NGU Rapport 93.124
Radioelement & trace element concentrations
in some Norwegian bedrock groundwaters -
Appendix.

NORGES GEOLOGISKE UNDERSØKELSE

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RAPPORT

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Tittel:

Radioelement & trace element concentrations in some Norwegian bedrock groundwaters - Appendix.

Konsentrasjoner av radio- og sporelementer i noen norske grunnvannstyper i fast fjell - Appendiks.

Forfatter:
David Banks (NGU)

Oppdragsgiver:
NGU, NILU, Statens Strålevern (NRPA)

Fylke:
Østfold, Nord-Trøndelag, Buskerud, Akershus

Kommune:
Hvaler, Leksvik, Steinkjer, Mosvik, Flatanger, Nesodden, Ås, Bærum, Hole, Kongsberg, Moss

Kartbladnavn (M=1:250.000)
Oslo, Skien, Trondheim, Namsos

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1992-1993	31.12.93	63.2589.00	Tor Erik Finne

Sammendrag:

28 samples of groundwater from bedrock boreholes in three distinct Norwegian geological provinces have been taken and analysed for content of ^{222}Rn, U and Th, together with a wide variety of minor and major species. Results are documented in NGU reports 93.121 and 93.126. This report documents the locations and further details of the sampling points.

28 grunnvannsprøver fra borehull i fast fjell i tre norske bergrunnsprovinser er analysert for 222-radon, uran og thorium, samt en rekke hoved- og sporelementer. Disse er rapportert i NGU-rapporter 93.121 og 93.126. Denne rapporten dokumenterer detaljer om prøvetakingslokalitetene.

Emneord: Hydrogeologi	Små grunnvannsverk	Grunnvann
Berggrunn	Grunnvannskvalitet	Uran
Thorium	Radon	Fagrapport

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Purpose of This Report

NGU reports 93.121 and 93.126 discuss the results of a pilot study to investigate the natural content of radon, uranium and a wide variety of major and trace elements in groundwater in bedrock aquifers. Samples were taken from boreholes in Nord-Trøndelag (10 samples), Hvaler (11 samples) and other regions around Oslofjord (7 samples). Two further samples were taken as controls from wells/boreholes in Quaternary deposits in Hvaler and Nord-Trøndelag.

Out of respect for personal privacy the locations of these wells are not detailed in the public NGU-reports. It is, however, regarded as desirable to detail the locations here in case of need for further follow-up work, such as time variant studies.

NGU rapporter 93.121 og 93.126 omtaler resultatene fra et pilotstudium som undersøker den naturlige kjemiske sammensetningen av grunnvann i fast fjell, med hensyn til radon, uran, thorium og en rekke andre hoved- og sporelementer. Prøver er tatt fra borehull i Nord-Trøndelag (10 prøver), Hvaler (11 prøver) og Oslofjordsregionen (7 prøver). Ytterligere to prøver er tatt fra løsmassebrønner i henholdsvis Nord-Trøndelag og Hvaler.

Ut fra hensyn til datavern er de nøyaktige lokaliseringene av prøvetakingspunktene ikke oppgitt i de offentlige NGU-rapportene. Det er imidlertid ønskelig å dokumentere disse punktene i denne rapporten, i tilfelle man ønsker å følge opp resultatene (f.eks. tidsserie-målinger) i et eventuelt hovedstudium.

References

Banks, D., Røyset, O., Strand, T. & Skarphagen, H. 1993. Radioelement (U, Th, Rn) concentrations in Norwegian bedrock groundwaters. *NGU rapport 93.121.*

Banks, D., Reimann, C., Røyset, O. & Skarphagen, H. 1993. Natural concentrations of major and trace elements in some Norwegian bedrock groundwaters. *NGU rapport 93.126.*

Sample nr.	Lithology (Class)	Depth (m)	Lithology No.	Location	Date of sampling	Field code
1	Precambrian gneiss	60 m	7	Nesodden vannverk, Bh.2, Blekslitjern	26/8/92	Ø1
2	Precambrian gneiss	90 m	7	Nesodden vannverk, Damenga	26/8/92	Ø2
3	Precambrian gneiss		7	NLH-Ås, Inst. for Fysikk	26/8/92	Ø3
4	Permian rhomb porphyry	60 m	2	Niskinn vannverk, Bærum	2/9/92	Ø4
5	Permian rhomb porphyry	25 m	2	Rohr-Torp, Solihøgda, Hole	2/9/92	Ø5
6	Permian rhomb porphyry		2	Hvittingfoss Vverk, Kongsberg	2/9/92	Ø6
7	Precambrian gneiss	65-100 m (2 wells)	7	Moss Aktiebryggeri Herik Gernersgt. 10	17/9/92	Ø7
8	Iddefjord granite	80 m	8	Sandbrekke Gjestegård	18/11/93	Ø8
9	Iddefjord granite		8	Bombua, Asmaløy	18/11/93	Ø9
10	Iddefjord granite	c.70 m	8	Jensen, Svanekil, Kirkeøy	8/2/93	Ø10
11	Iddefjord granite	80 m	8	Henriksen, Svanekil	8/2/93	Ø11
12	Iddefjord granite	80 m	8	Arne P. Svanekil, Svanekil	8/2/93	Ø12
13	Iddefjord granite	80 m *	8	A.P.Svanekil, new hole	8/2/93	Ø13
14	Iddefjord Granite	101 m	8	Granli, Korshavn	8/2/93	Ø14
15	Iddefjord granite	70 m	8	Pettersen, Korshavn	8/2/93	Ø15
16	Iddefjord granite	c. 45 m (?)	8	Melhuus, Saltvik	8/2/93	Ø16
17	Iddefjord granite	60 m	8	Brenne, Kirkeøy	9/2/93	Ø17
18	Iddefjord granite	c. 80 m (?)	8	L. Urdal, Urdal, borehole	9/2/93	Ø18
19	Quaternary sand.	2.5 m	1	L. Urdal, well	9/2/93	Ø19
20	Precambrian-cambrian garnet-mica schist	52 m	4	Fætten, Strand, Leksvik	9/9/92	Tr1
21	Precambrian-cambrian garnet-mica schist	120 m	4	Skarsaunet, Heggen, Leksvik	9/9/92	Tr2
22	Precambrian-cambrian quartz and garnet-mica schist	25.5 m (?)	4	Killingberg, Tronvik, Leksvik	9/9/92	Tr3
23	Precambrian-cambrian mica schist	75 m	4	Gangstad, Leksvik	9/9/92	Tr4
24	Ordovician(?) metadiorite	80 m	3	Våde, Trongsundet, Mosvik	9/9/92	Tr5
25	Precambrian gneiss	80 m	6	Hilstad, Flatanger	18/9/92	Tr6
26	Late Pre€-palæozoic metaarkose	120 m	4	Bjørsvik, Heistad, Sparbu, Steinkjer	11/9/92	Tr7
27	Quaternary sediments	1 m	1	Røysing vannverk, Steinkjer	11/9/92	Tr8
28	Ordovician(?) metadiorite	119 m	3	Vennes vannverk, Møsvik	11/9/92	Tr9
29	Pre€.-€. granodioritic gneiss	100 m	5	Bragstad vannverk, Mosvik	11/9/92	Tr10
30	Precambrian granitic gneiss	71 m	6	Nesset, Mosvik	11/9/92	Tr11

Table 1. Details of samples taken during the Norwegian pilot study. Samples 1 - 7 from Oslofjord, 8 - 19 Hvaler, 20 - 30 Nord Trøndelag. * = angled borehole.

Lithology numbers used in Table 1

1 = Quaternary wells
2 = rhomb porphyry basalts (Oslofjord)
3 = metadiorite (Trøndelag)
4 = metasediments (schists, meta-arkose, Trøndelag)
5 = granodiorite gneiss (Trøndelag)
6 = Precambrian gneiss (Trøndelag)
7 = Precambrian gneiss (Oslofjord)
8 = Iddefjord granite (Hvaler)

Comments on sampling

Sample No.	Comments
Ø1	Sample taken at end of hose. Yield 2800 l/hr.
Ø2	Sample taken at inflow to water tower. Red-brown flakes in water. Many gas bubbles.
Ø7	Two wells, one 65 m, one 100 m. Provide min. 50 m^3/day as washing water for brewery. Impossible to take sample in closed system. Sample taken after c. ½ m free fall.
Ø10	Water reported to contain some humus and fluoride. Owner has installed active carbon filter. Sample taken prior to filter. Worse water with much rainfall.
Ø12	Some clay particles and humus in water (persistent problem).
Ø13	Sample not filtered due to high particulate content.
Ø14	Ejector pump. Some H_2S smell.
Ø19	Clay and sand upon bedrock.
Tr2	Owner - Otto Skarsaunet. Heggen farm, Kråkmo, Leksvik.

