

Oskarshamn site investigation

Characterisation of bedrock and Quaternary deposits from excavations in the southern part of Laxemar subarea

Torbjörn Bergman, Kärstin Malmberg Persson,
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Geological Survey of Sweden

February 2005

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Keywords: AP PS 400-04-093, Excavation, Rock exposure, Modal analysis, Geochemical analysis, Outcrop data, Rock composition, Quaternary deposits, Till, Soil thickness, Quaternary stratigraphy, Grain size composition.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the authors and do not necessarily coincide with those of the client.

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Abstract

This document reports data gained from mapping and sampling of bedrock exposures and Quaternary cover in excavations in the southern part of the Laxemar subarea. Furthermore, results from analyses of rock types and grain size analyses of soil samples. The scope of the investigation was to improve the understanding of the compositional variations of the Ävrö granite in this poorly exposed part of the Laxemar subarea. In all excavations, the bedrock surface was composed of Ävrö granite.

Six rock samples were analysed with respect to modal and chemical composition. Four rock samples were classified as quartz monzodiorites, one as granite and one as granodiorite. The quartz content (modal composition) in the quartz monzodioritic varieties of the Ävrö granite have a quartz content varies between 10.2 and 13.6%.

The Quaternary deposits consist mainly of highly consolidated sandy to gravelly till, rich in angular cobbles. In a few test pits the till is overlain by a thin bed of glacial clay and/or silt. The uppermost unit is a thin bed of wave-washed sand.

Sammanfattning

Denna rapport redovisar resultaten av kartering av frilagda bergytor och jordartsprofiler från maskingrävda provgropar i den södra delen av delområde Laxemar. Vidare redovisas analyser av bergarter och jordarter. Syftet med undersökningen var att förbättra kunskapen om Ävrögranitens sammansättning in denna dåligt blottade del av Laxemarområdet. I samtliga provgropar utgjordes berggrundens överyta av Ävrögranit.

Sex bergartsprover undersöktes med avseende på modal- och kemisk sammansättning. Fyra av dessa prover blev klassade som kvartsmonzodiorit, en som granit och en som granodiorit. Kvartshalten (modal sammansättning) i de kvartsmonzodioritiska varieteterna varierar mellan 10,2 % och 13,6 %.

Jordlagren består främst av sandig till grusig morän. Moränen är i regel starkt konsoliderad och innehåller rikligt med kantiga stenar, huvudsakligen från den lokala berggrunden. Moränen överlagras i några av provgroparna av glacial lera/silt och postglacial svallsand.

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1 Introduction

This document reports data gained from sampling of bedrock exposures and Quaternary cover in excavations in the southern part of the Laxemar subarea. The fieldwork was performed in late November to early December 2004. The location of the sites included in this activity is shown in Figure 1-1.

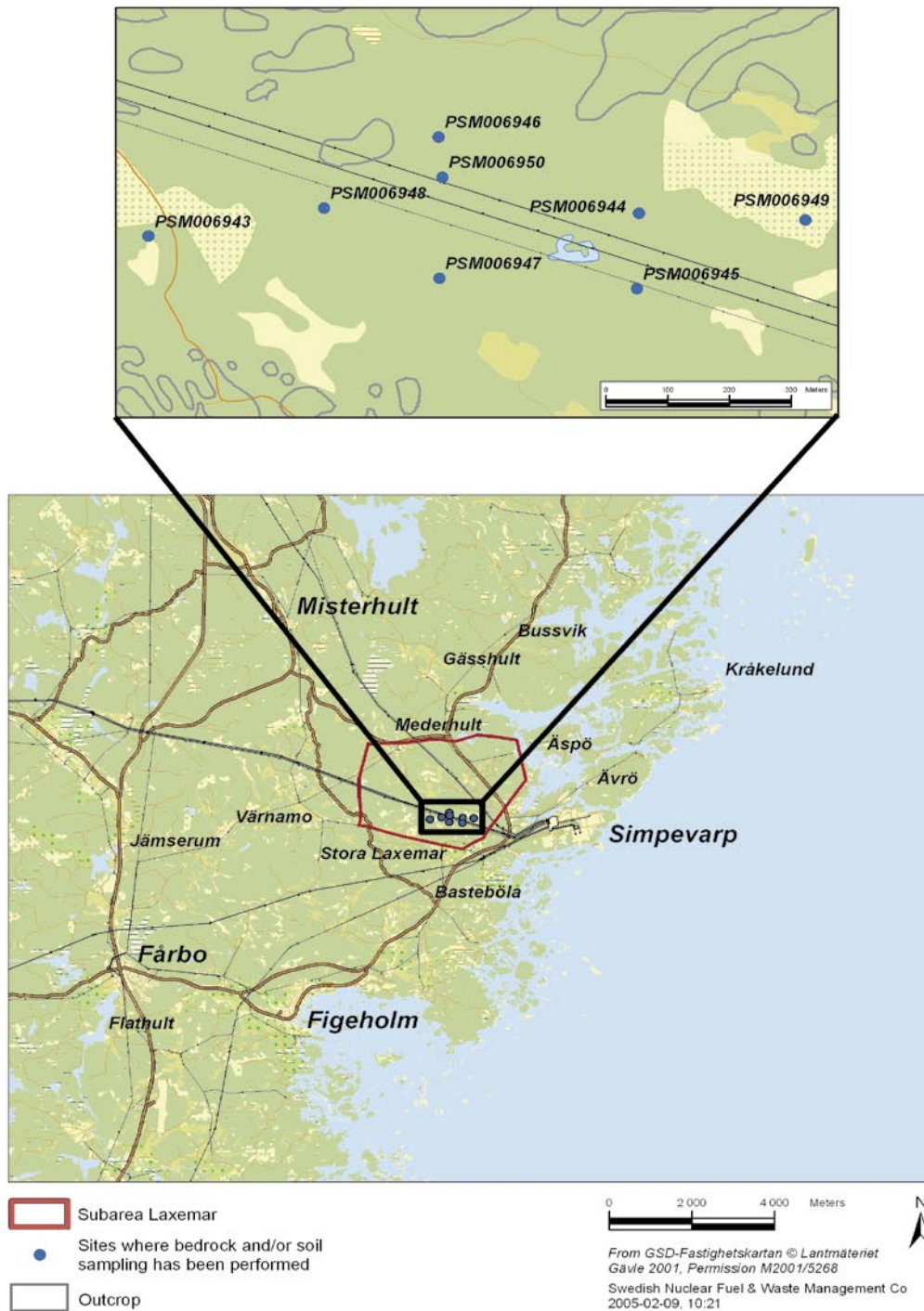


Figure 1-1. Map showing the sites where bedrock and/or soil sampling has been performed.

The work was carried out in accordance with activity plan SKB AP PS 400-04-093. In Table 1-1 controlling documents for the performance of this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents.

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

Activity plan	Number	Version
Karakterisering av berggrund och jordlager genom provgropar inom jordtäckt område, södra Laxemar, 2004	AP PS 400-04-093	1.0

Method descriptions	Number	Version
Metodbeskrivning för berggrundskartering	SKB MD 132.001	1.0
Metodbeskrivning för jordartskartering	SKB MD 131.001	1.0

2 Objective and scope

In the south-central part of the Laxemar subarea the bedrock is relatively poorly exposed. The bedrock mapping of the area, performed during the field season 2004 /Persson et al. 2004/, indicated that the Ävrö granite has a quartz monzodioritic composition, i.e. a relatively low quartz content, in outcrops adjacent to the currently investigated area. The scope of the present investigation was to improve the understanding of the compositional variations of the Ävrö granite, and an eventual relatively high frequency of , e.g diorite to gabbro, which is documented south of this poorly exposed part of the Laxemar subarea.

In lack of outcrops, a program for excavations was planned. In order to find parts with thin Quaternary cover, a separate activity with refraction seismics along 5 profiles was set up (AP PS 400-04-092). This activity was performed during the autumn 2004 /Lindqvist, 2004/. Based on the seismic profiles 13 sites were selected, where the Quaternary cover was indicated to be less than 2 metres.

In order to improve the understanding of the stratigraphy of the Quaternary deposits, the latter were also documented in the present study.

3 Equipment

3.1 Description of equipment and analytical methods

The excavations of the Quaternary cover were carried out by a tractor-excavator, see Figure 3-1.

The sampling of bedrock exposures was performed by using a sledge-hammer and/or a petrol-driven rock saw, see Figure 3-2. The documentation of the bedrock exposures was carried out in accordance with the method description for bedrock mapping (SKB MD 132.00, SKB internal document). A digital camera was used and photos were taken of each rock exposure.



