KULTURHISTORISK
MUSEUM
UNIVERSITETET I OSLO
FORNMINNESEKSJONEN
Postboks 6762,
St. Olavs Plass
0130 Oslo

RAPPORT

ARKEOLOGISK UTGRAVNING

Tjæremiler og kullgroper

Lauten 137/1, 152/27, 153/39 and
Vilberg 177/4, Ullensaker
Kommune, Akershus

Feltleder: Michael Derrick
Prosjektleder: Kjetil Loftsgarden

Oslo 2013

KULTURHISTORISK MUSEUM
UNIVERSITETET I OSLO

Gårds-/ bruksnavn Vilberg 177/4 Lauten 137/1, 152/27, 153/39	G.nr./ b.nr. 177/4 137/1, 152/27, 153/39
Kommune Ullensaker	Fylke Akershus
Saksnavn Reguleringsplan for Gardemoen næringspark II B&C	Kulturminnetype Tjæremiler og kullgroper
Saksnummer (arkivnr. KHM) 10/8247	Prosjektkode 430183
Eier/ bruker, adresse Diverse	Tiltakshaver Bergmoen AS
Tidsrom for utgravning 11. november - 18. november 2011	M 711-kart/ UTM-koordinater/ Kartdatum UTM; Sone 32 (EUREF89/WGS84) Nord: 6673465, Øst: 618947
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A-nr. 2011/349	C.nr. 58104
ID-nr (Askeladden) Id 112692134577, id 134587, id 134588, id 134497, id 134575 og id 134597.	Negativnr. (KHM) Cf34503
Rapport ved: Michael Derrick	Dato: 22.05.12
Saksbehandler: Kjetil Loftsgarden	Prosjektleder: Kjetil Loftsgarden

SAMMENDRAG

En arkeologisk utgravning av tre kullgroper og tre tjæremiler (Id 134577, 134587 og 134588 og id 134497, 134575 og 134597) ble gjennomført av Kulturhistorisk museum i perioden 01.11.11-18.11.11 på Lauten 137/1, 152/27, 153/39 og Vilberg 177/4, Ullensaker, Akershus i forbindelse med reguleringsplan for Gardermoen Næringspark. Lokalitetene lå nord for RV 35 og mellom E6 og Vilbergveien i nærheten til Oslo Lufthavn Gardermoen. Området er avsatt til næringsbebyggelse i kommunedelplanen. Flere kulturminner er registrert i nærområdet, hovedsakelig kullgroper, tjæremiler og fangstgroper fra middelalder og nyere tid. Det er også registrert et gravfelt på Låke gård (153/1, 7, 9) og løsfunn fra steinalder og vikingtid.

Strukturene lå i skogsterreng og ble undersøkt ved maskinell og manuell graving (Derrick 2012). I to av tjæremilene (id 134497 og id. 134597) ble det dokumentert eldre kullgroper, som tjæremilene var anlagt over. I id. 134597 ble det dokumentert to bruksfaser. Første fase ble datert fra slutten av 1300-tallet til midten 1400 tallet og den andre fasen begynte midten av 1400-tallet. Tjæremile 134577 ble datert fra tidlig 1400-tallet til 1500-tallet og id. 134575 var konstruert rundt 1420 AD. Tjæremile id 134497 hadde en maksimal avkastning på 3696 m^3 med en sannsynlig avkastning på mellom 2310-3080 m^3. Tjæremile id. 134577 hadde et optimalt utbytte på 2976 m^3 og en sannsynlig avkastning på 1860-2480 m^3. Den første fasen av tjæremile id. 134597 ville ha produserte en maksimal avkastning på 7104 m^3 med en sannsynlig avkastning på 4440-5920 m^3. Mens den andre fasen produsert maksimalt 4560 m^3 og en sannsynlig avkastning på 2850-3800 m^3.
Alle kullgropene på prosjektet viste seg å ha kvadratisk milebunn, og var av mellomstor/stor størrelse i henhold til gjeldende definisjoner for denne typen kulturminner (Narmo 1996). 17 kullprøver ble videresendt til vedartsbestemmelse hos Helge I. Høeg (2011). De ble datert til 1170-1225 AD (id 134588), 1170-1235 AD (id 134587) og 1050-1215 AD (id 134577). Prøvene inneholdt i all hovedsak furu samt noe bark og gran.

Kulturhistorisk museum, Fornminneseksjonen, Universitetet i Oslo
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Contents

ARCHAEOLOGICAL EXCAVATION REPORT

AN ARCHAEOLOGICAL EXCAVATION AT LAUTEN 137/1, 152/27, 153/39 AND VILBERG 177/4, ULLENSAKER KOMMUNE, AKERSHUS.

MICHAEL DERRICK

1. BACKGROUND

Gardemoen næringspark II B and C lies between Gardemoen international airport in the west and Villbergveien in the east. The northern part of the development area lies to the north of RV 35 and between the E6 and Villbergveien. (Reguleringsplan for Gardemoen II, B & C) (Johannessen 2010). A total of 24 archaeological structures were identified. Riksantikvaren gave permission for seven of these to be excavated (id 134572, id 134578, id134579, id 134580, id 134582, id 134584 and id 134497) in advance of the removal of gravel for the construction of a warehouse for COOP Norway. Id 134578, id 134579, id 134580, id 134582 and id 134584 were investigated by the Kulturhistorisk museum in autumn 2010 (Gundersen 2012).

The development area was extended towards the east and south in order to accommodate the infrastructure needed for such a large development. In 2010 Akershus fylkeskommune conducted an evaluation of this area and found 4 tar kilns, 5 charcoal pits, 13 pits of unknown function and a hollow way (Finstad and Eymundsson 2010).

In total the 27 localities investigated contained 10 tar kilns, 15 charcoal production pits, 1 pit trap, 13 pits of unknown function and a hollow way.

Akershus fylkeskommune sent the case to Riksantikvaren in accordance with the kulturminnelovens § 8, 4. dated the 9th March 2011, where they recommended archaeological excavation of the structures. The Kulturhistorisk museum sent a letter to Riksantikvaren dated 8th April 2011 in which they agreed with the findings of the fylkeskommune. Riksantikvaren gave permission for the archaeological excavation of the structures in a letter dated 14th April 2011.

On 22th October 2011 Riksantikvaren sent a letter informing the developer Bergmoen AS, that permission had been granted to excavate the following structures: pit trap id 70586, tar kilns id 134575, id 134592, id 134597, id 134599 and charcoal production pits id 134600, id 134577, id 134585, id 134587, id 134588, 134593, id 134594, id 134595, id 134596 and id 134598 in accordance with Kulturminneloven §10.

Bergmoen AS asked for the excavation to be carried out in the area in Autumn 2011. Riksantikvaren agreed and outlined the requirements and costs involved, in a letter dated 20th October 2011. On the 1st November 2011 the

Kulturhistorisk museum began the excavation of 6 of these structures (134577, id 134587, id 134588, id 134497, id 134575 and id 134597) (see figure 1).

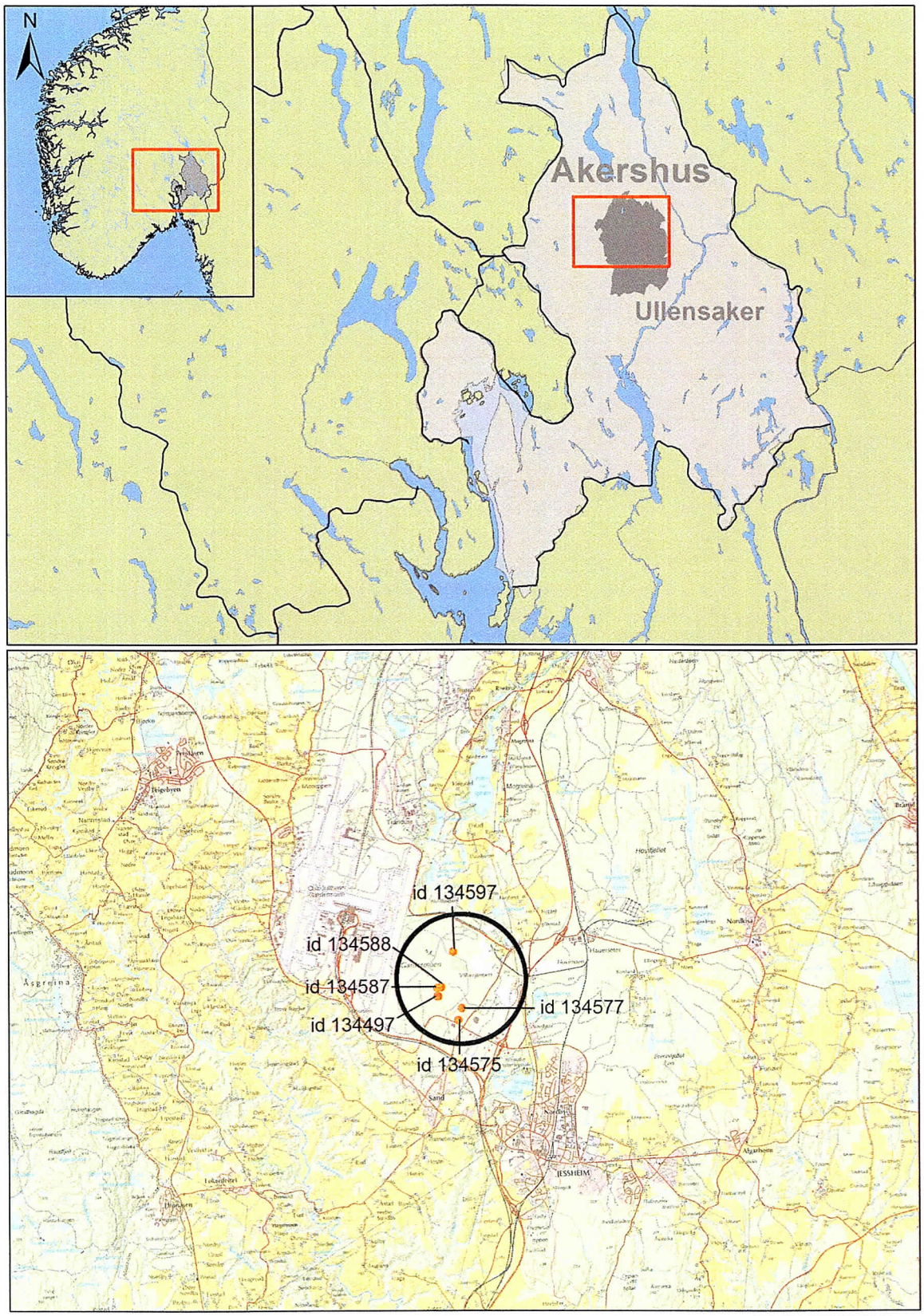


Figure 1: Location plan showing the excavated structures. Drawing: Magne Samdal and Michael Derrick. (background map: Statens kartverk. Permission nr. NR 12000-15048SAS).

2. STAFF AND TIMESCALE

The excavation team comprised one field leader, one assistant and a member of KHM's GIS staff. A breakdown of the work days is shown below:

Navn	Stilling	Tidsrom
Michael Derrick	feltleder	01.11.11- 18.11.11
Thorgeir Winther	feltassistent	01.11.11- 18.11.11
Magne Samdal	GIS	07.11.11
Total antall dagsverk		37 dager

3. PUBLIC VISITS

Magne Samdal arrived at the site on the 7th of November and measured in the structures using GIS. Project leader Kjetil Loftsgarden visited the area on the 8th November 2011.

4. LANDSCAPE, HISTORY AND ARCHAEOLOGY

Gardemoen næringspark lies on forested land between Gardemoen airport in the West and Vilbergveien in the east. The area comprises many farms, the largest of which are Lauten and Vilberg. The farm of Lauten is first mentioned in written sources in 1326 while Vilberg is mentioned later in 1594 (Rygh 1898). The fact that the farms are mentioned at this time shows that they were already well established by this point.

Ullensaker has been exploited from the earliest times as indicated from cultivation layers which have been dated to the Stone Age and Late Bronze Age periods (Reitan 2010; Skogsfjord 2008). The development area itself contains tar kilns, charcoal production pits and pit traps which have been dated to the mid to late-medieval period. These structures required a large quantity of timber and therefore are common in forested area.

There have been several archaeological investigations which has taken place in and around the development area. Between 1993 and 1996 excavations were carried out prior to the building of Gardemoen airport (Helliksen 1997). A series of charcoal production pits, hearths, cultivation layers and cooking pits dating from the Iron Age to the medieval period were unearthed immediately to the west of the Gardemoen Næringspark development. In 2006 and 2007 39 pits were investigated at Gardemoen (E6 Hovinmoen-Dal). Some of the structures were interpreted as charcoal production pits while others were believed to be pit traps (Dahle 2010). In 2010 an excavation of tar kilns, charcoal production pits, clearance cairns, cultivation layers and pit traps (id 95768, id 95776, id 95777, id 95778, id 95779 and id 95781) took place at Barntjernmoen which lay 3 km north-east from the development area (Wenn and Damlien 2011). The tar kilns and charcoal production pits were dated to the medieval period. In August 2010 the first stage of excavation at Gardemoen Næringspark was begun, in advance of the construction of a warehouse facility for Coop. 2 charcoal production pits and 2 tar kilns (id: 134582, id 134584 and 134578 134579 respectively) were excavated and samples from these were dated to the late-medieval period (Gundersen 2012).

Other structures of archaeological significance are situated close to the development area. A grave field (id 32521) comprising 2 grave mounds has been located at Låke gård 153/1, 7 and 9. While a small cairn (id 52384) and a tar kiln (id 32624) can be found at Ljøgot 137/43 and 1 respectively.

A number of unstratified finds have been unearthed in the vicinity of the development area. Two stone axes dating to the Stone Age (id 6713 and id 8474) and a hand quern (id 8478) dating to the late Iron Age were found at Vilberg 177/1 while a spear blade dating to the stone age was found at Ljøgot 137 (id. 21431). Two iron axes dating to the early Iron Age and Viking periods were found at Lauten 152/1 and 151/1 respectively (id 33109a and 33109b). The former axe is believed to have come from a grave mound which was removed in 1927.

5. EXCAVATION

5.1 AIMS AND PRIORITIES

This report concerns the investigation of 3 charcoal pits and 3 tar kilns (id 134577, id 134587, id 134588, id 134497, id 134575 and id 134597) which were discovered during the two periods of evaluation carried out by Johannessen (2010) and Finstad and Eymundsson (2010). A project plan was prepared by Kjetil Loftgarden (2011) in which he outlined specific research questions which should be addressed during the excavation. These aims are outlined below.

Charcoal pits

- Determine the type of wood used in the production process.
- Determine when charcoal production began in the area.
- Examine the form and dimensions of the pits. Do the pit's attributes reflect the construction period or do they reflect their function?
- Determine if it is possible to see how the wood was placed within the pit.

Tar kilns

- Determine what type of tar kiln is used. Is it a *tjæremile* or a *tjærehjell*?
- How were the tar kilns constructed and how did they function?
- Which species of wood is used and are they burning tree stumps or the trunk of the tree?
- At what date did tar production commence?
- How does the activity relate in date to the other activity in the area?
- Have the tar kilns been re-used?
- How much tar was produced?

5.2 METHOD

Work was carried out prior to the excavation in preparation for the arrival of the archaeologists. The developer ensured all the trees and vegetation were removed from in and around the structures and that the areas were clearly marked. A

series of updated maps were provided which were useful as much of the area had already been cleared of trees and other landmarks.

On arrival the structures were cleaned, measured, described, drawn and photographed. The charcoal pits were half-sectioned using a tracked excavator fitted with a 1.5 meter ditching bucket and the profiles were hand cleaned. They were then photographed and drawn at a scale of 1: 50. Charcoal samples were taken from sealed contexts and sent to NTNU for radiocarbon dating. A list of these samples is contained at the end of this report. The tar kilns were recorded in the same way however the method of machining was very different.

Excavation of the charcoal kilns presented some logistical problems. It was important that the profile was cut in such a way that the working components of the kiln could be observed. Ideally the lateral profile should show the bank on the outside of the kiln, the pit into which the wood is placed, the tapping channel along which the tar runs and the tar collection pit. In addition to this it is also useful to see the perpendicular profile.

As it is impossible to see the full length of both profiles without destroying one of the others it was decided to cut the tar kilns in quarter sections. This way the two opposing profiles could be cleaned, photographed and drawn before the area covering the lateral profile could be removed. The order of removal is illustrated below (figures 2 and 3)

Area A is removed revealing two perpendicular profiles. These are cleaned and recorded. Area B is then removed to reveal the complete lateral section running NW-SE. Finally C is removed to reveal the remainder of the opposing section. The final quadrant D is removed in order to make sure that there are no structures lying underneath. All layers revealed during machining were allocated numbers and described in detail.

The structures were located using a Trimble R6 GPS receiver with a TSC3 controller. All the data was saved as shape files comprising single points. The data was managed using ESRI ArcGIS 10. All the points were exported to ArcGis and converted to lines and polygons which were saved in a geodatabase. ArcGis was used to create the maps in the report. All the map data is set in the coordinate system UTM/ WGS84 zone 32. The map and metadata is archived at Kulturhistorisk museum Dokumentasjonsseksjonen.

5.3 Excavation progress

The project began on 1st November 2011 and was completed on the 18th November 2011. Originally it was planned to excavate a greater number of structures however the size of the structures together with time constraints and freezing conditions made this impossible. Instead it was decided to concentrate on fully excavating 6 structures. Recording of the structures began on 1st November 2011 and excavation was started on the 3rd November.

