P-04-86

Forsmark site investigation

Investigation of marine and lacustrine sediment in lakes

Stratigraphical and analytical data

Anna Hedenström
Sveriges Geologiska Undersökning

March 2004

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Keywords: Lake sediment, Grain size, Calcium carbonate, XRD-analysis, CNS-content, Gyttja, Clay. AP PF 400-02-49. Field note no Forsmark 98.

Contents

1 Introduction

SKB performs site investigations for localisation of a deep repository for high level radioactive waste. The site investigations are performed at two sites: Forsmark and Oskarshamn. This document reports data gained within the activity *Investigation of marine and lacustrine sediment in lakes*, performed within the site investigation at Forsmark. The investigations were carried out according to the Activity Plan PF 400-02-49 (SKB internal document), including the lakes and small ponds numbered in Figure 1-1. The working procedures followed the methods described in Metodbeskrivning för jordartskartering SKB MD 131.002 and Metodbeskrivning för torvmarksundersökning SKB MD 131.001 (both internal SKB controlling documents).

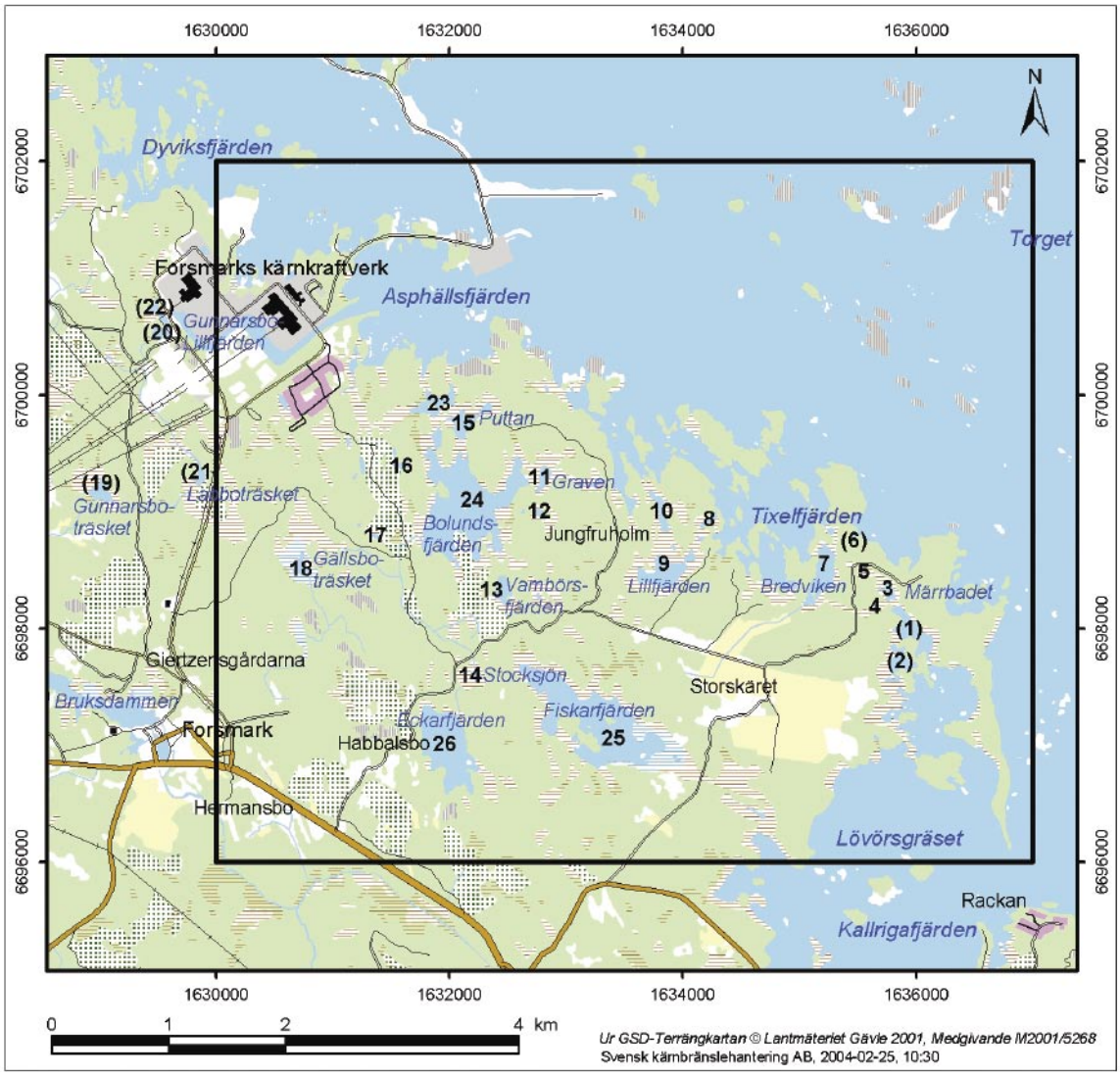

Figure 1-1. *Lakes included in the investigation are located within the black box, corresponding to the area where distribution of unconsolidated Quaternary deposits has been mapped. The lake numbers are taken from the activity "Sjömätningar, identifiering av avrinningsområden samt habitatkartering av sjöar i områden aktuella för platsundersökningar" AP PF 400-02-05 (SKB internal document). Lakes not included in the investigation are 1, 2 and 6 (shallow coastal lagoons) and 19–22 (located outside the study area).*

2 Objective and scope

The aim of this activity is to describe the spatial distribution of marine and lacustrine sediments, i.e. water laid sediments overlaying the glacial till and/or bedrock, in lakes and small ponds in the Forsmark area. The investigation was carried out within the area where mapping of unconsolidated Quaternary deposits was conducted during 2002 and 2003 /Sohlenius et al, 2003; 2004/. Since small and shallow lakes cover large areas in the Forsmark region, this work will give important information on the distribution and character of sedimentary deposits, which are not included in the regular mapping of unconsolidated Quaternary deposits /Sohlenius et al, 2004/.

Field data containing the stratigraphical descriptions from the corings was presented in April 2003 /Hedenström, 2003/. The present report contains the analytical data of the sediment together with stratigraphical cross sections from the lakes and ponds.

Samples were collected for laboratory analyses of grain size composition, total content of C, N and S and $CaCO_3$. Additionally, three samples of clay were analysed regarding mineralogical composition. The analyses were carried out on selected samples of representative lithological units, in order to characterise the chemical and physical properties of these units.

This activity includes investigation of the sediment column below the surface sediment, which are analysed within the activity “Sampling and analyses of surface sediment in lakes and shallow bays” /Borgiel, 2004/. Hence, the complete sediment column will be described and characterised at the sites shared by the two activities.

This activity also includes description of the sediment column at the groundwater monitoring wells in lakes, within the activity “Drilling and sampling in soil. Installation of groundwater monitoring wells and surface water level gauges” (AP PF 400-02-31, SKB internal document).

The analytical data will be used in the hydrogeological modelling and for the conceptual understanding of the post glacial geological evolution of the area. The mineralogical analyses of clay may provide information on the origin of the clay particles. The stratigraphical cross-sections will be useful in the construction of a three dimensional model of the unconsolidated Quaternary deposits in the Forsmark area.

3 Equipment

The equipment used in the field-work is described in P-03-24.

The grain size analyses were carried out according to /Standardiseringskommisionen i Sverige (SIS), 1992a,b/ Swedish standard.

The mineralogy was determined at the Geological Survey or Sweden, S. Snäll, with X-ray diffraction analysis (XRD) using a Siemens D5000 (theta-theta) diffractometer (CuKa). The X-ray generator was operating at 50 kV and 40 mA. The minerals were identified using the Bruker/Siemens software DIFFRACPLUS (version 2.2), including the /PDF, 1994/ database for mineral identification. Clay minerals were determined using data from /Brindley and Brown, 1984/.

The analyses of elemental C, N and S were carried out on a LECO element analyser according to /SIS, 1996/. The $CaCO_3$ content was determined using Passon apparatus /Talme and Almén, 1975/.

4 Execution

This report includes stratigraphical and analytical data from marine and lacustrine sediment in Lakes. The execution and results of the field work has previously been reported /Hedenström, 2003/. The description of the lithology of each coring site is stored in SICADA under Field note no Forsmark 98. The location of each coring site is shown in Appendix 1.

The samples collected in the field were later opened and inspected in the laboratory. Sub-samples were derived from the cores and given unique numbers by adding a suffix to the PFM-number of the sample. The sub-samples collected and the analyses performed are listed in Table 4-1 and Appendix 2.

Table 4-1. List of the coring sites where samples were collected together with the analyses performed. The index number of the lakes refers to the numbers in Figure 1-1. For location of the coring sites, see Figure 1-1 and Appendix 1. In Appendix 2, all the sub-samples and depths are listed.

Site	ID code	Analyse
Fiskarfjärden # 25	PFM004193	Grain size
Fiskarfjärden # 25	FPM004204	CNS, CaCO3; XRD, Grain size
Lake # 5	FPM004205	CNS, CaCO3, XRD Grain size
Bredviken # 7	PFM004216	Grain size; CaCO3
Graven # 11	PFM004222	Grain size
Puttan # 15	FPM004280	CNS, CaCO3
Stocksjön # 14	PFM004284	CaCO3
Eckarfjärden # 26	PFM004294	Grain size

4.1 Data handling

Field data were noted into a notebook. The point observations were given PFM numbers. At each coring site, PFM number, co-ordinates and date for the observation was stored as a waypoint in the GPS. The information from the waypoints was subsequently transformed digitally to a PC computer and stored as an Excel file. This data was exported to the SKB SICADA database under Field note no Forsmark 98.

After the field campaign, the field data (2-dimentional stratigraphical descriptions and geological observations) were stored in the database for mapping of unconsolidated Quaternary deposits at the Geological Survey of Sweden (Jorddagboken version 5.4.3). The data were subsequently exported to Excel format and delivered to SKB (April 2003) on a CD and entered into SICADA database under Field note no Forsmark 98. Photographs of sediment cores from the field work were delivered to SKB on a CD in jpeg format at the same occasion.

The results from the analyses were exported to SKB SICADA database (February 2004) under Field note no Forsmark 98. The present report and data delivery constitutes the finalisation of the activity *Investigation of marine and lacustrine sediment in lakes*.

The following data have been exported to SICADA, stored under Field note no Forsmark 98:

Results from analyses of:

- Grain size composition
- $CaCO_3$
- Total CNS content
- Qualitative XRD analyses of clay mineralogy

5 Results

5.1 Stratigraphy

The detailed stratigraphical descriptions from each coring site are stored in SICADA under Field note no Forsmark 98. Simplified, schematic stratigraphical cross sections together with maps showing the position of the coring sites from the 19 sedimentary basins investigated are displayed in Appendix 1. Generally, the sedimentary sequences were thin, especially the post-glacial layers. Below, three examples are described.

Lake Eckarfjärden is the oldest lake in the investigation, isolated from the Baltic c 850 years ago /Hedenström and Risberg, 2003/. A bottom layer of glacial clay covers the entire basin. The deepest coring, c 6 m, was recorded at PFM004297 where c 2 m glacial clay was obtained. Post glacial clay was only present in minor patches and is included in the clay in the stratigraphical cross section. A c 10–20 cm thick layer of wave washed sand covers the clay throughout the profile. The contact between the clay and the sand is erosive (Figure 5-1). The lithological boundary between the clay and sand is sharp and erosive, while the upper margin of the sand is gradual with increasing organic material and finer grain size up to a c 15 cm layer of clay gyttja. At the transition from a bay of the Baltic to an isolated fresh water lake, the input of minerogenic material decrease and algal gyttja starts to form in the lake. In Lake Eckarfjärden, algal gyttja and calcareous gyttja was observed, grouped together in the profile in Figure 5-2.

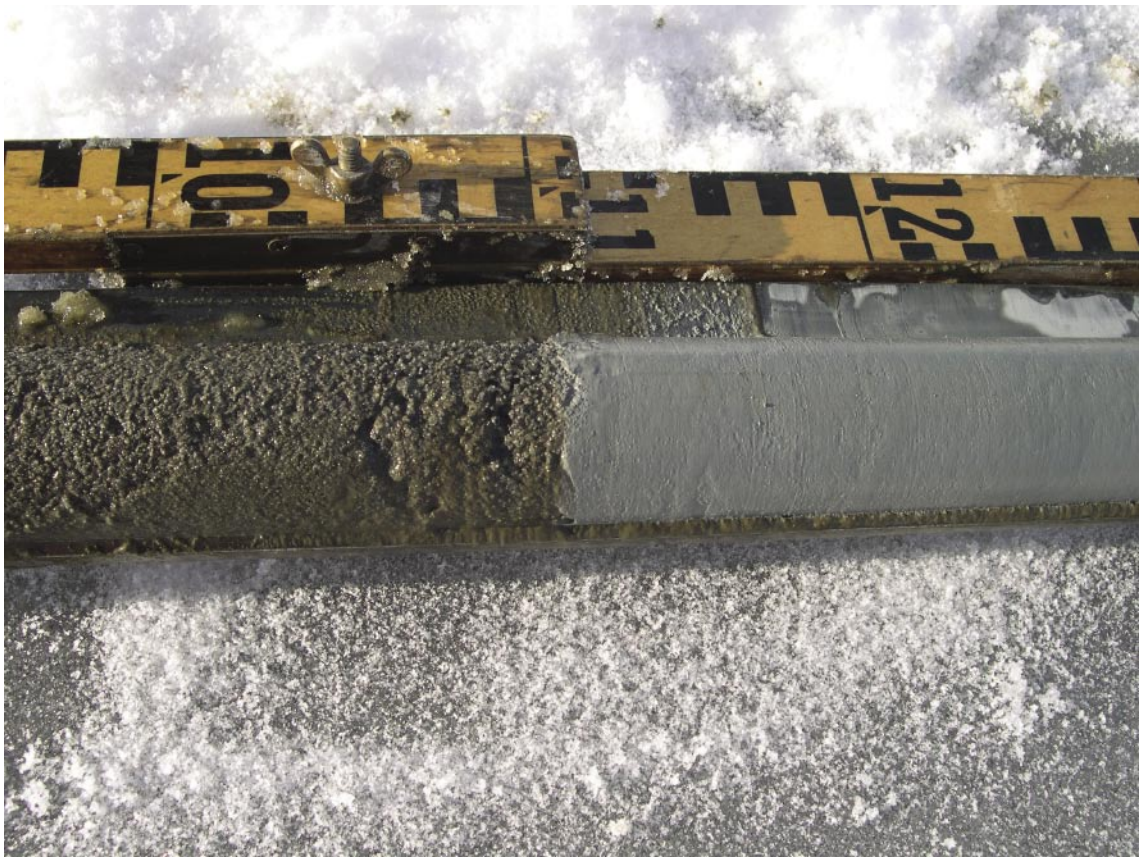

Figure 5-1. *Glacial clay and wave washed sand from Lake Eckarfjärden, PFM004301. The contact between the two units is erosive.*

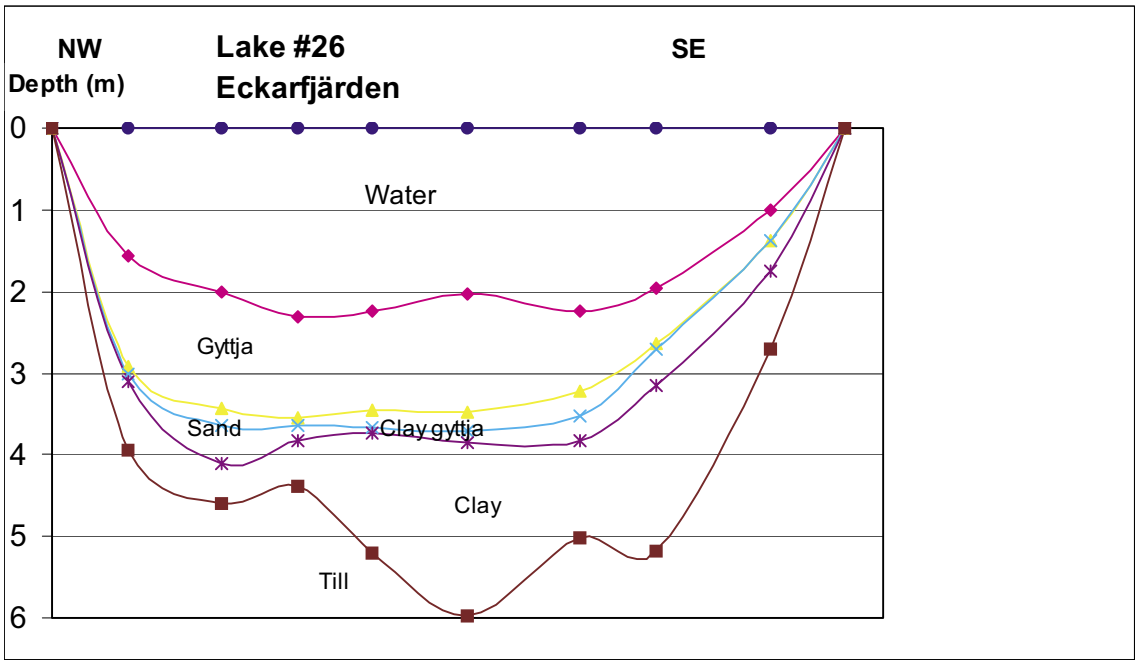

Figure 5-2. *Generalised stratigraphical cross section from a profile through the central part of Lake Eckarfjärden. For the location of the coring sites, see Appendix 1. The profile includes the coring sites from PFM004301 to PFM004293. The profile is c 900 m long.*

The sedimentary sequence in Lake Bolundsfjärden is generally very thin, often less than one metre. The sediment mainly consist of gyttja that rests directly on top of the till (Figure 5-3), thus the dense layer of clay covering the bottom of Lake Eckarfjärden is missing in Lake Bolundsfjärden.

Lake Stocksjön is c 100 m in diameter and the water depth is c 0.5 m. The maximum coring depth is less than 1.5 m. Also in this basin, the gyttja sediment is resting directly on coarse material, probably till. Approximately 0.5 m of algal gyttja and calcareous gyttja has started to fill in the shallow basin.

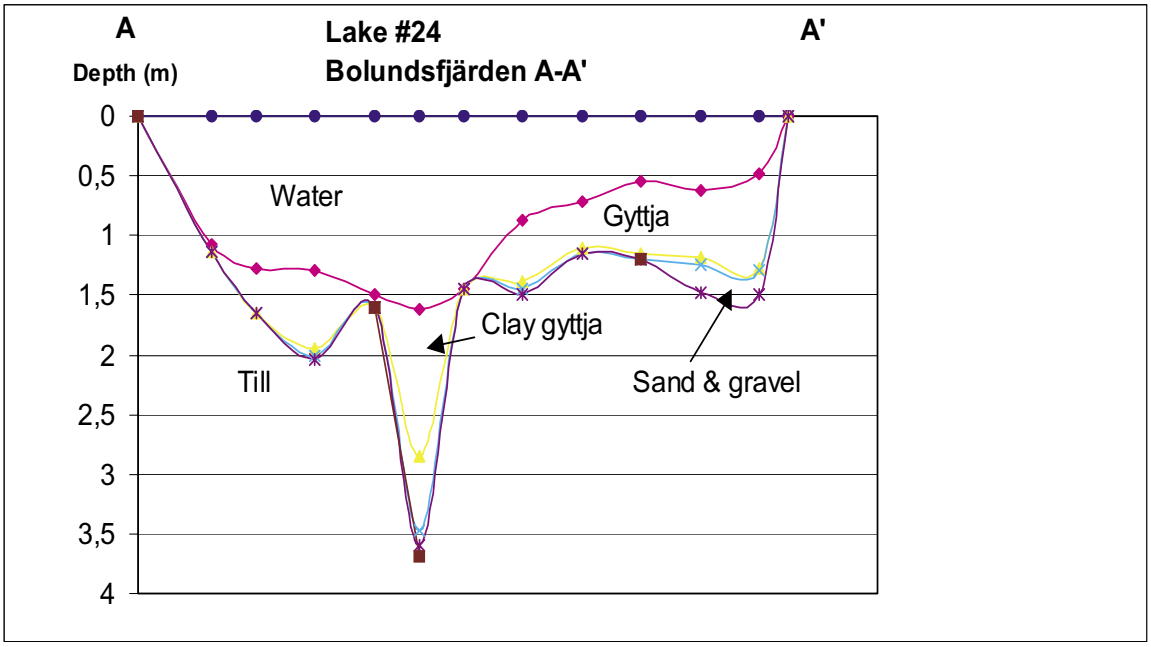

Figure 5-3. *Generalised stratigraphical cross section from profile through the central part of Lake Bolundsfjärden. For the location of the coring sites, see Appendix 1. The profile includes the coring sites from PFM004255 to PFM004227. The profile is c 1200 m long.*

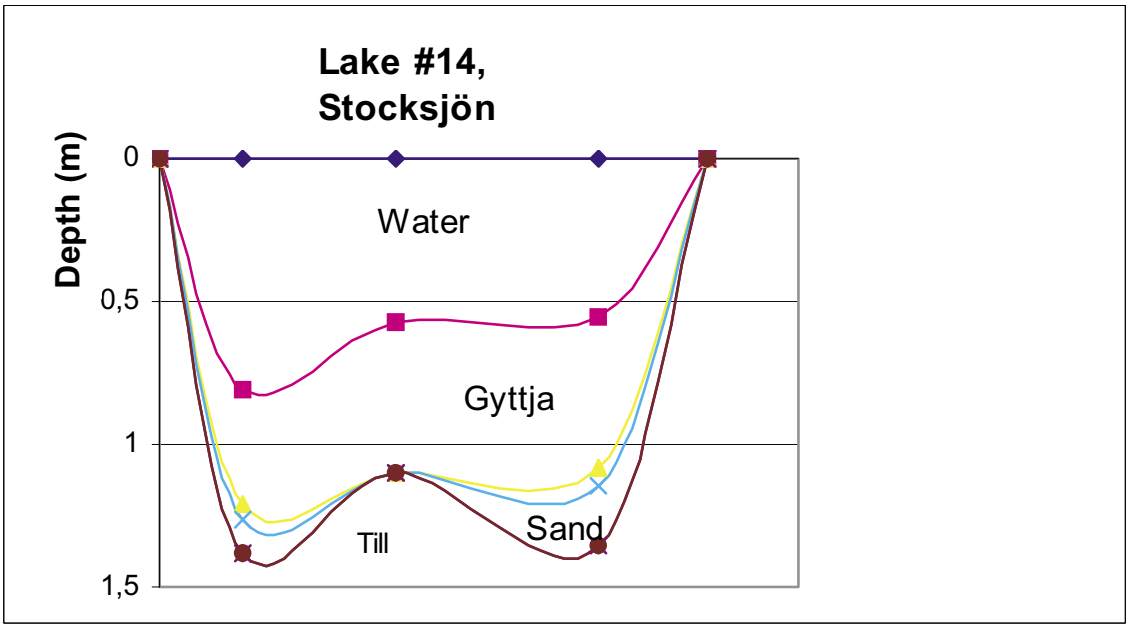

Figure 5-4. *Generalised stratigraphical cross section from a profile through Lake Stocksjön. For the location of the coring sites, see Appendix 1. The profile includes the coring sites PFM004285, PFM004284 and PFM004283. Note that the profile is only c 100 m long and 1.5 m deep.*

5.2 Analyses

During the field inventory, representative lithological sequences were collected for physical and chemical analyses. The collected samples, together with the type of analyses are listed in Appendix 2.

5.2.1 Calcium carbonate

Thirty samples were analysed for calcite content. The results are listed in Table 5-1. All samples of glacial clay contained calcite. The sediment from Lake Fiskarfjärden (PFM004204) contained between 16 and 26% $CaCO_3$. Lake Bredviken (PFM004216) contained varved glacial clay with 33 and 35% $CaCO_3$. In a small pond close to the Börstilåsen esker (Lake #5), ten samples of glacial clay were analysed (Figure 5-5). The sediment was sub-sampled with summer layers and winter layers separately, resulting in 33 and 29% $CaCO_3$ for two summer layers and 14% for the two winter layers. A sequence of six summer layers, on the contrary, contained less calcite (22%) than corresponding six winter layers (38%). A bulk-sample containing seven complete varves contained 28% $CaCO_3$. The average calcite content of the glacial clay analysed is 26 ±8% (n=16). The post glacial clay, on the contrary, only contained traces of calcite, c 0.5% (n=4).

The sediment deposited after the isolation of the lake basins consist of various types of gyttja and clay gyttja/gyttja clay. The highest content of calcite in sediment from the Forsmark area was obtained in two samples of calcareous gyttja from Lake Stocksjön, containing 57 and 63% $CaCO_3$. Algal gyttja, on the other hand, contained less than 0.5% calcite (e.g. Puttan, PFM004280). The clay gyttja/gyttja clay in Lake Fiskarfjärden (PFM004204) contained 0.5% calcite.

Table 5-1. Results from the CaCO3 analyses of 30 samples. The highest values were recorded in the calcareous gyttja from Lake Stocksjön. Some samples of postglacial clay and algal gyttja on the other hand, did not contain any calcite at all.

Site name and number	Idcode_sample from (m)	Depth	to (m)	quartenary_deposit	CaCO3 (%)	Comment
Fiskarfjärden # 25	PFM 004204_27	1.13	1.16	Algal gyttja	0	
Fiskarfjärden # 25	PFM 004204_28	1.32	1.36	Algal gyttja	0.7	
Fiskarfjärden # 25	PFM 004204_29	1.56	1.6	Algal gyttja	0.4	
Fiskarfjärden # 25	PFM 004204_30	1.67	1.7	Clay gyttja	0.5	
Fiskarfjärden # 25	PFM 004204_31	1.87	1.9	Clay gyttja	0.6	
Fiskarfjärden # 25	PFM 004204_18	2.3	2.45	Postglacial clay	0.9	
Fiskarfjärden # 25	PFM 004204_20	2.48	2.65	Postglacial clay	0.6	
Fiskarfjärden # 25	PFM 004204_22	2.68	2.85	Postglacial clay	0	
Fiskarfjärden # 25	PFM 004204_24	3.45	3.6	Postglacial clay	0.8	
Fiskarfjärden # 25	PFM 004204_25	4.2	4.35	Glacial clay	26	
Fiskarfjärden # 25	PFM 004204_26	4.8	4.94	Glacial clay	16	
Puttan # 15	PFM 004280_22	1.03	1.1	Algal gyttja	0.9	
Puttan # 15	PFM 004280_23	1.33	1.4	Algal gyttja	0.8	
Puttan # 15	PFM 004280_24	1.55	1.6	Algal gyttja	0.6	
Puttan # 15	PFM 004280_25	1.75	1.8	Algal gyttja	0.1	
Puttan # 15	PFM 004280_26	2.05	2.12	Algal gyttja	0.3	
Lake # 5	PFM 004205_6	1.27	1.37	Glacial clay	20	Distal varves
Lake # 5 varves	PFM 004205_8	1.5	1.65	Glacial clay	26	8 proximal
Lake # 5	PFM 004205_9	1.65	1.81	Glacial clay	14	Winter layers
Lake # 5	PFM 004205_10	1.7	1.81	Glacial clay	29	Summer layers
Lake # 5	PFM 004205_11	1.81	1.94	Glacial clay	33	Summer layers
Lake # 5	PFM 004205_12	1.81	1.94	Glacial clay	14	Winter layers
Lake # 5	PFM 004205_13	1.94	2	Glacial clay	26	4 varves
Lake # 5	PFM 004205_14	2	2.14	Glacial clay	28	7 varves
Lake # 5 layers	PFM 004205_15	2.14	2.27	Glacial clay	22	6 summer
Lake # 5	PFM 004205_16	2.14	2.27	Glacial clay	38	6 winter layers
Bredviken # 7	PFM 004216_1	3.62	3.79	Glacial clay	33	
Bredviken # 7	PFM 004216_2	4	4.1	Glacial clay	35	Bottom varves
Stocksjön # 14	PFM 004284_1	0.87	0.92	Calcaerous gyttja	63	
Stocksjön # 14	PFM 004284_2	0.92	0.97	Calcaerous gyttja	57	

Figure 5-5. *In Lake # 5, coring site PFM004205, the sedimentary sequence between 1.27–2.27 m depth consists of varved glacial clay. Bottom is to the right in the picture. The calcite content varied between 14 and 38% and the clay content varies between 74 and 43%. XRD analyses were performed on two samples from the coring site; one from a level above the photography (1.1 m) and one sample represents the proximal varves (1.37–1.5m). In both samples, Illite was the most common clay mineral.*

5.2.2 Grain size analyses

Twenty one samples were analysed with respect to grain size composition (Appendix 3). Eighteen of the samples were collected from the clay while three samples consisted of sand. The results of the analyses are summarised in a table in and the graphs of the grain size distribution are displayed in Appendix 4.

Varved glacial clay was observed at six lake basins. The varves were often well developed and distinct. Several localities contained thicker varves with large silt content, interpreted to represent the bottom varves. The thickness of the layers was between ca 25 mm in the bottom to ca 1 mm in the upper part of the varved sequence. The sediment sequence in Figure 5-5 consists of 51 varves with a mean thickness of 10 mm for the summer layers and 9 mm for the winter layers. The colour of the winter layer was bluish grey and the summer layers were pink.

The clay content in glacial clay varies between 33% (PFM004216, 4m) and 74% (PFM004205, 1.81 m). Proximal varves collected in Lake Bredviken (#7) contained 33% clay and is the only clay sample analysed and not classified as hard clay (Swedish “styv lera”). The classification was instead medium clay (Swedish “mellanlera”).

A layer of wave washed sand and gravel was observed on the top of the clay in a majority of the lake basins, e.g. in Lake Eckarfjärden (PFM004294), Lake Fiskarfjärden (PFM004193) and Graven (PFM004222). The sample from L. Eckarfjärden was classified as gravely sand and runs through the entire profile of Lake Eckarfjärden (Figure 5-1 and Appendix 4).

5.2.3 Qualitative XRD analyses

Three samples were analysed using X-ray diffraction. All samples consisted of clay. One sample from Lake Fiskarfjärden consisted of postglacial clay (FPM004204, 2.22 m). Two samples were glacial clay from the small pond Lake #5 (PFM004205, 1.1 m and 1.37 m (Figure 5-5). The uppermost sample was collected from disturbed distal varves while the bottom sample represents the proximal varves.

