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Ein Überblick über die Typen der Töpferöfen im Karpathenbecken

Zsolt Vágner

Introduction

The purpose of the present study is to give a brief overview about the types of the tenth- to sixteenth-century pottery kilns discovered in the Carpathian Basin in the territory of medieval Hungary, and to outline some problems that have been raised with regard to these finds. Pottery, which is basically a handmade product, is the most frequent and distinctive find on medieval sites. Accordingly, detailed analysis of potters' workshops is indispensable for the typological and chronological evaluation of the ceramics and the interpretation of its technical characteristics. Pottery kilns are the most important equipment of potters' workshops. The technical properties of the kiln and the standard of firing are the major factors that determine the quality of pottery production. This justifies a more detailed archaeological, technological and technological-historical study of the pottery kilns uncovered during archaeological excavations.

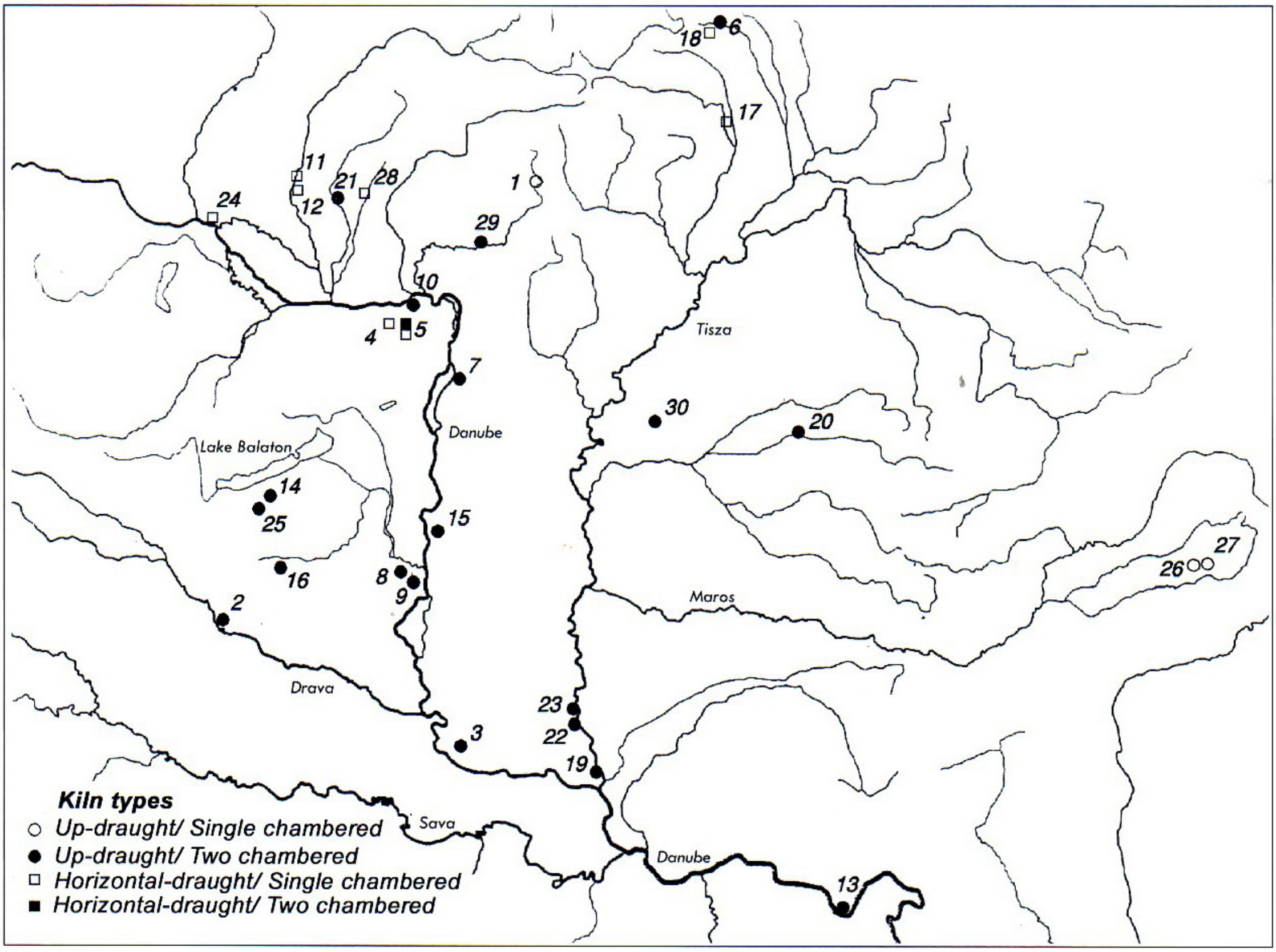


Fig. 1. *Distribution map of Medieval Kiln Sites in Carpathian Basin.*

Geographical background

The territory in question is the geographical region of the Carpathian Basin, which is nearly entirely enclosed by the high mountains of the Carpathians and the Alps. Large rivers, such as the Danube, the Tisza and the Drava cross the territory, which is situated at the meeting point of major European geographical regions. The Basin is divided by large plains, hill ranges and mid-mountains. The clay types that allow the existence of workshops show an uneven distribution. Kaolin and clays with high kaolin content, which can be fired at a high temperature, can be found mainly in the northern and eastern mountains of the country. Secondary clay of good or mediocre qualities can be met in large quantities in the hill ranges and the mid-mountains. The clay types in the plains, apart from a few restricted areas, are usually poor quality with many impurities and much lime, which can be fired at a low temperature (*Kalecsinszky 1905; Kresz 1985; Liffa 1935*).

Distribution of the kilns found in the Carpathian Basin

From the period under discussion, a total of 53 features that could be identified as pottery kilns were observed in 30 sites. Their distribution is varied, as it can be seen on the map *(Fig. 1)* and mirrors the research conditions in the different countries. It can be observed that the majority of the kilns were built near water, which was necessary for the building and for the maintenance of the kilns, and also as a precaution against the danger of fire.

Every potter's kiln stood within the territory of a medieval settlement. The number of kilns in rural and urban settlements was approximately the same, and only a single kiln stood in the territory of a manor. Their distribution shows a varied picture but also mirrors the specific preferences of investigation according to settlement types (*Vágner 2002*, 313–314).

Medieval pottery kiln types

Both of the main European types, up-draught and horizontal-draught kilns, can be found in the territory of the Carpathian Basin, together with their subtypes *(Fig. 1)*. The analysis of the kiln types shows a varied picture. The main types were distinguished according to the draught between the firebox or the stoke hole and the flue of the kiln, which determines the direction of the flames. The flame direction is vertical in up-draught kilns and horizontal in horizontal-draught kilns *(Fig. 2)*.

The most important feature is that every kiln was a pit kiln. The most obvious reason for this is that it ensured thermal isolation and, at the same time, it afforded easy and rapid construction and often provided a more secure structural solution than over-ground kilns. Kilns with wall construction have rarely been observed. In the most common type the entire structure was sunk into the ground, similar to the kilns recorded from earlier periods and modern ethnographic fieldwork (*Duma 1982*, 55–59).

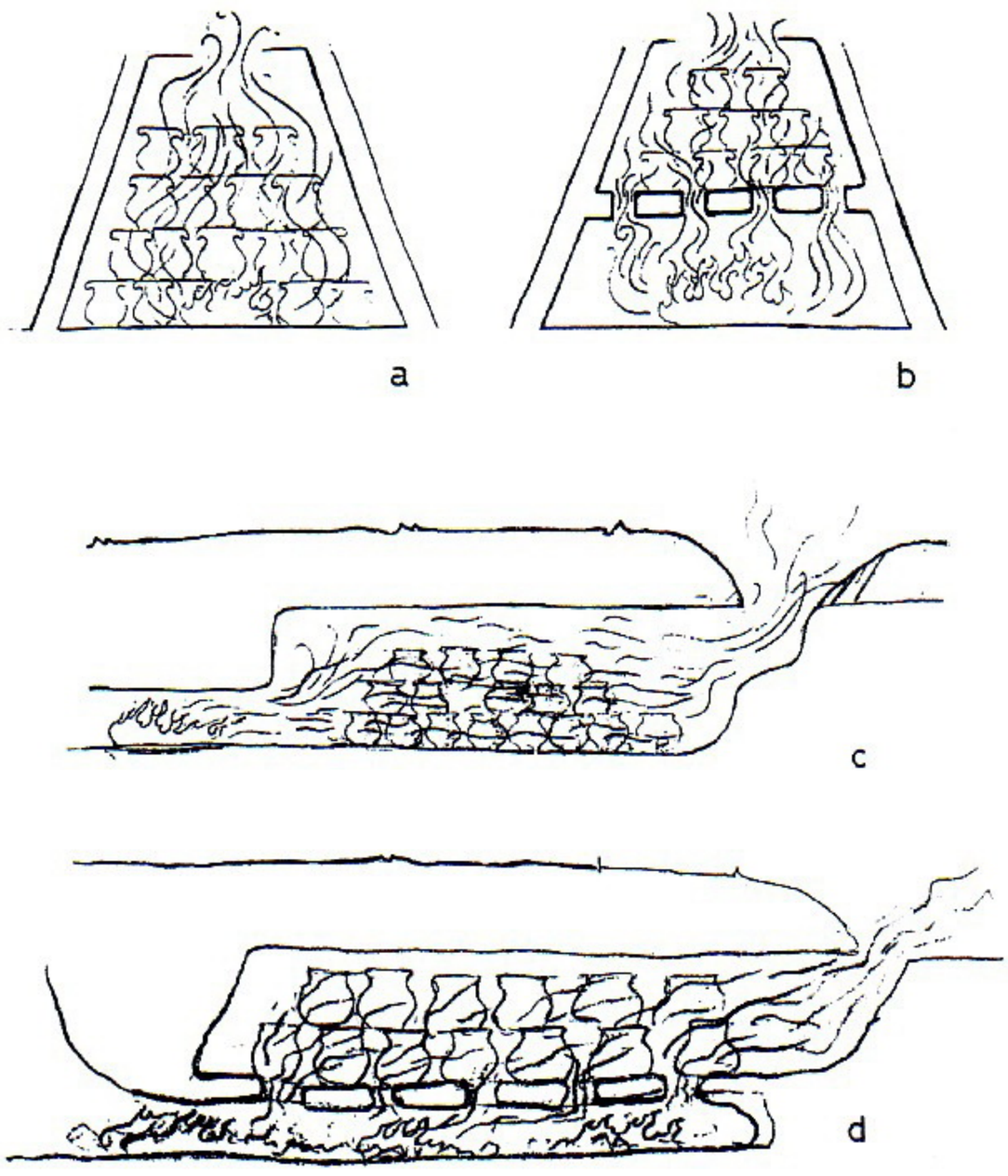


Fig. 2. *Scheme of the major kiln types.*
a. Up-draught – single chambered,
b. Up-draught – two chambered,
c. Horizontal-draught – single chambered,
d. Horizontal draught – two chambered.

To ensure that the firing in the kilns might be controlled, heating channels had to be created and the path of the flame directed, and the firebox and the firing chamber have to be separated to some extent. In kilns with a single chamber this was usually achieved by the loading of the pottery. Ethnographic analogues suggest that temporary grates could sometimes be built from pottery (*Fábián 1934–35*, 32). There are several variants of the structure of the single-chambered kilns. It is easier to repair but firing is less controlled and can be dangerous. Making good use of the properties of the kiln type needs a greater expertise. At the same time, firing is more controlled and safe in grated kilns but there are fewer possibilities for the arranging the pottery and for the application of diverse firing techniques.

Up-draught kilns

These usually have an oval, sometimes a rectangular ground plan because of the vertical direction of the flame or the draught. The firebox and the firing chamber are built one above the other. The kiln is loaded from above. Since the draught and the flame have a shorter distance to travel, control of the atmosphere of the kiln and the firing temperature is limited, so the size of the kiln can be decisive in the quality of firing *(Fig. 2/a, 3–15)*.

Their diameter measured between 0.8 m and 2 m, their height varied between 0.9 m and 2 m. The firing chamber was probably always open to the top and the pottery was loaded through this hole. The firing chamber has perished in many of the kilns studied or was badly damaged. Nevertheless, stratigraphic observations reveal that they were entirely sunken, and it is unlikely that they had a closed dome, since a hole would have had to be opened for loading somewhere on the side, which is impossible, or at least very difficult in pit kilns. Yet in some cases these kilns were reconstructed with fireboxes with closed domes and a lateral loading hole (*Pleiner 1988*). This solution, however, is not really effective since loading is difficult because of the narrower firebox and firing is less easy to control. Furthermore, ancient and modern ethnographic kilns suggest that kilns with closed domes were built to create reducing firing or for the production of special wares (*Dušek and Hohmann 1986*; *Kresz 1991*, 524–600; *Rhodes 1968*, 9–17). Such wares, however, have never been found in up-draught kilns of the Carpathian Basin.

The following subtype can be differentiated according to their internal organization. The firebox and the firing chamber may occupy the same space or be divided by a grate, and hence are termed single-chambered and two-chambered grated kilns.

Single-chambered kilns

Altogether four single-chambered up-draught kilns have been found from three sites in the Carpathian Basin *(Fig. 1)*. All four were pit kilns. The plastered walls were parallel or slightly narrowed downwards.

