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Forsmark site investigation

Petrographic analysis of gravel and boulders in the Forsmark candidate area

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Geological Survey of Sweden

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Abstract

This report gives the results from a petrographical documentation of boulders along three north-east south-west trending profiles within the Forsmark candidate area. Additionaly, the results of petrographical analysis on the gravel fraction of 12 till samples, from the Forsmark candidate area are presented.

This activity was conducted in order to test if the lithological composition of the till was similar to the composition of the local bedrock. Additionally, the activity tested if it was possible to trace the provenance, and thus the direction and length of glacial transport of the till.

The petrographical analyses show that the composition of the boulders is comparable to that of the local bedrock in the Forsmark area.

Two major glacial transportation directions are indicated for the boulders, from west north-west and north-west and the transport distance in the range of 0.5–8 km. The suggested glacial transportation directions coincide with the documented till fabric directions noted in the Forsmark area by /Sundh et al. 2004/.

The composition of the gravel fraction is dominated by metagranite to metagranodioritic rock and monomineralic quartz and feldspar fragments. Furthermore, it is concluded that the gravel fraction contains high amounts of Paleozoic limestone, c 20–40% and small amounts of amphibolite and felsic metavolcanic rock.

Sammanfattning

Denna rapport redovisar resultaten av petrografisk dokumentation av block, som utförts utmed tre nord-öst syd-västliga profiler inom Forsmarks kandidatområde. Dessutom redovisas resultaten av petrografisk analys av grusfraktionen från 12 moränprover. Syftet med aktiviteten var att testa om moränens litologiska sammansättning liknar den lokala berggrunden och om det gick att spåra ursprunget för moränblocken och på så sätt få en uppskattning om riktning och längd för den glaciala transporten.

Resultaten visar att moränblocken till stor del består av bergarter förekommande inom området. Två huvudsakliga transportriktningar indikeras: från väst nord-väst och nord-väst med möjligt ursprung mellan 0,5 och 8 km från profilerna. Den föreslagna transport-riktningen sammanfaller med resultaten från partikelorientering på morän i området /Sundh m fl 2004/.

Sammansättningen av grusfraktionen domineras av metagranitiskt till metagranodioritiskt material samt mineralkorn av kvarts och fältspat. Dessutom innehåller grusfraktionen stor andel Paleozoisk kalksten, cirka 20–40 %, samt fragment av amfibolit och sur metavulkaniska bergarter.

Contents

1 Introduction

This document reports the data gained within the activity "Mapping of rock types in boulders and gravel", which is one of the activities performed within the site investigation at Forsmark. The work was carried out in accordance with activity plan AP PF 400-05-094. In Table 1-1 the controlling documents for performing this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents.

The boulder mapping was performed in October 2005 and was carried out along three north-east south-west trending profiles. The profiles were located within the three different till areas defined during the mapping of Quaternary deposits in the Forsmark area /Sohlenius et al. 2004/, see Figure 1-1.

Area I is characterised by sandy till with normal frequency of superficial boulders. Area II is dominated by clayey till with low to normal frequency of superficial boulders, whereas area III is characterised by sandy till with high frequency of superficial boulders. The areas and location of mapped boulders are shown in Figure 1-1.

This activity also includes petrographical analysis of the gravel fraction from 12 samples, collected within the Forsmark candidate area. Till samples for grain size distribution analyses have been collected during different IPLU-activities in the Forsmark area /Sundh et al. 2004, Hedenström et al. 2004/. The petrographic analyses comprised determination of rock types and roundness of rock fragments in distinguished lithological subgroups. The sample sites are displayed in Figure 1-1.

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

Activity plan	**Number**	**Version**
Kartering av bergartsinnehåll i block och grus inom Forsmarksområdet	AP PF 400-05-094	1.0
Method descriptions	**Number**	**Version**
Metodbeskrivning för jordartskartering	SKB MD 131.001	1.0
Metodbeskrivning för berggrundskartering	SKB MD 132.001	1.0

