

Summaries

Project: Medieval Potters' Kilns

By Jan Kock

Potters' kilns first came into use in Denmark in the early Middle Ages. Until the early 1980s, only two medieval potter's kilns were known of in this country. In a very short period of time, from 1983 on, three new potter's kilns were found, along with the waster from their production. The three new kilns were quite different from each other in construction, and quite different from those already known. This gave rise to the establishment of a research and publication project, including processing the finds, carrying out a series of experimental archaeological experiments, and collecting archaeological and selected ethnological and ethnographical parallel material for comparison. This research is presented together with medieval potters' kilns in Denmark excavated later, so that the publication adequately covers this subject area when it appears in 2003.

Medieval potters' kilns and pottery in Denmark – a prelude

By Jan Kock

Based on a brief presentation of the kilns found at Hellum, Kragelund and Barmer, as well as the finds from Fredsø, Radby, Lindholtgård and the older finds from Farum Lillevang and Faurholm, the kilns are placed in a European context which is explored more thoroughly in the following articles. In addition, the publication discusses the value of the ethnological and ethnographic parallels

and of the experimental archaeology tests carried out.

One section is dedicated to finds of waster heaps from the potter's production. See also the articles on the finds of waster heaps from Aale and Illerup. Such finds augment the picture we already have of the work of potters in this country.

In addition, the publication discusses the value of the ceramic material found in the kilns, material which in the future will serve as points of orientation for the study of Danish medieval pottery, both typologically and chronologically.

The Hellum kiln. A potter's kiln from the early Middle Ages

By Jan Kock

In 1983, a medieval potter's kiln was discovered in a field near the western outskirts of the village of Hellum, east of Rold Skov. The kiln is of a vertical type, with the firing chamber placed vertically above the fire chamber, separated by a wheel-shaped grate made of clay. The type is common in the English area. Remains of pottery from the last firing were found in the left parts of the kiln. There were preserved parts of approx. 70 vessels, all globe-shaped, black-fired pots with out-bent rims. There were no handles or feet. The pottery itself as well as C-14 and thermo luminescence dating place the site somewhere in the first half of the 12th century.

The kilns from Barmer. Potter's kilns from the 14th century

By *Jan Kock*

Two potter's kilns were found near the village of Barmer, in western Himmerland. Both are the horizontal type of kiln, with the firing chamber placed in continuation of the fire chamber. The best-preserved kiln lay east-west, and was 3 m long and a little over 1 m wide. The entire bottom of the kiln was lined with a strong, sand-tempered clay mixture, carefully laid out and smoothed over. The kiln dome was also built of sand-tempered clay, and supported by a skeleton of branches that later burned off. The fire chamber lay to the west and was slightly sunken, about 30 cm lower than the oven chamber. The two sections were separated by three heavy pillars of clay. The firing chamber rose slightly toward the opening, which was preserved at the east end of the kiln.

A considerable amount of pottery was found in and around the kiln, in general typical of the 14th century. C-14-dating places the kiln in the second half of the 14th century. See the article on the pottery from Barmer in this publication.

The Kragelund kiln

By *Anne Birgitte Jessen*

In 1984 a kiln was excavated in the village of Kragelund near Silkeborg. The kiln contained a flue and a kiln chamber placed horizontally in relation to each other, which classes it as a double-chambered horizontal kiln. The floor of the kiln was covered with clay.

The kiln chamber contained a tongue-shaped platform, which was probably totally covered with clay. On each side of the platform was a rising flue. It is unknown whether the flue was as long as the kiln chamber or whether the flue rose to the level of the platform. The kiln was covered with a clay dome built up without any kind of osiers. It is likely that the back of the kiln had a loading aperture because it would have eased access to the kiln chamber, but the kiln was too badly preserved to determine whether an opening existed.

Neither repairs nor rebuilding was observed during the excavation. There was no sign of other kilns in the area. The presence of only one kiln with one kiln phase this indicates that the pottery in Kragelund only existed for a short period of time. The ceramics found together with the kiln points towards a dating in the 14th century. This dating is supported by C-14 analysis.

The kiln of a potter in Fredsø

By *Asmund Birkals and Per Bugge Vegger*

In 1994, an excavation in a building structure in the countryside led to the uncovering of a small kiln construction in Fredsø on the island of Mors in the Limfjord. Repeated ploughing may have removed possible traces of a superstructure, but the contour of the kiln was quite distinct in the subsoil. The kiln was relatively small, about 80 × 80 cm, horizontally positioned with separate furnace and kiln chambers. The construction of the kiln cannot be compared with other known potter's kilns in the Danish area, but must be designated as type 1 in Musty's typology.

The highly modest amount of pottery it contained indicates that the kiln only functioned for a brief period of time. Luminescence datings confirm a stylistically based dating of the earthenware to the 13th and 14th centuries.

