



Rapport NIKU Arkeologi avdeling Bergen 28/2008

**The Bryggen Monitoring Project,
Part 4: report on the archaeological
investigation of five dipwell
boreholes, 2005**

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1. Introduction

In early April 2005 a new round of drilling was undertaken to install five dipwells in and around the World Heritage Site of Bryggen. This was in line with plans for a step-by-step expansion of the dipwell grid for monitoring the deposits on which Bryggen rests. The new dipwells are numbered MB10, MB12, MB13, MB14 and MB16 (the last-mentioned installed in late November 2005 in connection with monitoring of deep groundwater).

And in connection with a separate project a sixth dipwell – designated MB11 – was installed further up the hillside behind Bryggen, some way to the rear of the property Øvregaten 19 (see separate report: Dunlop, 2005). Though not formally part of the Bryggen monitoring programme, this dipwell should yield some valuable data concerning part of the general groundwater catchment area.

The envisaged grid of dipwells is drawing steadily nearer to completion, and the dipwells installed in this phase of the project have helped fill out a number of grid lines:

- dipwells MB10, MB12 and MB14 form – together with MB11 and MB9 (the latter a short dipwell not far from the seaward gable of Holmedalsgården tenement's northern building-row) – an almost straight line running from north-east to south-west along the southern edge of the Bryggen area;
- dipwell MB13 forms a line with dipwells MB4/MB5 and MB7/MB8, this line running from north-east to south-west along the northern edge of the Bryggen area;
- dipwells MB13 and MB14 form – together with MB1 and MB2 in Svensgården tenement – a line running from north-west to south-east through roughly the middle of the Bryggen area.

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 NOTEBY doing the drilling work and dipwell installation. The purpose of the work was two-fold: a) to install the dipwells; 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. Analysing a variety of parameters will provide a detailed picture of the state of preservation of deposits at different depths, and the results can then be compared to the archaeological assessment based on visual inspection.

2. Background information

Annual surveys of measuring points on buildings and ground surface within the World Heritage Site of Bryggen have revealed that settling is taking place at different rates – from almost nothing to alarmingly fast – in different parts of the area. Data from dipwells already in place (cf. Jensen 2003; Matthiesen 2002, 2004, 2005a; see also Matthiesen 2005b for another line of research) have shown that this is chiefly linked to groundwater-level: the further the watertable is from the surface, the higher the rate of settling. Groundwater monitoring thus forms a very important part of the overall work aimed at ensuring the continued preservation of the World Heritage Site of Bryggen.

3. Methods

As in most previous dipwell installations, the drilling was done using a rotary drill whose total “thread” length was one metre. The drill was driven down under rotation one metre 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's Bergen office, apart from the fact that all photography was done using a digital camera. A few small finds were collected, along with samples for ¹⁴C-dating, and these have been registered in accordance with the

principles laid down by Bryggens Museum. One should note that each borehole has its own reference number for the purposes of finds recording: BRM 600 for MB10; BRM 601 for MB12; BRM 602 for MB13; BRM 603 for MB14; and BRM 619 for MB16. Details of information on finds and photos are to be found in separate tables in an MS-Access database (filename *156132904dba.mdb*).

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).

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

4.2 MB10: sediment sequence (visual inspection)

This hole was towards the south-western end of the extensive open area in the middle of Holmedalsgården’s southern building-row. NOTEBY determined its coordinates as X6701277.85/Y297505.5 (UTM 84 EUREF 32N), and the modern tarmac surface was at an elevation of ca. 1.45 masl.

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
1.45	0.90	MB10-01				Mod	E0	Tarmac over modern fill of stones/large pebbles
0.90	0.70	MB10-02		Sample: MB10 Pose 1		Mod	A0	Timber, relatively fresh-looking in colour and consistency Preservation indefinable
0.70	0.35	MB10-03				Post med	A0 B0	Probably dark-grey/black culture-layer with some humus content and charcoal (but very little material adhered to the drill) Groundwater-level at ca. 0.45 masl Preservation indefinable
0.35	-0.10	MB10-04		Sample: MB10 Pose 2		Post med	C3	Grey/black, very moist humus with many relatively fresh-looking woodchips Medium preservation
-0.10	-0.45	MB10-05				Post med (?)	C0	Medium-grey humus with sand, gravel and pebbles, still quite moist, fewer woodchips than in stratum above Preservation indefinable
-0.45	-0.90	MB10-06				Med (?)	C4	Very organic, somewhat laminated: fresh-looking woodchips, moss, birch-bark pieces, twigs, and a large amount of hazelnut shells; not much humus Good preservation

