

NIKU oppdragsrapport 43/2009

# **The Bryggen Monitoring Project, Part 8: report on the archaeological investigation of two dipwell boreholes, Holmedalsgården and Svensgården, 2009**

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## Sammendrag

Det er satt ned to miljøbrønner, MB28 and MB29 i fremre del av henholdsvis Holmedalsgården 8a og Svensgården 5a, Bryggen, Bergen. Hovedformålet med miljøbrønnene er å undersøke inntrengning og effekten av saltvann fra Vågen. Begge steder ble det tatt ut prøver i hele boresekvansens dybde. Lagene er dokumentert ved foto og beskrivelse, og det er tatt ut dateringsmateriale i form av <sup>14</sup>C-prøver. Kulturlagenes bevaringsgrad er også vurdert. Kulturlagenes bevaringsgrad øker med dybden, stort sett. I MB28 er bevaringen best fra ca. -1,0 til -4,0 m.o.h. og fra ca. -5,5 til -8,0 m.o.h. Fra 0,0 til -0,65, -2,0 til -2,5 og -3,5 til -4,0 m.o.h., er massene spesielt fuktige, et tegn på at vanngjennomstrømmingen er størst her. For MB29 er bevaringen best fra -3,5 til -6,0 m.o.h. Fra ca.-1,0 til -3,5 m.o.h., i sjiktene mellom ca. -4,5 and -5,5 m.o.h., og mellom -7,0 til -7,5 m.o.h., er massene mest fuktige. Ellers er bevaringen i grunnvannsnivå, i de tilfellene den har kunnet bedømmes, vurdert til medium god.

<b>NIKU prosjektnummer</b>	<b>156132919</b>
<b>Berørt område</b>	<b>Bryggen, Bergen</b>
<b>Gnr/Bnr</b>	<b>167/1610; 167/1622</b>
<b>Oppdragets art</b>	<b>Miljøovervåking – grunnboring og nedsetting av to miljøbrønner</b>
<b>Oppdragsgiver</b>	<b>Riksantikvaren</b>
<b>Oppdraget utført av</b>	<b>NIKU v/ Katharina Lorvik</b>
<b>Oppdraget utført dato</b>	<b>25.02-27.02.2009</b>
<b>Koordinater</b>	<b>N6701273,7/Ø297488,5; N6701289,2/Ø297473,3</b>
<b>Overflate – dagens</b>	<b>0,35 moh; 0,9 moh</b>
<b>Tilstedeværelse av automatisk fredete kulturminner</b>	<b>Ja</b>
<b>Kulturhistorisk tolkning</b>	<b>Kulturlagsavsetninger langs bryggefronten med bygningsrester og organiske utfyllmasser fra middelalder og nyere tid</b>
<b>Foto</b>	<b>NIKU v/ Katharina Lorvik. 61 digitale foto med filnavn: niku_ark 100000-100060, 100274</b>

## 1. Introduction

In connection with the Bryggen monitoring project, two more drillings were undertaken in February 2009 in two of the harbourfront buildings. Two dipwells – designated MB28 and MB29 – were installed, and soil samples were taken from the archaeological sequences. Results from the dipwells will contribute to the investigation of the Bryggen area's hydrogeological system in general, and particularly with regard to the hydrology and geochemical make-up of the area under the harbourfront buildings. The principal objective is to determine the extent to which the area at the front of Bryggen is affected by the incursion of sea-water from the harbour, and to this effect it was decided to place the dipwells' filters in the nethermost metre of the permeable layers that overlie the denser, organic-rich deposits (but no deeper than 4 metres below the surface, whatever the situation).

MB28 was installed in the front room of the Holmedalsgården tenement (gnr./bnr. 167/1610, also known as "Fiskebutikken") between the existing MB9 and the building's NV wall. MB29 was installed in the southeastern part of the front room of the Svensgården tenement (gnr./bnr. 167/1622).

The archaeological fieldwork was carried out by Katharina Lorvik from NIKU's Bergen office. The drilling work was carried out by the firm of Vestnorsk brønnboring AS, while bagging of soil samples was undertaken by Ole Martin Slaatten and Frank Dyrkolbotn, drilling technicians from the firm of Multiconsult AS.

The investigation's NIKU project number is 156132919. All documentation is to be found in *Riksantikvaren's* archives and in the topographic archive of *Middelaldersamlingen* at Bryggens Museum.