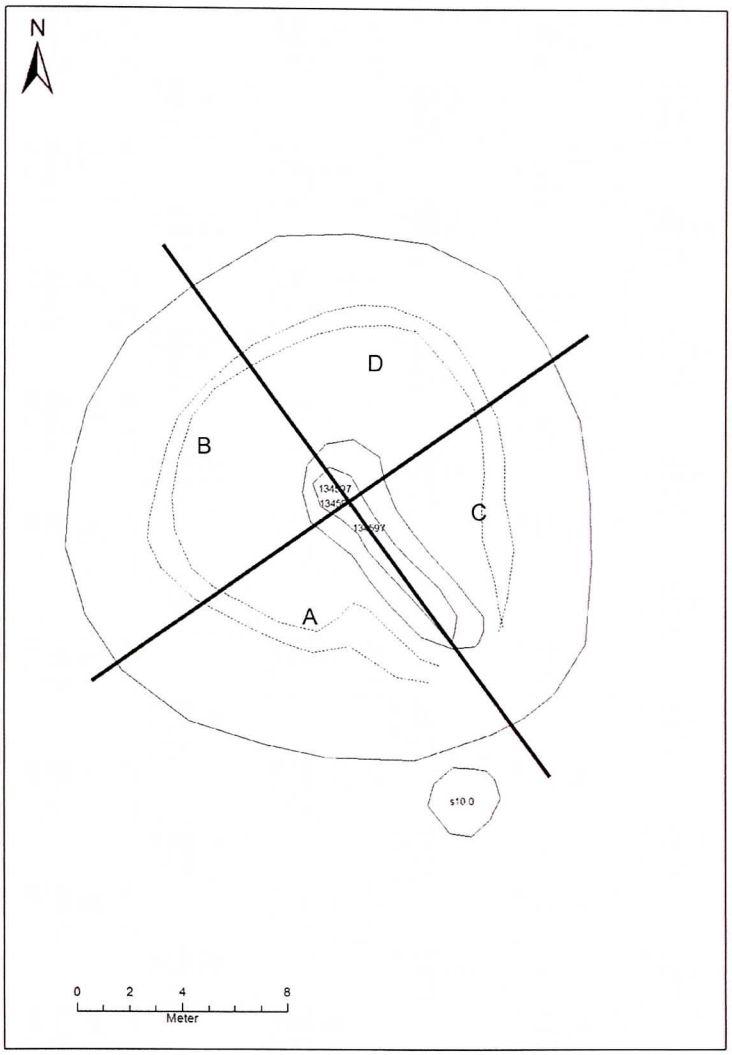


Figure 2: Showing the order of soil removal from tar kiln 134597. Drawing: Magne Samdal and Michael Derrick.

Figure 3: Removal of the first quadrant in tar kiln id 134597, looking north. Photo: Michael Derrick (Cf34503_113)

5.4 Problems and Limitations

A great deal of the problems associated with the excavation was caused by the weather. The temperature was below freezing for the duration of the project which made it difficult to clean the profiles. The ice also caused sections of profile to collapse overnight. This was compounded by the freeze / thaw conditions in the morning which damaged the newly exposed strata. The presence of freezing fog which constantly hung over the site, made it difficult to focus the camera and the constant changes in light affected the cameras automatic settings. This resulted in some photos being out of focus or too bright.

In most cases there was ample room for the machine to manoeuvre however this was not always the case. Tar kiln id 134575 was located in thick forest which made it difficult for the machine to get into position. This meant that the machine had to operate at full stretch and compromises had to be made with regard to the angle of the profile. This made it difficult to position the profile in the right area which was particularly unfortunate as the tar kiln was already damaged.

The sheer size of the tar kilns and the number of layers contained within meant that excavation and recording became very labour intensive. This meant that as mentioned earlier, fewer of the evaluated structures could be excavated. The positive side of this however was that the excavated structures were thoroughly investigated.

5.5 Excavation

Six archaeological structures were investigated. Three tar kilns (id 134497, 134575 and 134597) and three charcoal pits (id. 134577, 134587 and 134588). All were in relatively good condition with the exception of tar kiln id 134575 which was damaged in its centre and on its northern edge. This meant that part of the profile drawing had to be reconstructed using the surviving stratigraphy. The structures are described below.

5.5.1 Structures

Charcoal Pits

Charcoal pits id 134577, id 134587 and id 134588 were located on forested land where the underlying geology was orange sand. The pits were oval in form but became rectangular towards their base. The sides sloped at a 45 degree angle towards the centre of the pit before dropping vertically forming a flat base. The earth which was removed during the pits construction was piled up around the pit forming a bank.

Charcoal pit 134577 measured 8.25 m x 7.58 m on its outside edge including the excavation bank. The internal measurement of the pit was 3.5 x 3 m (see figure 4). It was 1.10 m deep and contained a series of layer. Layer 1 was part of the excavation bank and comprised light-grey yellow silt sand and small rounded pebbles. Layer 2 was a layer of preserved forest floor which comprised light to medium grey sand containing frequent charcoal flecks and some organic

material. This lay directly above the natural sand (3). Layer 4 was part of the bank which had collapsed into the pit and consisted of light-grey yellow silt sand. Layers 5 and 6 were layers which had collapsed into the pit after abandonment and comprised light grey silt sand mixed with orange sand and dark-grey orange silt sand with frequent charcoal flecks respectively.

Figure 4: Charcoal pit id 134577, looking south-east. Photo: Michael Derrick (Cf34503_13)

Layer 7, contained grey orange silt sand mixed with large charcoal fragments and represented a production layer. Layer 8 was the base layer in the pit and represents evidence for the last production of charcoal. A charcoal sample was taken from this layer which provided a date of AD 1050-1215 (KP 5). Layer 9 comprised light-grey yellow silt sand, small rounded pebbles and charcoal flecks and may have related to the abandonment of the structure. Layer 10 consisted of dark a grey charcoal layer containing small, medium and large rounded pebbles and may have been the remnants of an earlier production of charcoal or relate to abandonment and infilling. Layer 11 comprised dark-grey orange silt sand which may relate to abandonment or an earlier production of charcoal. Layer 12 comprised red orange burnt sand mixed with charcoal and provides evidence for *in situ* burning in the base of the pit. Layer 13 consists of light grey ash which would have been a waste product of charcoal production. Layer 14 was a mix of dark-red brown clay silt mixed with humus and turf. This is probably modern disturbance. Layer 15 comprised dark-grey brown humus and also represents modern disturbance (figure 5).

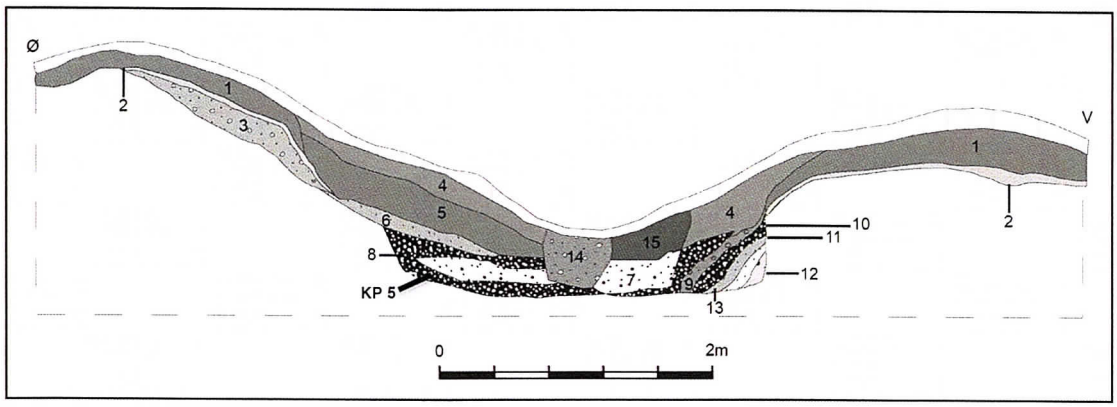


Figure 5: Profile of charcoal pit 134577, facing north. Drawing: Michael Derrick

Charcoal pit id 134587 measured 10 m x 8.5 m including the excavation bank and 3.75 x 3.44 m inside the pit. It was 1.50 m deep and contained many layers (see figures 6 and 7). Layer 1 consisted of a charcoal layer which was mixed with light orange sand and is part of the bank material. Layer 2 was part of the outside bank and comprised medium-grey orange silt sand, charcoal flecks and medium to large rounded pebbles. Layer 3 comprised burnt red sand which suggests *in situ* burning in the base of the pit. Layer 4 was part of the bank and comprised light-grey yellow sand and charcoal fragments. Layer 5 comprised light-grey white sand and was part of an earlier forest floor. Layers 6, 7 and 8 were layers which had collapsed into the pit after abandonment. Layer 6 comprised medium-grey yellow sand mixed with dark-

Figure 6: Charcoal production pit 134587, looking north-east. Photo: Michael Derrick (Cf34503_11)

grey brown sand. Layer 7 consisted of a forest floor layer comprising dark-grey brown clay silt and layer 8 comprised light orange sand originating from the natural sands under the pit. Layer 9 was a charcoal layer in the base of the pit which may represent one of the last productions of charcoal. Layer 10 comprises light grey ash which would have been a waste product from charcoal

production. Layer 11 was a layer of red orange burnt sand which provided evidence for *in situ* burning in the base of the pit. A charcoal sample was taken from this layer which was dated to 1170-1235 AD (KP 4, C58104/5).

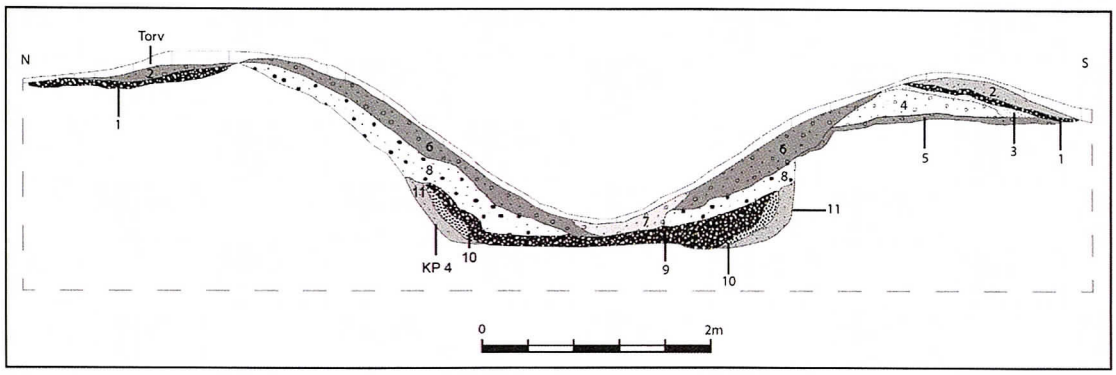


Figure 7: Profile of charcoal production pit 134587, facing west. Drawing: Michael Derrick

Charcoal pit id 134588 measured 9 m x 7.91 m on its outside edge including the excavation bank and 3.00 x 2.70 m inside the pit. It was 1.60 m deep and contained many layers (figures 8 and 9).

Layer 1 was a layer of turf which covered the structure. Layer 2 was a layer which had collapsed into the pit after abandonment and comprised light-yellow brown silt sand, small rounded pebbles and gravel. Layer 4 is a layer which had silted into the pit after abandonment and comprised dark-brown sand, small rounded pebbles and charcoal fragments. Layer 3, 5 and 6 are layers from the bank which have been thrown out of the pit during its construction. Layer 3 comprises light-yellow brown sand, gravel and small rounded pebbles. Layer 5 and 6 consisted of dark-grey sand with frequent small and large charcoal fragments.

Figure 8: Charcoal production pit 134588, looking north-west. Photo: Thorgeir Winther (Cf34503_10)

Layer 7 comprised burnt timbers which have been piled on top of each other in layers at right angles and are the remnants of the last production of charcoal. A charcoal sample was taken from this layer and was dated to 1170-1225 AD (KP 12). Layer 8 comprises red orange burnt sand which provides evidence for *in situ* burning in the base of the pit. Layer 9 and 10 are layers which have fell or silted into the pit after abandonment and comprised dark grey humus sand and charcoal fragments mixed and light-yellow grey silt sand (9) and light-yellow grey silt sand containing small rounded pebbles (10).

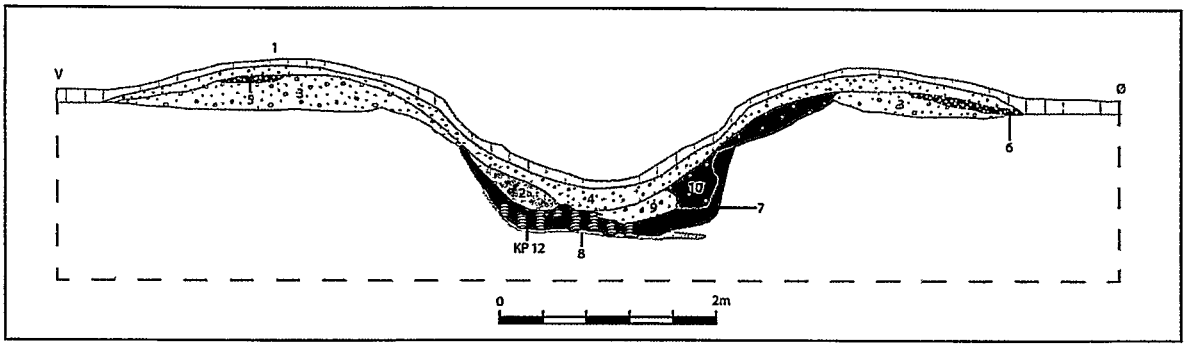


Figure 9: Profile of charcoal production pit 134588, facing south. Drawing: Michael Derrick

Tar kilns

Tar kilns id 134497, id 134575 and id 134597 were located on forested land where the underlying geology was orange sand. They were horseshoe-shaped in plan and consist of a bowl-shaped pit attached to a protruding tapping channel which inclined gently away from the centre of the pit. Both the pit and channel had steeply sloping sides and a relatively flat base. Encircling the kiln are banks of earth which were thrown up during its construction. The tar kilns contained many different layers which are described below.

Tar kiln id 134497 was located on flat terrain and was aligned NE-SW. The kiln including the bank measured 22.5 m x 18 m. The bowl pit was 10 meters in diameter and 1.5 m in depth. The tapping channel was 2.5 m long and 1.10 m wide. A steep-sided ditch ran out from the channel in a south-westerly direction for a further 10 meters (figure 10).

Layers 1-6 consisted of material which had been thrown out of the tar kiln during its construction. Layer 1 comprised light-grey orange silt sand and charcoal fragments. Layer 2 contained dark grey-orange silt sand with frequent charcoal fragments. Layer 3 consisted of dark-grey brown and dark-grey orange silt sand and charcoal fragments. Layer 4 comprised light-grey orange sand mixed with grey silt and charcoal fragments. Layer 5 consisted of dark grey silt and charcoal mixed with light orange sand which contained lenses of charcoal and light white sand. Layer 6 comprised light-orange grey silt sand and charcoal fragments with lenses of white sand.

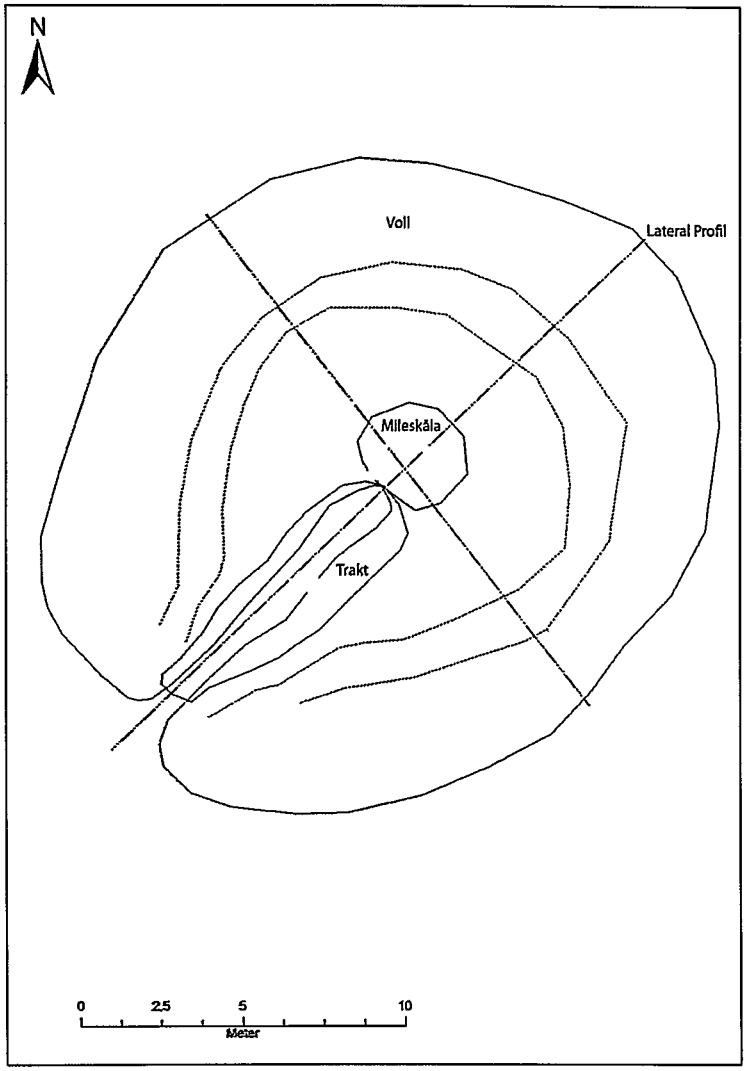


Figure 10: Tar kiln 134497 shown in plan. Drawing: Magne Samdal and Michael Derrick.

Layer 7 consisted of a layer of charcoal and orange sand from an earlier charcoal production pit (pit 2, see figure 11). Layer 8 was a layer of preserved forest floor which comprised light white sand mixed with charcoal. Layer 9 was an abandonment layer and consisted of light grey yellow sand with charcoal lenses.

Layer 10 was an abandonment layer lying on top of layer 11 and comprised medium brown silt sand with charcoal fragments. Layer 11 consisted of burnt timbers separated by layers of light-grey orange sand and represent some of the last tar production phases. There were also thin layers of bark present which probably lined the bottom of the fuel pit.

Layers 12-15 were abandonment layers which have fallen into pit 2. Layer 12 comprised redeposited orange sand and layer 13 consists of a dark grey charcoal layer. Layer 14 was a mixture of light-white yellow and dark orange sand while 15 (= 17) was a charcoal layer. Layer 16 consisted of red orange burnt sand in the base of pit 1 indicating *in situ* burning. Layer 18 comprises dark-grey brown silt sand with large fragments of charcoal and is the fill within an earlier posthole or part of the tapping system. Structure 19 is part of a burnt stake which lay under the fuel pit. Layers 20-24 are layers which fell into pit 1 post-

abandonment. Layer 20 comprised light- red orange burnt sand mixed with large charcoal fragments. Layer 21 consisted of light orange sand containing large charcoal fragments. A charcoal sample taken from the layer was dated to 1160-1215 AD (KP 21). Layer 22 contained light-grey brown silt and layer 23 contained orange burnt sand. Layer 24 consisted of a layer of charcoal containing burnt red sand.

Layers 25-28 may have been levelling layers built up for the purpose of laying the tar channel. Layer 25 comprised dark-brown orange silt sand containing charcoal fragments. Layer 26 comprised dark-grey orange silt sand with large charcoal fragments. Layer 27 was a charcoal layer and 28 comprised light orange silt sand with large charcoal fragments.