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-0.90	-1.10	MB10-07				Med (?)	C3	Medium-grey humus with sand, gravel, pebbles, and some woodchips Medium preservation
-1.10	-1.35	MB10-08				Med	C4	Very organic, somewhat laminated: fresh-looking woodchips (some very large), moss, birch-bark pieces, twigs, and a large quantity of hazelnut shells; grey, sandy humus present between the macroscopic constituents Good preservation
-1.35	-1.65	MB10-09				Med	C0	Difficult to say because of lack of adhering material: possibly sandy humus with charcoal and some animal bone Preservation indefinable
-1.65	-2.25	MB10-10				Med	C4	Medium-brown/yellow organic stratum with little humus, mostly small woodchips with numerous hazelnut shells and some animal bone Good preservation
-2.25	-5.75	MB10-11		AD 1200-1270 (¹⁴ C-dating sample MB10 Pose 5 from -4.05 to -4.25 masl; hazelnuts) Samples: MB10 Pose 3 from -2.25 to -2.45 masl MB10 Pose 4 from -3.15 to -3.35 masl MB10 Pose 6 from -5.25 to -5.45masl	600/1	Med	C5	Very organic, but almost no humus: mostly plant remains and moss with some very fresh woodchips, twigs, hazelnut shells, some animal bone etc, along with animal dung and straw Deposit showed no real stratum differentiation, just variations in compactness and lamination, but with increasing amount of moss below -5.25 masl Quantity of possible wood-fibre rope from -4.75 to -5.25 masl Excellent preservation
-5.75	-6.35	MB10-12		1 large fragment of flint from -6.15 masl Sample: MB10 Pose 7	600/2	Med	C4	Homogeneous brown/grey humus, surprisingly compact, with some fresh-looking woodchips and hazelnut shells, and a small amount of moss Good preservation
-6.35	-7.25 (ca.)	MB10-13					C0	Light-brown/greyish fine beach sand, well-sorted by wave action (but not much soil adhered to the drill from -6.55 to -7.25 masl)
-7.25 (ca.)	-	MB10-14						Transition to light-blue/grey-/green morainic sand

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
								Rotary drilling abandoned at -7.55 masl
-10.25 (ca.)								Bedrock

The archaeological deposits are a little more than 7 metres thick, which is no more than is to be expected in this particular area. No firelayers were visible in the sequence (it is worth noting that very few firelayers can be detected in the boreholes in and around Bryggen – something that still gives cause for surprise).

Regarding the “health” of the deposits, the state of preservation of the organic matter appeared – on visual inspection at least – to remain good throughout the entire length of the borehole (excluding the uppermost metre, about which little can be said with certainty).

4.3 MB12: sediment sequence (visual inspection)

This hole was some 10 metres seawards of roughly the middle of the seaward gable of Holmedalsgården’s northern building-row. NOTEBY determined its coordinates as X6701258.55/-Y297481.39 (UTM 84 EUREF 32N), and the modern planking was at an elevation of ca. 1.15 masl.

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
1.15	-0.35	MB12-01				Mod	E0	Planking over tarmac, over concrete, over modern fill of stones/large pebbles with pieces of brick
-0.35	-0.95	MB12-02		Sample: MB12 Pose 1		Post med	C2	Dark-grey earth, mostly relatively dry, with a lot of sand, gravel, stones and pieces of brick, some charcoal and a few woodchips, quite rotted Poor preservation
-0.95	-1.20	MB12-03				Post med	C0	Grey sand (fine to coarse) with a few small pieces of red brick
-1.20	-1.75	MB12-04		Sample: MB12 Pose 2 from -1.25 to -1.45 masl		Post med	C2	Sandy, gravelly, stony, grey humus with a quantity of half-rotted woodchips, some pieces of birch-bark and small pieces of red brick Strong H ₂ S stench Half-rotted timber from -1.45 to -1.75 masl Poor preservation
-1.75	-2.95	MB12-05		Sample: MB12 Pose 3 from -2.45 to -2.65 masl		Post med	C4	Light-grey gravelly sand (fine to medium fine) with a great deal of relatively well-preserved, small to large woodchips, numerous small pieces of birch-bark, quite a few pebbles; very little humus H ₂ S stench less pronounced Good preservation

