



## DET HANSEATISKE MUSEUM, BERGEN, 2020:

Arkeologisk undersøkelse av to naverboringer.

Dunlop, A.R.







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Oppdragsgiver(e) Bergen kommune, Etat for utbygging
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<p>Sammendrag</p> <p>I januar og mai 2020 undersøkte en arkeolog fra NIKU distriktskontor Bergen tre naverboringer utført langs den nordvestre siden av Finnegården 1A, Det Hanseatiske Museum. Boringene ble foretatt i forbindelse med peling for fundamentering av jekkerigg. Det ene av borepunktene bød på problemer hva gjelder opptak av jordlagssekvenser, men de to andre ga gode resultater i form av kulturlag fra middelalderen – som for det meste representerte utfylling i Vågen med bruk av husholdnings- og byggeavfall. Fire botaniske prøver og fire 14C-prøver ble analysert; rapporter er vedlagt.</p>
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Emneord Byggen, grunnboring, peling, kulturlag, middelalder, sjøbunn, karbondatering, botaniske analyser
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Avdelingsleder

Johansen, L.-M. B.

## Forord

Bergen kommune, Etat for utbygging takkes for oppdraget, og OBAS samt Vestnorsk Brunnboring AS for bistand i felt.

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NIKU prosjektnummer	1021718 (2019)
Berørt område	Finnegården 1A (Det Hanseatiske Museum)
Gnr./bnr.	167/1659
Oppdragets art	Arkeologisk undersøkelse ved naverboringer
Vedtaksdato; saksnummer	10.12.2019; 10/00457-43
Forvaltningsmyndighet	Riksantikvaren Distriktskontor Vest
Oppdraget utført av	NIKU distriktskontor Bergen
Oppdraget utført dato	Jan. og mai 2020
Koordinatorer	Se i MABYGIS og i rapporten
Overflate, dagens	opptil 1,45 moh
Filmnummer; antall foto	Bf30047; 16
Tilstedeværelse av automatisk fredete kulturminner	Ja
Kulturhistorisk tolkning	Middelalderske avfallslag, sjøbunn, naturavsetninger, fjell
BRM-nr.	1229
Aksesjonsnummer	2020/2

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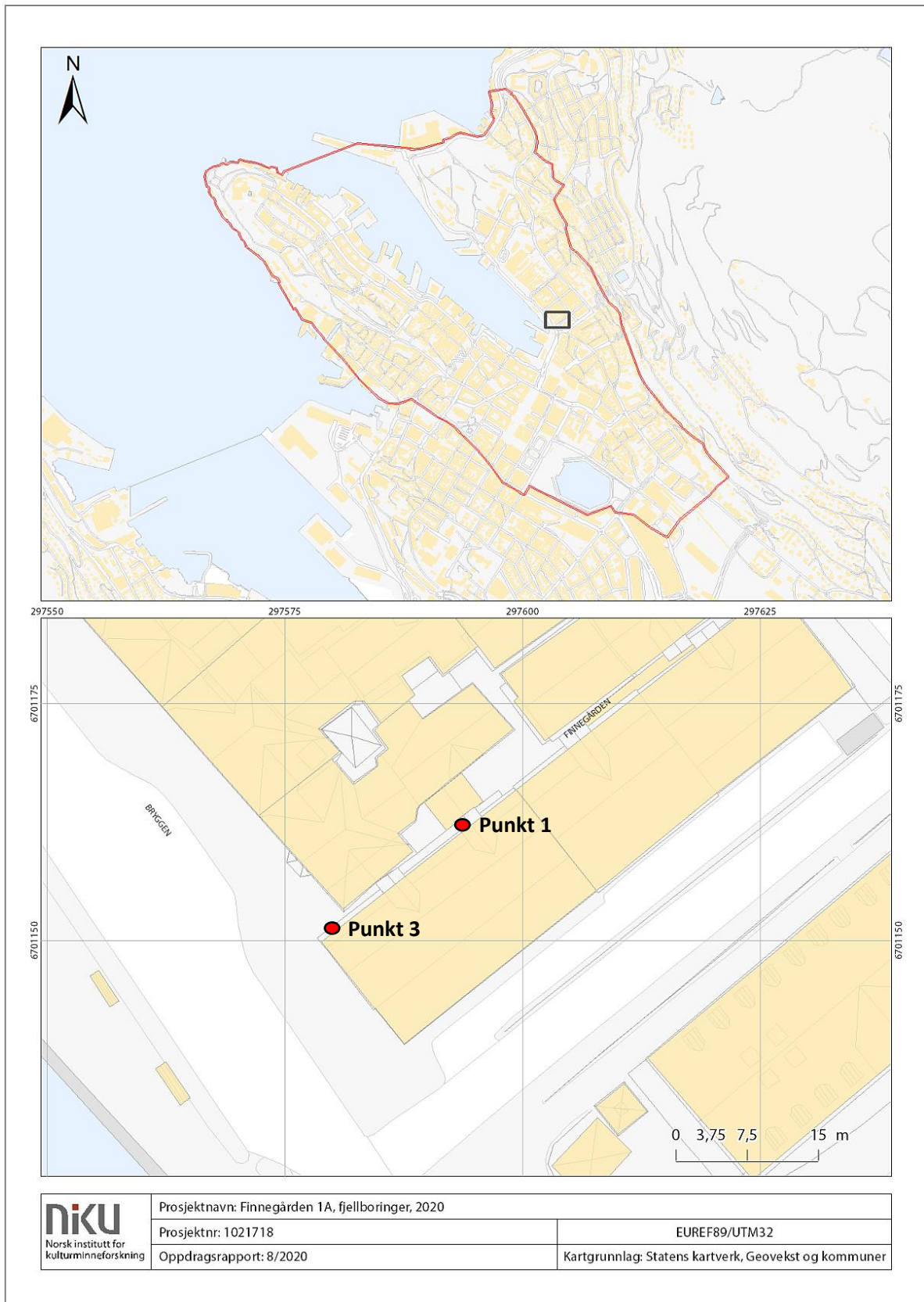


## **1 Innledning**

Det vises til Riksantikvarens vedtak datert 10.12.2019 (saksnummer 10/00457-43 og 20/01924-6). Oppdraget gjaldt arkeologiske undersøkelser i forbindelse med grunnboringer til fjell på eiendommen Finnegården 1A (Det Hanseatiske Museum, gnr./bnr. 167/1659, Bergen). Tiltakshaver var Bergen kommune, Etat for utbygging.

I forbindelse med utredning av behov for pelefundamentering for etablering av fundament for jekkerigg og for etablering av brannvegg ved Det Hanseatiske Museum, Finnegården 1A, var det behov for å avklare dybder til fjell. Det ble derfor besluttet å gjennomføre naverboring i tre av de planlagte pelepunktene i passasjen nord for Sjøstuens svalgang (se Figur 1); det skulle bores gjennom kulturlagene og ned til fjell.

Det arkeologiske feltarbeidet ble foretatt 13.-14. januar og 8. mai 2020.



Figur 1. Situasjonskart. (Kart: NIKU)

Formålet med den arkeologiske undersøkelsen var å sikre det arkeologiske kildematerialet, og resultatene skulle danne en del av grunnlaget i forbindelse med Riksantikvarens videre



håndtering av saken. All den informasjonen som man kunne få fra disse boringene ville være av stor verdi, ikke minst i sammenheng med fremtidige prosjekteringsarbeider.

## 2 Bakgrunn

Tiltaksområdet ligger innenfor det automatisk fredede kulturminnet *Middelalderbyen Bergen*, kulturminne-ID 89049, og Finnegården 1A er en del av verdensarvstedet Bryggen. Dette er et område av veldig høy kulturhistorisk betydning, og potensialet for konflikt med automatisk fredete kulturminner i form av kulturlag fra middelalderen var ansett som 100 %. Kulturlagene ville bestå av utfyllingsmasser fra sent 1100-tallet til 1702 eller senere. Det var forventet at den samlede tykkelsen til arkeologiske kulturlag i hvert borepunkt ville være på opptil seks meter.

## 3 Metoder

Borearbeidet ble utført av Vestnorsk Brunnboring AS, med arkeolog fra NIKU distriktskontor Bergen som ansvarlig for det arkeologiske registreringsarbeidet. Boringen ble utført som naverboring med beltegående borerigg under tilsyn av arkeolog, som fortløpende gransket lengdene tatt opp med naverboret og registrerte jordlagssekvensene i henhold til Norsk Standard NS9451:2009 (Standard Norge 2009) i utgangspunkt. Det ble samlet inn fire prøver til karbondatering, og fire prøver til botanisk analyse (alle innsamlet av arkeologen). Den botaniske analysen ble foretatt av QUEST, University of Reading (Richer & Young 2021: vedlegg 1). Dateringene ble foretatt av 14CHRONO Centre, Belfast (vedlegg 2). Prøvene er registrert i MUSIT-systemet under museumsnummer «BRM1229».

Innmåling av borepunktene ble foretatt av Anko AS på vegne av OBAS. Forkortelsen «moh» står for «meter over havet» (med utgangspunkt i referansesystemet NN1954); høyder under havnivå angis med et minustegn foran.

Monica Kristiansen førte topografiske opplysninger inn i MABYGIS.

## 4 Resultater fra det arkeologiske feltarbeidet

### 4.1 Generelle forklaringer

Resultater og observasjoner er presentert hovedsakelig i tabellform (se under), og da kan det trenge et par forklaringer. Nummerering av sjiktene – Bergenskontoret bruker «sjikt» istedenfor «lag» som betegnelsen for den stratigrafiske enheten i grunnboringer – er generert i dokumentasjonssystemet Intrasis. Kolonnen med overskrift «PC» inneholder angivelse av det enkelte sjiktets bevaringstilstand i henhold til SOPS-tabellen i NS9451:2009. Lysforholdene under feltarbeidet var brukbare.

### 4.2 Naverboringene: observasjoner

NIKU var med og undersøkte tre borepunkter. Det henvises til rapportdel 11.1 for bilder av borelengdene.

#### 4.2.1 Punkt 1

Borepunktet lå lengst mot nordøst, jf. figur 1. Dets koordinater var N6701162,17/Ø297593,74, og dagens overflate lå 1,45 moh.