Structure 29 was the channel along which the tar flowed. It was straight sided and had a flat base. It sloped slightly from NE to SW and was constructed from a mixture of tar, gravel and sand. The construction method is unclear however it appears that it was constructed *in situ* and that the tar may have been poured into a mould cut into the underlying soil deposits. A layer taken from bark on the surface of the channel was dated to 1450-1610 AD (KP 10).

Layers 30 and 31 were formed in the tar kiln post-abandonment. They comprised dark-grey orange silt sand with large charcoal fragments and dark grey silt sand with charcoal fragments respectively. A fragment of the tar channel was found in layer 30. Layers 32, 34 and 35 were layers which fell into pit 2 after abandonment. Layer 32 comprised light white and dark orange sand and layer 34 consisted of red burnt sand which indicated *in situ* burning in the base of the pit. Layer 35 contained dark-grey orange silt sand with flecks of red burnt sand. Layer 33 was a charcoal layer in the base of pit 2 and is likely to have originated from the last production of charcoal. A charcoal sample taken from this layer was dated to 1240-1285 AD (KP 20). Layer 36 was a layer which contained rotten vegetation mixed with humus and dark-grey brown silt sand. The layer is probably modern and was formed post-abandonment. Layer 37 is a layer under the tar channel which comprised charcoal and bark and which probably part of the fuel pit lining. Layer 38 is an abandonment layer which comprised grey brown silt sand with charcoal fragments.

Layers 39-44 were abandonment layers which fell into the tar collecting pit (pit 3). Layer 39 comprised dark grey silt sand which contained charcoal fragments. Layer 40 contained dark grey-brown silt mixed with sand and charcoal. There were also light brown sand flecks and parts of the broken tar channel (29). A charcoal sample taken from the layer was dated to 1455-1620 AD (KP 6). Layer 41 consisted of light orange brown and grey brown silt sand and charcoal flecks. Layer 42 comprised dark-red brown silt sand which showed evidence of burning.

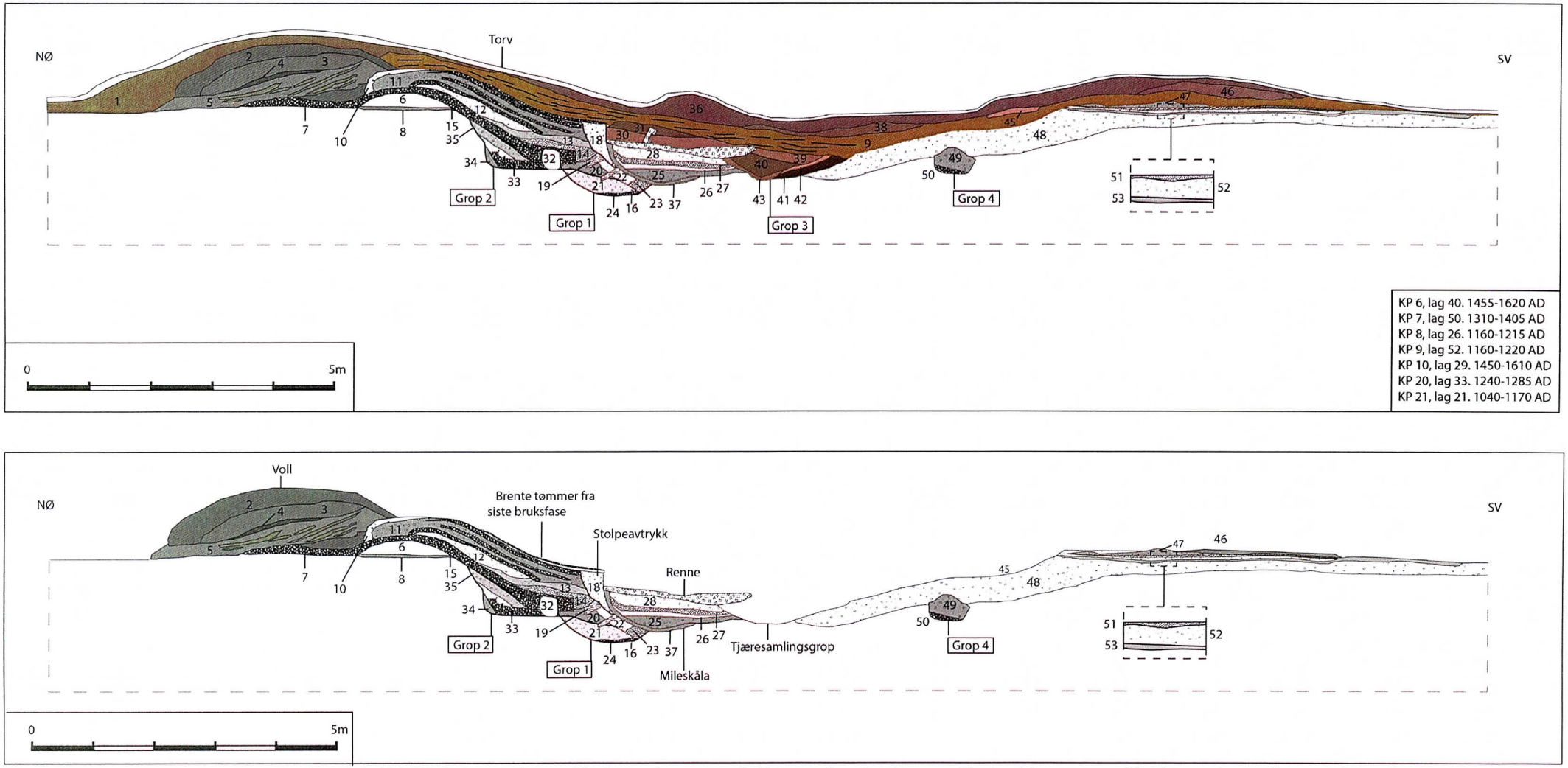


Figure 11: Above: A lateral profile through tar kiln 134497, facing north-west. The brown layers were laid down after abandonment. The bank is represented by the grey layers shown at the north-east end of the profile. The tapping channel 29 is shown running into collection pit 3. The bowl pit was cut through earlier pits 1 and 2. Below: Abandonment layers removed. Drawings Michael Derrick

Layer 43 consisted of light grey silt sand with charcoal fragments and 44 comprised light beige silt sand with charcoal flecks. Layers 45-47 were tar kiln abandonment layers. They comprised medium grey brown silt sand with charcoal flecks, light-grey brown silt sand with charcoal flecks and light-yellow brown silt sand with gravel and charcoal flecks respectively. Layer 48 is a layer which preceded the construction of the tar kiln and comprised orange sand with occasional charcoal flecks. Under layer 48 was a pit (pit 4) which was filled with two layers, 49 and 50. Layer 49 comprised dark grey silt sand with a large amount of charcoal. Layer 50 consisted of medium grey sand with charcoal fragments which were dated to 1310-1405 AD (KP 7). Layer 51 was a layer which lined the ditch leading out from the tar collection pit and comprised layers of bark and branches of pine. Layer 52 was an earlier charcoal layer that overlay layer 53. It was a layer of preserved forest floor and consisted of light grey silt sand. A charcoal sample taken from this layer was dated to 1160-1220 AD (KP 9)

Tar kiln id 134575 was located on flat terrain in dense forest. It was aligned NW-SE and was partially damaged on its eastern side. The kiln including the bank measured 17.10 m x 14.01 m. The bowl pit was 4.5 meters in diameter and 2.10 m in depth and the channel was 2.5 m long, 1.10 m wide and 75 cm in depth. A steep-sided ditch ran out from the channel in a south westerly direction for a further 7.5 m meters (figures 12 and 13).

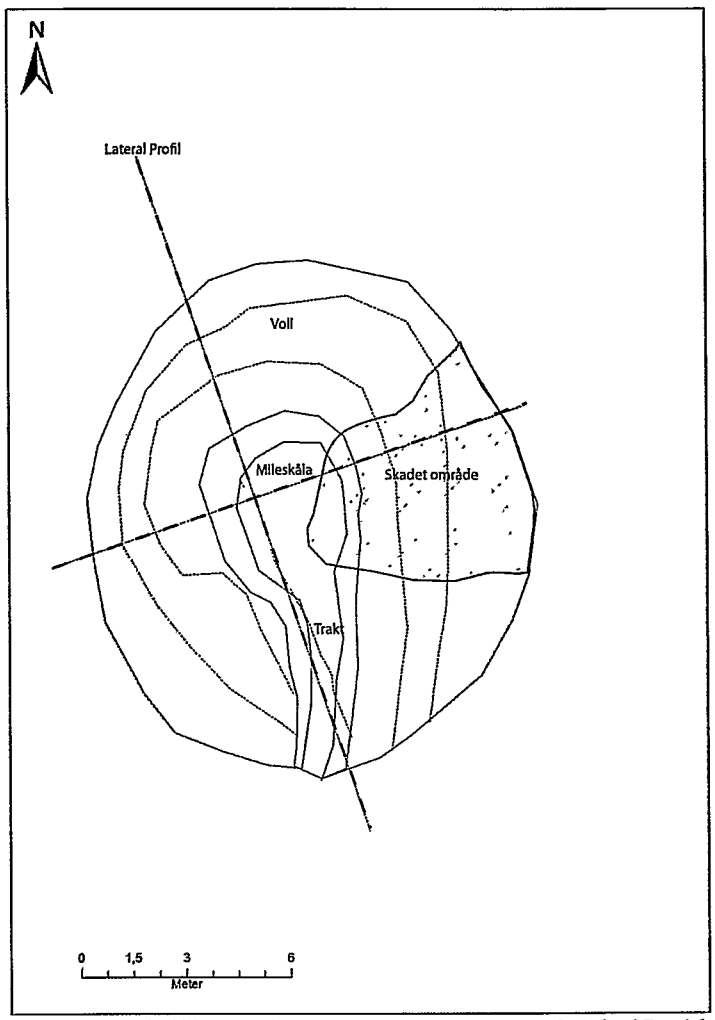


Figure 12: Tar kiln 134575 in plan. Drawing: Magne Samdal and Michael Derrick

Layers 1-4, 9, 16 and 18- 21 are all layers which were thrown out of the kiln when it was constructed to form a bank (see figure 14). Layer 1 contained dark and light grey silt sand with frequent charcoal fragments. Layer 2 comprised dark grey charcoal layers mixed with grey orange silt sand. Layer 3 consisted of large charcoal fragments mixed with orange sand. A sample from the layer was dated to 1290-1375 AD (KP 3). Layer 4 comprised light orange sand. Layer 9 contained light-grey orange sand and layer 16 was a charcoal layer. Layer 18 consisted of charcoal fragments in orange and white sand mixed with light-grey orange silt sand. Layer 19 comprised dark-red brown sand with charcoal fragments and flecks of orange sand. Layer 20 contained dark grey sand silt with frequent large charcoal fragments mixed with light white and orange sand. Layer 21 comprised dark-grey orange sand silt with frequent charcoal fragments.

Layer 5 consisted of light grey silt sand and was part of the preserved forest floor. Structure 6 comprised the tapping channel which had straight sides and a flat base. It sloped slightly from north-west to south-east and was constructed from a mixture of tar, gravel and sand. It appears that it was constructed *in situ* and that the tar may have been poured into a mould cut into the underlying soil deposits.

Figure 13: Tar kiln 134575. Showing the staggered profile, looking north. Photo Michael Derrick (Cf34503_59)

Layer 7 and 8 comprised levelling layers for the tar channel. Layer 7 consisted of a charcoal layer while layer 8 contained grey orange sand silt with frequent charcoal fragments and small rounded pebbles. A charcoal sample from layer 8 was dated to 1400-1420 AD (KP 1, C58104/6). Charcoal layer (10) was part of the original forest floor. Layers 11-14 and 17 were layers which had accumulated after the abandonment of the tar kiln. Layer 11 comprised light-grey white silt sand and layer 12 consisted of grey orange sand. Layer 13 consisted of redeposited orange sand and layer 14 was a modern layer of humus and rotten

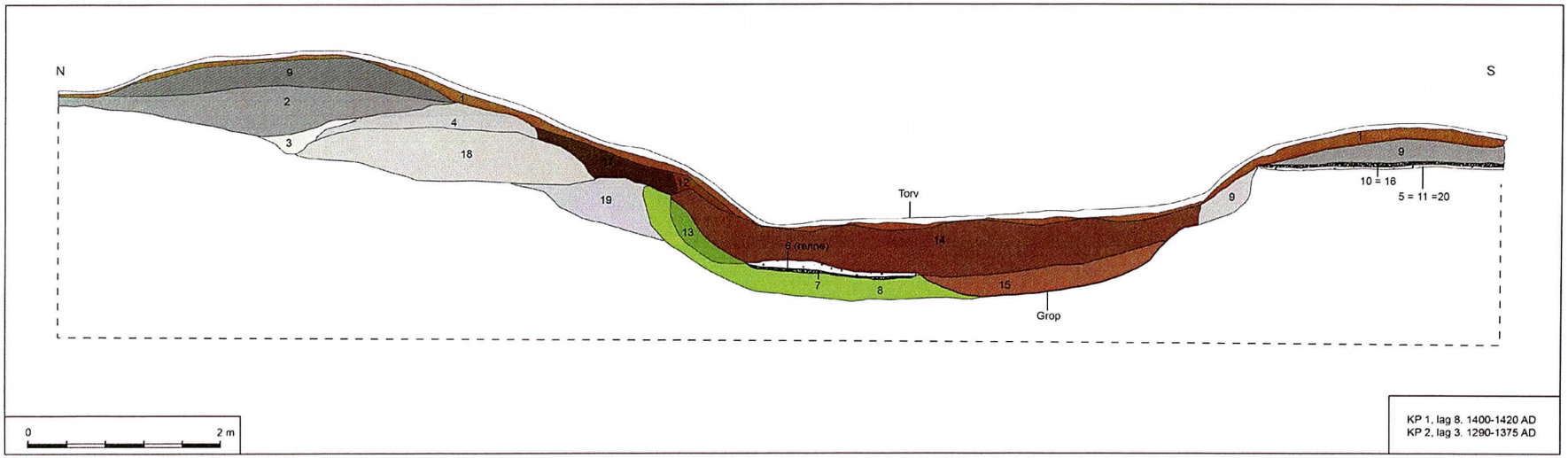


Figure 14: Reconstructed profile from tar kiln id 134575 showing the tapping channel (6) and tar collection pit 15. The banks lie at the north and south ends of the profile. The brown layers are abandonment layers. Drawing: Michael Derrick.

vegetation. Layer 17 comprised dark grey sand silt with frequent large charcoal fragments mixed with light white and orange sands. Layer 15 also accumulated in the tar pit post abandonment and comprised orange gravels mixed with dark-orange brown sand silt with charcoal fragments.

Tar kiln id 134597 was located on flat terrain and was aligned north-west / south-east. The kiln including the bank measured 20.30 m x 19.30 m. The bowl pit was 10 meters in diameter and 2.35 m in depth. The channel was 4 m long and 1.4 m wide. A steep-sided ditch ran out from the channel in a south-easterly direction for a further 8 meters (figure 15)

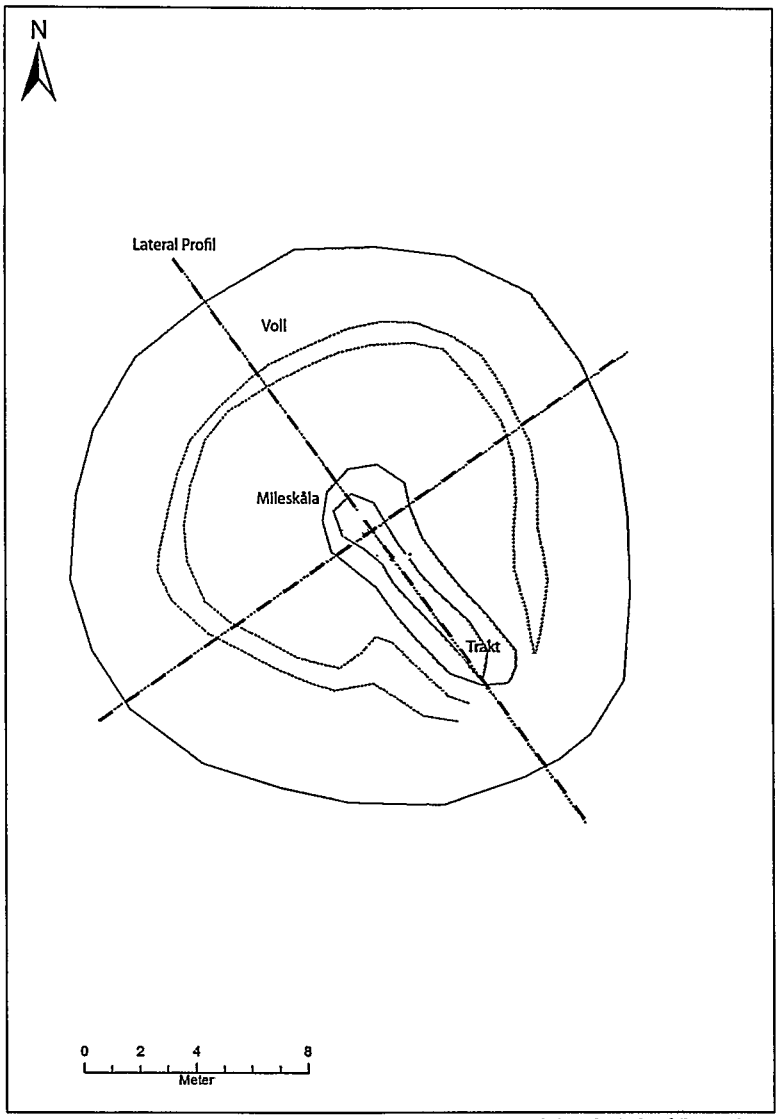


Figure 15: Tar kiln 134597 in plan. Drawing: Magne Samdal and Michael Derrick.

Layers 1-3, 13, 14, 29-36, 42 and 43 were all formed after the abandonment of the tar kiln (see figure 18). Layer 1 comprised dark-brown grey silt sand with rotten vegetation and other organic material. Layer 2 consisted of dark-grey orange silt sand with frequent charcoal fragments. Layer 3 comprised light grey-orange sand with frequent charcoal fragments. Layers 13 and 14 were fills in the tar collection pit. Layer 13 comprised light orange silt sand containing frequent

large fragments of charcoal. Layer 14 consisted of fine orange grey sand and frequent large charcoal fragments.

Charcoal layer 29 lay over tar channel 16. A charcoal sample from the layer was dated to 1290-1375 AD (KP 52, C58104/3). Layer 30 comprised light-grey orange silt sand with large charcoal fragments. Layer 31 contained dark grey sand silt. Layer 32 comprised light-grey orange silt sand. Charcoal layer 33 contained bark. Layer 34 consisted of light-grey sand silt and charcoal fragments. Layer 35 consisted of dark-grey brown silt sand and charcoal flecks. Layer 36 comprised light-orange brown silt sand. Layer 42 was mixture of light-grey brown silt sand and light orange white sand with large fragments of charcoal. Layer 43 consisted of light-grey brown silt sand with charcoal fragments.

