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Forsmark site investigation

Peatland investigation Forsmark

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May 2004

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Abstract

In connection with the site investigations at Forsmark two small peatlands have been investigated, Stenrösmosen and a peatland 500 m west of Lersättersmyran. The two mires were systematically cored along baselines systems, and the peat and the peatlands were classified and sampled. The individual peat samples were analysed on ash- and water content. General (composite) samples representing each metre of the peat layers were analysed on trace- and main elements including sulphur.

Both mires are very shallow young fens with bottom layers of gyttja and light yellow low humified *Phragmites* peat followed by medium to well humified wood-*Carex* peat and *Carex* peat. In both fens there are small areas that could rather be characterised as pine bogs, the peat layers are here dominated by low humified *Sphagnum* peat mixed with brown mosses, especially in the lower layers.

The mires are both very shallow; the depth of Stenrösmossen does rarely exceed more than one metre and the depth of the other mire is almost the same. One exeption is the pine bog area within the peatland west of Lersättersmyran, where a maximum depth of around three metres was measured.

Chemically Stenrösmossen is clearly influenced by the calcareous mineral soils and groundwater from the surroundings. The calcium oxide content in ash from a general (composite) sample is c 45%. The other mire west of Lersättersmyran has for areas with soils dominated by Precambrian rocks, a more normal value of c 15%. Concentrations of trace elements in both mires are normal except for lead and zinc, which are above average for Swedish mires. The uranium content is normal, and there are no reasons to assume any enrichment of radioactive substances related to natural uranium in the mires. Sulphur content is higher than normal in Stenrösmossen, which often is the case in this type of fens along the Baltic coastline.

Considering the peat types and the demands of the modern peat industry, a future use of the peat in Stenrösmossen as raw material for fuel production is not likely, this is due to its high ash and sulphur contents. Furthermore both the thickness of the peat layers and the peatland area are too small.

Stenrösmossen is on the other hand well suited for agricultural use, both with respect to its nutrient content and to its soil structure. One drawback is that it is underlain by till instead of clay or sand.

Conditions are similar for the mire west of Lersättersmyran except that the nutrient content in the dominating peat layers generally is lower. Of both mires it is possibly the southern part of this mire west of Lersättersmyran that is best-suited for agriculture, mainly because that the peat here is underlain by sand. Both mires are well suited for forestry.

The future development of these two mires (considering that no ditching will take place) will probably be characterised by the enhanced influence of rainwater and reduced influence from nutrient rich groundwater. This means that the fen vegetation will be replaced by less-nutrient demanding mosses and the fens will develop into more ombrotrophic bogs.

Sammanfattning

I samband med platsundersökningarna i Forsmark har på uppdrag av Svensk Kärnbränslehantering två mindre torvmarker, Stenrösmosen samt en torvmark 500 m väster Lersättersmyran undersökts enligt Metodbeskrivning för torvmarksundersökning (SKB MD 131.002) version 1.0, samt Miniaktivitetsplan (AP PF 400-03-62).

Stenrösmossen är till övervägande delen ett plant ca 1 m djupt topogent kärr bildat genom igenväxning av en havsvik efter avsnörning och uppgrundning i samband med landhöjningen. Norra, västra och den södra delen är skogbeklädd. De öppna delarna karakteriseras av starr ofta med ett bottenskikt av brunmossor, enstaka tuvor av näringskrävande vitmossor, skvattram, pors, ljung, kråkris, i sydväst även av örter, blåbär, lingon och ormbunke. Huvuddelen av detta kärr är påverkat av fastmarksvatten. Mitt i torvmarken mot väster finns ett område som bäst kan karakteriseras som en tallmosse.

Lagerföljden karakteriseras från botten av ganska tunna lager av gyttja eller lergyttja avlagrad på morän. Över dessa lager ligger vanligen ett tunnare lager med ren eller fräkeninblandad låghumifierad ljusgul vasstorv. I övrigt består torvlagren av måttligt till höghumifierad skogskärrtorv, starrtorv och starrmosstorv, dvs torvslagen motsvarar i hög utsträckning den nuvarande växtligheten på torvmarken, beaktat att vissa av de kraftigare beskogade delarna främst i norr, genom oxidering och uttorkning, fått en högre humifieringsgrad än övriga lager. I några öppna partier av torvmarken förekommer även 0,5 till 1 meter med låghumifierad starrtorv.

Torvmarken 500 m väster om Lersättermyran är också till sin övervägande del ett kärr av en grund typ som är vanlig i denna omgivning och som i dag oftast är skogsklädda och i vart fall många gånger i denna trakt har varit odlade. I den norra delen av detta kärr finns dock ett område som kan karakteriseras som en tallmosse även om här tillsammans med skvattram och vitmossor kan iakttas både blåbär och lingon samt skogsmossor av vilka de senare inte skall finnas på en renodlad mosse. Södra delen av detta kärr är kraftigt dikat och numera kalhugget. Huvuddelen av torvmarken underlagras av gyttja på morän utom i den södra delen där gyttjan eller lergyttjan ligger på sand. Torvslagen består av medel- till höghumifierad skogskärrtorv eller starrbrunmosstorv. Undantaget är den norra tallmossedelen där det, utom ett tunt av oxidering påverkat ytskikt av kärrtorv, finns 1 till 2 m låghumifierad vitmosstorv underlagrad av starrtorv och starrbrunmosstorv.

Stenrösmossen är tydligt påverkad av sin omgivning av kalkhaltiga jordlager. Spårelementen i de båda torvmarkerna visar normala värden med undantag för zink. I torvmarken 500 m väster Lersättermyran är även blyhalten i den översta metern anmärkningsvärt hög. Uranhalten i Stenrösmossen ligger inom den övre delen av det intervall som brukar vara normalt i denna typ av torvmark. Någon onormal förhöjning av naturliga radioaktiva ämnen kopplade till uran i berggrund eller i mineraljord är inte trolig.

Svavelhalten i Stenrösmossen är högre än motsvarande svenska medelvärden, vilket dock är normalt hos igenväxningstorvmarker lokaliserade vid Östersjöns kustområden. Dessa förhöjda svavelhalter anses bero på att reducerande miljö och havsvattnets salthalt gett förutsättningar för reduktion av sulfatsvavel ur vattnet.

Askhalterna är efter svenska förhållanden i stort sett normala. I kärrtorvslagen i Stenrösmossen varierar de mellan 7 och 10 %, vilket är något högre än normalt i motsvarande kärrtorvslag från andra delar av landet. Inom det område som karakteriseras som tallmosse är de dock lägre och varierar mellan 2,5 till 3,5 %. I torvmarken 500 m väster Lersättermyran återfinns låga och för låghumifierad vitmosstorv typiska askhalter på mellan 1 och 2 %. På övriga borrpunkter i denna torvmark är askhalterna normala för myrtypen. En viss förhöjning kan dock iakttas i den södra kraftigt dikningspåverkade delen av torvmarken.

Vattenhalten i torven visar även den typiska mönster dvs mellan 90 och 93 %, undantaget några blötare partier av torvmarkerna. Torrare partier finns främst i torvmarkernas kantpartier samt i skogsklädda och eller dikade delar.

Utgående från befintliga torvslag och nutida krav, bedöms framtida användning av torven i Stenrösmossen till bränsle som mindre trolig. Både svavelhalt och askhalt är olämpligt höga. Vidare är både mäktighet och utbredning av torvmarken för liten. Den framtida tillväxten av torvmarken, förutsatt att ingen ytterligare dikning sker, går också förmodligen mot en ökad försörjning med nederbördsvatten och med en mindre andel av näringsrikt fastmarksvatten. Detta innebär att torvmarkens vegetation kommer att utvecklas mot ett mossesamhälle, vilket betyder att nybildnigen av torv sker genom att det nuvarande kärrsamhället ersätts av mindre näringskrävande *Sphagnum* arter. Den då bildade oftast låghumifierade *Sphagnum* torven är i sig olämplig som bränsleråvara. Läget i den relativt småkuperade terrängen innebär också att någon mer betydande framtida utbredning i horisontaled knappast är trolig, dvs försumpning av den omgivande moränmarken och horisontell tillväxt kommer knappast att ske.

Till odlingsjord är torvslagen i Stenrösmossen väl lämpade, både avseende näringsinnehåll och struktur. Däremot är torvmarkens moränbotten olämplig. För att denna typ av torvmark skall vara lämplig för jordbruk krävs vanligen att torven underlagras av lera. Detta beror på att bortodlingen av den organiska substansen relativt snart gör att man kommer ner i den icke odlingsdugliga moränjorden. Vid normalt jordbruk försvinner i storleksordning en centimeter per år av torvjord.