The results from the qualitative X-ray diffraction showed an almost identical clay mineral content in the three samples analysed (Figure 5-6). Illite is the most common clay mineral in the three samples. One obvious discrepancy was that the post glacial clay did not contain any Calcite, present in the two glacial clay samples. Further more, detailed comparisons of the graphs showed that the sample consisting of disturbed distal varves contained more Quartz and Plagioclase, i.e. rock forming minerals. The results from these three XRD analyses are very similar to the results of XRD analyses performed on till samples within the mapping of unconsolidated Quaternary deposits (Sohlenius and Rudmark 2003).

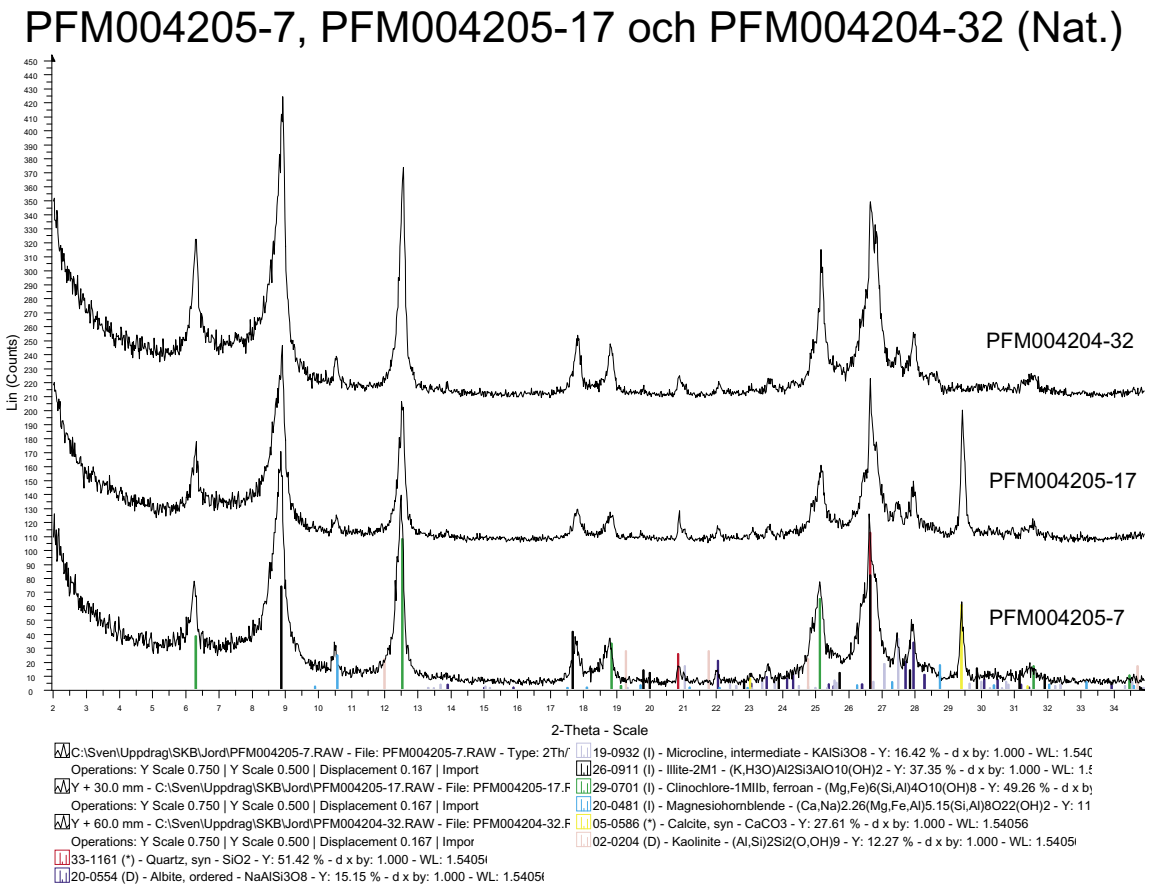

Figure 5-6. *X-ray diffractogram showing the distribution of clay minerals in three samples of clay from the Forsmark area. The upper graph represents a samp le of post-glacial clay collected at Lake Fiskarfjärden (PFM004204, 2.23–2.25 m). The middle graph represents the disturbed varves from the small pond Lake #5, situated close to the Börstilåsen esker (PFM004205, 1.1–1.15 m). The bottom graph represents proximal varves, collected at the same site (PFM004205, 1.37–1.5m). Illite is the dominating clay mineral in all three samples. One difference is that the post-glacial clay does not contain any calcite.*

5.2.4 CNS-content

46 samples were analysed with respect to total content of carbon, nitrogen and sulphur (CNS). The samples analysed were gyttja and clay gyttja sediment, collected from the upper part of the sediment column from three coring sites: PFM004204 (Fiskarfjärden), PFM004205 (Lake #5), PFM004280 (Puttan). The stratigraphic distribution of CNS in the sediment columns is shown in Figure 5-7.

In the three sites investigated, all elements increase upwards. The carbon content varies between c 1 and 25%. At PFM004204 the carbon content increase in two steps. At c 2.3 m depth, i.e. at the transition from postglacial clay to gyttja clay and at c 1.65 cm, the carbon content increases further as the sediment change to algal gyttja. The carbon content in the sediment of Puttan and Lake #5 shows a similar stepwise increase upward.

The nitrogen content varies between 0 (in the glacial clay) and c 3% (algal gyttja). The sulphur content vary between 0 (glacial clay) and >3% (algal gyttja). Generally, the sulphur content is higher than the nitrogen (Figure 5-7).

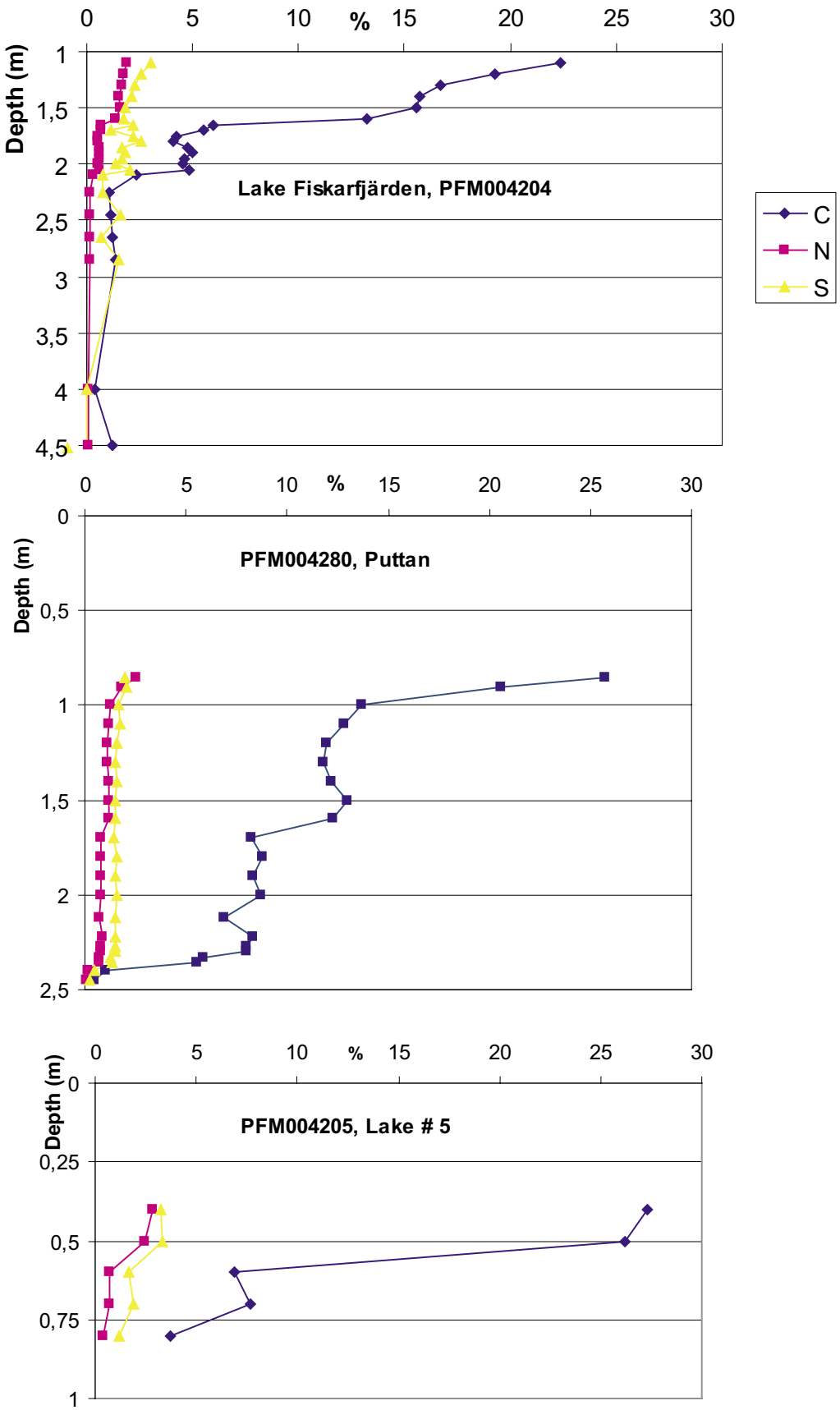

Figure 5-7. *Graphs showing the stratigraphic distribution of total content of carbon, nitrogen and sulphur (CNS) in three sediment cores. PFM004204 was collected in the north-western part of Lake Fiskarfjärden. The water depth at the coring site was c 0.6 m. PFM004280 was collected in the small Lake Puttan. The water depth at the coring site was c 0.9 m. PFM004205 was collected at Lake #5, a small pond close to the Börstil Esker. The water depth at the coring site was c 0.3 m.*

6 Summary and discussion

The investigations of marine and lacustrine sediment in the Forsmark area include c 140 corings distributed in 19 lakes and small ponds. The corings aimed at penetrating the sediment down to the underlying till or bedrock. The activity has resulted in a description of the spatial distribution of the sediment, which shows a uniform distribution pattern, summarised in Table 6-1. Erosion has affected the basins in various degrees why all basins do not contain all the lithological units. The succession of the layers however, is uniform. The sedimentary sequences are generally thin, maximum coring depth was recorded at Lake Fiskarfjärden (PFM004195) where 8.5 m glacial and post-glacial sediment was recorded.

A sediment core from Lake Eckarfjärden, at approximately the same location as PFM004298, was included in a shore displacement study. Radiocarbon datings and diatom analyses concluded that Lake Eckarfjärden was isolated from the Baltic at c 850 years ago /Hedenström and Risberg, 2003/. The major part of the investigated area has been isolated from the Baltic even more recently, during the last c 500 years.

The various types of gyttja represent lagoonal and lacustrine sediment. The short time available for lacustrine sediment to form has resulted in thin sequences of gyttja sediment in the lake basins. Two main types of algal gyttja was observed, separated visually by colour. A greenish-grey algal gyttja was often observed on top of the gyttja clay/clay gyttja, commonly overlaid by a reddish brown algal gyttja. In several sites, calcareous gyttja was observed in the upper part of the stratigraphy. The highest content of CaCO3, 63%, was recorded in a layer of calcareous gyttja in Lake Stocksjön.

Samples were collected for storage for eventual additional analyses. A complete sedimentary sequence from the deepest part of Lake Eckarfjärden (PFM004298) is kept in a cold storage at the Geological survey of Sweden, Uppsala. The samples collected for storage are listed in (Appendix 6).

Table 6-1. Generalized stratigraphy of the sediment in the Forsmark area and the environment in the water column at the formation of the units.

Environment	Lithology
Freshwater lake	Calcareous gyttja
Freshwater lake and coastal lagoons	Algal gyttja
Postglacial Baltic basin	Clay gyttja
Shallow coast	Sand and gravel
Postglacial Baltic basin	Postglacial clay
Late glacial Baltic basin	Glacial clay

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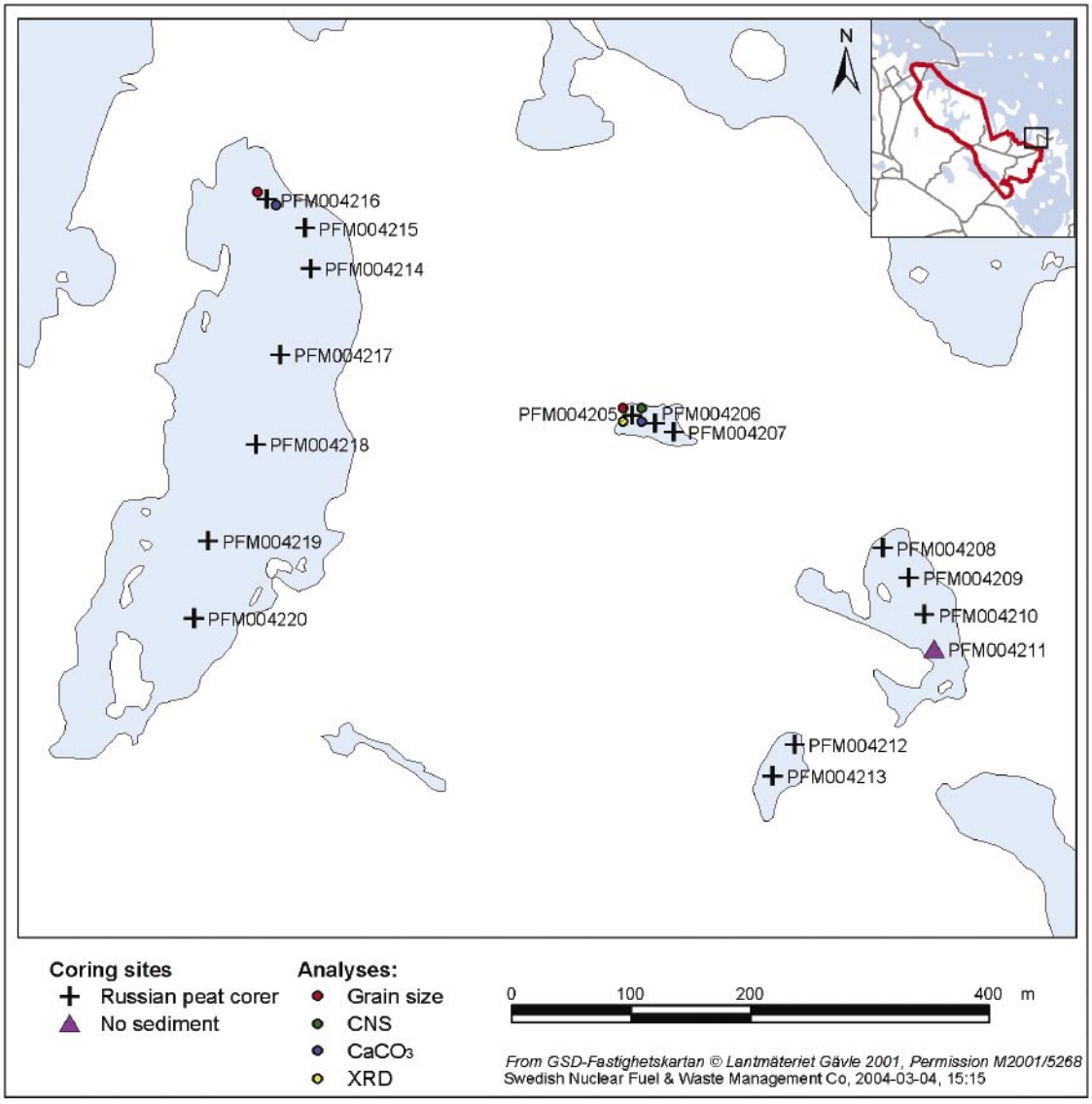
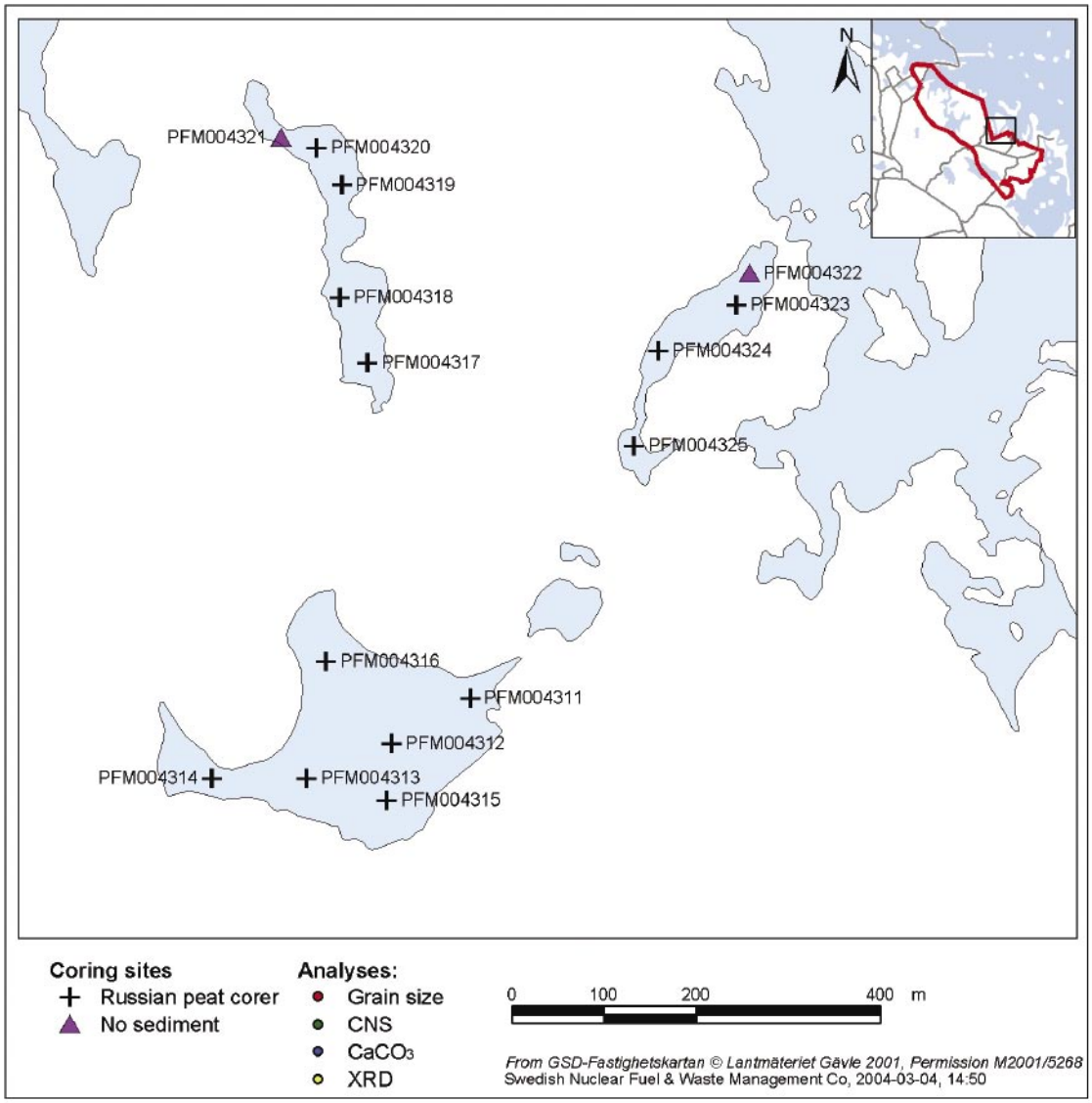
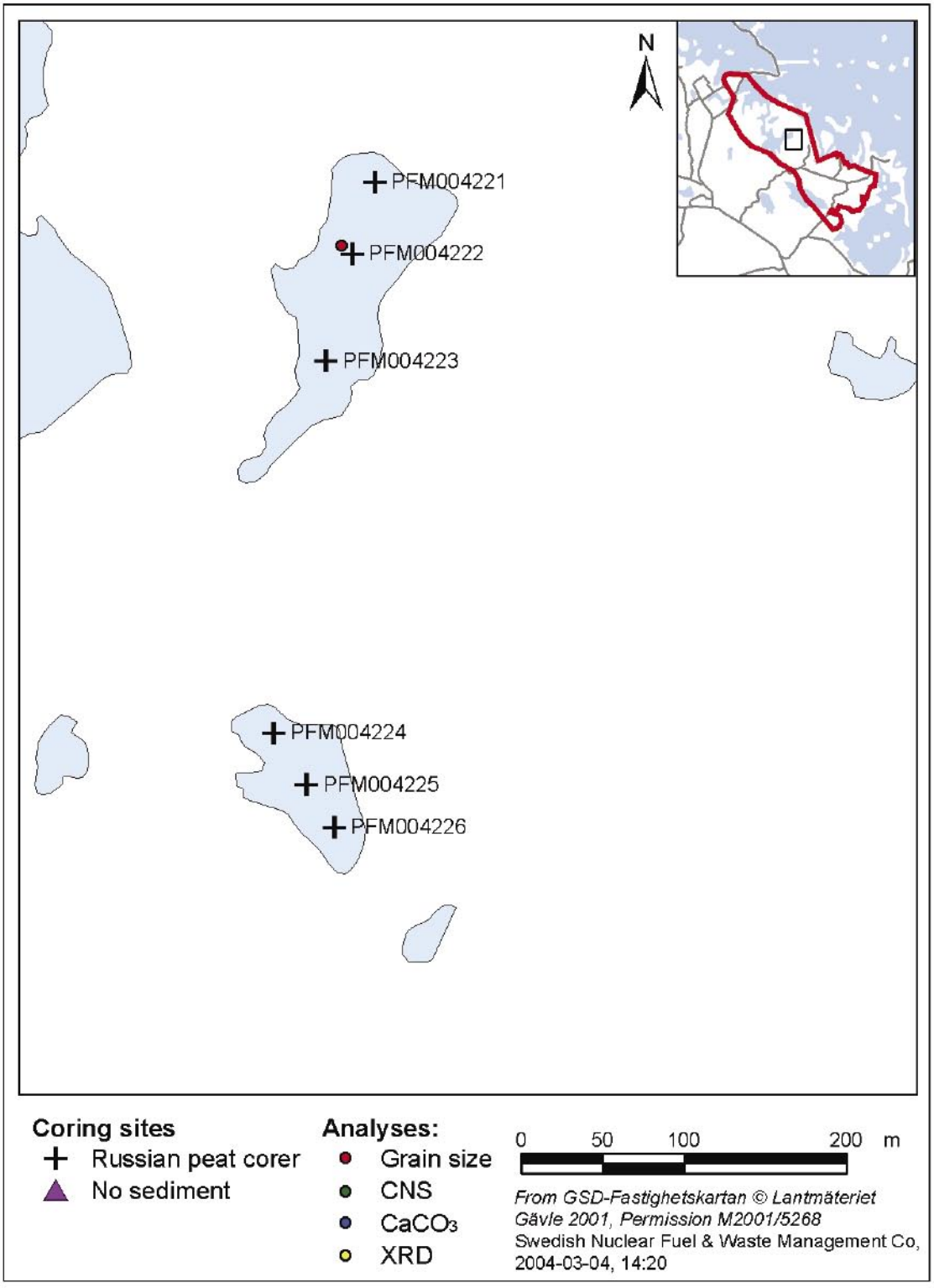
Appendix 1

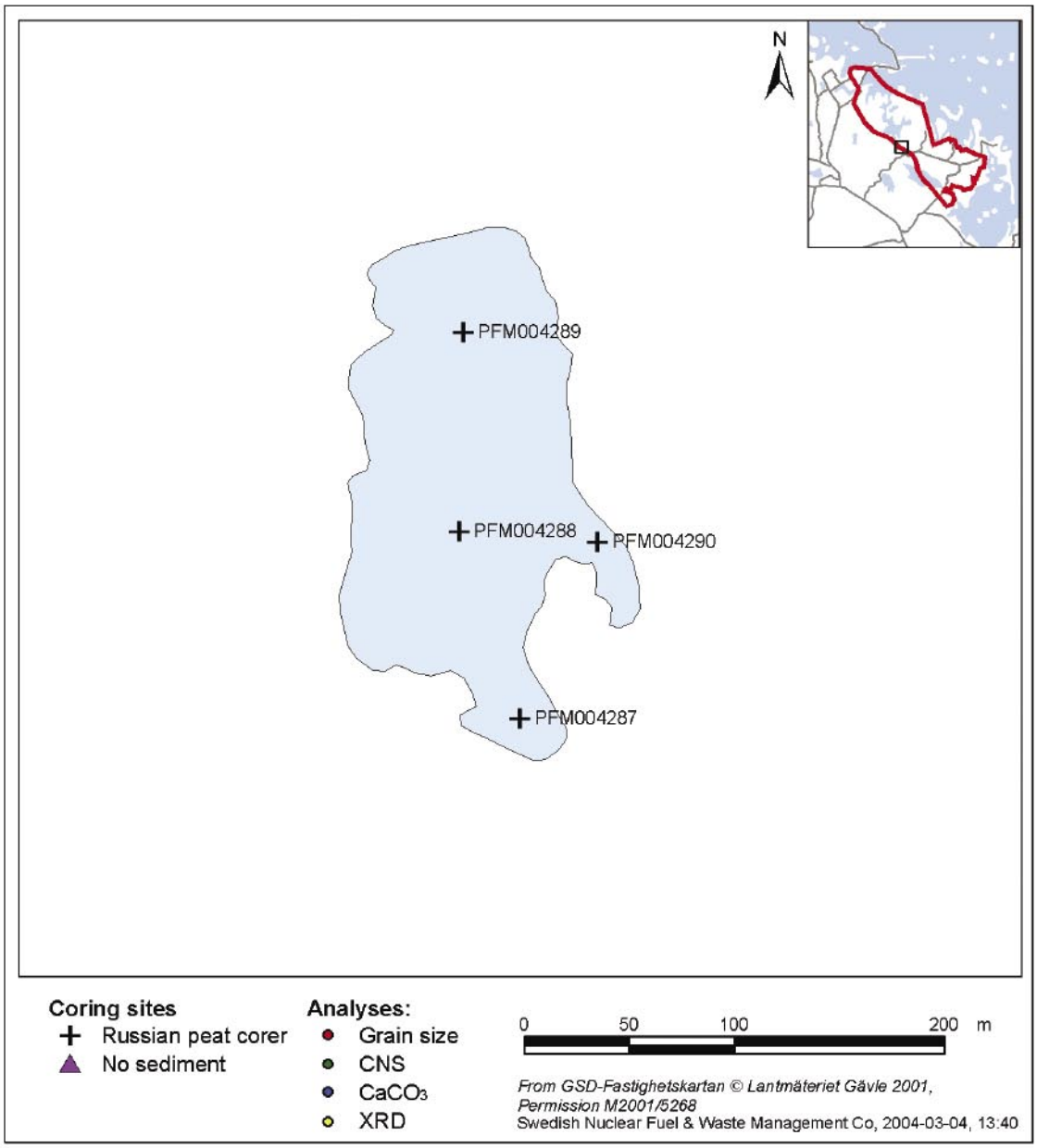
Location of the coring sites and stratigraphical cross sections

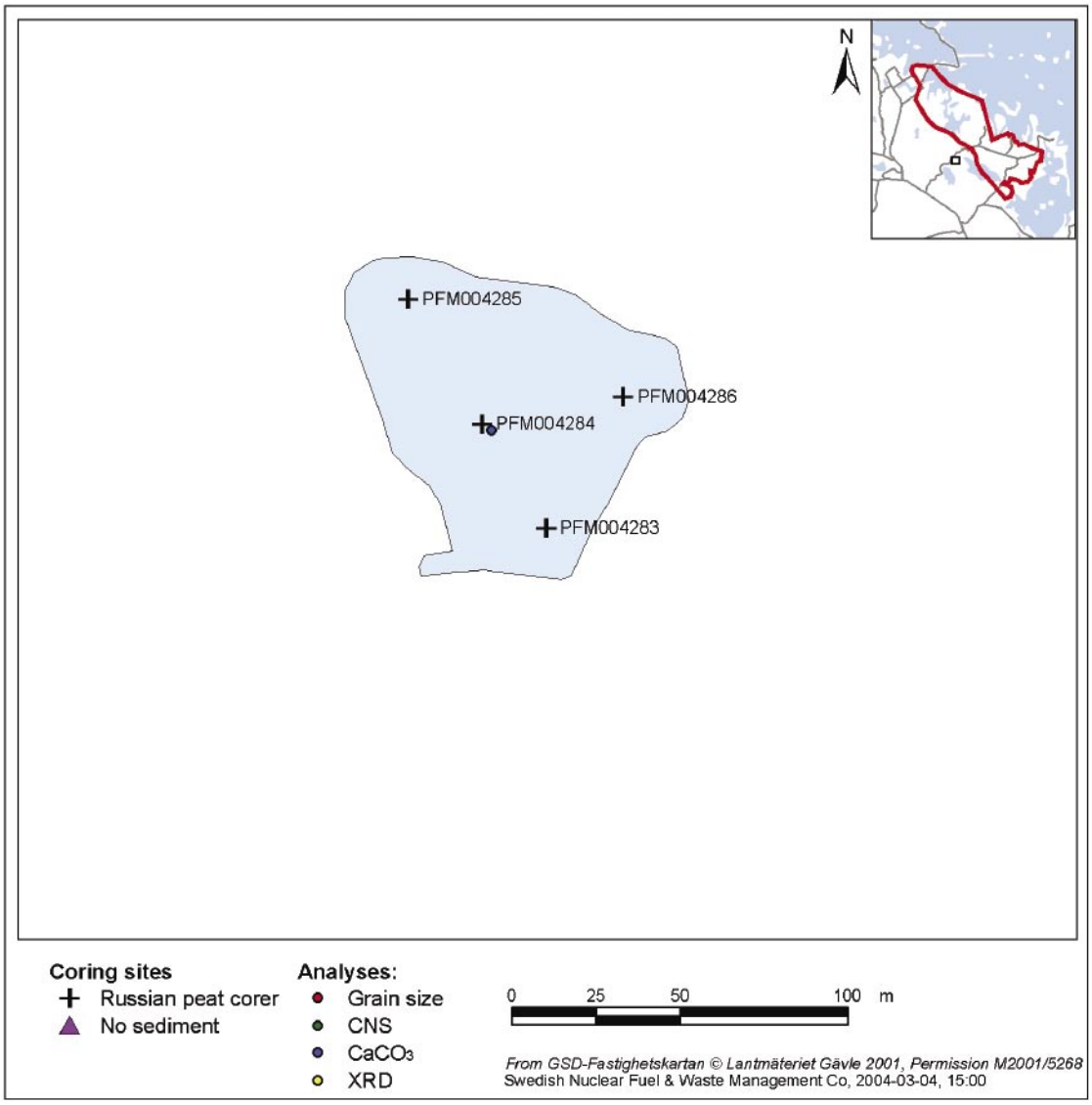
Appendix 1. Maps showing the locations of coring sites in the investigated lakes together with generalised stratigraphic cross sections. For locations of the lakes in the investigation area, refer to Figure 1-1. The detailed geological description to each coring site is stored in the SKB SICADA database under Field note no Forsmark 98.