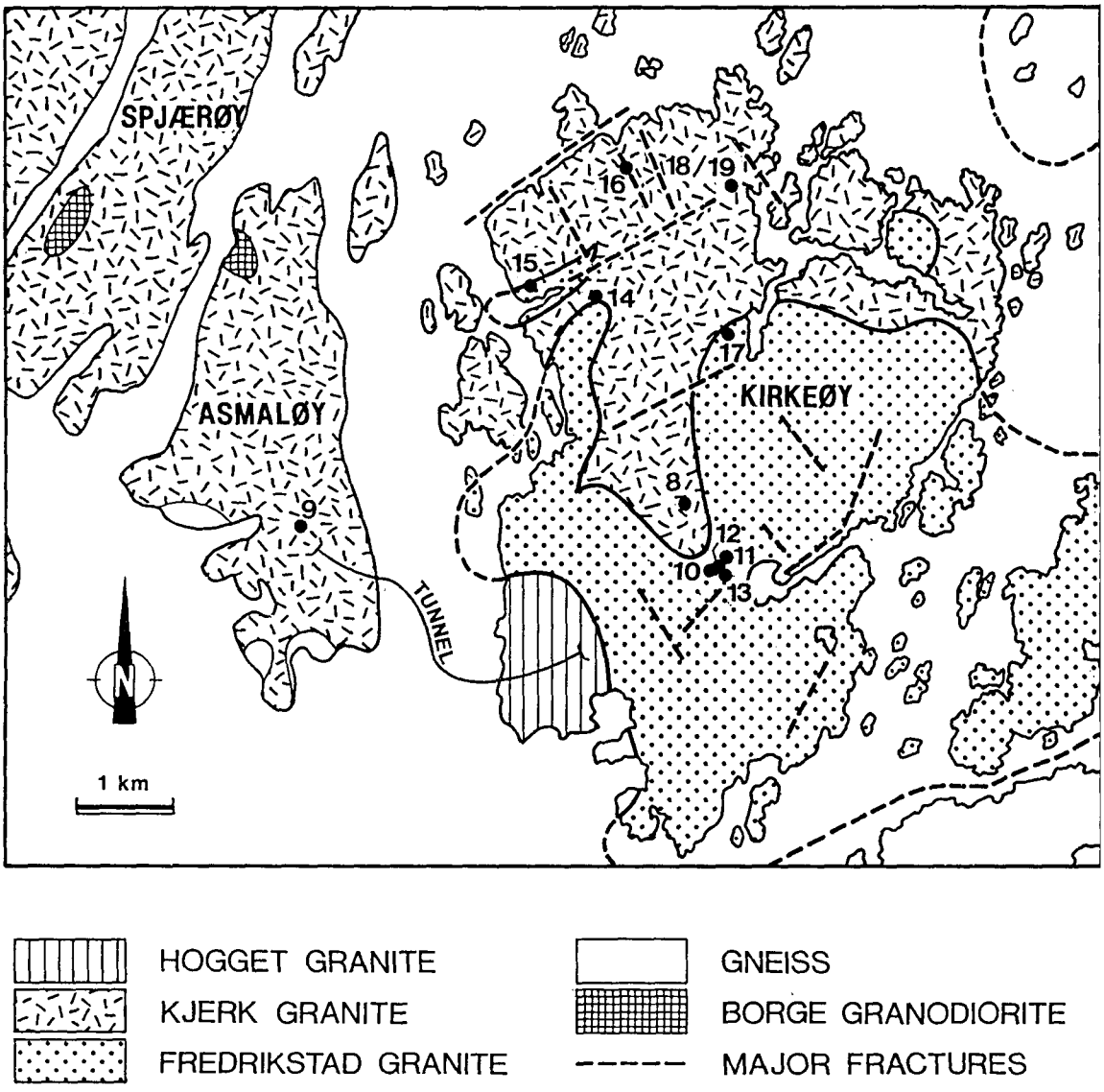

Fig.1. Map of Kirkeøy and Asmaløy showing location of samples from Hvaler.

Table 2 - UTM Grid references for sampling locations

Trøndelag

Indeks nr.	UTM (sone 32)
Tr1	5627 70483
Tr2	5620 70588
Tr3	5874 70658
Tr4	5808 70725
Tr5	5828 70800
Tr6	5858 71512
Tr7	6222 70933
Tr8	6304 71033
Tr9	6000 70851
Tr10	5991 70845
Tr11	5958 70880

Oslofjord

Ø1	5916 66313
Ø2	5908 66254
Ø3	6002 66153
Ø4	5762 66485
Ø5	5748 66489
Ø6	5589 65945
Ø7	5945 65903

Hvaler

Ø8	61642 654792
Ø9	61202 654740
Ø10	6166 65471
Ø11	6166 65472
Ø12	61662 654712
Ø13	61667 654706
Ø14	61519 655025
Ø15	6145 65502
Ø16	61550 655169
Ø17	61660 654982
Ø18	6166 65515
Ø19	6166 65515

Appendix 1

ICP analyses from NGU

(all samples field filtered and acidified, except sample 13)

ANALYSE-RAPPORT.

Norges Geologiske Undersøkelse.

Prosjektnr: 63.2589.00 Oppdragsnr: 152/92

Oppdragsgiver: NGU GRUNNVANN OG MILJØKJMI V/DAVID BANKS

Instrument: PLASMA

	Si ppb	Al ppb	Fe ppb	Ti ppb	Mg ppb	Ca ppb	Na ppb	K ppb	Mn ppb	P ppb
Nedre grense	20.0	20.0	10.0	10.0	50.0	20.0	10.0	200.0	2.0	100.0
	Cu ppb	Zn ppb	Pb ppb	Ni ppb	Co ppb	V ppb	Mo ppb	Cd ppb	Cr ppb	Ba ppb
Nedre grense	2.0	5.0	50.0	40.0	10.0	5.0	10.0	10.0	10.0	2.0
	Sr ppb	Zr ppb	Ag ppb	B ppb	Be ppb	Li ppb	Sc ppb	Ce ppb	La ppb	Y ppb
Nedre grense	2.0	5.0	10.0	20.0	2.0	2.0	2.0	50.0	10.0	2.0

Disse data er lagret i % på NGU's data-anlegg på filen A15292.BRK.KJAN Format : (A8,30(A1,F12.8))
Prøvenavnet kan leses som heltall,høyrejustert fra kolonne 7 med 8. kolonne
til å markere A- el. B-prøver dvs (I7,A1,30(A1,F12.8))

Prosjektnr: 63.2589.00 Oppdragsnr: 152/92

	Tr1-FS	Tr2-FS	Tr3-FS	Tr4-FS	Tr5-FS
Si	2.31 ppm	4.52 ppm	2.88 ppm	9.27 ppm	2.92 ppm
Al	<20.0 ppb	<20.0 ppb	25.9 ppb	<20.0 ppb	<20.0 ppb
Fe	<10.0 ppb	10.6 ppb	<10.0 ppb	781.1 ppb	<10.0 ppb
Ti	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Mg	8.66 ppm	1.89 ppm	21.11 ppm	9.81 ppm	3.38 ppm
Ca	22.35 ppm	14.76 ppm	18.52 ppm	97.45 ppm	10.61 ppm
Na	22.90 ppm	51.75 ppm	40.88 ppm	9.90 ppm	125.1 ppm
K	3.45 ppm	<200.0 ppb	9.31 ppm	6.02 ppm	2.30 ppm
Mn	< 2.0 ppb	< 2.0 ppb	36.1 ppb	401.3 ppb	< 2.0 ppb
P	<100.0 ppb	<100.0 ppb	<100.0 ppb	<100.0 ppb	<100.0 ppb
Cu	7.8 ppb	2.2 ppb	3.4 ppb	< 2.0 ppb	< 2.0 ppb
Zn	< 5.0 ppb	< 5.0 ppb	149.2 ppb	< 5.0 ppb	< 5.0 ppb
Pb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb
Ni	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb
Co	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
V	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb
Mo	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Cd	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Cr	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Ba	2.0 ppb	< 2.0 ppb	52.8 ppb	9.2 ppb	4.3 ppb
Sr	132.7 ppb	326.6 ppb	213.9 ppb	723.8 ppb	264.6 ppb
Zr	< 5.0 ppb	< 5.0 ppb	8.8 ppb	< 5.0 ppb	< 5.0 ppb
Ag	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
B	<20.0 ppb	20.1 ppb	50.3 ppb	40.2 ppb	159.1 ppb
Be	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Li	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	6.1 ppb	< 2.0 ppb
Sc	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Ce	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb
La	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Y	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb

29.SEP 1992

Prosjektnr: 63.2589.00 Oppdragsnr: 174/92

	TR6-FS		TR7-FS		TR8-FS		TR9-FS		TR10-FS		TR11-FS	
Si	3.59	ppm	5.14	ppm	4.63	ppm	3.43	ppm	4.34	ppm	4.86	ppm
Al	24.3	ppb	<20.0	ppb	32.8	ppb	23.2	ppb	21.8	ppb	38.5	ppb
Fe	<10.0	ppb	45.7	ppb	18.3	ppb	<10.0	ppb	14.6	ppb	47.5	ppb
Ti	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb
Mg	4.84	ppm	10.11	ppm	9.53	ppm	6.47	ppm	8.20	ppm	9.46	ppm
Ca	17.73	ppm	55.09	ppm	53.27	ppm	40.80	ppm	33.84	ppm	26.76	ppm
Na	75.86	ppm	10.39	ppm	8.54	ppm	32.55	ppm	19.76	ppm	15.29	ppm
K	1.36	ppm	426.1	ppb	6.31	ppm	3.69	ppm	3.34	ppm	1.58	ppm
Mn	< 2.0	ppb	209.3	ppb	9.4	ppb	20.1	ppb	79.7	ppb	370.2	ppb
P	<100.0	ppb	<100.0	ppb	<100.0	ppb	<100.0	ppb	<100.0	ppb	<100.0	ppb
Cu	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	2.9	ppb	3.4	ppb	3.4	ppb
Zn	7.2	ppb	< 5.0	ppb	< 5.0	ppb	6.2	ppb	< 5.0	ppb	9.8	ppb
Pb	<50.0	ppb	<50.0	ppb	<50.0	ppb	<50.0	ppb	<50.0	ppb	<50.0	ppb
Ni	<40.0	ppb	<40.0	ppb	<40.0	ppb	<40.0	ppb	<40.0	ppb	<40.0	ppb
Co	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb
V	< 5.0	ppb	< 5.0	ppb	< 5.0	ppb	< 5.0	ppb	< 5.0	ppb	< 5.0	ppb
Mo	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb
Cd	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb
Cr	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb
Ba	< 2.0	ppb	207.2	ppb	21.8	ppb	5.4	ppb	2.0	ppb	< 2.0	ppb
Sr	34.0	ppb	2.89	ppm	163.4	ppb	392.0	ppb	463.6	ppb	185.4	ppb
Zr	6.4	ppb	< 5.0	ppb	5.7	ppb	< 5.0	ppb	< 5.0	ppb	< 5.0	ppb
Ag	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb
B	93.3	ppb	<20.0	ppb	<20.0	ppb	21.2	ppb	<20.0	ppb	<20.0	ppb
Be	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb
Li	< 2.0	ppb	10.5	ppb	3.9	ppb	< 2.0	ppb	2.2	ppb	< 2.0	ppb
Sc	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb
Ce	<50.0	ppb	<50.0	ppb	<50.0	ppb	<50.0	ppb	<50.0	ppb	<50.0	ppb
La	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb	<10.0	ppb
Y	< 2.0	ppb	2.6	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb	< 2.0	ppb