Moh fra	Moh til	Sjikt-nummer	Samme som sjiktnr.	<sup>14</sup> C-datering/-funn/-prøver	Periode	PC	Beskrivelse av innhold
1,45	-0,05				Mod	D0	Forboret, føringsrør anlagt
-0,05	-0,55	7101			Etterref.	C-	(Veldig lite materiale på boret) Våte, løse, sand-, tegl- og steinholdige jordmasser; noen dyrebein, ett fiskebein Fot fra en etterreformatorkisk rødgods stjerpotte Svak lukt av diesel Ubestembar bevaringstilstand
-0,55	-2,15	7102		BRM1229/1 (nøtt) fra -0,75 moh; BRM1229/5 botanisk prøve fra -0,95 til -1,05 moh	AD 1291-1399	C3	Våt, løst, brunlig, høvorganisk lag med mange hasselnøttskall, sagflis og treflis (frisk farge, men bare middels-bra bevarte, de fleste av mindre størrelse), en god del røtter, neverflak, kvist, dyre- og fiskebein; stedvis mye mose, særlig fra -1,45 moh og nedover Økt innslag av sand og steiner fra -1,05 moh og nedover Blåskjell ved -1,50 moh Veldig lite differensiering synlig i sjiktet Sterk H <sub>2</sub> S lukt, ingen mørkning Mosen og røttene var bra bevarte Tilfeldig orientering Middels-bra bevaringstilstand
-2,15	-2,45	7103		BRM1229/2 (mose) fra -2,30 moh; BRM1229/6 botanisk prøve fra -2,30 til -2,40 moh	AD 986-1048/1087-1123/1138-1149	C4	Som sjikt 7102, men med mye mer mose, noe tegn til laminering Treflisene var bra bevarte Noen stykker av blåskjell stedvis Bra bevaringstilstand
-2,45	-3,10	7104			Forhistorisk	C0	Øverst naturavsetning Sjøbunn/skjellsand Forholdsvis tørr øverst, men våtere med økende dybde Seig, grå silt og finsand med mange stykker av skjell
-3,10	↓	7105			Forhistorisk	C0	Våt, blågrålig, marin sand
-3,55							Naverboring avsluttet
-5,15	-5,75						Morene (fra boring til fjell)
-5,75							Fjell

Den samlede kulturlagstykkelsen var på minst 2,5 meter.

### Sjikttoolkning

Sjikt 7101 er trolig en avsetning i et dråpefallsområde.

Sjikt 7102 er et avfallslag; den botaniske analysen viser at sjiktet består til en stor grad av husholdningsavfall, og mye av materialet stammer fra ølbrygging.

Sjikt 7103 er et avfallslag, kanskje deponert i et bolverkskar; den botaniske analysen viser at sjiktet består til en stor grad av husholdningsavfall, med bl.a. materiale som stammer fra latriner, materiale som ble brukt til å dekke jordgulv, og materiale tilknyttet ølbrygging.

Sjikt 7104 og 7105 er naturavsetninger.

#### 4.2.2 Punkt 2

Borepunktet lå mellom punkt 1 og punkt 3. Dets koordinater var N6701157,43/Ø297587,78, og utgangspunktet for dybdemålingen var 1,35 moh (terrengnivå).

Når det gjelder punkt 2, var det ikke mulig å utføre naverboring, pga. steinholdige masser. Informasjonen er derfor hentet fra Vestnorsk Brunnboring sin borelogg. Toppen av «kulturlaget» kan angis til 1,30 moh (dette for bruk i forbindelse med beregning av pelene). Det ble ikke tildelt kontekstnumre til sjiktene.

1,35 til -0,65 moh: føringsrør

-0,65 til -2,25 moh: steiner, m/ noe treverk – kan være en del av byggegropen for Bryggen 3 (treverket kan være fra forskalling)

-2,25 til -3,60 moh: sjøbunn

-3,60 til -4,75 moh: silt

-4,75 til -5,55 moh: morene

-5,55 moh: fjell

Det er ikke mulig å angi den samlede kulturlagstykkelsen med tilnærmet rimelig sikkerhet.

#### 4.2.3 Punkt 3

Borepunktet lå lengst mot sørvest, jf. figur 1. Dets koordinater var N6701150,933/Ø297579,530, og dagens overflate lå ca. 0,75 moh.

Moh fra	Moh til	Sjikt-nummer	Samme som sjiktnr.	<sup>14</sup> C-datering/-funn/-prøver	Periode	PC	Beskrivelse av innhold
0,75	-0,75				Mod. og etter-ref.	D0	Forboret, føringsrør anlagt; noen tømmerstokker påtruffet
-0,75	-1,75	7106		BRM1229/3 (nøtt) fra -1,55 moh; BRM1229/7 botanisk prøve fra -1,05 til -1,15 moh	AD 1231-1241/ 1259-1323/ 1356-1392	C2/ C3	(Stedvis veldig lite materiale på boret, særlig topp og bunn av lengden) Våte, forholdsvis løse Vekslende partier med 1) ustrukturert, mørkegrå/-brun, organisk materiale med en god del treflis (dårlig til middels-bra bevarte), noen sagflis og stykker av never, og en god del hasselnøttskall; stedvis mange blåskjellsbiter,

Moh fra	Moh til	Sjikt-nummer	Samme som sjiktnr.	<sup>14</sup> C-datering/-funn/-prøver	Periode	PC	Beskrivelse av innhold
							noen dyrebein og fiskebeinstykker 2) grålig finsand med en god del skjellbiter og enkelte fiskebein Hindring (stein?) helt nederst i lengden Sterk H <sub>2</sub> S lukt, ingen mørkning Havnebunnstype avsetning Dårlig til middels-bra bevaringstilstand
-1,75	-2,35	7107		BRM1229/4 (nøtt) fra -2,30 moh;  BRM1229/8 botanisk prøve fra -2,15 til -2,25 moh	AD 1221-1271	C3	Våt, løst, brunlig, høyorganisk lag med mange hasselnøttskall, sagflis og treflis (frisk farge, men bare middels-bra bevarte, de fleste av mindre størrelse), en del neverflak, kvist, dyre- og fiskebein Ingen humus Ikke så mange skjellstykker Sterk H <sub>2</sub> S lukt, ingen mørkning Tilfeldig orientering Middels-bra bevaringstilstand
-2,35	minst -2,95	7108			Mid.	C0	Hindring: stein, minst 0,6 meter i tykkelse Det måtte brukes slagbor for å komme igjennom Ikke flere kulturlag under
ca. -2,95	↓				(Forhistorisk)		Trolig overgang til geologisk lag
-2,35							Naverboring avsluttet

Den samlede kulturlagstykkelsen var på minst 1,6 meter.

#### Sjiktolkning

Sjikt 7106 er trolig en flerfoldig avsetning i en havnebunnskontekst; den botaniske analysen antyder at sjiktet består ikke bare av husholdningsavfall, men også til en viss grad av torv fra hustak – det er bl.a. mye mikrotrekull i sjiktet, noe som trolig stammer fra brann.

Sjikt 7107 er et avfallslag i en havnebunnskontekst; den botaniske analysen viser at sjiktet består til en viss grad av husholdningsavfall, med noe materiale fra bl.a. ølbrygging, og det er indikasjoner av brann.

Sjikt 7108 er en stein, kanskje beliggende i et bolverkskar.

## 5 Datering & funn

Karbondateringene ble utført av 14CHRONO Centre, Queen's University Belfast (se vedlegg 2). Ingen arkeologiske gjenstander ble samlet inn.

### 5.1 Punkt 1

To dateringsprøver ble samlet inn. Et hasselnøttskall (tilvekstnummer BRM1229/1, lab. ref.-nr. UB-42563) fra -0,75 moh i sjikt 7102 er datert til  $622\pm 31$  BP, kalibrert til AD 1291-1399. Og en stengel av mose (tilvekstnummer BRM1229/2, lab. ref.-nr. UB-42564) fra -2,30 moh i sjikt 7103 er datert til  $1000\pm 26$  BP, kalibrert til AD 986-1048/1087-1123/1138-1149.

### 5.2 Punkt 3

To dateringsprøver ble samlet inn. Et hasselnøttskall (tilvekstnummer BRM1229/3, lab. ref.-nr. UB-43261) fra -1,55 moh i sjikt 7106 er datert til  $704\pm 39$  BP, kalibrert til AD 1231-1241, 1259-1323, og 1356-1392 (medialsannsynlighet AD 1292). Og et hasselnøttskall (tilvekstnummer BRM1229/4, lab. ref.-nr. UB-43262) fra -2,30 moh i sjikt 7107 er datert til  $796\pm 20$  BP, kalibrert til AD 1221-1271 (medialsannsynlighet AD 1245).

### 5.3 Datering: konklusjoner

Det er bra innbyrdes overenstemmelse mellom de to dateringene i hvert borepunkt. Og det er bra overenstemmelse mellom den øvre dateringen i punkt 1 og den øvre i punkt 3.

Overgangen til middelalderse kontekster ser ut til å ligge på:

ikke lavere enn -0,55 moh i punkt 1.

ikke lavere enn -0,75 moh i punkt 3.

## 6 Bevaringstilstand

Bevaringssituasjonen er stort sett tilfredsstillende, og de mest organiske avsetningene ligger i den mettede sonen. Evalueringen av bevaringstilstanden til kulturlagene presenteres i tabell 1.

Tolkning av bevaringssituasjonen forkudres til en viss grad av følgende mangler:

- man har ingen kontroll angående opphavet til de ulike kontekstene – sjikt som viser dårlig bevaring kan inneholde redeponert materiale, materiale som var blitt betydelig nedbrutt før dets endelige deponering
- det finnes intet grunnlagsmateriale for å kunne sammenligne bevaringstilstanden tidligere (det vil si, for flere år eller tiår siden) med bevaringstilstanden nå.

Alt i alt betyr dette at man ikke har noe grunnlag for å si om det er blitt forandringer i bevaringstilstanden i løpet av nyere tid, og heller ikke kan man fra arkeologisk side si noe om hvorvidt det pågår en eventuell forverring av bevaringstilstanden.

Tabell 1. Skjematisk sammenligningspresentasjon av bevaringstilstanden (visuell vurdering) til kulturlagene i punkt 1 og punkt 3. Hvert enkelt symbol representerer en tykkelse på omkring 20 centimeter, og dybde fra overflaten øker fra venstre mot høyre.

Punkt 1	Punkt 3	Moh
§§	§§§?	2,0 – 1,0
§§§§§	§§§§§	1,0 – 0,0
??§XX	§§§§X	0,0 – -1,0
XXXXX	XXXXX	-1,0 – -2,0
XXNNN	XXA00N	-2,0 – -3,0
NNNNN		-3,0 – -4,0
NNNNN		-4,0 – -5,0
NNNNF		-5,0 – -6,0

SYMBOLER	
X - ELENDIG	? - UBESTEMBAR
X - DÅRLIG	0 - INGEN JORD PÅ BORET
X - MIDDELS	N - NATURLIG
X - BRA	A - BORING AVSLUTTET
X - UTMERKET	§ - IKKE ORGANISK
	F - FJELL

## 7 Konklusjoner

Den arkeologiske undersøkelsen har konstatert at automatisk fredete kulturminner er til stede i to av borepunktene, og det regnes som svært sannsynlig også for det tredje punktet.