## 2. Methods

The drillings were carried out using rotary drilling (a 1 ton rig and a 100 mm diameter drill) and in accordance with established procedures. Drilling proceeded metre by metre, and each metre-long length was photographed and the individual strata described. One sample for  $^{14}\text{C}$ -dating was recovered from each drilling, and numerous soil samples were taken for geochemical analysis at the Eurofins laboratory in Denmark; these have been registered under *Middelaldersamlingen's* reference numbers "BRM 902" and "BRM 903" for MB28 and MB29 respectively. The results of the geochemical analysis of the soil samples have been interpreted by Henning Matthiesen at the National Museum of Denmark's Department of Conservation (Matthiesen 2009).

The various strata distinguished in the drillings have been numbered in the following way. First comes "MBxx" (MB stands for *miljøbrønn*, the Norwegian for "dipwell"), followed by sequential numbering of the individual stratum (from top to bottom).

## 3. Results

### 3.1 General remarks

The tables in sections 3.1 and 3.2 present the results of the investigation of the two drillings, containing information on the individual stratum's elevation, identification, finds, samples, dating, state of preservation, and description (based on visual inspection). 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 presented in 'The monitoring manual' (RA/NIKU 2007).

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

### 3.2 Dipwell MB28 – Holmedalsgården: sediment sequence (visual inspection)

The dipwell is situated in the seaward part of Holmedalsgården building 8a (also known as "*Fiskebutikken*"), about a metre to the northwest of dipwell MB9, which was installed in November 2004 (Dunlop, in prep.). Multiconsult determined the borehole's coordinates as X6701273.696/Y297488.494 (UTM 84 EUREF 32N), and the modern earth surface was at 0.35 masl. The filter was placed at ca. -1.65 to -2.65 masl (2-3 m below the surface), and the grey shading in the table below shows the strata coinciding with the dipwell's filter. "PC" in the column second from right stands for Preservation Category.

Masl		Stratum number	Same as stratum no.	Samples $^{14}\text{C}$ Finds	Accession number	Period	PC	Description
From	To							

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
0.35	0.05	MB28-01				Mod/ Post med	A/B	Sandy, loose soil with some pieces of wood and red brick/tile Moderate H <sub>2</sub> S odour
0.05	-0.35	MB28-02				Post med	C-	Moist, grey/black, sandy soil with some pebbles, pieces of charcoal and animal bone Tar-like odour Preservation indefinable
-0.35	-0.65	MB28-03				Post med?	C3	Dark-grey, fine, sticky, silty soil with many woodchips Somewhat more compact and drier than MB28-02, but still moist Weak H <sub>2</sub> S odour
-0.65	-0.80	MB28-04		Sample: C-prøve 1 from -0.65 to -0.85 masl	902/2	Post med/ Med?	C3	Medium compact, dark-brown, organic, slightly "greasy" earth with many woodchips and wood pieces, mixed with some fine sand H <sub>2</sub> S odour present
-0.80	-1.15	MB28-05				Post med/ Med?	C3	Relatively compact, medium-brown to red-brown coarse sawdust with hazelnut shells Weak H <sub>2</sub> S odour
-1.15	-1.65	MB28-06		Piece of pantile*		Post med/ Med?	C4	Dark-brown, highly organic deposit with humus, many large and small woodchips, and wood pieces (light-coloured and fresh-looking) The drill may have gone through a timber
-1.65	-2.15	MB28-07		Sample: C-prøve 2 from -1.65 to -1.85 masl	902/3	Post med/ Med?	C4	Highly organic and wet deposit with some silt, numerous woodchips (light-coloured), bark, leather strips, animal bones (firm structure), and charcoal Medium H <sub>2</sub> S odour
-2.15	-2.50	MB28-08		Piece of pantile*		Post med/ Med?	C3	Dark, grey/black, loose and very wet soil that fell off the drill at the slightest touch Some woodchips (light-coloured)
-2.50	-2.95	MB28-09		Piece of pantile*		Post med/ Med?	C4	More compact and less wet than MB28-08 Mostly mineral components, but with many small woodchips