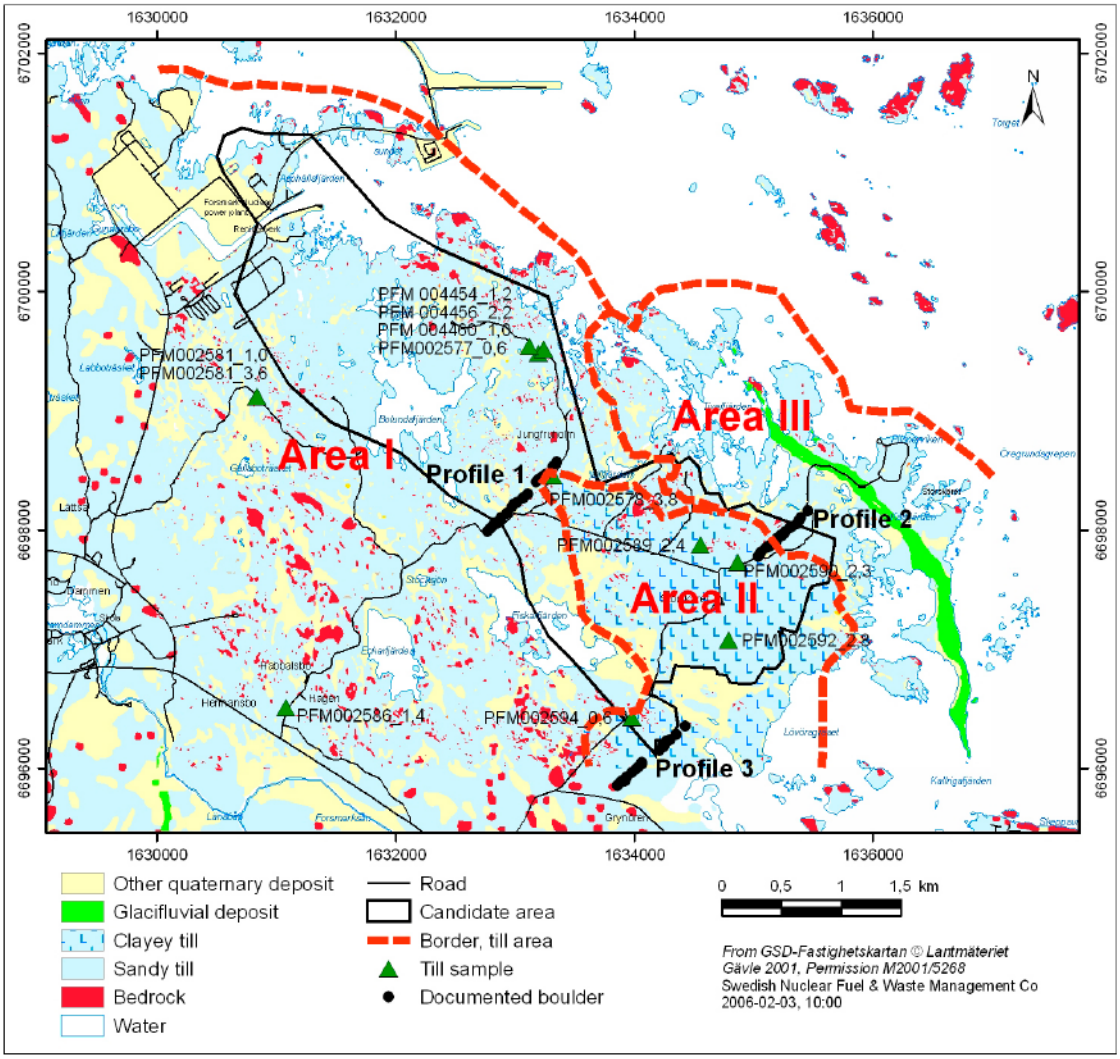


Figure 1-1. *Location of the documented boulders and till-samples. Area I is characterised by sandy till with normal frequency of superficial boulders. Area II is dominated by clayey till with low to normal frequency of superficial boulders. Area III is characterised by sandy till with high frequency of superficial boulders.*

2 Objective and scope

Based on the detailed knowledge of the bedrock in the Forsmark area, the present investigation was carried out in order to investigate if the lithological composition of the till was similar to the composition of the local bedrock. Additionally, the activity tested if it was possible to trace the provenance and directions of deposition of boulders and till in the previously defined till-areas at the Forsmark site investigation area.

If successful, the results from this activity will add information regarding:

1. The conceptual understanding of the site.
2. The direction of the glacial transport.
3. Soil forming and weathering properties.

3 Equipment

The mapping of the boulders was carried out in accordance to the method description for bedrock mapping (SKB MD 132.00, SKB internal document) and the methodology of /Lundqvist 1952/.

The following equipment was used during the boulder mapping:

- Garmin GPS 12 for positioning of boulders.
- Silva compass in order to keep bearing of profile.
- Instrument to measure magnetic susceptibility (Geoinstruments, Finland; GF Instruments, Czech Republic).
- A digital camera for taking photos of each boulder.
- Field notebook with standard observation protocol.

The petrographical analyses of washed gravel samples were carried out in the laboratory using a stereo microscope, Figure 3-1.