Layers 4-8 and 44-48 are layers which have been thrown out of the tar kiln during its construction. Layer 4 contained dark grey orange silt sand with frequent charcoal fragments. Layer 5 comprised light orange and dark-grey brown sand with charcoal fragments. Layer 6 consisted of light orange sand with charcoal fragments. Layer 7 comprised medium brown silt sand with lenses of charcoal and light orange sand. Layer 8 contained medium-orange brown sand with frequent charcoal fragments. Layer 44 comprised light-white brown silt sand with occasional charcoal fragments. Layer 45 was a mix of light orange and dark-grey brown sand and layer 46 was a mix of dark-grey brown silt sand mixed with burnt red sand. Layer 47 contained dark brown sand containing frequent charcoal fragments and lenses of white sand. Layer 48 comprised light-orange brown silt sand with charcoal fragments and lenses.

Layers 9 and 10 lined a passage which led from the tar pit to the outside of the tar kiln. Layer 9 comprised light-grey yellow sand with charcoal fragments and layer 10 contained light orange brown silt with preserved pine needles and bark. Layer 11 (same as 49) consisted of burnt red sand with frequent charcoal fragments. Layer 12 (same as 50) consisted of fine white sand which was slightly organic and is likely to be part of a preserved forest floor. Layer 28 contained organic humus silt with bark and large fragments of charcoal. It is likely to be a remnant layer of original lining from the bowl of the tar kiln.

Layer 37 appears to be traces of a post pipe from an upright timber which would have been used to control the stability of the wood within the kiln. It had straight sides and a rounded base and was filled with dark-grey brown organic silt sand. It had rotted *in situ*, leaving the post pipe and abutting abandonment layers on either side. Layer 38 and 41 are layers of preserved burnt wood which probably were burned during phase 1 of the kilns use. The wood comprised short timbers (*c.* 40-60 cm long) which lay at a 45 degree angle in the base of the tar pit. A charcoal sample (KP 53) was taken from layer 38 which provided a date of 1435-1450 AD.

Layer 40 was a layer of light orange burnt sand with large charcoal fragments which covered the layers of surviving burnt wood (38 and 41) in the tar kiln.

Structure 17 (same as 15) was the phase 1 tar channel and comprised a layer of tar, gravels and sand which had been allowed to harden forming a flat-bottomed U-shaped conduit. It contained part of a tree trunk which had been split longitudinally as shown in figure 16. The channel measured 5 m in length and was 80 cm in width. It began in the centre of the pit and continued for 1 m in a south-easterly direction before falling down 30 cm and sloping for a further 4 meters into the tar collecting pit (Pit I). Pit I was straight-sided and had a flat base. It was filled with abandonment layers 8, 18-23 and layers 9 and 10.

Structure 16 represents the tar channel from phase 2. It was 3 m in length and 60 cm wide. It was straight sided and had a flat base. It sloped steeply at its north-west end before gently sloping towards the south-east. It was constructed from a mixture of tar, gravel, twigs and sand and the north-west end was propped up by a quartered tree trunk (24). It appears that it was constructed *in situ* and that the tar may have been poured into a mould cut into the underlying soil deposits (figure 17). The tar was collected in a pit (Pit II) which was straight-sided and had a flat base and which was used during the second phase of use. It was filled with abandonment layers 3, 13 and 14.

Figure 16: Phase 1 tar channel (S.17) lined with a partially damaged hollowed-out timber. Looking north-west. Photo: Michael Derrick. (Cf 34503_152).

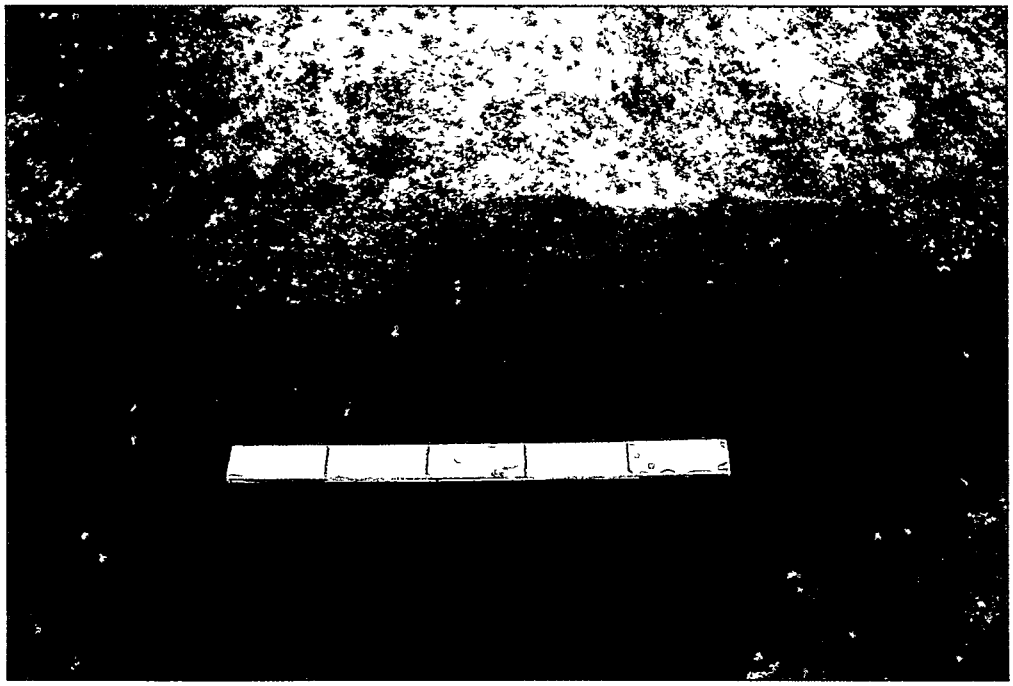


Figure 17: Phase 2 tar channel (S.16) damaged on one side. Looking east. Photo: Michael Derrick, (Cf 34503_151).

Layers 18-27 fell into the tar kiln after the abandonment of the first phase of use. Charcoal layer 18 was dated to 1470-1625 AD (KP 54). Layer 19 comprised light orange burnt sand and layer 20 consisted of light-orange grey sand with charcoal fragments. Layer 21 was a charcoal layer mixed with light-grey yellow silt sand. Layer 22 was a lump of tar and layer 23 comprised light-brown grey sand silt with charcoal flecks. Layer 24 was a quartered timber which had been used as a support for the phase 2 channel. Layer 25 comprised dark-grey brown sand silt containing bark, twigs and other plant material. A sample from this layer was dated to 1400-1420 AD (KP 50). Layer 26 contained humus and other organic material such as twigs, pine needles and bark and layer 27 consisted of light orange burnt sand. Both 26 and 27 also contained preserved wood which measured 30-60 cm long and 5 cm thick which is likely to be the remnants of the fuel burned to produce the tar.

One charcoal sample was taken from a layer in the south-west / north-east profile which is not illustrated here. The layer lay directly under the bank at the south-west end of the profile and appeared to occupy a small pit. The layer (11- not to be confused with the layer mentioned above) comprised light-grey orange clay sand with large fragments of charcoal and was dated to 1295-1385 AD.

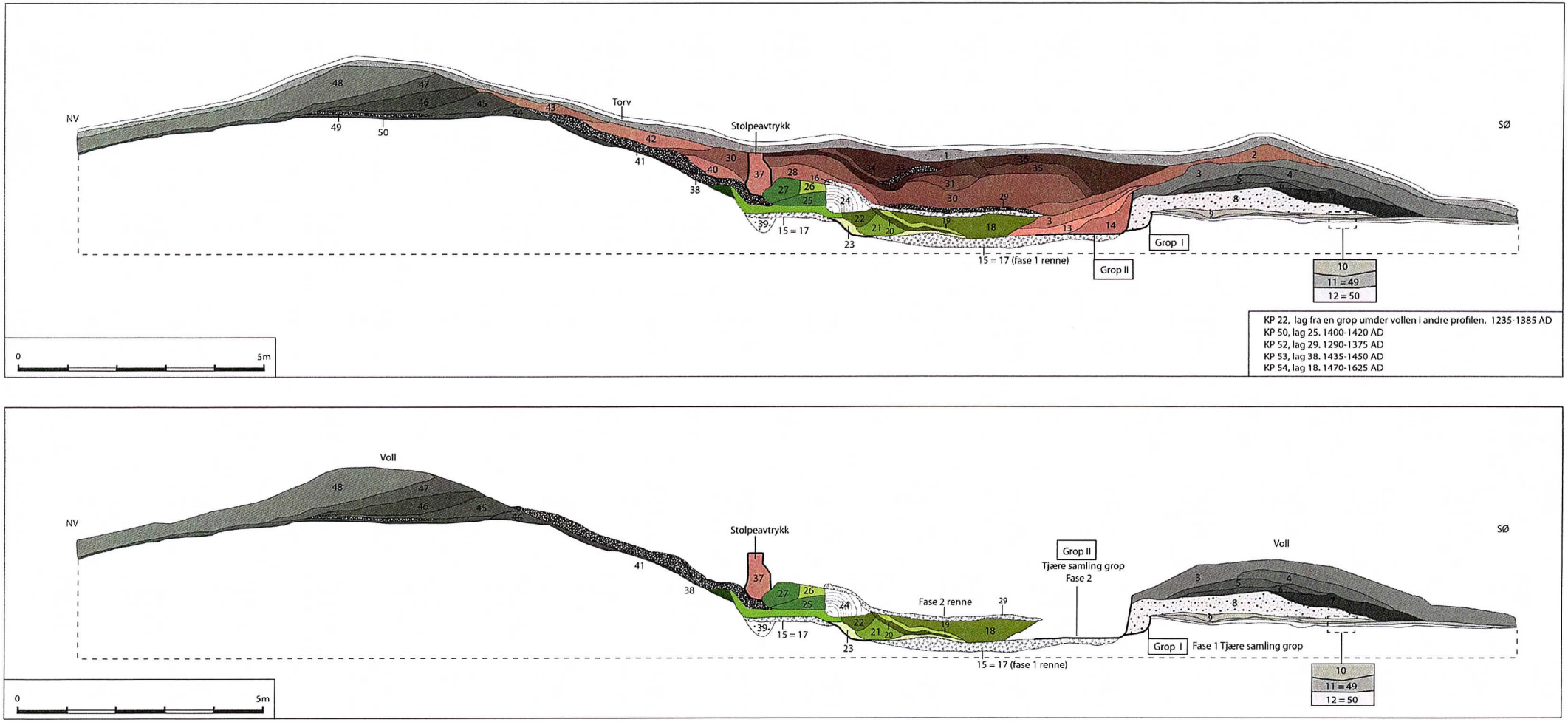


Figure 18: Above: A lateral profile through tar kiln 134597, facing south-west. The phase I channel (15) runs into pit 1 while the phase II channel (29) runs into collection pit II. A post-pipe 37 is shown in the centre of the bowl-shaped pit. The green layers were laid down after abandonment of phase 1 and the brown layers after the abandonment of phase 2. The bank is represented by the grey layers shown at the north-west and south-east ends of the profile. Below: Abandonment layers removed. Drawings: Michael Derrick

5.5.2 Dating and Analysis

17 samples were sent to Helge Høeg for species Identification. These samples were then sent to NTNU laboratoriet for radiologisk datering. The results are shown in figures 19 and 20:

KULLPRØVER							
Struktur Nr.	**Prøve Nr.**	**Struktur type**	**C-Nr.**	**Vekt**	**Vedart**	**C14-dat.**	**Kommentar**
id. 134497, lag 40*	6	Tjæremile		16,1 g	Pinus	calAD 1455-1620	Forbrukte ved analyse. Lab Ref. TRa-3701
id. 134497, lag 50*	7	Tjæremile		3,4 g	Pinus	calAD 1310-1405	Forbrukte ved analyse. Lab Ref. TRa-3702
id. 134497, lag 26.	8	Tjæremile		5,8 g	Pinus	calAD 1160-1215	Forbrukte ved analyse. Lab Ref. TRa-3703
id. 134497, lag 52*.	9	Tjæremile	C58104/2	1,0 g	Pinus og bark	calAD 1160-1220	Lab Ref. Tra-3704
id. 134497, renne 29*.	10	Tjæremile		1,3	Pinus	calAD 1450-1610	Forbrukte ved analyse. Lab Ref. TRa-3705
id. 134497, lag 33.	20	Tjæremile		7,4 g	Pinus	calAD 1240-1285	Forbrukte ved analyse. Lab Ref. TRa-3707
id. 134497, lag 21.	21	Tjæremile		18,5 g	Pinus	calAD 1040-1170	Forbrukte ved analyse. Lab Ref. TRa-3708
id. 134597, lag 18*	54	Tjæremile		47,5 g	Pinus	calAD 1470-1625	Forbrukte ved analyse. Lab Ref. TRa-3713
id. 134588	12	Kullgrop		9,6 g	Picea	calAD 1170-1225	Forbrukte ved analyse. Lab Ref. TRa-3706
id. 134597, grop 11 i sv-nø profil.	52	Tjæremile	C58104/3	1,3 g	Pinus	calAD 1295-1385	Lab Ref. TRa-3709
id. 134575, lag 8.	1	Tjæremile	C58104/6	2,4 g	Pinus og bark	calAD 1400-1420	Lab Ref. TRa-3697
id. 134575, lag 3.	3	Tjæremile	C58104/4	2,1 g	Pinus og bark	calAD 1290-1375	Lab Ref. TRa-3698
id. 134587	4	Kullgrop	C58104/5	1,8 g	Picea	calAD 1170-1235	Lab Ref. TRa-3699
id. 134577	5	Kullgrop		1,6 g	Picea	calAD 1050-1215	Forbrukte ved analyse. Lab Ref. TRa-3700
id. 134597, lag 25.	50	Tjæremile		2,2 g	Pinus	calAD 1400-1420	Forbrukte ved analyse. Lab Ref. TRa-3710
id. 134597, lag 29*.	52	Tjæremile	C58104/1	2,2 g	Pinus	calAD1290-1375	Lab Ref. TRa-3711
id. 134597, lag 38*.	53	Tjæremile		5,9 g	Pinus	calAD 1435-1450	Forbrukte ved analyse. Lab Ref. TRa-3712
* Struktur nmr. Byttet i etterarbeid p.g.a. duplikat nummering.							

Figure 19: Charcoal samples

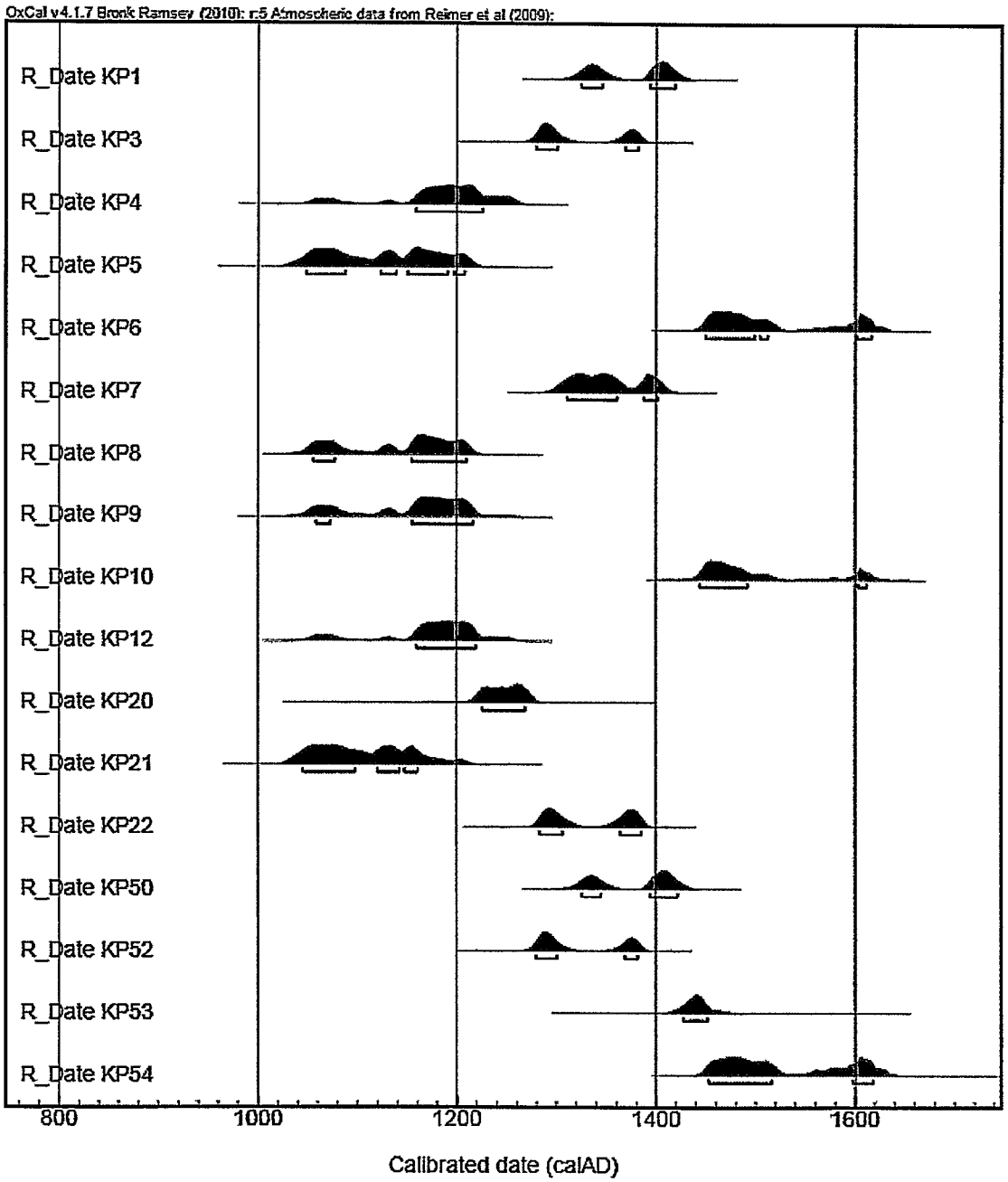


Figure 20: Radiocarbon dates.

6. Interpretation and Discussion

6.1 Tar kilns

The production of tar became very important in the Viking and medieval periods as it was useful in the construction of boats and buildings. The best quality tar was used to cover the interior of buildings and could be applied to the skin or ingested as a medicine (Martens and Paasche 2002).

