



NIKU Oppdragsrapport 246/2010

**The Bryggen Monitoring Project,
Part 11: report on the archaeological
investigation of two dipwell
boreholes, Bryggen and Finne-
gårdsgaten, 2010**

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Contents

1. Introduction	4
2. Background information.....	4
3. Methods	5
4. Description of the archaeological sediment sequences in the boreholes	5
4.1 General remarks	5
4.2 Drilling MB34: sediment sequence (visual inspection).....	6
4.3 Drilling MB35: sediment sequence (visual inspection).....	9
5. Finds & Dating.....	12
5.1 MB34	12
5.1.1 Archaeological material	12
5.2 MB35	12
5.2.1 Archaeological material	12
5.2.2 Radiometric dating.....	13
5.3 Dating: conclusions.....	13
6. State of preservation assessments.....	13
7. Concluding remarks.....	14
8. References.....	15
9. Documentation (NIKU)	15

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1. Introduction

In early September 2010 two new dipwells – designated MB34 and MB35 – were installed not in the World Heritage Site of Bryggen itself, but in the southeasternmost part of the original Bryggen area. Commissioned by *Riksantikvaren* (the Norwegian Directorate for Cultural Heritage), the work was undertaken in order to acquire baseline information on underground conditions well in advance of a proposed major infrastructure development project (*Bybane Nord* – the northern line of the Bergen Light Railway) that may well eventually impact the area. In addition, the information may help shed light on the causes of the settling that is affecting one of southern Bryggen's architectural landmarks, *Det Hanseatiske Museum* (the Hanseatic Museum).

Rory Dunlop from the Bergen office of the Norwegian Institute for Cultural Heritage Research (NIKU) was responsible for the archaeological side of things, with the local firm of Multiconsult AS doing the drilling work and dipwell installation. The purpose of the work was two-fold: a) to install the dipwells, naturally with full archaeological investigation of the soil sequence in each of the boreholes; and b) to obtain soil samples from various depths in each borehole. These samples will be subjected to chemical analysis, which is the responsibility of Henning Matthiesen (from the Department of Conservation at the National Museum of Denmark). Analysis of a variety of parameters will provide a detailed picture of preservation conditions at different depths in the deposits, and the results can then be compared to the archaeological assessment – based on visual inspection – of the state of preservation.

MB34 and MB35 come under NIKU project number 156132923. The work was funded in its entirety by *Riksantikvaren* (the Norwegian Directorate for Cultural Heritage).

2. Background information

Standing at the southeasternmost end of what is now Bryggen, *Det Hanseatiske Museum* – a neo-Gothic concoction with an eye-catching (if not downright garish) colour scheme – was built ca. 1870. Its stone foundations are about 1 metre deep and probably rest partially on the remains of timber buildings erected after the major fire of 1702.

The building immediately to the northwest of *Det Hanseatiske Museum* was constructed in 1905, and it is known that the site was excavated to a relatively great depth (thanks to one of Bergen's most prominent historian/archaeologists, Christian Koren Wiberg, who supervised the digging and carried out some recording of archaeological situations).

The building immediately to the northeast of *Det Hanseatiske Museum* was more or less fully excavated under the leadership of Andrzej Gołembnik in 1982 (Gołembnik 1993). The cultural deposits were up to 3.5 metres thick and the bulk of them were from the Middle Ages. The site contained a profusion of foundation timbers, some very massive, and at the bottom was found a row of three of the small, square, stone-filled *bolverkskar* that represent the quayfront at around 1170.

This means that the original deposits on two sides of *Det Hanseatiske Museum* have been removed and replaced with deep basements in modern times.

