P-04-78

Forsmark site investigation

Ground penetrating radar survey 2003

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May 2004

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ISSN 1651-4416
SKB P-04-78

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Keywords: Ground penetration radar, GPS, Overburden investigations, Forsmark, AP PF-400-03-04, Field note Forsmark no 112.

Contents

1 Background and objectives

On behalf of Svensk Kärnbränslehantering (SKB) Geosigma AB, Sweden and Suomen Malmi OY, Finland, have performed a Ground Penetrating Radar (GPR) survey in the Forsmark site investigation area. The objective of the survey was primarily to investigate how well the method can be expected to perform within the area, and, where applicable, to interpret the depth to the bedrock.

The fieldwork was made during two periods in February and March 2003. During 16 days of field work a total of 64,354 m of data were collected in 103 individual files.
Figure 1-1 shows location of the profiles measured.

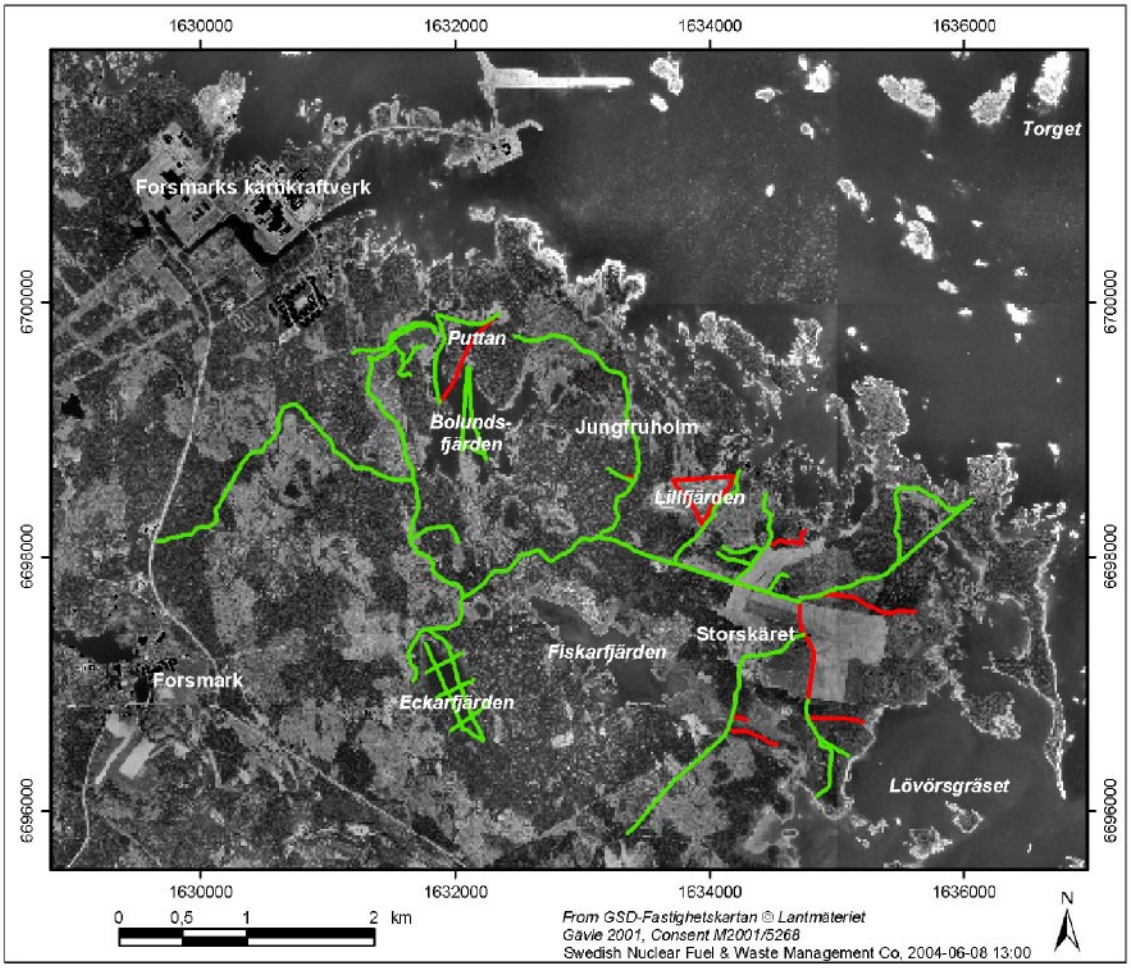


Figure 1-1. *GPR survey profiles. Green lines show profiles, which have yielded interpretable results along at least parts of each profile. Red lines show profiles of bad data.*

2 Methodology and equipment

2.1 The method

The Ground Penetrating Radar (GPR) method is a widely used electro-magnetic geophysical method, which is frequently applied for detecting subsurface objects and geological structures at shallow to moderate depths (i.e. 0–10 m). The method uses the dielectrical properties of the ground (overburden and bedrock), and works much in the same way as a common navigation radar. The depth penetration and resolution of the method depend basically on the frequency and strength of the signal, and the dielectrical properties of the ground. Generally speaking, a low frequency can “see” deeper down than a higher frequency, while a high frequency gives a higher resolution. A dry and well sorted material transmits the signal better than a water saturated fine-grained or poorly sorted material.

2.2 The instrument

The GPR itself is a technically sophisticated instrument, which is built around a control unit and a series of interchangeable antennas. In addition, a portable computer is used for storing data and controlling the setup of the instrument and the collection of data. The control unit and the computer is carried by the operator (see Figure 2-1). The signal is transmitted and received by an antenna, which is pulled by the operator. The transmitted signal is reflected against any underground surface which marks the transition between materials with different dielectrical properties (much like the signal from an echo sounder). The reflected signal is received by the antenna and stored in the computer for display and later processing. The result can immediately be analysed on the computer screen.

Although a rather rugged instrument, the equipment is sensitive to water and moist, which may impair work in certain areas. In addition, careful fieldwork is required to avoid damage of sensitive fibre-optic cables connecting the control unit with the antenna. Generally speaking though, the equipment allows for measurements in rather difficult terrains. However, if the ground for some reason inhibits signal transfer to target depth, the method is impractical. Fine grained material with strong dielectrical properties (for example salty clay) makes GPR measurements very difficult indeed. Many antennas are shielded, i.e. the major part of the signal energy is concentrated to a narrow lobe downwards and upwards. An unshielded antenna would send a signal that is roughly equal in energy in any direction, thus introducing reflexes from objects in the same horizontal plane as the antenna, such as trees, buildings, cars - Consequently: when discussing GPR data it is rather important to note whether the antenna is shielded or not. In this project, all production data is collected with shielded antennas.

2.3 Practical considerations

Depending on which frequency the antenna is constructed for, the antenna itself will have to be of larger and larger size, as the frequency gets lower (see the 100 MHz antenna in Figure 2-1). This means that the operator has to choose an antenna that suits the terrain, and yet is capable of solving the geophysical problem at hand. On roads and other flat open spaces, any antenna can be used. However, in dense forest and terrain with many obstacles, a smaller antenna has to be used, which reduces depth penetration in such areas. A balance between field circumstances and objectives must be maintained at all time. In very difficult areas, the ground may have to be prepared to allow for GPR measurements. Trees may have to be cut down, swamps may have to be drained, and boulders may have to be removed.

Figure 2-1. *The GPR equipped with a 100 MHZ antenna.*

3 Execution

The survey was executed according to activity plan AP PF 400-03-04 (SKB internal controlling document).

3.1 Fieldwork and personnel

The field campaign was carried out during two periods; 2003-02-17–2003-02-26 and 2003-03-10–2003-03-16. Field coordinator and project leader was Rikard Marek, Geosigma. Instrument operator was Jorma Valo, SMOY. All fieldwork was conducted in good or fair weather. During the first campaign, temperatures were low, particularly during morning hours, but not to an extent that it affected the instrument. Cold weather guaranteed dry conditions, both on the lakes and on the roads. During the second campaign, thaw inhibited safe work on ice and affected the data quality, in particular on roads and open places during afternoon hours when snow and ice started to thaw.

During the entire campaign, a Malå Geoscience RAMAC GPR CUII, was used (see Figure 2-1). Two different shielded antennas were used, one 250 MHz (owned by Geosigma) and one 100 MHz (owned by SMOY). For navigation purposes a hand-held, programmable GPS was used. High quality maps were provided by SKB and, in addition, digital maps from Garmin Map Source have been used. Ice rescue and safety equipment was used during all work on the lakes.

Co-ordinates (RT90 2,5 gon V 0:15) have been collected with a hand held GPS (Garmin Legend) with programming capabilities. Positioning has been made approximately every 30 m. X/Y co-ordinates have also been checked against two fix-points in the area, to secure data quality, see Table 3-1. The X/Y co-ordinates have been assigned Z values by SKB, by means of a digital terrain model (grid size 10x10 m). Elevations have been transferred from nearest grid point, which in average has been within 5–6 m away from the assigned point.

Table 3-1. Control points for navigational data. Correct positions taken from SKB files.

Point Name	GPSX	GPSY	Xcorrect	Ycorrect
1201	1631396	6699586	1631395	6699586
1001	1632368	6701358	1632367	6701362

All data was rudely checked in field, and at the end of each day field data was stored on a backup computer, as well as on CD. In addition, a field report file was written and stored each day along the field data. After each field day, rude processing was performed on the data. The result of this processing was then used for the planning of forthcoming data collection. After each field campaign, data was stored on a server at Geosigmas office, and backup CD:s were stored in safe archives.

3.2 Personal and ecological safety

All work on ice was carefully planned and executed only after that the ice had been checked. The field crew were equipped with mobile phones, ice claws and a safety life-line. The field crew consisted at all times of two persons.

The investigated area is located in a very sensitive ecological environment, which inhibits work in certain areas. Planning of field work was made by a group consisting of field coordinator, SKB activity leader and a panel of ecologists. In order to avoid any ecological disturbance, much of the work was performed on existing gravel roads and on frozen lakes. Additional attempts were also made on animal tracks in the forests and along previous geophysical profiles. Certain lakes and areas were, based on ecological concerns, designated as off limit at an early stage of the project, and have been left uninvestigated. As distance was measured by a wheel (see Figure 2-1), no thread has been used. No litter of any kind has been left behind during the project. Except for gas fumes related to car transports, no chemical emission of any kind has been made. As no engines are needed for GPR measuring, sound could be kept very low indeed.

4 Results and data delivery

All data were crudely analysed after each field day using a field computer equipped with GRADIX software. This analysis was used for the planning of each consecutive field day. In this way, the field work was directed to maximise the quality of the data, hence avoiding data collection in areas where poor results could be expected. All decisions on these matters were made after having conferred with the SKB activity leader. After completed field work, the entire data set underwent adequate processing in a processing station equipped with ReflexW software. All data that showed good quality and interpretable structures have been analysed. All such data has been transformed into line-files in a format that allows easy import into the SKB SICADA data base. In this report, the data has been presented in the form of drawings. The drawings are made to illustrate ground surface, bedrock surface, structures within the bedrock and structures within the overburden.

The results from the work have been organised into a series of geographical areas, designated A-U and consecutive numbers, e.g. b1, b2, b3 etc. The individual profiles have also been given an individual LFM-code (SICADA code). For a complete data table, see below. In case both 250 MHz and 100 MHz data has been interpreted along the same line-file the results have been combined. Please note that the positions of such combined data (i.e. point number) are arranged in accordance with the 250 MHz data. The drawings are arranged solely according to their LFM number, and 100 MHz and 250 MHz data are consequently displayed separately.

In Appendix 1, the individual data files are listed and briefly commented. The tables present the LFM-number, the field data name (FFID), and frequency used for each profile. Coordinates for start/stop are included, as well as profile length. A quality check code (OK/–) is given for each profile. Those listed as OK have been processed, interpreted and transformed into drawings (see Appendix 2).

All field and processed data have been delivered to SKB. Since a revised interpretation, based on both GPR data and supporting data, e.g. borehole information, is planned, only the line co-ordinates have been inserted in the SICADA data base at this stage. The SICADA reference is field note Forsmark no 112.

5 Interpretation

To begin with, it is important to point out that this first generation of interpretation is not co-ordinated with other results such as drilling, geological mapping etc. The interpretation is solely based on original GPR data and direct observations made by the field crew. This affects the interpretation, mainly leading to faulty depth assignments. When assigning depth, a signal velocity must be used to transform time-domain data to depth-domain data. The velocity of different geological materials should be checked by means of drillings in representative geological settings where good GPR data have been collected. In this way more accurate velocities can be used in processing, and a better geological model can be produced. A coordinated interpretation is planned for a forthcoming report.

In Appendix 2, the results are shown, both as images of the processed GPR data and drawings of the interpreted profiles.

The drawings have been made in order to present the following:

- Surface topography (from SKB topographical database).
- Structures within the overburden.
- Bedrock surface.
- Structures within the bedrock.

The drawings present these structures only where adequate data is available. The absence of interpreted structures does not mean there are no structures, but rather that the data quality is too poor for qualified interpretation.

6 Conclusions

With the exception of some modern gravel roads and areas with substantial clay cover, GPR measurements have been found to be a useful tool for investigations within the Forsmark site investigation area. The collection of GPR data is in comparison to many other field methods an ecologically safe method. The speed with which the data can be collected also makes it interesting when a larger area is to be investigated. GPR data can in many cases be helpful in designing forthcoming projects, such as drilling, sampling etc. GPR data can also be of value when investigating a smaller area in detail.

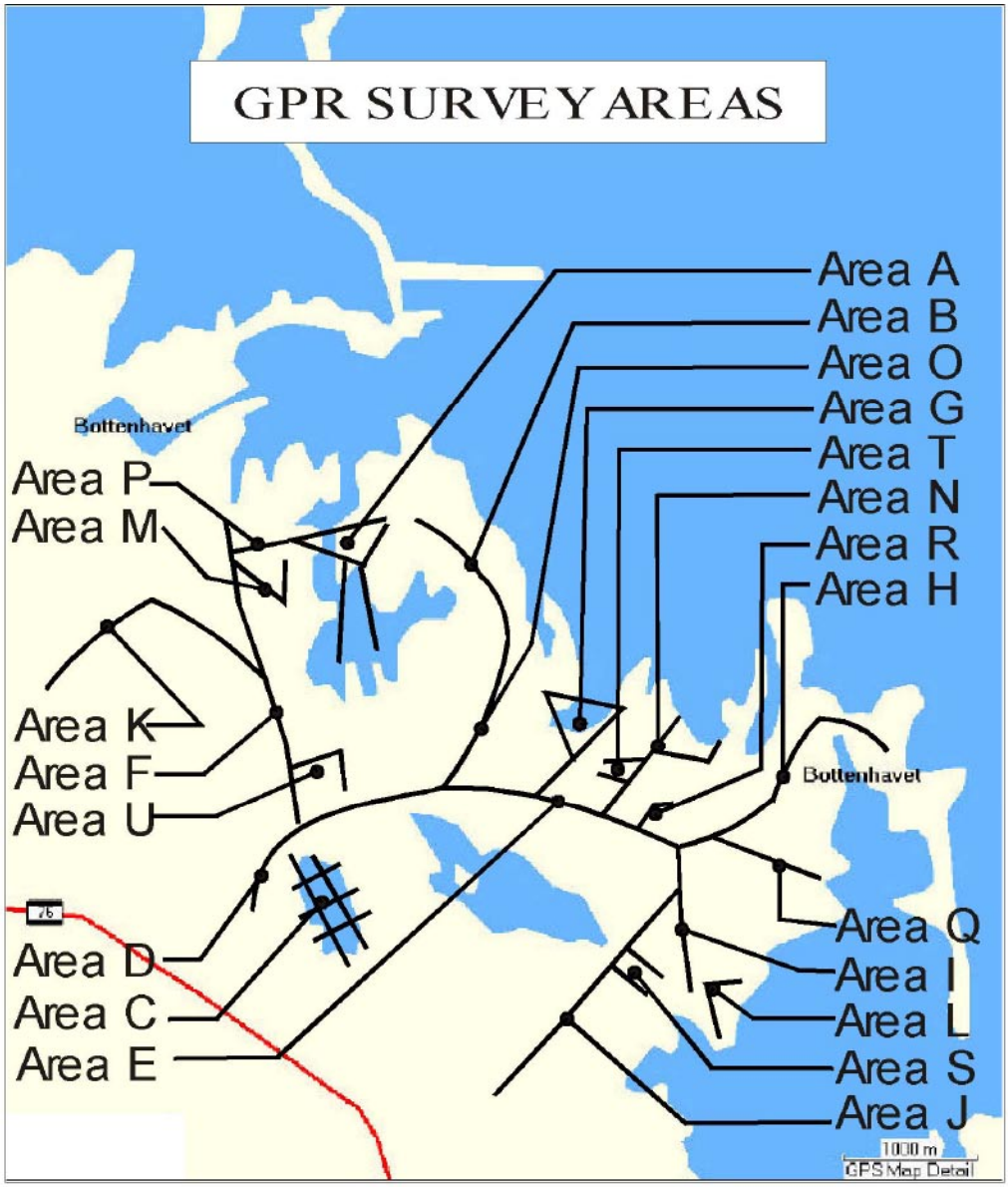
More than 64 km of GPR data have been collected, out of which more than 38 km have been processed, interpreted and transformed into drawings. The data quality differs between areas with different geological settings but is also depending on e.g. temperature and snow conditions at the time of data collection.

In areas with shallow overburden, exceptionally good data of bedrock structures have been found. Test runs on frozen lakes produced very good data in some areas, but failed in other areas where decaying organic materials are thought to be the main problem. It has been found that cold conditions and an even snow cover can improve conditions for investigations of areas where the GPR method usually is impractical.

Appendix 1

Survey areas and comments on the results

The figure below shows the GPR survey areas and the data files are briefly commented on in the following tables.



Area A. On lake-ice. Shallow mud with moraine protruding in places. Good data in south, poor data in north, probably due to effects from the mud.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000447	A1	100	1632099	6699490	1632051	6698834	601	–
LFM000448	A2	100	1632243	6698769	1632096	6699493	678	–
LFM000449	A4	250	1632099	6699490	1632051	6698834	620	OK
LFM000450	A5	250	1632243	6698769	1632096	6699493	698	OK
LFM000451	A6	250	1632099	6699490	1632469	6699731	529	OK
LFM000452	A7	250	1632340	6699906	1631878	6699211	803	–
LFM000453	A8	250	1631878	6699211	1631857	6699897	656	OK
LFM000454	A9	250	1631857	6699897	1632343	6699907	482	OK
LFM000455	A10	100	1632340	6699906	1631878	6699211	812	–
LFM000456	A11	100	1631878	6699211	1631857	6699897	666	–
LFM000457	A12	100	1631857	6699897	1632343	6699907	497	–

Area B. On gravel road. Good data all along road. Many structures within the bedrock. Shallow bedrock surface.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000458	B1	100	1633429	6698905	1633217	6699460	667	–
LFM000459	B2	100	1633217	6699460	1632848	6699729	474	–
LFM000460	B3	100	1632848	6699729	1632469	6699731	398	–
LFM000461	B4	250	1632469	6699731	1632848	6699729	381	OK
LFM000462	B5	250	1632848	6699729	1633217	6699460	492	OK
LFM000463	B6	250	1633217	6699460	1633429	6698905	663	OK

Area C. On lake-ice. Excellent data. Many interesting structures in lake sediments. Data does apparently not reach bedrock surface, despite good signal penetration.

LFM No	FFID	Frequency	StArtX	StArtY	StopX	StopY	Length	QC
LFM000464	C1	250	1631772	6697092	1632055	6697245	283	OK
LFM000465	C2	250	1632151	6697033	1631851	6696891	289	OK
LFM000466	C3	250	1631962	6696633	1632257	6696862	325	OK
LFM000467	C4	100	1631772	6697092	1632055	6697245	293	OK
LFM000468	C5	100	1632151	6697033	1631851	6696891	290	OK
LFM000469	C6	100	1631962	6696633	1632257	6696862	328	OK
LFM000470	C8	250	1631770	6697321	1632067	6696640	648	OK
LFM000471	C9	250	1632067	6696640	1632222	6696552	194	OK
LFM000472	C10	250	1632222	6696552	1631951	6697292	687	OK
LFM000473	C11	250	1631951	6697292	1631798	6697423	277	OK

Area D. Moderate quality data. Difficult to distinguish between bedrock surface and bedrock structures.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000474	D2	100	1632746	6697962	1632398	6697884	453	OK
LFM000475	D3	100	1632398	6697884	1632064	6697680	407	OK
LFM000476	D4	100	1632062	6697681	1631772	6697426	475	OK
LFM000477	D5	100	1631772	6697426	1631667	6697024	483	OK
LFM000478	D6	250	1631667	6697024	1631772	6697426	484	OK
LFM000479	D7	250	1631772	6697426	1632062	6697681	471	OK
LFM000480	D8	250	1632064	6697680	1632398	6697884	411	–
LFM000481	D9	250	1632398	6697888	1632746	6697962	448	OK
LFM000482	D10	250	1632746	6697962	1633299	6698105	628	OK

Area E. Along gravel road located on clay. Poor signal penetration in east, probably due to effects from clay. In west, however, good data that reach bedrock surface.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000483	E1	250	1633307	6698102	1634213	6697794	952	OK
LFM000484	E2	250	1634218	6697793	1634707	6697647	503	–
LFM000485	E3	100	1633723	6697946	1634707	6697647	1017	–
LFM000486	E4	100	1634213	6697794	1633307	6698102	958	OK
LFM000487	E7	250	1633723	6697946	1634707	6697647	1017	OK

Area F. Along gravel road, pass KBH01. Differing data quality along road. Good bedrock coverage along long stretch. Mostly moraine on bedrock.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000488	F1	100	1630940	6699965	1631389	6699558	676	–
LFM000489	F2	100	1631389	6699558	1631685	6698645	1090	OK
LFM000490	F3	100	1631685	6698645	1632070	6697688	1181	–
LFM000491	F4	250	1632070	6697688	1631685	6698645	1182	OK
LFM000492	F5	250	1631685	6698645	1631389	6699550	1094	OK
LFM000493	F6	250	1631389	6699558	1630940	6699965	676	

Area G. On road and lake. Road data are good, while lake data is very poor, probably due to lake sediments.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000494	G1	250	1633731	6697969	1634233	6698681	939	OK
LFM000495	G2	250	1634204	6698632	1633710	6698601	468	–
LFM000496	G3	250	1633710	6698601	1633936	6698257	386	–
LFM000497	G4	250	1633936	6698257	1634204	6698632	426	–
LFM000498	G5	100	1634204	6698632	1633710	6698601	434	–
LFM000499	G6	100	1633710	6698601	1633936	6698257	387	–
LFM000500	G7	100	1633936	6698257	1634204	6698632	434	–
LFM000501	G8	100	1634233	6698681	1633731	6697969	931	–

Area H. On road. Partially very good data.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000502	H1	250	1634703	6697645	1635438	6697920	811	OK
LFM000503	H2	250	1635438	6697920	1636060	6698449	1303	OK
LFM000504	H3	100	1636060	6698449	1635438	6697920	1308	OK
LFM000505	H4	100	1635438	6697920	1634703	6697645	809	OK

Area I. On road. Poor data close to clay field, good data in forest.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000506	I1	100	1634706	6697643	1635093	6696435	799	–
LFM000507	I2	100	1634772	6696874	1635093	6696435	607	–
LFM000508	I21	250	1635093	6696435	1634772	6696874	606	OK
LFM000509	I3	250	1635093	6696435	1634706	6697643	796	–

Area J. On road. Data of varying quality. Good data in sections.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000510	J1	250	1634736	6697396	1634170	6696741	1032	OK
LFM000511	J2	250	1634170	6696741	1633349	6695825	1230	OK
LFM000512	J3	100	1633349	6695825	1634170	6696741	1234	–
LFM000513	J4	100	1634170	6696741	1634736	6697396	1028	–

Area K. On road. Mostly moraine on bedrock. Some sedimentary structures in low-lying parts. Bedrock reaches surface in one location. Many deep structures within bedrock.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000514	K1	100	1631676	6698594	1631024	6698914	778	OK
LFM000515	K2	100	1631022	6698912	1630300	6698687	1151	–
LFM000516	K3	100	1630301	6698687	1629660	6698122	976,2	–
LFM000517	K4	250	1629660	6698122	1630301	6698687	976	OK
LFM000518	K5	250	1630300	6698687	1631022	6698912	1148,9	OK
LFM000519	K6	250	1631024	6698914	1631676	6698594	776,5	OK

Area L. Off road, across small mountain and close to sea. Good data on bedrock structures

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000520	L1	250	1634767	6696734	1635204	6696699	470	–
LFM000521	L2	250	1634861	6696576	1634845	6696116	578	OK
LFM000522	L3	100	1634845	6696116	1634861	6696576	570,2	–

Area M. In Forest. Attempt to use animal track. Data of varying quality.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000523	M1	250	1631387	6699564	1631650	6699431	427,9	OK
LFM000524	M2	250	1631621	6699530	1631745	6699665	242,8	OK

Area N. On road. Good data.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000525	N1	100	1634206	6697798	1634443	6698497	820,3	OK
LFM000526	N2	250	1634443	6698497	1634464	6698098	427,5	OK
LFM000527	N3	100	1634465	6698097	1634748	6698212	381,9	–
LFM000528	N4	250	1634748	6698212	1634206	6697798	781,3	–

Area O. On road. Good data in sections.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000529	O1	250	1633429	6698877	1633201	6698697	537,1	OK
LFM000530	O2	250	1633201	6698697	1633126	6698157	575	OK
LFM000531	O3	100	1633126	6698157	1633201	6698697	786,5	–
LFM000532	O4	100	1633429	6698877	1633201	6698697	532,9	–

Area P. In forest. Measurements along seismic profile. Data of varying quality.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000533	p1	250	1631199	6699599	1631842	6699777	834,4	OK
LFM000534	p2	250	1631859	6699755	1631416	6699568	697,2	OK

Area Q. On road. Mostly poor data.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000535	Q1	100	1634890	6697703	1635609	6697568	763,9	–
LFM000536	Q2	250	1635609	6697568	1634780	6697680	875,8	–

Area R. On road close to KBH002. Good data on high ground, poor data closer to Area E.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000537	R2	250	1634455	6697716	1634611	6697844	226,3	OK
LFM000538	R3	100	1634611	6697844	1634455	6697716	227,9	–

Area S. In forest. Attempt to collect data close to small river. Poor data.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000539	S1	100	1634170	6696741	1634290	6696719	124,4	–
LFM000540	S2	250	1634290	6696719	1634170	6696741	124,1	–
LFM000541	S3	250	1634166	6696638	1634528	6696524	441,1	–
LFM000542	S4	100	1634528	6696524	1634166	6696638	438,7	–

Area T. In forest along fence and tractor path. Good data on high ground, where bedrock is shallow or reaches surface.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000543	T1	100	1634334	6697931	1634060	6698030	297,4	OK
LFM000544	T2	250	1634060	6698030	1634334	6697931	293,6	–
LFM000545	T3	250	1634334	6697931	1634060	6698030	295,5	OK
LFM000546	T4	250	1634402	6698046	1634108	6698081	339	OK
LFM000547	T5	100	1634108	6698081	1634402	6698046	335,4	OK

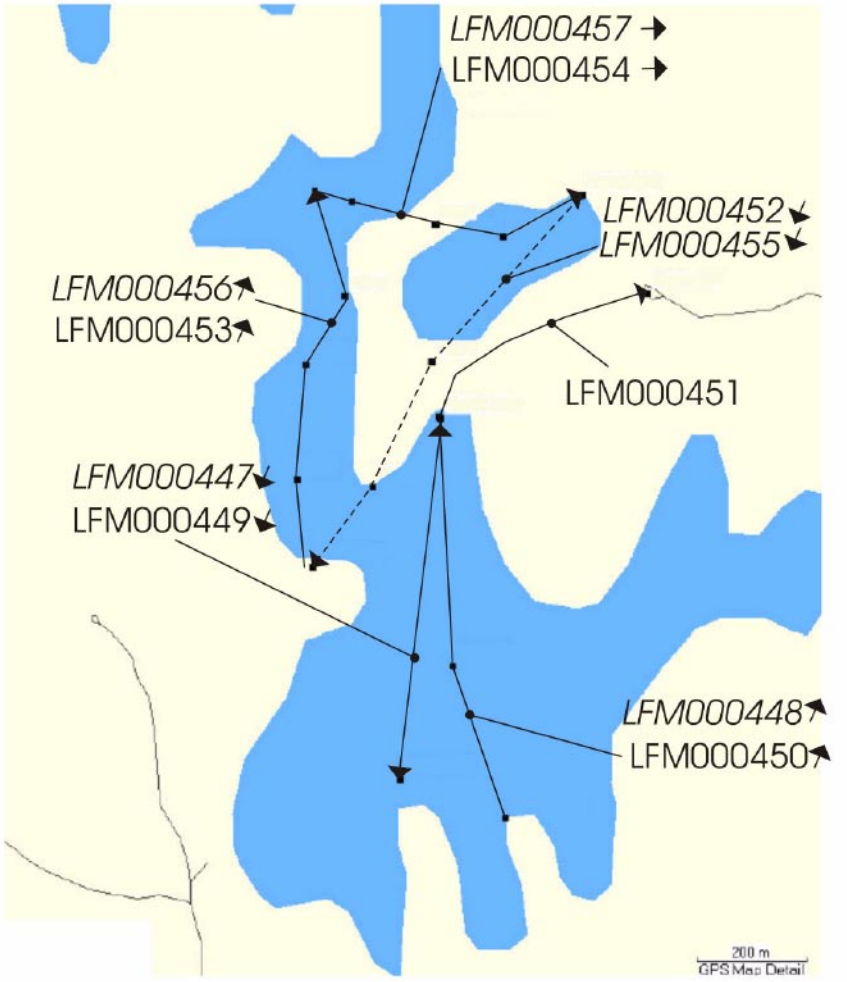
Area U. On tractor path in forest. Mostly moraine and ponds. Good coverage of bedrock surface with 100 MHz antenna.

LFM No	FFID	Frequency	StartX	StartY	StopX	StopY	Length	QC
LFM000548	U1	100	1631654	6698143	1631809	6698236	492,8	OK
LFM000549	U2	250	1631809	6698236	1631814	6698226	303	OK

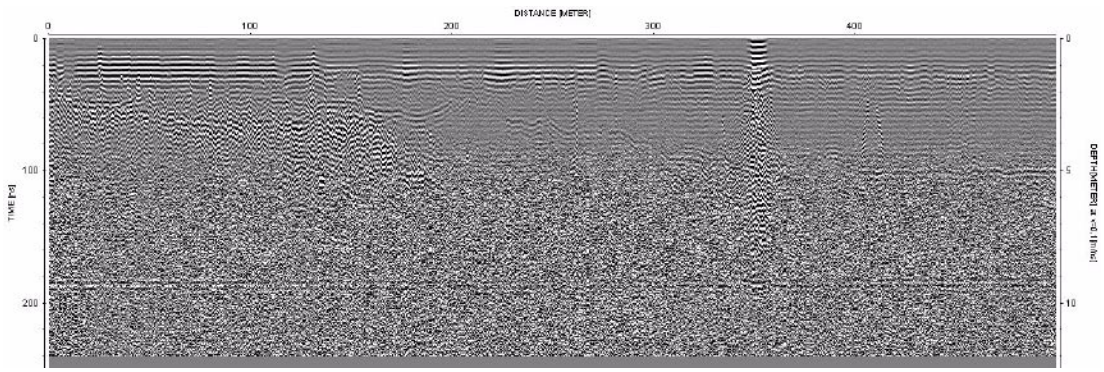
Appendix 2

Area maps, GPR profiles and interpretations

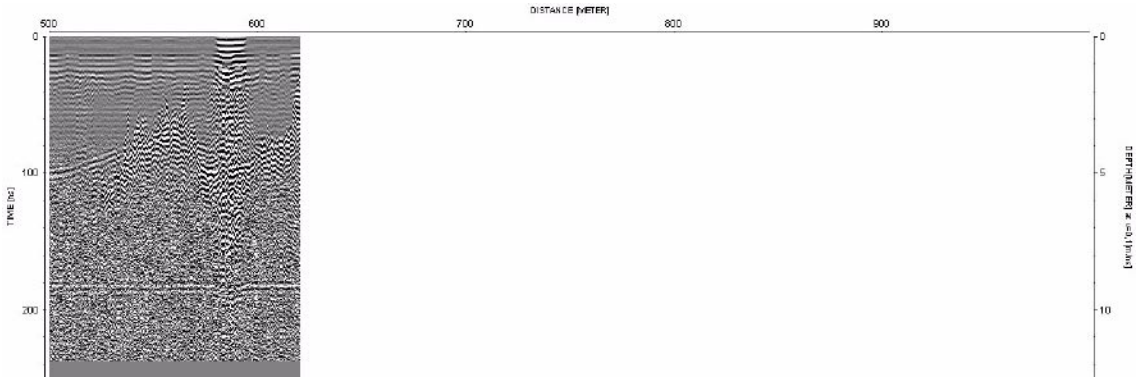
AREA A



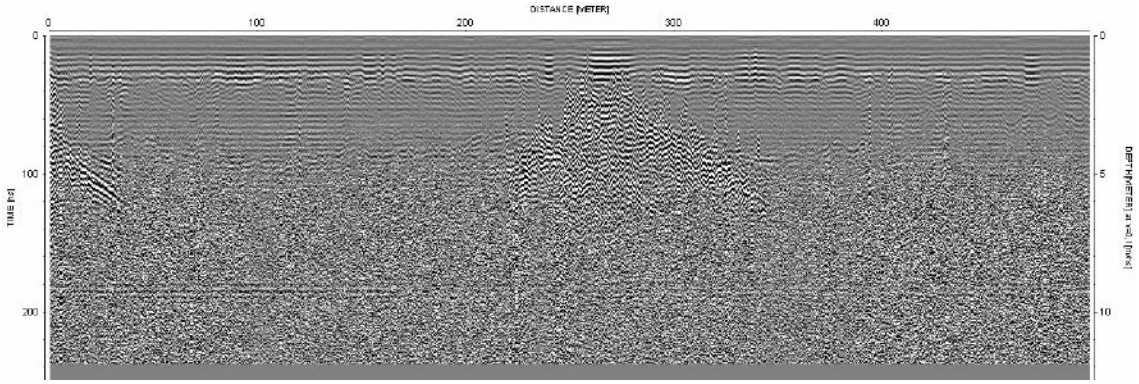
Fig, A1. Sketch map of area A .Codes in italic letters represent uninterpreted profiles.



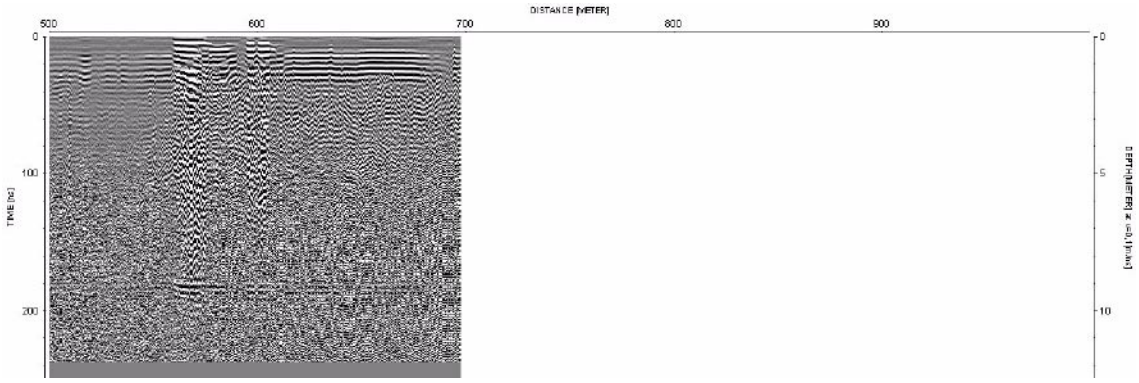
LFM 000449 , Profile A4, 0-500, from north to south



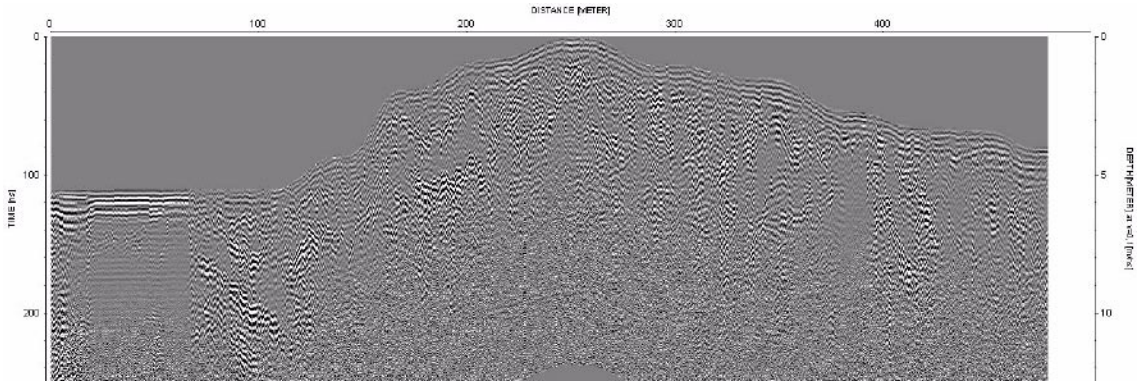
LFM 000449, Profile A4,500-620. from north to south



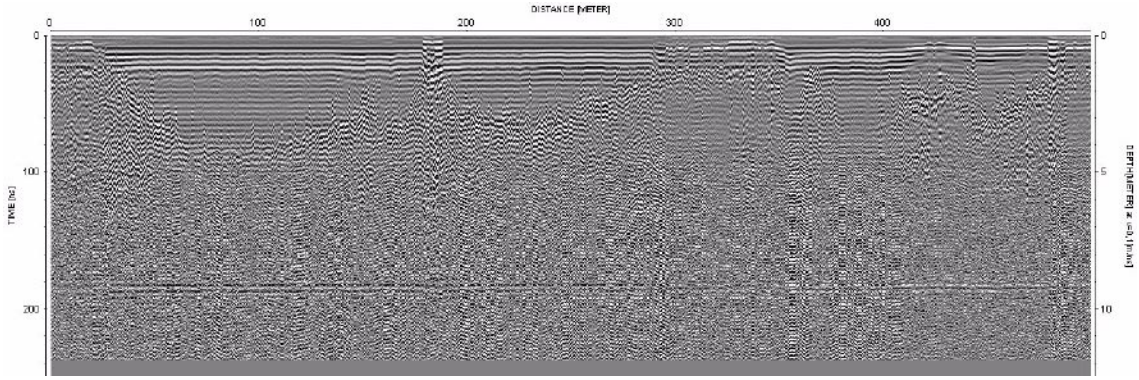
LFM 000450, Profile A5, 0-500, from south to north



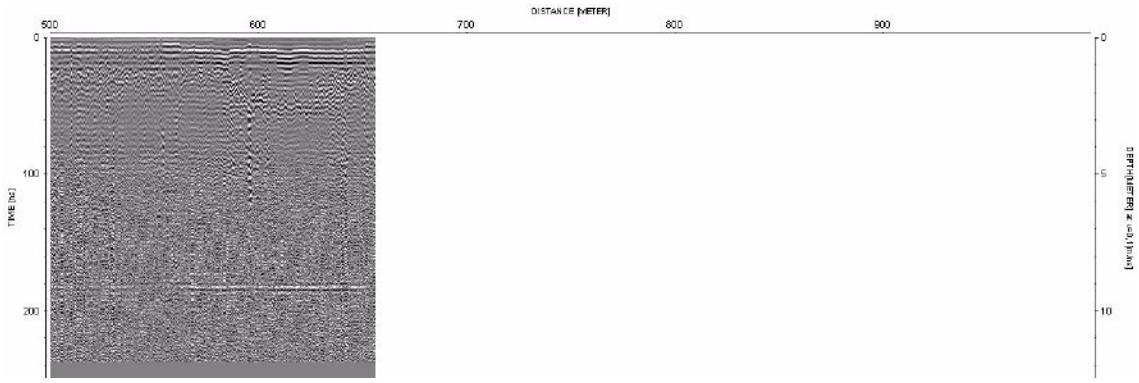
LFM 000450, Profile A5, 500-1000, from south to north



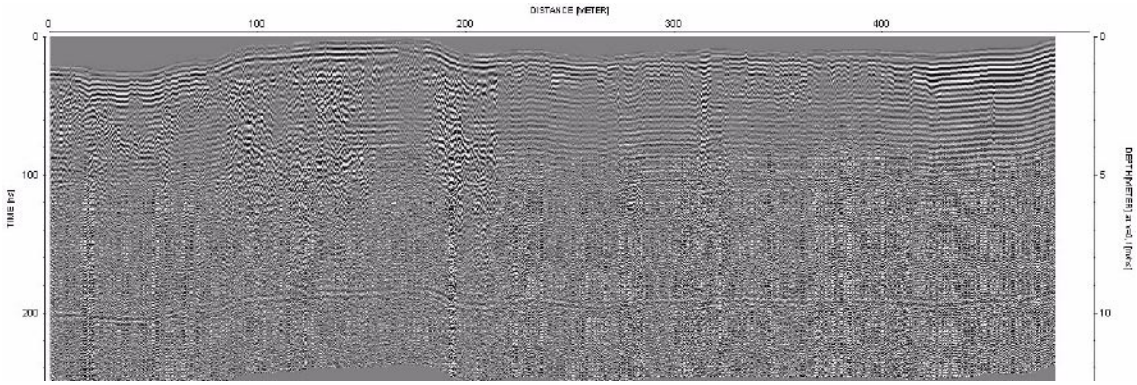
LFM 000451, Profile A6, 0-478, from west to east



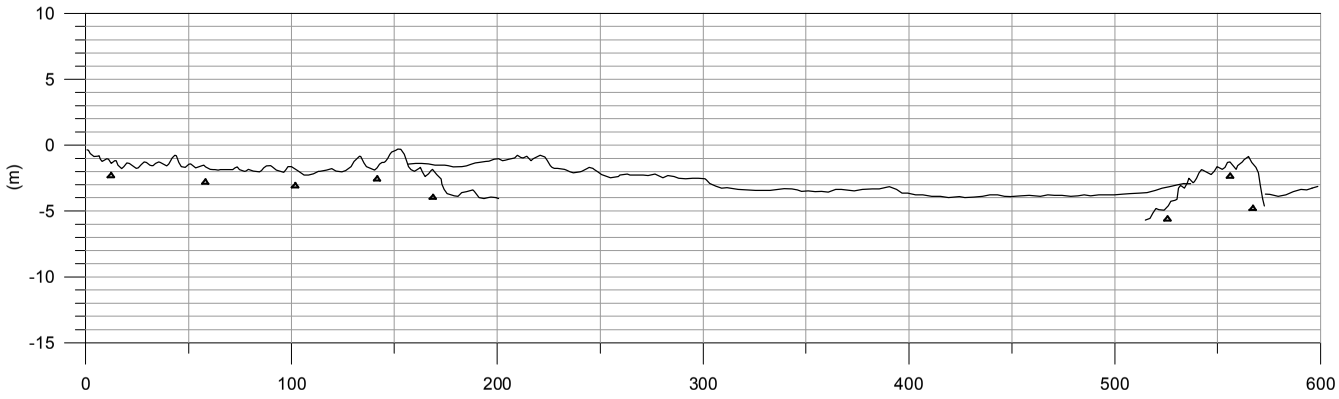
LFM 000453, Profile A8, 0-500, from south to north