Figure 3-1. Kärstin Malmberg Persson and tractor-excavator.



Figure 3-2. Torbjörn Bergman and the petrol-driven rock saw used for rock sampling.

The chemical analyses of rock samples were performed by Analytica AB, Luleå by the ICP-AES and ICP-QMS analytical methods.

Polished thin sections of rock samples were made by Minoprep AB, Hunnebostrand.

The modal analyses were carried out by Ekström Mineral AB, Täby by using a standard polarizing microscope with point-counting equipment.

The soil sections were cleaned manually with shovels and scrapers. They were documented according to SKB MD 131.001. Studies were made of the stratigraphies including sedimentary and deformational structures, lithology, sorting, particle roundness etc. The soil samples were collected by using a spade.

The grain size analyses of the soil samples made by sieving and sedimentation analyses, carried out by Sweco Geolab, Stockholm.

4 Execution

4.1 Execution of field work

Based on the refraction seismic information, 13 sites were selected. After a field visit they were reduced to 9 sites due to local circumstances, e.g. high level of surface water, access problems such as dense forest etc. Minor adjustments in position were also made for the excavated localities, generally only a few metres from the originally planned position. This was mainly due to local surface water pools at the planned position.

In 2 of the totally 9 excavations, the Quaternary cover was too thick, > 5 m, which implied that the bedrock surface was not reached. In one excavation the till was boulder rich, and the excavation was interrupted at approximately 2 m depth without any sign of bedrock. In 6 excavations the bedrock was reached and rock samples were taken. The Quaternary cover was described and sampled in 8 of the 9 excavations. The coordinates for all described and sampled excavations are given in Table 4-1.

Table 4-1. Position of excavations and type of samples.

Id-code	Easting	Northing	Bedrock sample	Soil sample	Soil depth
PSM006943	1548210	6366012	x	x	1.0 m
PSM006944	1549006	6366052		x	> 2 m
PSM006945	1549003	6365921	x	x	2.2 m
PSM006946	1548681	6366184	x	x	2.0 m
PSM006947	1548682	6365939	x	x	1.4 m
PSM006948	1548495	6366061		x	> 2.5 m
PSM006949	1549276	6366040	x	x	2.4 m
PSM006950	1548687	6366114	x	x	3.2 m

4.2 Data handling/post processing

The excavated rock exposures were documented and sampled. The information was transferred into an Access database by using the database application BGDATA, version 1.7.3. The Access database and a selection of data in Excel-format, organized to fit the SICADA database, have been delivered to SKB and are stored in the SICADA database.

The rock samples (6) were geochemically and petrographically analysed (modal analysis of thin section). The results have been delivered to SKB and are stored in the SICADA database.

The stratigraphic information of the Quaternary deposits was stored in SGU's database "Jorddagboken", version 5.4.3. Data from this database were exported to Excel files, which were delivered to SKB. All till beds and a bed of glacial clay were sampled for analyses of grain size distribution. The results have been delivered to SKB and are stored in the SICADA database.

4.3 Nonconformities

The work was carried out in accordance with activity plan SKB AP PS 400-04-093 with the exception for the rock sampling technique that originally was planned to be performed by core drilling.

5 Results

5.1 Documentation of rock exposures

The excavated rock exposures consist of Ävrö granite according to the nomenclature decided by SKB. The Ävrö granite varies from reddish grey, medium-grained with megacrysts of potassium feldspar, usually 1–2 cm in size, in the four southern excavations, to reddish grey to reddish, and less porphyritic in the two northern excavations (PSM006946 and PSM006950). In all excavations, the Ävrö granite is well preserved, more or less isotropic and relatively homogeneous, without enclaves or xenoliths of other rocks. However, in excavation PSM006945, minor veins of fine-grained granite were noted and in rock exposures PSM006945 and PSM006946, minor fracture fillings of epidote occurred. In this context it is important to note that the relatively homogeneous appearance of the Ävrö granite can be an effect of the limited size of the exposed bedrock surfaces, generally less than 1 m².

5.2 Modal analyses of rock samples

Modal analyses of thin-sections have been carried out for the six rock samples. The modal analyses are presented in Appendix 1. The sample sites are shown in Figure 5-1. The modal analyses were recalculated, with respect to the contents of quartz (Q), alkali feldspar (A) and plagioclase (P), QAP values, in order to classify the rocks in accordance with the rock nomenclature of /Streckeisen, 1976/. The result is shown in Figure 5-1 and 5-2. Four of the six rock samples are classified as quartz monzodiorites, one as granite and one as granodiorite. The quartz monzodiorites have a quartz content (modal composition) varying between 10.2 and 13.6%, see Appendix 1.

5.3 Chemical analyses of rock samples

The major element and trace element data for the six rock samples are presented in Appendix 2. The result of the chemical analyses are also presented in the rock classification diagram K₂O+Na₂O/SiO₂ (TAS, total alkali/silica), after /Middelmost, 1994/, see Figure 5-3. The samples display a granitic to monzonitic composition in the TAS-diagram in Figure 5-3. Four of the six samples plot in the monzonite field. These were the samples that based on the modal composition were classified as quartz monzodiorites. According to the international Union of Geological Sciences /Le Maitre, 2002/, the classification of rocks should be based on the modal composition. Thus, the diagram in Figure 5-3 should not be used strictly for classification purposes.

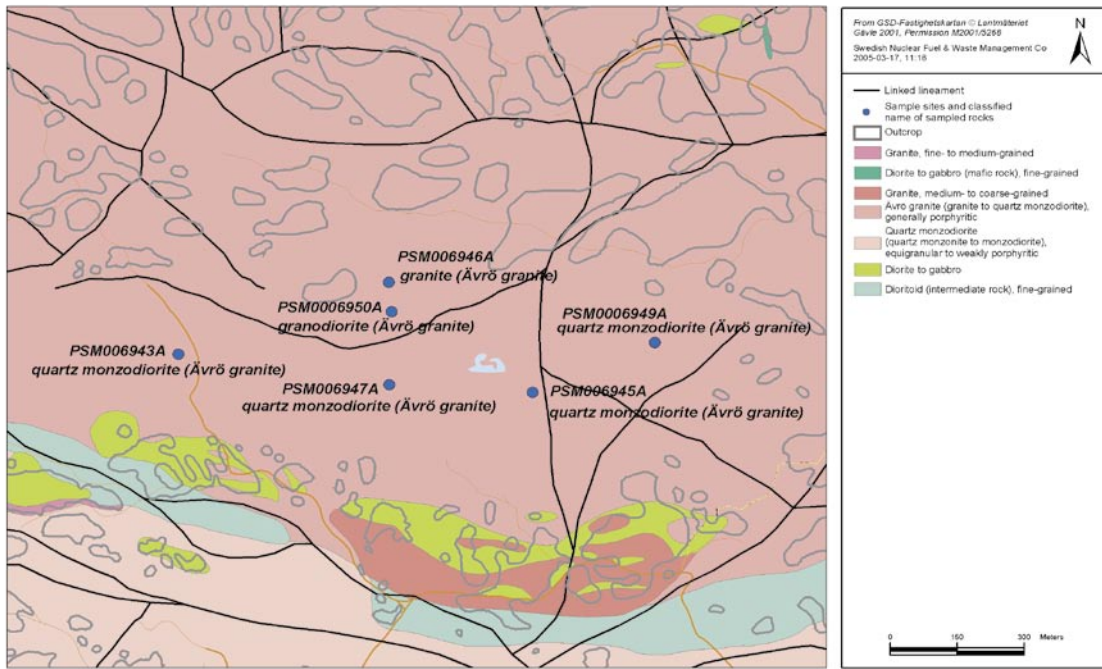


Figure 5-1. Bedrock map of the investigated area, sample sites and classified name (according to modal analysis) of sampled rocks.