The Farum Lillevang kilns

By *Niels-Knud Liebgott*

Farum Lillevang is situated about 25 km north of Copenhagen. The complex of medieval kilns there was discovered in 1953 in connection with an investigation of a deserted village (mentioned in 1370) carried out by a local historical association. This was the first time that a medieval pottery workshop had been located in Scandinavia. The archaeological excavation took place in 1953 and in 1970/71 under the supervision of the National Museum of Denmark. During the first phase of the excavation the base of an

oval pottery kiln – 2.6 × 4 metres in size – built partly of brick (figs. 1 & 2) was uncovered. At the south end there had been a stokepit. The kiln had without doubt had a clay dome. No further details about the construction of the kiln or kiln furniture etc. were found, apart from two “vent-stoppers” of fired clay with handles (fig. 3). The archaeological investigations in Farum Lillevang were resumed in 1970/71. At that time two rectangular brick kilns were excavated which were closely associated with the kiln previously identified. At the time of construction of the earliest of these brick kilns another oval pottery kiln had been almost completely removed, and only part of the damaged clay dome remained (fig. 5). In the remains of that kiln there were parts of the last firing, in the form of grey-fired pottery sherds which could be assembled to form five almost complete vessels. The brick kilns had been used for firing ordinary bricks, and also for architectural elements, floor tiles etc. (figs. 8-10). Unfortunately the archaeological investigations were not carried out to an acceptable academic standard. There are no available stratigraphic observations and excavation reports are virtually non-existent. Several attempts have been made – the latest initiated in 1997 by the present author – to collect C-14 and thermoluminescence datings, but without viable results. The dating of the find can however be established by a typological comparison of the pottery, and falls within the period around 1250-1350.

The Faurholm kilns

By Niels-Knud Liebgott

This medieval pottery-kiln complex was found in 1973 at Faurholm, some 35 km north of Copenhagen. The find came to light in connection with the construction of a road across an open field. In 1974 the present author carried out an archaeological investigation on behalf of the National Museum of Denmark. The complex consisted of two kilns, with the same construction, lying close beside one another. The kiln situated to the west was at a deeper level and was the better preserved of the two. The kilns were of a type with an oval, almost pear-shaped kiln chamber, 1.20 × 2.00 metres in size, linked by a flue to a stoke pit 1.60 × 1.70 metres in size, with its floor-level slightly higher than that of

the kiln's floor. In both kilns the red-fired clay dome, built on hazel branches using the wattle and daub technique, had collapsed but was preserved in the form of sizeable pieces found within the kiln. There was no trace of specific kiln furniture, and both kilns had a relatively simple structure known from other Danish finds from the Roman Iron Age. Both kilns had been rebuilt several times after the dome had collapsed. In the western and better-preserved kiln 5 phases could be distinguished, and 3 phases in the eastern one. In the case of both kilns it could be seen that they had been abandoned after a final firing which was at least partially unsuccessful. The collapsed domes had been left undisturbed, and the 30 or so complete vessels that can be assembled from the sherds in the western kiln suggest that probably the whole last firing in this case was abortive. In connection with the excavation in 1974 a number of attempts at dating were made. The archaeo-magnetic samples provided no useable results. Thermoluminescence dating resulted in a median dating to the year 1317, with a range from 1282 to 1352. A further thermoluminescence dating attempt in 1997 gave no useable dating result. The pottery workshop at Faurholm cannot have functioned for such a long period (70 years) as the two outermost dates would imply. Even though two kilns have been identified, and even though the two kilns might have been rebuilt eight or ten times in all, most likely with several successful firings between each rebuilding, it is difficult to imagine that the Faurholm complex was productive for more than one or two years, or at most a period covering a few years.

The Radby kiln

By Eskil Arentoft

The kiln intended for the firing of Funen black ware was excavated in 1989 near Radby, a small village 10 km west of Odense on Funen. The countryside there is hilly and elevated, with freshwater deposits of fine clay from the melting of the ice during the last ice age. Throughout the ages the area has produced considerable amounts of earthenware and bricks.

On the side of a hill the kiln appeared as a red spot in the earth underneath the layer of soil. The red spot lay underneath the fire

chamber itself. The fire chamber covered about 2 square meters. In front of it was a stoke pit. Beyond these traces nothing remained of the kiln on site. But in a waster pit a few meters away lay stones made brittle by fire and burned pieces of clay regarded as originating from the bottom of the firing chamber, apparently moved here when the place was cleared. These pieces tell that the bottom of the firing chamber consisted of a clay plate equipped with a large number of double conical holes through which fire and heat could penetrate. To support the bottom while it dried, old potshers, bricks, and pieces of tile roofing were built into it.

Next to the kiln were a number of big pits partially filled with broken pots. It is believed that the pits were dug in order to obtain clay for production. The construction is dated to about 1600 or to the first years of the 17th century, in part on the basis of thermoluminescence dating.

The Linholtgård kiln

By *Ann Bodilsen*

In 1998, upon exploring a ploughed windbreak at Lindholtgård in Sevel parish (fig. 1), a good deal of misfired pottery and large clumps of fired clay were registered, apparently originating from a potter's kiln. In June 1999, an excavation was therefore started in the area, on a section of about 100 square meters. The potter's kiln was located on sloping terrain, down towards a small brook.