Structural differences can be found in the number of stoke-holes. The kilns excavated at Alsó Poltár/Dolný Poltar (*Hrubec 1971*, 76) and Székelykeresztúr/Cristuru had a single stoke-hole (*Benkő 1992*, 159–160). This follows the arrangement of the most common up-draught kilns in Europe. The two kilns at 2 Katustava Street, Székelykeresztúr/Cristuru *(Fig. 3)* had two fac-

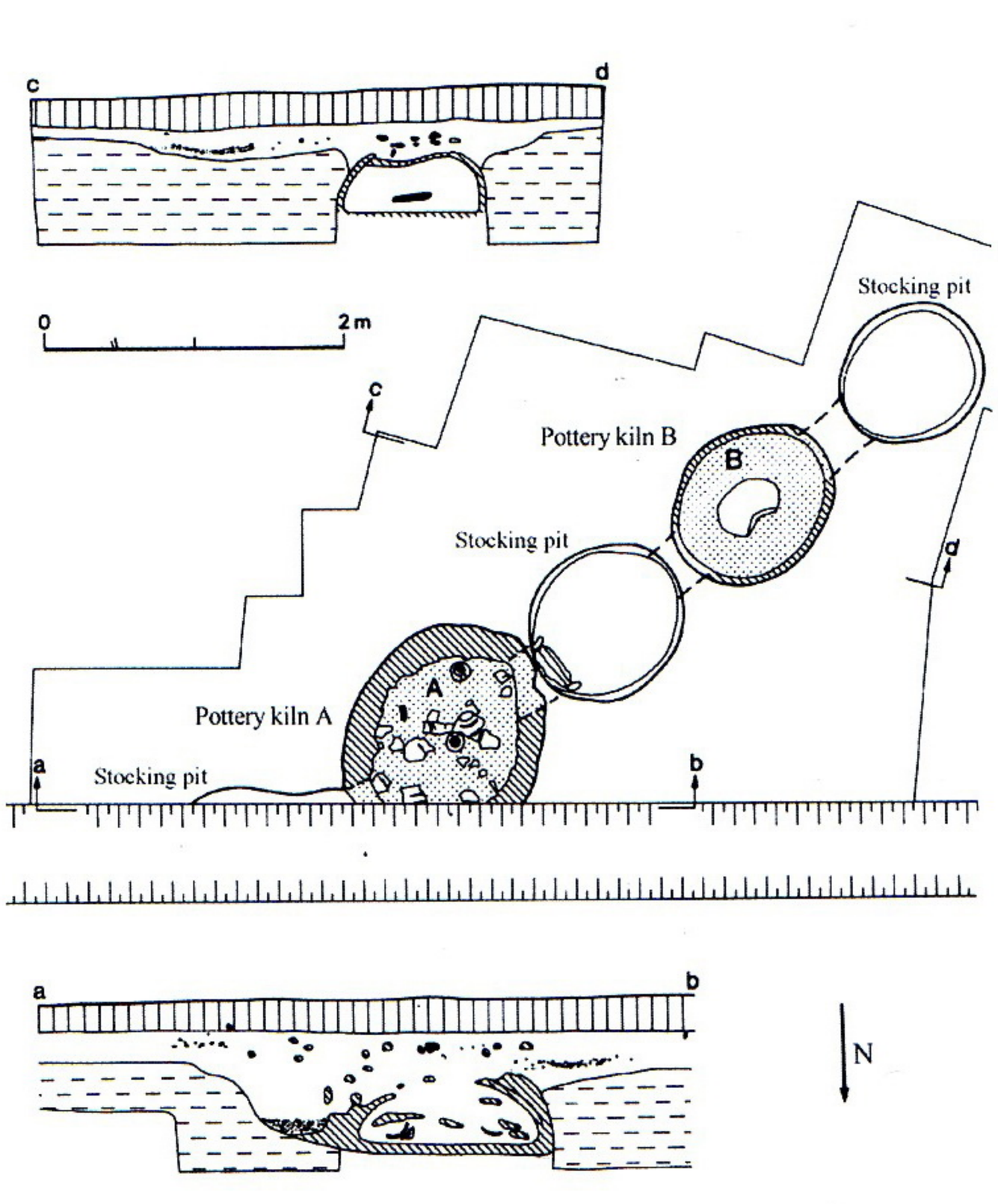


Fig. 3. *Up-draught – single chambered kiln. Excavated on Székelykeresztúr/Cristuru Secuisec (Romania), dated to c. 14–15th century (after Benkő 1992).*

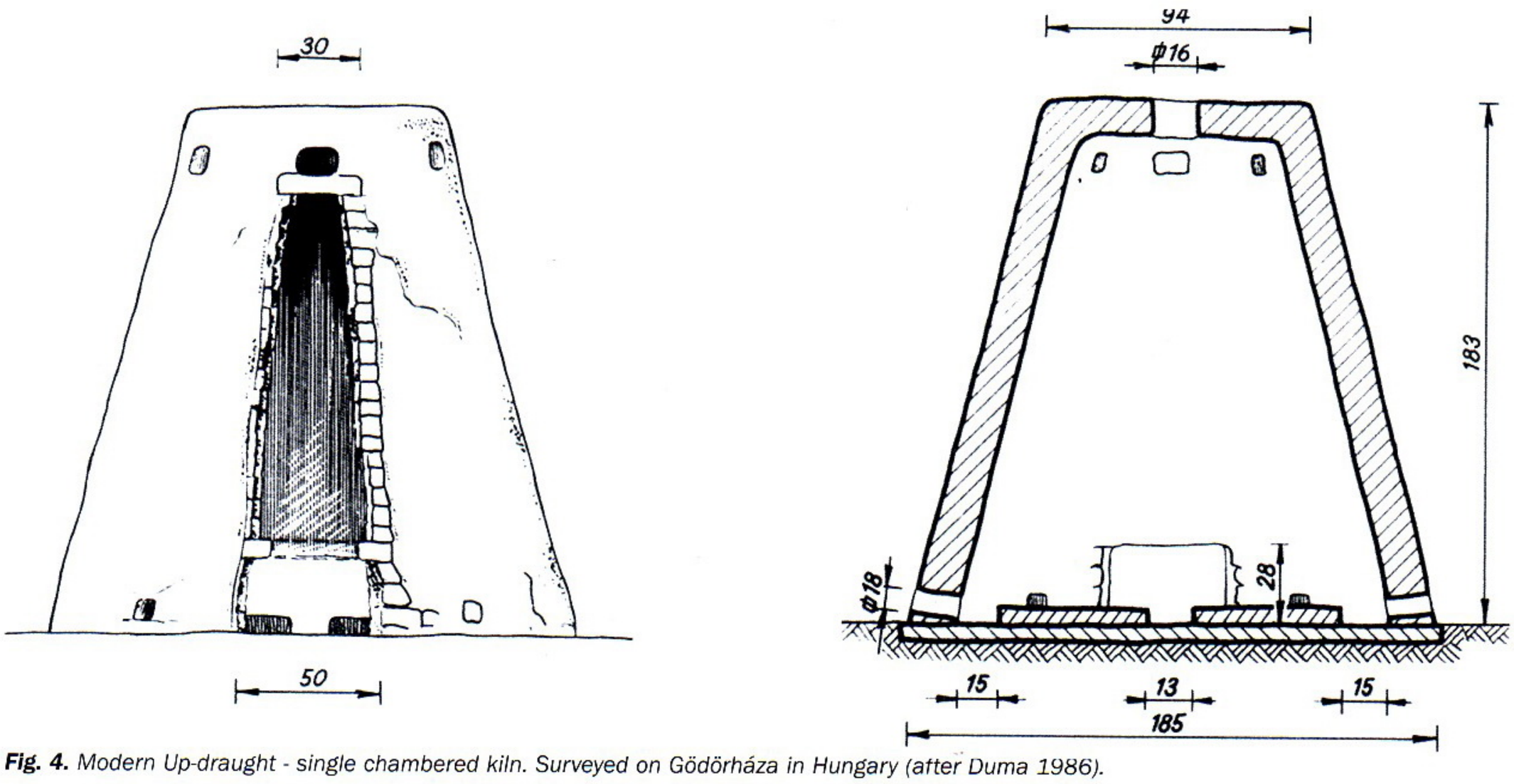


Fig. 4. *Modern Up-draught - single chambered kiln. Surveyed on Gödörháza in Hungary (after Duma 1986).*

ing stoke-holes, and the southwest hole of kiln ‚A' was covered with a large stone (*Benkő 1992*, 176–177). This arrangement favoured better control of the draught and kiln atmosphere. This type is relatively rare in Europe, apart from the kilns in England with many stoke-holes (*Moorhouse 1981*). Similar modern single-chambered up-draught kilns were surveyed both on South-West Hungary and Transylvania *(Fig. 4)*, but these built on the surface and having four stoke-holes *(After Duma 1986)*.

The kiln dimensions also varied. The Alsó Poltár/ Dolný Poltar kiln was especially large. The interior dimensions of 350 cm and the interior height of 240 cm are not characteristic of up-draught kilns of the period. The diameters of the three kilns from Transylvania (120–150 cm) are about average, yet their interior height was different: 40–50 cm and 125 cm.

Two-chambered, grated kilns

The grate that separated the firebox from the firing chamber of the up-draught, two-chambered kilns was built in various ways. The grate could be made without support or added later with support.

1. The firebox and the firing chamber of kilns with unsupported grates were sunk entirely into the

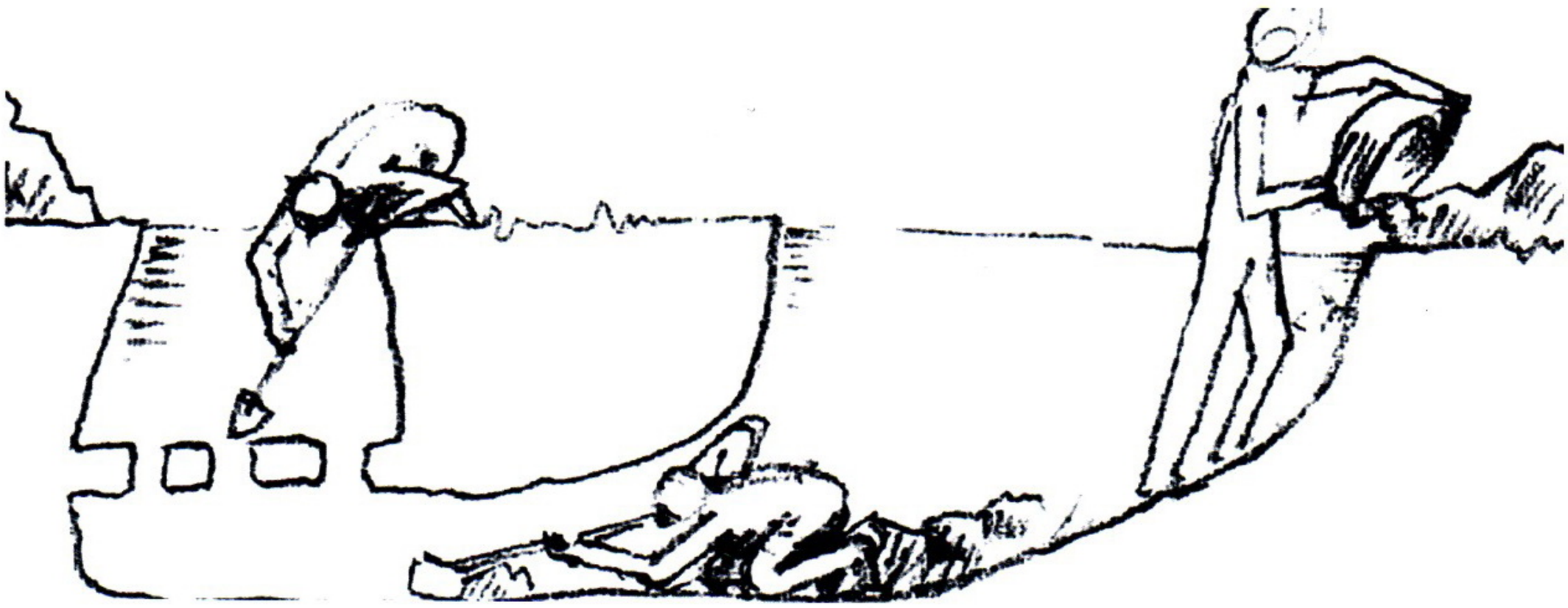


Fig. 5. *Reconstruction of the Pusztaberény kiln.*

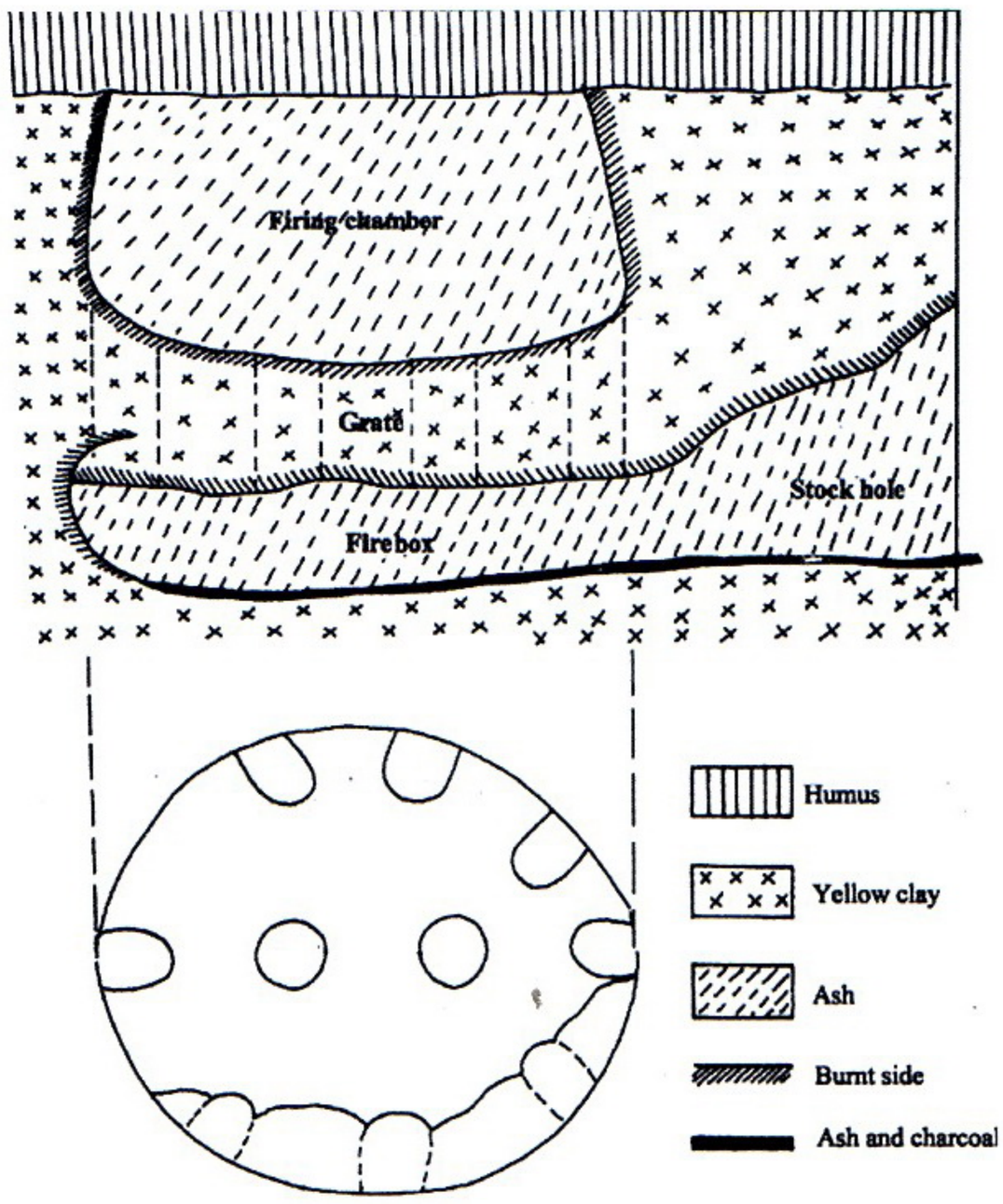


Fig. 6. *Up-draught – two chambered kiln with unsupported, monolith grate, excavated on Pusztaberény (Hungary), dated to c. 11–12th century (after Bárdos 1978).*

ground. The wall and the grate were formed of earth, which burnt hard during the firing. The building of this structure is very simple: a pit was dug from above and another from the side and the horizontal layer between the two was opened via a vertical hole *(Fig. 5.)*. An excellent example can be observed clearly at the eleventh-century kiln excavated in Pusztaberény *(Fig. 6)*.