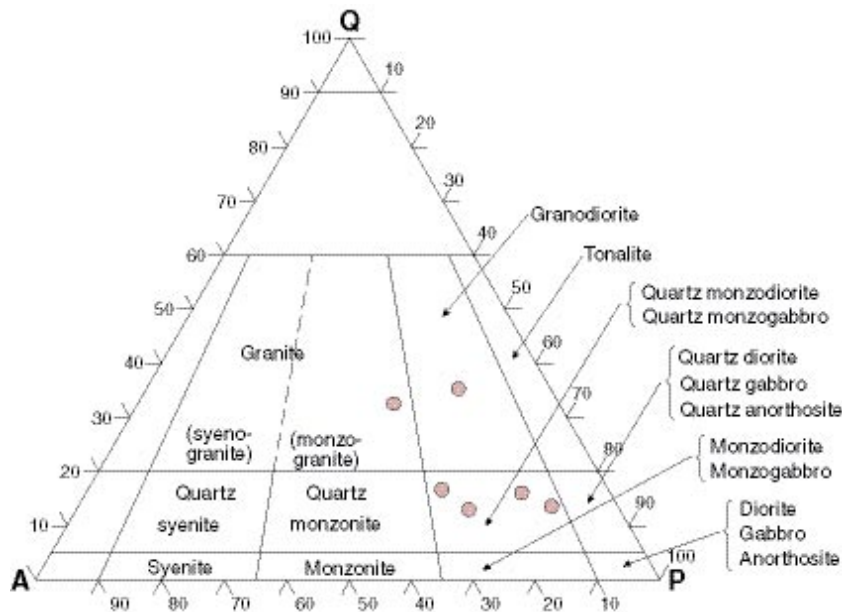


Figure 5-2. QAP classification /Streckeisen, 1976/ of rock samples based on modal analyses.

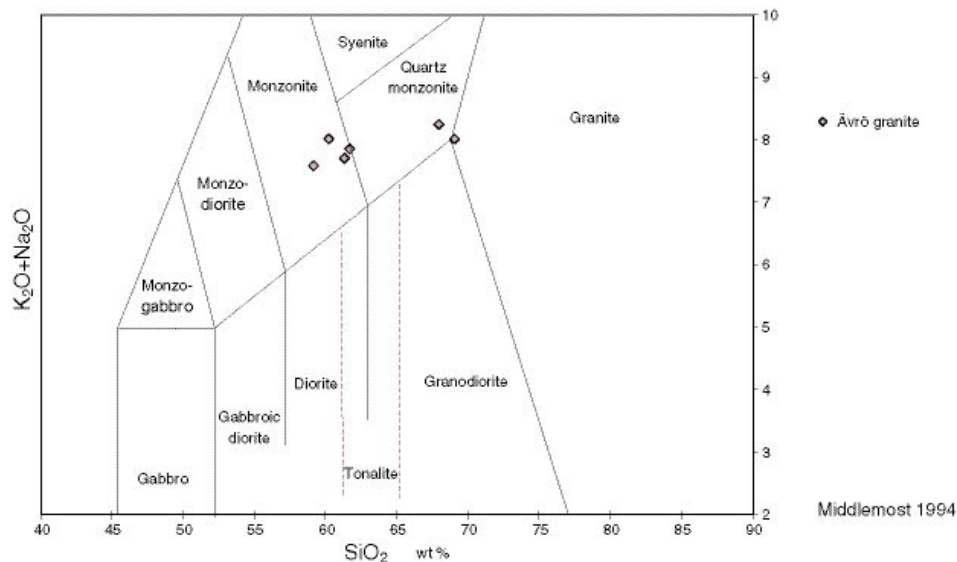


Figure 5-3. Rock classification based on chemical analyses, K_2O+Na_2O/SiO_2 . Diagram after /Middlemost, 1994/.

5.4 Stratigraphy of the Quaternary deposits

The stratigraphy is described from the bedrock and upwards and is summarized in Appendix 3. The stratigraphy and the characteristics of the different beds correspond to the rest of the Laxemar subarea /Rudmark et al. 2005/.

In the investigated area, the soil is thicker than in the rest of the Laxemar subarea. According to the seismic investigations /Lindqvist, 2004/, the thickness of the Quaternary deposits is up to 9.2 m, with a mean value of 3.6 m. The soil cover mainly consists of till with a gently undulating surface (cover moraine). Low-relief hummocky moraine is found in a part of the area (around excavations PSM006947 and PSM006948).

The predominating Quaternary unit is a brown sandy to gravelly till, which lies directly on the bedrock. The till is generally massive and matrix-supported with a normal to high degree of consolidation. It is rich in cobbles, which are angular or very angular. Parts of the till are clast-supported. The ground surface generally has an intermediate boulder frequency. The majority of the clasts are of local origin, suggesting a short transport distance for the till. The till is interpreted as a lodgement till.

In two of the sections, a looser, ca 1.5 m thick bed of stratified till was found, the stratification consisting of horizontal silt and sand laminae. In one case this till lies on top of lodgement till (PSM006950) and in the other case directly on the bedrock (PSM006947). These pits were excavated in hummocky moraine and the stratified till is probably an ablation till.

A 0.6 m thick bed of glacial clay was found on top of till in one section (PSM006948). Clay and silt intraclasts were also found in the upper part of the till in sections PSM006943 and PSM006944.

The uppermost bed in most of the sections consists of up to 0.3 m of postglacial wave-washed sand or up to 0.7 m of wave-washed till.

5.5 Grain size analyses of soil samples

Eleven soil samples from eight pits were analysed with respect to grain size composition. Cumulative curves are presented in Appendix 4. A summary of the samples and composition is presented in Table 5-1.

Table 5-1. Grain size composition of the soil samples.

Id-code	Depth (m)	Grain size composition
PSM006943	0.4	Clay till*
PSM006943	0.6	Clayey sandy till
PSM006944	1.0	Clayey sandy silt
PSM006944	1.8	Sandy till
PSM006945	1.4	Gravelly till
PSM006946	1.0	Gravelly till
PSM006947	1.0	Gravelly till
PSM006948	0.7	Clay
PSM006948	1.4	Gravelly till
PSM006949	2.1	Sandy till
PSM006950	1.1	Sandy till

* This sample was taken in a sandy till with clay intraclasts.

6 References

Le Maitre R W (editor), 2002. A classification of igneous rocks and glossary of terms: Recommendations of the International Union of Geological Sciences, Subcommission on the Systematics of Igneous Rocks, 2nd edition, Blackwell, Oxford.

Lindqvist G, 2004. Refraction seismic measurements in Laxemar autumn 2004. SKB P-04-298, Svensk Kärnbränslehantering AB.

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Persson Nilsson K, Bergman T, Eliasson T, 2004. Oskarshamn site investigation. Bedrock mapping 2004 – Laxemar subarea and regional model area. Outcrop data and description of rock types. SKB P-04-221, Svensk Kärnbränslehantering AB.

Rudmark L, Malmberg Persson K, Mikko H, 2005. Oskarshamn site investigation. Investigation of Quaternary deposits 2003–2004. SKB P-04-XX, Svensk Kärnbränslehantering AB.

Streckeisen A, 1976. To each plutonic rock its proper name. Earth Science Reviews 12, 1–33.

Appendix 1

EKSTRÖM MINERAL AB

MIKROSKOPERINGSFORMULÄR

ALLMÄN INFORMATION	SGU
Mikroskopering utförd av:	Provnummer: PSM006943A
Datum:	Annan märkning
Punkträkning utförd av: Mary Ekström	Diarienummer:
Antal punkter: 500	Uppgift:
Datum: 2005-01-17	Bergart:
Topoblad: Ekonomblad:	Lokal:
Koordinater:	BGDATA-id:

Bergartsbeskrivning
Kornstorlek:
Kornfogar:
Mikrosprickor:
Omvandling:
Struktur:
Textur:

MINERAL	OBSERVERAD	%	KOMMENTAR
Kvarts	+	13,6	
K-fältspat	+	21,6	
Plagioklas	+	45,6	delvis sericitiserad-och epidotiserad
Biotit	+	9,2	
Muskovit			
Klorit	+		
Epidot	+	1,2	
Titanit	+	0,8	
Kalcit	+		
Hornblände	+	6,6	
Opak min.	+	1,2	mg, ht, il och spår av py och cp
Apatit	+		
Zirkon	+		
Prehnt			
Brunmineral	+	0,2	omvandlingsmineral
Summa		100,0	

Övrigt:

Mikrosprickor fyllda med Fe-utfällning

mg = magnetit, py = pyrit, il = ilmenit, ht = hematit, cp= kopparkis

mg är lätt martitiserad

ALLMÄN INFORMATION		SGU
Mikroskopering utförd av:		Provnummer: PSM006945A
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Punkträkning utförd av: Mary Ekström		Diarienummer:
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Topoblad:	Ekonomblad:	Lokal:
Koordinater:		BGDATA-id:

Bergartsbeskrivning
Kornstorlek:
Kornfogar:
Mikrosprickor:
Omvandling:
Struktur:
Textur:

MINERAL	OBSERVERAD	%	KOMMENTAR
Kvarts	+	12,2	myrmekitbildning
K-fältspat	+	10,6	
Plagioklas	+	52,0	delvis sericitiserad-epidotiserad, vissa korn starkt sericitomv.
Biotit	+	17,4	
Muskovit			
Klorit	+		
Epidot	+	5,2	
Titanit	+	0,8	delvis omvandlad till rutil?
Kalcit			
Hornblände	+		
Opak min.	+	1,2	dominerande mg, mindre py, cp och il
Apatit	+	0,4	
Zirkon	+	0,2	
Prehntit			
Brunmineral	+		omvandlingsmineral
Summa		100,0	

