, Zr, Y. The maps are produced as single-element maps using a series of symbols for different ranges of analytical values based on the following percentiles of the values of the 746 regional samples: 25, 50, 75, 95, 98 and 99 %. However, the symbol values used for Cd and Au are different as these elements are present in much lower concentrations. The values for Ag were not plotted as no values were recorded for this element above the detection limit whilst the values for Si, Al and Na were also not plotted because only a very small proportion of the total content of these elements is extractable with 7 N HNO<sub>3</sub> according to NS4770.

Using reference samples and re-analysed samples, the repeatability of the analytical determinations was found to be better than +/- 10 % at the 95 % confidence level. The repeatability (including re-sampling and re-analysis) of an analytical value on re-sampling at a 25 m interval in the background area is assumed to be approximately +/- 25 to 40 % (based on the results of the traverses 1619-1627, 1618-1610, 1601-1609, 1737-1745, 1754-1746, 1755-1763, 1805-1764).

## 5 DISCUSSION

Till and peat cover the area around the three northernmost traverses (1601-1609, 1610-1618, 1619-1627). Soil was sampled in an attempt to determine the length of the skarn-mineralisation which is observed about 300 m NW of these traverses (Appendix 2). However, the base metal concentrations measured in samples taken from these traverses are low (see Appendices 4, 6 and 8) and no influence of sulphide mineralisation on the samples is readily apparent. An exception may be the 13 ppb Au content of sample no. 836, collected in 1994 and situated close to traverse 1619-1627 (Appendices 2 and 10). This may be a coincidence but given that:

- a) the next three traverses (1737-1763) contain three values of 10, 14 and 443 ppb Au,
- b) the direction of ice movement and the terrain slope are towards north and that
- c) only 9 of 746 regional samples collected in 1993 contained 13 ppb or more Au,

it is possible that the Au-mineralisation may be traced for more than 1.5 km in a southerly direction along the strike. However, the base metal analyses suggest that at least the Cu-concentration and possibly all of the base metals concentrations are strongly reduced in the southern part of this zone.

The traverses 1863-1868 and 1677-1682 are located close to and below the eastern slope of the pyrite mineralization (Appendix 2). The analyses of the soil from these traverses confirmed the lack of base metals observed during the mineralogical studies of the pyrite mineralisation (Bjerkgård & Larsen 1996).

The six traverses 1650-1676, 1713-1689, 1714-1736, 1649-1639, 1628-1638 and 1805-1764 are situated below, close to or on the eastern slope (ca. 20 degrees inclination) of the Rabotsbekken mineralisation and the TFEM anomalies. Several enhanced Zn-values come from the area on the north-eastern side of the mineralisation. Given the direction of ice movement and the slope, these values are interpreted as the result of the influence of the Rabotsbekken mineralisation. One Cu-value (200 ppm) is also interpreted to be the result of this mineralisation.

One sample from the northern end of traverse 1650-1676 contains 209 ppm Cu and enhanced values of a large number of other elements (Be, Ca, Co, Cr, Li, Mg, Mn, Ni, Sc, Sr and Zr). These enhanced values in the Bleikvassli area are generally not due to sulphide mineralisation but rather to carbonate-rich lithologies (Krog 1995a and b). This interpretation is supported by an examination of the geological map of the Grasvatnet area (Bjerkgård & Larsen 1996), where the northern end of traverse 1650-1676 is the only location within the Grassvatnet area where a calcite marble deposit coincides with sampling localities. For this reason none of the concentration levels measured in samples from the Grasvatnet area (including the elevated Cu-value) seem to be of use as indicators of mineralisation.

## **6 CONCLUSIONS**

Analysis of soil samples taken in 1996 from the Grassvatnet area have not produced any high values which can be interpreted as originating from an unknown mineralisation.

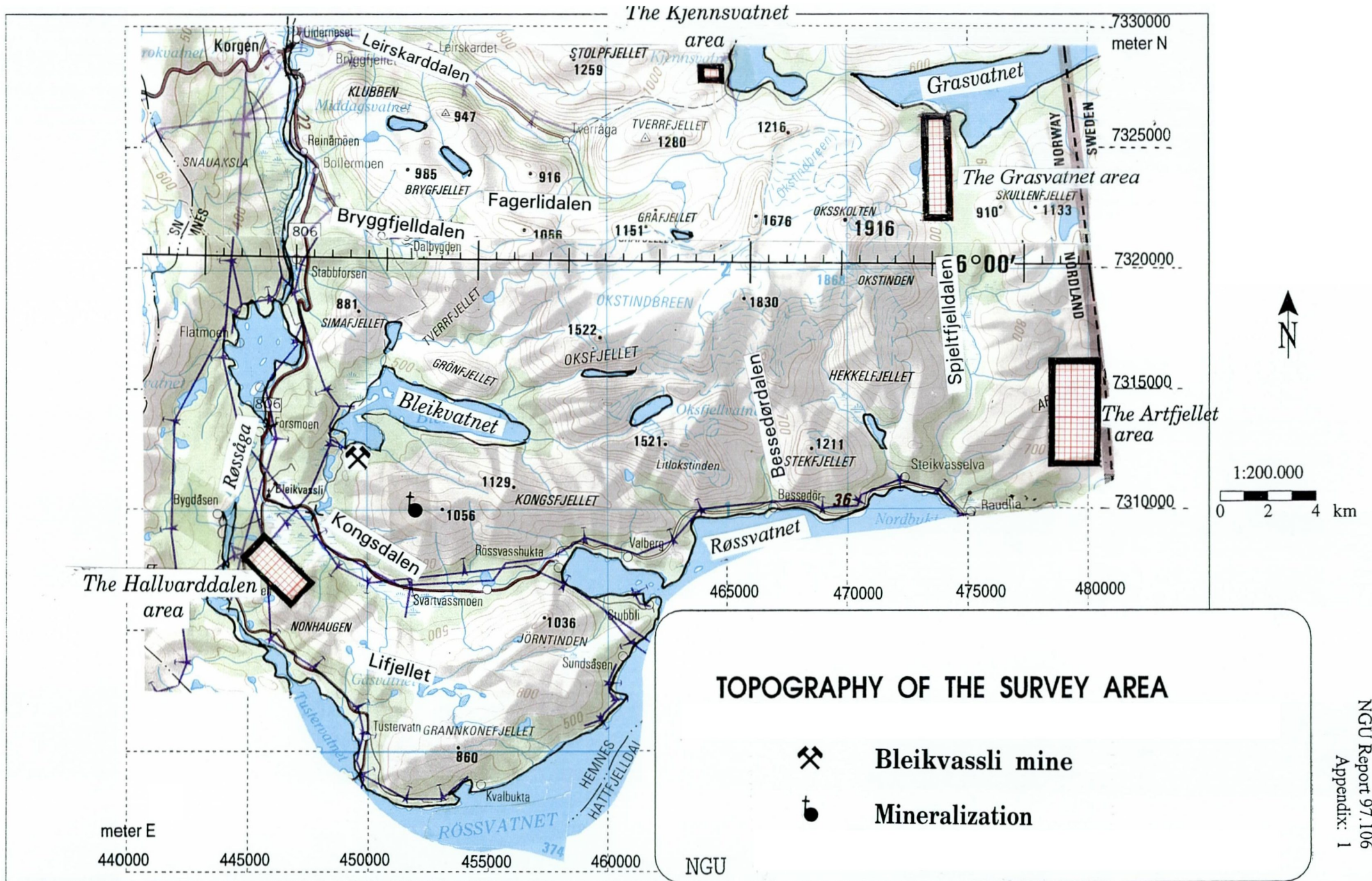
A limited number of enhanced Au-concentrations south of a skarn-type mineralisation in the study area indicate that this mineralisation may be traced for more than 1.5 km along the strike direction.

## **7 REFERENCES**

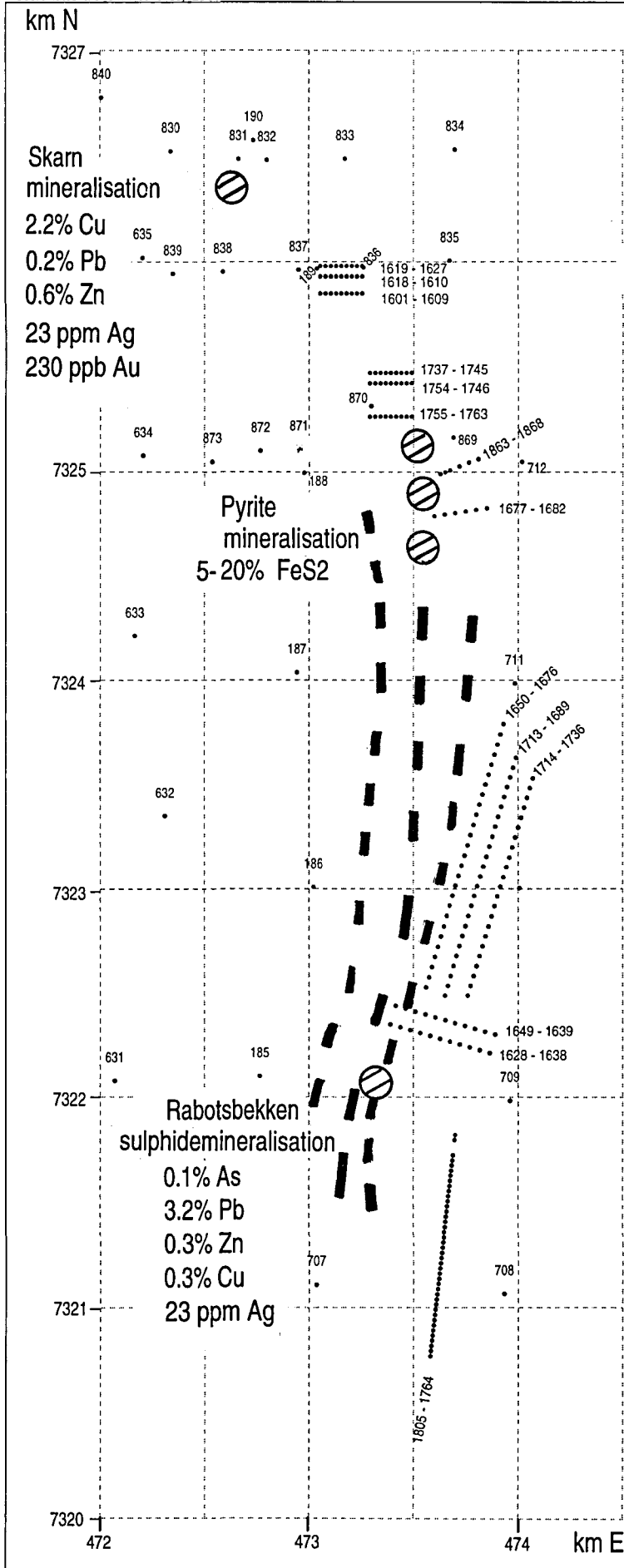
Bjerkgård, T., Larsen, R.B. & Marker, M. 1995. Regional Geology of the Okstindene Area, the Rödingsfjäll Nappe Complex, Nordland, Norway. NGU Report 95.153



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Coordinates are UTM zone 35, ED50



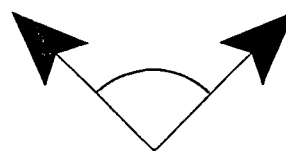
## GRASVATNET 1996

# FIELD NUMBERS, MINERALISATIONS, TFEM ANOMALIES

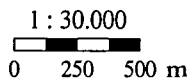
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COLLECTED 1993-1994 (33 SAMPLES)

SAMPLES NUMBERED 1601-1805  
COLLECTED 1996 (205 SAMPLES)