LFM 000453, Profile A8, 500-656, from south to north



LFM 000454, Profile A9, 0-483, from west to east



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

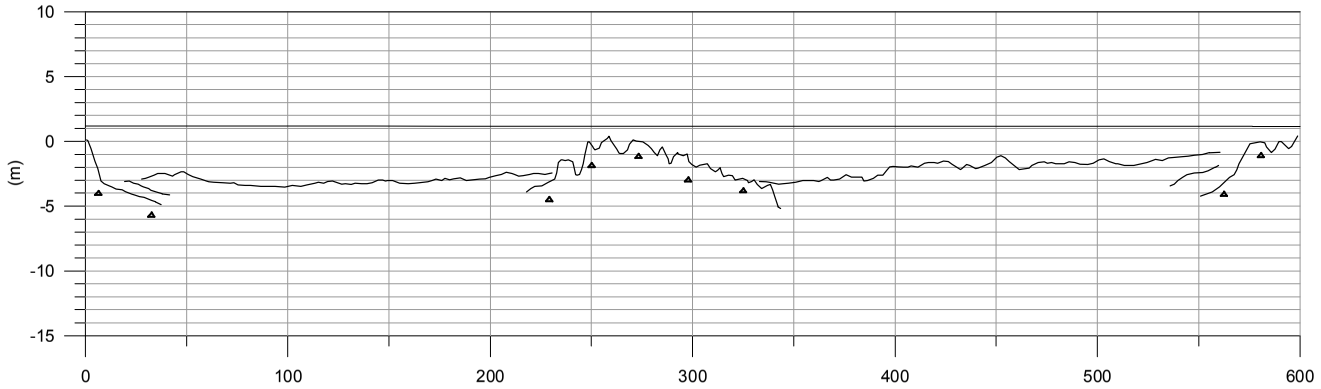
Markradarmätningar
Forsmark
LFM000449
A4

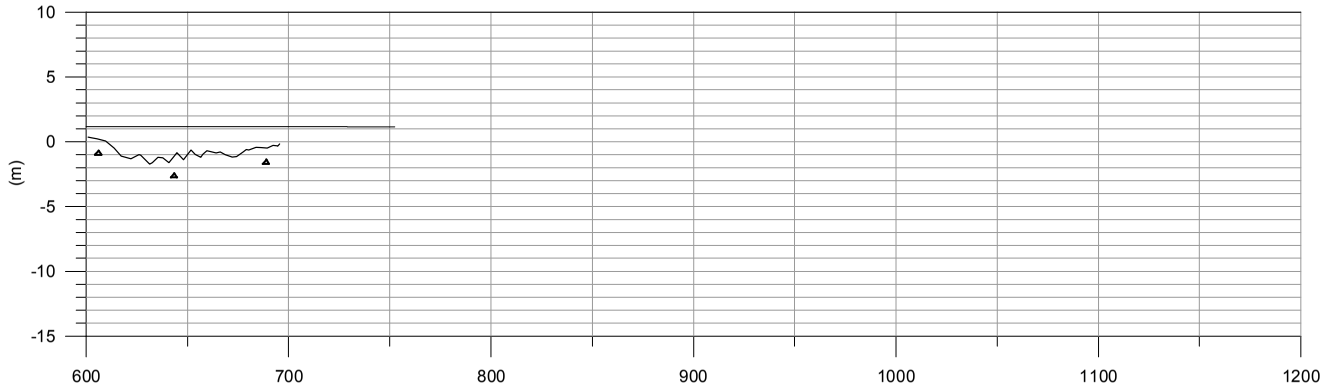
RITAD HANDLÄGGARE: Rikard Marek

UPPDRAGSGIVARE: SKB Forsmark

ID-NUMMER: Grap03018

SKALA:





Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

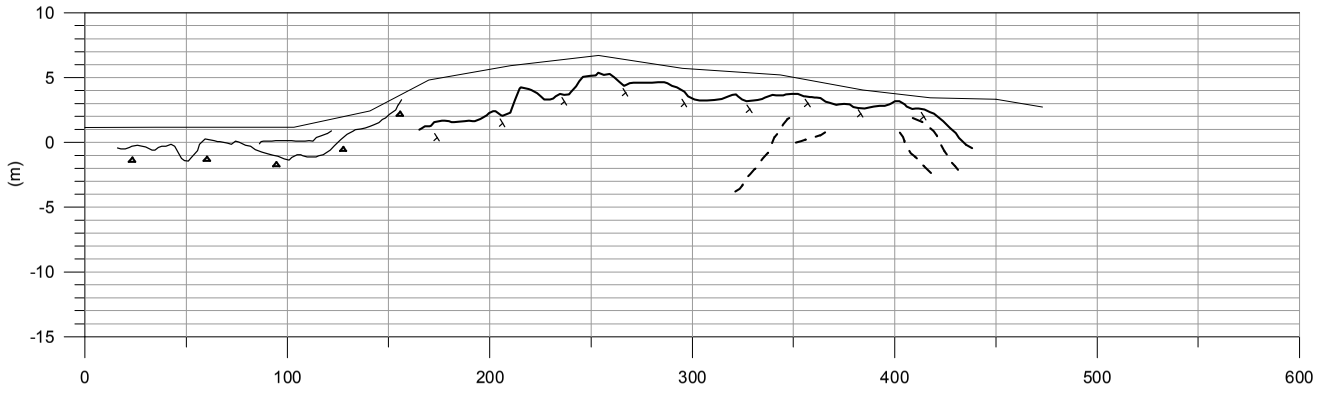
Markradarmätningar
Forsmark
LFM000450
A5

RITAD HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA

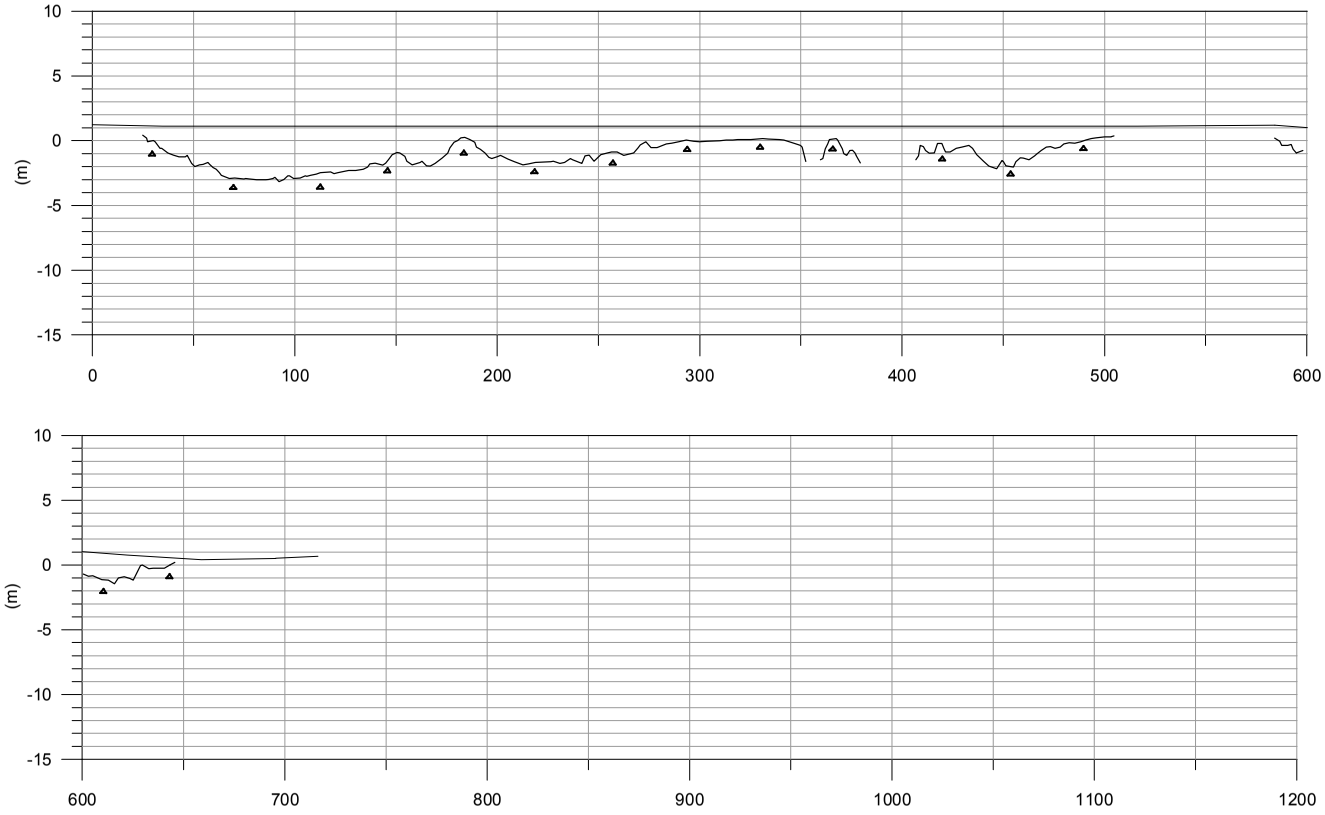


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000451
A6

RITAD: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

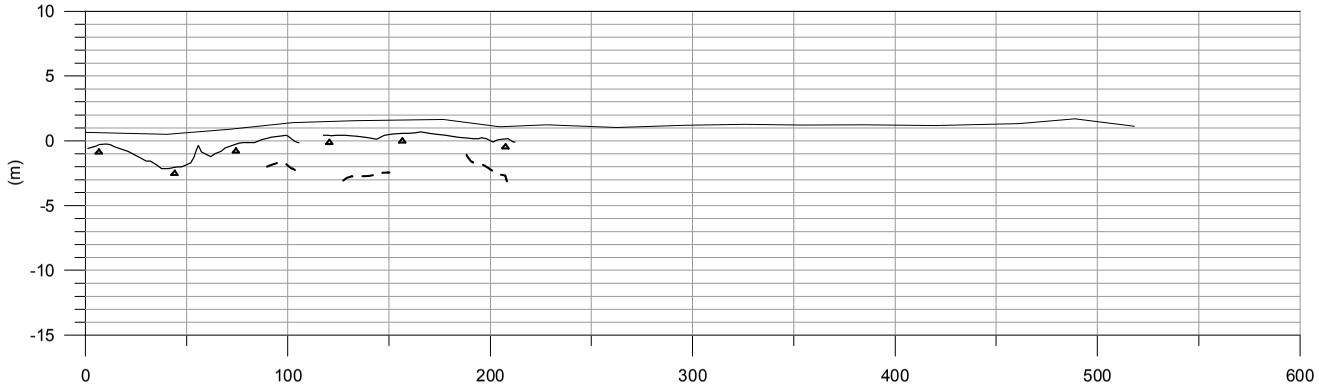


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000453
A8

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000454
A9

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA B

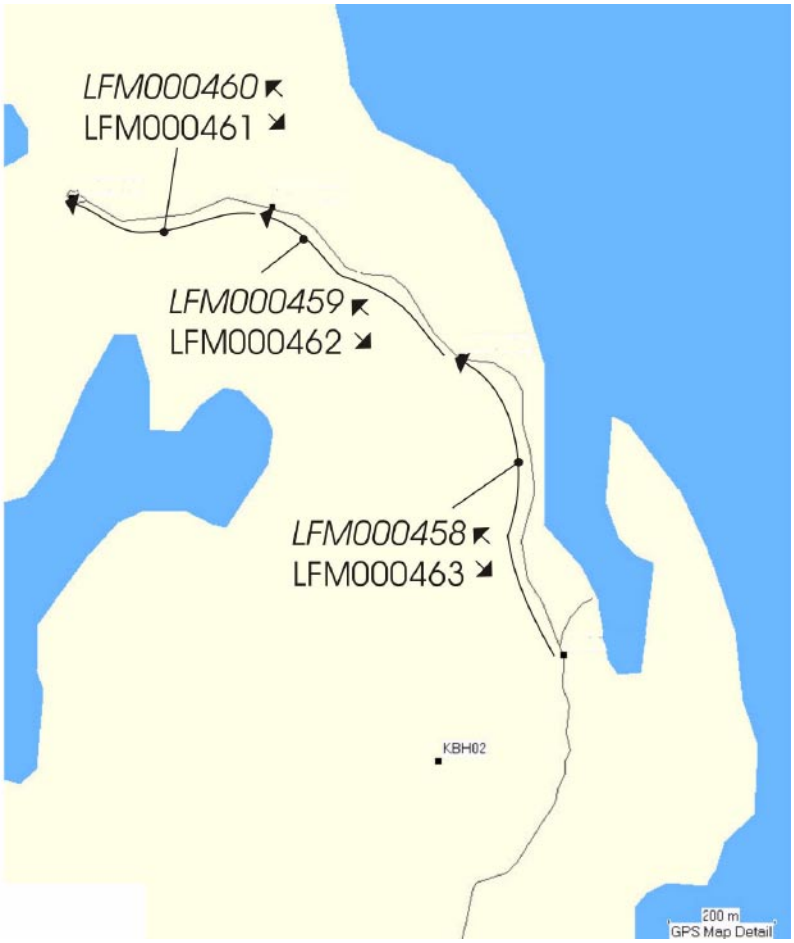
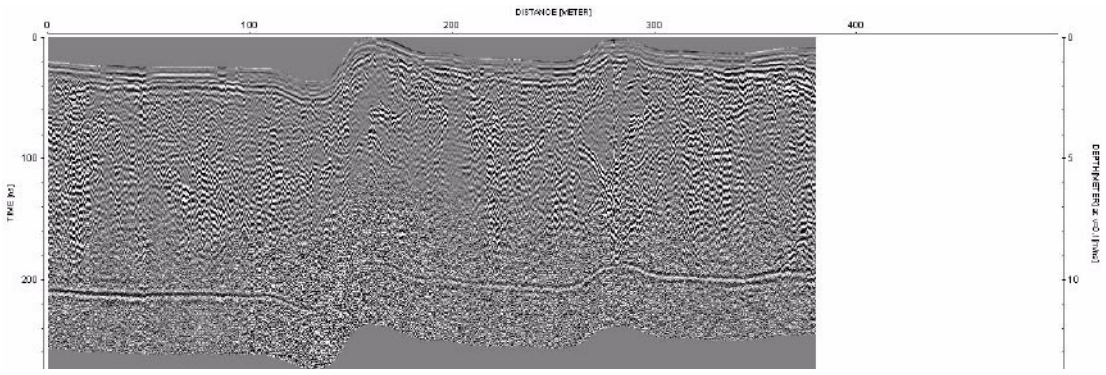
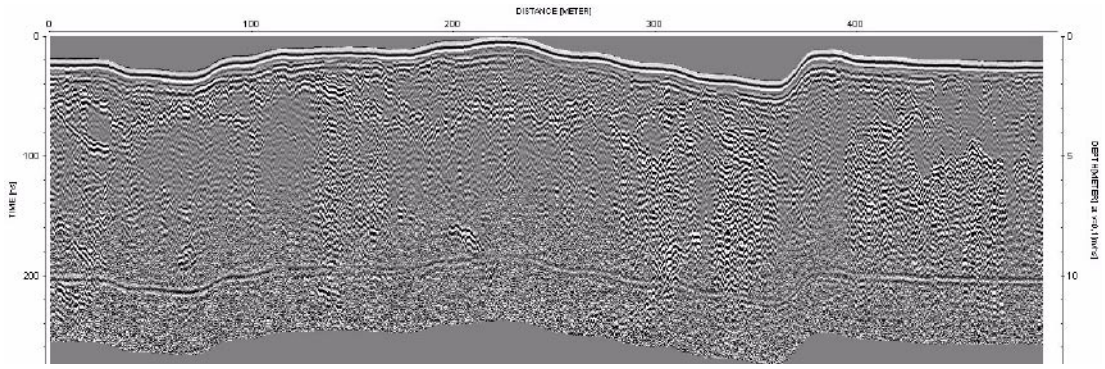


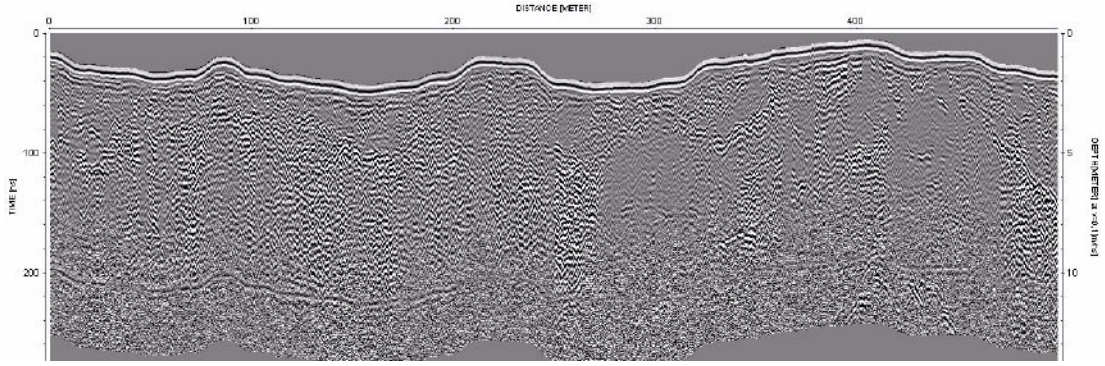
Fig. A2. Sketch map of area B. Codes in italic letters represent uninterpreted profiles.



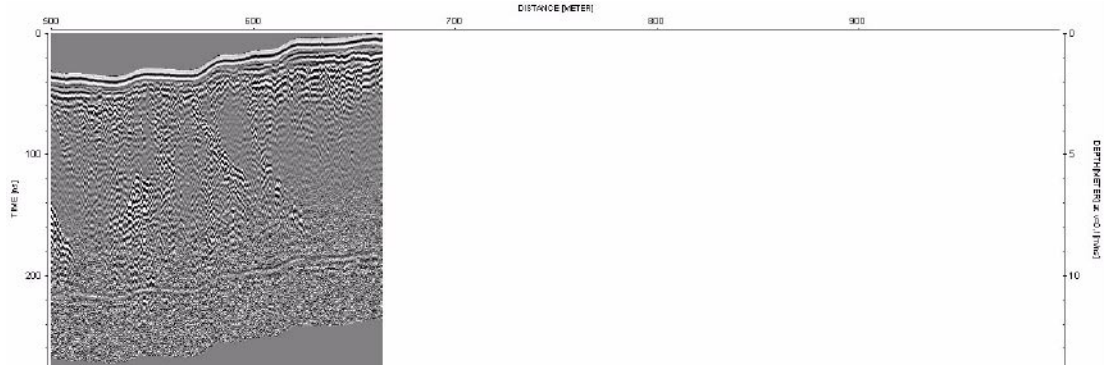
LFM000461, Profile B4, 0-380, from west to east



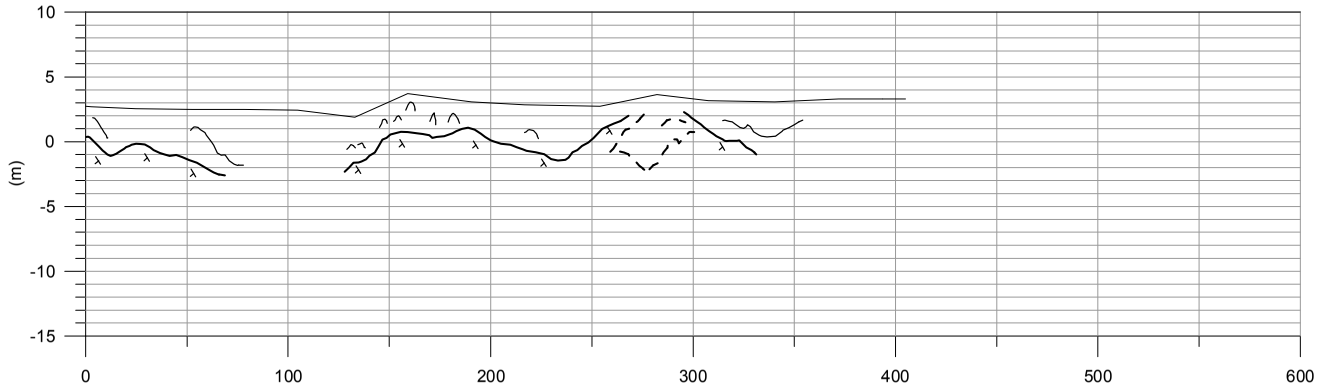
LFM000462, Profile B5, 0-492, from west to east



LFM000463, Profile B6, 0-500, from north to south



LFM000463, Profile B6, 500-663, from north to south

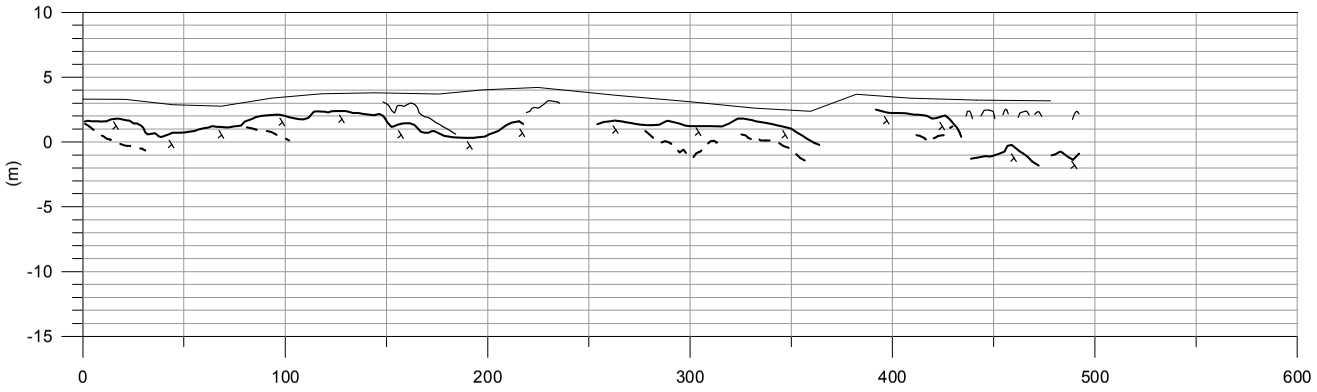


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000461
B4

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

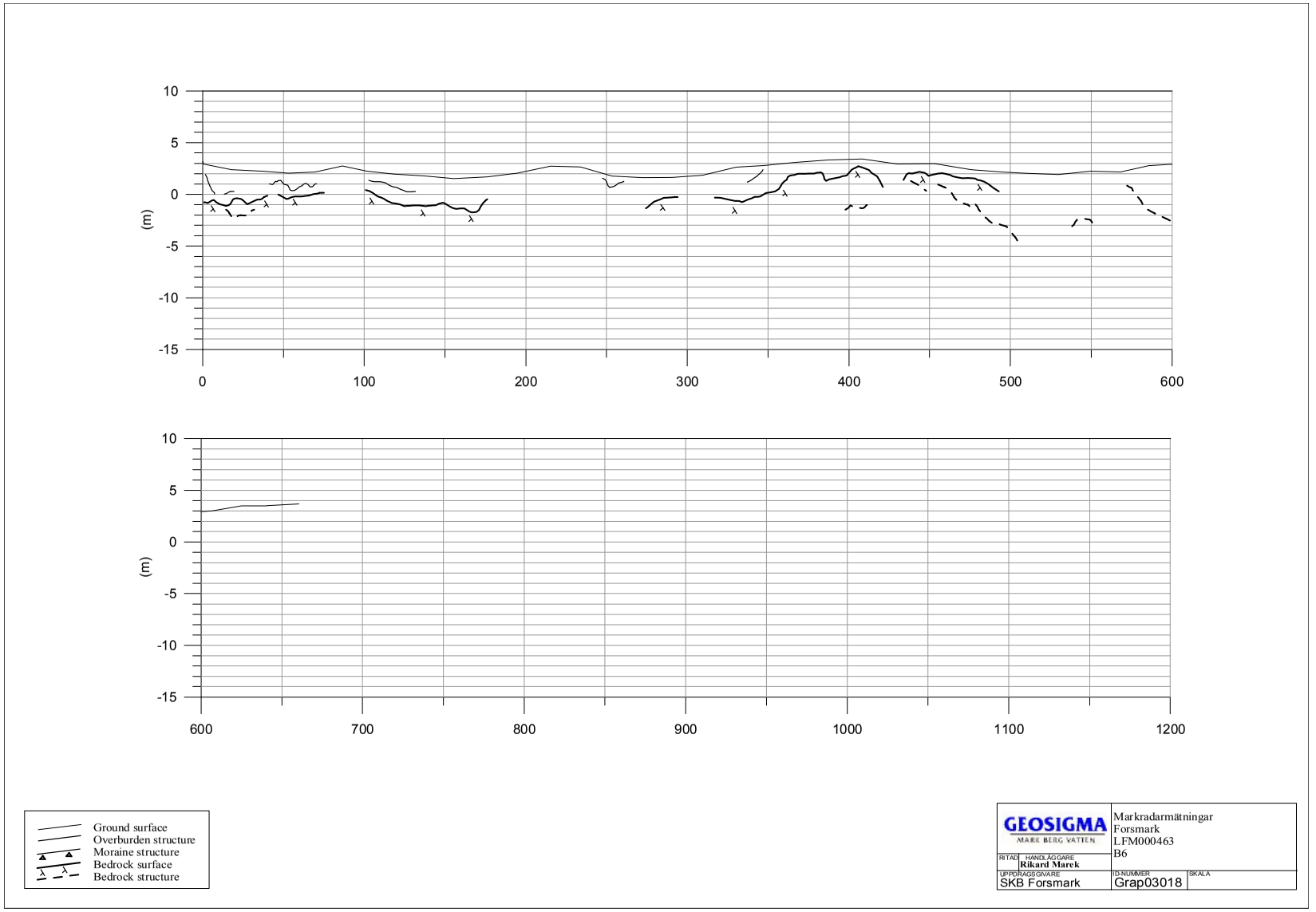


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000462
B5

RITAD: Rikard Marek
HANDLÄGGARE:
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:


10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600
10
5
0
-5
-10
-15
(m)
600
700
800
900
1000
1100
1200
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure
GEOSIGMA
MARK BERG VATTEN
RITAD HANDLÄGGARE
Rikard Marek
UPPDRAGSGIVARE
SKB Forsmark
Markradarmätningar
Forsmark
LFM000463
B6
ID-NUMMER
Grap03018
SKALA

AREA C

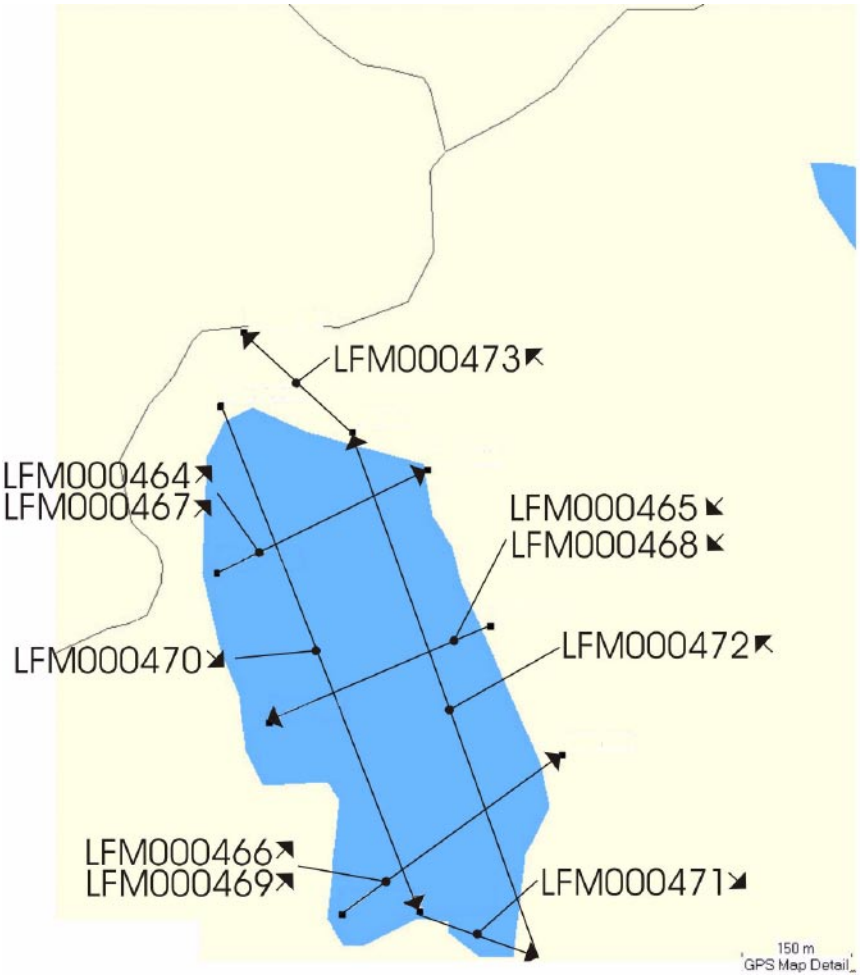
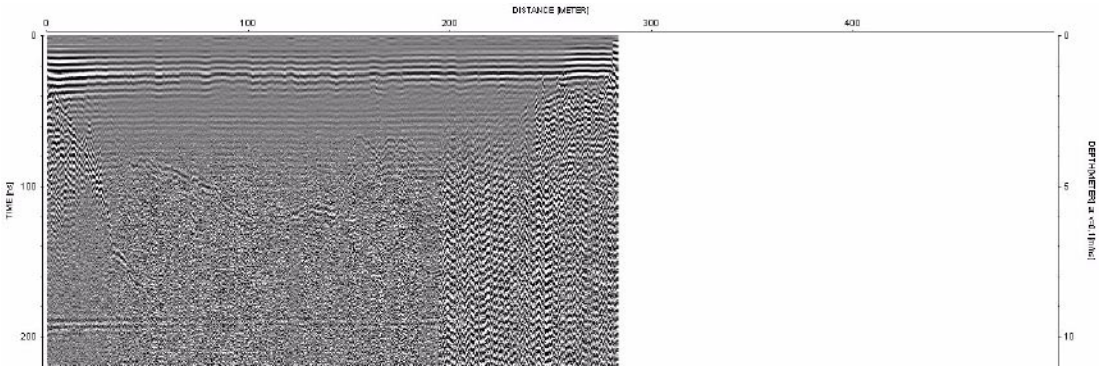
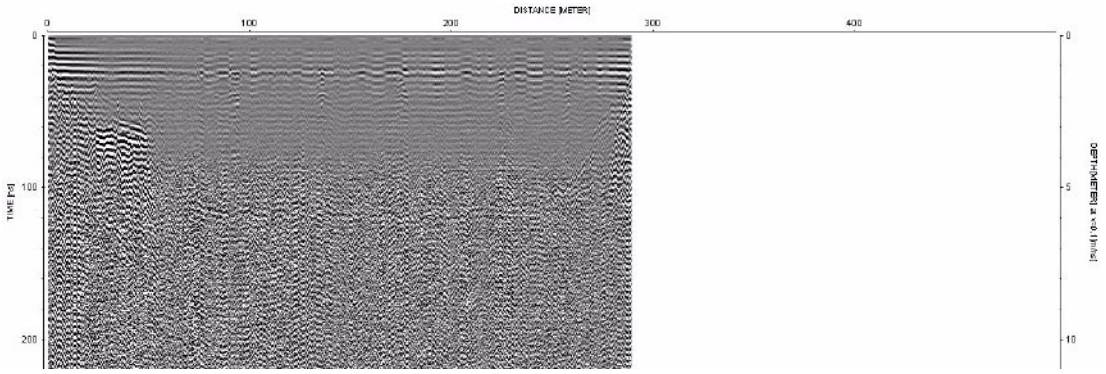


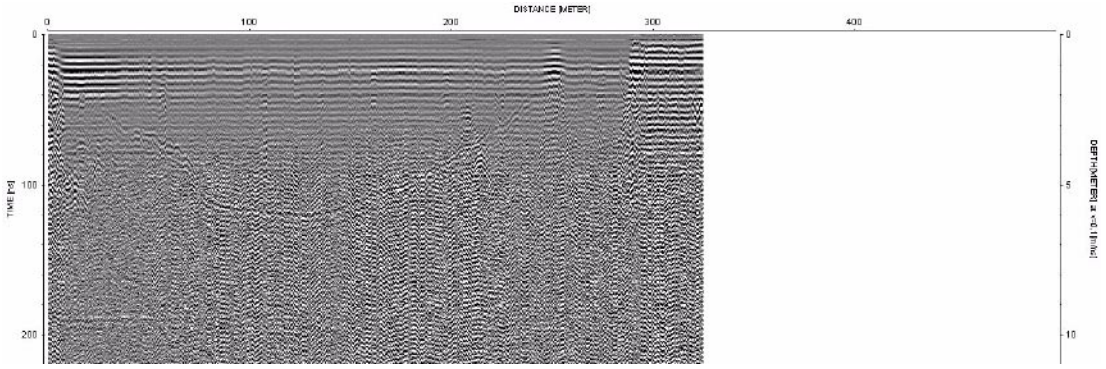
Fig.A3. Sketch map of area C.



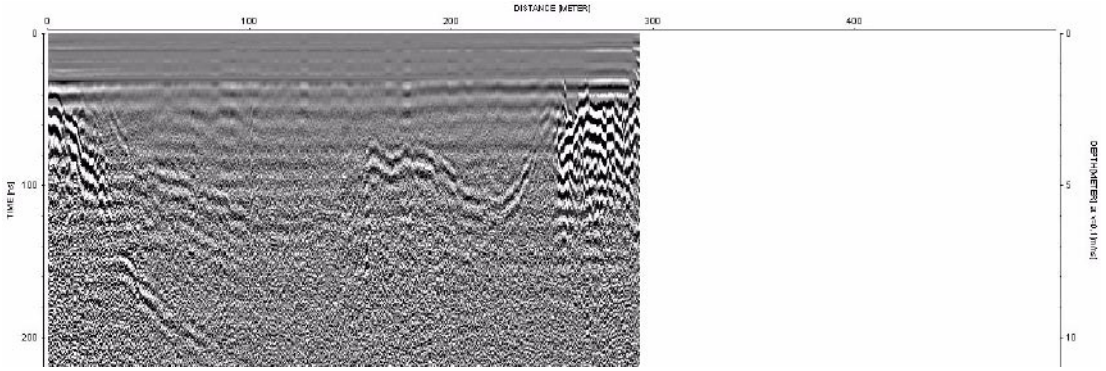
LFM000464 Profile C1, 0-283, from west to east



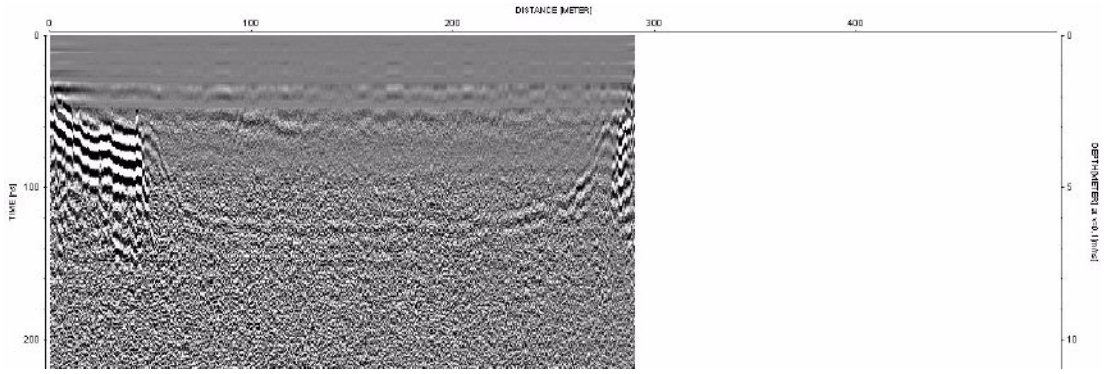
LFM000465 Profile C2, 0-289, from east to west



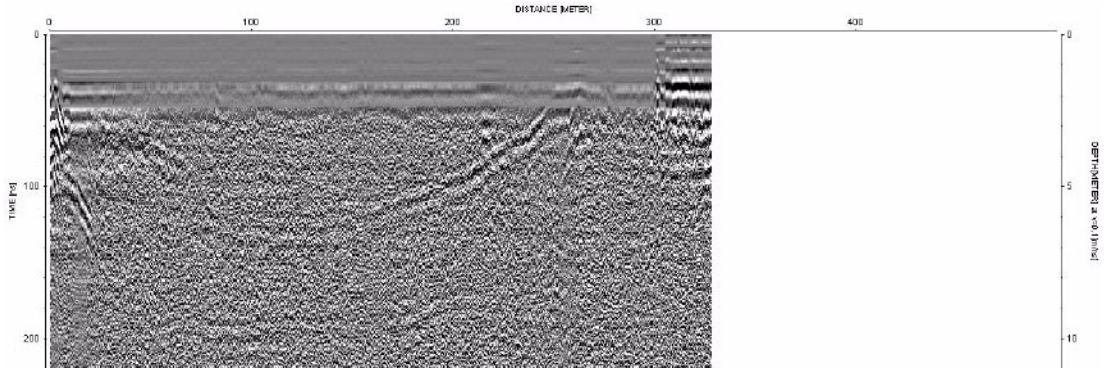
LFM000466 Profile C3, 0-324, from west to east



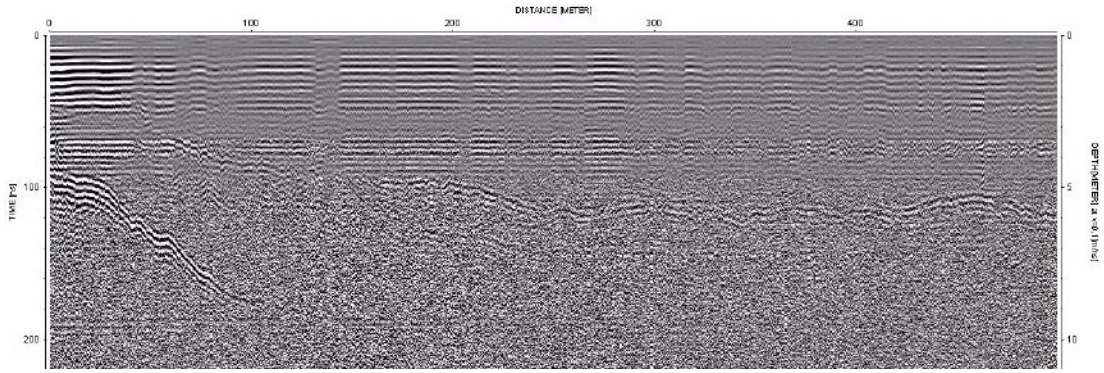
LFM000467 Profile C4, 0-293, from west to east



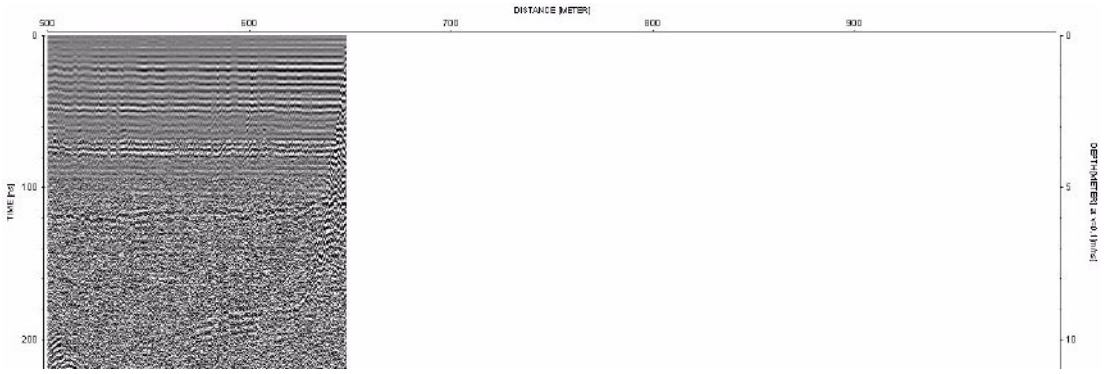
LFM000468 Profile C5, 0-289, from east to west



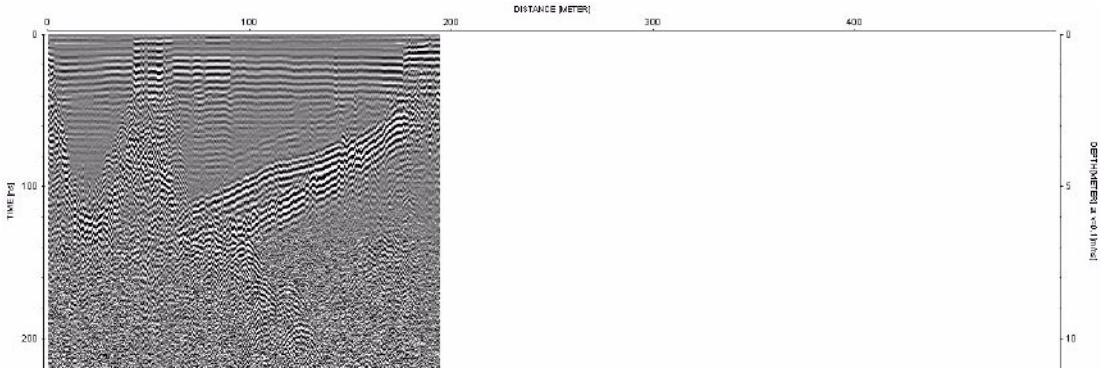
LFM000469 Profile C6, 0-328, from west to east



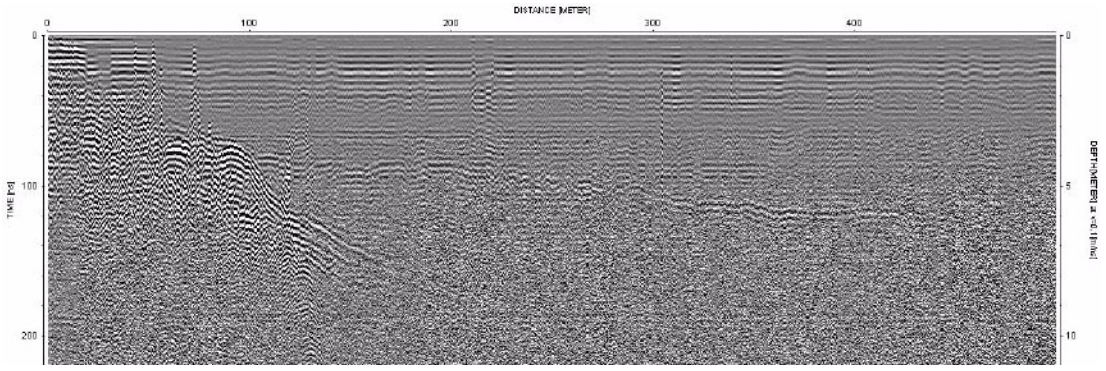
LFM000470 Profile C8, 0-500, from north to south



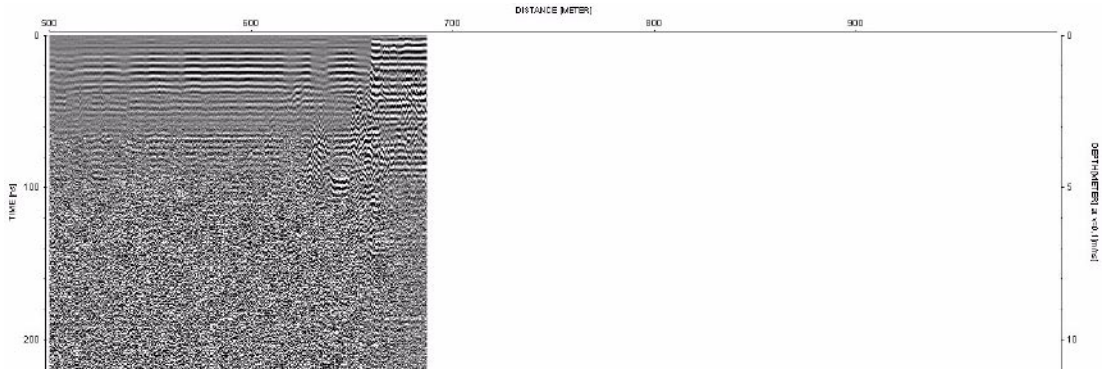
LFM000470 Profile C8, 500-648, from north to south