Prosjektnr: 63.2589.00 Oppdragsnr: 137/92

	Ø1SF	Ø2SF	Ø3SF
Si	4.22 ppm	5.50 ppm	4.85 ppm
Al	<20.0 ppb	25.4 ppb	<20.0 ppb
Fe	278.8 ppb	393.9 ppb	192.4 ppb
Ti	<10.0 ppb	<10.0 ppb	<10.0 ppb
Mg	2.89 ppm	7.50 ppm	5.49 ppm
Ca	24.24 ppm	49.93 ppm	20.28 ppm
Na	13.21 ppm	41.42 ppm	84.79 ppm
K	<200.0 ppb	1.38 ppm	3.75 ppm
Mn	585.5 ppb	472.0 ppb	149.4 ppb
P	<100.0 ppb	<100.0 ppb	<100.0 ppb
Cu	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Zn	< 5.0 ppb	< 5.0 ppb	28.4 ppb
Pb	<50.0 ppb	<50.0 ppb	<50.0 ppb
Ni	<40.0 ppb	<40.0 ppb	<40.0 ppb
Co	<10.0 ppb	<10.0 ppb	<10.0 ppb
V	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb
Mo	15.9 ppb	10.5 ppb	16.4 ppb
Cd	<10.0 ppb	<10.0 ppb	<10.0 ppb
Cr	<10.0 ppb	<10.0 ppb	<10.0 ppb
Ba	7.5 ppb	31.6 ppb	33.8 ppb
Sr	76.5 ppb	175.1 ppb	117.6 ppb
Zr	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb
Ag	<10.0 ppb	<10.0 ppb	<10.0 ppb
B	<20.0 ppb	48.4 ppb	66.5 ppb
Be	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Li	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Sc	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Ce	<50.0 ppb	<50.0 ppb	<50.0 ppb
La	<10.0 ppb	<10.0 ppb	<10.0 ppb
Y	4.5 ppb	2.0 ppb	< 2.0 ppb

23.OCT 1992

Prosjektnr: 63.2589.00 Oppdragsnr: 196/92

	Ø4-FS	Ø5-FS	Ø6-FS	Ø7-FS
Si	3.91 ppm	2.93 ppm	3.84 ppm	3.80 ppm
Al	31.3 ppb	29.3 ppb	21.5 ppb	31.0 ppb
Fe	113.6 ppb	12.8 ppb	<10.0 ppb	27.5 ppb
Ti	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Mg	2.82 ppm	4.00 ppm	6.60 ppm	10.24 ppm
Ca	25.88 ppm	39.27 ppm	28.42 ppm	16.91 ppm
Na	3.02 ppm	21.37 ppm	3.30 ppm	268.1 ppm
K	<200.0 ppb	<200.0 ppb	<200.0 ppb	10.02 ppm
Mn	354.6 ppb	< 2.0 ppb	< 2.0 ppb	49.5 ppb
P	<100.0 ppb	<100.0 ppb	<100.0 ppb	<100.0 ppb
Cu	2.3 ppb	41.8 ppb	2.3 ppb	3.8 ppb
Zn	< 5.0 ppb	41.1 ppb	< 5.0 ppb	< 5.0 ppb
Pb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb
Ni	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb
Co	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
V	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb
Mo	<10.0 ppb	<10.0 ppb	<10.0 ppb	12.7 ppb
Cd	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Cr	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Ba	139.6 ppb	< 2.0 ppb	51.4 ppb	27.6 ppb
Sr	241.0 ppb	285.1 ppb	306.0 ppb	211.6 ppb
Zr	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	12.1 ppb
Ag	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
B	<20.0 ppb	<20.0 ppb	<20.0 ppb	253.6 ppb
Be	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Li	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	2.2 ppb
Sc	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb
Ce	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb
La	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb
Y	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb

8.JAN 1993

Prosjektnr: 63.2589.00

Oppdragsnr: 239/92

	Ø8FS		Ø9FS	
Si	7.19	ppm	4.24	ppm
Al	<20.0	ppb	30.3	ppb
Fe	377.8	ppb	16.3	ppb
Ti	<10.0	ppb	<10.0	ppb
Mg	3.08	ppm	1.66	ppm
Ca	10.48	ppm	20.80	ppm
Na	70.96	ppm	59.13	ppm
K	2.92	ppm	3.76	ppm
Mn	128.4	ppb	27.7	ppb
P	<100.0	ppb	<100.0	ppb
Cu	< 2.0	ppb	3.2	ppb
Zn	59.0	ppb	10.7	ppb
Pb	<50.0	ppb	<50.0	ppb
Ni	<40.0	ppb	<40.0	ppb
Co	<10.0	ppb	<10.0	ppb
V	< 5.0	ppb	< 5.0	ppb
Mo	21.9	ppb	24.7	ppb
Cd	<10.0	ppb	<10.0	ppb
Cr	<10.0	ppb	<10.0	ppb
Ba	6.7	ppb	3.9	ppb
Sr	76.3	ppb	101.4	ppb
Zr	43.1	ppb	13.1	ppb
Ag	<10.0	ppb	<10.0	ppb
B	72.6	ppb	117.7	ppb
Be	< 2.0	ppb	< 2.0	ppb
Li	< 2.0	ppb	4.5	ppb
Sc	< 2.0	ppb	< 2.0	ppb
Ce	<50.0	ppb	<50.0	ppb
La	<10.0	ppb	<10.0	ppb
Y	< 2.0	ppb	< 2.0	ppb

18.MAR 1993

Prosjektnr: 63.2589.00 Oppdragsnr: 38/93

	Ø10FS	Ø11FS	Ø12FS	Ø13	Ø13S	Ø14FS	Ø15FS	Ø16FS	Ø17FS	Ø18FS		Ø19FS
Si	5.81 ppm	5.38 ppm	5.19 ppm	3.31 ppm	3.12 ppm	5.77 ppm	5.33 ppm	5.90 ppm	5.95 ppm	4.69 ppm	Si	3.75 ppm
Al	438.1 ppb	84.3 ppb	728.9 ppb	398.2 ppb	368.7 ppb	47.8 ppb	146.7 ppb	300.7 ppb	26.1 ppb	44.3 ppb	Al	1.17 ppm
Fe	1.31 ppm	424.2 ppb	763.5 ppb	291.8 ppb	261.3 ppb	1.34 ppm	132.3 ppb	290.1 ppb	27.1 ppb	93.3 ppb	Fe	127.2 ppb
Ti	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	Ti	<10.0 ppb
Mg	2.48 ppm	7.54 ppm	1.34 ppm	9.97 ppm	9.88 ppm	2.35 ppm	3.14 ppm	726.2 ppb	1.56 ppm	5.10 ppm	Mg	2.21 ppm
Ca	4.98 ppm	13.40 ppm	2.82 ppm	45.86 ppm	45.44 ppm	3.65 ppm	13.91 ppm	1.31 ppm	3.25 ppm	16.90 ppm	Ca	4.00 ppm
Na	95.03 ppm	317.2 ppm	76.26 ppm	167.9 ppm	166.1 ppm	116.4 ppm	28.28 ppm	110.8 ppm	169.6 ppm	122.7 ppm	Na	18.75 ppm
K	4.92 ppm	7.26 ppm	<200.0 ppb	5.53 ppm	6.07 ppm	2.68 ppm	1.39 ppm	1.30 ppm	1.14 ppm	3.80 ppm	K	<200.0 ppb
Mn	105.5 ppb	194.5 ppb	300.9 ppb	58.8 ppb	58.7 ppb	49.8 ppb	184.4 ppb	17.9 ppb	19.3 ppb	152.6 ppb	Mn	79.7 ppb
P	<100.0 ppb	<100.0 ppb	<100.0 ppb	<100.0 ppb	<100.0 ppb	<100.0 ppb	<100.0 ppb	101.2 ppb	<100.0 ppb	<100.0 ppb	P	<100.0 ppb
Cu	4.4 ppb	18.7 ppb	4.4 ppb	26.7 ppb	29.7 ppb	< 2.0 ppb	7.2 ppb	14.0 ppb	6.9 ppb	3.0 ppb	Cu	20.6 ppb
Zn	88.0 ppb	< 5.0 ppb	8.8 ppb	116.2 ppb	120.6 ppb	< 5.0 ppb	84.2 ppb	61.5 ppb	< 5.0 ppb	15.3 ppb	Zn	80.2 ppb
Pb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	Pb	<50.0 ppb
Ni	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	<40.0 ppb	Ni	<40.0 ppb
Co	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	Co	<10.0 ppb
V	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	< 5.0 ppb	V	< 5.0 ppb
Mo	25.6 ppb	42.5 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	13.2 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	Mo	<10.0 ppb
Cd	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	Cd	<10.0 ppb
Cr	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	Cr	<10.0 ppb
Ba	7.8 ppb	9.7 ppb	7.5 ppb	21.1 ppb	20.1 ppb	9.1 ppb	21.7 ppb	4.5 ppb	4.5 ppb	2.6 ppb	Ba	20.4 ppb
Sr	36.1 ppb	105.8 ppb	16.8 ppb	361.8 ppb	357.3 ppb	30.2 ppb	91.7 ppb	9.8 ppb	36.0 ppb	146.0 ppb	Sr	30.2 ppb
Zr	65.1 ppb	82.5 ppb	14.0 ppb	< 5.0 ppb	< 5.0 ppb	22.0 ppb	< 5.0 ppb	15.9 ppb	9.9 ppb	< 5.0 ppb	Zr	< 5.0 ppb
Ag	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	Ag	<10.0 ppb
B	129.1 ppb	408.4 ppb	87.6 ppb	113.0 ppb	108.4 ppb	145.3 ppb	34.6 ppb	152.3 ppb	177.7 ppb	147.7 ppb	B	<20.0 ppb
Be	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	Be	< 2.0 ppb
Li	< 2.0 ppb	3.4 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	3.9 ppb	Li	< 2.0 ppb
Sc	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	< 2.0 ppb	Sc	< 2.0 ppb
Ce	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	<50.0 ppb	Ce	<50.0 ppb
La	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	<10.0 ppb	La	<10.0 ppb
Y	3.5 ppb	3.2 ppb	5.9 ppb	< 2.0 ppb	2.4 ppb	< 2.0 ppb	2.4 ppb	5.5 ppb	< 2.0 ppb	4.2 ppb	Y	< 2.0 ppb

Appendix 2

Ion chromatography results - NGU

(all samples unfiltered, unacidified)

Side 2
152/92 Dato 05.10.92

Prøve nr	F^-	Cl^-	NO_2^-	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
Tr 1	<50.0ppb	14.3ppm	<250 ppb	63.6ppb	1.63ppm	<200 ppb	7.86ppm
Tr 2	192 ppb	12.6ppm	<250 ppb	78.0ppb	<50.0ppb	<200 ppb	6.12ppm
Tr 3	1.62ppm	17.2ppm	<250 ppb	35.3ppb	616 ppb	<200 ppb	18.3ppm
Tr 4	<50.0ppb	22.4ppm	<500 ppb	151 ppb	<50.0ppb	<200 ppb	817 ppb
Tr 5	<50.0ppb	86.0ppm	<1.00ppm	243 ppb	88.2ppb	<200 ppb	46.1ppm