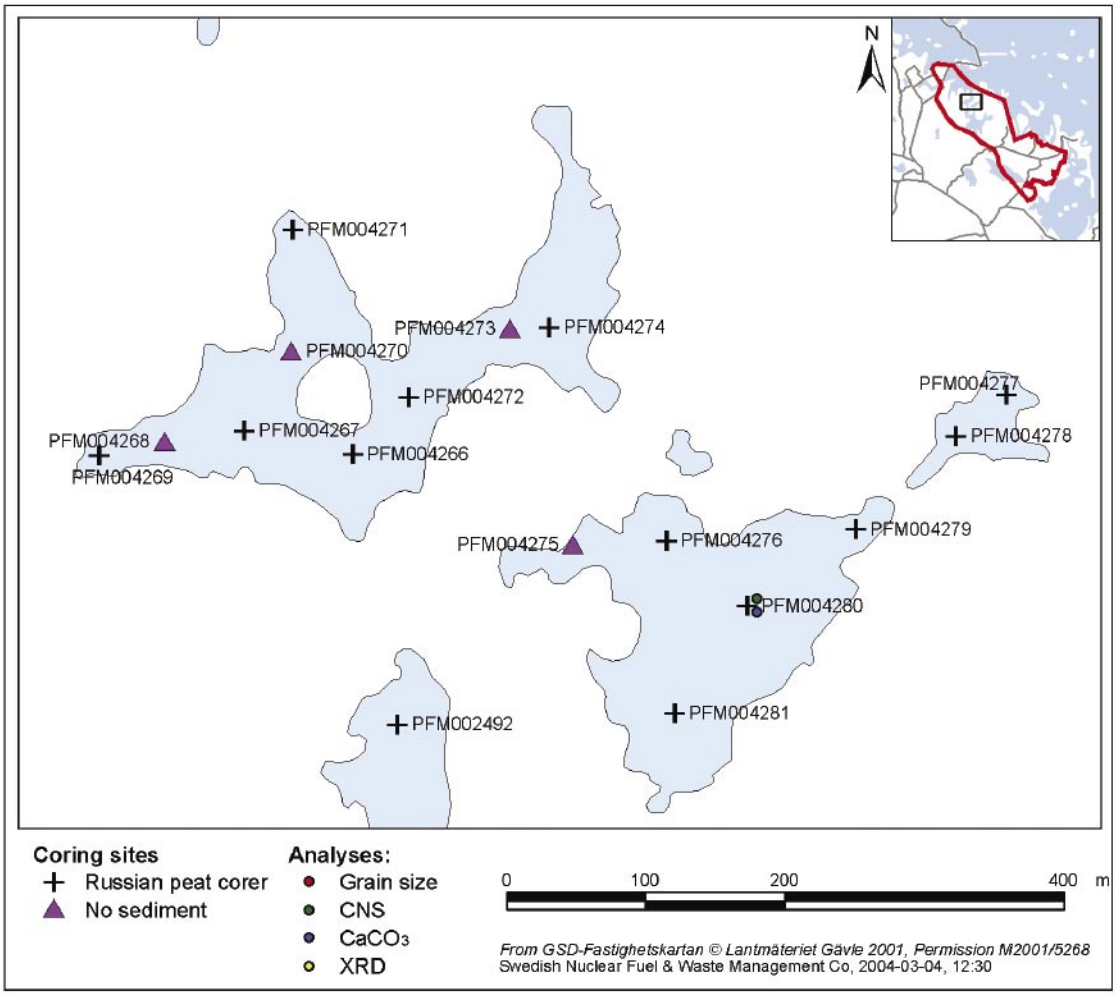


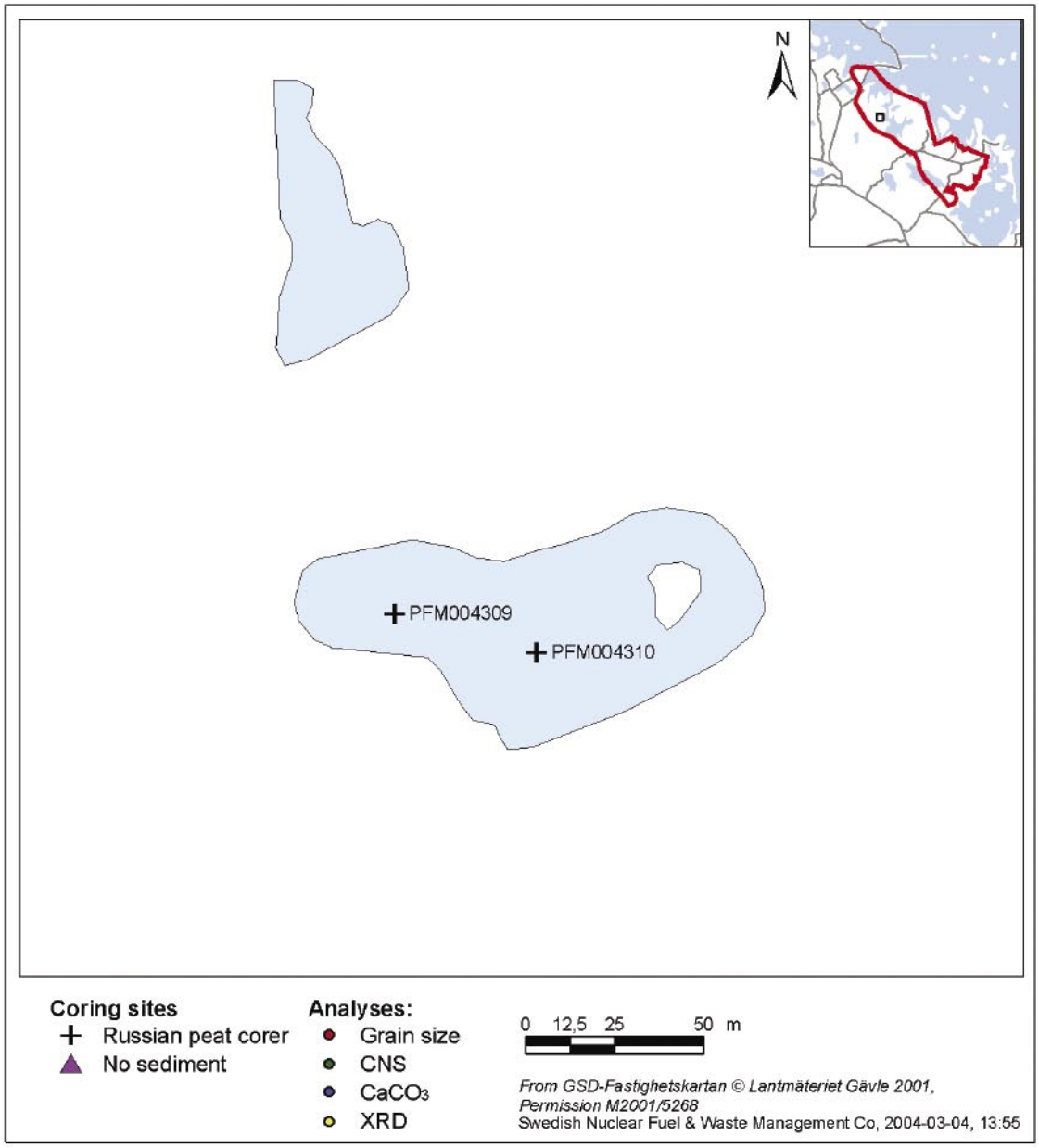

N
PFM004321
PFM004320
PFM004319
PFM004318
PFM004317
PFM004322
PFM004323
PFM004324
PFM004325
PFM004316
PFM004311
PFM004312
PFM004314
PFM004313
PFM004315
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
100
200
400
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 14:50

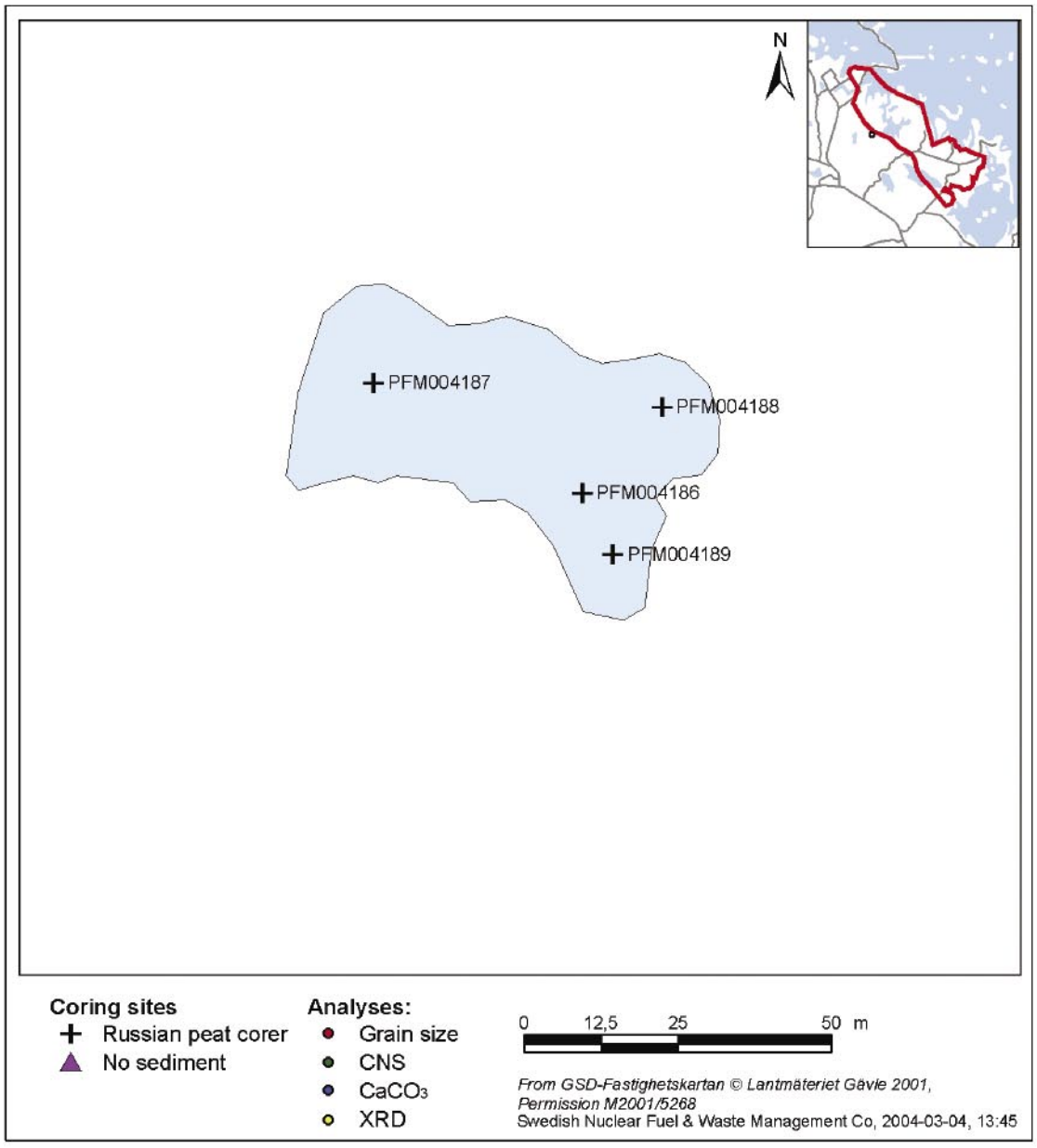

N
PFM004221
PFM004222
PFM004223
PFM004224
PFM004225
PFM004226
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
50
100
200
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 14:20

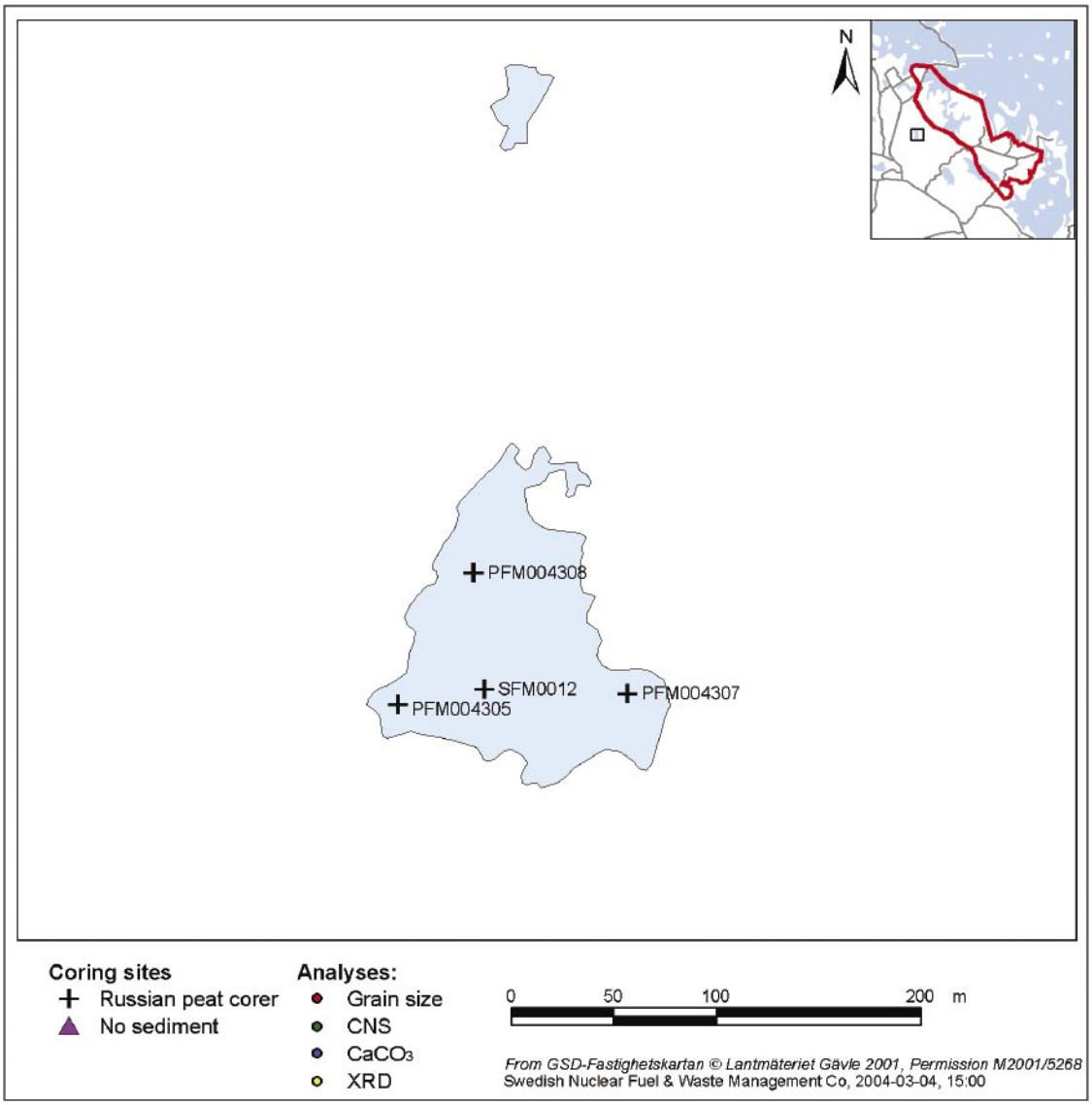

N
PFM004289
PFM004288
PFM004290
PFM004287
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
50
100
200
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001,
Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 13:40

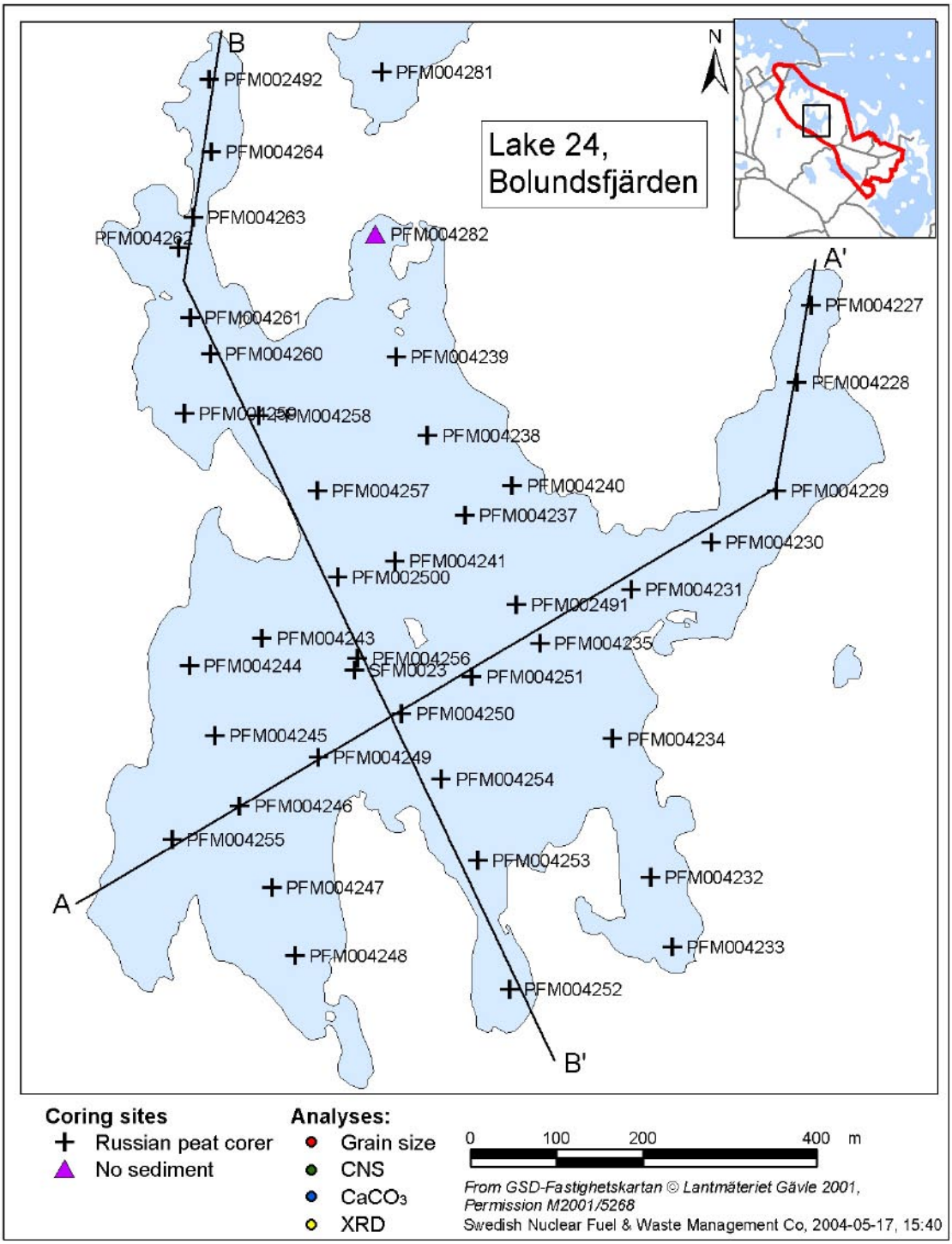

N
PFM004285
PFM004286
PFM004284
PFM004283
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
25
50
100
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 15:00

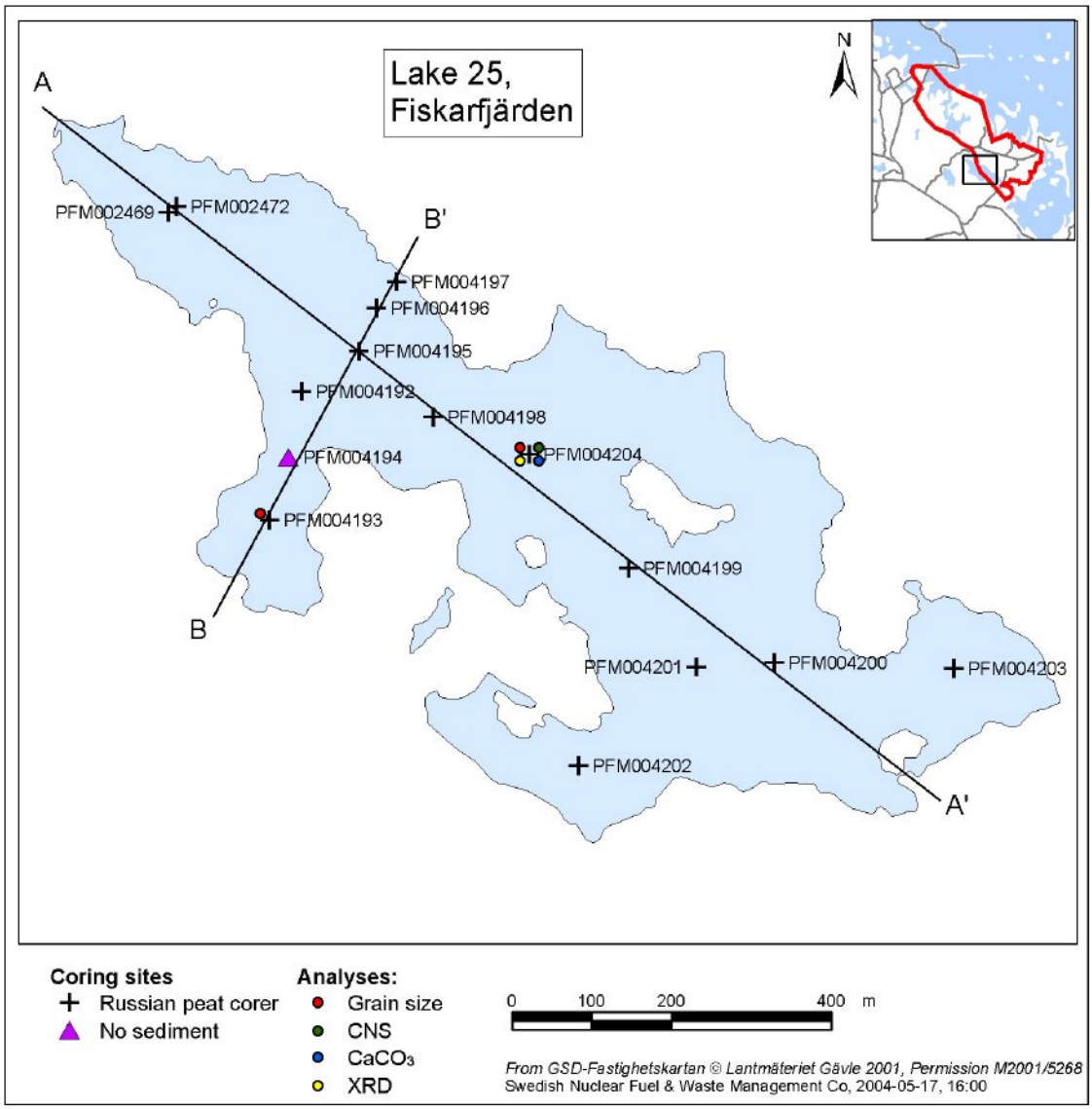

N
PFM004271
PFM004273
PFM004274
PFM004270
PFM004272
PFM004277
PFM004268
PFM004267
PFM004278
PFM004269
PFM004266
PFM004275
PFM004276
PFM004279
PFM004280
PFM002492
PFM004281
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
100
200
400
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 12:30

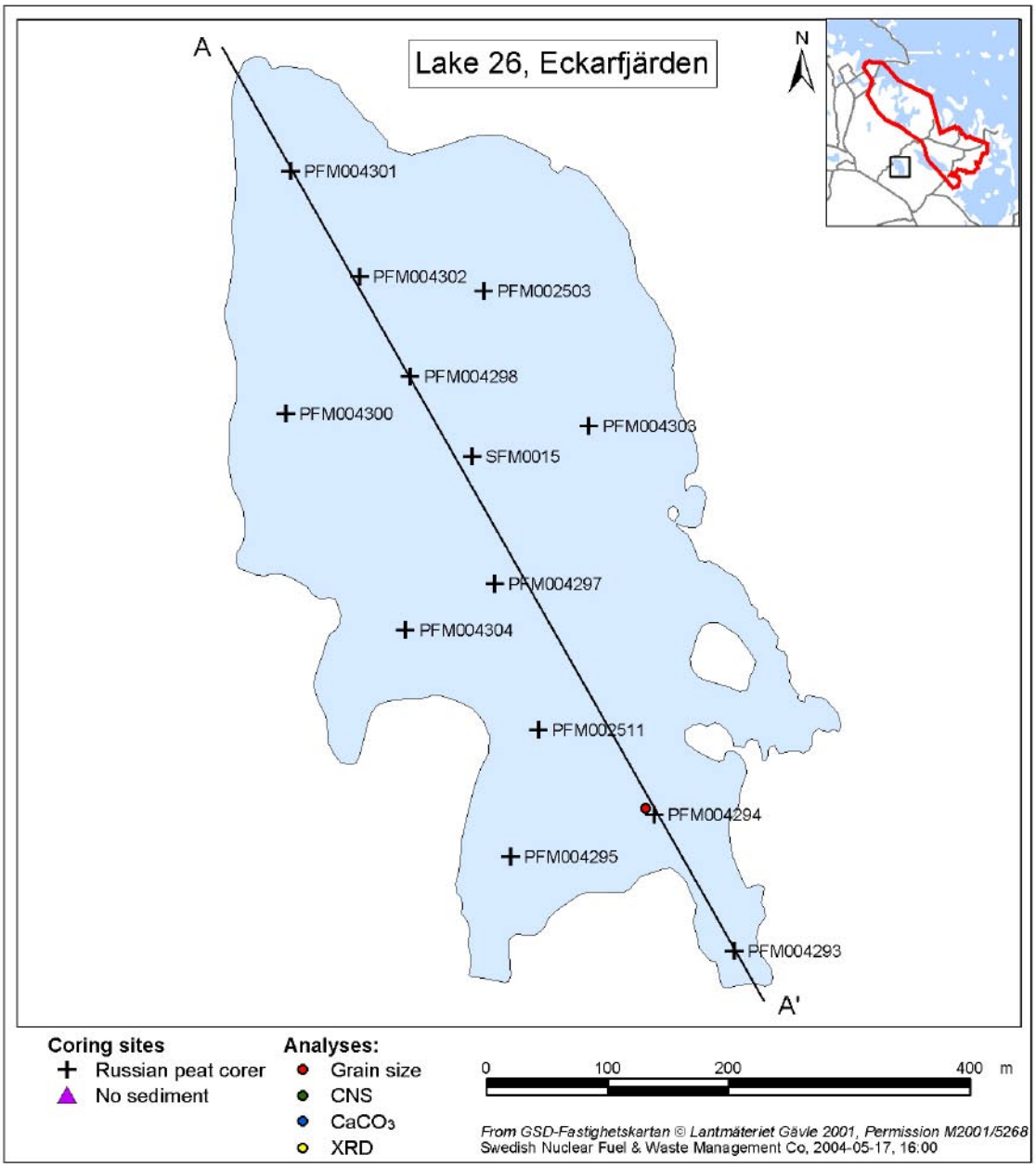

N
PFM004309
PFM004310
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0 12,5 25 50 m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001,
Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 13:55

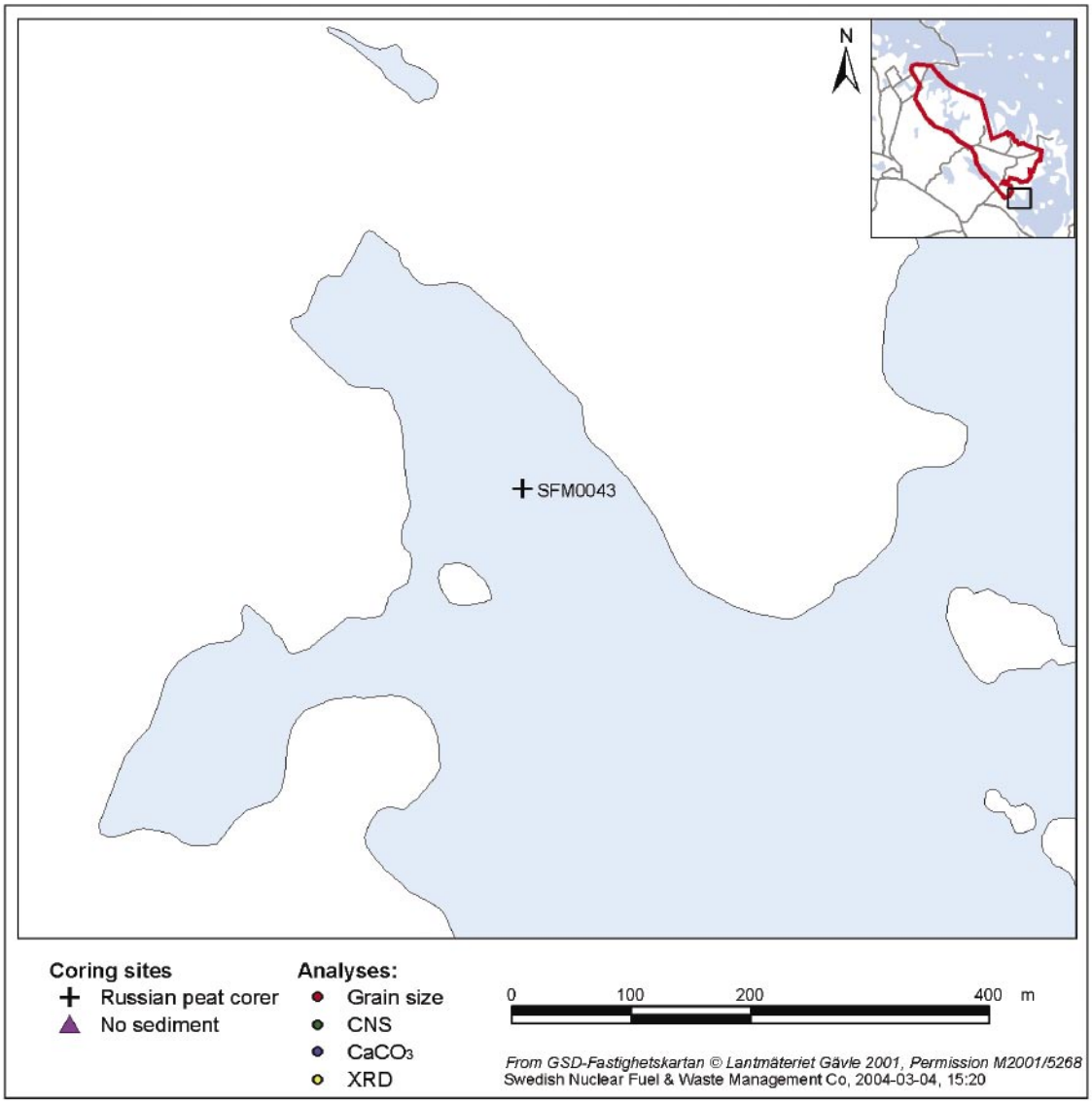

N
PFM004187
PFM004188
PFM004186
PFM004189
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0 12,5 25 50 m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001,
Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 13:45