Den botaniske rapporten bekrefter og utfyller det arkeologiske bildet: at de dypere liggende kulturlagene representerer ymse avfallsmasser som ble brukt til utfylling i havnebassenget i forbindelse med forskyvninger av kaifronten.

Undersøkelsen har således bidratt med verdifulle opplysninger om det arkeologiske bildet under den nordvestre siden til Det Hanseatiske Museum samt om naturtopografien i nærområdet.

## 8 Summary

In January and May 2020, an archaeologist from the Bergen office of the Norwegian Institute for Cultural Heritage Research (NIKU) investigated three auger drillings carried out along the north-western side of Det Hanseatiske Museum at Finnegården 1A.

Cultural deposits under statutory protection were documented in two of the drillings and are presumed to be present in the third as well. The drillings have provided good-quality information (including the results of botanical analyses) regarding the immediate areas' archaeology and natural topography, as well as concerning the state of preservation of the organic deposits that were encountered.

## 9 Henvisninger

Johannessen, L. & Eriksson, J.-E.G., 2015. Faglig program for middelalderarkeologi. Byer, sakrale steder, befestninger og borger. Riksantikvaren.

Richer, S. & Young, D.S. 2021. Finnegarden 1A, Bergen, Norway. Pollen, Non-Pollen Palynomorphs Analyses, Macrofossils Rapid Assessment Report. – Quaternary Scientific (QUEST) Unpublished Report April 2021 (PDF); Project Number 127/18.

Standard Norge 2009. Kulturminner. Krav til miljøovervåking og -undersøkelse av kulturlag. Norsk Standard NS9451:2009. ICS 13.020.99: 91.010.99.

## 10 Dokumentasjon (NIKU)

- Innmålingsdata er i Intrasis-prosjektet Bybasen for Bergen (kontekstnumre f.o.m. 7101)
- 16 digitalbilder (filmnummer Bf30047, både jpg- og raw-format), lastet inn i MUSIT sin Fotobase
- Opplysninger om dateringsprøver og botaniske prøver er i MUSIT sin Gjenstandsbase, Bergen Museum under museumsnummer BRM 1229

### Fotoliste

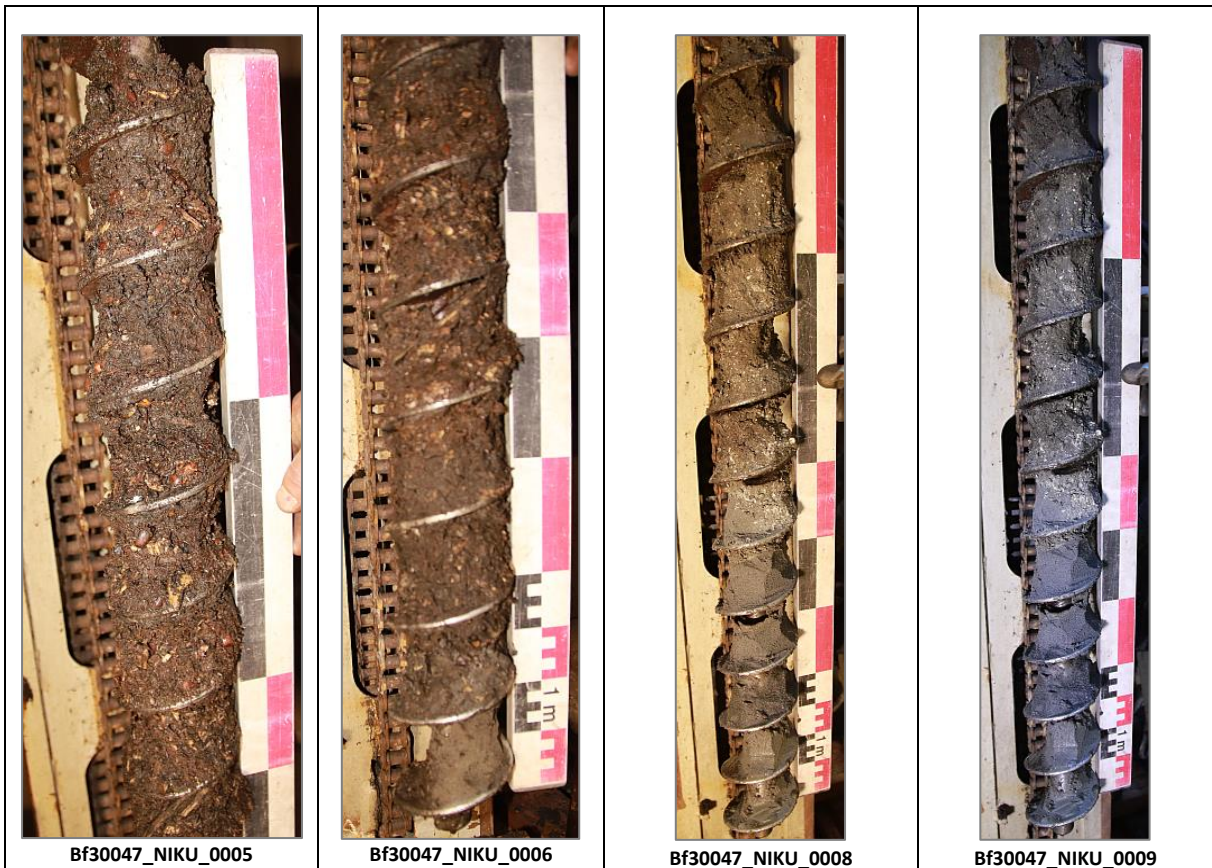
Filnavn	Motiv	Opptaksdato	Sett mot	Fotograf	Strukturnr/Objektnr
Bf30047_NIKU_0001	Punkt 1: lengden fra -0,55 til -1,55 moh	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0002	Punkt 1: lengden fra -0,55 til -1,05 moh	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0003	Punkt 1: lengden fra -1,00 til -1,55 moh	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0004	Punkt 1: lengden fra -1,55 til -2,55 moh	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0005	Punkt 1: lengden fra -1,55 til -2,10 moh	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0006	Punkt 1: lengden fra -1,95 til -2,55 moh	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0007	Punkt 1: arbeidsbilde	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0008	Punkt 1: lengden fra -2,55 til -3,55 moh (blitz)	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0009	Punkt 1: lengden fra -2,55 til -3,55 moh (white, fluorescent light)	13.01.2020	-	Rory Dunlop	-
Bf30047_NIKU_0010	Punkt 3: lengden fra -0,75 til -1,75 moh	08.05.2020	-	Rory Dunlop	-
Bf30047_NIKU_0011	Punkt 3: lengden fra -0,75 til -1,30 moh	08.05.2020	-	Rory Dunlop	-
Bf30047_NIKU_0012	Punkt 3: lengden fra -1,20 til -1,75 moh	08.05.2020	-	Rory Dunlop	-
Bf30047_NIKU_0013	Punkt 3: lengden fra -1,00 til -1,55 moh	08.05.2020	-	Rory Dunlop	-
Bf30047_NIKU_0014	Punkt 3: lengden fra -1,75 til -2,35 moh	08.05.2020	-	Rory Dunlop	-
Bf30047_NIKU_0015	Punkt 3: lengden fra -1,75 til -2,15 moh	08.05.2020	-	Rory Dunlop	-
Bf30047_NIKU_0016	Punkt 3: lengden fra -1,95 til -2,35 moh	08.05.2020	-	Rory Dunlop	-

## 11 Vedlegg

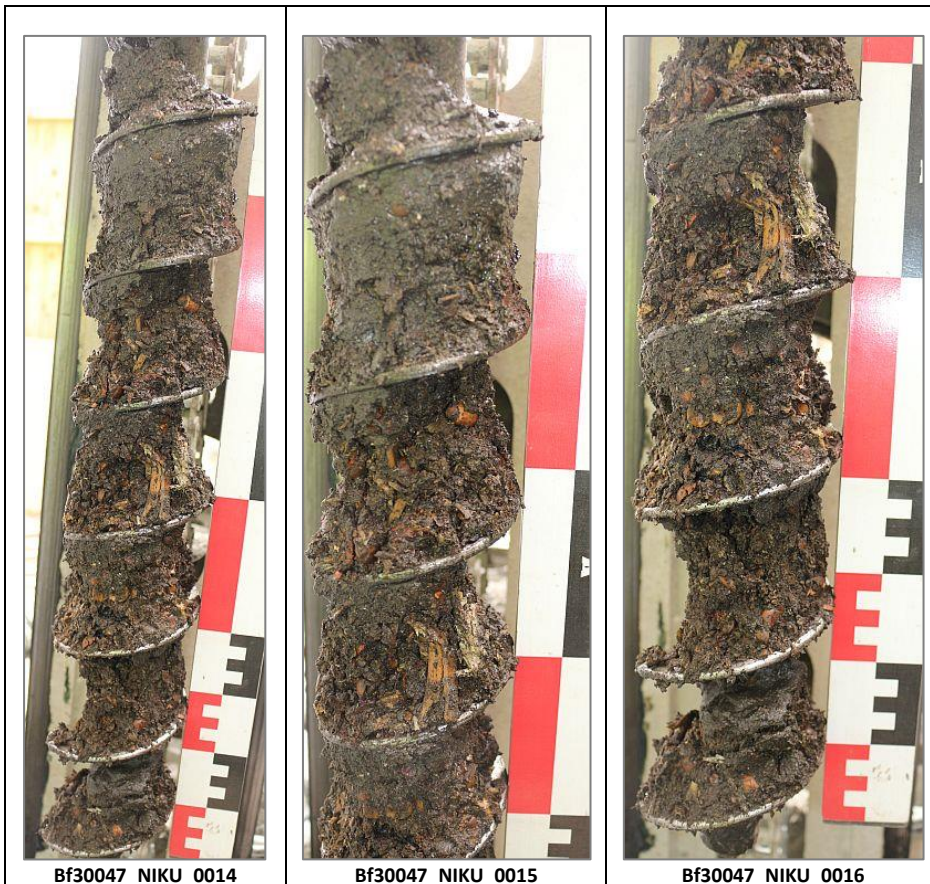
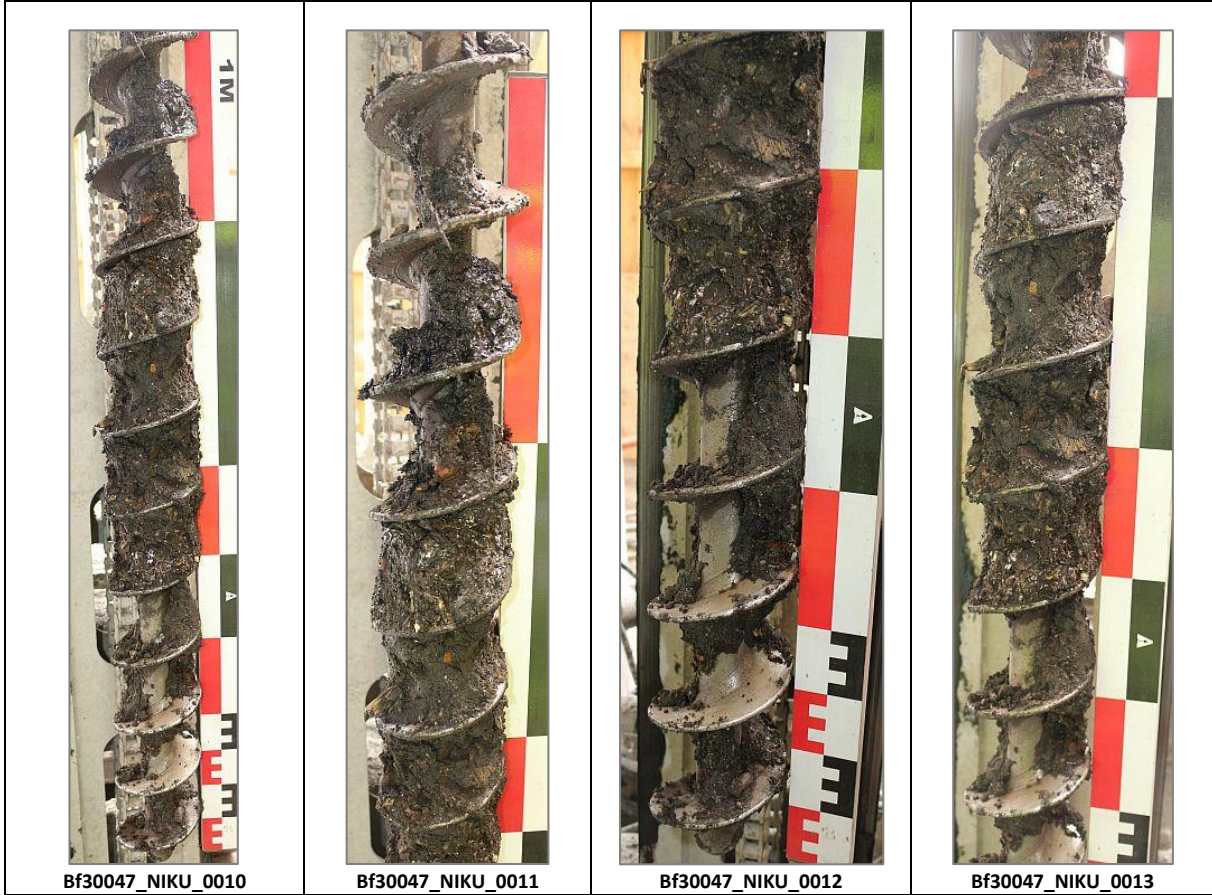
- 1: rapporten om den botaniske undersøkelsen
- 2: rapportene om karbondateringene