Figure 3-1. *Laboratory set-up for petrographic analysis of washed gravel samples.*

4 Execution

4.1 General

The mapping of the boulders was performed along three profiles, approximately 800 m long in north-east south-west direction, see Figure 1-1. Boulders were documented at every 10 to 50 m depending on the frequency of superficial boulders in the till. A total amount of 58 boulders were documented.

The boulders were documented with respect to rock type, colour, structural characteristics, magnetic susceptibility and roundness. A digital photo was taken of each boulder and the assumed provenance area was noted as well.

Petrographic analyses of washed gravel-fraction (grains > 2 mm) were performed on 12 samples from different parts of the candidate area. The gravel grains were separated into groups based on rock type and colour. The number of grains in each group was counted, and the proportion of each group was calculated. The roundness of the boulders and gravel grains was estimated on a scale 1–5, where 1 is rough and 5 is well rounded. The following rock types were found in most of the samples:

- Metagranite, red.
- Metagranite to Metagranodiorite, grey.
- Limestone, grey.
- Limestone, red.
- Mono mineral: quartz or feldspar.
- Amphibolite.
- Felsic metavolcanic rock.
- Unspecified rock fragment.

In addition, in two samples sandstone and hard clayey till were recognised in small amounts.

4.2 Data handling/post processing

The result of the boulder mapping was transferred into an Access database by using the database application BGDATA, version 1.7.3. The Access database and a selection of data from the Access database are stored in the SKB primary database (SICADA). The data are traceable by the activity plan number. The result of the petrographic analyses of the gravel-fraction (grains > 2 mm) is stored in the file archive of the SICADA database.

4.3 Nonconformities

The work has followed the activity plan without any nonconformities.

5 Results

5.1 Boulder mapping

The main part of the boulders along the three profiles constitutes rock types occurring within the detailed mapped part of the Forsmark area, /SKB 2005/. If possible, a provenance area is suggested for each boulder, based on rock type, colour and grade of ductile deformation. Two major transportation directions are indicated, from west north-west and north-west. A suggested transportation direction for each boulder is presented in Figure 5-1. The suggested provenance areas are shaded in Figure 5-1 and define an area within which each boulder most likely has its source in the bedrock.

The location coordinates for the documented boulders and their most important characteristics are listed in Appendix 1.

5.1.1 Profile 1, sandy till

The major part of the boulders along profile 1 consists of weakly deformed, medium grained, red metagranite typical for the area around lake Bolundsfjärden, i.e. the central part of the SKB-candidate area. This suggests a transportation direction from north-west and an approximative transportation distance of 0.5–2 km for these boulders. However, two boulders are more foliated and consist of metagranite-metagranodiorite typical for the north-western part of the candidate are, which implies a transportation direction more from west north-west for these two boulders. The north-eastern most boulder in the profile consists of fine grained red metagranite. This type of rock occurs mainly along the coast north and north-east of the candidate area but also in minor occurrences within the candidate area. A certain suggestion of provenance for this boulder is therefore difficult to make.