Övrigt:

mg = magnetit, py = pyrit, il = ilmenit, ht = hematit, cp= kopparkis

ALLMÄN INFORMATION		SGU
Mikroskopering utförd av:		Provnummer: PSM006946A
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Topoblad: Ekonomblad:		Lokal:
Koordinater:		BGDATA-id:

Bergartsbeskrivning
Kornstorlek:
Kornfogar:
Mikrosprickor:
Omvandling:
Struktur:
Textur:

MINERAL	OBSERVERAD	%	KOMMENTAR
Kvarts	+	28,8	
K-fältspat	+	23,6	
Plagioklas	+	36,0	delvis sericitiserad-epidotiserat, vissa korn starkt sericitomv.
Biotit	+	7,6	delvis kloritiserad
Muskovit			
Klorit	+		
Epidot	+	2,8	
Titanit	+	0,6	omvandlad
Kalcit	+		
Hornblände			
Opak min.	+	0,4	mg, ht, spår av il och py
Apatit	+	0,2	
Zirkon	+		
Prehntit	+		
Summa		100,0	

Övrigt:

Mikrosprickor fyllda med opakmineral, glimmer, epidot.

Det finns ett pigmenterat lermineral.

mg = magnetit, py = pyrit, il = ilmenit, ht = hematit, cp= kopparkis

mg är lätt martitiserad.

ALLMÄN INFORMATION		SGU
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Topoblad:	Ekonomblad:	Lokal:
Koordinater:		BGDATA-id:

Bergartsbeskrivning
Kornstorlek:
Kornfogar:
Mikrosprickor:
Omvandling:
Struktur:
Textur:

MINERAL	OBSERVERAD	%	KOMMENTAR
Kvarts	+	11,6	
K-fältspat	+	9,0	
Plagioklas	+	63,0	delvis sericitiserad-epidotiserad
Biotit	+	9,2	
Muskovit			
Klorit	+		
Epidot	+	0,4	
Titanit	+	1,8	
Kalcit			
Hornblände	+	3,8	
Opak min.	+	0,8	mg, il, ht och litet py och cp
Apatit	+	0,4	
Zirkon	+		
Prehntit			
Summa		100,0	

Övrigt:

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Topoblad: Ekonomblad:		Lokal:
Koordinater:		BGDATA-id:

Bergartsbeskrivning
Kornstorlek:
Kornfogar:
Mikrosprickor:
Omvandling:
Struktur:
Textur:

MINERAL	OBSERVERAD	%	KOMMENTAR
Kvarts	+	10,2	
K-fältspat	+	18,6	
Plagioklas	+	47,8	sericit-epidotomvandlad
Biotit	+	12,2	kloritiserad
Muskovit			
Klorit	+		
Epidot	+	3,6	
Titanit	+	1,6	
Kalcit	+		
Hornblände	+	3,4	
Opak min.	+	1,8	mg, il, ht, litet py och cp
Apatit	+	0,8	
Zirkon	+		
Prehnit	+		
Summa		100,0	

Övrigt: mg = magnetit, py = pyrit, il = ilmenit, ht = hematit, cp= kopparkis
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ALLMÄN INFORMATION		SGU
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Topoblad: Ekonomblad:		Lokal:
Koordinater:		BGDATA-id:

Bergartsbeskrivning
Kornstorlek:
Kornfogar:
Mikrosprickor:
Omvandling:
Struktur:
Textur:

MINERAL	OBSERVERAD	%	KOMMENTAR
Kvarts	+	31,4	
K-fältspat	+	13,2	
Plagioklas	+	44,2	delvis sericitiserad
Biotit	+	7,8	lätt kloritiserad
Muskovit			
Klorit	+		
Epidot	+	1,4	
Titanit	+	0,4	
Kalcit	+		
Hornblände	+	0,2	
Opak min.	+	1,2	dominerande mg, spår av il, ht, py och cp
Apatit	+	0,2	
Zirkon	+		
Prehntit			
Summa		100,0	

Övrigt:

mg = magnetit, py = pyrit, il = ilmenit, ht = hematit, cp= kopparkis

Appendix 2

From: Analytica AB, 977 75 Luleå. Tfn: 0920/28 99 00. Fax: 0920/28 99 40. Email: lule@analytica.se

To: SGU

Ref: Torbjörn Bergman

[torbjorn.bergman@sgu.se]

Program: G0

Ordernumber: L0416015 (Nr 04-40113)

Report created: 2005-01-24 by asa

ELEMENT	SAMPLE	PSM 006943A	PSM 006945A	PSM 006946A	PSM 006947A	PSM 006949A	PSM 006950A
TS	%	99,8	99,8	99,9	99,8	99,9	99,9
SiO2	% TS	61,5	61,1	67,7	60	58,9	68,8
Al2O3	% TS	17,8	18,2	15,8	18	18,2	15,3
CaO	% TS	4,42	4,34	2,44	4,54	4,74	2,75
Fe2O3	% TS	6,16	5,83	3,82	5,96	6,32	3,94
K2O	% TS	3,35	3,29	4,28	3,35	2,94	4,27
MgO	% TS	2,48	2,51	1,29	2,41	2,61	1,32
MnO	% TS	0,0903	0,082	0,0624	0,0814	0,0889	0,0562
Na2O	% TS	4,49	4,41	3,96	4,66	4,65	3,74
P2O5	% TS	0,384	0,357	0,176	0,369	0,394	0,191
TiO2	% TS	0,87	0,875	0,491	0,869	0,921	0,541
Summa	% TS	101,5	101	100	100,2	99,8	100,9
LOI	% TS	0,5	1,1	0,8	0,5	0,8	0,4
Ba	mg/kg TS	1710	1640	1100	1650	1800	1720
Be	mg/kg TS	2,28	2,55	2,42	2,29	2,31	2,18
Co	mg/kg TS	13,8	10,9	7,09	12,1	11,2	5,92
Cr	mg/kg TS	34,8	38	12,8	46,5	48,4	58
Cu	mg/kg TS	42,4	34,9	29,1	34,9	50,5	26,5
Ga	mg/kg TS	100	86,3	66,3	86,4	94,5	92,3
Hf	mg/kg TS	5,62	4,85	3,39	4,61	5,2	5,11
Mo	mg/kg TS	<2	<2	<2	<2	<2	<2
Nb	mg/kg TS	12,9	12,1	10,6	10,8	13	11,9
Ni	mg/kg TS	29,8	33,7	16,7	37,1	34,8	34,1
Rb	mg/kg TS	84,3	77,5	95,4	78,5	89,3	99,4
Sc	mg/kg TS	9,29	8,82	4,43	9,2	9,62	3,91
Sn	mg/kg TS	3	3,32	2,91	5,06	11	12,5
Sr	mg/kg TS	1360	1320	708	1440	1480	1140
Ta	mg/kg TS	0,896	0,843	0,767	0,733	1	0,998
Th	mg/kg TS	4,61	4,81	8,61	5,33	5,2	6,43
U	mg/kg TS	1,73	2,78	1,86	2,26	2,38	3,69
V	mg/kg TS	94,8	91,3	48,5	94,3	101	60,2
W	mg/kg TS	0,606	1,93	1,49	0,671	0,361	<0.3
Y	mg/kg TS	23,6	22,8	11,8	21,5	26	15,7
Zn	mg/kg TS	109	112	92,8	92,2	108	64,9
Zr	mg/kg TS	270	270	193	269	295	243

From: Analytica AB, 977 75 Luleå. Tfn: 0920/28 99 00. Fax: 0920/28 99 40. Email: lule@analytica.se

To: SGU

Ref: Torbjörn Bergman

[torbjorn.bergman@sgu.se]

Program: G5

Ordernumber: L0416016 (Nr 04-40113)