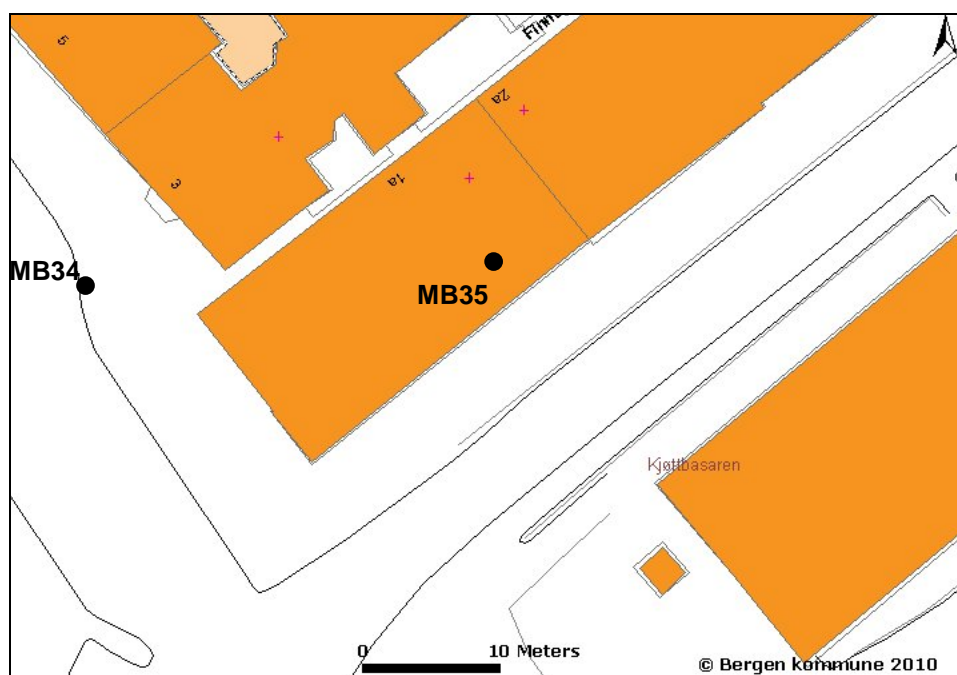


Fig. 1. Map showing approximate positions of MB34 and MB35.

3. Methods

As in most previous dipwell installations, the drilling was done using an auger, a rotary drill, whose total “thread” length was 0.8 metres long (as opposed to the more normal length of 1.0 metre). The drill was driven down under rotation 0.8 metres at a time, and then retracted without rotation so that the adhering soil could be inspected (after having scraped away the outermost material, which could readily become “contaminated” as a result of contact with higher strata).

Documentation/recording adhered to the standard procedures employed by NIKU, and all photography was done using a digital camera. Two ^{14}C -dating samples and a few small finds were collected, and these have been registered in accordance with the principles laid down by Bergen Museum’s *Middelaldersamlingen* (the Medieval Collections). One should note that each borehole has its own reference number for the purposes of finds recording: «BRM 934» for MB34; and «BRM 935» for MB35.

4. Description of the archaeological sediment sequences in the boreholes

4.1 General remarks

In this report, the stratigraphic sequence in each drilling is presented in tabular form. One of the columns is headed PC, which stands for Preservation Category, and the values in this column are in accordance with the State of Preservation Scale.

The various strata distinguished in the drillings have been numbered in the following way. First comes “MBXX” (for the dipwell in question: MB stands for *miljøbrønn*, the Norwegian for “dipwell”) followed by sequential numbering of the individual stratum (from top to bottom). Thus “MB34-01” denotes the first archaeological stratum in dipwell MB34.

The abbreviation “masl” stands for “metres above sea-level”. Depths below sea-level are therefore prefixed with a minus sign.

4.2 Drilling MB34: sediment sequence (visual inspection)

This hole was just a few metres to the northwest of the western corner of *Det Hanseatiske Museum*. Multiconsult AS determined its coordinates as X6701153.65/Y297578.50 (UTM EUREF 32N), and the modern cobbled surface was at an elevation of ca. 2.20 masl (datum NN1954). Weather conditions during the investigation were reasonably good.

The grey shading indicates the strata that are more or less spanned by the dipwell's filter.

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
2.20	1.00	MB34-01				Mod	D0	Cobblestones over light-grey/yellow, fine to coarse sand with some pebbles (possible ditch-fill)
1.00	0	MB34-02				Mod	D0	Loose, grey sandy soil with numerous pieces of brick, some pebbles and a couple of very poorly preserved pieces of wood Pieces of pantile at 0.70 masl Iron nail at 0.40 masl Sherd of modern porcelain at 0.20 masl Very probably back-fill deposited in the construction pit for the building erected in 1905 Groundwater at ca. 0,30 masl (as measured late Nov. 2010)
0	-0.20	MB34-03				Mod	D0	Relatively loose, dark-grey (brownish), very sandy soil with many pebbles and a few pieces of water-logged but still tough wood The wood appeared to be relatively young, and may well be from shuttering that lined the construction pit for the building erected in 1905
-0.20	-0.40	MB34-04				Mod	D4	Probable timber, with some sand and pebbles The wood had a strong odour of freshly cut pinewood, appeared to be relatively young, and may well be from shuttering that lined the construction pit for the building erected in 1905