11.1 Foto







Norsk institutt for kulturminneforskning er et uavhengig forsknings- og kompetansemiljø med kunnskap om norske og internasjonale kulturminner.

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# FINNEGARDEN 1A, BERGEN, NORWAY

## Pollen, Non-Pollen Palynomorphs Analyses, Macrofossils Rapid Assessment Report

**Site code:** BRM1229

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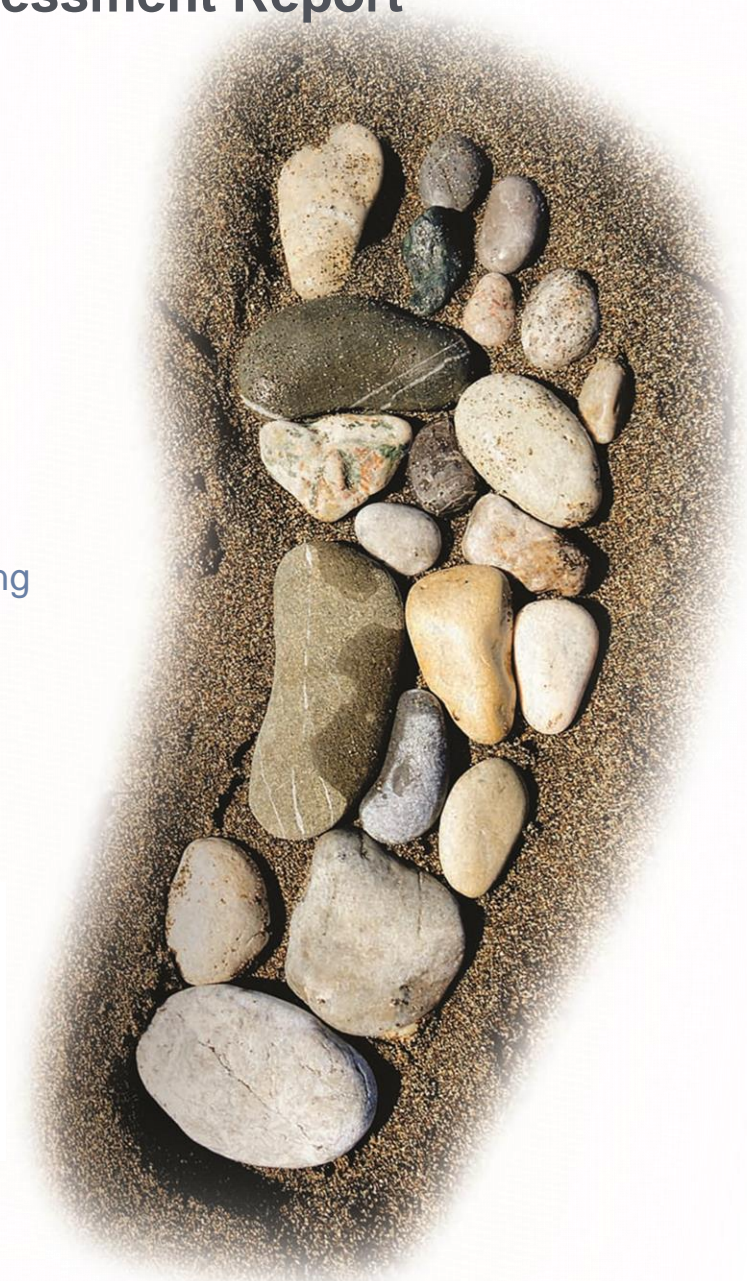
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## 1. NON-TECHNICAL SUMMARY

Pollen analysis and plant macrofossils rapid assessment were carried out by Quaternary Scientific (University of Reading) in connection with excavations at Finnegarden 1A, Bergen (Norway). The work was commissioned by the Norwegian Institute for Cultural Heritage Research (NIKU). Four samples extracted from two auger holes, Punkt 1 and Punkt 3 were submitted.

The deposits are thought to be either household rubbish that was dumped in connection with activities carried out by people (such as land reclamation, i.e. infill in the harbour area), or material that had been deposited by natural mechanisms – or, in all likelihood, a mixture of both. The aims of the pollen analysis were to provide a detailed reconstruction of the past environmental conditions at the sites and human activity/diet and in particular understanding how the area has developed over time. The plant macrofossils rapid assessment aimed to ascertain whether this technique has the potential to contribute to a palaeoenvironmental reconstruction.

The results of the investigations have established the following:

- 1) The pollen evidence is highly anthropogenic, largely consistent with waste material deposits but associated with different activities and different contexts;
- 2) Waste from flooring material, brewing beer, and from latrines formed most of the waste from samples in Punkt 1;
- 3) Interpretation of the samples from Punkt 3 is more tentative, and the anthropogenic signal is weaker:
  - high levels of microcharcoal could be associated with clearing-out after one of the many historic fires that affected the city;
  - the uppermost sample showed evidence of soil formation, possibly representing turf used as roofing material;
- 4) Samples BRM1229/5, BRM1229/7 and BRM1229/8 are suitable for further analysis of the seeds and fruits in order to investigate the vegetation history, environment of deposition and human activity at the site;
- 5) The mosses in samples BRM1229/5 and BRM1229/7 may provide further information on the general environmental history of the site and its environs and could be linked with the use of the feature as a latrine;
- 6) The moderate to high quantities of identifiable charcoal and waterlogged wood in all four samples may also provide further information on economy and diet of the site's inhabitants;
- 7) Bone in sample BRM1229/5 (if identified) may provide more information on context 7102.

## 2. INTRODUCTION

### 2.1. Site context

This report details the results of pollen, insect, parasite eggs and macrofossils analyses undertaken by Quaternary Scientific (University of Reading) in connection with augering work undertaken at Finnegarden 1A, Bergen (Norway). Quaternary Scientific was commissioned by the Norwegian Institute for Cultural Heritage Research (NIKU) to undertake the works. This report covers samples extracted from two auger holes, Punkt 1 and Punkt 3 (see Figure 1).

Two samples (BRM1229/5 and BRM1229/6) were from Punkt 1 and two samples (BRM1229/7 and BRM1229/8) were from Punkt 3. Both samples from Punkt 1 were from highly organic deposits, thought to be household rubbish, but the presence of mussel shell in BRM1229/6 suggests that this layer could have been redeposited refuse as a fill in the harbour. The lower sample (BRM1229/6), context 7103, dated from the end of the 10<sup>th</sup> century to the mid-12<sup>th</sup> century. The upper sample (BRM1229/5), context 7102, dated to the 14<sup>th</sup> century. Radiocarbon dates from Punkt 3 were not available at the time of writing, but BRM1229/8 (from context 7107) is thought to date to the early Middle Ages, and BRM1229/7 (from context 7106) has been placed in the later Middle Ages. Both samples (BRM1229/7 and BRM1229/8) are thought to be from household refuse that was (re-)deposited into the harbour as fill; the earlier deposit was highly organic in nature, and the later sample was from a mixed organic-inorganic deposit. The four samples were assessed and analysed for pollen remains and a rapid macro-fossil assessment was also carried out.

### 2.2. Archaeological and palaeoenvironmental significance

#### Pollen & non-pollen palynomorphs

The sediments have the potential to contain a wealth of further information on the past landscape, through the assessment/analysis of pollen. Such investigations can identify the nature and timing of changes in the landscape, and the interaction of different processes (e.g. vegetation change, human activity), thereby increasing our knowledge and understanding of the site and nearby area. In the case of human activity, palaeoenvironmental evidence can include: (1) decreases in tree and shrub pollen suggestive of woodland clearance; (2) the presence of herbs indicative of disturbed ground, pastoral and/or arable agriculture; (3) charcoal/microcharcoal suggestive of anthropogenic or natural burning, and (4) non-pollen palynomorphs indicative of domesticated animals.