After the topsoil was removed by machine, the outline of a potter's kiln appeared, with an accompanying stoke pit and behind it a pit with waster (fig. 2). The kiln construction itself was very poorly conserved, and only the layers *u* and *x*, affected by fire, can with certainty be interpreted as the remains of a kiln. Layer *u* consists of parts of a burnt-red clay surface with single horizontally layered potshers on the surface, while layer *x* consists of yellowish-brown loamy sand with a hard-burned surface. The two layers can be interpreted as two different phases of the bottom of the kiln. By measuring the extension of layer *u* and *x* the kiln is assumed to have been a minimum of 1.4 m wide and 2.75 m long, but the precise size is unknown, as it was not possible to observe any definite delimitation of the kiln. In the lengthwise cut (fig. 3) it is evident that the bottom of the kiln rises towards its back wall.

The kiln installation was so poorly conserved that it was not possible to further account for its construction and type. No traces from flues were observed in the cross profile, and it is thus possible to reject the idea that this is a kiln with a platform construction. It is indirectly possible to get an impression of the construction of the kiln dome, there being traces of a skeleton-bearing structure made of branches in a few of the fragments from the kiln dome (fig. 4). However, there are also fragments of kiln dome without traces of branches, so the dome may have been constructed differently in the different phases.

The kiln was installed above a large, long oval pit filled with different, slightly loamy layers of sand without finds of any kind. In this respect its contents were distinctly different from those of the stoke pit and the waster pit. The pit is therefore interpreted as being a prerequisite for or a part of the kiln construction, but without it being possible to provide a comprehensive explanation. The stoke pit lies north of the apparent stoke opening of the kiln and is a four- to five-meter-wide trough-shaped pit. Its length is unknown, as the layer of ashes continues down the slope towards the brook. The stoke pit is asymmetrically situated in respect to the stoke opening of the kiln, and it has been suggested that a fence or dike or the like existed toward the west to shield against the wind. However, no traces of any of these were found.

The objects found in the stoke pit consisted of misfired pottery and fragments of kiln dome. However, a single object was found that is interpreted as a tool for forging the rounded body of the vessels (fig. 6).

The fairly circular waster pit was situated southeast of the kiln. The pit is interpreted as a pit that provided clay and was later used as a pit for waster. The objects from the waster pit consisted of great quantities of misfired pottery, fragments of the dome, as well as a number of brick and tile fragments. The brick and tile fragments are assumed to have been used in connection with stacking the pottery in the kiln, many of the fragments displaying evidence of glaze.

On the basis of the pottery, the Lindholtgård kiln can be dated to the latter half of the 1300s and most likely to the years just prior to the year 1400.

The potter's kiln in Lindholtgård faces NW-SE, with its stoke opening facing northwest, where the stoke pit is also located. Despite its poor state of conservation, it seems reasonable to describe the kiln in Lindholtgaard as belonging to the horizontal or downdraft one-chamber type without platform construction inside. In respect to the parallel Danish material, it seems to be most closely related

to the Faurholm kiln, with which it is also fairly contemporaneous in light of the pottery material.

The pottery from Hellum

By Jan Kock

Sherds from approx. 70 vessels were found in the fire chamber itself. With the exception of a couple of sherds, all were from round pots, with an opening-diameter of 4-20 cm. All the vessels are pressed and coil-built, the rim is out-bent, and not or only slightly thickened on the outside. On the inside, the rim can have a more or less obvious ridge, and double ridges as well as completely smooth rims also occur. The rim is thrown both inside and out with a wet cloth. The marks of the potter's fingers and knuckles can often clearly be seen on the inside. The material is mainly fired in reducing atmosphere. There are no feet, ears, or handles, which fits well with the C-14-dating showing that the workshop was in use sometime in the first half of the 12th century.

The pottery from Barmer

By Jan Kock

Considerable pottery has been found in and around kilns I and II, all made of fine, sand-tempered clay. Almost all the pottery is coil built and pressed up. The main forms are bowls with a rounded body and base and out-bent rims, bowls with strongly profiled rims and shoulders, bowls with in-bent openings, pots with a rounded body and base, smaller pots, also with a rounded body and base, and finally, a small number of jugs. All the pottery is greyish brown to grey, sand-tempered ware and fired to varied degrees of hardness. Everything indicates that it was intended to produce fairly hard-fired, reduction-fired ware. The C-14-dating and the occurrence of very similar vessels from a nearby castle mound whose construction can be dendrochronologically dated to the last quarter of the 14th century allow for a clear dating of when the Bar-

mer potter was active. A comparative analysis of the clay used for the pottery from the two places is exactly the same and this qualifies the dating. The analysis was made by Kaare Lund Rasmussen.