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-2.95	-6.30	MB12-06		3 sherds of quite modern-looking glass (not retained) from ca. -4.15 masl Piece of leather from -5.75 masl, and a second from -6.25 masl (neither retained) Sample: MB12 Pose 4 from -5.15 to -5.45 masl		Post med and Med	C4	Very organic, but almost no humus: refuse from wood-working dominated, from sawdust (a great deal) to relatively large woodchips, along with twigs, hazelnut shells, pieces of birch-bark, some animal bone and fragments of mussel shells; on the mineral side, some sand and a few stones (with an increasing content of fine to coarse sand from -3.85 to -4.85 masl) No visible pieces of brick Deposit showed no real layer differentiation, just variations in compactness and lamination, but with increasing amount of soft, grey humus below -4.85 masl (and the deposit was most compact and dry below -4.85 masl too) Concentration of oyster shells and fish bones from -4.45 to -4.75 masl Patch of pure, laminated moss at -4.75 masl Increasing quantity of mussel shell fragments below -4.85 masl Good preservation, but the woodchips could be broken in two without much effort in the upper half of the deposit
-6.30	-6.70	MB12-07				Med	C0	Light-grey silt and fine sand with a quantity of sea shell fragments; wetter and less compact than the overlying deposit
-6.70	-7.45	MB12-08		Sample: MB12 Pose 5 from -7.25 to -7.45 masl		Med	C4	Dung/straw and plant remains with numerous woodchips (most inclined "horizontally" and hard to break); deposit was dry and very compact Good preservation
-7.45	-7.60	MB12-09				Med	C0	Light-grey silt and fine sand with a quantity of sea shell fragments; wetter and less compact than the overlying deposit

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-7.60	-8.25	MB12-10		AD 1150-1220 (¹⁴ C-dating sample MB12 Pose 6 from ca. -7.85 masl; hazelnuts) Piece of leather (precise depth uncertain; <u>not retained</u>)	601/1	Med	C4	As for -6.70 to -7.45 masl, but with some thin roots and twigs; decreasing quantity of woodchips and larger organic components with depth; mussel shell fragments still present Good preservation (as far as one could tell)
-8.25	?	MB12-11					C0	Transition to sea-bed deposit: medium-brownish sand with many sea shell fragments
								Rotary drilling abandoned at ca. -8.85 masl

The archaeological deposits are just about 8 metres thick, which is less thick than might have been expected in this harbourfront area. The absence of firelayers in the sequence is no real surprise in view of the borehole's location well out beyond the built-up area itself.

Regarding the "health" of the deposits, there appears to be – on visual inspection at least – only one zone where the state of preservation of the organic matter can be classified as poor:

- from -0.35 to -1.75 masl (in other words, roughly the uppermost 1.5 metres of the cultural deposits; the covering stone fill can be disregarded).

4.4 MB13: sediment sequence (visual inspection)

This hole was in the former eavesdrop area between Bredsgården and Bugården tenements, roughly halfway between the existing dipwell pairs MB4/MB5 and MB7/MB8. NOTEBY determined its coordinates as X6701355.87/Y297477.47 (UTM 84 EUREF 32N), and the modern surface was at an elevation of ca. 2.10 masl.

It is worth noting that the borehole is very close to the sheet piling around the hotel site.

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
2.10	0.80	MB13-01				Mod	E0	Cobblestones in mortar down to 1.70 masl, over modern brownish earth fill containing stones/large pebbles with pieces of brick (NB but not the loose stony fill found elsewhere along the sheet piling) Preservation indefinable
0.80	0.60	MB13-02				Mod	A0	Apparently grey-black sandy earth with pieces of brick (but not much material adhered to the drill) Preservation indefinable

