Early Neolithic Pottery and its Environment in Hungary

Taubald, H. [1], T. Biró, K. [2]), Kasztovszky, Zs. [3]) and Balla, M. [4])

[1]) University of Tübingen, Germany, [2]) Hungarian National Museum, Budapest, [3]) Institute of Isotopes, Hungarian Academy of Sciences, Budapest, [4]) Technical University of Budapest

Introduction

Pottery is among the great invention of productive economies, as it contributed to storage, household and arts. Pyrotechnical innovations and their control (e.g. firing temperature) prepared the way to chemical and mineralogical alteration of a variety of raw materials resulting in specific material properties. The earliest phase of pottery use, during the Neolithic, is especially interesting.

The authors investigate the problem of pottery provenance and site endowments in the frame of a collaborative project in 2005 and 2006 between Tübingen University, Germany and the Hungarian National Museum, Budapest. More than eight Neolithic settlements, spread throughout Hungary, mainly from the earliest stages will be investigated by petrographical, mineralogical and geochemical methods (see Fig. 1). Here we present first results from five selected localities (highlighted in red in Fig. 1) and compare pottery and daub with soil samples collected by layers with hand drilling to a depth of 2 m in measures of 10 cm, as well as with potential clay deposits in the vicinity of the localities. The sites represent different geographical and geological environments as well as different cultural influence (e.g. Vörs, Starčevo culture (see Fig. 2), Szarvas-Endröd and others, Körös culture).

Around 100 petrographical thin sections and XRD samples for mineralogical characteristics were prepared and around 220 chemical XRF (University of Tübingen), PGAA (Institute of Isotopes, Budapest) and INAA (Technical University of Budapest) analyses of soil, daub and pottery samples have been performed, application of several other techniques is planned. In this poster preliminary results focus on geochemical data and their possible interpretations. The chemical analyses provided concentrations for eight major (SiO_2, Al_2O_3, TiO_2, Na_2O, K_2O, CaO, MgO, MnO, P_2O_5 and several trace elements (Cr, V, Ba, Rb, Sr, Ni, Ce, La, B, Sm, Nd, Zr, Zn, Hf, Y). Out of the variety of geochemical data in Fig. 3 - 9 we present those as diagrams that help to show both, significant similarities and major differences between pottery, daub and soil samples the best way possible. Most of these elements are regarded as geochemically immobile.

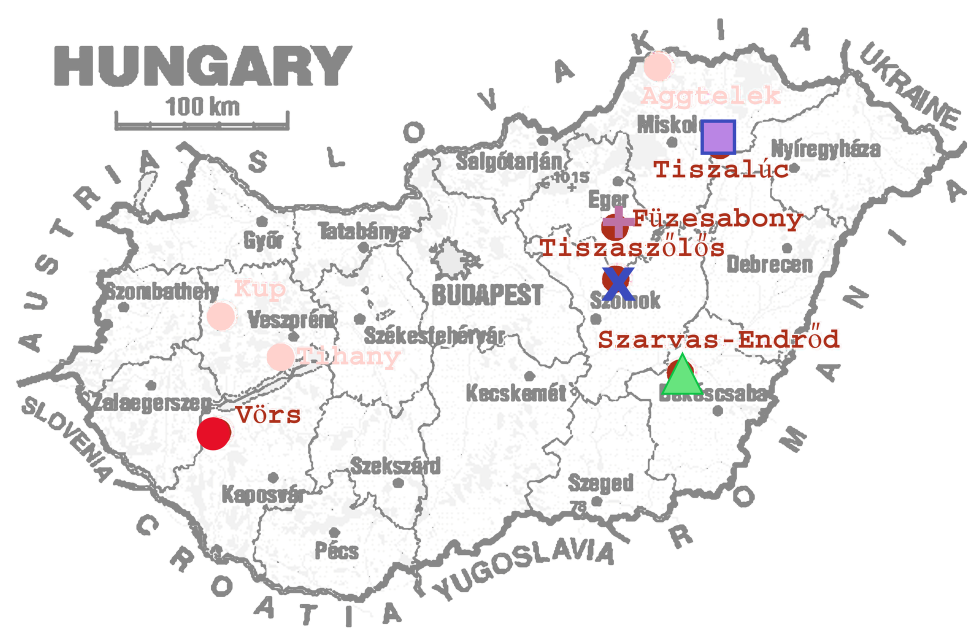


Fig. 1: Schematic map of Hungary showing the Neolithic localities investigated in the frame of the DAAD-MÖB project (red and pink). Samples from sites selected for this poster are marked in red. Data from other localities are in progress and/or will be sampled in summer 2006.