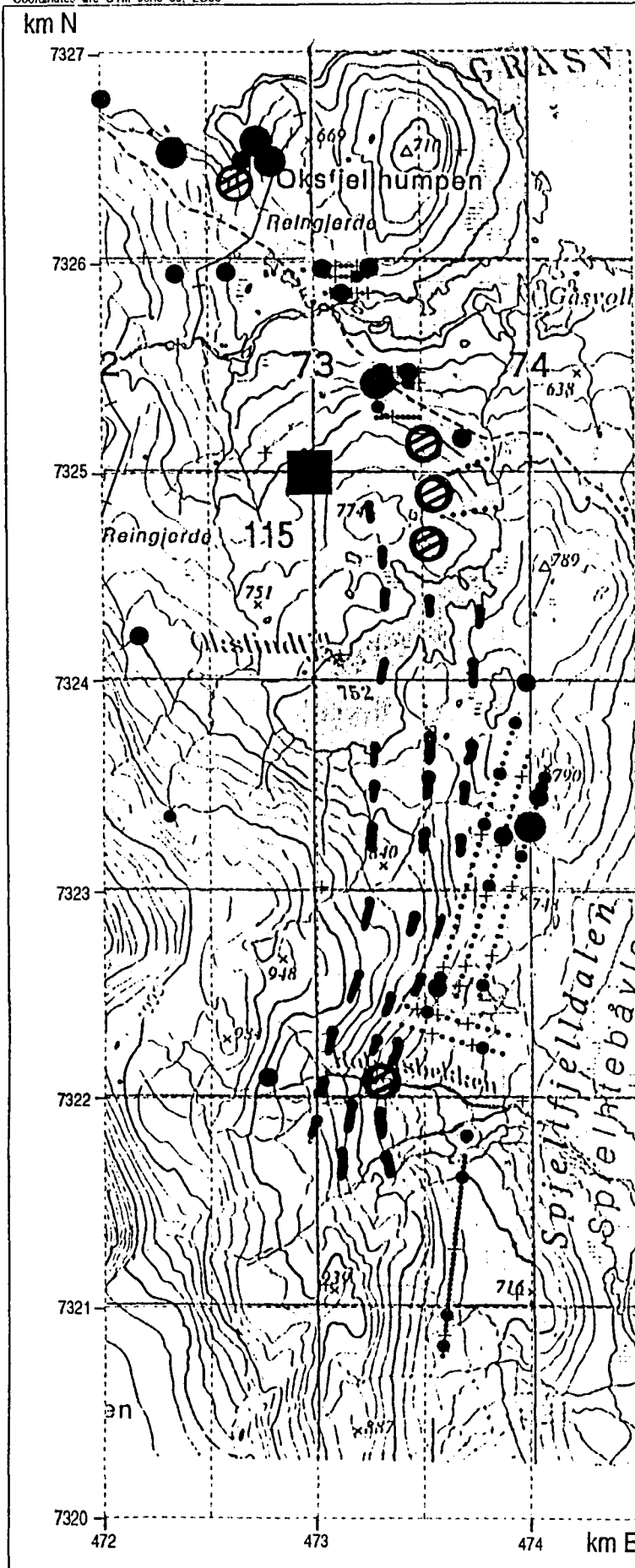
-  MINERALIZATION
-  TFEM ANOMALIES



*Direction of ice  
movement*



Coordinates are UTM zone 35, ED50



# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES

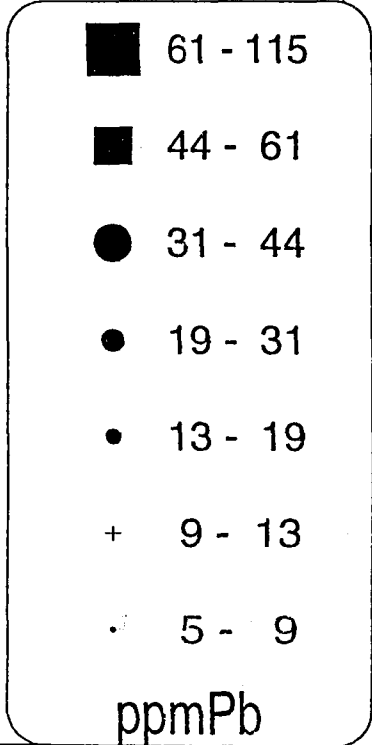
1 : 30.000  
0 250 500 m



 MINERALIZATION

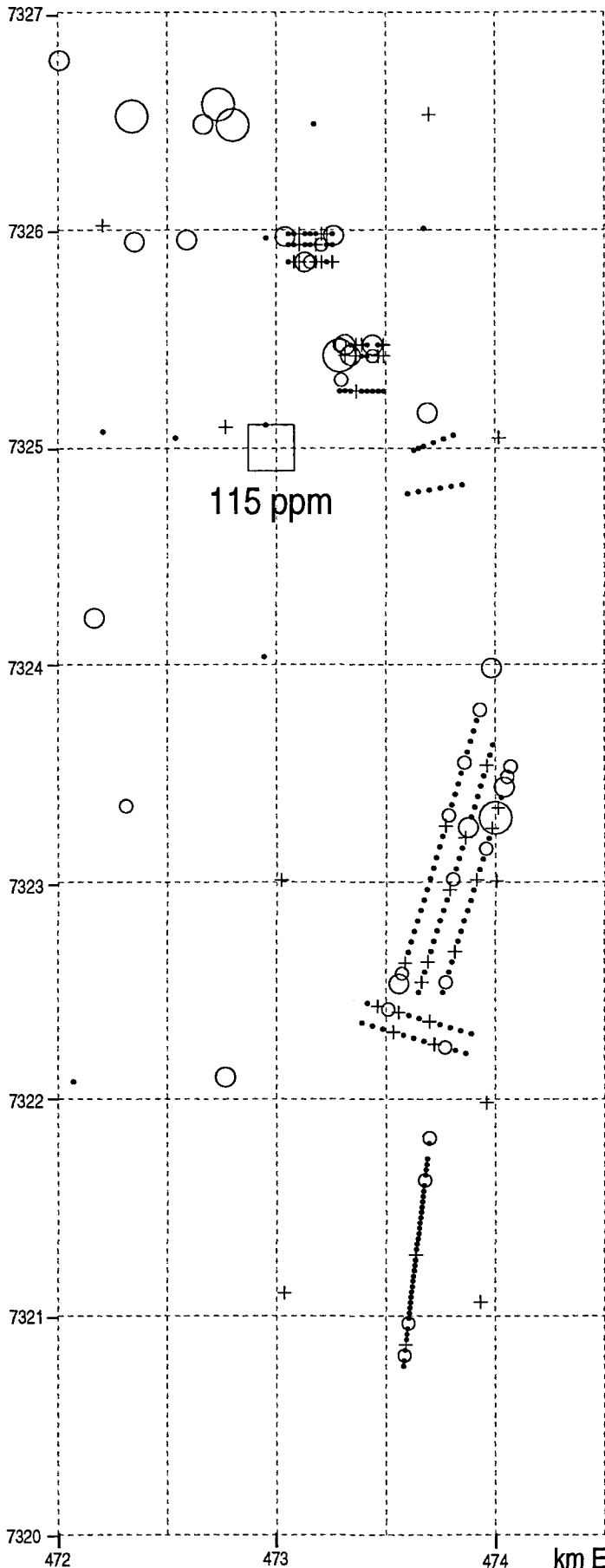
 TFEM ANOMALIES

SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES



Coordinates are UTM zone 35, ED50

km N



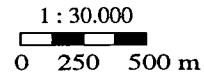
# GRASVATNET 1996

SOIL SAMPLES: 238

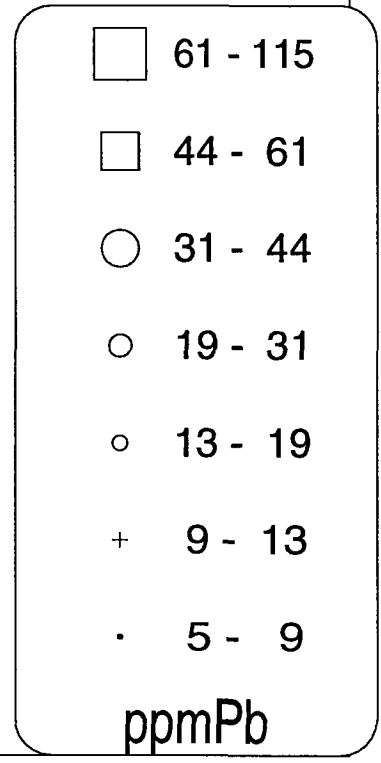
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EXTRACTION: HNO<sub>3</sub>

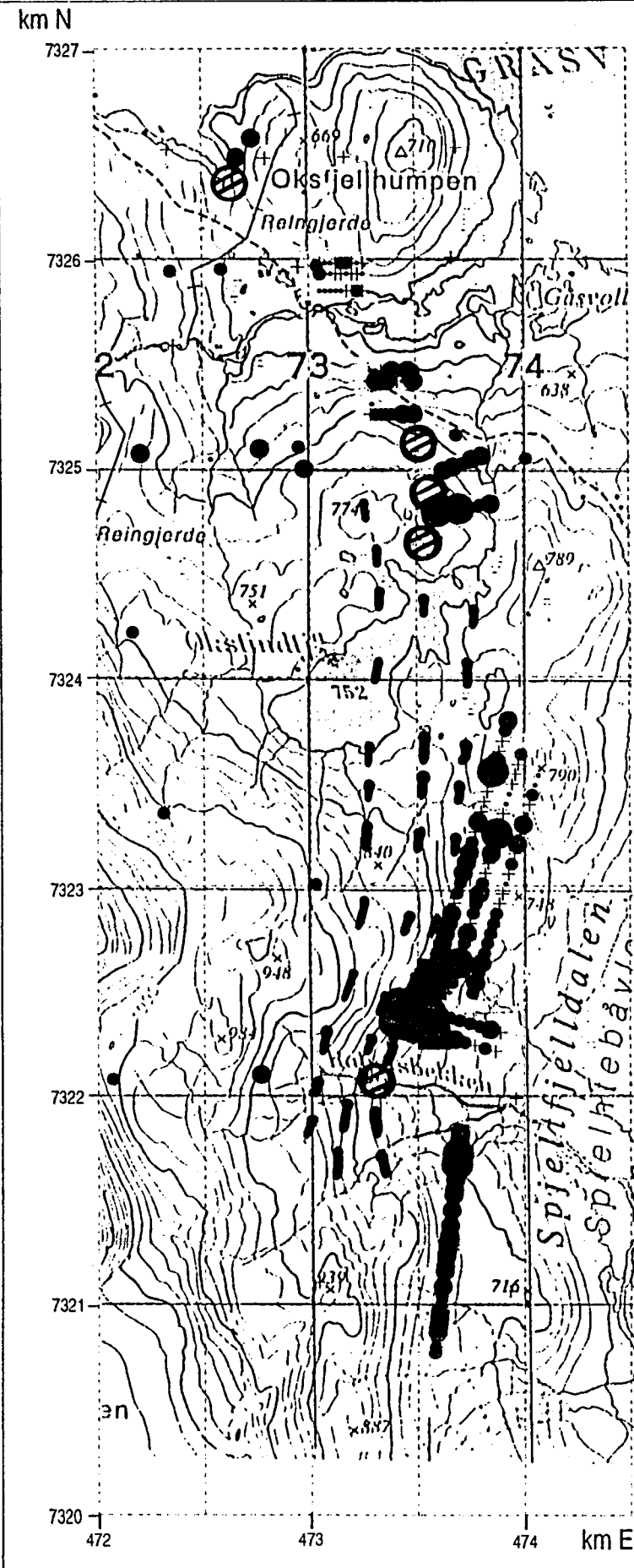
ANALYSIS: ICP-AES



SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES



Coordinates are UTM zone 35, ED50



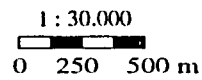
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SOIL SAMPLES : 238

FRACTION : -0.06 MM

EXTRACTION : HNO<sub>3</sub>








ANALYSIS : ICP-AES



 MINERALIZATION

 TFEM ANOMALIES

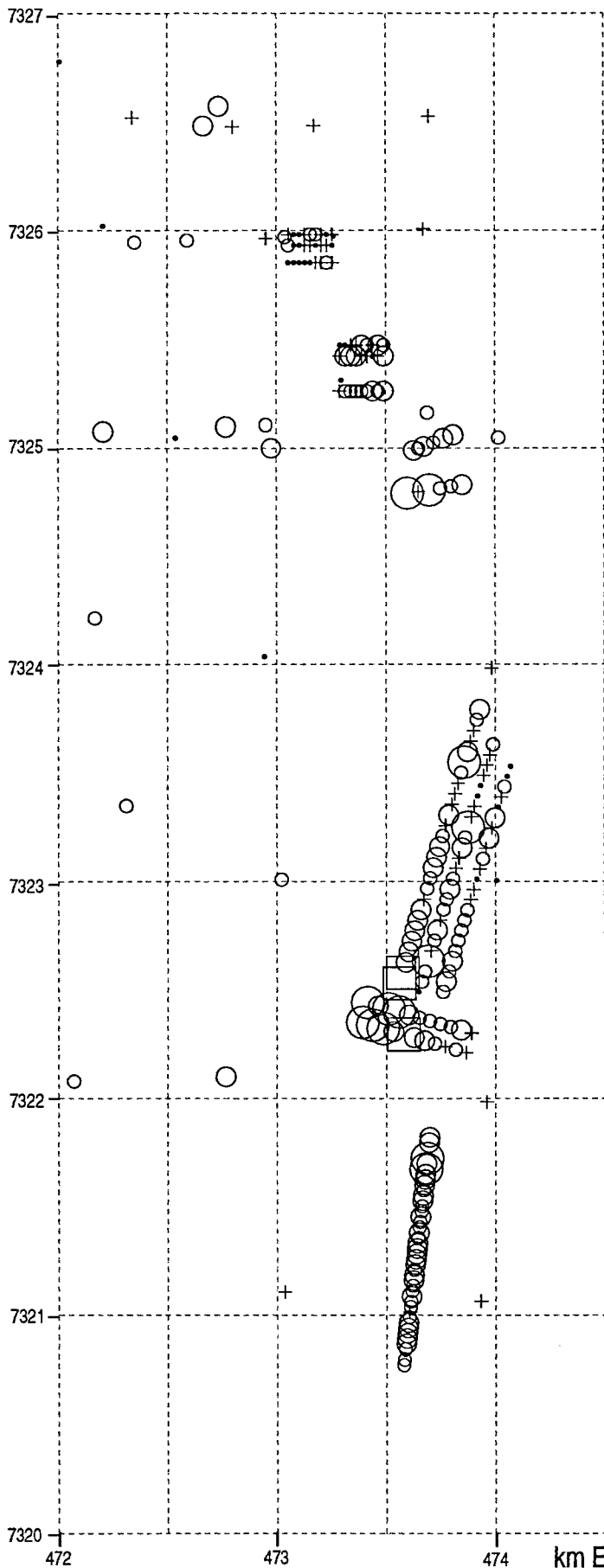
SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

-  190 - 389
-  137 - 190
-  115 - 137
-  82 - 115
-  61 - 82
-  42 - 61
-  11 - 42

ppmZn

Coordinates are UTM zone 35, ED50

km N



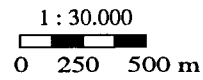
# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO3

ANALYSIS: ICP-AES

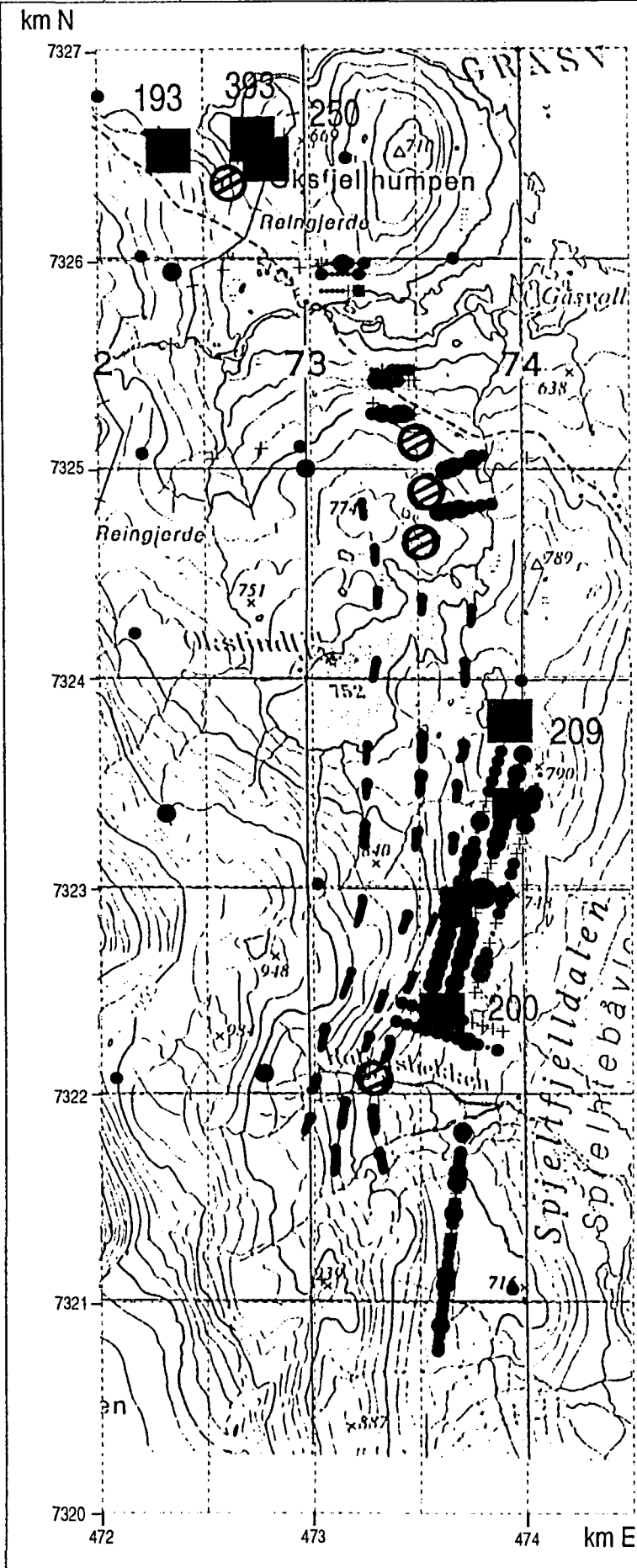


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

- 190 - 389
- 137 - 190
- 115 - 137
- 82 - 115
- 61 - 82
- + 42 - 61
- 11 - 42

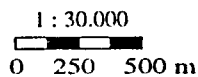
ppmZn



Coordinates are UTM zone 35, ED50










# GRASVATNET 1996

SOIL SAMPLES: 238  
FRACTION: -0.06 MM  
EXTRACTION: HNO3  
ANALYSIS: ICP-AES



-  MINERALIZATION
-  TFEM ANOMALIES

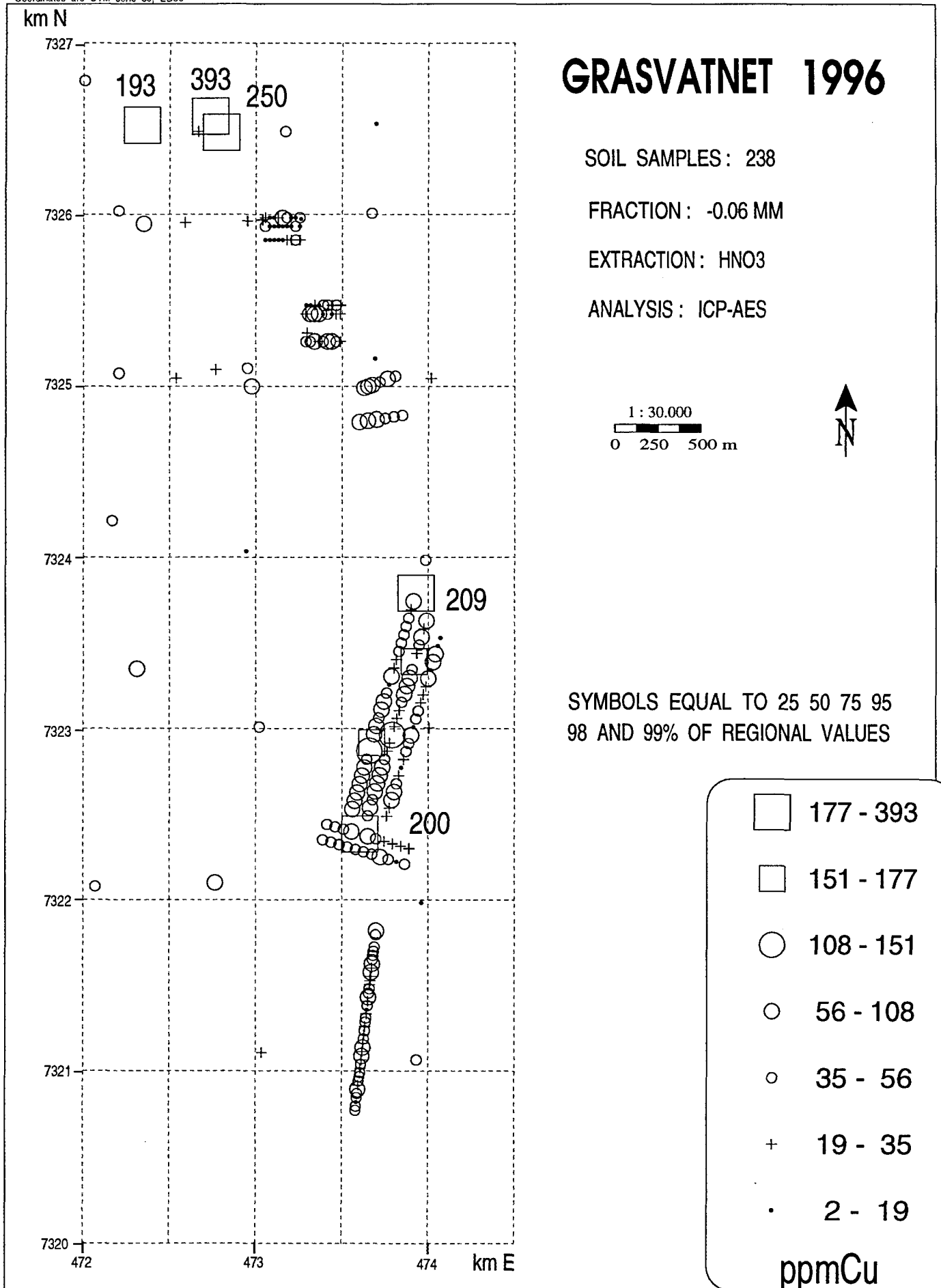
SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