The pottery from Kragelund

By Anne Birgitte Jessen

The pottery from the kiln and the waster pit from Kragelund come from at least 54 vessels primarily of the types, pitcher, pot and bowl. All the vessel types are mainly coil built. The pitchers however are hand built up to the shoulder, after which the neck and the rim are thrown.

The decoration is simple. On the pitchers occur horizontal grooves (often in pairs) placed in such a way that they accentuate changes in the shape of the pitcher. In addition to the horizontal grooves painted stripes of iron oxide and applied and raised motifs resembling raspberries occur. Pots and bowls are decorated with horizontal grooves right below the rim. In a few cases an undulating line occurs below the grooves. Glaze only occurs on pitchers, but unglazed pitchers are represented as well.

The very common form and decoration types that characterize the pottery from Kragelund do not allow a narrow dating. The kiln seems to have functioned for a short period of time in the 14th century.

The pottery from the kiln in Fredsø

By Asmund Birkals and Per Bugge Vegger

During the excavation of a small kiln construction in Fredsø, 217 pieces of pottery appeared. Since the construction was quite disturbed by fieldwork at the time of the excavation, there was possibly a good deal more potsherds present when the kiln was abandoned. The most interesting part of the quantity of potsherds was the 32 rims that could be identified. By means of an EVE measurement these potsherds are separated according to the size of their dia-

meter, which is between 12 and 22 cm. On the basis of these rims it may be determined that the 32 potsherds represent a minimum of 12 vessels. Of the 12 vessels 11 were thrown with the same basic form, i.e., pots with a flat base. Although the main form has been identified, the vessels of the main group reflect great variation in form. The modest quality of the potsherd material suggests that the potter from Fredsø was not a particularly talented craftsman.

The pottery from Farum Lillevang

By Niels-Knud Liebgott

The pottery that was found when the kilns at Farum Lillevang were excavated in 1953 (see article on the Farum Lillevang Kilns) provoked a re-evaluation of the pre-existing view that all glazed and decorated pottery in medieval Denmark was imported from England or from the Netherlands. It was now demonstrated that the potters in Denmark could master the whole repertoire and make products of a standard equivalent to what was made in the large production locations abroad. Given the lack of other Scandinavian finds of medieval pottery production sites (no kiln has so far been found in the other Nordic countries), during the 1950s and 1960s many archaeologists believed, as one can observe in the archaeological publications from those decades, that all glazed pottery in those countries must have come from Farum Lillevang. This view has now been abandoned, not least in the light of the later finds of medieval pottery workshops in Denmark. The ceramic material collected during the investigations in Farum Lillevang in 1953 and 1970/71 amounted in all to some 6-7 tons. The way the sherd material has been handled since excavation has made systematic processing problematic. It can be established, however, that about 75% of all vessels produced in Farum Lillevang consisted of grey-fired unglazed kitchenware – mainly globular and tripod pots. The glazed material consists chiefly of decorated or undecorated jugs with handles. A few matrices (stamps) used for the decoration of glazed pottery were found during the excavation (figs. 13-15). It seems that production in Farum Lillevang must have lasted for one decade at most. With a calculated success rate of 80% it can be estimated that the total of grey-fired vessels alone reaching the market must have been at least around 15,000. But only very few

examples of finds outside Farum Lillevang can be associated with this production site with any degree of probability. There are a few vessels from Roskilde, that fall within this category (fig. 21).

The pottery from Faurholm

By Niels-Knud Liebgott

The total amount of pottery collected during the investigation of the Faurholm kilns in 1974 makes up about 1 cubic metre. By far the largest part of this was found in the western kiln, KILN 1, and it consists of all or most of the last pottery firing in that kiln. The Faurholm potter did not make grey- or black-fired kitchenware, such as that which made up most of the pottery from Farum Lillevang (see article on the Farum Lillevang pottery). Even though globular and tripod pots occur in the Faurholm material, the production there – apart from some bowls which are unique in Danish medieval pottery – consisted mainly of large jugs, up to 32 cm in height, with handles and pinched-out spouts. Some jugs have a decoration painted with iron oxide – either a chevron pattern or vertical stripes. The Danish Technical University undertook a number of analyses of the sherd material in 1974, with a view to determining the colours and composition of the glaze, and the firing temperature and technique. These analyses show for instance that the green glaze used did not contain copper, as expected, but only iron compounds and, of course, lead. The sought-after green colour of glaze was therefore achieved by first firing the pottery in an atmosphere with oxygen present, and then finishing the firing with a phase where the temperature would have to reach about 900 degrees Celsius, in order to form the glaze, and with reduced oxygen in the atmosphere. To carry out this complicated firing technique with a relatively primitive kiln construction must have made heavy demands on the potter's craftsmanship and skills, but it is also the explanation for the frequent failures of the firings at Faurholm with the collapsing of the kiln as the result.