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
								(the larger ones resisted snapping), animal bones, and some small bits of baked clay H <sub>2</sub> S odour present
-2.95	-3.05	MB28-10				Post med/ Med?	C0	Relatively compact, dark-grey fine sand
-3.05	-3.65	MB28-11				Post med/ Med?	C4	Relatively compact, dark-grey, highly organic deposit mixed with some silt, fine sand and pebbles Woodchips and pieces of wood, fish bones, sea shell fragments (partly degraded), twigs, bark Slow darkening H <sub>2</sub> S odour present
-3.65	-3.95	MB28-12		<sup>14</sup> C-dating sample 405±35 BP (cal AD 1445-1610) Sample: C-prøve 3 from -3.65 to -3.85 masl	902/1  902/4	Post med/ Med	C4	Dark-grey/brown, wet, highly organic deposit with many larger woodchips (quite soft), hazelnut shells and twigs H <sub>2</sub> S odour present
-3.95	-4.10	MB28-13				Med	C3	Relatively compact, dark-brown, very organic deposit with laminated vegetable matter (grass/leaves/straw) Finer and more "greasy" than MB28-12 (more malleable)
-4.10	-4.10	MB28-14				Med	C0	Thin strip of sand and small pebbles
-4.10	-4.25	MB28-15				Med	C3	Relatively compact, dark-brown, highly organic deposit with laminated vegetable matter (grass/leaves/straw) Same deposit as MB28-13
-4.25	-4.65	MB28-16				Med	C3	Dark-grey/brown, wet, somewhat "greasy", highly organic deposit with larger woodchips (quite soft), hazelnut shells and twigs Quite a lot of the material fell off the drill

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
-4.65	-4.85	MB28-17		Piece of pantile* Sample: C-prøve 4 from -4.65 to -4.85 masl	902/5	Med	C3	Medium H <sub>2</sub> S odour Dark-grey/brown, wet, somewhat "greasy", highly organic deposit with many woodchips (light-coloured, but snapped quite easily), birch-bark and other bark, hazelnut shells, grass-like vegetable matter (badly preserved) All in all, the proportion of relatively badly preserved organic matter seemed to be greater than in the overlying strata
-4.85	-4.85	MB28-18				Med	C0	Thin strip of sand
-4.85	-5.05	MB28-19				Med	C3	Dark-grey/brown, wet, somewhat "greasy", highly organic deposit with many woodchips (light-coloured, but snapped quite easily), birch-bark and other bark, hazelnut shells, grass-like vegetable matter (badly preserved), some animal bones and a few sea shell fragments
-5.05	-5.65	MB28-20				Med	C3	Dark-grey/brown, wet, somewhat "greasy", highly organic deposit with many woodchips (light-coloured, but snapped quite easily), birch-bark and other bark, hazelnut shells, grass-like vegetable matter (badly preserved)
-5.65	-6.10	MB28-21		Pieces of leather, one with seam (not retained)		Med	C4	Dark-grey/brown, wet, somewhat "greasy", highly organic deposit with numerous woodchips (light-coloured, but snapped quite easily), birch-bark and other bark, hazelnut shells (light-grey-yellow in colour), grass-like vegetable matter, fruit pips/seeds, some animal bones, and some fine sand and silt Strong H <sub>2</sub> S odour
-6.10	-6.65	MB28-22		Pieces of red brick-tile*		Med	C4	Compact, brown, quite dry deposit with small woodchips, hazelnut shells, animal bones and

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
								grass-like vegetable matter Deposit could be broken off in lumps that took pressure to separate
-6.65	-7.45	MB28-23		Pieces of red brick-tile*		Med	C4	Compact (though somewhat spongy), brown, humus-like deposit with wood pieces (none observed with axe-marks), twigs, fish bones, hazelnut shells, bark, laminated vegetable matter (grass/leaves/straw) Deposit could be broken off in lumps that took pressure to separate
-7.45	-7.65	MB28-24				Med	C4	Considerable resistance – the drill may have gone through a timber. The wood that came up on the drill was quite plastic-like in appearance, yellow-white in colour, and hard
-7.65	-8.10	MB28-25		Piece of leather (not retained) Samples: C-prøve 5 from -7.65 to -7.85 masl C-prøve 6 from -7.85 to -8.05 masl	902/6  902/7	Med	C4	Dark-brown, loose, wet deposit with wood pieces, hazelnut shells, strips of leather, some vegetable matter (grass/leaves/straw), and some sand H <sub>2</sub> S odour
-8.10	-8.65	MB28-26					-	Very wet, light-grey silt Top of natural (Little soil stayed on drill)
								Drilling abandoned at -8.65 masl

\*probably contamination from overlying layers

### 3.3 Dipwell MB29 – Svensgården: sediment sequence (visual inspection)

The dipwell is situated in the seaward part of Svensgården building 5a. Multiconsult determined the borehole's coordinates as X6701289.209/Y297473.319 (UTM 84 EUREF 32N), and the modern concrete surface was at 0.90 masl. The filter was placed at ca. -2.1 to -3.1 masl (3-4 m below the surface), and the grey shading in the table below shows the strata coinciding with the dipwell's filter. "PC" in the column second from right stands for Preservation Category.