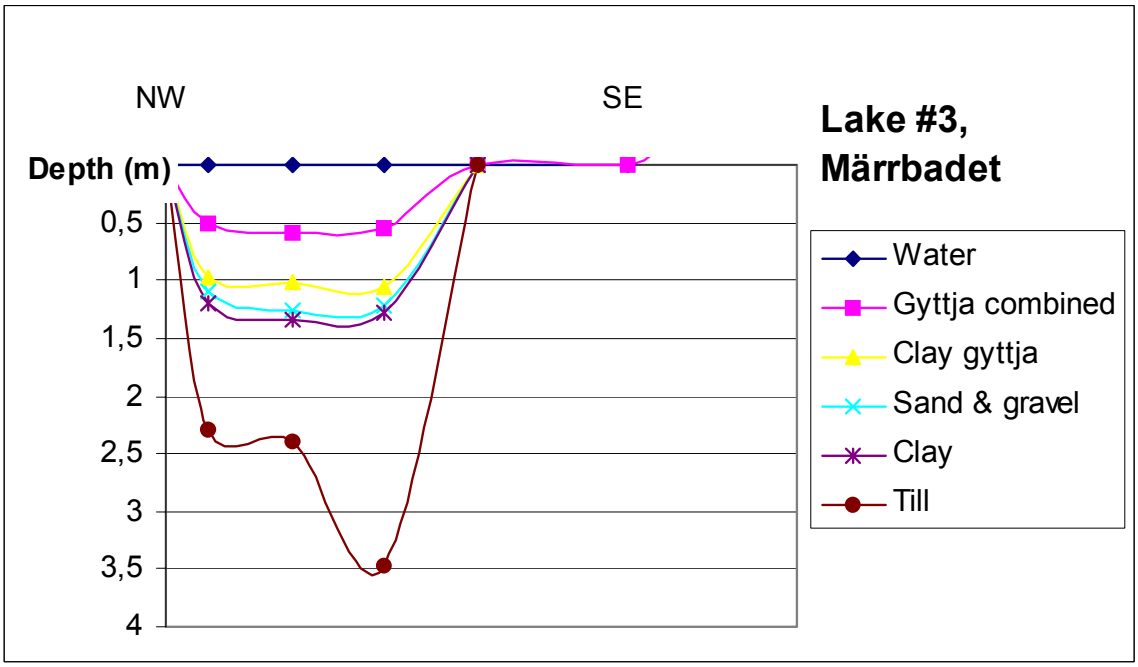

N
PFM004308
SFM0012
PFM004307
PFM004305
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
50
100
200
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 15:00

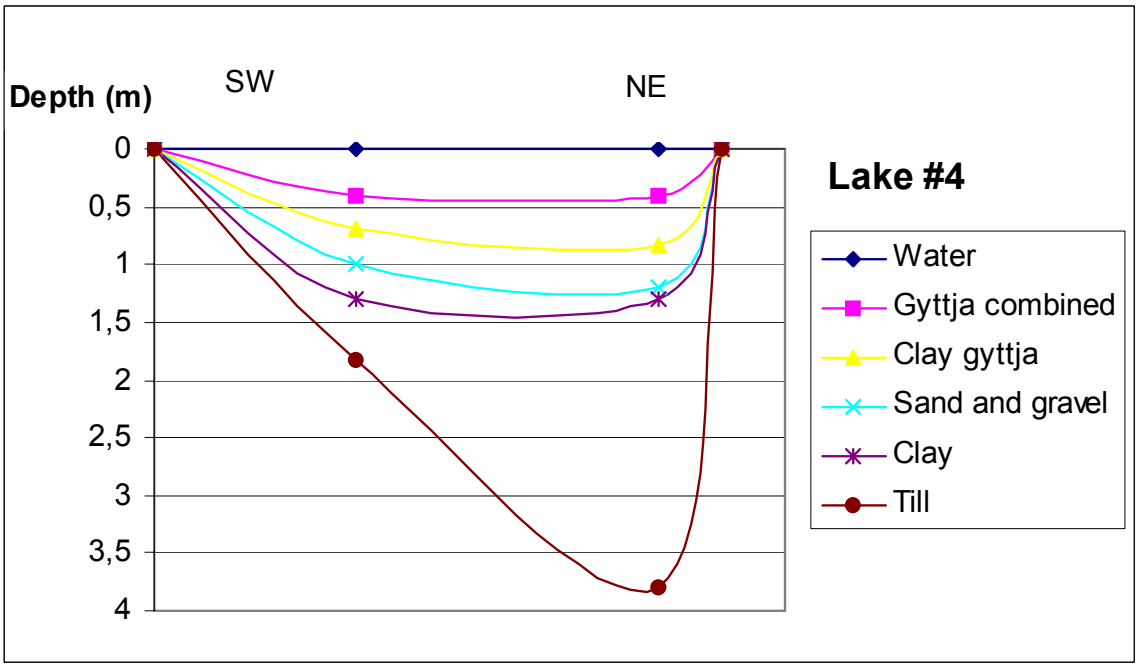

Lake 24,
Bolundsfjärden
N
A
A'
B
B'
PFM002492
PFM004281
PFM004264
PFM004263
PFM004262
PFM004282
PFM004261
PFM004260
PFM004239
PFM004259
PFM004258
PFM004238
PFM004257
PFM004240
PFM004237
PFM004241
PFM002500
PFM004243
PFM004244
PFM004256
SFM0023
PFM004245
PFM004249
PFM004246
PFM004255
PFM004247
PFM004248
PFM004227
PFM004228
PFM004229
PFM004230
PFM004231
PFM002491
PFM004235
PFM004251
PFM004250
PFM004234
PFM004254
PFM004253
PFM004232
PFM004233
PFM004252
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
100
200
400 m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001,
Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-05-17, 15:40

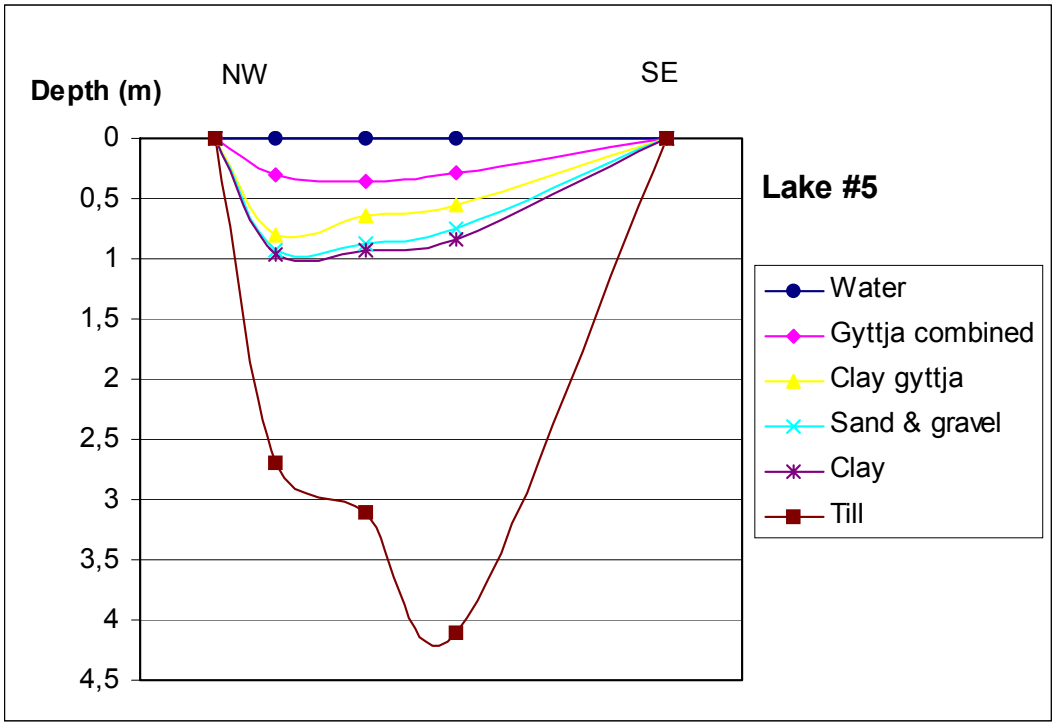

Lake 25,
Fiskarfjärden
N
A
A'
B
B'
PFM002469
PFM002472
PFM004197
PFM004196
PFM004195
PFM004192
PFM004198
PFM004194
PFM004204
PFM004193
PFM004199
PFM004201
PFM004200
PFM004203
PFM004202
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
100
200
400
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-05-17, 16:00

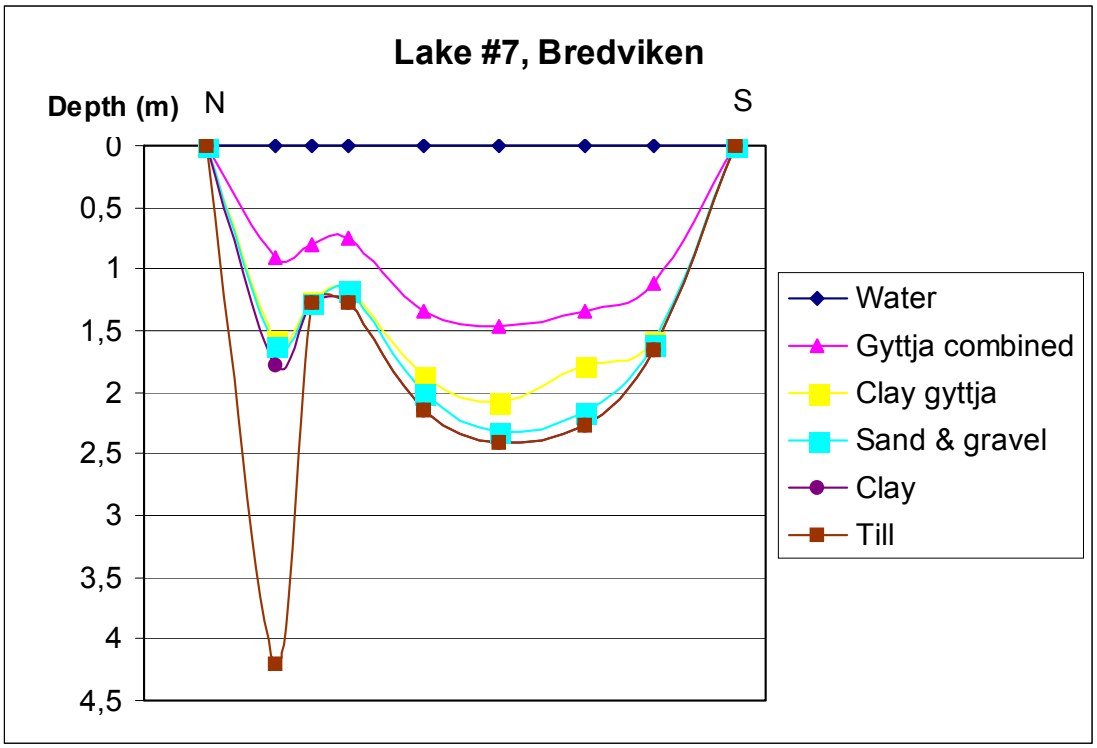

Lake 26, Eckarfjärden
A
A'
N
PFM004301
PFM004302
PFM002503
PFM004298
PFM004300
PFM004303
SFM0015
PFM004297
PFM004304
PFM002511
PFM004294
PFM004295
PFM004293
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
100
200
400 m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-05-17, 16:00

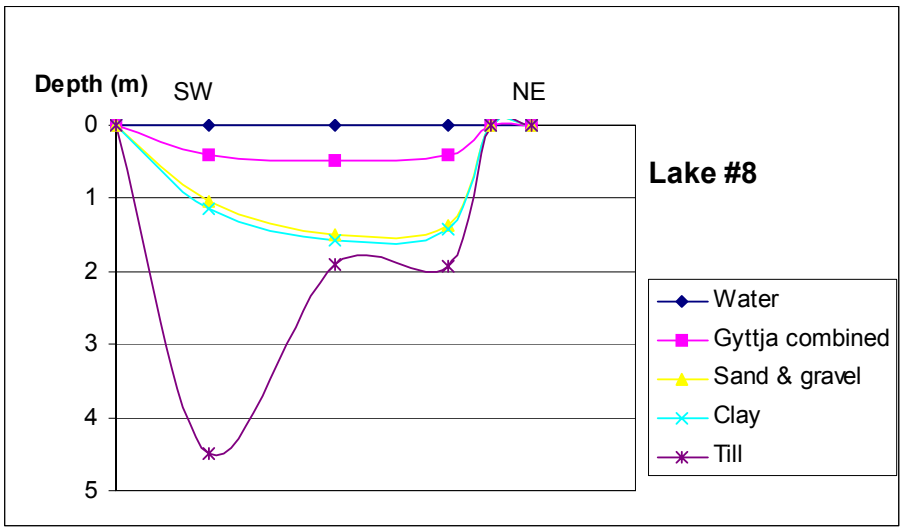

N
SFM0043
Coring sites
Russian peat corer
No sediment
Analyses:
Grain size
CNS
CaCO3
XRD
0
100
200
400
m
From GSD-Fastighetskartan © Lantmäteriet Gävle 2001, Permission M2001/5268
Swedish Nuclear Fuel & Waste Management Co, 2004-03-04, 15:20

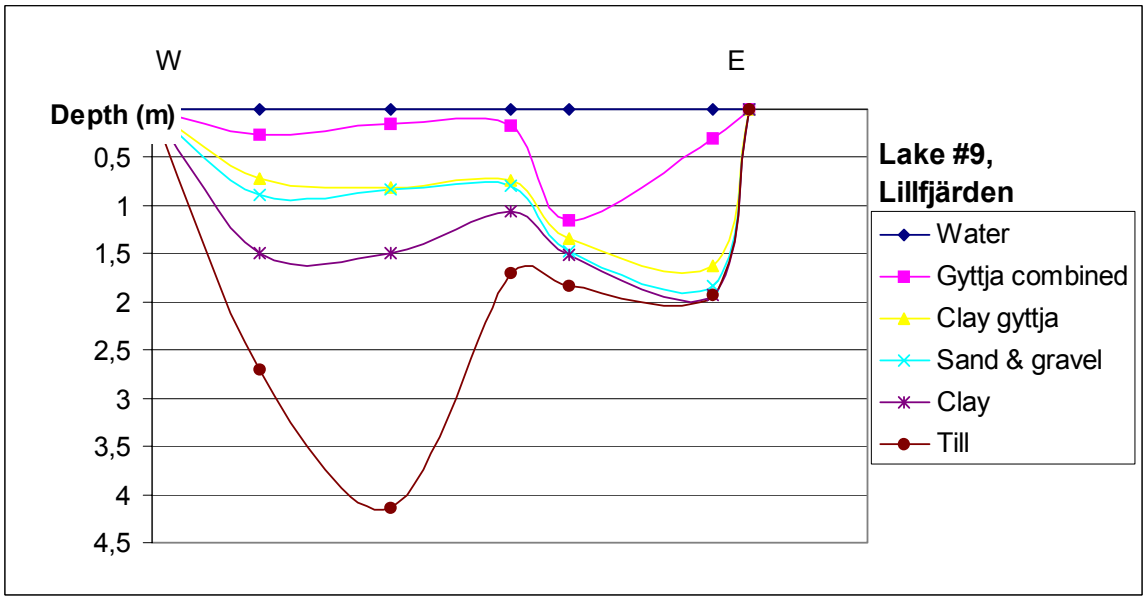

NW
SE
Depth (m)
0,5
1
1,5
2
2,5
3
3,5
4
Lake #3, Märrbadet
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

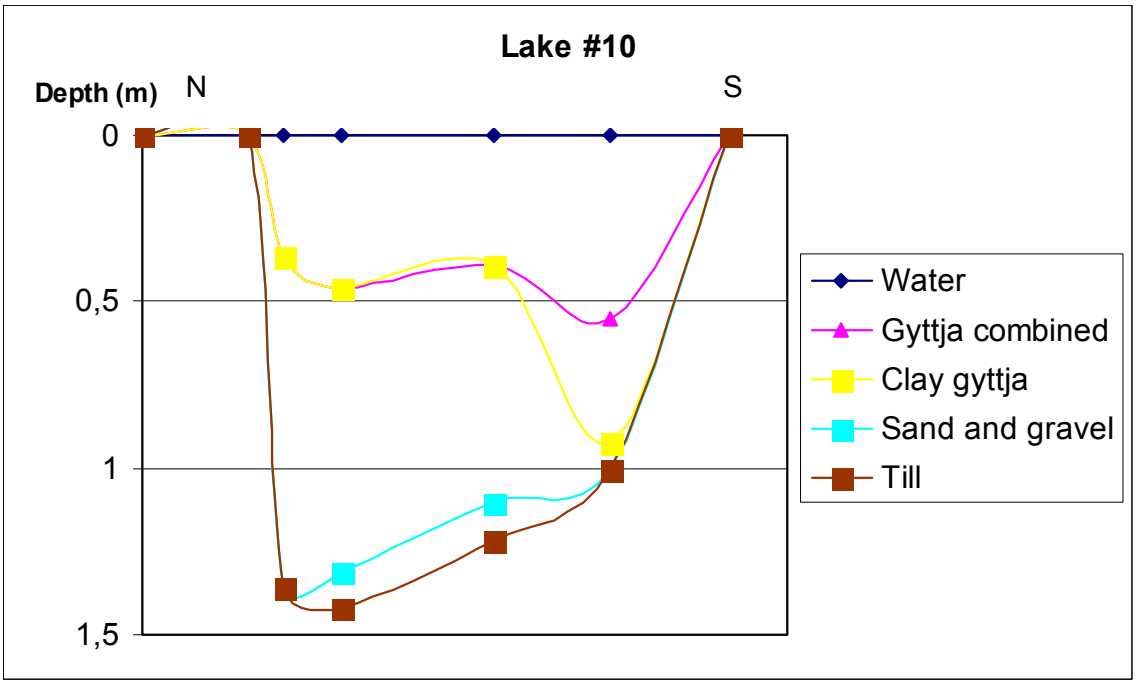

Depth (m)
SW
NE
0
0,5
1
1,5
2
2,5
3
3,5
4
Lake #4
Water
Gyttja combined
Clay gyttja
Sand and gravel
Clay
Till

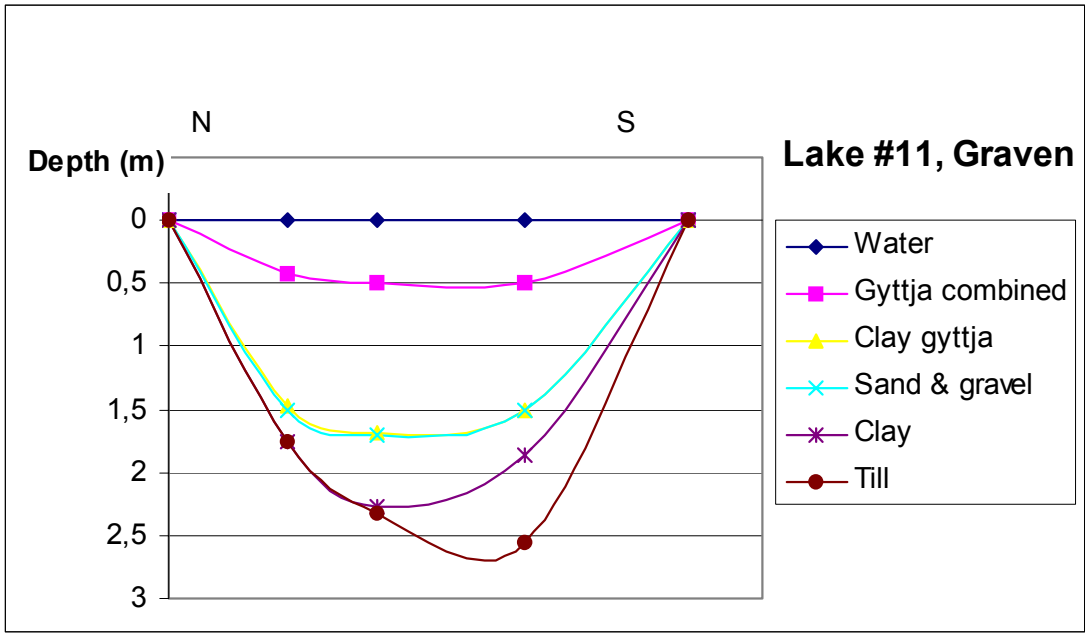

Depth (m)
NW
SE
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5
Lake #5
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

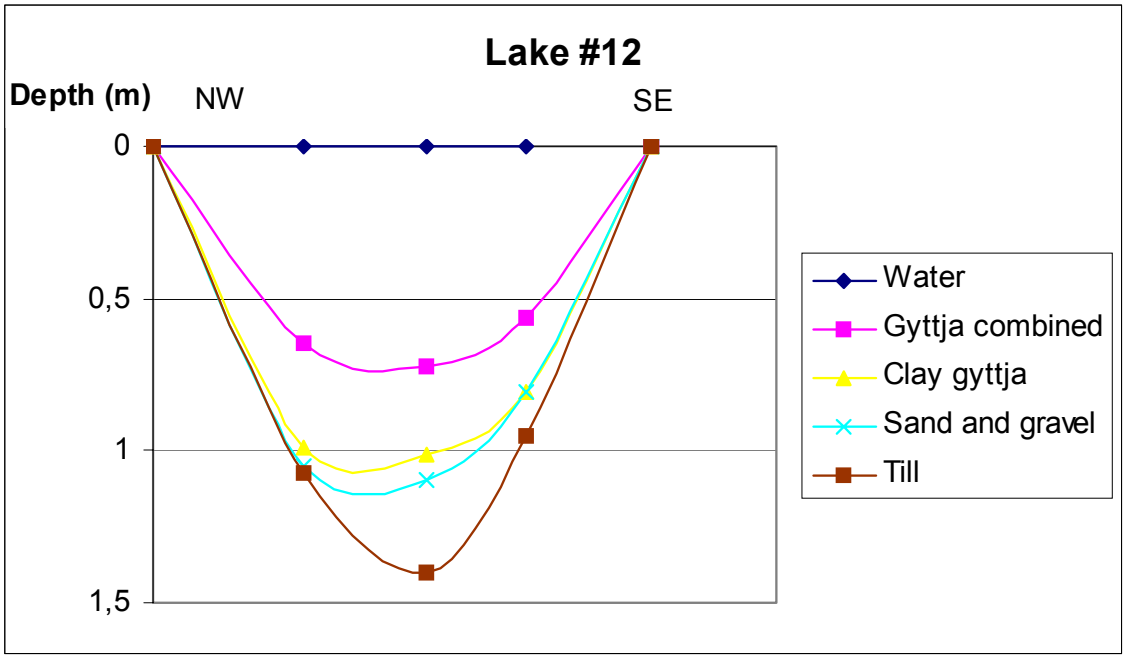

Lake #7, Bredviken
Depth (m)
N
S
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

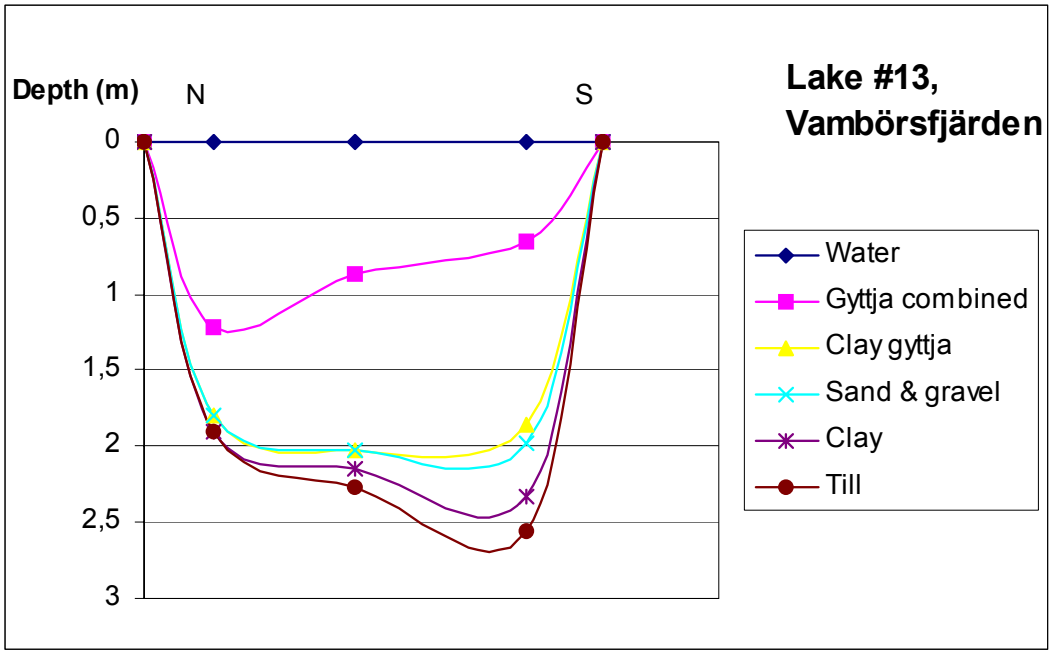

Depth (m)
SW
NE
0
1
2
3
4
5
Lake #8
Water
Gyttja combined
Sand & gravel
Clay
Till

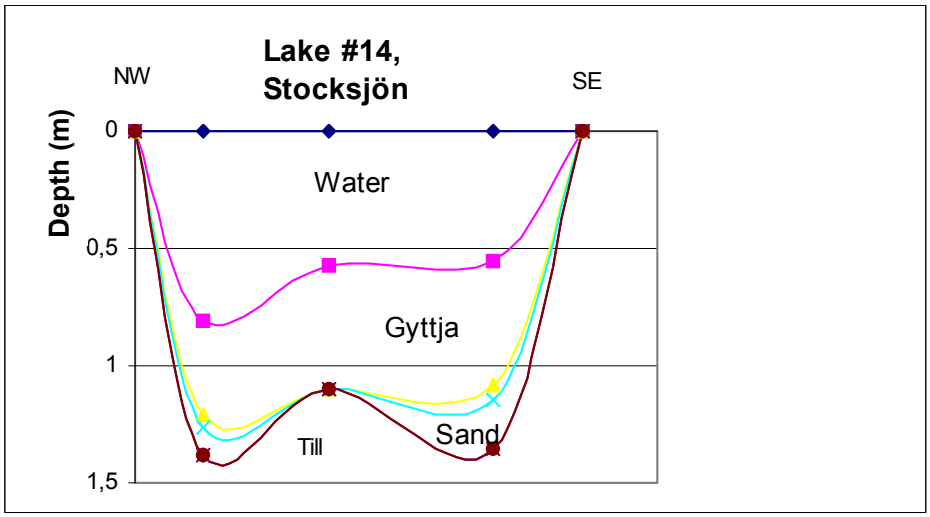

W
E
Depth (m)
0,5
1
1,5
2
2,5
3
3,5
4
4,5
Lake #9, Lillfjärden
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

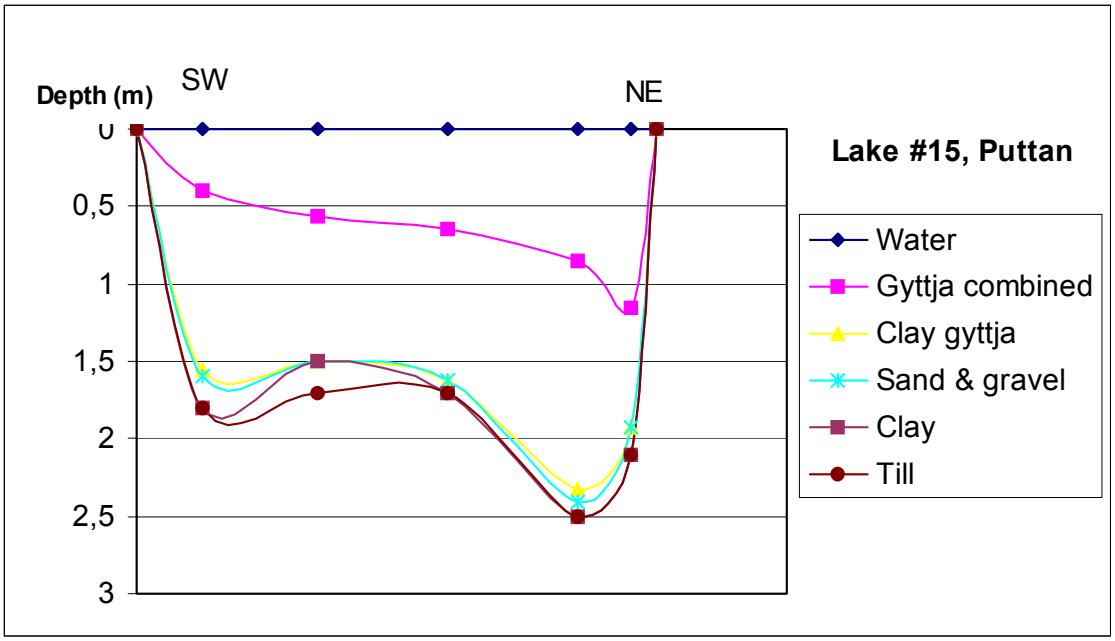

Lake #10
Depth (m)
N
S
0
0,5
1
1,5
Water
Gyttja combined
Clay gyttja
Sand and gravel
Till