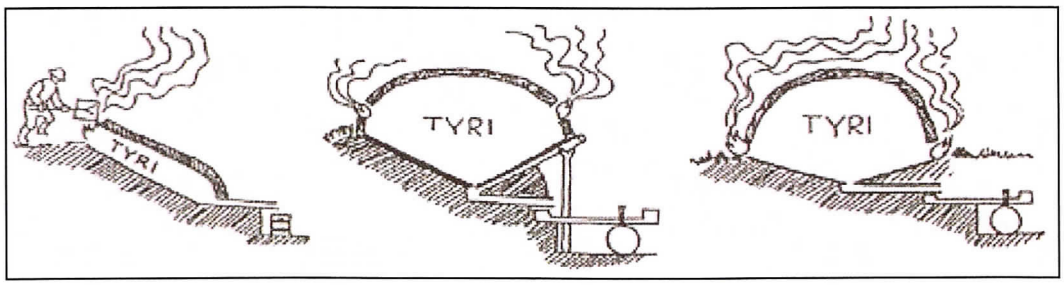
The most important factors to consider when constructing a tar kiln would be the location, the volume of the pit, the abundance of resources and a method of tapping which provided a steady flow and which could enable easy access for

separation of the high and low quality tar. The method used to construct the three tar kilns is described below.

6.1.1 Construction

All three tar kilns were horseshoe-shaped and comprised a large bowl-shaped fuel pit, tapping channels and tar collection pits. Two of the kilns were placed on terrain which was higher at the back-end of the kiln and lower at the tapping end (id 134575 and id 134597). The slope was accentuated by earthen banks which lay along the edge of the fuel pit. These banks acted as support for the fuel which would have been arranged in a fan around a post which helped organise the wood and regulate the flow of the tar (Farbregd 1989). The wood would was piled up and covered over with turf before being lit.

The area directly over the tapping pit would have to be accessible therefore it appears that a series of supports would have to have been constructed over the tapping area in order to accommodate the overhanging woodpile. This type of construction is known as a tjærehjell and is illustrated below together with two other types of tar kiln (figure 21).



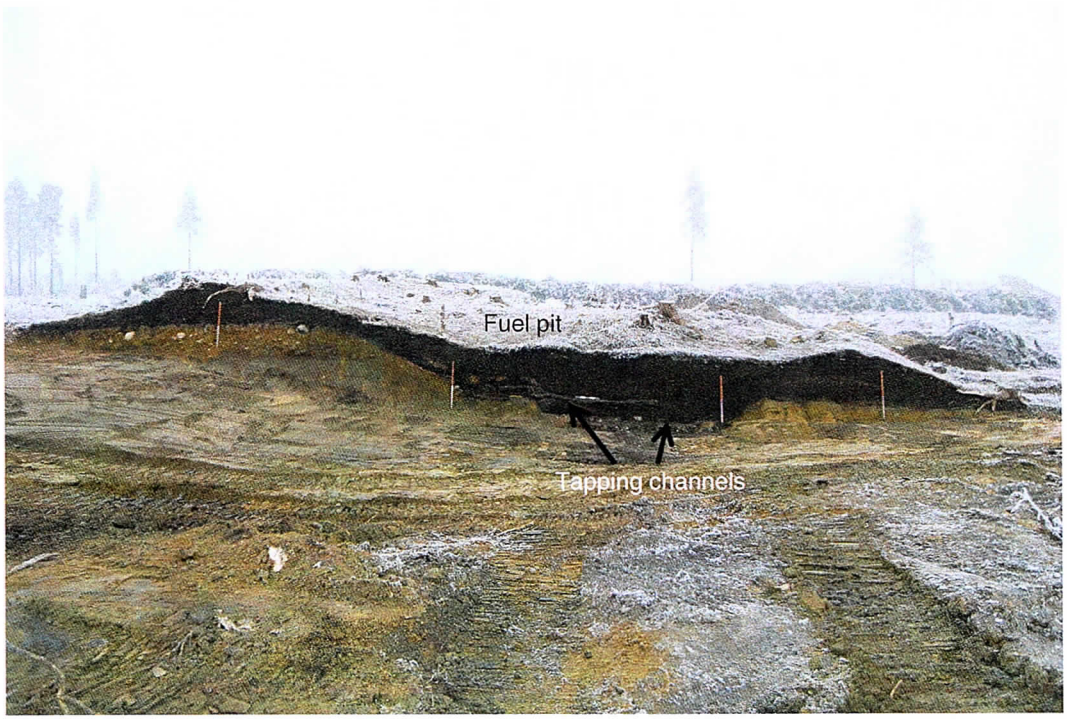


Figure 21: Above: (from L. to R.)Tar burning in a ditch, tjærehell and tar pit (Fossum 1992). Below: Tjærehell id 134597 showing the drop in terrain from the back of the structure towards the tapping channel. Photo: M. Derrick (Cf 34503_143

Tar kiln id 134497 appears to be a tar pit (*tjæregrop*) (figure 22). These operate in the same way as the *tjærehell* but they are not located on steep terrain and therefore do not require wooden supports. The tar pit has been constructed on flat terrain which contradicts the view held in The Norsk Arkeologisk Leksikon which states that all charcoal kilns are found on steep terrain (Østmo and Hedeager, p.392). This also concurs with the findings at Barntjernmoen (*et al*) in Ullensaker, where similar tar pits occupied flat areas of land (Wenn and Damlien 2011, p.67).

Figure 22: Tar kiln id 134497. Looking north. Photo Thorgeir Winther (Cf 34503_21).

After construction of the tar kiln, the fuel pit would have been lined with bark and pine twigs which prevented impurities entering the tar. Evidence for this lining was found in tar kiln id 134497 layer 11, which consisted of burnt wood lying *in situ* on layers of bark and in layer 37 which comprised bark and pine twigs. Bark and pine-needle layers were also found in the fuel pit of tar kiln 134597 (layer 27). Such layers were also observed during the excavations at Barntjernmoen (*ibid.*), Lauten (Gundersen 2012) and Bykle (Rolfsen 2002).

The wood used as fuel in this case was pine which appears to have been cut into small sticks. It would have been and dried before being placed in the kiln (Rolfsen 2002). Some of these sticks survived in the base of the fuel pit in layers 26 and 27 of tar kiln id 134597 as shown in figure 23.

Figure 23: Bark lining in tar kiln 134597 (left) and surviving sticks (right) Photo: M. Derrick. (Cf 34503_120)

As mentioned above, the sticks would have been laid out radially in the base of the fuel pit, built up around a central post. The post would have been positioned over the opening of the tapping channel and would have extended vertically through the wood pile and out through the top as shown in figure 24.

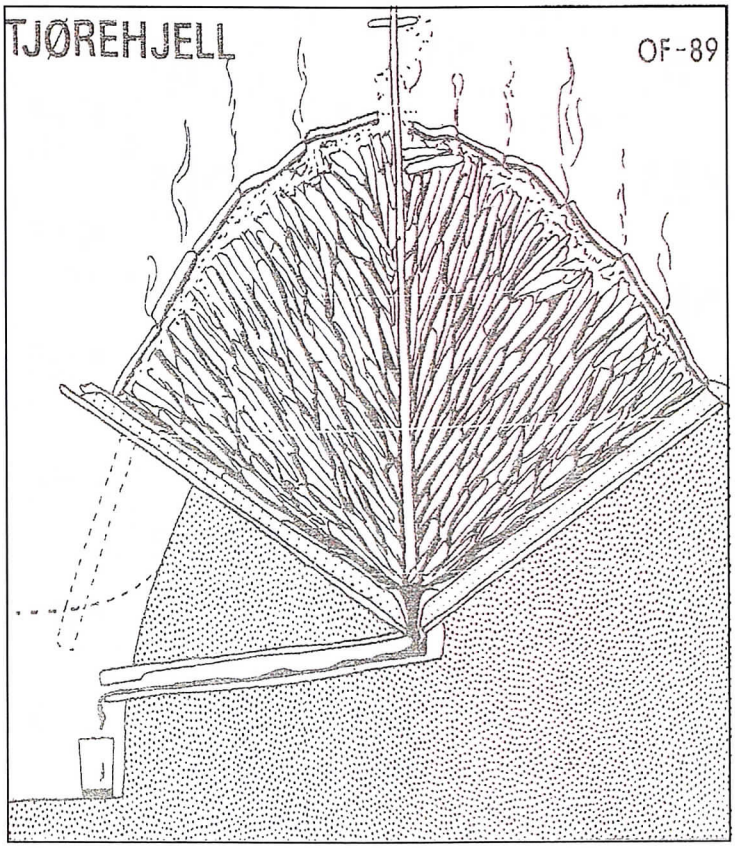


Figure 24: Arrangement of wood within the fuel pit. (Farbregd 1989).

It is not often that the central post survives however the appearance of an *in situ* post-pipe (37) in tar kiln id 134597 provided such evidence (see figure 18). The post-pipe lay in the centre of the fuel pit in an upright position. It stood above the tapping channel and was abutted at a 45 degree angle, by layers of bark and fuel (11). The *in situ* fuel and central post relate to the first phase of use (discussed below). Another possible indication of such a post was contained within *tjæregrop* 134497 where an upright almost funnel shaped layer (18) has partially survived where fuel pit meets the tapping channel. It was difficult however to determine whether this was a post-pipe or whether it was part of the original tapping system which directed the tar into the tar channel. It appears however to represent an integral part of the working tar kiln.

After the tar kiln was lit, the wood began to burn and the tar begun to flow into the tapping channel. In all the tar kilns the tapping channel consisted of a mixture of tar, organic material, gravel and sand. This seems to have been manufactured *in situ* by pouring tar into a mould cut directly into the natural sand and letting it harden. The channel sloped downwards at shallow angle in order to facilitate the flow of the tar. The sides were straight, the base was slightly rounded and they were relatively short in length (2-3 m).

The tapping channels in tar kilns id 134575, id 134497 and the second phase of id 134597 all appear to have been open and do not appear to incorporate a wooden pipe in their construction. However the channel from the first phase of use in tar kiln id 134597 does contain a long timber which appears to have been split laterally. This could indicate an attempt at reuse which has failed due to the timber being stuck fast in the tar. If this is evidence of reuse then it is possible that the other channels could also have incorporated a hollowed out wooden pipes which has subsequently been removed.

The tar would have flowed along the tapping channel before being collected in a pit. These pits were located at the end of the channel and are flat based. The pits are relatively shallow and would not have contained a collection barrel. Instead the tar would probably have been retrieved using bowls as was the case at Kofstad. This made it easier to separate the higher quality tar from the lower quality tar which in turn increased its value (Martens and Paasche 2002).

In two of the tar kilns (id 134497 and id 134597) a passage-way was evident which led from the collection pit to the outside of the structure (layer 51 and layers 9 & 10 respectively). This was flat and was lined with bark and pine branches (figure 25). These passages were also observed in one of the tar kilns excavated at Barntjernmoen (Wenn and Damlien 2011).

Figure 25: Passage lined with bark (foreground) leading down to the collection pit in tar kiln 134497, looking north. Photo M. Derrick (Cf 34503_90)

6.1.2 Dating and phases

Problems with the dating of tar kilns has been discussed extensively (e.g. Amundsen 2007, pp.302-303; Martens and Paasche 2002, pp. 192-193; Reitan 2009, pp. 144-145). One consideration which must be taken into account when interpreting the dates is that the wood used in the tar kilns is pine. This species can have grown for many years before being used in the kiln and can therefore give an artificially older date. Likewise the wood which is used is often the heartwood in the stump and roots of the tree as this yields the best tar. These tree stumps can have been lying in the ground for many hundreds of years before being used (Amundsen 2007).

It is therefore better to use bark rather than heartwood for radiocarbon dating as it is the youngest part of the tree. Comparisons have been made between dates taken from heartwood and those from bark. At the Gråfjellprosjekt there was a difference of 200-400 years between dates based on bark and those taken from heartwood (Amundsen 2007, p.302). At Kongsvinger and Sør-Odal kommune the difference was 200 years (Reitan 2009, p.144). Investigations at Øvre Eiker revealed much closer dates however this was probably due to the bark lining being contaminated by tar (Martens and Paasche 2002).

When taking charcoal samples from tar kilns it is also very important to try and avoid contamination from other layers. This however is quite difficult to achieve as inevitably layers become mixed as organic material rots post-abandonment. In addition it is important to choose those layers which give the optimum amount of information about the structure. Layers of *in situ* bark and sealed layers under the bank are ideal. A good scenario is to obtain a dating sequence which

provides a pre-construction date, a date when the kiln was in use and an abandonment date. Again this can prove difficult to attain and it allows little room for error when interpreting the layers in the field or when reinterpreting in post-ex. It is important therefore to have a full understanding of the structure before taking the charcoal samples.

Tar kiln id 134597 comprised 2 construction phases. The first phase comprised a tapping channel (17), collection pit (Pit I), a series of wood layers (38) and a central post-pipe. Layer 38 comprised 2 distinct layers of wood from the last firing of the tar kiln reflecting two periods of use. It is probable however that the kiln was reused many times and that numerous other layers have been removed.

A date from under the bank provided a *terminus post quem* (TPQ) date of 1235-1385 AD for the construction of the tar kiln. The wood layer (38) was dated to 1435-1450 AD providing a *terminus ante quem* (TAQ) for the construction of the kiln and a TPQ for the abandonment of the first phase of construction as well as providing a date for production. Abandonment layer 18 was dated to 1470-1625 AD while other preserved bark found in layer 25 was dated to 1400-1420. From the dates it would appear that the first phase of construction began sometime after the end of the 14th-century and production had begun shortly after this. The production of tar appears to have ended in the mid-15th century and the kiln was abandoned.

The second phase consisted of a tapping channel (16) and a collection pit (pit II). Only one charcoal sample was taken from a layer (29) which overlay the tapping channel. This however appears to have been contaminated as it was dated to 1290-1375 AD which is earlier than the underlying layers of phase 1. It is therefore not possible to say exactly when or for how long the phase 2 tar kiln was in use. However the phase 1 dates appear to indicate that the second phase must have occurred sometime after the mid-15th century.

Tar kiln id 134597 was the only kiln which comprised two phases of construction. Other tar kilns excavated at Barntjernmoen, Lauten and during the Gardemoprosjekt did not have these rebuild phase but rather had separate production phases (Wenn and Damlien 2011; Gundersen 2012; Helliksen 1997). The first phase was established sometime at the end of the 14th-century and produced tar up till the middle part of the 15th century. It is then abandoned at this time and falls into decay. The abandonment layers date from the 15th to the 17th centuries. It is unclear exactly how long it lay abandoned however the layers are quite thick and it was obvious that it was in enough disrepair to warrant a complete rebuild. It is improbable that such a large tar kiln would be abandoned as it should be easy to clean out the fuel pit and reuse the structure without complete reconstruction. One explanation could be that the land around the kiln had been over exploited in the period leading up to abandonment. The amount of charcoal pits and tar kilns in the area would have put a strain on local resources, not to mention house and ship building. It is possible then that tar kiln id 134597 among others would have lain dormant for many years until the regeneration of new forest.

Tar kiln 134497 appears to have only one phase of construction; however the remains of earlier charcoal production pits survive under the structure. It is probable that the pre-existing pits were reused in order to save time and manpower when constructing the tar kiln. Previous excavations of tar kilns at Lauten and Barntjernmoen have also revealed earlier charcoal production pits in the base of tar kilns (*ibid.*). The earliest pit (pit 1) lay directly under the centre of the tar kiln and was dated to 1040-1170 AD (layer 21). A charcoal layer which overlay the forest floor may have related to this phase of charcoal production and was dated to 1160-1220 AD (layer 52). A flat-based charcoal pit (pit 2) overlay pit 1 and was dated to 1240-1285 AD (layer 33). A smaller pit (pit 4) lay under the exit passage and was dated to 1310-1405 AD (layer 50).

The above dates provide a TPQ for the tar kilns establishment which appears to be sometime in the early 15th-century. A sample taken from the tapping pit was dated to 1455-1620 AD and therefore gives an indication that it was abandoned sometime during this period. A sample taken from the surface of the tapping channel also provided similar dates (1450-1610 AD). The wood layers (11) represent the last period of use. Three distinct layers were discerned. It is probable however that the kiln was reused many more times prior to abandonment.

Tar kiln id 134575 was badly damaged and there were very few undisturbed contexts to take the charcoal samples from. A sample taken from under the bank (KP 2, layer 3) was dated to 1290-1375 AD providing a TPQ for the construction of the tar kiln. A sample taken from a layer under the tapping channel was dated to 1400-1420 AD, also providing a TPQ. In this case it is only possible to say that the tar kiln was constructed sometime after 1420 AD.

Even after taking into account the problems associated with dating tar kilns it appears that the dates obtained from id 134497, id 134597 and id 134575 can be trusted. All the dates correspond to the stratigraphic sequence within the kilns with the exception of one in tar kiln id 134597. The dating also compares well to those obtained from the tar kilns at Lauten (Gardemoen Næringspark) and Barntjernmoen respectively (*ibid.*) which were also dated to the 15th and 16th centuries. Further afield, tar kilns at Kongsvinger and Sør-Odal in Hedmark have also been dated to this period (Reitan 2009).

Tar kilns at Øvre Eiker in Buskerud were dated to the high middle ages (Martens og Paasche 2002, p.192-193). The earliest date based on bark is from the late medieval period however dating based on pine goes back to 970-1030 AD. (Bergstøl 1997, p.45). Even if a deviation of 200 years is taken into account for use of pine, the tar kilns at Rødsmoen still date to the high middle ages. At Gråfjellprosjektet the dates suggested a post-reformation date for tar production (Amundsen 2007, p.302-303) while the tar kilns from Hovden in Bykle kommune, Aust-Agder, were dated to the late-medieval to modern period (Rolfsen 2002, p.257).

6.2.3 PRODUCTION

Studies on how much tar is produced from tar kilns have been carried out by among others Bergstol (1997, p.37) and Rolfsen (2002, p.258). By calculating

the area of the fuel pit it is possible to find out how much wood it would have contained. It is then possible to calculate how much tar can be produced from the amount of wood present.

The fuel pit is for all intents and purposes a semi-sphere. The formula for calculating the area of a sphere is $V= {}^{4}/_{3}\ \pi\ r^2 h$ where r is the radius and h is the height of the fuel pit. Since the pit represents a half-sphere this means the formula should instead be: $V= {}^{2}/_{3}\ \pi\ r^2 h$. The height is measured from the base of the fuel pit up to the highest point on the edge of the pit and the radius is measured from a centre point to the highest point on the edge of the kiln. When calculating the area of the pit it is important to keep in mind that the wood would only occupy 70 % of the whole area therefore this must be taken into consideration when calculating the tar yield (Rolfsen 2002, p.258). Experiments have shown that it is possible to obtain 48 litres per cubic meter of wood however 30-40 litres is more likely (Bloch-Nakkerud 1987, p.97).