Mention should be made of the fact that at the first attempt the drill encountered an impassable stone obstruction at ca. -1.60 masl. A new spot was tried to the northwest of the first, but the same problem occurred there. The drill was then moved to a third spot just to the east of the first, and this time everything went well.

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
0.90	0.55	MB29-01				Mod	E0	Concrete flooring
0.55	0.25	MB29-02				Mod	E0	Concrete pieces and soil – uncertain context
0.25	0.20	MB29-03		Red brick (not retained)		Mod	A-	Black charcoal and ash deposit with some larger charcoal pieces 1702 fire? Preservation indefinable
0.20	0.05	MB29-04				Mod/Post-med	A-	Light-brown/grey sand and silt deposit with some organic matter Preservation indefinable
0.05	0.00	MB29-05				Post-med	A-	Black charcoal/ash Preservation indefinable
0.00	-0.20	MB29-06				Post-med	C0	Grey, homogenous fine sand and silt
-0.20	-1.10	MB29-07		Sample: C-prøve 1 from -0.20 to -0.30 masl	903/2	Post-med	C3	Dark-brown, homogenous woodchip deposit with some sand (woodchips measured ca. 2x5 cm and were easy to snap) Medium preservation
-1.10	-1.60	MB29-08				Post-med	C3	Brown/grey, looser, wetter deposit than over; many woodchips (ca. 2 cm in width), animal bones (some larger fragments), water-logged wood, some bark of deciduous trees, and hazelnut shells; some fine sand in between Strong H <sub>2</sub> S odour
-1.60	-1.80	MB29-09				Post-med	C-	Timber, very fragmented
-1.80	-1.85	MB29-10				Post-med	C-	Charcoal
-1.85	-2.10	MB29-11				Post-med	C3	Dark-brown, wet, organic deposit, quite loose but adhered to the drill all the same; a large quantity of relatively decomposed plant matter, hazelnut shells, bits of leather, and fragments of sea shell Strong H <sub>2</sub> S odour
-2.10	-2.30	MB29-12				Post-med	C3	Grey/brown, soft organic deposit with very decomposed plant matter and woodchips (very soft) Strong H <sub>2</sub> S odour that dissipated fast

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
-2.30	-2.60	MB29-13				Post-med	C3	Same basic matrix as stratum MB29-12, but somewhat more compact; plant matter, bits of leather, cereal husks, many hazelnut shells and sea shell fragments, some fish bones and animal bones
-2.60	-3.10	MB29-14		2 pieces of iron slag (not retained)		Post-med	C3	Basically the same as strata MB29-12/-13, but wetter, and more dark-brown in colour
-3.10	-3.50	MB29-15				Post-med	C4	Medium compact, very organic deposit: brown/grey vegetable matter with woodchips (very small), bark and hazelnut shells Strong H <sub>2</sub> S odour that dissipated fast
-3.50	-3.70	MB29-16				Post-med	C3	Dark-brown/grey deposit, looser and wetter than MB29-15, soil did not adhere well to the drill; larger woodchips and pieces of wood (very soft), some sea shell fragments
-3.70	-4.10	MB29-17				Post-med	C4	Medium compact, highly organic deposit: brown/grey vegetable matter with woodchips (very small), bark, hazelnut shells and animal bones (some larger fragments) Strong H <sub>2</sub> S odour that dissipated fast
-4.10	-4.45	MB29-18				Med	C4	Dark-brown/grey organic deposit that adhered well to the drill; coarse woodchips, birch-bark and other bark, animal bones (black in colour), fish bones, and straw (?)
-4.45	-4.75	MB29-19				Med	C3	Coarser, wet material Not much adhered to the drill
-4.75	-5.10	MB29-20		Piece of red brick-tile* and two bits of baked clay/clay lining (not retained)		Med	C4	Dark-brown, quite compact deposit with fewer woodchips than stratum MB29-18, wood pieces (resisted snapping) birch-bark, hazelnut shells, vegetable matter, animal bones (black in colour)
-5.10	-5.30	MB29-21		Bit of		Med	C4	Medium compact, wet,