The waster from the potter in Illerup

By *Morten Søvusø*

The article deals with two finds of pottery remains from the Illerup river valley near Skanderborg. A survey of the material reveals that there were distinct differences between the types of vessels in the two finds, and – rather surprisingly – it is hardly a question of remains from the same potter, but instead from two potters who did not necessarily work during the same period of time. The predominant type of vessel in the first collection was an unglazed globular pot with a rounded body and an outbent rim. Furthermore, there are many potsherds from simple decorated pitchers as well as some from big unglazed bowls. These types of vessels were also present in the pottery from the other collection, but there was a considerably larger share of the big bowls. Moreover, there were potsherds of smaller bowls glazed on the inside, as well as a few potsherds from very small pitchers. A number of feet in the find indicate that some of the pots have been applied with tripod feet. One distinguishing feature of both of the finds is that the profiles of the rims of the pots or vessels vary greatly, and that the potter did not work with any standard type; a fact that ought to be remembered before fine-meshed typologies on the rim profiles are set up.

Both pottery finds belong to the 14th century, but it is not possible to say whether one of the finds is younger than the other. The pottery from both finds must be designated as typical high-medieval kitchenware of a simple, undecorated type, which is the most commonly found one in East Jutland.

A waster from a potters' workshop in Åle. A presentation of the tendencies in the pottery forms

By *Asmund Birikals*

A large find of pottery was made in 1955 in the central part of Jutland. In the town of Åle about 400 kilos of pottery were unearthed in an area that constituted about 36 m². The circumstances of the

find are described very superficially and there is no archaeological drawing of the construction.

In order to form a general idea of this large quantity of pottery, about 40 kilos were examined to infer, if possible, the main tendencies in the composition of the pottery. The examination of the potsherds, which are highly fragmented, indicated that the find primarily consists of discarded vessels from a workshop that technically speaking produced rather primitive pottery. Only a limited part (3%) is glazed and the variation in form is quite limited. The majority of the potsherds are from cooking pots, while a smaller portion comes from jugs with handles.

A closer examination of the excavator's description opens the possibility that the burned red layers of clay in the ground under the site of the find are an indication of a potter's kiln, but since the kiln construction was known in Denmark for the first time in 1955 this clue was possibly overlooked.

Products from the potter in Radby

By *Eskil Arentoft*

The pottery fired in the Radby kiln belongs to a type designated as "Funen black ware". The pottery was produced on Funen during a long period from the late Middle Ages to about the year 1900. In contrast to the contemporaneous Jutlandish pots from Jutland, the Funen black ware was fired in real kilns.

The clay used is fine-grained, often without temper, and after firing it often appears to be grey to blue-grey. The vessels were shaped on a potter's wheel, and they were frequently touched up with a knife so that their surface is smooth as silk. The vessels are hefty, both in terms of size and thickness. Glaze was not used.

From the site of the Radby find five types of vessels are represented: jugs, bowls, pipkins, churns, and flat-based pots. The jugs were quite big and when filled with liquid they weighed between 5 and 7 kilos.

Earthenware from Lindholtgård

By Ann Bodilsen

The majority of the earthenware stems from the waster pit or the stoke pit and is made up of misfired or discarded pottery, while in the kiln itself only single potsherds were found. The majority of the pottery was discarded because it was too softly fired, but there are also sintered and melted potsherds as a result of too intense firing.

At the time of writing, 4,859 potsherds have been cleaned and numbered, which is estimated to correspond to 1/4 of the material. The presentation of the pottery material is only based on a survey of the cleaned material considered to be representative. This is not a detailed presentation but a quick review in which the most important characteristics are highlighted.

Only a few vessel forms are represented in the material. The predominant forms are pitchers and pots with a rounded body and outbent rim with so-called lid grooves on the inside. But there is also a small quantity of pots only with outbent rims, shallow bowls, and a few pans.

Pitchers. So far it has not been possible to gather large pieces of a pitcher. However, they seem to have been fairly uniform as far as their size is concerned, with a base diameter of between 12 and 14 cm, a rim diameter of about 10 cm and an estimated height of between 20 and 25 cm.

The pitchers all had frilled flat bases shaped by finger pressure along the base edge (fig. 1). The most frequently occurring one is a frilled type with a wide, horizontally indented thumb print all the way around. The body of the pitcher is shaped almost cylindrically from the base, but with a slight outward curve. The pitchers have a distinctly thrown rim with horizontal grooves on the neck; the body, however, seems to have been shaped by hand.

There are several versions of pitcher handles (fig. 2) with a handle twisted to the right occurring most frequently. At the top the handles were attached at the opening, whereas at the bottom they are attached at the transition between neck and body.

The rim profile is highly uniform with a distinct fluted moulding directly beneath the rim and beneath this a moulding. The spout of the pitcher is pulled out (fig. 3 and 4).

The pitchers are richly decorated and there are both plastic and painted decorations (figs. 5-8). Only very few of the pitchers are glazed, but there is no doubt that all of the pitchers were intended

to be glazed. In the cases where it is possible to observe a well-melted glaze, the color varies from yellow-green to green and brown.