Report created: 2005-01-24 by asa

ELEMENT	SAMPLE	PSM 006943A	PSM 006945A	PSM 006946A	PSM 006947A	PSM 006949A	PSM 006950A
La	mg/kg TS	51,4	43,5	35,4	46,4	49,9	36,1
Ce	mg/kg TS	121	105	71,5	114	125	83,5
Pr	mg/kg TS	14,6	12,7	8,07	13,5	14,6	9,45
Nd	mg/kg TS	53	50,3	29,2	50,2	56,3	31,9
Sm	mg/kg TS	8,11	8	4,82	7,47	7,33	4,8
Eu	mg/kg TS	0,838	0,984	0,344	0,801	0,74	0,175
Gd	mg/kg TS	5,1	3	1,69	4,32	5,11	1,7
Tb	mg/kg TS	2	1,09	0,503	0,64	0,843	0,465
Dy	mg/kg TS	4,32	3,59	1,74	3,41	3,41	2,16
Ho	mg/kg TS	1,98	0,873	0,556	0,709	0,711	0,412
Er	mg/kg TS	3,55	2,06	0,837	1,55	1,69	0,919
Tm	mg/kg TS	1,42	0,394	0,118	0,219	0,254	0,136
Yb	mg/kg TS	1,99	1,6	1,35	1,77	1,87	1,52
Lu	mg/kg TS	0,373	0,231	0,178	0,248	0,363	0,176

Appendix 3

Summary of stratigraphy of the Quaternary deposits

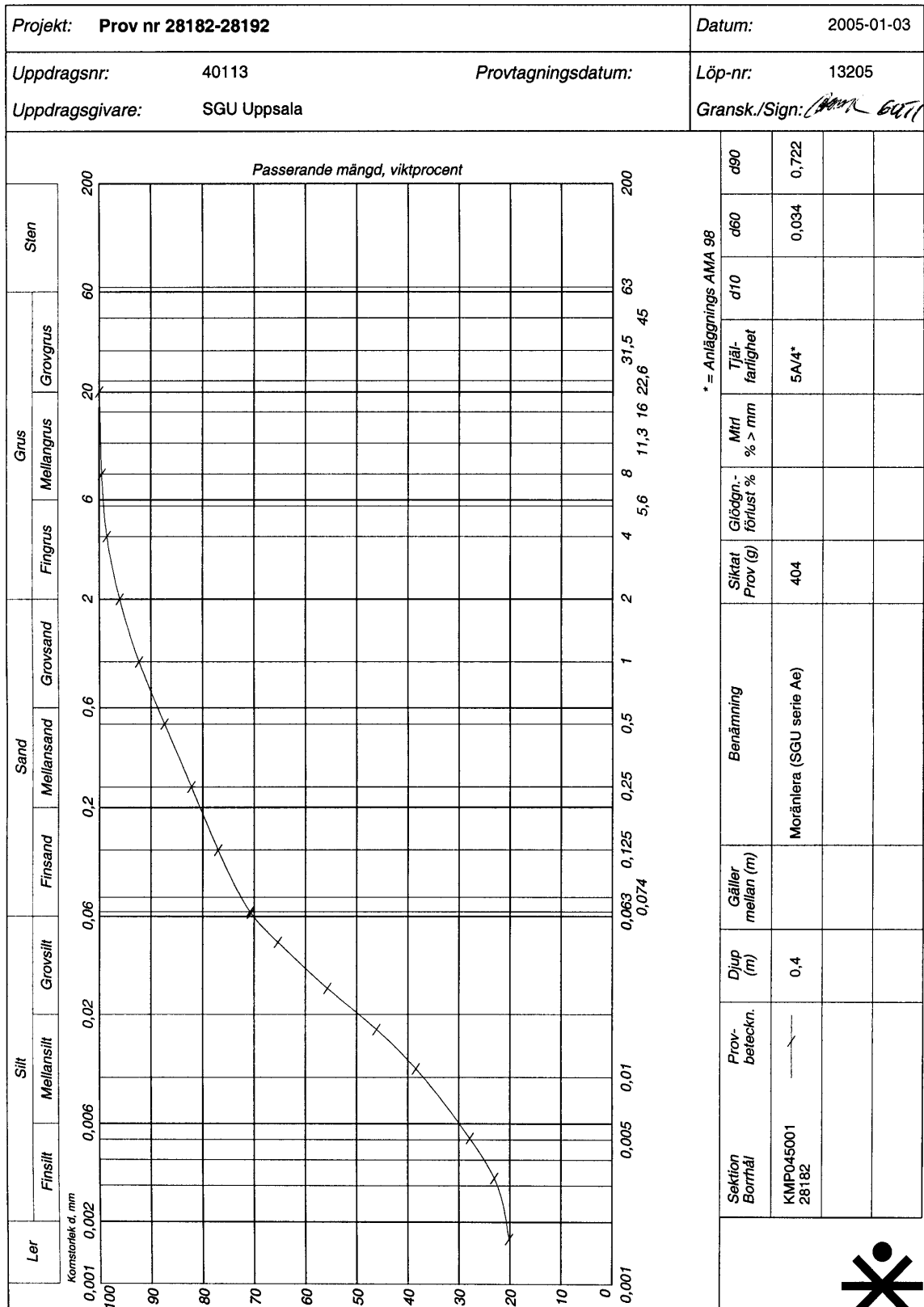
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	2	0,2	0,3	coarse sand		
	3	0,3	0,5	sandy silty diamicton	clay till	PSM006943_0,4
	4	0,5	1,0	sandy diamicton	clayey sandy till	PSM006943_0,6
	5	1,0		bedrock		
PSM006944	1	0,0	0,2	sand		
	2	0,2	0,3	coarse sand		
	3	0,3	2,0	sandy diamicton	clayey sandy silt	PSM006944_1,0
					sandy till	PSM006944_1,8
PSM006945	1	0,0	0,7	gravelly sand		
	2	0,7	2,2	gravelly diamicton	gravelly till	PSM006945_1,4
	3	2,2		bedrock		
PSM006946	1	0,0	0,7	sandy diamicton		
	2	0,7	2,0	gravelly diamicton	gravelly till	PSM006946_1,0
	3	2,0		bedrock		
PSM006947	1	0,0	1,4	gravelly diamicton	gravelly till	PSM006947_1,0
	2	1,4		bedrock		
PSM006948	1	0,0	0,3	sand		
	2	0,3	0,9	clay	clay	PSM006948_0,7
	3	0,9	2,5	sandy diamicton	gravelly till	PSM006948_1,4
PSM006949	1	0,0	2,4	sandy diamicton	sandy till	PSM006949_2,1
	2	2,4		bedrock		
PSM006950	1	0,0	1,5	sandy diamicton	sandy till	PSM006950_1,1
	2	1,5	3,2	sandy diamicton		
	3	3,2		bedrock fragments		

Kornfördelning

enl. SS027123 och SS027124

Prov: PSM006943, jorddjup 0,4 m

SWECO GEOLAB



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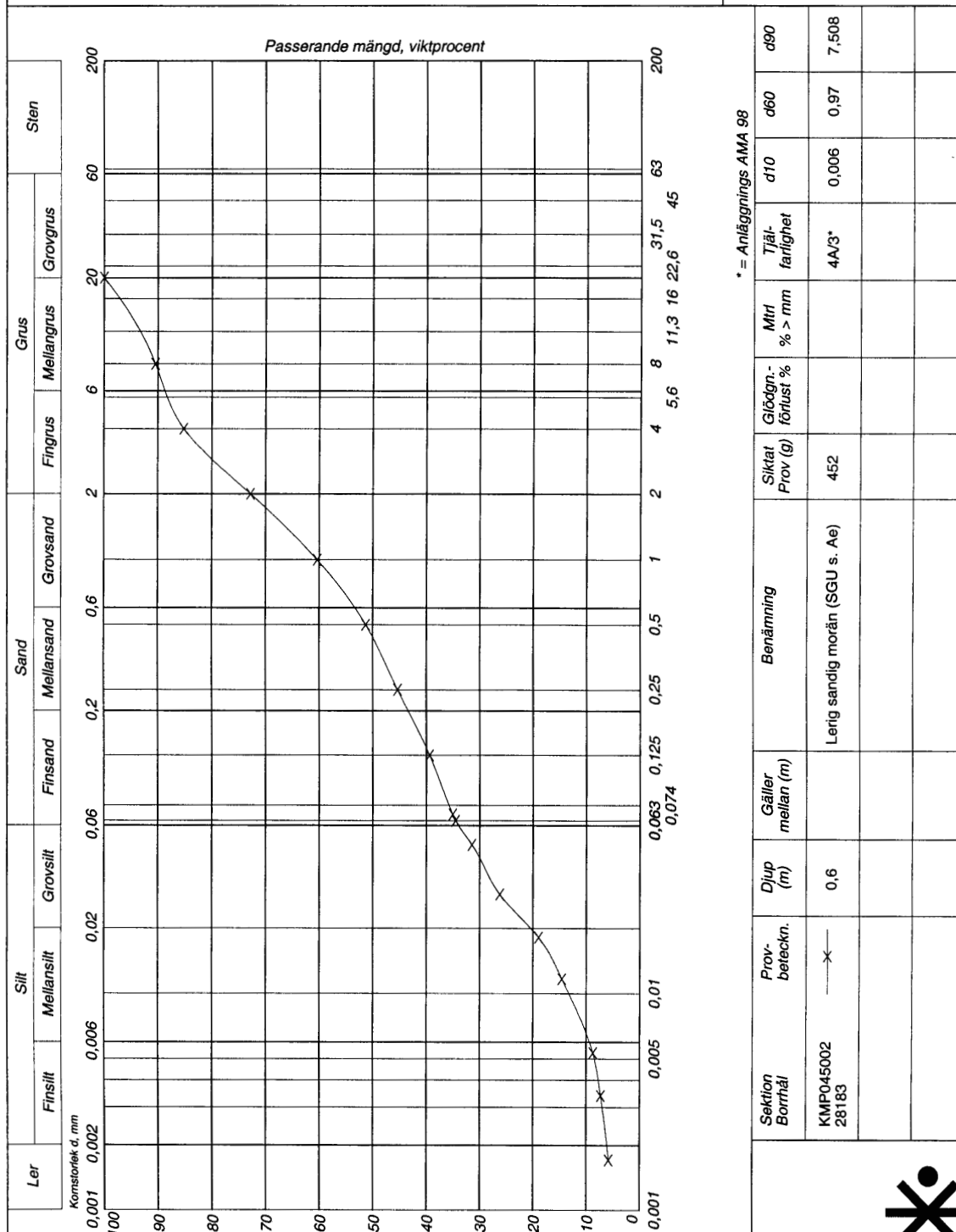