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
				baked clay/clay lining (not retained)				fine-grained deposit with humus, wood pieces and hazelnut shells; little or nothing in the way of mineral components
-5.30	-5.70	MB29-22		Piece of red brick/tile (not retained)*		Med	C4	Wet, organic deposit, coarser than MB29-21, with vegetable matter, woodchips (up to 5 cm wide), wood pieces, hazelnut shells, animal bones, sea shell fragments Strong H <sub>2</sub> S odour on retraction, but switches rapidly to just turf/wood odour
-5.70	-6.10	MB29-23				Med	C4	Drier, brown humus-like deposit with much vegetable matter coarse woodchips, large sea shell fragments, corn No hazelnut shells visible Turf-like odour
-6.10	-6.50	MB29-24		Bit of baked clay/clay lining (not retained)		Med	C4	Medium compact, coarse textured, dark-brown organic deposit with relatively small woodchips, some larger wood pieces, berry and fruit pips/seeds, and some fine sand in between No H <sub>2</sub> S odour
-6.50	-6.60	MB29-25				Med	C0	Medium compact, brown "gyttja"-like, silt and clayey deposit Relatively malleable Old sea-bed?
-6.60	-6.73	MB29-26				Med	C0	Compact, grey silt and clay (upper part slightly mixed)
-6.73	-6.80	MB29-27				Med	C-	Dark-brown, turf-like deposit with humus, fine plant roots and a small pocket of fine grey sand Preservation indefinable
-6.80	-6.85	MB29-28				Med	C0	Grey, fine sand
-6.85	-7.10	MB29-29		<sup>14</sup> C-dating sample 835±30 BP (AD 1210 -1250)	903/1	Med	C3	Medium compact, brown mixture of sand, gravel and small stones with "gyttja"-like earth and some woodchips, animal bones and hazelnut shells
-7.10	-7.50	MB29-30				Med	C0	The drill got stuck, and therefore the retracted

Masl		Stratum number	Same as stratum no.	Samples <sup>14</sup> C Finds	Accession number	Period	PC	Description
From	To							
								soil may have been very disturbed/mixed Along the innermost part of the drill adhered some remains of dark-grey silt and sand mixed with a lot of organic matter (woodchips, hazelnut shells, animal bones) Possibly "gyttja" or old sea-bed deposit Preservation indefinable
-7.50								Drilling abandoned

\*probably contamination from overlying layers

## 4. Finds & dating

### 4.1 MB28

#### 4.1.1 Archaeological material

A piece of pantile was found at a depth of -2.95 masl, and the strata down to this level are very likely post-medieval. A second piece of pantile from stratum MB28-17 at a depth of between -4.65 and -4.85 masl was attached to the very outermost part of the drill and had probably come from some stratum at a higher level. In stratum MB28-21 (-5.65 to -6.10 masl) was found a scrap of leather with seam, probably part of a shoe (not retained, but photographed: photo no. *niku\_ark\_100274*).

#### 4.1.2 <sup>14</sup>C-dating

Dating of a sample of hazelnut shells (finds accession number 902/1) from stratum MB28-12, from -3.65 to -3.95 masl, yielded a result of 405±35 BP (AD 1445-1610). This means that the stratum is either late medieval or early post-medieval.

### 4.2 MB29

#### 4.2.1 Archaeological material

Two pieces of iron slag were observed in stratum MB29-14 at ca. -3.0 masl. Pieces of fired clay or clay lining were observed in strata MB29-20, MB29-21 and MB29-24. Small pieces of red brick/tile were observed sporadically down to ca. -5.50 masl; these most likely represent contamination from higher, younger strata. None of these artefacts have been retained.

#### 4.2.2 <sup>14</sup>C-dating

Dating of a sample of hazelnut shells (finds accession number 903/1) from stratum MB29-29, from -6.85 to -7.1 masl, yielded a result of 835±30 BP (AD 1210-1250).

### 4.3 Dating: conclusions

The level for the transition from post-medieval to medieval deposits is deemed to be at about -4.0 moh.

As regards MB29, the <sup>14</sup>C-dating is perhaps not as old as one might have expected at this depth.

