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INVESTIGATION OF LAKE HÖRNTRÄSKET, LYCKSELE KOMMUN

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Passive water sampling using DGT

Passive water sampling is a sampling method that has advantages as monitoring tool because of its low expences, simplicity, long-term operatio and the fact that it does not require electricity. EMD (Exposmeter metals) is based on DGT technology (diffusive gradients in thin films). It represents one of the passive sampling methods used for:

- For measuring, trace metals, phosphate, sulphide and radionuclides.
- Measures average concentrations (hours to weeks) in freshwaters and seawater.
- Measures both fluxes and concentrations in soils and sediments.
- Measures effective hazardous concentrations (bioavailable fraction).
- Measures at high spatial resolution (microns to centimetres).

EMD can be obtained in two configurations:
1. EMD for the sampling in water
2. EMD sediment probe for the sampling in sediments

Simple, but precision plastic EMD devices accumulate dissolved substances in a controlled way. Conventional analysis in the laboratory provides the in situ concentration at the time of deployment.

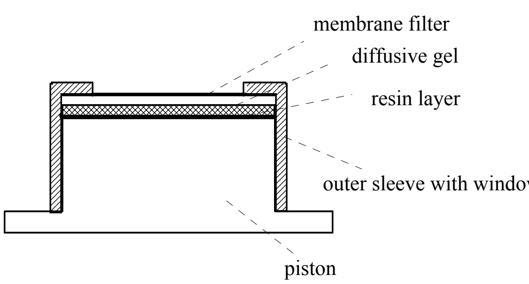

Figure 1. EMD device

EMD sediment probe fabricated as slim probe can be inserted into the sediment. The simple plastic DGT device is deployed for a known time and then the mass of metal on the resin layer is measured after elution with acid by, for example, AAS or ICP-MS. Providing the temperature is known, the interfacial concentration in solution can be calculated precisely.

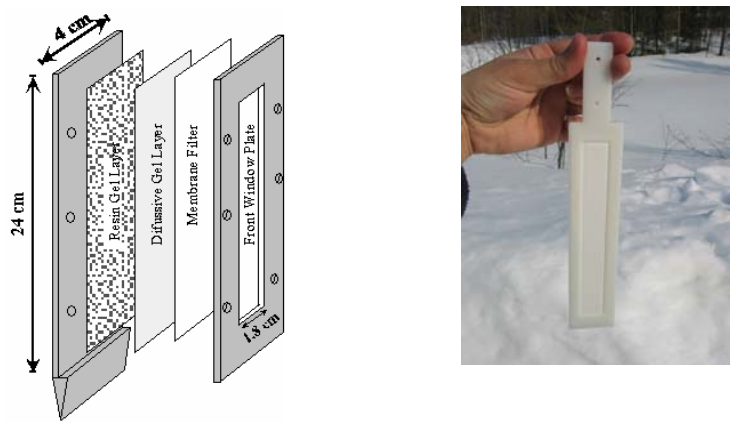

Figure 2. EMD sediment probe

Sampling using EMD in lake **HÖRNTRÄSKET**

Sampling locations

Sampling locations were according project goal:
1. Sampling in the inflow into the lake places chosen according ortophotographic map presented in figures 3 and 4. (IN)
2. Sampling in the deep areas in the lake. EMDs were deployed at different levels. (DA)
3. Sampling in the drill areas. EMDs were deployed at the different levels

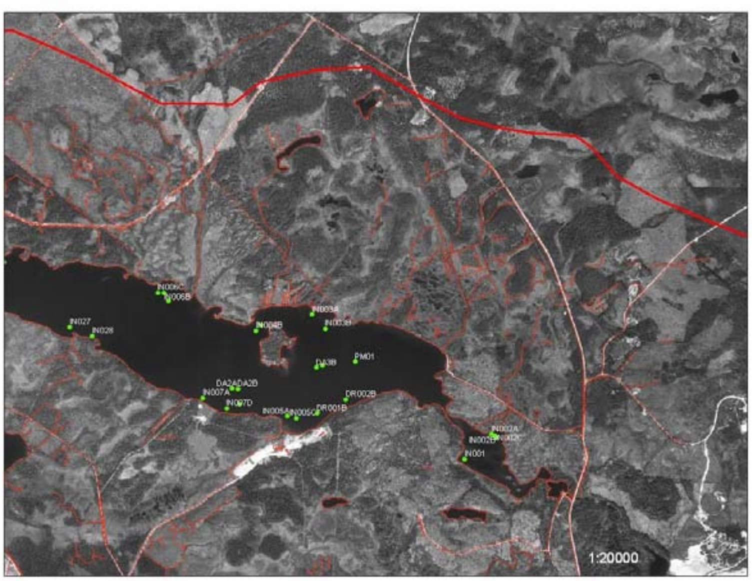

Figure 3. Ortophotographic map of west side of the lake. Inflows are marked with red colour, sampling places marked in green.

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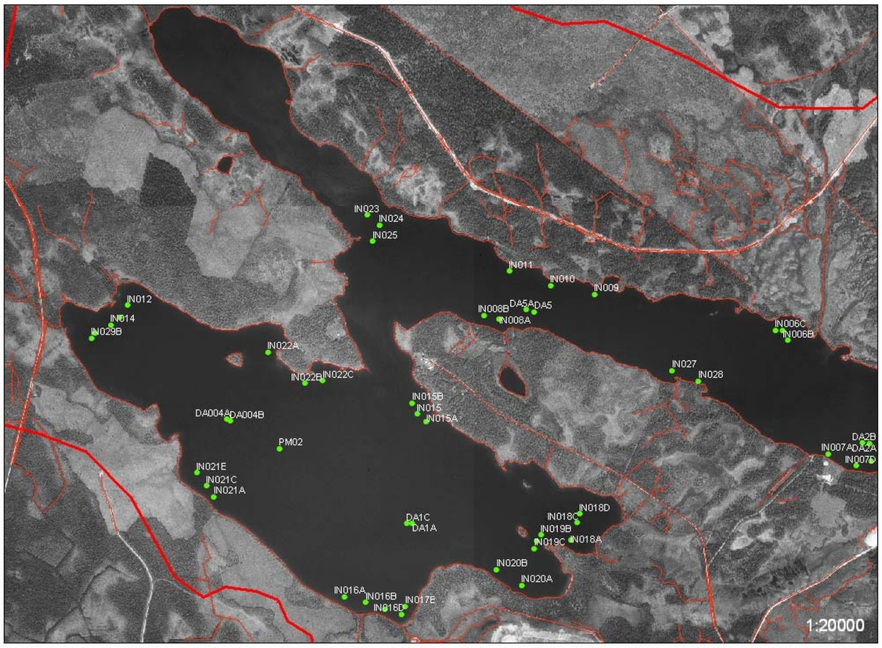

Figure 4. Ortophotographic map of west side of the lake. Inflows are marked with red colour, sampling places marked in green.

Sampling time

First EMDs were deployed during first week of April in 71 locations. Lake was covered by ice (in average 1 m thick during the sampling). EMDs were sampling continuously during 4 weeks trouly dissolved metals in water.

Figure 5. Sampling in deep areas. EMDs tighten to the rope at the different levels.

Figure 6. Example of EMDs deployment

EMD sediment probes were deployed in April in sediment core taken from deep areas. EMD sediment probes have sampled continuously metals from the sediments for 36 hours.

Second set of EMDs were deployed in lake 16 of July. EMDs were retrieved after four weeks.

Figure 7. EMD sampling in summer time

EMDs were deployed in ground water well during July 15-16. EMDs were retrieved after four weeks.

Figure 8. EMD sampling in ground water wells

Detail deployment procedure description

EMD were removed from the sealed plastic bag prior the deployment. EMD was deployed by attaching a >0,4mm thick fishing line to the small hole in the base. Unit was deployed in lake 0.5 - 1 m under the ice to avoid physical damage due to the contact with the ice. Ancer was attached at the end of fishing line to ensure that the white face of the EMD unit is fully immersed during the whole deployment period. Deployment time and the temperature of the water during deployment were recorded using Multisensor probe. Also other basic parameters such as pH were measured.

Detail retrieval procedure description

On retrieval of the holding assembly, EMD unit was immediately (minutes) removed, taking care not to touch the face filter. EMD unit was rinsed with a stream of distilled/deionised water from a wash-bottle and shacked off obvious surface water (without drying it). EMD was placed in a clean plastic bag and sealed with minimum air space. Sample details were marked on the bag. EMDs were send to the laboratory for analysis.

Analysis procedure

Resin gel from EMD was treated with 1M HNO_3 solution before analysis. Analysis of extract was performed with ICP - AES, ICP - SFMS, AFS

Samples ID and coordinates

Table 1. Spring samples ID and coordinates

Sample ID	Coordinaters			Sample ID	Coordinaters		
	X	Y	Number of samples		X	Y	Number of samples
IN001	7223071	1628989	1	**IN015A**	7223696	1624713	1
IN002B	7223239	1629197	1	**IN015B**	7223810	1624628	1
IN002C	7223224	1629212	1	**IN016A**	7222641	1624217	3
IN002A	7223248	1629180	1	**IN016B**	7222607	1624347	1
IN003A	7224095	1627909	1	**IN016C**	7222567	1624461	1
IN003B	7223995	1628002	1	**IN016D**	7222534	1624563	1
IN003C	7224013	1627881	1	**IN017E**	7222582	1624587	1
IN003D	7224013	1627915	1	**IN018A**	7222983	1625584	1
IN004A	7224021	1627546	1	**IN018B**	7223037	1625604	1
IN004B	7223979	1627512	1	**IN018C**	7223088	1625621	1
IN005A	7223375	1627733	1	**IN018C1**	7222534	1625621	1
IN005B	7223379	1627766	1	**IN018D**	7223140	1625635	1
IN005C	7223360	1627797	1	**IN019A**	7222976	1625380	1
IN005D	7223396	1627836	1	**IN019B**	7223013	1625403	1
DA3A	7223735	1627981	3	**IN019C**	7222931	1625364	1
DA3B	7223718	1627939	3	**IN020A**	7222709	1625288	1
DA2A	7223570	1627341	3	**IN020B**	7222803	1625135	1
DA2B	7223567	1627382	3	**IN021A**	7223242	1623433	1
IN006A	7224190	1626890	1	**IN021C**	7223308	1623388	1
IN006B	7224248	1626860	1	**IN021E**	7223389	1623329	1
IN006C	7224249	1626815	1	**IN022B**	7223928	1623982	1
IN007A	7223503	1627136	1	**IN022A**	7224116	1623757	1
IN007B	7223526	1627103	1	**IN022C**	7223944	1624089	1
IN007C	7223466	1627208	1	**IN023**	7224944	1624357	1
IN007D	7223431	1627302	1	**IN024**	7224882	1624430	1
IN/DA007E	7223460	1627392	4	**IN025**	7224786	1624391	1
DA5	7224360	1625363	3	**IN026**	7224872	1624577	1
IN008A	7224313	1625152	1	**IN027**	7224006	1626194	1
IN008B	7224338	1625063	1	**IN028**	7223942	1626352	4
DA5A	7224373	1625312	3	**IN029A**	7224230	1622715	1
IN009	7224466	1625726	1	**IN029B**	7224201	1622695	1

Sample ID	Coordinaters			Sample ID	Coordinaters		
	X	Y	Number of samples		X	Y	Number of samples
IN010	7224518	1625460	1	**DA004A**	7223711	1623511	3
IN011	7224604	1625212	1	**DA004B**	7223702	1623531	3
IN012	7224399	1622913	1	**DR001A**	7223389	1627905	3
IN013	7224325	1622868	1	**DR001B**	7223395	1627942	3
IN014	7224280	1622810	1	**DR002A**	7223467	1628103	3
DA1A	7223083	1624629	5	**DR002B**	7223493	1628148	3
DA1C	7223081	1624595	3				
IN015	7223743	1624658	1				

Table 2. Summer samples ID and coordinates

	Coordinates		Number of samples
	X	Y	
SM1	7223411	1628013	1
SM2	7223663	1628601	3
SM3	7223739	1628806	3
SM4	7223966	1628408	3
SM5	7223491	1628808	3
SM6	7223481	1628121	3
SM7	7223464	1629303	1
GW1	1625755	7225758	1
GW2	1626003	7224743	1
GW3	1625112	7222335	1
GW4	1626586	7223092	1
GW5	1625398	7223630	1
GW6	1627995	7223328	1
GW7	1628883	7223704	1
GW8	1629426	7224717	1

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Results

Spring sampling

Table 3. Metal concentrations in inflow EMD samples

SAMPLE	Fe 0,5 m from top	Al 0,5 m from top	As 0,5 m from top	Ba 0,5 m from top	Cd 0,5 m from top	Co 0,5 m from top	Cr 0,5 m from top	Cu 0,5 m from top	Mn 0,5 m from top	Ni 0,5 m from top	Pb 0,5 m from top	Zn 0,5 m from top
	µg/l											
INOO1	16	18	0.01	2	1	1	0.23	18	39	1	0.04	281
IN002A	136	32	0.01	1	0.2	1	0.05	5	46	1	0.04	82
IN002B	154	30	0.01	1	0.2	1	0.03	5	51	1	0.04	84
IN002C	161	29	0.02	1	0.2	1	0.03	4	52	1	0.04	70
IN003A	4	14	*ND*	1	1	1	0.06	29	30	2	0.1	498
IN003B	4	12	*ND*	1	1	1	0.21	27	24	2	0.09	446
IN003C	4	13	*ND*	1	1	1	0.34	29	31	2	0.09	478
IN003D	3	12	*ND*	1	1	1	0.05	26	23	2	0.1	451
IN004A	11	4	0.01	1	1	5	0.14	16	197	2	0.01	332
IN004B	3	11	*ND*	1	1	1	0.03	26	30	2	0.08	478
IN005A	19	40	0.006	1	2	1	0.1	77	16	2	0.46	689
IN005B	8	23	0.006	1	1	1	0.05	50	18	2	0.22	591
IN005C	10	27	0.006	1	1	1	0.02	57	19	2	0.27	616
IN005D	6	22	*ND*	1	1	1	0.06	45	19	2	0.19	550
IN006A	3	11	0.003	1	1	1	0.21	23	33	2	0.08	433
IN006B	2	11	0.01	1	1	1	0.05	25	24	2	0.08	435
IN006C	2	10	0.003	1	1	1	0.07	22	29	1	0.07	396
IN007A	3	12	0.005	1	1	1	0.2	28	26	2	0.08	457
IN007B	3	11	0.005	1	1	1	0.03	27	21	2	0.08	462
IN007C	2	11	0.004	1	1	1	0.03	25	27	1	0.07	424
IN007D	2	12	0.007	1	1	1	0.02	28	29	2	0.08	490
IN008A	3	12	0.007	1	1	1	0.02	22	29	2	0.06	439
IN008B	3	12	0.006	1	1	1	0.02	23	30	2	0.06	425
IN0009	3	12	0.004	1	1	1	0.02	24	23	2	0.06	458
IN010	3	11	0.004	1	1	1	0.03	25	24	2	0.07	457
IN011	3	12	0.005	1	1	1	0.07	23	31	2	0.06	466
IN012	3	11	0.003	1	1	0.5	0.07	16	19	2	0.02	428
IN013	3	11	0.006	1	1	0.5	0.04	15	31	2	0.03	414
IN014	2	10	*ND*	1	1	1	0.03	17	33	2	0.02	442
IN015	2	11	0.003	1	1	0.5	0.02	16	32	2	0.03	430
IN015A	3	14	ND	1	1	1	0.02	21	29	2	0.04	533
IN015B	2	10	ND	1	1	0.5	0.01	17	27	2	0.03	424
IN016A	3	14	0.005	1	1	1	0.02	19	35	2	0.03	487
IN016B	3	13	0.003	1	1	1	0.03	18	34	2	0.03	483
IN016C	4	20	0.005	1	1	1	0.04	18	31	2	0.04	475
IN016D	21	98	0.012	1	1	1	0.02	23	31	3	0.08	610
IN017E	10	63	0.003	1	1	1	0.02	21	29	3	0.06	545
IN018A	2	13	*ND*	1	1	1	0.03	18	32	2	0.03	470
IN018B	2	11	0.006	1	1	1	0.02	16	32	2	0.03	454
IN018C	2	11	0.004	1	1	1	0.04	16	41	2	0.02	471

SAMPLE	Fe 0,5 m from top	Al 0,5 m from top	As 0,5 m from top	Ba 0,5 m from top	Cd 0,5 m from top	Co 0,5 m from top	Cr 0,5 m from top	Cu 0,5 m from top	Mn 0,5 m from top	Ni 0,5 m from top	Pb 0,5 m from top	Zn 0,5 m from top
	μg/l											
IN018D	2	12	0.005	1	1	1	0.02	17	37	2	0.03	445
IN019A	2	13	0.006	1	1	1	0.02	19	26	2	0.03	486
IN019B	10	57	0.005	1	1	1	0.02	26	31	3	0.05	781
IN019C	2	13	0.004	1	1	1	0.03	18	29	2	0.03	495
IN020A	3	15	0.006	1	1	1	0.01	16	38	2	0.03	411
IN020B	6	20	0.004	1	1	1	0.02	17	40	2	0.03	453
IN021A	2	11	*ND*	1	1	0.5	0.02	15	27	2	0.02	386
IN021C	2	8	0.003	0.4	1	0.4	0.01	13	16	2	0.02	362
IN021E	2	12	0.010	1	1	1	0.01	16	32	2	0.02	434
IN022A	2	13	0.003	1	1	1	0.02	17	32	2	0.02	449
IN022B	2	12	0.005	1	1	1	0.02	17	40	2	0.03	512
IN022C	2	13	*ND*	1	1	1	0.02	18	31	2	0.03	491
IN023	6	19	0.006	1	1	1	0.02	23	21	2	0.05	489
IN024	5	15	*ND*	1	1	1	0.03	25	30	2	0.05	506
IN025	12	17	*ND*	1	1	1	0.08	22	42	2	0.04	472
IN026	3	11	0.005	1	1	1	0.02	19	34	1	0.04	401
IN027	9	13	0.004	1	1	1	0.02	28	31	2	0.09	533
IN028	2	15	0.005	1	1	1	0.02	24	30	2	0.08	431
IN029A	2	13	0.009	1	1	1	0.03	16	49	2	0.02	437
IN029B	2	7	*ND*	1	0.5	0.3	0.02	9	32	1	0.01	246