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-0.40	-1.10	MB34-05		Sample: SFMB1-1 from -0,60 to -0,80 masl		Mod	-	Very loose, quite wet, dark-grey, very sandy soil with many pebbles and numerous pieces/fibres of water-logged but still tough wood, mixed with a small amount of redeposited older cultural-deposit material containing humus, woodchips and some hazelnut shells The wood appeared to be relatively young, and may well be from shuttering that lined the construction pit for the building erected in 1905 Strong H ₂ S odour Very probably back-fill in the construction pit Preservation indefinable
								The drill length from -1.00 to -1.80 masl was poor (wet and loose), and there is a good possibility that it became contaminated with material from higher up during retraction to the surface
-1.10	-2.00	MB34-06		Sample: SFMB1-2 from -1,40 to -1,50 masl 2 sherds of post-medieval redware from -1,30 masl	934/1, 934/2	Post med	C2	Wet, loose, dark-grey fine sand and silt with some poorly preserved woodchips (brown, easily snapped, randomly inclined), localized concentrations of hazelnut shells and mussel shell fragments, a few animal and fish bones, and very little humus No "modern"-looking wood, and no visible pieces of brick/tile Medium H ₂ S odour No darkening Bad preservation

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-2.00	-2.70	MB34-07		Sample: SFMB1-3 from -2,30 to -2,40 masl		Med ?	C3	Loose, not so wet, dark-grey, highly organic refuse stratum with many medium-well-preserved woodchips (both fresh and dull in colour, mostly randomly inclined), many hazelnut shells (mostly crushed, not just halved), some moss and straw (poorly preserved), some mussel shell fragments, a few pieces of birch-bark, a couple of larger fragments of animal bone, very little humus; quite a lot of silt/fine sand and some pebbles Medium H ₂ S odour No darkening Medium preservation
-2.70	-2.85	MB34-08				Med	C4	Compact, brown (with shades of red and grey), laminated turf and roots, possibly with some bog myrtle, a couple of poorly preserved woodchips, and some fine sand in places Medium H ₂ S odour Slow darkening Medium preservation
-2.85	-3.45	MB34-09		Sample: SFMB1-4 from -3,25 to -3,35 masl		Med	C3	Loose, quite dry, dark-grey, highly organic refuse stratum with many medium-well-preserved woodchips (many small-sized, both fresh and dull in colour, mostly randomly inclined), many hazelnut shells (mostly crushed, not just halved), some moss and straw (poorly preserved), some mussel shell fragments, a few pieces of birch-bark, a couple of larger fragments of animal bone and charcoal, very little humus; some silt/fine sand and pebbles Medium H ₂ S odour No darkening Medium preservation

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-3.45	-3.55	MB34-10				Med	-	Dark-grey, ooze-like stratum with a couple of poorly preserved woodchips and one thin pocket of sea-shells (including some whole periwinkles) Weak H ₂ S odour No darkening Preservation indefinable
-3.55	-3.80	MB34-11					-	Wet, loose, grey silt and fine sand with in places many fragments of crushed sea-shell, a couple of small, poorly preserved woodchips, some pebbles and small stones Weak H ₂ S odour Transitional deposit between cultural and natural deposits
-3.80	↓							Sea-bed Hard, light-grey silt and fine sand with many sea-shell fragments
								Rotary drilling abandoned at ca. -4.15 masl

Nine digital photos were taken in all: two (one with flash) of the length from -0.20 to -1.00 masl; one (with flash) of the length from -1.00 to -1.80 masl; one (with flash) of the length from -1.80 to -2.60 masl; two (one with flash) of the length from -2.60 to -3.40 masl; one of the length from -3.40 to -4.05 masl; and two showing the drill rig.

The archaeological deposits are a little less than 3 metres thick – but this is an “artificial” result that is due to the fact that numerous higher-lying (post-medieval) deposits must have been removed in connection with excavation of the construction pit for the building erected in 1905. Medieval deposits may have amounted to a thickness of only about 1.5 metres. No firelayers were observed.