I huvudsak liknande förhållanden gäller för torvmarken 500 m väster Lersättermyran, utom att denna torvmark generellt är näringsfattigare. Möjligen är den södra delen av denna torvmark som underlagras av sand, den del av dessa båda torvmarker som är mest lämpad för odling.

Contents

1 Introduction

This document reports the results gained by the "Peatland investigation Forsmark", which is one of the activities performed within the site investigation at Forsmark. The work was carried out in accordance with activity plan AP PF 400-03-62. In Table 1-1 controlling documents for performing this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents. Data references are in Table 1-2. Figure 1-1 is an overview over the Forsmark site investigation area and the localisation of the investigated peatlands.

The planning and the fieldwork was done in late autum 2003 by the author and an assistant (Joachim Albrecht), both from the Geological Survey of Sweden (SGU). The report was written in spring 2004. The chemical analysis were performed during the winter 2004 by Analytica AB and by the author at the soil laboratory at SGU.

The final positioning of the sampling points was carried out by GEOCON AB and the construction of the maps over the sampling points by SWECO in spring 2004.

The investigation, which is a part of the characterization of Quaternary deposits within the site investigations at Forsmark, consists of corings, peat classifications and chemical analysis. The peat classifications were done according to the system used at SGU. Chemical analysis and choice of coring and sampling points were executed after the same principles that are used in investigations of peatlands aimed for industrial use.

Table 1-1. Controlling documents for the performance of the activity.

Activity plan	Number	Version
Mini AP Torvmarksundersökningar	AP PF 400-03-62	1.0
Method descriptions	**Number**	**Version**
Metodbeskrivning för torvmarksundersökning	SKB MD 131.002	1.0

Table 1-2. Data references.

Subactivity	Database	Identity number
Protocol for peatland investigation, stratigraphical descritpions, chemical analysis, water and ahs content	SICADA	Field note no 326

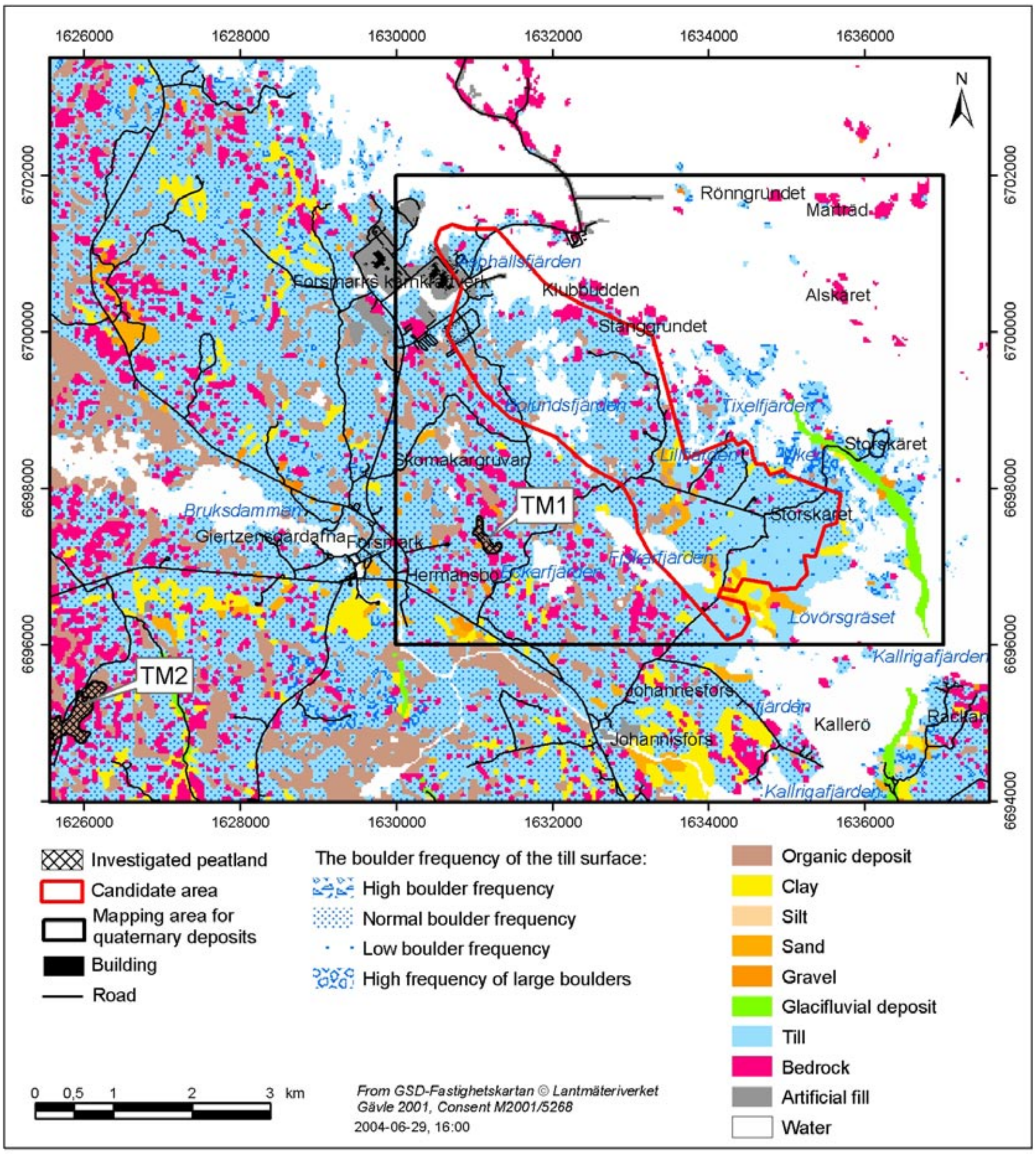

Figure 1-1. General overview over the Quaternary deposits at the Forsmark site investigation area and the localisation of the investigated peatlands.The two investigated peatlands are located at TM 1 (Stenrösmossen) and TM 2 (500 m west of Lersättersmyran).

2 Objective and scope

The investigation has several objectives and scopes. One is to gain knowledge about the earlier development of the landscape and the peatlands and thus to get a better understanding of the future development and changes of the landscape. The different peat layers that build up a peatland have normally been preserved for many thousands of years and represent an historic archive for the vegetation and climatic development of the landscape. The understanding of the development of the peatlands also contributes to the knowledge about groundwater chemistry and present and future hydrogeological changes in the landscape.

Another objective with the investigations is not only to secure protection and natural conservation of the mires and/or the peatlands, but also to secure a render economic use of the peatlands in the near or remote future.

Agricultural or forestry use of peatlands is frequent today and is supposed to be so also in the future. The complex chemistry of peat also makes it to a valuable raw material for industrial processes. Its usefulness in many industrial processes for production of e.g. active carbon, waxes, paper, insulation material, biostimulators, steroids and other chemical products are today well known. However, today the most frequent use of peat and peatlands, except for agriculture and forestry, is as a highly valued industrial fuel and as growing media in horticulture.

3 Description of equipment/interpretation tools

Only simple hand operated tools were used.

- Hand operated peat-corer (Russian model) with a 0,5 m long and 3 cm wide sampling devise.
- Silva hand compass.
- Measuring tape 100 m.
- Digital camera, OLYMPUS My 300, Digital.
- pH-test sticks, MERCK Universalindikator pH 0–14.
- Hand operated GPS-receiver, GARMIN GPS 12.

4 Execution

4.1 General

After preliminary studies of topographic and Quaternary maps as well as aerial photographs, followed by a one-day field reconnaissance (2003-07-04) with some advisory corings, two peatlands were selected for the investigations.

The first selected peatland, Stenrösmossen, in the following text called TM 1, has a midpoint at N6697470/E1631050 in the RT90 national grid system and has a surface-altitude of c 8 m (Figure 1-1). TM 1 is located within the mapped area regarding Quaternary deposits /Sohlenius et al, 2004/.

The second selected peatland c 500 m west of Lersättersmyran, in the following text called TM 2, has a midpoint at N6695290/E1626030 and a surface-altitude of c 16 m. TM 2 is situated outside the Quaternary investigation area c 2 km WSW of Forsmarks bruk.

The objective for the selection of the peatlands was first to find an example of an as well as possible developed peatland within the Quaternary investigation area and then additionally a deeper, older and more developed peatland as close as possible to the first one.

All investigation work was done in accordance with the method description, SKB MD 131.002 and the activityplan, AP PF 400-03-62.

The chemical analyses were executed at Analytica AB, Luleå and the preparation of samples and analysis of water content at the laboratory at SGU in Uppsala. Measuring of pH-values was done in the field with simple pH-sticks during the revision trip 2004-05-22.

4.2 Preparations

No calibrations of instruments were done since the only measuring devices used in the field were a hand compass, a measuring tape and a simple handheld GPS receiver. The final measuring of the co-ordinates of the coring points was then done by Geocon AB in a separate project.