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
0.60	-0.35	MB13-03		Samples: MB13 Pose 1 from 0.50 to 0.30 masl MB13 Pose 2 from -0.05 to -0.35 masl		Mod (?)	B2 C2	Sandy, brown humus with a quantity of relatively decomposed woodchips, some small stones and small pieces of red brick (not much material on the drill from 0.40 to 0.10 masl) 1 piece of plastic at ca. 0.50 masl Groundwater-level at ca. 0.40 masl? Poor preservation – may be redeposited earth in trench for sheet piling
-0.35	-0.45	MB13-04				Med (?)	C0	Coarse grey sand and gravel, wet and loose
-0.45	-0.70	MB13-05		Sample: MB13 Pose 3		Med	C4	Dark-brown, compact humus with a quantity of woodchips, pieces of birch-bark and hazelnut shells, but small pockets of sand/gravel probably present as well Fairly well-preserved timber from -0.55 to -0.70 masl Good preservation
-0.70	-1.40	MB13-06				Med	C4	Fairly loose, grey fine to coarse sand, gravel and pebbles with a quantity of relatively well-preserved, small to large woodchips (most probably inclined “horizontally”), some hazelnut shells and animal bone fragments, a few pieces of birch-bark; almost no humus Good preservation
-1.40	-1.60	MB13-07				Med	C4	Timber pieces, fresh-looking and solid Good preservation
-1.60	-1.80	MB13-08		Sample: MB13 Pose 4		Med	C4	Dark-grey/brown humus with a quantity of fairly well-preserved woodchips (most probably inclined “horizontally”) and a few pieces of birch-bark Good preservation
-1.80	-2.30	MB13-09		Sample: MB13 Pose 5		Med	C5	Very organic, but almost no humus; very compact, laminated moss and some other plant remains, along with a small amount of excrement Possible fragment of wood-fibre rope at -2.20 masl Excellent preservation

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-2.30	-2.65	MB13-10				Med	C4	Fairly loose, grey fine to coarse sand, gravel and pebbles with a quantity of relatively well-preserved, small to large woodchips (most probably inclined "horizontally"), some hazelnut shells and animal bone fragments, a few pieces of birch-bark; almost no humus Good preservation
-2.65	-2.80	MB13-11				Med	C5	Very organic, but almost no humus; very compact, laminated moss and some other plant remains, including some woodchips, along with a small amount of excrement Excellent preservation
-2.80	-2.90	MB13-12				Med	C0	Probably stone with mortar
-2.90	-3.50	MB13-13		AD 1045-1215 (¹⁴ C-dating sample MB13 Pose 6 from -3.40 to -3.50 masl; hazelnuts)	602/1	Med	C4	Fairly loose, grey fine to coarse sand, gravel and pebbles with a quantity of relatively well-preserved, small to large woodchips (most probably inclined "horizontally"), some hazelnut shells and animal bone fragments, a few pieces of birch-bark; some interspersed pockets of moss as well; almost no humus Concentration of hazelnut shells from -3.30 to -3.50 masl Good preservation
-3.50	-3.65	MB13-14				Med	C0	Grey coarse sand and gravel, wet and loose
-3.65	-4.10	MB13-15	MB16-03			Med	C4	Fairly loose, grey fine to coarse sand, gravel and pebbles with a quantity of relatively well-preserved, small to large woodchips (most probably inclined "horizontally"), some hazelnut shells and animal bone fragments, a few pieces of birch-bark; some interspersed pockets of moss as well; almost no humus Good preservation
-4.10	-4.30	MB13-16				Med	C0	Grey-black fine to coarse sand with gravel and a quantity of ash

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-4.30	-4.40	MB13-17				Med	C4	Fairly loose, grey fine to coarse sand, gravel and pebbles with a quantity of relatively well-preserved, small to large woodchips (most probably inclined "horizontally"), some hazelnut shells and animal bone fragments, a few pieces of birch-bark; almost no humus Good preservation
-4.40	-6.05	MB13-18	MB16-05	Samples: MB13 Pose 7 from -4.50 to -4.70 masl MB13 Pose 8 from -5.50 to -5.70 masl		Med (early)	C5	Very organic, but almost no humus; very compact, laminated moss and some other plant remains, a substantial quantity of well-preserved woodchips (mostly inclined "horizontally"), along with a small amount of excrement Deposit showed no real stratum differentiation, just variations in compactness and lamination, especially from -4.90 to -6.05 masl, but most of the deposit was very compact Excellent preservation; the woodchips were difficult to snap
-6.05	-6.50	MB13-19					C0	Transition to natural deposits: light-grey/green fine to coarse sand with gravel, pebbles and a few larger-sized, rounded stones No sea shell fragments or organic components at all
-6.50	?	MB13-20						As above, but now with finer sand and a quantity of silt, along with sea shell fragments; more light-brown in colour Drilled down to ca. -8.00 masl, but no real change in deposit below -6.50 masl, apart from increasing proportion of silt and fine sand
								Rotary drilling abandoned at ca. -8.00 masl
-11.00 (ca.)	↓							Bedrock: data from nearby MB17 (installed 1.11.2005)