Unsupported kilns, especially common in the tenth to thirteenth century, were usually small, with a diameter measuring 90–120 cm on average, as it can be seen by the sample of Hács-Béndek-puszta *(Fig. 7)*, Bács/Bač *(Fig. 8)* and Felsőlupkó/Gornea – Țarmuri *(Fig. 9)*. As a result, the firebox was often wider than the firing chamber. The total height of the kilns is often impossible to determine, since the firing chamber or its top is frequently damaged. The height of the complete kilns can be estimated to measure about 90–110 cm from the intact examples and fragmentary structures. The firebox was usually the smaller chamber measuring 20–30 cm on average. The grate was often very thick because of the building technique, and measured 25–40 cm on average. The firebox had an average height of 30–50 cm. At the same time, two large late medieval kilns at Óbecse/Bečej – Perlek measured 150 cm in diameter and were built with unsupported grates (*Stanojev 1996*,

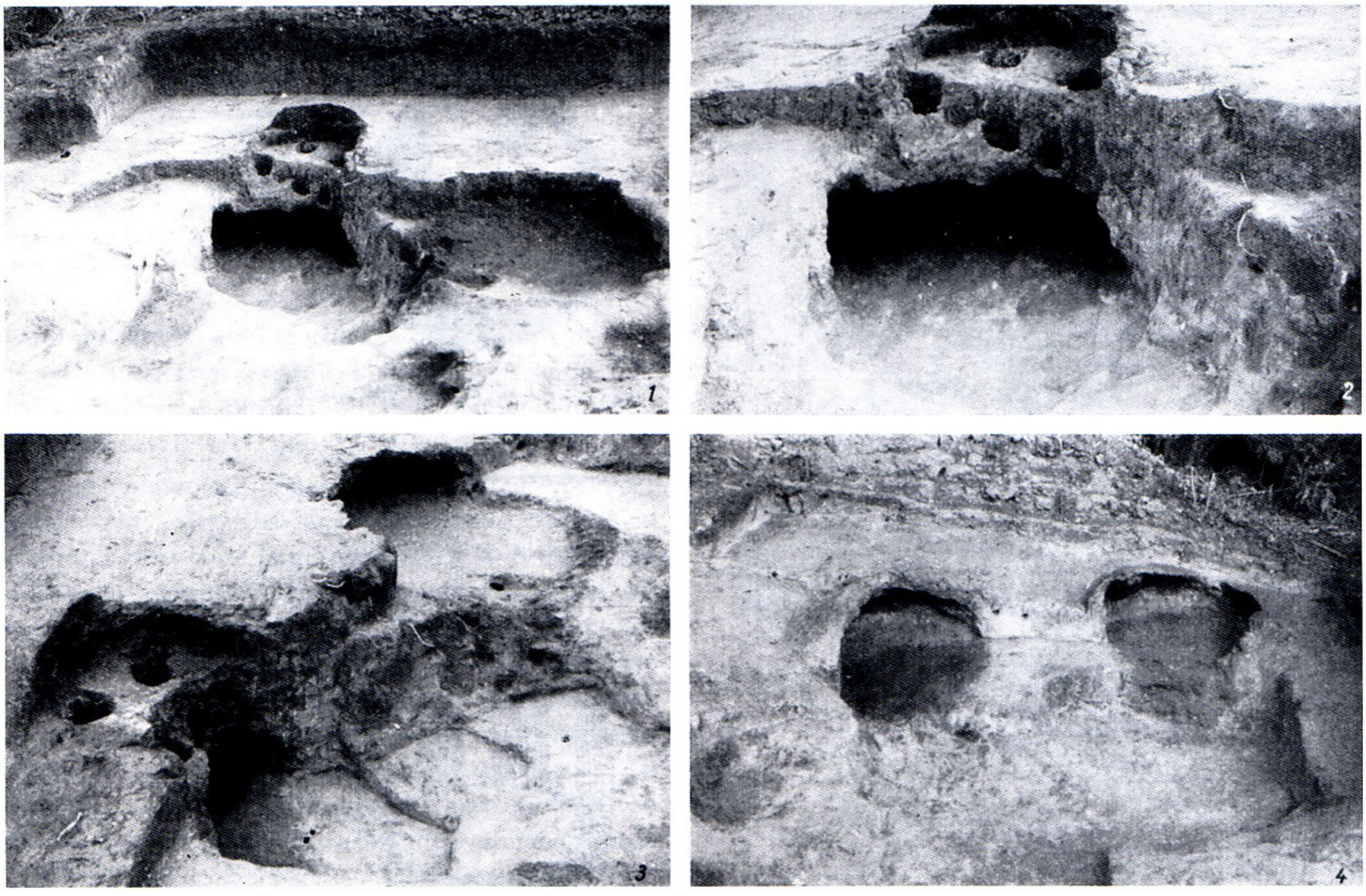
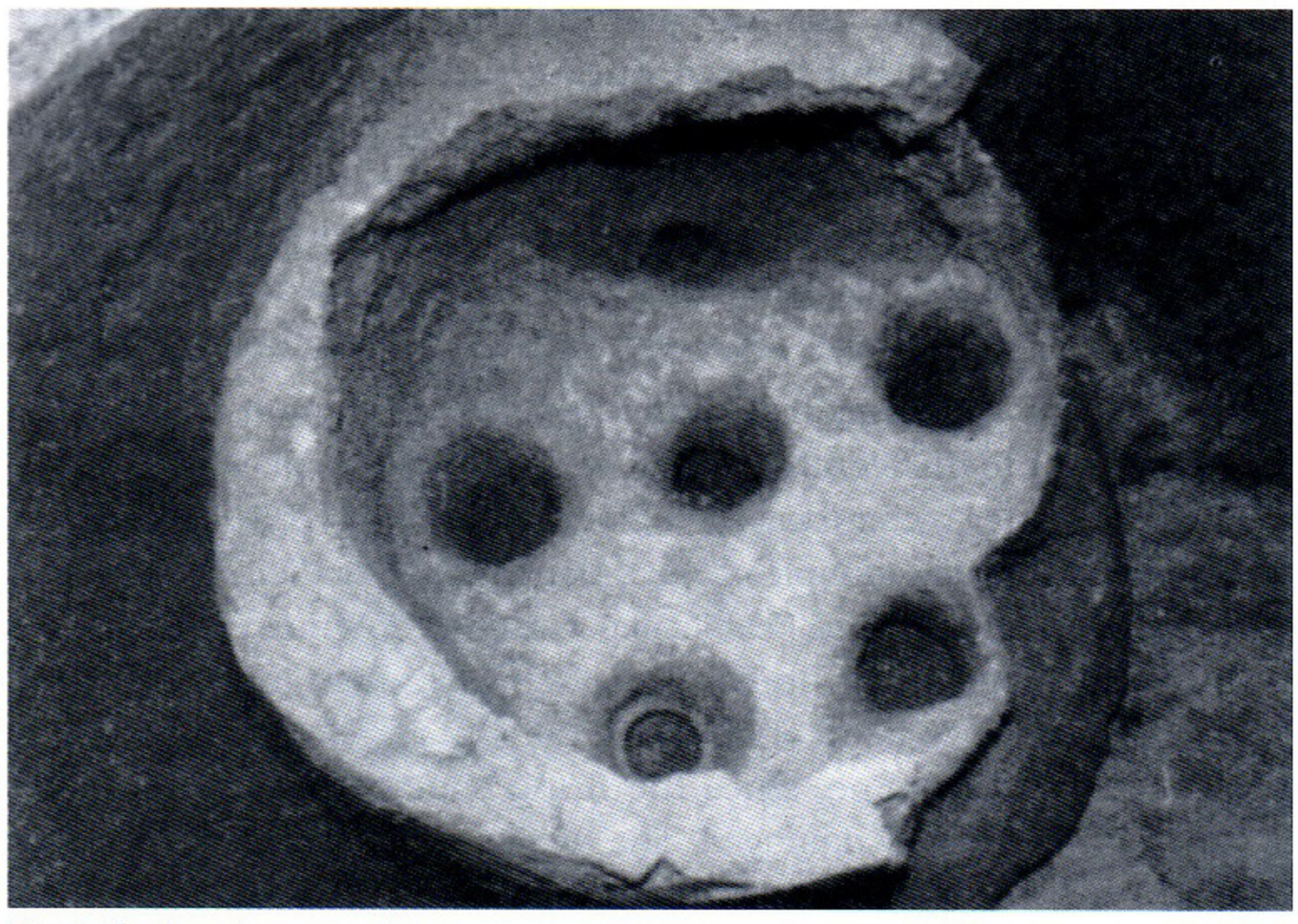
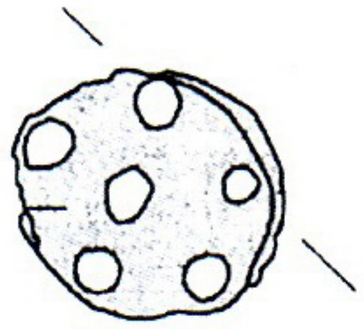


Fig. 7. *Up-draught – two chambered kiln unsupported monolith grate, excavated on Hács – Béndek-puszta (Hungary), dated to c. 13th century (after Parádi 1967).*





Horizontal section of the grate

1 m

Cross section of the kiln

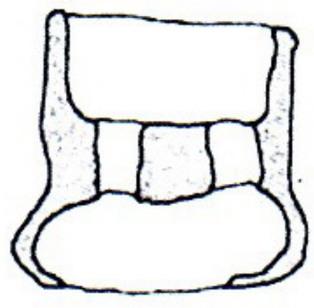
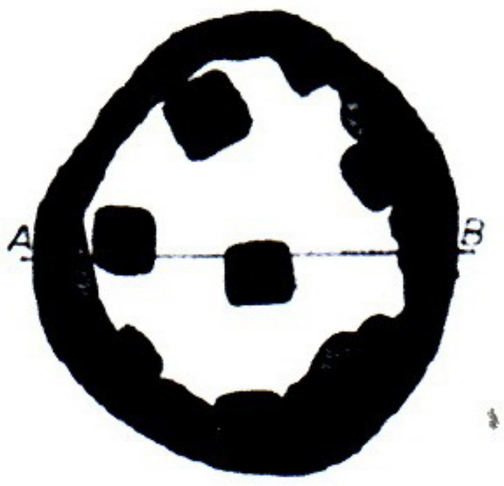


Fig. 8. *Up-draught – two chambered kiln with unsupported, monolith grate, excavated on Bács/Bač (Yugoslavia-Voyvodina), dated to c. 13th century (Stanojev 1996, 15).*

71–73). In this exceptional case the kilns were built in a clayey soil, which gave solidity to the grate.