Table 4. Metal concentrations in deep areas and drill areas EMD samples

SAMPLE	Fe 0,5 m from top	Fe 1,5 m from bottom	Fe 0,5 m from bottom	Fe 0,2 m from bottom	Al 0,5 m from top	Al 1,5 m from bottom	Al 0,5 m from bottom	Al 0,2 m from bottom	As 0,5 m from top	As 1,5 m from bottom	As 0,5 m from bottom	As 0,2 m from bottom
	μg/l											
IN/DA007E	2	3	3	3	10	23	30	37	0.005	0.004	0.005	0.005
DA1A		4	15	16		ND	215	319		0.01	0.01	0.01
DA1C		14	20	21		183	364	439		0.01	0.01	0.01
DA2A		9	11	8		204	278	302		0.03	0.01	0.04
DA2B		5	6	7		93	124	184		0.02	0.02	0.04
DA3A		5	4	17		45	38	40		0.02	0.01	0.01
DA3B		4	6	851		23	40	20		0.004	0.01	0.11
DA004A		3	3	517		21	6	4		ND	ND	0.1
DA004B		3	3	1646		22	3	18		0.004	ND	0.2
DA5		5	5	6		19	24	25		0.006	ND	0.004
DA5A		3	3	4		16	19	18		ND	0.01	0.01
DR001A		8	10	12		25	33	38		0.008	0.01	0.008
DR002A		9	11	11		32	37	33		ND	ND	0.01
DR001B		8	9	11		34	30	31		0.007	0.007	0.005
DR002B		6	7	8		24	25	27		ND	0.005	ND

SAMPLE	Ba 0,5 m from top	Ba 1,5 m from bottom	Ba 0,5 m from bottom	Ba 0,2 m from bottom	Cd 0,5 m from top	Cd 1,5 m from bottom	Cd 0,5 m from bottom	Cd 0,2 m from bottom	Co 0,5 m from top	Co 1,5 m from bottom	Co 0,5 m from bottom	Co 0,2 m from bottom
	μg/l											
IN/DA007E	1	1	1	1	1	1	1	1	1	1	1	1
DA1A		1	0.2	0.1		1	1	0.4		1	2	2
DA1C		0.2	0.1	0.1		1	0.4	0.3		2	2	2
DA2A		0.2	0.1	0.1		1	1	1		2	1	2
DA2B		1	0	0		2	2	2		2	2	3
DA3A		0.2	0.2	0.2		2	2	2		4	4	4
DA3B		1	1	1		1	2	1		1	1	2
DA004A		2	1	1		1	1	0.3		1	2	2
DA004B		2	1	2		1	1	0.2		1	2	2
DA5		1	2	1		1	1	1		1	0.4	1
DA5A		1	1	1		1	1	1		1	0.5	0
DR001A		2	2	2		2	2	2		1	1	1
DR002A		2	2	1		2	2	2		1	1	1
DR001B		1	2	1		1	2	2		1	1	1
DR002B		2	1	1		1	1	1		1	1	1

SAMPLE	Cr 0,5 m from top	Cr 1,5 m from bottom	Cr 0,5 m from bottom	Cr 0,2 m from bottom	Cu 0,5 m from top	Cu 1,5 m from bottom	Cu 0,5 m from bottom	Cu 0,2 m from bottom	Mn 0,5 m from top	Mn 1,5 m from bottom	Mn 0,5 m from bottom	Mn 0,2 m from bottom
	μg/l											
IN/DA007E	0.13	0.02	0.02	0.02	26	35	47	63	25	21	24	16
DA1A		0.02	0.02	0.03		23	58	87		45	13	8
DA1C		0.04	0.03	0.03		50	105	92		10	7	7
DA2A		0.02	0.03	0.04		501	867	771		4	2	3
DA2B		0.03	0.1	0.03		180	326	424		13	8	5
DA3A		0.02	0.08	0.05		607	578	573		5	5	6
DA3B		0.09	0.02	0.04		47	98	61		52	24	106
DA004A		0.03	0.03	0		13	9	3		274	550	248
DA004B		0.03	0.02	0		15	7	6		294	586	273
DA5		0.02	0.04	0.02		22	23	25		35	31	34
DA5A		0.02	0.01	0.03		23	24	21		22	24	30
DR001A		0.03	0.03	0.1		48	59	69		43	38	41
DR002A		0.03	0.03	0.04		55	64	63		41	38	34
DR001B		0.03	0.02	0.02		46	56	56		42	39	36
DR002B			0.03	0.02	0.03		43	45	54		34	40

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SAMPLE	Ni 0,5 m from top	Ni 1,5 m from bottom	Ni 0,5 m from bottom	Ni 0,2 m from bottom	Pb 0,5 m from top	Pb 1,5 m from bottom	Pb 0,5 m from bottom	Pb 0,2 m from bottom	Zn 0,5 m from top	Zn 1,5 m from bottom		
	µg/l											
IN/DA007E	1	2	2	2	0.08	0.1	0.2	0.3	422	450		
DA1A		3	9	11		0.03	0.1	0.2		589		
DA1C		8	14	14		0.1	0.2	0.2		811		
DA2A		3	3	4		3	4	3		767		
DA2B		2	3	3		1	2	3		918		
DA3A		6	6	6		4	3	3		1394		
DA3B		2	2	1		0.4	1	1		496		
DA004A		2	2	1		0.02	ND	ND		377		
DA004B		2	1	1		0.02	ND	0.05		366		
DA5		2	2	2		0.04	0.1	0.05		428		
DA5A		2	2	2		0.1	0.1	0.04		444		
DR001A		2	2	3		0.2	0.3	0.3		614		
DR002A		2	3	2		0.3	0.3	0.3		638		
DR001B		2	2	2		0.2	0.3	0.3		599		
DR002B		2	2	2		0.2	0.2	0.3		555		

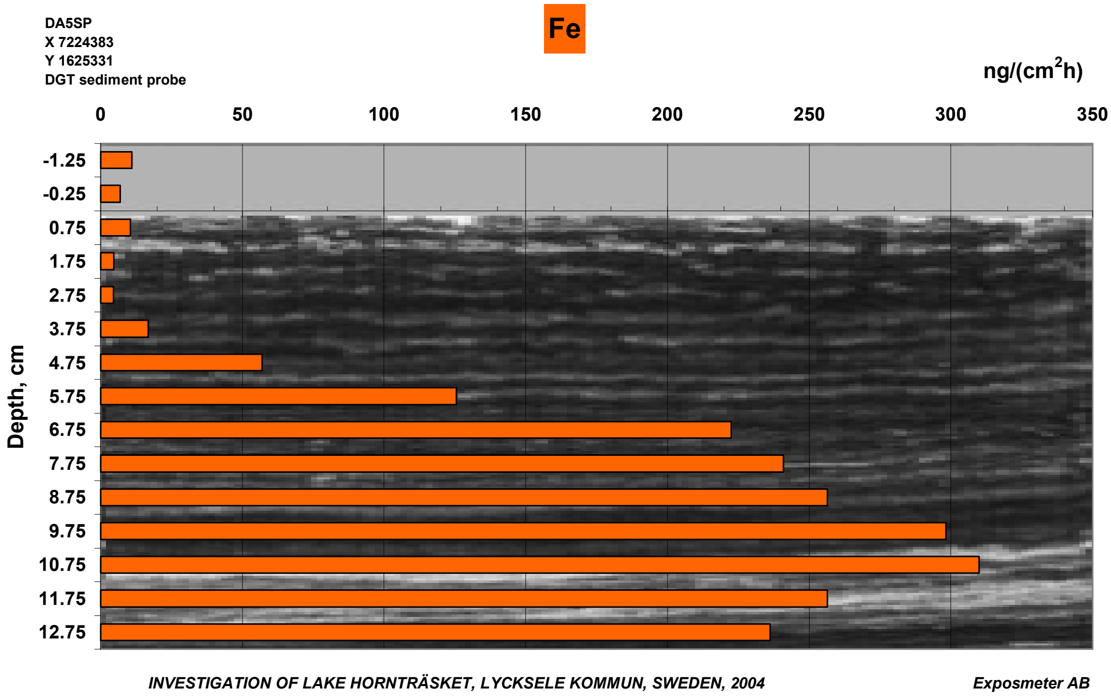
Table 5. Metal concentrations from EMD sediment probes

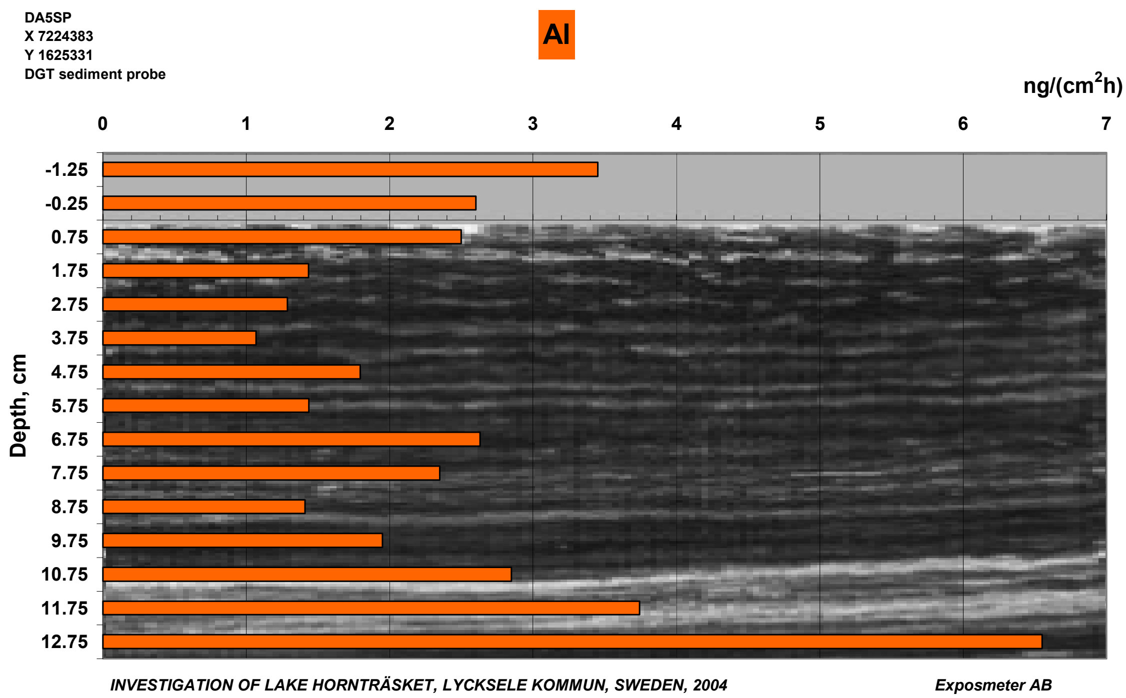
	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP	AD1SP
Depth, cm	**-1.25**	**-0.25**	**0.75**	**1.75**	**2.75**	**3.75**	**4.75**	**5.75**	**6.75**	**7.75**	**8.75**	**9.75**	**10.75**	**11.75**	**12.75**
	ng/(cm^2*h)														
Fe	7	7	9	5	2.3	2.6	2.0	2.5	5	7	11	13	19	28	26
Al	76	76	81	55	23	13	10	9	15	14	13	18	20	19	32
As	0.04	0.03	0.02	0.1	0	0	0.02	0.01	0.02	0	0.05	0.1	0.1	0.01	0.05
Ba	0.5	0.5	0.6	0.6	0.7	0.8	1.1	0.8	0.8	1.0	0.7	1.0	1.1	0.9	0.9
Cd	0.4	0.4	0.5	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.02	0.02	0.02	0.01	0.0
Co	0.6	0.7	0.7	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Cr	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.0	0.0	0.1	0.1
Cu	10	10	11	6	0.9	0.5	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.6
Mn	23	36	36	37	50	34	28	24	30	34	36	39	43	47	43
Ni	2.1	2.3	2.5	1.7	0.7	0.6	0.4	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.6
Pb	0.04	0.05	0.05	0.04	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.05
Zn	377	357	401	292	85	42	28	23	22	14	11	9	9	9	25

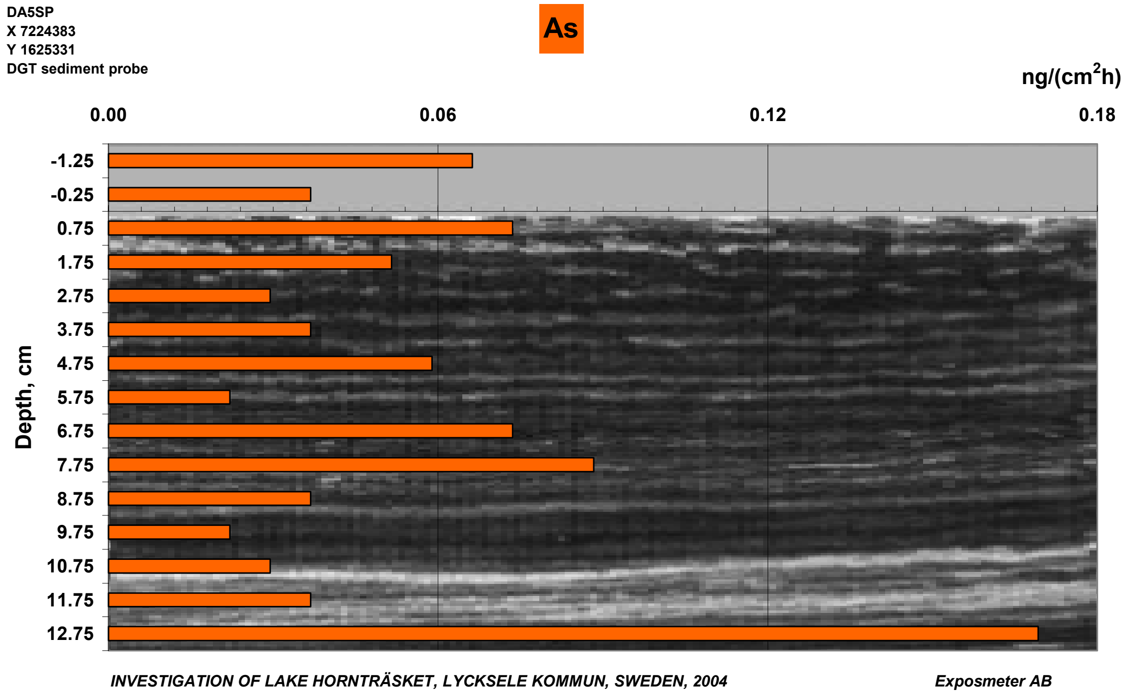
	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP	DA004SP
Depth, cm	**-1.25**	**-0.25**	**0.75**	**1.75**	**2.75**	**3.75**	**4.75**	**5.75**	**6.75**	**7.75**	**8.75**	**9.75**	**10.75**	**11.75**	**12.75**
	ng/(cm^2*h)														
Fe	104	95	59	109	156	82	87	68	59	58	46	94	97	71	41
Al	3.0	2.8	3.2	2.2	2.0	1.5	1.9	2.5	2.1	2.0	1.9	1.9	2.3	3.1	4.0
As	0	0.01	0	0	0.01	0	0	0	0	0	0	0	0	0	0
Ba	0.9	1.2	1.1	1.0	1.4	1.4	1.9	2.2	2.0	1.9	1.7	1.7	1.8	1.9	1.2
Cd	0.04	0.03	0.03	0.01	0.01	0.003	0.003	0.004	0.003	0.003	0.002	0.001	0.002	0.004	0.01
Co	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.07	0.07	0.05	0.06	0.05	0.04	0.03
Cr	0.05	0.04	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.04
Cu	0.8	0.6	1.7	1.2	1.1	0.8	0.8	0.5	0.3	0.3	0.4	0.3	0.4	0.3	0.5
Mn	106	107	49	56	81	58	74	69	50	50	42	50	52	40	32
Ni	0.2	1.4	0.7	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.3	0.2	0.2
Pb	0.07	0.06	0.05	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.05	0.08
Zn	99	98	9.9	4.9	4.2	2.9	3.8	2.5	1.4	1.1	1.1	1.3	1.4	1.6	3.5

	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP	DA3SP
Depth, cm	**-1.25**	**-0.25**	**0.75**	**1.75**	**2.75**	**3.75**	**4.75**	**5.75**	**6.75**	**7.75**	**8.75**	**9.75**	**10.75**	**11.75**	**12.75**
								ng/(cm^2*h)							
Fe	28	15	70	176	459	626	857	813	880	1015	898	839	766	804	339
Al	8.1	3.8	3.4	2.2	1.8	2.9	1.8	1.6	1.9	1.9	2.4	2.4	2.1	3.4	5.0
As	0.02	0.001	0	0	0	0.04	0.07	0.1	0.1	0.07	0.2	0.2	0.1	0.2	0.04
Ba	1.4	0.9	0.9	0.9	1.1	1.6	1.7	1.6	2.1	2.2	2.1	2.2	2.0	2.2	1.5
Cd	0.4	0.2	0.1	0.06	0.05	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03
Co	0.4	0.2	0.1	0.09	0.08	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.03	0.03	0.07
Cr	0.04	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04
Cu	15	7.5	6.2	5.0	4.8	2.3	1.2	0.9	0.8	0.9	0.9	0.8	1.2	1.4	2.7
Mn	30	16	16	17	24	30	37	39	46	57	51	49	49	53	36
Ni	1.1	1.1	0.7	0.3	0.3	0.9	0.3	0.3	0.1	0.1	0.5	0.2	0.2	0.3	0.4
Pb	0.2	0.1	0.1	0.07	0.07	0.08	0.07	0.1	0.08	0.09	0.1	0.1	0.2	0.2	0.2
Zn	360	130	48	27	16	9.0	4.9	3.8	3.4	3.8	4.5	5.5	5.8	6.7	13