The archaeological deposits are a little less than 7 metres thick, which is about what one might expect in this area. No firelayers were visible in the sequence.

Regarding the "health" of the deposits, there appears to be – on visual inspection at least – only one zone where the state of preservation of the organic matter can be classified as poor:

- from 0.80 to -0.35 masl (in other words, roughly the uppermost metre of the cultural deposits; the covering earth fill can be disregarded).

One sherd of medieval pottery (accession no. 602/2) was recovered from a depth of between 5.00 and 6.00 m (from between -2.90 to -3.90 masl; precise depth uncertain).

4.5 MB14: sediment sequence (visual inspection)

This hole was towards the north-eastern end of the extensive open area in the middle of Holmedalsgården's southern building-row. NOTEBY determined its coordinates as X6701295.77/Y297534.3 (UTM 84 EUREF 32N), and the modern shingle surface was at an elevation of ca. 2.30 masl.

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
2.30	2.20	MB14-01				Mod	E0	Shingle
2.20	2.10	MB14-02				Mod	E0	Smashed pantiles and some stones
2.10	1.80	MB14-03				Mod	A0	Grey, sticky soil with pieces of brick and stones
1.80	1.70	MB14-04				1702 fire?	A0	Firelayer, but only charcoal visible Preservation indefinable
1.70	0.55	MB14-05		1 fragment of post-medieval windowpane (not retained) Samples: MB14 Pose 1 1.60-1.40masl MB14 Pose 2: 0.80-0.60masl		Post med	A2 B2 C2	Dark-grey/brown humus (slightly sandy, but sticky) with some half-rotted woodchips, birch-bark pieces and hazelnut shells Relatively dry, apart from at ca. 1.30 masl (groundwater?) Poor preservation
0.55	0.30?	MB14-06				Post med (?)	C0	Probably in situ firelayer: patches of reddish ash/sand present in amongst charcoal Preservation indefinable
0.30?	-0.30	MB14-07				Post med (?)	C3	Most of the soil was washed off the drill on its retraction up through the groundwater Some larger pieces of medium-preserved wood at 0.20-0.00 masl
-0.30	-1.00	MB14-08				Med (?)	C4	Very organic, but almost no humus: fine pieces of plant remains with a great quantity of laminated moss, and probably some excrement too, along with hazelnut shells and fresh-looking woodchips Strong H ₂ S stench Good preservation
-1.00	-1.20	MB14-09				Med (?)	C4	Timber pieces, fresh-looking and solid Good preservation

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-1.20	-4.05	MB14-10		AD 1035-1185 (¹⁴ C-dating sample taken from MB14 Pose 5 (-3.80/-4.00 masl; birch-bark) 1 piece of metallic slag (?) from -2.30 masl Samples: MB14 Pose 3 from -1.40 to -1.60 masl MB14 Pose 4 from -3.20 to -3.40 masl MB14 Pose 5 from -3.80 to -4.05 masl	603/1 603/2	Med	C5	Very organic, but almost no humus: mostly plant remains, dung/straw, a considerable quantity of fresh woodchips along with some twigs and hazelnut shells; very few fragments of animal bone Surprisingly soft and runny, and a lot of material was washed off the drill, especially down to -2.70 masl, but then very compact in the startum's final metre or so Some differentiation, as follows: -1.70 to -2.70 masl: probably more laminated moss than dung/straw, and varying quantities of woodchips, twigs and hazelnut shells -2.70 to -4.05 masl: definitely laminated moss, and varying quantities of woodchips, twigs and hazelnut shells Excellent preservation in especially lower half of deposit
-4.05	-4.15	MB14-11					C0	Transition to light-grey/brown sand with sea shell fragments
-4.15	↓	MB14-12						Seabed deposit: grey, relatively coarse sand with sea shell fragments
								Rotary drilling abandoned at ca. -4.70 masl

The archaeological deposits are about 6 metres thick, which is about what one might expect in this area. Two probable firelayers were visible in the sequence.

