

Rudolf Procházka, Kateřina Těsnohlídková
Karel Slavíček, Gabriele Scharrer-Liška,
Eva Nová, Martin Košťál, Dalibor Všianský

FROM CLAY TO KILN

Medieval pottery production
in the Bohemian-Moravian
Highlands, eastern Moravia
and Lower Austria

Czech Academy of Sciences, Institute of Archaeology, Brno

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Authors: Rudolf Procházka, Kateřina Těsnohlídková, Karel Slaviček,
Gabriele Scharrer-Liška, Eva Nová, Martin Košťál, Dalibor Všíanský

Reviewers:

Mgr. Ladislav Čapek, Ph.D.
prof. PhDr. Rudolf Krajíc, CSc.
Simona Raneri, Ph.D.

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1

Introduction

As a primary and abundant source of material culture, medieval ceramics have been and continue to be the subject of interest to archaeologists. However, they are mainly analysed from a typological and morphological perspective, as researchers focus primarily on external features such as types of vessels and their shapes or decorations. Due to their relatively high variability over time, the possibilities of dating ceramics stand at the forefront of scholarly interest. Much less attention is paid to their technological essence and how it is reflected in the so-called production chain – i.e. the structure and preparation of raw materials, forming, and firing. This is a topic that requires an interdisciplinary approach with the extensive use of scientific methods and experimentation. By drawing on knowledge gained mainly from foreign research and to a lesser extent from domestic research (notable examples include the works of W. Hołubowicz, P. M. Rice, V. Roux, N. Cuomo di Caprio, M. Richter, M. Gregerová, and R. Thér), we have attempted in this book to take a complex approach to ceramic assemblages of a special kind, i.e. the remains of pottery kiln batches. We have based our work upon the results of previous research, in particular on experiments carried out at Masaryk University's workplace in Panská Lhota, as well as within the framework of the broadly conceived NAKI project (2017–2021). A number of findings now being further developed were collected and evaluated by K. Těsnohlídková in her doctoral thesis (2021). The research drew from the remarkable assemblages of ceramics from seven pottery kilns in the eastern part of the Bohemian-Moravian Highlands, which were in operation between approximately 1250 and 1400. An interesting comparison was provided by

the pottery from two kilns and a pottery hoard on the opposite edge of Moravia – from Staré Město near Uherské Hradiště – and from two other firing facilities in the Lower Austrian town of St. Pölten. While common assemblages from settlement areas are often quite heterogeneous as they come from multiple workshops, in the case of kiln pottery, the area is confined to a single workshop, although this may involve the remains of multiple kiln batches. In addition, limited intrusions of deposited waste of uncertain origin cannot be ruled out. Notable advantage is the presence of a number of whole or reconstructable vessels, which allows for a detailed study of the entire process of production.

From a thematic perspective, we have focused on three areas: the structure of the ceramic material, the shaping of the vessels, and their firing. From a methodological point of view, a combination of traditional archaeological evaluation, scientific analytical procedures, and statistics was applied. This approach made it possible to study the ceramic raw materials, their provenance, and the changes caused by firing. All these stages of the production chain were compared with findings obtained via experimental production, including both the preparation of the material and firing in various types of pyro-technological equipment.

The introductory section of the book presents a chapter on the settlement context of pottery workshops and the socio-economic status of the individuals who operated them. It also includes a chapter dealing with written reports on the sources of pottery clay. The next and highly important part of the book presents the characteristics of the assemblage of examined kilns and their batches. It includes

both a description and classification of the kilns and a comprehensive characterisation of the pottery found in them in terms of morphology, petrography, and forming and firing technology. The extensive following chapter presents and evaluates 12 seasons of experimental pottery production, which thematically cover the entire operational chain. The results presented in the material and experimental parts of the monograph are discussed in the context of contemporary research. In the discussion, we attempt to show the advantages and pitfalls of the chosen methodological approach and, in some areas, possibilities for further research.