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Projekt: Prov nr 28182-28192		Datum: 2004-12-30	
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Uppdragsgivare: SGU Uppsala		Gransk./Sign: <i>Pom...</i>	



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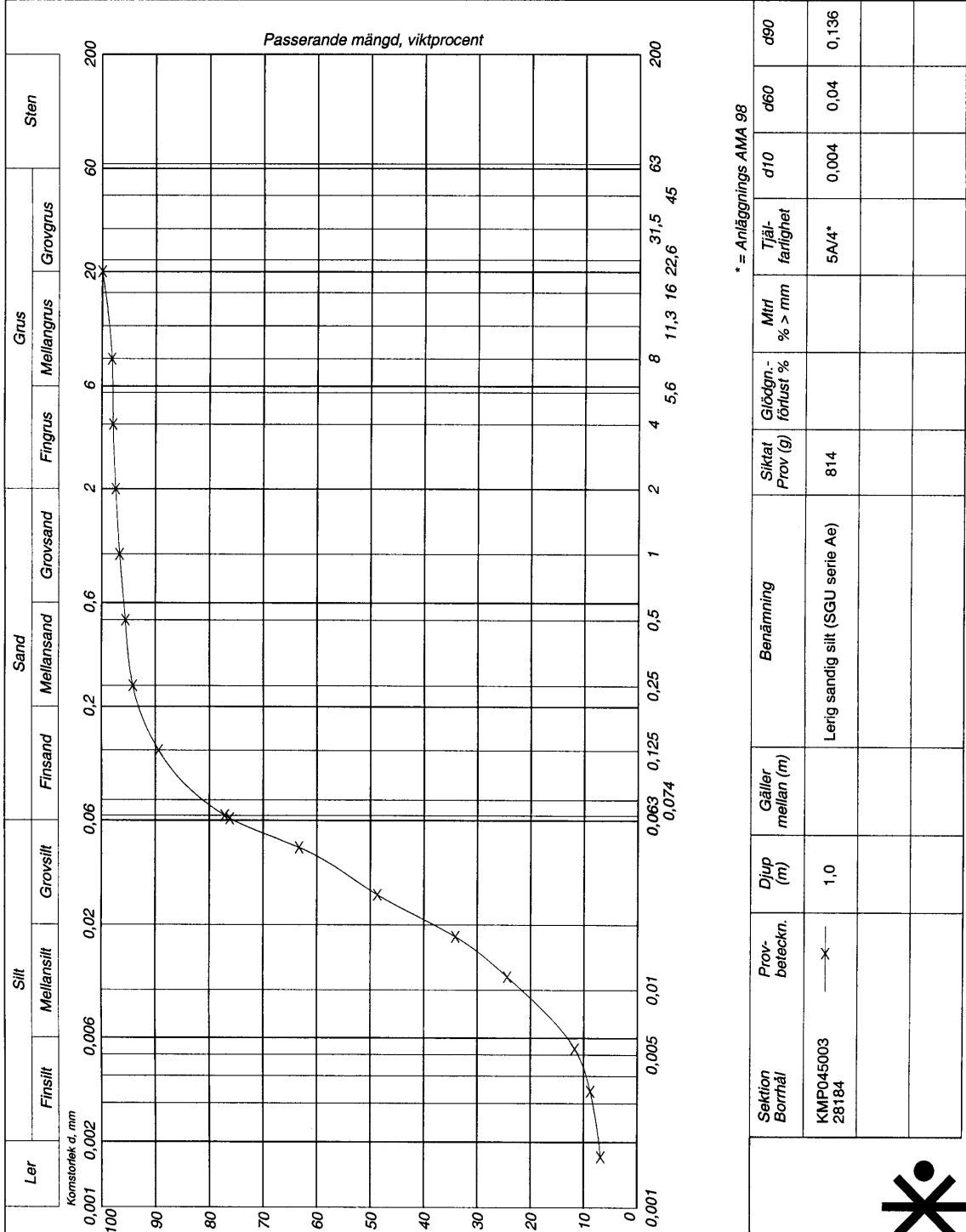
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SWECO GEOLAB

Projekt: Prov nr 28182-28192		Datum: 2004-12-30	
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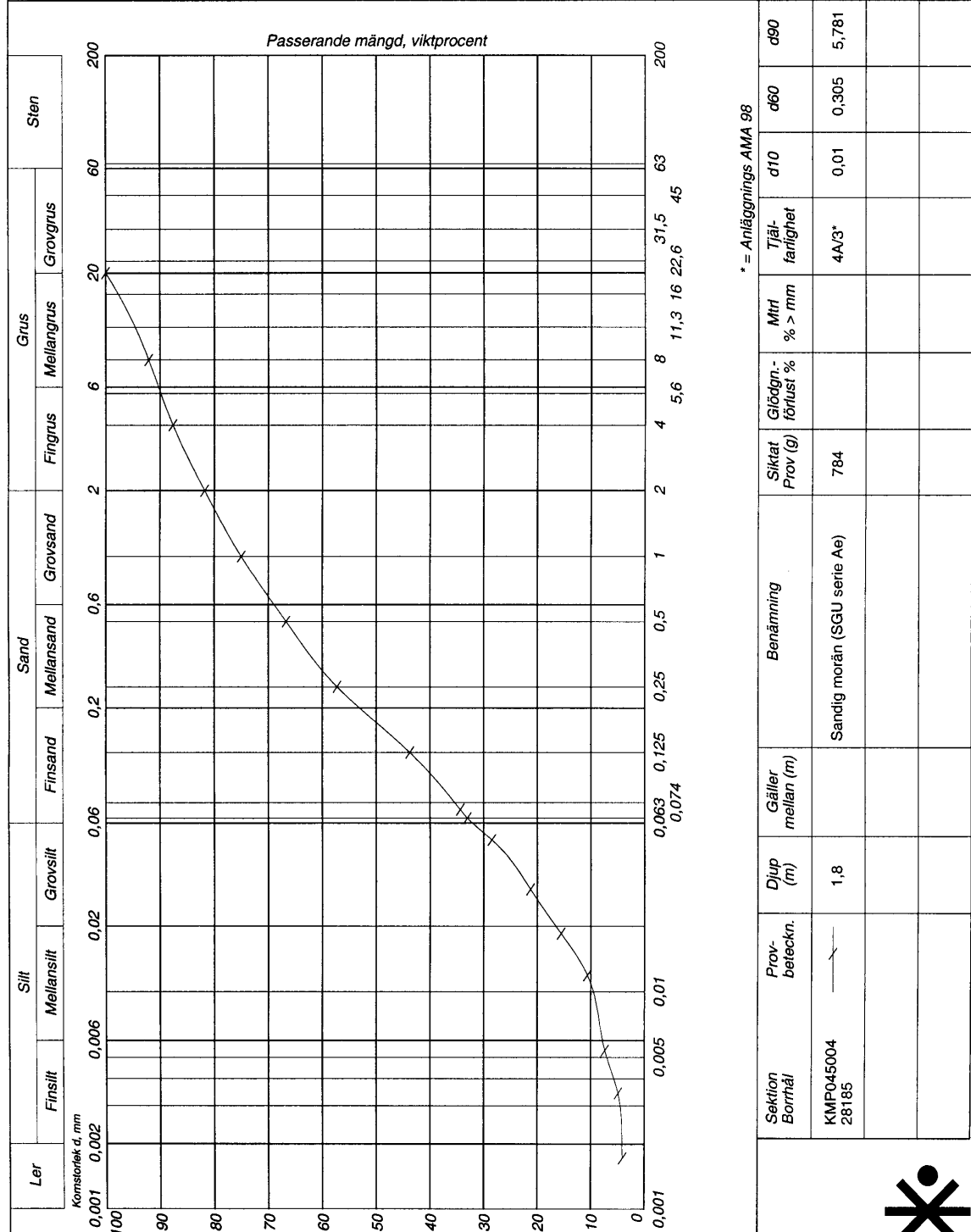