4.3 Execution of field work including handling of samples

The field investigations started 2003-10-20 with localisation and marking of the investigation lines and the coring points at TM 1 (Figure 4-1). The positioning of the coring points was made by a 100 m measuring line and a hand held compass. The investigation lines were placed in a way that enabled a possible expansion to a 100 m grid, if needed during the work or in the future. The coring points were marked with systematically numbered wooden sticks. Because of local circumstances at TM 1 the coring points were in some cases placed with 50 m distance instead of 100. The reason for this was to try to get some coring at the deepest points of the peatlands. The corings, description of the coring points and the sampling of the 11 coring points at TM 1 were finished during the second day.

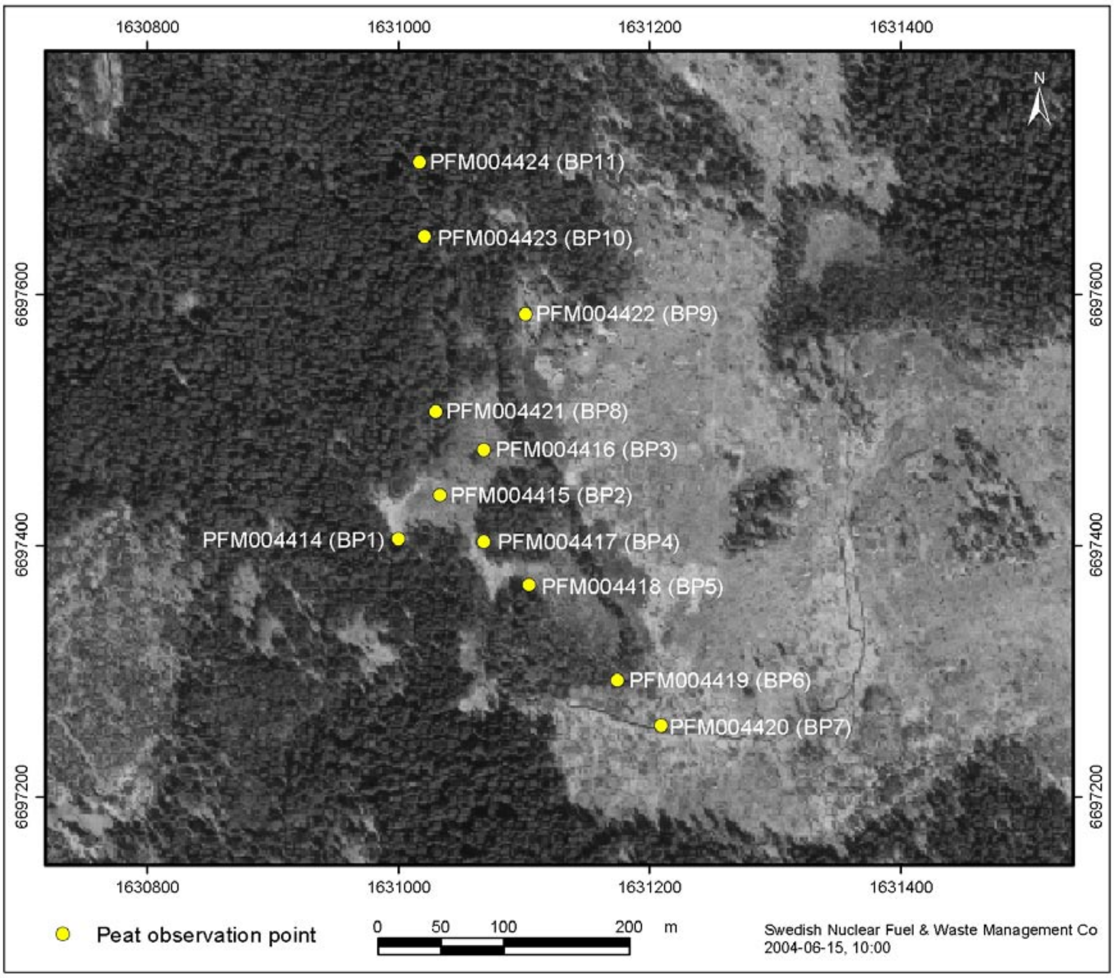

***Figure 4-1**. Localisation of the coring points at Stenrösmossen (TM 1).*

The second day ended with localisation and marking of the investigation line and coring points at TM 2 (Figure 4-2). At this more elongated peatland, all the coring points were situated along one single baseline and at 100 m distance from each other, starting from the point that had been estimated as deepest during the reconnaissance 2003-07-04.

The third day started and ended by corings, sampling and description of the coring points of the five investigation points at TM 2. The work was finished in a heavy snowfall that made the identification of peat type and especially the botanical composition difficult. No perpendicular lines were investigated at TM 2 since it was never more than 100 m to the nearest mineral soil surface at this peatland.

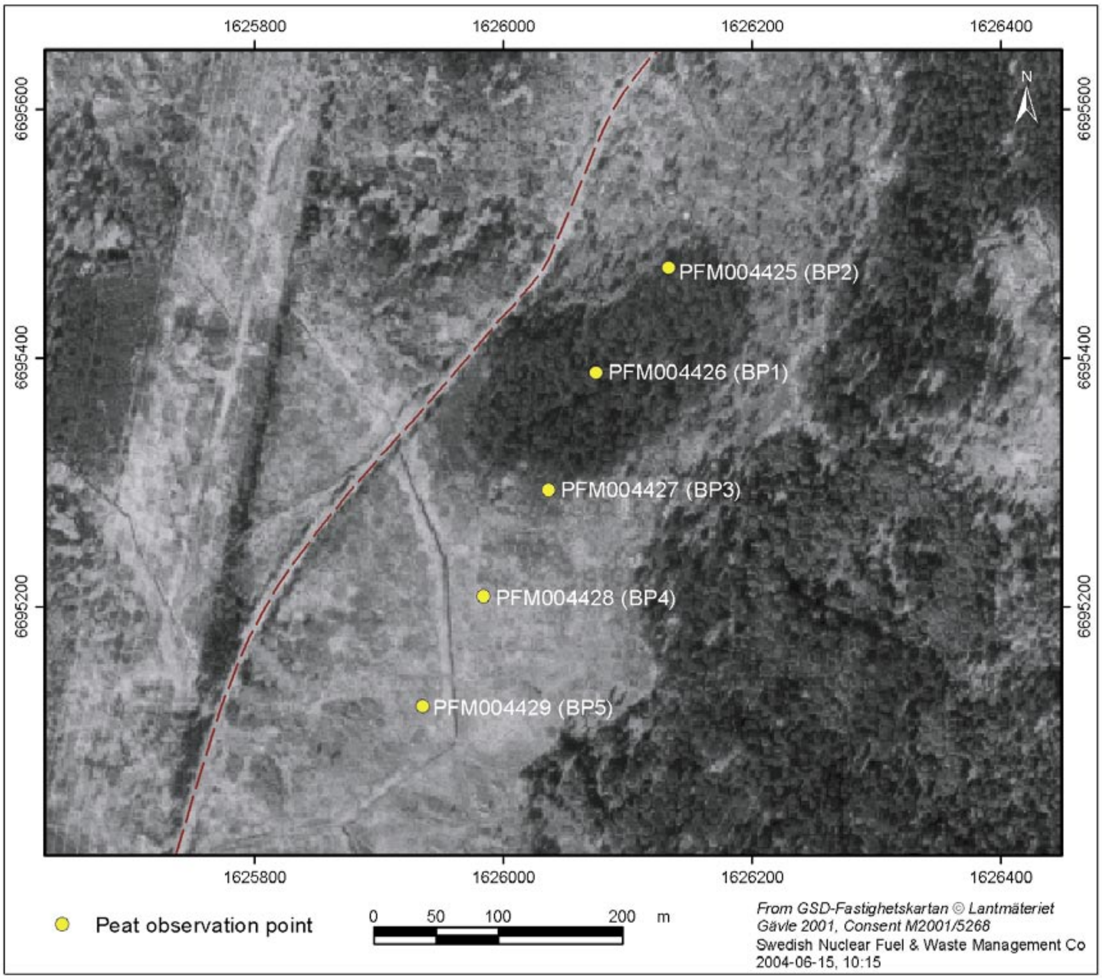

***Figure 4-2**. Localisation of the coring points at the peatland 500 m west of Lersättersmyran (TM 2).*

The corings and sampling were executed manually by a Russian peat-corer that takes 50 cm long and 3 cm wide undisturbed peat samples. The coring was always done through the complete peat and gyttja layers down to the underlying mineral soils.

Additionally to this work a one day revision was done 2004-05-22. The main reason for this was to conduct some extra observations of peat types and to do some orientating measurements of pH-values in surface- and pore water.