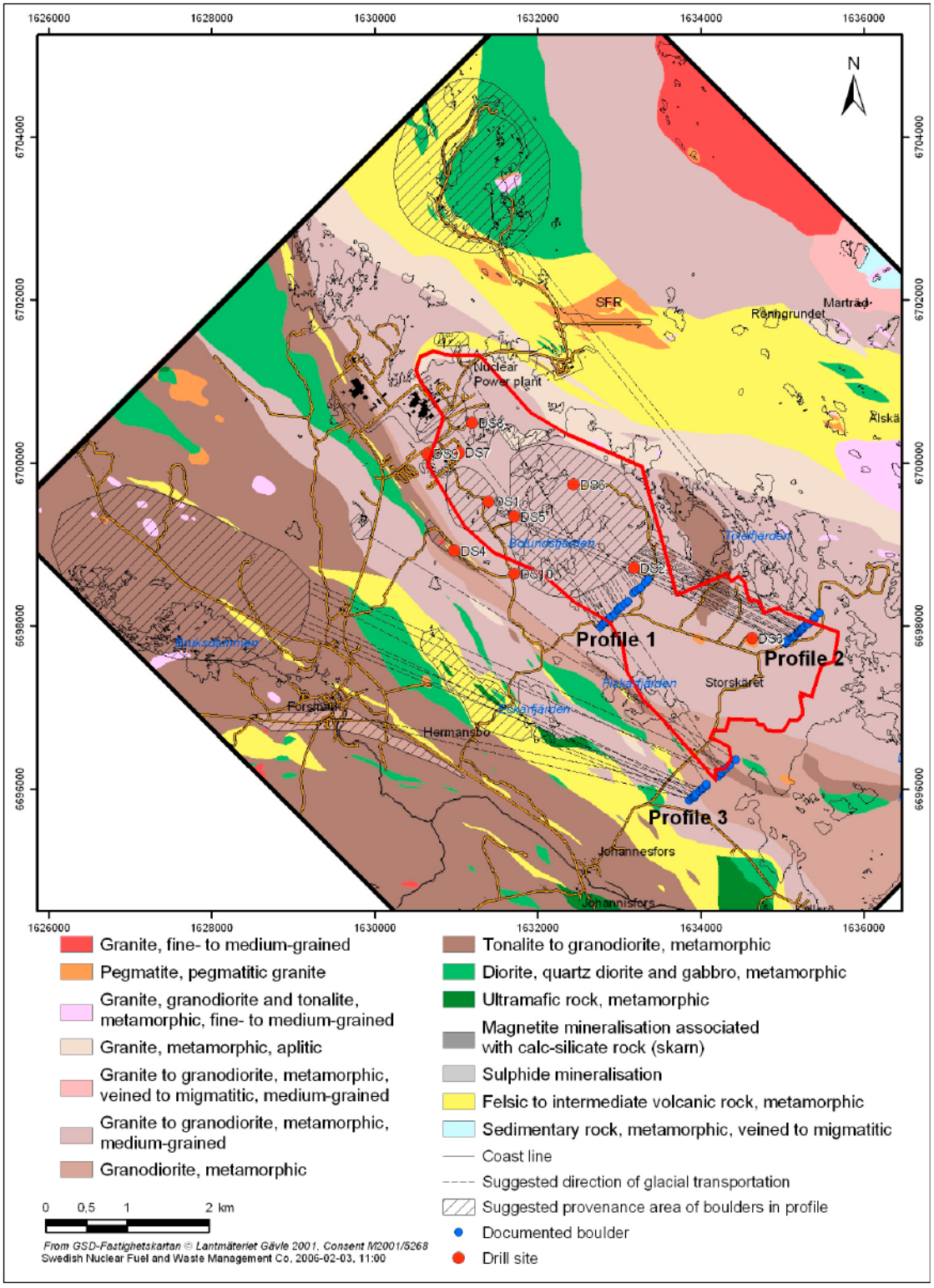
The roundness of the boulders along the profile is estimated to 3–4, i.e. quite well rounded boulders.

5.1.2 Profile 2, high frequency of boulders

A majority of the boulders along this profile consist sof medium grained weakly foliated metagranite which is interpreted to have its source in the area around Bolundsfjärden, the central part of the candidate area, see Figure 5-1. This indicates a transportation from west north-west, approximately 290–300°, with a possible origin of the boulders approximately 2.5–4 km from the profile.

A somewhat different direction is indicated for the two north-eastern most boulders in the profile, a fine grained, grey metadacite boulder and a boulder of medium grained diorite to gabbro. These two rock types are frequent in the area around Biotestsjön, which implies a possible transportation direction more from north-west, more similar to what was suggested for a majority of the boulders in profile 1, see Figure 5-1.

The roundness of the boulders is generally estimated to 3 with a few exceptions, see Appendix 1.



Figur 5-1. *Bedrock geological map of the Forsmark area. Blue dots show the location of documented boulders and the shaded areas are suggested provenance areas for the boulders.*

5.1.3 Profile 3, clayey till

The boulders along profile 3 exhibit a various collection of rock types from the Forsmark area. The most frequent type is a weakly to strongly foliated, medium grained metagranodiorite-tonalite. These boulders are most likely from the area north of Bruksdammen, where similar rocks are outcropping, see Figure 5-1. In addition, several boulders consist of fine grained felsic metavolcanic rock, typical for the rock unit west and north-west of Eckarfjärden, i.e. highly magnetic felsic metavolcanic rocks with a high content of magnetite.

Both the metagranodiorite-metatonalite and the felsic metavolcanic rocks indicate transportation directions from west north-west, which is quite similar to what was noted in profile 2. Two boulders consist also of slightly porphyritic metagranodiorite which is a rock type that is known from a small area south and west of Forsmark village. However, this type of rock has also been noted in some outcrops in the area north of Bruksdammen which makes the interpretation of the source for these boulders somewhat difficult.

A slightly more south-eastern transportation direction is noted for some pale granitic boulders that most likely have their source in the area around Power plant 1 and 2, where pale silicified rocks are outcropping. This transportation direction is also quite similar to what was noted for boulders along profile 1, see Figure 5-1.

Two of the boulders along the profile, one gneissic metagranodiorite and one strongly foliated metatonalite, are most likely from the western border of the candidate area, which implies a transportation directions somewhat in between the two previous interpreted transportation directions for boulders in this profile, see Figure 5-1.

