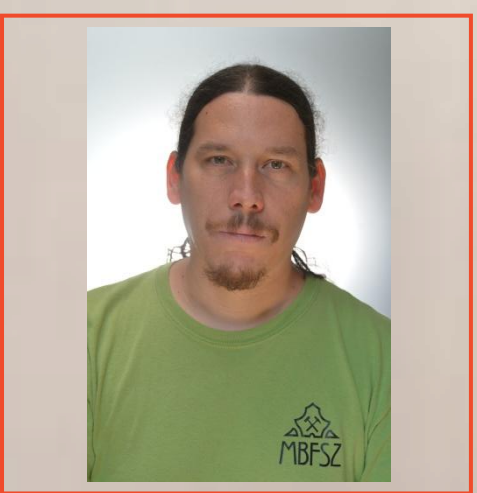


FROM GEOLOGICAL HERITAGE TO ARCHAEOMETRIC APPLICATION: POTENTIAL OF THE KALECSINSZKY HISTORICAL CLAY COLLECTION

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1. THE ROLE OF COMPARATIVE COLLECTIONS IN ARCHAEOMETRY (RAW MATERIAL STUDIES)

In the study of archaeological and historical **ceramics** one of the most important questions is the raw material: **what kind of clay** was used and whether it came from the vicinity of the site or was imported from somewhere else.

Comparing the material of the ceramics with potential raw materials (sampling, firing, thin section studies etc.) could answer these questions. However, in many cases, raw material samples cannot be collected near the archaeological site or exploitation sites known from written sources because the area has been built up or destroyed (e.g. by mining activities).

In such cases, existing **comparative raw material collections** are helpful. One such historical clay collection, covering a large area of the Carpathian Basin (and even partially extending beyond it), and its potential uses are presented here.

3. CASE STUDY: APPLICATION OF THE KCC SAMPLES IN WHITE CERAMIC RESEARCH

The appearance of the white pottery and red-on-white painted tableware was a distinctive development in the pottery traditions of Hungary in the 12th century. Whiteware soon became one of the most popular and widespread ceramic types in the Kingdom of Hungary, remaining in use until at least the 17th century. Identifying and tracing the spatial and chronological distribution of different whiteware types, however, is not possible without investigating their raw materials.

Based on petro-mineralogical and geochemical characteristics, **archaeological whiteware** samples could be classified into several groups. These groups show clear **analogies with light-coloured or light-firing clays** from various regions of the Carpathian Basin **represented in the KCC**. As an initial step, more than 200 light-coloured or light-firing clays from the KCC were selected for study. These samples were subjected to controlled firing (**Fig. 3**), and the thin section petrographic characteristics of the fired clays were compared with those of white ceramics dating from the Middle Ages (12th c.) to the Modern Period (19th c.). Through these analyses, we aim to refine the identification of raw material sources and thereby contribute to discussions of provenance and ceramic technological choices **[2]**.

At this early stage of research, based solely on petrographic observations, it is already possible to hypothesize that raw materials from major ethnographic pottery districts (e.g. Gömör/Gemer, Körösrév/Vadu Crisului) and smaller clay outcrops (e.g. Hollóháza in NE Hungary; **Fig. 3**) served as sources for Medieval to Early Modern Age whiteware.

Fig. 3. Sample No. 313 from the Kalecsinszky Clay Collection, from the locality of Hollóháza (Hungary). It illustrates a case in which a dark-coloured raw clay turns white upon firing. **a)**: grey raw clay, before firing; **b)**: white fired clay; **c-d)**: photomicrographs of the fired samples (c: PPL, d: XPL); **e-f)**: photomicrographs of a 13th c. whiteware from Tiszaeszlár-Basahalom (HNM 64.24.18.B.) for comparison representing the same fabric type of light-fired clay (e: PPL, f: XPL).

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2. THE KALECSINSZKY CLAY COLLECTION (KCC)

The so-called Kalecsinszky Clay Collection (KCC) was established at the turn of the 19th and 20th centuries in the former Hungarian Royal Geological Institute, by S. Kalecsinszky and his colleagues. The aim of the collection was to **compile the clay resources used in handicraft and industrial production** across the Carpathian Basin and to investigate their firing and refractory properties **[1]**.

In terms of **fire resistance** the clays were classified into **7 grades**, based on firing experiments: at a maximum firing temperature of 1000 °C to simulate pottery and brick firing; 1200 °C to simulate glaze firing; 1500 °C to simulate the highest firing temperature used in industry **[1]**.

The samples were stored in glass containers specially made for this purpose (**Fig. 1**): the raw clay samples were placed in the upper vessel and the experimental fired clay pyramids in the lower.



Fig. 1. A clay sample displayed in a special glass container in the "History of Collections" showcase of the permanent exhibition at SARA.