	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP	DA5SP
Depth, cm	**-1.25**	**-0.25**	**0.75**	**1.75**	**2.75**	**3.75**	**4.75**	**5.75**	**6.75**	**7.75**	**8.75**	**9.75**	**10.75**	**11.75**	**12.75**
								ng/(cm^2*h)							
Fe	11	6.9	10	4.6	4.5	17	57	125	223	241	256	298	310	256	236
Al	3.5	2.6	2.5	1.4	1.3	1.1	1.8	1.4	2.6	2.3	1.4	2.0	2.8	3.7	6.5
As	0.03	0.01	0.03	0.02	0.01	0.01	0.02	0.01	0.03	0.04	0.01	0.01	0.01	0.01	0.1
Ba	1.4	1.1	0.9	1.3	1.8	2.3	2.1	2.5	2.6	2.5	2.3	2.4	2.4	2.2	2.0
Cd	0.1	0.1	0.1	0.1	0.1	0.1	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Co	0.1	0.05	0.02	0.03	0.07	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cr	0.04	0.03	0.03	0.03	0.03	0.03	0.1	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04
Cu	2.7	2.4	2.3	1.2	1.1	1.0	0.9	0.7	1.2	1.2	0.9	1.5	2.2	2.8	2.5
Mn	20	14	13	27	45	77	77	62	49	42	39	45	45	39	38
Ni	0.3	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pb	0.03	0.03	0.04	0.00	0.02	0.02	0.04	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1
Zn	54	40	26	21	20	19	12	7.2	5.4	4.1	1.9	2.3	2.7	3.2	5.1


DA5SP
X 7224383
Y 1625331
DGT sediment probe
Fe
ng/(cm²h)
0 50 100 150 200 250 300 350
Depth, cm
-1.25 -0.25 0.75 1.75 2.75 3.75 4.75 5.75 6.75 7.75 8.75 9.75 10.75 11.75 12.75
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB


DA5SP
X 7224383
Y 1625331
DGT sediment probe
Al
ng/(cm²h)
0 1 2 3 4 5 6 7
Depth, cm
-1.25 -0.25 0.75 1.75 2.75 3.75 4.75 5.75 6.75 7.75 8.75 9.75 10.75 11.75 12.75
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB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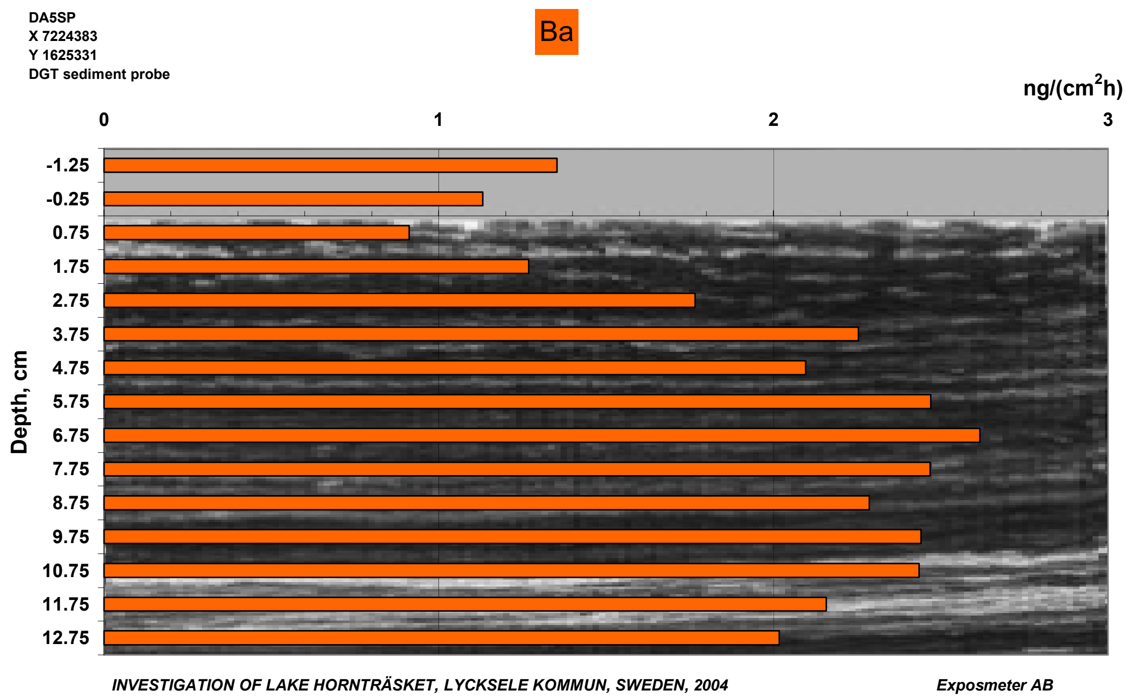
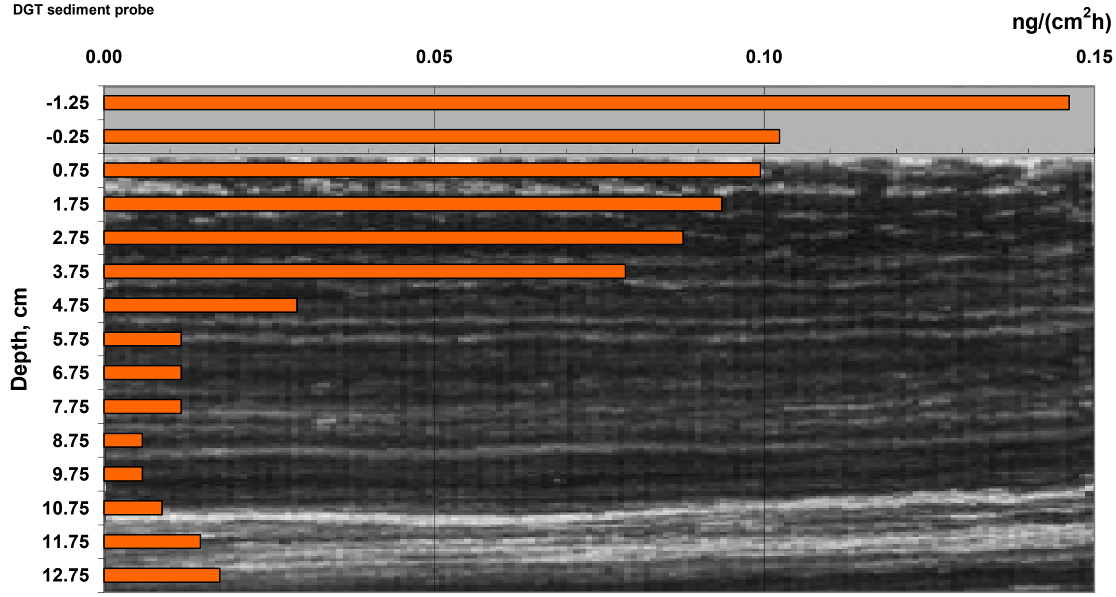
X 7224383
Y 1625331
DGT sediment probe
As
ng/(cm2h)
0.00
0.06
0.12
0.18
Depth, cm
-1.25
-0.25
0.75
1.75
2.75
3.75
4.75
5.75
6.75
7.75
8.75
9.75
10.75
11.75
12.75
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB


DA5SP
X 7224383
Y 1625331
DGT sediment probe
Ba
ng/(cm2h)
0
1
2
3
Depth, cm
-1.25
-0.25
0.75
1.75
2.75
3.75
4.75
5.75
6.75
7.75
8.75
9.75
10.75
11.75
12.75
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB

DA5SP
X 7224383
Y 1625331
DGT sediment probe

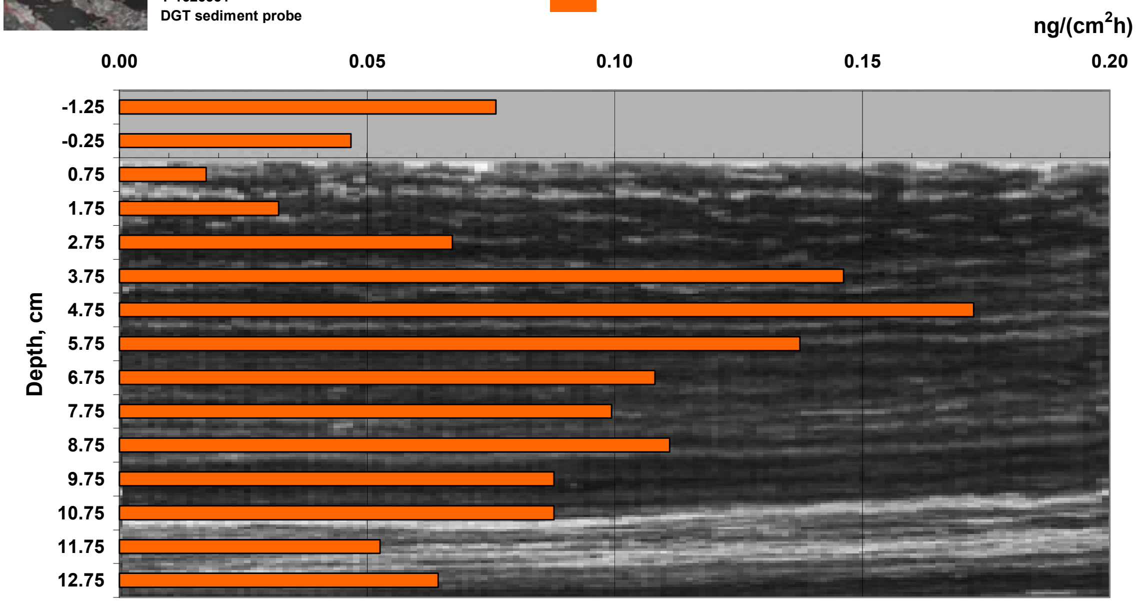
Cd



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

DA5SP
X 7224383
Y 1625331
DGT sediment probe

Co



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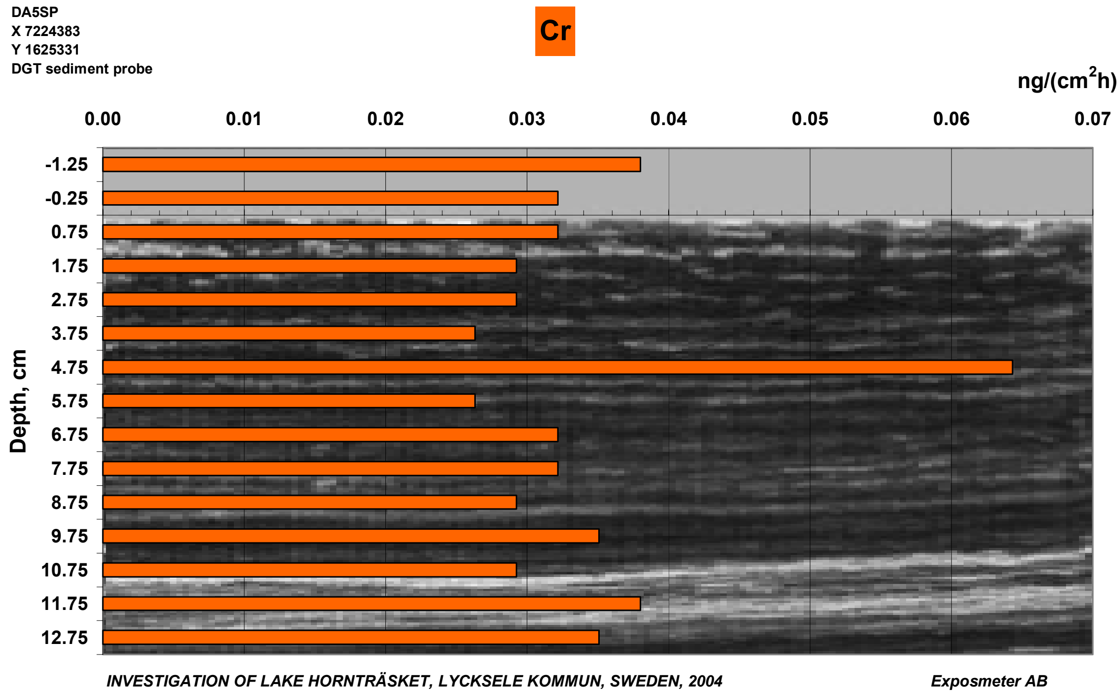
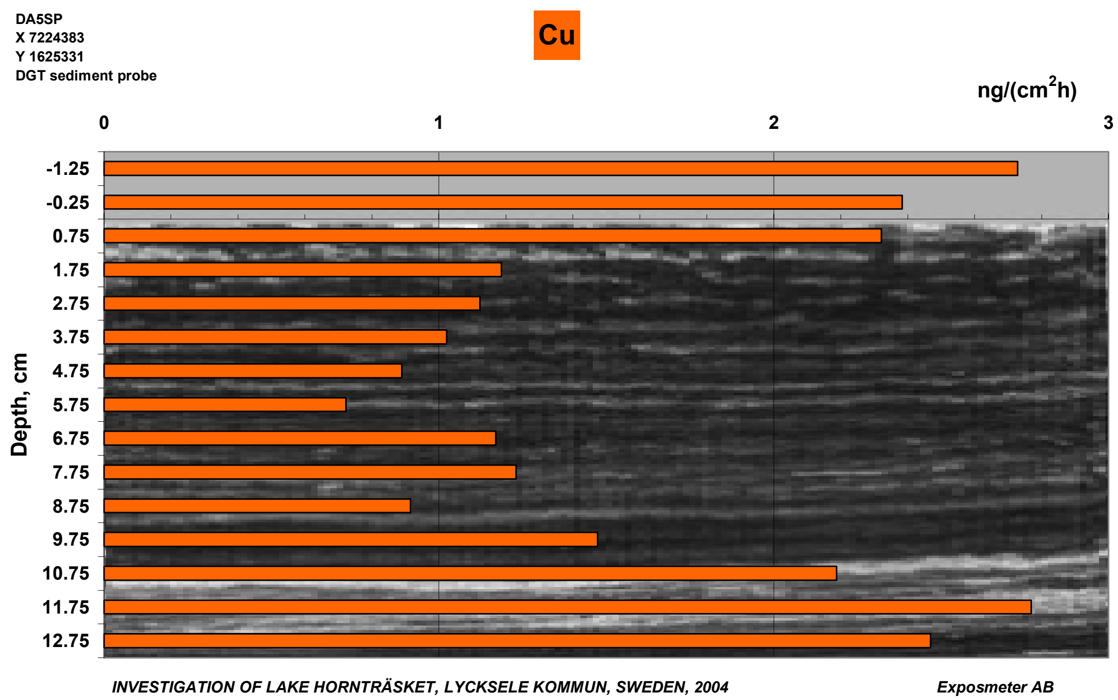
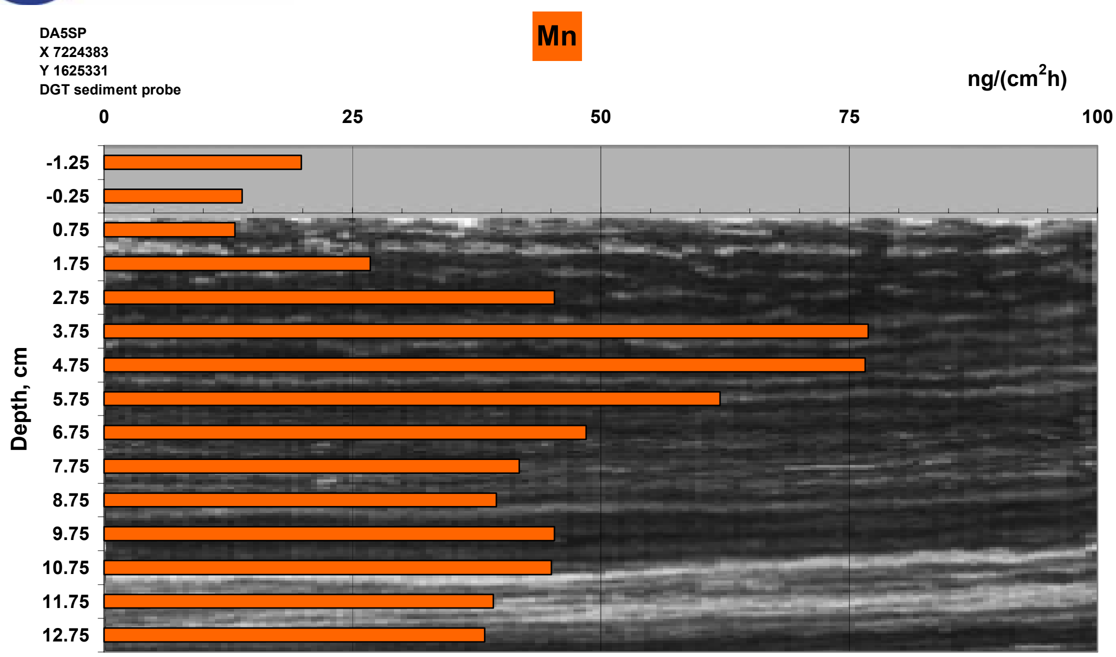
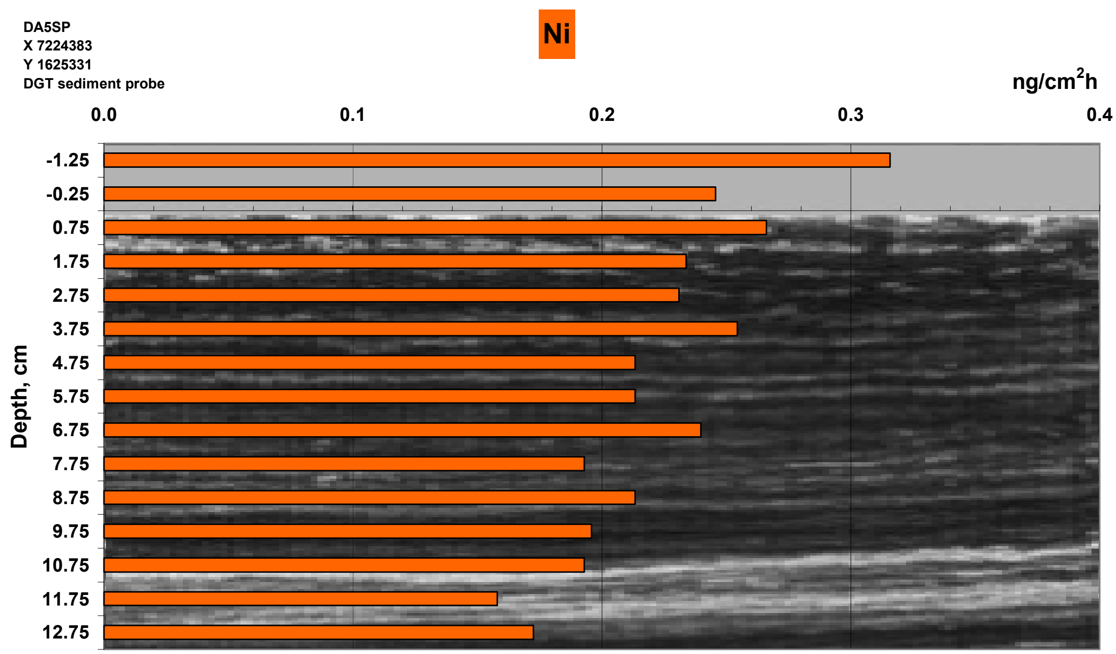
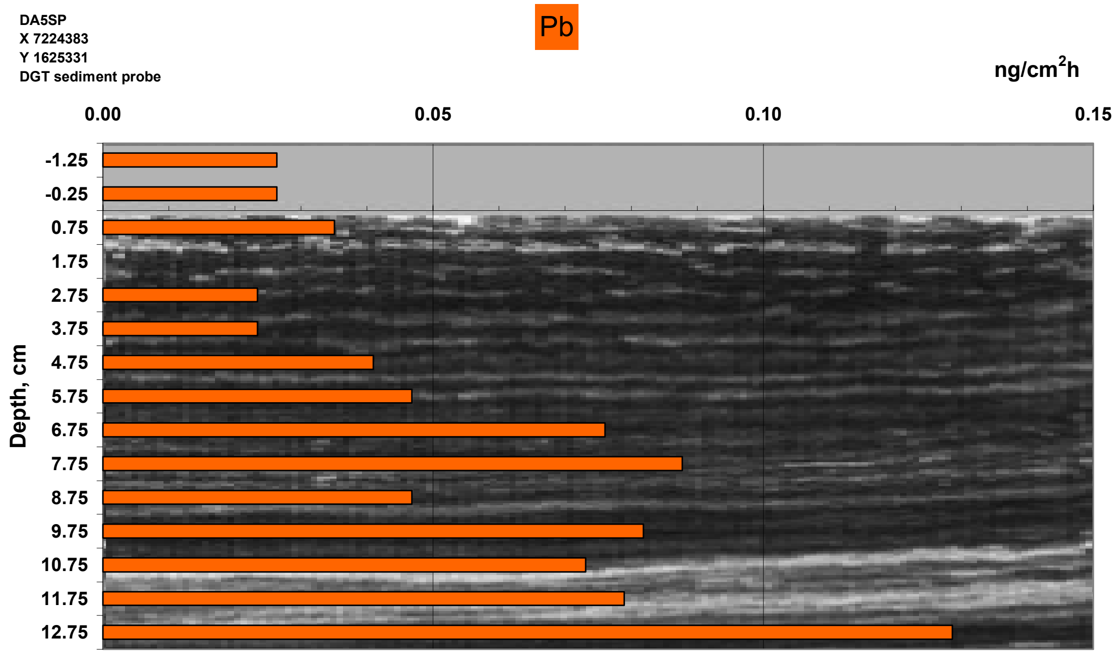