The peat samples were collected in paper bags, which were placed individually in separate numbered plastic bags. All individual samples from each coring point were then placed in a separate plastic bag. After finishing the field work the third day, the samples were immediately transported to a cold room (+5°C) at the laboratory at SGU in Uppsala.

After storing in the cold room over the night, the paper bags with the wet samples were weighted, the bags were then opened and left for air drying at a laboratory desk. In connection with this a simple microscope investigation, mainly on the samples from coring point BP 1 at TM 2, was done. The reason for this microscope investigation was that it had been very difficult to separate and identify the low humified *Sphagnum* peat from a suspected low humified brown moss peat at certain layers at this coring point due to bad light conditions in the field.

After some weeks of air drying, an appr 1 g subsample was taken from each peat sample, which at that time weighted between 20 and 50 g each. The subsamples were then mixed to general samples for the chemical analysis. The original samples in the paper bags were then dried in an oven at 105°C over night and weighed. The water content was calculated after correction for the material loss compared to the general samples. Finally between 5 and 10 g from the oven dried original samples were collected for the ash content analysis.

4.4 Data handling/post processing

During the field investigation data was noted in standard field protocols described in the method description (SKB MD 131.002). The field protocols are included in this report (Appendix 1). Some digital photos were embedded in these protocols. Analytical data was saved in the form they were delivered from the analytical laboratories and the results are also included in this report (Appendix 2 and Table 5-2).

Principles for classification of the peat and the humification degree correspond to /von Post and Granlund, 1926; Lappalainen et al, 1978/. Analytical standards referring to methods and good laboratory practice at Analytica AB and /Svensk Standard, 1998/ were used.

Since the classification of peat types was done in a Swedish system, the Swedish terms needed to be translated into English terminology. As no international standard for peat classification exists, the English terms used in the data reporting in some cases needed to be generalised in a way that makes them less precise than the original Swedish ones.

Between 10 and 20 g of oven dried (105°C) leftover samples from all sampling points are stored in plastic bags at the soil laboratory at SGU in Uppsala.

5 Results

The detailed stratigraphical descriptions from the corings, together with description of the vegetation at the surface, are presented in Appendix 1. The results from the analyses of water and ash content are listed in Appendix 2 and the coordinates of the coring points are listed in Appendix 3.

The peatlands

Stenrösmossen (TM 1) is to a large extent a shallow minerotrophic horizontal fen originally developed in a stagnant waterbody, which was formed as a result of the isostatic crustal uplift after the last deglaciation. During the process of land uplift the costal waters of the Baltic Sea continuously got more and more shallow. Finally the water became stagnant and shallow enough to start an infilling with vegetation and a terrestrialization forming the present peatland.

Today the north-western and southern parts of the fen are covered with forest vegetation, which is dominated by pine and spruce in north-west and predominantly birch, alder and aspen in the south. The open central parts of the fen are mostly covered with different *Carex* species mixed in a bottom layer of brown mosses and a scattered distribution of more nutrient demanding S*phagnum* species together with *Ledum palustre*, *Myrica gale*, *Calluna vulgaris* and *Empetrum nigrum*. This part of the mire has today relatively nutrient-poor vegetation and the surface can be classified as a nutrient-poor fen. PH-values in the surface water in this part of the fen are between 5 and 6. In the southwest the vegetation is richer and more nutrient demanding with different grasses, herbs, lingonberry and fern. The pH-value in the surface water in this part of the fen is between 6 and 7.

The main part of the mire is influenced by minerotrophic, nutrient rich groundwater from the surrounding mineral soils. The horizontal surface of the mire is today reflecting the groundwater surface. However, the westcentral part of the mire contains an area that best can be characterised as a well-drained pine bog that is, and has been influenced by less nutrient rich water.

The stratigraphy is at the bottom characterised of a thin layer of gyttja or claygyttja deposited directly on till. The gyttja or claygyttja is often overlain by a thin layer of pure low-humified light yellow *Phragmites* peat, normally mixed with *Equisetum* remnants. Above these layers the peat normally consists of medium to well humified wood-*Carex* peat, *Carex* peat, *Carex-Bryales* peat and *Carex-Spagnum* peat (Appendix 1). These layers also to a major extent represents the present vegetation of the fen, except from in the northern part, where the densely forested mire show a higher humification of the remaining peat layers, due to ditching and oxidation. In some of the open parts of the fen also a 0,5 to 1 m thick pure low-humified *Carex* peat occurs.

A generalised picture over the peat stratigraphy and the humification degrees at the coring points in TM 1 is shown in Figure 5-1.

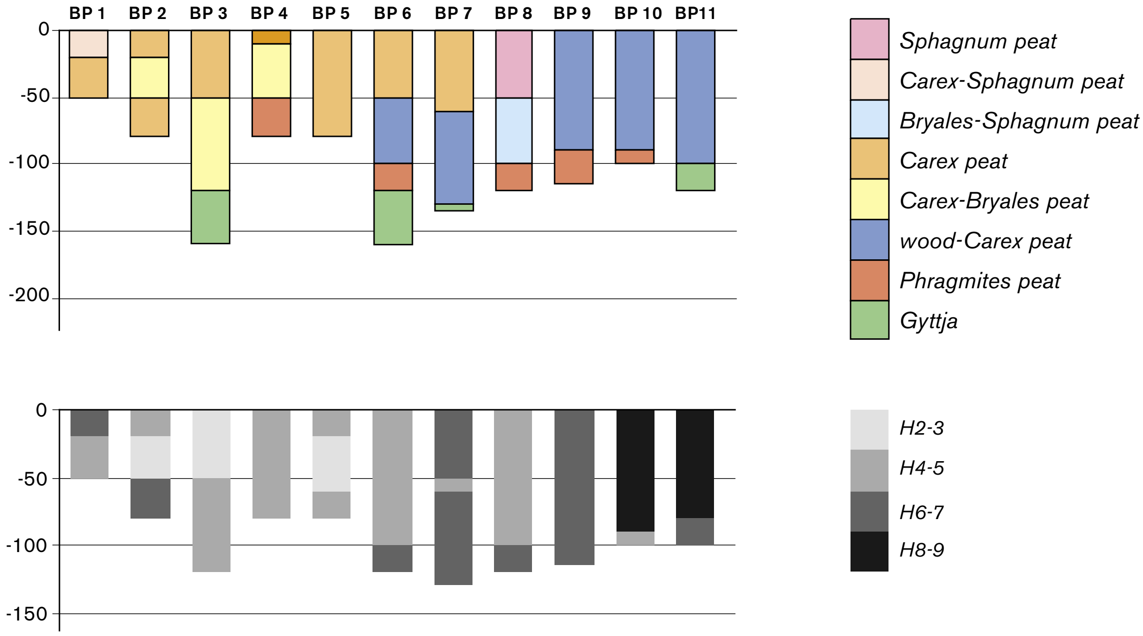

Figure 5-1. *Generalised picture over peat stratigraphy (upper) and humification degree (lower) at coring points at Stenrödsmossen (TM 1). The values on the y axis are depth from ground surface, in cm. The elevation of the mire is between 8.2 and 9.1 m a s l. For location of the coring points, see Figure 4-1.*

The peatland west of Lersättersmyran (TM 2) is also to its dominating part a shallow forest fen typical for this region. Today this type of peatlands are often ditched for forestry and sometimes cultivated for agriculture. In the northern part of TM 2 there is an area that best can be classified as a pine bog, in spite of a frequent abundance of blueberry, lingonberry and mosses that normally do not occur in bog vegetations, as well as an occurrence of *Ledum palustre*, *Myrica gale* and *Sphagnum spp.* This pine bog area shows a lot of similarities with the pine bog area in the westcentral part of TM 1. The pH-values in the pore water in the uppermost layers in this part of TM 2 are between 4 and 5.

The southern part of TM 2 is effectively ditched and today clean cut for forestry. The bottom layers of TM 2 are characterised by gyttja deposited on till, except for the southern part where the gyttja or claygyttja is deposited on sand. A generalised picture over the peat stratigraphy in TM 2 is shown in Figure 5-2.

The peat layers consist of medium to well humified wood-*Carex* peat or *Carex-Bryales* peat. In the northern pine bog part of the fen some between 1 and 2 m thick layer of low humified *Sphagnum* peat occurs. This mostly ombrotrophic *Sphagnum* peat layer is covered with a thin layer of oxidised wood-*Sphagnum* peat. The *Sphagnum* peat is underlain by *Carex-Bryales* peat, *Carex* peat and finally with gyttja.