### **Waterlogged, charred and mineralised macroplants (seeds and fruits)**

Charring is predominantly associated with human activity in archaeological assemblages with material often redeposited as waste. Burning *in situ* however can be difficult to detect. Waterlogging occurs in anoxic conditions; the low oxygen levels impede the decaying process allowing for the preservation of organic material. Macroplants (including seeds and fruits) preserved in peat and alluvium are liable to contain naturally-occurring plant material and can be used, to a certain extent, to reconstruct local vegetation. Waterlogged macroplants in urban contexts can inform on the diet and daily economy of the inhabitants.

### **Waterlogged wood and charcoal**

Waterlogged wood occurs naturally in peat, alluvium and soils, and can be used to reconstruct the local vegetation and environment. In urban contexts it is often associated with human activity deriving from structures, woodworking activities, wooden artefacts and fuel. Charcoal in archaeological contexts is habitually interpreted as spent fuel, though it can represent burnt wooden structures to provide evidence of fires. Charcoal is used to inform on fuel collection and use, woodland management strategies, such as coppicing and pollarding, timber selection as well as the local environment.

## **2.3. Aims and objectives**

The aims of the pollen investigation analyses were to provide a detailed reconstruction of the past environmental conditions of the site and human activity/diet. The macrofossils rapid assessment aims were: (1) to evaluate the concentration, nature/quality of preservation and key taxa, and (2) ascertain whether the sequences have the potential to provide a detailed reconstruction of vegetation history of the site, and in particular, to identify any evidence for human activity, diet and economy.

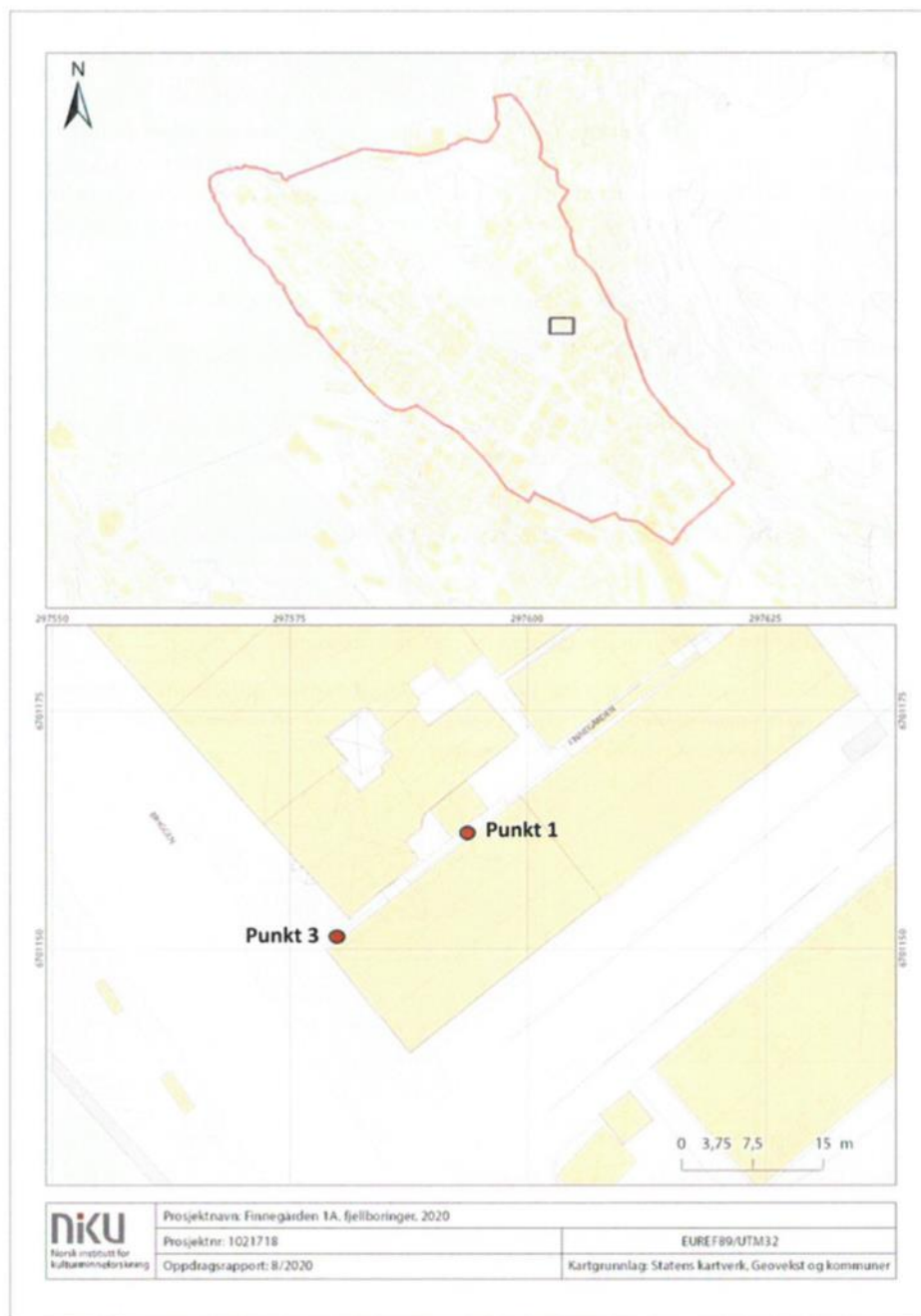


Figure 1: Illustrating the locations of the auger holes (Punkt 1 and Punkt 3) at Finnegården 1A. Image: provided by NIKU.



## 3. METHODS

### 3.1. Pollen & non-pollen palynomorph analysis

Four samples had pollen extracted. The pollen was extracted as follows (1) sampling a standard volume of sediment (6g); (2) adding two tablets of the exotic clubmoss *Lycopodium clavatum* to provide a measure of pollen concentration in each sample; (3) deflocculation of the sample in 1% Sodium pyrophosphate; (4) sieving of the sample to remove coarse mineral and organic fractions (>125 $\mu$ ); (5) acetolysis; (6) removal of finer minerogenic fraction using Sodium polytungstate (specific gravity of 2.0g/cm<sup>3</sup>); (7) mounting of the sample in glycerol jelly. Each stage of the procedure was preceded and followed by thorough sample cleaning in filtered distilled water.

Pollen grains were identified using the keys, photographs and diagnostic features published in Moore *et al.* (1991) and Beug (2004), and the author's reference collection. Identification of cereal pollen followed the criteria of Dickson (1988). Separation of *Corylus avellana* and *Myrica gale* was undertaken using criteria published in Punt *et al.* (2002); where it was not possible to distinguish between grains they were recorded as Coryloid-type. Categorisation of indeterminable grains was according to Delcourt and Delcourt (1980). Reference photographs and criteria from Cugny *et al.* (2010), van Geel (1978) and van Geel *et al.* (2003) were used to aid in the specific identification of NPPs. Types of microscopic charcoal were identified according to Courtney Mustaphi and Pisaric (2014).

All four samples were assessed by scanning four transects (10%) of the prepared slides. Concentration and preservation of pollen grains and spores were recorded, along with the principal taxa (Appendix 1). Analysis involved recording pollen grains, spores and non-pollen palynomorphs (NPPs) until a count of 300 total land pollen (TLP) was achieved.

Pollen percentages have been calculated based on terrestrial plants (trees, shrubs, heaths and herbs). Spores, aquatics and NPPs are calculated as a percentage of the total microfossil assemblage, excluding microcharcoals. Due to the extremely high counts of microcharcoal this data is presented as a count data only and not included in any sums. The results of analysis are displayed as percentage pollen diagrams (Figures 1 and 2) and produced using Tilia 2.1.1 (Grimm, 2017).

### 3.2. Macrofossil extraction and rapid assessment

Four samples were extracted and processed for the recovery of macrofossil remains, including waterlogged and charred plant macrofossils, charcoal, wood, insects, and Mollusca. The extraction process involved the following procedures: (1) measuring the sample volume by water displacement,

and (2) processing the sample by wet sieving using 300µm and 1mm mesh sizes. Each sample was scanned under a stereozoom microscope at x7-45 magnifications and sorted into the different macrofossil classes. The concentration and preservation of remains was estimated for each class of macrofossil, with the results of the initial assessment shown in Table 1. Identifications of some of the seeds and fruits have been made using modern comparative material and reference atlases (e.g. Martin & Barkley, 2000; NIAB, 2004; Cappers *et al.*, 2006). Nomenclature used follows Stace (2005).

## 4. RESULTS, INTERPRETATION AND DISCUSSION OF THE POLLEN ANALYSIS

### 4.1. Results and interpretation of the pollen assessment

All four samples indicated that preservation was good to excellent and concentration was good. Based on this, and the high numbers of taxa indicative of anthropogenic activity, full analysis was conducted on all four samples. This gave the opportunity to record rarer types in the samples and allowed for further identification of the cereal grains. The results of the initial assessment can be found in Appendix 1.

### 4.2. Results and interpretation of the pollen analysis

A pollen diagram has been constructed to aid in the interpretation of the pollen and NPP results. The samples are shown in stratigraphic order for each auger hole; but please note that the fact that Punkt 3 is shown below Punkt 1 in the pollen diagram (Figure 1) does not mean that Punkt 3 is older – actually, the upper and lower samples from the respective auger holes are more or less contemporaneous.

Due to the low number of samples from each auger hole, the diagram (Figure 2) has been presented using histograms and zoning was not undertaken. In the pollen diagram, pollen taxa are grouped into seven categories to aid description and interpretation, comprising (1) trees, (2) shrubs, (3) heaths, (4) herbs, (5) aquatics, (6) spores, and (7) non-pollen palynomorphs.

#### Punkt 1

Two samples (BRM1229/5 and BRM1229/6) were analysed from Punkt 1 (Figure 2). The pollen grains in both samples were preserved in excellent condition, with only occasional grains being folded. Folding indicates that the grains had been physically transported to their resting place or that the sediments had been compacted (Delcourt and Delcourt, 1980). Pollen concentration was excellent in BRM1229/5 and good in BRM1229/6.

#### Sample BRM1229/6

Open ground taxa dominate this sample (48%), composed predominantly of *Centaurea cyanus* (13%), Poaceae (7%), Brassicaceae (3%), *Trifolium repens*-type (3%), *Potentilla*-type (2.5%), *Matricaria*-type (2.5%), and *Mentha*-type (2.5%), Cerealia-type (2%) and *Plantago* sp. (2%). Also, of note in the rarer taxa (<1%), were *Vicia*-type, *Jasione montana*-type, *Rumex*-type, *Succisa*-type, and the cereals *Triticum/Avena* and *Hordeum*-type.