There are various factors to take into consideration when calculating the volume of the fuel pit. Firstly it is probable that many of the production phases have been damaged thus rendering the height and radius measurements inaccurate. Secondly the fuel pit would have not necessarily been spherical and variations in its shape would affect the calculations (Wenn and Damlien 2012). Thirdly it is impossible to calculate how high the woodpile would have been stacked thus how much fuel would have been present in the pit. Nonetheless the calculations are useful when comparing the results from other excavated tar kilns and give us a general idea about production. The volume of wood and associated tar yield has been calculated and is shown in figure 24 below.

Tar kiln id 134575							
Phase of production	Radius	Height	Vol. of fuel pit m^3	Vol. of wood (70%)	Production 48 l/m^3	Production 30 l/m^3	Production 40 l/m^3
N/A	4.50 m	2.10 m	89	62	2976*	1860	2480
Tar kiln id 134597. First construction phase							
Structure	Radius	Height	Vol. of fuel pit	Vol. of wood (70%)	Production 48 l/m^3	Production 30 l/m^3	Production 40 l/m^3
1st	6.78 m	2.20 m	212	148	7104*	4440	5920
2nd	6.11 m	1,75 m	136	95	4560*	2850	3800
Tar kiln id 134597. Second construction phase							
Phase of production	Radius	Height	Vol. of fuel pit	Vol. of wood (70%)	Production 48 l/m^3	Production 30 l/m^3	Production 40 l/m^3
N/A	6.66 m	1.70 m	157	111	5328*	3330	4440
Tar kiln id 134497							
Phase of production	Radius	Height	Vol. of fuel pit	Vol. of wood (70%)	Production 48 l/m^3	Production 30 l/m^3	Production 40 l/m^3
1st	5.58 m	1.7 m	110	77	3696*	2310	3080

2nd	5.07 m	1.55 m	83	58	2784	1740	2320
3rd	4.99 m	1.25 m	65	46	2208	1380	1840
*Denotes the optimum tar yield for each kiln.							

Figure 26: Wood volume and tar yield

It can be seen from the table above that tar kiln id 134575 had an optimum yield of 2976 litres and a realistic yield of between 1860 and 2480 litres. Tar kiln id 134597 would have produced an optimum 7104 litres during the first construction phase and a realistic yield of 4440-5920 litres. The second phase of construction produced a top yield of 5328 litres and a realistic yield of 3330-4440 litres. Tar kiln id 134497 could have produced 3696 litres in its first phase of production but is more likely to have yielded between 2310 and 3080 litres of tar. It comes as no surprise that the largest tar kiln (id 134597) produced the most tar. Bergstøl (1997, p.48) has mentioned that in 1560 a total of 5000 litres of tar was used to cover Åmot church. Only tar kiln id 134597 comes close to producing this amount. The other tar kilns produce only a fraction of this total. It appears that this kiln was used on a more industrial scale than the others. It is therefore possible that while the smaller tar kilns were producing tar for local domestic needs the larger kiln was producing for an external market which required larger quantities such as the ship building and construction industries.

6.2 Charcoal Pits

Charcoal production pits are relatively common in *utmarka* in eastern parts of southern Norway, where they were used for charcoal production from the late Iron Age to the medieval period. They provide a very quick and simple method for producing charcoal and are relatively easy and quick to construct. A pit is dug and the fuel, in this case spruce (*Picea)* is arranged in a tightly packed mound. The mound is then lit and covered over with turf. The wood burns in a reduced atmosphere where there is very little oxygen. This causes the wood to smoulder rather than burn producing charcoal. The mound is then removed after a few days and the charcoal retrieved. The pit is reused until the fuel runs out whereupon a new charcoal pit is dug nearer to a new fuel source.

6.2.1 Construction

The pits can vary in size, form and dimension which can reflect both regional variation and function. These differences in form were evident in the charcoal pits excavated during the Gardemoprosjekt which were both oval and rectangular (Helliksen 1997). The pits investigated during this period of work (id 134577, id 134587 and id 134588) were oval in plan however the actual working area in the centre of the pit was rectangular. The sides sloped down at a 45 degree angle before becoming falling steeply forming a flat base. Their plan and profile was similar to the pit (id 134582) which was excavated during the first stage of excavation at Gardemoen Næringspark (Gundersen 2012) and to those found at Barntjernmoen (Wenn 2011).

The rectangular shape of the pit would have held the wood tightly ensuring that most of the space within the pit was utilised. This would have the dual benefit of restricting the presence of oxygen and increasing the charcoal yield. A series of burnt timbers survived *in situ* in charcoal production pit id 134588. The timbers

were piled carefully in layers, at right angles to each other (figure 27) following the rectangular plan of the pit.

Figure 27: Charcoal production pit id 134588 showing a layer of in situ burnt timbers (8). Looking north. Photo: Michael Derrick (Cf34503_12).

The pits found during the Gardemoprosjekt were 1.5 – 7 m in diameter and 0.55 – 2.7 m in depth. They were classified as medium to large in accordance with criteria defined by Narmo (1996). The pits from this period of work had an inner diameter of between 5 - 5.75 m an outer diameter of 8.25-10 m and they ranged in depth from 110 -160 cm and can be defined as being medium large using Narmo's scale.

6.2.2 Dating

The three charcoal production pits were dated to 1170-1225 AD (id 134588), 1170-1235 AD (id 134587) and 1050-1215 AD (id 134577). It is probable that id 134588 and 134587 operated in unison as they were similar in date and located only 85 meters apart. Pit id 134577 is slightly earlier but it also spans the period occupied by the other 2. The remains of two other charcoal production pits were found under tar kiln id 134497. These were dated to 1040-1170 AD and 1240-1285 AD. All of the excavated pits used spruce (*Picea*) as fuel which gives a slightly more reliable date than pine which can be relatively old before use. Those pits found under tar kiln id 134497 used pine as their fuel source.

Previous archaeological work in the area has yielded dates from six other charcoal production pits. Pit id 134596 and id 134585 were dated during the second evaluation and yielded dates of 990-1160 AD and 1040-1260 AD respectively (Johannessen 2010). Charcoal pit id 134582 was dated to 1285-1300 AD and 1290-1370 AD (Gundersen 2012). The date obtained from id 134585 corresponds to those excavated during this period of work. Spruce was used as its fuel source while pits id 134596 and id 134582 were dated outside this time span and use pine as the source of charcoal. Three charcoal production pits found at Barntjernmoen were dated to 1030-1165 AD, 1030-1165 AD and

770-415 BC. The first two dates correspond with the period of charcoal production at Gardemoen næringspark whilst the latter date is likely to have come from a contaminated sample.

The dates obtained from the excavated pits are predominately based on charcoal samples from spruce (*Picea*). This gives a more reliable date than pine (which some of the earlier dated pits have used as fuel).

The dates obtained during evaluation can also be problematic as it is impossible to see where the sample is taken from. This can result in samples being taken from much later or earlier contexts. Nonetheless, taking into consideration the problems with dating it would appear that charcoal production was prolific in the area in the 11th- century and continued into the 14th-century and possibly later. These dates also correspond with those obtained from charcoal production pits which were excavated during the Gardemoprosjekt which lay to the west of Gardemoen Næringspark. 17 pits were dated from 1000-1400 AD with the majority dating to the late medieval period (Helliksen 1997).

The charcoal produced in these pits could have been used in iron working and other non-ferrous metalworking activities. There is however no evidence for metalworking in the area and as mentioned earlier the local landscape is typically agrarian. On the other hand further excavation in the area may eventually reveal evidence for metalworking or forging sites which would have been vital for the day to day running of a medieval farming community. Helliksen (1997) also concluded that the charcoal production pits found during the Gardemoprosjekt were likely to be related to local forging rather than the production of iron.

As charcoal is light and relatively easy to transport it is possible that it could have been traded and exported to other parts of the country. If over production occurred then it would have been possible to trade some of your surplus. The expansion of Oslo in the medieval period for example would have put a strain on local resources and manpower. This could have been relieved by obtaining materials from outside the city.

7. Conclusion

The Kulturhistorisk museum investigated 3 charcoal production pits and 3 tar kilns in accordance with the regulation plan for Gardemoen næringspark in the period 01.11.11-18.11.11. The structures were dated to the medieval period

Charcoal production pits id. 134577, id 134587 and id 134588 were dated to the early medieval period. Pit 134577 was in use between 1050 and 1215 AD. However both 134587 and 134588 seem to have been contemporary and operated between 1170 and 1235 AD. All the pits used spruce (*Picea*) as fuel. Evidence from pit 134588 showed that medium sized timbers were piled up at right angles to each other forming a tight cube. This not only utilised all the space within the kiln but also reduced the amount of oxygen entering the pit ensuring a slow burn.

Two of the three tar kilns (id. 134575 and 134597) were built on sloping terrain while kiln (id. 134497) was constructed on flat ground and was defined as a tar pit. Fragments of small sticks of pine were found *in situ* in kiln id. id. 134597 suggesting that timber fuel was preferred over tree roots and stumps. The fuel pits in id. 134497 and id. 134597 also contained traces of a tree bark and pine-needle lining.

The drainage systems in kilns id. 134497, 134575 and 134597 were very similar. The tar flowed through an opening in the bottom of the fuel pit held open by an upright post. Evidence for such a post was found in kilns 134497 and 134597. The tar then drained into a tapping channel which led into a collection pit. It appears that the tapping channels were made by pouring tar directly into a mould cut into the underlying natural deposits. This hardened forming a solid drainage channel which could be reused many times.

Tar kiln id. 134597 contained two phases of construction. The first phase of construction began sometime at the end of the 14th-century and tar production continued until the mid-15th century when the kiln was abandoned. The second phase began shortly after this period. Tar kiln 134497 was built over earlier charcoal pits and associated layers. These structures helped date the establishment of the kiln to the early 15th-century. Charcoal samples taken from abandonment layers in the collection pit and from the surface of the tapping channel were dated to 1450-1620 AD. Tar kiln id. 134575 was badly damaged which made it more difficult to date. However it was concluded that it was established close to 1420 AD.

The overall tar yield from the tar kilns was extensive. Kiln id 134497 had a maximum yield of 3696 cubic meters with a probable yield of between 2310-3080 m^3. Kiln id. 134575 meanwhile had an optimum yield of 2976 m^3 and a probable yield of 1860-2480 m^3. The first phase of kiln id. 134597 would have produced a maximum yield of 7104 m^3 with a probable yield being 4440-5920 m^3. While the second phase produced a maximum of 4560 m^3 and a probable of 2850-3800 m^3.

The radiocarbon dates have shown that the medieval and post-medieval landscape around Gardemoen was dominated by charcoal and tar production. This infers that the surrounding area was densely forested as a great deal of fuel was required to produce tar and charcoal. These structures were probably abandoned as the forest disappeared and the workers relocated to other areas of dense forest. The regeneration of new forest would have attracted industry back to the area as illustrated by the reuse of one of the tar kilns.

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9. APPENDIX

9.1 STRUCTURE LIST

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
134577	Kullgrop	Rund	Ja	110	825	750	Rette	Flat	En rund kullgrop som er nedgravd i oransje sand. Kullgropa har mange lag, disse er beskrevet under: Lag1 er en voll på vest-siden av strukturen. Det er masser som har vært lagt opp under graving av kullgropen og består av lys grågul siltholdig sand og noen små stein. Lag 2 er den original skogbunn som ble dekket av lag1. Det består av lys til medium grå sandholdig kull. Lag 3: Lys oransje sand – steril undergrunn. Lag 4: Vollen har raste inn. Fyllet består av lys grågul siltholdig sand. Lag 5: Blanding av lys grå siltholdig sand og oransje sand. Innraste masser. Lag 6: Mørk gråoransje siltholdig sand med noen kullflekker. Innraste masser. Lag 7: Kullfragmenter og flekker blandet med gråoransje siltholdig sand. Lag 8: Kullag blandet med gråoransje siltholdig sand med medium og store stein. Fra siste produksjon av kull. Kullprøven ble datert til AD 1050-1215 Lag 9: Lys grågul siltholdig sand med små stein og kullflekker. Lag 10: Mørk grått kullag med liten, medium og stor stein. Lag 11: Mørk gråoransje siltholdig sand. Lag 12 Rødbrent sand blandet med kull. Lag 13 Lys grå siltholdig aske.

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									Lag 14 En moderne grop fylt med mørk rødbrun leireholdig silt blandet med humus og torv. Lag 15 Mørk gråbrun humusholdig masser.
134587	Kullgrop	Oval	Ja	150	1000	850	Rette	Flat	En rund kullgrop som er nedgravd i oransje sand. Kullgropa har mange lag, disse er beskrevet under: Lag 1: Et tynt kullag blandet med lys oransje sand. Dette lå under vollen. Lag 2: Et lag i vollen som består av medium gråoransje siltholdig sand, kullflekker, medium og stor stein. Lag 3: Rødbrent sand lag i vollen. Lag 4: Lys grågul sand med kullbiter - lag i voll. Lag 5 Lys gråhvit sand. Gammel skogbunn. Lag 6 Medium grågul sand blandet med mørk gråbrun sand. Innraste masser. Lag 7: Mørk gråbrun leireholdig silt. Sansynligvis materiale frå skogbunn som har falt inn. Lag 8: Lys oransje sand - redeponert undergrunn. Innraste masser. Lag 9: Kullag av store kullfragmenter i bunn av kullgropen. Lag 10: Lys grå askeholdig silt. Lag 11: *In situ* rødbrent sand. Kullprøven datert til cal.AD 1170-1235.
134588	Kullgrop	Oval	Ja	160	900	791	Rette	Flat	En rund kullgrop som er nedgravd i oransje sand. Kullgropa har mange lag, disse er beskrevet under: Lag 1: Torv Lag 2: Lys gulbrun siltholdig sand med innslag av små stein / grus. Innraste masser. Lag 3: Lys gulbrun siltholdig sand med grus og stein. Utkastede masser frå tømming av grop

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									Lag 4: Mørk brun sand med småstein og kullbiter. Utkastede masser frå tømming av grop. Noe av massene har senere rast inn i gropa. Lag 5: Mørk grått sand med store mengder store og små kullbiter. Utkastede masser frå tømming av gropa. Lag 6: Samme som lag 5. Lag 7: Mørk grått kullag med rester fra forkullede og brente trestokker. Rester etter kullproduksjonen. Kullprøven ble datert til AD 1170-1225. Lag 8: Rødbrent sand med grus og stein. Svært kompakt. Lag 9: Mørk grått humusholdig sand, kullbiter og flekker av lys gulgrå siltholdig sand. Innraste masser. Lag 10: Lys gulgrå siltholdig sand. Innslag av småstein. Innraste masser.
134575		Oval	Ja	210	1710	1401	Skrå	Flat	En skadet tjæremile som er nedgravd i oransje sand. Tjæremila har mange lag, disse er beskrevet under: Lag 1: Mørk og lys grå siltholdig sand med masse kullbiter. Fra siste rensing eller utkastede masser fra konstruksjonen av tjæremile. Lag 2: Mørk grått kullag blandet med gråoransje siltholdig sand. Utkastede masser fra konstruksjonen av tjæremilen. Lag 3: Store kullbiter blandet med oransje sand. Utkastede masser fra konstruksjonen av tjæremilen. Kullprøve ble datert til AD 1290-1375 Lag 4:Lys oransje sand. Utkastede masser fra konstruksjonen av tjæremile. Lag 5: Lys grå siltholdig sand. Gammel skogbunn. Struktur 6: Renne til tjæremile som er laget av tjære, sand og småstein. Lag 7: Kullag under renne. Lag 8: Gråoransje sandholdig silt med masse kullbiter og småstein. Kullprøve ble datert til AD 1400-1420. Lag 9: Lys gråoransje sand. Utkastede masser fra konstruksjonen av

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									tjæremile. Lag 10: Et tynt kullag. Gammel skogbunn. Lag 11: Lys gråhvit siltholdig sand. Innraste masser. Lag 12: Gråoransje sand. Innraste masser. Lag 13: Oransje sand. Innraste masser. Lag 14: Humusholdig mørkgrå organisk materiale fra skogen med masse kullbiter. Lag 15: Oransje grus blandet med kullbiter / flekker og mørk oransjebrun sandholdig silt. Innraste masser. Lag 16: Kullag. Utkastede masser fra konstruksjonen av tjæremile. Lag 17: Mørk grå sandholdig silt med mange stor-kull fragmenter blandet med lys hvit og oransje sand. Utkastede masser fra konstruksjonen av tjæremile. Lag 18: Kull-fragmenter i oransje og hvit sand blandet med lys gråoransje siltholdig sand. Utkastede masser fra konstruksjonen av tjæremile. Lag 19: Mørk rødbrun sand med kullbiter blandet med flekker av oransje sand. Utkastede masser fra konstruksjonen av tjæremile. Lag 20: Mørk grått sandholdig silt med mye stor kull fragmenter blandet med lys hvit og oransje sand. Utkastede masser fra konstruksjonen av tjæremile. Lag 21: Mørk gråoransje sandholdig silt med mye kull fragmenter. Utkastede masser fra konstruksjonen av tjæremile.
134597		Oval	Ja	235	2030	1940	Skrå	Flat	En tjæremile som er nedgravd i oransje sand og som snitter en eldre kullgrop. Tjæremila og kullgropa har mange lag, disse er beskrevet under: Lag 1: Mørk brungrå siltholdig sand med råtten vegetasjon og annet

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									organisk materiale. Lag 2: Mørk gråoransje siltholdig sand med høyt innhold av kullbiter. Lag 3: Lys gråoransje sand med høyt innhold av kullbiter. Lag i gropen tilknyttet til tjæremile. Lag 4: Mørk gråoransje siltholdig sand med høyt innhold av kullbiter som er utkastede masser fra konstruksjonen av en kullgrop. Lag 5: Lys oransje og mørk gråbrun sand med kullbiter. Utkastede masser fra konstruksjonen av en kullgrop. Lag 6 Lys oransje sand med kullbiter. Utkastede masser fra konstruksjonen av gropen. Lag 7: Medium brun siltholdig sand med lenser av hvit og lys oransje sand og kull. Utkastede masser fra konstruksjonen av gropen. Lag 8: Medium oransje brun kullholdig sand med store kullfragmenter. Utkastede masser fra konstruksjonen av gropen. Lag 9: Lys grågul sand blandet med store kullbiter. Bunn av sti. Lag 10: Lys oransje brun silt med bevart bark og furunåler. Sti bunn. Lag 11: Rødbrent fin sand med masse kullbiter. Gammel skogbunn. Lag 12: Hvit sand. Gammel skogbunn. Lag 13: Store kullfragmenter i lys oransje siltholdig sand. Innraste masser. Lag 14: Kullfragmenter i fin oransje grå sand. Innraste masser. Lag 15: se 17 Struktur 16: Renne i tjæremile dannet av tjære, kvister og stein som har størknet, gravd *in situ*. Rennen har en flat bunn og rette sider som skaper en kanal hvor tjæren renner. Andre fase av bruk. Lag 17: Renne i tjæremile dannet av en blanding av tjære, sand, kvister og stein som har størknet, gravd *in situ*. Rennen har en flat bunn og rette

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									sider som skaper en kanal hvor tjære renner. En skjært tømmer lå i bunnen. Fra første fase av tjæremiles bruk. Lag 18: Kullag under renne. Planeringsmasse. 1470-1625 AD Lag 19: Lys oransje brent sand. Innraste masser. Lag 20: Lys oransjegrå kullholdig sand med kullbiter. Innraste masser. Lag 21: Kullag blandet med lys grågul siltholdig sand. Innraste masser. Lag 22: Tjære-klump. Innraste masser. Lag 23: Lys brungrå sandholdig silt med kullflekker. Innraste masser. Lag 24: En fjerde del av en stamme som støtter rennen. Lag 25: Mørk gråbrun sandholdig silt med tre, kvister og annet plante materiale. Innraste masser. AD 1400-1420 Lag 26: Humus-holdig organisk materiale som inneholdte bevarte pinner (30-60 cm lang and 5 cm tykk), bark og furunåler. Innraste masser. Lag 27: Lys oransje brent sand med store kullbiter og bevarte pinner (30-60 cm lang and 5 cm tykk). Innraste masser. Lag 28: Organisk humusholdig sandsilt med bark og kullbiter. Tetning i tjæremile. Lag 29: Kullag som lå over fase 2 renne. 1290-1375 AD Lag 30: Lys gråoransje siltholdig sand med store kullbiter. Innraste masser. Lag 31: Mørk grå sandholdig silt med store kullfragmenter. Innraste masser. Lag 32: Lys gråoransje siltholdig sand. Innraste masser. Lag 33: Kullag blandet med bark. Innraste masser. Lag 34: Lys grå sandholdig silt med kullbiter. Innraste masser. Lag 35: Mørk gråbrun siltholdig sand med kullbiter. Innraste masser. Lag 36: Lys oransjebrun siltholdig sand. Innraste masser.