## 5. State of preservation assessment

It was stipulated that the report should contain archaeological assessments of the state of preservation of the deposits, and table 1 below attempts to provide an easy-to-grasp picture of the situations in the two boreholes (with the short, hand-drilled MB9 – installed in November 2004 at a spot very close to MB28 – included for comparison with MB28, and with MB25 – installed in September 2007 at some distance from MB29 – included for comparison with MB29).

Table 1. Schematic comparative presentation of the state of preservation (archaeological assessment) of the deposits in MB28, MB29, MB25 and MB9. 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 elevation of the dipwell's filter.

MB25 (2007)	MB29 (2009)	MB28 (2009)	MB9 (2004)	Masl	Symbols
			??	2.0 – 1.0	§ - INORGANIC
00000	§§§§?	??	?XXXX	1.0 – 0.0	X - VERY POOR
00000	§XXXX	??XXX	XXXXX	0.0 – -1.0	X - POOR
000XX	XXX?X	XXXXX	XX	-1.0 – -2.0	X - MEDIUM
XXX00	XXXXX	XXXXX		-2.0 – -3.0	X - GOOD
XXXXX	XXXXX	XXXXX		-3.0 – -4.0	X - VERY GOOD
XXXXX	XXXXX	XXXXX		-4.0 – -5.0	? - INDEFINABLE
XXXXX	XXXXX	XXXXX		-5.0 – -6.0	0 - NO SOIL RECOVERED
XXXXX	XXX§X	XXXXX		-6.0 – -7.0	N - NATURAL
XXXXX	XA	XXXXX		-7.0 – -8.0	A - DRILLING ABANDONED
XN		XN		-8.0 – -9.0	

The state of preservation situations are more or less what one might expect, with the best-preserved strata located in the lower part of the deposit sequence. Other than that, it is difficult to draw any detailed conclusions – the main problem, as virtually always applies in the case of drilling, lies in not knowing whether layers exhibiting poorer preservation were exposed to decomposition prior to, or around the time of, or long after deposition.

One finds a medium state of preservation in the uppermost part of MB28 and in the upper part of MB29 – and this is perhaps to be expected in view of the presence/effect of chlorides and sulphates from salt water. In view of this, it is somewhat surprising to find a good state of preservation as high as from -1.15 to -2.15 masl in MB28.

In MB29, the bottommost strata displayed only a medium state of preservation – which is similar to the situation in the “neighbouring” MB25. In MB28, on the other hand, one finds a good state of preservation from -5.65 masl and the rest of the way down to the natural.

MB28: comparison of state of preservation (archaeological assessment) with LOI and water-content results (analysed by Multiconsult)

Stratum no./nos.	PC	LOI (%)	H <sub>2</sub> O (%)	Notes
MB28-02	-	10,6	77	Described as moist
MB28-03, -04	C3	37,3	218	Both strata contained many woodchips
MB28-05	C3	26,7	310	Organic-rich stratum
MB28-06, -07	C4	72,7	567	Both strata were highly organic
MB28-07	C4	53,5	436	Highly organic stratum
MB28-07, -08	C4/C3	10,1	228	Most of the sample must have come from MB28-08, which was inorganic
MB28-08	C3	18,0	143	Inorganic stratum

MB28-09	C4	22,8	153	Mostly inorganic stratum
MB28-09	C4	20,1	170	Mostly inorganic stratum
MB28-11	C4	21,3	147	Highly organic stratum
MB28-15	C3	30,2	238	Highly organic stratum
MB28-17	C3	35,4	235	Highly organic stratum
MB28-22	C4	31,4	193	Highly organic, described as dry
MB28-23	C4	45,5	210	Highly organic stratum
MB28-24	C4	25,6	153	Probable timber

MB29: comparison of state of preservation (archaeological assessment) with LOI and water-content results (analysed by Multiconsult)

Stratum no./nos.	PC	LOI (%)	H <sub>2</sub> O (%)	Notes
MB29-02, -03, -04	-	11,4	82	Mostly inorganic strata
MB29-07	C3	68,1	517	Many woodchips
MB29-09, -10, -11	-, -, C3	23,0	206	Mostly organic strata
MB29-11	C3	23,1	184	Wet and mostly organic stratum
MB29-12	C3	20,9	189	Mostly organic stratum
MB29-13	C3	13,3	140	Mostly organic stratum
MB29-13, -14	C3	13,7	144	Mostly organic strata
MB29-14	C3	21,7	184	Mostly organic stratum, quite wet
MB29-14	C3	28,8	227	Mostly organic stratum, quite wet
MB29-17	C4	30,4	185	Highly organic stratum
MB29-20	C4	32,6	235	Organic stratum
MB29-23	C4	30,1	192	Organic, quite dry stratum
MB29-27	-	29,2	171	Turf-like, some sand
MB29-28	C0	9,1	59	Very inorganic stratum
MB29-29	C3	31,3	189	Mixture of organic and inorganic

## 6. Conclusions

Overall, the state of preservation situations in the two dipwells can be described as satisfactory. It will be very interesting to see what the geochemical analyses have to say about preservation conditions – particularly with regard to the influx and effect of salt-laced water from the harbour.