DA5SP
X 7224383
Y 1625331
DGT sediment probe
Cr
ng/(cm²h)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
-1.25
-0.25
0.75
1.75
2.75
3.75
4.75
5.75
6.75
7.75
8.75
9.75
10.75
11.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB


DA5SP
X 7224383
Y 1625331
DGT sediment probe
Cu
ng/(cm²h)
0
1
2
3
-1.25
-0.25
0.75
1.75
2.75
3.75
4.75
5.75
6.75
7.75
8.75
9.75
10.75
11.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB

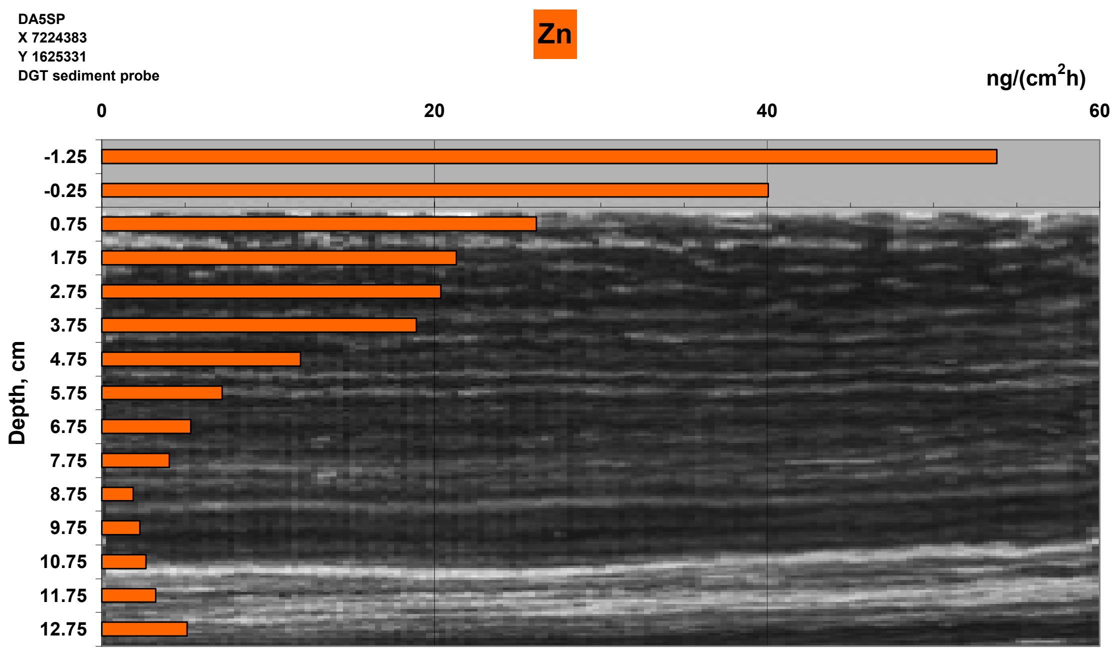




INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

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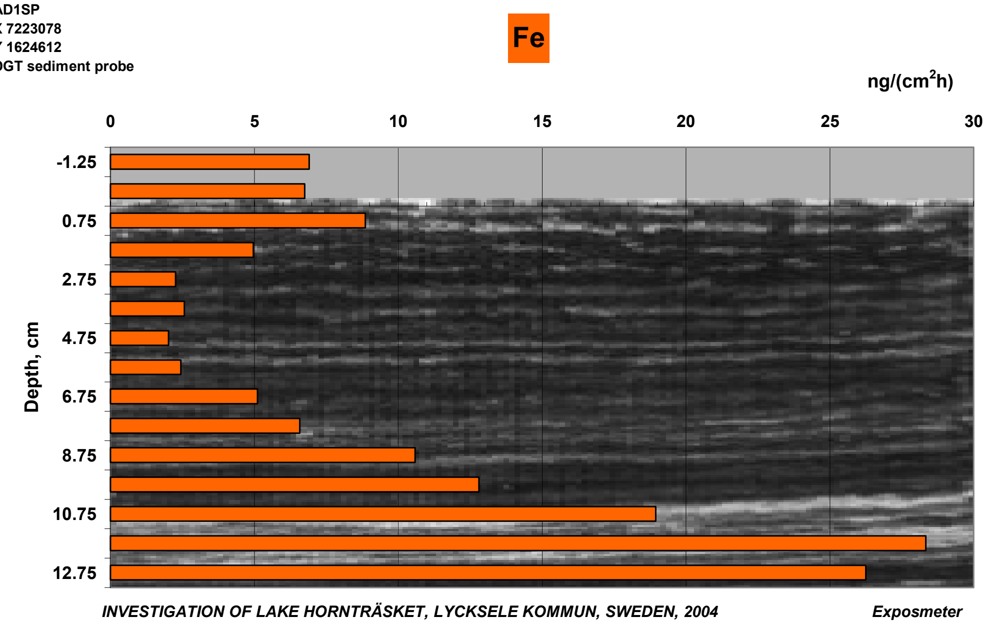
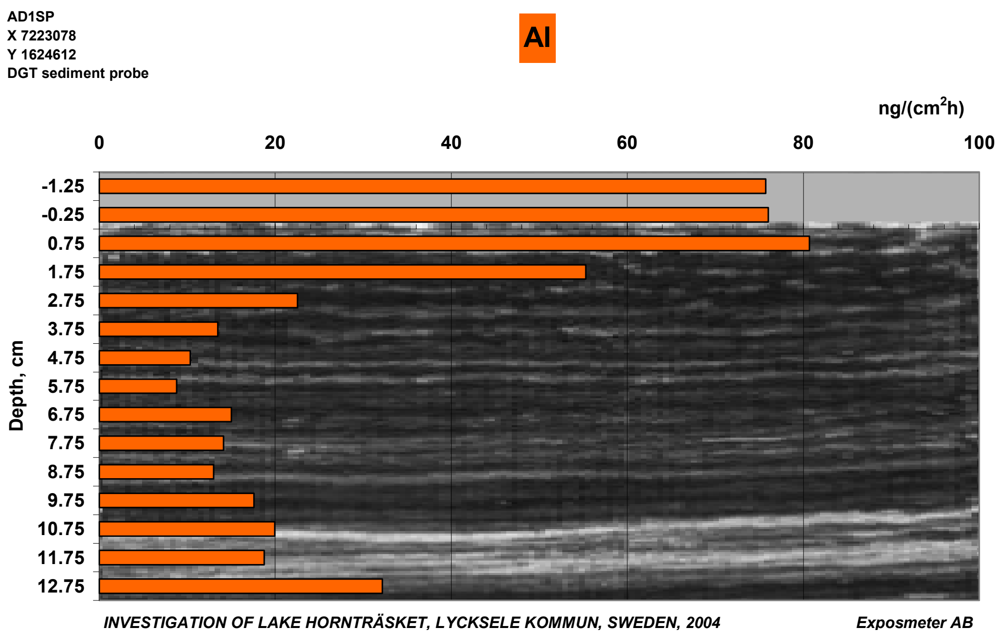
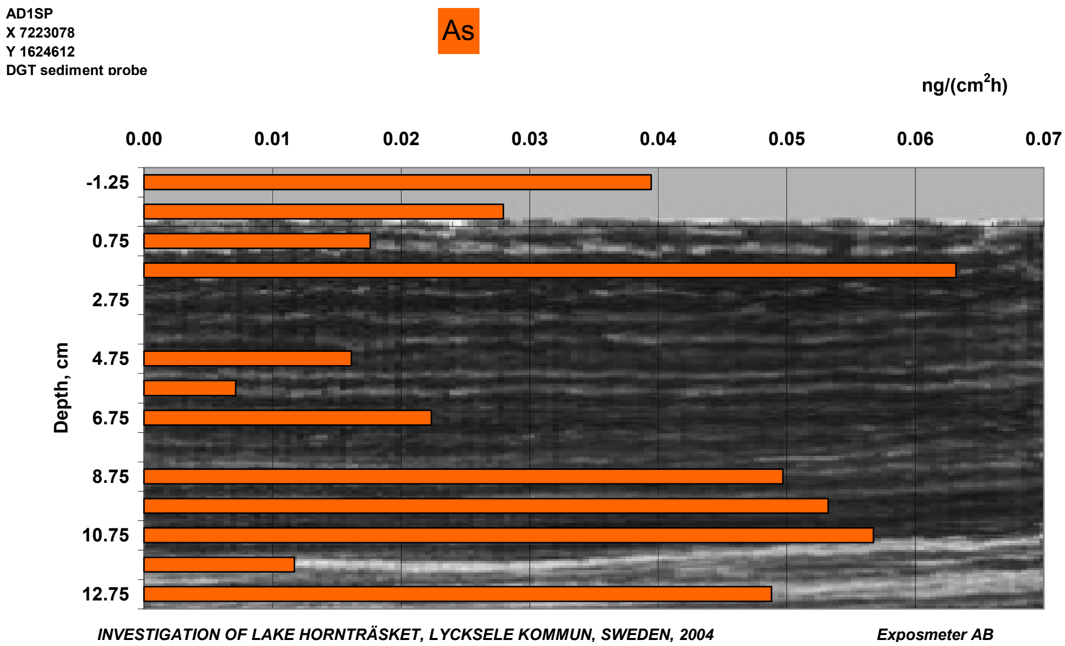
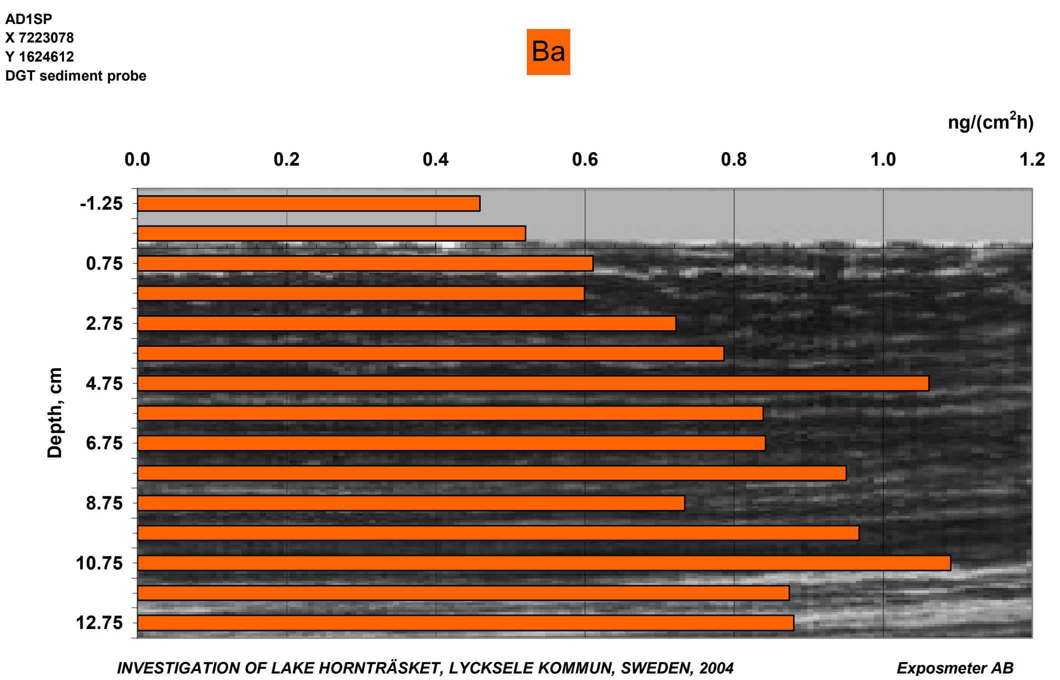
AD1SP
X 7223078
Y 1624612
DGT sediment probe



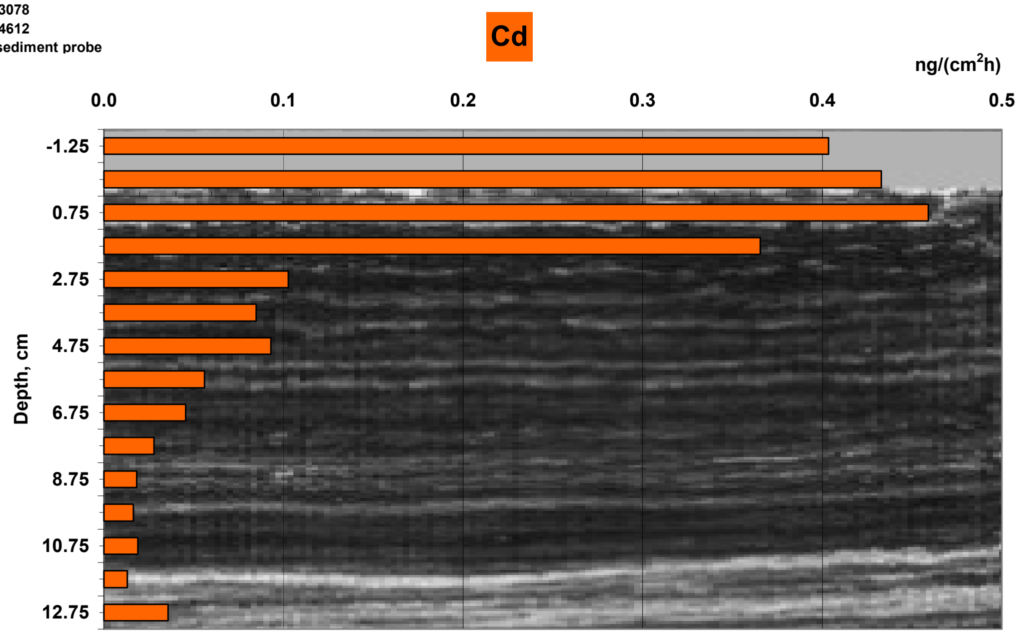
AD1SP
X 7223078
Y 1624612
DGT sediment probe




AD1SP
X 7223078
Y 1624612
DGT sediment probe
As
ng/(cm2h)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
-1.25
0.75
2.75
4.75
6.75
8.75
10.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB

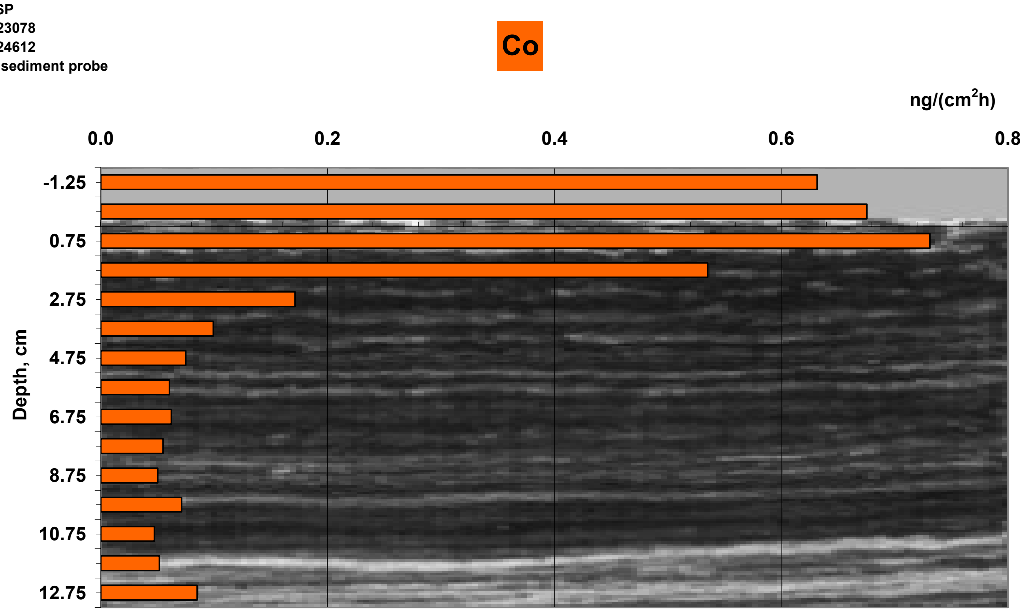

AD1SP
X 7223078
Y 1624612
DGT sediment probe
Ba
ng/(cm2h)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
-1.25
0.75
2.75
4.75
6.75
8.75
10.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB

AD1SP
X 7223078
Y 1624612
DGT sediment probe



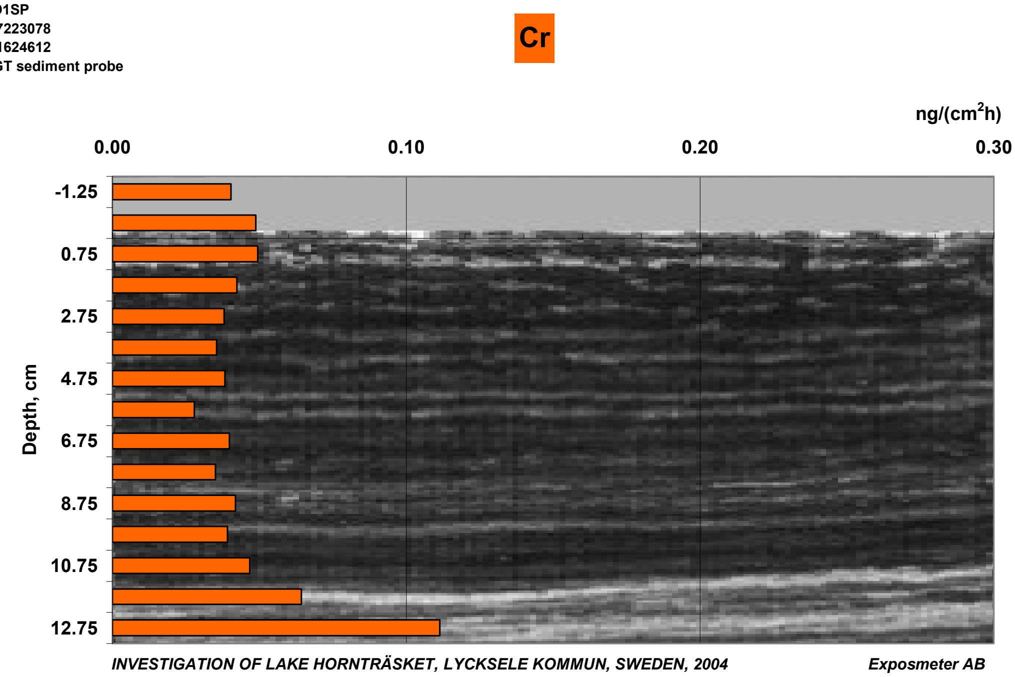
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

AD1SP
X 7223078
Y 1624612
DGT sediment probe

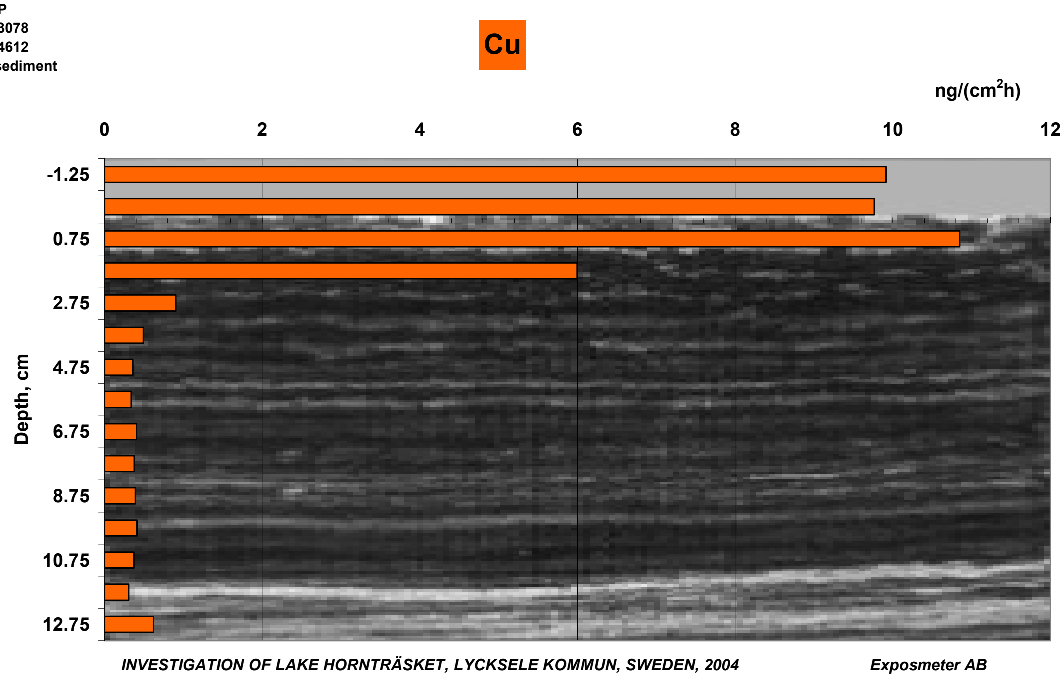


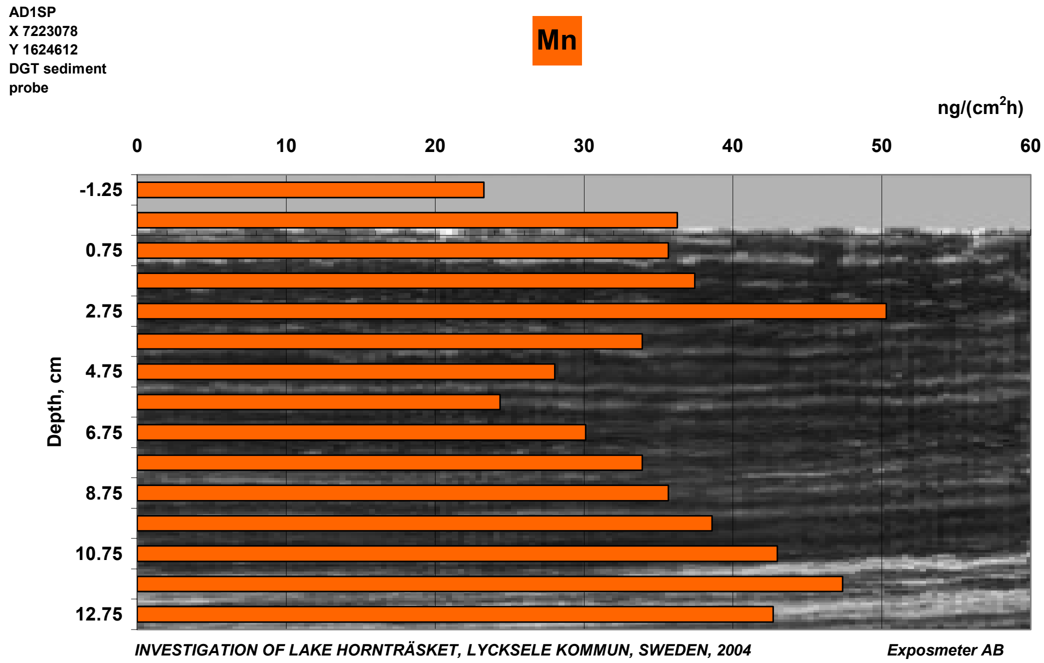
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

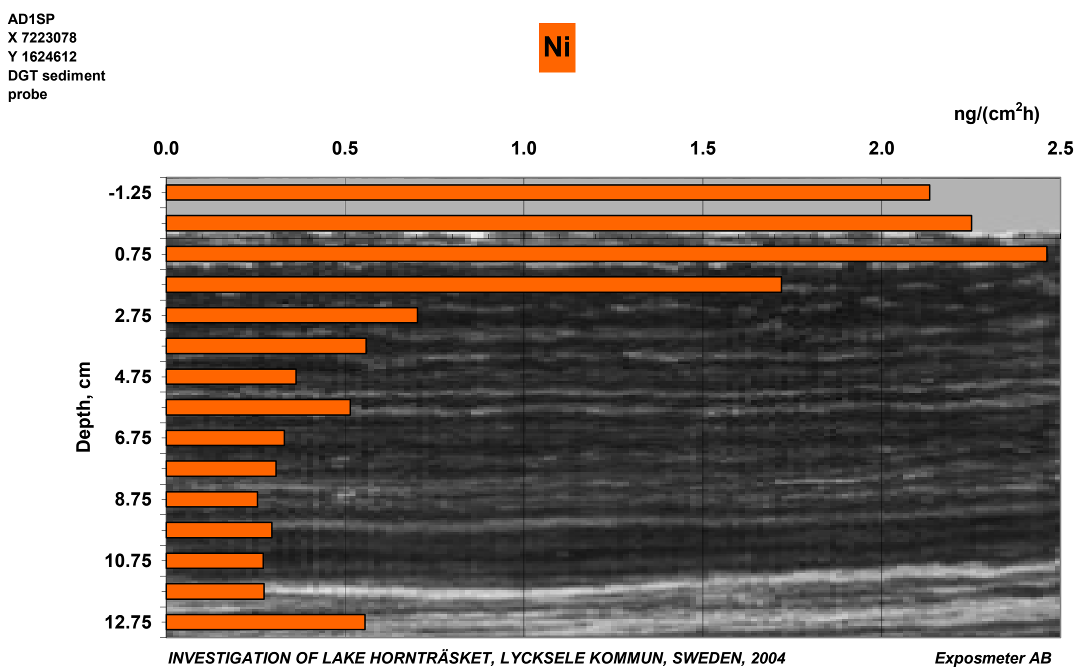
AD1SP
X 7223078
Y 1624612
DGT sediment probe



AD1SP
X 7223078
Y 1624612
DGT sediment
probe

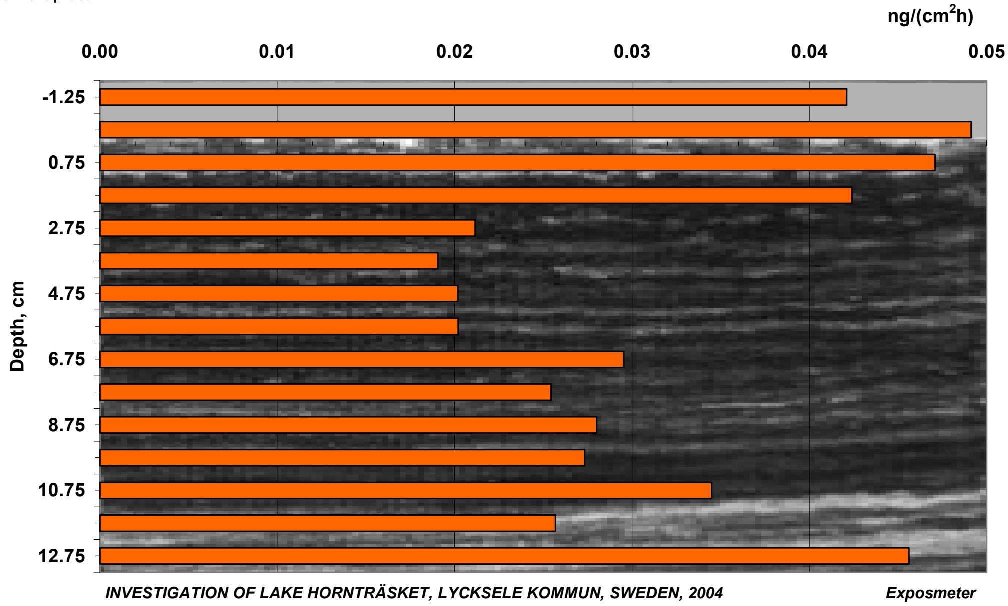



AD1SP
X 7223078
Y 1624612
DGT sediment probe
Mn
ng/(cm2h)
0
10
20
30
40
50
60
-1.25
0.75
2.75
4.75
6.75
8.75
10.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB


AD1SP
X 7223078
Y 1624612
DGT sediment probe
Ni
ng/(cm2h)
0.0
0.5
1.0
1.5
2.0
2.5
-1.25
0.75
2.75
4.75
6.75
8.75
10.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB

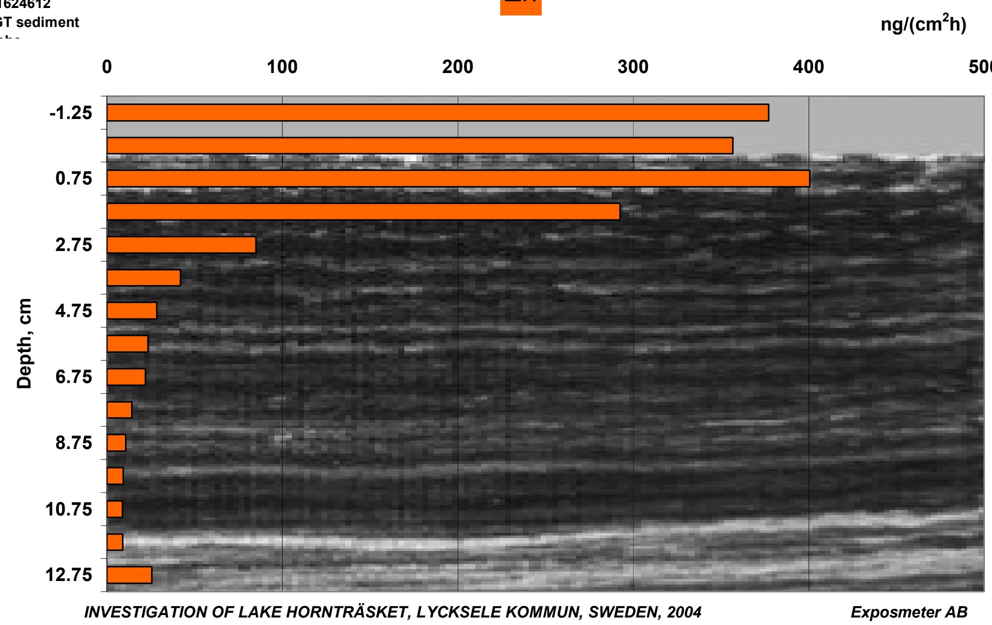
AD1SP
X 7223078
Y 1624612
DGT sediment probe