	177 - 393
	151 - 177
	108 - 151
	56 - 108
	35 - 56
	19 - 35
	2 - 19

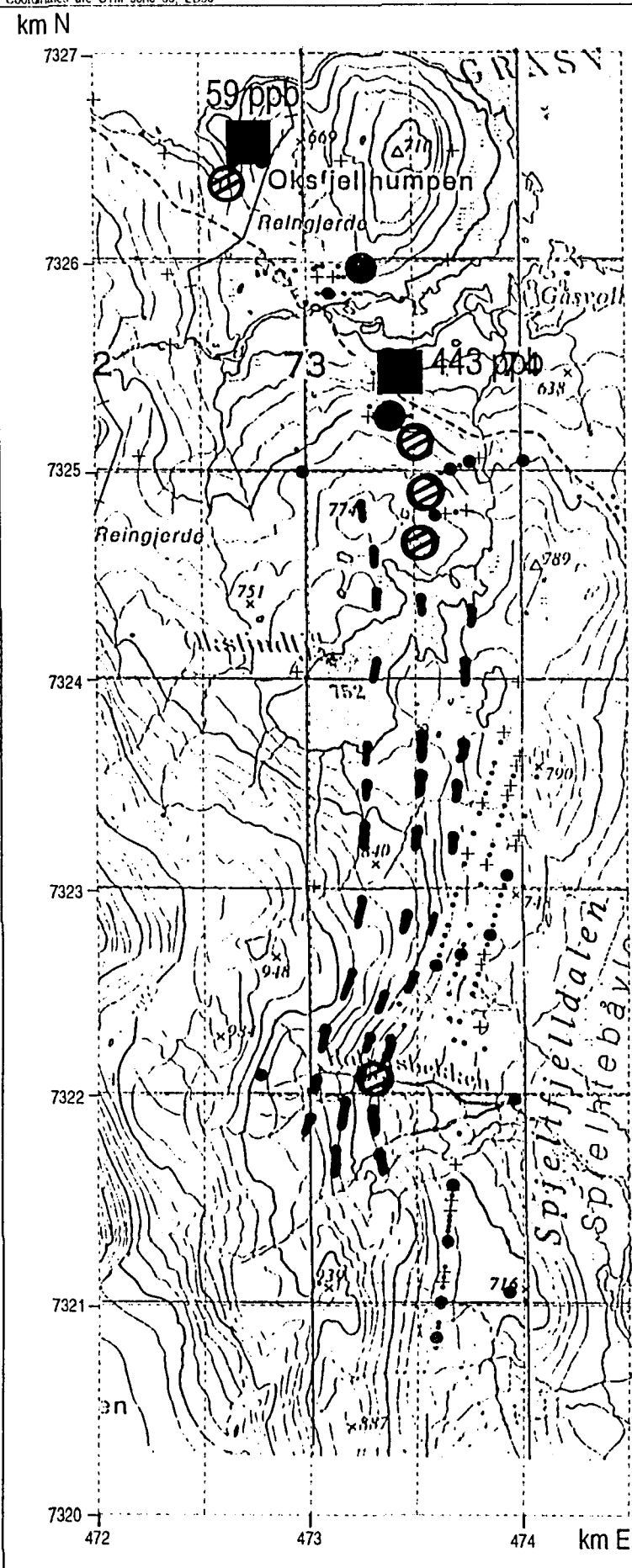
ppmCu



Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50



# GRASVATNET 1996

SOIL SAMPLES: 162

FRACTION: -0.06 MM

EXTRACTION: FIRE ASSAY

ANALYSIS: ICP-AES


1 : 30.000  
0 250 500 m




 MINERALIZATION


 TFEM ANOMALIES

SYMBOLS EQUAL TO REGIONAL MAP

 50 - 443

 17 - 50

 12 - 17

 8 - 12

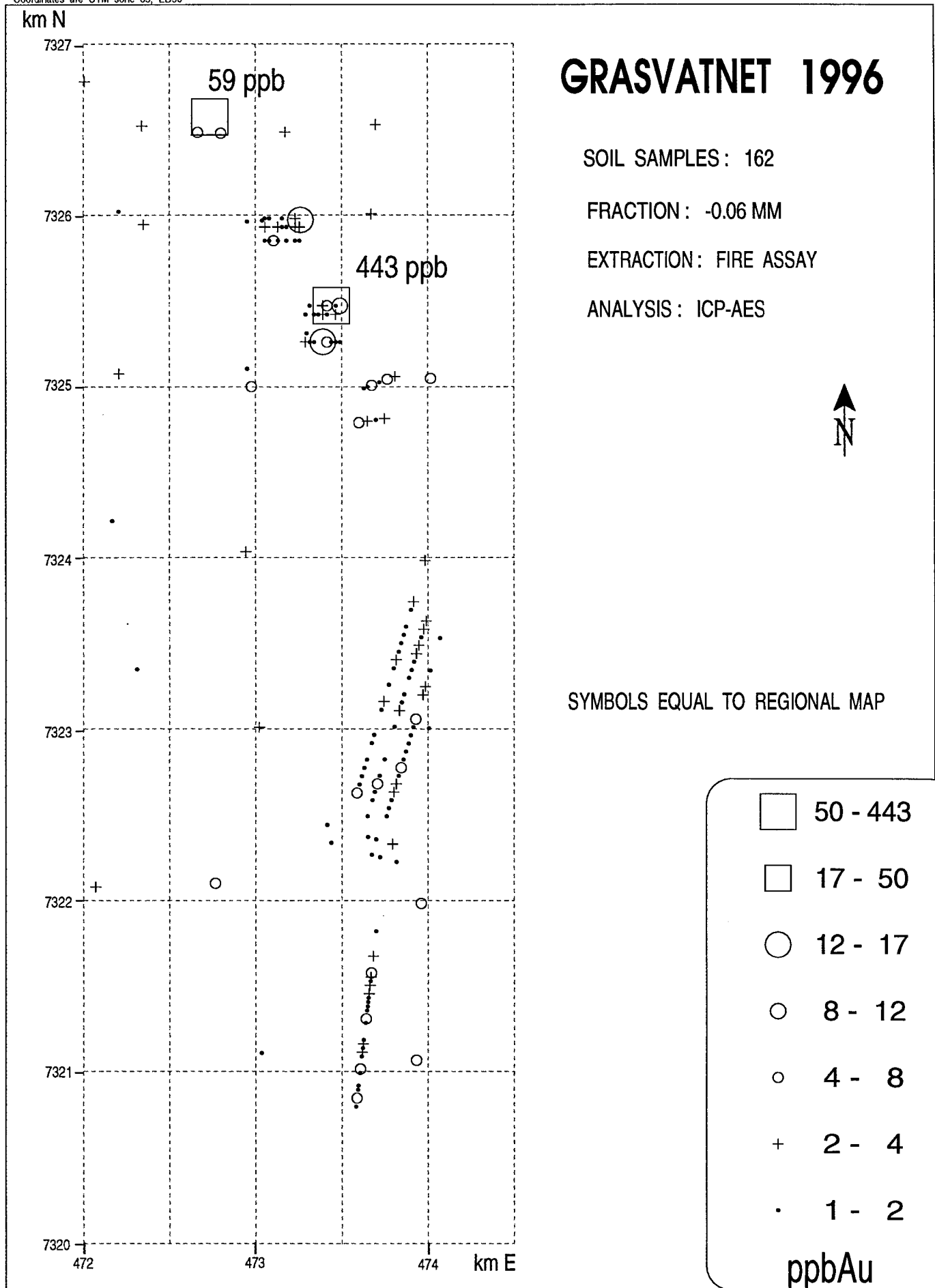
 4 - 8

 2 - 4

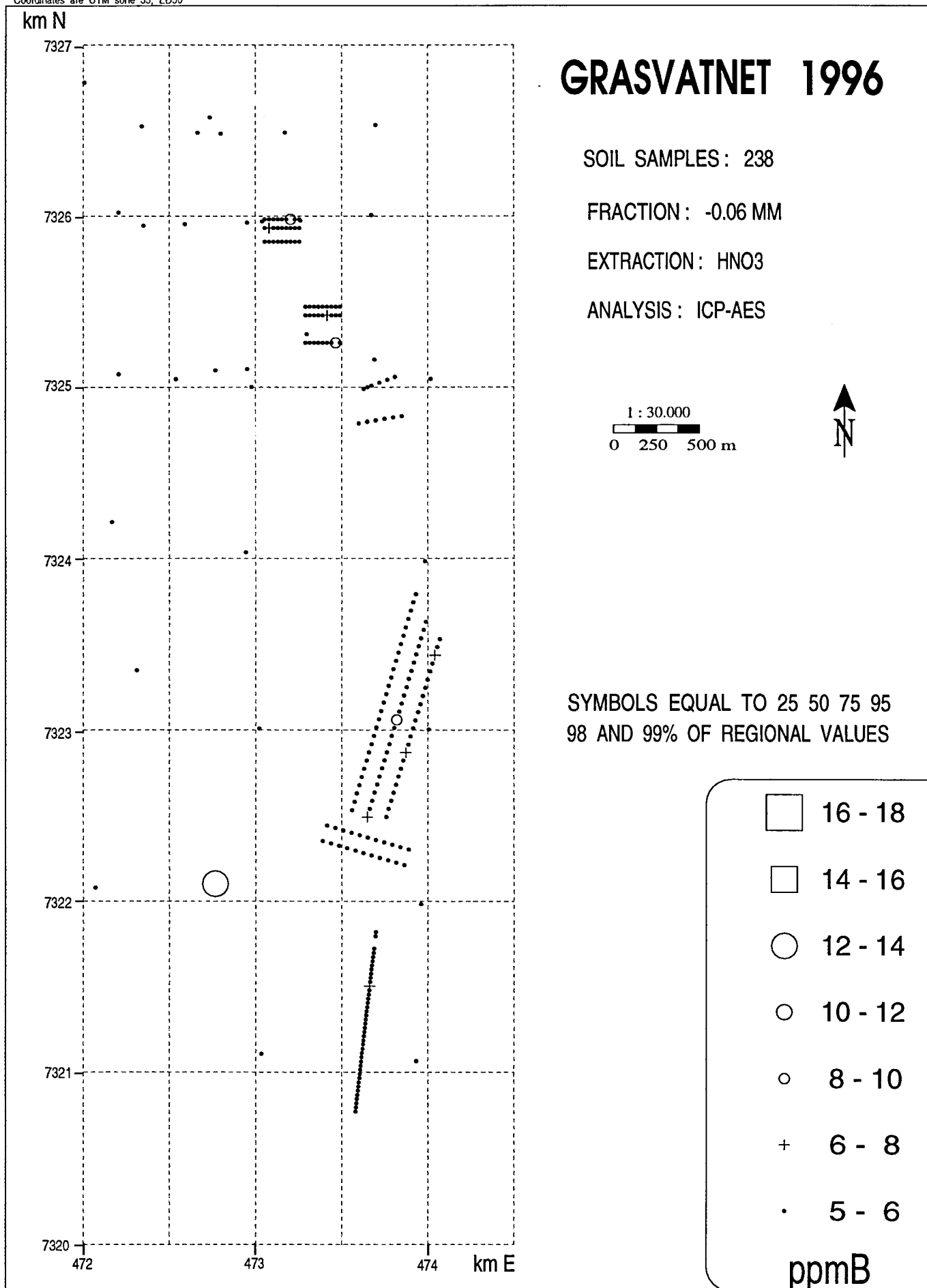
 1 - 2

ppbAu

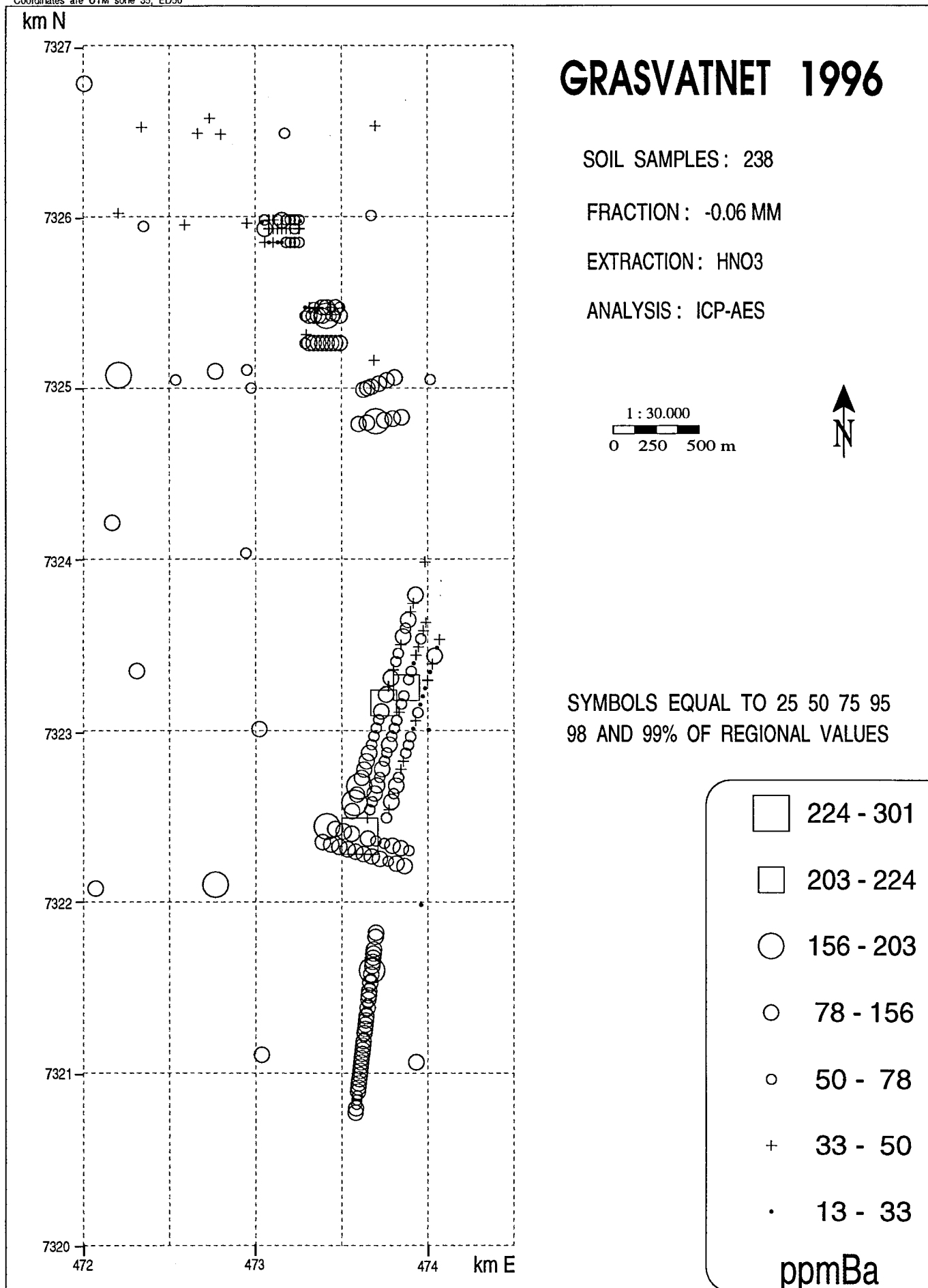
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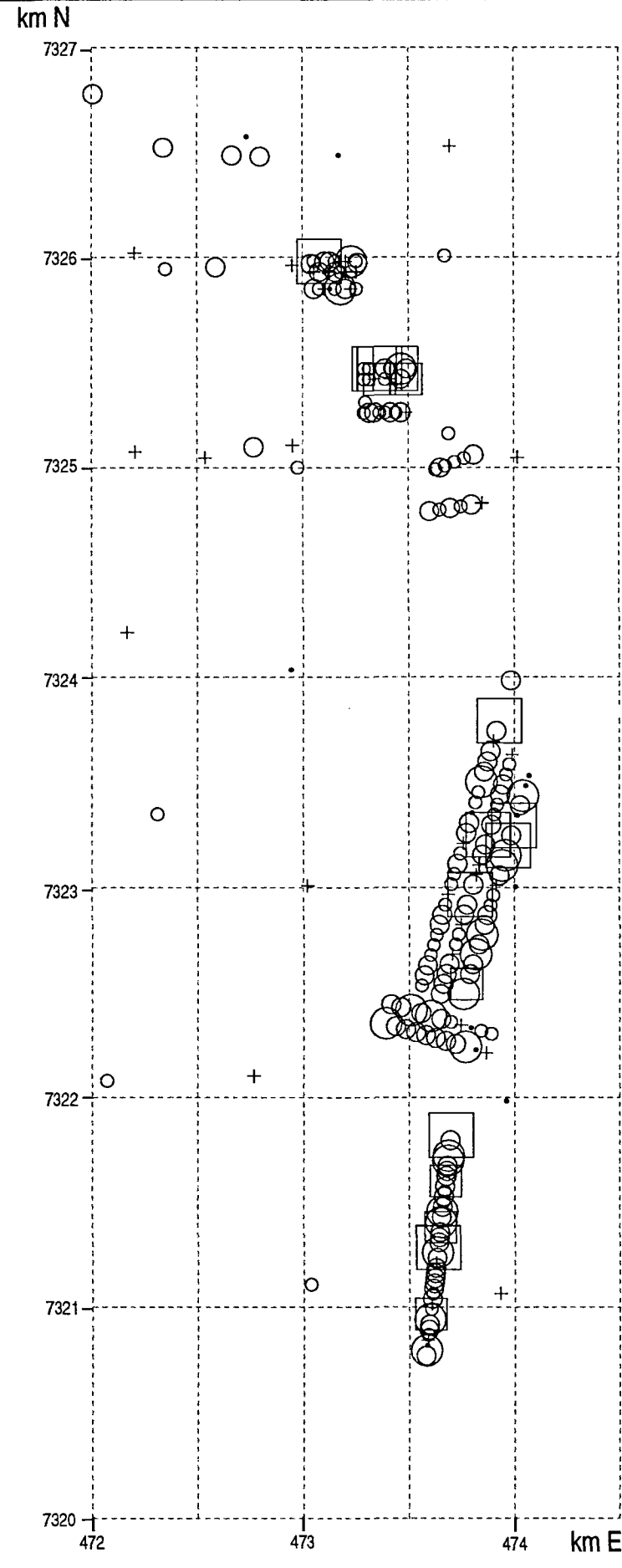
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Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50



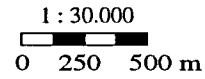
# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES

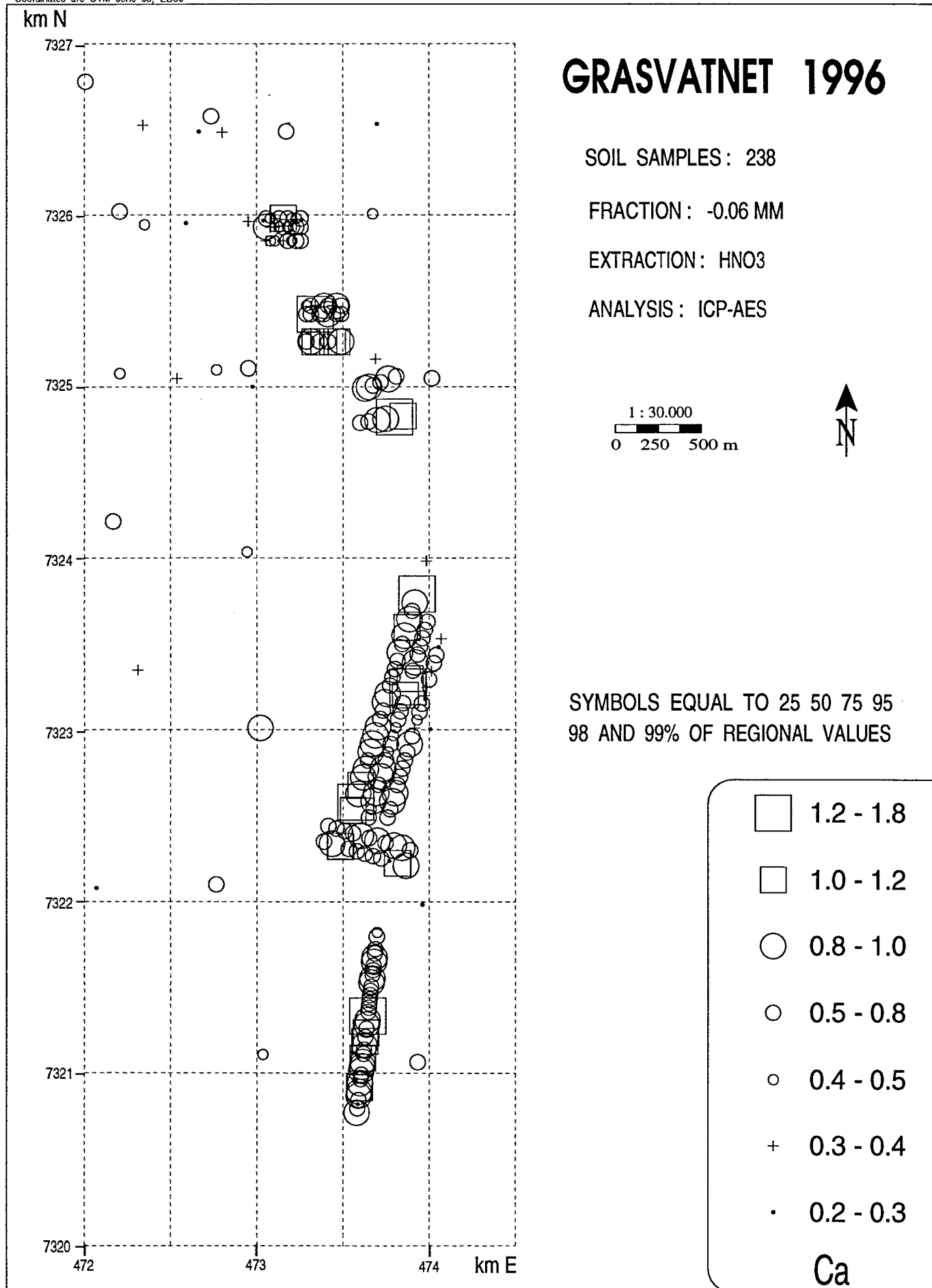


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

- 18 - 26
- 17 - 18
- 15 - 17
- 11 - 15
- 9 - 11
- + 7 - 9
- 2 - 7

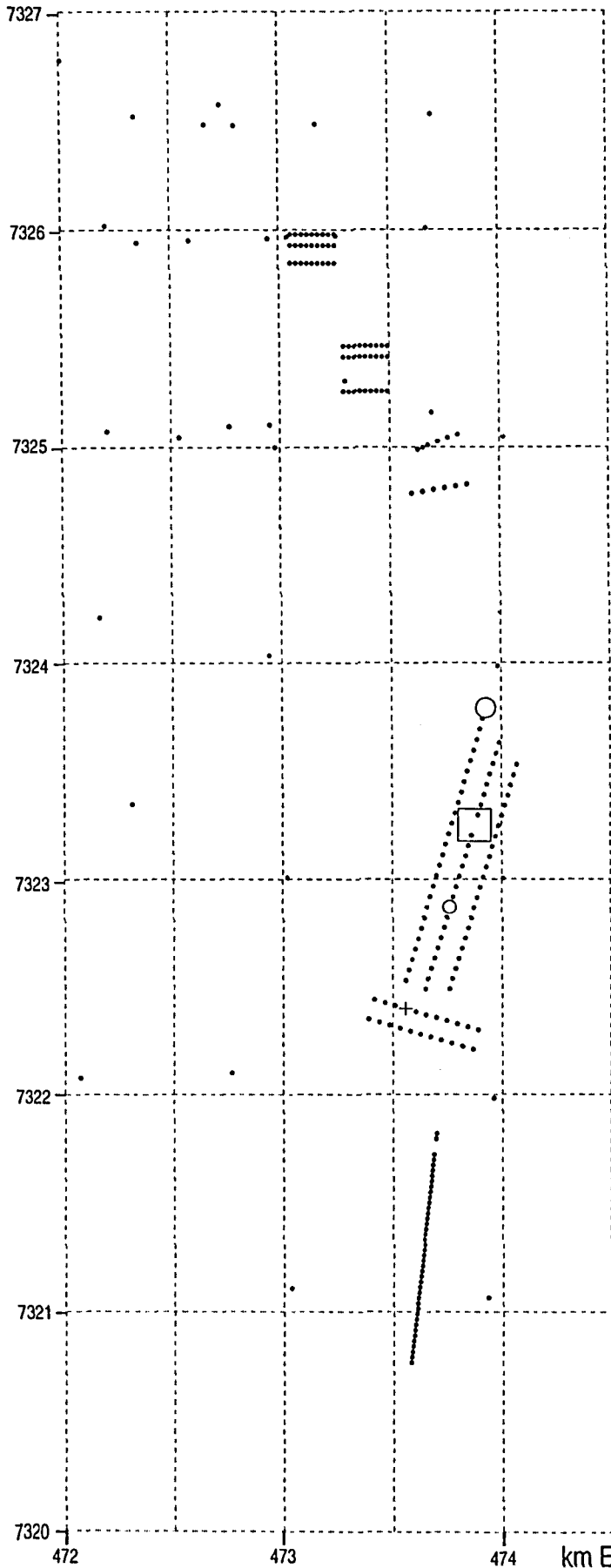
ppmBe

Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50

km N



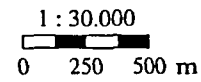
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SOIL SAMPLES : 238

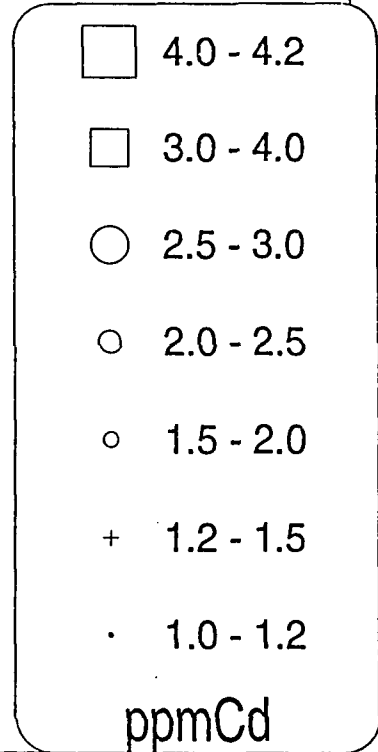
FRACTION : -0.06 MM

EXTRACTION : HNO<sub>3</sub>

ANALYSIS : ICP-AES

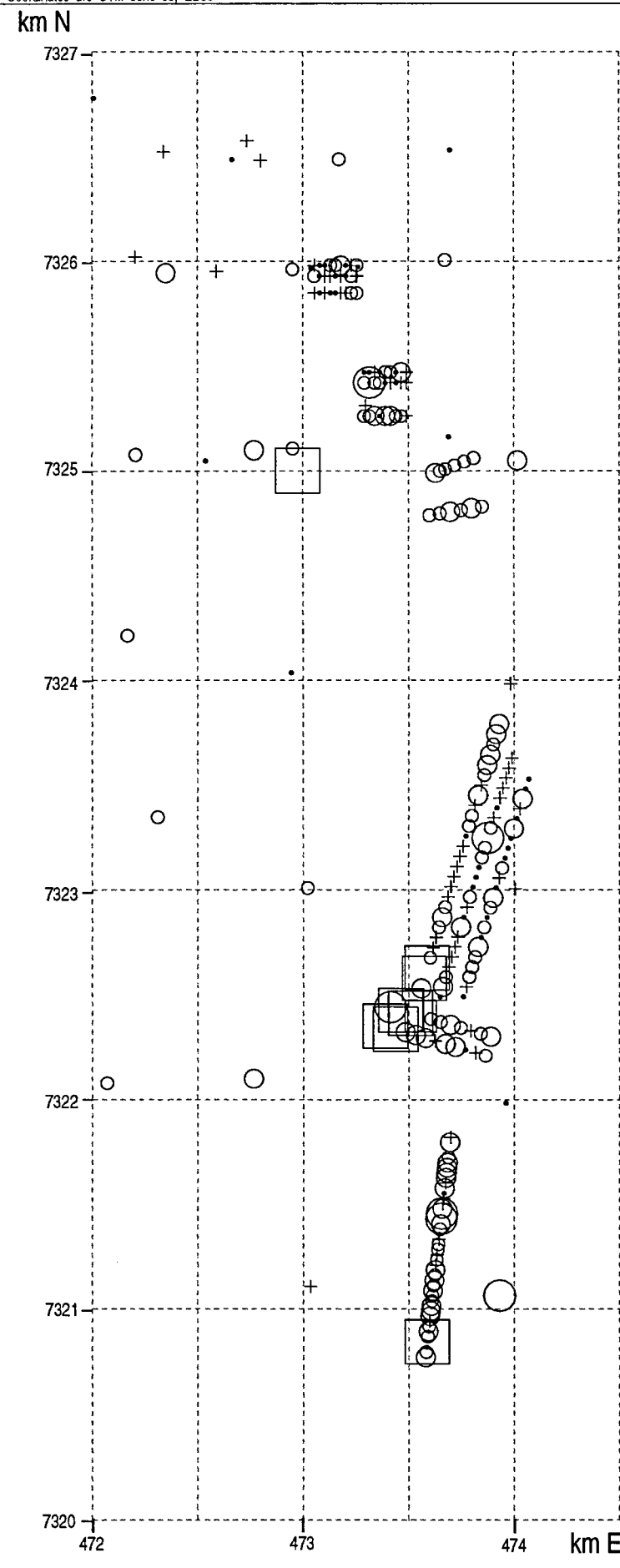


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES





Coordinates are UTM zone 35, ED50



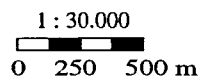
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SOIL SAMPLES: 238