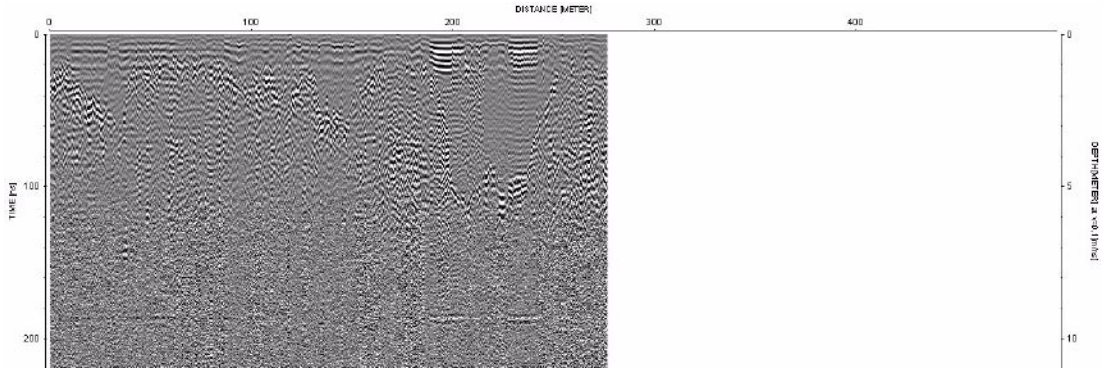
LFM000471 Profile C9, 0-195, from west to east



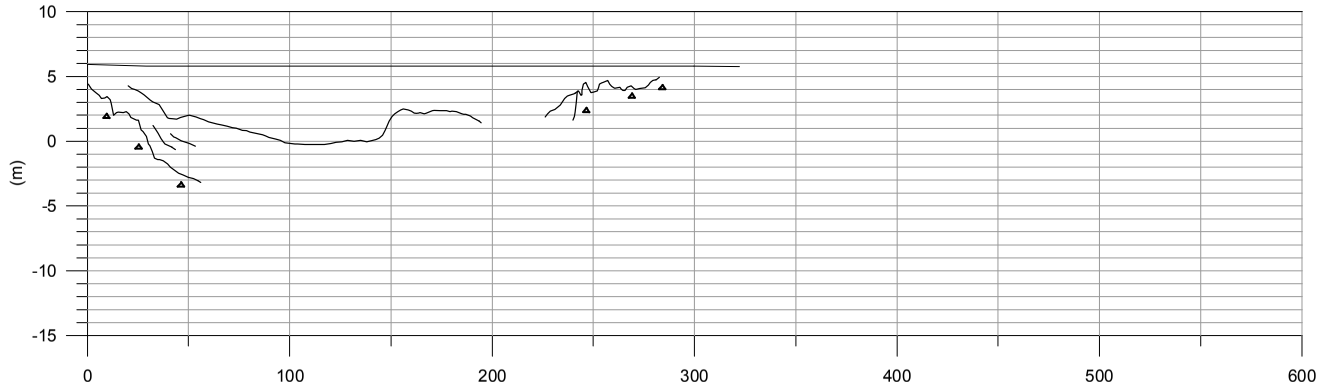
LFM000472 Profile C10, 0-500, from south to north



LFM000472 Profile C10, 500-686, from south to north



LFM000473 Profile C11, 0-277, from south to north

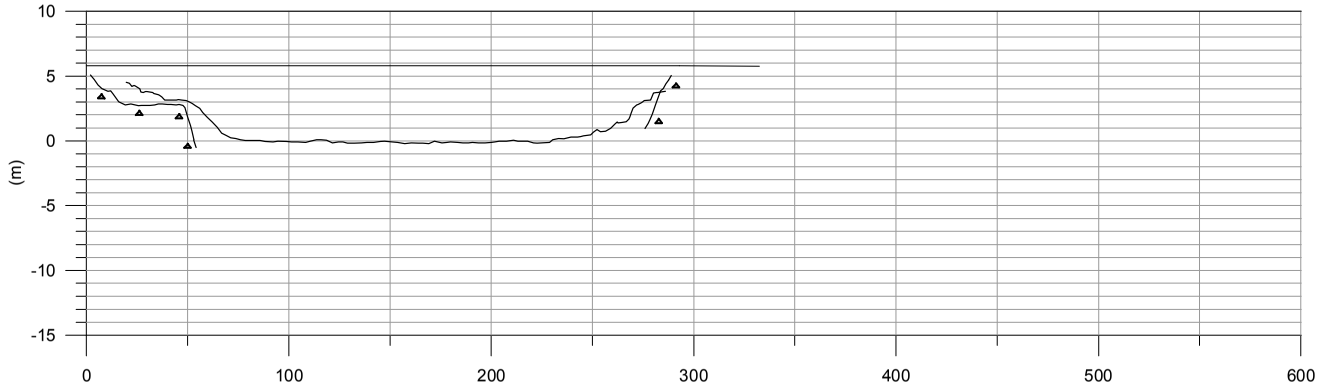


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000464
C1

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

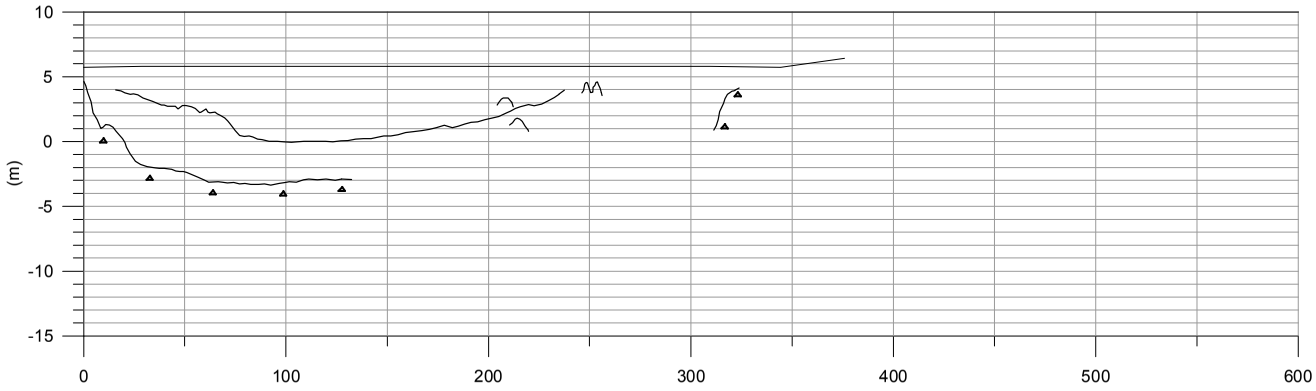
Markradarmätningar
Forsmark
LFM000465
C2

RITAD: HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA

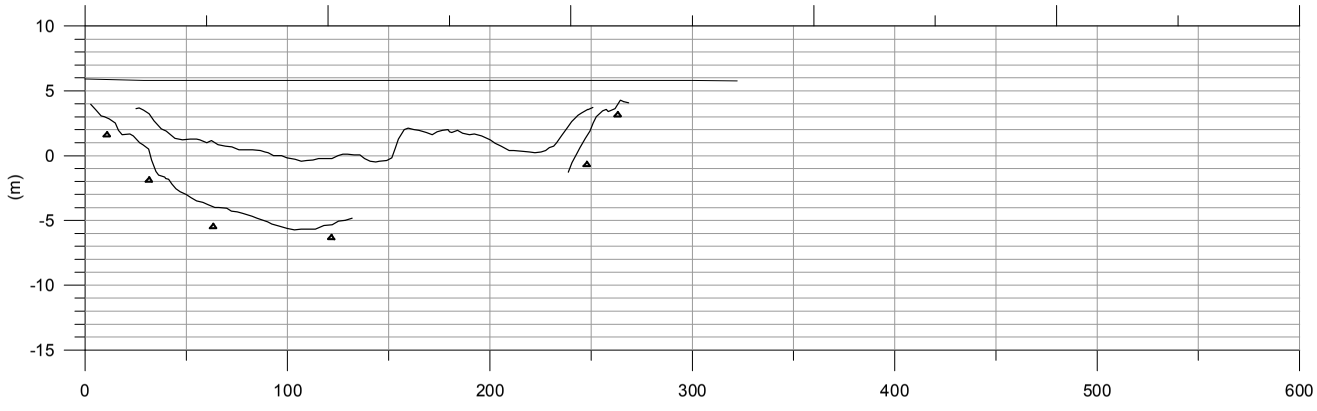


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000466
C3

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

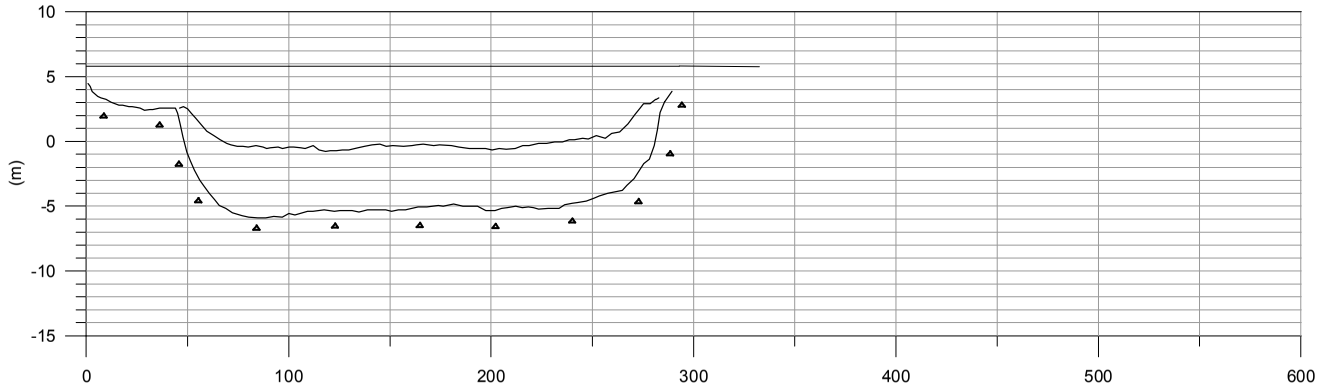


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000467
C4

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

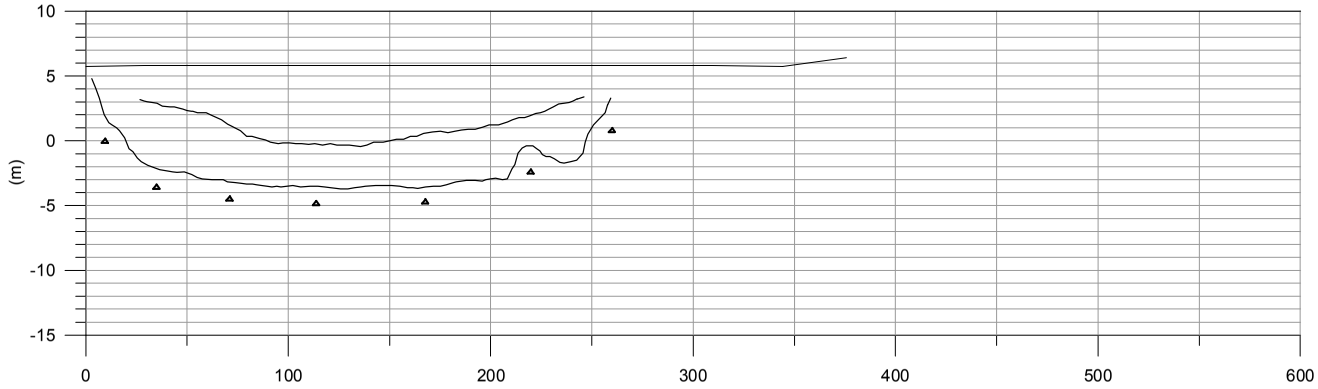


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000468
C5

RITAD: HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

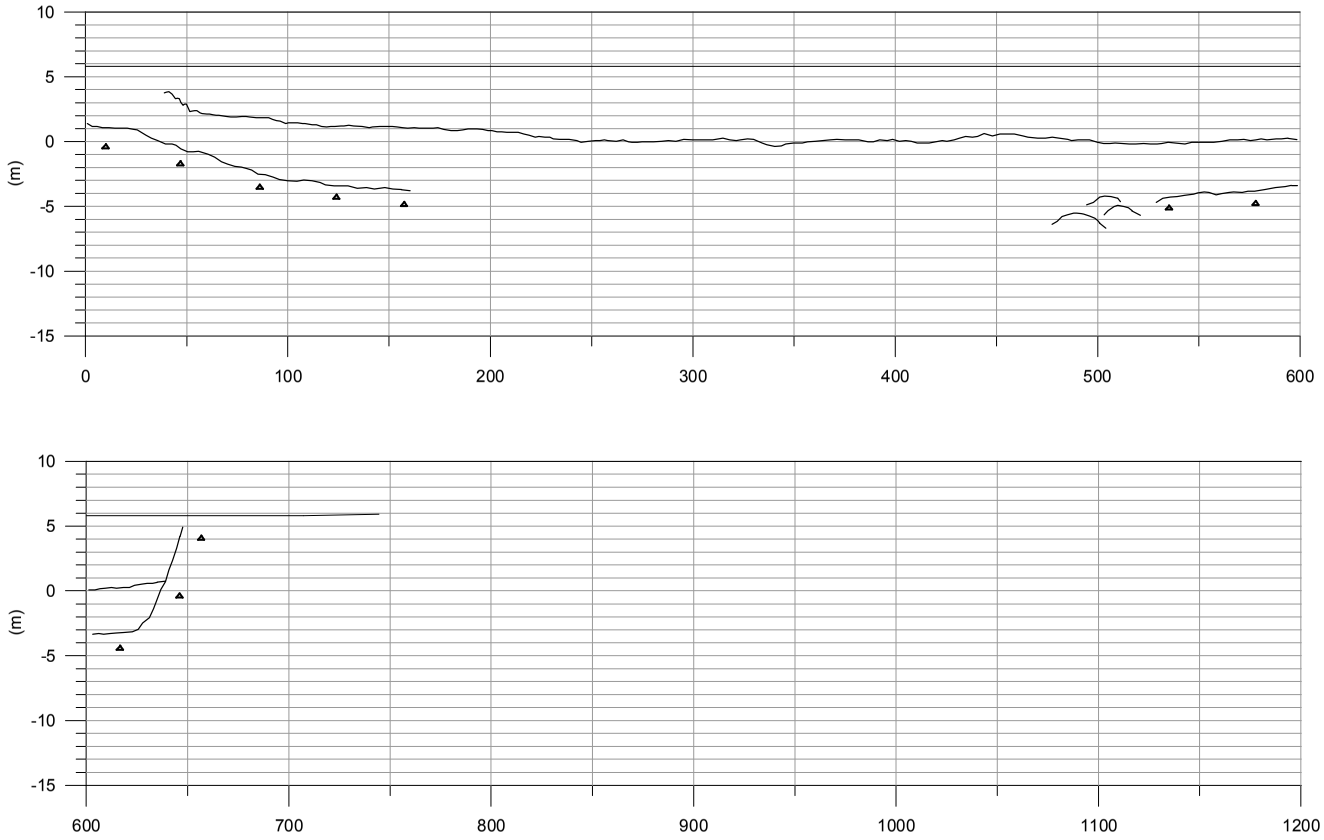
Markradarmätningar
Forsmark
LFM000469
C6

RITAD HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA

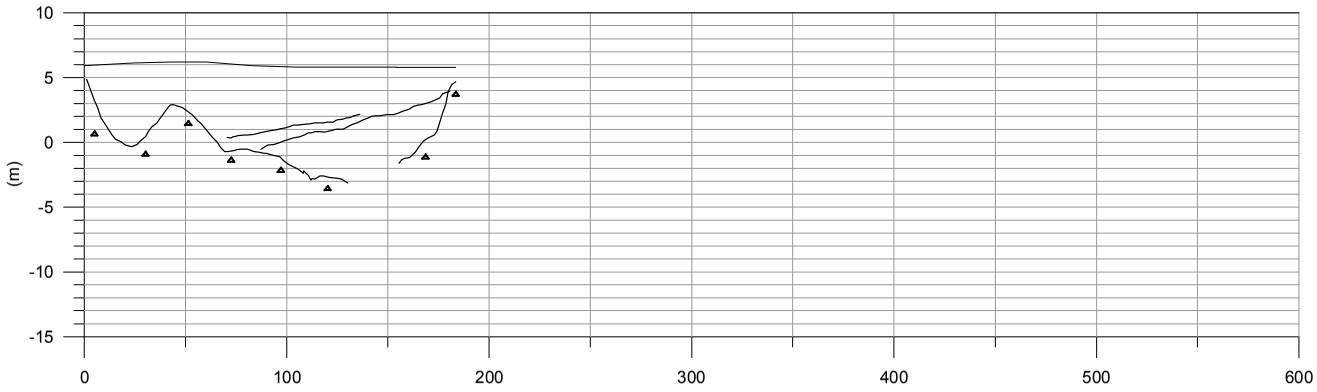


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000470
C8

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

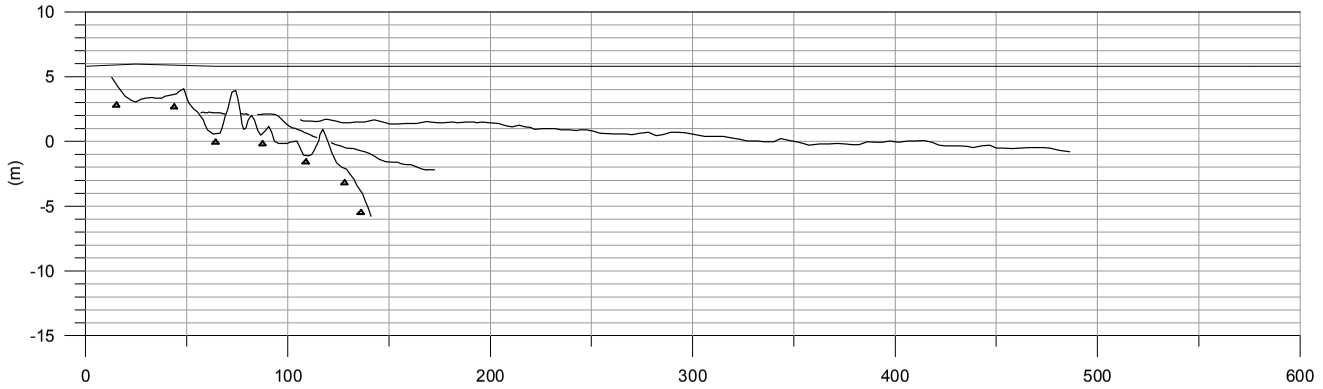


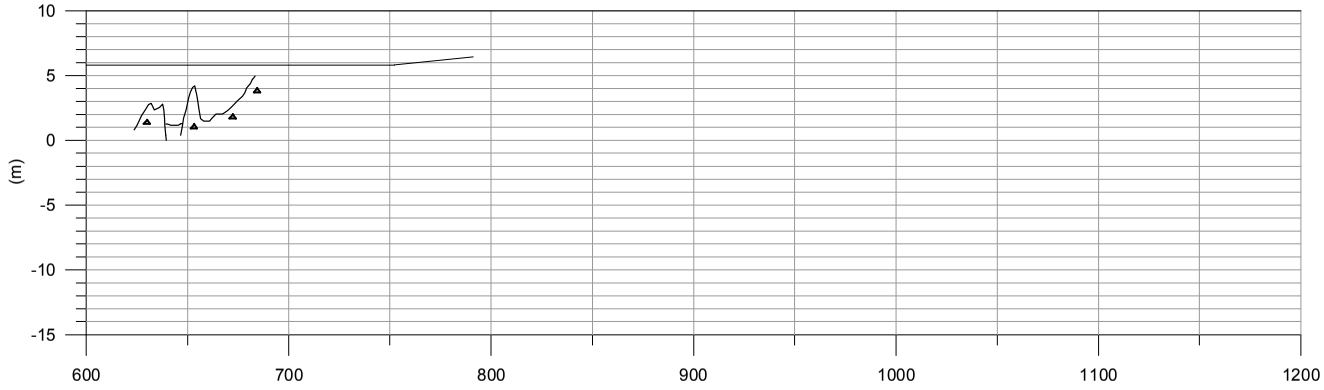
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000471
C9

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



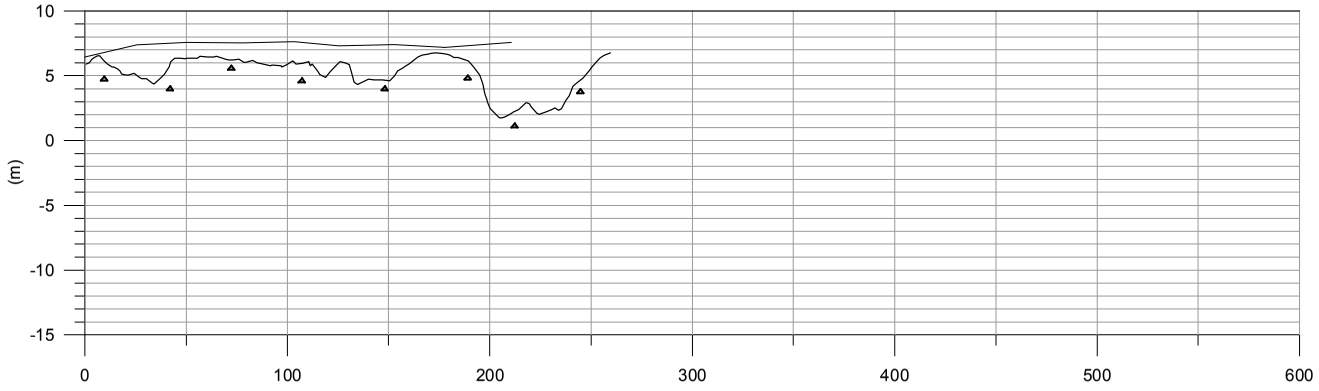


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000472
C10

RITAD | HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000473
C11

RITAD: HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA D

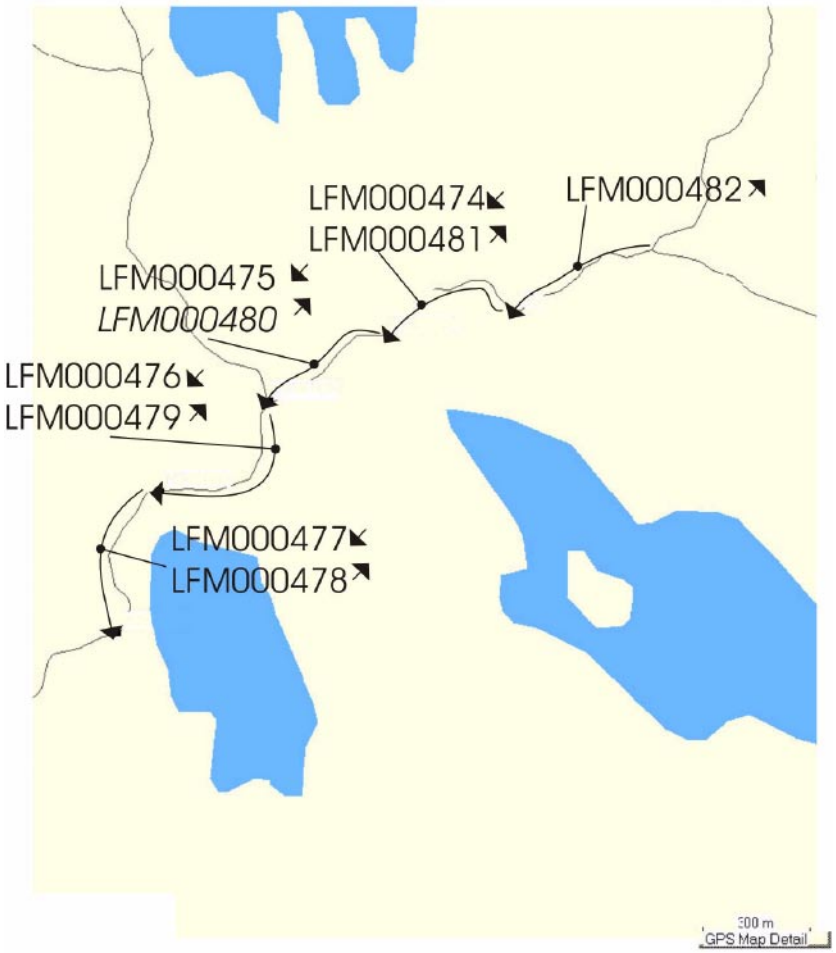
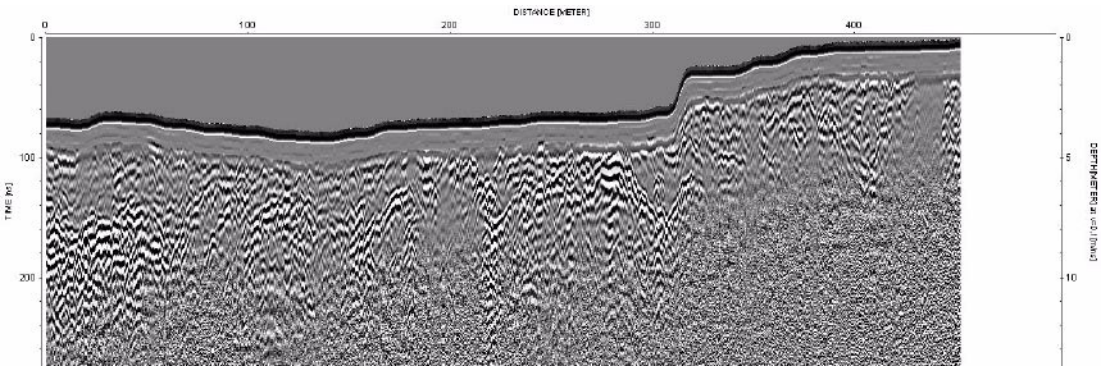
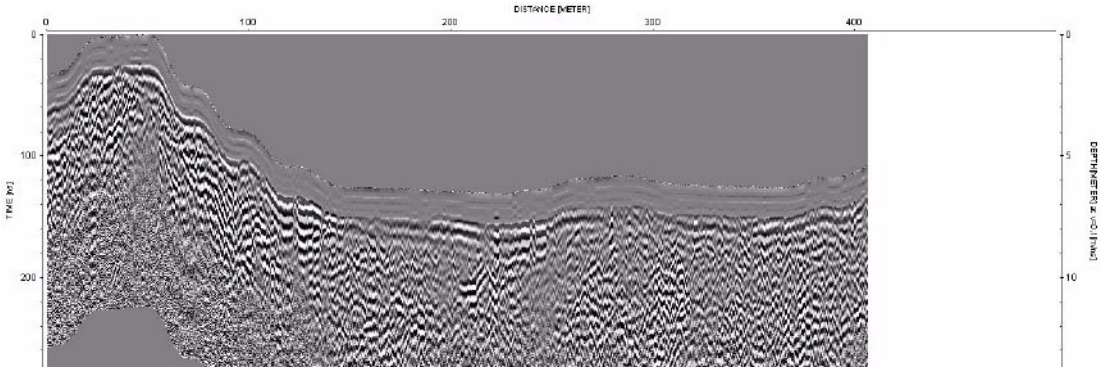


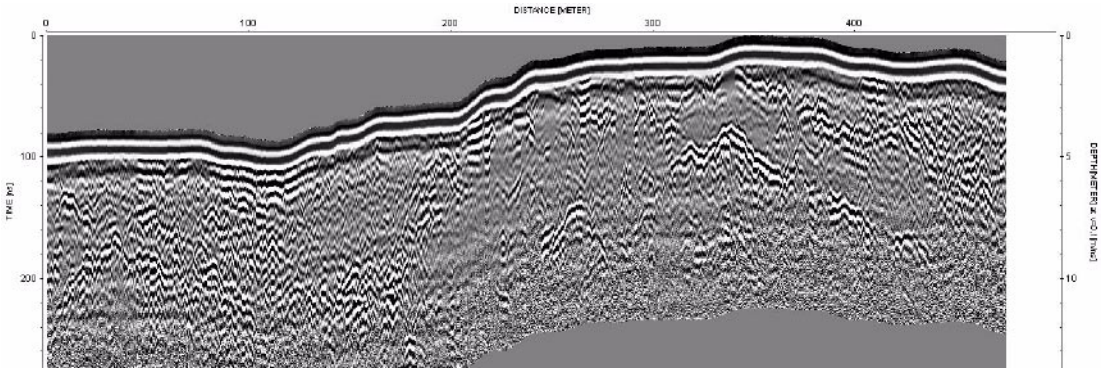
Fig. A4. Sketch map Area D. Codes in italic letters represent uninterpreted profiles.



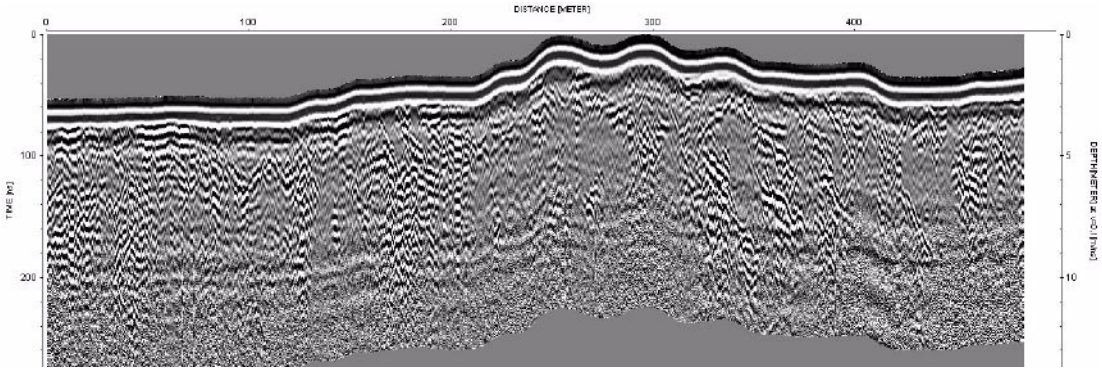
LFM000474 Profile D2, 0-453, from east to west



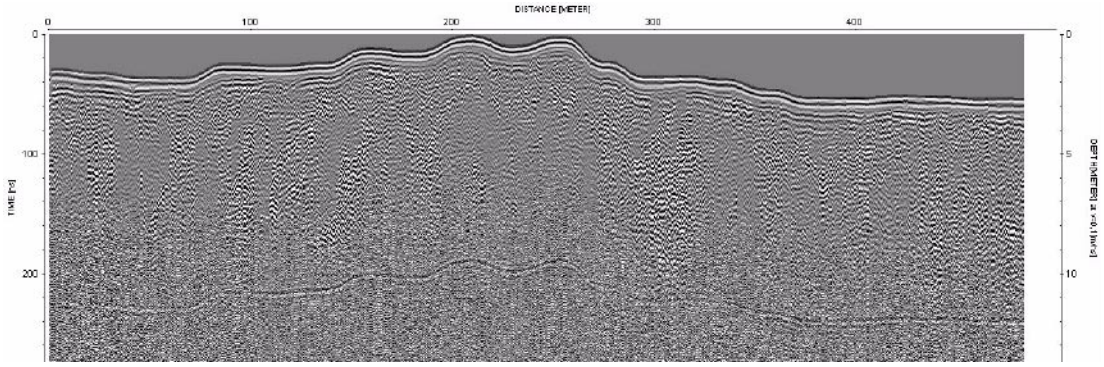
LFM000475 Profile D3, 0-407, from east to west



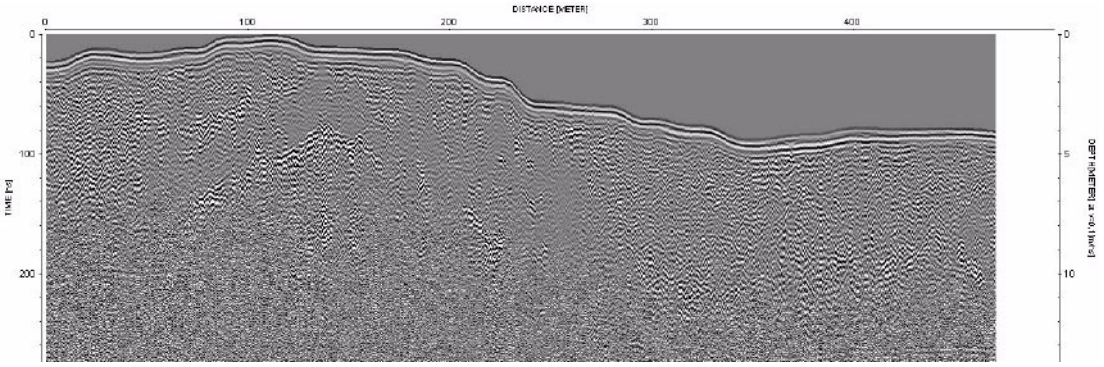
LFM000476 Profile D4, 0-475, from east to west



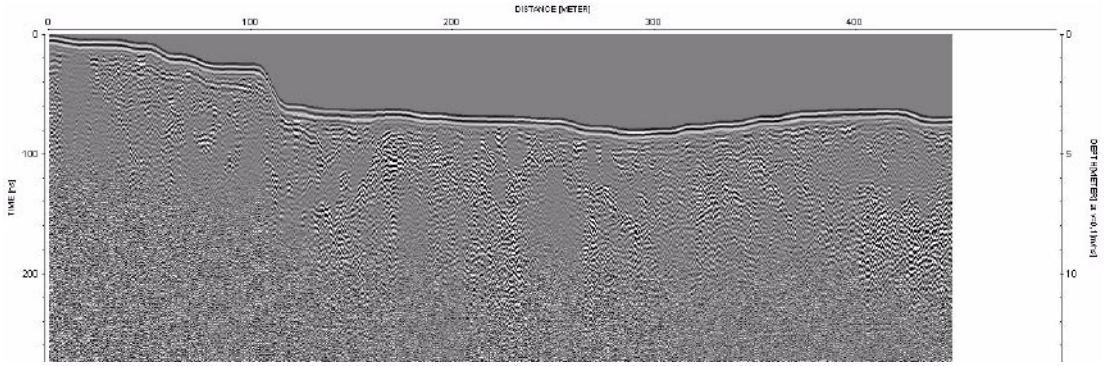
LFM000477 Profile D5, 0-483, from noth to south



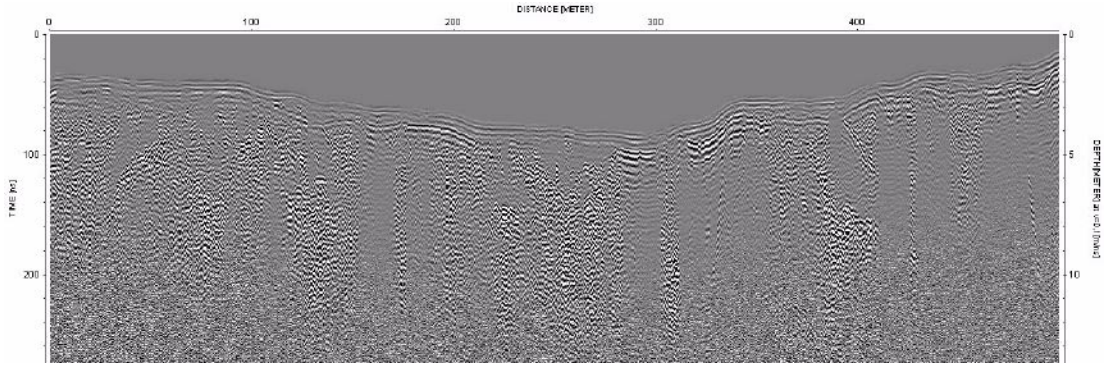
LFM000478 Profile D6, 0-483, from south to north



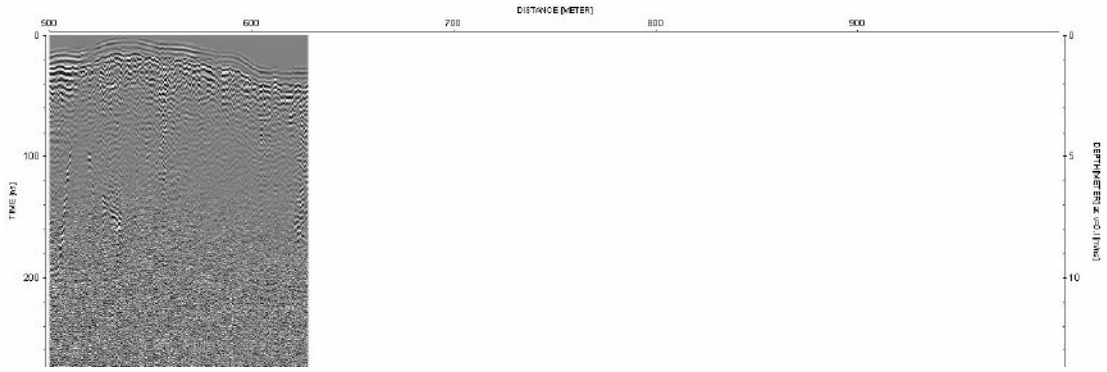
LFM000479 Profile D7, 0-471, from west to east



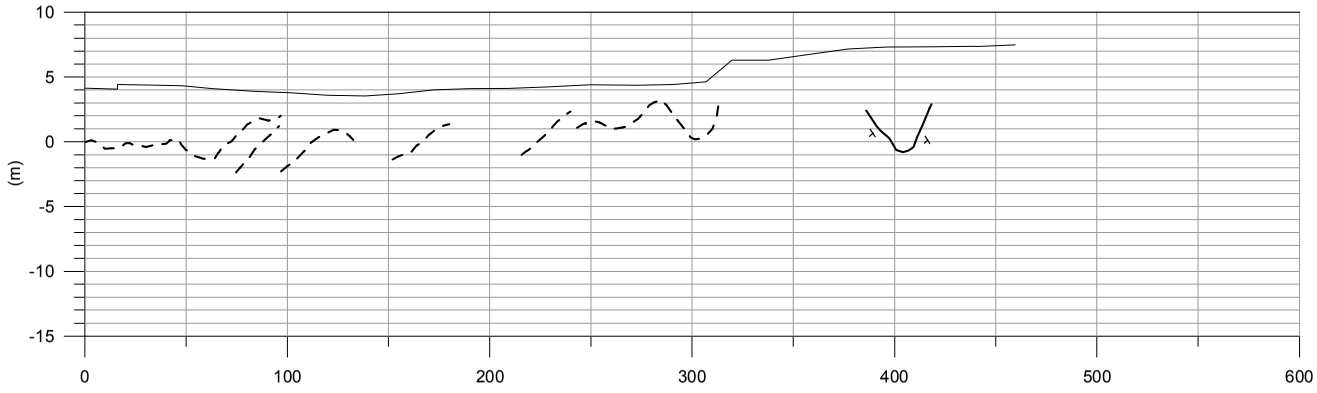
LFM000481, Profile D9, 0-448, from west to east



LFM000482, Profile D10, 0-500, from west to east



LFM000482, Profile D10, 500-628, from west to east

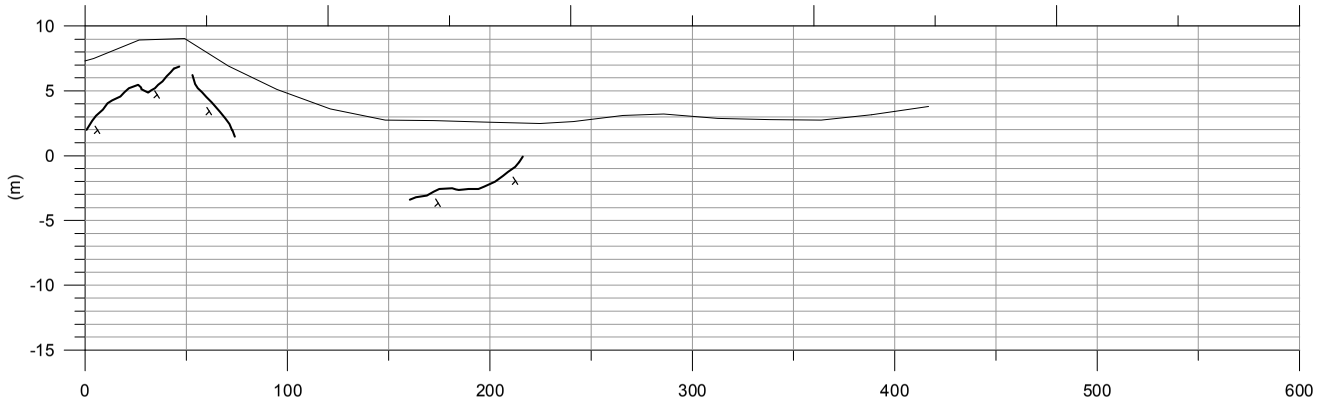


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000474
D2

RITAD HANDLÄGGARE: Riard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

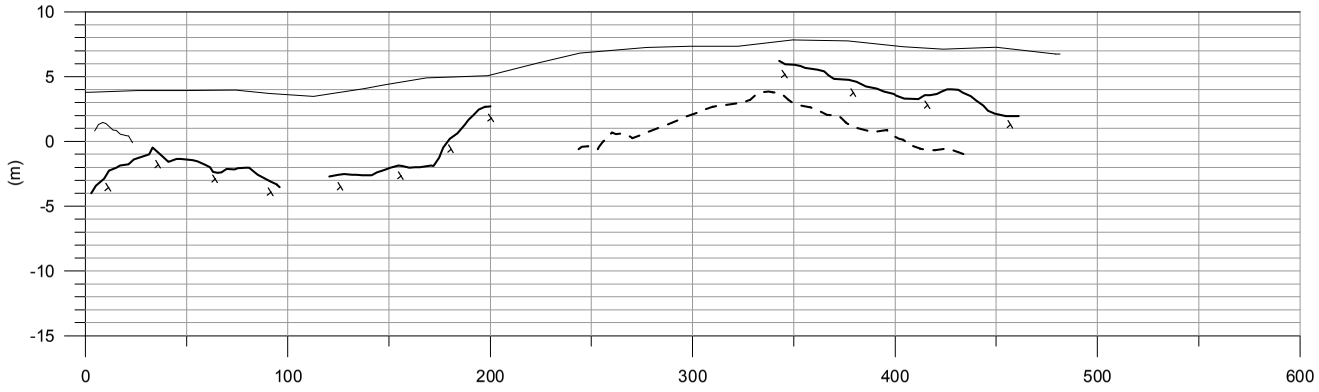


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000475
d3

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

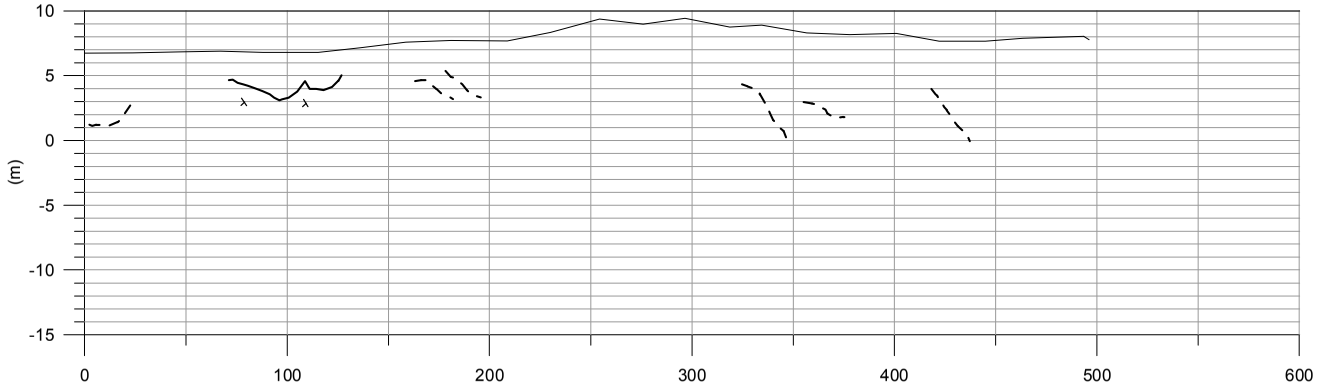


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000476
D4

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

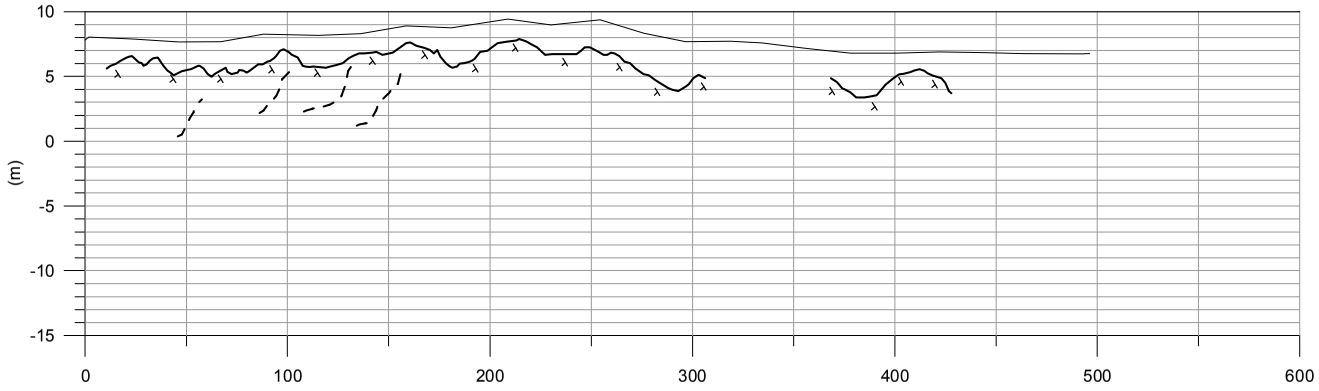


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000477
D5

RITAD | HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

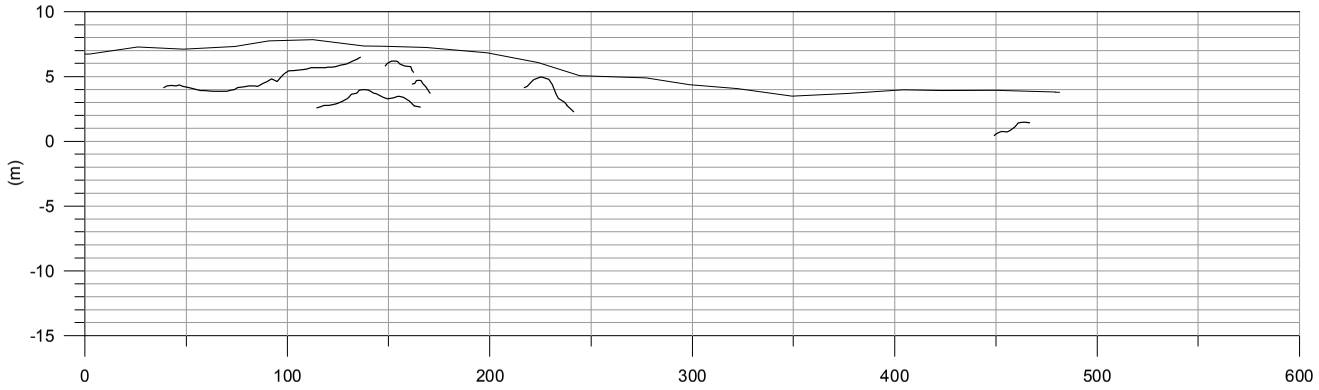
Markradarmätningar
Forsmark
LFM000478
D6