All these boulders suggest a transportation distance of approximately 3–8 km and a transportation direction from north-west, approximately 280–310°. The roundness is estimated to 3–4, i.e. quite well rounded for till boulders.

In addition, one boulder (PFM007149) consists of medium to coarse grained, hornblende bearing, red granite. This type of rock has not been noted in outcrops in the Forsmark area. Hornblende bearing granite is typical for the “Rapakivi type” of granites generally found on Åland and in some minor occurrences along the Swedish coast further to the north.

5.2 Petrographic analysis of the gravel fraction in till samples

The petrographic analysis of gravel was performed on 12 till samples from the area, see Figure 1-1. The results are presented in Appendix 2. Most of the samples are dominated by metagranite to metagranodioritic fragments, Paleozoic limestone fragments and monomineralic quartz and/or feldspar fragments. Subordinately also amphibolite, felsic metavolcanic rock fragments and various amounts of unspecified rock and mineral fragments occur. In two samples a few grains (< 2%) of sandstone were noted as well as 2.5% of hard clayey till pellets in one sample.

The metagranite-metagranodioritic fragments were subdivided into red metagranite fragments and grey metagranite-metagranodioritic fragments. The same type of subdivision, in red and grey, was also made for the Paleozoic limestone fragments.

The number of metagranite and metagranite-metagranodiorite fragments varies between 38–88% in the till samples. The dominating part of the samples, however, consists of 40–50% of metagranite-metagranodiorite fragments. The roundness of the grains varies between 2–4. The grey metagranite-metagranodiorite fragments are generally more rounded compared to the red metagranite fragments.

The red and grey limestone fragments generally constitute 20–40% of the grains in most of the samples and in sample (PFM002589, 2.4 m) as much as 48% of the grains. The limestone grains are generally well rounded and the roundness is estimated to 3–4 with dominance in roundness of 4.

A relatively large proportion of the fragments is mono-mineralic quartz and feldspar fragments, and constitutes in most of the samples about 10% and up to 17% of the fragments. The roundness is generally quite low, with an estimated value of 2 for most of the grains.

Amphibolite fragments generally constitute less than 4% of the grains. The roundness varies between 2 and 4 with a dominance of well rounded grains.

Felsic metavolcanic rock fragments of fine grained metadacit-ryolite, occur in small amounts (< 5%) in all samples.

In all samples a number of grains are present that not fit in to any of the other groups. These grains were collected under the label “Unspecified”. This group comprises several different rock types and minerals, e.g. red stained and altered rock fragments and fracture filling minerals such as epidote and prehnite.

6 Summary and discussions

This activity was conducted as a pilot study to test if the petrographical composition of the till was similar to the composition of the local bedrock. Additionally, the activity tested if it was possible to trace the provenance, and thus the direction of glacial transport of the till. Even though the activity only comprised three days of geological mapping of boulders in the Forsmark area and less than one week of petrographical analyses in the laboratory, the study resulted in some clear and interesting results.

The suggested provenances for the boulders and gravel in this activity are based on the detailed knowledge of the bedrock composition within the Forsmark candidate area and its immediate surroundings. The experience from the geological mapping makes it possible to separate the boulders on a very detailed level. It should be noted, however, that the distance and direction of transportation are suggestions. Several of the rock types encountered may also have their origin outside the Forsmark area. The suggested direction of glacial transportation coincide with the dominating till fabric directions /Sundh et al. 2004/ while a majority of the glacial stria are formed from the north /Sohlenius et al. 2004/.

The mapping of boulders shows that the composition of the boulders is comparable to that of the local bedrock in Forsmark.

The composition of the gravel fraction is dominated by metagranite to metagranodioritic rock and mono-mineralic quartz and feldspar fragments. Furthermore, it is concluded that the gravel fraction contains high amounts of Paleozoic limestone, c 20–40% and small amounts of amphibolite and felsic metavolcanic rock.