Pb



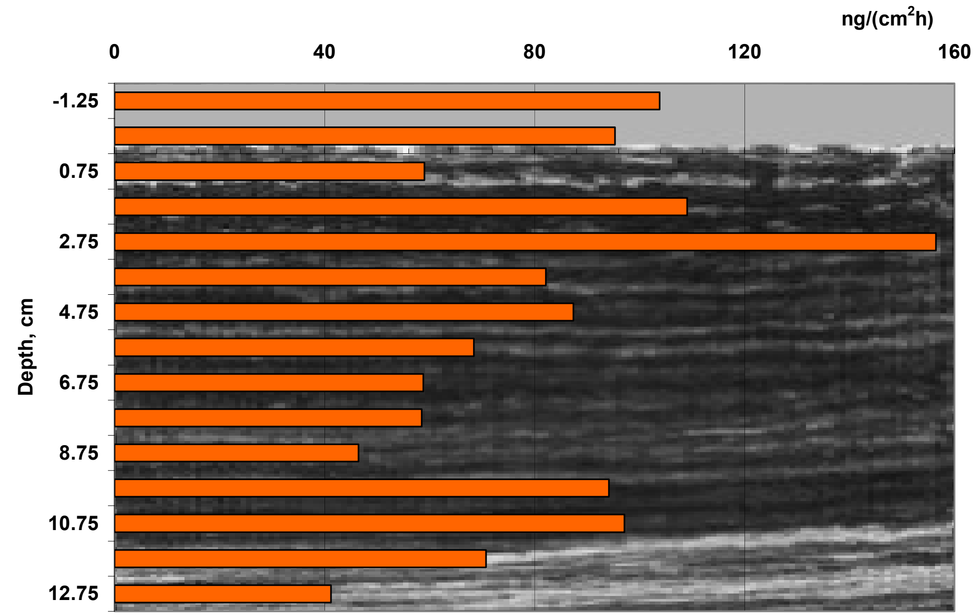
AD1SP
X 7223078
Y 1624612
DGT sediment

Zn



DA004SP
X 7223708
Y 1623522
DGT sediment probe

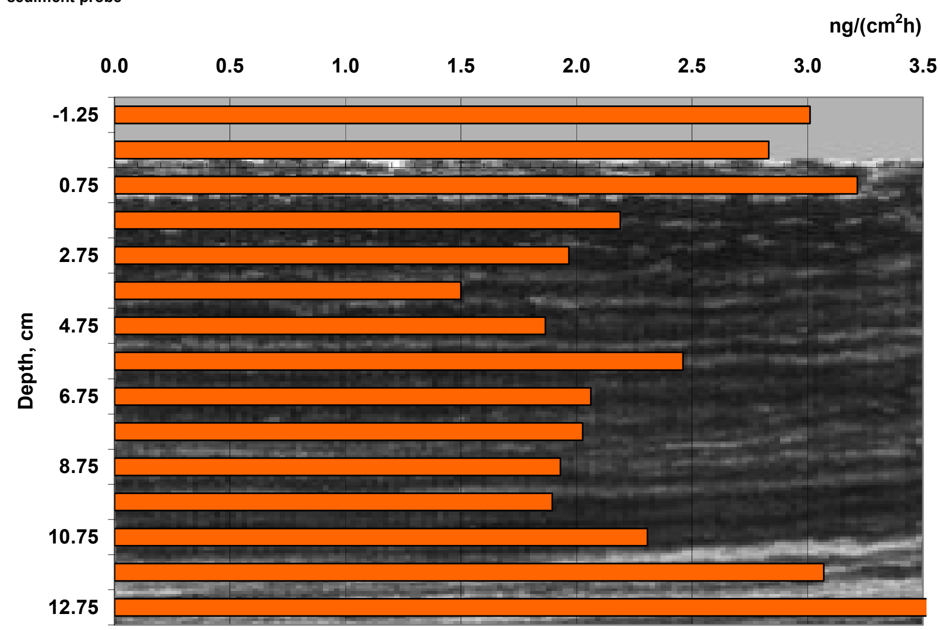
Fe



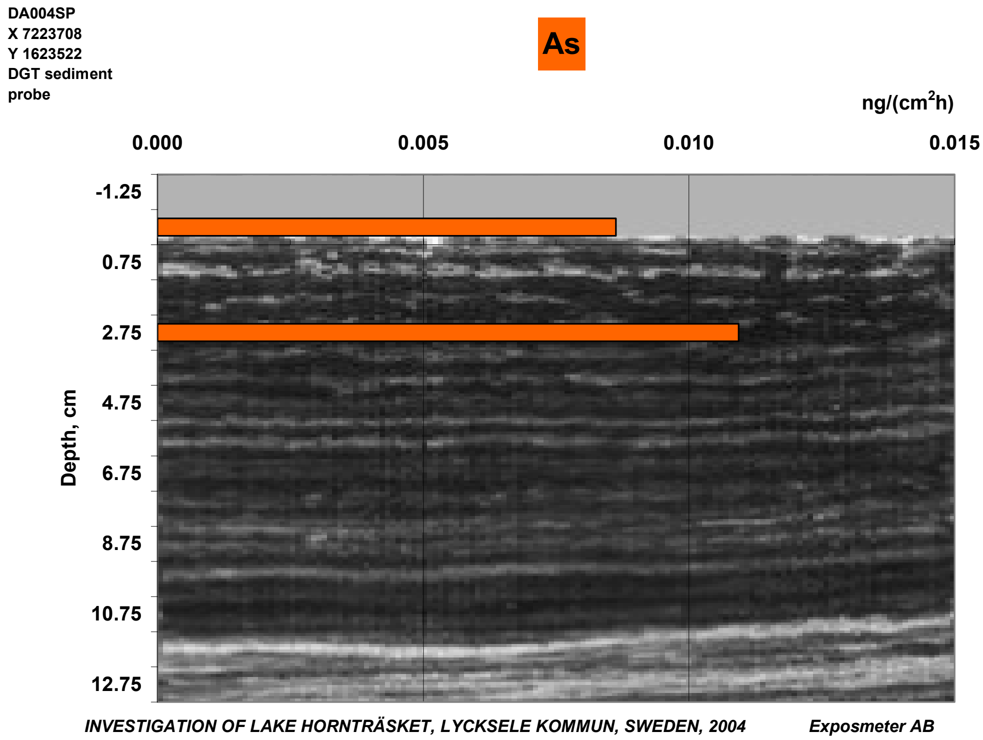
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

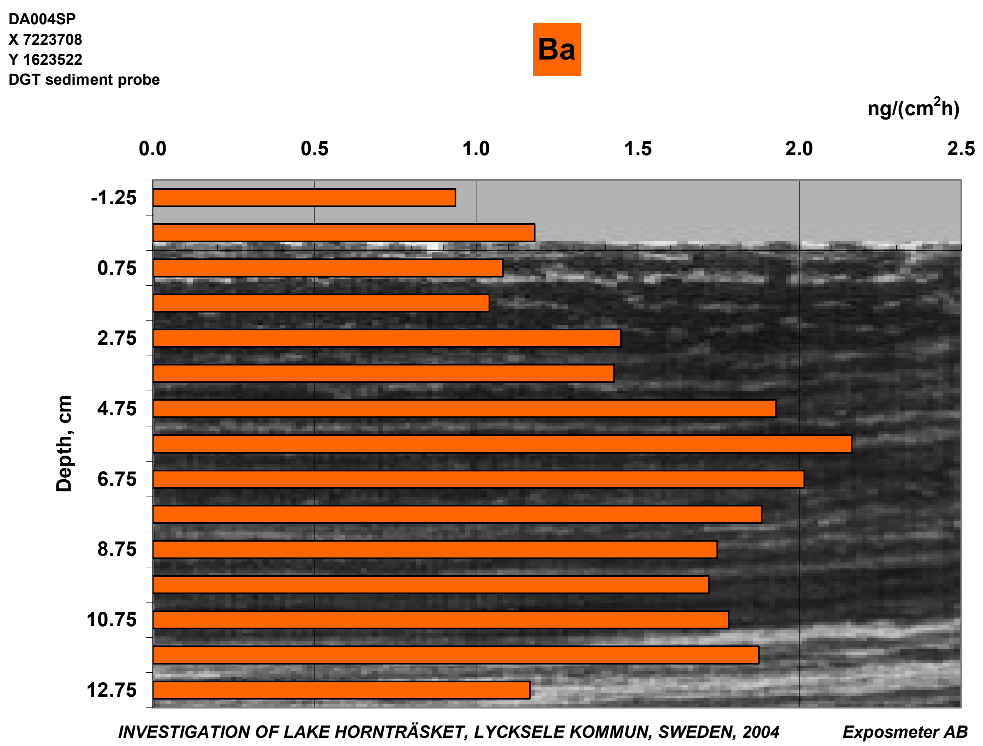
DA004SP
X 7223708
Y 1623522
DGT sediment probe

Al



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*





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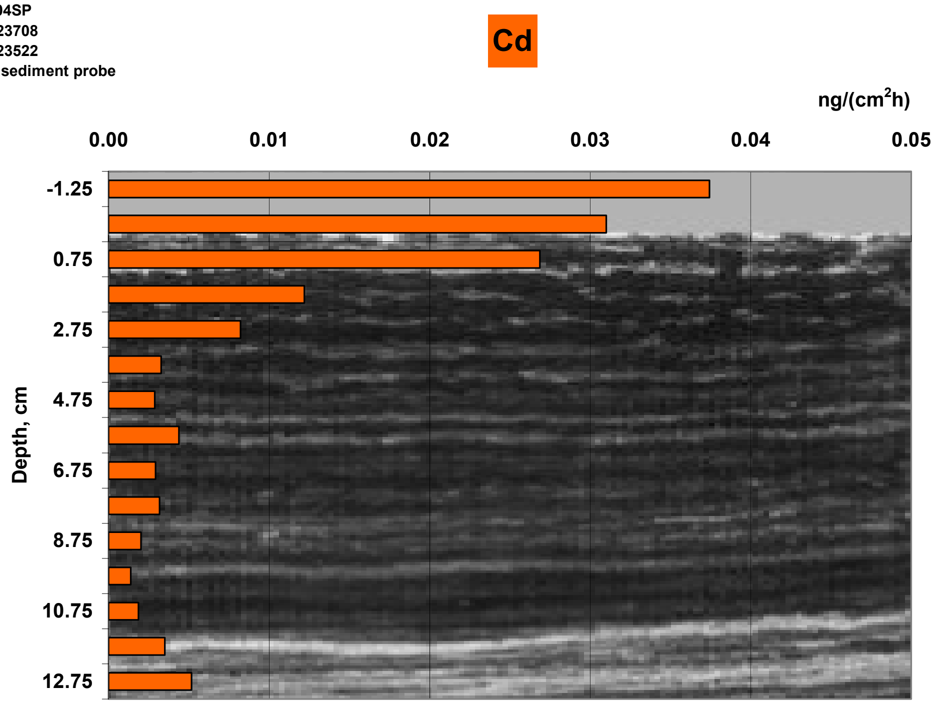
DA004SP
X 7223708
Y 1623522
DGT sediment probe



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

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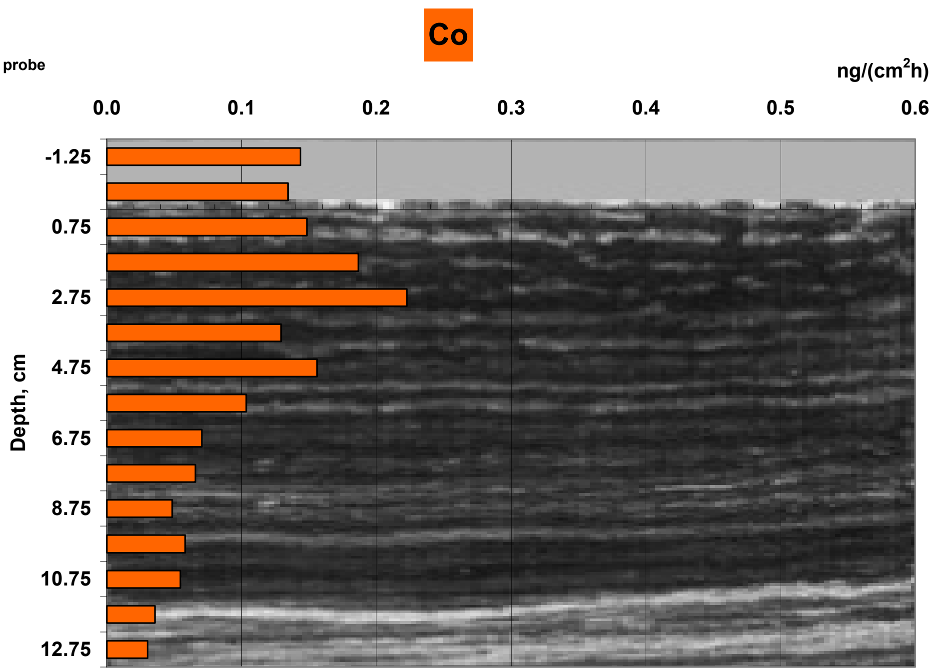

INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

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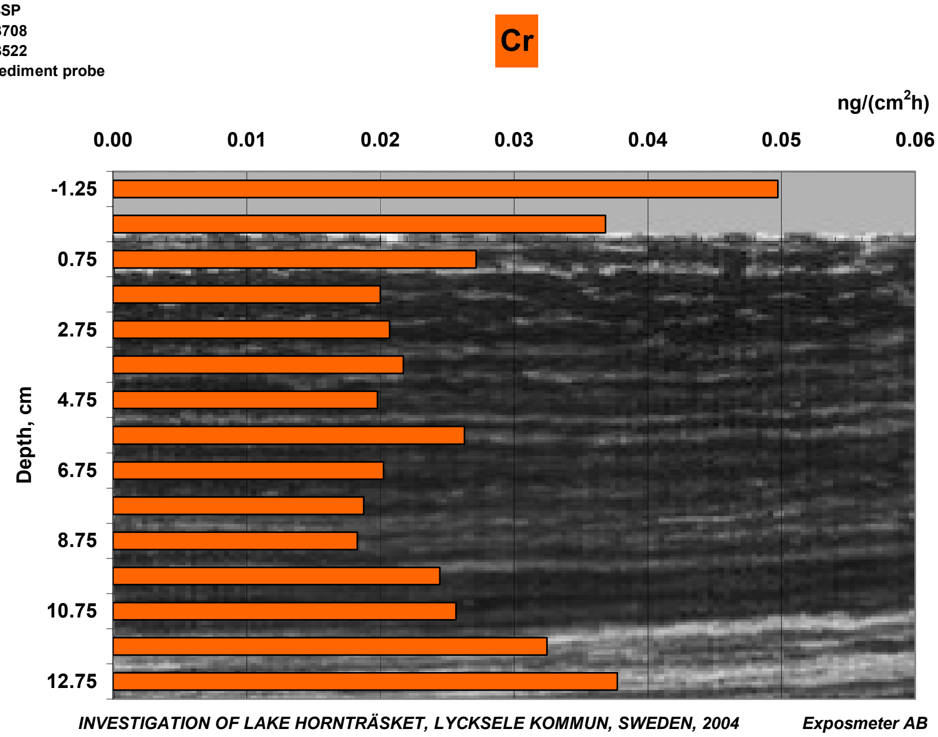

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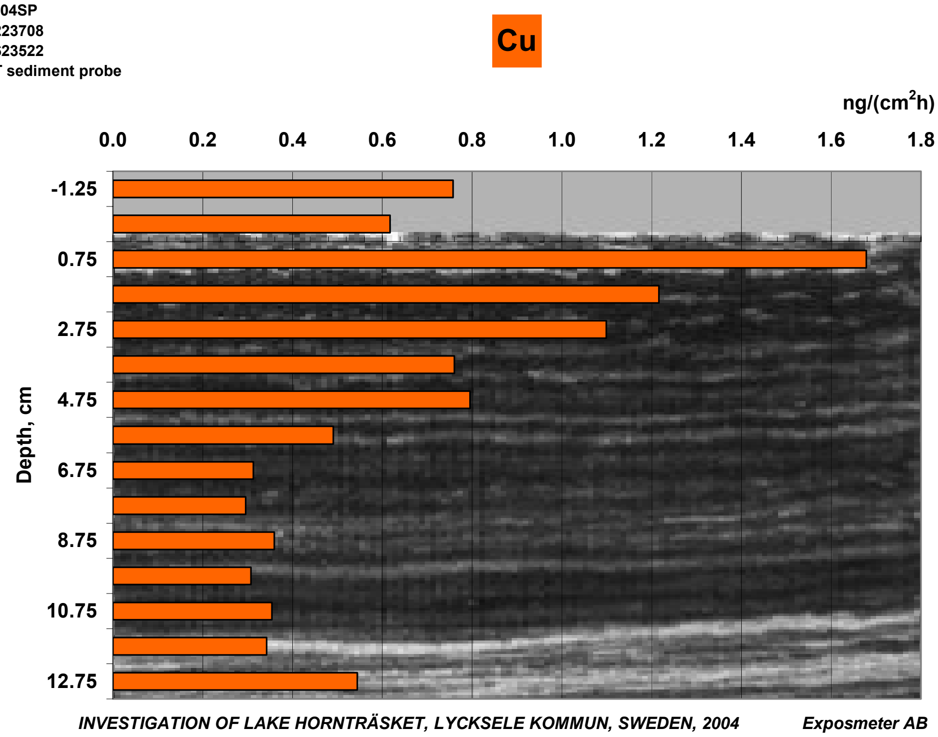
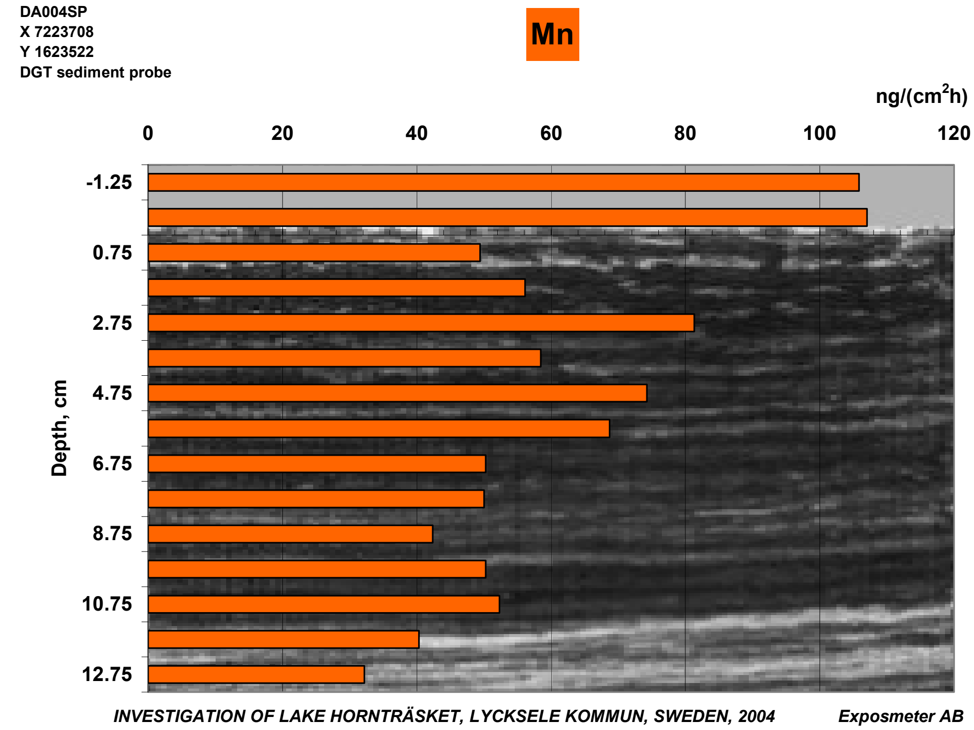
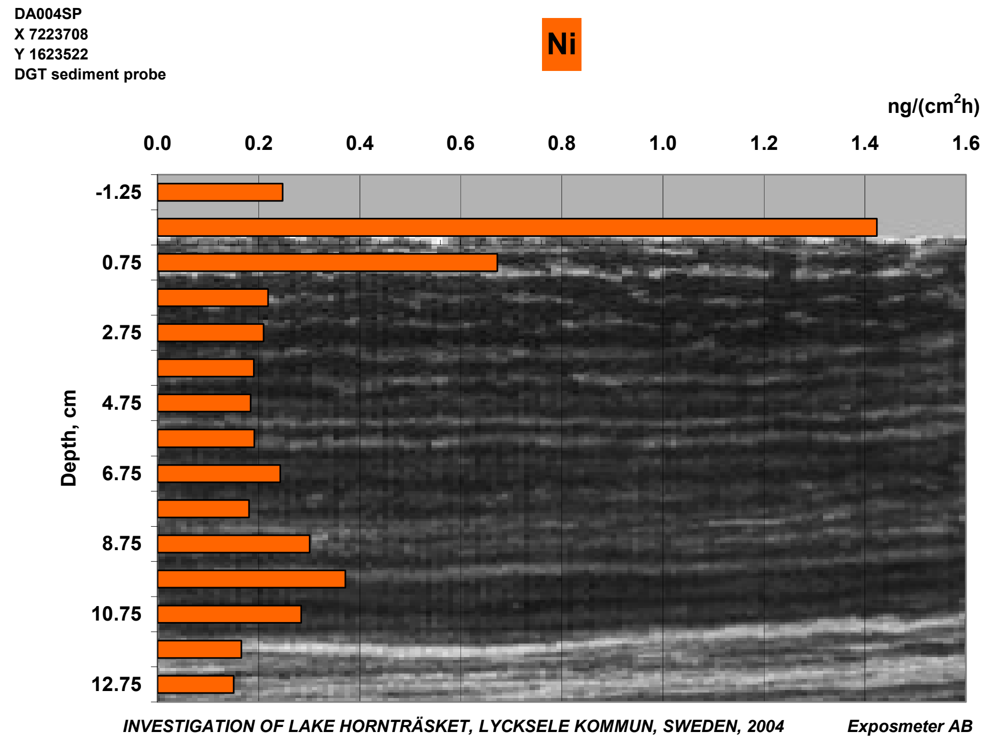
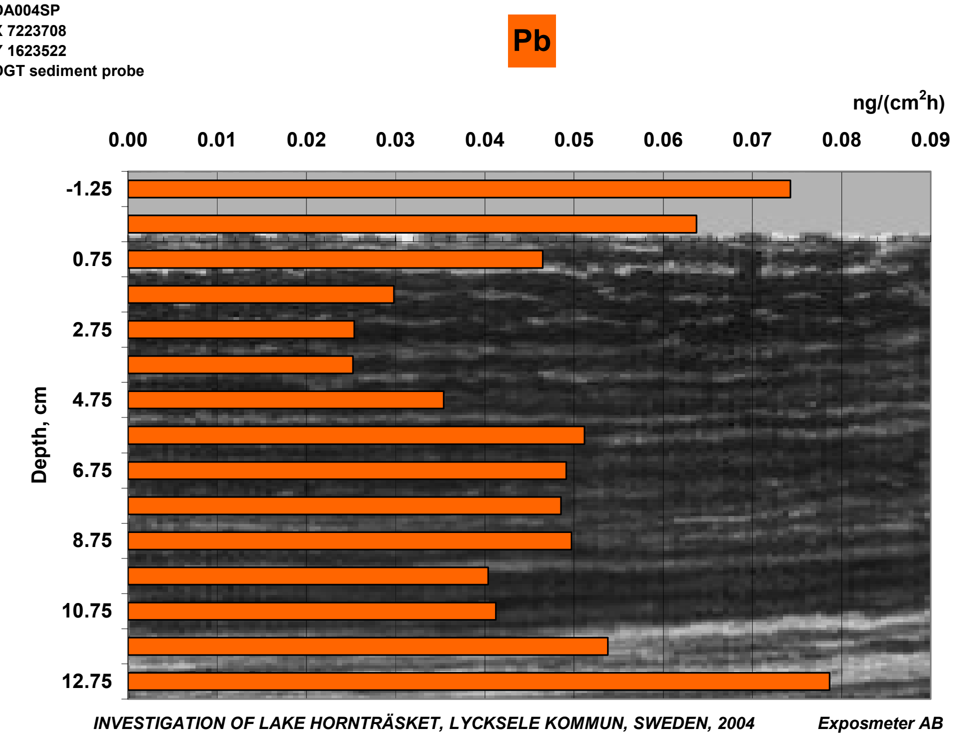