Side 2
Dato 09.10.92

174/92

Prøve nr	F^-	Cl^-	NO_2^-	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
Tr 6	1.45ppm	78.1ppm	<1.00ppm	220 ppb	<50.0ppb	<200 ppb	24.9ppm
Tr 7	311 ppb	7.76ppm	<100 ppb	72.2ppb	<50.0ppb	<200 ppb	3.99ppm
Tr 8	1.09ppm	18.6ppm	<250 ppb	38.3ppb	8.71ppm	<200 ppb	24.2ppm
Tr 9	229 ppb	17.6ppm	<250 ppb	43.6ppb	<50.0ppb	<200 ppb	9.79ppm
Tr 10	219 ppb	12.2ppm	<250 ppb	27.4ppb	<50.0ppb	<200 ppb	11.1ppm
Tr 11	159 ppb	12.2ppm	<250 ppb	50.6ppb	<50.0ppb	<200 ppb	3.04ppm

Oppdrags nummer :137/92

Prøve nr	F^-	Cl^-	NO_2^-	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
ø1	522 ppb	8.30ppm	<100 ppb	<20.0ppb	<50.0ppb	<200 ppb	6.97ppm
ø2	987 ppb	47.4ppm	<250 ppb	141 ppb	<50.0ppb	<200 ppb	35.0ppm
ø3	981 ppb	20.6ppm	<250 ppb	57.8ppb	<50.0ppb	<200 ppb	21.4ppm

Oppdrags nummer :196/92

Prøve nr	F^-	Cl^-	NO_2^-	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
ø4	1.08ppm	2.39ppm	<50.0ppb	<20.0ppb	166 ppb	<200 ppb	6.63ppm
ø 5	231 ppb	49.4ppm	<500 ppb	22.2ppb	3.83ppm	<200 ppb	9.82ppm
ø 6	1.00ppm	3.24ppm	<50.0ppb	<20.0ppb	929 ppb	<200 ppb	8.14ppm
ø 7	2.85ppm	284 ppm	<2.50ppm	915 ppb	300 ppb	<200 ppb	61.3ppm

Oppdrags nummer : 239/92

Prøve nr	F^-	Cl^-	NO_2^-	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
ø 8	3.12ppm	36.5ppm	<500 ppb	78.6ppb	<50.0ppb	<200 ppb	12.0ppm
ø 9	3.39ppm	24.6ppm	<500 ppb	<20.0ppb	248 ppb	<200 ppb	21.2ppm

Oppdragsnummer : 38/93

Prøve nr	F^-	Cl^-	NO_2^-	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
ø 10	3.05ppm	67.2ppm	<500 ppb	191 ppb	130 ppb	<200 ppb	24.4ppm
ø 11	4.44ppm	390 ppm	<5.00ppm	853 ppb	326 ppb	<200 ppb	62.9ppm
ø 12	2.26ppm	99.2ppm	<1.00ppm	164 ppb	99.0ppb	<200 ppb	16.5ppm
ø 13	1.35ppm	281 ppm	<5.00ppm	583 ppb	1.42ppm	<200 ppb	48.0ppm
ø 14	3.92ppm	94.5ppm	<1.00ppm	175 ppb	<50.0ppb	<200 ppb	21.7ppm
ø 15	821 ppb	43.5ppm	<500 ppb	56.8ppb	6.37ppm	<200 ppb	13.9ppm
ø 16	3.97ppm	56.9ppm	<500 ppb	103 ppb	63.2ppb	<200 ppb	11.6ppm
ø 17	4.11ppm	114 ppm	<1.00ppm	254 ppb	61.8ppb	<200 ppb	29.0ppm
ø 18	3.26ppm	111 ppm	<1.00ppm	229 ppb	<50.0ppb	<200 ppb	27.6ppm
ø 19	171 ppb	44.9ppm	<500 ppb	<20.0ppb	<50.0ppb	<200 ppb	11.2ppm

Appendix 3

pH, alkalinity, conductivity results - NGU

(all samples unfiltered, unacidified)

Oppdragsnr. 152/92

Nr.	Prøvemrk.	Ledn.evne µS/cm	pH	Alkalitet mmol/l
1.	Tr-1	273	7.67	2.31
2.	Tr-2	287	8.17	2.65
3.	Tr-3	425	7.79	3.79
4.	Tr-4	563	7.56	5.49
5.	Tr-5	622	8.66	3.23

Oppdragsnr. 174/92

Nr.	Prøvemrk.	Ledn.evne µS/cm	pH	Alkalitet mmol/l
1.	Tr- 6	464	8.20	2.12
2.	Tr- 7	358	7.83	3.75
3.	Tr- 8	371	7.25	2.78
4.	Tr- 9	368	7.88	3.42
5.	Tr-10	303	7.99	2.76
6.	Tr-11	255	7.21	2.40

Oppdragsnr. 137/92

Nr.	Prøvemrk.	Ledn.evne µS/cm	pH	Alkalitet mmol/l
1.	Ø-1	200	6.88	1.68
2.	Ø-2	531	7.01	3.46
3.	Ø-3	473	7.76	4.25

Oppdragsnr. 196/92

Nr.	Prøvemrk.	Ledn.evne µS/cm	pH	Alkalitet mmol/l
1.	Ø-4	159	6.87	1.54
2.	Ø-5	335	7.01	1.65
3.	Ø-6	197	8.14	1.90
4.	Ø-7	1.47 mS	8.15	3.71

Oppdragsnr. 239/92

Nr.	Prøvemrk.	Ledn.evne µS/cm	pH	Alkalitet mmol/l
1.	Ø-8	382	7.67	2.79
2.	Ø-9	373	8.35	2.75

Oppdragsnr. 38/93

Nr.	Prøvemrk.	Ledn.evne µS/cm	pH	Alkalitet mmol/l
1.	Ø-10	481	6.55	1.81
2.	Ø-11	1.61 mS	7.95	3.79
3.	Ø-12	429	6.86	1.04
4.	Ø-13	1094	6.65	1.64
5.	Ø-14	555	7.19	2.56
6.	Ø-15	244	6.43	0.88
7.	Ø-16	480	7.91	2.96
8.	Ø-17	784	8.41	3.55
9.	Ø-18	690	7.61	2.87
10.	Ø-19	155	4.82	- *

*)= Ikke påvist

Appendix 4

ICP-MS results, NILU

(FS = field filtered and acidified)

Na values given here are known to be erroneous and have not been used.

NORSK INSTITUTT FOR LUFTFORSKNING - NORWEGIAN INSTITUTE FOR AIR RESEARCH
POSTBOKS 64, N-2001 LILLESTRØM

NILU

Norges Geologiske undersøkelse
v/David Banks
Postboks 3006
Lade
7002 Trondheim

ANK.	4.293
AVD.	G-vann
BESV.	
JNR.	556
ansv.	BAF
KONF.	
S.BEH.	
ARK.	

Kopi: D. Banks V

Deres ref./*Your ref.*:	Vår ref./*Our ref.*:	Dato/*Date:*
	OR/MAa/O-92115/B	2. februar 1993

Resultater -Kartlegging av U, Th i grunnvann, Østfold & Trøndelag.

Vi viser til Deres bestilling av 29.10.1992 for 20 vannprøver, ufiltrert og filtrert surgjordt. Vedlagt følger analyseresultater for elementer oppnådd med ICPMS for de 20 prøvene. Resultatene er rapportert i ng/ml.

Prøvepreparering:
I henhold til Deres bestillig var prøvene behandlet på følgende måte

1 Ufiltrert ukonservert
2 Filtrert konservert med 1 dråpe kons. HNO_3 pr 100 ml (dvs. ca. 0.01 M HNO_3)

Ved ICPMS-analyse ble 10 ml prøve tatt ut og tilsatt 100 µl konsentrert HNO_3 (1% HNO_3). Dette ble gjort med både de konserverte og de ukonserverte prøven for å tilpasse syrematriksen til standardløsningene som benyttes ved ICPMS. Prøvene ble også tilsatt Sc, In og Re (50 ng/ml) som intern standard. Ihht. vår muntlige avtale skulle den ufiltrerte ukonserverte prøven analyseres uten noen syrekonservering, men bare tilsatt internstandard (noe som ville medføre at syrekonsentrasjonen etter tilsetting av intern standard ble ca 0.001 M HNO_3). Dette ble også gjort, men det viste seg at responsen på den interne standarden da sank betydelig, noe som medførte at resultatene tilsynelatende ble altfor høye (tildels betydelig høyere enn for de syrekonserverte prøvene). Vi tror imidlertid at resultatene fra de ukonserverte prøvene ikke er betydelig påvirket av at vi konserverte de etter uttak fra prøveflasken noen timer før ICPMS-analyse. Det ble lagt vekt på å ikke riste flasken for å unngå å virvle opp eventuelt bunnfall, og prøvene ble analysert samme dag som de ble konservert, noe som skulle forhindre frigjøring eventuelt tungtløselige metallfaser.

I vårt kvalitetssikringsprogram blir kaliberingen for ICPMS kontrollert mot referansestandarder fra SPEX Industries, USA, med krav om maksimalt 10% avvik ved konsentrasjonen 10 ng/ml for

å akseptere kaliberingen. Disse standardene er sporbare til primære sertifiserte standarder fra NIST (U.S. National Institute of Standards and Technology).

Analyseresultatene i rapporten er oppgitt med varierende antall gjeldende siffer. Vennligst legg merke til at antall gjeldende siffer er 2 (to) for alle analyseresultater. Grunnen til at det gis for mange gjeldene siffer er at det rapportgeneratoren i vårt laboratoriedatasystem er vanskelig å justere antall gjeldende siffer.

Vi håper at analysene av U og Th er så interessante at dette gir grunnnlag for ytterligere kartlegginger av disse elementene i grunnvann senere. Vi på NILU håper da at vi kan samarbeide om dette og eventuelt være med på en felles prosjektsøknad til feks. SFT sammen med NGU. Som avtalt rapporterer vi en rekke andre tungmetaller utover U og Th i disse vannprøvene, for å vise hvilke muligheter som ICPMS gir for kartlegging av elementer i grunnvann og andre miljøprøver. Siden det etter avtalen ikke skal betales for disse ekstra analysene, ber vi vennligst om at disse ekstra analyseresultatene ikke publiseres uten etter avtale med med NILU.