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									Lag 37: Mørk gråbrun organisk siltholdig sand. En stolpe avtrykk. Lag 38: Fint lag av brente ved og kull som har organisk komponenter i fyll. Bevarte brente ved i bunn av tjæremile fr fase 1. Datert til 1435-1450 AD Lag 39: Lys grå sandholdig silt med kullbiter, flekker av brente sand og små stein. Planeringsmasse eller fyll av en eldre grop. Lag 40: Lys oransje brent sand med store kullbiter som dekker 38 og 41 (bevarte ved). Samme lag som 27. Innraste masser. Lag 41: Kullag med store kullfragmenter og brente ved. Bevarte brente ved i bunn av tjæremile fr fase 1. Lag 42: Lys gråbrun siltholdig sand blandet med lys oransje hvit sand og store kullbiter. Lys oransje brent sand med store kullbiter. Innraste masser. Lag 43: Lys gråbrun siltholdig sand med kullbiter. Innraste masser. Lag 44: Lys hvitbrun siltholdig sand med kullbiter. Utkastede masser fra konstruksjonen av tjæremilen. Lag 45: Lys oransje sand blandet med mørk gråbrun sand og store kullbiter. Lag 46: Mørk gråbrun siltholdig sand blandet med rødbrent sand og store kullbiter. Utkastede masser fra konstruksjonen av tjæremilen. Lag 47: Mørk brun sand med store kullbiter og hvite linser av sand. Utkastede masser fra konstruksjonen av tjæremilen. Lag 48: Lys oransjebrun siltholdig sand med kullbiter og kull linser. Utkastede masser fra konstruksjonen av tjæremilen. Lag 49: Kullag. Gammel skogbunn. Lag 50: Hvit sand. Gammel skogbunn.
134497		Oval	Ja	150	2250	1800	Skrå	Flat	En tjæremile som er nedgravd i oransje sand og som snitter eldre

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									kullgroper. Tjæremila og kullgroper har mange lag, disse er beskrevet under: Lag 1: Lys gråoransje siltholdig sand med kullfragmenter. Utkastede masser fra konstruksjonen av tjæremile. Lag 2: Mørk gråoransje kullholdig silt sand. Utkastede masser fra konstruksjonen av tjæremile. Lag 3: Mørk gråbrun og mørk gråoransje siltholdig sand med kullfragmenter. Utkastede masser fra konstruksjonen av tjæremile. Lag 4: Lys gråoransje sand blandet av grå kullholdig silt og kullfragmenter. Utkastede masser fra konstruksjonen av tjæremile. Lag 5: Mørk grått kullholdig silt blandet med mørk og lys oransje sand og linser av kull og lys hvit sand. Utkastede masser fra konstruksjonen av tjæremile. Lag 6: Lys oransje grå siltholdig sand med kullbiter og hvite sand linser. Utkastede masser fra konstruksjonen av tjæremile. Lag 7: Et kullag blandet med oransje sand som lå over en eldre kullgrop. Lag 8: Lys hvit sand blandet med kull. Gammel skogbunn. Lag 9: Lys grågul sand med kull-linser. Lag 10: Medium gråbrun siltholdig sand med kullbiter som lå over en eldre kullgrop. Lag 11: lys gråoransje sand med in situ lag av brente tømmer fra siste bruk av tjærehellen. Blandet med lager av bark som lå i bunn av mileskålen. Lag 12: Oransje sand som lå over en eldre kullgrop. Lag 13: Mørk grått kullag som lå over en eldre kullgrop. Lag 14: En blanding av lys hvitgul og mørk oransje sand som lå over en eldre kullgrop.

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									Lag 15: Kullag som lå over en eldre kullgrop. Lag 16: Brent sand. Lag 17: Kullag i en kullgrop. Lag 18: Mørk gråbrun siltholdig sand med store kullfragmenter. Mulig stolpehull eller tappesystem. Struktur 19: Del av brent staur som lå over en eldre kullgrop. Lag 20: Lys oransje brent sand, blandet med kullfragmenter. Lag i en kullgrop. Lag 21: Lys oransjegrå sand med store kullbiter. Lag i en eldre kullgrop. Datert til AD 1040-1170. Lag 22: Lys gråbrun silt som lå over en eldre kullgrop. Lag 23: Oransje brent sand som lå over en eldre kullgrop. Lag 24: Kullag med rødbrent sand på bunn. Bunnlag i en kullgrop. Lag 25: Mørk brunoransje siltholdig sand med kullbiter. Lag i tjæremile. Lag 26: Mørk gråoransje siltholdig sand med store kullbiter. Lag i tjæremile. Datert til AD 1160-1215 Lag 27: Kullag i tjæremile. Lag 28: Lys oransje kullholdig silt sand med stor kullbiter. Lag i tjæremile. Lag 29: Renne i tjæremile dannet av tjære, kvister og stein som har størknet gravd *in situ*. Rennen har en flat bunn og rett sider som skaper en kanal hvor tjære renner. Datert til AD 1450-1610. Lag 30: Mørk gråoransje kullholdig silt sand med store kullbiter. Lag 31: Mørk grå siltholdig sand med kullbiter. Lag 32: Lys hvitt og mørk oransje sand i en kullgrop. Lag 33: Kullag i bunn av en kullgrop. Datert til AD 1240-1285. Lag 34: Rødbrent sand i bunn av en kullgrop.

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									Lag 35: Mørk gråoransje siltholdig sand flekket av rødbrent sand i en kullgrop. Lag 36:Mørk gråbrun humusholdig silt sand med kullbiter og råtten vegetasjon. Lag 37: Kullag med bark. Lag i tjæremile. Lag 38: Gråbrun silt sand med kullflekker og små kullbiter. Lag 39:Mørk grå siltholdig sand med kullflekker og små og store kullfragmenter. Lag 40: Mørk gråbrun silt og kullholdig sand med mye små og store kullbiter. Flekket av lys brun siltsand. Harde klumper med sand trekull og stein i overgang med lag 29. Lag som lå over en grop tilknyttet til tjæremile. Datert til AD 1455-1620 Lag 41: Lys oransje brun og gråbrun siltholdig sand med kullbiter. Lag i grop tilknyttet til tjæremile. Lag 42: Mørkt rødbrun siltholdig rødbrent sand med kullbiter. Lag 43: Lys grått siltholdig sand med små kullbiter. Lag i grop tilknyttet til tjæremile. Lag 44: Lys beige siltholdig sand med kullbiter. Lag i grop tilknyttet til tjæremile. Lag 45: Gråbrun silt sand med kullflekker og små kullbiter. Lag 46: Lys gråbrun siltholdig sand med små kullflekker og biter.. Lag 47: Lys gulbrun siltholdig sand med grus og kullbiter. Lag 48 Oransje sand og grus med noen kullbiter. Lag 49: Mørk grå siltholdig sand med høyt innhold av trekull. Lag i en grop. Lag 50: Medium grå sand med noen små kullflekker. Bunnlag i en grop. Datert til AD 1310-1405

Strukt. nummer	Type	Form	Snittet	Dybde (cm)	Lengde (cm)	Bredde (cm)	sider	Bunn	Beskrivelse
									Lag 51: Flere tynne lag med bark. Lag 52: Et tynt kullag på gammel skogbunn. Datert til AD 1160-1220. Lag 53: Lys grått siltholdig sand. Gammel skogbunn.

9.2 FINDS

C58104/1-6

Produksjonsplass fra **middelalder** fra GARDEMOEN NÆRINGSPARK LAUTEN (152/27), (137/1), (153/39) og Vilberg (177/4) ULLENSAKER K., AKERSHUS.

Funnomstendighet: Arkeologisk utgravning av tre kullgroper og tre tjæremiler (id: 134587, 134497, 134588, 134577, 134575 og 134597) er foretatt i perioden 1.11.11-18.11.11 i forbindelse med reguleringsplan for Gardermoen Næringspark. Området ble registrert av Akershus Fylkeskommune i 2009 (Johannessen 2010). Flere kulturminner er registrert i nærområdet, hovedsakelig kullgroper, tjæremile og fangstgroper fra middelalder og nyere tid. Strukturene lå i skogsterreng og ble undersøkt med maskinell og manuell graving (Derrick 2012). I to av tjæremilene (id 134497 og id. 134597) ble det dokumentert eldre kullgroper, som tjæremilene var anlagt over. I id. 134597 ble det dokumentert to bruksfaser. Første fase ble datert fra slutten av 1300-tallet til midt-1400 tallet og den andre fasen begynt midten i 1400-tallet. Tjæremile 134577 ble datert fra tidlig 1400-tallet til 1500-tallet og id. 134575 var konstruert rundt 1420 AD. Tjæremile id 134497 hadde en maksimal avkastning på 3696 kubikkmeter med en sannsynlig avkastning på mellom 2310-3080 m^3. Tjæremile id. 134577 hadde et optimalt utbytte på 2976 m^3 og en sannsynlig avkastning på 1860-2480 m^3. Den første fasen av tjæremile id. 134597 ville ha produserte en maksimal avkastning på 7104 m^3 med en sannsynlig avkastning på 4440-5920 m^3. Mens den andre fasen produserte maksimalt 4560 m^3 og en sannsynlig avkastning på 2850-3800 m^3. Alle kullgropene på prosjektet viste seg å ha kvadratisk milebunn, og var av mellomstor/stor størrelse i henhold til gjeldende definisjoner for denne typen kulturminner (Narmo 1996). De ble datert til 1170-1225 AD (id 134588), 1170-1235 AD (id 134587) og 1050-1215 AD (id 134577). 17 kullprøver ble videresendt til vedartsbestemmelse hos Helge I. Høeg (2011). Prøvene inneholdt i all hovedsak furu samt noe bark og gran. Prøver ble deretter videresendt til radiologisk datering hos Nasjonallaboratoriet for C14-datering (DF-4564).

Kullprøver

1) 30 biter er vedartbestemt som Pinus. Av disse var 1 g Pinus radiologisk datert til 680 +/_ 30 BP calAD1290-1375 (Tra-3711). Fra lag under renne 17 i tjæremile id 134597.

2) 20 biter er vedartbestemt som Pinus. Av disse var 0,5 g Pinus radiologisk datert til 875 +/- 30 BP calAD 1160-1220 (Tra-3704). Fra lag 31 i tjæremile id 134497.

3) 40 biter er vedartbestemt som Pinus. Av disse var 0,5 g Pinus radiologisk datert til 665 +/- 30 BP calAD 1295-1385 (TRa-3709). Fra grop 11 i tjæremile 134597.

4) 40 biter er vedartbestemt. Av disse var 31 Pinus og 9 bark. 0,7 g Pinus er radiologisk datert til 680 +/- 30 BP calAD 1290-1375 (TRa-3698). Fra lag 3 i tjæremile 134575.

5) 30 biter er vedartbestemt. Av disse var 20 Picea og 10 Pinus. 0,7 g Picea er radiologisk datert til 850 +/- 35 BP calAD 1170-1235 (TRa-3699). Fra kullgrop 134587.

6) 40 biter er vedartbestemt. Av disse var 36 Pinus og 4 bark. 1 g Pinus er radiologisk datert til 555 +/- 30 BP calAD 1400-1420 (TRa-3697). Fra tjæremile 134575.

Orienteringsoppgave: Planområdet, Gardermoen næringspark II B og C, ligger mellom Oslo Lufthavn Gardermoen, i vest og Villbergveien i øst. Området er avsatt til næringsbebyggelse i kommunedelplanen. Den nordlige delen av planområdet ligger nord for RV 35 og mellom E6 og Villbergveien.

Kartreferanse: M711/N50, *Projeksjon:* EU89-UTM; Sone 32, *N:* 6673465, *Ø:* 618947.
Lokalitets id: 134497/134575/134577/134587/134588/134597.
litteratur: Derrick M., 2012: *An archaeological excavation at Lauten 137/1, 152/27 153/39 and Vilberg 177/4, Ullensaker kommune, Akershus.*
Johannessen L, 2010: *Rapport fra registrering av automatisk fredete kulturminner i forbindelse med regulering av gardemoen næringspark gbnr. 137/1 Ljøgot, 152/2 Lauten m. fl. og 177/1 Vilberg m. fl. i Ullensaker kommune, Akershus.*
Loftsgarden K., 2011: *Reguleringsplan for Gardemoen næringspark II B og C - utvidet område Lauten 153/3, Haug 136 /1 mfl. Ullensaker kommune, Akershus.*

9.3 PHOTO LIST

Fotoliste, Negativnr. Cf.34503

Filnavn	Motivbeskrivelse	RetningSett Mot	Intern merknad
Cf34503_01.JPG	Kullgrop id 134598 i plan.	N	TW
Cf34503_02.JPG	Tjæremile id 134597 i plan. Viser at mila ligger i skrånende terreng.	NNV	MD
Cf34503_03.JPG	Innsiden av tjæremile id 134597. Punkt for uttak av tjære synlig som en grøft eller kanal gjennom tjæremilas voll midt i bildet.	SV	MD
Cf34503_04.JPG	id 134597. Punkt for uttak av tjære sett fra utsiden av tjæremila.	NØ	MD
Cf34503_05.JPG	id 134597. Punkt for uttak av tjære sett fra utsiden av tjæremila.	NØ	MD
Cf34503_06.JPG	Oversiktbilde av tjæremile id 134597 i terrenget.	V	MD
Cf34503_07.JPG	Oversiktsbilde av tjæremile id 134597 i terrenget.	V	MD
Cf34503_08.JPG	Oversiktsbilde av tjæremile id 134597 i terrenget.	NNØ	MD
Cf34503_09.JPG	Rydding av tømmer fra kullgrop id 134588 før graving.	NØ	MD
Cf34503_10.JPG	Kullgrop id 134588 i plan. Tatt fra maskin	NV	TW
Cf34503_11.JPG	Kullgrop id 134587 i plan. Tatt fra maskin.	NØ	MD
Cf34503_12.JPG	Kullgrop id 134588 i profil.	N	TW
Cf34503_13.JPG	Kullgrop id 134577 i plan. Tatt fra maskin.	SØ	MD
Cf34503_14.JPG	Kullgrop id 134577 i plan. Tatt fra maskin.	S	MD
Cf34503_15.JPG	Kullgrop id 134577 i profil.	S	TW
Cf34503_16.JPG	Detaljfoto av nedgraving i kullgrop id 134577.	S	TW
Cf34503_17.JPG	Detaljfoto av gammel torv/skogbunn under voll av kullgrop id 134577.	S	TW
Cf34503_18.JPG	Kullgrop id 134587 i profil.	NØ	MD
Cf34503_19.JPG	Tjæremile id 134497 i plan. Tatt fra maskin.	SV	TW
Cf34503_20.JPG	Tjæremile id 134497 i plan. Tatt fra maskin.	SV	
Cf34503_21.JPG	Tjæremile id 134497 i plan. Grop gjennom yttervoll for uttak av tjære markert av Mick Derrick. Tatt fra maskin.	NØ	TW
Cf34503_22.JPG	Tjæremile id 134578 i plan. Tatt fra maskin.	N	TW
Cf34503_23.JPG	Detaljfoto av overgang mellom voll og grop i Ø-V profil av tjæremile id 134578 før fjerning av rot.	S	TW
Cf34503_24.JPG	Profil SØ-NV i tjæremile id 134497.	NØ	TW
Cf34503_25.JPG	Detaljfoto av grop i SØ-NV profil i tjæremile id 134497.	NØ	TW
Cf34503_26.JPG	Detaljfoto av voll i SØ-NV profil i tjæremile id 134497.	NØ	TW
Cf34503_27.JPG	Arbeidsbilde under graving av tjæremile id 134578. Plasseringen av profilen har fjernet hoveddelen av mila, men renna/utløpet for tjæra er synlig i plan.	Ø	MD
Cf34503_28.JPG	Arbeidsbilde av tjæremile id 134578. Detaljfoto av grop i profil.	NNV	MD
Cf34503_29.JPG	Arbeidsbilde av tjæremile id 134578. Detaljfoto av grop i profil.	NNV	MD