DA004SP
X 7223708
Y 1623522
DGT sediment probe
Mn
ng/(cm²h)
0
20
40
60
80
100
120
-1.25
0.75
2.75
4.75
6.75
8.75
10.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB


DA004SP
X 7223708
Y 1623522
DGT sediment probe
Ni
ng/(cm²h)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
-1.25
0.75
2.75
4.75
6.75
8.75
10.75
12.75
Depth, cm
INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004
Exposmeter AB

DA004SP
X 7223708
Y 1623522
DGT sediment probe



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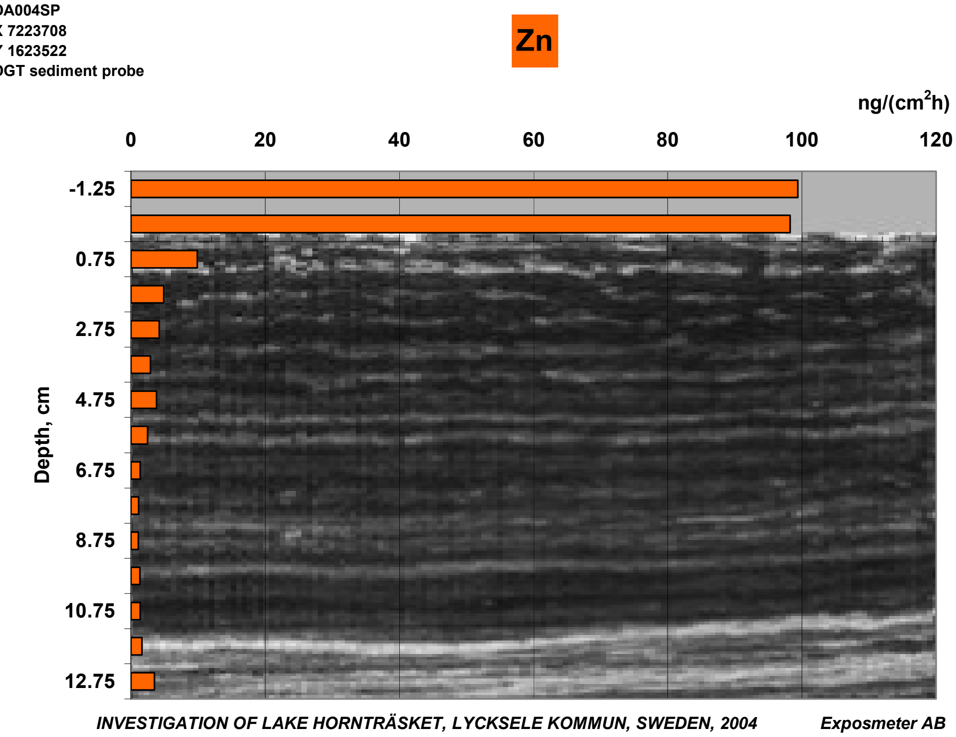
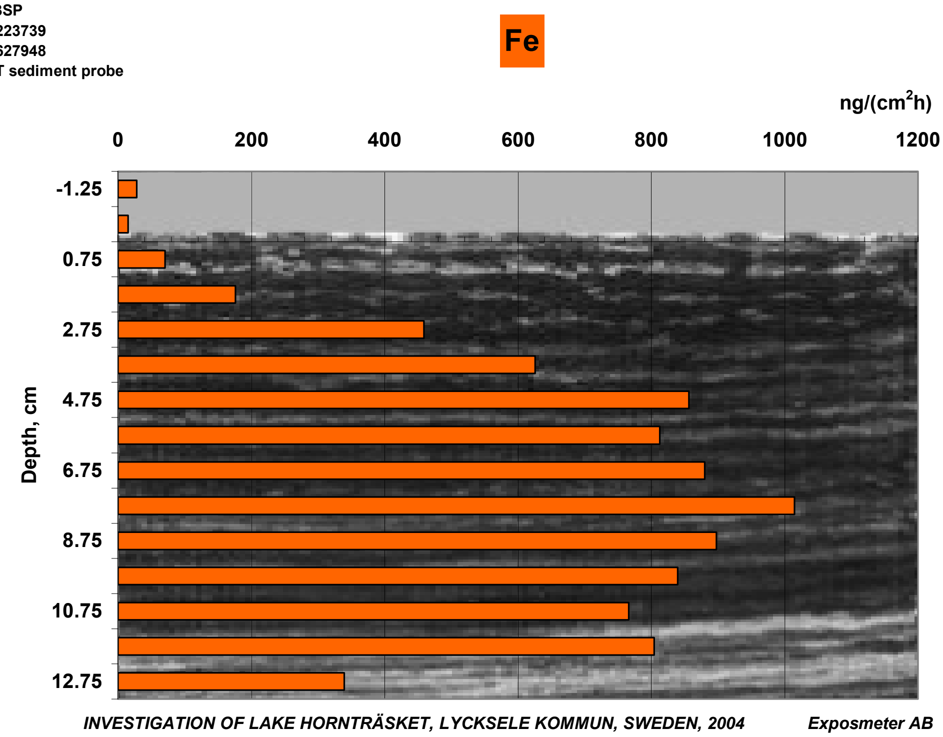


DA3SP
X 7223739
Y 1627948
DGT sediment probe



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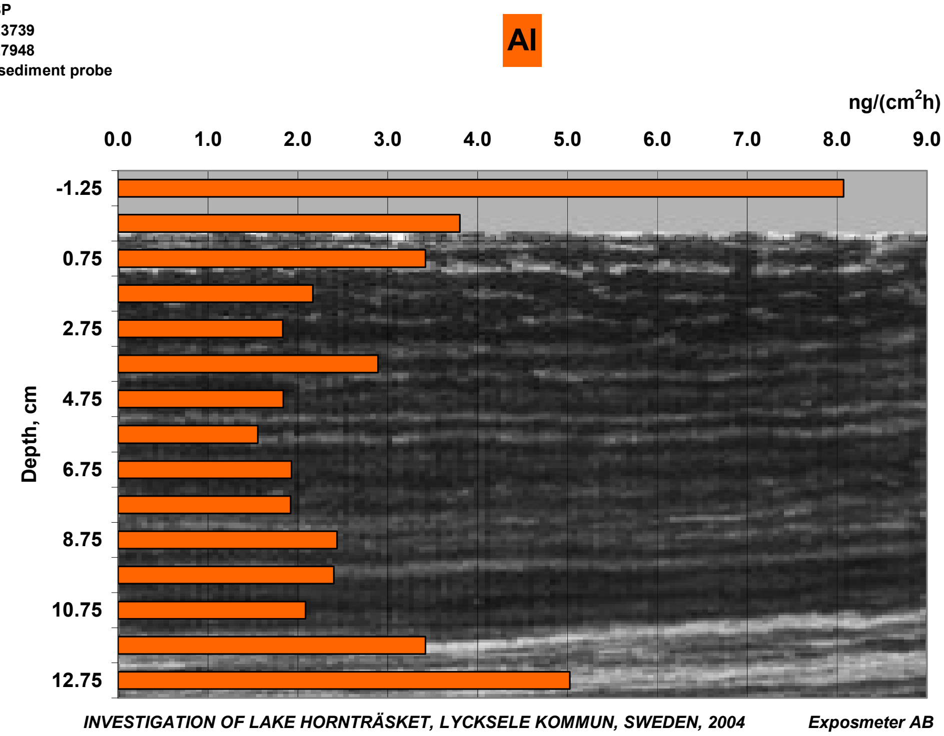
Y 1627948
DGT sediment probe



DA3SP
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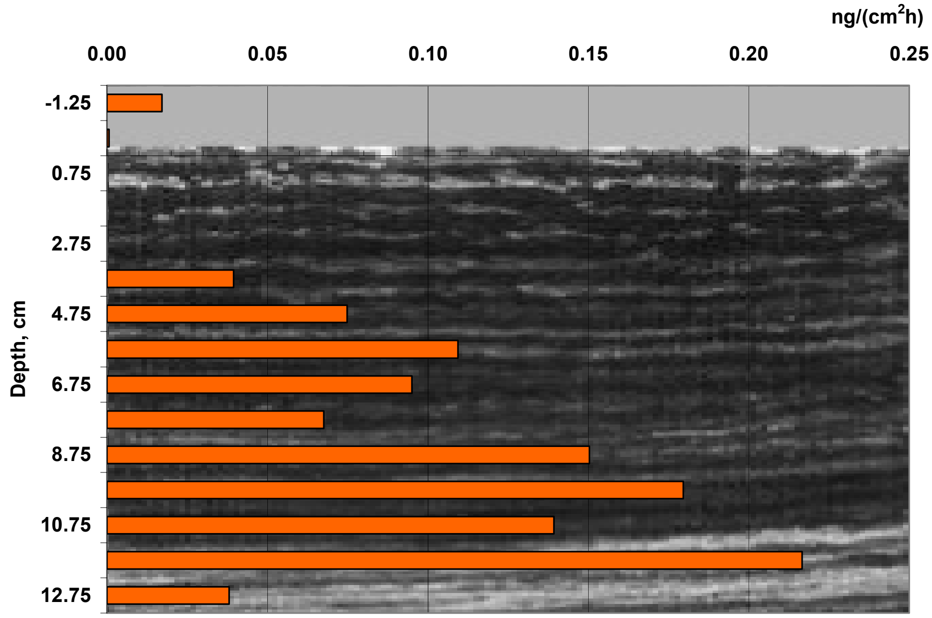
Y 1627948
DGT sediment probe

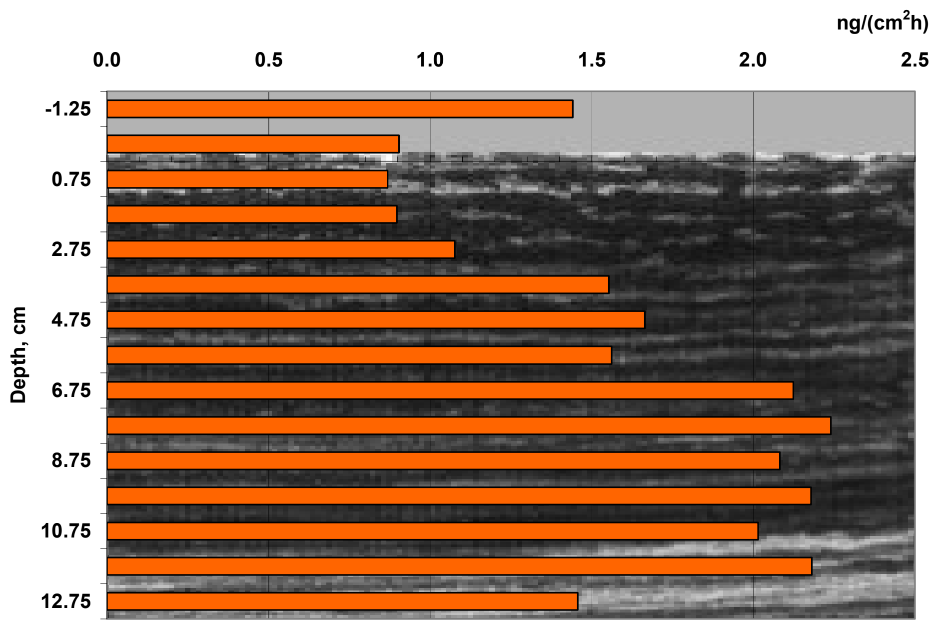
As



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 ***Exposmeter AB***

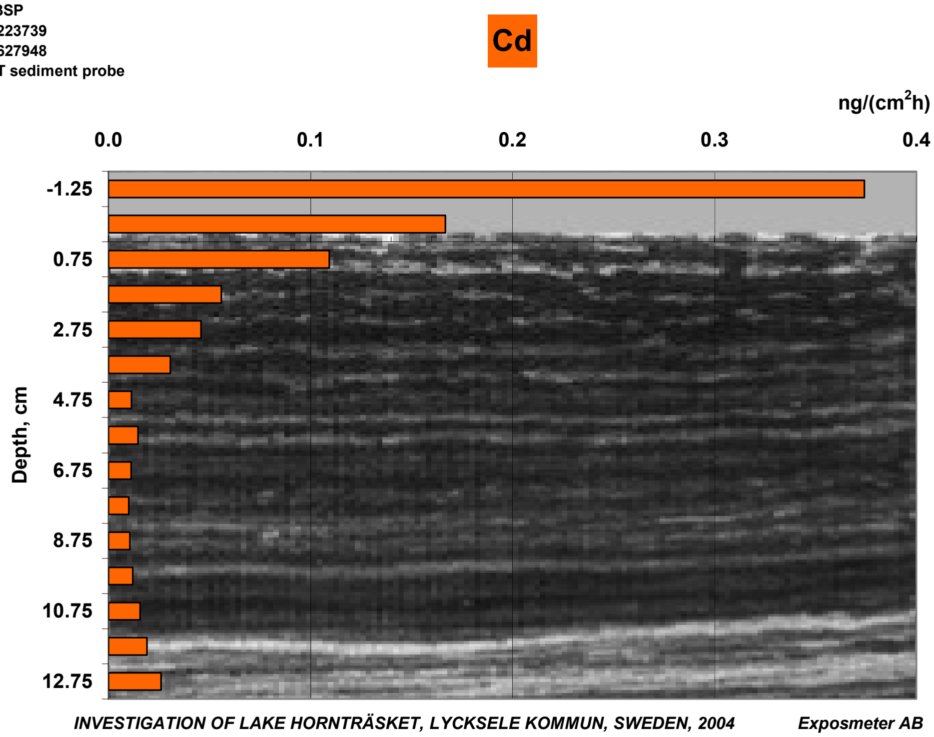
DA3SP
X 7223739
Y 1627948
DGT sediment probe