4.3 Drilling MB35: sediment sequence (visual inspection)

This hole was in the street Finnegårdsgaten almost directly southeast of the eastern corner of *Det Hanseatiske Museum*. Multiconsult AS determined its coordinates as X6701153.90/Y297609.40 (UTM EUREF 32N), and the modern asphalt surface was at an elevation of ca. 1.95 masl (datum NN1954). Weather conditions during the investigation were kind.

The grey shading indicates the strata that are more or less spanned by the dipwell's filter.

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
1.95	1.15	MB35-01				Mod	D0	Asphalt over light-grey fine to coarse sand over ditch-fill (the soil on the drill contained pieces of ceramic sewage pipe)

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
1.15	0.90	MB35-02				Med	-	In situ firelayer: quite a lot of brownish clay in the middle portion of the stratum, otherwise mostly charcoal, along with a couple of poorly preserved woodchips Preservation indefinable
0.90	0.80	MB35-03		Sample SFMB2-1		Med	A2 / B2	Wet, brown, very sandy humus with many poorly preserved woodchips (mostly small and lying parallel to plane of deposition) and crushed hazelnut shells; some gravel and a few pieces of red brick/tile Weak H ₂ S odour No darkening Occupation deposit Poor preservation
0.80	0.35	MB35-04				Med	-	Loose, wet, grey, coarse sand with gravel, some pebbles and a few small stones (a couple were fire-cracked), a couple of poorly preserved woodchips, some pieces of burnt animal bone, and in places numerous small pieces of red brick/tile No odour Very probably an eavesdrop deposit Preservation indefinable Groundwater at ca. 0.75 masl (as measured late Nov. 2010)
0.35	0	MB35-05				Med	C3	Horizontal timber, medium-well preserved
0	-0.05	MB35-06				Med	-	Loose, wet, grey, fine to coarse sand with gravel, some pebbles and a few small stones (a couple were fire-cracked), a couple of poorly preserved woodchips, some pieces of burnt animal bone, and a few crushed hazelnut shells No visible pieces of brick/tile No odour Very probably an eavesdrop deposit Preservation indefinable

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-0.05	-0.15	MB35-07		Sample: SFMB35-2		Med	C3	Semi-compact, quite wet, brown, somewhat laminated, highly organic refuse stratum with much diverse vegetable matter (incl. some moss), few woodchips, numerous hazelnut shells (mostly crushed, not just halved), a fragment of animal bone, one strip of leather, very little humus; some silt/fine sand Medium H ₂ S odour Slow darkening Medium preservation
-0.15	-0.50	MB35-08				Med	-	Loose, wet, grey, fine to coarse sand with gravel, some pebbles and a few small stones (a couple were fire-cracked), a couple of poorly preserved woodchips, some pieces of burnt animal bone, and a few crushed hazelnut shells No odour Very probably an eavesdrop deposit Preservation indefinable
-0.50	-0.95	MB35-09		Samples: SFMB2-3 from -0,85 to -0,95 masl ¹⁴ C-sample (hazelnut) from -0,65 masl AD 1180-1235	935/1	Med	C3	Relatively loose, wet, slightly laminated, brown, highly organic refuse stratum with much diverse vegetable matter (incl. some moss), few woodchips, numerous hazelnut shells (mostly crushed, not just halved), several fragments of animal bone (a few quite large), very little humus; some silt/fine sand (increasing proportion of sand with depth) Medium H ₂ S odour Slow darkening Medium preservation
-0.95	-1.10	MB35-10				Med	C3	50/50 mixture of mineral (coarse sand, gravel, pebbles) and organic components (woodchips, hazelnut shells) No odour No darkening Medium preservation
-1.10	-1.25							No soil adhered to drill (removed by stone that became wedged between drill and the borehole's side)

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-1.25	-1.95	MB35-11		Samples: SFMB2-4 from -1,25 to -1,35 masl SFMB2-5 from -1,75 to -1,85 masl ¹⁴ C-sample (hazelnut) from -1,75 masl AD 1170- 1230	935/2	Med	C3	Loose, wet, somewhat laminated, brown, highly organic refuse stratum with much diverse vegetable matter (incl. a lot of poorly preserved moss), a good deal of wood-chips (mostly parallel to plane of deposition, and varying from poorly preserved to medium-well preserved), numerous hazelnut shells (mostly crushed, not just halved), some fragments of fish and animal bone, very little humus; a good deal of fine/medium-fine sand, and some small stones Medium H ₂ S odour Medium-fast darkening Medium preservation (everything considered)
-1.95	↓	MB35-12						Light-grey (with brownish tints) fine sand without visible organic matter Increasing amount of seashell fragments with depth Top of natural
								Rotary drilling abandoned at ca. -3.05 masl

Four digital photos were taken: one of the length from 1.15 to 0.35 masl; one of the length from 0.35 to -0.45 masl; one of the length from -0.45 to -1.25 masl; and one of the length from -1.45 to -2.25 masl.