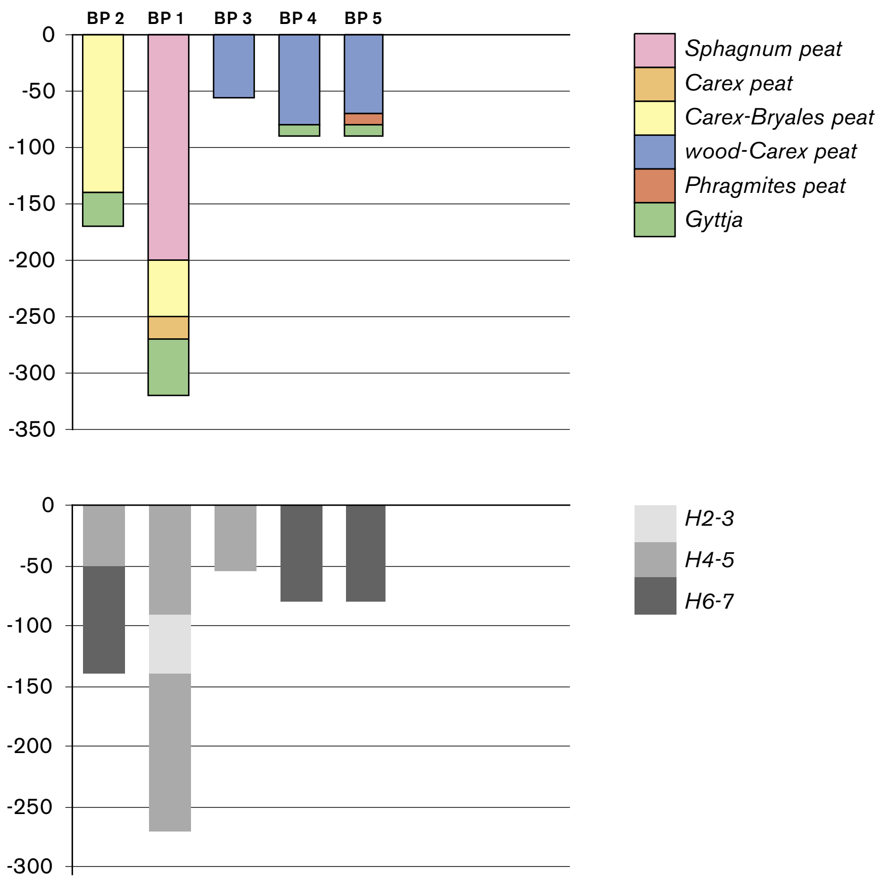

***Figure 5-2.** Generalised picture over peatstratigraphy (upper) and humification degree (lower) at coring points at the peatland west of Lersättersmyran (TM 2). The values on the y axis are depth from ground surface, in cm. The elevation of the mire is between 15.7 and 16.8 m a s l. For location of the coring points, see Figure 4-2.*

Chemical Properties

Peat is an organic soil that in addition to its more or less humified organic remnants from the former mire vegetation contains primary mineral particles and secondary formed minerals. The normal chemical properties concerning main and trace element in Swedish mires are relatively well known /Fredriksson, 1984/. This knowledge is mostly derived from different mineral prospecting activities and investigations related to extraction of peat fuel.

The occurrence of different substances and elements in the peat layers reflects the composition of the underlying soils and bedrock i.e. the chemical composition of the groundwater and to some extent rainwater and deposition of airborne particles. Therefore, the chemical composition, despite its relative complex relations, normally is possible to predict. This also means that divergences between individual mires and mire areas, depending on different natural and antropogenic circumstances, often can be foreseen. For instance ombrotrophic *Spagnum* peat (feed by rainwater) shows very low concentrations of trace elements and small variations regarding to the main elements. Locally and regionally the differences between individual ombrotrophic bogs often are small.

On the other hand the chemical composition in fens and mixed mires is depending more on local geological factors and on the groundwater chemistry. Concerning the main elements this is most obvious in regions with calcareous mineral soils. The trace elements show a more scattered picture, but they also reflect the composition of the bedrock and the groundwater. The main reason for the good knowledge about trace elements in peatlands, is the frequent use of peat investigation in mineral prospecting activities.

The chemical composition of the peat in the two peatlands TM 1 and TM 2 has been analysed from general (composite) samples. The general samples consist of grinded and mixed homogenised subsamples. The subsamples, which are of equal weight, represent the first metre of peat layers in TM 1 and the first respectively the second metre in TM 2. The subsamples in the individual general samples represented in the different general samples are shown in Table 5-1.

The concentration of calcium oxide in TM 1 (47.1% in ash) shows that this fen is strongly influenced by the calcareous mineral soils in its vicinity.

Calcium calculated as oxide in the ash fraction of Swedish peat layers normally shows a bimodal distribution. In areas were the soils are dominated by acid Precambrian bedrock material the calcium oxide content normally is around 15%, but in regions with calcareous soils a calcium oxide content of around 45% is more common.

It might be noted from the analytical results (Table 5-2) that the sum of the main-elements in the calcium influenced mire (TM 1) differs considerably from 100%. This can be explained by that the calcium in the ash fraction in reality exists as carbonate and not in its oxide form.

The concentration of trace elements in the two mires shows normal values except for lead and zinc. Even taken into consideration that the mean and median values for Swedish mires shown in Table 5-2 (except for cadmium, arsenic and mercury) are analysed by x-ray fluorescence (XRF) and the values for TM 1 and TM 2 by plasma technique (ICP) the zinc concentration in both mires is clearly increased. Also the lead content in the uppermost metre of TM 2 is clearly increased. The reason for this is not known, both mires are localised remote from known industrial activities. However, historically the region has been subject to mining and iron-casting industry, for example at Forsmark Bruk, located c 1–4 km from the two mires.

One possible explanation of the lead anomaly in the uppermost metre of TM 2 is ditching and forestry. The general sample from this layers mainly represent peat that is strongly influenced by ditching and forestry. The zinc anomaly in TM 2 might result from some unknown sulphide mineralisation, but on the other hand the general sample with the highest value only represents layers from BP 1, where the peattypes are of a kind that normally not is affected by groundwater.

The uranium content in the upper part of TM 1 is normal for this type of mires. No anomal concentration of radioactive substances connected to natural uranium can be suspected in any of TM 1 or TM 2.

It might be noted that the concentrations of main and most trace elements in Table 5-2 are calculations from concentrations measured in dry samples analysed with ICP.

Table 5-1. Subsamples represented in the different general samples.

TM 1 (0–100 cm)	BP 1 (0–50), BP 2 (0–50), BP 3 (0–50), BP 3 (50–100), BP 4 (0–50), BP 5 (0–50), BP 6 (0–50), BP 6 (50–100), BP 7 (0–50), BP 7 (50–100), BP 8 (0–50), BP 8 (50–100), BP 9 (0–50), BP 9 (50–100), BP 10 (0–50), BP 10 (50–100)
TM 2 (0–100 cm)	BP 1 (0–50), BP 1 (50–100), BP 2 (0–50), BP 2 (50–100), BP 3 (0–50), BP 4 (0–50), BP 5 (0–50)
TM 2 (100–200 cm)	BP 1 (100–150) BP 1 (150–200)

Table 5-2. Concentrations of main- and trace elements, sulphur and ash in general samples from TM 1 and TM 2 compared with mean and median values for Swedish peatlands, representing 13,000 ha (for Ra-226 c 1000 ha) /Fredriksson, 1984/.

		TM 1 0–1 m	TM 2 0–1 m	TM 2 1–2 m	Mean Sweden	Median Sweden	St dev
CaO	% (in ash)	47.1	20.8	8.2	24.7	21.6	12.9
Al2O3	"	2.19	7.9	10.2	10.5	9.7	5.6
Fe2O3	"	2.69	6.7	7.0	17.8	16.6	10.0
K2O	"	0.56	1.85	2.64	0.48	0.35	0.41
MgO	"	1.6	1.7	1.7	2.8	2.0	2.8
Na2O	"	0.40	1.15	1.33	0.38	0.26	0.46
MnO	"	0.07	0.06	0.08	0.27	0.22	0.16
P2O5	"	1.00	1.03	0.54	1.82	1.8	0.97
SiO2	"	7.6	41.3	60.5	22.0	17.7	16.6
TiO2	"	0.05	0.34	0.51	0.29	0.26	0.17
Co	mg/kg (in ash)	5.7	10.6	11.4	33.8	33.0	21.1
Cr		25	63	86	120	100	83
Cu	"	104	90	79	228	200	128
Mo	"	19.8	15.3	11.6	55.1	36.0	49.6
Ni	"	35.3	47.5	56.1	101.5	85.0	73.9
Pb	"	116.5	1600	79.5	64	35	93
Sr	"	513.4	370.7	172.6	567.5	515.0	224.3
Th	"				40	35	26
U	"	77.8	<20	<20	70	34	110
V		24	64	76	134	98	124
Zn	"	620	951	1526	227	170	311
As	mg/kg DS	1.4	1.4	1.0	4.3	1.0	12.0
Cd	"	0.20	0.17	0.14	0.23	0.10	0.23
Hg	"	0.086	0.094	0.030	0.055	0.010	0.114
Ra-226	Bq/kg (wf)				9		
Ash	% DS	9.7	7.7	9.5	5.1	4.3	3.4
Sulphur	% DS	0.72	0.30	0.37	0.27	0.24	0.14

The sulphur content in TM 1 (0.72%) is increased compared to normal values in this type of mires. High sulphur content in mires is often related to *Bryales* peat and to *Phragmites* peat. Increased sulphur content is also common in mires close to sulphide clay deposits near the low coasts of Bothnia. It is believed to result from reduction of sulphate in the seawater. The conditions for this process have also been favourable during the mire forming due to crustal uplift in these regions.