Fig. 2: Beautiful example of Neolith pottery from the Starčevo cultur from Vörs-Máriaasszonysziget

Pottery, daub and soil samples from Vörs, Szarvas-Endröd, Tiszaszőlős, Füzesabony and Tiszalúc

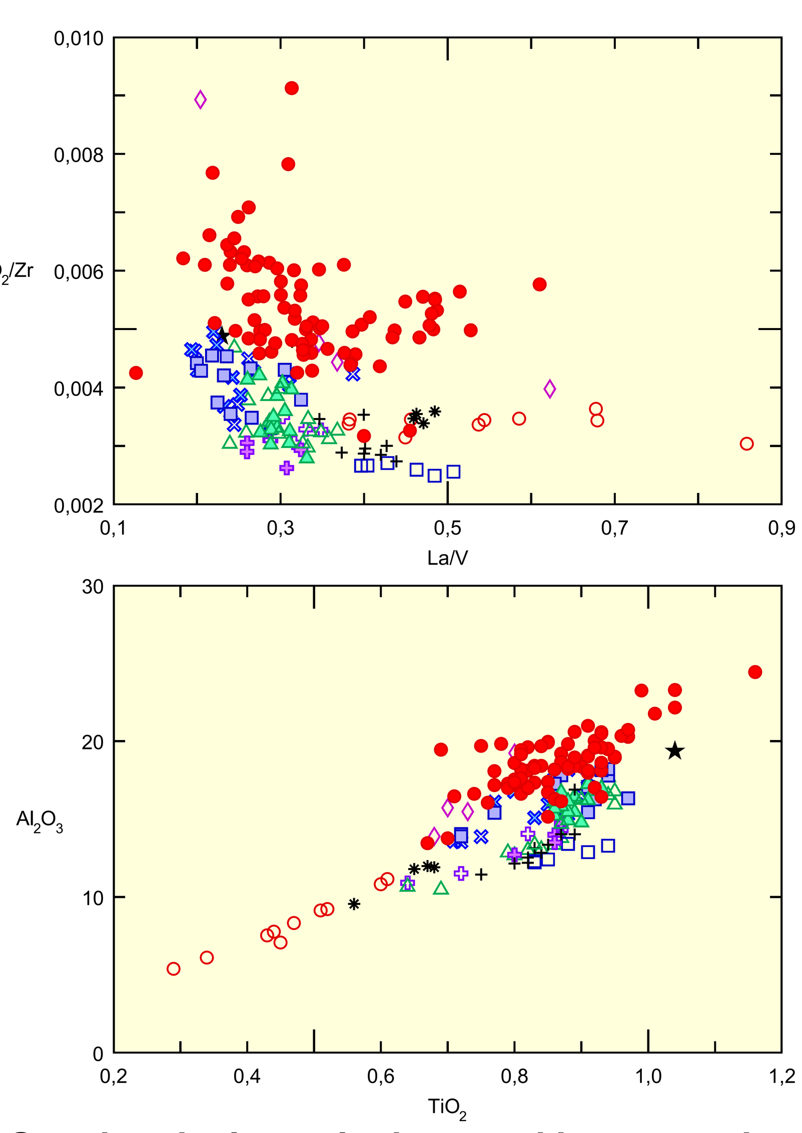


Fig. 3 - 4: Variation diagrams with Al, Ti, Zr, La and V (XRF data) to show heterogeneity and homogeneity at different localities.

Sample Identification:

- Batthyánpuszta clay mine
- Vörs soil
- Vörs pottery
- Tiszalúc pottery
- Tiszalúc soil
- Szarvas-Endröd pottery
- Szarvas-Endröd soil
- Füzesabonyp pottery
- Füzesabony soil
- Tiszaszőlős pottery
- Tiszaszőlős soil
- Szarvas-Endröd daub
- Vörs daub