The archaeological deposits are a little in excess of 3 metres thick, which is somewhat less thick than might have been expected in this area. All of the deposits are from the Middle Ages. There was one definite firelayer situated near the top of the sequence (stratum MB35-02 – see report section 5.5 for a discussion of this stratum's likely dating).

5. Finds & Dating

5.1 MB34

5.1.1 Archaeological material

- two wall-sherds of post-medieval redware (accession nos. 934/1-/2) from stratum no. MB34-06, from around -1,30 masl

5.2 MB35

5.2.1 Archaeological material

No archaeological dating material was recovered.

5.2.2 Radiometric dating

Two samples were taken for ^{14}C -dating. Hazelnuts (accession no. 935/1) from -0.65 masl in stratum MB35-09 were dated to 845 ± 30 BP, calibrated to AD 1180-1235. Hazelnuts (accession no. 935/2) from -1.75 masl in stratum MB35-11 were dated to 850 ± 30 BP, calibrated to AD 1170-1230.

It is perhaps worth pointing out that the dating from the stratigraphically lower stratum is also radiometrically the older, though only slightly.

5.3 Dating: conclusions

In the case of MB34 there is, unfortunately, little to go on when trying to determine at exactly what level the transition from post-medieval to medieval deposits takes place. We have two sherds of post-medieval redware from stratum MB34-06, which stretches down to -2.0 masl – and this will therefore be treated, until further information comes to light, as the level at which the transition from post-medieval to medieval deposits takes place at this particular spot.

As regards MB35, pieces of brick/tile – a material that in Bergen at least is taken to be primarily post-medieval in origin – are present down to ca. 0.35 masl. However, comparison of levels with the situation in Finnegården 3A reveals that the firelayer stratum MB35-02 must represent one of the two major fires that occurred in the decades on either side of 1400 (1393 and 1413) – and MB35-02 was encountered at 1.15 masl.

In fact, in the southwestern part of the excavation site Finnegården 3A, the transition from medieval to post-medieval deposits took place somewhere around 1.50 masl. In MB35, this part of the deposit sequence was of course truncated by modern activities.

There is therefore – as far as we can tell – a difference of about 3.5 metres between the level of the medieval/post-medieval transition in the two dipwells. This is, at first sight, admittedly considerable – particularly in view of the fact that the drop occurs over a distance of less than 30 metres. However, when one recalls that MB34 is located well out in the infilled harbour area – and some distance out beyond the late medieval quayfront – the difference becomes more comprehensible.

As for the two ^{14}C -datings from MB35, the deeper one is certainly in good accordance with the dating of the earliest phases at Finnegården 3A. The higher one, on the other hand, is older than one would have expected at this depth – but at least it is not younger than expected, which would have been harder to explain!

6. State of preservation assessments

Assessments of the “health” of the archaeological sequences are presented in table 1 below. Generally, the situation can be characterized as just satisfactory, at most. However, it must be pointed out that, in the case of layers exhibiting poor preservation, archaeological assessments of the state of preservation of strata in boreholes cannot provide a sure determination as to whether the observed decomposition is due to ongoing processes, or took place at the time of the layer’s deposition instead.

Table 1. Schematic comparative presentation of state of preservation (archaeological assessment) of the deposits in MB34 and MB35. Each individual symbol represents a length of about 20 centimetres, and depth from the surface increases from left to right. Grey shading indicates the approximate position of the dipwell's filter.

MB34	MB35	Masl
§		3.0 – 2.0
§§§§§	§§§§?	2.0 – 1.0
§§§§§	X??XX	1.0 – 0.0
§X???	X??XX	0.0 – -1.0
XXXXX	XXXX	-1.0 – -2.0
XXXXX	N	-2.0 – -3.0
XX??N		-3.0 – -4.0

SYMBOLS	
X - VERY POOR	? - INDEFINABLE
X - POOR	0 - NO SOIL RECOVERED
X - MEDIUM	N - NATURAL
X - GOOD	A - DRILLING ABANDONED
X - VERY GOOD	§ - INORGANIC

As for MB34, we can safely leave the three uppermost metres of modern deposits out of consideration. The bulk of the deposits where it was possible to assess state of preservation were no better than medium-well preserved; there was only one thin stratum displaying a good state of preservation.