The ash content in the analysed peat layers corresponds mainly to the expected, i.e. it is close to normal. The fen peat layers in TM 1 have ash contents between 7 and 10%, somewhat higher than in corresponding fen peat layers in other parts of Sweden, where they normally are between 4 and 8%. In the *Sphagnum* peat layers at coring point BP 8 the ash contents are as expected lower (between 2.5 and 3.5%). The highest ash contents in TM 1 were measured in the northern part of the mire, where they reach 15% in the dry high humified wood-*Carex* peat.

In the low humidified *Sphagnum* peat layers in TM 2 the ash contents is very low, between 1 and 2%. The other layers in this mire have normal values for this type of mires, except for a slight increase in the southern heavily ditched part of the mire.

The water content in the analysed samples also shows normal values, i.e. between 90 and 93% except for some of the wettest parts of the mires. Dryer peat is preferably occurring in the marginal and the heavily ditched parts of the mires. The lowest water content was measured in the southern part of TM 2.

6 Summary and discussions

Considering, the peat types and the demand of the modern peat industry, a future use of the peat in Stenrösmossen as fuel is not likely. This is mostly due to high ash and sulphur contents and that the peat thickness and the area of the peatland are too small.

The future development of the mire (considering that no ditching will take place) will probably be characterised by an increased influence of rainwater and reduced influence from nutrient rich groundwater. This means that the fen vegetation will be replaced by less nutrient demanding mosses and the fen will slowly develop into a bog. The peat layers that will develop in such an environment are normally not well suited for fuel production. The location of the small mire in the small scale hilly terrain in the area also makes it less probable that any significant horizontal expansion of the mire will occur in the future, i.e. the paludification of the surrounding areas will probably be limited.

The fen-peat types in Stenrösmossen are well suited for agricultural use both with respect to nutrient content and to soil structure. One drawback is that the mire is underlain by till instead of fine grained sediments. This means that the bottom layer of till relatively soon will be reached by any cultivation. These till layers are unsuitable for agricultural use.

Ordinary agricultural use of peatlands normally causes yearly losses of peat up to one centimetre. This doesn't count for pasturage that sometimes even can cause an enrichment of the organic soils at least in present type of climate.

Conditions are similar for the peatland west of Lersättersmyran except that the nutrient content in the peat layers generally is lower. Comparing both peatlands, the southern part of the peatland west Lersättersmyran is probably best suited for agriculture, mainly because of that the peat here is underlain by sand. Both peatlands are well suited for forestry.

Anomalous concentrations of zinc are detected in both peatlands. High concentration of lead is also found in the uppermost metre of the peatland west Lersättersmyran. The reason for this is not known. Otherwise the peatlands have normal physical and chemical properties except for increased sulphur content in Stenrösmossen, something that is relatively common in this region.

No enrichment of uranium or other radioactive substances has been detected or is suspected in the two peatlands.

References

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Protocols from the corings

The notifications in the coring protocols refers to the method description (SKB MD 131.002 Ver 1.0), e.g. mineral soil surface at –23/00 means that the mire surface terminates 23 m before the zero point (00/00) along the baseline, according to the local field grid system. The abbreviations in the observation column refer to the Finnish classification system /Lappalainen et al, 1978/ and means relevant remains of: S (*Sphagnum*), B (*Bryales*), C (*Carex*), EQ (*Equisetum*) and PR (*Phragmites*).

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id no: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004414 BP 1 00/00	Date of investigation: 2003-10-20 Dag Fredriksson
Map:	X= Northing 6697405	Y= Easting 1631000	Z= Altitude 8,4

AREA DESCRIPTION

Peatland- or miretype: Minerotrophic horizontal fen

Surface : Scattered small low hummocks

Vegetation: *Ledum palustre, Myrica gale, Carex spp,* scattered *Sphagnum* hummocks Pine (ca. 40 year), scattered Spruce
Notes: Mineralsoil surface at ca. –23/00 Sample 0-50 cm

PEAT TYPE

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-20	*Carex-Spagnum peat*	*Brown-black*	*H7*	*B2*	*F0*	*R1*	*V0*	*Oxidised surface layer*
20-50	*Carex peat*	*Brown*	*H5*	*B3*	*F0*	*R2*	*V0*	*EQ*
50	*Stop on stone*							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004415 BP 2 50/00	Date of investigation: 2003-10-20 Dag Fredriksson
Map:	X= Northing 6697440	Y= Easting 1631034	Z= Altitude 8,4

AREA DESCRIPTION

Peatland- or miretype: Minerotrophic horizontal fen, open

Surface: Small hummocks (2-3 dm)

Vegetation: *Carex spp.* with a bottom layer of *Bryales spp.,* scatterd *Calluna vulgaris, Andromeda polifolia* Pine (ca. 0,5 m)
Notes: Sample 0-50 cm, Sample 50-80 cm pH 6

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Notes
0-20	*Carex peat*	*Dark brown*	*H4*	*B3*	*F0*	*R2*	*V0*	*Oxidised surface layer*
20-50	*Carex-Bryales peat*	*Light brown*	*H3*	*B4*	*F0*	*R3*	*V0*	
50-80	*Carex peat*	*Light brown*	*H6*	*B4*	*F0*	*R2*	*V0*	*EQ PR, Gyttja* H_2S
	Stop on stone or till							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004416 BP 3 100/00	Date of investigation: 2003-10-20 Dag Fredriksson
Map:	X= Northing 6697476	Y= Easting 1631068	Z= Altitude 8,4

AREA DESCRIPTION

Peatland- or miretype : Minerotrophic horizontal fen, open

Surface: Small hummocks 2-3 dm

Vegetation: *Carex spp., Myrica gale*, *Ledum palustre*, *Calluna vulgaris, Vaccinium oxycoccus, Sphagnum spp.* Small- and scattered larger pines (ca. 8-10 m)
Notes: Sample 0-50 cm, Sample 50-100 cm, Sample 120-150 cm Mineralsoil surface at +123/00

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-15	*Carex peat*	*Dark brown*	*H3*	*B3*	*F0*	*R2-3*	*V0*	*Oxidised surface layer*
15-50	*Carex peat*	*Light brown*	*H3*	*B3*	*F0*	*R3*	*V0*	*S*
50-100	*Carex-Bryales peat*	*Light brown*	*H4*	*B3*	*F0*	*R2*	*V0*	*S, EQ, PR*
100-120	*Carex-Bryales peat*	*Light brown*	*H5*	*B3*	*F0*	*R2*	*V0*	*EQ* *Gyttja mixed*
120-160	*Gyttjaclay*	*Brown-green*						
	Stop on till							


Photo: Dag Fredriksson 2003-10-20


Photo: Dag Fredriksson 2004-05-22

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004417 BP 4 50/H50	Date of investigation: 2003-10-20 Dag Fredriksson
Map:	X= Northing 6697403	Y= Easting 1631068	Z= Altitude 8,3

AREA DESCRIPTION

Peatland- or miretype: Minerotrophic horizontal fen, open

Surface: Small hummocks 2-3 dm

Vegetation: *Carex spp, Bryales, Myrica gale*, At the forest edge Pine (60-70 year) and scattered Birch
Notes: Sample 0-50 cm, Sample 50-80 cm Mineralsoil surface at ca. 60/H50

PEAT TYPE

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-10	*Carex peat*	*Dark brown*	*H5*	*B2*	*F0*	*R1*	*V0*	*Oxidised surface layer*
10-50	*Carex-Bryales peat*	*Dark brown*	*H4*	*B3*	*F0*	*R2*	*V0*	*Oxidised*
50-80	*Phragmites peat*	*Light yellow*	*H4*	*B3*	*F0*	*R2*	*V0*	*B*
	Stop on stone or till							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004418 BP 5 50/H100	Date of investigation: 2003-10-21 Dag Fredriksson
Map:	X= Northing 6697368	Y= Easting 1631104	Z= Altitude 9,1