No strata exhibiting grade 5 (excellent) state of preservation were observed, but this is not at odds with the picture that we have from previous drillings along the front of Bryggen.

Generally – and happily! – one finds that there is good agreement between the assessments carried out by Lorvik (MB28, MB29) in 2009 and Dunlop (MB9, MB25) in 2004 and 2007. However, Lorvik identified 3 times as many individual strata in MB29 than Dunlop did in MB25! There are a number of good reasons for this discrepancy, but suffice it to say at this juncture that sometimes it's better to work inside buildings rather than outside...

## 7. Documentation (NIKU)

61 digital photos: *niku\_ark\_100000-100059*, *niku\_ark\_100274*  
 Report on PC (file name *156132919.doc*)  
 All the documentation is to be found in *Riksantikvaren's* archive

## 8. References

Dunlop, A. R. (in prep.). Nordre Holmedalsgården, bygning 8a, Bryggen, Bergen: Arkeologisk undersøkelse av fundamentsjiktet samt grunnboring for en miljøbrønn, 2004-6.

Matthiesen, H. 2009. MB28 and MB29: Composition of soil and groundwater focussing on seawater intrusion beneath the quay front buildings of Bryggen, Bergen. – Report no. 1829-17. Copenhagen, National Museum of Denmark, Department of Conservation.

Riksantikvaren/NIKU 2007. *The Monitoring Manual – Procedures and guidelines for the monitoring, recording and preservation/management of urban archaeological deposits.*

## 8. Photo list

ID	NIKU_ARK_NR*	Prosjektnr*	Undnr	Rapportnr	Motiv 1*	Motiv 2	Fotograf*	Sett mot	TA/BRM/ONR/TNR
1434	niku_ark_100000	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 1, 0-1m, øvre del	KL		BRM902
1435	niku_ark_100001	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 1, 0-1m, nedre del	KL		BRM902
1436	niku_ark_100002	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 2 1-2 m, øvre del	KL		BRM902
1437	niku_ark_100003	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 2, 1-2m, midtre del	KL		BRM902
1438	niku_ark_100004	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 2, 1-2 m, nedre del	KL		BRM902
1439	niku_ark_100005	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 3, 2-3m, øvre del	KL		BRM902
1440	niku_ark_100006	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 3, 2-3m, midtre del	KL		BRM902
1441	niku_ark_100007	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 3, 2-3m, nedre del	KL		BRM902
1442	niku_ark_100008	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Boring, MB28	KL	N	BRM902
1443	niku_ark_100009	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 4, 3-4 m, øvre del	KL		BRM902
1444	niku_ark_100010	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 4, 3-4 m, midtre del	KL		BRM902
1445	niku_ark_100011	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 4, 3-4 m, nedre del	KL		BRM902
1446	niku_ark_100012	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Boring MB28	KL	SV	BRM902
1447	niku_ark_100013	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Boring MB28	KL	NØ	BRM902
1448	niku_ark_100014	1561329	19	43/2009	MOV brønnboring	Boring MB28	KL	NØ	BRM902