Vi håper at resultatene i rapporten er tilfredstillende. Dersom det skulle være noen uklarheter står vi med glede til tjeneste for å oppklare dette.

Vennlig hilsen

Oddvar Røyset
Dr. Scient.
Leder, Uorganisk analyse

Marit Vadset
Ingeniør

NILU ICPMS REPORT PROJECT NB. 0-92115 DATE: 93/02/01 UNIT

aPRFIL	SAMPLE ID	Volum	Dil_fkt	mm	Filter Air.vol Weight	Pb	Cd	Cu	Zn	Cr	Ni	Co	Fe	Mn	V
ng27167	0-92115.BOMBU HV.92/11/18.0.....Ø9 1%...j	1.	1.			0.329	0.044	2.099	6.75	4.951	0.92	0.123	247.8	17.7	2.816
ng27168	0-92115.BOMBU HV.92/11/18.0.....Ø9FS...j	1.	1.			0.684	0.059	3.708	10.40	5.359	1.41	0.125	277.5	22.1	3.094
ng27139	0-92115.BRAGSTAD.92/09/11.0.....Tr10 1%...j	1.	1.			0.872	-0.010	1.425	-0.50	2.187	0.69	-0.100	339.2	65.5	0.392
ng27140	0-92115.BRAGSTAD.92/09/11.0.....Tr10FS...j	1.	1.			1.896	-0.010	1.298	0.93	2.205	0.70	-0.100	372.4	71.9	0.589
ng27130	0-92115.HEISTAD.92/09/11.0.....Tr 7 1%...j	1.	1.			0.095	-0.010	0.710	3.14	2.253	1.41	0.144	535.6	168.1	0.446
ng27131	0-92115.HEISTAD.92/09/11.0.....Tr 7FS...j	1.	1.			0.124	-0.010	-0.100	3.18	1.561	1.34	0.131	620.5	188.3	0.481
ng27161	0-92115.HVITTING.92/09/02.0.....PR6 1%...j	1.	1.			0.069	-0.010	1.501	2.09	1.548	0.74	-0.100	303.2	-1.0	0.433
ng27162	0-92115.HVITTING.92/09/02.0.....PR6FS...j	1.	1.			0.227	-0.010	1.505	4.08	1.341	0.84	-0.100	330.9	-1.0	0.443
ng27145	0-92115.MOSS AKT.92/09/17.0.....Ø7 1%...j	1.	1.			1.281	0.021	2.912	0.98	34.450	0.58	-0.100	192.7	-1.0	10.279
ng27146	0-92115.MOSS AKT.92/09/17.0.....Ø7FS...j	1.	1.			1.102	0.022	3.659	3.40	42.031	1.16	-0.100	221.7	43.9	13.025
ng2815	0-92115.NESODDE.92/08/26.0.....PKT1 1%...j	1.	1.			0.212	0.013	0.386	-0.50	1.474	0.70	0.128	448.6	434.5	0.400
ng2816	0-92115.NESODDE.92/08/26.0.....PKT1FS...j	1.	1.			0.249	0.027	0.752	2.46	0.942	0.82	0.152	545.4	535.5	0.406
ng2818	0-92115.NESODDE.92/08/26.0.....PKT2 1%...j	1.	1.			0.613	0.030	1.602	1.06	4.558	1.31	0.166	2724.6	93.6	1.331
ng2819	0-92115.NESODDE.92/08/26.0.....PKT2FS...j	1.	1.			0.411	0.014	0.938	2.60	4.828	1.25	0.246	612.6	402.8	1.535
ng27142	0-92115.NESSET.92/09/11.0.....Tr11 1%...j	1.	1.			0.114	-0.010	0.736	-0.50	2.006	0.62	-0.100	276.0	-1.0	0.492
ng27143	0-92115.NESSET.92/09/11.0.....Tr11FS...j	1.	1.			0.248	-0.010	1.702	9.27	2.283	0.68	0.212	334.8	342.1	0.636
ng27155	0-92115.NISKINN.92/09/02.0.....PR4 1%...j	1.	1.			0.079	0.023	1.462	1.38	1.997	0.74	-0.100	269.1	172.2	0.567
ng27156	0-92115.NISKINN.92/09/02.0.....PR4FS...j	1.	1.			0.222	-0.010	2.467	3.42	1.299	0.81	-0.100	385.1	351.9	0.713
ng27148	0-92115.NLH ÅS.92/09/26.0.....PKT3 1%...j	1.	1.			0.326	0.035	3.537	15.07	7.398	0.61	-0.100	215.7	133.6	1.869
ng27149	0-92115.NLH ÅS.92/09/26.0.....PKT3FS...j	1.	1.			0.444	0.043	2.814	29.55	6.693	0.72	-0.100	404.0	141.9	1.996
ng27158	0-92115.ROHR TOR.92/09/02.0.....PR5 1%...j	1.	1.			0.439	-0.010	28.472	32.36	7.178	1.17	0.129	453.5	-1.0	2.269
ng27159	0-92115.ROHR TOR.92/09/02.0.....PR5FS...j	1.	1.			0.806	0.014	35.677	37.23	7.388	1.24	0.136	473.0	-1.0	2.427
ng27133	0-92115.RØYSING.92/09/11.0.....Tr 8 1%...j	1.	1.			0.143	-0.010	0.396	2.89	2.980	2.26	0.133	510.3	2.3	0.673
ng27134	0-92115.RØYSING.92/09/11.0.....Tr 8FS...j	1.	1.			0.197	-0.010	0.909	3.72	2.787	2.41	0.143	588.5	8.5	0.783
ng27164	0-92115.SAND HV..92/11/18.0.....Ø8 1%...j	1.	1.			0.345	-0.010	0.787	42.16	4.736	-0.50	-0.100	299.3	113.1	1.380
ng27165	0-92115.SAND HV..92/11/18.0.....Ø8FS...j	1.	1.			0.382	-0.010	1.653	49.69	4.162	-0.50	-0.100	452.9	115.8	1.544
ng27136	0-92115.VENNES.92/09/11.0.....Tr 9 1%...j	1.	1.			0.181	-0.010	0.732	0.64	2.688	0.92	-0.100	418.1	-1.0	0.534
ng27137	0-92115.VENNES.92/09/11.0.....Tr 9FS...j	1.	1.			0.270	0.015	1.865	5.94	2.434	0.88	0.107	438.5	18.3	0.687
ng27112	0-92115...0.....Tr 1 1%...j	1.	1.			0.161	-0.010	7.450	2.52	2.207	0.53	-0.100	215.0	-1.0	0.616
ng27113	0-92115...0.....Tr 1FS...j	1.	1.			0.224	0.022	8.184	3.02	1.855	-0.50	-0.100	240.9	-1.0	0.779
ng27115	0-92115...0.....Tr 2 1%...j	1.	1.			0.152	-0.010	1.516	1.11	2.328	-0.50	-0.100	149.3	-1.0	0.480
ng27116	0-92115...0.....Tr 2FS...j	1.	1.			0.178	-0.010	2.147	1.77	1.841	-0.50	-0.100	172.9	1.1	0.572
ng27118	0-92115...0.....Tr 3 1%...j	1.	1.			0.206	-0.010	3.125	126.86	2.207	0.51	-0.100	184.2	-1.0	0.400
ng27119	0-92115...0.....Tr 3FS...j	1.	1.			0.284	-0.010	4.280	138.03	1.634	0.60	-0.100	198.7	34.8	0.514
ng27121	0-92115...0.....Tr 4 1%...j	1.	1.			0.362	-0.010	0.607	4.11	3.501	7.23	0.615	1031.9	350.4	0.784
ng27122	0-92115...0.....Tr 4FS...j	1.	1.			0.350	-0.010	0.175	5.90	2.796	7.07	0.561	1757.2	360.9	1.510
ng27124	0-92115...0.....Tr 5 1%...j	1.	1.			0.658	-0.010	1.423	1.45	9.469	-0.50	-0.100	116.4	1.7	2.777

NILU ICPMS REPORT PROJECT NB. O-92115 DATE: 93/02/01 UNIT

aPRFIL	SAMPLE ID	Volum	Dil_fkt	mm	Filter Air.vol Weight	Pb	Cd	Cu	Zn	Cr	Ni	Co	Fe	Mn	V
ng27125	O-92115...0.....Tr 5FS...j	1.	1.			0.881	-0.010	1.197	5.90	9.392	-0.50	-0.100	126.4	2.1	3.392
ng27127	O-92115...0.....Tr 6 1%...j	1.	1.			0.456	-0.010	1.214	6.72	10.004	-0.50	-0.100	174.4	-1.0	3.355
ng27128	O-92115...0.....Tr 6FS...j	1.	1.			0.685	-0.010	1.441	6.62	10.798	-0.50	-0.100	182.7	-1.0	3.951