Our work, supported by the Czech Science Foundation through the project Emergence of the high medieval pottery – pottery kilns and their batches, would not have been possible without the gracious help of the experts at the Museum of the Vysočina Region in Jihlava, especially David Zimola; the Regional Museum in Žďár nad Sázavou – Martina Schutová and Miloš Lopaur; the Slovak Museum in Uherské Hradiště, namely Dana Menoušková and Tomáš Chrástek; the Moravian Museum – Kateřina Bergerová, Lucie Valášková and Luděk Galuška.

The Archaeological Institute of the Czech Academy of Sciences and the Department of Geological Sciences at Masaryk University also provided us with the optimal environment for work and research. We would also like to mention the support of the Institute of Archaeology and Museology at Masaryk University's Faculty of Arts, particularly in the area of 3D imaging methods. The extensive experiments that have been ongoing since 2012 would not have been possible without the involvement of a number of collaborators – archaeology students and archaeologists, professional and amateur potters, and members of the public interested in experimental archaeology. Thanks to these 'experimental' meetings, some of

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6

Experimental medieval pottery production

The chapters of this book that are devoted to experimental archaeology are based on experiments carried out as part of the co-author's doctoral thesis from 2013 to 2019 (Těsnohlídková 2021). From 2020 to 2024, further experiments were conducted with a focus on the technology of high and late medieval pottery production, reflecting and complementing the results of previous experiments.

The initial aim of this extensive experimental project was to verify the technological procedures that are assumed to have been used in medieval pottery, to explain various macroscopic traces on the pottery, and to provide new insights into various topics that have been addressed hitherto in only a more traditional manner. Gradually, the most significant part of the project focused on ceramics in the Bohemian-Moravian Highlands and pottery production in the 13th century to the first half of the 14th century, primarily in regard to the processing of pottery kiln finds and kiln batches. The implemented experiments provide an additional source for the study of medieval and late medieval pottery production, and partially also for the research of ceramics of other periods.

As with the previous sections, the structure of this part of the thesis is divided into topics as they progress along the operational chain of pottery production. The first section deals with the issue of sources for the production of ceramic fabric and the properties of ceramic fabric with different types of inclusions. The second section focuses on the formation of vessels with an emphasis on the technology of wheel coiling, which was predominant in the vessels from the kilns under study, and its comparison with the wheel-throwing of vessels from a single piece

of fabric. The third section focuses on the technology of firing ceramics with the use of different firing strategies so the characteristics of the final product would correspond to medieval goods. This part consists of three sub-chapters focusing on the construction of pottery kilns, the firing of ceramics, and the properties of ceramic fabrics during firing.

6.1 Ceramic pastes

The aim of the experiments was to obtain a sufficient base of raw materials for solving general issues concerning the technology of high and late medieval pottery production. Suitable regional raw materials were sought out mainly in the area of interest, i.e. the Bohemian-Moravian Highlands. At the same time, purchased, pre-prepared materials were used in the experiments. We came to this compromise due to the poor availability and complex processing of natural clays, although we acknowledge the fact that properties of current industrially-produced clays do not match the material used to produce medieval pottery.

In terms of natural clays, we encounter issues concerning their processing and appropriate treatment. This is the part of pottery production that has deviated the most from historical tradition and has been completely abandoned. We know the procedures for the processing and treatment of clay partly from ethnography, and the manual extraction and preparation of clay is the most physically and time-consuming part of the entire production process. Regions with a rich presence of loess or loess loam, which are suitable for the production of medieval pottery and relatively easy to process, have a certain

advantage in terms of ceramic fabric. However, these sediments are found only in the peripheral parts of the Bohemian-Moravian Highlands, and mostly so-called brickmaking (non-loess) clays (Zaoralová, Slavíček 2021). In addition to the basic clays, various types of inclusions were also sought out and tested, especially graphite. For comparison, both the industrially-processed fabrics and high-quality natural pottery clays from neighbouring areas were used for the experiments.

6.1.1 Historical sources of pottery and brickmaking clays in the Bohemian-Moravian Highlands

Information concerning the sources of clay for historical pottery can be obtained from written sources or place names. In addition to the abundance of wood there, it was also primarily a source of high-quality clay, on which the development of pottery in the region depended. The relationship between pottery workshops and sources of primarily loess or loess loam has been observed recently by L. Čapek (2024, 13–18). Demands on the quality of the clay have increased for some of the more recent branches of pottery. An example of this is faience, the production of which was centred in Velká Bíteš (Svoboda 1927, 240; Černo-horský 1941, 14–17).