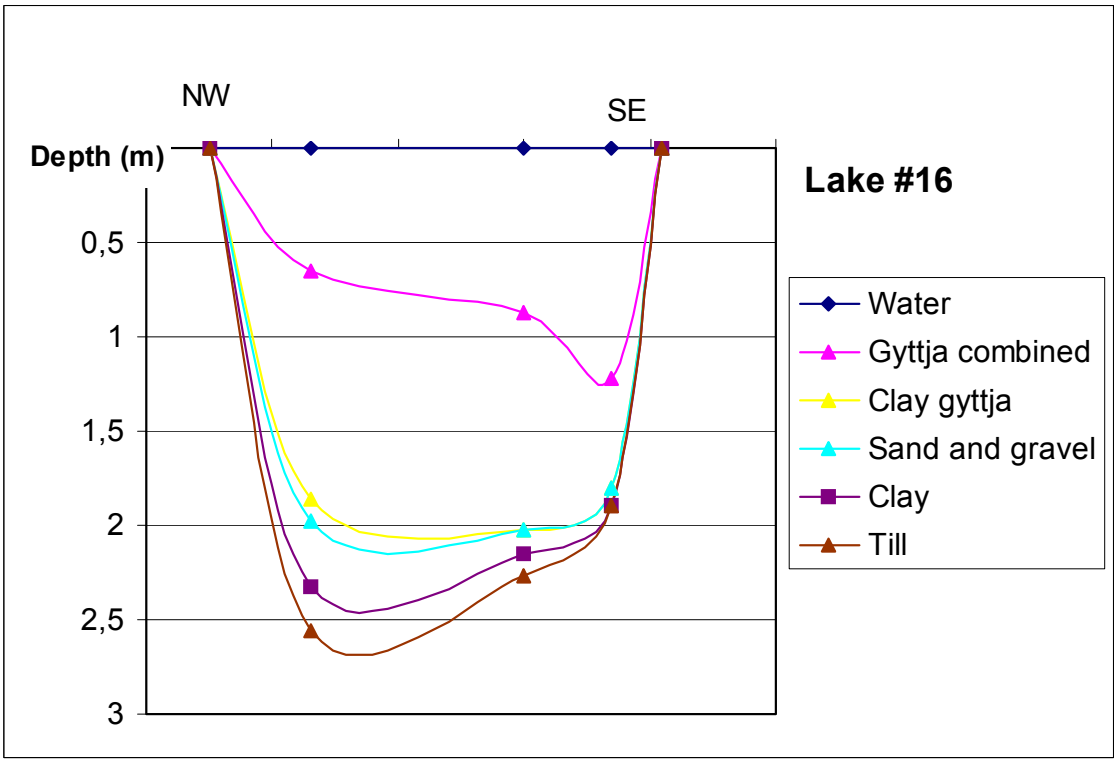

N
S
Depth (m)
Lake #11, Graven
0
0,5
1
1,5
2
2,5
3
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

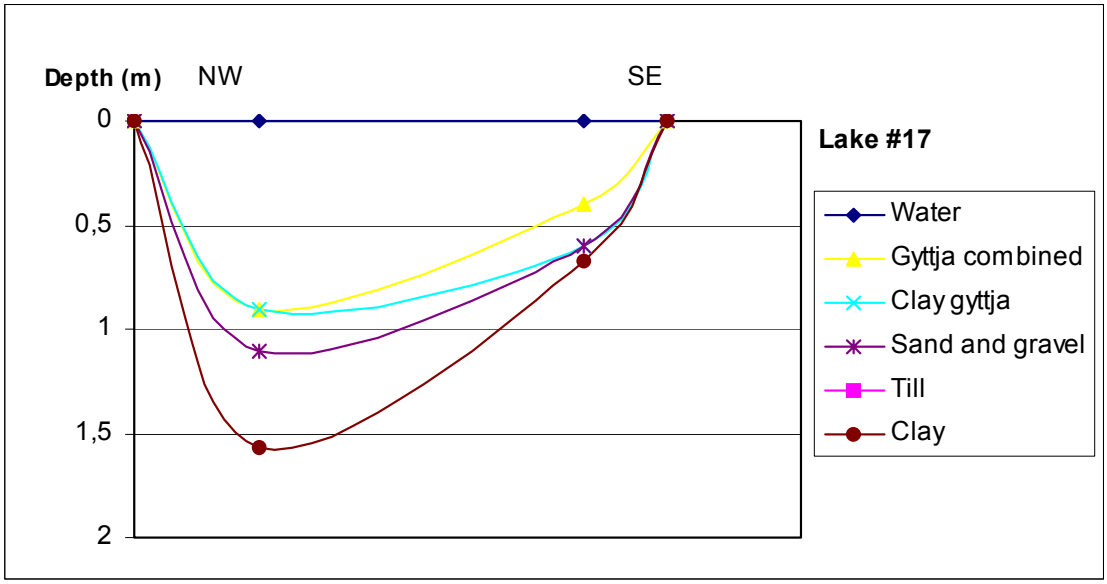

Lake #12
Depth (m)
NW
SE
0
0,5
1
1,5
Water
Gyttja combined
Clay gyttja
Sand and gravel
Till

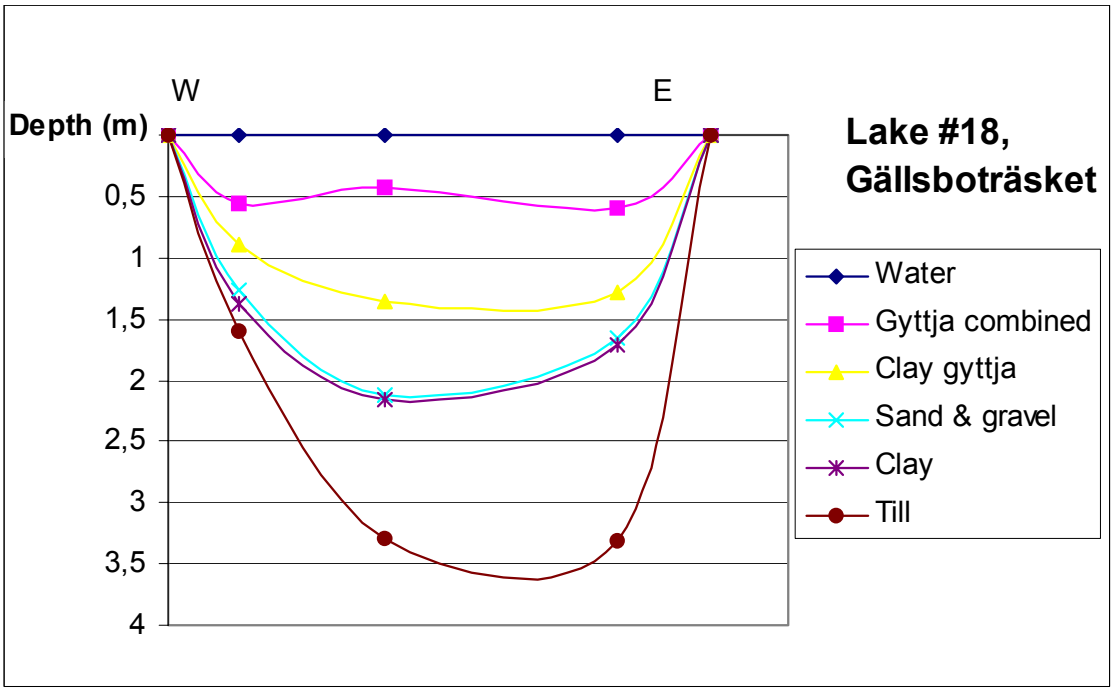

Depth (m)
N
S
0
0,5
1
1,5
2
2,5
3
Lake #13,
Vambörsfjärden
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

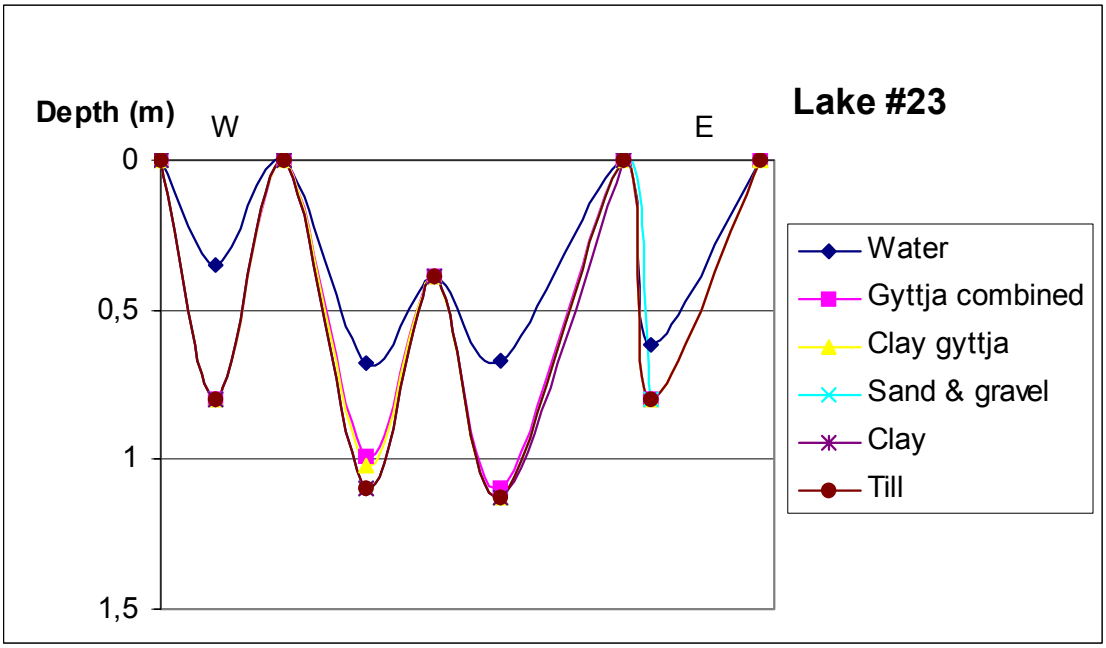

Lake #14,
Stocksjön
NW
SE
Depth (m)
0
0,5
1
1,5
Water
Gyttja
Till
Sand

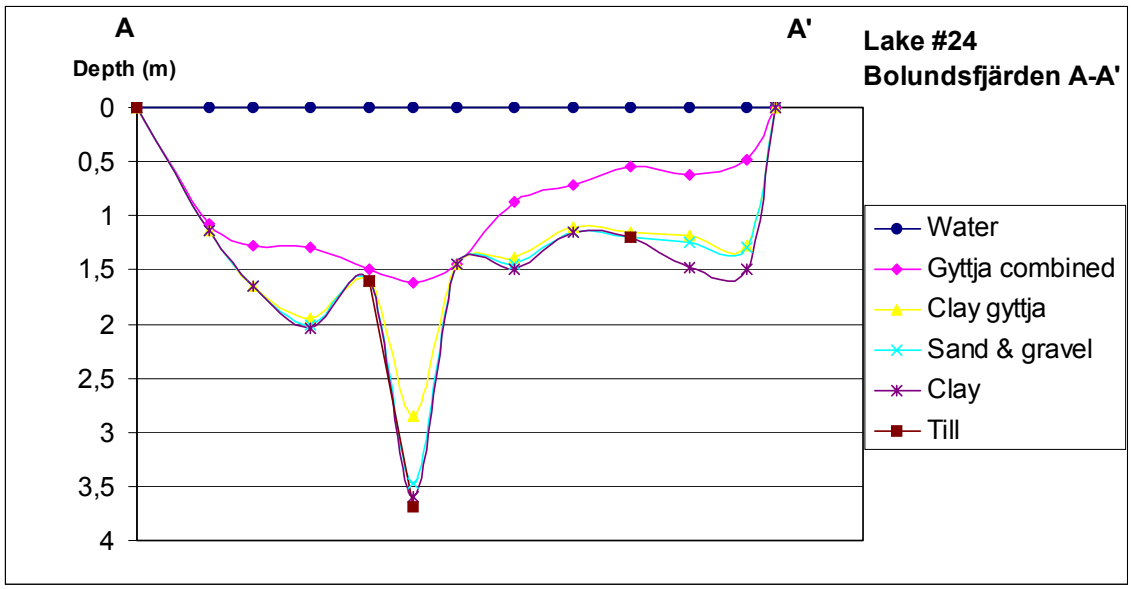

Depth (m)
SW
NE
0
0,5
1
1,5
2
2,5
3
Lake #15, Puttan
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

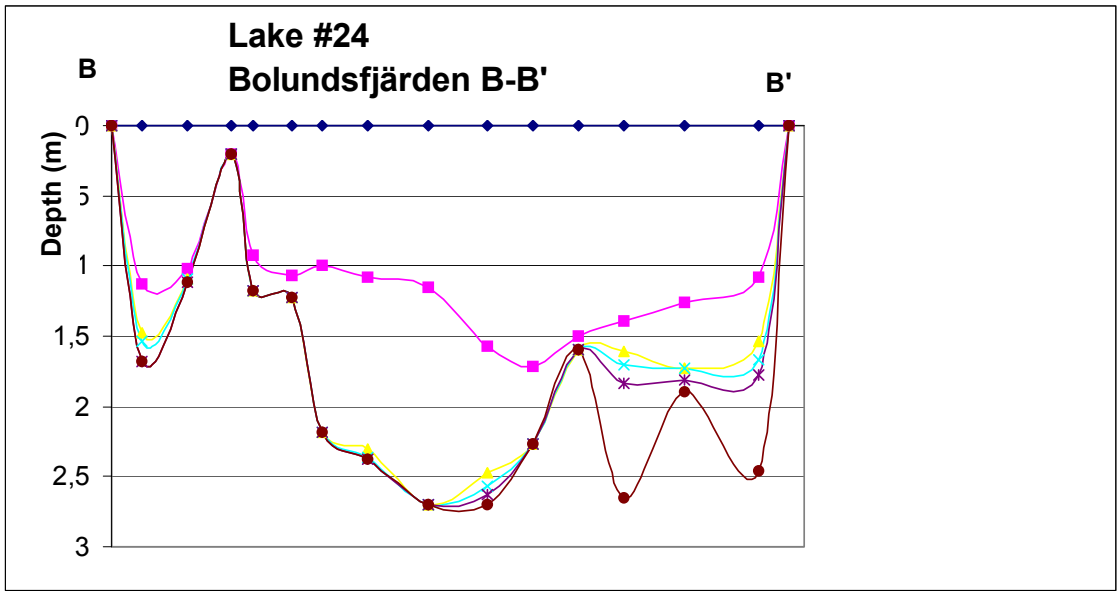

NW
SE
Depth (m)
0,5
1
1,5
2
2,5
3
Lake #16
Water
Gyttja combined
Clay gyttja
Sand and gravel
Clay
Till

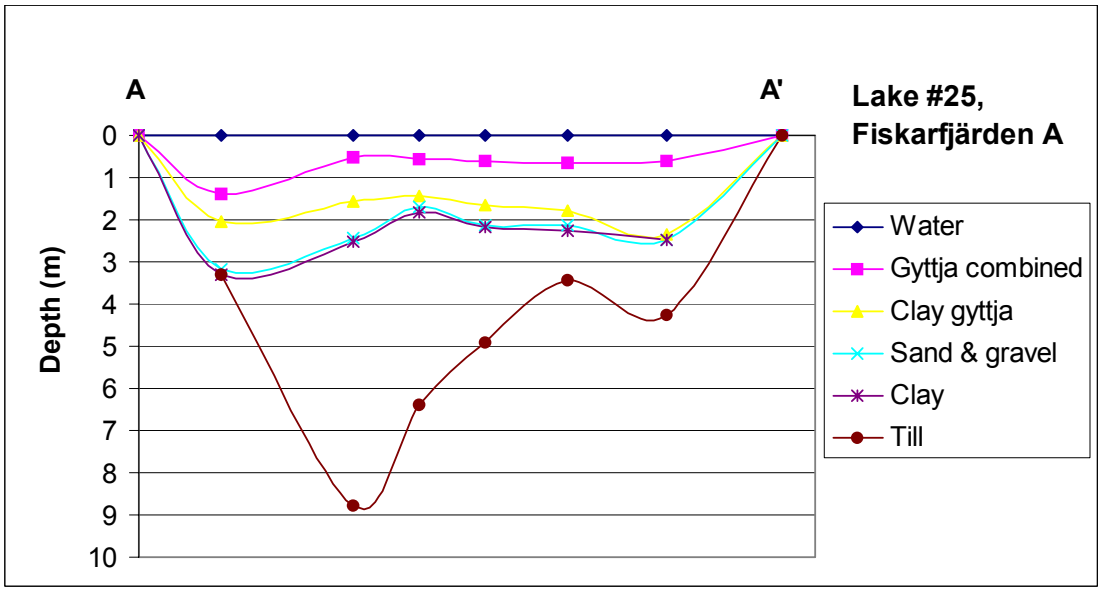

Depth (m)
NW
SE
0
0,5
1
1,5
2
Lake #17
Water
Gyttja combined
Clay gyttja
Sand and gravel
Till
Clay

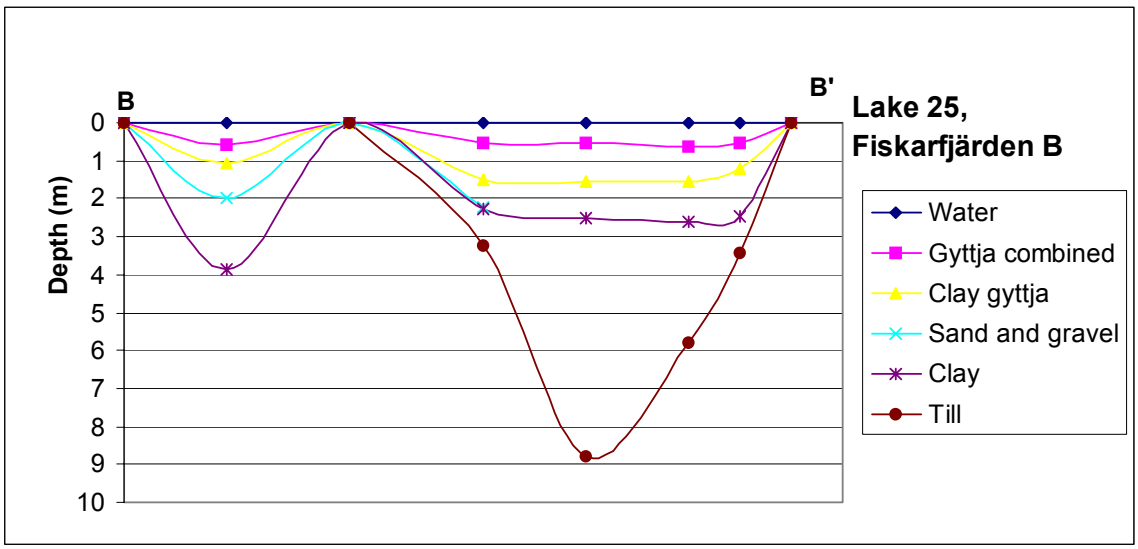

W
E
Depth (m)
0,5
1
1,5
2
2,5
3
3,5
4
Lake #18,
Gällsboträsket
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

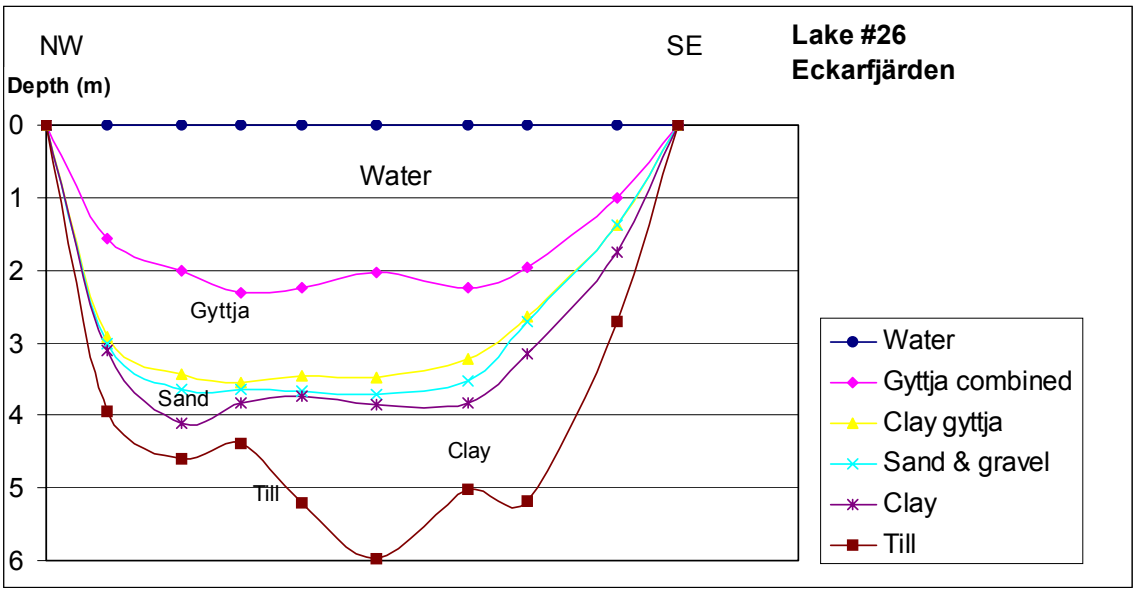

Depth (m)
W
E
0
0,5
1
1,5
Lake #23
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till


A
A'
Depth (m)
0
0,5
1
1,5
2
2,5
3
3,5
4
Lake #24
Bolundsfjärden A-A'
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till


Lake #24
Bolundsfjärden B-B'
B
B'
Depth (m)
1
1,5
2
2,5
3


A
A'
Lake #25,
Fiskarfjärden A
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till


B
B'
Lake 25,
Fiskarfjärden B
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
Water
Gyttja combined
Clay gyttja
Sand and gravel
Clay
Till


NW
SE
Depth (m)
0
1
2
3
4
5
6
Water
Gyttja
Sand
Clay
Till
Lake #26
Eckarfjärden
Water
Gyttja combined
Clay gyttja
Sand & gravel
Clay
Till

Appendix 2

List of samples and analyses performed

Appendix 2. List of the sub-samples collected for analyses. The suffix after the ID code was added to the PFM number of each coring site.

Site	ID code	Depth (m)	Analyse
Fiskarfjärden #25	PFM004193_1	2.0–2.5	Grain
Fiskarfjärden #25	FPM004204_1	1.1–1.13	CNS
Fiskarfjärden #25	FPM004204_27	1.13–1.16	CaCO3
Fiskarfjärden #25	FPM004204_2	1.2–1.22	CNS
Fiskarfjärden #25	FPM004204_3	1.3–1.32	CNS
Fiskarfjärden #25	PFM004204_28	1.32–1.36	CaCO3
Fiskarfjärden #25	FPM004204_4	1.4–1.42	CNS
Fiskarfjärden #25	FPM004204_5	1.5–1.52	CNS
Fiskarfjärden #25	FPM004204_29	1.56–1.6	CaCO3
Fiskarfjärden #25	FPM004204_6	1.6–1.62	CNS
Fiskarfjärden #25	FPM004204_7	1.65–1.67	CNS
Fiskarfjärden #25	FPM004204_30	1.67–1.7	CaCO3
Fiskarfjärden #25	FPM004204_8	1.7–1.72	CNS
Fiskarfjärden #25	FPM004204_9	1.75–1.77	CNS
Fiskarfjärden #25	FPM004204_10	1.8–1.82	CNS
Fiskarfjärden #25	FPM004204_11	1.85–1.87	CNS
Fiskarfjärden #25	FPM004204_31	1.87–1.9	CaCO3
Fiskarfjärden #25	FPM004204_12	1.9–1.92	CNS
Fiskarfjärden #25	FPM004204_13	1.95–1.97	CNS
Fiskarfjärden #25	FPM004204_14	2.0–2.04	CNS
Fiskarfjärden #25	FPM004204_15	2.05–2.07	CNS
Fiskarfjärden #25	FPM004204_16	2.1–2.12	CNS
Fiskarfjärden #25	FPM004204_32	2.23–2.25	XRD
Fiskarfjärden #25	FPM004204_17	2.25–2.28	CNS
Fiskarfjärden #25	FPM004204_18	2.3–2.45	Grain; CaCO3
Fiskarfjärden #25	FPM004204_19	2.45–2.48	CNS
Fiskarfjärden #25	FPM004204_20	2.48–2.65	Grain; CaCO3
Fiskarfjärden #25	FPM004204_21	2.65–2.68	CNS
Fiskarfjärden #25	FPM004204_22	2.68–2.85	Grain; CaCO3
Fiskarfjärden #25	FPM004204_23	2.85–2.88	CNS
Fiskarfjärden #25	FPM004204_24	3.45–3.6	Grain; CaCO3
Fiskarfjärden #25	FPM004204_33	4.0–4.03	CNS
Fiskarfjärden #25	FPM004204_25	4.2–4.35	Grain; CaCO3
Fiskarfjärden #25	FPM004204_34	4.5–4.54	CNS
Fiskarfjärden #25	FPM004204_26	4.8–4.94	Grain; CaCO3
Lake # 5	FPM004205_1	0.4–0.45	CNS
Lake # 5	FPM004205_2	0.5–0.55	CNS
Lake # 5	FPM004205_3	0.6–0.65	CNS
Lake # 5	FPM004205_4	0.70–0.75	CNS

Lake # 5	FPM004205_5	0.80–0.85	CNS
Lake # 5	FPM004205_6	1.27–1.37	Grain; CaCO3
Lake # 5	FPM004205_7	1.37–1.50	XRD
Lake # 5	FPM004205_8	1.50–1.65	Grain; CaCO3
Lake # 5	FPM004205_9	1.65–1.81	Grain; CaCO3
Lake # 5	FPM004205_10	1.70–1.81	Grain; CaCO3
Lake # 5	FPM004205_11	1.81–1.94	Grain; CaCO3
Lake # 5	FPM004205_12	1.81–1.94	Grain; CaCO3
Lake # 5	FPM004205_13	1.94–2.0	Grain; CaCO3
Lake # 5	FPM004205_14	2.0–2.14	Grain; CaCO3
Lake # 5	FPM004205_15	2.14–2.27	Grain; CaCO3
Lake # 5	FPM004205_16	2.14–2.27	Grain; CaCO3
Lake # 5	FPM004205_17	1.10–1.15	XRD
Bredviken # 7	PFM004216_1	3.62–3.79	Grain; CaCO3
Bredviken # 7	PFM004216_2	4.0–4.1	Grain; CaCO3
Graven # 11	PFM004222_1	1.8–2.0	Grain
Puttan # 15	FPM004280_1	0.85–0.9	CNS
Puttan # 15	FPM004280_2	0.9–0.95	CNS
Puttan # 15	FPM004280_3	1.0–1.03	CNS
Puttan # 15	FPM004280_22	1.03–1.1	CaCO3
Puttan # 15	FPM004280_4	1.10–1.13	CNS
Puttan # 15	FPM004280_5	1.20–1.23	CNS
Puttan # 15	FPM004280_6	1.30–1.33	CNS
Puttan # 15	FPM004280_23	1.33–1.4	CaCO3
Puttan # 15	FPM004280_7	1.4–1.45	CNS
Puttan # 15	FPM004280_8	1.5–1.55	CNS
Puttan # 15	FPM004280_24	1.55–1.6	CaCO3
Puttan # 15	FPM004280_9	1.6–1.65	CNS
Puttan # 15	FPM004280_10	1.7–1.75	CNS
Puttan # 15	FPM004280_25	1.75–1.8	CaCO3
Puttan # 15	FPM004280_11	1.8–1.85	CNS
Puttan # 15	FPM004280_12	1.9–1.95	CNS
Puttan # 15	FPM004280_13	2.0–2.05	CNS
Puttan # 15	PFM004280_26	2.05–2.12	CaCO3
Puttan # 15	FPM004280_14	2.12–2.15	CNS
Puttan # 15	FPM004280_15	2.22–2.27	CNS
Puttan # 15	FPM004280_16	2.27–2.30	CNS
Puttan # 15	FPM004280_17	2.3–2.33	CNS
Puttan # 15	FPM004280_18	2.33–2.36	CNS
Puttan # 15	FPM004280_19	2.36–2.39	CNS
Puttan # 15	FPM004280_20	2.4–2.45	CNS
Puttan # 15	FPM004280_21	2.45–2.5	CNS
Stocksjön # 14	PFM004284_1	0.87–0.92	CaCO3
Stocksjön # 14	PFM004284_2	0.92–0.94	CaCO3
Eckarfjärden # 26	PFM004294_1	2.7–3	Grain

Appendix 3

Results of grain size analyses

Appendix 3. Results from the grain size analyses. The graphs of the grain size distributions are displayed in Appendix 4 and stored in SICADA under Field note no Forsmark 98.

Idcode	Sample nr	Secup (m)	Seclow (m)	Quartenary_ deposit	Fine material (%)	Sand (%)	Gravel (%)	Clay content 2mm/0.006mm)
PFM004193	1	2	2.5	Siltig sand	16	65	19	
PFM004204	18	2.3	2.45	Styv lera	99.8	0.2	0	49
PFM004204	20	2.48	2.65	Styv lera	100	0	0	48.5
PFM004204	22	2.68	2.85	Styv lera	100	0	0	43
PFM004204	24	3.45	3.6	Styv lera	100	0	0	53
PFM004204	25	4.2	4.35	Styv lera	100	0	0	65
PFM004204	26	4.8	4.94	Styv lera	99	1	0	61
PFM004216	1	3.62	3.79	Sryv lera	99.5	0.5	0	53
PFM004216	2	4	4.1	Mellanlera	100	0	0	33
PFM004205	6	1.27	1.37	Styv lera	100	0	0	66
PFM004205	8	1.5	1.65	Styv lera	100	0	0	66
PFM004205	9	1.65	1.81	Styv lera	100	0	0	74
PFM004205	10	1.7	1.81	Styv lera	100	0	0	56
PFM004205	11	1.81	1.94	Styv lera	100	0	0	55
PFM004205	12	1.81	1.94	Styv lera	100	0	0	74
PFM004205	13	1.94	2	Styv lera	100	0	0	53
PFM004205	14	2	2.14	Styv lera	100	0	0	54
PFM004205	15	2.14	2.27	Styv lera	100	0	0	58
PFM004205	16	2.14	2.27	Styv lera	99.5	0.5	0	43
PFM004294	1			Grusig sand	3	75	22	
PFM004222	1	1.8	2	Sand	4	85	11	

Grain size distribution curves

Appendix 4. Grain size distribution of sediments in the Forsmark area.