NILU ICPMS REPORT PROSJEKT NR. O-92115 DATO #DATE UNIT

SAMPLE ID	Volum	Dil.fkt	mm	Filter Air vol.	Weight	As	Ba	Sr	Al	Sb	Bi	Tl	U	Th	Be
O-92115.BOMBU HV.92/11/18.0.....Ø9 1%...j	1.	1.				36.478	4.85	106.10	29.7558	0.641	0.012	-0.020	173.327	0.027	-0.050
O-92115.BOMBU HV.92/11/18.0.....Ø9FS...j	1.	1.				32.444	5.09	107.75	39.3697	0.687	-0.010	-0.020	170.345	0.028	-0.050
O-92115.BRAGSTAD.92/09/11.0.....Tr10 1%...j	1.	1.				4.949	3.48	473.88	-1.	0.028	-0.010	-0.020	10.795	-0.010	-0.050
O-92115.BRAGSTAD.92/09/11.0.....Tr10FS...j	1.	1.				4.813	3.38	484.64	1.8952	0.032	-0.010	-0.020	11.137	-0.010	-0.050
O-92115.HEISTAD.92/09/11.0.....Tr 7 1%...j	1.	1.				0.947	220.01	1472.23	-1.	0.010	-0.010	-0.020	8.198	0.012	-0.050
O-92115.HEISTAD.92/09/11.0.....Tr 7FS...j	1.	1.				0.868	228.31	1399.24	2.4943	-0.010	-0.010	-0.020	8.672	0.020	-0.050
O-92115.HVITTING.92/09/02.0.....PR6 1%...j	1	1.				-0.100	53.61	315.03	-1.	-0.010	-0.010	-0.020	3.122	-0.010	-0.050
O-92115.HVITTING.92/09/02.0.....PR6FS...j	1	1.				-0.100	58.33	346.96	2.6003	0.014	-0.010	-0.020	3.282	-0.010	-0.050
O-92115.MOSS AKT.92/09/17.0.....Ø7 1%...j	1	1.				2.306	31.88	233.81	8.149	0.021	-0.010	0.158	15.938	-0.010	-0.050
O-92115.MOSS AKT.92/09/17.0.....Ø7FS...j	1	1.				2.649	31.71	228.68	15.0182	0.045	-0.010	0.105	16.141	-0.010	0.062
O-92115.NESODDE.92/08/26.0.....PKT1 1%...j	1	1.				0.416	9.33	88.98	5.2303	0.023	0.024	0.045	5.075	0.093	-0.050
O-92115.NESODDE.92/08/26.0.....PKT1FS...j	1	1.				0.402	8.62	85.77	6.6156	0.042	-0.010	-0.020	5.469	0.097	0.082
O-92115.NESODDE.92/08/26.0.....PKT2 1%...j	1	1.				0.656	25.36	167.55	3.2962	0.192	-0.010	0.197	22.100	0.036	0.140
O-92115.NESODDE.92/08/26.0.....PKT2FS...j	1	1.				0.451	25.24	179.13	2.5112	0.117	-0.010	0.136	19.712	0.015	0.117
O-92115.NESSET.92/09/11.0.....Tr11 1%...j	1	1.				2.455	-0.05	181.43	3.9386	0.016	-0.010	-0.020	0.636	-0.010	-0.050
O-92115.NESSET.92/09/11.0.....Tr11FS...j	1	1.				2.442	0.10	179.46	15.1512	0.013	-0.010	-0.020	0.589	-0.010	-0.050
O-92115.NISKINN.92/09/02.0.....PR4 1%...j	1	1.				0.253	151.10	244.51	3.3495	0.044	0.026	-0.020	0.713	0.019	0.058
O-92115.NISKINN.92/09/02.0.....PR4FS...j	1	1.				0.245	154.38	251.86	13.2	0.062	-0.010	-0.020	0.744	0.012	0.090
O-92115.NLH ÅS.92/09/26.0.....PKT3 1%...j	1	1.				0.368	36.64	122.00	-1.	-0.010	-0.010	-0.020	6.837	-0.010	-0.050
O-92115.NLH ÅS.92/09/26.0.....PKT3FS...j	1	1.				0.357	37.76	126.68	1.4292	0.011	-0.010	-0.020	6.605	-0.010	0.064
O-92115.ROHR TOR.92/09/02.0.....PR5 1%...j	1	1.				0.287	3.09	324.37	6.4334	0.041	-0.010	-0.020	1.253	-0.010	-0.050
O-92115.ROHR TOR.92/09/02.0.....PR5FS...j	1	1.				0.284	3.00	309.98	8.9309	0.051	-0.010	-0.020	1.197	-0.010	-0.050
O-92115.RØYSING.92/09/11.0.....Tr 8 1%...j	1	1.				0.352	23.90	164.14	3.2492	0.017	-0.010	-0.020	4.220	-0.010	-0.050
O-92115.RØYSING.92/09/11.0.....Tr 8FS...j	1	1.				0.377	22.79	174.22	6.8872	0.025	-0.010	-0.020	4.435	-0.010	-0.050
O-92115.SAND HV..92/11/18.0.....Ø8 1%...j	1	1.				0.252	6.68	79.95	2.4008	0.013	-0.010	-0.020	2.116	0.096	1.563
O-92115.SAND HV..92/11/18.0.....Ø8FS...j	1	1.				0.254	6.88	79.61	4.1757	0.013	-0.010	-0.020	2.447	0.208	1.976
O-92115.VENNES.92/09/11.0.....Tr 9 1%...j	1	1.				0.148	6.53	375.24	1.4871	0.078	-0.010	-0.020	2.733	-0.010	-0.050
O-92115.VENNES.92/09/11.0.....Tr 9FS...j	1	1.				0.173	7.17	427.03	3.0166	0.078	-0.010	-0.020	2.608	-0.010	-0.050
O-92115...0.....Tr 1 1%...j	1	1.				0.113	3.77	137.74	2.0118	-0.010	-0.010	0.089	3.148	-0.010	-0.050
O-92115...0.....Tr 1FS...j	1	1.				0.127	3.42	136.86	1.7834	0.012	-0.010	0.084	3.223	-0.010	-0.050
O-92115...0.....Tr 2 1%...j	1	1.				0.106	1.17	328.55	2.2986	-0.010	-0.010	0.068	0.873	-0.010	-0.050
O-92115...0.....Tr 2FS...j	1.	1.				0.106	1.33	344.23	3.9416	-0.010	-0.010	0.058	0.955	-0.010	-0.050
O-92115...0.....Tr 3 1%...j	1.	1.				1.619	56.58	207.67	1.1426	0.114	-0.010	0.083	14.477	-0.010	-0.050
O-92115...0.....Tr 3FS...j	1.	1.				1.413	56.80	214.13	9.1206	0.129	-0.010	0.053	14.351	-0.010	-0.050
O-92115...0.....Tr 4 1%...j	1.	1.				1.059	11.24	763.10	-1.	0.225	-0.010	0.082	11.666	0.012	-0.050
O-92115...0.....Tr 4FS...j	1.	1.				1.604	11.74	787.87	-1.	0.195	-0.010	0.050	12.036	0.032	0.073
O-92115...0.....Tr 5 1%...j	1.	1.				1.030	6.98	284.82	6.3824	0.046	-0.010	0.169	1.261	-0.010	-0.050

NILU ICPMS REPORT PROSJEKT NR. O-92115 DATO #DATE UNIT

SAMPLE ID	Volum	Dil.fkt	mm	Filter Air vol. Weight	As	Ba	Sr	Al	Sb	Bi	Tl	U	Th	Be
O-92115...0.....Tr 5FS...j	1.	1.			1.056	7.11	305.22	6.8438	0.050	-0.010	0.086	1.243	-0.010	-0.050
O-92115...0.....Tr 6 1%...j	1.	1.			0.407	0.19	30.83	2.1713	-0.010	-0.010	0.084	9.766	-0.010	-0.050
O-92115...0.....Tr 6FS...j	1.	1.			0.514	0.22	32.08	3.2548	-0.010	-0.010	0.065	10.336	-0.010	-0.050

N I L U I C P - M S - R E P O R T DATE: 93/02/01

CONCENTRATION :

SAMPLE ID	Volum	Dil_fkt	Filter Air vol.	Weight	Se	Li	Rb	Cs	Mg	Na	Ca	Mo	Y	La
0-92115.BOMBU HV.92/11/18.0.....Ø9 1%...j	1.	1.				12.641	7.61	0.109	2478.460	-50.000	2.303E4	24.494	0.810	-0.050
0-92115.BOMBU HV.92/11/18.0.....Ø9FS...j	1.	1.				13.494	7.85	0.150	2700.452	-50.000	2.3612E4	25.935	0.925	-0.050
0-92115.BRAGSTAD.92/09/11.0.....Tr10 1%...j	1.	1.				4.673	10.61	1.891	9557.913	289.745	2.9822E4	2.956	-0.100	-0.050
0-92115.BRAGSTAD.92/09/11.0.....Tr10FS...j	1.	1.				5.040	11.32	1.938	1.0191E4	292.635	3.3423E4	2.989	-0.100	-0.050
0-92115.HEISTAD.92/09/11.0.....Tr 7 1%...j	1.	1.				16.293	11.35	6.262	1.0607E4	613.395	5.0949E4	0.463	2.496	-0.050
0-92115.HEISTAD.92/09/11.0.....Tr 7FS...j	1.	1.				17.000	11.52	6.543	1.1102E4	564.288	5.4367E4	0.471	3.339	-0.050
0-92115.HVITTING.92/09/02.0.....PR6 1%...j	1.	1.				0.819	0.50	-0.050	8152.099	2567.496	2.8685E4	4.284	-0.100	-0.050
0-92115.HVITTING.92/09/02.0.....PR6FS...j	1.	1.				0.996	0.49	-0.050	8730.818	2670.778	3.1493E4	4.340	-0.100	-0.050
0-92115.MOSS AKT.92/09/17.0.....Ø7 1%...j	1.	1.				10.213	5.46	0.155	1.3401E4	-50.000	1.8326E4	5.348	0.638	-0.050
0-92115.MOSS AKT.92/09/17.0.....Ø7FS...j	1.	1.				11.445	5.37	0.147	1.3261E4	-50.000	1.8639E4	5.762	0.906	-0.050
0-92115.NESODDE.92/08/26.0.....PKT1 1%...j	1.	1.				1.214	1.71	0.101	3021.640	3064.866	3.0099E4	8.393	2.982	0.264
0-92115.NESODDE.92/08/26.0.....PKT1FS...j	1.	1.				1.330	2.00	0.091	2863.768	2874.623	2.8832E4	8.192	4.212	0.305
0-92115.NESODDE.92/08/26.0.....PKT2 1%...j	1.	1.				5.130	2.60	0.649	7216.626	478.414	4.3618E4	6.272	5.278	0.356
0-92115.NESODDE.92/08/26.0.....PKT2FS...j	1.	1.				5.116	2.56	0.645	7490.660	264.355	4.579E4	6.584	1.338	-0.050
0-92115.NESSET.92/09/11.0.....Tr11 1%...j	1.	1.				4.262	1.80	0.691	1.0595E4	513.634	2.5802E4	0.556	-0.100	-0.050
0-92115.NESSET.92/09/11.0.....Tr11FS...j	1.	1.				4.982	1.96	0.718	1.1218E4	582.572	2.6388E4	0.598	-0.100	-0.050
0-92115.NISKINN.92/09/02.0.....PR4 1%...j	1.	1.				1.232	0.36	-0.050	3269.750	2739.525	2.6225E4	2.546	0.169	-0.050
0-92115.NISKINN.92/09/02.0.....PR4FS...j	1.	1.				1.370	0.38	-0.050	3463.735	2628.808	2.6723E4	2.658	0.373	0.052
0-92115.NLH ÅS.92/09/26.0.....PKT3 1%...j	1.	1.				7.829	3.64	-0.050	7069.047	-50.000	2.1749E4	12.312	0.472	-0.050
0-92115.NLH ÅS.92/09/26.0.....PKT3FS...j	1.	1.				8.001	3.55	-0.050	7653.660	-50.000	2.2565E4	13.780	1.170	-0.050
0-92115.ROHR TOR.92/09/02.0.....PR5 1%...j	1.	1.				3.396	1.05	-0.050	5298.996	259.918	4.1319E4	1.030	-0.100	-0.050
0-92115.ROHR TOR.92/09/02.0.....PR5FS...j	1.	1.				3.269	0.99	-0.050	5818.826	213.726	4.4571E4	1.091	-0.100	-0.050
0-92115.RØYSING.92/09/11.0.....Tr 8 1%...j	1.	1.				5.797	0.67	-0.050	9954.729	780.948	4.9464E4	2.545	-0.100	-0.050
0-92115.RØYSING.92/09/11.0.....Tr 8FS...j	1.	1.				5.800	0.82	-0.050	1.0571E4	846.355	5.2918E4	2.691	0.165	-0.050
0-92115.SAND HV..92/11/18.0.....Ø8 1%...j	1.	1.				8.162	1.81	-0.050	4373.060	-50.000	1.0694E4	1.299	0.357	-0.050
0-92115.SAND HV..92/11/18.0.....Ø8FS...j	1.	1.				8.100	1.96	-0.050	4281.678	-50.000	1.1666E4	1.239	0.732	0.227
0-92115.VENNES.92/09/11.0.....Tr 9 1%...j	1.	1.				5.030	5.84	1.888	7722.497	-50.000	3.9339E4	1.794	-0.100	-0.050
0-92115.VENNES.92/09/11.0.....Tr 9FS...j	1.	1.				5.675	6.19	1.867	8317.846	-50.000	4.3143E4	2.040	-0.100	-0.050
0-92115...0.....Tr 1 1%...j	1.	1.				1.883	1.15	-0.050	9070.996	104.934	2.2843E4	0.546	0.131	-0.050
0-92115...0.....Tr 1FS...j	1.	1.				1.942	1.29	-0.050	9638.165	126.067	2.3225E4	0.495	0.133	-0.050
0-92115...0.....Tr 2 1%...j	1.	1.				2.460	3.85	-0.050	2031.849	-50.000	1.3993E4	0.110	0.339	-0.050
0-92115...0.....Tr 2FS...j	1.	1.				2.675	4.51	-0.050	2331.366	-50.000	1.6355E4	0.118	0.480	-0.050
0-92115...0.....Tr 3 1%...j	1.	1.				4.143	5.87	0.246	2.127E4	-50.000	1.9417E4	4.656	-0.100	-0.050
0-92115...0.....Tr 3FS...j	1.	1.				4.260	6.05	0.225	2.1785E4	-50.000	1.9428E4	4.562	-0.100	-0.050
0-92115...0.....Tr 4 1%...j	1.	1.				10.521	16.36	0.660	1.0139E4	801.360	7.2016E4	1.440	0.381	-0.050
0-92115...0.....Tr 4FS...j	1.	1.				10.880	16.92	0.644	1.01E4	802.974	6.8227E4	1.555	1.240	0.360
0-92115...0.....Tr 5 1%...j	1.	1.				6.179	3.11	-0.050	4390.183	-50.000	1.1197E4	3.671	-0.100	-0.050