AREA DESCRIPTION

Peatland- or miretype: At the edgy of the open minerotrophic horizontal fen

Surface: Low hummocks

Vegetation: *Sphagnum spp., Carex spp., Myrica gale, Ledum palustre, Empetrum nigrum, Bryales spp.* Scattered small Pines (larger in the forested part), scattered Birch and Spruce
Notes: Sample 0-50 cm, Sample 50-80 cm Mineralsoil surface at ca. –15/H100 and 110/H100

PEAT

Depth	Peat type	Colour	Humifi-cation	Wetness	Fibres	Rots	Wood	Obs.
0-20	*Carex peat*	*Dark brown*	*H5*	*B2*	*F0*	*R2*	*V1*	*Oxidised surface layet*
20-60	*Carex peat*	*Dark brown*	*H3-4*	*B3*	*F0*	*R2-3*	*V0*	*B*
60-80	*Carex peat*	*Light brown*	*H5*	*B4*	*F0*	*R2*	*V0*	*PR, EQ,* H_2S
	Stop on stone or till							

Photo: Dag Fredriksson 2003-10-21

Photo: Dag Fredriksson 2003-10-21

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004419 BP 6 50/H200	Date of investigation: 2003-10-21 Dag Fredriksson
Map:	X= Northing 6697293	Y= Easting 1631174	Z= Altitude 8,3

AREA DESCRIPTION

Peatland- or miretype: Minerotrophic horizontal fen

Surface: Small hummocks 20-40 cm

Vegetation: *Carex spp, Sphagnum spp, Pleurocium schreberi, Myrica gale* Birch, Pine 5-10 m, Spruce, Aspen, Alder, Lingonberry, Blueberry, Herbs, Bracken, scattered Juniper
Notes: Sample 0-50 cm, Sample 50-100 cm Mineralsoil surface at ca. 92/H200 and -50/H200 with a thin peatlayer continuing in to the spruceforest

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-10	*Carex peat*	*Dark brown*	*H5*	*B2*	*F0*	*R1*	*V0*	*Oxidised surface layert*
10-40	*Carex peat*	*Dark brown*	*H4*	*B3*	*F0*	*R2*	*V1*	
40-90	*Wood-Carex peat*	*Brown*	*H4*	*B3*	*F0*	*R1*	*V1*	
90-100	*Carex-Phragmites peat*	*Light brown*	*H5*	*B4*	*F0*	*R1*	*V1*	*EQ*
100-120	*Carex-Phragmites peat*	*Brown*	*H7*	*B3*	*F0*	*R1*	*V1*	*EQ, PR*
120-160	*Claygyttja*							
	Stop on stone							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004420 BP 7 50/H250	Date of investigation: 2003-10-21 Dag Fredriksson
Map:	X= Northing 6697257	Y= Easting 1631209	Z= Altitude 8,2

AREA DESCRIPTION

Ditched fen

Surface: Small hummocks 20-30 cm

Vegetation: *Phragmites communis* Small Birch, Alder, Grass, scattered Spruce, Bracken
Notes: Open ditch 2 m south

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-40	*Carex peat*	*Dark brown*	*H6*	*B2*	*F0*	*R0-1*	*V0*	*Oxidised surface layer*
40-50	*Carex peat*	*Dark brown*	*H7*	*B3*	*F0*	*R0-1*	*V0*	
50-60	*Carex peat*	*Brown*	*H5*	*B3*	*F0*	*R2*	*V0*	
60-130	*Wood- Carex peat*	*Brown*	*H6*	*B3*	*F0*	*R1*	*V1*	
130-135	*Gyttja*							
	Stop on stone							

Photo: Dag Fredriksson 2003-10-21

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004421 BP 8 100/V50	Date of investigation: 2003-10-21 Dag Fredriksson
Map:	X= Northing 6697507	Y= Easting 1631030	Z= Altitude

AREA DESCRIPTION

Pin bog (poor fen)

Surface: Small hummocks 10-30 cm

Vegetation character: *Sphagnum spp., Ledum palustre*, *Eriophorum vaginatum, Holocomium splendens, Pleurocium schreberi, Polytricum spp.* Pine (30-50 year), Lingonberry, Blueberry
Notes: Sample 0-50 cm, Sample 50-100 cm Mineralsoil surface at ca. 100/V110

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-50	*Sphagnum peat*	*Brown*	*H5*	*B3*	*F0*	*R0*	*V0*	*Mixed with Brown mosses*
50-100	*Sphagnum peat*	*Light brown*	*H4*	*B3-4*	*F0*	*R0-1*	*V0*	*B, EQ,, C, PR Brons coulor*
100-120	*Phragmites peat*	*Light brown*	*H6*	*B4*	*F0*	*R2*	*V0*	*EQ*
	Stop on stone							

Photo: Dag Fredriksson 2003-10-21

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004422 BP 9 200/V50	Date of investigation: 2003-10-21 Dag Fredriksson
Map:	X= Northing 6697584	Y= Easting 1631102	Z= Altitude 9,1

AREA DESCRIPTION

Minerotrophic horizontal (poor) fen

Surface: Small hummocks 10-30 cm

Vegetation: *Bryales spp., Ledum palustre, Eriophorum vaginatum Calluna vulgaris, Empetrum nigrum, Vaccinium oxycoccus* High Grasses, Lingonberry, scattered Spruce
Notes: Sample, 0-50 cm, Sample 50-100 cm Mineralsoil surface at ca. 210/V50

PEAT

Depth	Peat type	Colour	Humifi-cation	Wetness	Fibres	Rots	Wood	Obs.
0-50	*Wood-Carex peat*	*Dark brown*	*H6*	*B3*	*F0*	*R1*	*V1*	
50-90	*Wood-Carex peat*	*Dark brown*	*H7*	*B3-4*	*F0*	*R2*	*V0-1*	
90-115	*Phragmites peat*	*Light brown*	*H6*	*B4*	*F0*	*R1*	*V0*	*Mixed with Gyttja*
	Stop on stone							

Photo: Dag Fredriksson 2003-10-21

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004423 BP 10 200/V150	Date of investigation: 2003-10-21 Dag Fredriksson
Map:	X= Northing 6697646	Y= Easting 1631021	Z= Altitude 8,7

AREA DESCRIPTION

Forest fen

Surface: Dry, scattered small hummocks 10-30 cm

Vegetation: *Bryales spp.* Productive Spruce forest with scattered Pines (50-60 Year), Bracken, Herbs, Lingonberry
Notes: Sample 0-50 cm, Sample 50-100 cm Mineralsoil surface at 260/V150

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-50	*Wood-Carex peat*	*Black*	*H8*	*B2*	*F0*	*R0*	*V0-1*	
50-90	*Wood-Carex peat*	*Black*	*H8*	*B3*	*F0*	*R0*	*V1*	
90-100	*Phragmites peat*	*Brown-yellow*	*H5*	*B3*	*F0*	*R1*	*V0*	
	Stop on till							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 1	Name of peatland: Stenrösmossen	Coring point Id: PFM004424 BP 11 250/V200	Date of investigation: 2003-10-21 Dag Fredriksson
Map:	X= Northing 6697705	Y= Easting 1631017	Z= Altitude

AREA DESCRIPTION

Forest fen

Surface: Dry, Hummocks 10-50 cm

Vegetation: *Pleurocium schreberi, Bryales spp.* Productive Spruce forest with scattered Pines (50-60 year), Lingonberry; Blueberry, Herbs,
Notes: No Samples

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-80	*Wood-Carex peat*	*Black*	*H8*	*B1-2*	*F0*	*R0*	*V1*	
80-100	*Wood-Carex peat*	*Brown-black*	*H7*	*B3*	*F0*	*R1*	*V1*	
100-120	*Claygyttja*							
	Stop in sand							

Photo: Dag Fredriksson 2003-10-21

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 2	Name of peatland: Peatland 500 m west Lersättersmyran	Coring point Id: PFM004426 BP 1 100/00	Date of investigation: 2003-10-22 Dag Fredriksson
Map:	X= Northing 6695388	Y= Easting 1626075	Z= Altitude 16,3

AREA DESCRIPTION

Flat pine bog

Surface: Small hummocks 10-20 cm

Vegetation: Productive Pine forest (50-60 year), surface snow covered From later reconnaissance (2004-05-22) at the same spot; *Ledum palustre , Pleurocium schreberi ,Holocomium splendens, Empetrum nigrum, Eriophorum vaginatum, Polytricum spp., Sphagnum spp. Lingonberry, Blueberry*
Notes: Sample 0-50 cm, Sample 50-100 cm, Sample 100-150 cm, Sample 150-200 cm, Sample 200-250 cm Open ditch N54^{O}E 5 m east

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-20	Wood-*Sphagnum* peat	*Dark brown*	*H5*	*B2*	*F0*	*R1*	*V1*	*Oxidised surface layer*
20-50	*Sphagnum peat*	*Light brown*	*H4*	*B2*	*F0*	*R0-1*	*V0*	
50-90	*Sphagnum peat*	*Light brown*	*H4*	*B3*	*F0*	*R0*	*V0*	
90-140	*Sphagnum peat*	*Light brown*	*H3*	*B3*	*F1*	*R0*	*V0*	
140-200	*Sphagnum peat*	*Light brown*	*H4*	*B3*	*F0*	*R0*	*V0*	*B*
200-250	*Carex-Byales peat*	*Light brown*	*H4-5*	*B3*	*F0*	*R1*	*V0*	*PR*
250-270	*Carex peat*	*Light brown*	*H4*	*B3*	*F0*	*R2*	*V0*	*B, PR, EQ*
270-285	*Coarse detritusgyttja*	*Brown-green*						
285-300	*Gyttja*	*Grey-green*						
300-320	*Claygyttja*							
	Stop ?							