Heaths were composed of *Empetrum nigrum* (9% TLP) and shrub pollen accounted for 17% of the total land pollen (TLP). *Myrica gale* dominated the shrub pollen (8%), but *Corylus avellana* (6%) and undifferentiated Coryloid-type (3%) were also present.

Tree pollen provided 26% of the total land pollen and was primarily composed of *Pinus sylvestris* (12%) and *Alnus* (10%); however, occasional grains of *Betula*, *Quercus* and *Ulmus* were also present. *Sphagnum* and general fern spores were present in the sample, along with evidence of parasites. Whipworm eggs (*Trichuris* sp.) were found along with an unfertilised roundworm egg (*Ascaris* sp.). Unfortunately, not enough whipworm eggs were noted to be able to ascertain whether this was the species that infected humans or pigs; roundworm also infects both humans and animals. However, the general lack of evidence of dung fungal spores associated with herbivores (with the exception of a few *Sordaria* pollen grains being noted) would suggest that human waste is the more likely source of the parasite eggs. Microcharcoal was also present.

#### **Sample BRM1229/5**

Shrubs dominated this sample, accounting for over half of the total land pollen (55%); they were composed of *Myrica gale* (31%) and undifferentiated Coryloid-type (24%). Given the total absence of any *Corylus avellana* pollen grains, the Coryloid-type are likely to be *Myrica gale*.

Herbaceous taxa also had a strong representation in the sample (30%), being composed of undifferentiated *Cerealia* (10%), Poaceae (3%), *Cerealia: Hordeum*-type (3%), *Crepis*-type (2%), *Centaurea cyanus* (2%), *Plantago* sp. (1%), Brassicaceae (1%), *Cerealia: Secale* (1%). Rare types present in quantities of less than 1% included *Vicia*-type, *Potentilla*-type, *Jasione montana*-type, *Filipendula*, Cannabaceae and *Cerealia: Triticum/Avena*.

The taxa represented in the tree pollen were similar to BRM1229/6, except they were present in lower quantities: *Alnus* (4%) and *Pinus sylvestris* (4%) dominated with lower amounts of *Quercus*, *Ulmus*, *Tilia* and *Betula* also being present.

Aquatics, spores and NPPs were largely absent from this sample, with the exception of pollen from the aquatic plant *Potamogeton* being recorded, along with one egg from whipworm (*Trichuris* sp.). Microcharcoal was present, but in low amounts compared to the other three samples.

### Punkt 3

Two samples (BRM1229/7 and BRM1229/8) were analysed from Punkt 3 (Figure 2). The pollen grains in both samples were preserved in good condition, with only occasional grains being folded. Folding indicates that the grains had been physically transported to their resting place or that the sediments had been compacted (Delcourt and Delcourt, 1980). Pollen concentration was good, but high amounts of microcharcoal in BRM1229/7 considerably diluted the pollen concentration.

#### Sample BRM1229/8

Similarly to BRM1229/5, this sample was dominated by pollen from shrubs (46% TLP); however, unlike BRM1229/5, the composition of the shrub pollen was split fairly evenly between *Corylus avellana*-type (20%) and *Myrica gale* (19%), suggesting that whilst *Myrica* was present it was not as dominant here as it was in BRM1229/5.

Tree pollen (24% TLP) was similar to the other samples in that it was dominated by *Alnus* (9%) and *Pinus sylvestris* (7%); however, *Betula* pollen contributed a greater proportion (6%) compared to the samples from Punkt 1. *Ulmus* was absent in Punkt 3 samples. Heaths provided 10% of the total land pollen and were composed entirely of *Empetrum nigrum*-type.

The lowest percentage of herbaceous taxa was recorded in this sample; however, it still accounted for 20% of total land pollen. It was composed predominantly of Poaceae (7%), Cyperaceae (3%) and cereal pollen (undifferentiated = 2% and *Secale* = 2%). Other taxa present in low amounts (<2%) included *Plantago* sp., *Centaurea cyanus*, *Rumex* sp., *Ranunculus acris*-type, *Trifolium*-type, *Vicia*-type, *Crepis*-type, Chenopodiaceae, and Brassicaceae.

Algal spores were present in high quantities in this sample, along with stomata from a coniferous tree, a plant phytolith and a part of a feather (but not enough for the species to be determined). Quantities of microcharcoal were high.

#### Sample BRM1229/7

Herbaceous species were the dominant group in this sample, accounting for 38% of total land pollen. Poaceae dominated the assemblage (19%); other taxa that were present were similar to BRM1229/8, they were just observed in slightly higher amounts. These included: *Cerealia* (undifferentiated), *Secale*, *Plantago* sp., *Rumex* sp., *Ranunculus acris*-type, *Crepis*-type, Chenopodiaceae and Brassicaceae, with lower amounts of *Centaurea cyanus*.

Tree and shrub pollen were both present in equal amounts (29%). Similarly to BRM1229/8, tree pollen was dominated by *Alnus* (7%), *Pinus sylvestris* (16%) and *Betula* (6%), with a single pollen grain of *Tilia* also being noted. Shrub pollen was primarily from *Corylus* pollen (23%), with some *Myrica gale* (3%) and some undifferentiated *Corylus* pollen grains (3%).

*Sphagnum*, *Polypodium* and indeterminate fern spores were present in this sample, along with non-pollen palynomorphs that included *Glomus* sp. spores and a chironomid mouth part. This sample contained the highest levels of microcharcoal from both the burning of wood and leaves/grasses.



### 4.3. Discussion of the pollen analysis

Pollen analysis was undertaken to reconstruct the local environment and provide evidence of human activity around Finnegarden, Bryggen, Bergen, Norway. The deposits examined were from two auger holes, Punkt 1 and 3. The deposits are thought to be rubbish that was dumped, or refuse that had been deposited. Each sample is discussed individually given that the deposits have not built up gradually over time but are likely to be episodic or associated with discrete events.

However, the tree pollen seen in all three samples is remarkably similar, but present in low quantities, which would suggest that it is likely to be representative of the wider landscape, either coming in with other material that was dumped, or being a component of the airborne pollen assemblage. The main taxa present were alder (*Alnus*) and Scots pine (*Pinus sylvestris*), with birch (*Betula*) also being present in higher quantities in Punkt 3. Studies undertaken in Bergen in the 1970s, comparing the pollen rain from inside the town with that from the surrounding area, showed that the town only received one tenth of the pollen compared to sample sites outside of the city. This supports the idea that the low numbers of arboreal pollen are likely to be representative of the vegetation on the slopes around the city (Krzywinski, 1983).

#### Punkt 1 – Sample BRM1229/6

This sample contained eggs from both whipworm and roundworm – parasites that are known to infect both humans and animals. Due to the low number of eggs found, it is not possible to distinguish whether the whipworm was the species that infects people or pigs. However, it does tell us that faecal matter was contained in this sample. Analysis of samples from a latrine excavated at Bryggen in the 1970s/80s revealed that mosses were likely used as toilet paper (Krzywinski, 1983), with an estimated 15–20 tonnes of moss needed every year for a town of 5,000 people. *Sphagnum* moss spores were present in this sample, but in low quantities. Their presence would lend some support to the idea that this deposit contained human latrine deposits, but the low number of spores would suggest other material was also incorporated with the sample.

It is possible that some of the 'other material' could have been discarded flooring. There is a high proportion of cornflower pollen in the sample, but relatively low numbers of cereal grains. Cornflower is likely to have entered Norway with imported cereal grain during the 11–12<sup>th</sup> centuries (Richer, 2020a), and given its association with cereals (Bakels, 2012) it is strange that the proportion of cornflower pollen is considerably higher than cereal pollen grains. A similar scenario was found in a deposit from a post-medieval cellar floor in Torvet, Trondheim, where pollen from rosemary/mint/thyme (*Mentha*-type) family was also noted (Richer, 2020b). In that instance, it was



interpreted that herbs were used as strewing herbs on the floor to create a sweet smell when they were walked over, or to keep pests at bay. The cornflower is likely to have grown with the cereal crop, and to have been harvested with it. However, because cornflower does not grow as high as most cereals (especially rye, with which it is usually associated), when the heads of the cereals and their pollen were removed for processing, the whole cornflower plant (including the flower and its pollen) would have stayed with the cereal stalks/straw. This would suggest that high numbers of cornflower pollen are likely to be associated with the straw, rather than with the grain from cereals. This situation would account for why the cornflower pollen is present in higher numbers compared to the cereal pollen. In addition, this is the only sample where pollen from rosemary/mint/thyme were recorded. Therefore, it is highly likely that flooring material was incorporated into this deposit.

Lastly, there is some evidence for brewing in this sample, in the form of pollen from bog myrtle (*Myrica gale*) and barley (*Hordeum*); this is discussed further in sample BRM1229/5. However, the amounts were low in BRM1229/6. Another rare type, Sheep's bit scabious (*Jasione montana*-type), is not usually found in waterlogged deposits because it is insect pollinated and prefers well-drained soils, which are not ideal for pollen preservation. This would suggest that the mechanism for its incorporation into both samples in Punkt 1 is likely to have a human origin. One possible route is through honey, or other products from bees; this is because the plant is highly favoured by bees, being rich in nectar and having petals that reflect ultraviolet, making it strongly visible.

### **Punkt 1 – Sample BRM1229/5**

Cornflower pollen continues to be present in this sample; however, it is now outnumbered by cereal pollen, in particular from rye (*Secale*) and barley (*Hordeum*). It therefore seems unlikely that its presence here is related to flooring material, as was the case in sample BRM1229/6. Instead, bog myrtle (*Myrica gale*) dominates the assemblage. Bog myrtle is known to be one of the main ingredients in medieval beer production, and its association in this context with barley would suggest that this sample was predominantly composed of material from brewing waste. The excavations in the 1970s/80s found that medieval plant macrofossils of barley had been germinated to make malt needed in brewing; this malt was found in conjunction with high proportions of bog myrtle pollen and was interpreted as evidence of brewing (Krzywinski, 1983). It would therefore seem likely that this sample contained a large proportion of waste from the brewing process. The single whipworm egg found would, however, suggest that other types of waste had also been included, such as excrement.

### Punkt 3 – Sample BRM1229/8

In comparison to the samples from Punkt 1, this sample does not have the same strong signals for a dominant type of waste/activity. Cereal pollen, in particular rye pollen, is present along with cornflower, which suggests cultivation of cereals (Bakels, 2012). Bog myrtle pollen is present, but in lower quantities compared to BRM1229/5 and there is an absence of barley pollen in this sample — however, it does inform us that bog myrtle pollen was entering the archaeological record. In addition, bean (*Vicia*-type) was present in low quantities and hazel (*Corylus*) pollen was present in its highest quantities in this sample; and like BRM1229/7 microcharcoal was extremely high.