Pots. On the basis of the rim two types of cooking pots may be distinguished, both with outbent rims (figs. 9-10). The most common type has a strongly marked so-called lid groove on the inside, while the other is one without the so-called lid groove. The upper part of the bowl seems to be thrown. As far as size is concerned, the pots were rather uniform: the diameter of the rim varying from 19 to 26 cm – most of them measuring about 20 cm.

With the exception of the pitcher bases, no flat bases were registered in the material, and it must therefore be assumed that all of the pots had a rounded body. Fragments of feet and pulled feet show that some of the pots existed in a tripod version (fig. 11). Lugs or other kinds of handles that might belong to the bowls were not found in the material.

Bowls. A few sherds are definitely from bowls. These are shallow, wide bowls, 8-10 cm high and a minimum of 20 cm in diameter – all with a pronounced outbent curved rim (figs. 12-13).

Pans. The only vessels of which it was possible to gather large pieces are two pans (figs. 14-15). Both pans are equipped with toes, but none of them still have a handle or lugs.

Potsherds serving an unknown purpose. Single potsherds with a highly uniform appearance cannot be attributed to any of the above-mentioned kinds of vessels (figs. 16-17). These are sturdy, flat potsherds decorated with a strong, slightly arched moulding with a notch on the top. The potsherds have tentatively been interpreted as covers.

Just as in the other Danish finds of potter kilns, the Lindholtgård kiln was not found in a context from which it could be dated. The dating of the kiln is thus exclusively based on the pottery material. The types of the vessels and the details of their decoration point towards the second half of the 14th century as for their dating, and with the presence of the pans the finds can probably be dated at the earliest to the years up to the year 1400.

The potter in Lindholtgård most likely sold his wares in his local region. Unfortunately, there are few localities nearby with pottery material from the same period as the finds from Lindholtgaard. One locality is Sevel Skovby, not quite two kilometers from Lindholtgård. From here there is a small collection of pottery with a great number of similarities to the pitchers in the Lindholtgård material (fig. 18). The other locality is Tvis Kloster, located about 14 kilometers southwest of Lindholtgård. Here there are also many similarities to the pitchers from Lindholtgård.

Peter Potter in Slagelse. Stove tiles and matrixes from the potter's waster

By Ole Kristiansen

In the years 1981-82, the National Museum excavated waster from a Renaissance pottery and stove tile workshop in Slagelse. The potter's kiln itself was not found, but rejected stove tiles, pipkins, frying pans, bowls and platters, as well as inserts for the kiln, potter's tools and lead for making glazes indicate activity in the last half of the 16th century and for a couple of decades into the 17th century.

More than 60 different types of stove tiles were found – partly as rejects from firing, partly as used, sooty pieces from repairs. Based on the history of clothing and German aristocracy, and on graphical depictions and varying glazes, they can be dated from 1531 at the earliest to shortly after 1611, with the main part from around 1600. The 12 more or less fragmented matrixes are all older, namely from the middle of the 16th century. One matrix has on its reverse the mark of an unidentified maker. A stove tile pattern differing slightly in eastern and western Zealand shows an individual finishing touch given to matrixes moulded in the same patrix and indicates two centres of stove tile production. However, matrixes seem to be imported exclusively from Germany; only for one item can a Danish artist be assumed. It is shown that graphical works by Aldegrever (1531), Flötner (1546), Maarten de Vos (1581), and a student of Goltzius (1589) were directly used and that Dürer and Cornelis Bos provided strong inspiration.

Stove tiles found in nearby villages are remarkably identical with the older matrixes and the younger tiles from the Slagelse workshop.

Based on the investigation of traces from production and use found on matrixes and tiles, with subsequent attempts at reconstruction, the patrix, matrix and stove tile production and the shape of the tiled stove are discussed.

Diary of kiln experiments with the kilns from Hellum, Barmer and Kragelund, spring and summer, 1987

By Egon Hansen

As a member of the local museum staff, museum assistant Egon Hansen, from the Prehistoric Museum, was responsible for many of the practical aspects of the process of recreation. He kept a diary while the work of reconstructing the kilns went on, and did the actual firing. In the diary we can find many of the minor details so important to the whole, and many of the questions that arose along the way are recorded. However, all essential results are documented and presented in the articles on the individual kilns.

Background for the reconstruction of the kilns in 1987. Construction, technology and materials

By Birgit Als Hansen and Morten Aaman Sørensen

In the space of a few years, three medieval pottery kilns were discovered and excavated in Jutland. The kilns appear to be of varying construction, representing three types not previously found in this country. This inspired the excavators and a small group of kiln enthusiasts to try a reconstruction and subsequent firing of all three kilns.

The reconstruction of the kiln from Hellum afforded few problems. The preserved substructure indicated a simple round, updraft kiln, where the floor was supported by a central pillar with radiating clay bars. A type well known all over Europe from ancient times to our day, and in our case very similar to a kiln from Torksey in Lincolnshire (fig. 1).