RITAD HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA

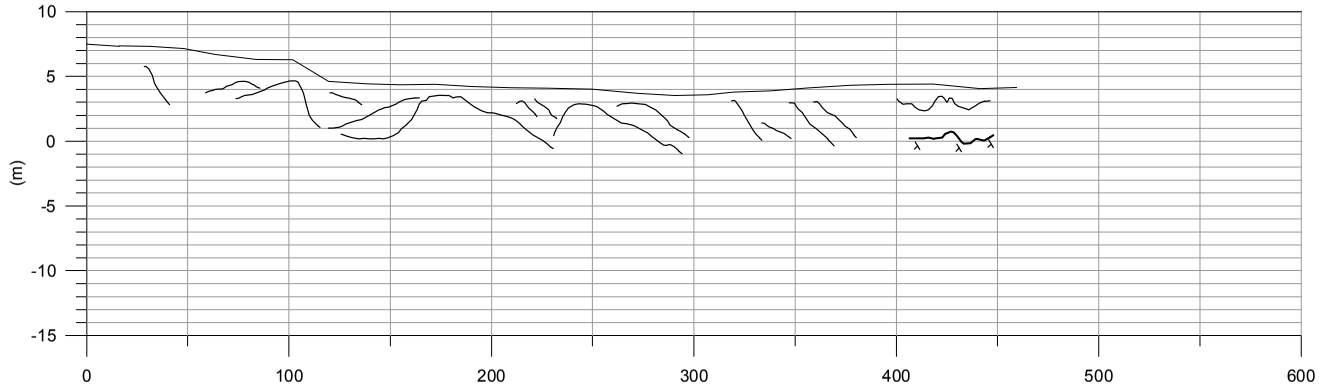


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000479
D7

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

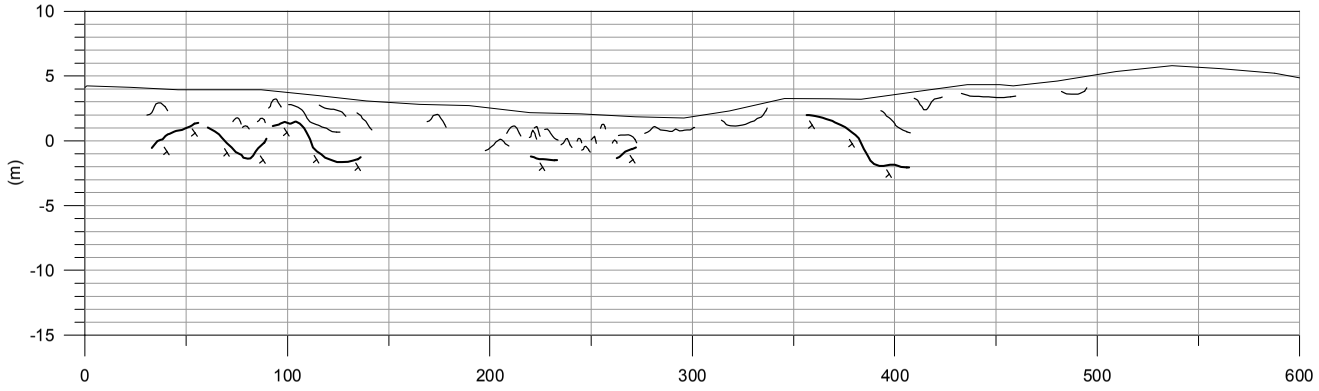


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000481
D9

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

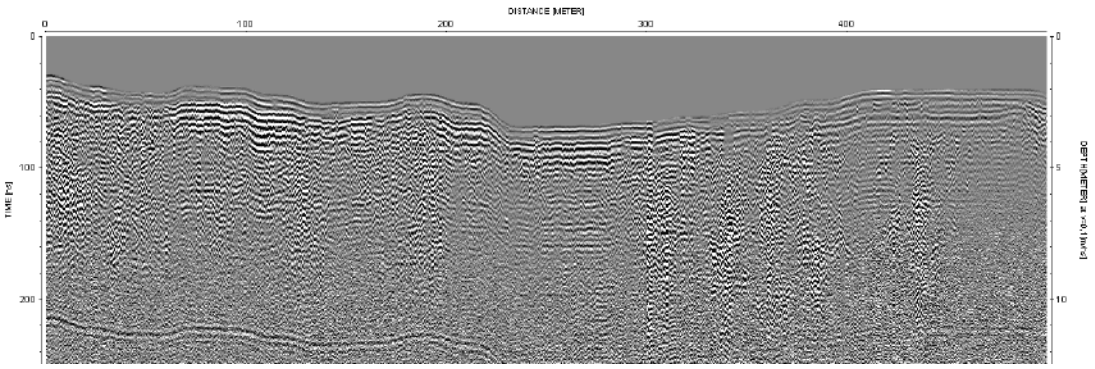
GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM00482
D10

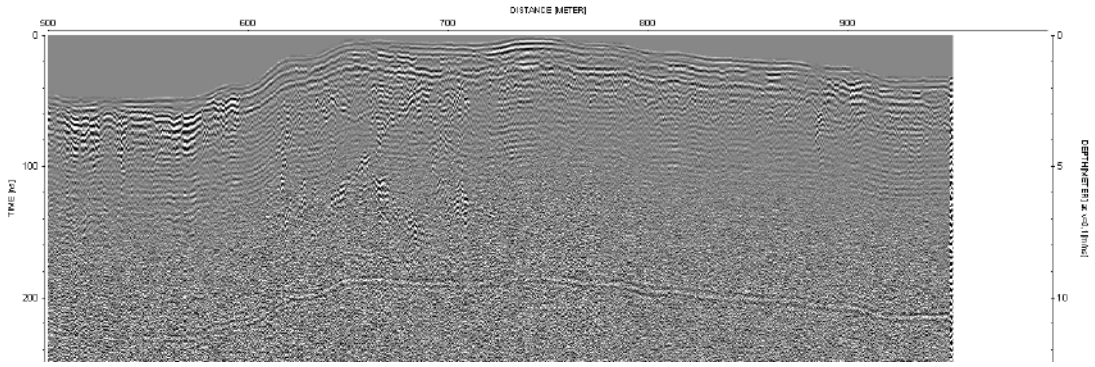
RITAD: HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA E

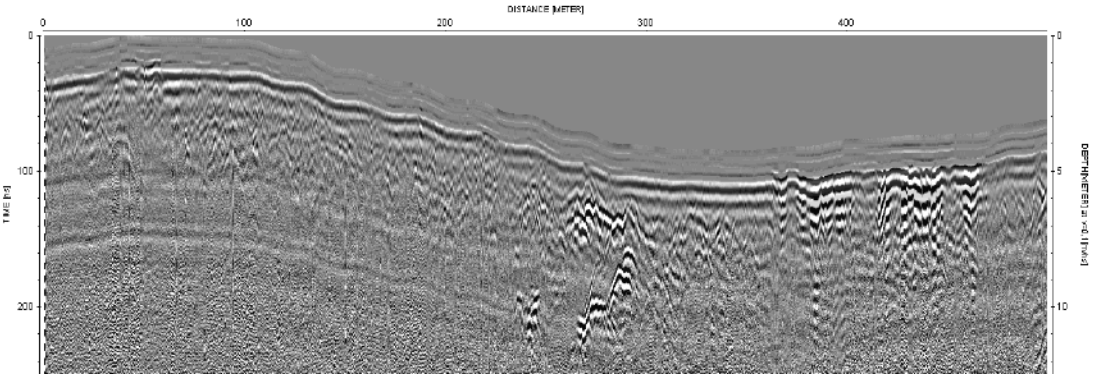
Fig. A5. Sketch map area E. Codes in italic letters represent uninterpreted profiles.



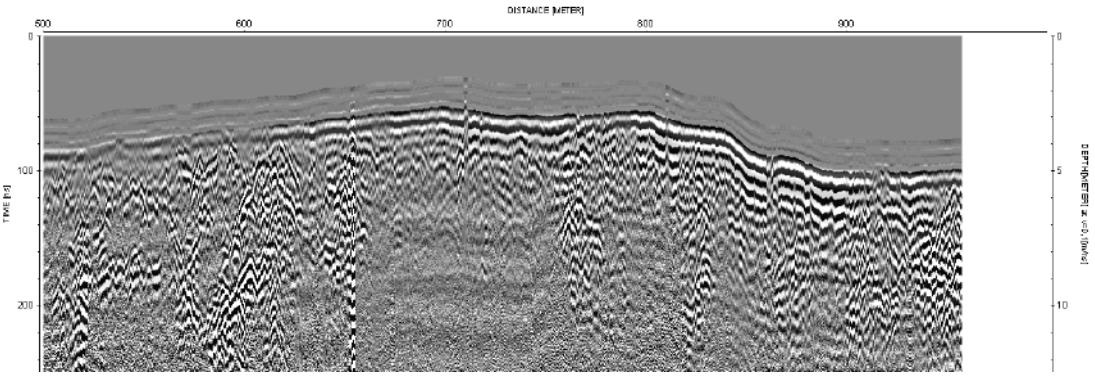
LFM000483, Profile E1, 0-500, from west to east



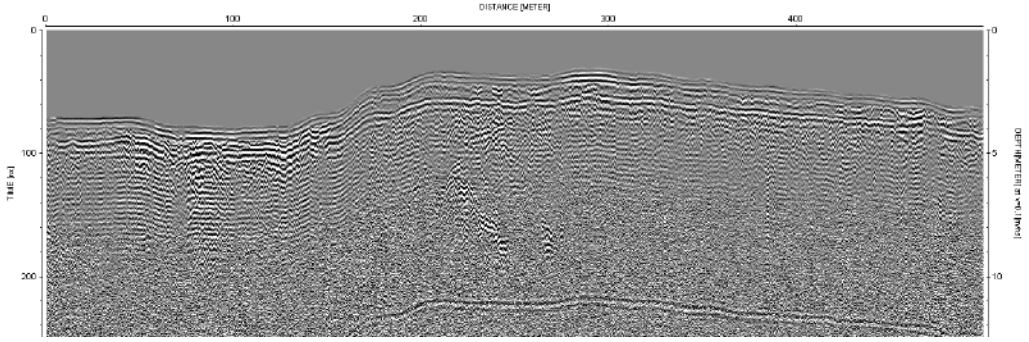
LFM000483, Profile E1, 500-952, from west to east



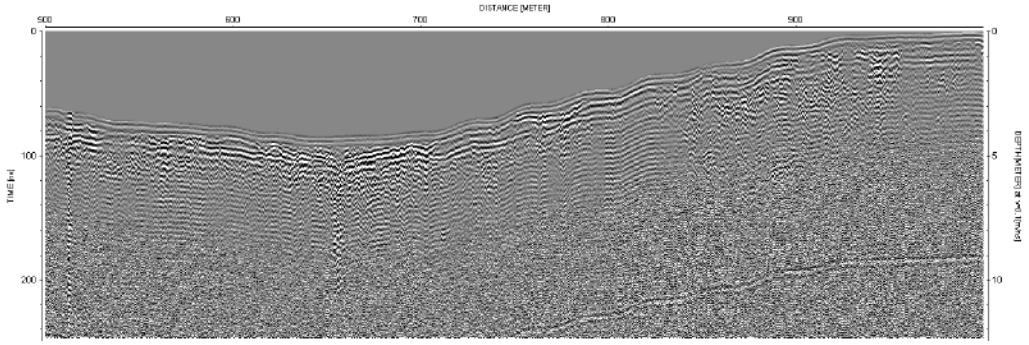
LFM000486, Profile E4, 0-500, from west to east



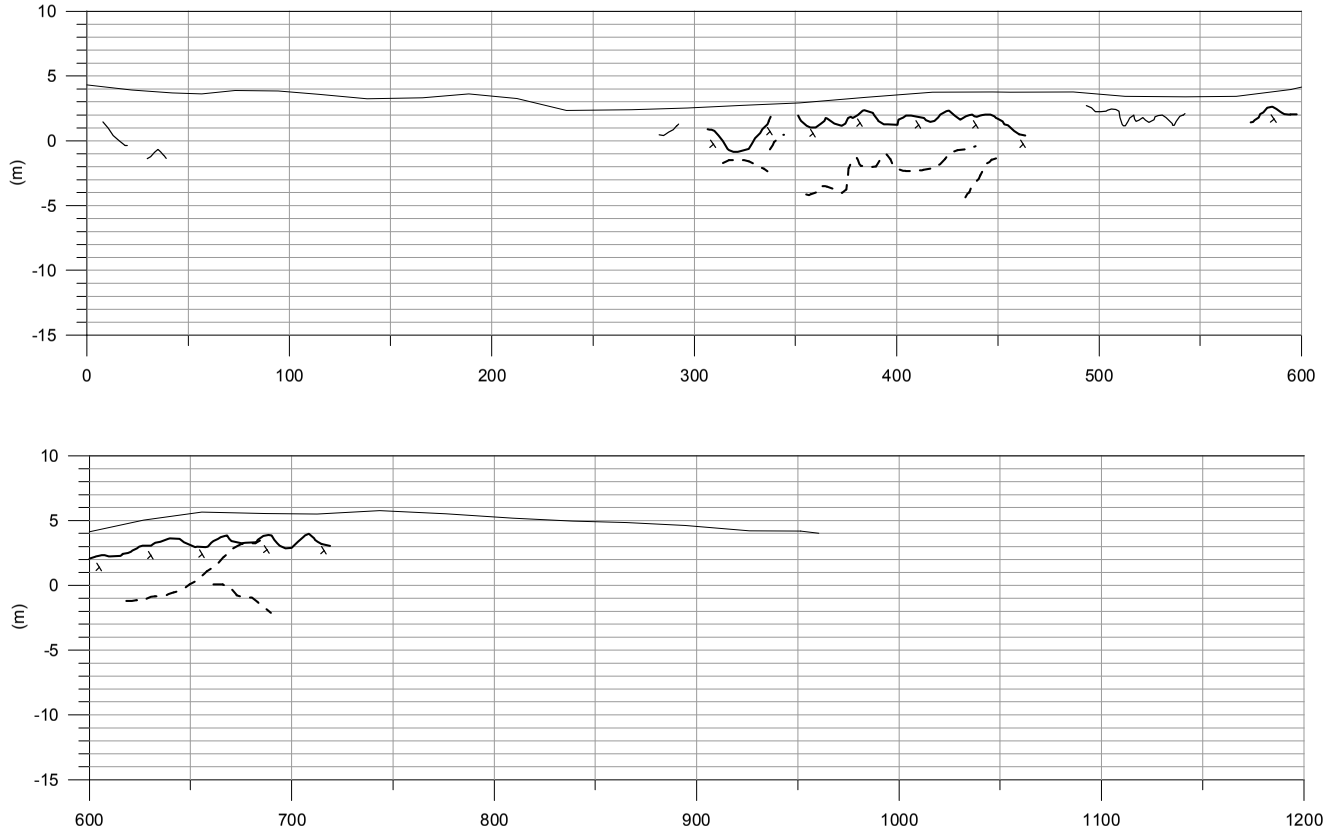
LFM000486, Profile E4, 500-957, from west to east



LFM000487, Profile E7, 0-500, from west to east



LFM000487, Profile E7, 500-1000, from west to east

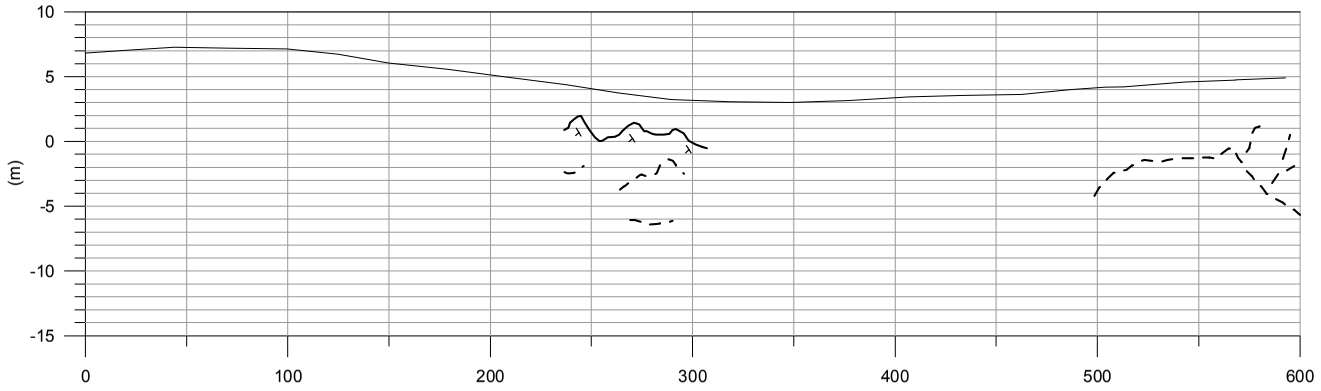


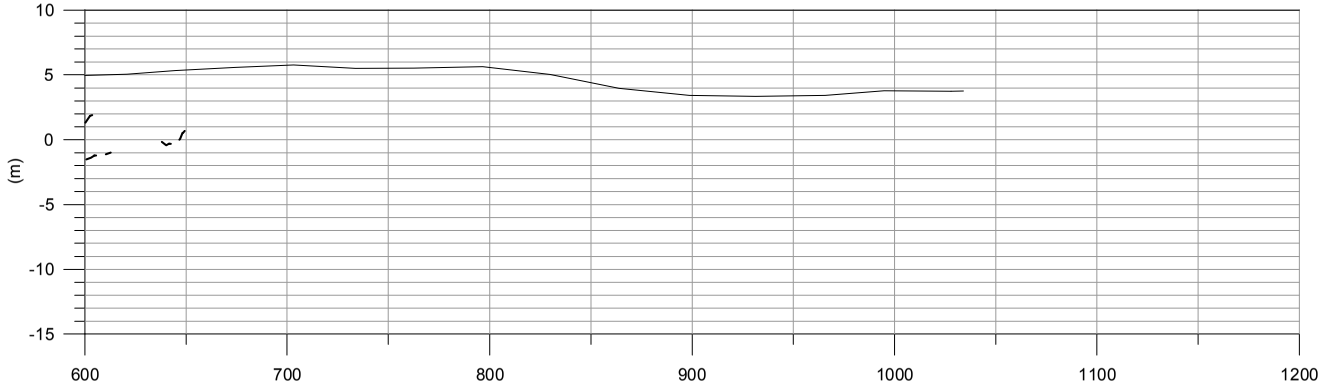
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000483
E1

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



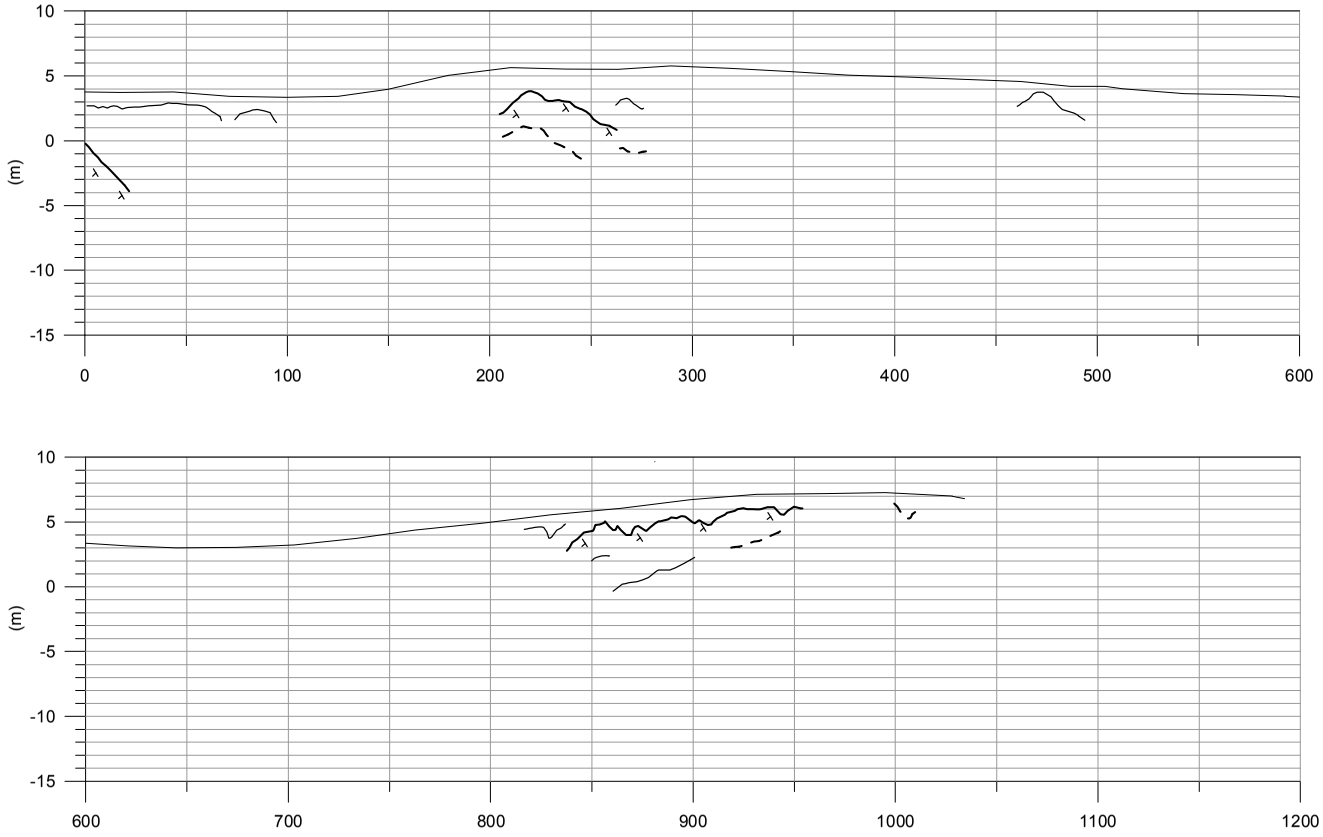


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000486
E4

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000487
E7

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA F

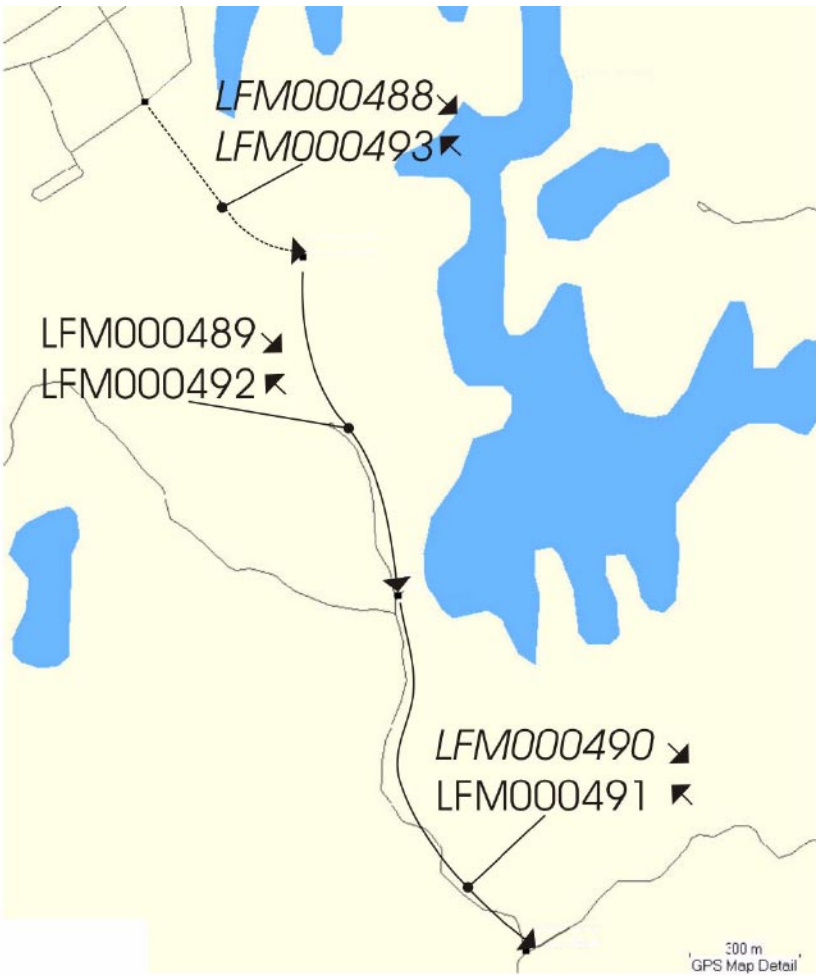
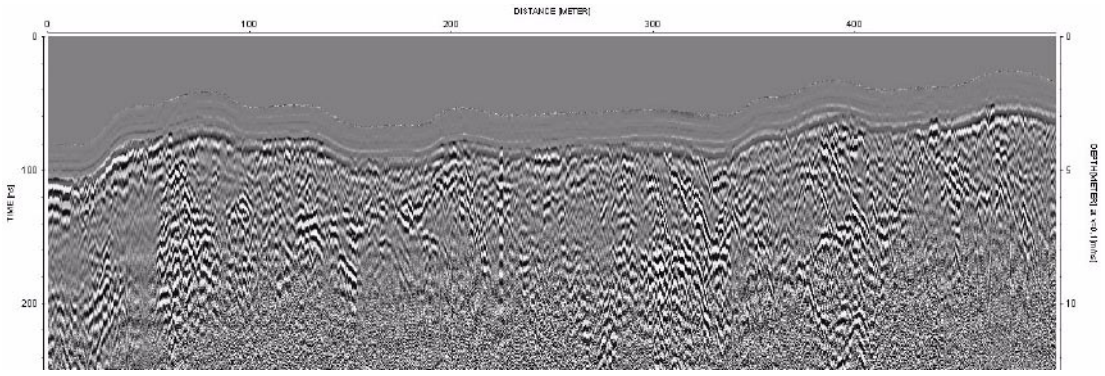
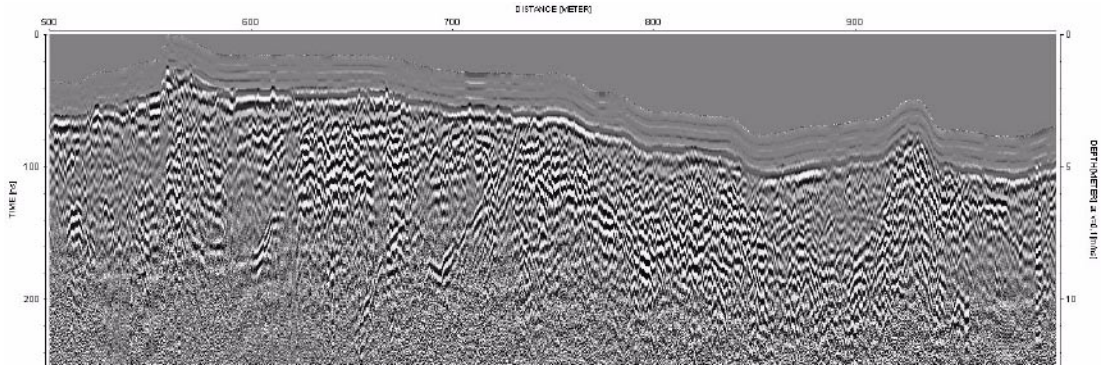


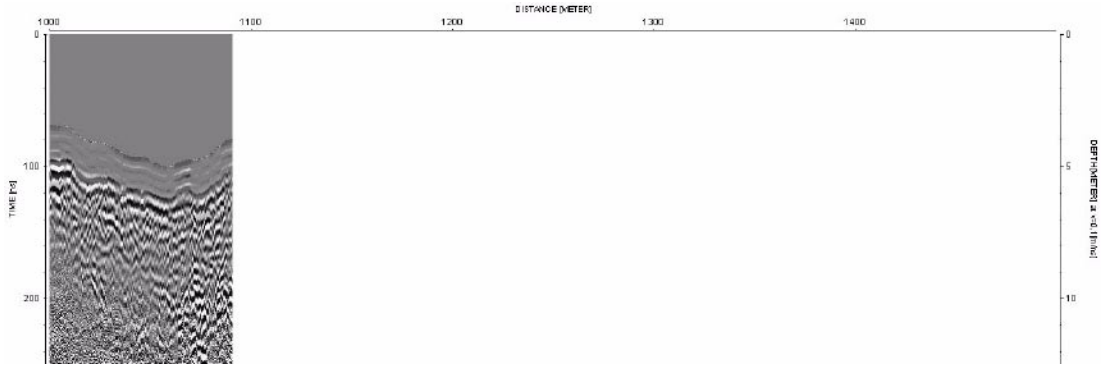
Fig. A6. Sketch map area F. Codes in italic letters represent uninterpreted profiles.



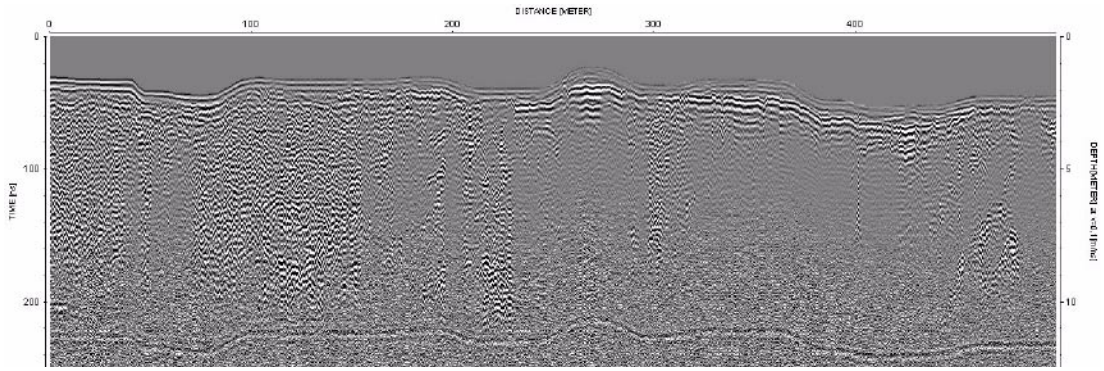
LFM000489, Profile F2, 0-500, from north to south



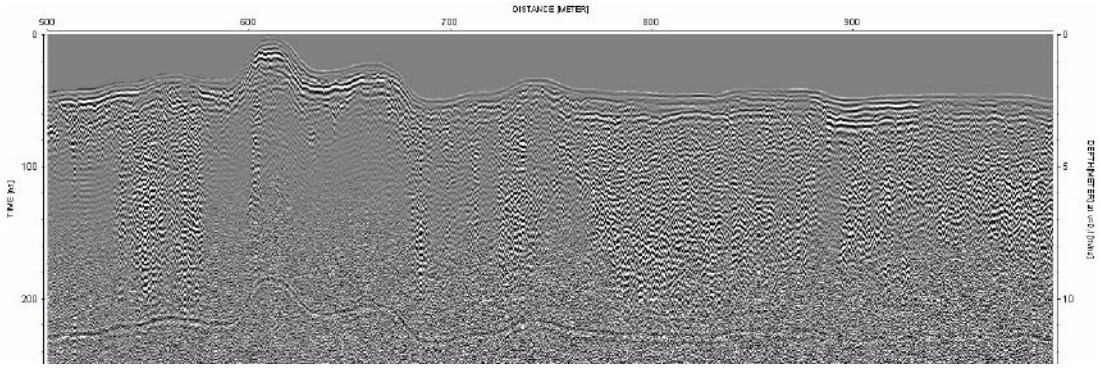
LFM000489, Profile F2, 500-1000, from north to south



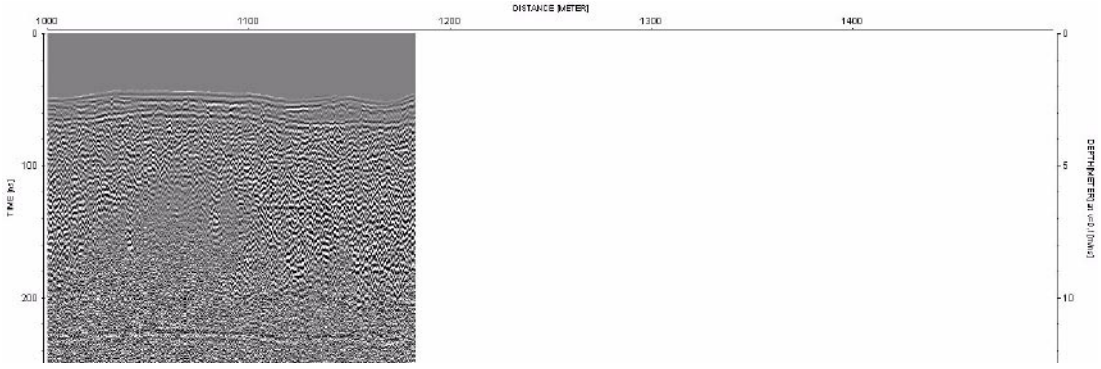
LFM000489, Profile F2, 1000-1091, from north to south



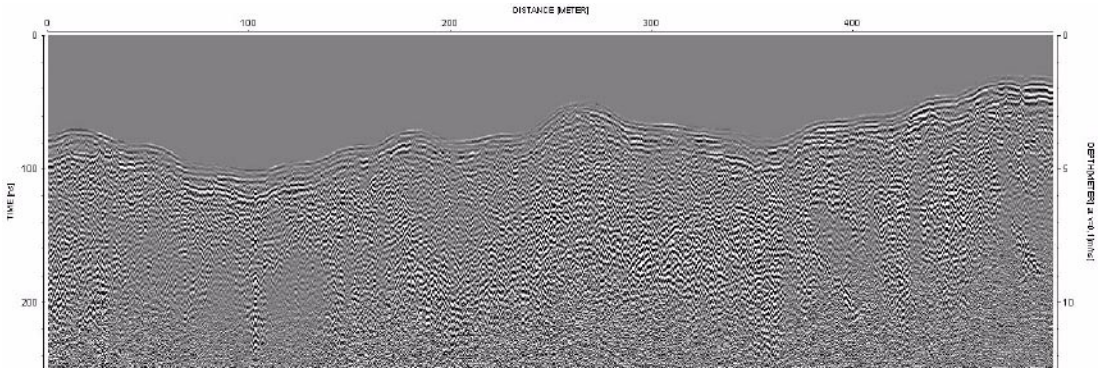
LFM000491, Profile F4, 0-500, from south to north



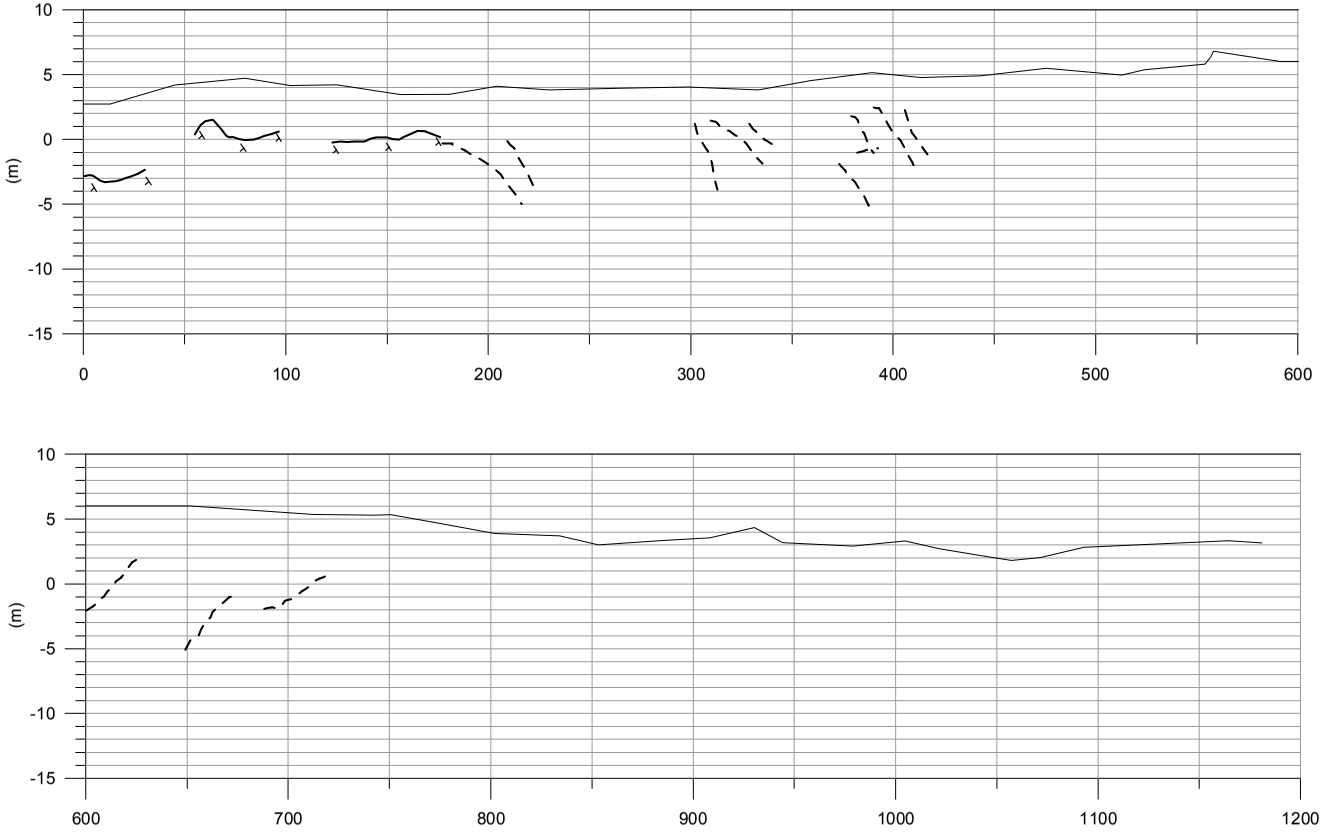
LFM000491, Profile F4, 500-1000, from south to north

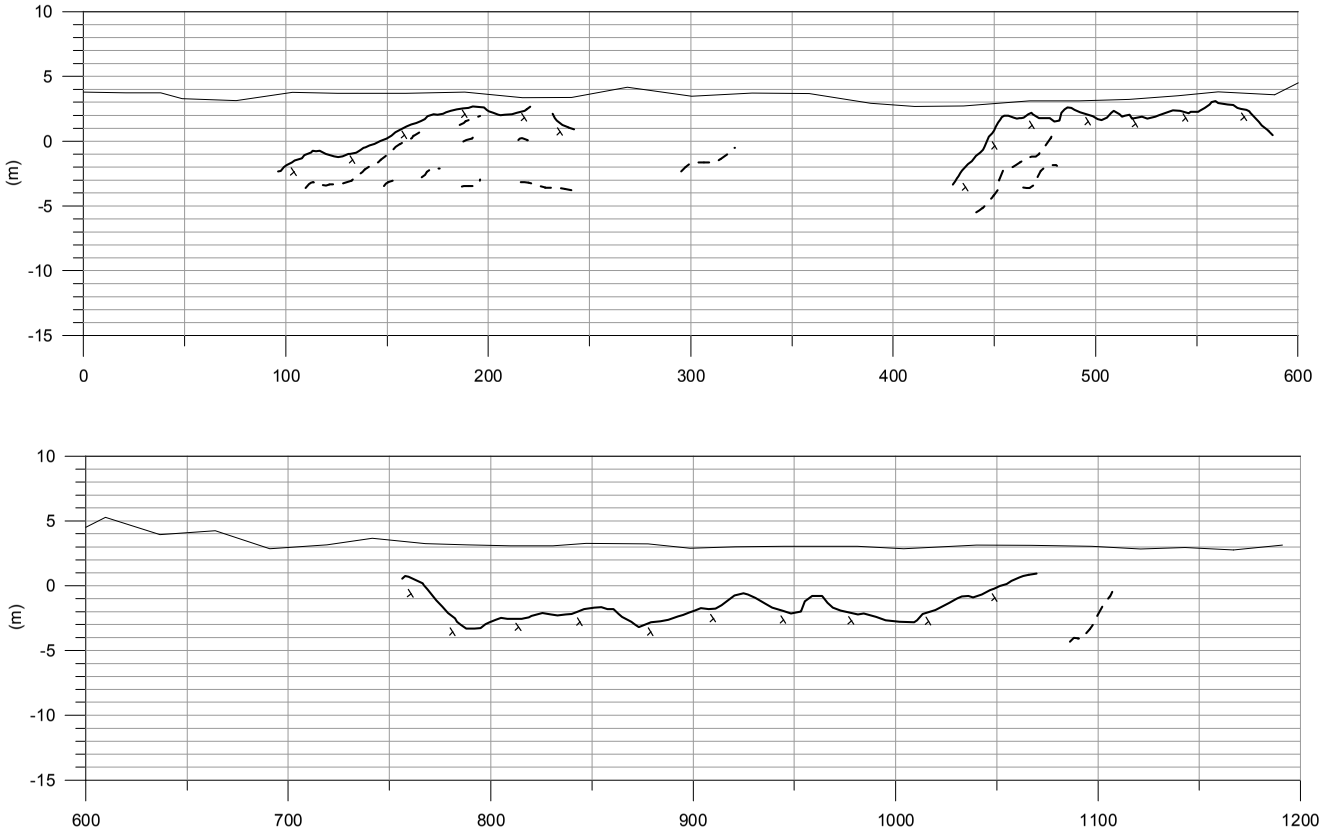


LFM000491, Profile F4, 1000-1183, from south to north



LFM000492, Profile F5, 0-500, from south to north


10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600
10
5
0
-5
-10
-15
(m)
600
700
800
900
1000
1100
1200
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure
GEOSIGMA
MARK BERG VATTEN
RITAD HANDLÄGGARE
Rikard Marek
UPPDRAGSGIVARE
SKB Forsmark
Markradarmätningar
Forsmark
LFM000489
F2
ID-NUMMER
Grap03018
SKALA