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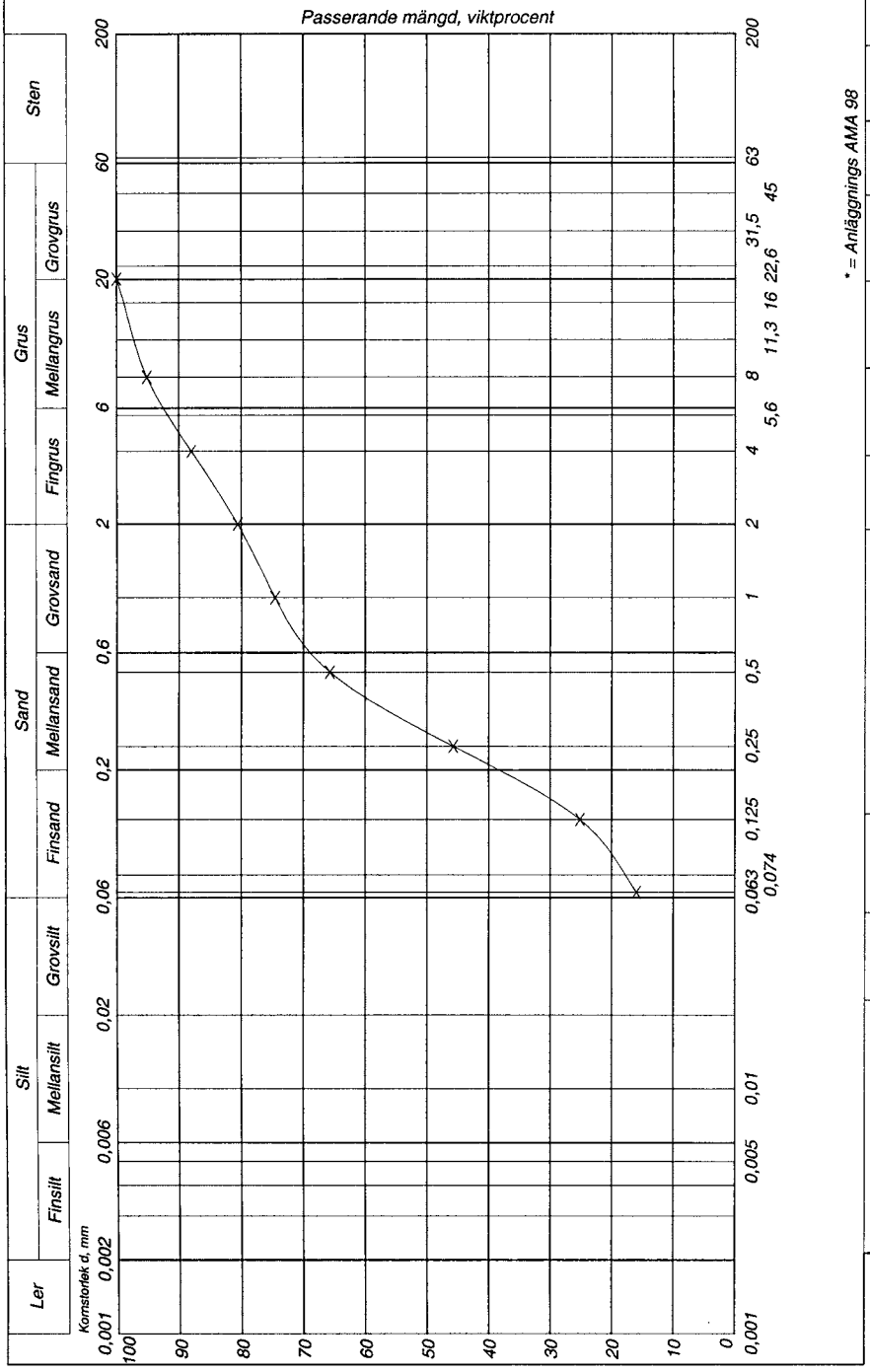

* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004193-1 27958	—×—		2,00-2,50	Siltig sand (SGU serie Ae)	350			3B/2*		0,41	4,857

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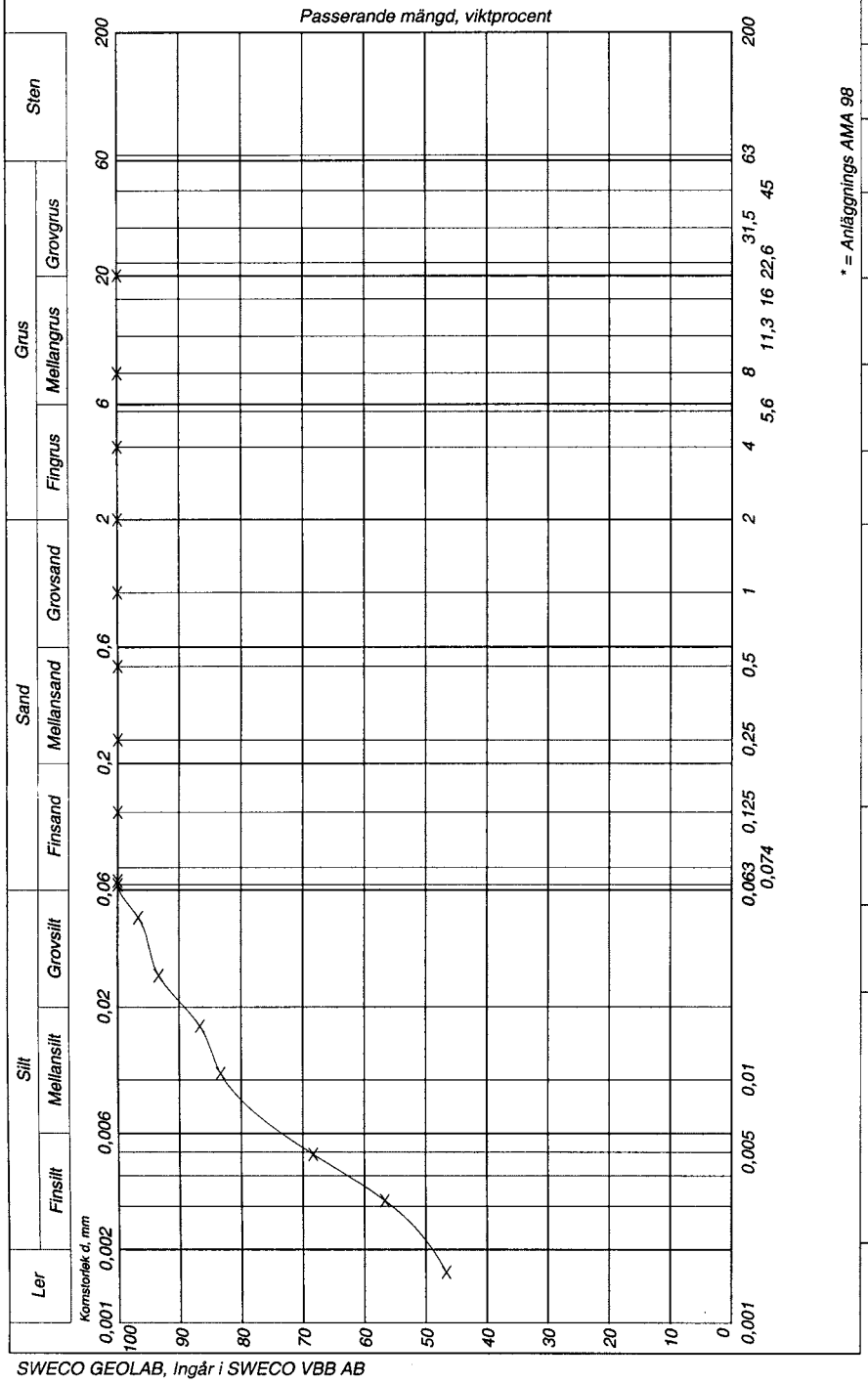

* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjälfarlighet	d10	d60	d90
PFM 004204-18 27926	—×—		2,30-2,45	Styv lera (SGU serie Ae)	0			4B/3*		0,004	0,021

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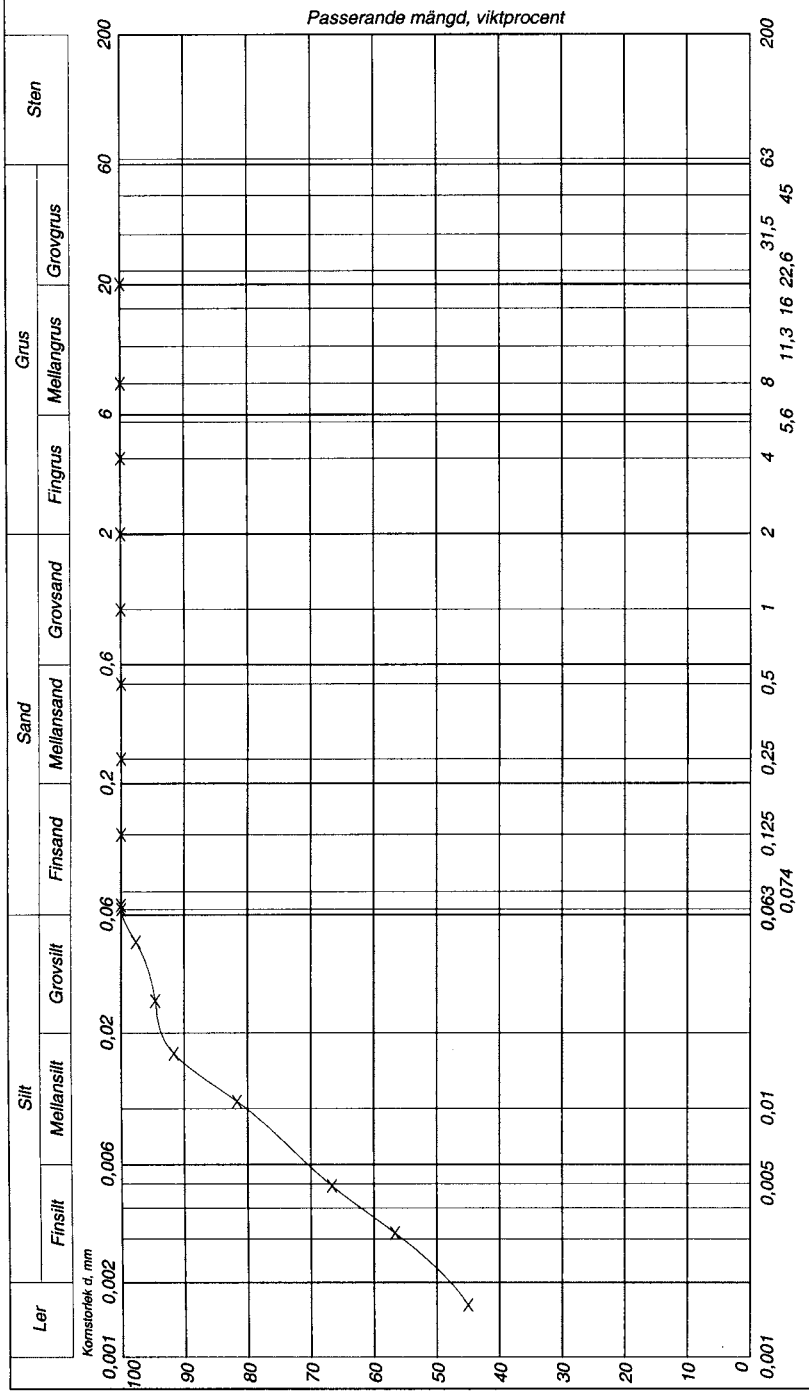

* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004204-20 27927	—×—		2,48-2,65	Styv lera (SGU serie Ae)	0			4B/3*		0,004	0,015

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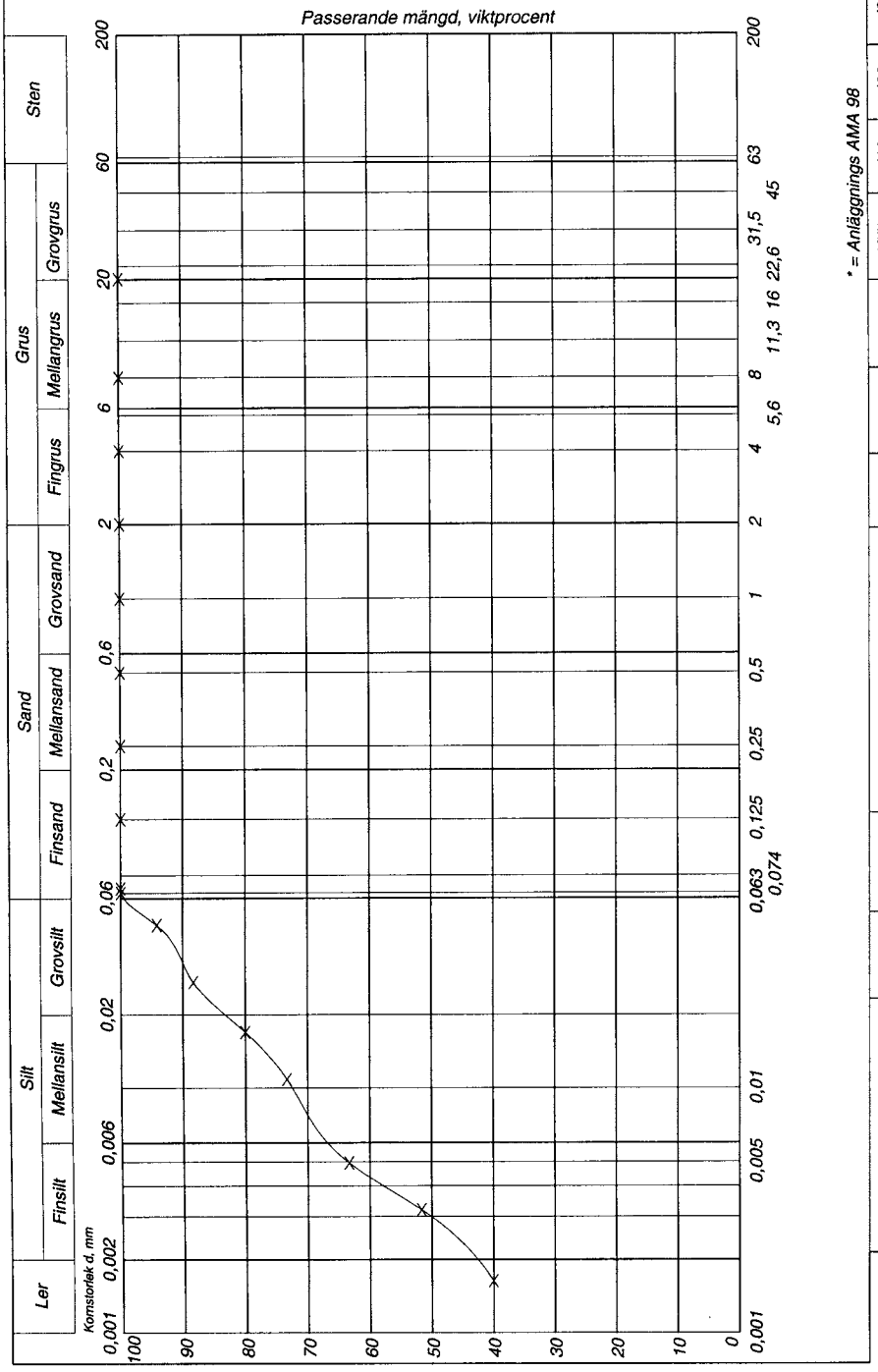

* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004204-22 27928	—×—		2,68-2,85	Styv lera (SGU serie Ae)	0			4B/3*		0,004	0,032

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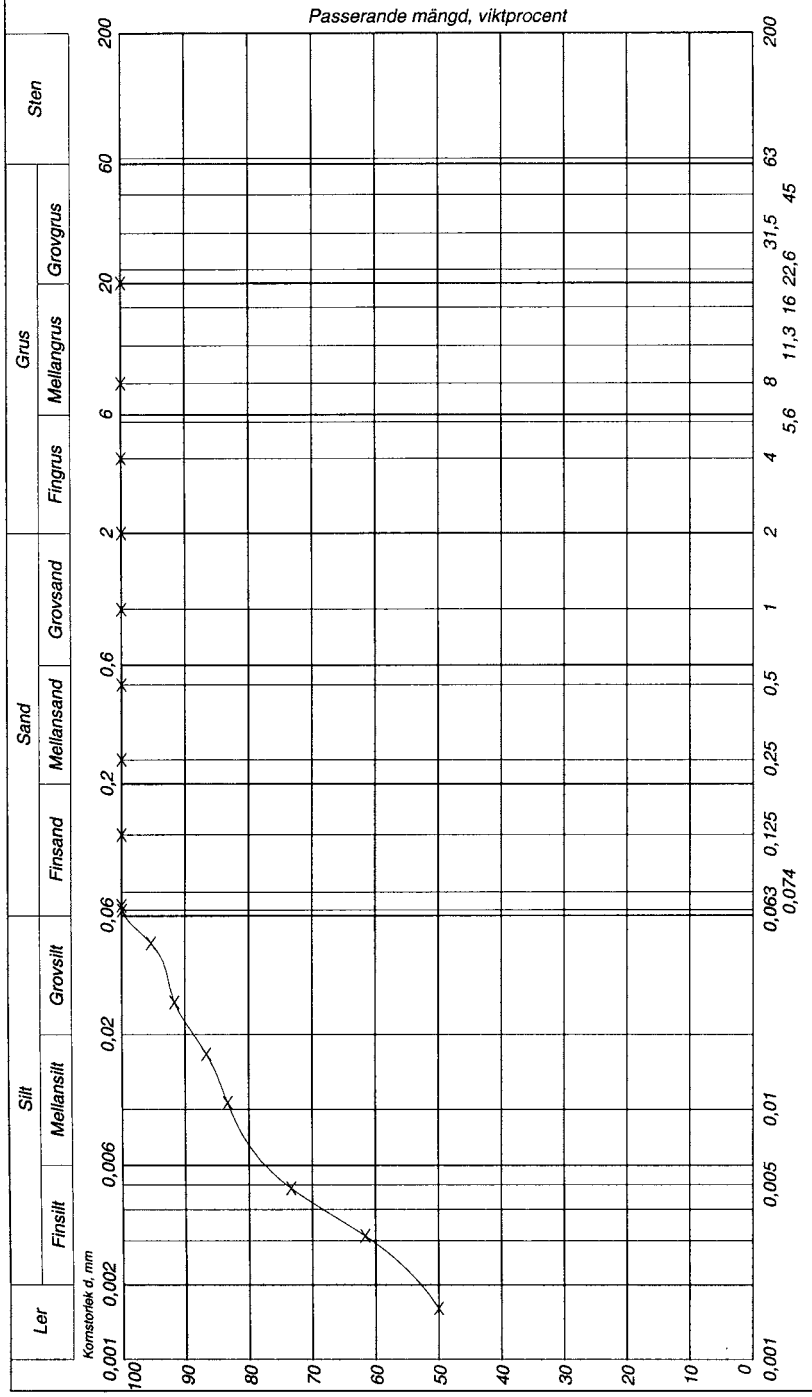

* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004204-24 27929	×		3,45-3,60	Styv lera (SGU serie Ae)	0			4B/3*		0,003	0,023

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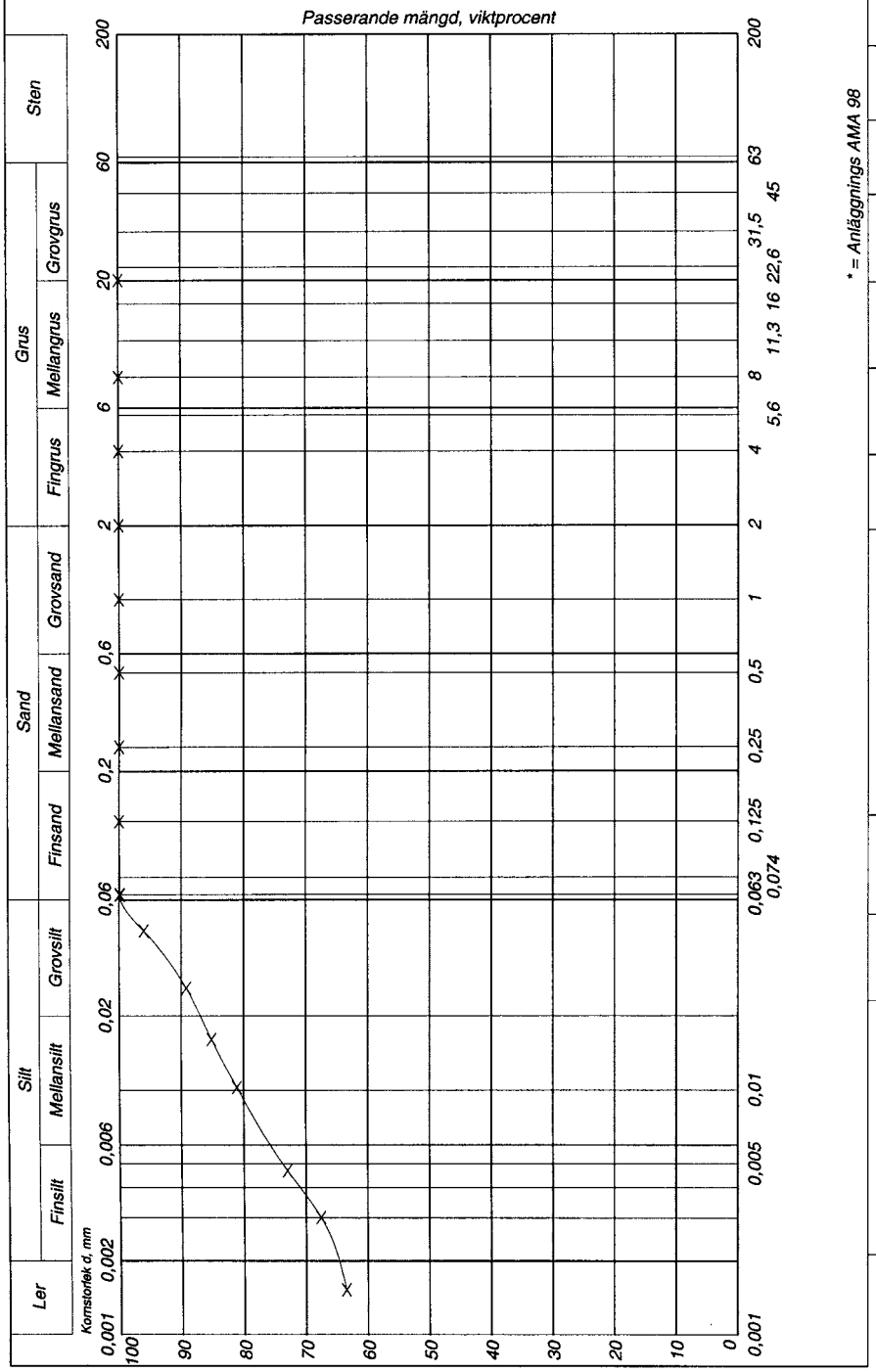

* = Anläggnings AMA 98

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PFM 004204-25 27930	—×—		4,20-4,35	Styv lera (SGU serie Ae)	0			4B/3*			0,028

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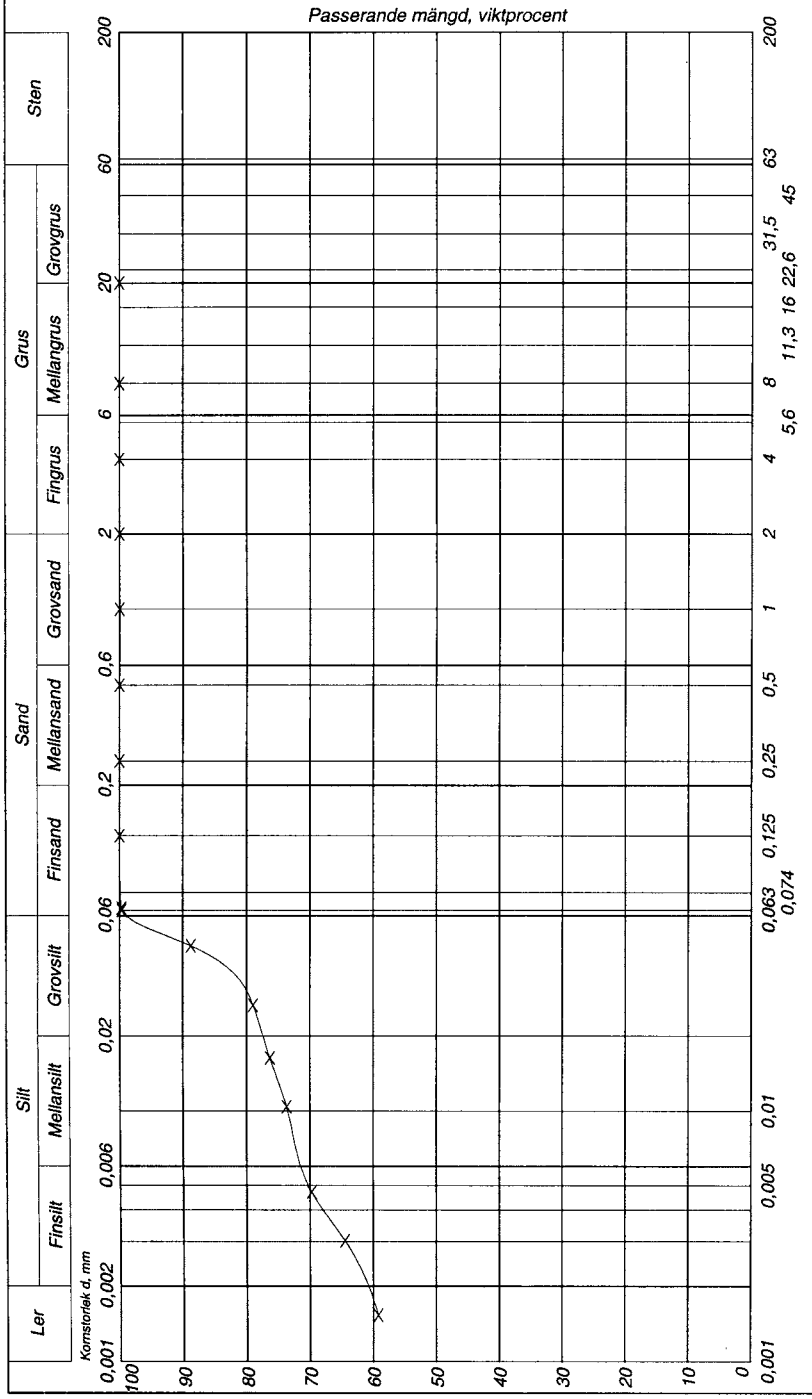

* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004204-26 27931	—×—		4,80-4,94	Styv lera (SGU serie Ae)	0			4B/3*		0,002	0,047

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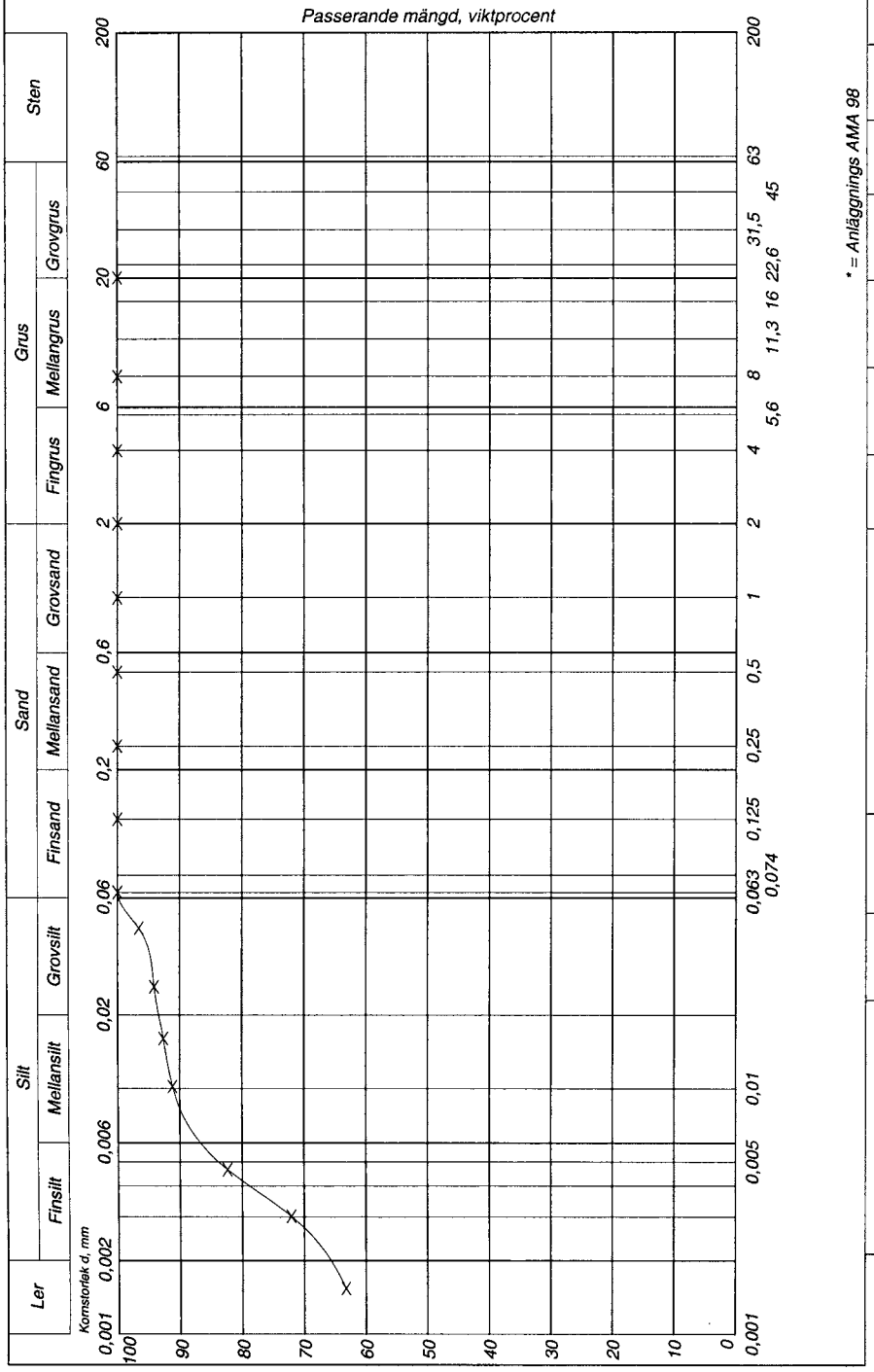