From a sequence from a medieval building at Bryggen, plant material from a fire layer revealed a combination of hazelnuts (*Corylus*), rye (*Secale*) and bean (*Vicia*-type) (Krzywinski, 1983). A similar assemblage is seen in this sample, including the evidence of fire in the form of high levels of microcharcoal; therefore, it can be tentatively suggested that this sample could be representative debris after a fire from a domestic context.

This sample contained both organic and inorganic material. The pollen is from the organic component. Very fine particles of sand were also in the sample, which is suggestive of water movement. This sample was the only one with a high number of algal spores recorded, therefore it would seem likely that at some point in the past water washed in — potentially bringing the sand with it — leaving still/slow-moving water that allowed the algae to form. Overall, the anthropogenic signal in this sample is more diluted than from the previous samples.

### Punkt 3 – Sample BRM1229/7

This sample contains the highest concentrations of microcharcoal, suggesting that either the coring site was located close to a source of fire, or more likely, that the material deposited here contained high amounts of ash from a fire. It is also the sample that is most indicative of a natural environment, not just dumped material. Tree pollen is at its highest in this sample, along with the highest percentages of hazel and grasses. However, evidence of cereal cultivation is limited and bog myrtle and anthropogenic indicators of disturbed ground, such as plantain and sorrel, are reduced. A clue concerning the origins of this sample exists in the non-pollen palynomorphs. Spores from *Glomus* sp. were present, which is a species that forms on roots when soil formation has started, this would suggest that — unlike the samples from Punkt 1, which consisted primarily of waste from specific activities — here, soil had formed, allowing plants to establish. It is not possible to say for certain whether this soil had developed *in situ*, or whether it had been moved/cleared/eroded to this location, but one hypothesis is that it represents turf used as roofing material, something that was common

on medieval buildings at Bryggen. This would explain why there is a higher representation of taxa associated with soil disturbance – and it would also tie in well with the high prevalence of microcharcoal, which could have derived from a fire. In addition, the lack of evidence for domestic or industrial waste, in conjunction with the greater representation of trees, grasses, and herbs, suggests a more naturalised environment.

## 5. RESULTS, INTERPRETATION AND DISCUSSION OF THE MACROPLANT ANALYSIS

The results of the macrofossil rapid assessment are shown in Table 1. The results of the assessment indicate that all four samples include moderate to high concentrations of charcoal, including identifiable fragments (>4mm on all axes) in all four samples. No charred seeds were identified in any of the four samples, but waterlogged seeds and fruits were identified in low concentrations in sample BRM1229/6, and in moderate to high concentrations in the remainder of the samples. Taxa identified in these samples included *Persicaria* sp. (knotweed), *Chenopodium* sp. (goosefoot), *Corylus avellana* (hazelnut shell fragments), *Prunus* cf. *persica* (cf. peach), *Prunus* cf. *avium* (sweet cherry), *Silene/Stellaria* sp. (campion/stitchwort), *Ranunculus* sp. (buttercup), and *Rubus* sp. (e.g. bramble/raspberry). Waterlogged moss remains were present in samples BRM1229/5, BRM1229/6, and BRM1229/7; various species were present, including *Polytrichum* sp. (haircap moss). Waterlogged wood was recorded in moderate to high quantities in all four samples; in each case this included identifiable fragments greater than 4mm in diameter on all axes.

High concentrations of Mollusca, present in most cases as unidentifiable fragments, were recorded in sample BRM1229/7 but were absent elsewhere. Fragments of bone were present in samples BRM1229/5 and BRM1229/8; in the latter this included large fragments. In both samples these appeared to be uncharred. Fragments of insects were identified in low to moderate concentrations in samples BRM1229/5, BRM1229/6, and BRM1229/7.

**Table 1: Results of the macrofossil rapid assessment of samples from Finnegarden 1A, Bergen, Norway.**

Sample number	Borehole number	Context number	Description	Fraction	Sample size (l)	Charcoal (>4mm)	Charcoal (2-4mm)	Charcoal (<2mm)	Charred Seeds	Charred Seed Identifications	Waterlogged Wood	Waterlogged Seeds	Main taxa	Mollusca (Whole)	Mollusca (Fragments)	Bone (Charred)	Bone (Large)	Bone (Small)	Bone (Fragments)	Insects	Moss
BRM1229/5	Punkt 1	7102	Highly organic, probable household refuse; 14 <sup>th</sup> century	300µm	0.75	-	-	1	-	-	-	1	Indeterminate seed casings	-	-	-	-	-	-	2	-
				1mm		2	2	-	-	-	3	3	<i>Persicaria</i> sp. <i>Chenopodium</i> sp. <i>Corylus avellana</i>	-	-	-	-	2	-	-	3
BRM1229/6		7103	Highly organic, probable household waste; end 10 <sup>th</sup> to mid-12 <sup>th</sup> century	300µm	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1
				1mm		2	2	-	-	-	3	1	<i>Prunus</i> cf. <i>persica</i> <i>Polytrichum</i> sp.	-	-	-	-	-	-	3	-
BRM1229/7	Punkt 3	7106	Mixed organic/inorganic, probably household waste; later Middle Ages	300µm	0.05	-	-	4	-	-	-	1	<i>Silene/Stellaria</i> sp.	-	4	-	-	-	-	1	-
				1mm		2	2	-	-	-	3	4	<i>Corylus avellana</i> <i>Ranunculus</i> sp. <i>Prunus</i> cf. <i>avium</i> <i>Rubus</i> sp.	-	3	-	-	-	-	-	2
BRM1229/8		7107	Highly organic, probable household waste; early Middle Ages.	300µm	0.15	-	-	4	-	-	-	1	Indeterminate seed casings	-	-	-	-	-	-	-	-
				1mm		3	3	-	-	-	4	3	<i>Persicaria</i> sp. <i>Corylus avellana</i>	-	-	-	2	1	-	-	-

## 6. CONCLUSIONS

The pollen evidence from all four samples is highly anthropogenic. The interpretation of the pollen and NPPs is largely consistent with the archaeological interpretation that the deposits contained in both auger holes were from waste material, either in a primary location or deposited. However, the material being dumped appears to have been associated with different activities and different locations.

The samples in Punkt 1 illustrate that different types of waste were dumped together or mixed together as part of redeposition. Waste from flooring material, brewing beer, and from latrines formed most of the waste from samples in Punkt 1. However, interpretation of the samples from Punkt 3 is more tentative, and the anthropogenic signal is fainter. Both samples contain high levels of microcharcoal and could be associated with clearing-out after one of the many historic fires that affected the city. The uppermost sample in this core showed evidence of soil formation, with the most likely interpretation being that it represents turf used as roofing material.

With regards to the plant macroremains, samples BRM1229/5, BRM1229/7 and BRM1229/8 are suitable for further analysis of the seeds and fruits in order to investigate the vegetation history, environment of deposition and human activity (including economy and diet) at the site, whilst the mosses in samples BRM1229/5 and BRM1229/7 may also provide further information on the general environmental history of the site and its environs. The moderate to high quantities of identifiable charcoal and waterlogged wood in all four samples may also provide further information on economy and diet of the site's inhabitants, whilst the bone in sample BRM1229/5 (if identified) may provide more information on the nature of context 7102.

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## APPENDIX 1: POLLEN ASSESSMENT COUNTS, FINNEGARDEN 1A, BERGEN (NORWAY)

Date/Period		14th century	10-12th century	late Middle Ages?	early Middle Ages?
Location		Punkt 1		Punkt 3	
Sample		5	6	7	8
Latin name	Common name				
<i>Alnus</i>	alder	9	15	4	10
<i>Betula</i>	birch	3	2	3	5
<i>Quercus robur-pubescens</i> -type	oak	1	3		
<i>Tilia</i>	small-leaved lime	1			
<i>Ulmus</i>	elm	1			
<i>Pinus sylvestris</i>	Scot's pine	9	22	13	9.5
Coryloid-type	hazel/bog myrtle	53	2	14	13
<i>Corylus avellana</i>	hazel		8	11	12
<i>Myrica gale</i>	bog myrtle	78	8	7	11
<i>Salix</i>	willow		1	1	
<i>Empetrum nigrum</i>	crowberry	7	11	3	8
Poaceae undiff	grasses	3	13	14	10
Cyperaceae	sedges	1	1	1	4
Cerealia undiff	cereal	28	5		2
Cerealia: <i>Secale</i>	cereal: rye	3			1
Cerealia: <i>Triticum/Avena</i>	cereal: wheat/oats	3			
Apiaceae	carrot family		1		
Brassicaceae	brassica family	3	6	4	1
Cannabaceae	hemp/hop	1			
<i>Centaurea jacea</i> -type	knapweed		7	1	
<i>Centaurea cyanus</i> -type	cornflower	4	11	2	
<i>Crepis</i> -type	includes dandelion	3	1	1	1
<i>Jasione montana</i> -type	sheep's bit	1	1		
<i>Matricaria</i> -type	includes yarrow		3	2	
<i>Mentha</i> -type	mint/oregano/thyme/catmint/winter savory		5		
<i>Plantago</i> sp.	plantain	3	5		1
<i>Polygonum aviculare</i> -type	knotweed	2			
<i>Potentilla</i> -type	cinquefoil	2	7		
<i>Ranunculus acris</i> -type	buttercup		1	2	2
<i>Rumex</i> sp.	sorrel/dock		1	1	
<i>Scabiosa</i> -type	scabious		4		
<i>Silene</i>	campions	1			
<i>Trifolium repens</i> -type	clover		1		1
<i>Vicia</i> -type	pea/bean/vetch	2			
Potamogeton	pond weed	7			
Agal spore	agal spores				141
<i>Sphagnum</i>	spagnum moss		3	1	2
<i>Ophioglossum</i>	adder's toungue fern		2		
<i>Polypodium vulgare</i>	common polypody		6		2
Pteropside (mono) indet	fern spore	1	7	3	
<i>Glomus</i>	spore indicative of soil			4	
<i>Sordaria</i> -type	dung fungal spore			2	
<i>Trichuris</i> sp. ova	whipworm egg	1	3		
<i>Ascaris</i> (unfertilised) ova	roundworm egg		1		
Phytolith	silica form of plant cell				1
Microcharcoal: wood		125	151	496	342
Microcharcoal: leaf/grass		17	25	76	57
Exotic marker counted		34	21	118	57
<b>Total Land Pollen (grains counted)</b>		<b>222</b>	<b>145</b>	<b>84</b>	<b>91.5</b>
<b>Concentration</b>		3	2	2	2
<b>Preservation</b>		3	3	2	2
<b>Suitable for further analysis</b>		<b>YES</b>	<b>YES</b>	<b>YES</b>	<b>YES</b>

Concentration: 0 = 0 grains; 1 = 1–75 grains; 2 = 76–150 grains; 3 = 151–225 grains; 4 = 226–300 grains; 5 = 300+ grains per slide. Preservation: 0 = absent; 1 = poor; 2 = good; 3 = excellent.