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Appendix 1

Location of boulder observations

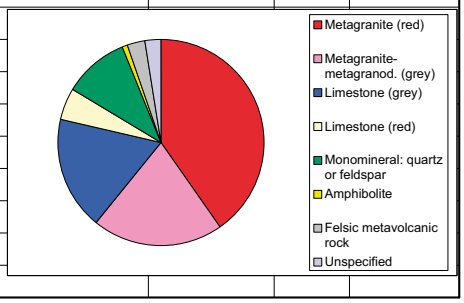
Boulder id	Roundness	Rock type	easting	northing	Profile
PFM007118	2	Metagranite	1635043	6697784	2
PFM007119	4	Metagranite	1635047	6697794	2
PFM007120	3	Metagranite	1635054	6697800	2
PFM007121	3	Metagranite-metagranodiorite	1635069	6697821	2
PFM007122	3	Metagranite	1635110	6697856	2
PFM007123	3	Metagranite	1635124	6697863	2
PFM007124	3	Metagranite	1635144	6697869	2
PFM007125	3	Metagranite	1635155	6697886	2
PFM007126	3	Metagranite-metagranodiorite	1635192	6697909	2
PFM007127	3	Metagranite	1635197	6697922	2
PFM007128	3	Metagranite	1635202	6697935	2
PFM007129	3	Metagranite	1635212	6697940	2
PFM007130	3	Metagranite	1635231	6697958	2
PFM007131	3	Metagranite	1635239	6697957	2
PFM007132	3-4	Metagranite	1635256	6697975	2
PFM007133	3	Metagranite	1635272	6697994	2
PFM007134	3	Metagranite	1635309	6698022	2
PFM007135	2-3	Metagranite	1635325	6698028	2
PFM007136	2-3	Metagranite	1635366	6698057	2
PFM007137	3	Metagranite	1635388	6698086	2
PFM007138	3	Metadiorit	1635398	6698109	2
PFM007139	4	Metadacit	1635454	6698163	2
PFM007140	3	Metadacit	1633861	6695862	2
PFM007141	4	metagranodiorite	1633886	6695888	2
PFM007142	3	Metagranodiorite-metatonalit	1633902	6695898	2
PFM007143	3	Metaryolite-metadacite	1633923	6695901	3
PFM007144	3-4	Metagranodiorite	1633925	6695915	3
PFM007145	3	Metatonalite	1633938	6695936	3
PFM007146	3	Metagranodiorite	1633986	6695974	3
PFM007147	3-4	Metagranodiorite	1634013	6695998	3
PFM007148	3	Metagranodiorite	1634034	6696014	3
PFM007149	3-4	Granite (Rapakivi granite)	1634065	6696039	3
PFM007150	3-4	Metagranite	1634068	6696055	3
PFM007151	3	Metagranodiorite	1634214	6696159	3
PFM007152	3-4	Metagranite	1634248	6696188	3
PFM007153	3-4	Metadacite	1634246	6696204	3
PFM007154	3-4	Metaryolite	1634271	6696230	3
PFM007155	3-4	Metatonalit	1634299	6696245	3
PFM007156	3-4	Metatonalit	1634355	6696293	3
PFM007157	3	Metagranodiorite	1634430	6696363	3
PFM007158	3	Metagranite	1632769	6697990	1
PFM007159	3	Metagranite	1632796	6698018	1
PFM007160	3	Metagranite	1632815	6698040	1
PFM007161	3	Metagranite	1632837	6698064	1
PFM007162	3	Metagranite	1632875	6698084	1
PFM007163	3	Metagranite-metagranodiorite	1632888	6698110	1
PFM007164	3	Metagranite	1632939	6698144	1
PFM007165	3	Metagranite	1632977	6698196	1
PFM007166	3	Metagranite	1632997	6698221	1
PFM007167	3	Metagranite	1633023	6698237	1
PFM007168	3	Metagranite	1633072	6698272	1
PFM007169	2	Metagranite	1633109	6698306	1
PFM007170	3	Metagranite	1633178	6698409	1
PFM007171	4	Metagranite	1633205	6698431	1
PFM007172	4	Metagranite	1633242	6698456	1
PFM007173	3	Metagranite	1633262	6698471	1
PFM007174	3	Metagranite	1633321	6698537	1
PFM007175	3	Metagranite	1633354	6698573	1

Appendix 2

Petrographic analyses of gravel from till samples

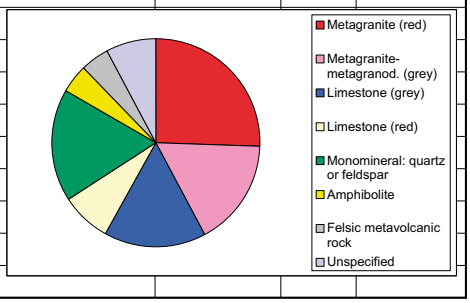
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28036	SKB id: PFM002577		Depth: 0,6 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	429	40,40	2
Metagranite-metagranod. (grey)	217	20,43	2
Limestone (grey)	189	17,80	3
Limestone (red)	53	4,99	4
Monomineral: quartz or feldspar	110	10,36	2
Amphibolite	8	0,75	2
Felsic metavolcanic rock	29	2,73	2
Unspecified	27	2,54	2
Sum	1062	100,00	