Apart from the traditional usage, the practical structure of the kilns, which was easy to build, may explain why this kiln-type was the only one found in Árpádian Era (tenth to thirteenth centuries) potters' workshops. The pyrotechnical analyses of earthenware finds suggest that firing could be achieved at an average tem-



Horizontal section of the grate

1 m

Vertical section of the kiln

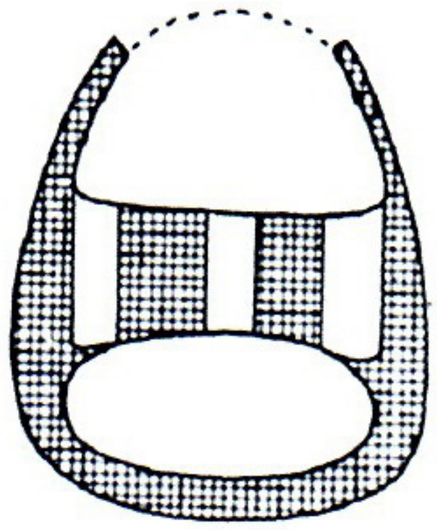


Fig. 9. *Up-draught – two chambered kiln with unsupported, monolith grate, excavated on Felsőlupkó – Gornea (Romania), dated to c. 13th century (after Uzum – Ţeicu 1978).*

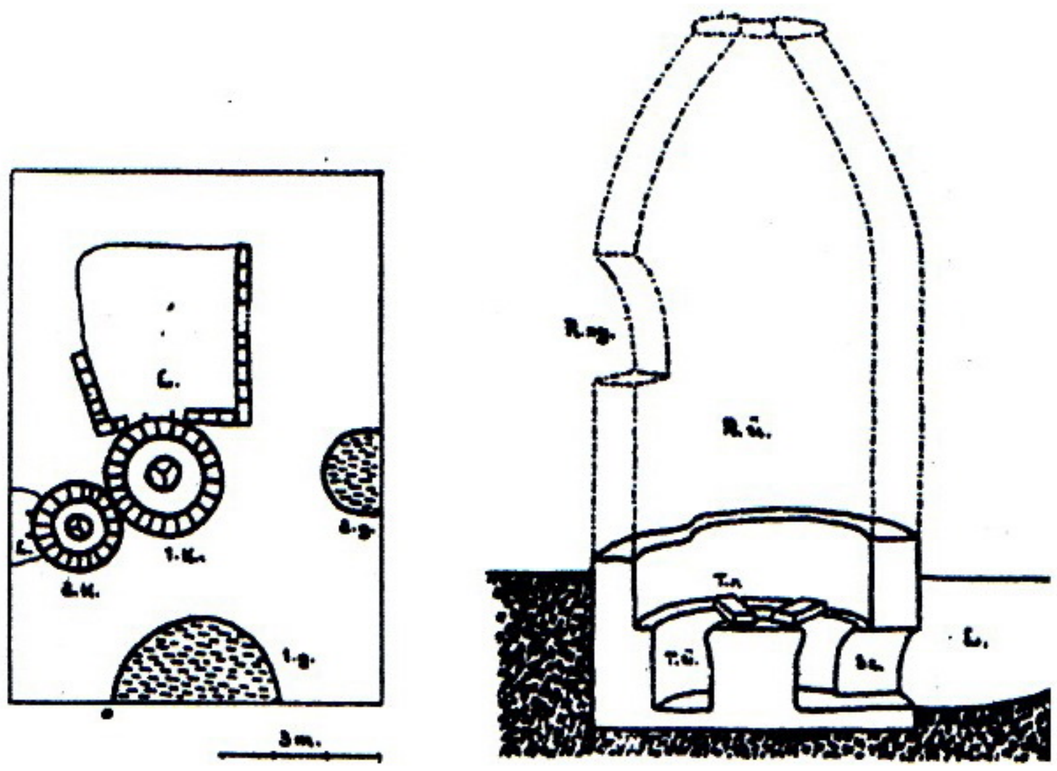


Fig. 10. *Up-draught – two chambered kiln, excavated on Decs-Ete (Hungary), dated to c. 16th century (after Csalogovits 1937).*

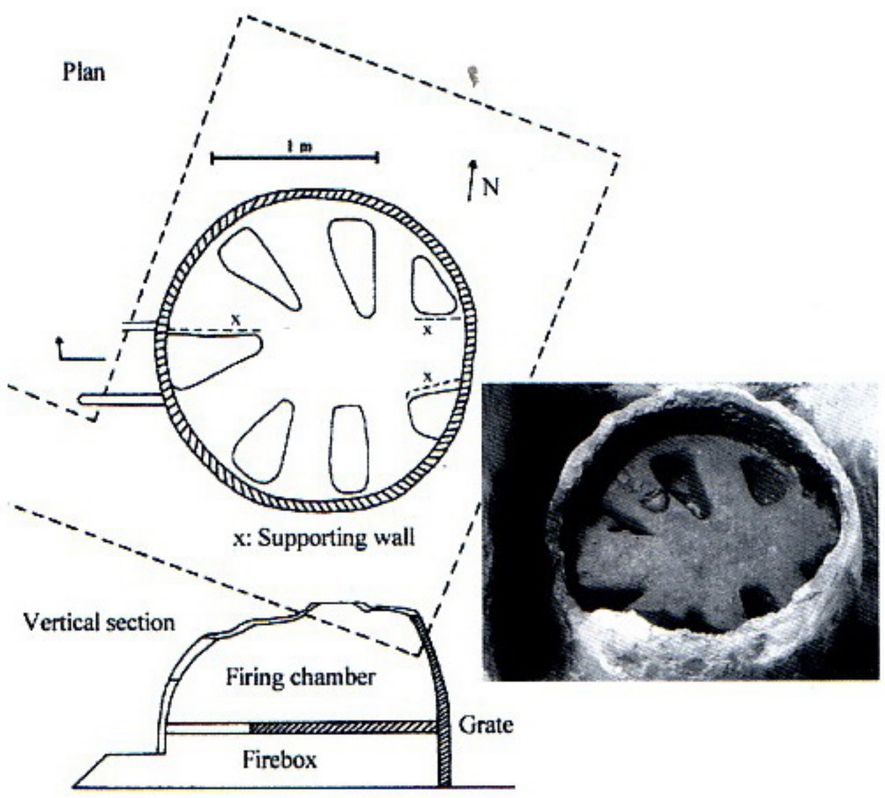


Fig. 11. *Up-draught – two chambered kiln, the grate is supported on a wall, excavated on Babócsa (Hungary), dated to c. 16th century (after Magyar 1990).*

perature of 800–950°C (*Stanojević 1980*, 25; *Pleiner 1988*). This sort of structure, however, has limited dimensions, as the kilns built in this manner cannot be larger than 120–150 cm.

2. The supported grates in kilns of that type were always made after the pit had been dug. These late medieval kilns were larger than those of the tenth to thirteenth centuries. The inner diameter varied between 150 and 200 cm. In the kilns excavated at Kalocsa *(Fig. 12)* and Decs-Ete *(Fig. 10)*, the width of the firebox is smaller than that of the firing chamber above it, since the arms of the grate rest on the shelf projecting from the wall of the firebox. Such kilns could be around 150–170 cm in height. The lower firebox was 30–50 cm high. The grate was relatively thin compared to the monolithic small kilns, and measured 10–20 cm in average. The interior height of the firing chamber was 70–100 cm. The relatively low, interior height of the kiln excavated in Kalocsa *(Fig. 12)*, which measured 60–70 cm high and 120–150 cm in diameter, shows a slight divergence.

The grate rested on a small ledge or a fire-bar. The walls and the fire-bars that supported the grate were made of earth, as for example in the kilns excavated at Babócsa–Nárciszos *(Fig. 11)*, Esztergom–Szenttamáshegy and Túrkeve-Csudaballa (*Magyar 1990*, 133–134; *Balogh 1928*; *Fehér – Parádi 1960*, 36; *Vágner 2001*, 180), or the clay fire-bars were built after the firebox had been prepared as at Kalocsa *(Fig. 12.)* and Decs-Ete *(Fig. 10*; *Vágner 2001*, 102–106; *2002*, 324; *Csalogovits 1937*).

The grate usually had arms, which rested, like spokes, on the central wall or on a fire-bar and the side wall of the kiln. Two types are known: adobe-type arms made of dried pieces of walling were used most frequent, especially in Decs-Ete *(Fig. 10)*, Babócsa *(Fig. 11)*, and Túrkeve; however these were usually daubed, so they look like a perforated clay plate (*Csalogovits 1937*, 329; Vágner *2001*, 51, 180). This arrangement is most characteristic of the kilns described from ethnographic work in Hungary *(Fig. 13–15)*. The

Fig. 12. *Up-draught – two chambered kiln. Excavated on Kalocsa (Hungary), dated to c. 16th century.*

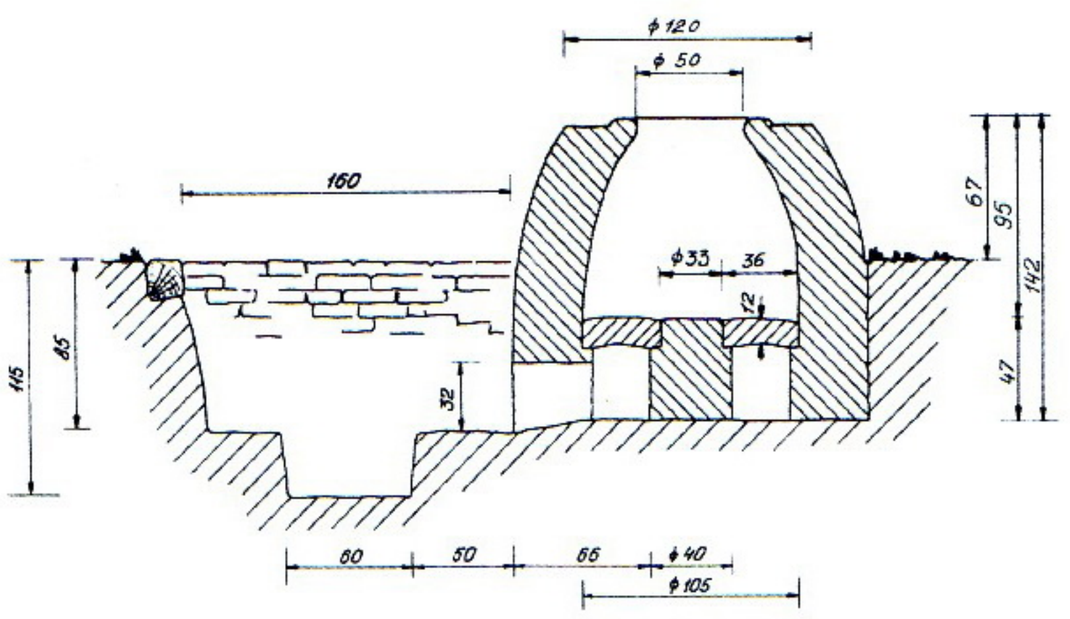


Fig. 13. *Modern up-draught – two chambered, supported grated kiln, surveyed on Mohács in Hungary (after Duma 1986).*

Fig. 14. *Daub building material for modern up-draught – two chambered, supported grated kiln (after Duma 1986).*

Fig. 15. *Modern up-draught – two chambered kilns, surveyed on Mohács in Hungary (after Duma 1986).*

second type has a grate made of arched clay bars was found in the kiln excavated at Kalocsa *(Fig. 12)*. Contemporary analogues are known from the territory of Romania, from the kilns unearthed at Coconi (*Constantinescu 1972*, 82–91) and Tomesti (*Andronic 1970*, 408–410). The supported grate allowed the kiln to be enlarged, thus increasing its efficiency. Grates made of arms are easier to repair than a monolithic structure of supported grates made of earth. This arrangement was common in the Roman period (*Duhamel 1978–79*) and is also frequently found in modern kilns (*Duma 1982*, 70–77).

The remains of a monolithic grate daubed on a wattle structure were found in the Turkish-period kiln unearthed at Esztergom-Szenttamás hill (*Fehér – Parádi 1960*). The kiln stoke-holes were often equipped with a stoking channel extending in front of the firebox. This allowed better control of firing, reducing the hazards of unexpected changes of draught and wind strength in the kilns *(Fig. 11)*.

Horizontal-draught kilns

This type had an elongated oval or oblong-shaped ground plan because of the horizontal direction of the draught. The firebox and the firing chamber were arranged lengthwise *(Fig. 2)*. The kiln was usually loaded from the side because of the elongated shape of the kiln. The draught and the flame had a longer distance to travel, and could be better managed than in the former type, and, accordingly, the atmosphere of the kiln and the firing temperature could better be controlled and balanced than in up-draught kilns. This kiln type has the capability to reach and maintain a higher temperature (900–1250°C) than an up-draught kiln. It suggests the pyrotechnical analysis were undertaken with German horizontal-draught kilns or its products (Stephan 1988), as indicated by the first investigation of the Bajna – Csima 1. Kiln *(Fig. 17; Vágner 2002*, 332–333). A greater skill, and degree of attention and experience were necessary to use the facility to reach higher temperatures *(Fig. 16–29)*.

They had closed domes, with the kiln being made of the soil. To direct the draught, most of the kilns had a bottom that slightly rose toward the end. A similar arrangement was observed at nineteenth- to twentieth-century archaic horizontal-draught pit kilns *(Fig. 21–22)* in Central and Eastern Europe (*Duma 1966*, 105; *Moszyńszki 1929*, 349; *Plicková 1959*, 39). These kilns could be loaded through the stoke hole or through the flue as in Bajna-Csima kiln no. 2 *(Fig. 17)*, where the firing chamber was built lengthwise behind the flue.

The dimensions of horizontal-draught kilns vary, but they are usually much larger than up-draught kilns. Their length, width and interior height are the most characteristic measurements. We may also differentiate:

- a group with smaller dimensions with an average length of 200–250 cm, width of 100 cm and height of 60–80 cm *(Fig. 16, 18)*;
- a group with medium dimensions: length 350 cm, width 160 cm, height *c.* 80 cm *(Fig. 19)*;
- and a group with very large dimensions: length 430–600 cm, width 200–220 cm, height 150–160 cm *(Fig. 17)*.