Filnavn	Motivbeskrivelse	RetningSett Mot	Intern merknad
Cf34503_30.JPG	Tjæremile id 134578, profil A.	NNV	MD
Cf34503_31.JPG	Tjæremile id 134578, detaljfoto av voll i profil A.	NNV	MD
Cf34503_32.JPG	Tjæremile id 134578, første del av profil B.	Ø	MD
Cf34503_33.JPG	Tjæremile id 134578, andre del av profil B.	Ø	MD
Cf34503_34.JPG	Tjæremile id 134578, detaljfoto av profil B.	Ø	MD
Cf34503_35.JPG	Tjæremile id 134578, detaljfoto av profil B.	Ø	MD
Cf34503_36.JPG	Tjæremile id 134578, detaljfoto av profil B.	Ø	MD
Cf34503_37.JPG	Tjæremile id 134578, detaljfoto av profil B.	Ø	MD
Cf34503_38.JPG	Tjæremile id 134578, bunn av grop i plan.	Ø	MD
Cf34503_39.JPG	Tjæremile id 134578, bunn av grop i plan.	Ø	MD
Cf34503_40.JPG	Tjæremile id 134578, bunn av grop i plan.	N	MD
Cf34503_41.JPG	Tjæremile id 134578, detaljfoto av profil B.	Ø	MD
Cf34503_42.JPG	Tjæremile id 134578, arbeidsbilde.	NØ	MD
Cf34503_43.JPG	Tjæremile id 134578, profil A (nordlig del).	Ø	MD
Cf34503_44.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_45.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_46.JPG	Tjæremile id 134578, detaljfot av profil A (nordlig del).	Ø	MD
Cf34503_47.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_48.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_49.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_50.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_51.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_52.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_53.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_54.JPG	Tjæremile id 134578, detaljfoto av profil A (nordlig del).	Ø	MD
Cf34503_55.JPG	Tjæremile id 134578, kompakt materiale i bunn av grop (renne). I profil A.	Ø	MD
Cf34503_56.JPG	Tjæremile id 134578, kompakt materiale i bunn av grop (renne).I profil A.	Ø	MD
Cf34503_57.JPG	Tjæremile id 134578, profil A. Sentrum av tjæremila.	Ø	MD
Cf34503_58.JPG	Tjæremile id 134578, profil A. Sentrum av tjæremila.	Ø	MD
Cf34503_59.JPG	Tjæremile id 134578, profil A.	N	MD
Cf34503_60.JPG	Tjæremile id 134578. Sørlig del av profil A.	Ø	MD
Cf34503_61.JPG	Tjæremile id 134578. Detaljfoto av profil B.	N	MD
Cf34503_62.JPG	Tjæremile id 134578. Detaljfoto av voll i profil B.	N	MD
Cf34503_63.JPG	Tjæremile id 134578. Detaljfoto av voll i profil B.	N	MD
Cf34503_64.JPG	Tjæremile id 134578. Detaljfoto av voll i profil B.	N	MD
Cf34503_65.JPG	Tjæremile id 134578. Detaljfoto av voll i profil B.	N	MD
Cf34503_66.JPG	Tjæremile id 134578. Detaljfoto av voll i profil B.	N	MD
Cf34503_67.JPG	Tjæremile id 134578. Detaljfoto av overgang mellom grop og voll i profil B.	N	MD
Cf34503_68.JPG	Tjæremile id 134497. Del av profil NØ-SV.	SØ	MD
Cf34503_69.JPG	Tjæremile id 134497. Del av profil NØ-SV.	SØ	MD
Cf34503_70.JPG	Tjæremile id 134497.Del av profil NØ-SV.	SØ	MD
Cf34503_71.JPG	Tjæremile id 134497. Grop under Tjæremila i NØ-SV profil.	SØ	MD
Cf34503_72.JPG	Tjæremile id 134497. Grop under Tjæremila i NØ-SV profil.	SØ	MD

Filnavn	Motivbeskrivelse	RetningSett Mot	Intern merknad
Cf34503_73.JPG	Tjæremile id 134497. Grop under Tjæremila i NØ-SV profil.	SØ	MD
Cf34503_74.JPG	Tjæremile id 134497. Renne i SV-NØ profil.	SØ	MD
Cf34503_75.JPG	Tjæremile id 134497. Renne i SV-NØ profil.	SØ	MD
Cf34503_76.JPG	Tjæremile id 134497. Arbeidsbilde	SØ	TW
Cf34503_77.JPG	Tjæremile id 134497. Bark og furunål-lag i bunnen av uttakskanalen/gropa for tjæra (i SV-NØ profil).	SØ	MD
Cf34503_78.JPG	Tjæremile id 134497. Bark og furunål-lag i bunnen av uttakskanalen/gropa for tjæra (i SV-NØ profil).	SØ	MD
Cf34503_79.JPG	Tjæremile id 134497. Bark og furunål-lag i bunnen av uttakskanalen/gropa for tjæra (i SV-NØ profil).	SØ	MD
Cf34503_80.JPG	Tjæremile id 134497. Bark og furunål-lag i bunnen av uttakskanalen/gropa for tjæra.	SØ	MD
Cf34503_81.JPG	Tjæremile id 134497. Planker i bunnen av den gamle gropa (i NV-SØ profil).	NØ	MD
Cf34503_82.JPG	Tjæremile id 134497. Planker i bunnen av den gamle gropa (i NV-SØ profil).	NØ	MD
Cf34503_83.JPG	Tjæremile id 134497. Planker i bunnen av den gamle gropa (i NV-SØ profil).	NØ	MD
Cf34503_84.JPG	Tjæremile id 134497. Planker i bunnen av den gamle gropa (i NV-SØ profil).	NØ	MD
Cf34503_85.JPG	Tjæremile id 134497. Arbeidsbilde.	S	MD
Cf34503_86.JPG	Tjæremile id 134497. Arbeidsbilde.	SV	MD
Cf34503_87.JPG	Tjæremile id 134497. Arbeidsbilde.	SØ	MD
Cf34503_88.JPG	Tjæremile id 134497. Arbeidsbilde.	NØ	MD
Cf34503_89.JPG	Tjæremile id 134497. Arbeidsbilde.	SV	MD
Cf34503_90.JPG	Tjæremile id 134497.Detaljfoto av bark og furunål-lag i bunnen av uttakskanalen/gropa for tjæra (i plan).	N	MD
Cf34503_91.JPG	Tjæremile id 134497.Detaljfoto av bark og furunål-lag i bunnen av uttakskanalen/gropa for tjæra (i plan).	SØ	MD
Cf34503_92.JPG	Tjæremile id 134497. Oversiktsbilde.	NØ	MD
Cf34503_93.JPG	Tjæremile id 134497. Oversiktsbilde.	N	MD
Cf34503_94.JPG	Tjæremile id 134497. Oversiktsbilde av utgravd del av mila i plan. Tatt fra maskin.	SØ	MD
Cf34503_95.JPG	Tjæremile id 134497. Oversiktsbilde av utgravd del av mila i plan. Tatt fra maskin.	NØ	TW
Cf34503_96.JPG	Tjæremile id 134497. Detaljfoto av renne i midten av tjæremila.	SØ	MD
Cf34503_97.JPG	Tjæremile id 134497. Detaljfoto av renne i midten av tjæremila.	NØ	MD
Cf34503_98.JPG	Tjæremile id 134497. Detaljfoto av renne i midten av tjæremila.	SØ	MD
Cf34503_99.JPG	Tjæremile id 134497. Detaljfoto av renne i midten av tjæremila.	NØ	MD
Cf34503_100.JPG	Tjæremile id 134497. Detaljfoto av sentrum av tjæremila langs SØ-NV profil.	NØ	MD
Cf34503_101.JPG	Tjæremile id 134497. Detaljfoto av sentrum av tjæremila langs SØ-NV profil.	NØ	MD
Cf34503_102.JPG	Tjæremile id 134497. Detaljfoto av SØ del av SØ-NV profil.	NØ	MD
Cf34503_103.JPG	Tjæremile id 134497. Detaljfoto av voll i SØ del av SØ-NV profil.	NØ	MD
Cf34503_104.JPG	Tjæremile id 134497. Detaljfoto av overgang mellom voll og grop i NV del av SØ-NV profil.	NØ	MD
Cf34503_105.JPG	Tjæremile id 134497. Detaljfoto av voll i NV del av SØ-NV profil.		
Cf34503_106.JPG	Tjæremile id 134497.Oversiktsbilde over SØ-NV profil.	NØ	MD
Cf34503_107.JPG	Tjæremile id 134497.Oversiktsbilde over SØ-NV profil.	NØ	MD
Cf34503_108.JPG	Tjæremile id 134597. Arbeidsbilde.	N	MD
Cf34503_109.JPG	Tjæremile id 134597. Arbeidsbilde.	SØ	MD
Cf34503_110.JPG	Tjæremile id 134597. Arbeidsbilde.	S	MD
Cf34503_111.JPG	Tjæremile id 134597. Arbeidsbilde.	NV	MD
Cf34503_112.JPG	Tjæremile id 134597. Arbeidsbilde.	V	MD
Cf34503_113.JPG	Tjæremile id 134597. Arbeidsbilde.	NNV	MD
Cf34503_114.JPG	Tjæremile id 134597. Profil NV-SØ.	NØ	MD

Filnavn	Motivbeskrivelse	RetningSett Mot	Intern merknad
Cf34503_115.JPG	Tjæremile id 134597. Detaljfoto av grop i NV-SØ profil.	NØ	MD
Cf34503_116.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 og 2 i NV-SØ profil.	NØ	MD
Cf34503_117.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 og 2 i NV-SØ profil.	NNV	MD
Cf34503_118.JPG	Tjæremile id 134597. Detaljfoto av renne fase 2 ogi NV-SØ profil i sentrum av mila.	NØ	MD
Cf34503_119.JPG	Tjæremile id 134597. Detaljfoto av rødbrent sand og bevart treverk i sentrum av mila (SØ-NV profil).	NØ	MD
Cf34503_120.JPG	Tjæremile id 134597. Detaljfoto av rødbrent sand og bevart treverk i sentrum av mila (SØ-NV profil).	N	MD
Cf34503_121.JPG	Tjæremile id 134597. Detaljfoto av renner i NV-SØ profil i sentrum av mila.	NØ	MD
Cf34503_122.JPG	Tjæremile id 134597. Detaljfoto av grop og renner i NV-SØ profil.	NØ	MD
Cf34503_123.JPG	Tjæremile id 134597. Detaljfoto av voll i NV-SØ profil.	NØ	MD
Cf34503_124.JPG	Tjæremile id 134597. Detaljfoto av voll i NV-SØ profil.	NØ	MD
Cf34503_125.JPG	Tjæremile id 134597. Detaljfoto av voll i NV-SØ profil.	NØ	MD
Cf34503_126.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 i NV-SØ profil	NØ	MD
Cf34503_127.JPG	Tjæremile id 134597. NØ-SV profil.	NV	MD
Cf34503_128.JPG	Tjæremile id 134597. Detaljfoto av voll i NØ-SV profil.	NV	MD
Cf34503_129.JPG	Tjæremile id 134597. Detaljfoto av voll i NØ-SV profil.	NV	MD
Cf34503_130.JPG	Tjæremile id 134597. Detaljfoto av grop i NØ-SV profil.	NV	MD
Cf34503_131.JPG	Tjæremile id 134597. Detaljfoto av grop under voll i NØ-SV profil.	NV	MD
Cf34503_132.JPG	Tjæremile id 134597. Detaljfoto av grop under voll i NØ-SV profil.	NV	MD
Cf34503_133.JPG	Tjæremile id 134597. Detaljfoto av voll i NØ-SV profil.	NV	MD
Cf34503_134.JPG	Tjæremile id 134597. Detaljfoto av voll i NØ-SV profil.	NV	MD
Cf34503_135.JPG	Tjæremile id 134597. Detaljfoto av grop/renne i NØ-SV profil.	NV	MD
Cf34503_136.JPG	Tjæremile id 134597. NØ-SV profil med skygge.	NV	MD
Cf34503_137.JPG	Tjæremile id 134597. Bevart tre i rennekonstruksjon i NV-SØ profil.	NØ	MD
Cf34503_138.JPG	Tjæremile id 134597. Bevart tre i rennekonstruksjon i NV-SØ profil.	NØ	MD
Cf34503_139.JPG	Tjæremile id 134597. Bevart tre i rennekonstruksjon i NV-SØ profil.	NØ	MD
Cf34503_140.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 og 2 i NV-SØ profil.	NØ	TW
Cf34503_141.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 og 2 i NV-SØ profil.	NØ	TW
Cf34503_142.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 i NV-SØ profil.	NØ	TW
Cf34503_143.JPG	Tjæremile id 134597. Oversiktsbilde av NV-SØ profil.	NØ	MD
Cf34503_144.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 og 2 i NV-SØ profil.	NØ	MD
Cf34503_145.JPG	Tjæremile id 134597. Detaljfoto av renne fase 1 og 2 i NV-SØ profil.	NØ	MD
Cf34503_146.JPG	Tjæremile id 134597. Andre halvdel av profil NV-SØ. Oversiktsbilde	NØ	MD
Cf34503_147.JPG	Tjæremile id 134597. Oversiktsbilde av profil NV-SØ.	NNV	MD
Cf34503_148.JPG	Tjæremile id 134597. Oversiktsbilde av profil NV-SØ.	ØSØ	MD
Cf34503_149.JPG	Tjæremile id 134597. Nærbilde av renne fase 2 etter uttak.	VNV	MD
Cf34503_150.JPG	Tjæremile id 134597. Nærbilde av renne fase 2 etter uttak.	NV	MD
Cf34503_151.JPG	Tjæremile id 134597. Nærbilde av renne fase 2 etter uttak.	SV	MD
Cf34503_152.JPG	Tjæremile id 134597. Arbeidsbilde. Rensing av fase 1 renne.	NV	MD
Cf34503_153.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan.	NV	MD
Cf34503_154.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan.	NV	MD
Cf34503_155.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan.	SØ	MD
Cf34503_156.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan.	SØ	MD
Cf34503_157.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan. SØ ende av renna.	NV	MD

Filnavn	Motivbeskrivelse	RetningSett Mot	Intern merknad
Cf34503_158.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan.SØ ende av renna.	NV	MD
Cf34503_159.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan. SØ ende av renna.	NV	MD
Cf34503_160.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan. SØ ende av renna.	NV	MD
Cf34503_161.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan.	NV	MD
Cf34503_162.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan og i relasjon til profil NØ-SV.	NV	MD
Cf34503_163.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan. NV ende av renna.	NV	MD
Cf34503_164.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan.	NØ	MD
Cf34503_165.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan og i relasjon til profil NØ-SV.	V	MD
Cf34503_166.JPG	Tjæremile id 134597. Fase 1 renne fremrenset i plan og i relasjon til profil NØ-SV.	V	MD
Cf34503_167.JPG	Tjæremile id 134597. Andre halvdel av profil NØ-SV.	NV	MD

9.4 ANALYSIS

LABORATORIET FOR RADIOLOGISK DATERING
Adr.: NTNU – Gløshaugen, Sem Sælandsv. 5, 7491 Trondheim
Telefon 73593310 Telefax 73593383

DATERINGSRAPPORT

Oppdragsgiver: Loftsgarden, Kjetil
KHM/Fornminneseksjonen/UiO
Postboks 6762 St. Olavs plass, 0130 Oslo

DF-4564

Lab. ref.	Oppdragsgivers ref.	Materiale	Datert del	^{14}C alder før nåtid	Kalibrert alder	δ^{13}C ‰
TRa-3701	KP6, ID134497 Lauten, Haug, Ullensaker Akershus	Trekull Furu		385 ± 30	AD1455-1620	-23.9
TRa-3702	KP7, ID134497 Lauten, Haug, Ullensaker Akershus	Trekull Furu		595 ± 30	AD1310-1405	-24.0
TRa-3703	KP8, ID134497 Lauten, Haug, Ullensaker Akershus	Trekull Furu		885 ± 25	AD1160-1215	-24.0
TRa-3704	KP9, ID134497 Lauten, Haug, Ullensaker Akershus	Trekull Furu		875 ± 30	AD1160-1220	-24.0
TRa-3705	KP10, ID134497 Lauten, Haug, Ullensaker Akershus	Trekull Furu		400 ± 30	AD1450-1610	-23.4
TRa-3706	KP12, ID134588 Lauten, Haug, Ullensaker Akershus	Trekull Gran		860 ± 30	AD1170-1225	-25.4
TRa-3707	KP20, ID134497 Lauten, Haug, Ullensaker Akershus	Trekull Furu		780 ± 30	AD1240-1285	-24.5
TRa-3708	KP21, ID134497 Lauten, Haug, Ullensaker Akershus	Trekull Furu		915 ± 30	AD1040-1170	-24.1
TRa-3709	KP22, ID134597 Lauten, Haug, Ullensaker Akershus	Trekull Furu		665 ± 30	AD1295-1385	-23.1

Dato: 29 MAR 2012

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DF-4564

Lab. ref.	Oppdragsgivers ref.	Materiale	Datert del	^{14}C alder før nåtid	Kalibrert alder	δ^{13}C ‰
TRa-3710	KP50, ID134597 Lauten, Haug, Ullensaker Akershus	Trekull Furu		550 ± 30	AD1400-1420	-24.6
TRa-3711	KP52, ID134597 Lauten, Haug, Ullensaker Akershus	Trekull Furu		680 ± 30	AD1290-1375	-24.3
TRa-3712	KP53, ID134597 Lauten, Haug, Ullensaker Akershus	Trekull Furu		455 ± 30	AD1435-1450	-25.1
TRa-3713	KP54, ID134497 Lauten, Haug, Ullensaker Akershus	Cellulose Furu		375 ± 30	AD1470-1625	-23.0

Dato: 29 MAR 2012

Laboratoriet for Radiologisk Datering

Sølvi Stene

Einar Værnes

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DF-4564

Lab. ref.	Oppdragsgivers ref.	Materiale	Datert del	^{14}C alder før nåtid	Kalibrert alder	δ^{13}C ‰
TRa-3697	KP1, ID134575 Lauten, Haug, Ullensaker Akershus	Trekull Furu		555 ± 30	AD1400-1420	-24.0
TRa-3698	KP3, ID134575 Lauten, Haug, Ullensaker Akershus	Trekull Furu		680 ± 30	AD1290-1375	-25.0
TRa-3699	KP4, ID134587 Lauten, Haug, Ullensaker Akershus	Trekull Gran		850 ± 35	AD1170-1235	-24.4
TRa-3700	KP5, ID134577 Lauten, Haug, Ullensaker Akershus	Trekull Gran		895 ± 35	AD1050-1215	-25.5

Dato: 16 MAR 2012

Laboratoriet for Radiologisk Datering

Sølvi Stene

Einar Værnes