N I L U I C P - M S - R E P O R T DATE: 93/02/01

CONCENTRATION :

SAMPLE ID	Volum	Dil_fkt	Filter Air vol.	Weight	Se	Li	Rb	Cs	Mg	Na	Ca	Mo	Y	La
0-92115...0.....Tr 5FS...j	1.	1.				6.576	3.23	-0.050	4455.984	-50.000	1.1998E4	3.718	-0.100	-0.050
0-92115...0.....Tr 6 1%...j	1.	1.				4.136	0.57	-0.050	5653.265	-50.000	1.8029E4	1.479	0.119	-0.050
0-92115...0.....Tr 6FS...j	1.	1.				4.878	0.63	-0.050	6175.859	-50.000	1.8757E4	1.530	0.129	-0.050

Kopi: Finne 30.3 93 hfg Postliste

NORSK INSTITUTT FOR LUFTFORSKNING - NORWEGIAN INSTITUTE FOR AIR RESEARCH
POSTBOKS 64, N-2001 LILLESTRØM

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ANK.	29.3.93
AVD.	~~Gjeole~~
BESV.	
JNR.	1543
ansv.	BAS
KONF.	
S.BEH.	~~Rolvsen~~ Banks
ARK.	63.2589.00

Grann Kopi → DB

Deres ref./*Your ref.*: | Vår ref./*Our ref.*: OR/MAa/O-92115/B | Dato/*Date*: 18. mars 1993

Resultater -Kartlegging av U, Th i grunnvann, Østfold & Trøndelag.

Vi viser til Deres bestilling av 29.10.1992 for 20 vannprøver, ufiltrert og filtrert surgjordt og bestilling av 12.2.93 på 19 prøver. Vedlagt følger resultatene for den siste serien. Alle resultatene for begge serier sendes også på en floppydisk. Resultatene er rapportert i ng/ml.

Prøvepreparering:
I henhold til Deres bestillig var prøvene behandlet på følgende måte

1 Ufiltrert ukonservert
2 Filtrert konservert med 1 dråpe kons. HNO_3 pr 100 ml (dvs. ca. 0.01 M HNO_3)

Ved ICPMS-analyse ble 10 ml prøve tatt ut og tilsatt 100 µl konsentrert HNO_3 (1% HNO_3). Dette ble gjort med både de konserverte og de ukonserverte prøven for å tilpasse syrematriksen til standardløsningene som benyttes ved ICPMS. Prøvene ble også tilsatt Sc, In og Re (50 ng/ml) som intern standard. Ihht. vår muntlige avtale skulle den ufiltrerte ukonserverte prøven analyseres uten noen syrekonservering, men bare tilsatt internstandard (noe som ville medføre at syrekonsentrasjonen etter tilsetting av intern standard ble ca 0.001 M HNO_3). Dette ble også gjort, men det viste seg at responsen på den interne standarden da sank betydelig, noe som medførte at resultatene tilsynelatende ble altfor høye (tildels betydelig høyere enn for de syrekonserverte prøvene). Vi tror imidlertid at resultatene fra de ukonserverte prøvene ikke er betydelig påvirket av at vi konserverte de etter uttak fra prøveflasken noen timer før ICPMS-analyse. Det ble lagt vekt på å ikke riste flasken for å unngå å virvle opp eventuelt bunnfall, og prøvene ble analysert samme dag som de ble konservert, noe som skulle forhindre frigjøring eventuelt tungtløselige metallfaser.

I vårt kvalitetssikringsprogram blir kaliberingen for ICPMS kontrollert mot referansestandarder fra SPEX Industries, USA, med krav om maksimalt 10% avvik ved konsentrasjonen 10 ng/ml for

63 81 41 70

å akseptere kaliberingen. Disse standardene er sporbare til primære sertifiserte standarder fra NIST (U.S. National Institute of Standards and Technology).

Analyseresultatene i rapporten er oppgitt med varierende antall gjeldende siffer. Vennligst legg merke til at antall gjeldende siffer er 2 (to) for alle analyseresultater. Grunnen til at det gis for mange gjeldene siffer er at det rapportgeneratoren i vårt laboratoriedatasystem er vanskelig å justere antall gjeldende siffer.

Vi håper at analysene av U og Th er så interessante at dette gir grunnnlag for ytterligere kartlegginger av disse elementene i grunnvann senere. Vi håper at vi kan delta som medforfattere på en evnetuell rapport eller publikasjon, hvor disse dataene for U og Th presenteres. NILU har lagt et betydelig merarbeid i å utvikle en metode for bestemmelse av U og Th enn det som fremkommer i den fakturerte prisen for dette oppdraget. Vi på NILU håper da at vi kan samarbeide om dette og eventuelt være med på en felles prosjektsøknad til feks. SFT sammen med NGU. Som avtalt rapporterer vi en rekke andre tungmetaller utover U og Th i disse vannprøvene, for å vise hvilke muligheter som ICPMS gir for kartlegging av elementer i grunnvann og andre miljøprøver. Siden det etter avtalen ikke skal betales for disse ekstra analysene, ber vi om at disse ekstra analyseresultatene ikke publiseres uten etter avtale med med NILU.

Vi håper at resultatene i rapporten er tilfredstillende. Dersom det skulle være noen uklarheter står vi med glede til tjeneste for å oppklare dette.