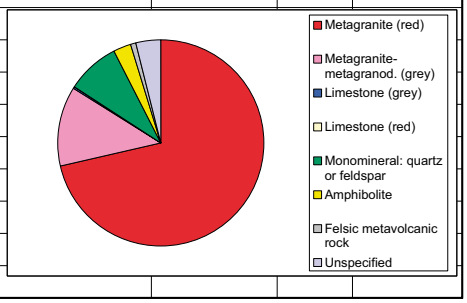
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28038	SKB id: PFM002578		Depth: 3,8 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	80	25,56	2
Metagranite-metagranod. (grey)	52	16,61	4
Limestone (grey)	50	15,97	2
Limestone (red)	24	7,67	4
Monomineral: quartz or feldspar	55	17,57	2
Amphibolite	14	4,47	3
Felsic metavolcanic rock	14	4,47	2
Unspecified	24	7,67	3
Sum	313	100,00	



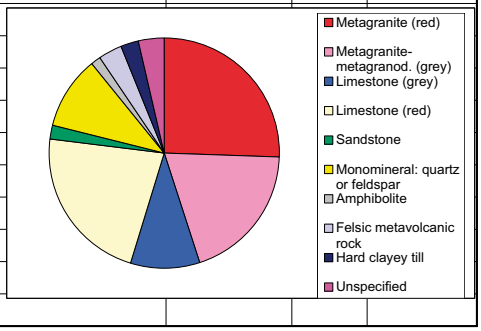
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28039	SKB id: PFM002581		Depth: 1,0 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	318	71,30	2
Metagranite-metagranod. (grey)	56	12,56	2
Limestone (grey)	1	0,22	4
Limestone (red)			
Monomineral: quartz or feldspar	37	8,30	2
Amphibolite	13	2,91	4
Felsic metavolcanic rock	4	0,90	3
Unspecified	17	3,81	2
Sum	446	100,00	



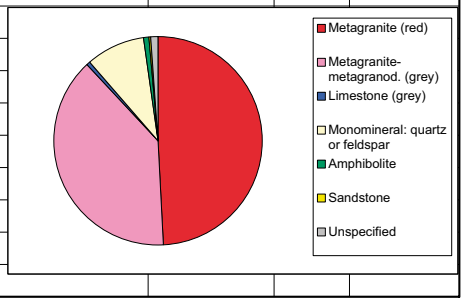
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28041	SKB id: PFM002581		Depth: 3,6 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	220	25,64	2
Metagranite-metagranod. (grey)	166	19,35	2
Limestone (grey)	83	9,67	3
Limestone (red)	190	22,14	3
Sandstone	17	1,98	4
Monomineral: quartz or feldspar	90	10,49	2
Amphibolite	11	1,28	2
Felsic metavolcanic rock	28	3,26	3
Hard clayey till	21	2,45	5
Unspecified	32	3,73	2
Sum	858	100,00	



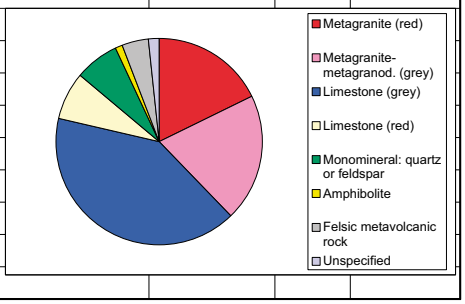
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28045	SKB id: PFM002586		Depth: 1,4 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	238	49,07	2
Metagranite-metagranod. (grey)	189	38,97	2
Limestone (grey)	3	0,62	4
Monomineral: quartz or feldspar	44	9,07	2
Amphibolite	4	0,82	2
Sandstone	1	0,21	3
Unspecified	6	1,24	2
Sum:	485	100,00	



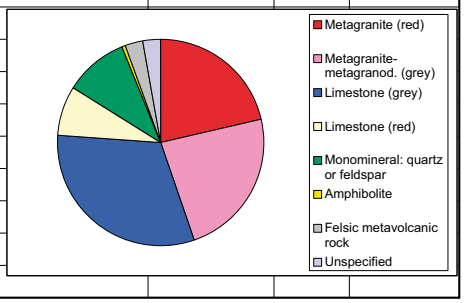
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28050	SKB id: PFM002589		Depth: 2,4
Rocktype	Number of grains	%	Roundness
Metagranite (red)	110	17,66	3
Metagranite-metagranod. (grey)	126	20,22	4
Limestone (grey)	254	40,77	4
Limestone (red)	46	7,38	4
Monomineral: quartz or feldspar	43	6,90	2
Amphibolite	7	1,12	4
Felsic metavolcanic rock	27	4,33	2
Unspecified	10	1,61	3
Sum	623	100,00	