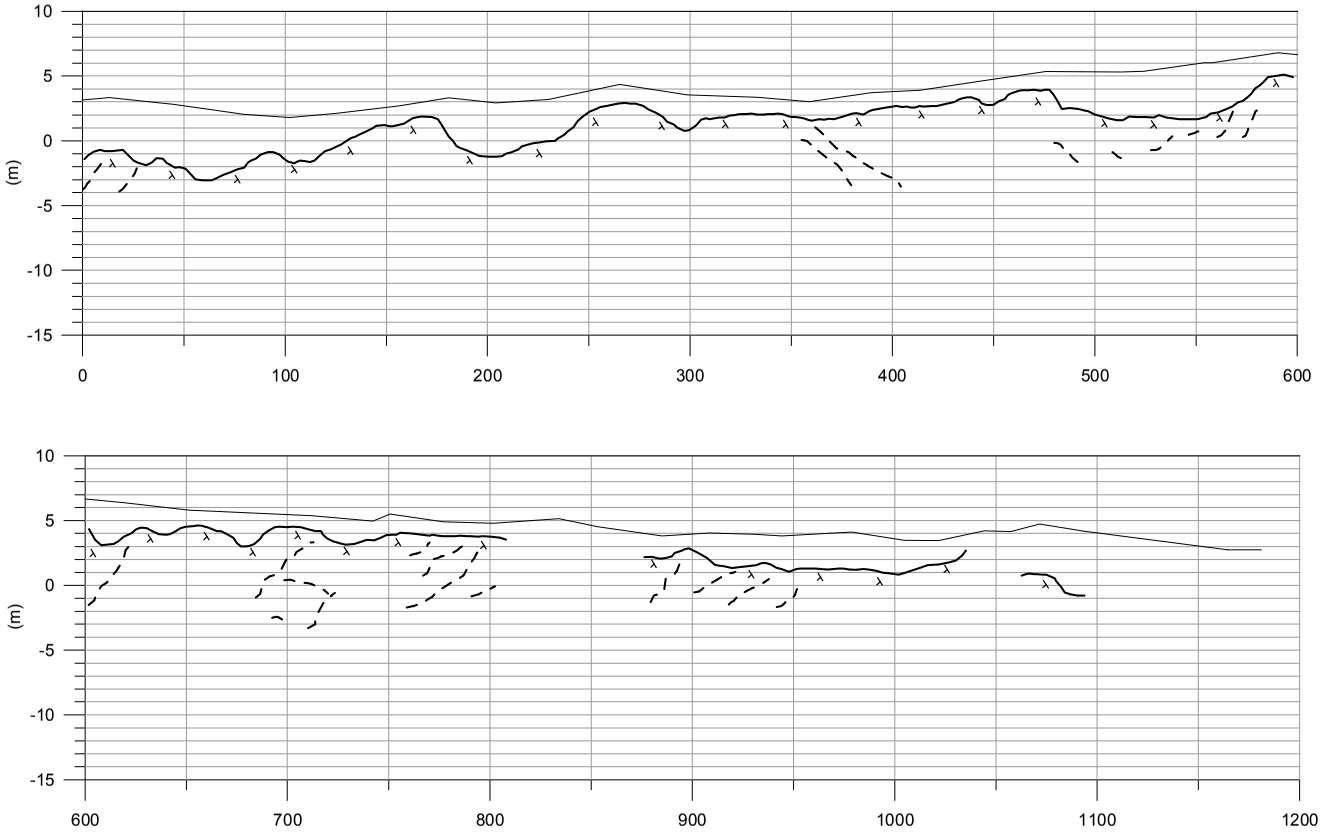


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000491
F4

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:


10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600
10
5
0
-5
-10
-15
(m)
600
700
800
900
1000
1100
1200
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure
GEOSIGMA
MARK BERG VATTEN
RITAD HANDLÄGGARE
Rikard Marek
UPPDRAGSGIVARE
SKB Forsmark
Markradarmätningar
Forsmark
LFM000492
F5
ID-NUMMER
Grap03018
SKALA

AREA G

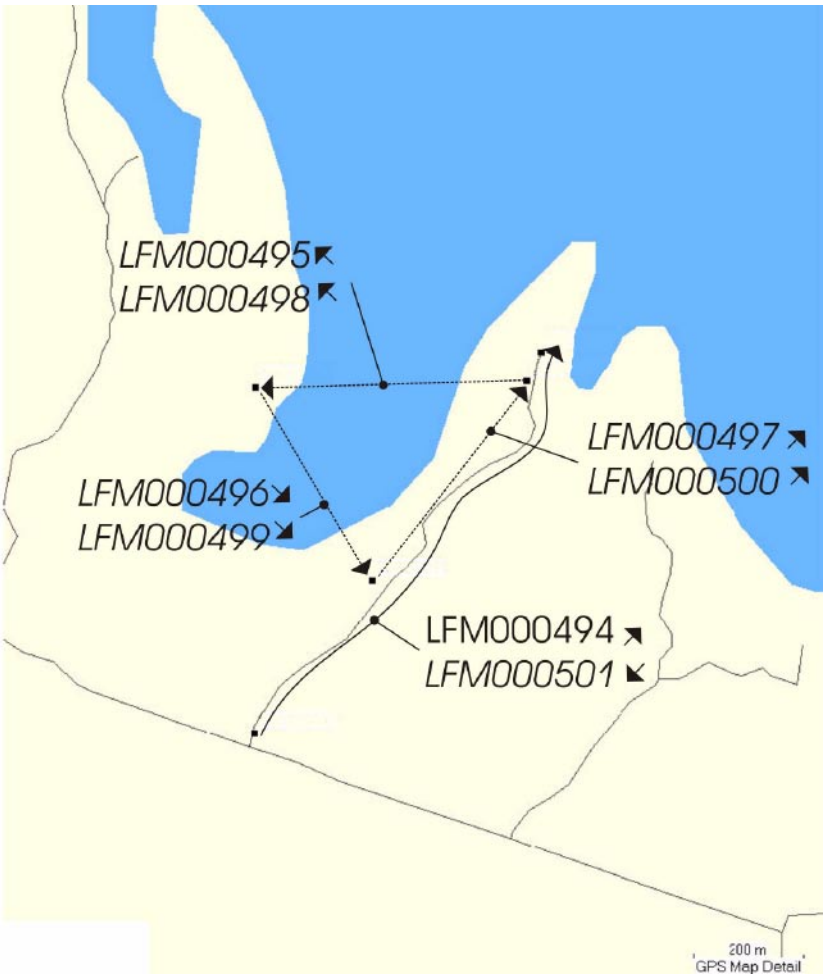
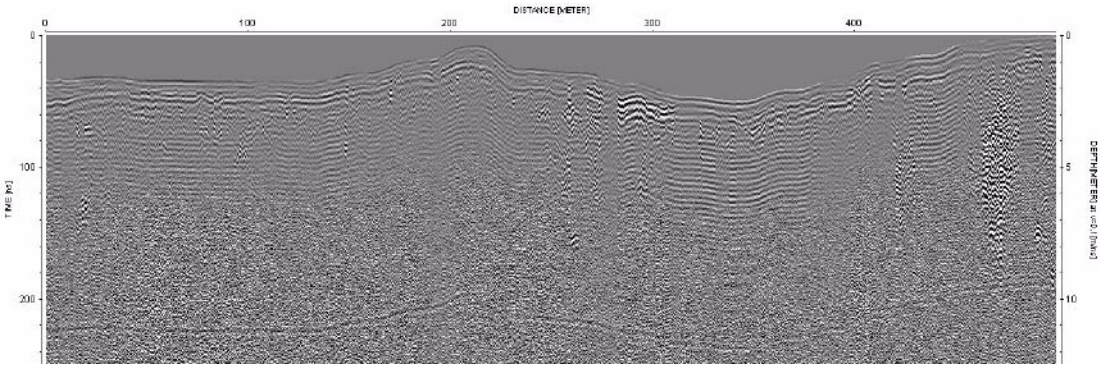
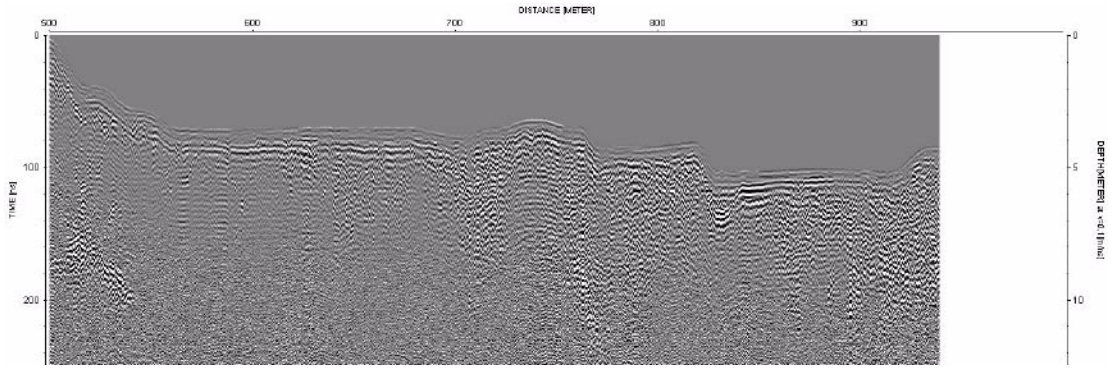


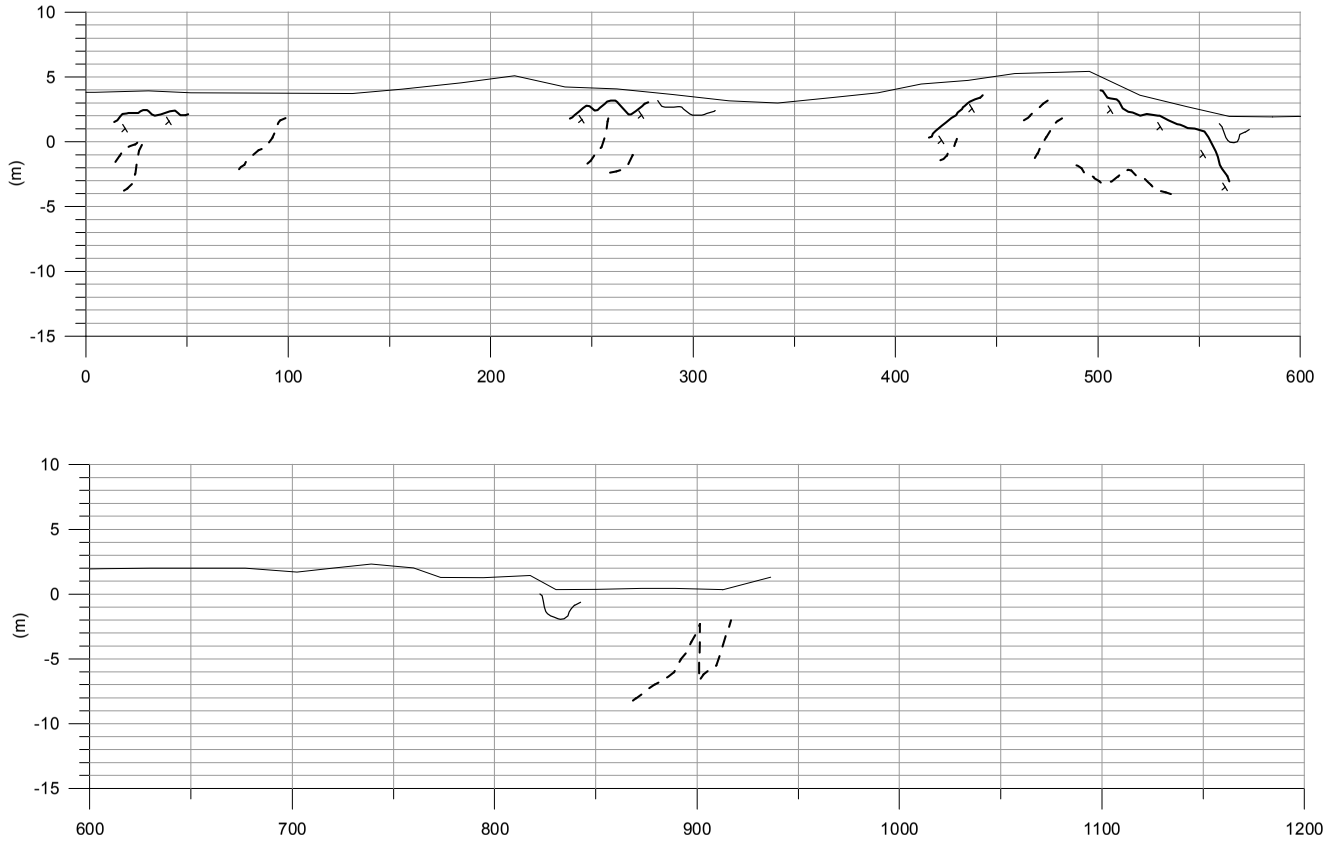
Fig. A7. Sketch map area G. Codes in italic letters represent uninterpreted profiles.



LFM000494 Profile G1, 0-500, from south to north



LFM000494 Profile G1, 500-938, from south to north



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

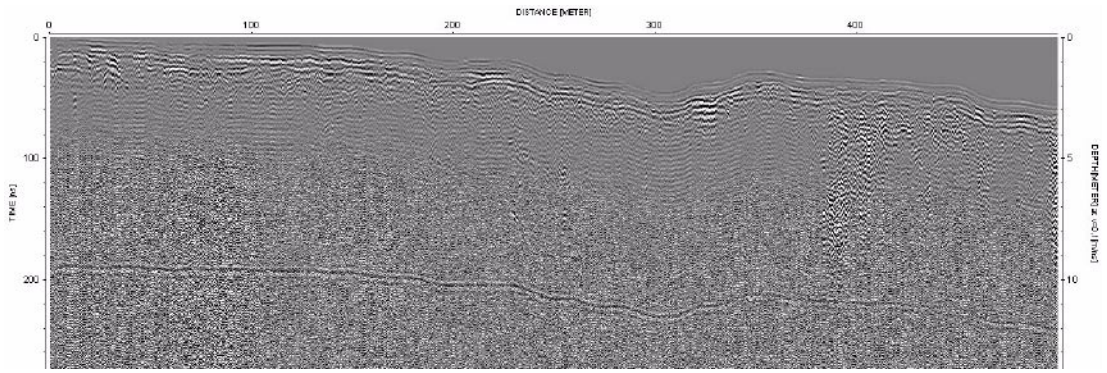
GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000494
G1

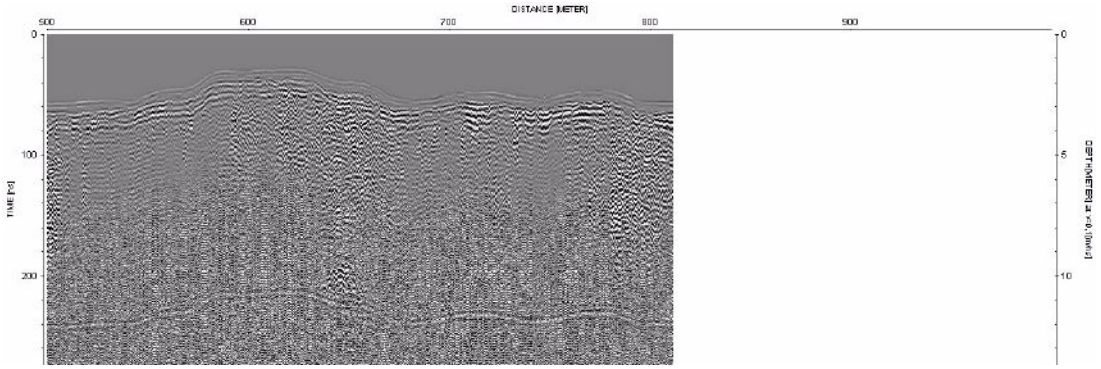
RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA H

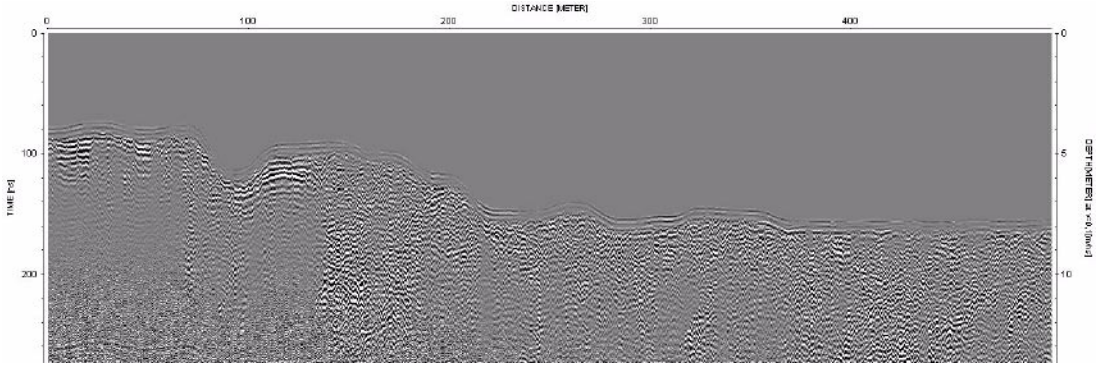
Fig. A8. Sketch map of area H



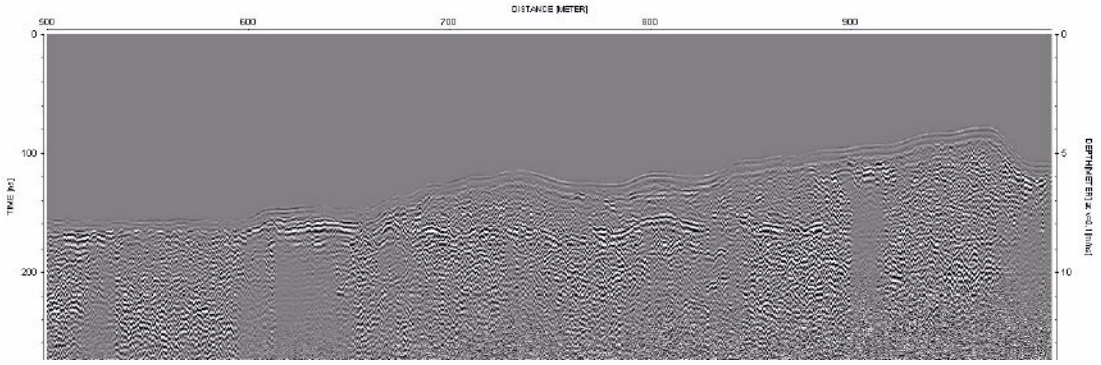
LFM000502, Profile H1 0-500, from west to east



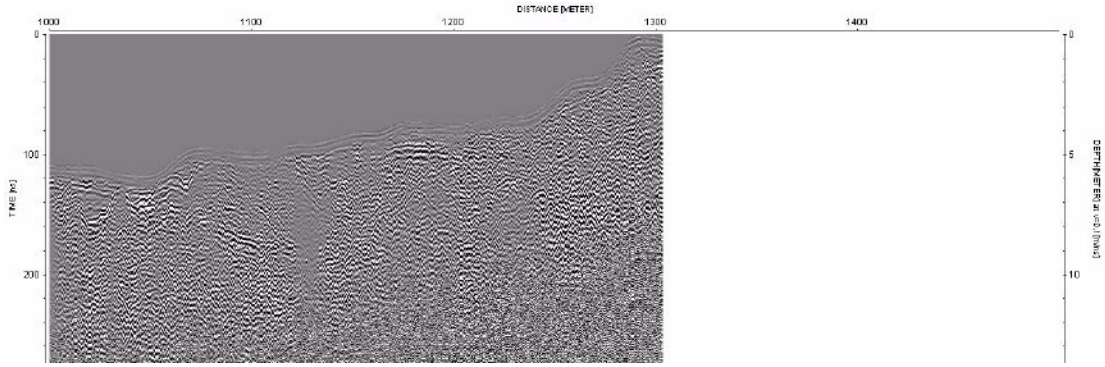
LFM000502, Profile H1, 500-811, from west to east



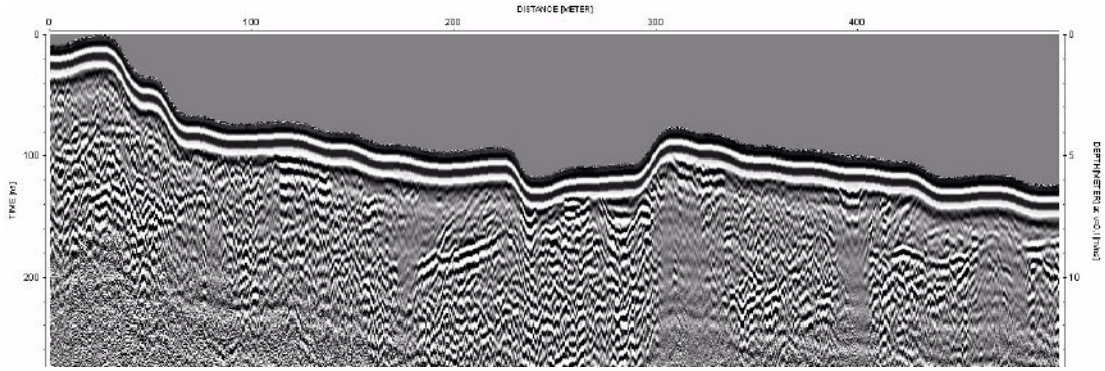
LFM000503, Profile H2, 0-500, from west to east



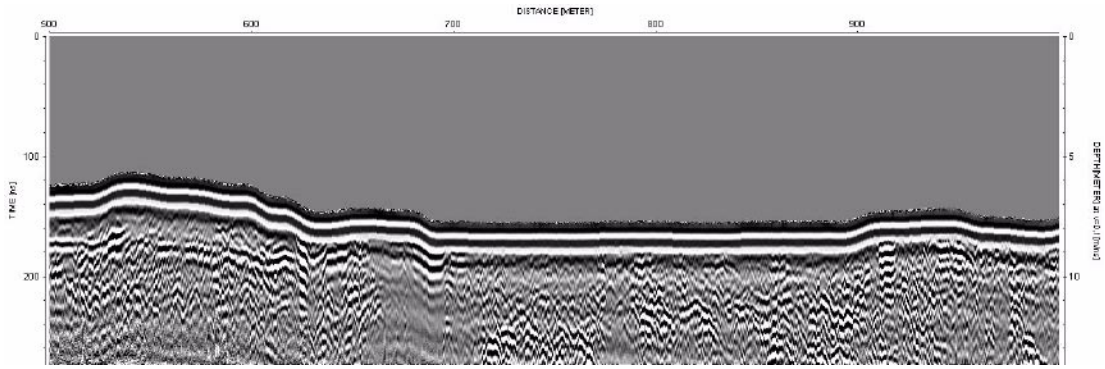
LFM000503, Profile H2, 500-1000, from west to east



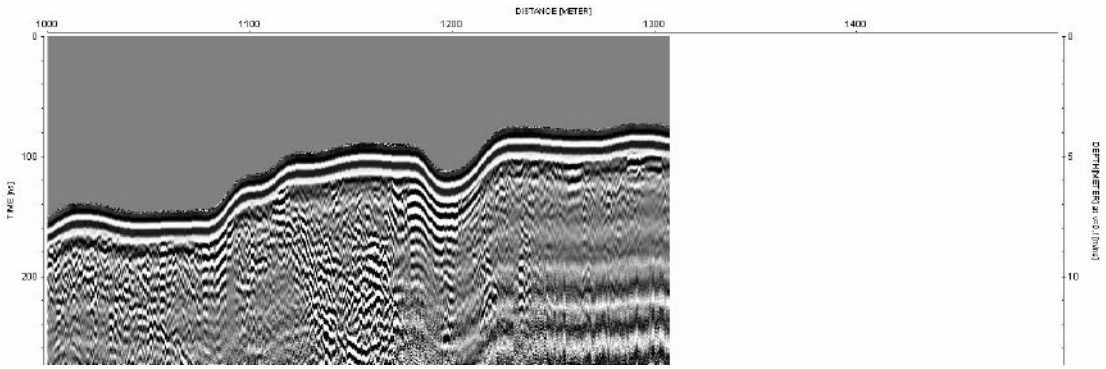
LFM000503, Profile H2, 1000-1303, from west to east



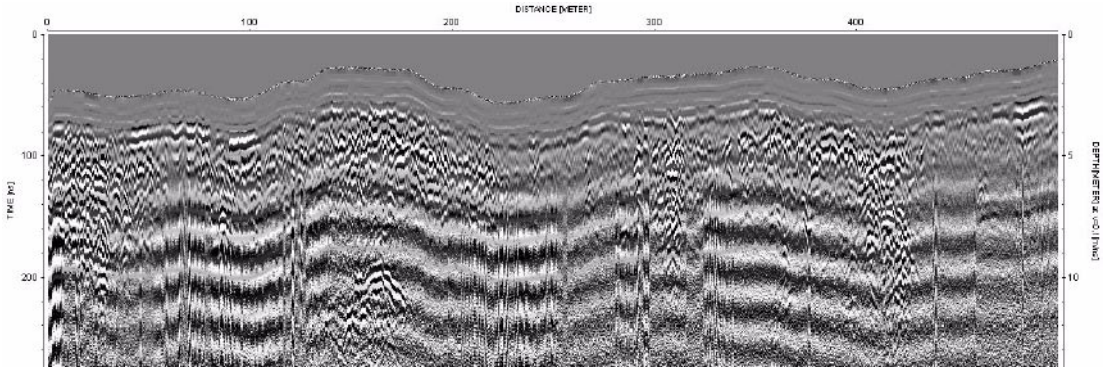
LFM000504, Profile H3, 0-500, from east to west



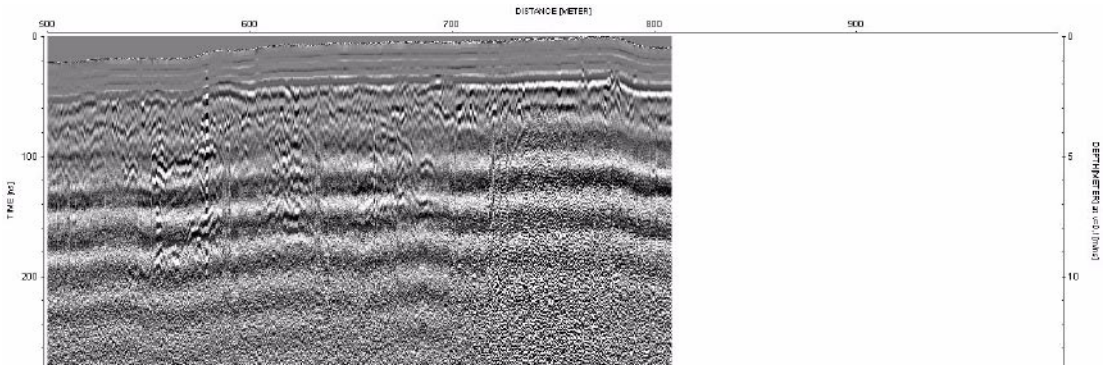
LFM000504, ProfileH3, 500-1000, from east to west



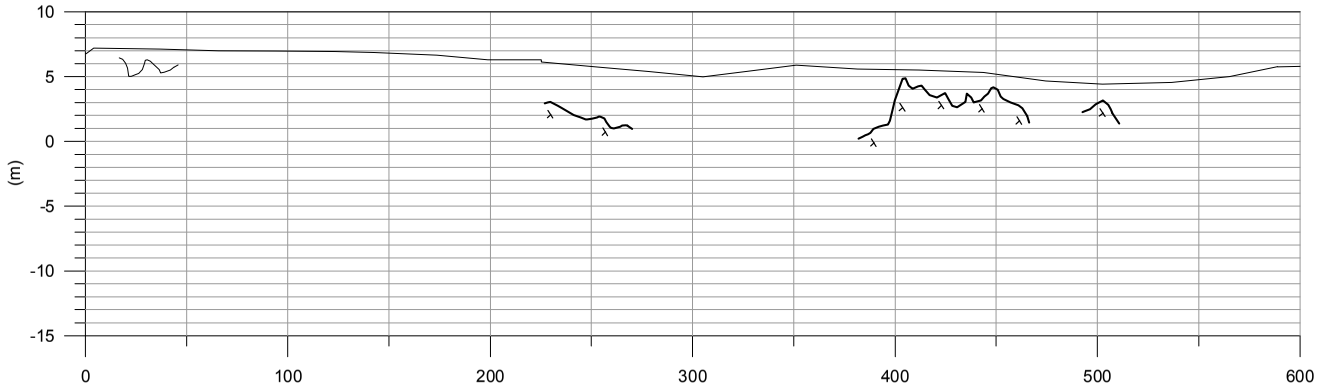
LFM000504, Profile H3, 1000-1308, from east to west

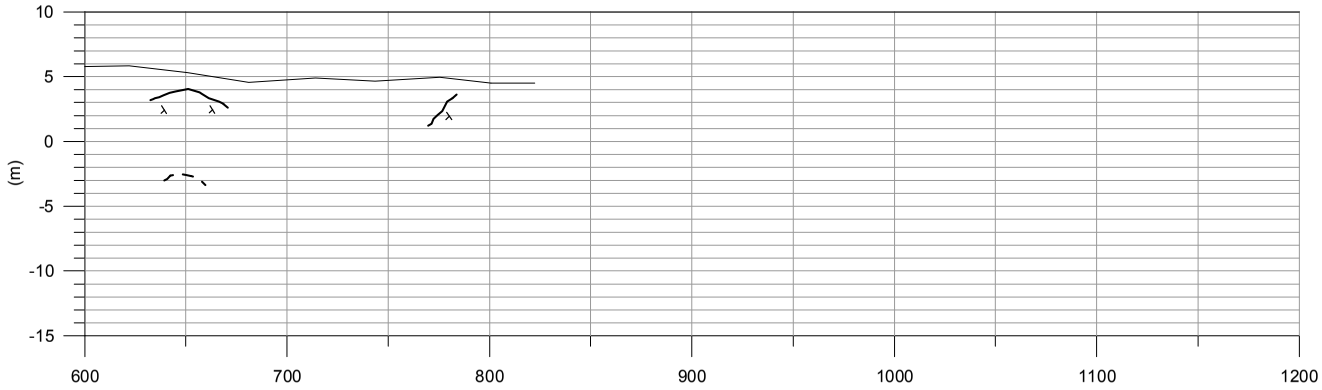


LFM000505, Profile H4, 0-500, from east to west



LFM000505, Profile H4, 500-809, from east to west



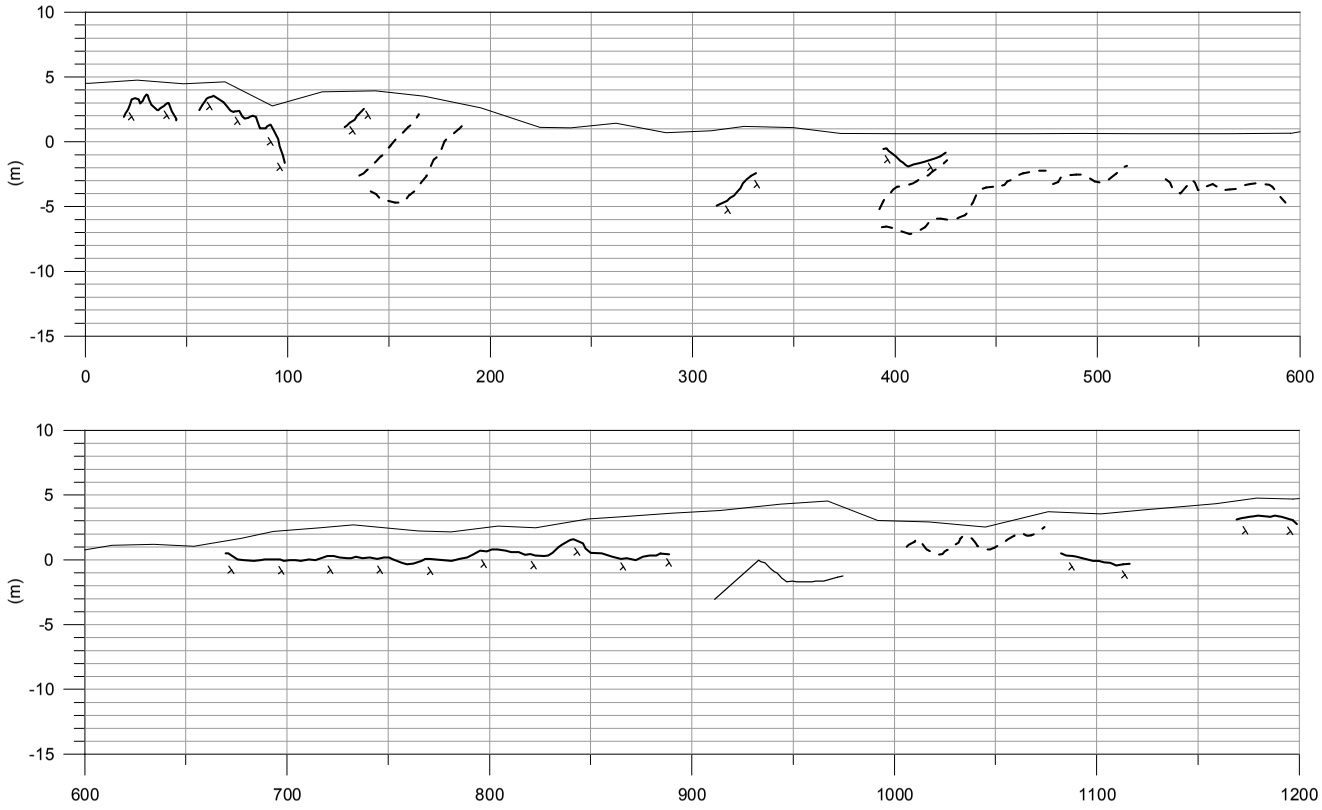


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000502
H1

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

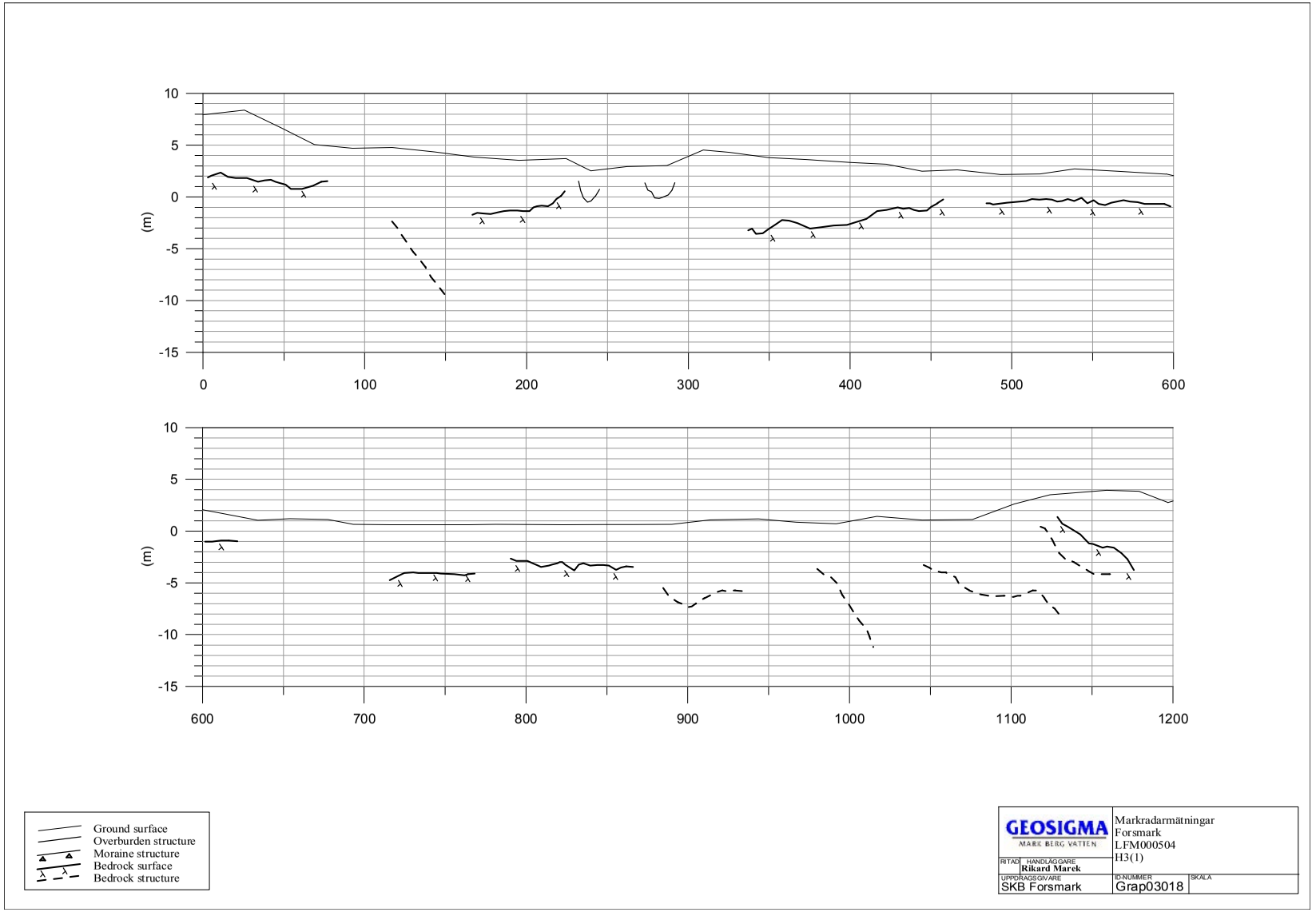


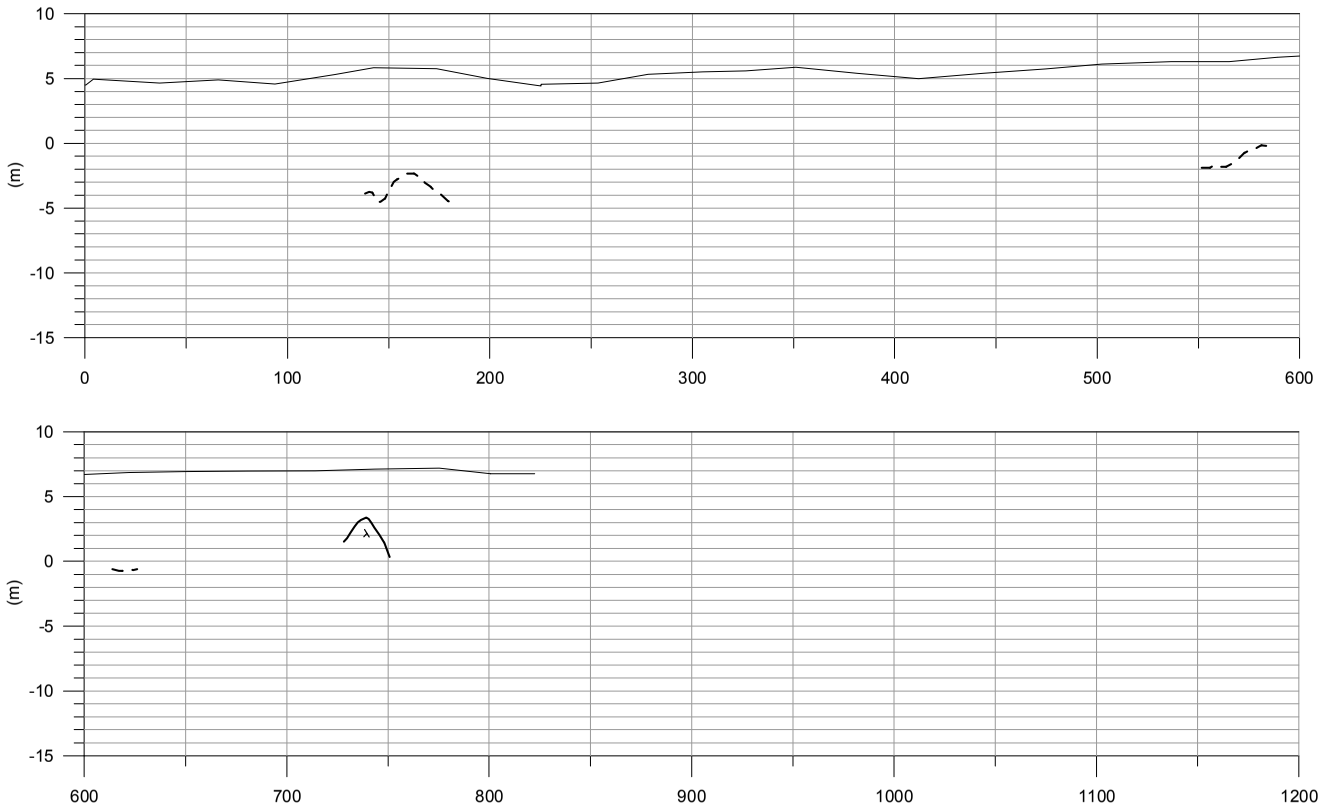
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000503
H2(1)

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:


10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600
10
5
0
-5
-10
-15
(m)
600
700
800
900
1000
1100
1200
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure
GEOSIGMA
MARK BERG VATTEN
Markradarmätningar
Forsmark
LFM000504
H3(1)
RITAD HANDLÄGGARE
Rikard Marek
UPPDRAGSGIVARE
SKB Forsmark
ID-NUMMER
Grap03018
SKALA



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

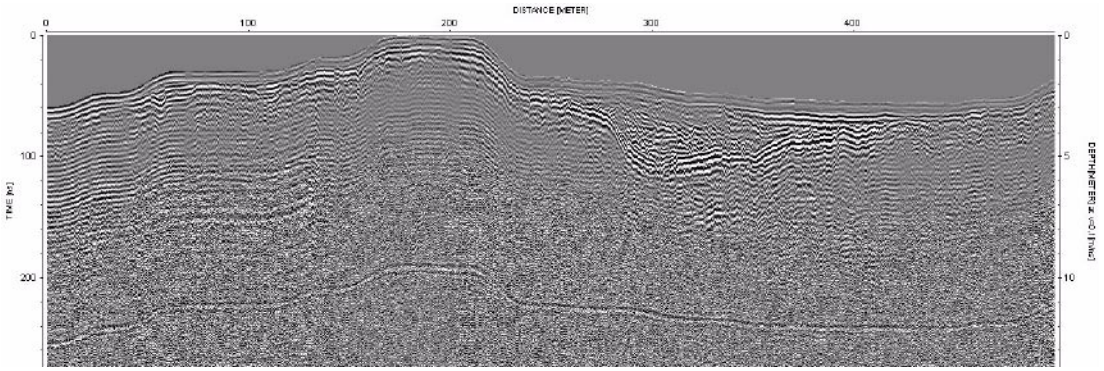
GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000505
H4

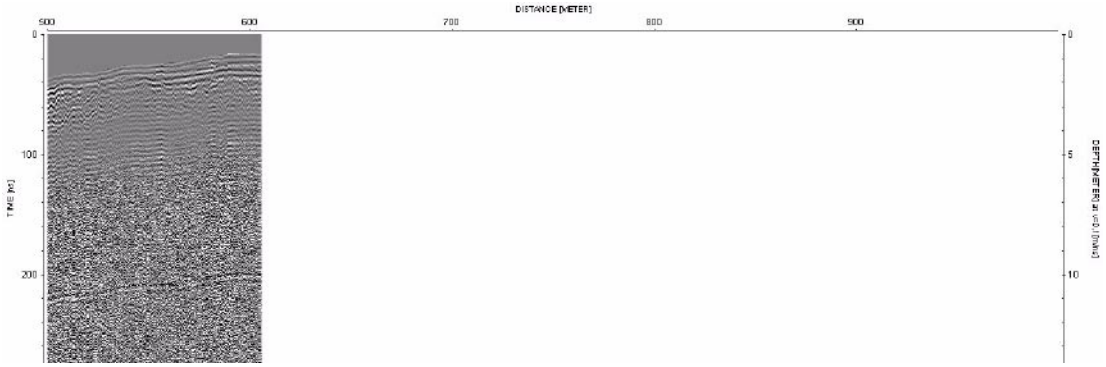
RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA I