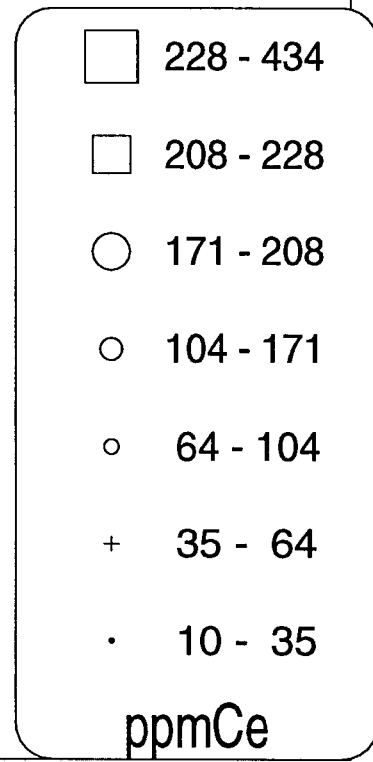
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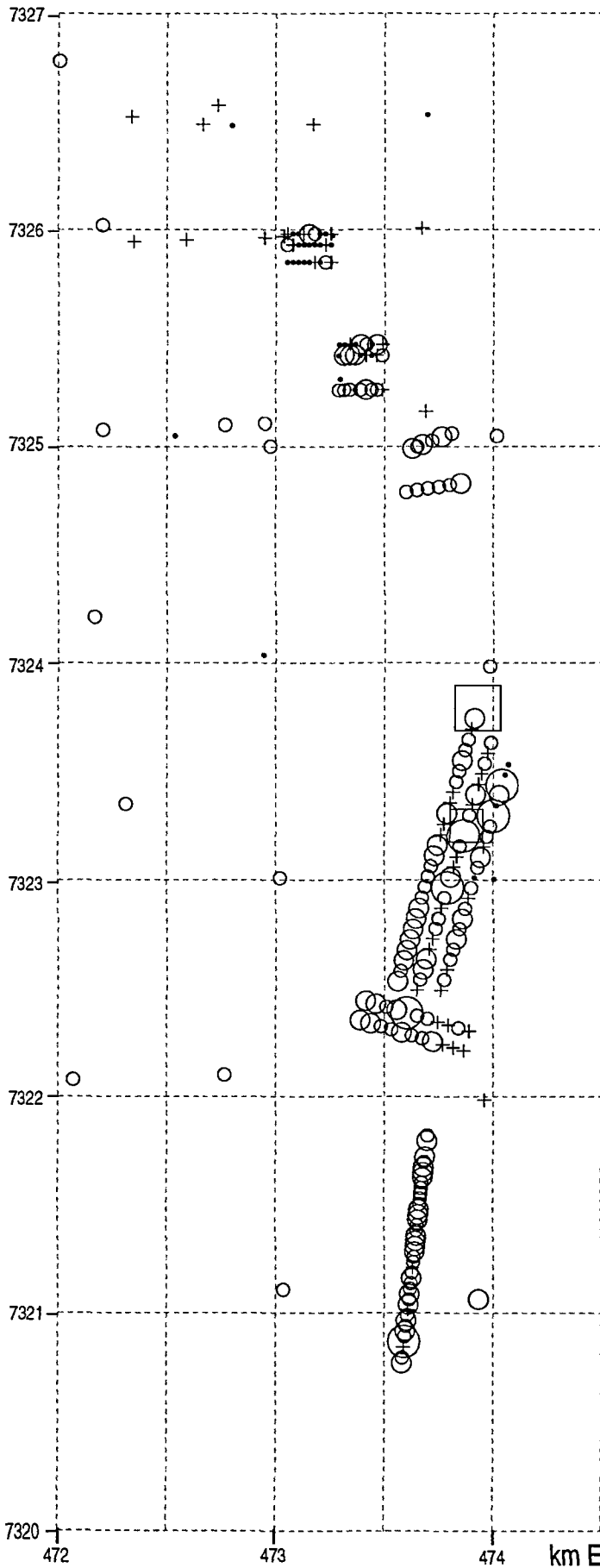


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES



Coordinates are UTM zone 35, ED50

km N



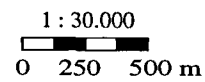
# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: <math>-0.06\text{ MM}</math>

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES

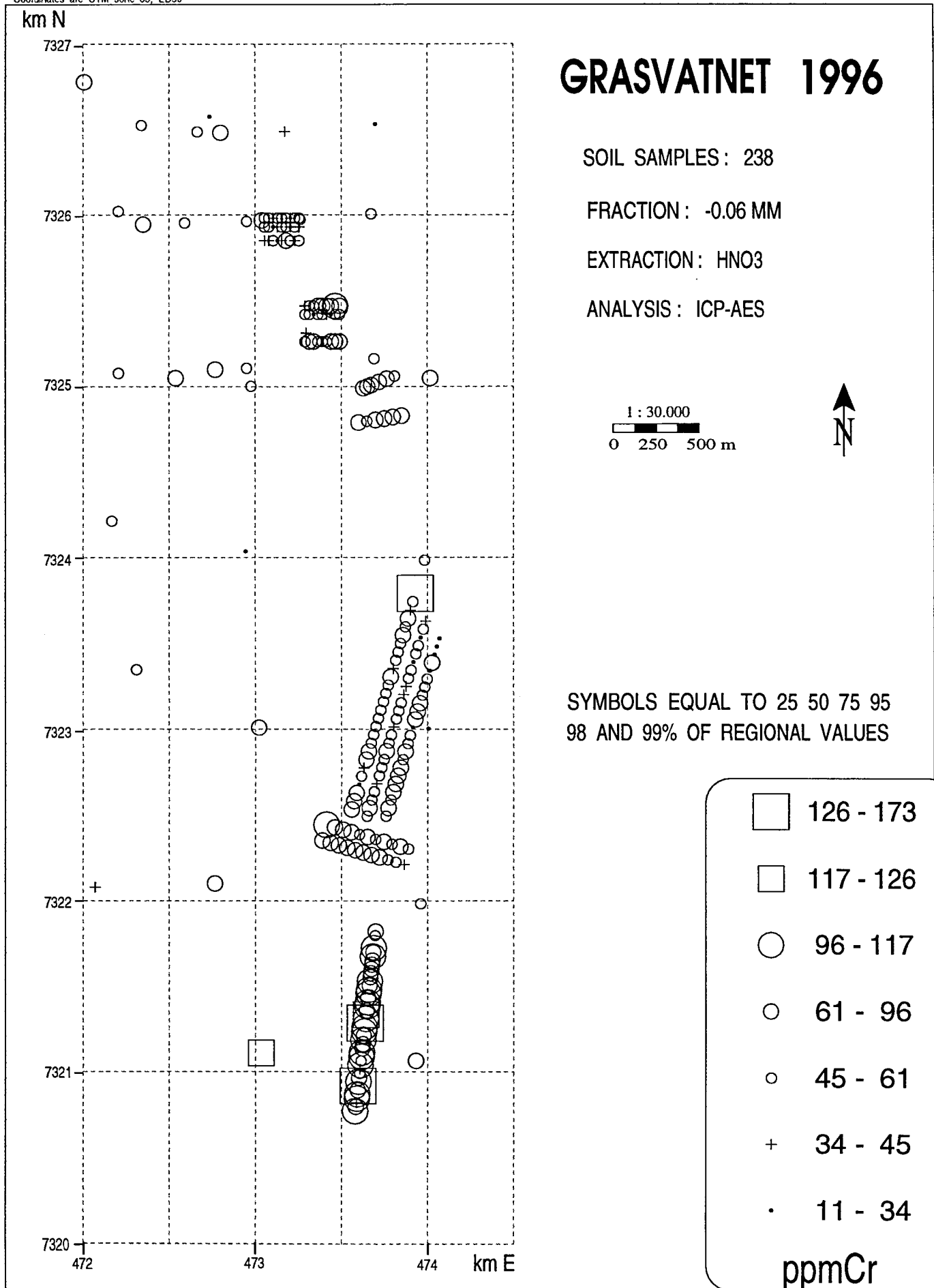


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

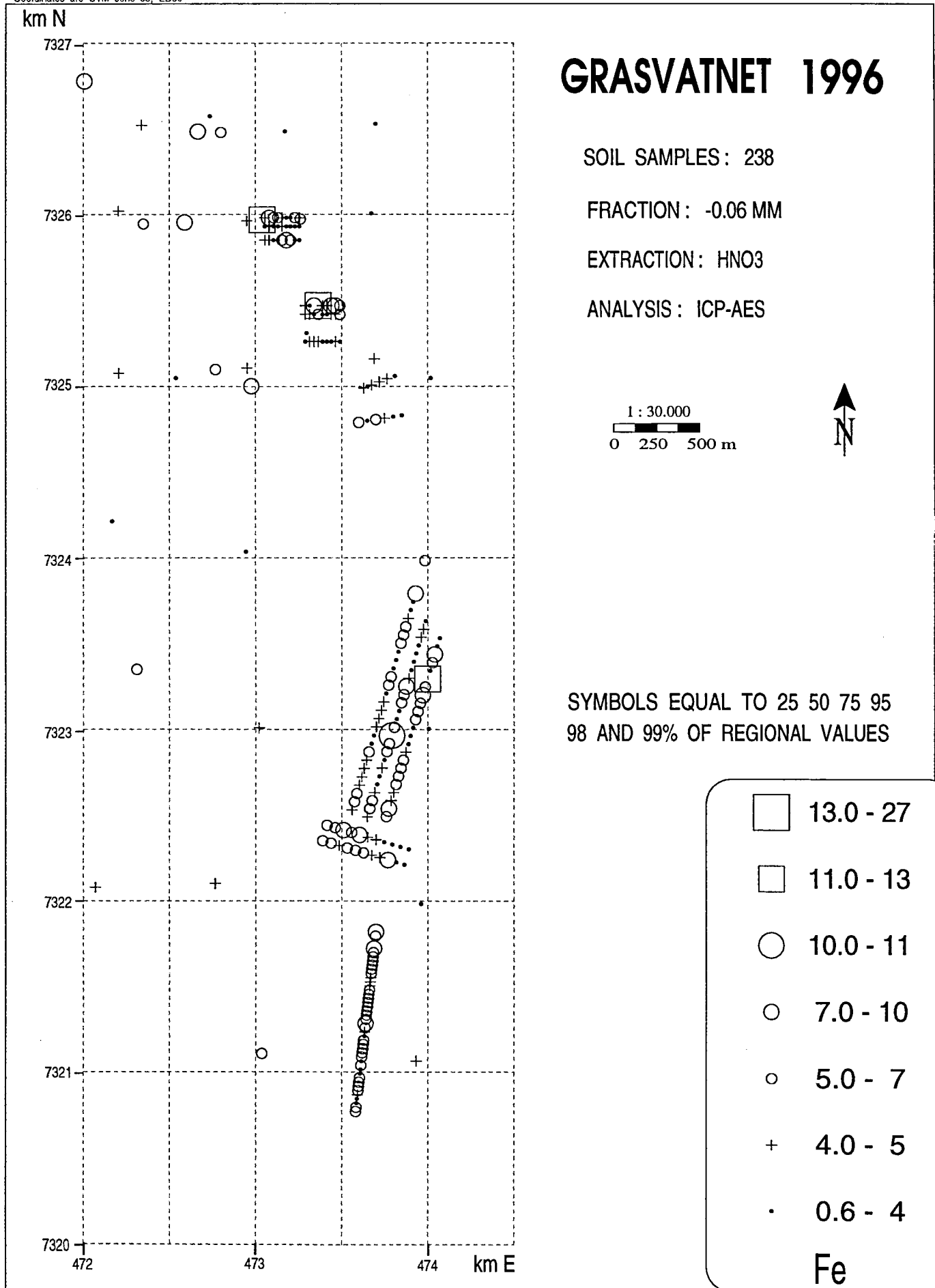
- 59 - 81
- 53 - 59
- 37 - 53
- 20 - 37
- 13 - 20
- + 8 - 13
- 1 - 8

ppmCo

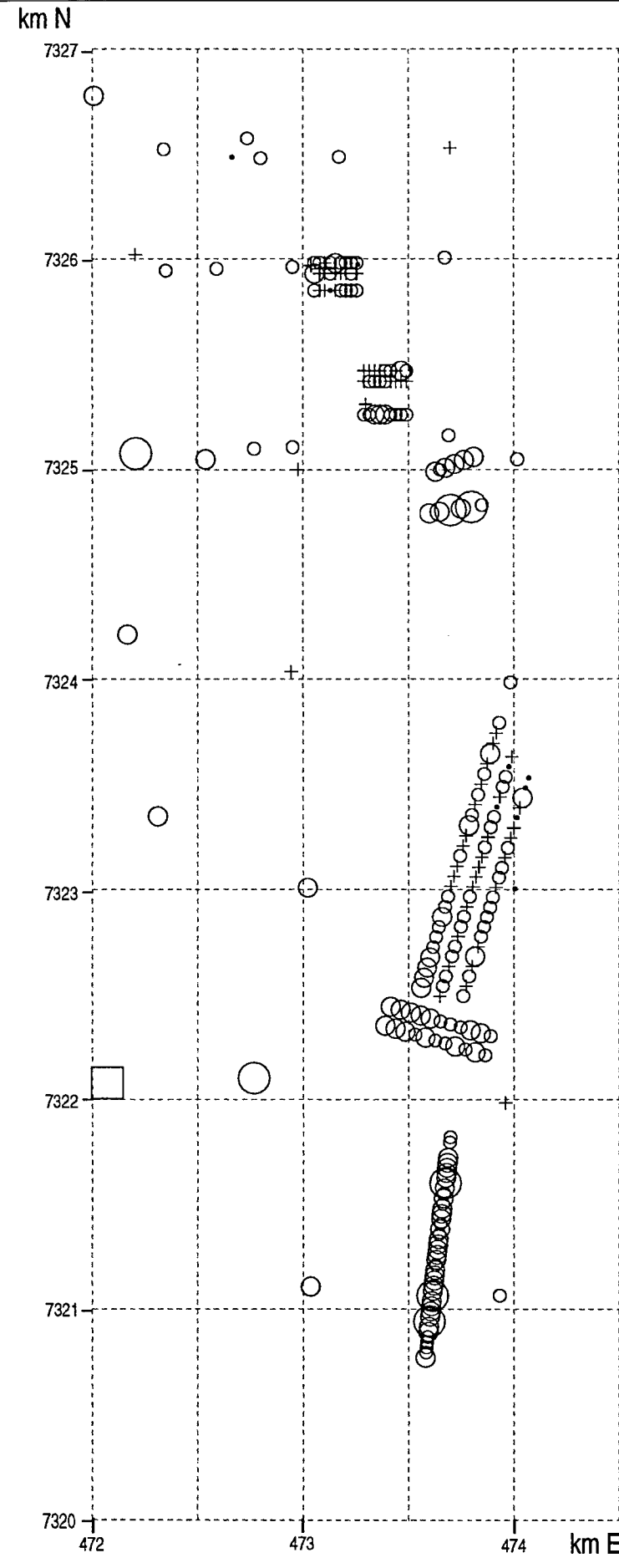
Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50



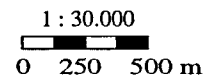
# GRASVATNET 1996

SOIL SAMPLES: 238

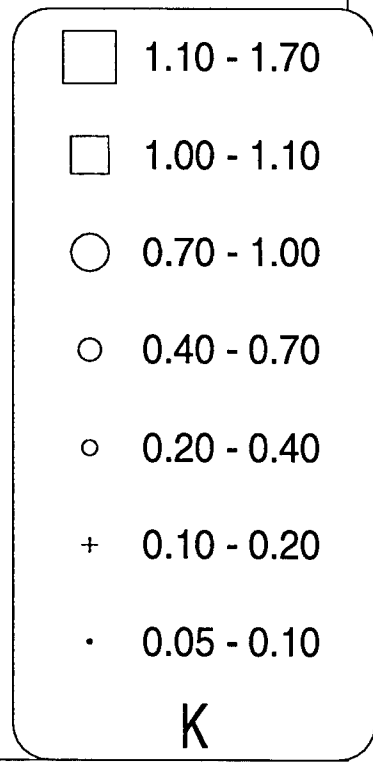
FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