ID	NIKU_ARK_NR*	Prosjektnr*	Undnr	Rapportnr	Motiv 1*	Motiv 2	Fotograf*	Sett mot	TA/BRM/ONR/TNR
1449	niku_ark_100015	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Boring MB28	KL		BRM902
1450	niku_ark_100016	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Boring MB28	KL		BRM902
1451	niku_ark_100017	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 5, 4-5 m, øvre del	KL		BRM902
1452	niku_ark_100018	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 5, 4-5 m, midtre del	KL		BRM902
1453	niku_ark_100019	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 5, 4-5 m, nedre del	KL		BRM902
1454	niku_ark_100020	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 6, 5-6 m, øvre del	KL		BRM902
1455	niku_ark_100021	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 6, 5-6 m, nedre del	KL		BRM902
1456	niku_ark_100022	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 7, 6-7 m, øvre del	KL		BRM902
1457	niku_ark_100023	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 7, 6-7 m, midtre del	KL		BRM902
1458	niku_ark_100024	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 7, 6-7 m, nedre del	KL		BRM902
1459	niku_ark_100025	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 8, 7-8m, øvre del	KL		BRM902
1460	niku_ark_100026	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 8, 7-8m, midtre del	KL		BRM902
1461	niku_ark_100027	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 8, 7-8m, nedre del	KL		BRM902
1462	niku_ark_100028	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Holmedalsgården	KL		BRM902
1463	niku_ark_100029	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Holmedalsgården	KL		BRM902
1464	niku_ark_100030	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 9, 8-9m, nedre del	KL		BRM902

ID	NIKU_ARK_NR*	Prosjektnr*	Undnr	Rapportnr	Motiv 1*	Motiv 2	Fotograf*	Sett mot	TA/BR M/ONR/TNR
1465	niku_ark_100031	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 9, 8-9m, øvre del	KL		BRM902
1466	niku_ark_100032	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 9, 8-9m, nedre del	KL		BRM902
1467	niku_ark_100033	1561329	19	43/2009	MOV brønnboring	MB28 boresekvens 9, 8-9m, midtre del	KL		BRM902
1468	niku_ark_100034	1561329	19	43/2009	MOV brønnboring, arbeidsbilde	Svensgården, flytting av rigg - trang passasje	KL		BRM903
1469	niku_ark_100035	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 1, 0-1m, øvre del	KL		BRM903
1470	niku_ark_100036	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 1, 0-1m, nedre del	KL		BRM903
1471	niku_ark_100037	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 2, 1-2 m, øvre del(feil mål foto)	KL		BRM903
1472	niku_ark_100038	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 2, 1-2m, midtre del	KL		BRM903
1473	niku_ark_100039	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 2, 1-2m, nedre del	KL		BRM903
1474	niku_ark_100040	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 3, 2-2,5 m	KL		BRM903
1475	niku_ark_100041	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 4, 2,5-3m	KL		BRM903
1476	niku_ark_100042	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 5, 3-4 m, øvre del	KL		BRM903
1477	niku_ark_100043	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 5, 3-4 m, nedre del	KL		BRM903
1478	niku_ark_100044	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 6, 4-5 m, øvre del	KL		BRM903
1479	niku_ark_100045	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 6, 4-5 m, nedre del	KL		BRM903
1480	niku_ark_100046	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 7, 5-6 m, øvre del	KL		BRM903
1481	niku_ark_100047	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 7, 5-6 m, midtre del	KL		BRM903

ID	NIKU_ARK_NR*	Prosjektnr*	Undnr	Rapportnr	Motiv 1*	Motiv 2	Fotograf*	Sett mot	TA/BRM/ONR/TNR
1482	niku_ark_100048	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 7, 5-6 m, nedre del	KL		BRM903
1483	niku_ark_100049	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 8, 6-7 m, øvre del	KL		BRM903
1484	niku_ark_100050	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 8, 6-7 m, midtre del	KL		BRM903
1485	niku_ark_100051	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 8, 6-7 m, nedre del	KL		BRM903
1486	niku_ark_100052	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, øvre del	KL		BRM903
1487	niku_ark_100053	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, midtre del	KL		BRM903
1488	niku_ark_100054	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, nedre del	KL		BRM903
1489	niku_ark_100055	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, hele boret	KL		BRM903
1490	niku_ark_100056	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, øvre del	KL		BRM903
1491	niku_ark_100057	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, nedre del	KL		BRM903
1492	niku_ark_100058	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, øvre del	KL		BRM903
1493	niku_ark_100059	1561329	19	43/2009	MOV brønnboring	MB29 boresekvens 9, 7-8 m, nedre del	KL		BRM903
2218	Niku_ark_100274	1561329	19	43/2009	MOV brønnboring	Leatherbit med sømhull	KL		BRM903

## 9. Finds list

<b>Finds acc. no.</b>	<b>Type</b>	<b>Context</b>	<b>Date</b>
BRM 902/1	<sup>14</sup> C-prøve hazelnut shells	MB28-12	25/2-09
BRM 903/1	<sup>14</sup> C-prøve hazelnut shells	MB29-29	26/2-09