This situation may have been brought about by a combination of the following factors:

- the depth to which the construction pit for the 1905 building was excavated;
- the relatively aerated soil that was used to backfill the construction pit;
- blowouts (at least two in number) of the water main running along Bryggen;
- continued exposure to sulphate-rich seawater

In MB35, we again find that the bulk of the deposits where it was possible to carry out state of preservation assessments were no better than medium-well preserved. The main problem in this area may be its proximity to the site of Finnegården 3A, which was excavated more or less completely to allow construction of a cellar. This may well have had a detrimental effect on the water-table. A secondary problem could be intrusion of sulphate-rich seawater via some of the more permeable sandy strata.

All in all, the prognosis for most of the lower-lying organic deposits is uncertain. What is sure is that *Riksantikvaren* should refuse permission to any subsurface works that might worsen preservation conditions in the immediate area.

7. Concluding remarks

In MB34, the generally high content of sand and the apparently random inclination of components such as woodchips in the most of the archaeological strata may indicate that these deposits were subjected to some form of dredging, quite possibly with a mud rake, during the period when they constituted the harbour bottom. The relatively high permeability of these deposits – and this includes some of the strata in MB35 too – may pose a substantial threat to the more organic deposits in the area closest to the harbour. This is treated in detail in Matthiesen's geochemical report on the composition of soil and groundwater in dipwells MB24, MB25, MB26, MB27 and FB1 (Matthiesen 2008), and will not be discussed further here.

As for *Det Hanseatiske Museum*, it is not surprising that the building should be suffering from differential settling. After all, it is bounded on two sides (northwest and northeast) by areas that have been excavated either entirely or to a considerable depth, and this must surely have had a significantly negative effect on the stability and integrity of the cultural deposits that support the building's foundations.

8. References

Gølembnik, A. 1993. Report on the excavations in Finnegården 3A. – Riksantikvarens utgravningskontor for Bergen. [Organized for publication by A. R. Dunlop.]

Matthiesen, H., 2008. Composition of soil and groundwater in dipwells MB24, 25, 26, 27 and FB1 at the quay front of Bryggen, Bergen. – Copenhagen: National Museum of Denmark, Department of Conservation. Report no. 10832-0014-1.

9. Documentation (NIKU)

- Sequences noted down in *Boreprøvebok* (drilling logbook) 6 and in NIKU's FEDOBA
- 13 digital photos (9 for MB34, 4 for MB35)
- Finds/samples information entered into MUSIT *Gjenstandsbasen, Bergen Museum*

Photo list

Bildenummer	Undersøkelsestype	Motiv
niku_ark_101145	Grunnboring (naver)	Naverboring MB34: lengde fra -0,2 til -1,0 moh
niku_ark_101146	Grunnboring (naver)	Naverboring MB34: fra -0,2 til -1,0 moh (blitz)
niku_ark_101147	Grunnboring (naver)	Naverboring MB34: fra -1,0 til -1,8 moh (blitz)
niku_ark_101148	Grunnboring (naver)	Naverboring MB34: fra -1,8 til -2,6 moh (blitz)
niku_ark_101149	Grunnboring (naver)	Naverboring MB34: fra -2,6 til -3,4 moh (blitz)
niku_ark_101150	Grunnboring (naver)	Naverboring MB34: fra -2,6 til -3,4 moh
niku_ark_101151	Grunnboring (naver)	Naverboring MB34: situasjonsbilde
niku_ark_101152	Grunnboring (naver)	Naverboring MB34: situasjonsbilde
niku_ark_101153	Grunnboring (naver)	Naverboring MB34: fra -3,4 til -4,05 moh (blitz)
niku_ark_101154	Grunnboring (naver)	Naverboring MB35: lengde fra 1,15 til 0,35 moh
niku_ark_101155	Grunnboring (naver)	Naverboring MB35: fra 0,35 til -0,45 moh
niku_ark_101156	Grunnboring (naver)	Naverboring MB35: fra -1,45 til -2,25 moh
niku_ark_101157	Grunnboring (naver)	Naverboring MB35: fra -0,45 til -1,25 moh