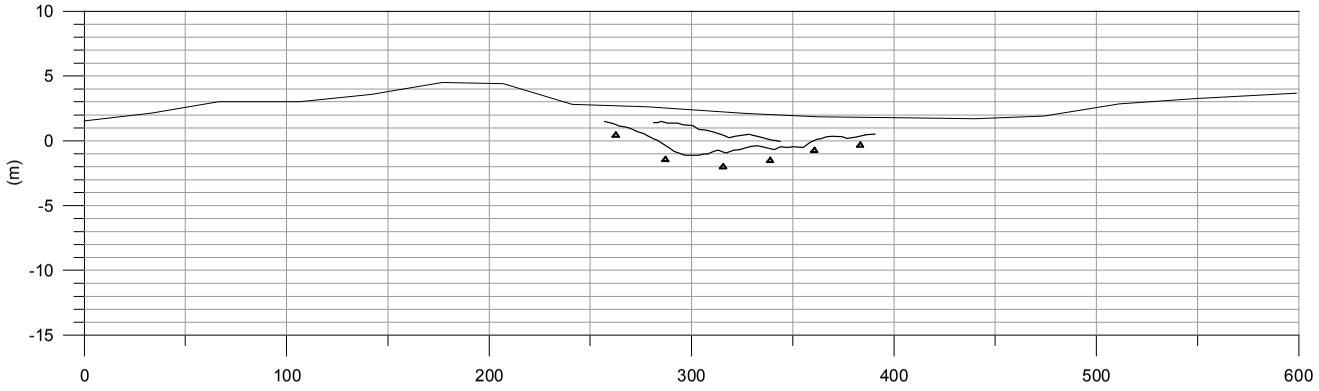
Fig. A9. Sketch map of area I. Codes in italic letters represent uninterpreted profiles



LFM000508, Profile I21, 0-500, from south to north



LFM00508, Profile I21, 500-606, from south to north



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000508
I3

RITAD | HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA

AREA J

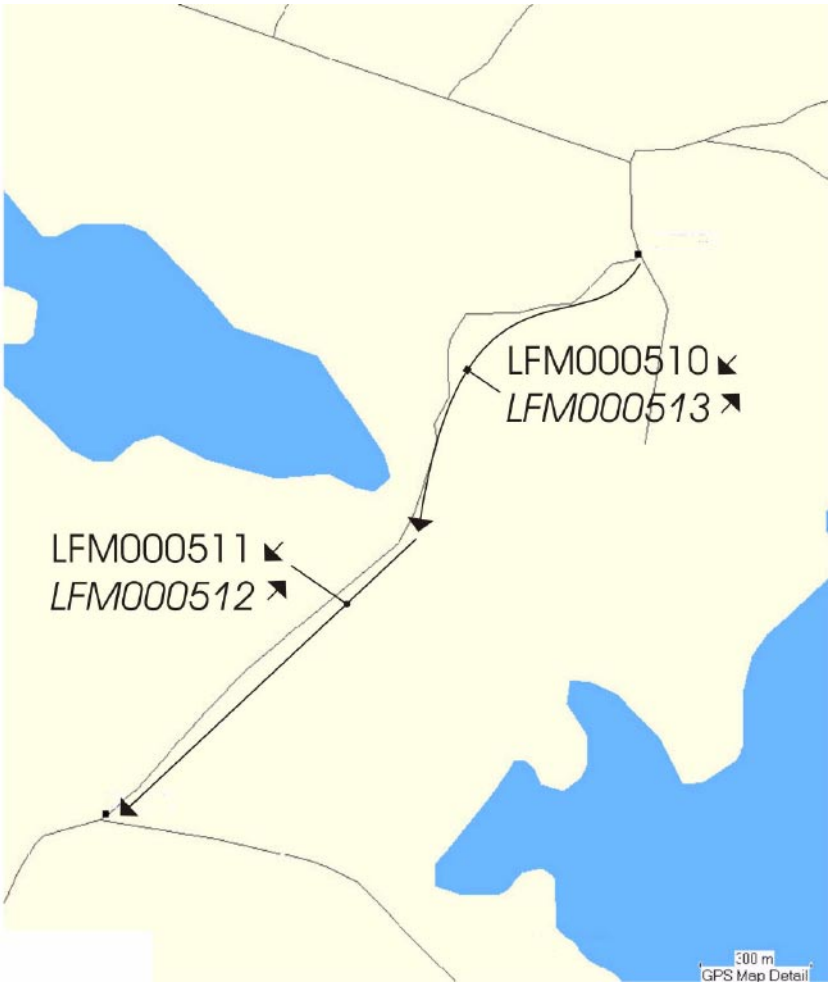
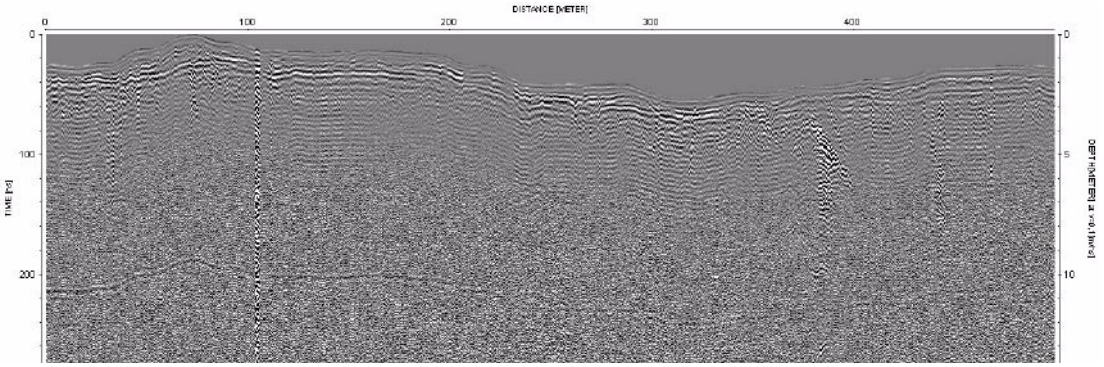
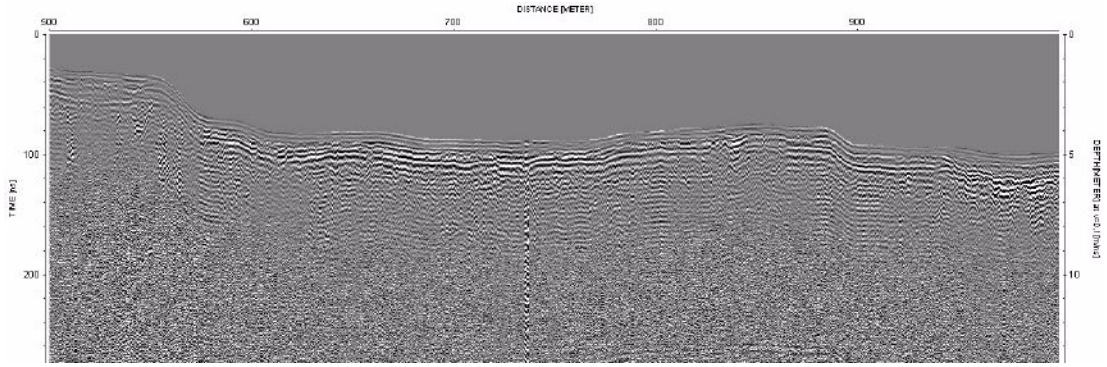


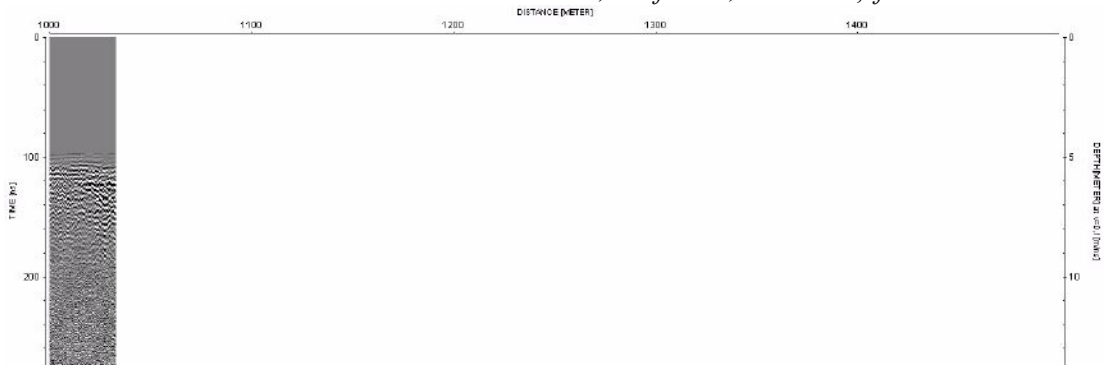
Fig. A10. Sketch map of area J. Codes in italic letters represent uninterpreted profiles.



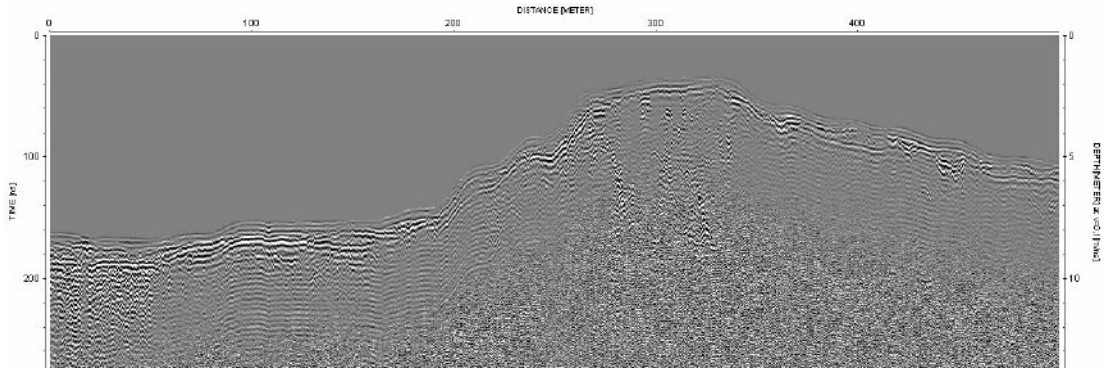
LFM000510, Profile J1, 0-500, from north to south



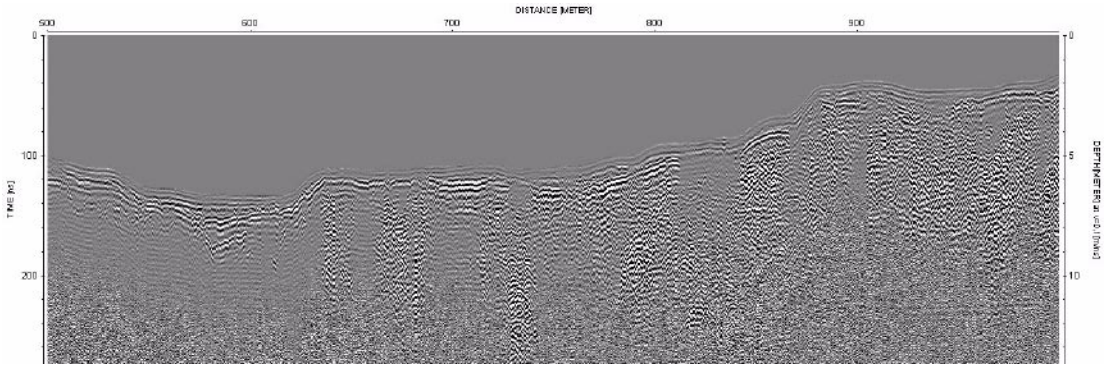
LFM000510, Profile J1, 500-1000, from north to south



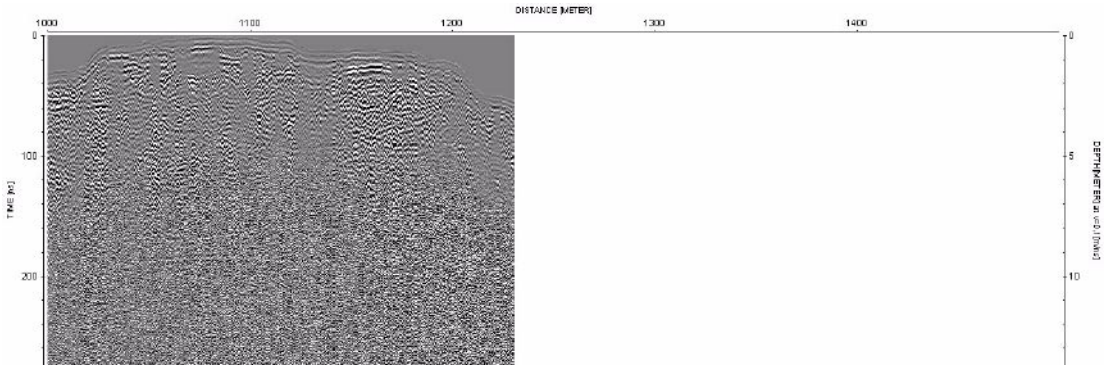
LFM000510, Profile J1, 1000-32, from north to south



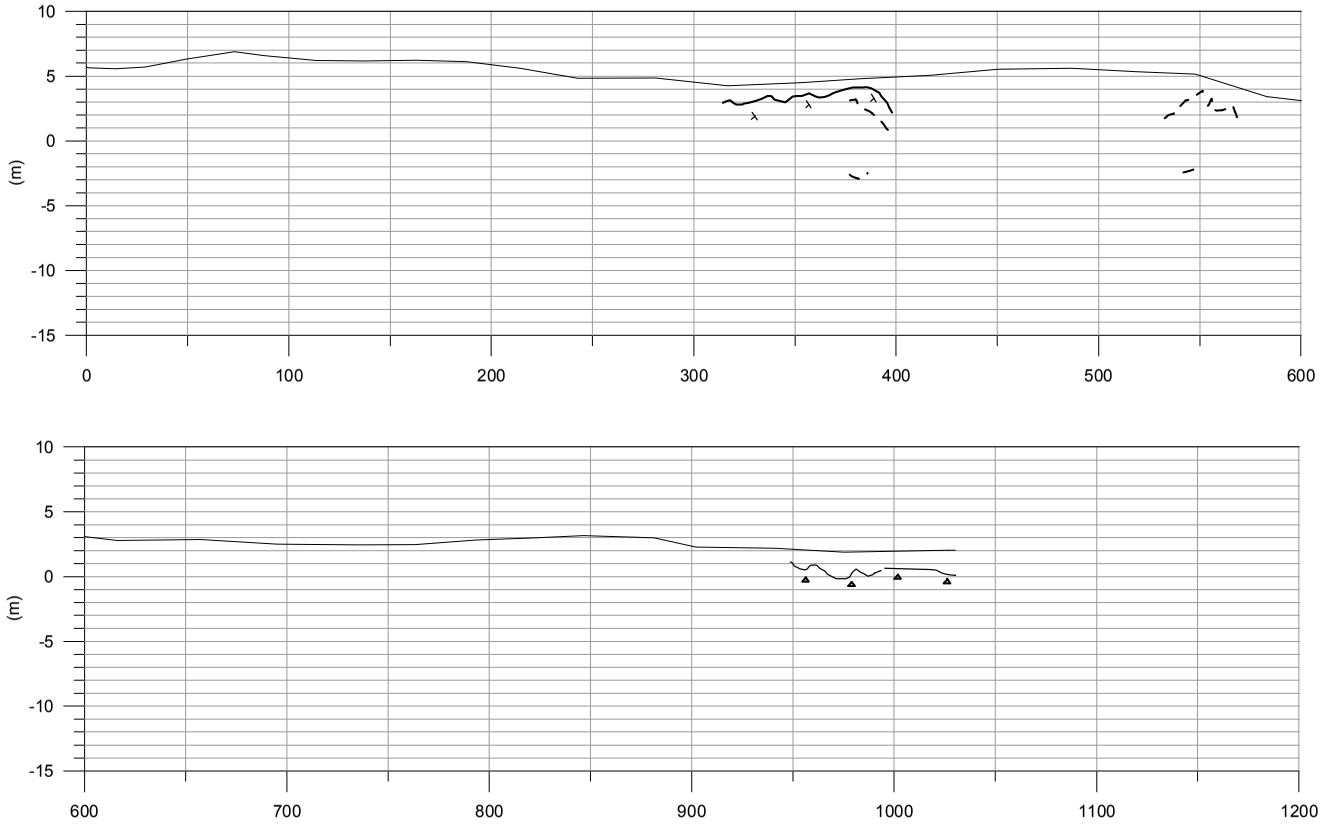
LFM000511, Profile J2, 0-500, from north to south



LFM000511, Profile J2, 500-1000, from north to south



LFM000511, Profile J2, 1000-1230, from north to south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-15
(m)
0
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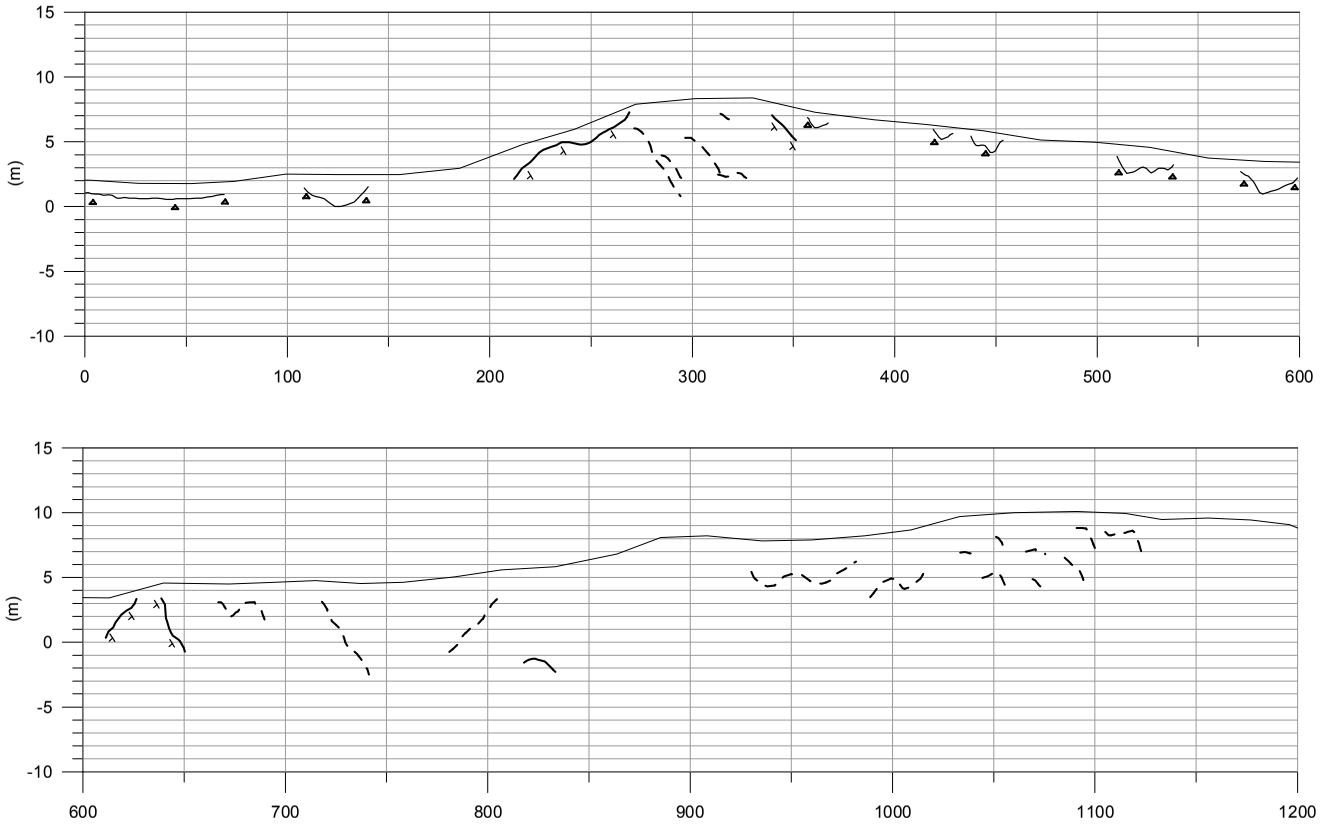
200
300
400
500
600
10
5
0
-5
-10
-15
(m)
600
700
800
900
1000
1100
1200
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure
GEOSIGMA
MARK BERG VATTEN
Markradarmätningar
Forsmark
LFM000510
J1
RITAD HANDLÄGGARE
Rikard Marek
UPPDRAGSGIVARE
SKB Forsmark
ID-NUMMER
Grap03018
SKALA



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000511
J2

RITAD HANDLÄGGARE: Riard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA K

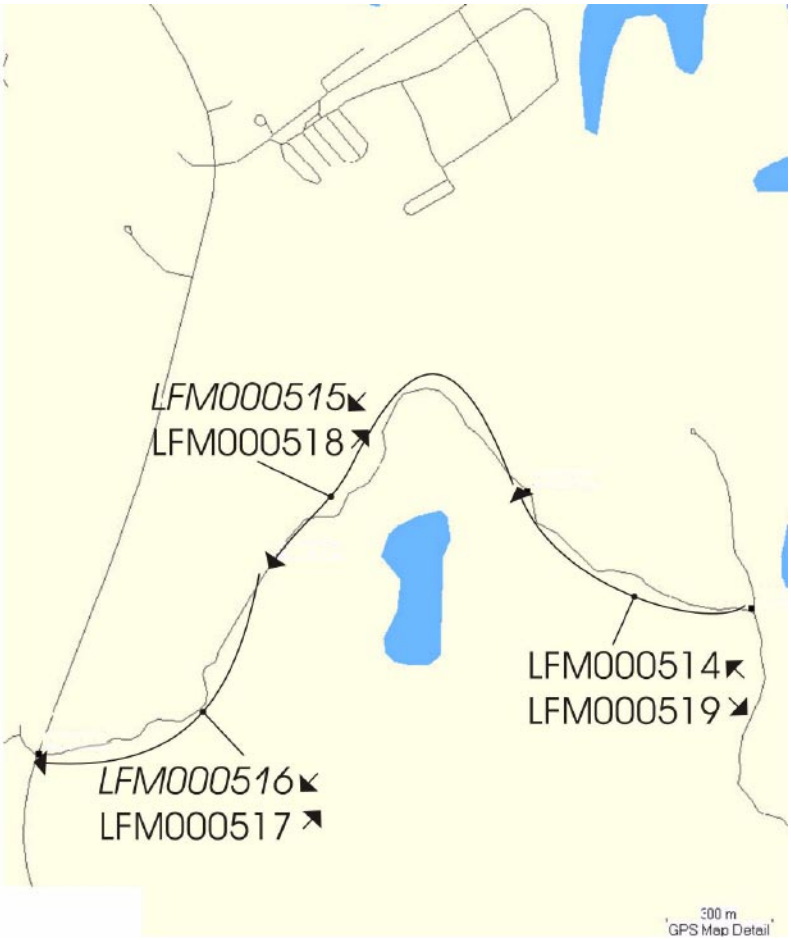
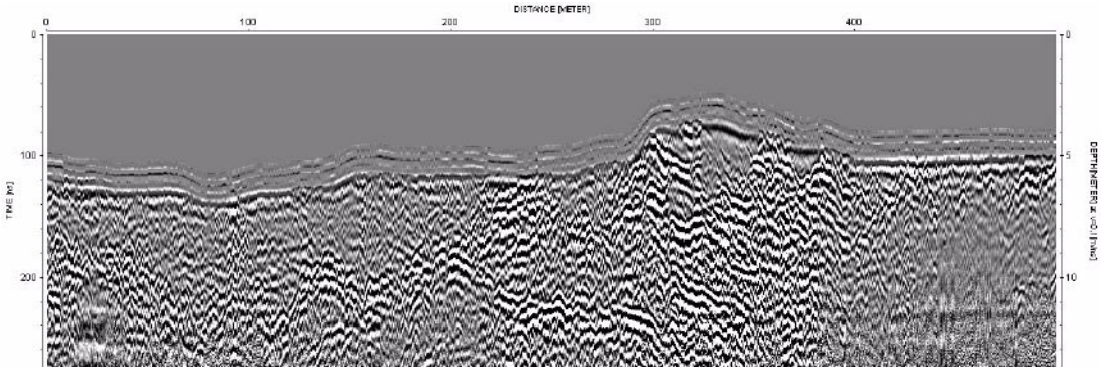
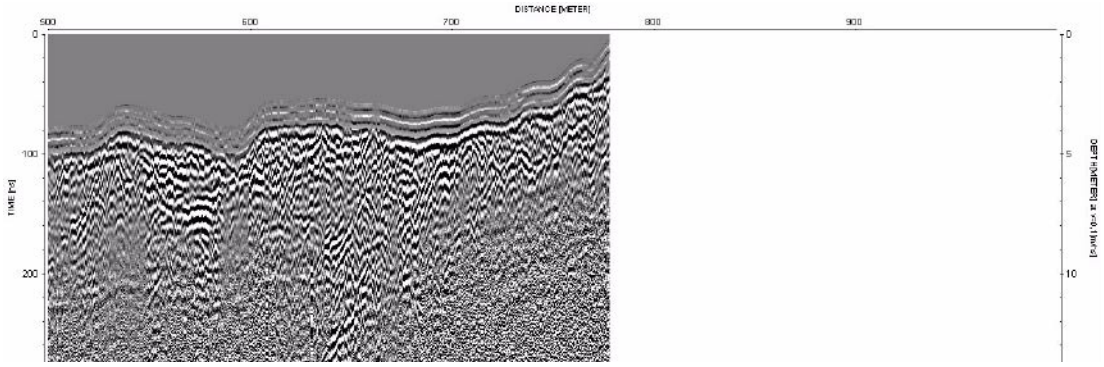


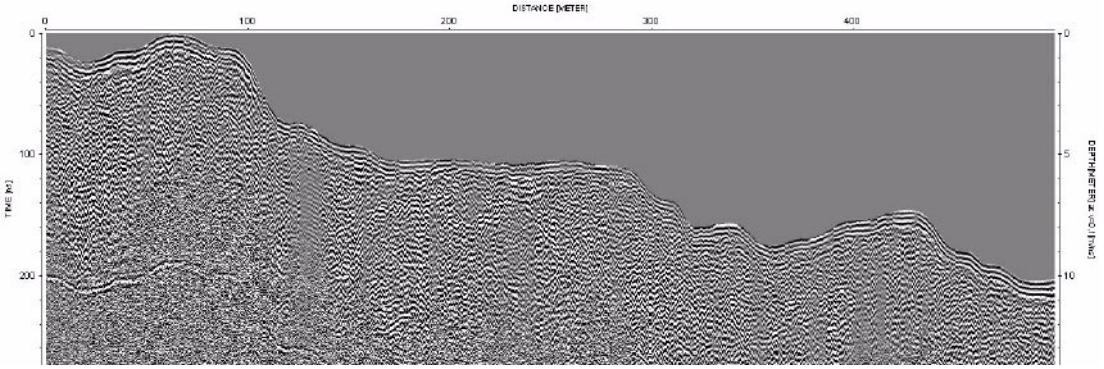
Fig. A11. Sketch map Area K. Codes in italic letters represent uninterpreted profiles.



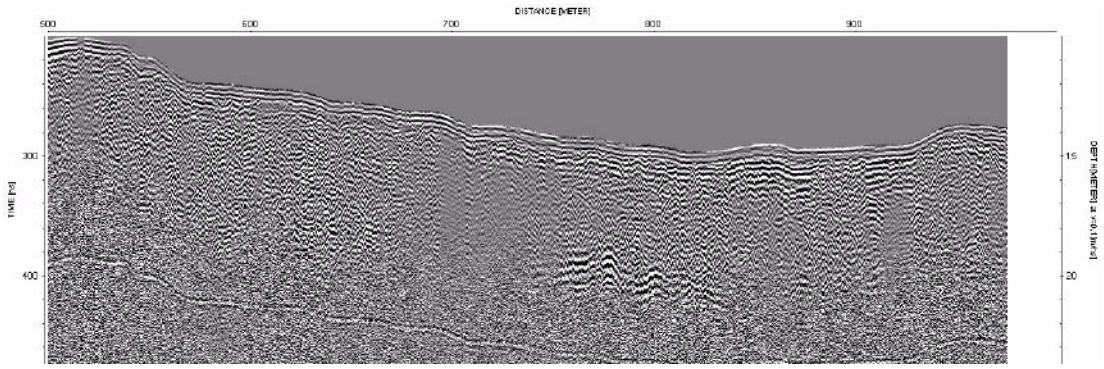
LFM000514 Profile K1, 0-500, from east to west



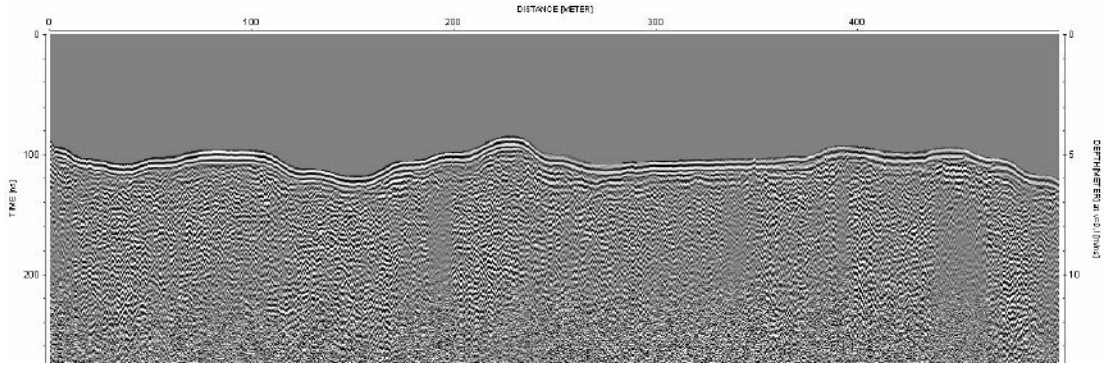
LFM000514 Profile K1, 500-778, from east to west



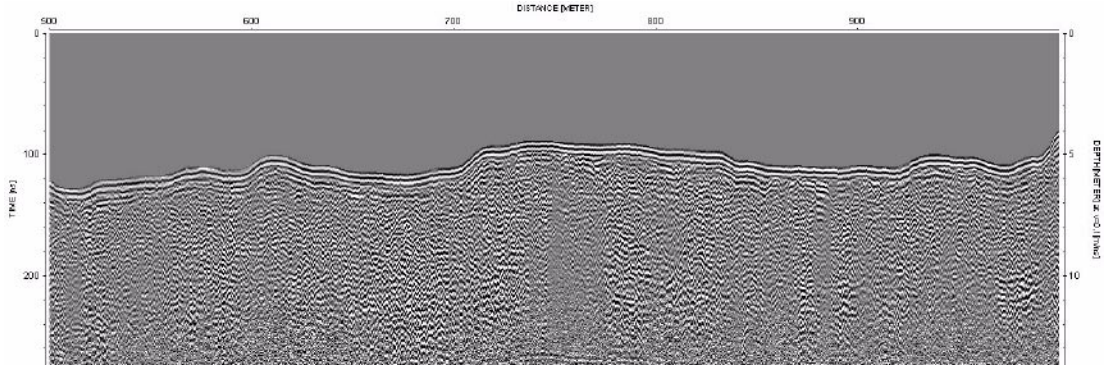
LFM000517 Profile K4, 0-500, from west to east



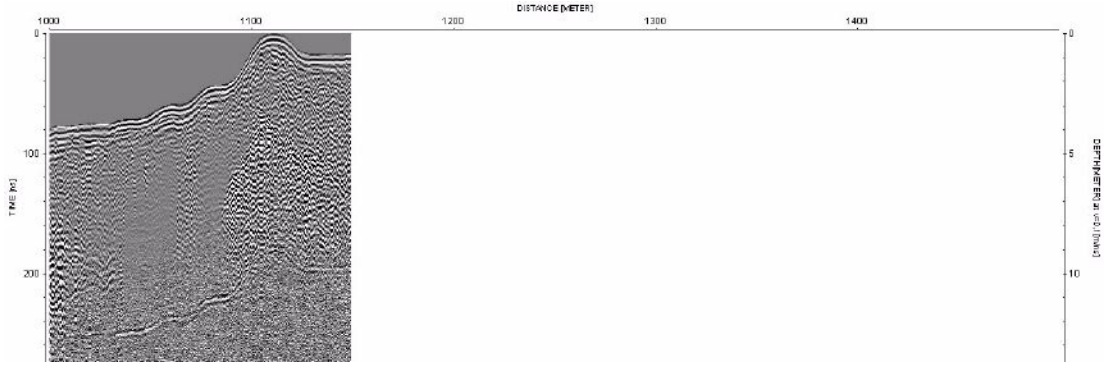
LFM000517 Profile K4, 500-976, from west to east



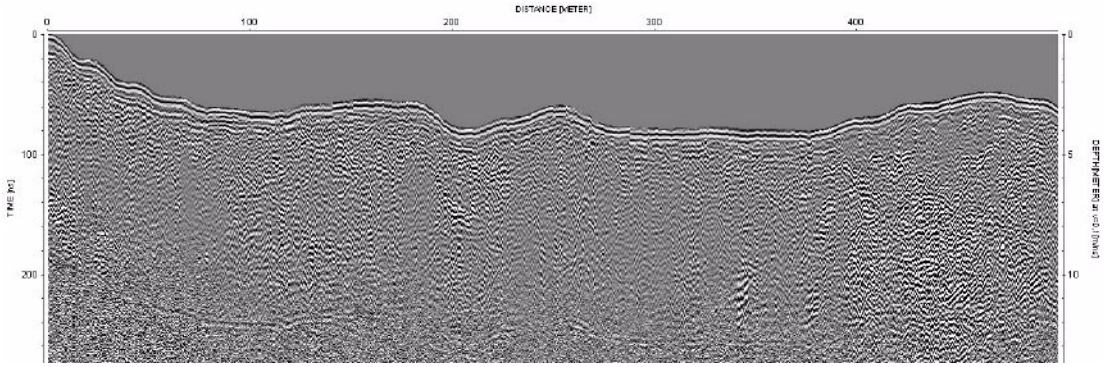
LFM000518 Profile K5, 0-500, from west to east



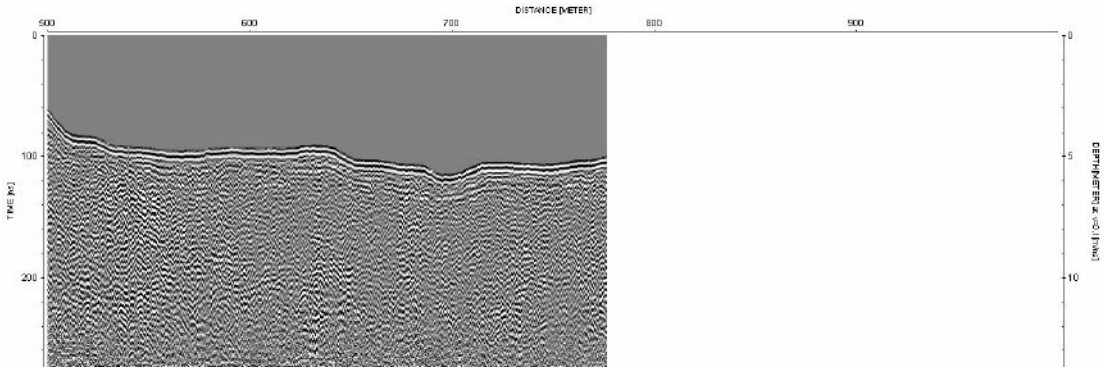
LFM000518 Profile K5, 500-1000, from west to east



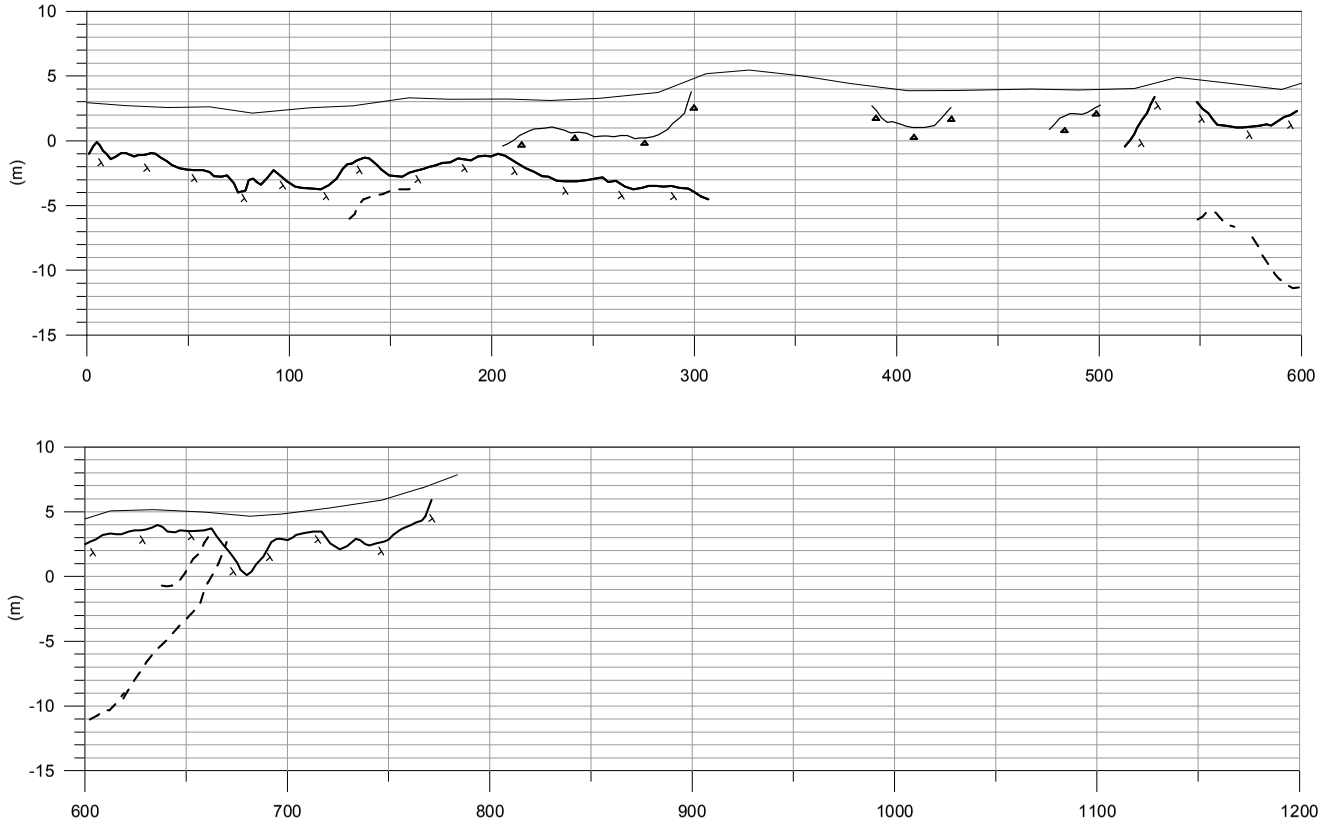
LFM000518, Profile K5, 1000-1149, from west to east



LFM000519, Profile K6, 0-500, from west to east



LFM000519, Profile K6, 500-776, from west to east

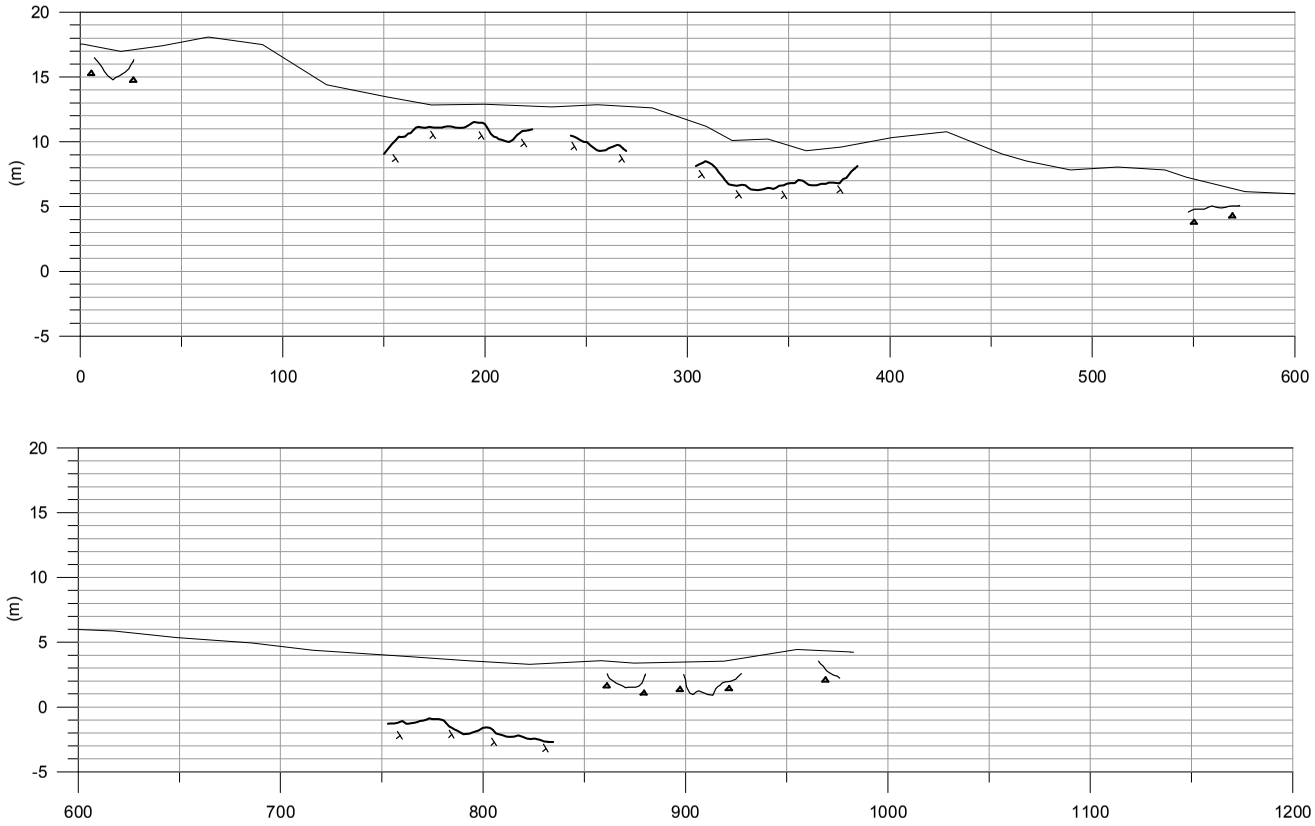


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000514
K1

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

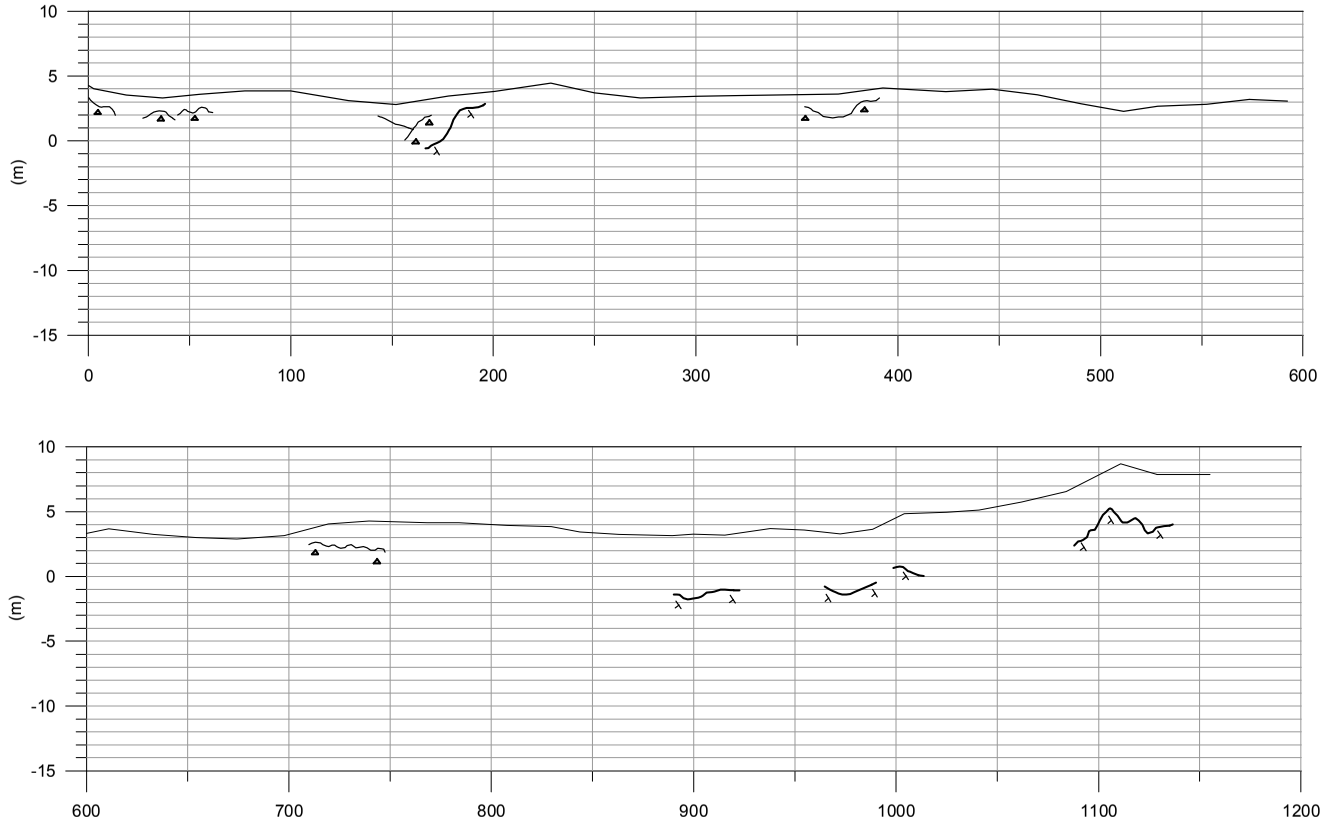


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000517
K4

RITAD: HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

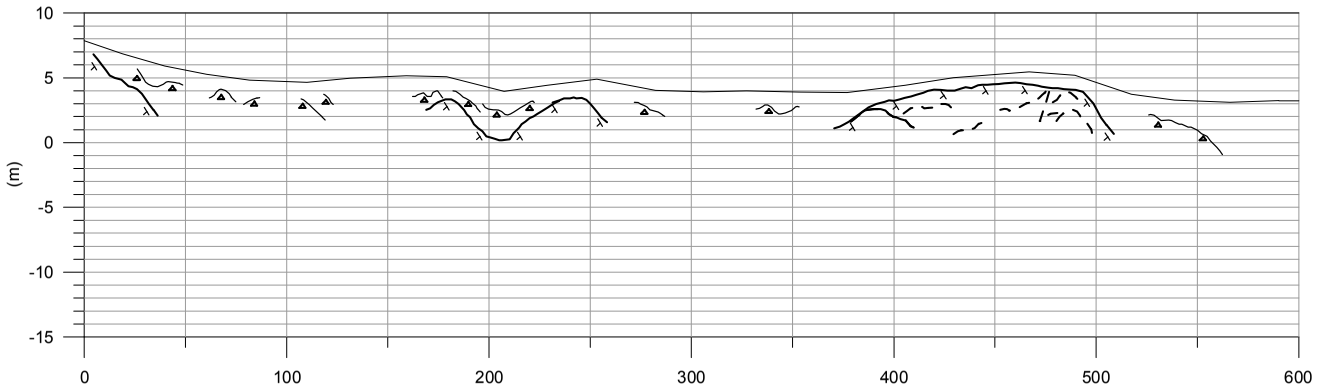


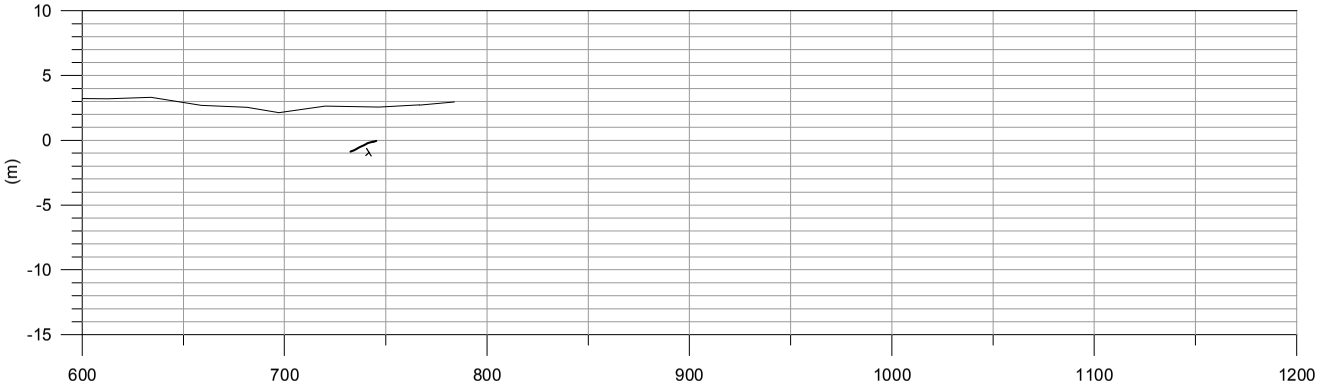
Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000518
K5