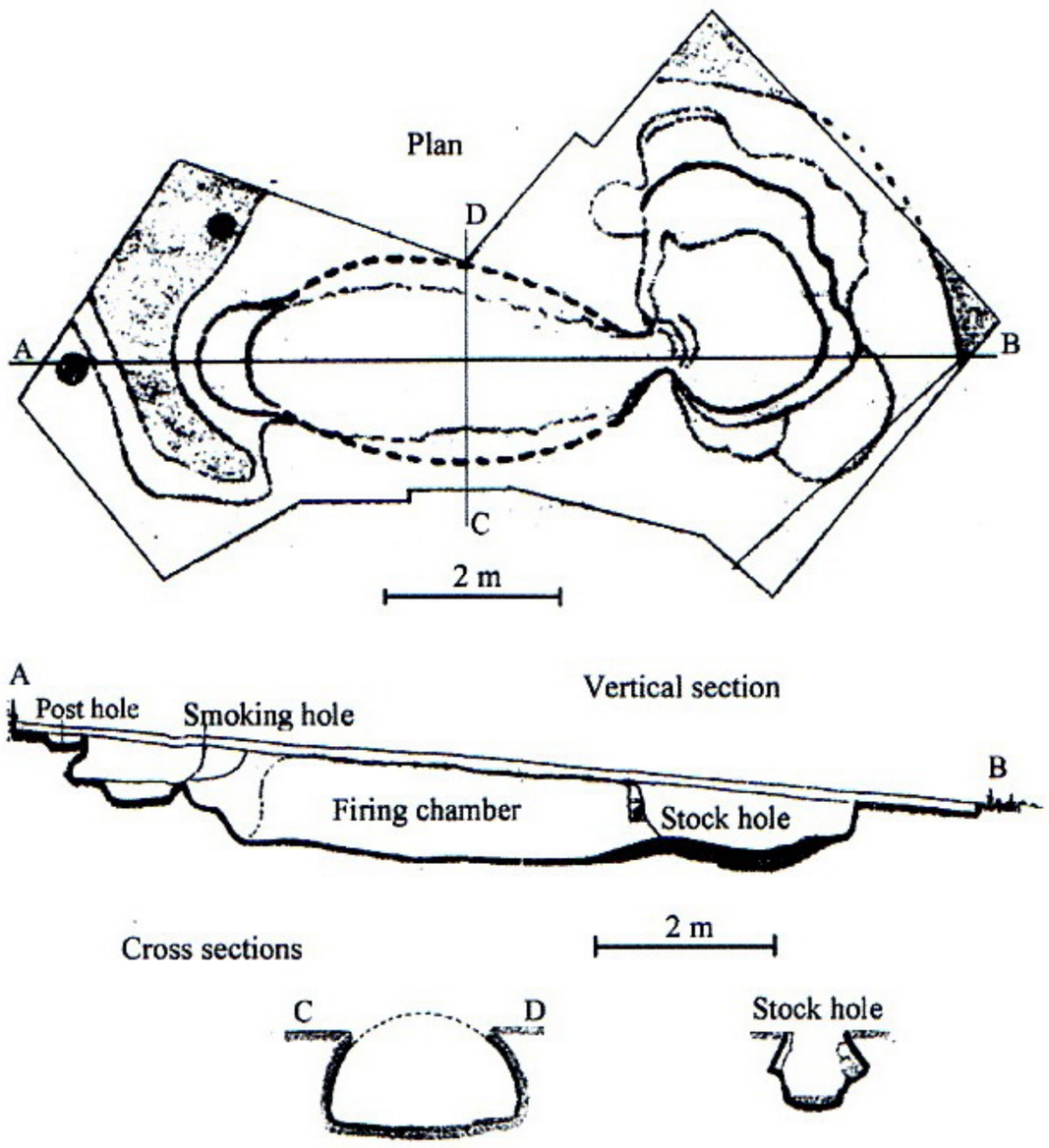


Fig. 17. *Horizontal-draught – single chambered kiln. Excavated on Bajna-Csima (Hungary), dated to c. 16th century.*

As may be observed, width and height are not really proportionate to length. This is because the fire can be controlled by lengthening the path of the flame or the heat.

All the known kilns were originally built with a single chamber, only Bajna-Csima kiln no. 1 was rebuilt to have two chambers *(Fig. 27–28)*.

It was important to control the path of the fire to ensure even quality of firing and to protect the vessels and the flame, and to prevent direct contact between the loaded pottery and the heat and flames.

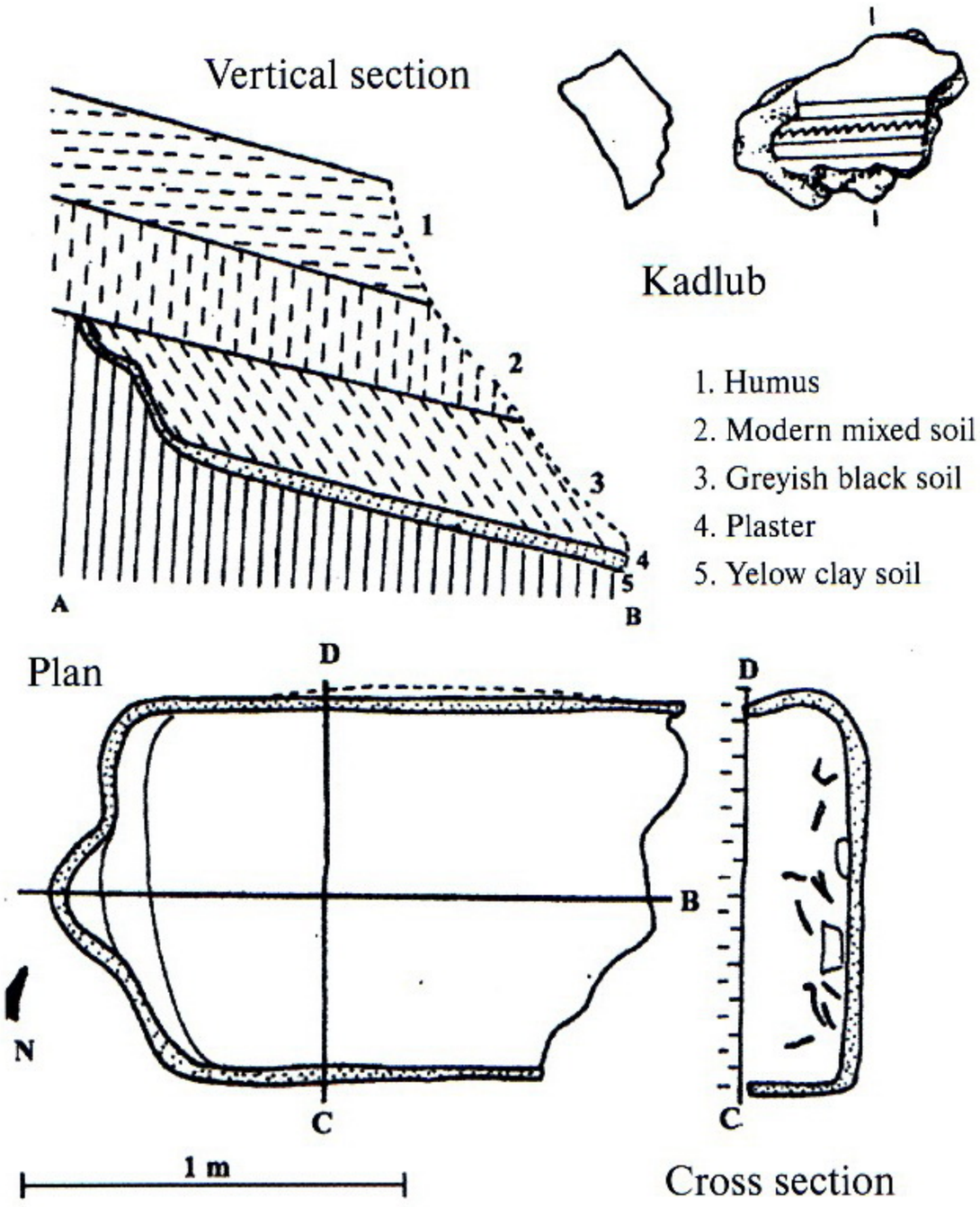


Fig. 16. *Horizontal-draught – single chambered kiln, excavated on Szelezsény/Sľažany (Slovakia), dated to c. 16th century (after Ruttkay 1988).*

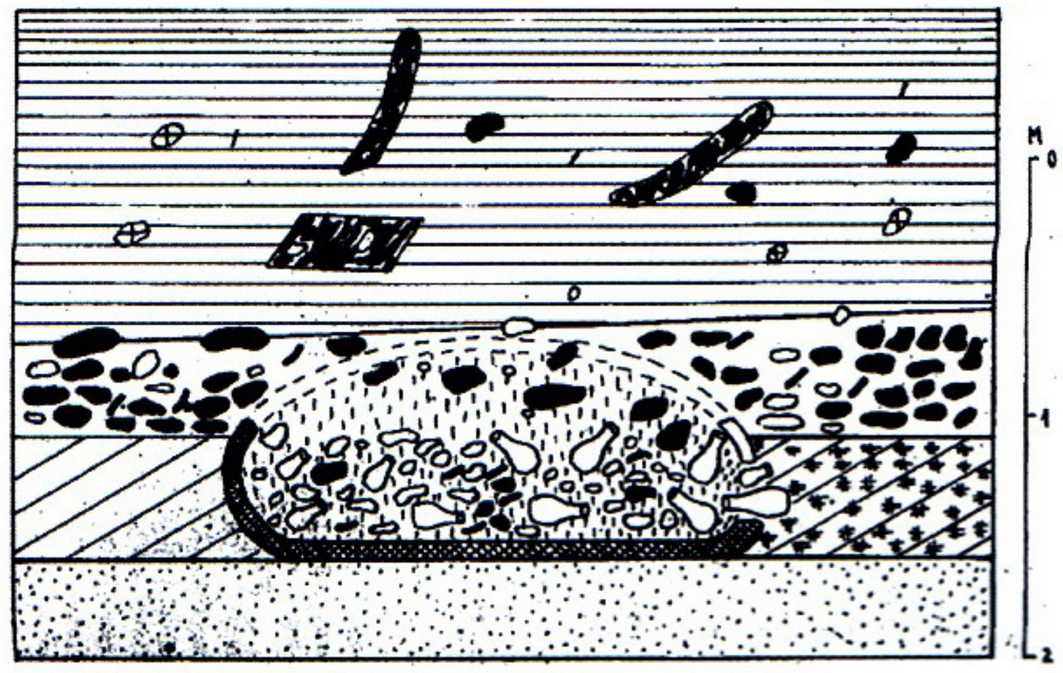


Fig. 18. *Horizontal-draught – single chambered kiln, excavated on Kassa/Košice (Slovakia), dated to c. 15th century (after Pastor 1959).*

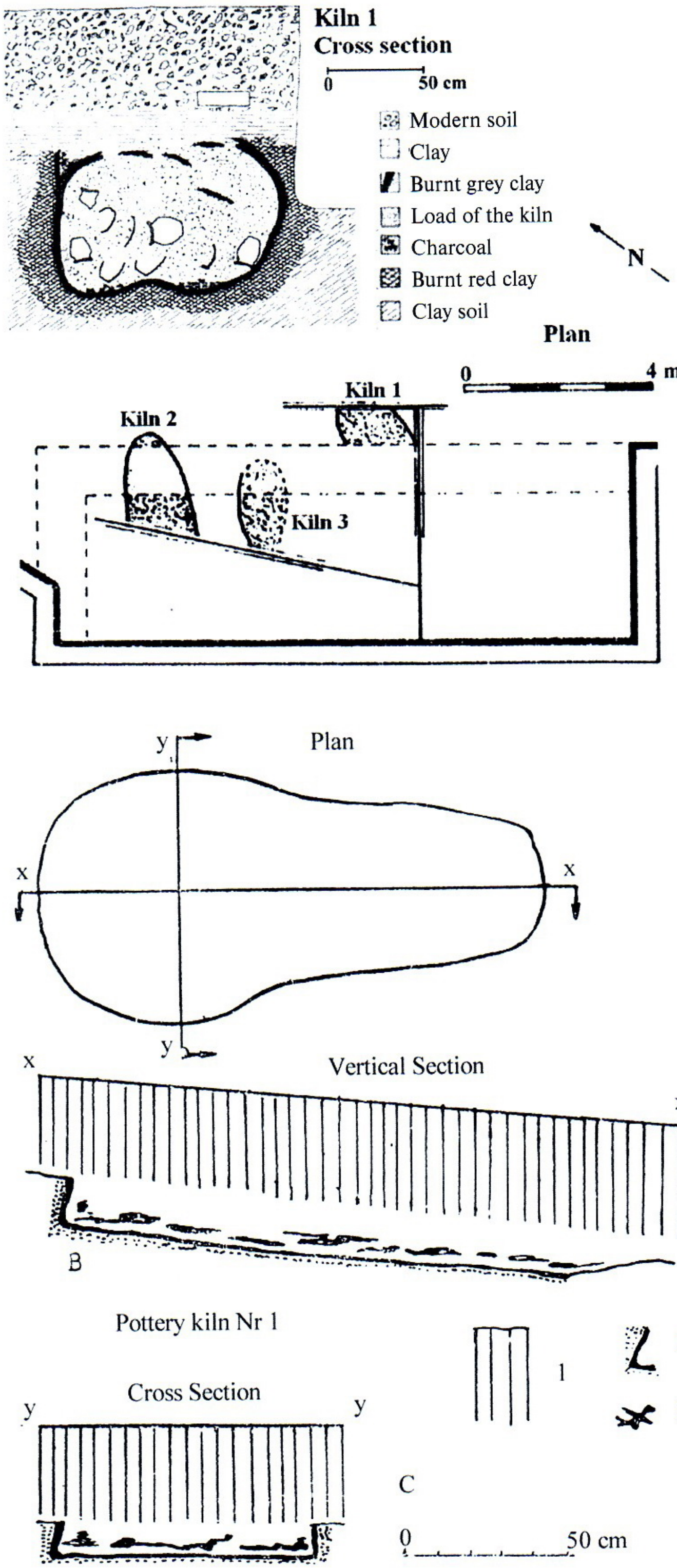


Fig. 19. *Horizontal-draught – single chambered kilns, excavated on Galgóc/Hlohovce (Slovakia), dated to c. 14–15th century (after Polla – Rejholec 1961).*

Fig. 20. *Horizontal-draught – single chambered kiln, excavated on Igołomia (Poland), dated to c. early 16th century (after Gajewski 1959).*