Historically, we know sources from which one of the last potters in the Vysočina Region František Čurda from Knínice in the Telčsko Region (Hladík 1988) drew clay. Toponyms present or preserved on old mappings may also refer to sources of clay, e.g. the place name ‘U bílé hlíny’ (which means “by white clay”) near Mohelno and Dalešice (Kuča 2013, 32). It is also possible to locate preserved clay deposits by means of airborne laser scanning (LiDAR) in combination with field survey, and possibly also via place names and written sources. This is how clay deposits can be traced, for example, near Ledec nad Sázavou or Svratka, two important modern-era pottery centres. At Ledec nad Sázavou, where pottery was gradually replaced by stove production, we have evidence of clay extraction along the road towards Kozlí (Chvátal et al. 2013, 184–200). In Svratka, there were rich clay deposits in Borovina by the road to Hlinsko and in other places. Significant relics are still visible in the terrain today (Bálek 1989, 57). In the case of another pottery centre in Nové Veselí, the sources of pottery clay were in close proximity to the village, e.g. around the present-day Veselský rybník (Veselský Pond) or in the vicinity of the Chapel of St Roch (Landsmannová 2020, 31).

In archival sources, we most often encounter records concerning the sources of pottery clay in cases where there was a dispute over its extraction, e.g. we know of such a case from 1865 in Nové Veselí (Těsnohlídková 2021, 9). The extraction of pottery clay was permitted by the sovereign for a fee in some places and free of charge in others (Černo-horský 1941, 14–17).

Brickyards are another type of historical monument that can guide us to the sources of pottery clay. Brickyards served as a source for the production of fired and air-dried bricks, which were used more frequently in rural construction from the 20th century onwards (Kuča 2013, 30). However, sufficient brickmaking required a much lower quality of clay than was the case for pottery. The use of clays from old brickyards is often limited by the fact that in growing towns, these brickyards usually ended up underneath the built-up area or flooded with water, e.g. in Žďár nad Sázavou (Lopaur 2012, 145–146), Nové Město na Moravě (Cihelský rybník [Cihelský Pond]; the brickyards building burnt down in 1929; Marková 2009, 78–79), Havlíčkův Brod (Cihlář Pond, residential built-up area), or Jihlava (today’s Na Hliništi Street).

Sites of clay sources can also be found in the vicinity of late-modern pottery production centres. In the Highlands, this included, e.g. Svratka, Velká Bíteš, Nové Veselí, or Knínice near Telč. These centres were in operation until the second half of the 19th century, and in some cases until the first half of the 20th century. The last pottery workshops probably operated in Jihlava, Telč and Knínice until the 1940s or early 1950s. Among the last to operate a workshop in Knínice near Telč was František Čurda, who officially terminated his trade in 1944. As late as the 1950s, J. Pelikán still occasionally fired smoked goods in Ostrov nad Oslavou (for details, see Scheufler 1972, 136–138; Válka 1994, 12–13; Landsfeld 1950, 307–309; Hladík 1988, 171–172; oral testimony from the chronicler of the village of Ostrov nad Oslavou, J. Doupal).

6.1.2 Ceramic fabrics used in conducted experiments

Over the course of the experiments, several different sets of samples were produced in succession to address questions concerning the behaviour of ceramic fabrics with varying properties during forming and experimental firing. The samples were continually supplemented to include new materials, and the main type of raw material, i.e. non-loess

brickmaking clay, has very similar properties across the region. For forming, fabrics were continuously processed and stored so that they were available for use when needed and also to allow for the monitoring of changing properties throughout the course of processing and maturation (for a precise description of the processing procedure, see Těsnohlídková 2021, 110–111, Appendices 1–5; Fig. 136).