RITAD: HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:





Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000519
K6

RITAD | HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA L

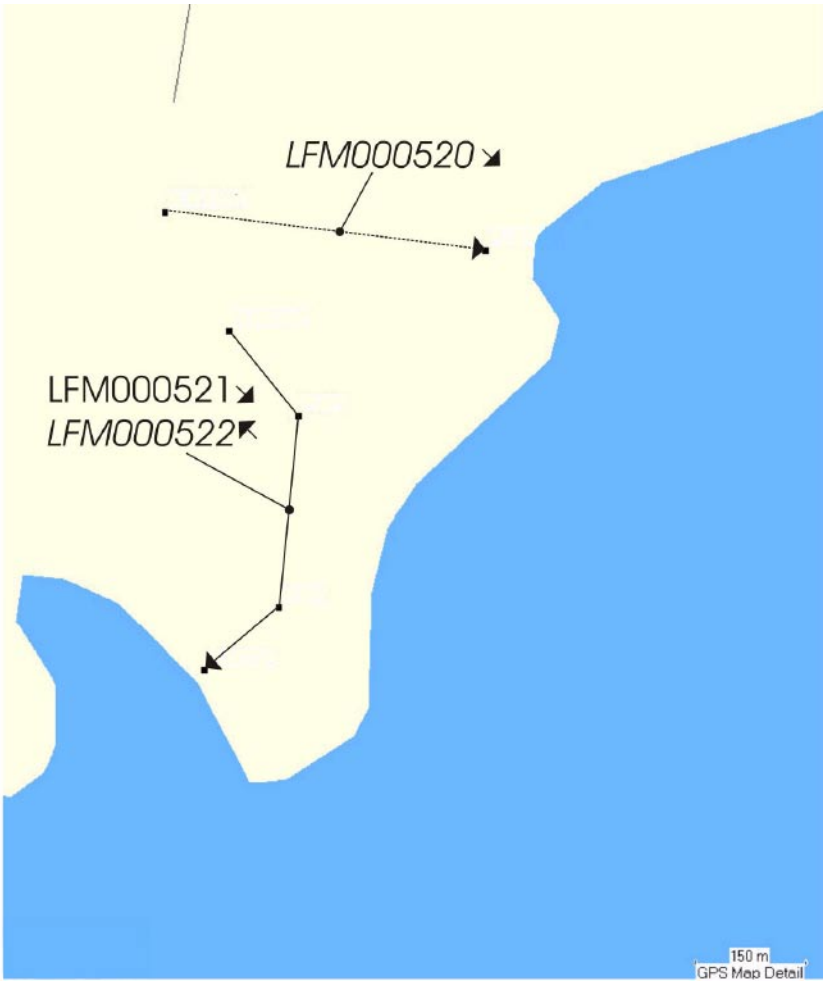
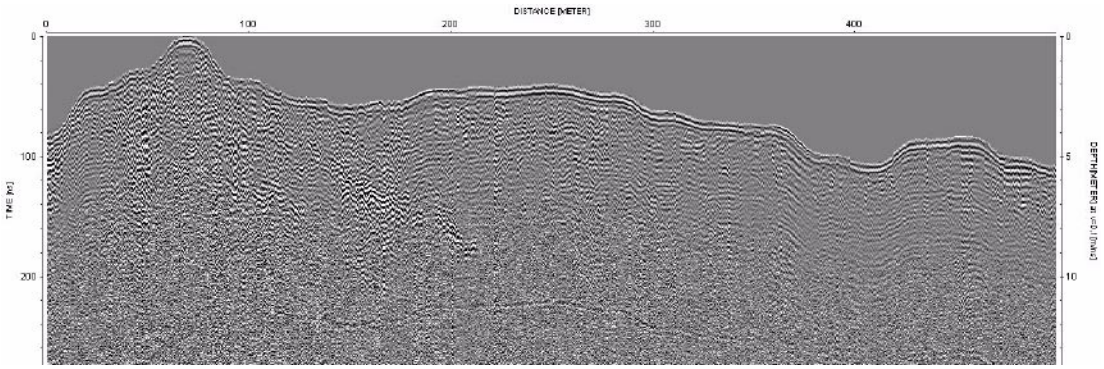
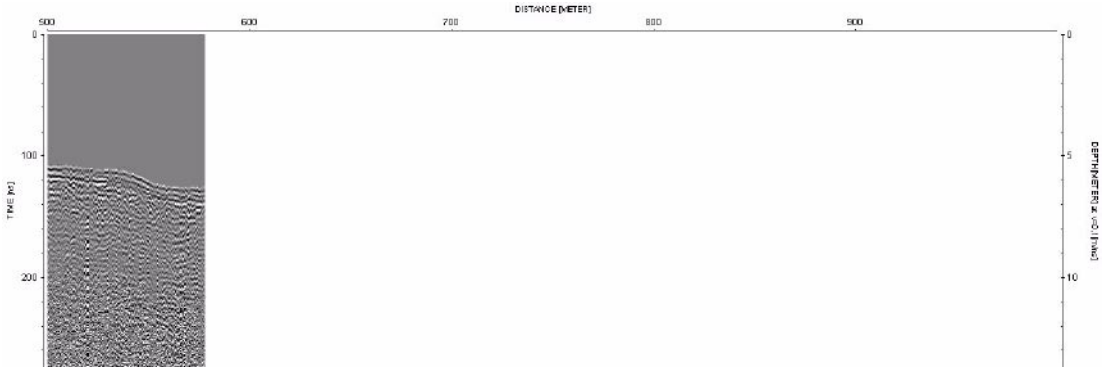


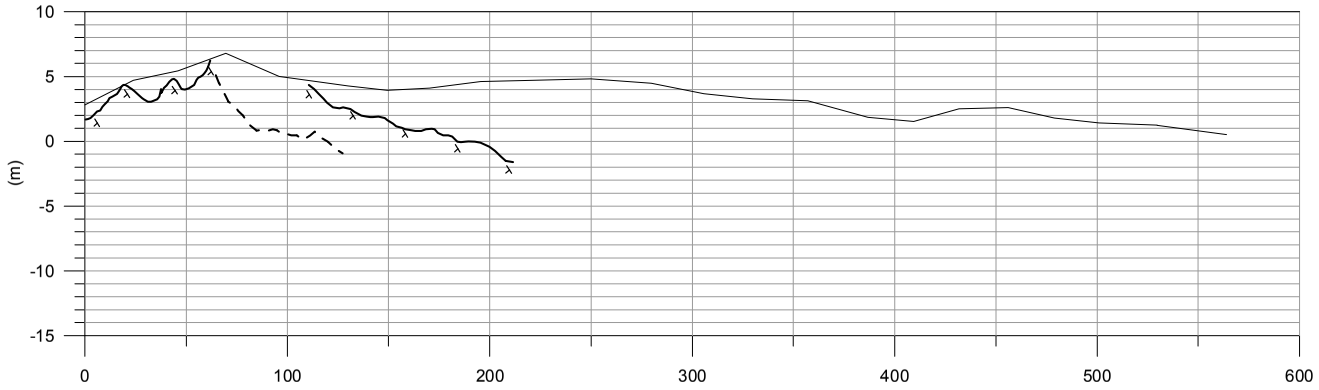
Fig. A12. Sketch map Area L. Codes in italic letters represent uninterpreted profiles



LFM000521 Profile L2, 0-500, from north to south



LFM000521 Profile L2, 500-578, from north to south



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000521
L2

RITAD HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA

AREA M

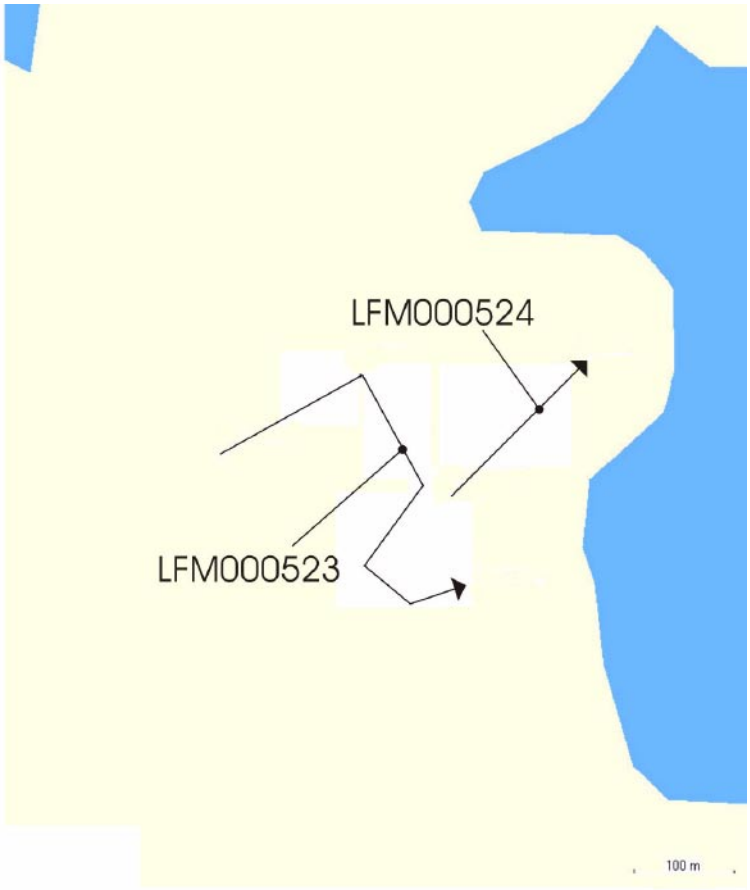
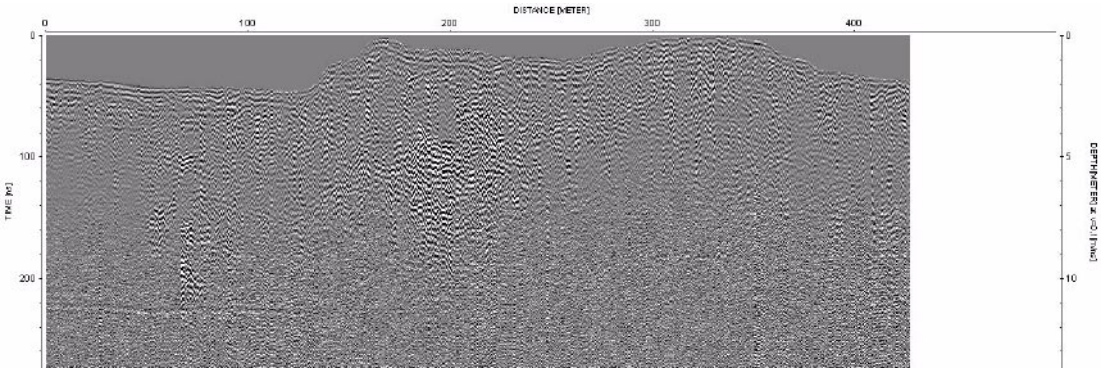
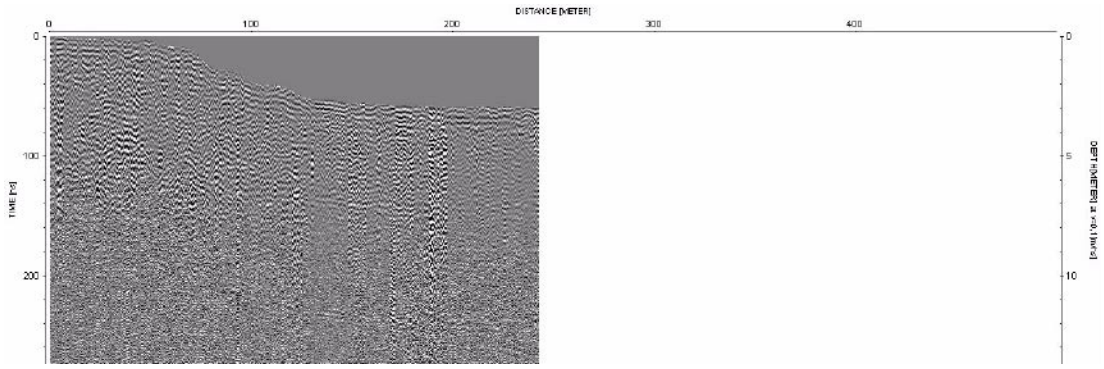


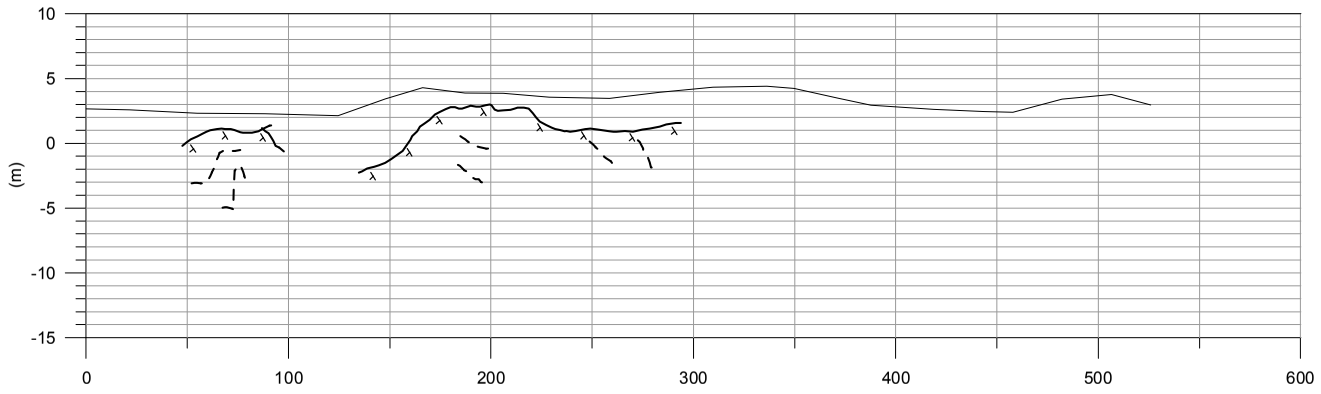
Fig. A13. Sketch map Area M



LFM000523 Profile M1, 0-500, from northwest to southeast



LFM000524 Profile M2, 0-500, from southwest to northeast

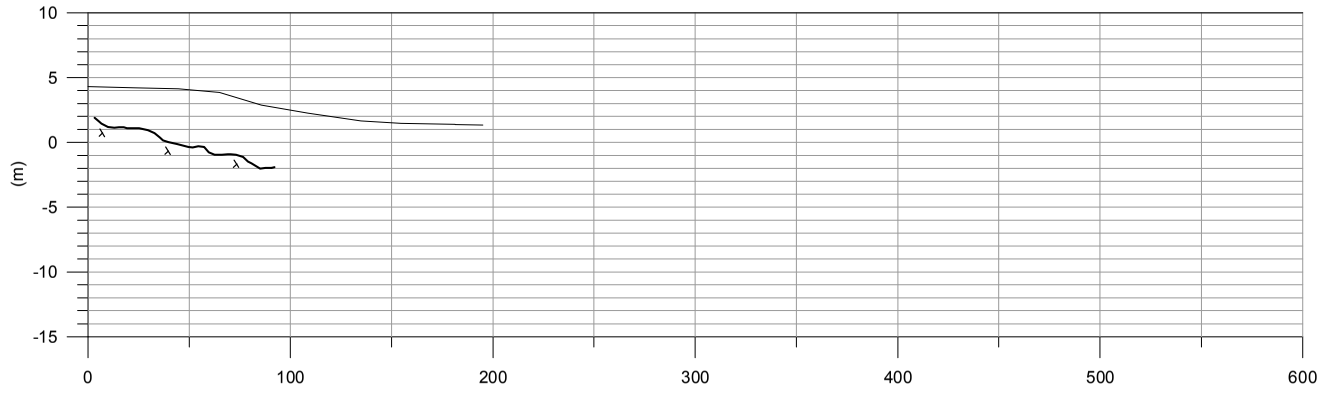


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000523
M1

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000524
M2

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA N

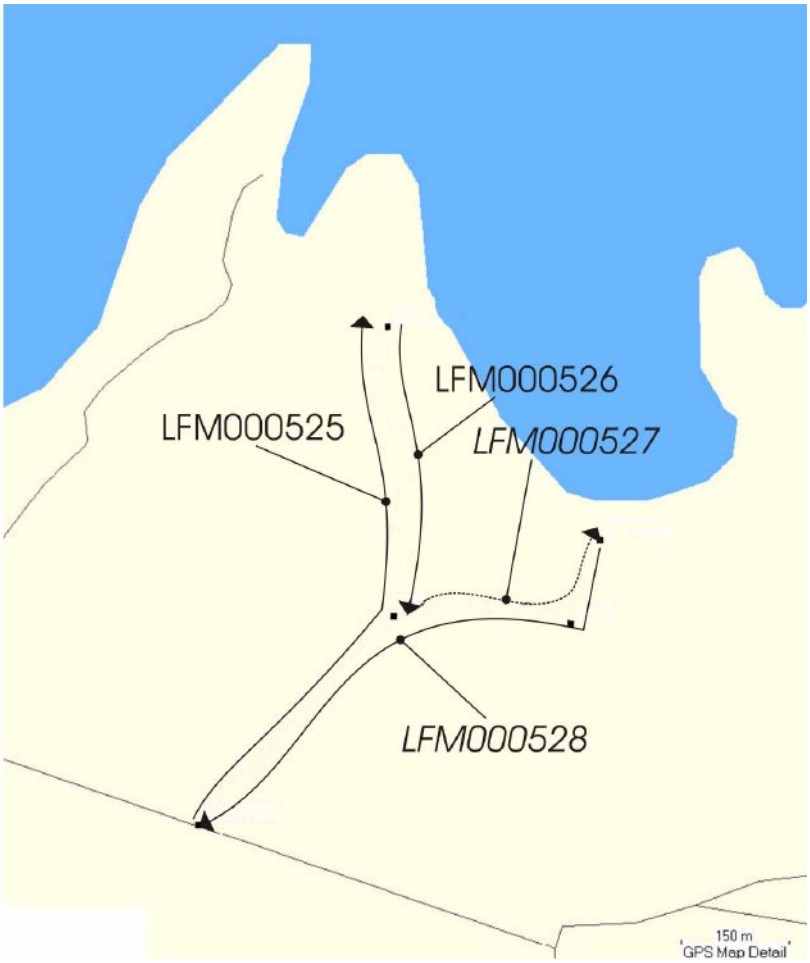
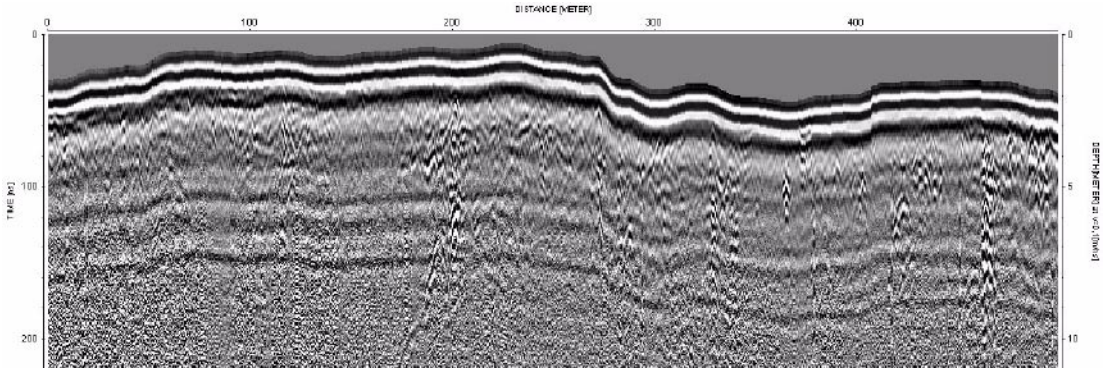
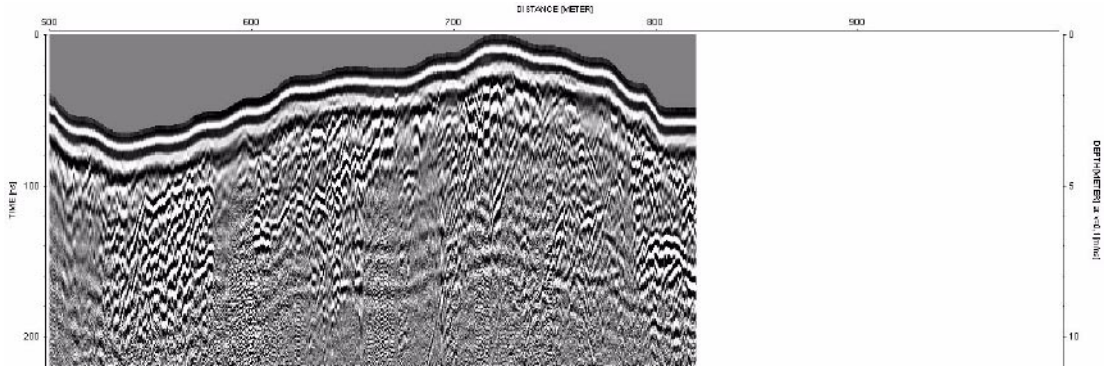


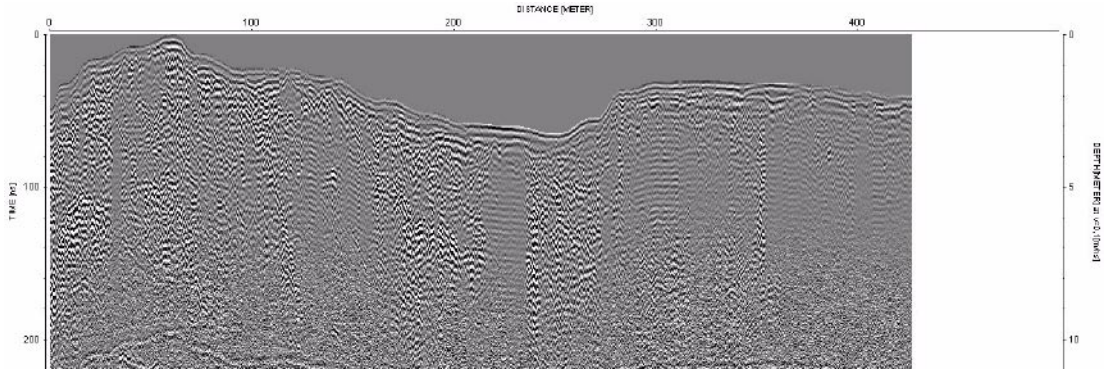
Fig. A14. Sketch map Area N. Codes in italic letters represent uninterpreted profiles



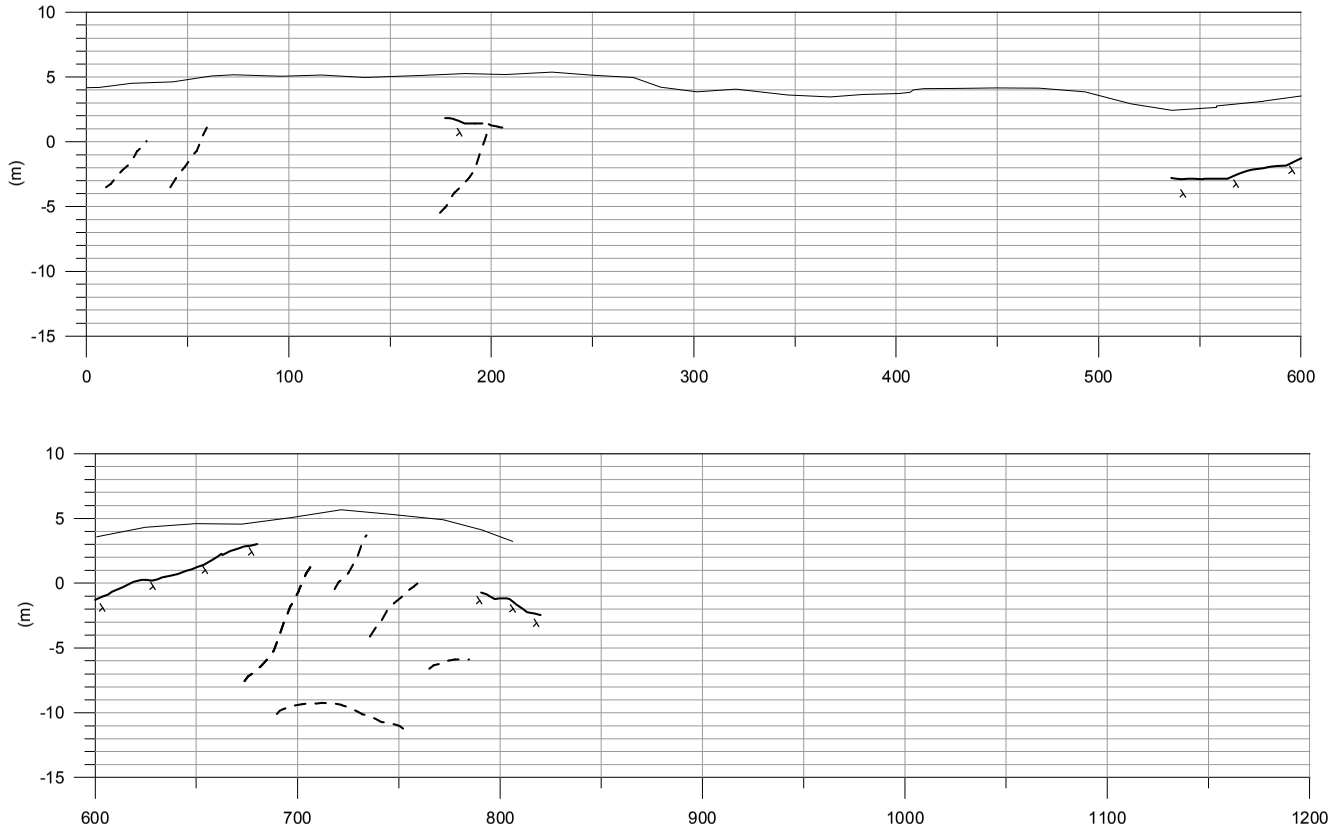
LFM000525 Profile 1, 0-500, from south to north



LFM000525 Profile N1, 500-820, from south to north



LFM000526 Profile N2, 0-427, from north to south

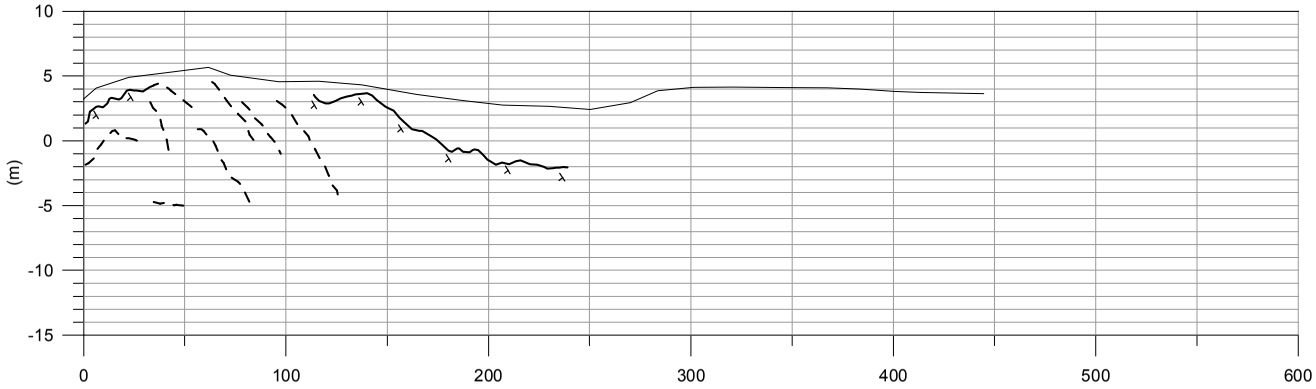


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000525
N1

RITAD: HANDLÄGGARE Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000526
N2

RITAD: HANDLÄGGARE: **Rikard Marek**
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA O

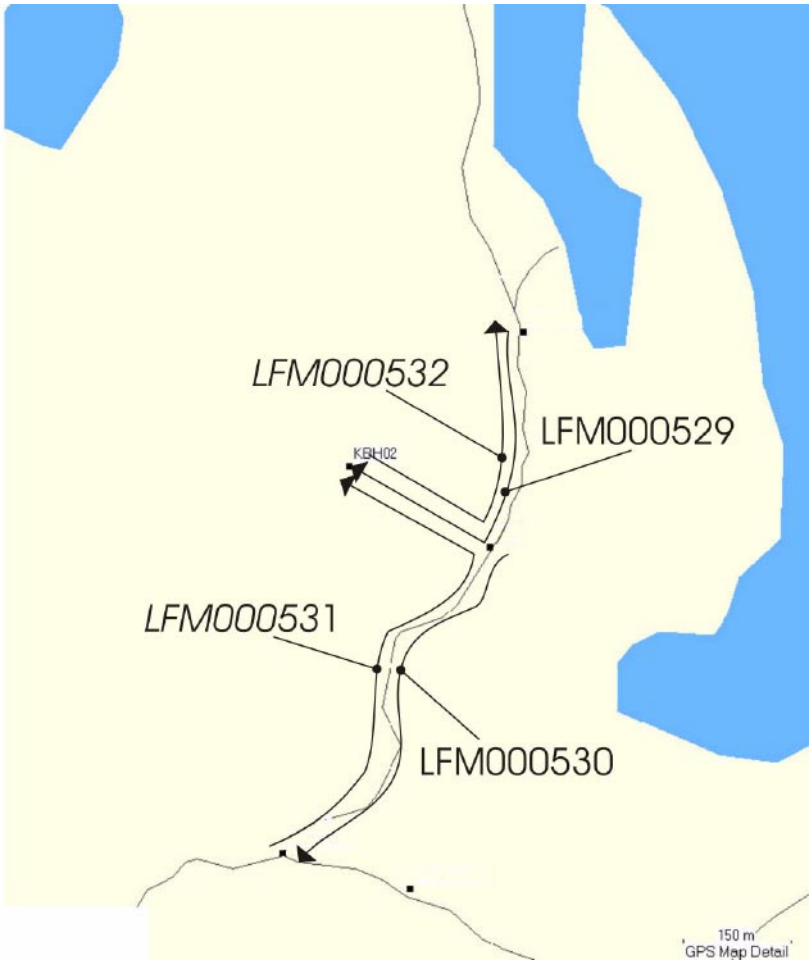
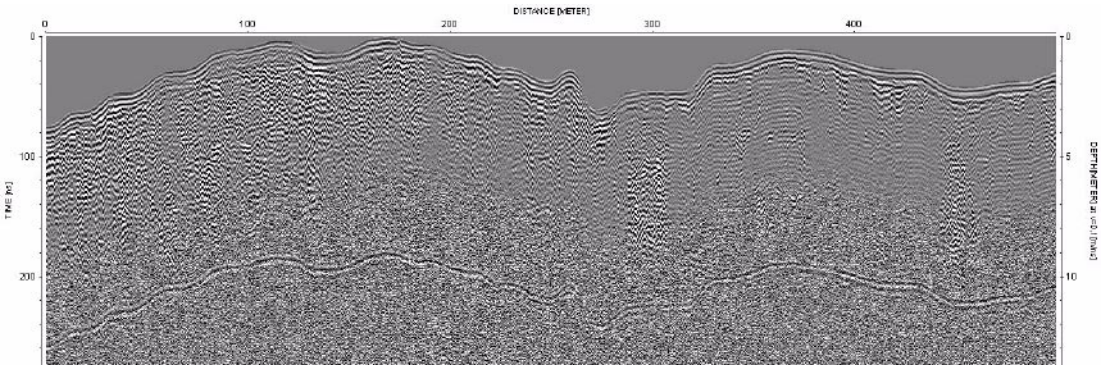
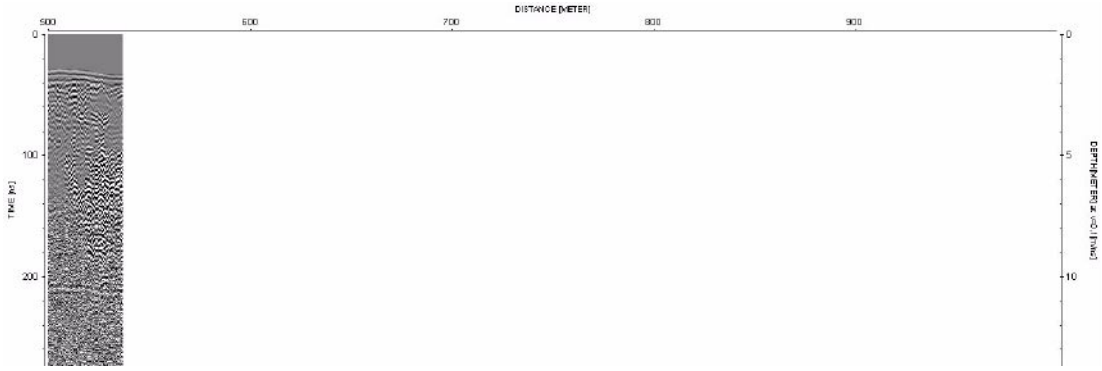


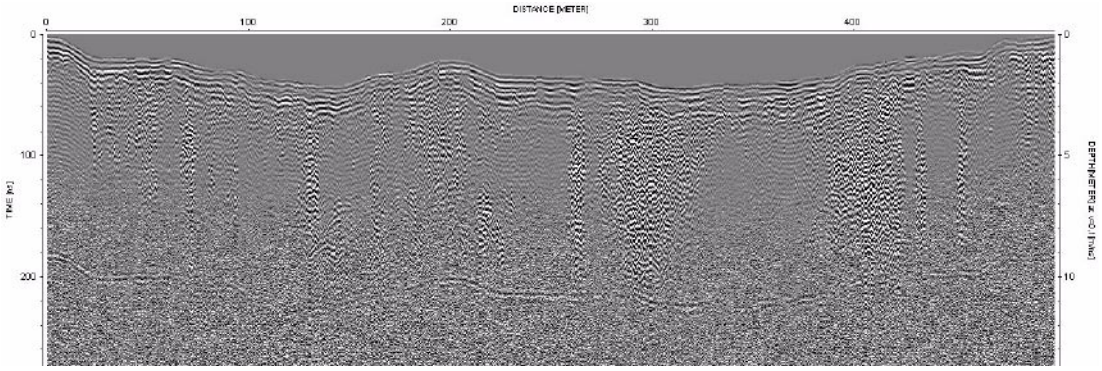
Fig. A15. Sketch map Area O. Codes in italic letters represent uninterpreted profiles.