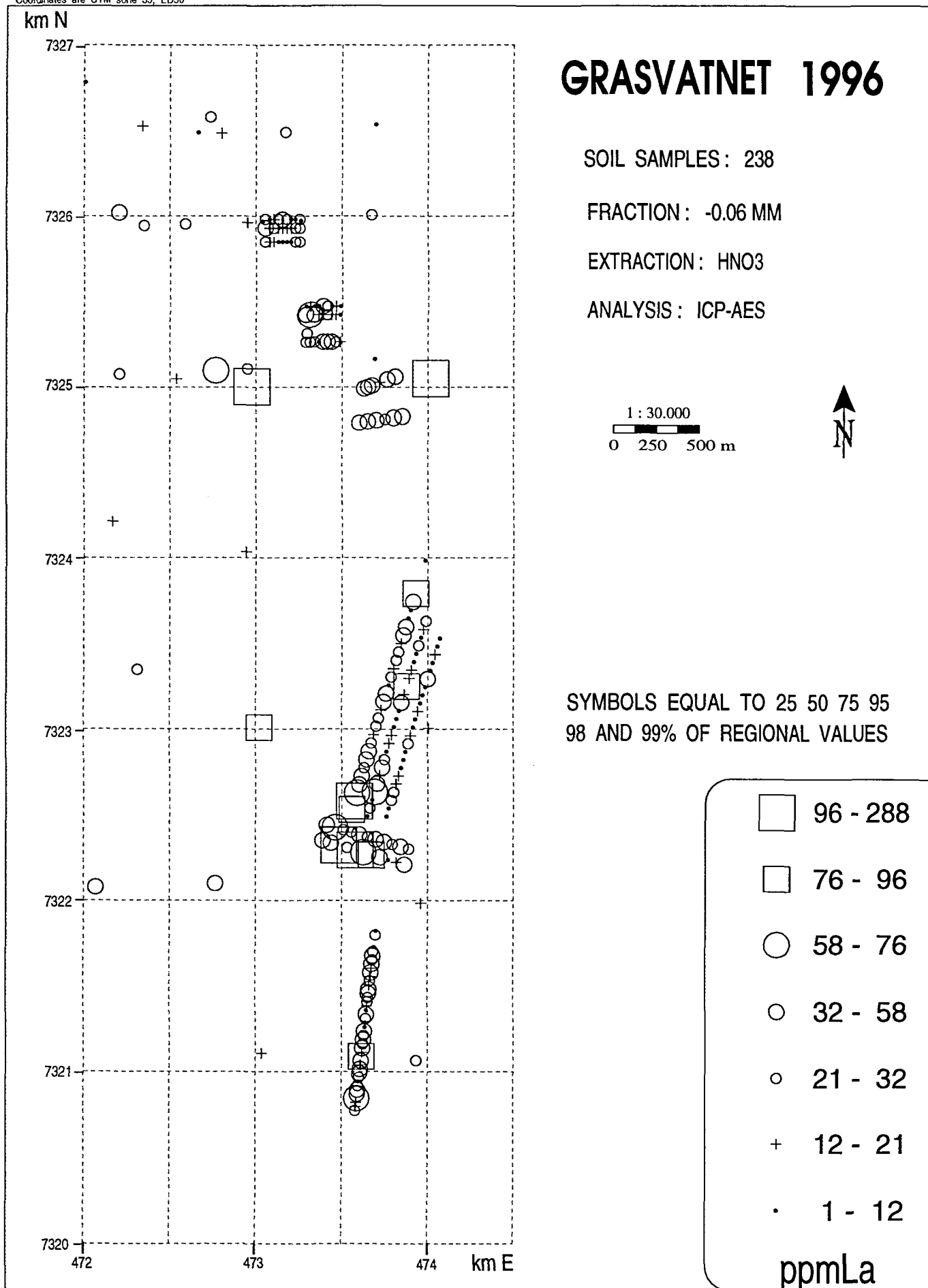
ANALYSIS: ICP-AES



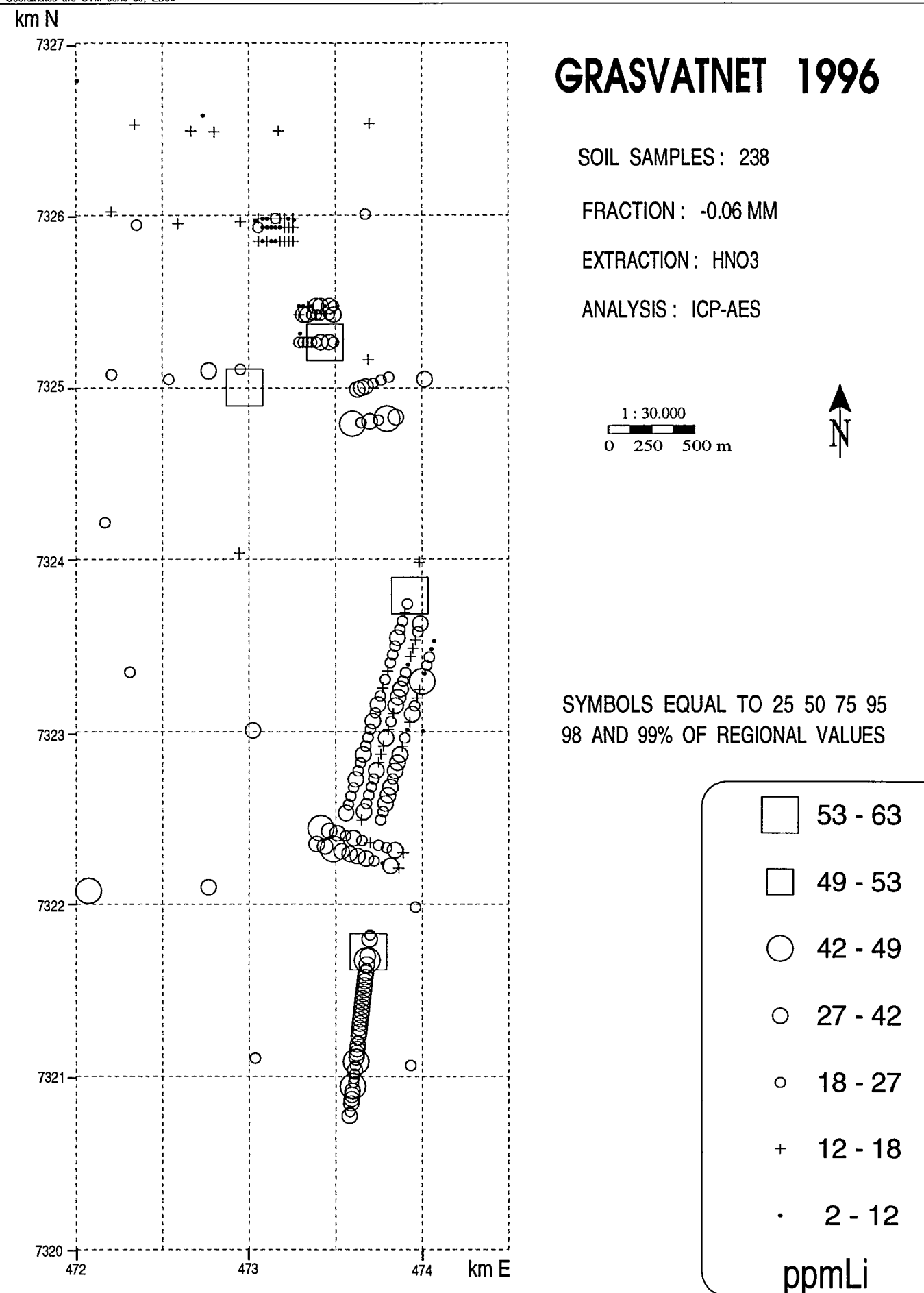
SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES



Coordinates are UTM zone 35, ED50

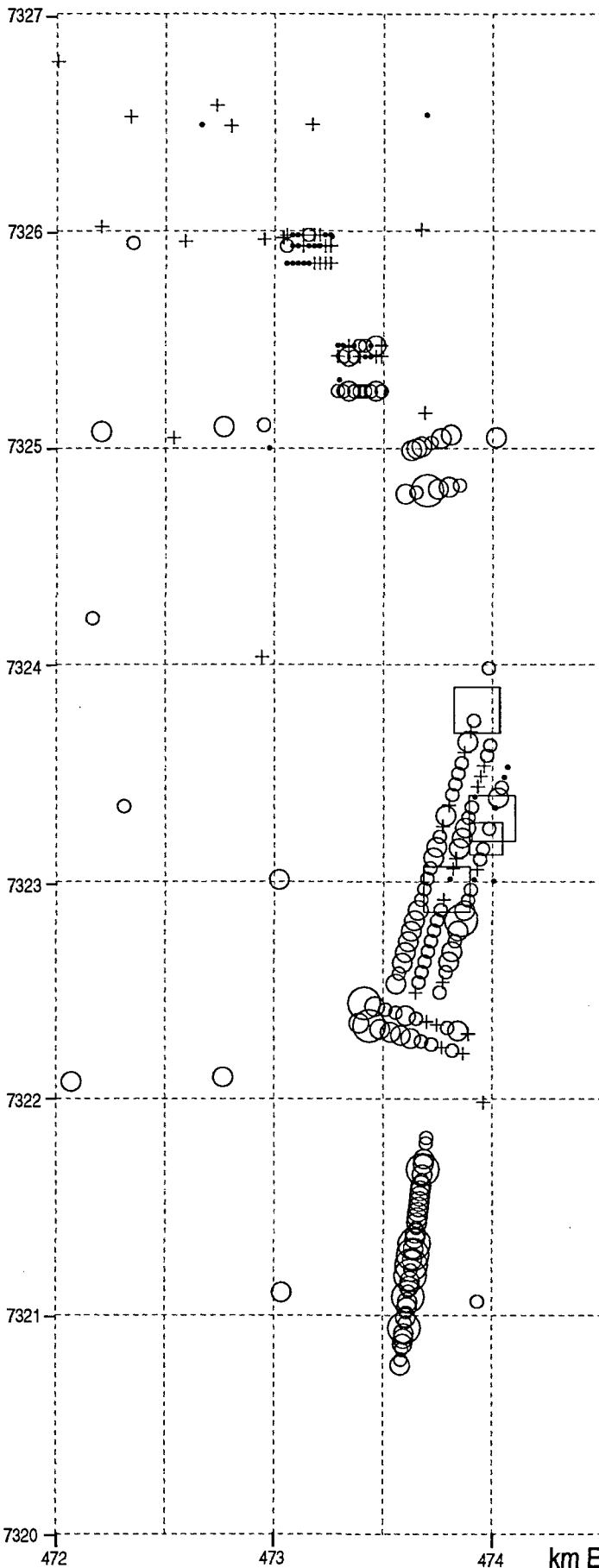


Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50

km N



# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

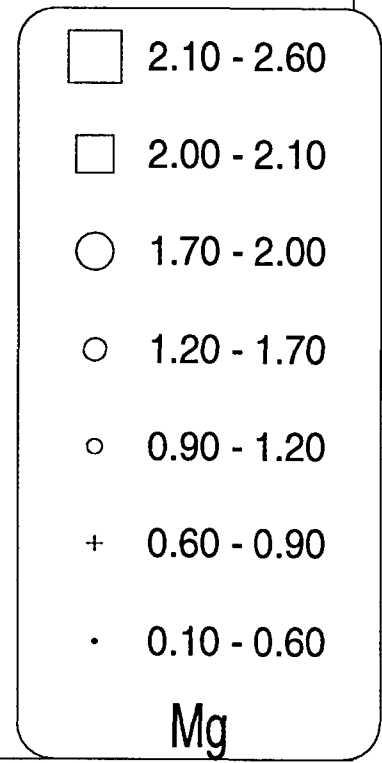
EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES

1 : 30.000  
0 250 500 m

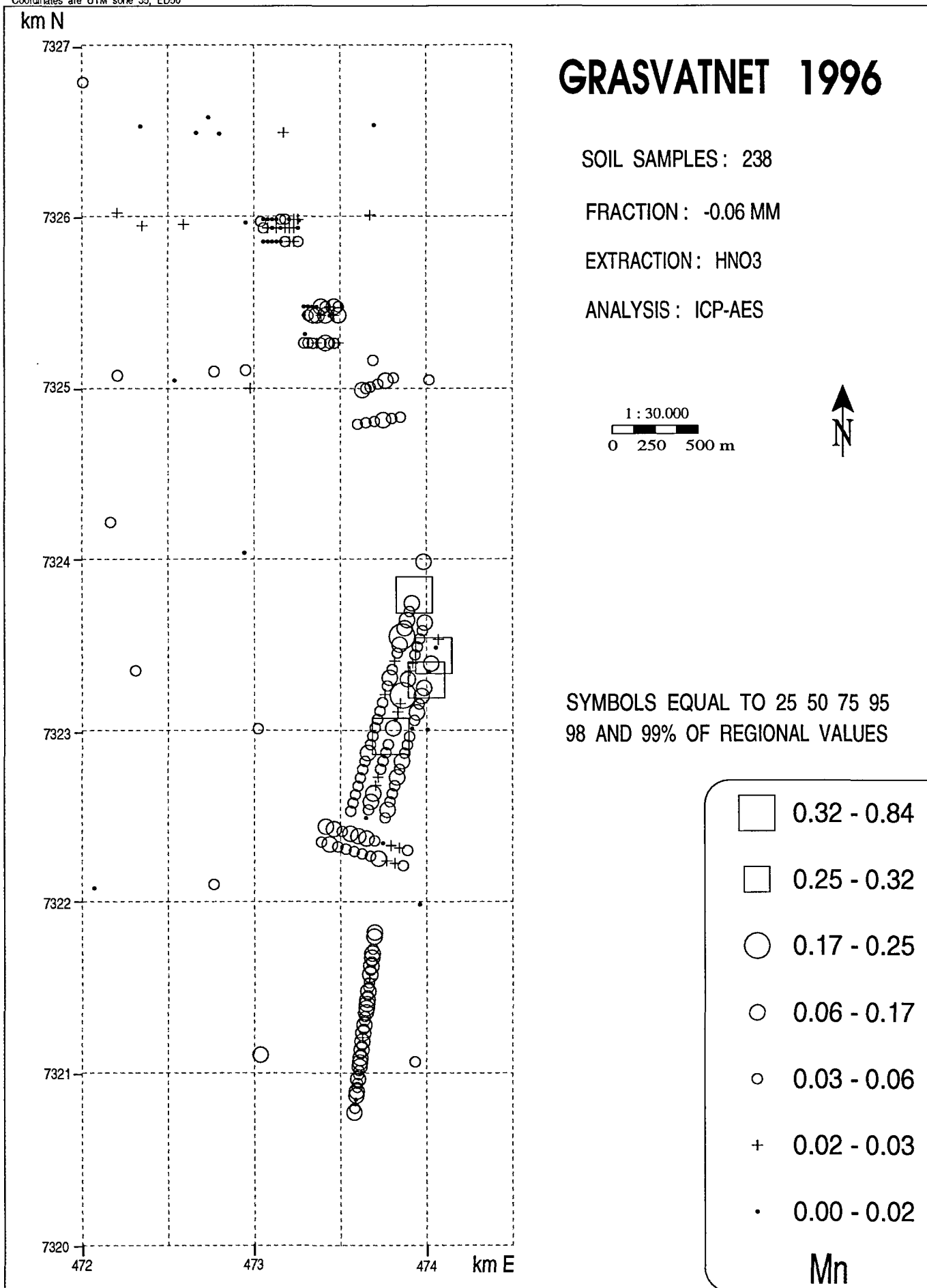


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES



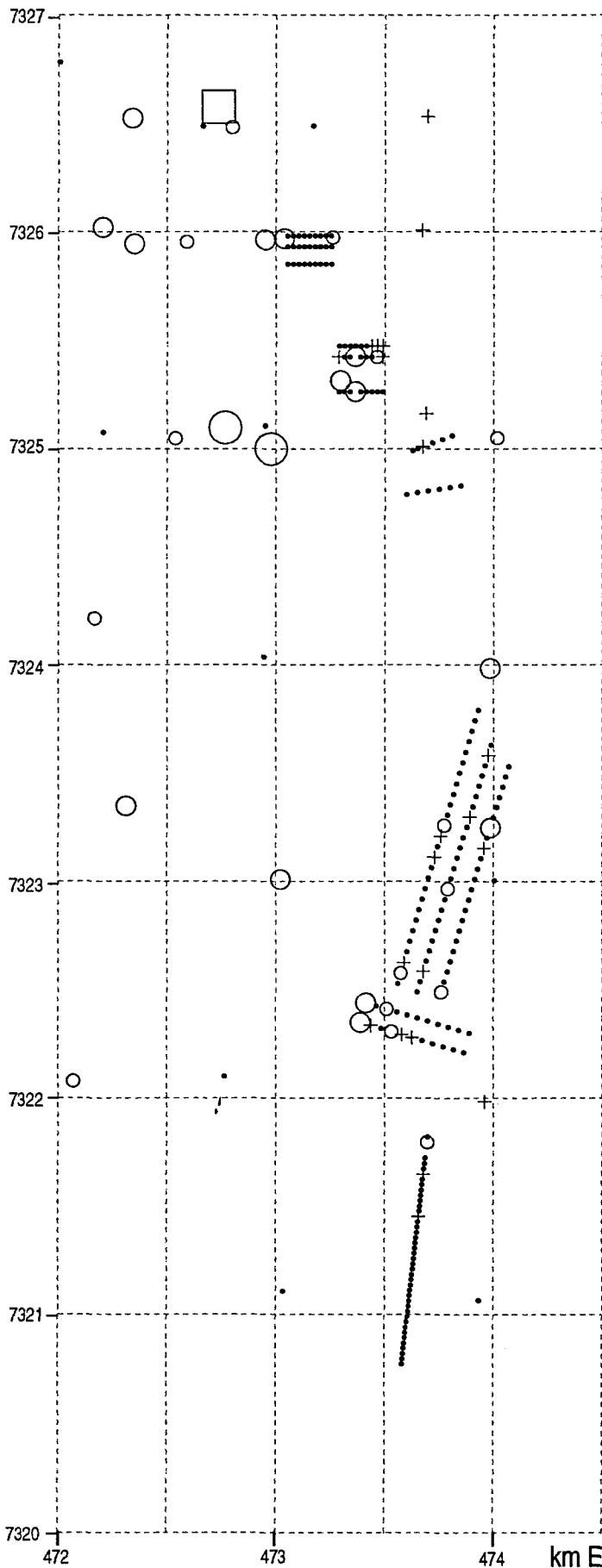


Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50

km N



# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES

1 : 30.000  
0 250 500 m

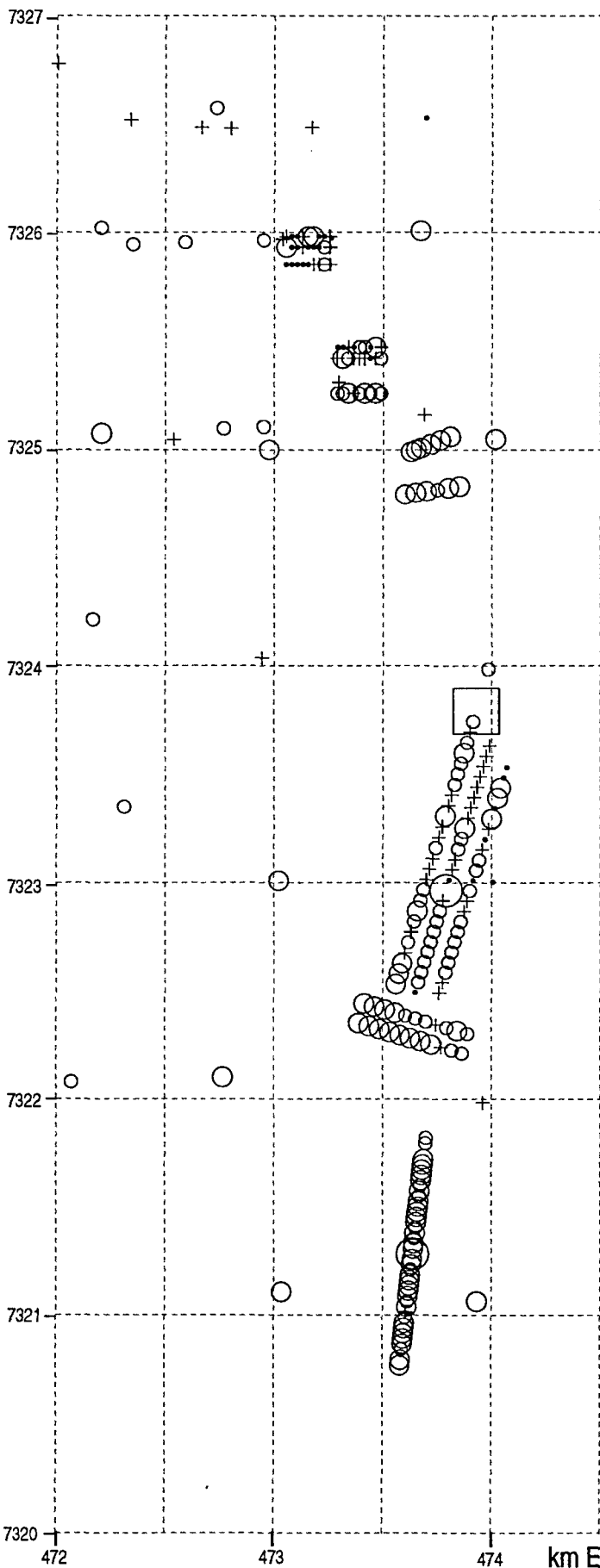


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

- 7.4 - 19.2
  - 6.1 - 7.4
  - 4.5 - 6.1
  - 2.2 - 4.5
  - 1.5 - 2.2
  - + 1.2 - 1.5
  - 1.0 - 1.2
- ppmMo

Coordinates are UTM zone 35, ED50

km N



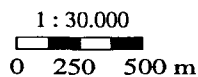
# GRASVATNET 1996

SOIL SAMPLES : 238

FRACTION : -0.06 MM

EXTRACTION : HNO3

ANALYSIS : ICP-AES



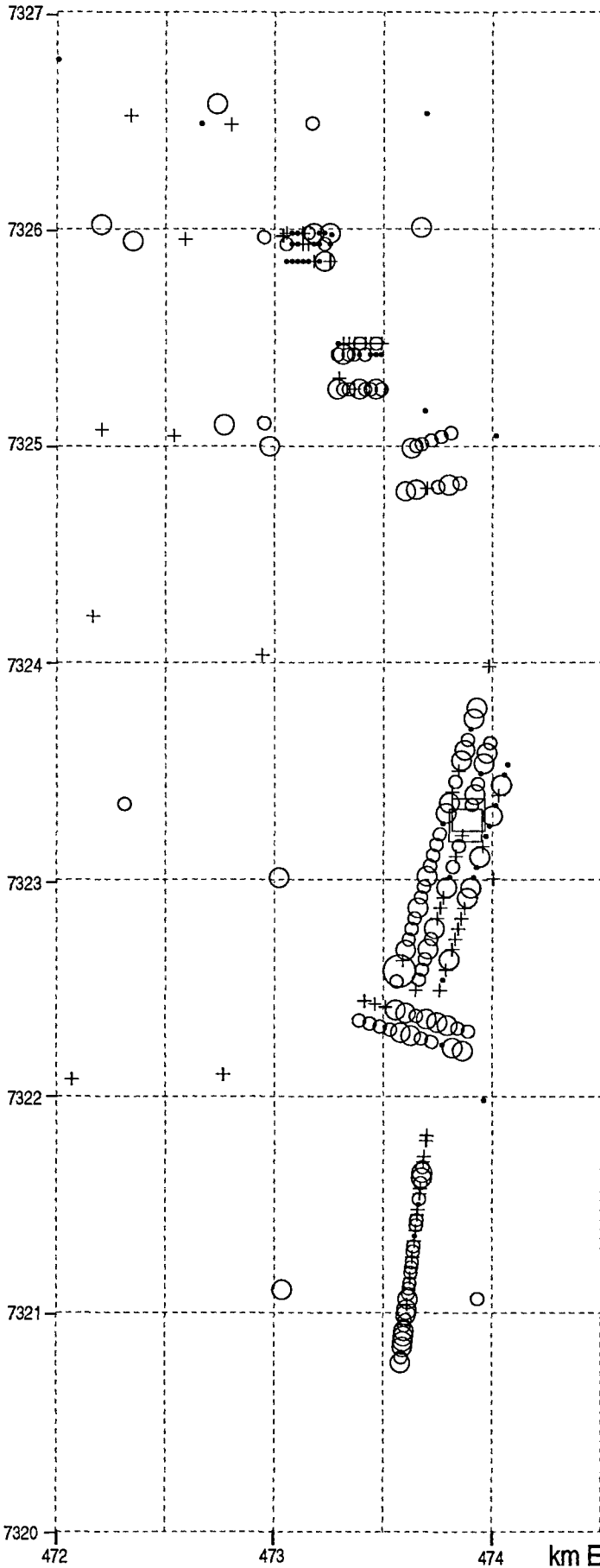
SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

- 135 - 210
- 104 - 135
- 78 - 104
- 43 - 78
- 29 - 43
- + 17 - 29
- 2 - 17

ppmNi

Coordinates are UTM zone 35, ED50

km N



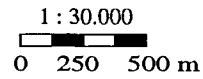
# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES

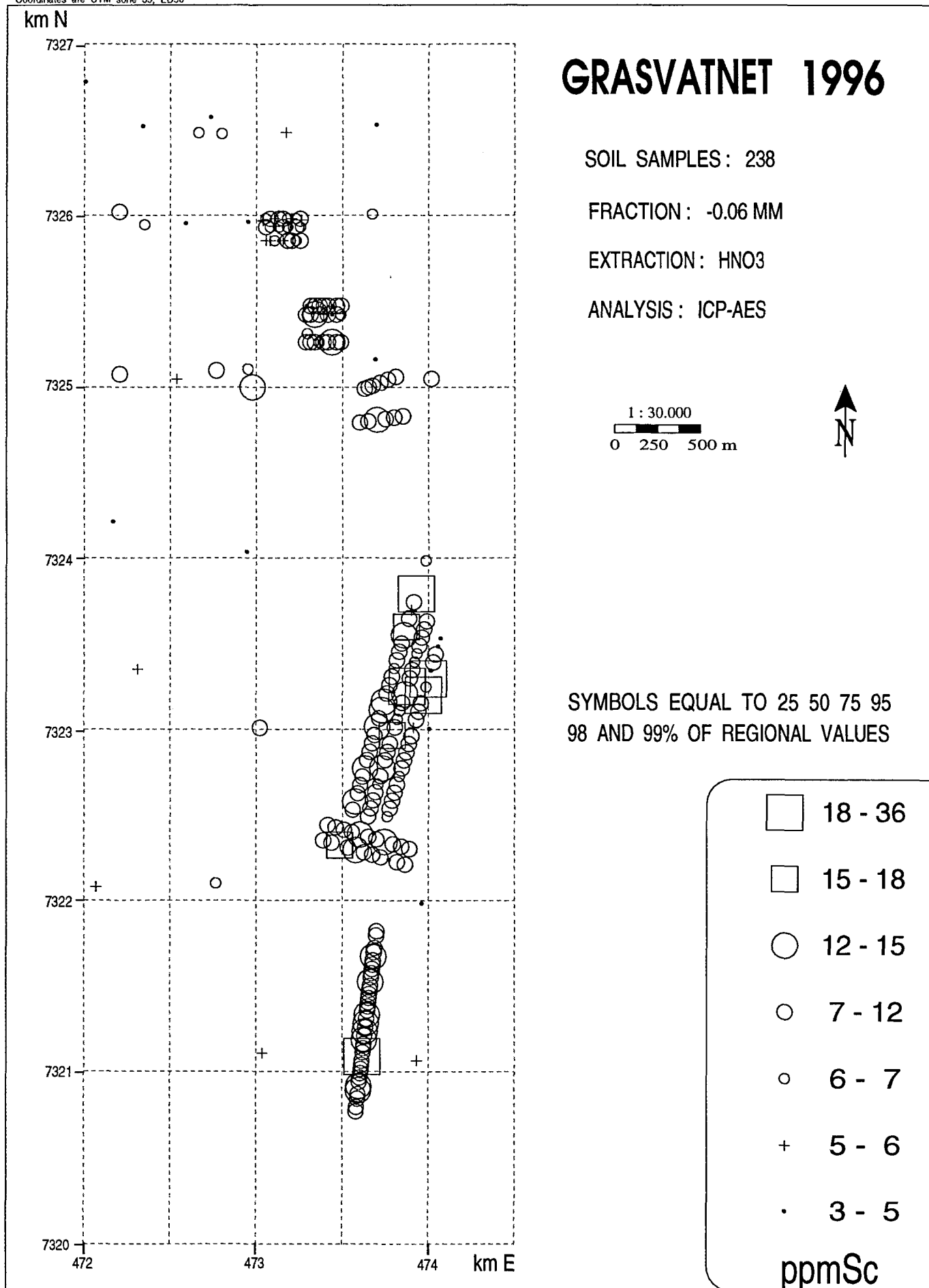


SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

- 0.32 - 3.85
- 0.25 - 0.32
- 0.19 - 0.25
- 0.12 - 0.19
- 0.09 - 0.12
- + 0.06 - 0.09
- 0.00 - 0.06

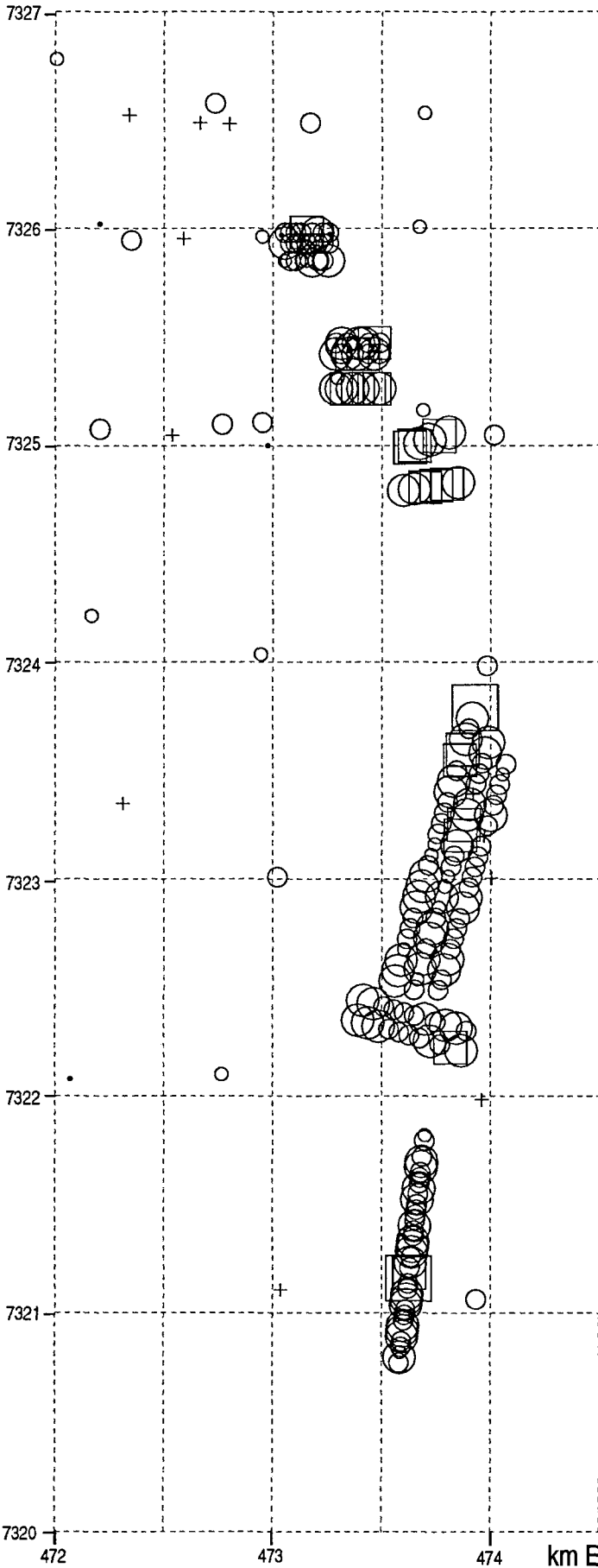
P

Coordinates are UTM zone 35, ED50



Coordinates are UTM zone 35, ED50

km N



# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES

1 : 30.000  
0 250 500 m



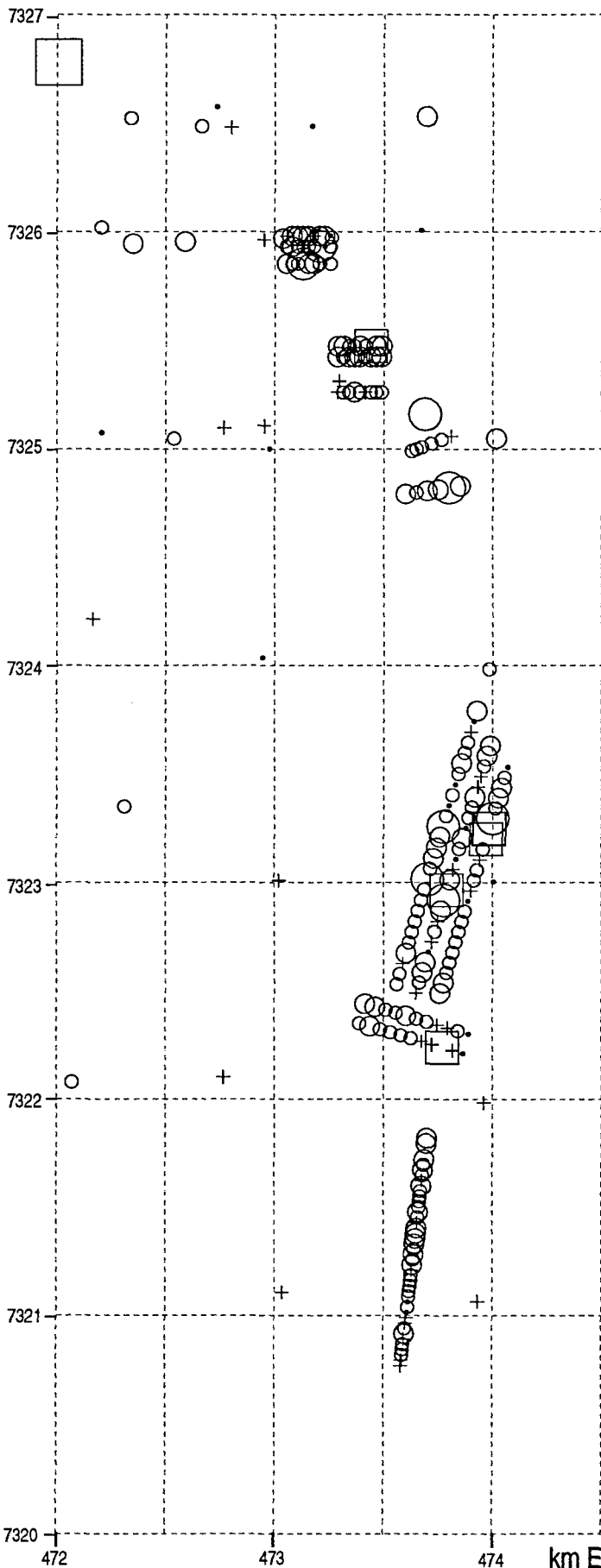
SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