In an ideal case, ceramic fabrics obtained from the vicinity of the sites with pottery kiln finds (which are the focus of this publication) could be used for experiments. So far, similar research has only been carried out in the case of the kiln from Žďár nad Sázavou – ‘Staré Město’, primarily in order to determine the provenance of the pottery produced. Unfortunately, even here there was no directly available source that would provide a sufficient quality of clay for processing in the experiments. Sample collection was complicated by the current built-up area in the area surrounding the kilns. Possibilities of probing for potential sources were continuously monitored and planned in the framework of further research. For this reason, materials that had already been prepared during previous research projects, i.e. from 2015 to 2019, were preferred for the experiments in this project. This was also due to the time-consuming nature of preparing the clays.

The clays used for the forming experiments were mainly clays from modern brickyards and clay deposits, loess from Šlapanice and Bukovsko and brickmaking clays from the sites of Luka nad Jihlavou (brickyards), Panská Lhota (brickyards), and Kejílice, a modern clay deposit and clay from a pottery storage site from the archaeological research of a potter’s house in Telč No. 48 (hitherto unevaluated research by Archaia Brno). Part of the clay was enriched to include finely ground graphite with a coarseness of up to 1 mm, a portion of which was put through a sieve to achieve a finer coarseness (up to 2 mm). Clays from other sources have only been used on a small scale for testing.

6.1.3 Phase analysis of the composition of the used natural sources of pottery clays

Selected clay samples were subjected to a series of analyses: powder X-ray diffraction (XRD) and thermal analysis. This was performed by Dalibor Všíanský from the Institute of Geological Sciences, Faculty of Science, Masaryk University. The aim was to determine the quality of the clays and their suitability for use as a ceramic raw material. For this purpose, kaolinite and clay mineral content was

monitored. Fabrics from medieval brickyards in the Bohemian-Moravian Highlands assumed to be of the same quality as medieval pottery were selected. These were supplemented with several comparative samples possessing different properties.

Powder X-ray diffraction analysis was performed using a Panalytical X’Pert PRO MPD apparatus with a Co anode ($\lambda K\alpha = 0.17902$ nm), an RTMS detector (X’Celerator), and fixed divergence slits in a conventional reflection geometry. Step size: $0.033^\circ 2\theta$, time per step: 240 s, angular range: $5\text{--}100^\circ 2\theta$, total scan time: 5345 s. The data were processed using Malvern Panalytical HighScore 5.2 plus and Bruker AXS DIFFRAC plus Topas 4 software. (Semi) quantitative phase analysis was performed using the Rietveld method. Only the crystalline phases were quantified.

Thermal analysis by differential scanning calorimetry (DSC) and thermogravimetry (TG) was carried out using a Setaram Setsys EVO 1700 instrument. The experiment was conducted in a dynamic air atmosphere during heating in the range of $40\text{--}1000^\circ\text{C}$ with a heating rate of $10^\circ\text{C}/\text{min}$. The data were processed using Setaram Processing software.

All seven samples of five selected fabrics from brickyards had very similar kaolinite contents and other clay minerals. The proportion of kaolinite ranged from 7 to 12%. Clay minerals with illite accounted for 21–31% of the fabric. Thus, all the analysed samples can be considered usable for the production of ceramics, and we refer to them in this work as ‘brickmaking’ non-loess clays or non-loess clays ‘of a brickmaking quality’. Furthermore, fabric from the modern-era clay storage in the potter’s house in Telč was analysed, which in quality was equivalent to the brickmaking clays mentioned above. The content of clay minerals was roughly twice as high in two analysed loess clays from Horní Skrýchov (Jindřichův Hradec District) and Pilsen. As expected, fabric from Chřestovice (Písek District), composed of more than 50% kaolin, stood out strongly (Tab. 34; Všíanský 2020).