LFM000529 Profile O1, 0-500, from north to south

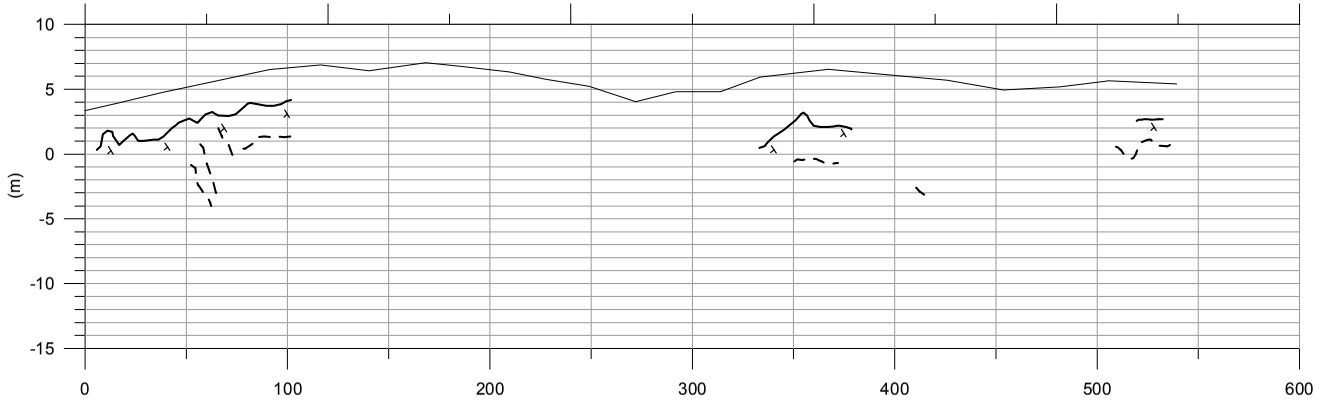


LFM000529 Profile O1, 500-537, from north to south



LFM000530 Profile O2, 0-500, from north to south

LFM000530 Profile O2, 500-575, from north to south

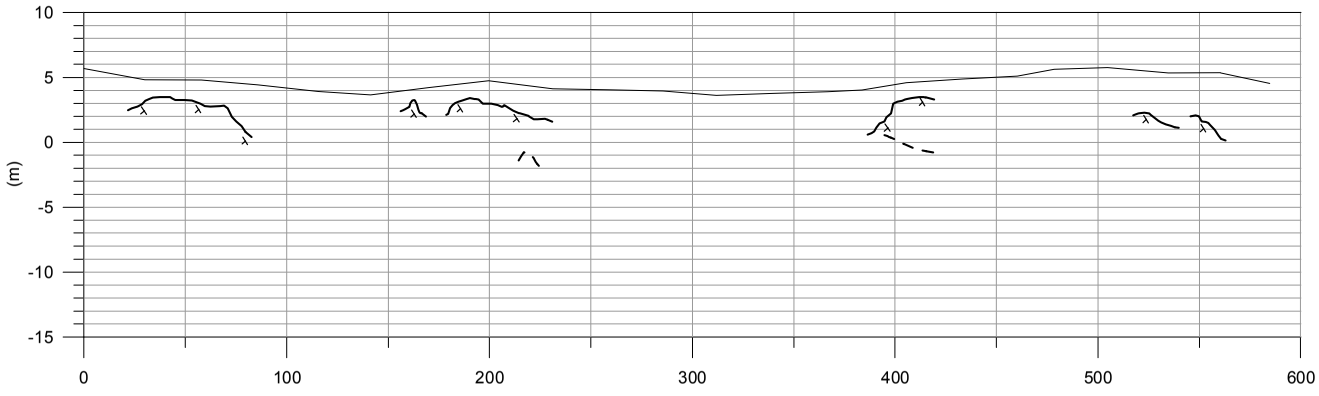


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM00529
O1

RITAD | HANDLÄGGARE: Riard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000530
O2

RITAD: HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA P

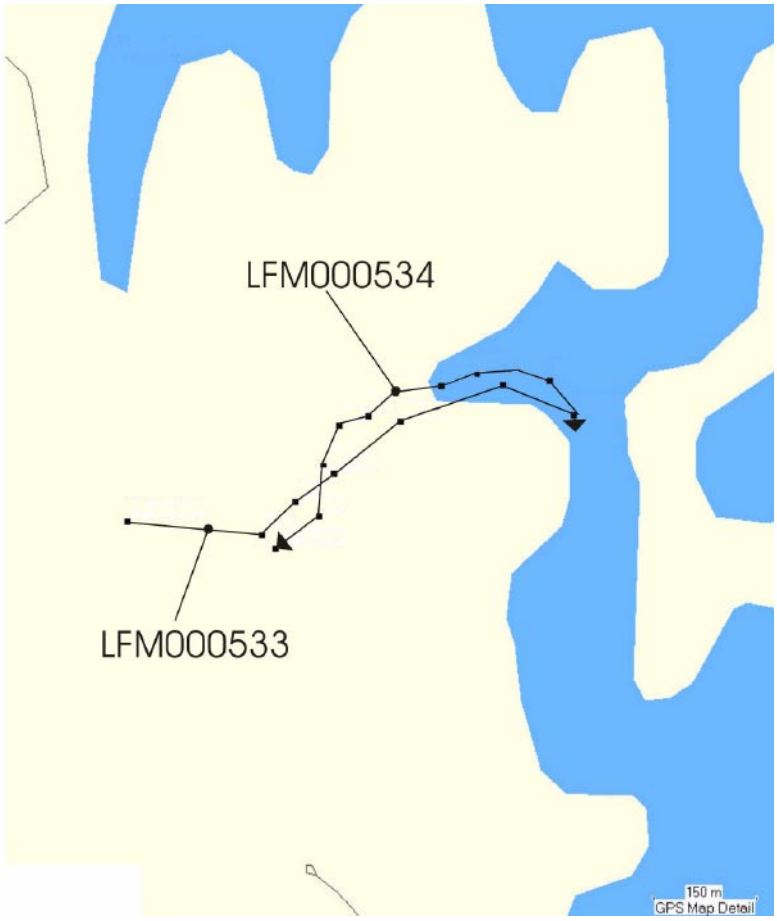
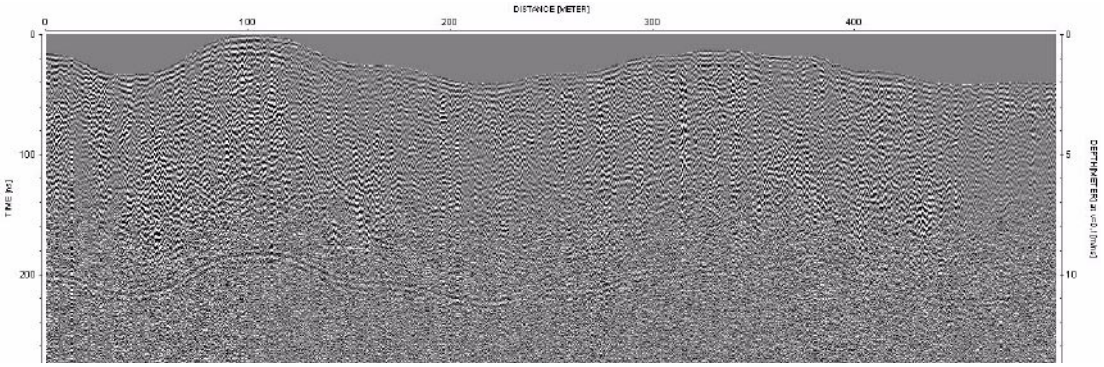
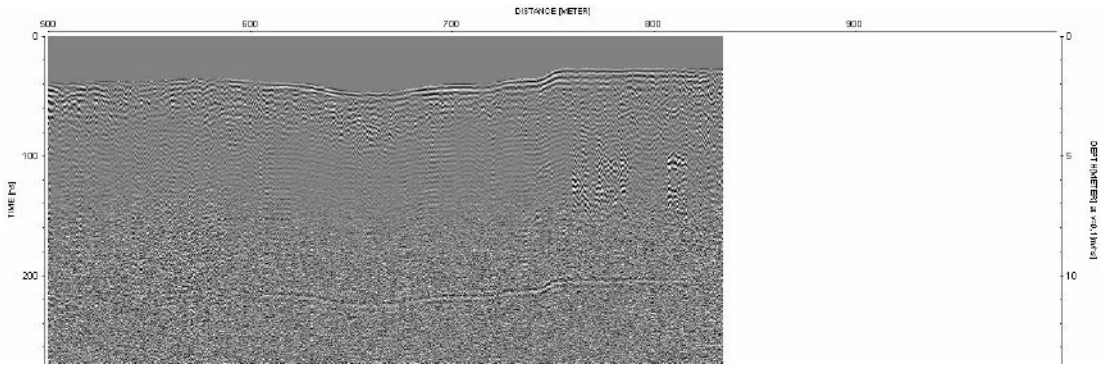


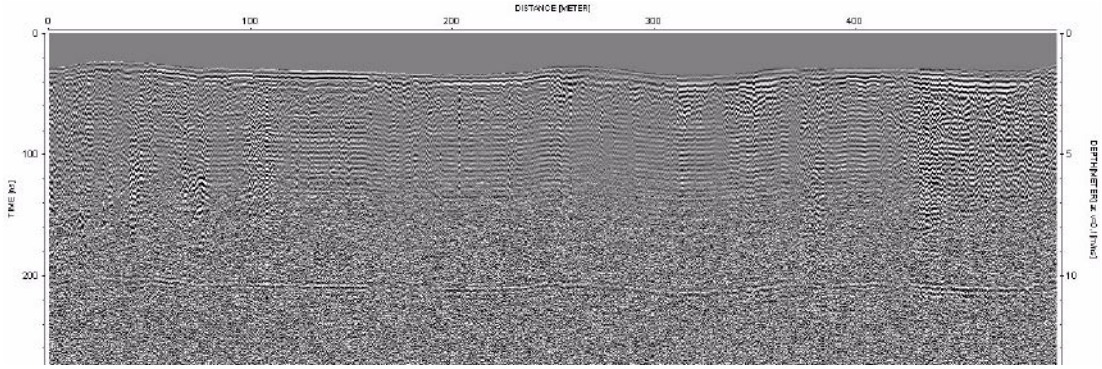
Fig. A16. Sketch map Area P



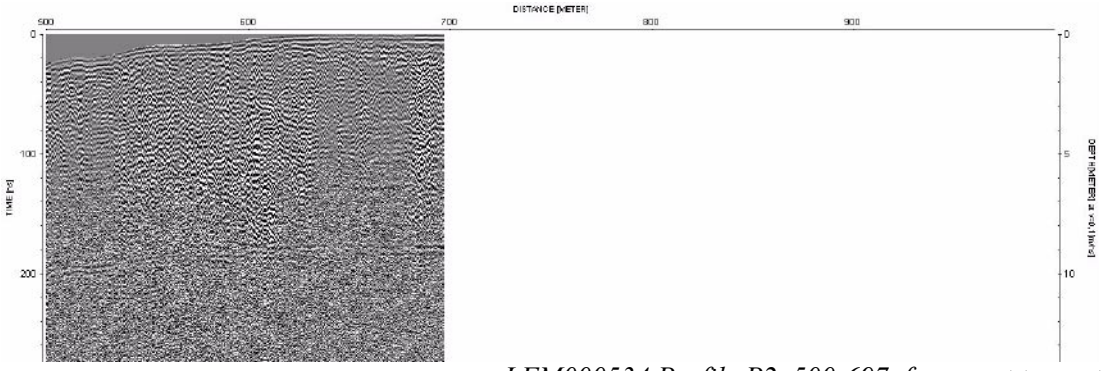
LFM000533 Profile P1, 0-500, from west to east



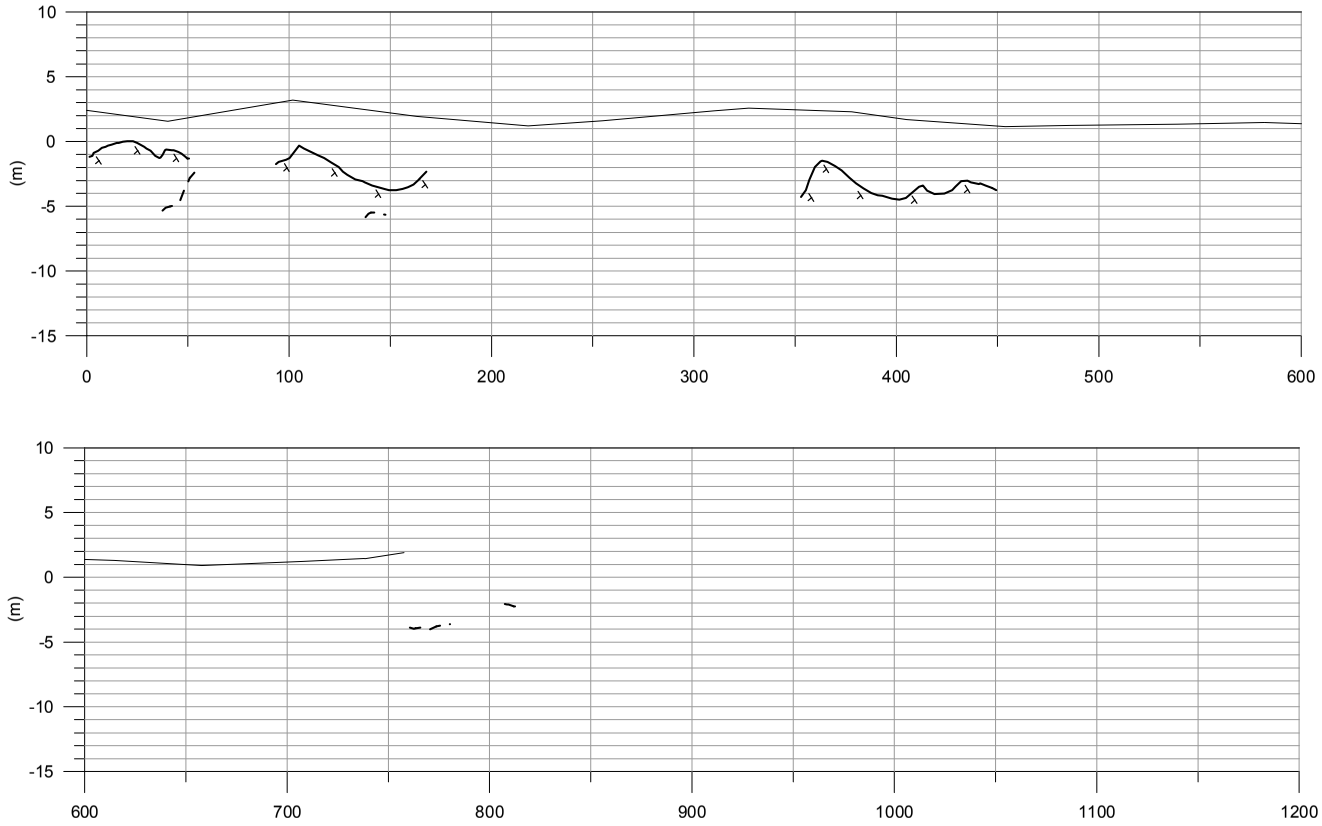
LFM000533 Profile P1, 500-834, from west to east



LFM000534 Profile P2, 0-500, from east to west



LFM000534 Profile P2, 500-697, from east to west

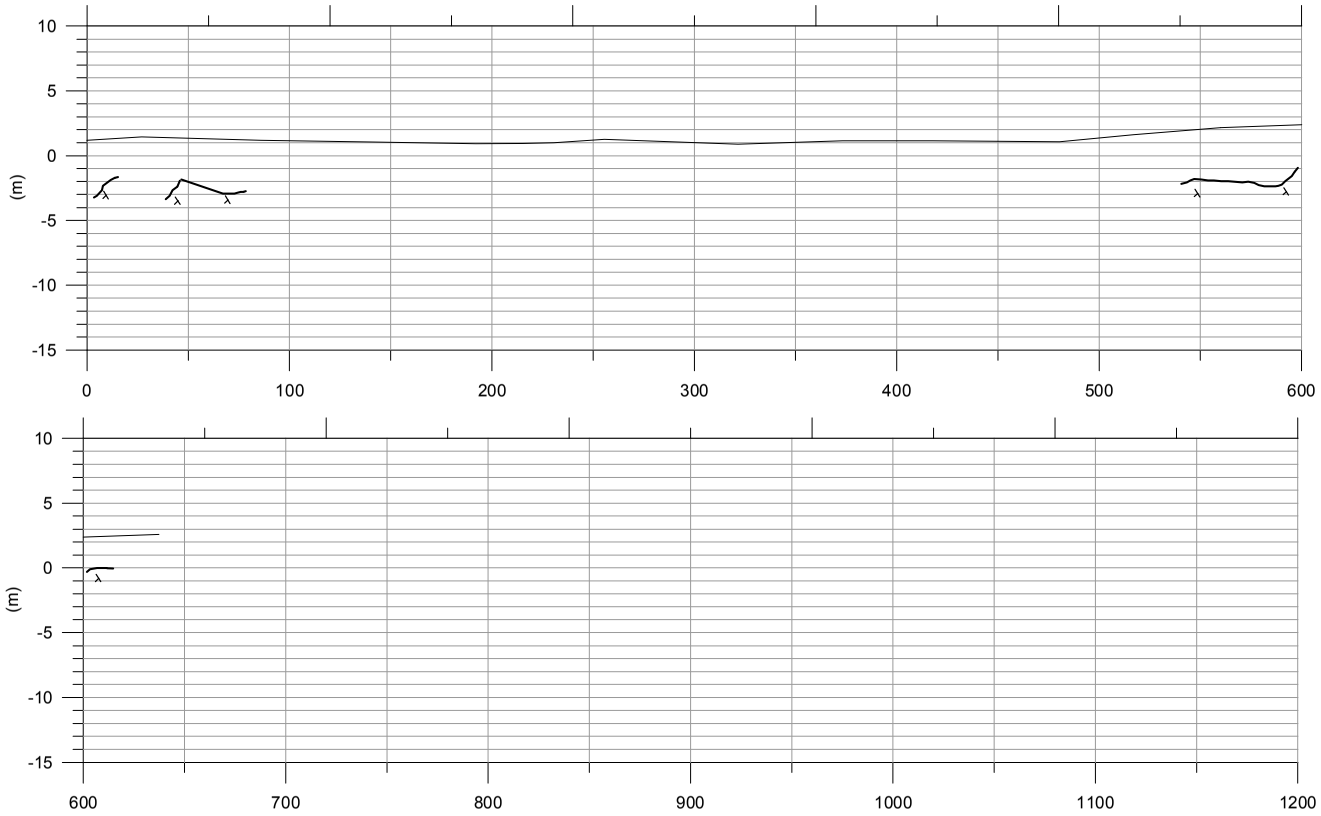


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000533
P1

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000534
p2

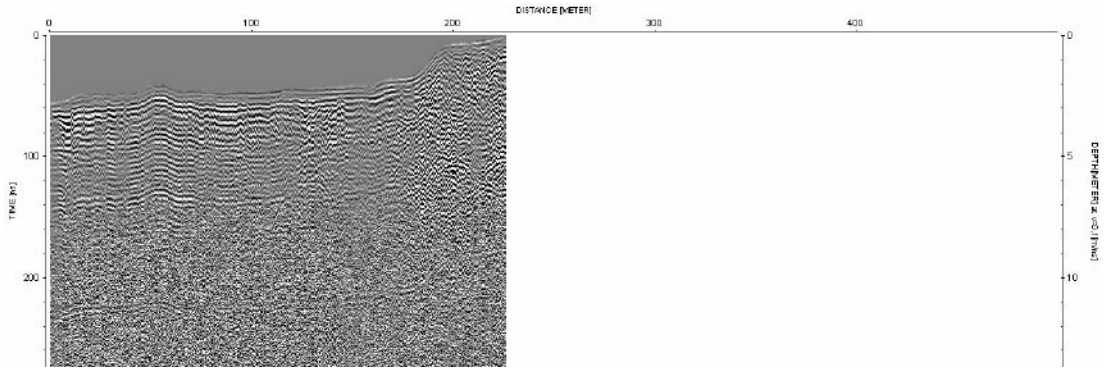
RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA Q

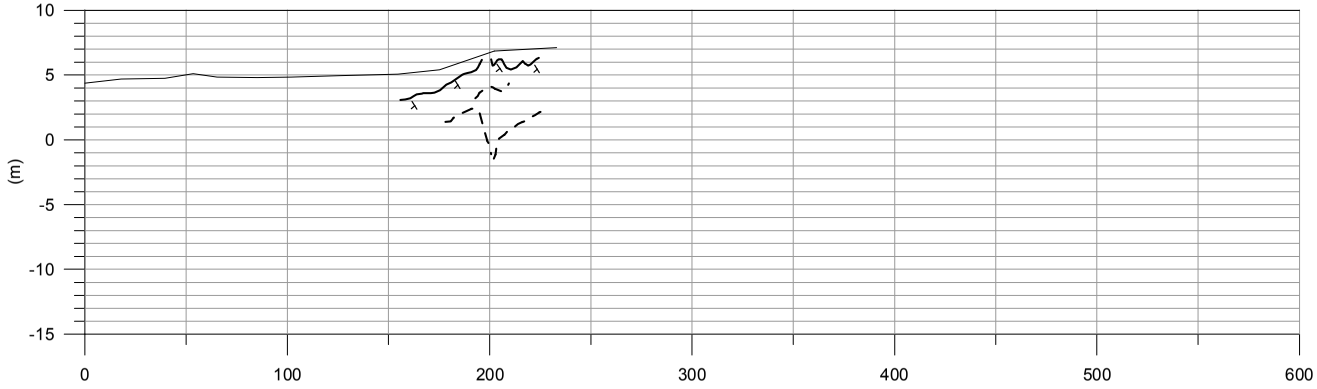
Fig. A17. Sketch map Area Q. Codes in italic letters represent uninterpreted profiles.

AREA R

Fig. A18. Sketch map Area R. Codes in italic letters represent uninterpreted profiles.



LFM000537, Profile R2, 0-226, from south to north



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000537
R2

RITAD HANDLÄGGARE: Riard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA S

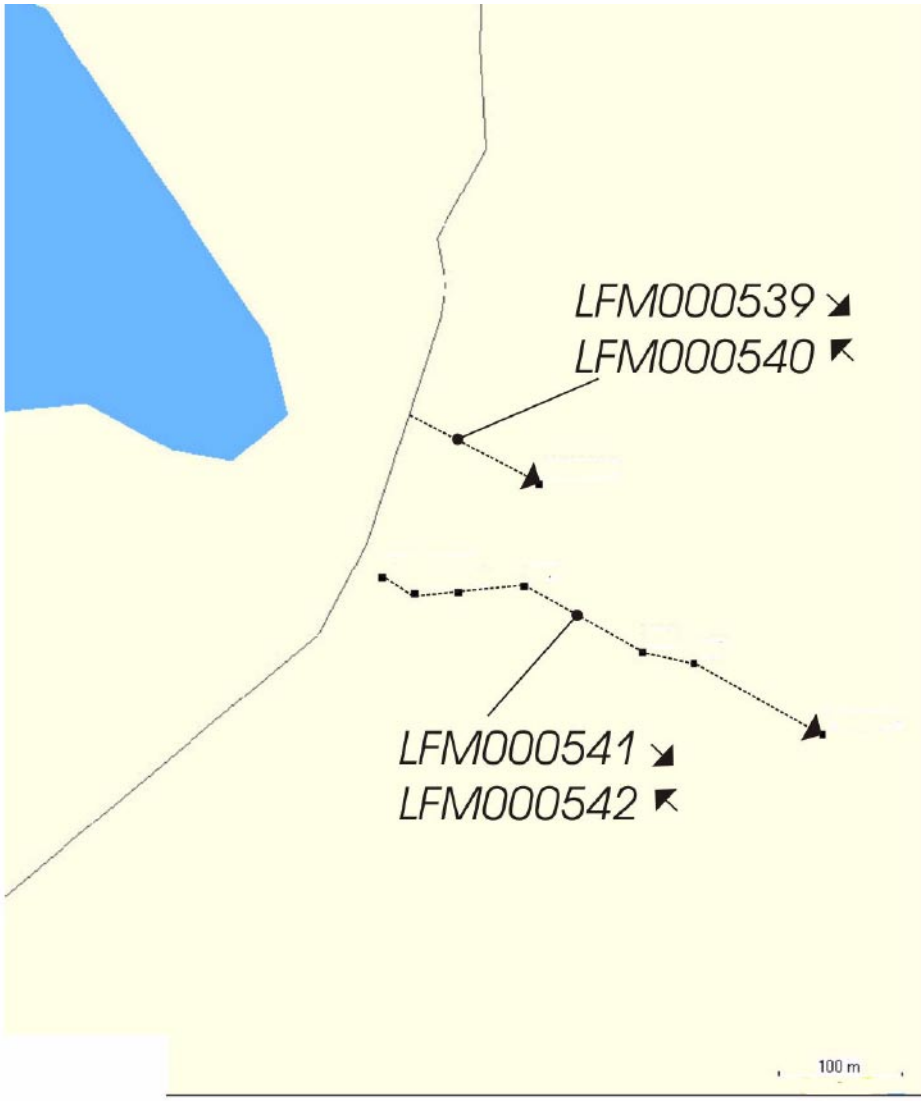


Fig. A19. Sketch map Area S. Codes in italic letters represent uninterpreted profiles.

AREA T

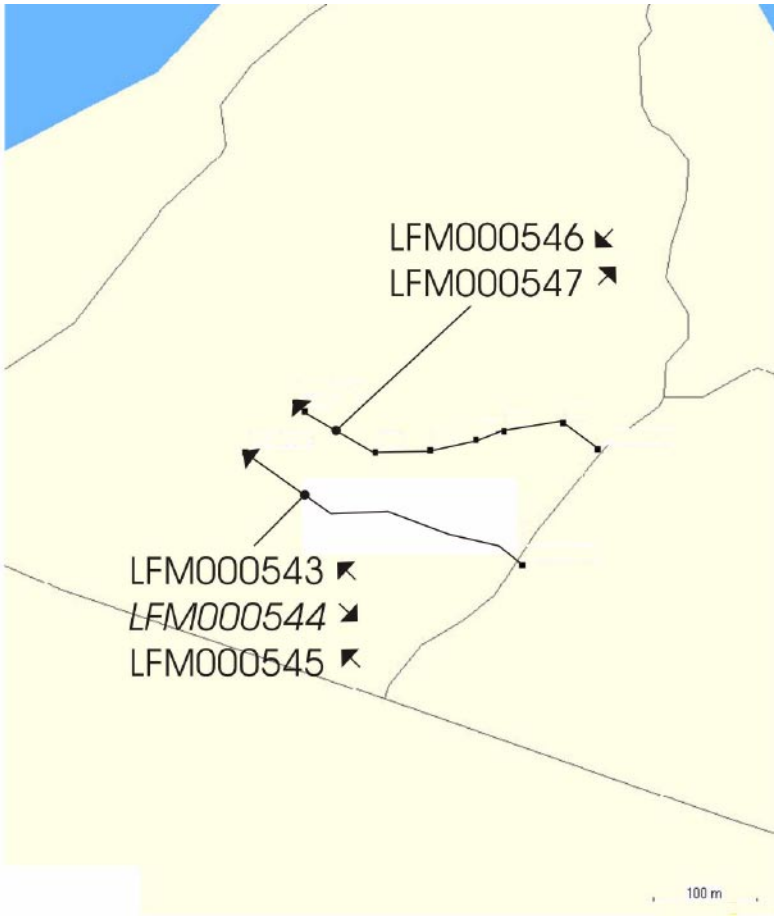
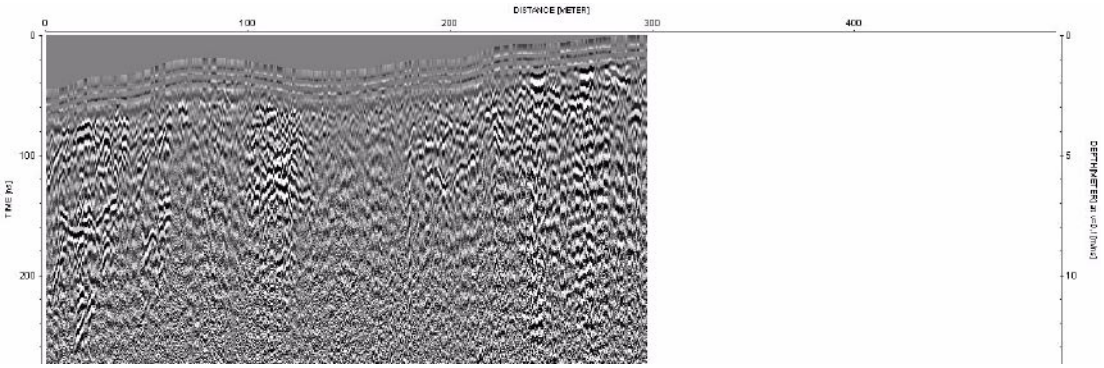
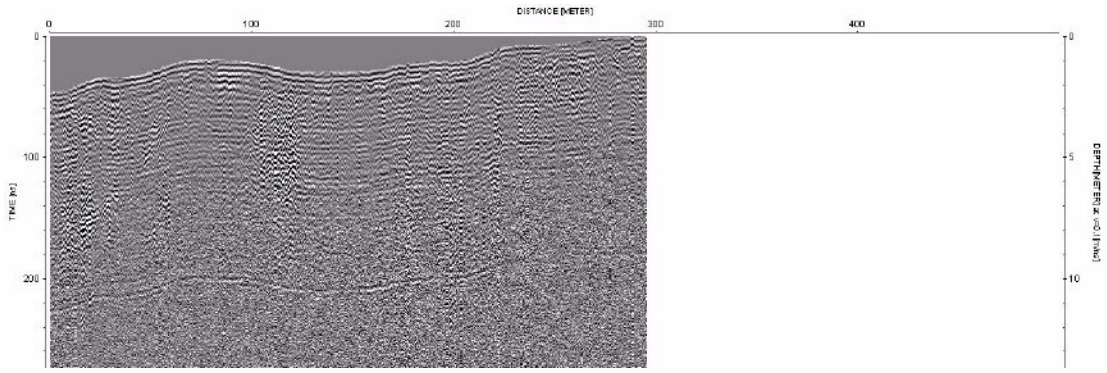


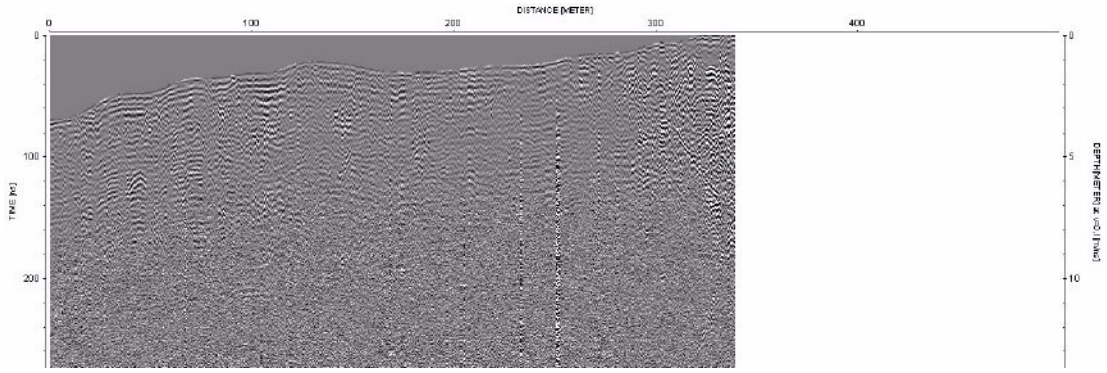
Fig. A20. Sketch map Area T. Codes in italic letters represent uninterpreted profiles.



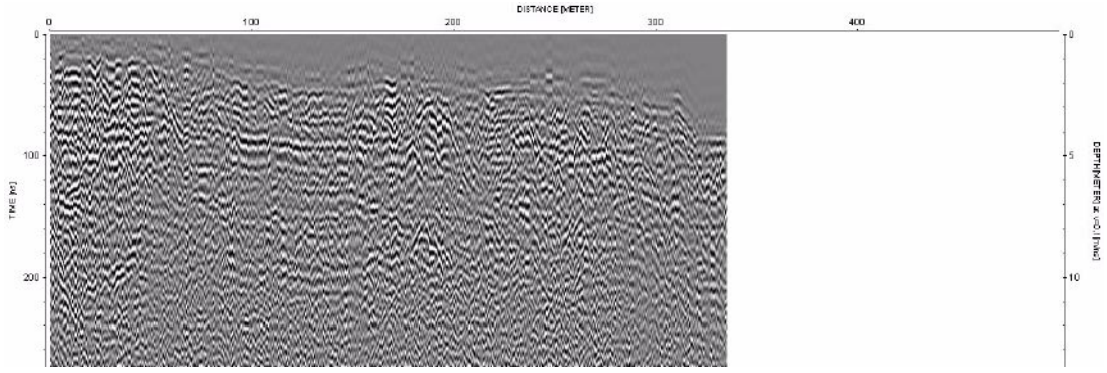
LFM000543, Profile T1, 0-297, from east to west



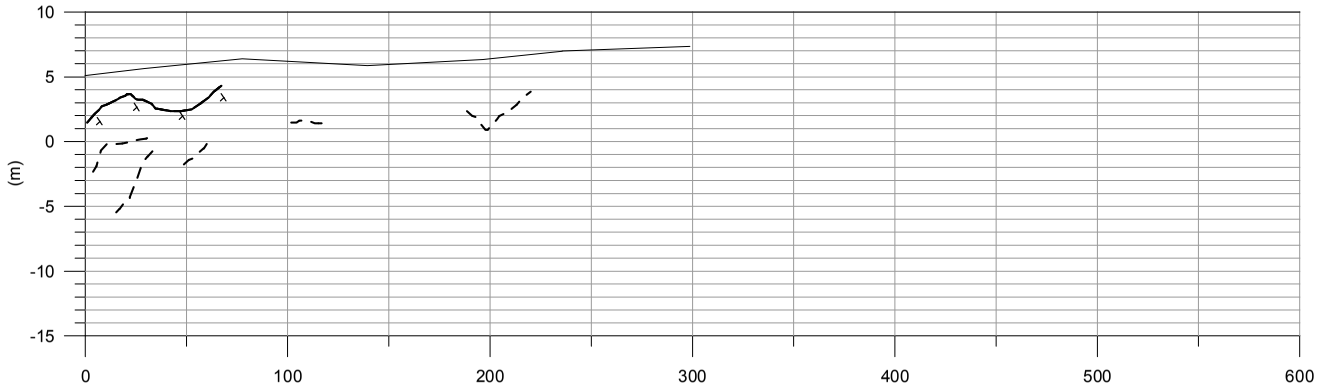
LFM000545, Profile T3, 0-296, from west to east



LFM000546, Profile T4, 0-339, from east to west



LFM000547, Profile T5, 0-335, from west to east



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

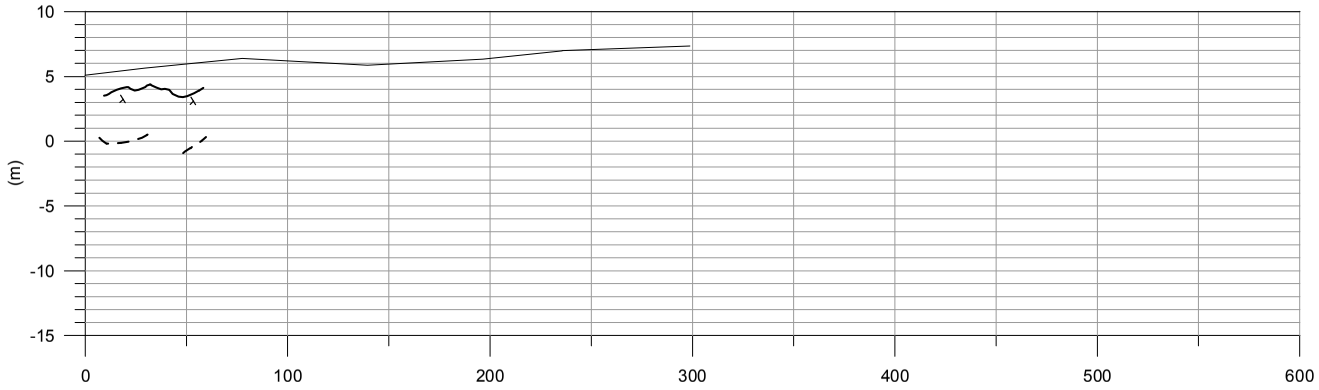
Markradarmätningar
Forsmark
LFM000543
T1

RITAD HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA

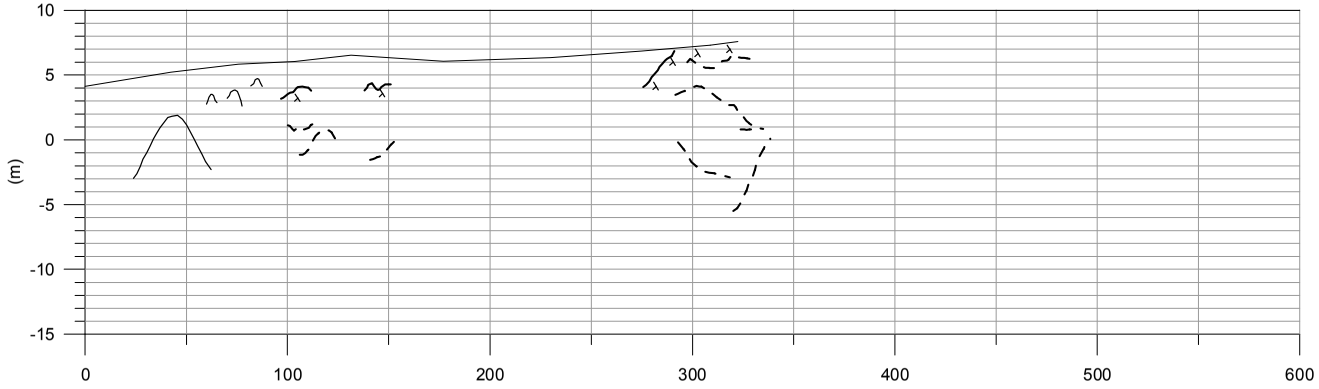


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000545
T3

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

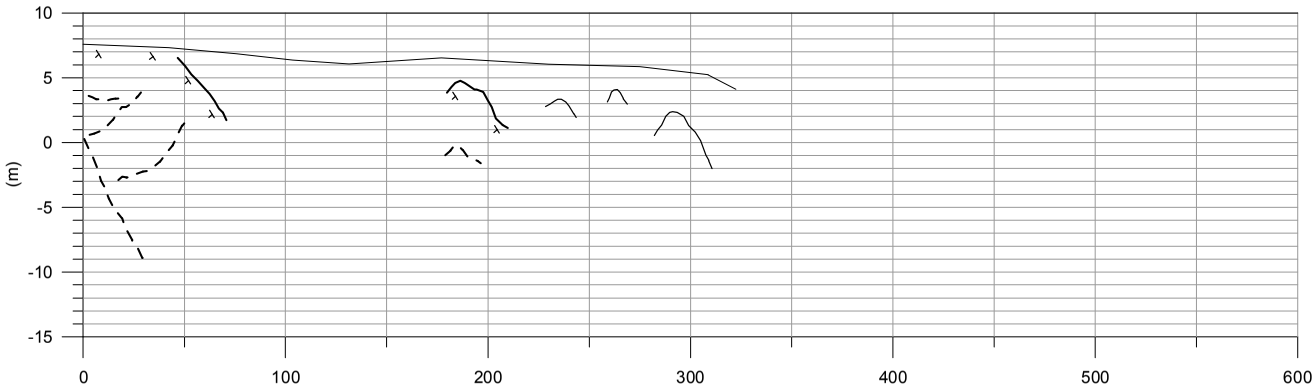
Markradarmätningar
Forsmark
LFM000546
T4

RITAD HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000547
T5

RITAD HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:

AREA U

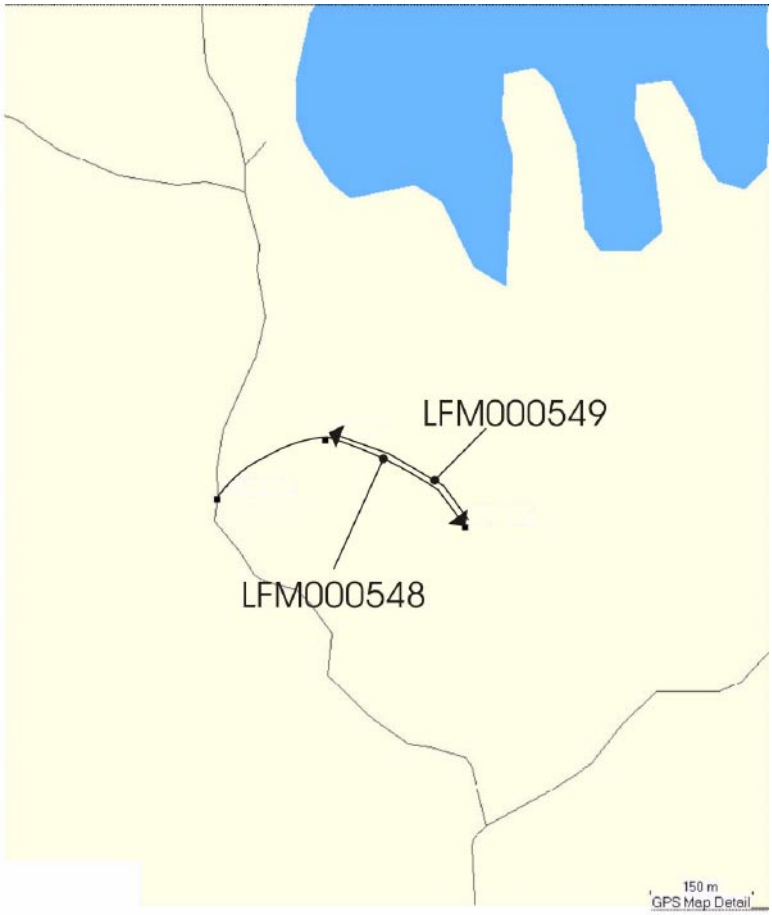
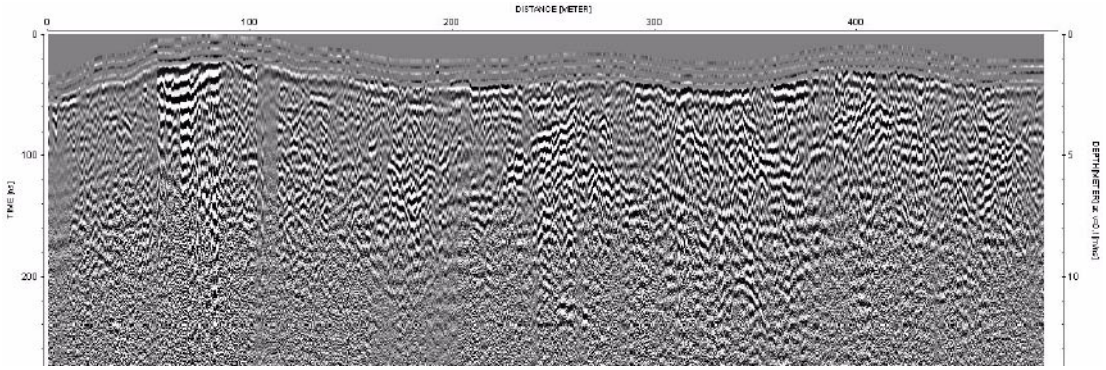
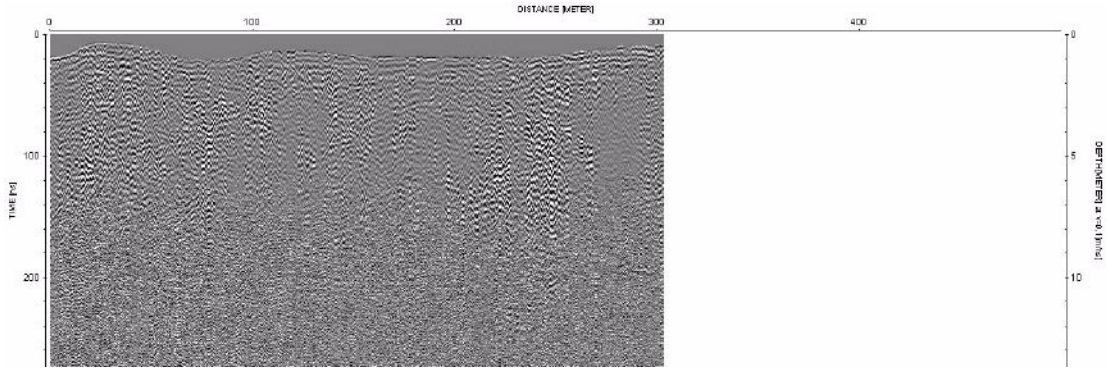


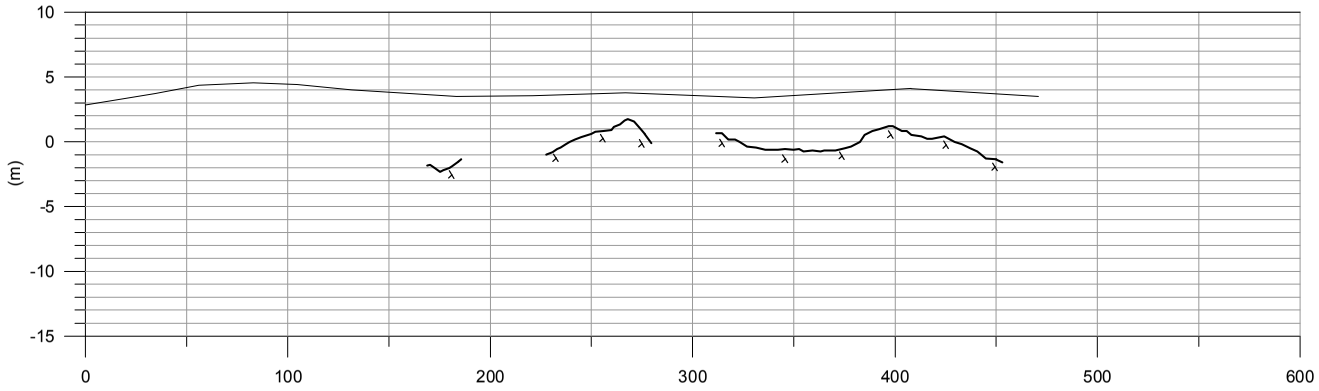
Fig. A21. Sketch map Area U



LFM000548, Profile U1, 0-493, from west to east



LFM000549, Profile U2, 0-303, from east to west

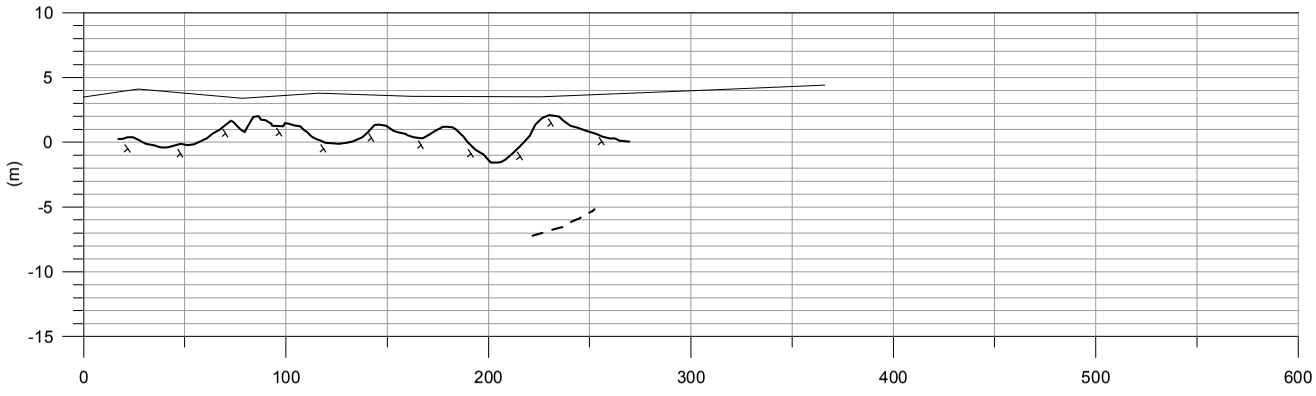


Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MÄRK BERG VATTEN

Markradarmätningar
Forsmark
LFM000548
U1

RITAD | HANDLÄGGARE: Rikard Marek
UPPDRAGSGIVARE: SKB Forsmark
ID-NUMMER: Grap03018
SKALA:



Ground surface
Overburden structure
Moraine structure
Bedrock surface
Bedrock structure

GEOSIGMA
MARK BERG VATTEN

Markradarmätningar
Forsmark
LFM000549
U2

RITAD HANDLÄGGARE
Rikard Marek

UPPDRAGSGIVARE
SKB Forsmark

ID-NUMMER
Grap03018

SKALA