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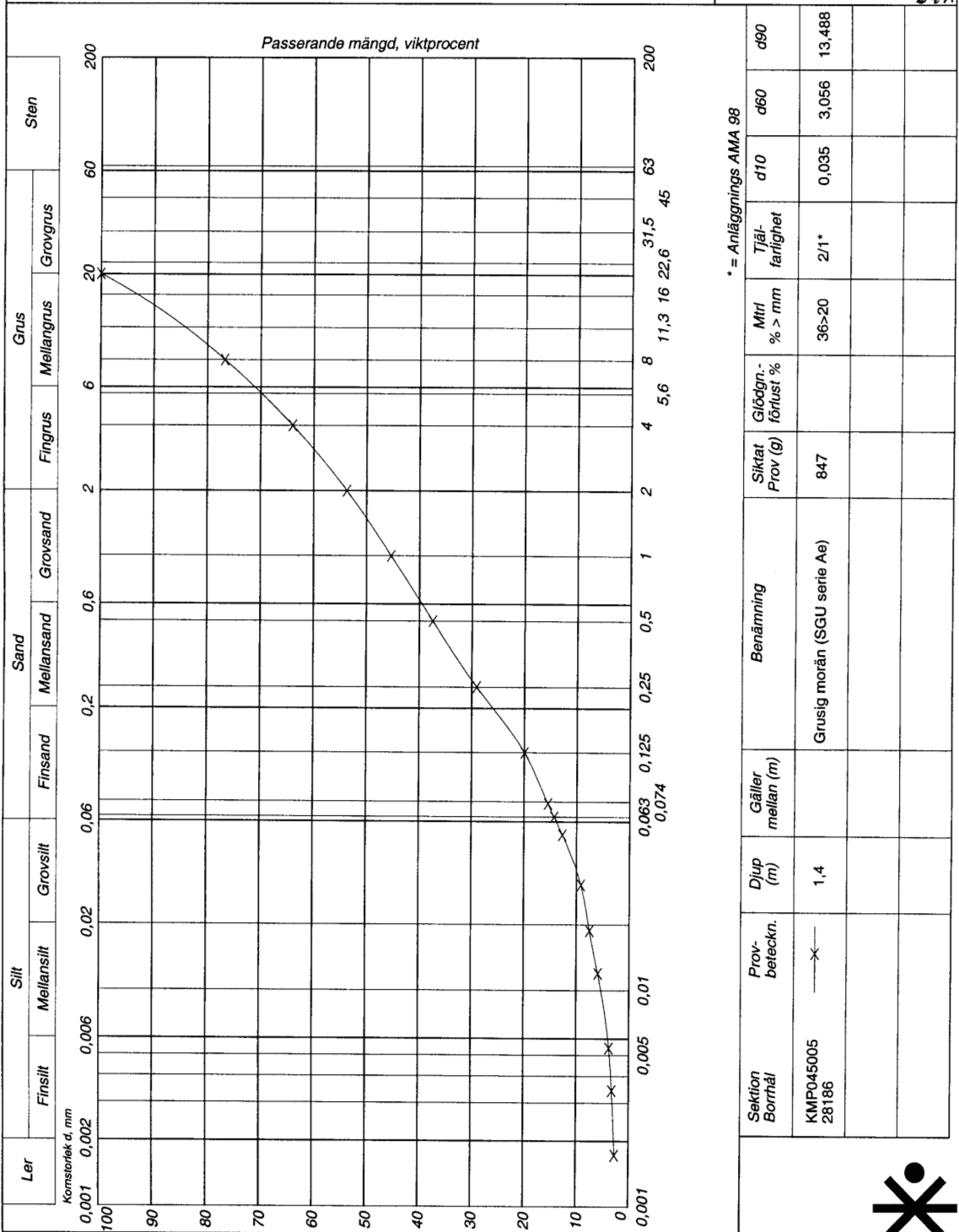
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	Gransk./Sign: <i>[Signature]</i>



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Projekt: Prov nr 28182-28192	Datum: 2004-12-30
Uppdragsnr: 40113	Provtagningsdatum:
Uppdragsgivare: SGU Uppsala	Löp-nr: 13205
	Gransk./Sign: <i>Pom</i> 6411



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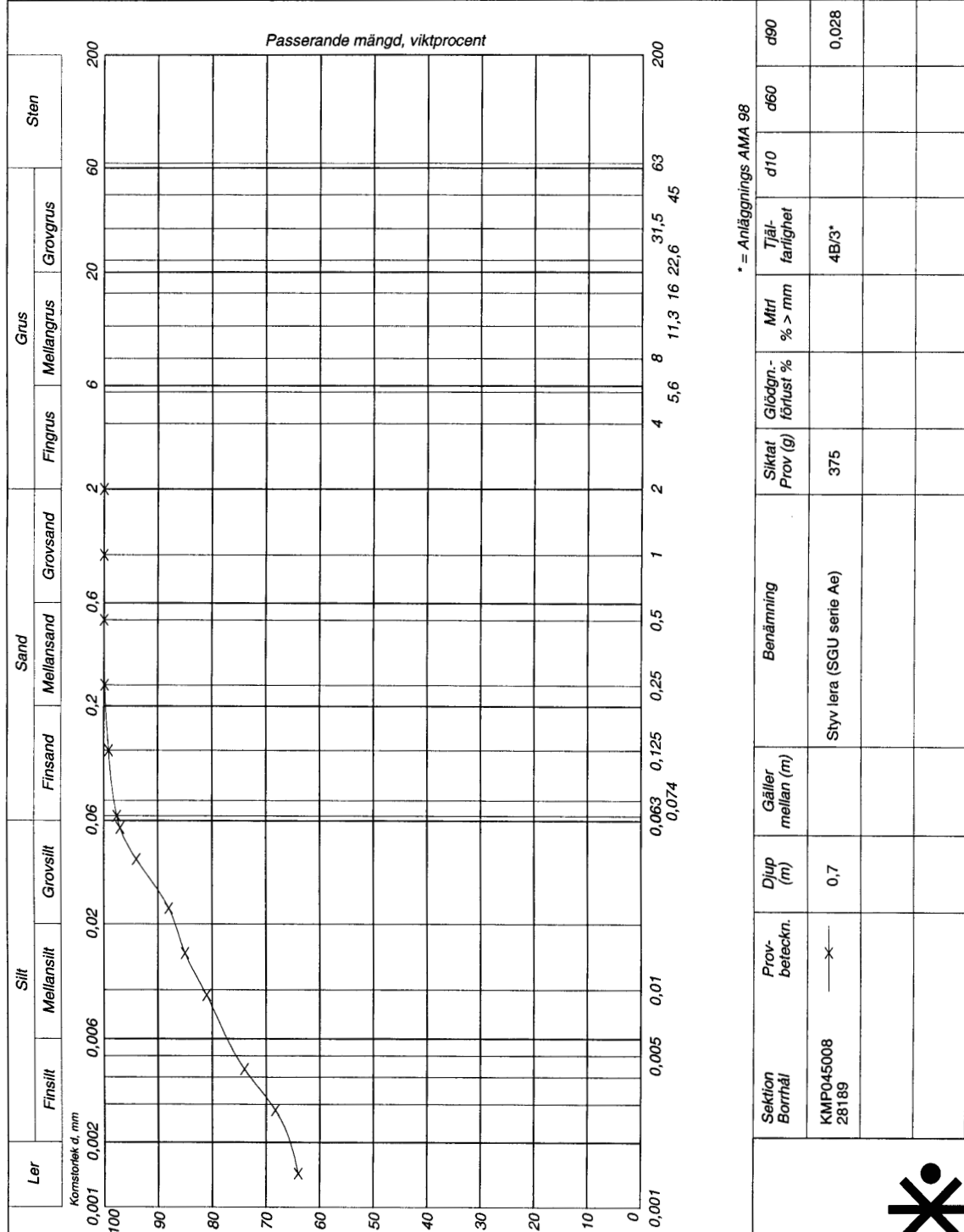