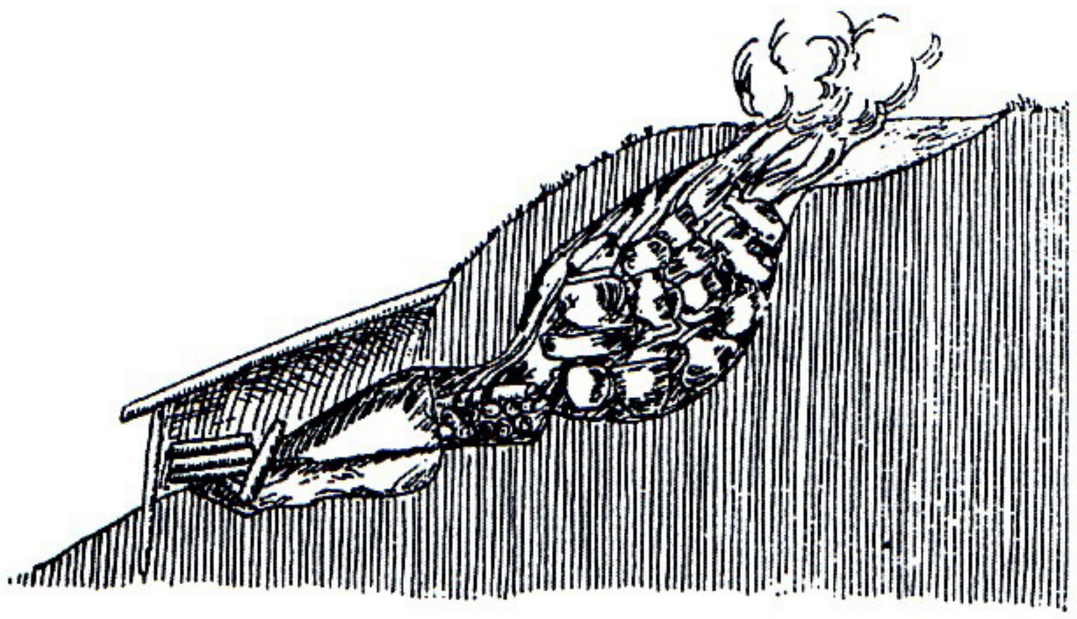


Fig. 21. *Early-modern horizontal-draught – single chambered kiln, surveyed on Medyň (Byelorussia), dated on 18–19th century (after Moszyński 1929).*

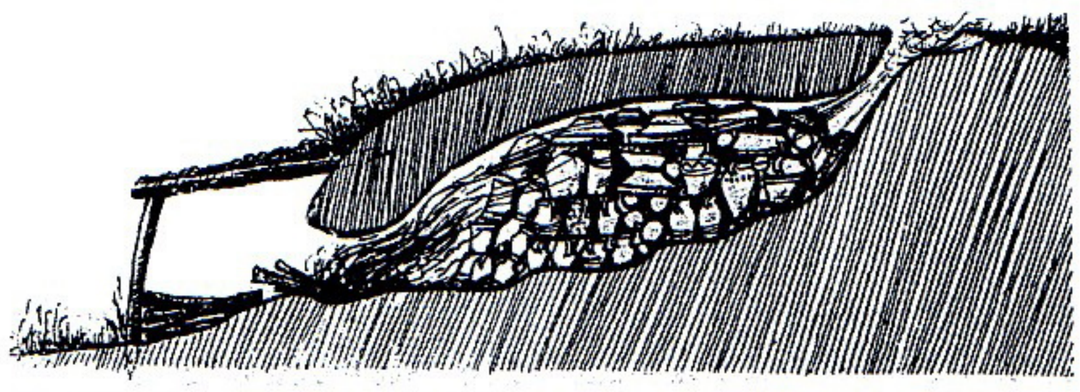


Fig. 22. *Reconstruction of 19th century modern horizontal-draught – single chambered kiln from Pazdics/Rozdišovce (Slovakia) (after Plicková 1959).*

Single-chambered kilns

The bottom of the kilns may be flat as in the case of Felső Szelezsény/Slažany – Horné Slažany *(Fig. 16)*, Bajna-Csima 2 *(Fig. 17)*, and Pozsony/Bratislava *(Fig. 24)*, or segmented by elongated, shallow, 10–15 cm deep, draught channels as in the kilns excavated at Jesensky Street, Galgóc/Hlohovce *(Fig. 19)*, and at Michalská Street, Galgóc/Hlohovce (*Pastorek 1985*, 114) and 39 Kossuth Street, Bajna *(Fig. 23)*. These channels helped the diffusion of the fire and the flames, and contributed to the separation of the pottery from the fire. Similar channels were found in kilns from the fourteenth century along the Rhine, e.g. at Langerwehe – Jüngersdorf and Hauptstrasse (*Gaimster 1997*, 42–43; *Jürgens 1988*, 126–129, 134–136).

Clay slabs, called *kadlub* in the Slovakian literature, were found in the flat-bottomed Felső Szelezsény/Slažany – Horné Slažany kiln *(Fig. 16*; *Ruttkay 1988*, 128) and in the Jesensky Street, Galgóc/Hlohovce kiln *(Fig. 19)*, the bottom of which latter was divided by channels (*Polla – Rejholec 1961*, 262). The slabs, which show the imprints of the mouths of the vessels attest to the way the kilns were loaded. These slabs served to separate the pottery from the fire on the bottom of the kiln. The imprints of the vessels suggest that the vessels loaded on the bottom of the kilns were surrounded by unfired clay slabs.

The vertical clay bars or slabs with horizontal perforation standing behind the stoke hole of the kiln also served to separate the pottery from the flames. They were observed in the kilns excavated at Hurban Square in Pozsony/Bratislava *(Fig. 24)*, and under 39 Kossuth Lajos Street, Bajna *(Fig. 23)*. They are probably identical to the structure described from the medieval kilns of Rhineland in Paffrath *(Fig. 25.)* and Saxony in Dümmerin and Granzin (*Böhner 1955–56*; *Drews 1978–79*, 46–47; *Lung 1955–56*) and Saint-Denis in northern France (*Meyer 1987*, 52), and those in horizontal-draught kilns discussed in the recent ethnographic literature *(Fig. 26*; *Fábián 1934–35*, 32; *Duma 1982*, 62–63). They seem to have separated the firebox from the firing chamber in the same way as the grates in the up-draught kilns. However they only helped the better

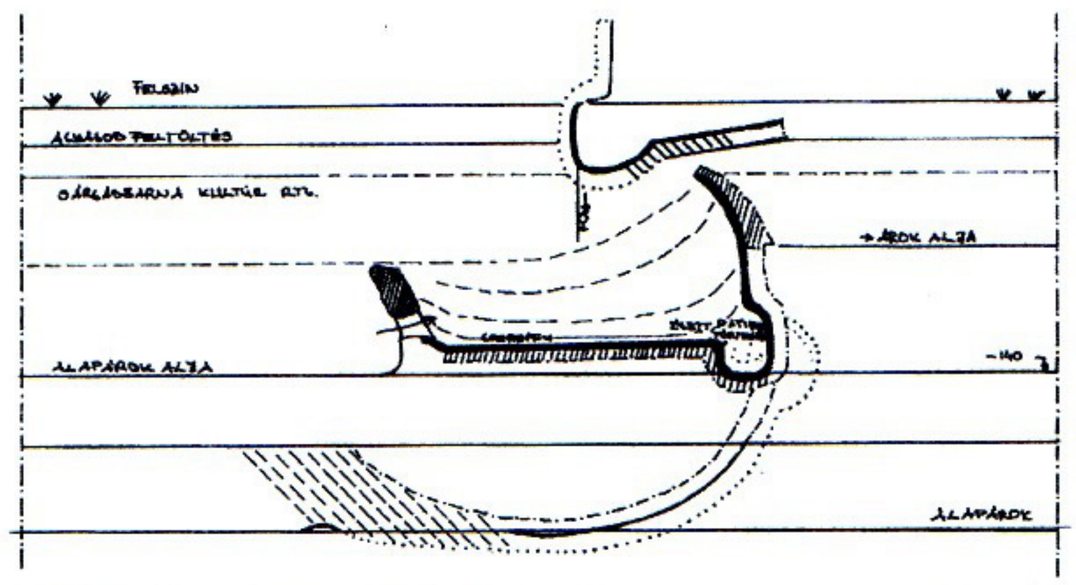


Fig. 23. *Horizontal-draught – single chambered kiln, excavated on Bajna Kossuth Lajos Street (Hungary), dated to c. 15th century.*

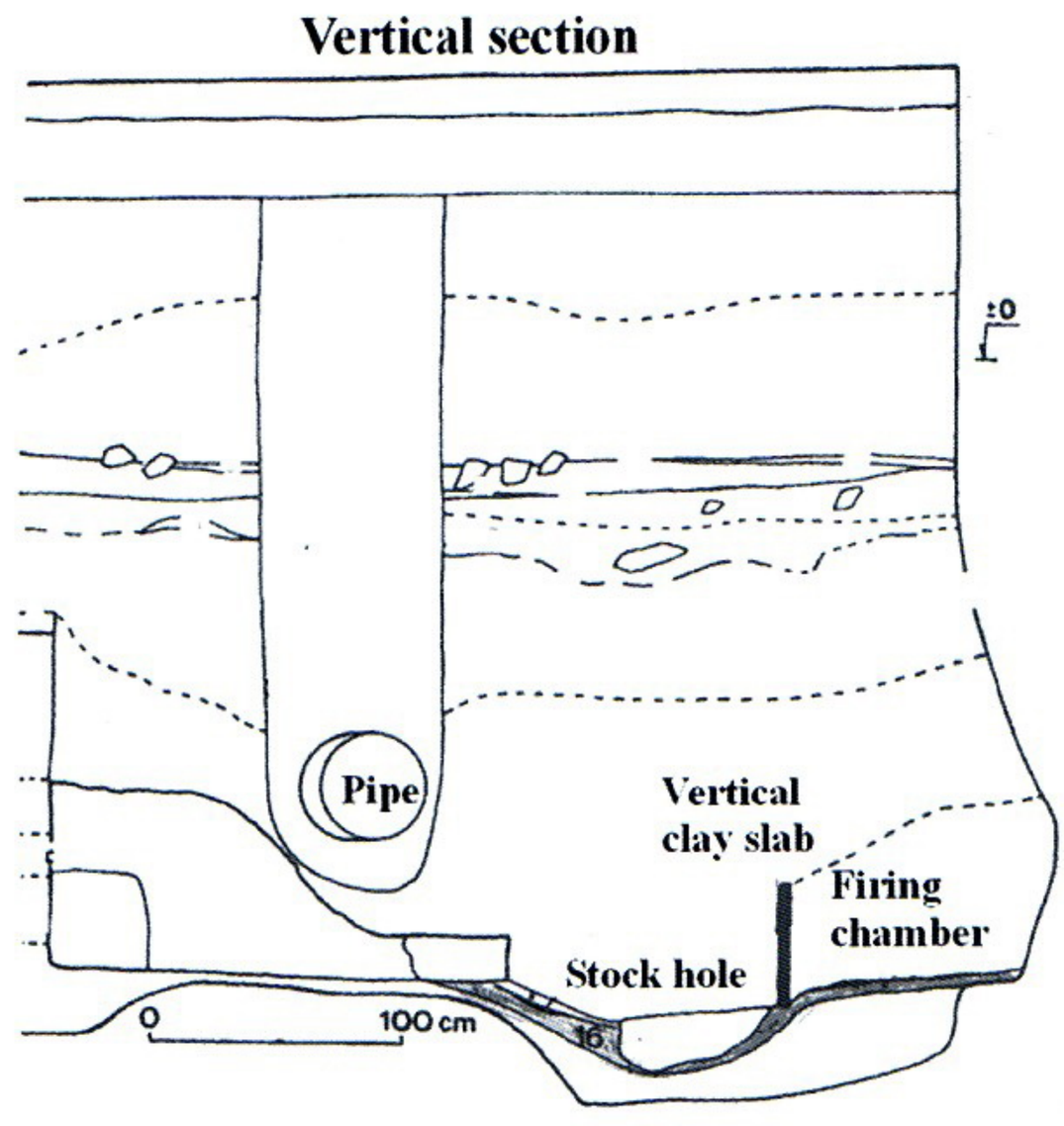


Fig. 24. *Horizontal-draught – single chambered kiln, excavated on Poszony/Bratislava – Hurban Square (Slovakia), dated to 13–14th century (after Lung 1955–1956).*

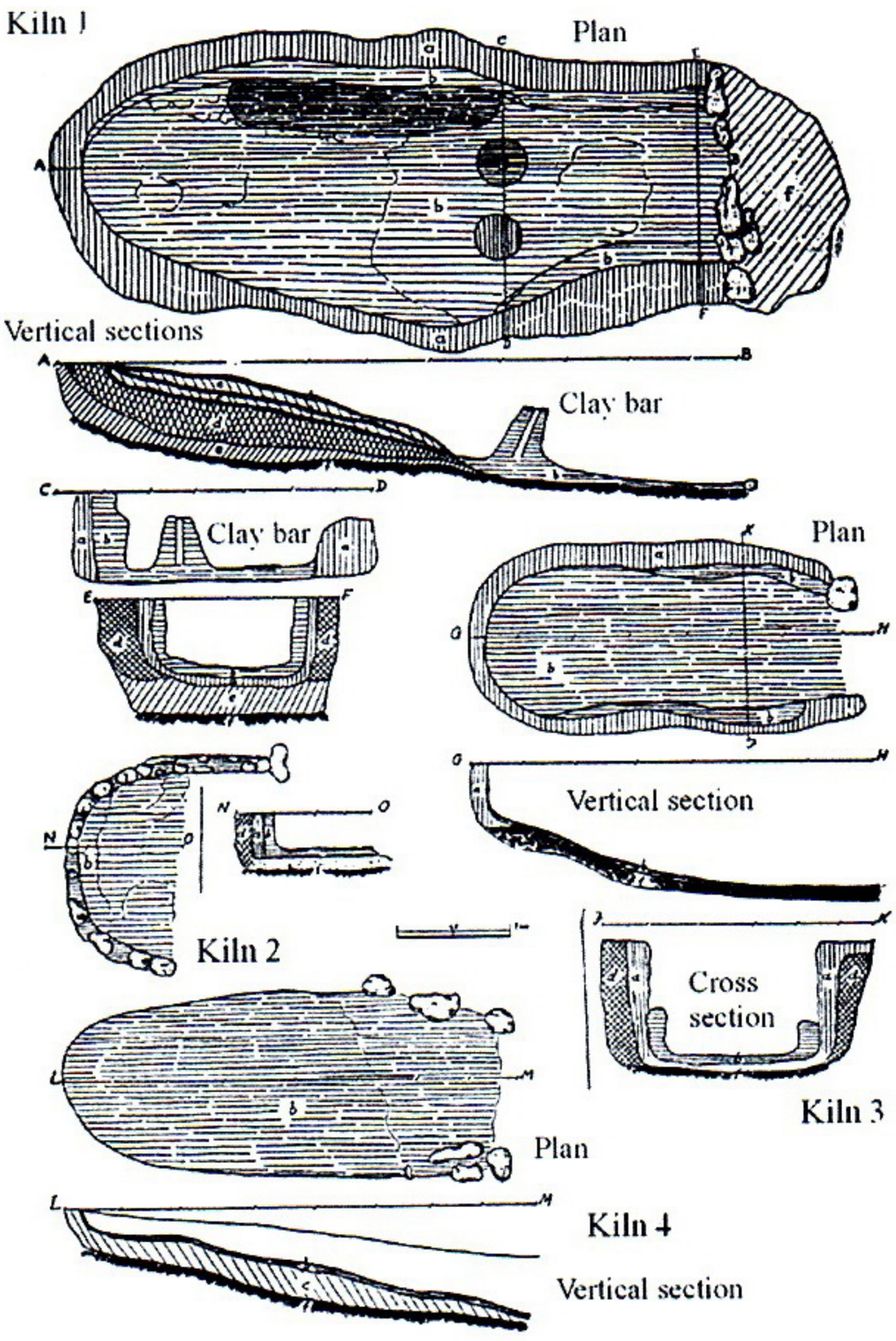


Fig. 25. *Horizontal-draught – single chambered kilns from the Rhineland, in Germany excavated on Paffrath, dated to 13–14th century (after Lung 1955–1956).*