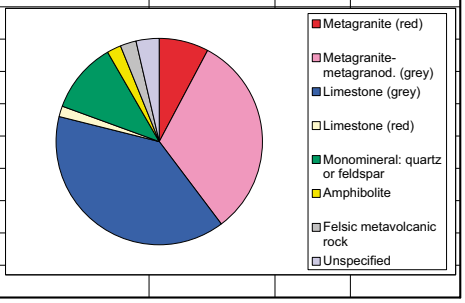
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28052	SKB id: PFM002590		Depth: 2,3 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	164	21,38	2
Metagranite-metagranod. (grey)	179	23,34	3
Limestone (grey)	241	31,42	4
Limestone (red)	59	7,69	4
Monomineral: quartz or feldspar	78	10,17	3
Amphibolite	4	0,52	4
Felsic metavolcanic rock	20	2,61	2
Unspecified	22	2,87	3
Sum	767	100,00	



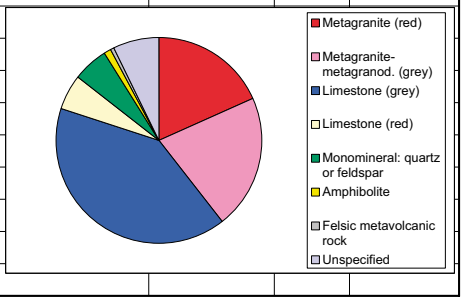
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28058	SKB id: PFM002592		Depth: 2,8 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	30	7,77	3
Metagranite-metagranod. (grey)	123	31,87	3
Limestone (grey)	151	39,12	3
Limestone (red)	7	1,81	4
Monomineral: quartz or feldspar	43	11,14	2
Amphibolite	8	2,07	4
Felsic metavolcanic rock	10	2,59	2
Unspecified	14	3,63	2
Sum	386	100,00	



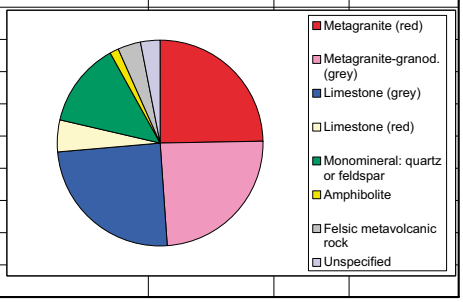
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28059	SKB id: PFM002594		Depth: 0,6 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	99	18,20	3
Metagranite-metagranod. (grey)	115	21,14	4
Limestone (grey)	221	40,63	4
Limestone (red)	30	5,51	4
Monomineral: quartz or feldspar	31	5,70	3
Amphibolite	6	1,10	4
Felsic metavolcanic rock	2	0,37	2
Unspecified	40	7,35	3
Sum	544	100,00	



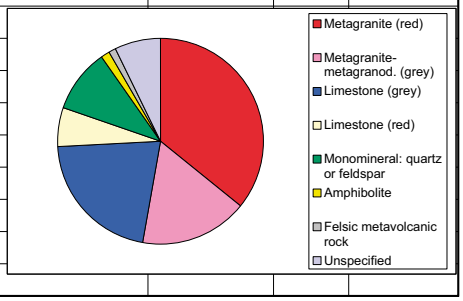
Petrographic analysis: gravel fraction, Forsmark

Lab id: 28154	SKB id: PFM004454		Depth: 1,2
Rocktype	Number of grains	%	Roundness
Metagranite (red)	483	24,68	3
Metagranite-granod. (grey)	474	24,22	4
Limestone (grey)	481	24,58	4
Limestone (red)	100	5,11	4
Monomineral: quartz or feldspar	260	13,29	3
Amphibolite	31	1,58	4
Felsic metavolcanic rock	66	3,37	2
Unspecified	62	3,17	2
Summa	1957	100,00	



Petrographic analysis: gravel fraction, Forsmark

Lab id: 28156	SKB id: PFM004456		Depth: 2,2 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	267	35,70	2
Metagranite-metagranod. (grey)	127	16,98	2
Limestone (grey)	160	21,39	4
Limestone (red)	47	6,28	4
Monomineral: quartz or feldspar	74	9,89	2
Amphibolite	10	1,34	4
Felsic metavolcanic rock	10	1,34	2
Unspecified	53	7,09	2
Sum	748	100,00	



Petrographic analysis: gravel fraction, Forsmark

Lab id: 28158	SKB id: PFM004460		Depth: 1,0 m
Rocktype	Number of grains	%	Roundness
Metagranite (red)	99	39,92	2
Metagranite-metagranod. (grey)	44	17,74	2
Limestone (grey)	41	16,53	4
Limestone (red)	21	8,47	4
Monomineral: quartz or feldspar	27	10,89	2
Amphibolite	5	2,02	4
Felsic metavolcanic rock	2	0,81	3
Unspecified	9	3,63	3
Sum	248	100,00