Photo: Dag Fredriksson 2003-10---23

Photo: Dag Fredriksson 2004-05-22

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 2	Name of peatland: Peatland 500 m west Lersättersmyran	Coring point Id: PFM004425 BP 2 00/00	Date of investigation: 2003-10-22 Dag Fredriksson
Map:	X= Northing 6695472	Y= Easting 1626133	Z= Altitude 16,8

AREA DESCRIPTION

Minerortophic fen

Surface: Dry, small hummocks 10-30 cm

Vegetation : Surface snow covered *Calluna vulgaris,, Ledum palustre* Scattered Spruce ca 10 m, and Birch 10-20 m, Lingonberry,
Notes: Sample 0-50 cm, Sample 50-100 cm, Sample 100-150 cm

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-10	*Carex-Bryales peat*	*Dark brown*	*H5*	*B2*	*F0*	*R0-1*	*V0*	
10-50	*Carex-Bryales peat*	*Brown*	*H5*	*B3*	*F0*	*R0-1*	*V0*	
50-100	*Bryales-Carex peat*	*Brown*	*H6*	*B3*	*F0*	*R1-2*	*V0*	*EQ*
100-140	*Bryales-Carex peat*	*Brown*	*H7*	*B3*	*F1*	*R2*	*V1*	*EQ, PR*
140-170	*Claygyttja*							
	Stop on stone							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 2	Name of peatland: Peatland 500 m vestLersättersmyran	Coring point Id: PFM004427 BP 3 200/00	Date of investigation: 2003-10-22 Dag Fredriksson
Map:	X= Northing 6695294	Y= Easting 1626036	Z= Altitude 16,2

AREA DESCRIPTION

Minerotrophic fen

Surface: Covered with snow

Vegetation character: Small Birch and Spruce (2-3 m high)
Notes: Bedrock surface at ca. 200/V25 Sample 0-50 cm

TORVSLAG

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-10	*Forest fen peat*	*Dark brown*	*H5*	*B2*	*F0*	*R0*	*V0*	
10-55	*Forest fen peat*	*Brown*	*H5*	*B3*	*F0*	*R1*	*V0-1*	
	Stop on stone							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 2	Name of peatland: Peatland 500 m westLersättersmyran	Coring point Id: PFM004428 BP 4 300/00	Date of investigation: 2003-10-22 Dag Fredriksson
Map:	X= Northing 6695208	Y= Easting 1625984	Z= Altitude 15,9

AREA DESCRIPTION

Peatland (fen), clean cut for forestry

Surface: Dry, scattered small hummocks 10-30 cm

Vegetation: Small Birch and planted Pine (ca. 1,5 m high)
Notes: Surface covered with snow Sample 0-50 cm, Sample 50-80 cm

PEAT

Depth	Peat type	Colour	Humif.n	Wetness	Fibres	Rots	Wood	Obs.
0-50	*Forest fen peat*	*Brown-black*	*H7*	*B2*	*F0*	*R1-2*	*V0-1*	
50-80	*Forest fen peat*	*Brown-black*	*H7*	*B3*	*F0*	*R2*	*V1*	*Carex rots*
80-90	*Gyttja*							
	Stop on till or sand							

PROTOCOL FOR PEATLANDINVESTIGATION

ADMINISTRATIVE INFORMATION

Id nr: TM 2	Name of peatland: Peatland 500 m west Lersättersmyran	Coring point Id: PFM004429 BP 5 400/00	Date of investigation: 2003-10-22 Dag Fredriksson
Map:	X= Northing 6695119	Y= Easting 1625935	Z= Altitude 15,7

AREA DESCRIPTION

Peatland (fen), clean cut for forestry

Surface: Dry, covered with snow

Vegetation: Scattered small Birch and planted Pine (0,5-1 m high)
Notes: Ditch at 352/00 Bedrock surface at 425/00 Sample 0-50 cm, Sample 50-100 cm

PEAT

Depth	Peat type	Colour	Humif.	Wetness	Fibres	Rots	Wood	Obs.
0-20	*Forest fen peat*	*Brown-black*	*H7*	*B2*	*F0*	*R0-1*	*V0*	
20-70	*Forest fen peat*	*Brown-black*	*H7*	*B2-3*	*F0*	*R0-1*	*V1*	
70-80	*Carex-Phragmites peat*	*Brown*	*H7*	*B3*	*F0*	*R1*	*V0*	
80-90	*Claygyttja*							
	Stop in sand							

Appendix 2

Water and ash analysis

Peatland investigation Forsmark

Coring point TM 1	Depth cm TM 1	Water content % SGU TM 1	Ash content % Analytica TM 1
BP1 00/00	0–50	89	10.1
BP2 50/00	0–50	94	7.8
	50–80	93	39.5
BP3 100/00	0–50	94	6.6
	50–100	95	5.8
	120–150	84	80.6
BP4 50/H50	0–50	93	8.4
	50–80	95	7.1
BP5 50H100	0–50	90	8.4
	50–80	93	10.7
BP6 50/H200	0–50	88	8.9
	50–100	92	8.3
BP7 50/H250	Ej prov		
BP8 100/V50	0–50	93	2.4
	50–100	95	3.5
BP9 200/V50	0–50	88	10.7
	50–100	92	8.5
BP10 200/V150	0–50	85	15.7
	50–100	87	13.5
BP11 250/V200	Ej prov		

Coring point TM 2	Depth cm TM 2	Water content % SGU TM 2	Ash content % Analytica TM 2
BP1 100/00	0–50	90	3.2
	50–100	92	4.1
	100–150	92	1.3
	150–200	93	1.8
	200–250	92	2.6
BP2 00/00	0–50	90	2.5
	50–100	89	3.2
	100–150	89	17
BP3 200/00	0–50	83	5
BP4 300/00	0–50	80	5.9
	50–80	86	6
BP5 400/00	0–50	76	8.1
	50–100	82	7.5

Appendix 3

Protocol of co-ordinates

Coring points at Stenrösmossen (TM 1).

Date of measuring 2004-04-28–30, GEOCON AB.

Co-ordinatsystem: RT90 2.5 g V 0: –15.

SKB ID	SGU ID	Sekt	X	Y	h
PFM004414	BP1	00/00	6697405.24	1631000.17	8.44
PFM004415	BP2	50/00	6697439.85	1631033.61	8.39
PFM004416	BP3	100/00	6697476.12	1631067.95	8.37
PFM004417	BP4	50/H50	6697402.81	1631068.39	8.30
PFM004418	BP5	50/H100	6697368.56	1631104.41	9.13
PFM004419	BP6	50/H200	6697292.68	1631174.13	8.28
PFM004420	BP7	50/H250	6697257.02	1631209.18	8.16
PFM004421	BP8	100/V50	6697506.62	1631030.25	No value
PFM004422	BP9	200/V50	6697584.22	1631101.59	9.07
PFM004423	BP10	200/V150	6697645.88	1631020.94	8.71
PFM004424	BP11	250/V200	6697705.00	1631017.00	No value

Coringpoints at the peatland 500 m west Lersättersmyran (TM 2).

Date of measuring 2004-04-30, GEOCON AB.

Co-ordinatsystem: RT90 2.5 g V 0: –15.

SKB ID	SGU ID	Sect	X	Y	h
PFM004425	BP2	00/00	6695472.39	1626132.77	16.84
PFM004426	BP1	100/00	6695388.11	1626074.61	16.31
PFM004427	BP3	200/00	6695293.88	1626036.23	16.18
PFM004428	BP4	300/00	6695207.98	1625984.27	15.88
PFM004429	BP5	400/00	6695119.74	1625935.08	15.67