Regarding the "health" of the deposits, there appear to be – on visual inspection at least – only the one zone where the state of preservation can be classified as relatively poor:

- from 1.80 to 0.30(?) masl (in other words, roughly the uppermost 1.5 metres of the cultural deposits).

4.6 MB16: sediment sequence (visual inspection)

This hole was close by MB13, but on the hotel side of the sheet piling. NOTEBY determined its coordinates as X67235.10/Y59859.50 (no UTM coordinates available), and the modern shingle surface was at an elevation of ca. 2.10 masl.

The sky was overcast and some snow fell during drilling.

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
2.10	-3.40	MB16-01				Mod	-	Protective sleeving down through loose, stony fill

Masl		Stratum number	Same as stratum no.	Samples/ ¹⁴ C-dating/ finds	Accession number	Period	PC	Description
From	To							
-3.40	-3.90	MB16-02				Med	C0	(Protective piping down to 6 metres under surface) Drill boss reported organic/sandy culture-layer present in final 0.5 metre of length
-3.90	-4.15	MB16-03	MB13-15			Med	C2 C3	Relatively compact, homogeneous, medium-grey sand (mostly fine) and some gravel, with a very few relatively decomposed woodchips Poor/medium preservation
-4.15	-4.30	MB16-04		Sample: MB16 1 (soil)	619/1	Med	C4	Compact, dark-brown to brown woodchips (small and apparently inclined “horizontally”, mostly), still with quite a good deal of fine sand, and some hazelnut shells Good preservation
-4.30	-5.60	MB16-05	MB13-18	AD 970-1010 (¹⁴ C-dating sample MB16 5 from -4.50 masl; hazelnuts) Samples: MB16 2 (soil) from -4.70 to -4.80 masl MB16 3 (leather) from -4.40 masl MB16 4 (bone) from -4.40 masl MB16 6 (soil) from -5.10 to -5.20 masl	619/5 619/2 619/3 619/4 619/6	Viking Age/ Med (early)	C5	Very organic, but almost no humus; compact, laminated moss and some other plant matter, a substantial quantity of well-preserved woodchips (mostly inclined “horizontally”) Marked, quite rapid change to darker colour Excellent preservation
								Rotary drilling abandoned at ca. -5.60 masl

Regarding the “health” of the deposits in MB16, one can say that the deposits directly beneath the hotel basement/garage’s floor – the underside of which lies at around -3.30 masl – were, not unexpectedly, in a poor state of preservation, but the underlying deposits were surprisingly well preserved. The picture is of course incomplete, as the drilling did not extend all the way down to the natural deposits.

The prognosis for these deposits is good enough, always providing there is no change in preservation conditions. And this is not likely, since it is virtually impossible to lower the water-table under the hotel’s basement.

5. Finds & Dating

5.1 General remarks

Three of the radiocarbon datings were carried out by the National Dating Laboratory, the Norwegian University of Science and Technology, Trondheim, while the other two (from MB12 and MB16) were

dated by Accelerator Mass Spectrometry at the University of Uppsala, Sweden. The archaeological finds were examined by Dunlop.

5.2 MB10

Radiocarbon dating

The sample (accession number 600/1) from -4.05 to -4.25 masl yielded a result of BP 775±35, calibrated to AD 1200-1270.

Archaeological material

- one large fragment of flint (accession no. 600/2) from -6.15 masl

5.3 MB12

Radiocarbon dating

The sample (accession number 601/1) from ca. -7.85 masl yielded a result of BP 875±35, calibrated to AD 1150-1220.

Archaeological material

- from ca. -4.15 masl came three sherds of relatively modern-looking glass (not retained)
- from -5.75 masl came a small piece of leather, plus a second from -6.25 masl (neither retained)

5.4 MB13

Radiocarbon dating

The sample (accession number 602/1) from -3.40 to -3.50 masl yielded a result of BP 900±40, calibrated to AD 1045-1215.