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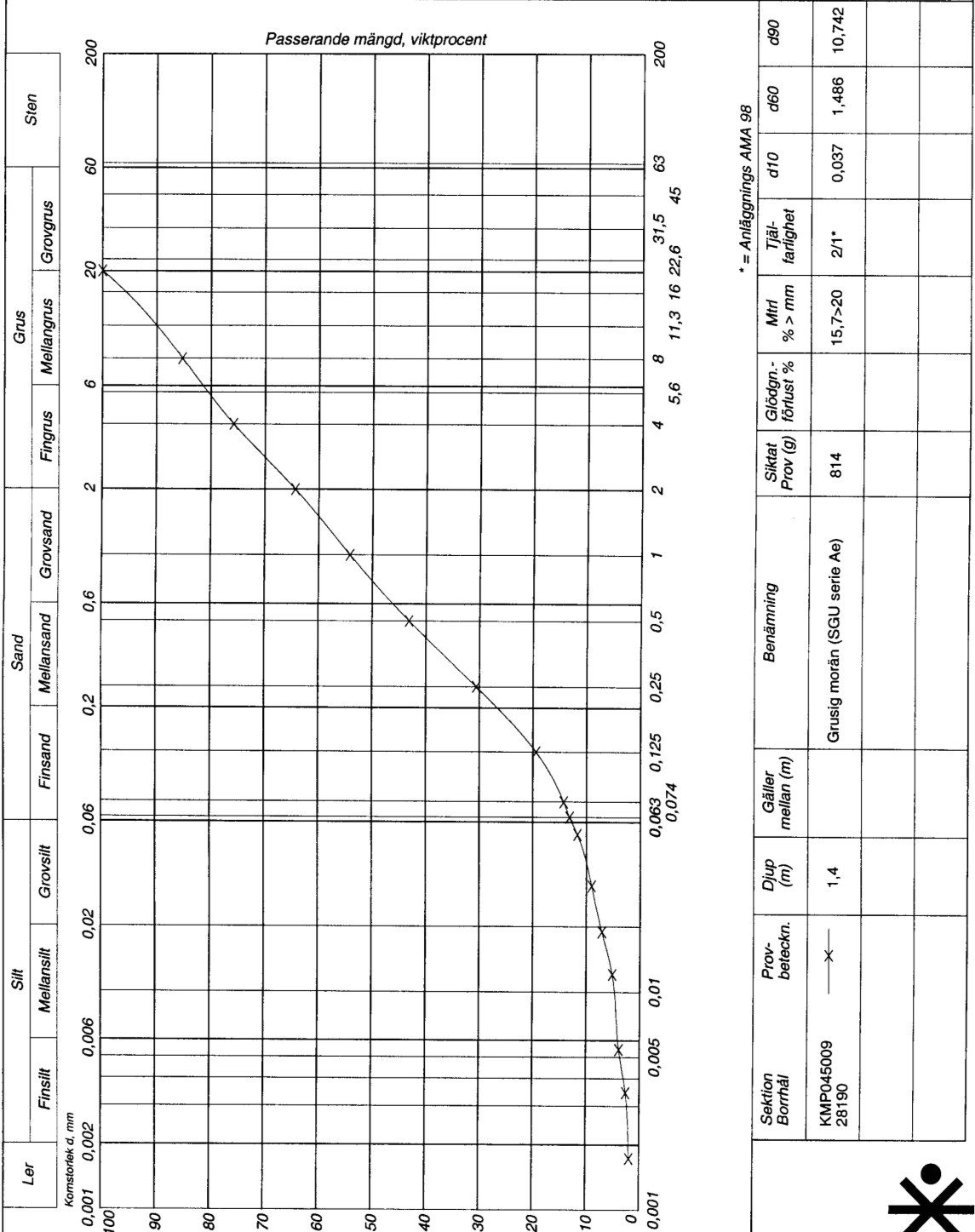
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Uppdragsnr: 40113	Provtagningsdatum:
Uppdragsgivare: SGU Uppsala	Löp-nr: 13205
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Uppdragsgivare: SGU Uppsala	Löp-nr: 13205
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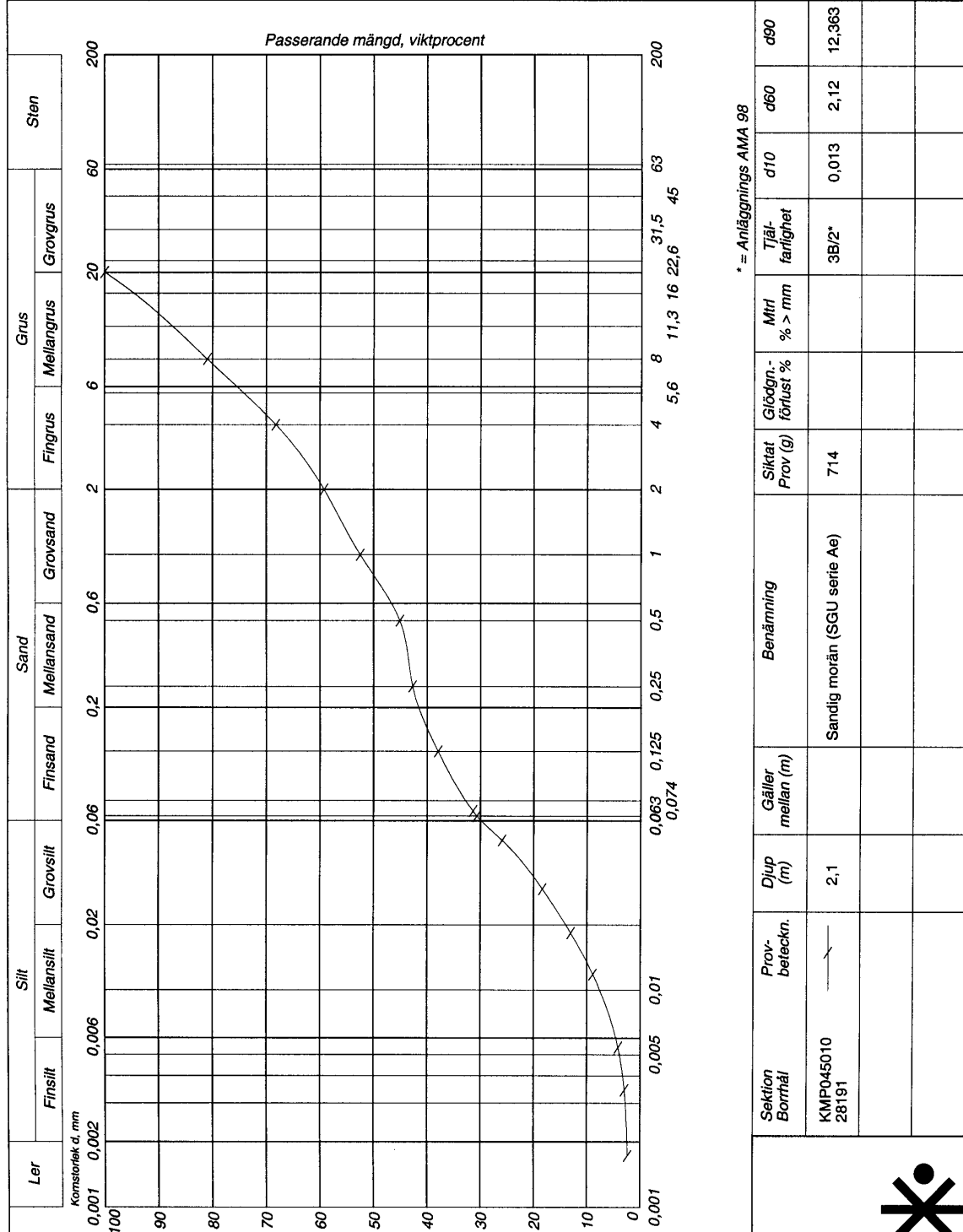


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Uppdragsnr: 40113	Provtagningsdatum:
Uppdragsgivare: SGU Uppsala	Löp-nr: 13205
	Gransk./Sign: <i>[Signature]</i>



* = Anläggnings AMA 98	
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Prov-beteckn.	—
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Gjöögn-förlust %	
Mtrl % > mm	
Tjäl-farfnghet	3B/2*
d10	0,013
d60	2,12
d90	12,363

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