6.1.4 Properties of experimentally prepared ceramic fabrics with regard to the technique of forming and firing medieval pottery

The forming experiment targeted the technique of wheel coiling and the ways it differed from wheel-throwing, which is also reflected in the ideal composition of the ceramic fabric. Experiences from experimental production and the analysis of archaeological pottery finds show that the demands on clay

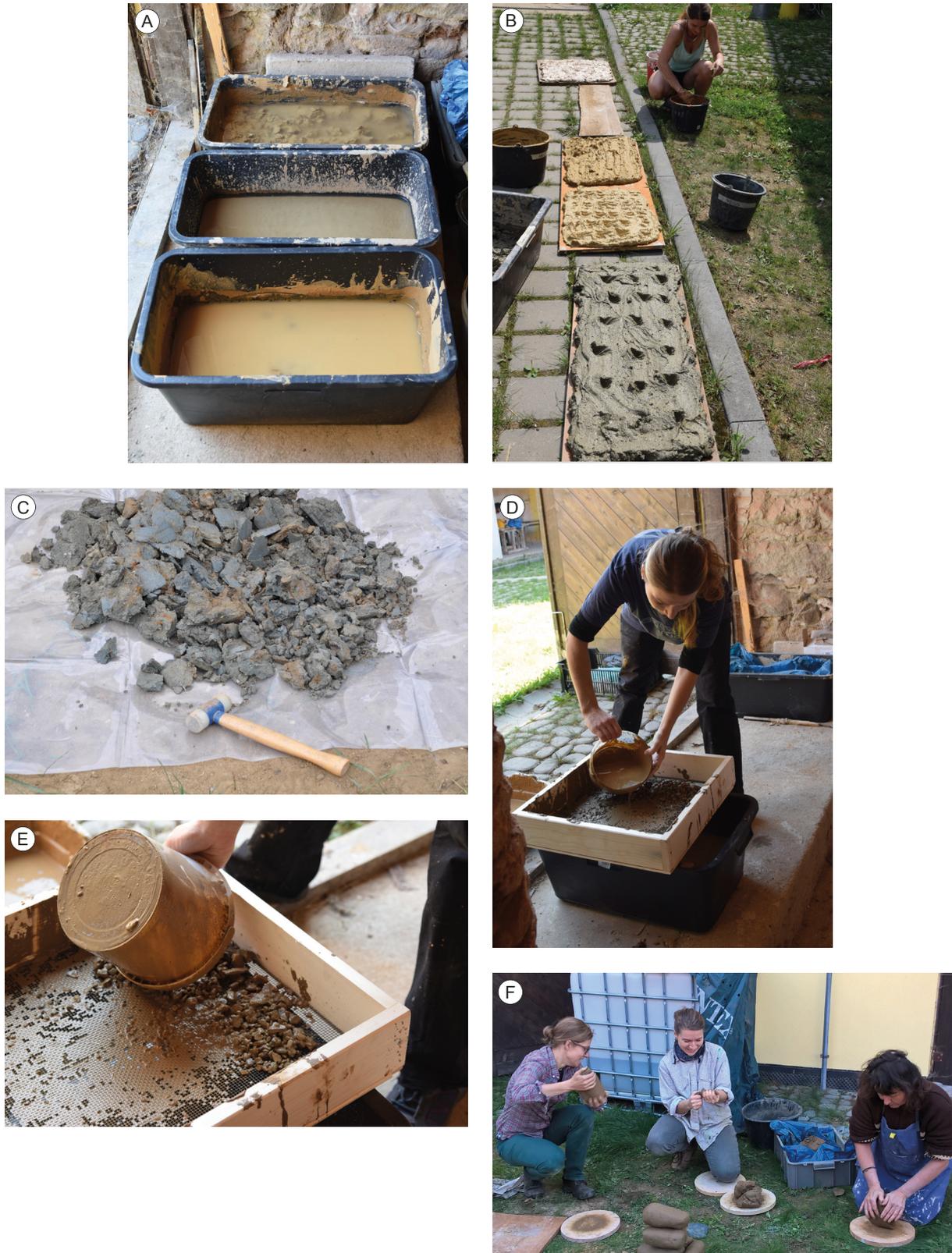


Fig. 136. Storage and processing of brickmaking clays: A – storage of clays in a moist state in plastic tubs; B – drying clays on wooden boards to the desired moisture content before processing; C – coarse crushing of clay for easier levigation; D – levigation to refine the material; E – detail of coarse impurities on the sieve during levigation; F – kneading the material into 'loaf' shapes on wooden boards. Photo by K. Těsnohlídková.

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