Ba



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 ***Exposmeter AB***

DA3SP
X 7223739
Y 1627948
DGT sediment probe



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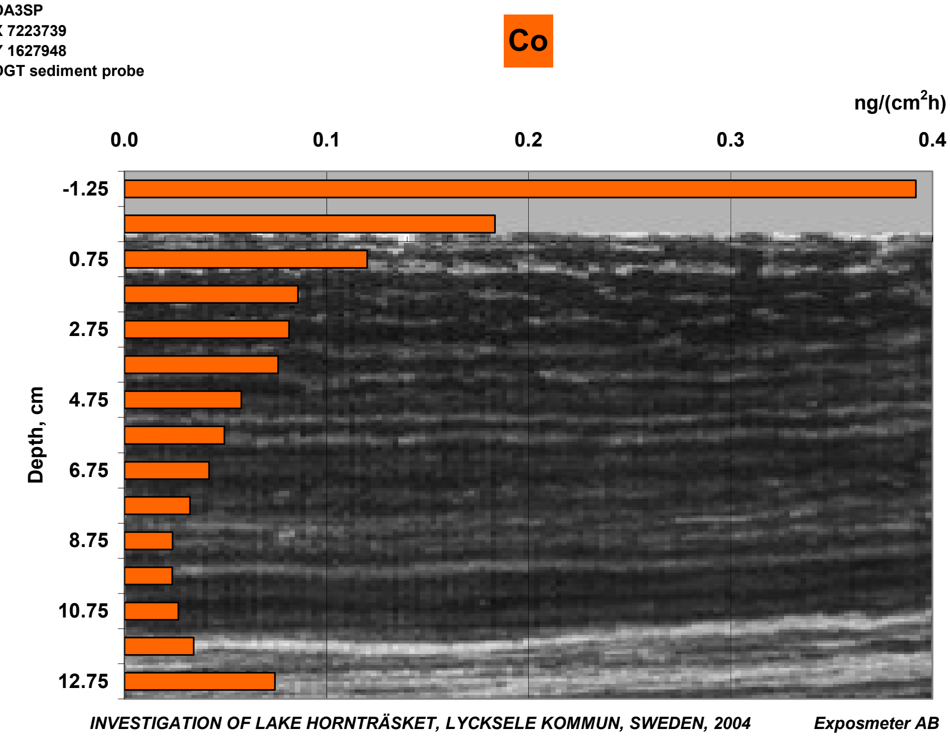
Y 1627948
DGT sediment probe



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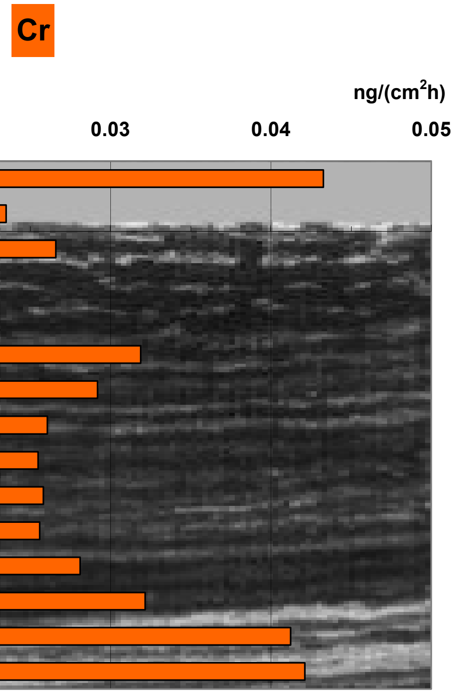
X 7223739
Y 1627948
DGT sediment probe



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

DA3SP
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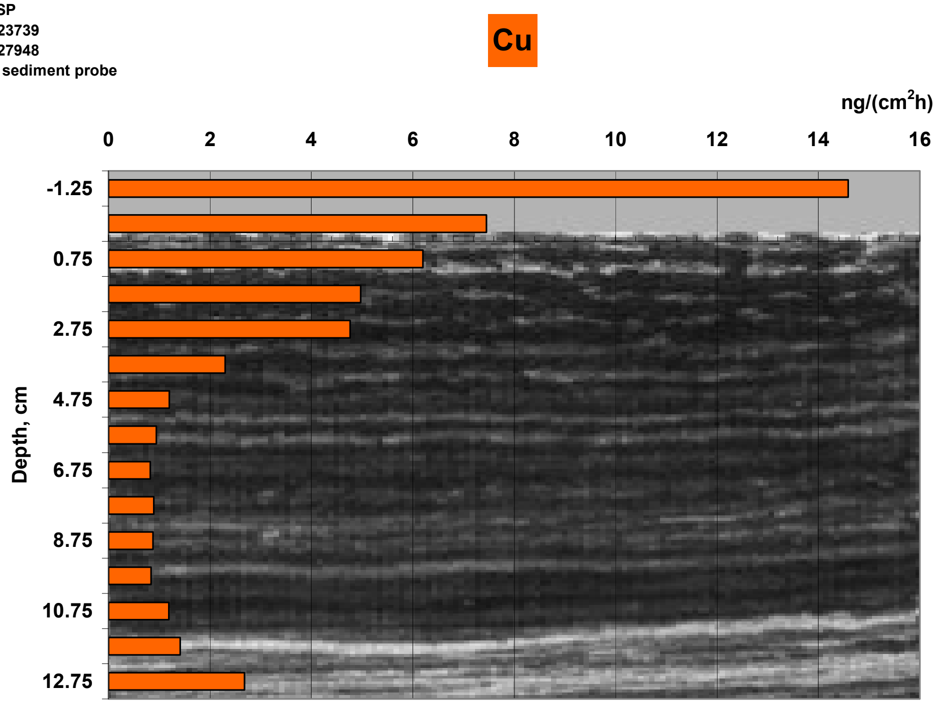
Y 1627948
DGT sediment probe



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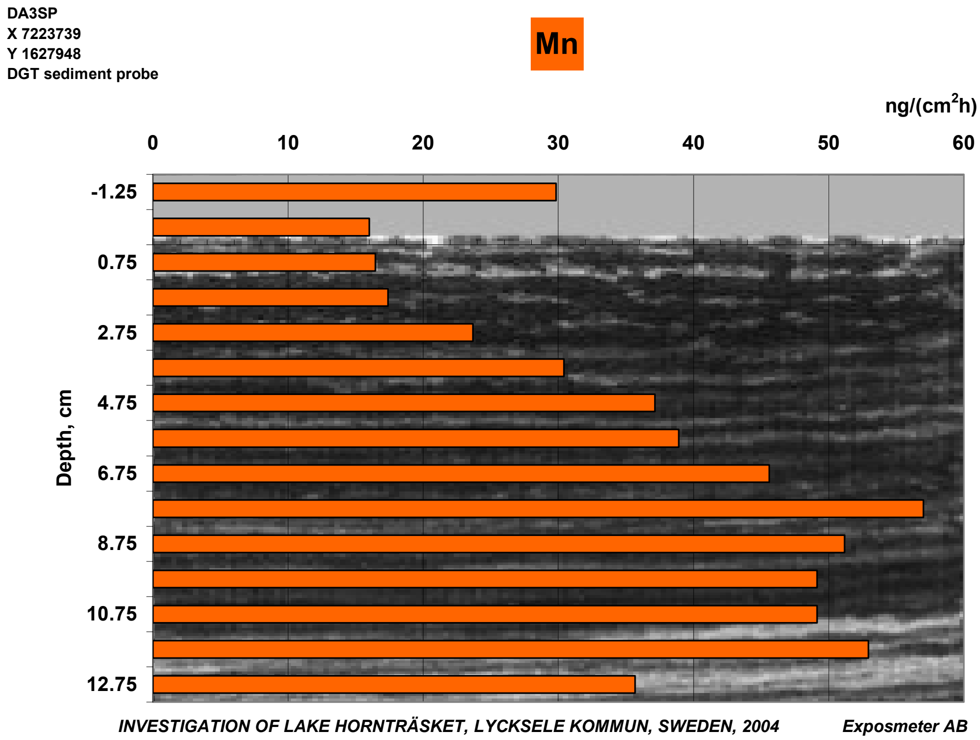

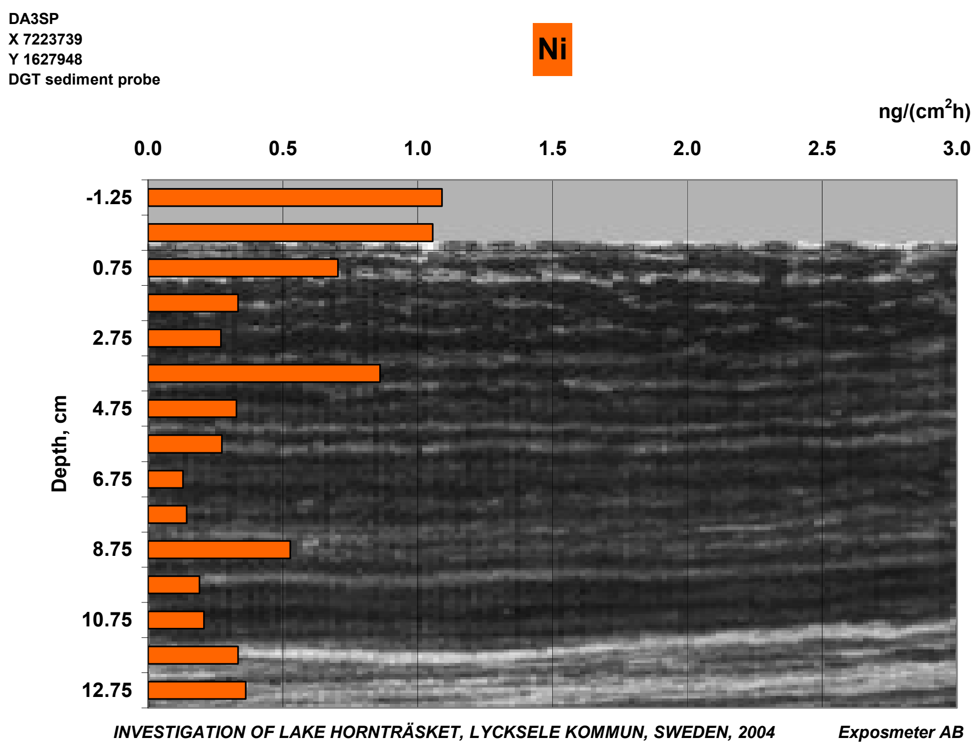

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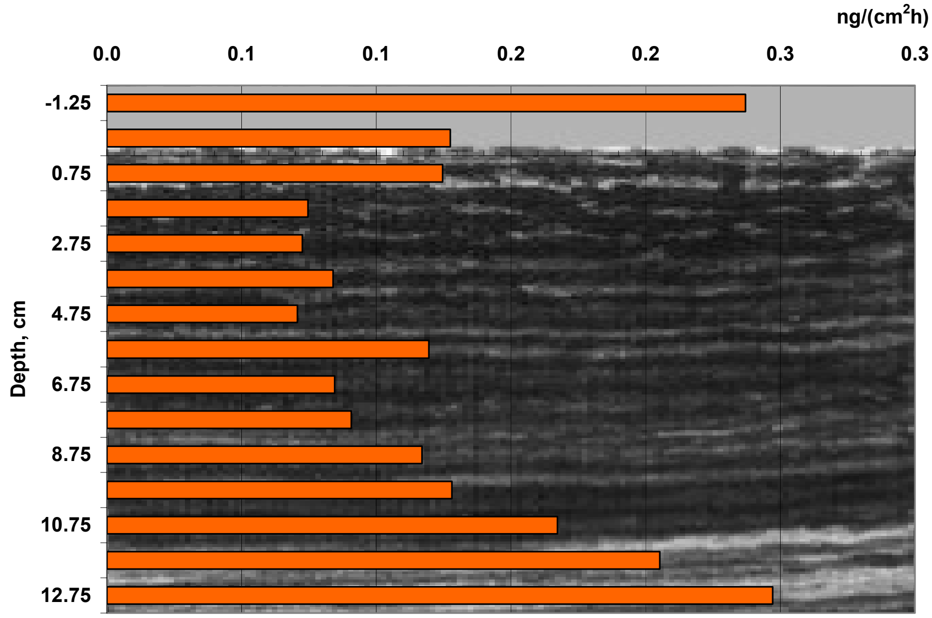
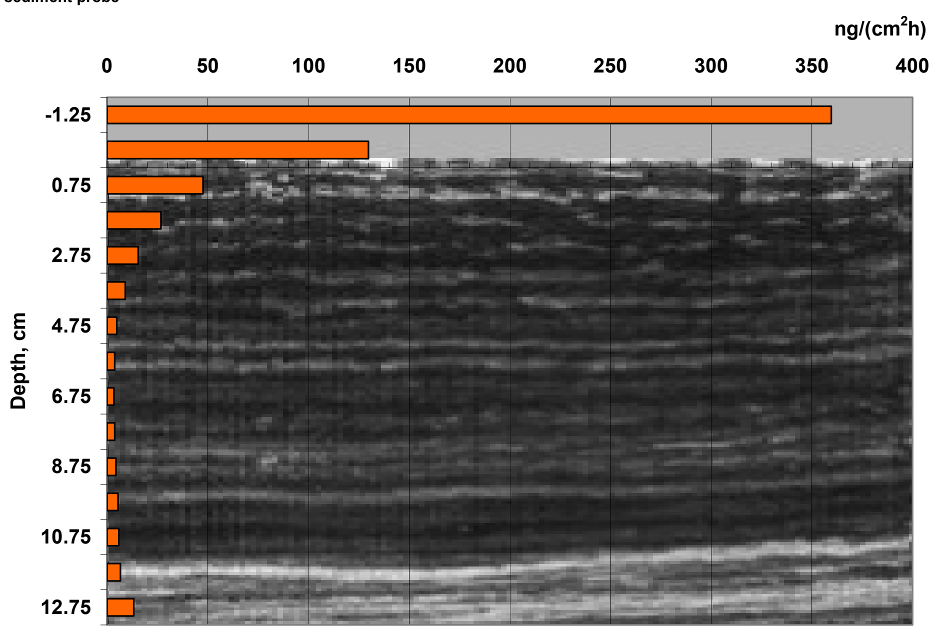
Pb



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

DA3SP
X 7223739
Y 1627948
DGT sediment probe

Zn



INVESTIGATION OF LAKE HORNTRÄSKET, LYCKSELE KOMMUN, SWEDEN, 2004 *Exposmeter AB*

Summer sampling

Table 6. Metal concentrations in the lake from EMD samples

	Fe 0,5 m from top	Fe 1 m from bottom	Fe 0,5 m from bottom	Al 0,5 m from top	Al 1 m from bottom	Al 0,5 m from bottom	Ba 0,5 m from top	Ba 1 m from bottom	Ba 0,5 m from bottom
	µg/l								
SM1	2.7			7.1			0.2		
SM2	3.3	1.9	1.7	6.6	9.5	9.2	0.2	0.6	0.3
SM3	5.6	4.5	2.6	8.9	8.1	9.9	0.2	0.2	0.3
SM4	2.9	2.9	2.6	6.6	7.4	8.5	0.2	0.2	0.3
SM5	3.1	6.9	2.5	7.7	9.4	10	0.2	0.2	0.4
SM6	2.6	2.5	2.8	5.4	7.3	8.4	0.2	0.2	0.2
SM7	55			72			0.4		
	Cd 0,5 m from top	**Cd 1 m from bottom**	**Cd 0,5 m from bottom**	**Co 0,5 m from top**	**Co 1 m from bottom**	**Co 0,5 m from bottom**	**Cr 0,5 m from top**	**Cr 1 m from bottom**	**Cr 0,5 m from bottom**
	µg/l								
SM1	1.0			1.0			<0.01		
SM2	0.9	1.4	1.0	1.0	1.2	0.90	<0.01	<0.01	<0.01
SM3	1.2	1.2	1.1	1.0	1.1	1.00	0.02	<0.01	<0.01
SM4	1.0	1.0	1.3	1.1	1.0	1.06	0.02	<0.01	<0.01
SM5	1.0	0.9	1.3	1.1	1.0	1.13	0.02	0.01	0.02
SM6	0.7	1.0	1.2	0.9	1.0	1.07	<0.01	<0.01	<0.01
SM7	0.0			0.7			0.01		
	Cu 0,5 m from top	**Cu 1 m from bottom**	**Cu 0,5 m from bottom**	**Mn 0,5 m from top**	**Mn 1 m from bottom**	**Mn 0,5 m from bottom**	**Ni 0,5 m from top**	**Ni 1 m from bottom**	**Ni 0,5 m from bottom**
	µg/l								
SM1	28			9.2			2.2		
SM2	29	25	28	5.6	26	11	2.6	2.4	1.9
SM3	30	30	30	15	10	16	2.8	2.6	2.3
SM4	28	28	27	10	8.1	9.7	2.6	2.4	2.5
SM5	29	27	28	12	9.8	23	2.6	2.4	2.6
SM6	29	31	31	7.7	11	7.7	2.5	2.4	2.4
SM7	2.1			8.4			0.7		
	Pb 0,5 m from top	**Pb 1 m from bottom**	**Pb 0,5 m from bottom**	**Zn 0,5 m from top**	**Zn 1 m from bottom**	**Zn 0,5 m from bottom**			
	µg/l								
SM1	0.1			533					
SM2	0.09	0.1	0.1	558	661	480			
SM3	0.08	0.09	0.1	630	627	586			
SM4	0.1	0.08	0.09	571	580	646			
SM5	0.09	0.1	0.09	596	527	677			
SM6	0.08	0.1	0.2	524	540	596			
SM7	0.02			9.9					

Table 7. Metal concentrations in the groundwater from EMD samples

	Fe	Al	As	Ba	Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn
	μg/L											
GW1	5.9	2.6	<0.04	5.2	0.01	0.3	<0.04	0.04	10	0.3	<0.01	1.5
GW2	1082	3.4	NM	0.5	0.01	0.4	0.02	0.3	7.3	0.5	0.05	4.7
GW3	760	3.3	NM	0.02	<0.002	0.2	0.04	2.7	14	0.8	0.05	14
GW4	3.3	3.2	NM	0.5	0.03	0.5	<0.01	0.7	7	1.6	0.2	8.5
GW5	1.7	4.3	<0.04	2.5	0.1	1.7	0.02	48	42	1.9	7.9	15
GW6	0.5	3.9	<0.04	0.4	0.03	0.3	0.01	1.2	15	0.9	0.2	1.8
GW7	210	5.8	NM	0.7	0.03	0.8	0.02	0.3	23	2.5	<0.01	2.0
GW8	1.0	7.6	NM	1.3	0.07	1.1	0.02	0.9	19	3.0	0.2	19

Quality control of sampling and analysis methods

Table 8. STD values

	Fe	Al	As	Ba	Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn
	STD											
inlet, triplicate	0.01	0.04	0.0001	0.021	0.007	0.003	0.001	0.2	0.6	0.007	0.001	4.0
deap area, triplicate	0.8	0.5	0.0001	0.006	0.02	0.10	0.0005	0.7	0.2	0.03	0.001	22.4
summer - winter inlet, dublicate	0.2	1.9	0.1	*NA*	0.03	0.1	*ND*	0.7	1.1	0.4	0.004	58.6