* = Anläggnings AMA 98

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PFM 004205-6 27941	—×—		1,27-1,37	Styv lera (SGU serie Ae)	0			4B/3*			0,009

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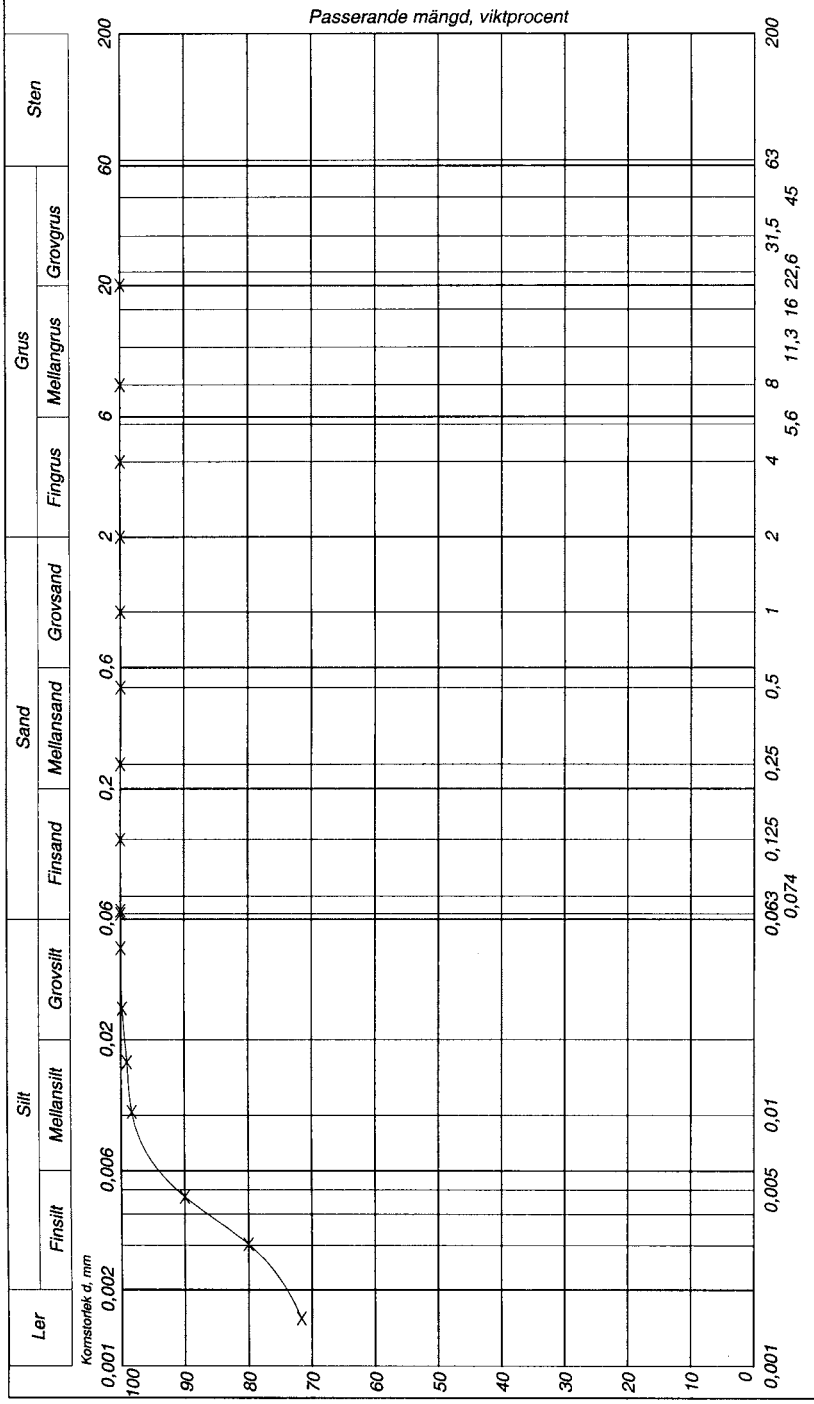

* = Anläggnings AMA 98

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PFM 004205-9 27943	—×—		1,65-1,81	Styv lera (SGU serie Ae)	0			4B/3*			0,005

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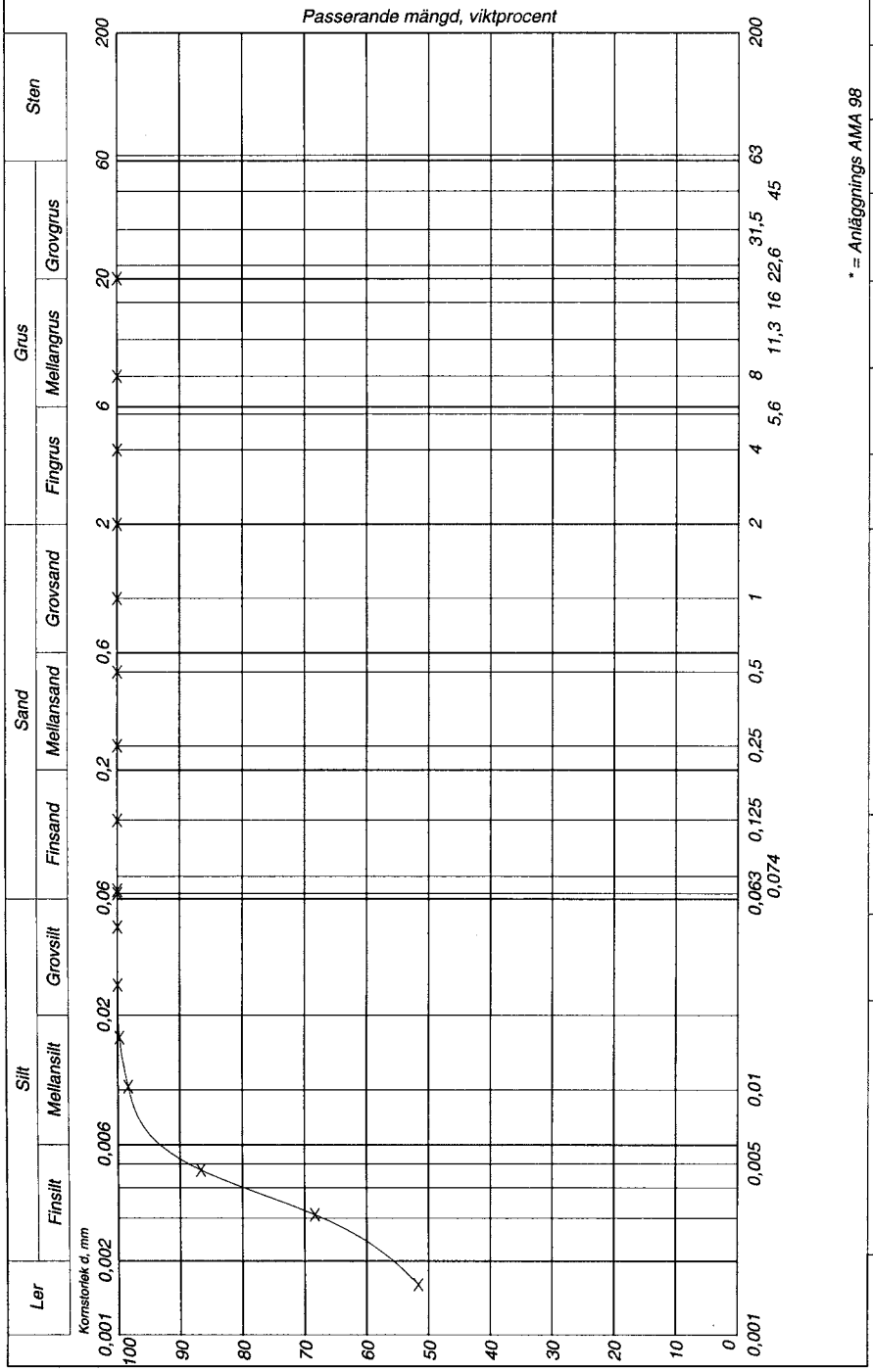

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PFM 004205-10 27944	—×—		1,70-1,81	Styv lera (SGU serie Ae)	0			4B/3*		0,002	0,006

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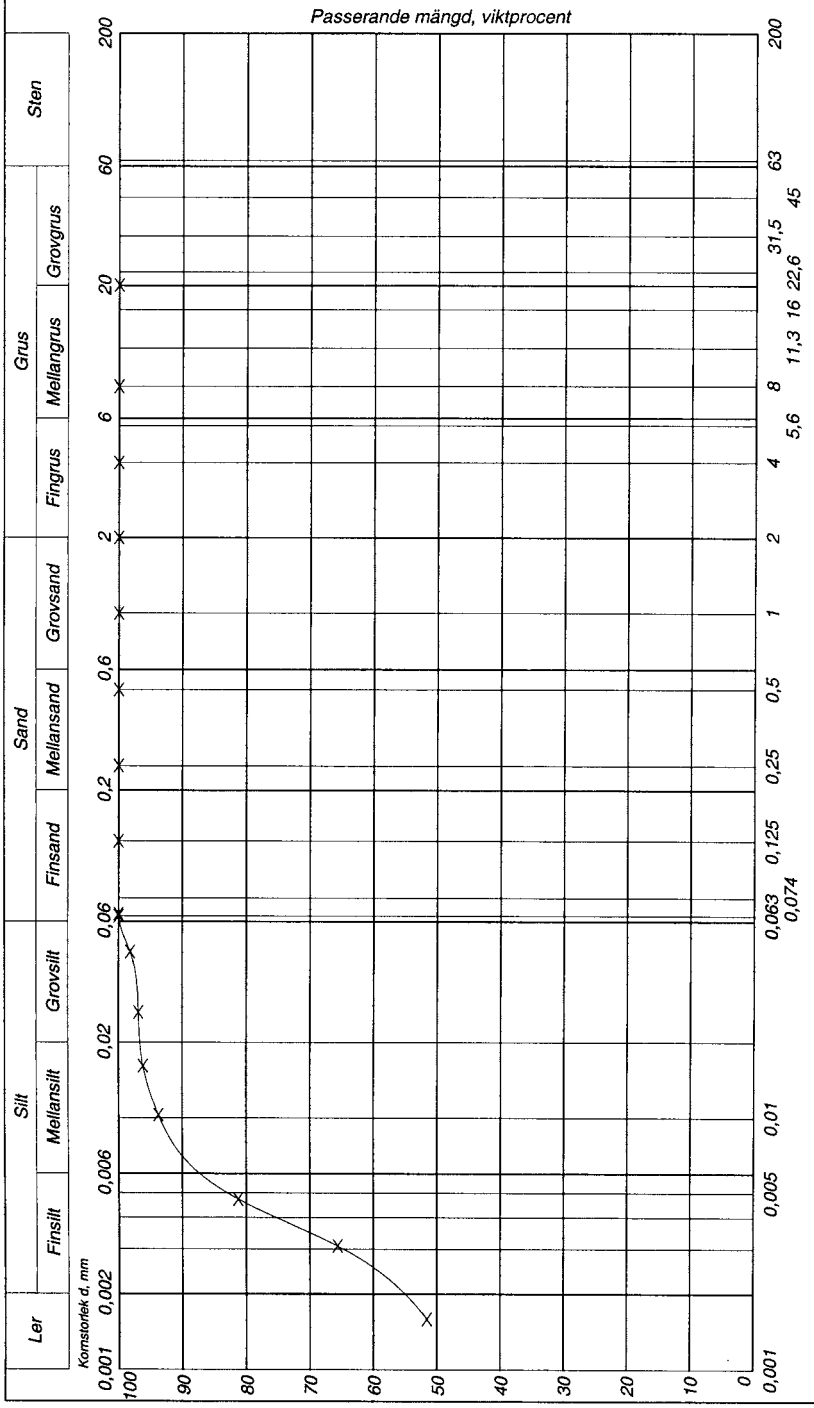

**= Anläggnings AMA 98*

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PFM 004205-11 27945	—×—		1,81-1,94	Styv lera (SGU serie Ae)	0			4B/3*		0,002	0,008

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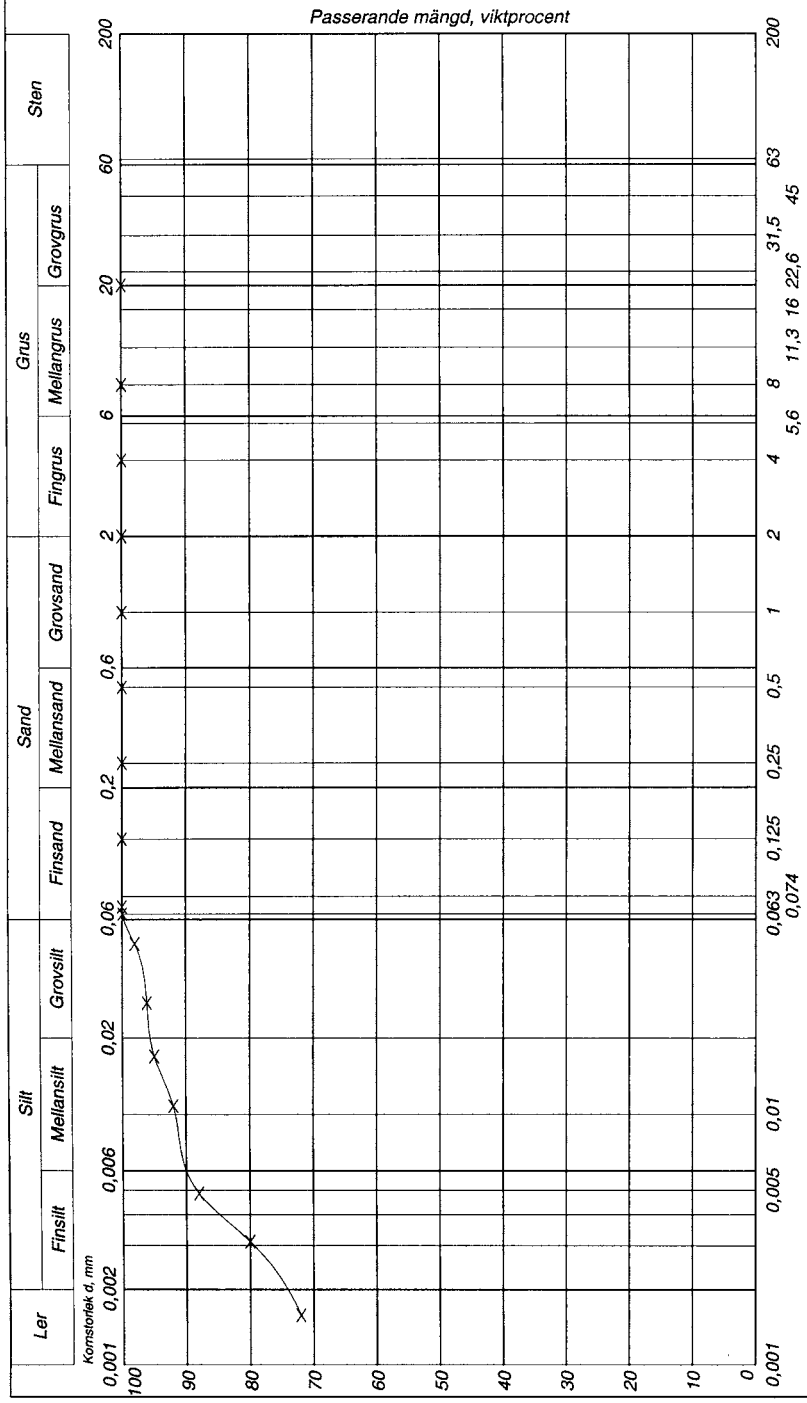
Projekt: **Prov nr 27926-27958**			*Datum:* 2003-04-11
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004205-12 27946	—×—		1,81-1,94	Styv lera (SGU serie Ae)	0			4B/3*			0,007

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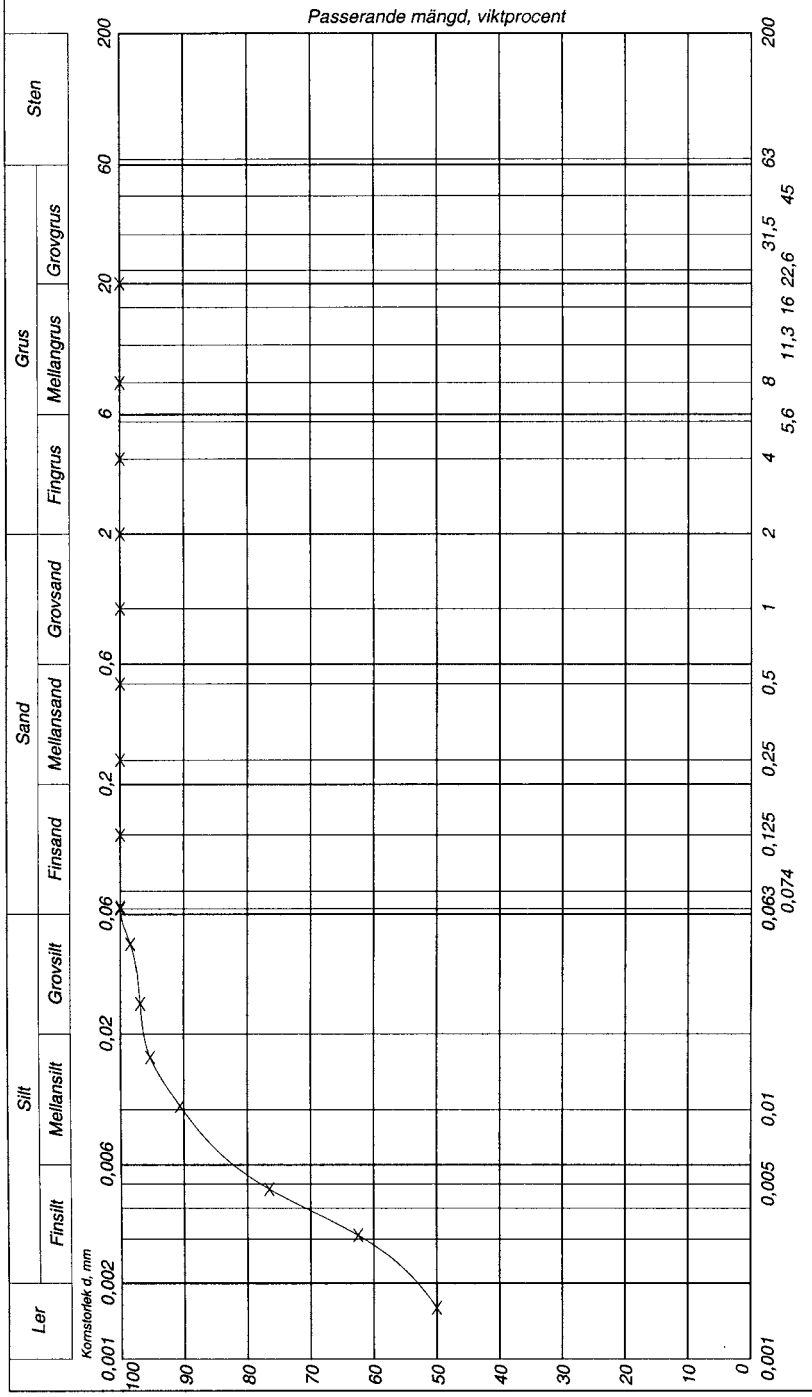
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004205-13 27947	—×—		1,94-2,00	Styv lera (SGU serie Ae)	0			4B/3*		0,003	0,01

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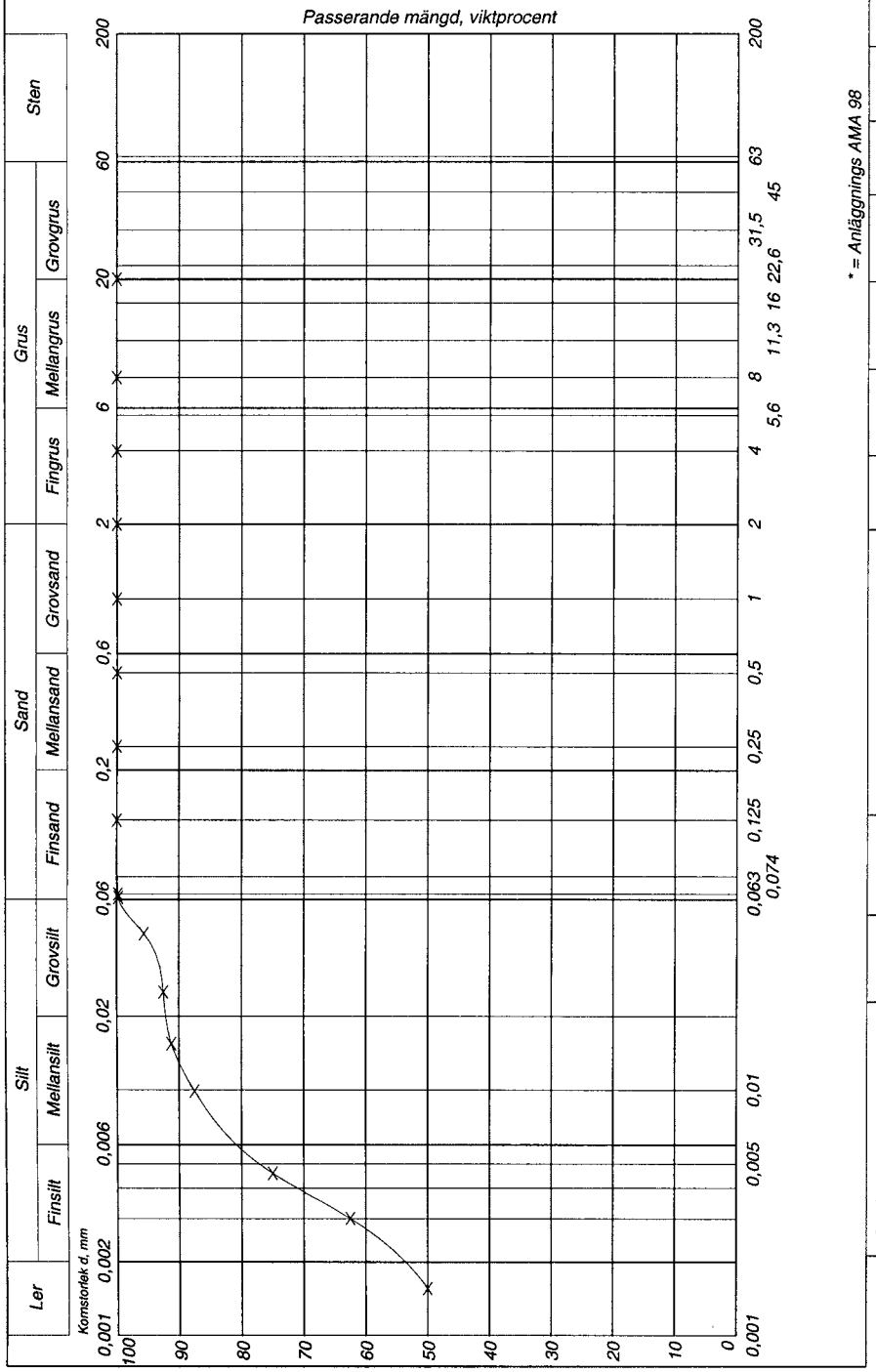
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004205-14 27948	—×—		2,00-2,14	Styv lera (SGU serie Ae)	0			4B/3*		0,003	0,013

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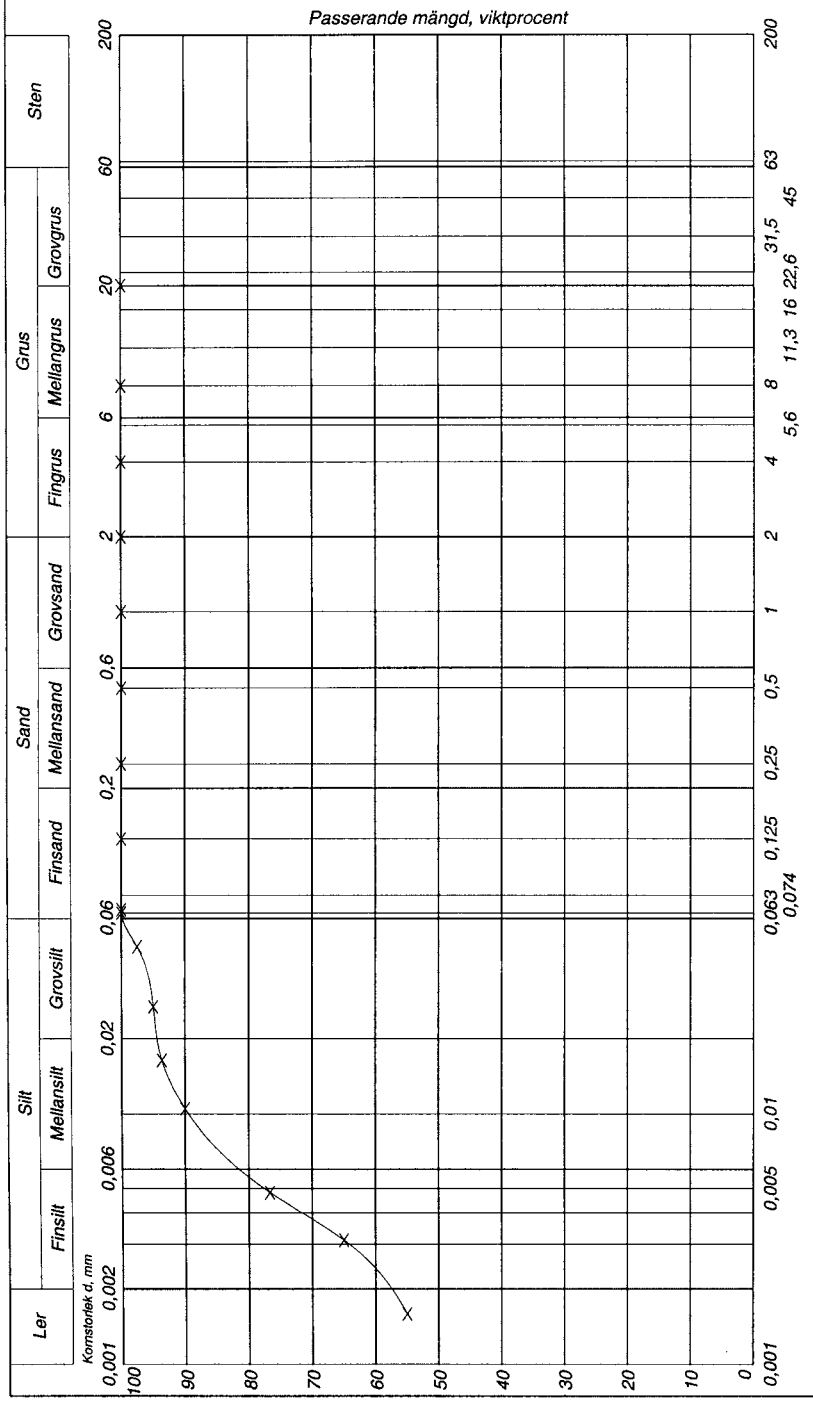
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004205-15 27949	—×—		2,14-2,27	Styv lera (SGU serie Ae)	0			4B/3*		0,002	0,01

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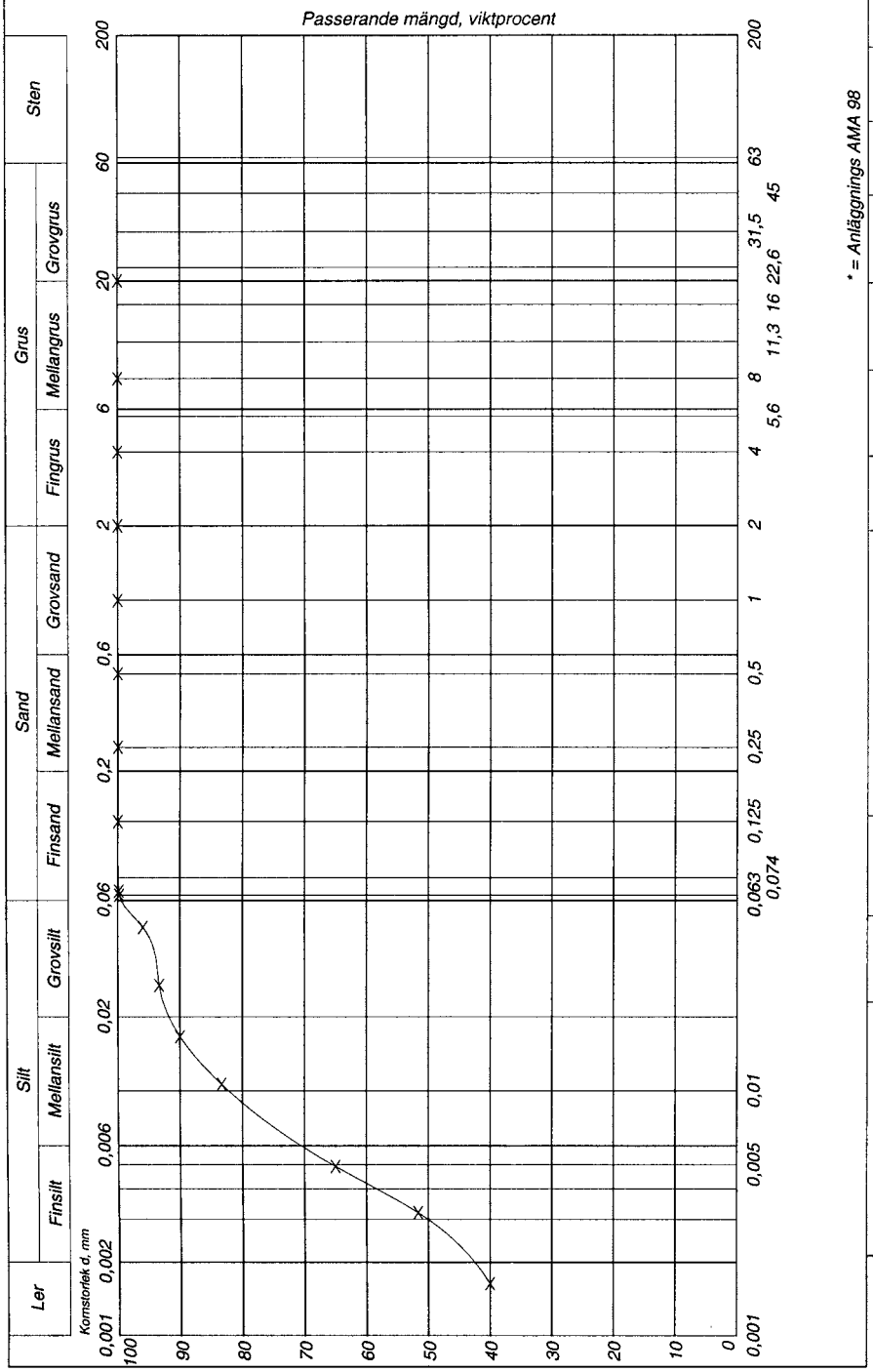
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004205-16 27950	—×—		2,14-2,27	Styv lera (SGU serie Ae)	0			4B/3*		0,004	0,017