UBANo	Sample ID	Material Type	<sup>14</sup> C Age	±	F14C	±	mg Graphite
UBA-42563	BRM1229/1	Hazelnut	622	31	0.9255	0.0036	1.200
UBA-42564	BRM1229/2	Moss	1000	26	0.8830	0.0028	0.788

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## Radiocarbon Date Certificate

Laboratory Identification: UBA-42563  
Date of Measurement: 2020-07-17  
Site: Finnegården 1A  
Sample ID: BRM1229/1  
Material Dated: seed or nutshell  
Pretreatment: AAA  
mg Graphite: 1.200  
Submitted by: Rory Dunlop

Conventional	622±31
<sup>14</sup> C Age:	BP
	using
Fraction	AMS
corrected	δ <sup>13</sup> C

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## Radiocarbon Date Certificate

Laboratory Identification: UBA-42564

Date of Measurement: 2020-07-21

Site:

Sample ID: BRM1229/2

Material Dated: plant macrofossil

Pretreatment: AAA

mg Graphite: 0.788

Submitted by: Rory Dunlop

Conventional	1000±26
<sup>14</sup> C Age:	BP
	using
Fraction	AMS
corrected	δ <sup>13</sup> C

## Information about radiocarbon calibration

RADIOCARBON CALIBRATION PROGRAM\*

CALIB REV7.0.1

Copyright 1986-2019 M Stuiver and PJ Reimer

\*To be used in conjunction with:

Stuiver, M., and Reimer, P.J., 1993, Radiocarbon, 35, 215-230.

Annotated results (text) - -

42563

UBA-42563

Radiocarbon Age BP 622 +/- 31

Calibration data set: intcal13.14c

% area enclosed cal AD age ranges

# Reimer et al. 2013

relative area under  
probability distribution

68.3 (1 sigma) cal AD 1298- 1322

0.383

1347- 1372

0.388

1378- 1392

0.229

95.4 (2 sigma) cal AD 1291- 1399

1.000

42564

UBA-42564

Radiocarbon Age BP 1000 +/- 26

Calibration data set: intcal13.14c

% area enclosed cal AD age ranges

# Reimer et al. 2013

relative area under  
probability distribution

68.3 (1 sigma) cal AD 995- 1037

1.000

95.4 (2 sigma) cal AD 986- 1048

0.813

1087- 1123

0.154

1138- 1149

0.032

References for calibration datasets:

Reimer PJ, Bard E, Bayliss A, Beck JW, Blackwell PG, Bronk Ramsey C, Buck CE, Cheng H, Edwards RL, Friedrich M, Grootes PM, Guilderson TP, Hafliðason H, Hajdas I, Hattala C, Heaton TJ, Hogg AG, Hughen KA, Kaiser KF, Kromer B, Manning SW, Niu M, Reimer RW, Richards DA, Scott EM, Southon JR, Turney CSM, van der Plicht J.

IntCal13 and MARINE13 radiocarbon age calibration curves 0-50000 years calBP

Radiocarbon 55(4). DOI: 10.2458/azu\_js\_rc.55.16947

Comments:

\* This standard deviation (error) includes a lab error multiplier.

\*\* 1 sigma = square root of (sample std. dev.^2 + curve std. dev.^2)

\*\* 2 sigma = 2 x square root of (sample std. dev.^2 + curve std. dev.^2)

where ^2 = quantity squared.

[ ] = calibrated range impinges on end of calibration data set

0\* represents a "negative" age BP

1955\* or 1960\* denote influence of nuclear testing C-14

NOTE: Cal ages and ranges are rounded to the nearest year which may be too precise in many instances. Users are advised to round results to the nearest 10 yr for samples with standard deviation in the radiocarbon age greater than 50 yr.

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UBANo	Sample ID	Material Type	<sup>14</sup> C Age	±	F14C	±	mg Graphite
UBA-43261	BRM1229/3	Hazelnut	704	39	0.9161	0.0044	0.945
UBA-43262	BRM1229/4	Hazelnut	796	20	0.9056	0.0023	1.002

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## Radiocarbon Date Certificate

Laboratory Identification: UBA-43261  
Date of Measurement: 2020-09-07  
Site: Finnegården 1A  
Sample ID: BRM1229/3  
Material Dated: seed or nutshell  
Pretreatment: AAA  
mg Graphite: 0.945  
Submitted by: Rory Dunlop

Conventional <sup>14</sup> C	
Age:	704±39 BP
	using AMS
Fraction corrected δ <sup>13</sup> C	



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## Radiocarbon Date Certificate

Laboratory Identification: UBA-43262  
Date of Measurement: 2020-09-07  
Site: Finnegården 1A  
Sample ID: BRM1229/4  
Material Dated: seed or nutshell  
Pretreatment: AAA  
mg Graphite: 1.002  
Submitted by: Rory Dunlop

Conventional <sup>14</sup> C
Age: 796±20 BP
using AMS
Fraction corrected δ <sup>13</sup> C

## Marine samples will require re-calibration with the marine calibration curve

2

### RADIOCARBON CALIBRATION PROGRAM\*

CALIB REV8.2

Copyright 1986-2020 M Stuiver and PJ Reimer

\*To be used in conjunction with:

Stuiver, M., and Reimer, P.J., 1993, Radiocarbon, 35, 215-230.

UBA-43261

43261

Radiocarbon Age BP 704 +/- 39

Calibration data set: intcal20.14c

% area enclosed cal AD age ranges

# Reimer et al. 2020

relative area under  
probability distribution

68.3 (1 sigma) cal AD 1273- 1302

0.793

1368- 1379

0.207

95.4 (2 sigma) cal AD 1231- 1241

0.016

1259- 1323

0.716

1356- 1392

0.268

Median Probability: 1292

UBA-43262

43262

Radiocarbon Age BP 796 +/- 20

Calibration data set: intcal20.14c

% area enclosed cal AD age ranges

# Reimer et al. 2020

relative area under  
probability distribution

68.3 (1 sigma) cal AD 1228- 1247

0.636

1253- 1265

0.364

95.4 (2 sigma) cal AD 1221- 1271

1.000

Median Probability: 1245

#### References for calibration datasets:

Reimer P, Austin WEN, Bard E, Bayliss A, Blackwell PG, Bronk Ramsey C, Butzin M, Edwards RL, Friedrich M, Grootes PM, Guilderson TP, Hajdas I, Heaton TJ, Hogg A, Kromer B, Manning SW, Muscheler R, Palmer JG, Pearson C, van der Plicht J, Reim Richards DA, Scott EM, Southon JR, Turney CSM, Wacker L, Adolphi F, BÄntgen U, Fahrni S, Fogtmann-Schulz A, Friedrich R, KÄhler P, Kudsk S, Miyake F, Olsen J, Sakamoto M, Sookdeo A, Talamo S. 2020.

The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0-55 cal kB Radiocarbon 62. doi: 10.1017/RDC.2020.41.

#### Comments:

\* This standard deviation (error) includes a lab error multiplier.

\*\* 1 sigma = square root of (sample std. dev.^2 + curve std. dev.^2)

\*\* 2 sigma = 2 x square root of (sample std. dev.^2 + curve std. dev.^2)

where ^2 = quantity squared.

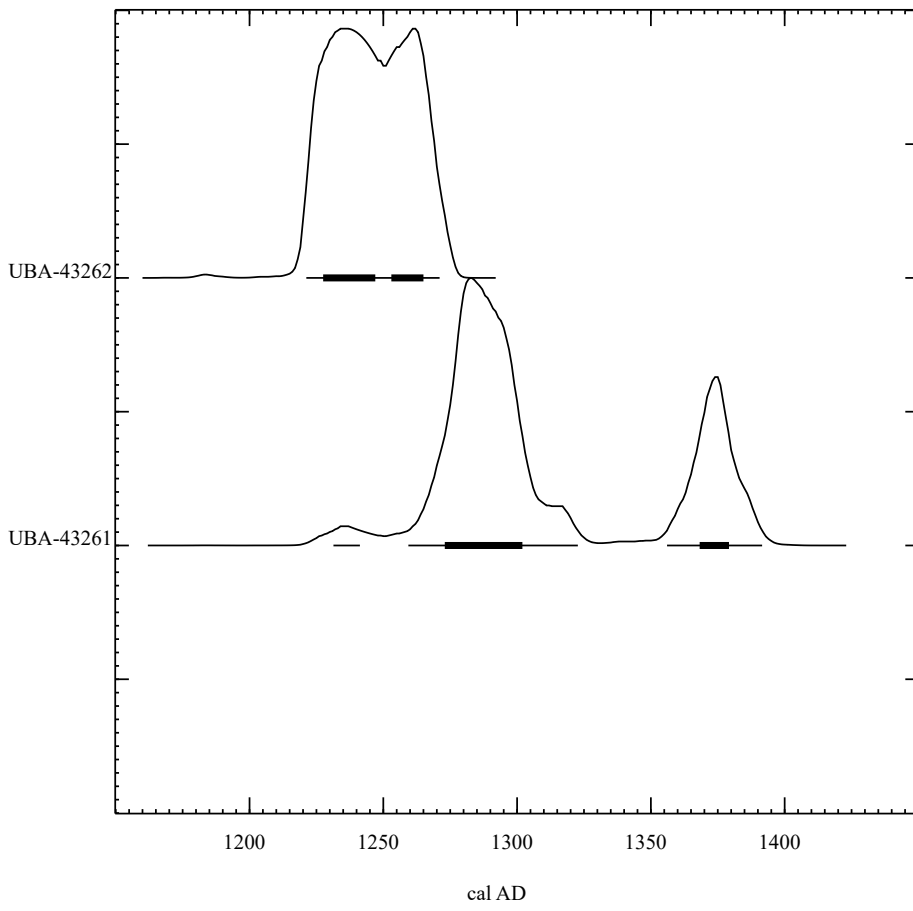
[ ] = calibrated range impinges on end of calibration data set

0\* represents a "negative" age BP

1955\* or 1960\* denote influence of nuclear testing C-14

NOTE: Cal ages and ranges are rounded to the nearest year which may be too precise in many instances. Users are advised to round results to the nearest 10 yr for samples with standard deviation in the radiocarbon age greater than 50 yr.

Posterior Probability Distributions



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