- 59 - 112
- 43 - 59
- 32 - 43
- 21 - 32
- 16 - 21
- + 12 - 16
- 11 - 12

ppmSr

Coordinates are UTM zone 35, ED50

km N



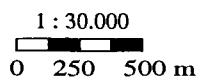
# GRÅSVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES



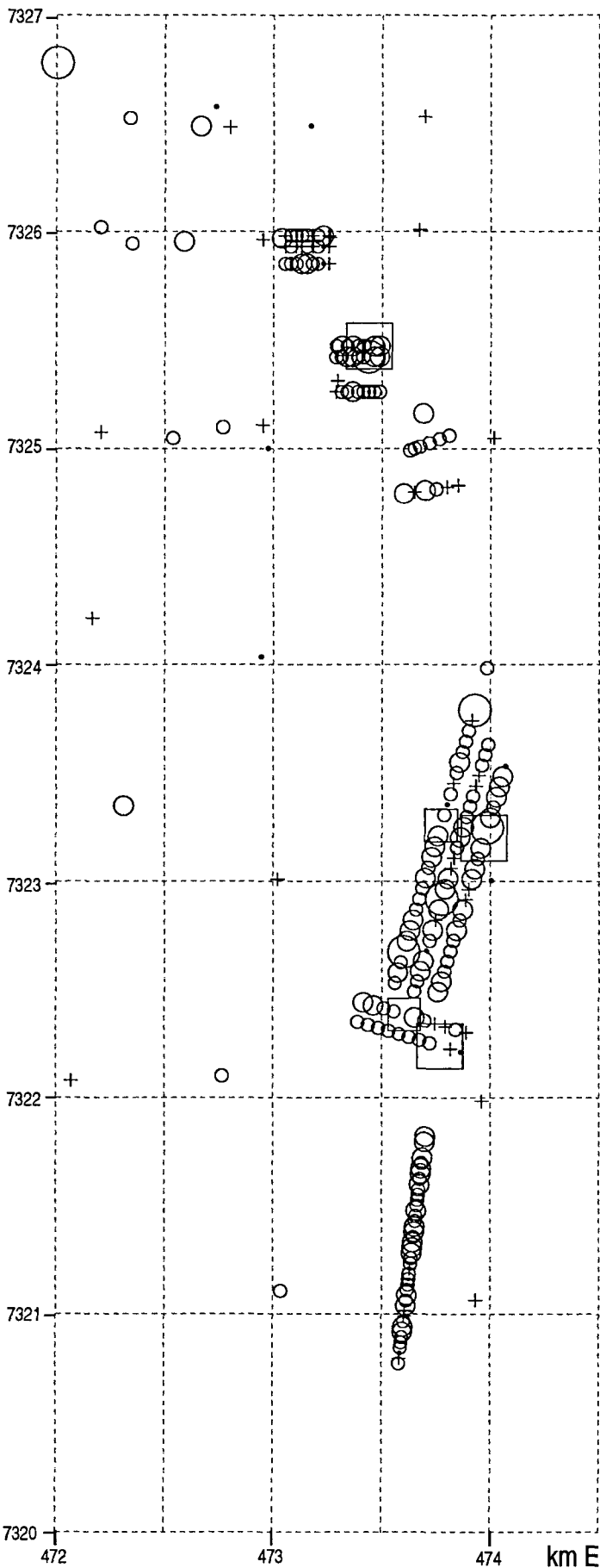
SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

- 0.45 - 0.67
- 0.39 - 0.45
- 0.34 - 0.39
- 0.24 - 0.34
- 0.19 - 0.24
- + 0.15 - 0.19
- 0.10 - 0.15

Ti

Coordinates are UTM zone 35, ED50

km N



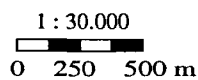
# GRASVATNET 1996

SOIL SAMPLES: 238

FRACTION: -0.06 MM

EXTRACTION: HNO<sub>3</sub>

ANALYSIS: ICP-AES



SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES

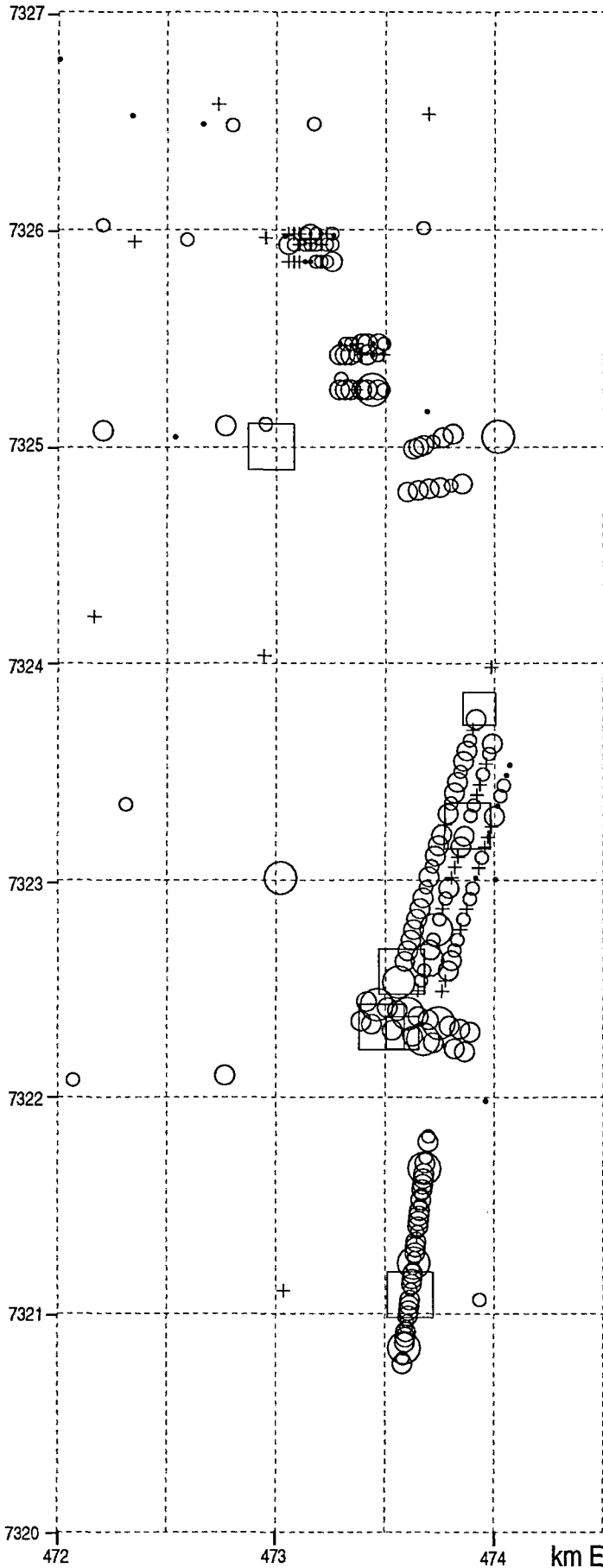
- 179 - 291
- 160 - 179
- 138 - 160
- 96 - 138
- 72 - 96
- + 56 - 72
- 39 - 56

ppmV



Coordinates are UTM zone 35, ED50

km N



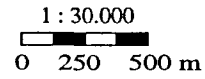
# GRASVATNET 1996

SOIL SAMPLES : 238

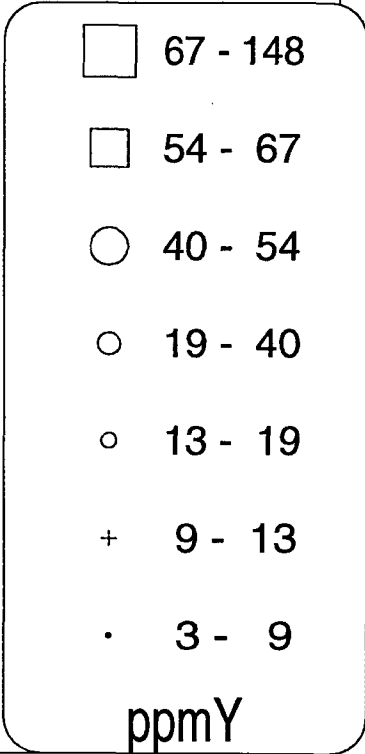
FRACTION : -0.06 MM

EXTRACTION : HNO<sub>3</sub>

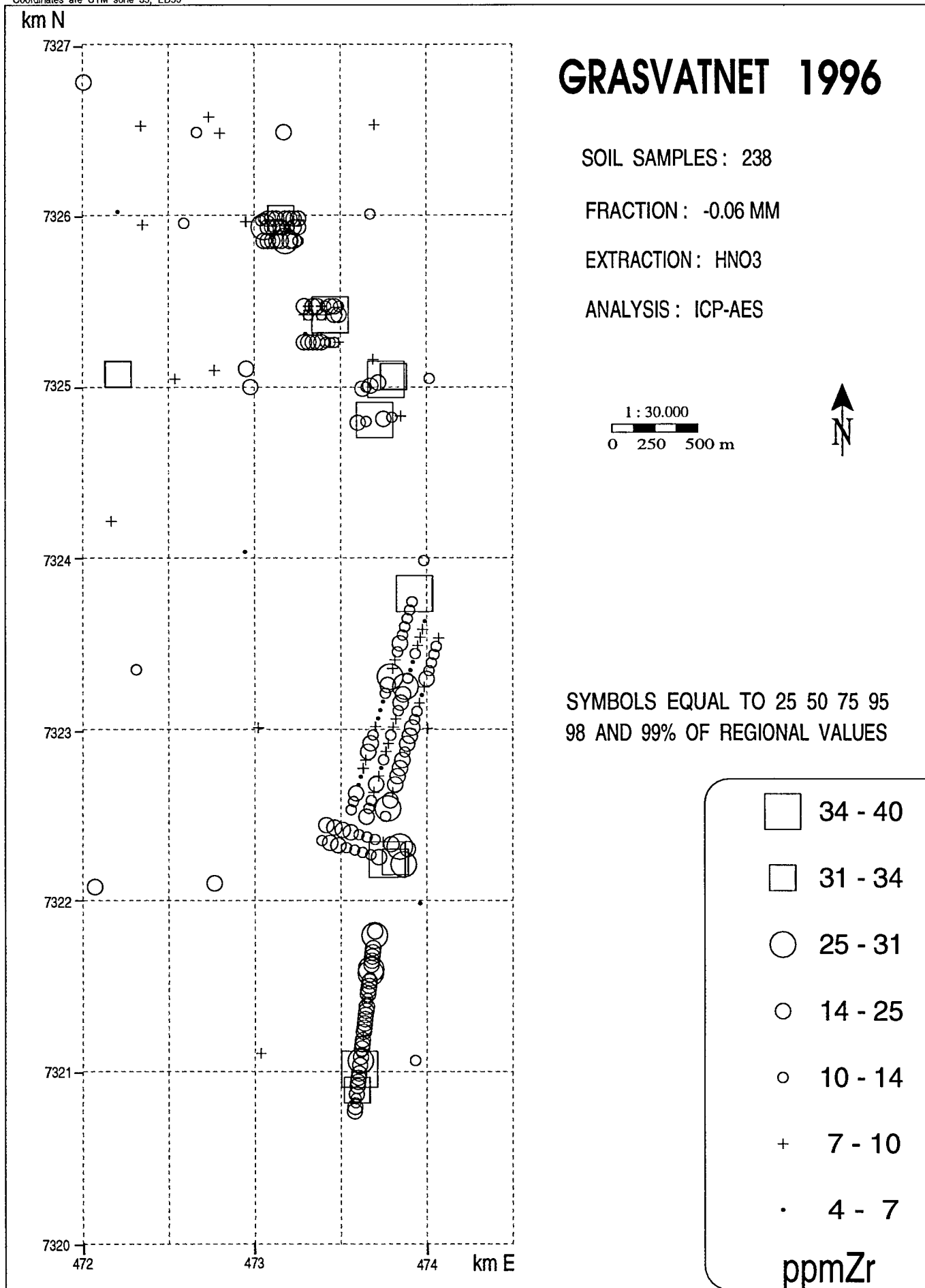
ANALYSIS : ICP-AES



SYMBOLS EQUAL TO 25 50 75 95  
98 AND 99% OF REGIONAL VALUES



Coordinates are UTM zone 35, ED50



STATISTICS OF ANALYTICAL VALUES OF REGIONAL SOIL SAMPLES

	Unit	Min	Max	Median	Average	SD	N
Pb	ppm	5	157	12.77	15.27	13.22	746
Zn	ppm	3	954	60.98	64.59	50.39	746
Cu	ppm	1	3206	33.62	46.37	123.36	746
Au	ppb	1	90	2	3.32	5.69	746
Ag	ppm	1	1	1	1	0	746
Al	%	0.147	6.6	2.41	2.40	0.82	746
B	ppm	5	119	5	5.39	5.01	746
Ba	ppm	10	436	50.95	64.53	48.31	746
Be	ppm	0	39	8.69	9.05	3.91	746
C	%	0.02	37.8	3.54	4.33	3.63	746
Ca	%	0.020	6.8	0.36	0.42	0.40	746
Cd	ppm	1	2	1	1.00	0.05	746
Ce	ppm	10	434	62.67	75.18	55.82	746
Co	ppm	1	93	13.11	16.03	12.42	746
Cr	ppm	1	173	45.35	50.50	25.22	746
Fe	%	0.044	26.9	4.74	5.25	2.69	746
Fines	%	7	97	33.33	35.37	13.97	746
K	%	0.000	1.6	0.20	0.28	0.244	746
La	ppm	1	287	20.31	25.51	23.92	746
Li	ppm	1	75	18.38	20.45	11.67	746
Mg	%	0.014	2.7	0.86	0.90	0.47	746
Mn	%	0.001	0.9	0.03	0.05	0.07	746
Mo	ppm	1	19	1.43	1.91	1.55	746
Na	%	0.010	0.1	0.03	0.03	0.01	746
Ni	ppm	2	205	28.81	33.91	26.33	746
P	%	0.003	3.0	0.08	0.09	0.12	746
S	%	0.00	0.4	0.02	0.04	0.04	746
Sc	ppm	1	31	5.71	6.28	3.28	746
Si	%	0.010	0.4	0.01	0.02	0.032	746
Sr	ppm	2	880	15.84	18.55	33.56	746
Ti	%	0.022	0.6	0.19	0.20	0.08	746
V	ppm	3	378	72.26	79.20	34.35	746
Zr	ppm	1	45	9.57	11.18	6.51	746
Y	ppm	1	260	13.09	16.63	16.63	746