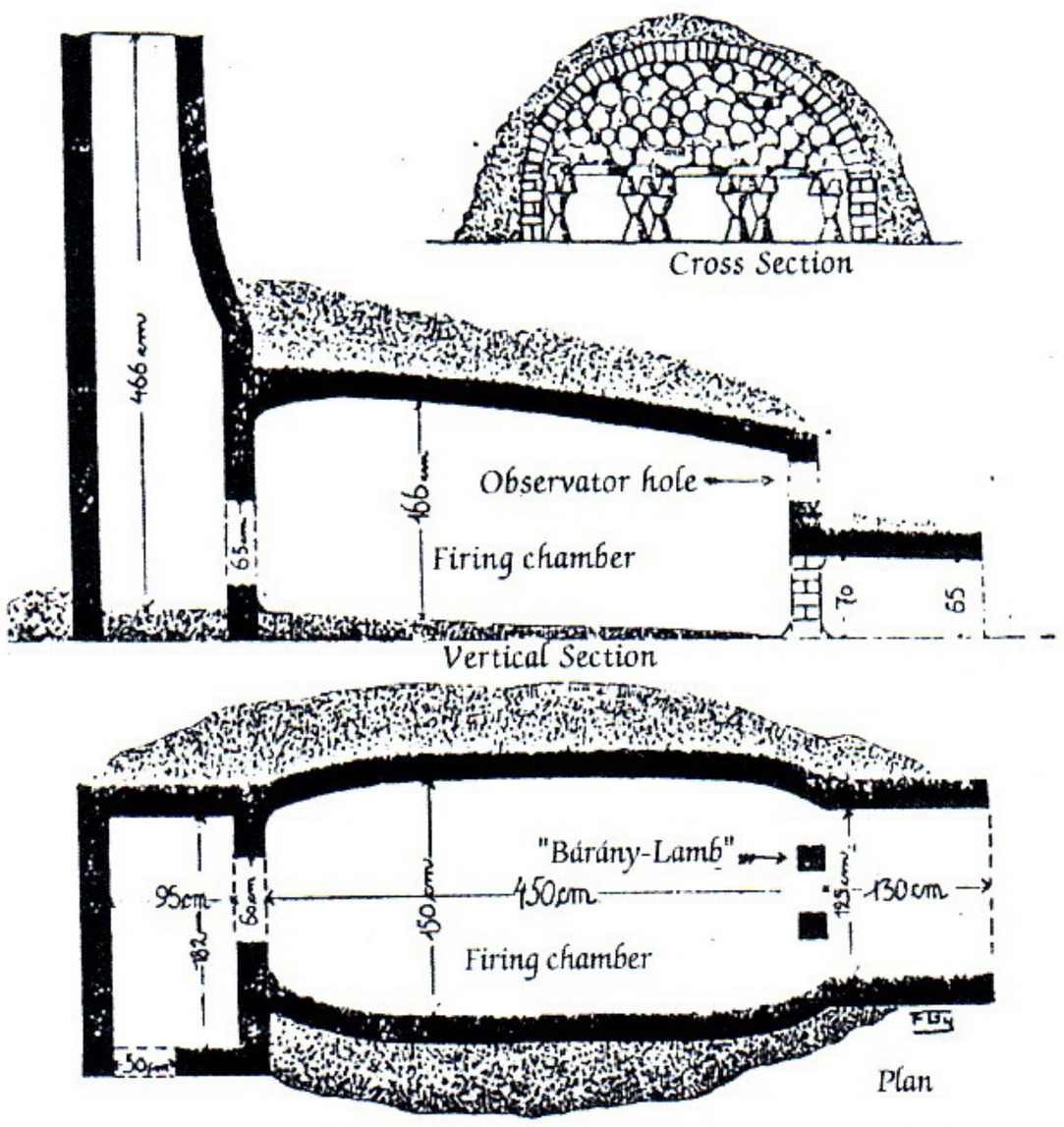


Fig. 26. *Modern horizontal-draught - two chambered kiln form Hungary, surveyed in Ják (after Fábián 1934–35).*

The vertical clay bars or slabs with horizontal perforation standing behind the stoke hole of the kiln also served to separate the pottery from the flames. They were observed in the kilns excavated at Hurban Square in Pozsony/Bratislava *(Fig. 24)*, and under 39 Kossuth Lajos Street, Bajna *(Fig. 23)*. They are probably identical to the structure described from the medieval kilns of Rhineland in Paffrath *(Fig. 25.)* and Saxony in Dümmerin and Granzin (*Böhner 1955–56*; *Drews 1978–79*, 46–47; *Lung 1955–56*) and Saint-Denis in northern France (*Meyer 1987*, 52), and those in horizontal-draught kilns discussed in the recent ethnographic literature *(Fig. 26*; *Fábián 1934–35*, 32; *Duma 1982*, 62–63). They seem to have separated the firebox from the firing chamber in the same way as the grates in the up-draught kilns. However they only helped the better distribution of the flames. As the firebox is horizontal and longer, the flames extended into the firing chamber, and their path has to be lengthened. A good example is provided, even though it was in a fragmentary state, by the kiln excavated under 39, Kossuth Lajos Street in Bajna *(Fig. 23)*, where the floor of the firing chamber was further divided by channels behind the fire-bar.

Two-chambered grated kilns

A grate was found only in a single case, in Bajna-Csima kiln no. 1 *(Fig. 27–28)*, which was made during the rebuilding of the kiln. A bench was built in the centre of the medium-large, 3.5 m long kiln, then a shelf was added to each of the two sides. They enclosed two horizontal 50 cm-wide draught channels, which were bridged by fired clay bars. This construction helped to control the heat in the kiln and, at the same time, temporary modifications were still possible due to the distance between the bars of the grate. This arrangement is similar to the above-mentioned horizontal draught channels excavated in the Langerwehe kilns, which did not have a grate. A similar, smaller kiln with a more regular ground plan was found from the same period in Brno, Moravia *(Fig. 29)*, where the grate was composed of mobile, removable plates (*Nekuda 1978–79*, 131–133). These structures are the forerunners of the so-called Kassel or German kilns, which were introduced in the seventeenth to eighteenth centuries, and which have been used to the present day *(Fig. 26*; *Fábián 1934–35*; *Duma 1966*; *1982*, 62–63).

Kiln orientation is not standardised because of the varied geographical properties of individual sites. In sites where more than one kiln were found, the individual kilns had different orientations as, for example, at Bajna-Csima or Decs-Ete.

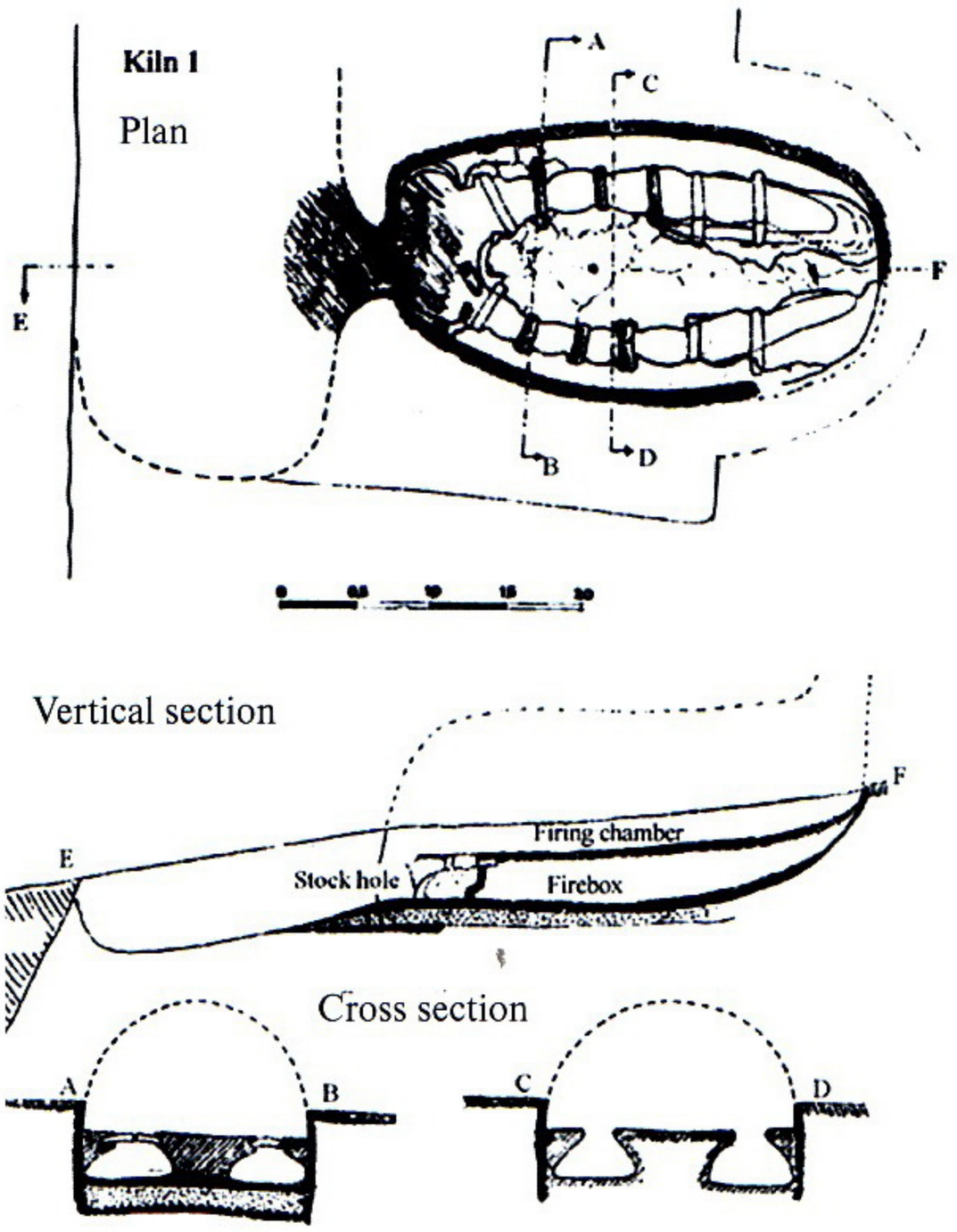


Fig. 27. *Horizontal-draught – two chambered kiln. Excavated on Bajna-Csima (Hungary), dated to c. 15–16th century (after Horváth – Kelemen – Torma 1979).*

Distribution of the medieval pottery kiln types

Definite trends can be identified from the distribution map of the kilns in the Carpathian Basin *(Fig. 1)*. To understand this picture better it is worth outlining the history of the kilns.

Up-draught kilns:

Tenth to thirteenth centuries

Up-draught kilns are the only type known in the Carpathian Basin from the period between the beginning of the tenth century and the end of the thirteenth century. Most of the kilns had two chambers with a grated structure; from this period, only one single-chambered kiln was found in Slovakia (*Hrubec 1971*, 76).