Archaeological material

- one wall-sherd of medieval pottery (accession number 602/2), probably a cooking-pot type, was recovered from between -2.90 masl to -3.90 masl (but the precise depth could not be ascertained)

5.5 MB14

Radiocarbon dating

The sample (accession number 603/1) from -3.80 to -4.00 masl yielded a result of BP 920±45, calibrated to AD 1035-1185.

Archaeological material

- from -2.30 masl came a piece of metallic slag(?) (accession no. 603/2).

5.6 MB16

Radiocarbon dating

The sample (accession number 619/5) from -4.50 masl yielded a result of BP 1070±35, calibrated to AD 970-1010, which places it in the late Viking Age. This is somewhat older than expected, given the fact that the sample almost certainly did not come from the very bottom of the archaeological deposit sequence. Nor can one explain it by claiming that the sample consisted of material that was much older than the context in which it was found – the sample consisted of hazelnut shells, which were normally consumed and discarded more or less immediately. Nor does the stratum exhibit any signs of having been redeposited – in fact, quite the contrary. One must therefore conclude, for the time being, that the dating is somewhat anomalous.

5.7 Dating: conclusion

The radiocarbon datings provide confirmation – as expected – that the deeper-lying deposits are early medieval in date, if not even older in some cases. 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 in this particular area. However, we can at least ascertain the minimum elevation that the medieval deposits reach up to. This data will be plotted onto a map at a later time.

6. Concluding remarks

Assessments of the “health” of the archaeological sequences have been presented separately under the description of each drilling, and there is nothing to be gained from going into detail here. Generally,

the situation can be characterized as pretty good for the most part – see table 1 below – but there are definite differences depending on location within the Bryggen area. However, it must be pointed out that, in the case of layers exhibiting poor preservation, archaeological assessments of the state of preservation of strata found by drilling (as opposed to strata examined on excavation sites) cannot really reveal whether this 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 various drillings at Bryggen (table format developed from Christensson). Each individual symbol represents a length of about 20 centimetres, and depth from the surface increases from left to right.

Rotary drilling 1 (2002)	MB4 (coring, 2002)	MB10	MB12	MB13	MB14	MB16	Masl
		?		?????	?XXXX		2.0 – 1.0
?XXXX	XXXXX	???XX	?????	??XXX	XX???		1.0 – 0.0
XXXXX	?????	??XXX	??XXX	XXXXX	?XXXX		0.0 – -1.0
XXXXX	00000	XX?XX	?XXXX	XXXXX	XXXXX		-1.0 – -2.0
?XXXX	00000	XXXXX	XXXXX	XXXXX	XXXXX		-2.0 – -3.0
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	???	-3.0 – -4.0
XXXXX	?????	XXXXX	XXXXX	XXXXX	N	XXXXX	-4.0 – -5.0
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX		XXXA	-5.0 – -6.0
XXXXX	??XA	XXN	XX??X	N			-6.0 – -7.0
XX???			XX?XX				-7.0 – -8.0
XXXXX			XN				-8.0 – -9.0
XXN							-9.0 – -10.0

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

MB13 in particular needs some further comment:

- It provides no indication in support of an idea proposed earlier – based on conclusions drawn in connection with the MB4/MB5 drillings (Dunlop 2003) – that the culture-layers and their organic contents may be subject to “attack” from the bottom up in the Bredsgården area (cf. lowest metre of Rotary drilling 1 in Table 1 above).
- Having said that, MB13 is situated quite a way back from the front in relation to the above-mentioned drillings, so it is not possible to dismiss this idea as yet.
- The lower deposits seem to be little affected despite their close proximity to the sheet piling.

One thing to note in particular is that no smell of pollution (meaning hydrocarbons) was detected in any of the boreholes.

7. References

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Matthiesen, H., 2005b. Influence of piling on cultural deposits at Bryggen, Bergen. – Copenhagen: National Museum of Denmark, Department of Conservation. Report no. 10832-0007-1.

8. Documentation (NIKU)

- Sequences noted down in *Boreprøvebok* (drilling logbook) 2
- 27 digital photos (6 for MB10, 5 for MB12, 10 for MB13, 2 for MB14, 4 for MB16)
- MS-Access database (filename *156132904dba.mdb*)