The kiln from Barmer was constructed differently. What was left under ground level looked like a hip bath, with stoke hole and fire chamber in the lower part, and a slightly sloping floor for the pots in the upper part, where an opening at the rear was presumably used for stacking the pottery, and during the firing as a vent for

the exhaust. The two chambers were separated by a fire screen in the shape of three solid pillars – very much like kilns found in France and Germany (fig. 2). No traces of the upper parts of the kiln remained in Barmer, but a row of small holes with charred wood in the sidewalls indicated a barrow vault moulded on a wooden structure.

In Kragelund, only the front part of the kiln was preserved. The stoke hole, with a flue on either side of a raised platform, indicated a type of kiln found in the Netherlands, France and Germany. None of these kilns offered much information about the structure above ground level, except possibly one of a series of kilns from Brunssum (fig. 3), where the foremost part of a domed roof seemed to have rested on the front part of the platform. A reconstruction along these lines seemed a permissible experiment.

Potters and potters' kilns. Ethnological and ethnographic parallels

By Jan Kock and Lone Schmidt

Ethnological and ethnographic parallels in traditional pottery making can be very important for our understanding of the remains of medieval pottery kilns found in Denmark. A comprehensive regional investigation in southwestern Europe is pointed out, showing that the updraft type of kiln has been dominant in that area in recent times, while the downdraft kiln has been more common in northern and eastern Europe.

A specific example of the updraft type of kiln from Crete is shown. A number of examples from Denmark of traditional pottery works with downdraft kilns in recent time are reviewed, providing much supplementary knowledge of the furnishing of the workshops, the raw material for both pottery clay and lead glaze, production, the construction of the kilns, fuel, the actual firing, and marketing conditions; all elements that expand our understanding of the archaeologically established medieval pottery works.

Laboratory analyses of the potsherds from Hellum, Barmer and Kragelund

By Anders Lindahl

Laboratory analyses of the potsherds from Hellum, Barmer and Kragelund were performed in order to study the manufacturing techniques at the different sites. During the planning of the project it was suggested that the reconstructed pots to be fired in the kilns should not only have a shape resembling the original products, but also that the composition of their raw material should be as similar as possible to the medieval pots. Hence, the results of the laboratory analyses should be used as “recipes” for the manufacture of pottery from each kiln. These recipes would give suggestions of raw clays and temper material, amount and grain size of the temper as well as indications of forming techniques and firing conditions. Ten samples, three from each kiln and one raw lump of clay, were selected for thin-section analyses under a polarising microscope for the study of the composition of the ceramic ware. An additional 11 sherds from the Kragelund kiln were selected for the study of glazes and glazing methods. The results of the analyses indicate a great difference in the manufacture of vessels among the three kilns. The forming technique varies from modelling to wheel thrown and the tempering ranges from added crushed rock to added sand to the use of a naturally tempered finesandy clay. The three kilns could represent either different stages in the development process of the handicraft or different modes of production for different markets.

Measuring the firing temperature in reconstructed medieval pottery kilns

By Hugo Rasmussen

This article explains how measurements are done and the technical prerequisites for measuring the temperature. In this series of experiments, 48 temperature sensors were used concurrently. The sensors used are mechanically stable at temperatures of approx. 1000 degrees Celsius, but are, unfortunately, easily affected by the

oxygen content of the air. A computer continuously collected measurements. The results thus obtained can be used to compare the manner in which the three kilns function, but cannot be used for a precise determination of the actual temperatures in the kilns.

The pottery and kiln from Hellum and a discription of the firing

By Annette B. Bibby & Inge Sell

Duplicating the Hellum kiln consists of reconstructing both the kiln itself and the pottery vessels to be fired in it. The original vessels are all spherical pots of different sizes, produced without a fast wheel and unglazed.

The reconstructed pots are therefore built in the lap, and when the clay is sufficiently stable the outer surface is clapped with a clapping bat. After finishing the rim by bending it out over the righthand thumb, the pots are left to dry completely before being fired in the kiln.

The kiln consists of an underground firing chamber with a narrow stoking channel and a firing chamber above ground. To build the floor of the firing chamber a large stone was placed in the middle of the firing chamber, with thick clay bars spreading out to the outer walls.

For the reconstruction of the kiln the building site is dug and the floor and outer walls of the firing chamber are moulded in clay. The large stone is placed in the middle and covered with clay. Then the difficult task of building the floor of the firing chamber begins. Thick bars of clay are arched between the stone and the outer walls. The finished floor looks like a wheel with thick spokes. Finally the walls of the firing chamber are moulded, narrowing upward and leaving an outlet for smoke.

Stacking produces a problem, because some of the pots have to hang, firmly wedged by those standing on the bars, over the holes down to the firing chamber. Taking great care in placing the pots solves this problem, and the rest of the stacking is easily done.