Fourteenth to seventeenth centuries

Up-draught kilns are known from the late Middle Ages and the Turkish Period, mainly from the southern, central and eastern parts of the Carpathian Basin *(Fig. 1)*. Kilns with a single chamber known from Transylvania *(Fig. 3)* and Slovakia (*Benkő 1992*, 159–160, 176–177; *Hrubec 1971*, 76). According to ethnographic observations, up-draught kilns with a single chamber were common in Transylvania (*Kós 1986*) and in the south-western Hungary in the twentieth century *(Fig. 4*; *Duma 1982*,78). Two-chambered grated kilns dating to the fourteenth to seventeenth centuries were mainly found in the central and southern regions of

Fig. 28. *Horizontal-draught – two chambered kiln, excavated on Bajna-Csima (Hungary), dated to c. 15–16th century (after Horváth – Kelemen – Torma 1979).*

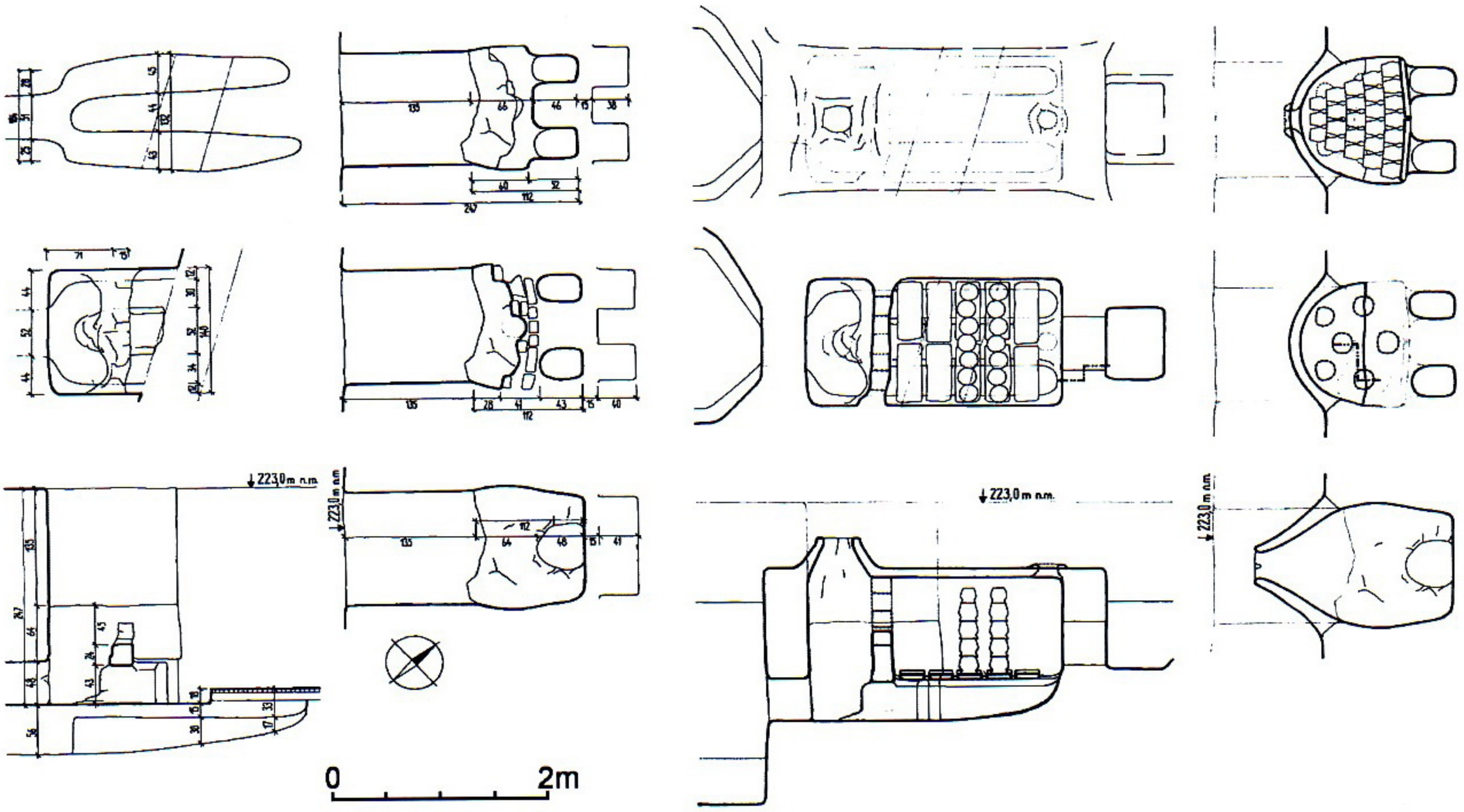


Fig. 29. *Horizontal-draught two chambered kiln with grate. Excavated on Brno, Czech Republic. Dated to c. 15–16th century (simplified after Nekuda 1978–1979).*

medieval Hungary *(Fig. 1)*. They were probably the developed versions of the kilns of the Árpádian Era. The type was used to the present day, and they were the characteristic pottery kilns of the nineteenth and twentieth centuries *(Fig. 13–15)* in the Hungarian Plain and in a part of Transdanubia (*Duma 1982*, 78).

The antecedents of up-draught grated kilns were also known before the Hungarian conquest. They existed in the eastern and southern territories of the Carpathian Basin from the late Neolithic (*Comşa 1976*; *Ellis 1984*, 130–163) and reappeared and diffused in the late Iron Age (*Jerem et al. 1998*; *Pieta 1995*) and the Roman period (*Bónis 1981*), first of all as a result of exterior influence, and the ancient traditions survived in the Migration period (*Rosner 1981*) as well The Hungarians may also have brought the type with them, as it was commonly used in their earlier homelands, among others in the settlements of the Saltovo-Majack culture, where pottery kilns identical with the eleventh- to thirteenth-century types were unearthed (*Pletneva 1981*, 48, 74).

Horizontal-draught kilns:

Thirteenth to seventeenth centuries

The type first appeared in Pozsony/Bratislava *(Fig. 24)* on the Danube, at the north-eastern gates of the Carpathian Basin, at the beginning of the fourteenth century (*Egyházy-Jurovská 1984*, 277). It spread through the Carpathian Basin especially between the middle of the fourteenth century and the beginning of the sixteenth century, first of all in areas of present-day Slovakia and less characteristically in the northern part of Transdanubia *(Fig. 1)*. After the Turkish wars, the German population settling in Hungary in the seventeenth to eighteenth centuries brought in a more modern version of the type *(Fig. 26)* in Transdanubia: the so-called Kassel or German kiln (*Duma 1966*; *1982*, 60–63; *Mészáros 1968*, 27–28).

The antecedents of the type are not known in the Carpathian Basin. The origin of horizontal-draught kilns has not yet been clarified. Horizontal-draught kilns are first known from the end of the early Middle Ages, the late Carolingian period in the northern and western territories of present-day Germany, then they were diffused as a result of the fast development of the pottery industry on the Rhine in the thirteenth and fifteenth centuries (*Gaimster 1997*, 41–44; *Stephan 1988*).

The pottery industry on the Rhine was based on a high-quality raw material with a high kaolin content, which needed high firing temperature. This necessitated a more special kiln type that could produce a higher firing temperature and afforded a better than average control. This explains why the kiln type appeared in the region of the pottery industry of the Rhine region and in its diffusion area and the territories where it was traded (*Janssen 1983*, 320–396; *Gaimster 1997*, 41–44; *Flambard-Héricher 2000*). Then, in the four-

teenth to seventeenth centuries, the population that moved to the east from these territories, or wandering craftsmen or tradesmen brought it to Moravia and Bohemia (*Nekuda – Reichertová 1968*, 39–49), to southern Poland (*Gajewski 1959*; *Kwapieniowa – Walowy 1966*, 217–225) and the territories of Pannonia already discussed. The eastward diffusion of these kilns was in parallel to the economic development of the above-mentioned central European territories. New versions of the type were born in the modern period in many parts of Europe, for example in the so-called German or Kassel type kilns *(Fig. 26*; *Fábián 1934–35*, 32; *Duma 1966*, 93–94;*1982*, 60–63). At the same time, some archaic single-chambered versions of the horizontal-draught kiln type has remained in use in the region of the Carpathian Basin (*Duma 1966*, 103; *Plicková 1952*; *1959*) and in Eastern Europe *(Fig. 21–22*; *Kwapieniowa – Walowy 1966*, 217–219; *Moszyńszki 1929*, 349; *Rybakov 1948*).

Evidence for workshop organization

There is little historical information on the medieval potters' workshops before the sixteenth century since guild development started in Hungary relatively late. Historical sources rarely provide information on individual workshops and their locations, so we have to rely primarily on archaeological sources, which can be augmented by ethnographic data. The small number of kilns found at individual sites, the structure of the kilns and the finds they contained, suggest that the majority of the kilns were operated in workshops run by independent potters and their families.

The existence of independent potters' workshops is indicated by the fact that the majority of the kilns were found alone or in small clusters. Likewise, ethnographic data shows that later, including in the Modern period, independent or small clusters of kilns were typical of the Carpathian Basin. A larger number of kilns (five) is known from one site, the pottery workshop in the early village settlement of Óbecse-Botra (Serbia). Their structure, size and location in the settlement match the average picture built of tenth- to thirteenth-century pottery kilns. The finds, however, and the results of the comparative analyses tell us that the raw material for the pottery was transported from a few kilometres away on the other side of the River Tisza, which presupposes an organised activity (*Stanojević 1980*, 25).

It is worth mentioning that the early pottery kilns (of the tenth to thirteenth centuries) were often built between household ovens, in oven clusters, in villages (attached to their fire pits or working pits). This does not, however, mean that the pottery kilns were used only on a household level since the finds recovered from them imply a greater technical skill. A good example is offered by the kiln at Hács-Béndekpuszta where a small and very simple up-draught, two-chambered, grated kiln was found between the household ovens, which contained high quality finds (*Parádi 1967*, 25).

The structural characteristics of the kilns may also imply features that are difficult to interpret with respect to workshop organization. The very simple structure of the small up-draught kilns characteristic of the tenth to thirteenth centuries might imply pottery manufacture that satisfied household demand. But the above-mentioned pyrotechnical analyses and the ethnographic data proved that small, up-draught grated kilns with a diameter of about 1 m could produce a controllable firing at 800–900°C. The common, simple and poor-quality household ceramics of the tenth- to thirteenth-century settlements and cemeteries have not been found in the pottery kilns excavated so far. At the same time, the small dimensions of the kilns in the region may be explained by the closed economic system of the period between the tenth and thirteenth centuries and earlier, when production for markets was negligible.

Late medieval workshops can be characterised by significantly larger kilns. This was caused by a change in the economic system of the country that started in the fourteenth century (*Sprusansky 1968*). This involved the concentration of market districts and centres and an increased demand for production. This increase led in the case of up-draught kilns to a greater variety of structural arrangements.

The larger size of the kilns indicates the demand for a larger-scale production. So it is no accident that they appeared in the Carpathian Basin with the new economic and market demand at the beginning of the fourteenth century. Serial mass production could be observed first of all in horizontal-draught kilns. One of the reasons is that, beside the larger size of the kilns, their structure and technology allowed more balanced firing. This, in turn, guaranteed the production of a larger number of vessels with relatively uniform high quality. The demand for this type and scale of production supposes more significant markets or market districts and this explains why the horizontal-draught kilns were usually built in cities (Kassa/Košice, Pozsony/Bratislava, Kisszeben/Sabinov), smaller towns (Galgóc/Hlohovce) or near outcrops of high quality raw material close to central places. Of these, only the kilns of Kassa/Košice and Kisszeben/Sabinov can be associated with a degree of certainty to the activity of town guilds (*Pástor 1959*, 617–618; *Slivka 1978*, 182).

The especially large horizontal-draught kilns satisfied the demand for special production, such as those workshops where rare, extremely high-quality white pottery (proto-stoneware, near-stoneware) based on

kaolin raw material fired at a high temperature was produced in large quantities. In the Carpathian Basin, two workshops have been completely excavated, both situated in the territories of two distant kaolin outcrops. The earlier, thirteenth- to fifteenth-century, kiln excavated in the territory of Alsó Poltár/Dolný Poltar was built in the recently extremely important stoneware-producing region in Gömör, while the later kilns of Bajna, dated to the end of the fifteenth century and the beginning of the sixteenth century, operated in a smaller, less well known region. As well as their age and location, the structures and the topographic characteristics of the kilns also show significant divergences. At Alsó Poltár/Dolný Poltar a large up-draught kiln with a 4 m diameter was excavated, while in Bajna large horizontal-draught kilns of western origin from the Rhine region were uncovered. These large kilns and the unique finds recovered from them suggest organised production, which can be justified by being bound to the territory because of the scarcity of the high-quality raw material that lent a unique quality to the vessels.

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The list of medieval pottery kilns in the Carpathian Basin

site	country	item	references
1. Alsó Poltár/Dolný Poltar	Slovakia	1	Hrubec 1971
2. Babócsa – Nárciszos	Hungary	1	Magyar 1990
3. Bács/Bač	Yugoslavia – Serbia	1	Stanojev 1996, 12–14
4. Bajna – Csima	Hungary	2	Horváth – Kelemen – Torma 1979
5. Bajna, 39, Kossuth Lajos street	Hungary	1	Vágner 2001, 55–57
6. Bártfa/Bardejov, Šiancova street	Slovakia	1	Čaplovič – Slivka 1988
7. Budapest XX, Soroksár Várhegy	Hungary	1	Írásné-Melis 1992
8. Decs – Ete puszta	Hungary	2	Csalogovits 1937
9. Decs, 8, Pilisi Elemér street	Hungary	1	Vágner 2001, 79
10. Esztergom, Szenttamás hill, 6, Lépcső street	Hungary	1	Fehér – Parády 1960
11. Galgóc/Hlohovce Jesensky (Malinovsky) ul.	Slovakia	3	Polla – Rejholec 1961
12. Galgóc/Hlohovce/Hlohovce Michalska ul.	Slovakia	1	Pastorek 1985
13. Felsőlupkó/Gornea – Ţarmuri	Romania	1	Uzum – Ţeicu 1978
14. Hács Béndekpuszta	Hungary	1	Parády 1967
15. Kalocsa, 17, I. István király street	Hungary	1	Vágner 2001, 102–106
16. Kaposvár – road no. 61 leading eastwards out of the town	Hungary	2	Vágner 2001, 107–108
17. Kassa/Košice, 57, Šrobarovska street	Slovakia	1	Pastor 1959
18. Kisszeben/Sabinov	Slovakia	1	Slivka 1978
19. Mozsor/Mošorin– Bostanište	Yugoslavia – Serbia	1	Veselinović 1952
20. Nagyvárad/Oradea	Romania	1	Rusu 1996
21. Nyitra//Nitra – Lupka	Slovakia	13	Chropovský 1959, 1961
22. Óbecse/Bečej – Botra	Yugoslavia – Serbia	5	Stanojev 1980
23. Óbecse/Bečej – Perlek	Yugoslavia – Serbia	2	Stanojev 1996, 42–74
24. Pozsony/Bratislava Hurbanovo square	Slovakia	1	Egyházy-Jurovská 1984
25. Pusztaberény – Pig sty	Hungary	1	Bárdos 1978, Vágner 2001
26. Székelykeresztúr/Cristuru Secuisec, 26, Iskola street – hospital	Romania	1	Benkő 1992, 159–160
27. Székelykeresztúr/Cristuru Secuisec Katustava, /2, Hajnal street	Romania	2	Benkő 1992, 176–177
28. Szelezsény – Felső Szelezsény/Slažany – Horné Slažany	Slovakia	1	Ruttkay 1988
29. Tótgyarmat/Slovenské Ďarmoty – Malý Iliašov	Slovakia	1	Vendtová 1964
30. Túrkeve – Csudabala, site no. 8	Hungary	1	Vágner 2001,178–180

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