Vennlig hilsen

Oddvar Røyset

Oddvar Røyset
Dr. Scient.
Leder, Uorganisk analyse

Marit Vadset

Marit Vadset
Ingeniør

NILU ICPMS REPORT PROJECT NB. 0-92115 DATE: 93/03/19 UNIT ng/ml

aPRFIL	SAMPLE ID	Volum	Dil_fkt	mm	Filter Air.vol Weight	Pb	Cd	Cu	Zn	Cr	Ni	Co	Fe	Mn	V
ng10315	0-92115.Hv.Brem.93/02/08.0.....Ø17 1%...j	1.	1.			0.774	0.027	2.066	2.88	17.733	-0.50	-0.100	-50.0	16.7	5.358
ng10316	0-92115.Hv.Brem.93/02/08.0.....Ø17FS...j	1.	1.			0.695	0.044	2.601	4.72	17.103	1.32	-0.100	-50.0	17.0	5.886
ng1039	0-92115.Hv.Granl.93/02/09.0.....Ø14 1%...j	1.	1.			1.237	0.064	2.360	1.58	22.978	-0.50	-0.100	989.7	41.3	7.266
ng10310	0-92115.Hv.Granl.93/02/09.0.....Ø14FS...j	1.	1.			1.110	0.052	0.890	3.58	20.590	-0.50	-0.100	1178.5	45.5	7.246
ng10311	0-92115.Hv.Ko.Pe.93/02/08.0.....Ø15 1%...j	1.	1.			1.918	0.087	6.523	68.32	12.167	3.83	1.061	457.1	162.9	4.494
ng10312	0-92115.Hv.Ko.Pe.93/02/08.0.....Ø15FS...j	1.	1.			2.168	0.092	6.680	85.31	10.248	3.60	0.980	339.8	166.0	3.921
ng10319	0-92115.Hv.Løsma.93/02/09.0.....Ø19 1%...j	1.	1.			0.936	0.202	9.238	57.78	14.069	2.03	1.571	215.7	75.6	4.673
ng10320	0-92115.Hv.Løsma.93/02/09.0.....Ø19FS...j	1.	1.			1.086	0.173	24.424	67.96	13.030	2.03	1.511	206.0	74.5	4.302
ng10313	0-92115.Hv.Melhs.93/02/08.0.....Ø16 1%...j	1.	1.			14.582	0.084	11.620	51.29	12.390	-0.50	0.160	414.7	15.7	6.130
ng10314	0-92115.Hv.Melhs.93/02/08.0.....Ø16FS...j	1.	1.			11.805	0.068	10.081	53.16	9.986	-0.50	0.115	241.5	14.9	5.510
ng1032	0-92115.Hv.Sv.He..0.....Ø11 1%...j	1.	1.			1.924	0.085	12.838	2.67	55.531	0.94	0.127	734.1	174.6	17.889
ng1033	0-92115.Hv.Sv.He..0.....Ø11FS...j	1.	1.			1.933	0.167	23.817	5.86	49.230	0.72	-0.100	499.6	176.3	17.976
ng1034	0-92115.Hv.Sv.Je..0.....Ø10 1%...j	1.	1.			1.632	0.091	5.510	61.64	19.161	-0.50	0.150	1416.4	81.3	7.257
ng1035	0-92115.Hv.Sv.Je..0.....Ø10FS...j	1.	1.			1.093	0.055	3.386	61.65	17.910	-0.50	0.194	1164.1	95.2	6.645
ng1036	0-92115.Hv.Svane.93/02/08.0.....Ø12 1%...j	1.	1.			2.732	0.079	4.100	9.39	18.377	1.10	1.078	1345.4	250.2	9.316
ng1037	0-92115.Hv.Svane.93/02/08.0.....Ø12FS...j	1.	1.			1.227	0.055	2.501	8.22	15.931	0.53	0.988	709.7	264.9	6.834
ng1038	0-92115.Hv.Svane.93/02/08.0.....Ø13 1%...j	1.	1.			2.444	0.164	27.848	108.99	60.880	7.63	0.581	1882.3	54.9	19.750
ng10317	0-92115.Hv.Urdal.93/02/09.0.....Ø18 1%...j	1.	1.			1.652	0.083	1.976	9.38	29.666	1.40	0.313	671.4	140.0	9.373
ng10318	0-92115.Hv.Urdal.93/02/09.0.....Ø18FS...j	1.	1.			1.556	0.097	1.946	21.44	34.661	1.64	0.331	775.3	164.0	11.338

NILU ICPMS REPORT PROSJEKT NR. O-92115 DATO #DATE UNIT ng/ml

SAMPLE ID	Volum	Dil.fkt	mm	Filter Air vol.	Weight	As	Ba	Sr	Al	Sb	Bi	Tl	U	Th	Be
O-92115.Hv.Brenn.93/02/08.0.....Ø17 1%...j	1.	1.				1.143	8.96	36.67	1.5674	0.018	-0.010	0.132	4.822	0.225	-0.050
O-92115.Hv.Brenn.93/02/08.0.....Ø17FS...j	1.	1.				1.236	9.85	35.25	1.8112	0.017	-0.010	0.124	4.843	0.244	-0.050
O-92115.Hv.Granl.93/02/09.0.....Ø14 1%...j	1.	1.				0.963	13.79	30.13	12.3635	-0.010	0.012	0.212	6.117	0.570	0.442
O-92115.Hv.Granl.93/02/09.0.....Ø14FS...j	1.	1.				0.974	15.05	32.02	10.5216	0.012	0.013	0.162	6.501	0.562	0.521
O-92115.Hv.Ko.Pe.93/02/08.0.....Ø15 1%...j	1.	1.				0.961	28.34	94.87	124.4593	0.099	-0.010	0.227	39.758	0.340	0.139
O-92115.Hv.Ko.Pe.93/02/08.0.....Ø15FS...j	1.	1.				0.919	26.41	91.23	101.55	0.086	-0.010	0.204	41.459	0.216	0.147
O-92115.Hv.Løsma.93/02/09.0.....Ø19 1%...j	1.	1.				0.623	24.58	29.70	479.8436	0.066	-0.010	0.056	0.303	0.134	0.404
O-92115.Hv.Løsma.93/02/09.0.....Ø19FS...j	1.	1.				0.568	22.92	27.84	483.6681	0.080	-0.010	0.050	0.315	0.147	0.430
O-92115.Hv.Melhs.93/02/08.0.....Ø16 1%...j	1.	1.				1.135	11.16	11.02	145.8999	0.053	0.116	0.117	13.691	2.729	0.132
O-92115.Hv.Melhs.93/02/08.0.....Ø16FS...j	1.	1.				1.035	8.85	10.47	197.1745	0.062	0.082	0.108	13.149	2.203	0.104
O-92115.Hv.Sv.He..0.....Ø11 1%...j	1.	1.				1.858	14.94	97.14	2.3215	0.024	0.085	0.753	24.840	1.737	0.772
O-92115.Hv.Sv.He..0.....Ø11FS...j	1.	1.				2.423	14.42	111.50	2.5793	0.033	0.074	0.858	26.039	1.732	0.644
O-92115.Hv.Sv.Je..0.....Ø10 1%...j	1.	1.				1.034	12.48	34.80	79.3309	0.055	0.046	0.626	6.557	1.400	0.891
O-92115.Hv.Sv.Je..0.....Ø10FS...j	1.	1.				0.852	12.04	33.97	50.0332	0.059	0.051	0.331	6.332	1.280	1.215
O-92115.Hv.Svane.93/02/08.0.....Ø12 1%...j	1.	1.				0.993	22.52	19.21	-1.	0.088	0.183	0.321	19.803	3.264	1.402
O-92115.Hv.Svane.93/02/08.0.....Ø12FS...j	1.	1.				0.832	10.97	15.95	74.3157	0.077	0.092	0.227	14.953	1.902	1.224
O-92115.Hv.Svane.93/02/08.0.....Ø13 1%...j	1.	1.				2.230	30.33	426.60	35.849	0.234	-0.010	0.377	17.934	0.376	0.115
O-92115.Hv.Urdal.93/02/09.0.....Ø18 1%...j	1.	1.				1.152	9.55	183.53	39.3752	0.058	-0.010	0.148	144.289	0.180	1.191
O-92115.Hv.Urdal.93/02/09.0.....Ø18FS...j	1.	1.				1.234	7.64	158.30	21.5704	0.060	-0.010	0.101	148.246	0.164	1.429

N I L U I C P - M S - R E P O R T DATE: 93/03/19

CONCENTRATION : ng/ml

SAMPLE ID	Volum	Dil_fkt	Filter Air vol.	Weight	Li	Rb	Cs	Mg	Na	Ca	Mo	Y	La
0-92115.Hv.Brenn.93/02/08.0.....Ø17 1%...j	1.	1.			4.956	1.58	-0.050				3.759	0.416	0.410
0-92115.Hv.Brenn.93/02/08.0.....Ø17FS...j	1.	1.			5.444	1.78	-0.050				3.736	0.532	0.484
0-92115.Hv.Granl.93/02/09.0.....Ø14 1%...j	1.	1.			4.605	1.48	-0.050				5.671	1.550	1.302
0-92115.Hv.Granl.93/02/09.0.....Ø14FS...j	1.	1.			5.146	1.70	-0.050				5.822	1.570	1.099
0-92115.Hv.Ko.Pe.93/02/08.0.....Ø15 1%...j	1.	1.			1.497	4.97	-0.050				1.025	2.193	1.563
0-92115.Hv.Ko.Pe.93/02/08.0.....Ø15FS...j	1.	1.			1.494	4.79	-0.050				0.905	2.451	1.633
0-92115.Hv.Løsma.93/02/09.0.....Ø19 1%...j	1.	1.			1.772	1.14	0.059				-0.100	1.783	2.593
0-92115.Hv.Løsma.93/02/09.0.....Ø19FS...j	1.	1.			1.886	1.12	-0.050				-0.100	1.822	2.576
0-92115.Hv.Melhs.93/02/08.0.....Ø16 1%...j	1.	1.			3.717	1.99	0.069				2.965	5.659	10.134
0-92115.Hv.Melhs.93/02/08.0.....Ø16FS...j	1.	1.			3.608	1.29	-0.050				2.885	5.412	7.429
0-92115.Hv.Sv.He..0.....Ø11 1%...j	1.	1.			8.768	2.25	0.095				8.311	3.253	3.427
0-92115.Hv.Sv.He..0.....Ø11FS...j	1.	1.			10.330	2.21	0.055				8.583	3.097	3.108
0-92115.Hv.Sv.Je..0.....Ø10 1%...j	1.	1.			5.994	2.95	0.069				2.814	3.548	3.082
0-92115.Hv.Sv.Je..0.....Ø10FS...j	1.	1.			6.288	2.57	0.052				2.713	3.628	3.337
0-92115.Hv.Svane.93/02/08.0.....Ø12 1%...j	1.	1.			5.093	5.80	0.572				3.501	7.348	7.272
0-92115.Hv.Svane.93/02/08.0.....Ø12FS...j	1.	1.			4.613	2.32	0.126				2.700	5.627	4.441
0-92115.Hv.Svane.93/02/08.0.....Ø13 1%...j	1.	1.			4.962	3.40	0.255				6.188	1.662	2.611
0-92115.Hv.Urdal.93/02/09.0.....Ø18 1%...j	1.	1.			13.000	2.46	0.102				11.461	3.900	0.536
0-92115.Hv.Urdal.93/02/09.0.....Ø18FS...j	1.	1.			13.802	2.42	-0.050				11.293	5.117	0.615

Appendix 5

Radon determinations, Statens Strålevern

		kBq/m³
Nr. 1	Nesoddden V. Verk	890
-11- 2	— 11 —	780
-11- 3	NLH	200
-11- 4	Bærum kom.	100
-11- 5	Eidsr-Torp	230
-11- 6	Huittingfoss vannv.	630
-11- 7	Moss aktiebryggj.	730
Tr 1.	Falten	90
Tr. 2.	Skarsaunet	210
Tr. 3	Killingberg	235
Tr. 4	Gangstad	125
Tr. 5	Våde	30
Pr. 8	Sandbekke gjg.	5660
Pr. 9	Bombra Hvalert.	1470

Tr 6 — 80 kBq/m³

1. Heistad — 140 —11—
2. Rdysing — 40 —11—
3. Mosvik — 70 —11—
4. Mosvik — 160 —11—
5. Nesset — 130 —11—

Målinger av radon i vann fra borede brønner i Hvaler kommune, Februar 1993.

Resultater :

Prøvenr.	kBq/m³
Ø 10	2620
Ø 11	8515
Ø 12	65
Ø 13	340
Ø 14	2510
Ø 15	840
Ø 16	1280
Ø 17	2750
Ø 18	3450
Ø 19	7

Med hilsen

Bjørn Lind