The firing starts very slowly with a small fire in the stoking channel. After two hours with moderate feeding, the fire is allowed to burn more freely and wood fuel and embers are pushed

into the fire chamber. A problem with steam in the outlet smoke from very wet fuel forces us to keep the outlet open for longer than planned, but after five hours' firing it is narrowed to ten by ten centimetres. After a further five hours' of firing the temperature reaches 820 degrees Celsius, and a glance down into the kiln shows the pots glowing a translucent red. Thereafter the kiln is closed.

The pottery and kiln from Barmer and the result of the firing

By Rikke Barlebo

In 1984 the remains of two medieval pottery kilns were found at Barmer, southwest of Aalborg. On the basis of the knowledge revealed by the archaeological excavation in 1985 and results from other European finds of medieval pottery kilns, a reconstruction of the Barmer kiln was made in the spring of 1987 at the Prehistoric Museum, Moesgaard, in Aarhus.

The kiln was filled with a number of pots that were reconstructions of the pots excavated at Barmer. The result of the firing was successful, though a few details had to be adjusted to achieve a kiln which would work to full satisfaction.

Barmer kiln II was built in the Spring of 1989 at Poulstrup, south of Aalborg, giving us a chance to make the necessary adjustments. The firing of Barmerkiln II was very successful, and indicated that with this construction of the kiln, we had come very close to the kiln used by the medieval potter at Barmer.

The Kragelund kiln. Reconstruction of a kiln and firing of the pottery

By Birgit Als Hansen, Morten Aaman Sørensen and Jens Christian Ørting.

The kiln from Kragelund was the largest and most complicated of the three kilns in the experiment. The lower part, with the stoke

hole, flues, and the front part of an elevated platform that could safely be copied from the plan of the excavation; whereas the domed roof, its shape and the number of openings and vents partly had to be decided on the basis of experience with previous experiments in kiln building. There were no traces of a wooden structure to support the vault during construction and the dome had to be hand-moulded from several layers of clay. A regular hemispherical form was attempted, with moderate success. A small hole was left open in the top of the dome to let steam out in the early phases of the firing. An opening was made to the rear for stacking the pottery, and later used in a diminished form as a vent to let out exhaust. Another vent in the front of the dome was to allow for regulating the draught during firing.

After a couple of firings to dry out the kiln, copies of the original pottery, consisting of glazed jars and pots, were stacked on the platform, and the firing could begin.

The next 28 hours gave every opportunity to experiment with adjusting the draught and changing the methods of firing. For a 20-hour period, it seemed impossible to force the temperature up to the desired 900 degrees Celsius. Ultimately, it was decided to try an extensive firing, regardless of the amount of wood consumed. Within a few hours the temperature reached 900-1000 degrees, and the firing was stopped. The stokehole and other openings were blocked up, and to intensify a reduced atmosphere in the kiln, a small mountain of previously removed charcoal was put back into the firing chamber.

The experiment could hardly be called a success. The kiln was difficult to manage and consumed far too much wood, and although the pottery was well fired, the glaze was grey and lustreless, with small particles of metallic lead. The sudden rise in temperature in the final phase indicated that intensifying the firing at an early stage could save time and wood, and the lustreless glaze might be caused by the large amount of charcoal, producing an atmosphere excessively deficient in oxygen.

Medieval lead-glazed pottery – an experiment

By Lone Schmidt

Pottery has been produced in Denmark for thousands of years, often of very high quality. In the early Middle Ages the technique was vigorously developed as new aids such as the potter's wheel were put into use, making it possible to mass produce goods. Clay kilns were built that could be heated to extremely high temperatures. New pottery shapes appeared, first of all the pitcher, and we find glaze for the first time.

The article describes a reconstruction of medieval lead-glazed pitchers – a cooperative experiment undertaken by the Moesgaard Museum, the National Museum, and the potter Lone Schmidt. The experiment involved the throwing of 100 pitchers according to measurements of original material from, for instance, Farum Lillevang, Faurholm, Roskilde, Svendborg, Aarhus and Endelave. A copy of the Faurholm kiln was built to fire the 100 pitchers.

From a medieval source we know how lead glaze and glazed pottery were produced: “if you wish to lead-glaze the pot, take some wheat flour, boil it in a pan with water, then let it cool and cover the whole of the surface of the pot with it. Then take some lead well ‘solutum’ (divided). However, if you want to obtain a green colour, take some copper, or better still, some brass, and mix it with the lead as follows: take the lead and melt it in a pot; when it is molten stir it by turning with your hands (sic) in the pot until a powder is produced, and mix this then with 6 parts of brass filings. When the pot has been dampened with water and flour sprinkle it immediately with lead, i.e. with the filings mentioned above” (note 1).

Different variations of this “recipe” led to the theoretical conclusion that the right glazing technique was probably as follows: boil up a thin wheat flour thickening and allow it to cool before pouring it over the ‘leather-hard’ pitchers, then sprinkle these with a mixture of red lead and clay powder. This is how the well-known bare spots underneath the handle appears. Together with the gelatine that separates from the flour as the thickening boils, the dry lead powder will combine with the still damp clay and “take root” during the drying process. An experiment that is worth trying!