The catalogue of clay samples was published in several publications, gradually expanded and supplemented with maps and data till 1905 **[1]**. But the KCC itself – raw clay samples and their experimental pyramids – then expanded further, to nearly 1,000 pieces encompassing **all the larger and more important clay deposits** of the Carpathian Basin, as well as many smaller and less important ones, and a few comparative samples from outside the Carpathian Basin.

Despite the turbulent fate of the KCC in the 20th century – e.g. decades without proper curation, multiple moves, changes of ownership (transfer and return) –, a substantial portion of the original assemblage – more than 700 specimens – has been preserved and is accessible for study today in the Supervisory Authority for Regulatory Affairs (SARA, the legal successor of the Geological Institute). During the reevaluation of the KCC, the names of 419 sites were successfully identified with still existing settlements. From **353** of these **sites** we have one or more **studyable samples** (**Fig. 2**). This collection offers significant potential for research in ceramic archaeometry.

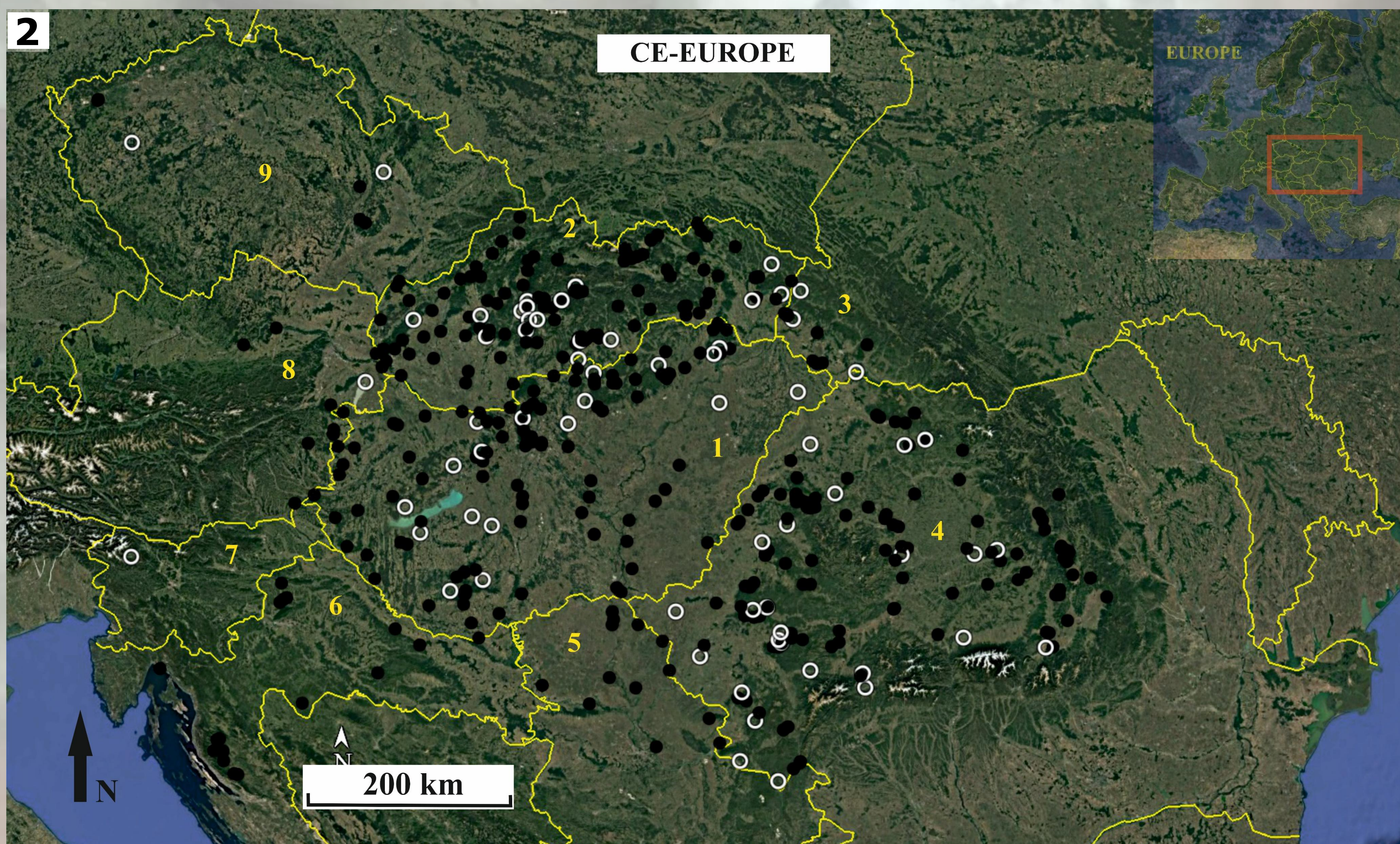
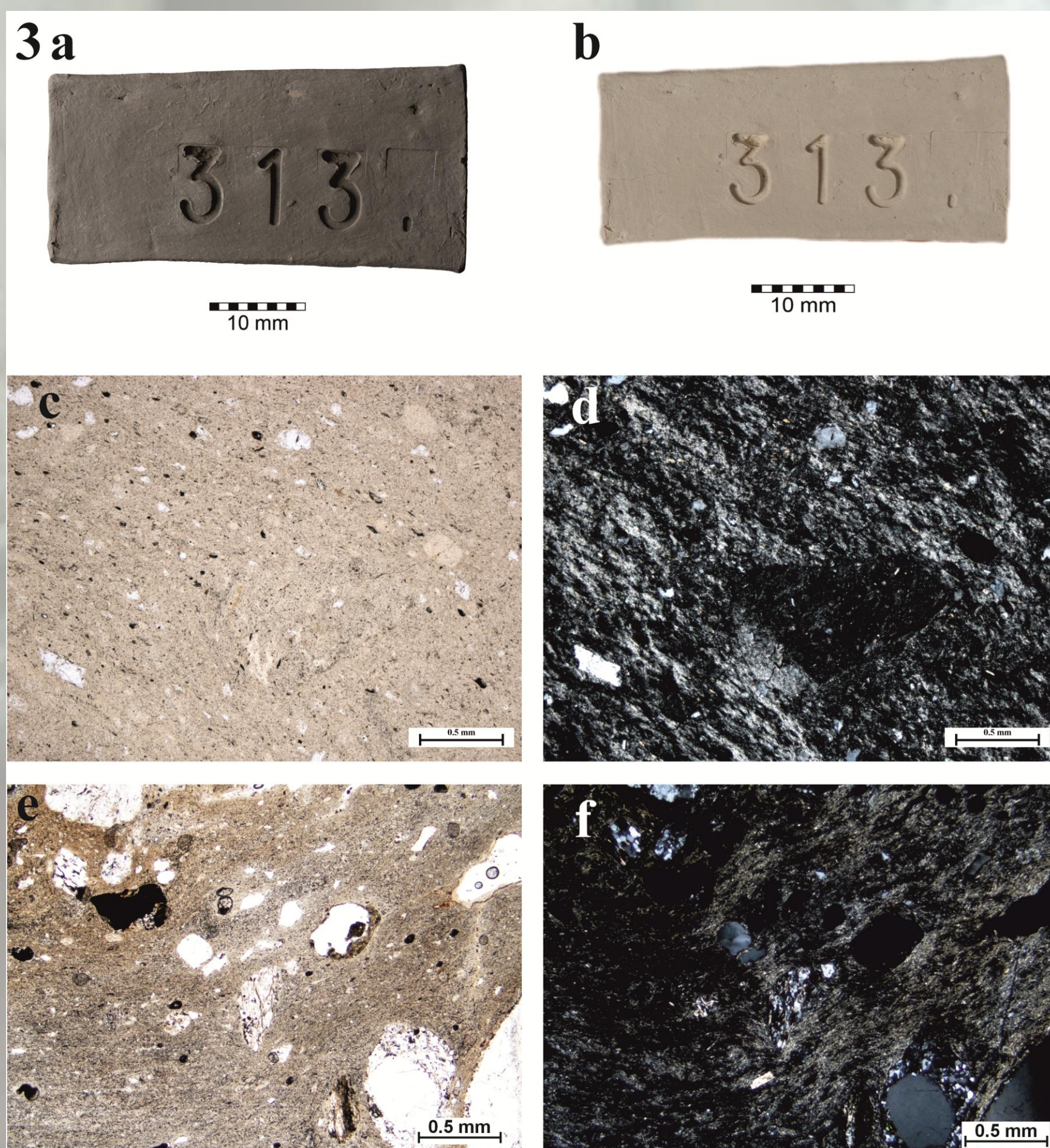


Fig. 2. Map of the Carpathian Basin and its surroundings (Central Eastern Europe). Filled circles: settlements with clay samples in 2026. Open circles: settlements included in the original catalogue (1905) for which no samples exist in 2026. Yellow numbers: 1. Hungary, 2. Slovakia, 3. Ukraine, 4. Romania, 5. Serbia, 6. Croatia, 7. Slovenia, 8. Austria, 9. Czech Republic. Base map: Google Earth.



4. TAKE-HOME MESSAGE

There is a continuous demand in ceramic studies for the systematic processing and use of clay databases, as these provide new and unique interpretative opportunities for understanding ceramic-making traditions. Our work demonstrates the research potential of analysing samples from historical collections such as the Kalecsinszky Clay Collection. By processing this collection using modern analytical techniques, we can establish a robust baseline data set on the composition of the most significant clay sources in the Carpathian Basin. This dataset would serve as a valuable reference for ceramic archaeometric research in the region. Through the application of modern mineralogical, petrographic, and chemical methods, combined with experimental firing, it is possible to **transform a historical clay collection into a modern, high-resolution provenance research database**.

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