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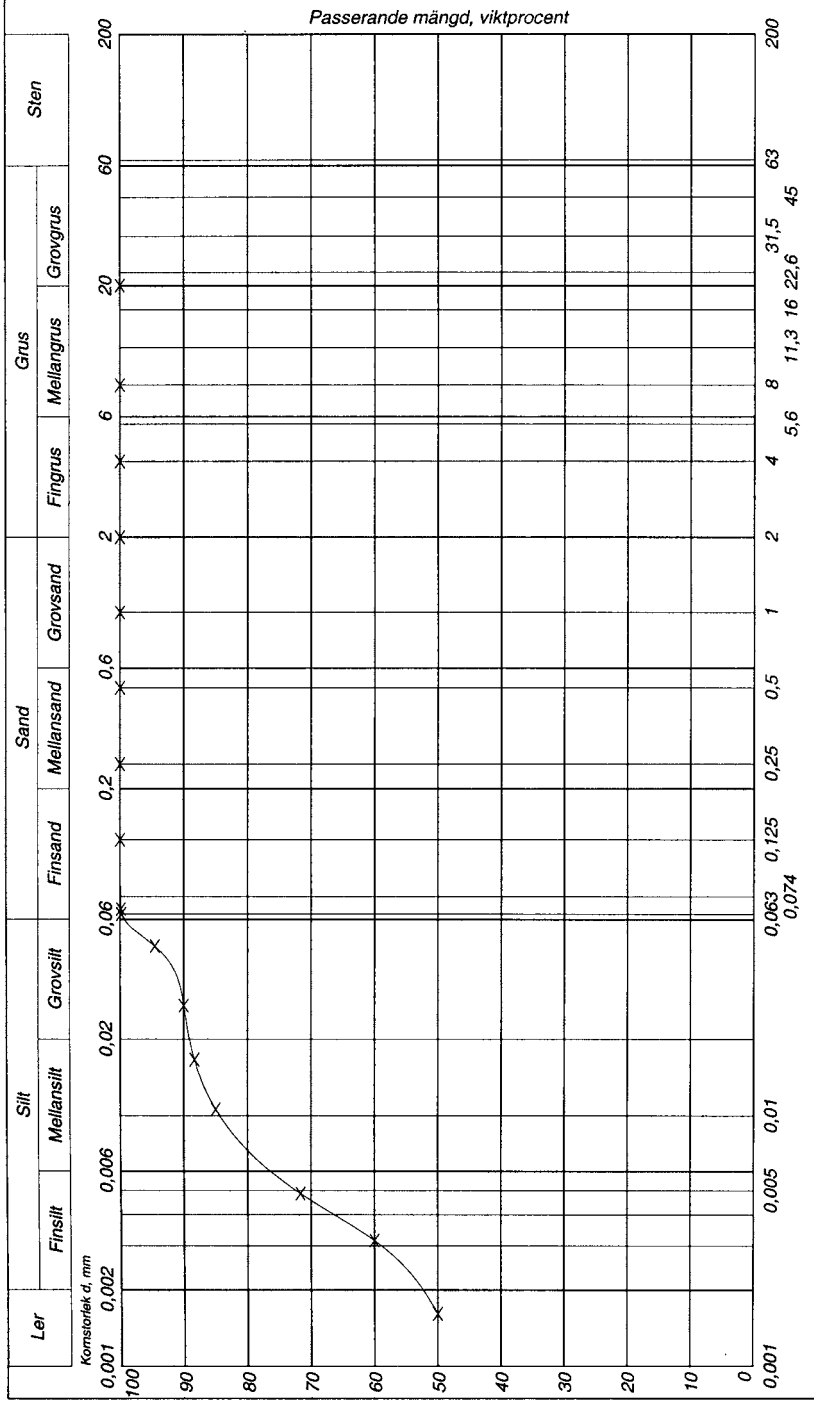
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004216-1 27937	—×—		3,62-3,79	Styv lera (SGU serie Ae)	0			4B/3*		0,003	0,027

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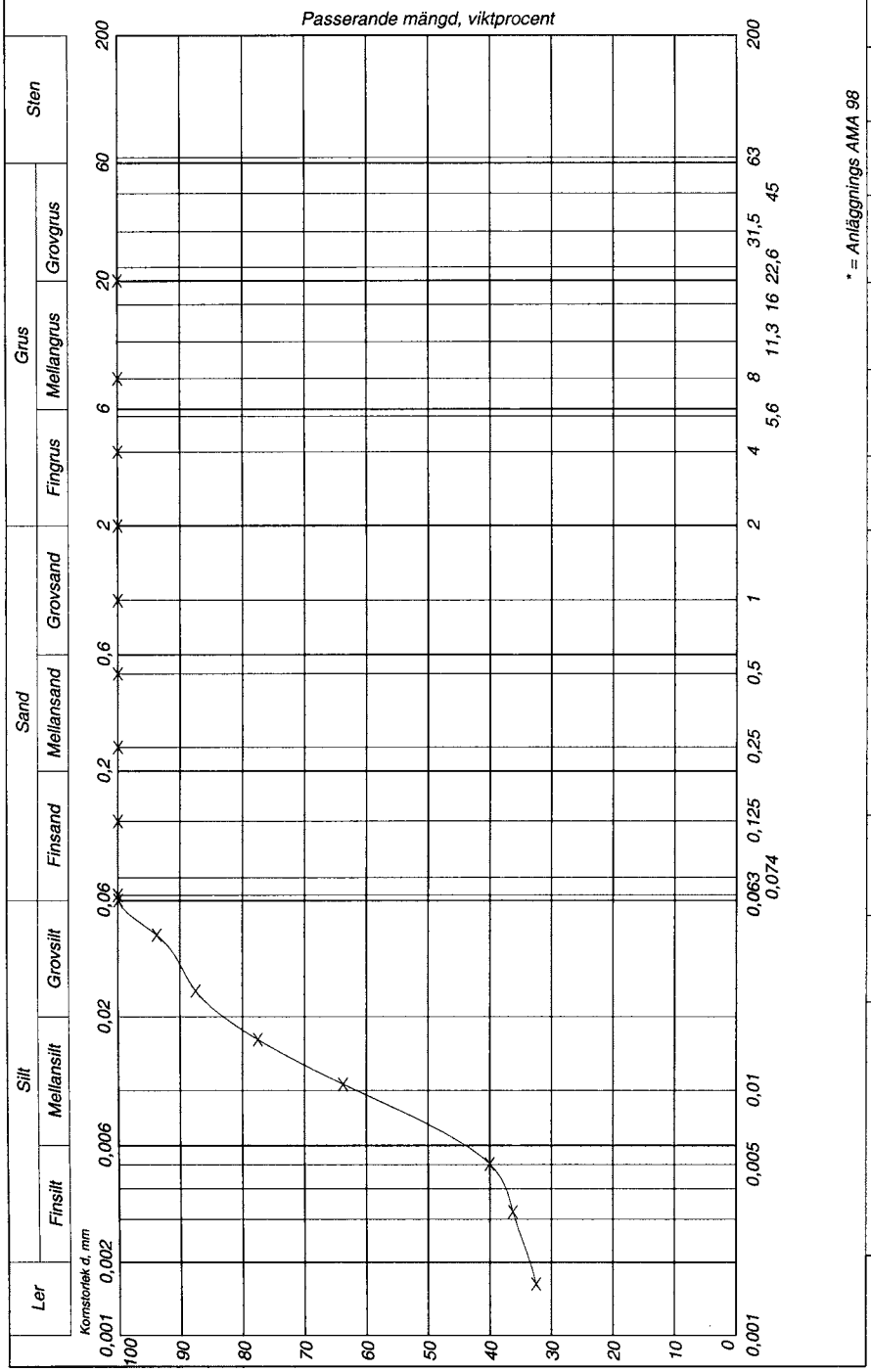
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004216-2 27938	—×—		4,00-4,10	Mellanlera (SGU serie Ae)	0			5A/4*		0,009	0,032

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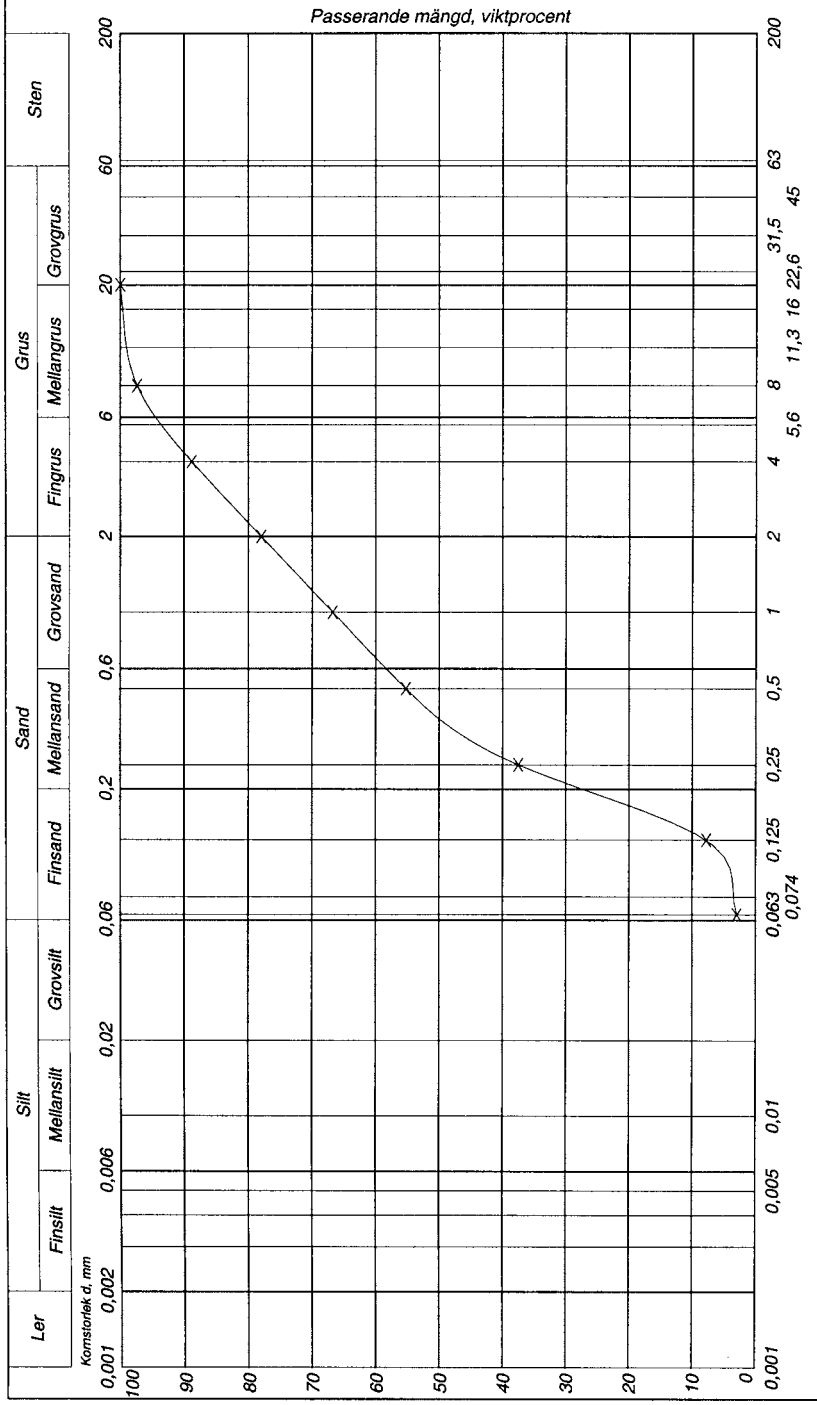
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004294-1 27956	—×—		-	Grusig sand (SGU serie Ae)	304			2/1*	0,132	0,665	4,403

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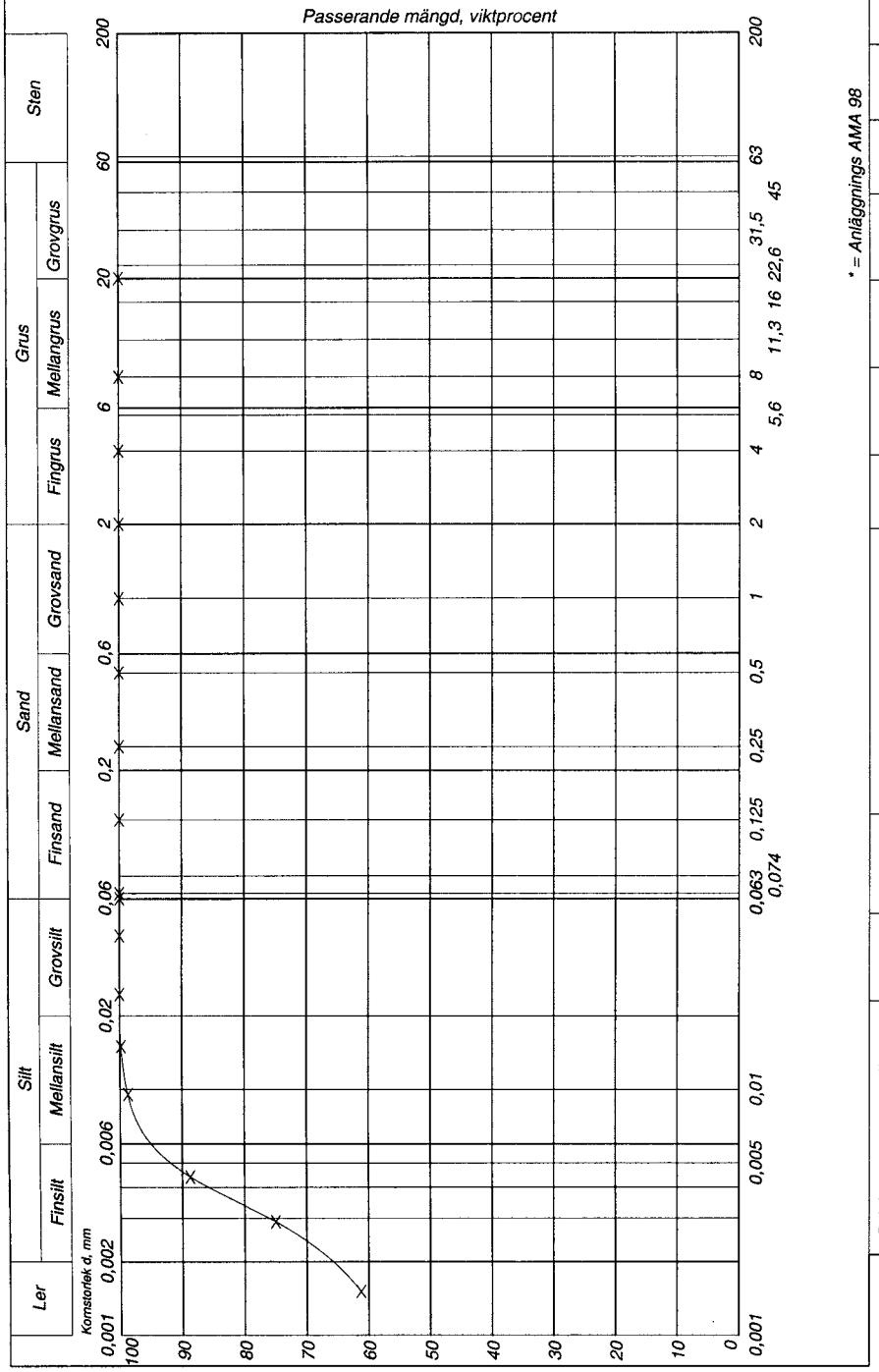
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



* = Anläggnings AMA 98

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004205-8 27942	—×—		1,50-1,65	Styv lera (SGU serie Ae)	0			4B/3*			0,005

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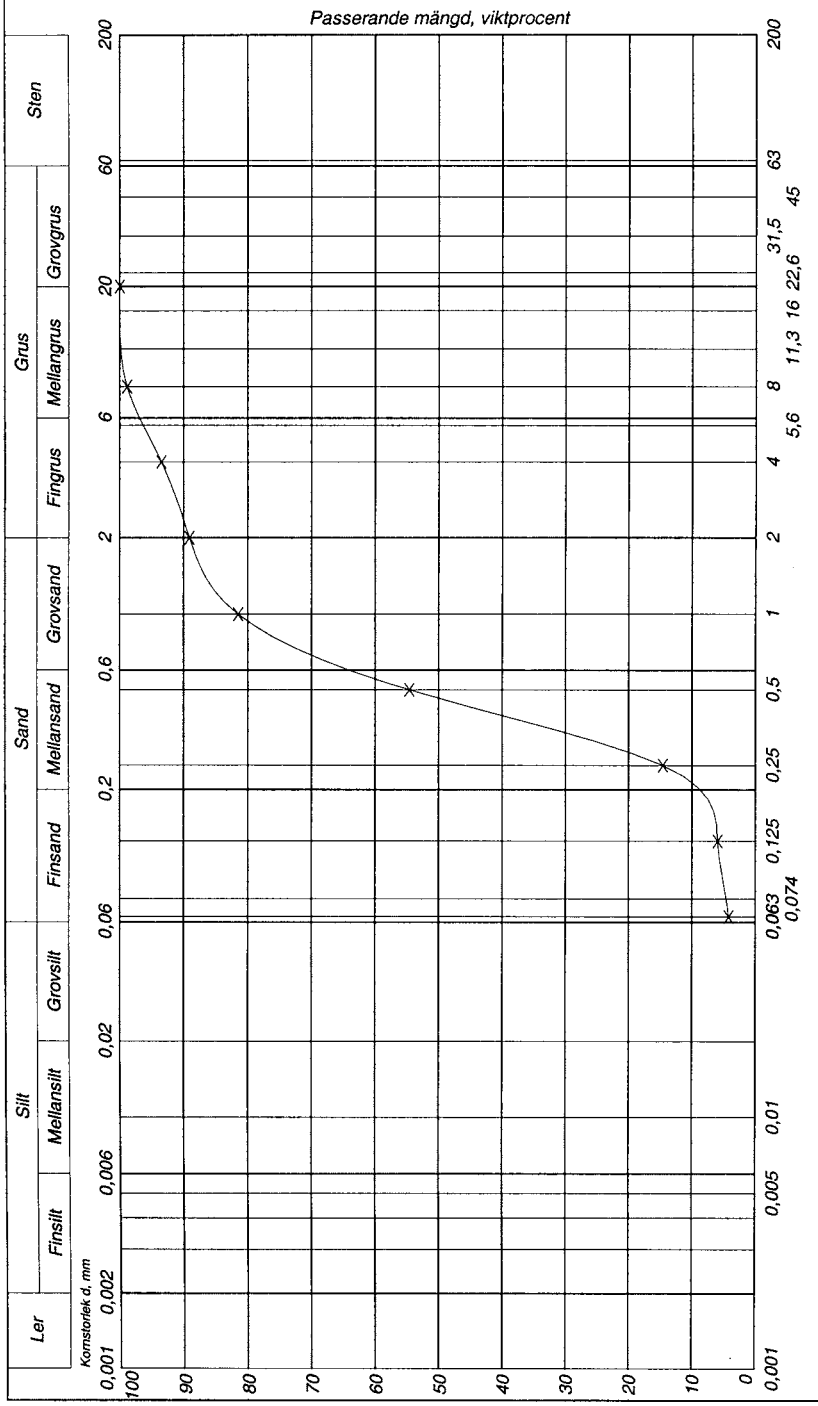
Uppdragsnr:	40066	*Provtagningsdatum:*	*Löp-nr:* 10800
Uppdragsgivare:	SGU, Uppsala		*Gransk./Sign:*



** = Anläggnings AMA 98*

Sektion Borrhål	Prov-beteckn.	Djup (m)	Gäller mellan (m)	Benämning	Siktat Prov (g)	Glödgn.-förlust %	Mtrl % > mm	Tjäl-farlighet	d10	d60	d90
PFM 004222-1 27957	—×—		1,80-2,00	Sand (SGU serie Ae)	119			2/1*	0,173	0,574	2,313

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Appendix 5

Results of CNS and CaCO3 analyses

Appendix 5. Results of the analyses of elemental CNS together with CaCO3 content.

Site	ID code	depth (m)	Quaternary deposit	C	N	S	CaCO3
Fiskarfjärden #25	FPM004204_1	1.1-1.13	algal gyttja	22.4	1.86	3.00	-
Fiskarfjärden #25	FPM004204_27	1.13-1.16	algal gyttja				0
Fiskarfjärden #25	FPM004204_2	1.2-1.22	algal gyttja	19.3	1.72	2.59	-
Fiskarfjärden #25	FPM004204_3	1.3-1.32	algal gyttja	16.7	1.64	2.26	-
Fiskarfjärden #25	PFM004204_28	1.32-1.36	algal gyttja				0.7
Fiskarfjärden #25	FPM004204_4	1.4-1.42	algal gyttja	15.7	1.53	2.11	-
Fiskarfjärden #25	FPM004204_5	1.5-1.52	algal gyttja	15.6	1.59	1.82	-
Fiskarfjärden #25	FPM004204_29	1.56-1.6	algal gyttja				0.4
Fiskarfjärden #25	FPM004204_6	1.6-1.62	algal gyttja	13.2	1.39	1.73	-
Fiskarfjärden #25	FPM004204_7	1.65-1.67	clay gyttja	5.94	0.66	2.17	-
Fiskarfjärden #25	FPM004204_30	1.67-1.7	clay gyttja				0.5
Fiskarfjärden #25	FPM004204_8	1.7-1.72	clay gyttja	5.5	0.65	1.17	-
Fiskarfjärden #25	FPM004204_9	1.75-1.77	clay gyttja	4.24	0.52	2.21	-
Fiskarfjärden #25	FPM004204_10	1.8-1.82	clay gyttja	4.1	0.51	2.59	-
Fiskarfjärden #25	FPM004204_11	1.85-1.87	clay gyttja	4.75	0.59	1.69	-
Fiskarfjärden #25	FPM004204_31	1.87-1.9	clay gyttja				0.6
Fiskarfjärden #25	FPM004204_12	1.9-1.92	clay gyttja	4.95	0.61	1.82	-
Fiskarfjärden #25	FPM004204_13	1.95-1.97	clay gyttja	4.59	0.57	1.68	-
Fiskarfjärden #25	FPM004204_14	2.0-2.04	clay gyttja	4.57	0.56	1.35	-
Fiskarfjärden #25	FPM004204_15	2.05-2.07	clay gyttja	4.84	0.59	2.04	-
Fiskarfjärden #25	FPM004204_16	2.1-2.12	clay gyttja	2.34	0.27	0.77	-
Fiskarfjärden #25	FPM004204_17	2.25-2.28	postglacial clay	1.07	0.12	0.79	-
Fiskarfjärden #25	FPM004204_18	2.3-2.45	postglacial clay				0.9
Fiskarfjärden #25	FPM004204_19	2.45-2.48	postglacial clay	1.16	0.13	1.59	-
Fiskarfjärden #25	FPM004204_20	2.48-2.65	postglacial clay				0.6
Fiskarfjärden #25	FPM004204_21	2.65-2.68	postglacial clay	1.2	0.13	0.65	-
Fiskarfjärden #25	FPM004204_22	2.68-2.85	postglacial clay				0
Fiskarfjärden #25	FPM004204_23	2.85-2.88	postglacial clay	1.33	0.15	1.52	-
Fiskarfjärden #25	FPM004204_24	3.45-3.6	postglacial clay				0.8

Fiskarfjärden #25	FPM004204_33	4.0-4.03	glacial clay	0.41	0.06	0,00	-
Fiskarfjärden #25	FPM004204_25	4.2-4.35	glacial clay				26
Fiskarfjärden #25	FPM004204_34	4.5-4.54	glacial clay	1.21	0.05	0,00	-
Fiskarfjärden #25	FPM004204_26	4.8-4.94	glacial clay				16
Lake # 5	FPM004205_1	0.4-0.45	algal gyttjaa	27.3	2.88	3.27	-
Lake # 5	FPM004205_2	0.5-0.55	algal gyttja	26.2	2.47	3.31	-
Lake # 5	FPM004205_3	0.6-0.65	algal gyttja	6.85	0.69	1.64	-
Lake # 5	FPM004205_4	0.70-0.75	algal gyttja	7.7	0.73	1.87	-
Lake # 5	FPM004205_5	0.80-0.85	clay gyttja	3.74	0.39	1.22	-
Lake # 5	FPM004205_6	1.27-1.37	glacial clay, distal varves				20
Lake # 5	FPM004205_8	1.50-1.65	glacial clay, 8 prox varv				26
Lake # 5	FPM004205_9	1.65-1.81	glacial clay, winter layers				14
Lake # 5	FPM004205_10	1.70-1.81	glacial clay, summer layers				29
Lake # 5	FPM004205_11	1.81-1.94	glacial clay, summer layers				33
Lake # 5	FPM004205_12	1.81-1.94	glacial clay, winter layers				14
Lake # 5	FPM004205_13	1.94-2.0	glacial clay, 4 varves				26
Lake # 5	FPM004205_14	2.0-2.14	glacial clay, 7 varves				28
Lake # 5	FPM004205_15	2.14-2.27	glacial clay, 6 summer layers				22
Lake # 5	FPM004205_16	2.14-2.27	glacial clay, 6 winter layers				38
Bredviken # 7	PFM004216_1	3.62-3.79	glacial clay				33
Bredviken # 7	PFM004216_2	4.0-4.1	glacial clay, bottom slayer				35
Puttan # 15	FPM004280_1	0.85-0.9	algal gyttja	25.7	2.55	2.01	-
Puttan # 15	FPM004280_2	0.9-0.95	algal gyttja	20.6	1.86	2.05	-
Puttan # 15	FPM004280_3	1.0-1.03	algal gyttja	13.7	1.27	1.7	-
Puttan # 15	FPM004280_22	1.03-1.1	algal gyttja				0.9
Puttan # 15	FPM004280_4	1.10-1.13	algal gyttja	12.8	1.21	1.72	-
Puttan # 15	FPM004280_5	1.20-1.23	algal gyttja	11.97	1.13	1.59	-
Puttan # 15	FPM004280_6	1.30-1.33	algal gyttja	11.8	1.14	1.47	-
Puttan # 15	FPM004280_23	1.33-1.4	algal gyttja				0.8
Puttan # 15	FPM004280_7	1.4-1.45	algal gyttja	12.2	1.16	1.57	-
Puttan # 15	FPM004280_8	1.5-1.55	algal gyttja	13,0	1.21	1.54	-
Puttan # 15	FPM004280_24	1.55-1.6	algal gyttja				0.6
Puttan # 15	FPM004280_9	1.6-1.65	algal gyttja	12.3	1.18	1.49	-
Puttan # 15	FPM004280_10	1.7-1.75	algal gyttja	8.25	0.83	1.42	-
Puttan # 15	FPM004280_25	1.75-1.8	algal gyttja				0.1
Puttan # 15	FPM004280_11	1.8-1.85	algal gyttja	8.78	0.8	1.59	-
Puttan # 15	FPM004280_12	1.9-1.95	algal gyttja	8.31	0.78	1.47	-
Puttan # 15	FPM004280_13	2.0-2.05	algal gyttja	8.69	0.8	1.6	-
Puttan # 15	PFM004280_26	2.05-2.12	algal gyttja				0.3

Puttan # 15	FPM004280_14	2.12-2.15	algal gyttja	6.91	0.75	1.49	-
Puttan # 15	FPM004280_15	2.22-2.27	algal gyttja	8.34	0.85	1.5	-
Puttan # 15	FPM004280_16	2.27-2.30	algal gyttja	7.99	0.82	1.54	-
Puttan # 15	FPM004280_17	2.3-2.33	algal gyttja	8.03	0.83	1.49	-
Puttan # 15	FPM004280_18	2.33-2.36	clay gyttja	5.85	0.72	1.29	-
Puttan # 15	FPM004280_19	2.36-2.39	clay gyttja	5.51	0.69	1.37	-
Puttan # 15	FPM004280_20	2.4-2.45	sand	1.06	0.12	0.45	-
Puttan # 15	FPM004280_21	2.45-2.5	sand	0.45	0.05	0.27	-
Stocksjön # 14	PFM004284_1	0.87-0.92	calcareous gyttja				63
Stocksjön # 14	PFM004284_2	0.92-0.94	calcareous gyttja				57

Appendix 6

Samples kept in cold storage

Appendix 6. The following samples are kept in cold storage at the Geological survey of Sweden, Uppsala.

PFM004280	PFM004204	PFM004205	PFM004298
0.95–1	1–1.1	0.95–1.10	2.4–3.3
1.03–1.1	1.13–1.16	1.15–1.95	2.74–3.74
1.13–1.2	1.16–1.2		3.39–4.39
1.25–1.3	1.22–1.26		
1.33–1.4	1.26–1.3		
1.45–1.5	1.32–1.36		
1.52—1.6	1.36–1.4		
1.55–1.6	1.42–1.46		
1.6–1.65	1.46–1.5		
1.65–1.7	1.56–1.6		
1.65–1.7	1.52–1.56		
1.7–1.75	1.62–1.65		
1.75–1.8	1.67–1.7		
1.85–1.9	1.72–1.75		
1.95–1.98	1.77–1.8		
2.05–2.12	1.82–1.85		
2.15–2.2	1.87–1.9		
	1.92–1.95		