Analytical error is always smaller than symbol size

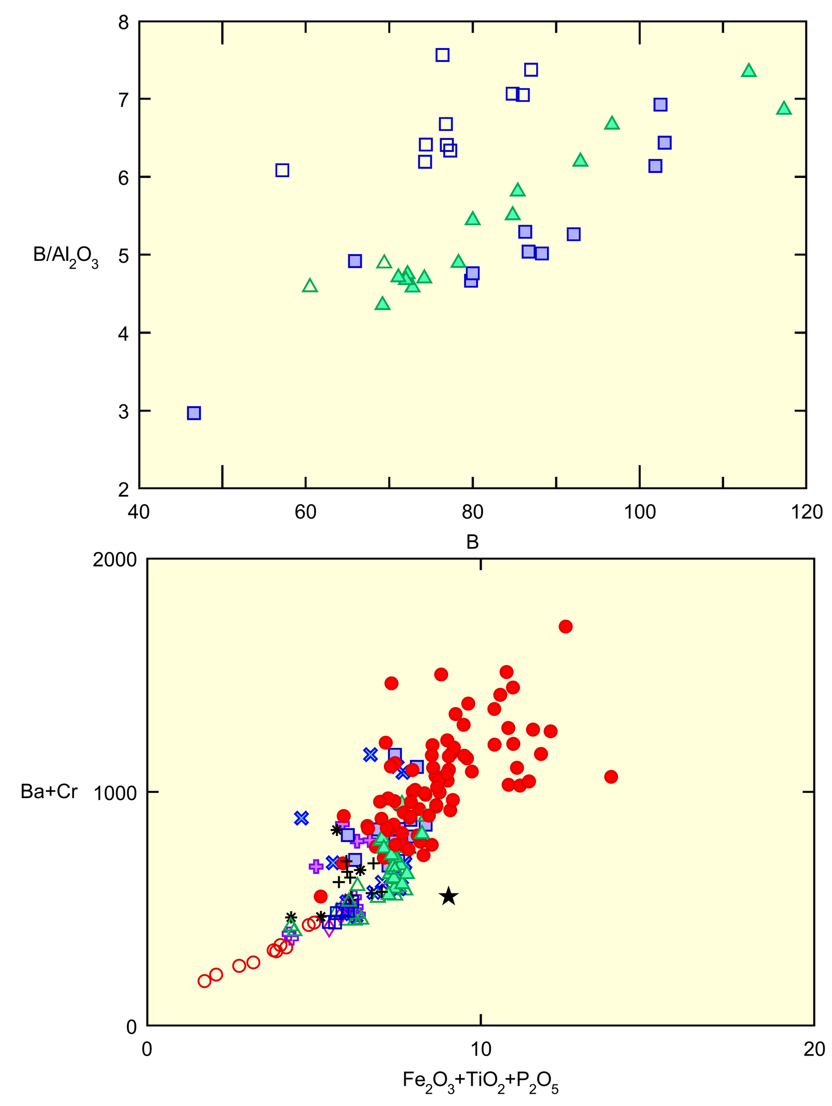


Fig. 5 - 6: Variation diagrams with Al, B, (PGAA data) and Ba, Cr, Fe, Ti and P (XRF data).

The data in the upper diagram show that B and Al help to distinguish between soil and pottery at Tiszalúc, whereas at Szarvar-Endröd soil and pottery are very similar. B is exclusively measured by PGAA, at the moment data from other sites are not available as analysis is in progress.

The lower diagram shows the enrichment of Ba, Cr, Fe, Ti and P in pottery samples compared to soil samples. This phenomenon applies for all localities and is thus a typical phenomenon for pottery investigated in the frame of this project. The reason for this has to be discussed.

Geochemical conclusions and interpretation:

- Soils of Vörs are more sandy and different from other localities to the East. However, a clay mine nearby (5km, Batthyánpuszta) is similar to Eastern clay sources and a possible source.
- Ceramics and daub from all localities (except Vörs) are relatively homogeneous, samples from Vörs are strongly heterogeneous (possibly due to different neolithic cultures of Vörs, see below).
- Vörs and Szarvas-Endröd: Pottery is different from soil, however, daub from both localities is very similar to soil. Pottery is always Al_2O_3 enriched, due to higher amount of clay minerals.
- Pottery of Vörs does not overlap with soil samples from Vörs (but with Batthyánpuszta), while ceramic of Szarvas-Endröd, Tiszaszőlős, Tiszalúc and Füzesabony plot very close to local sediments.
- **Pottery at Szarvas-Endröd, Tiszalúc, Tiszaszőlős and Füzesabony probably made of clay rich variation of soil from the same site, i.e. locally produced (due to better quality of soil?).**
- **Pottery at Vörs probably made with material from clay mine nearby, not from local sediment on site (too sandy variation).**
- **Daub always made from local sediment on site.**
- **Pottery always enriched in Ba, Cr, Fe, Ti and P compared to soil at all localities.**

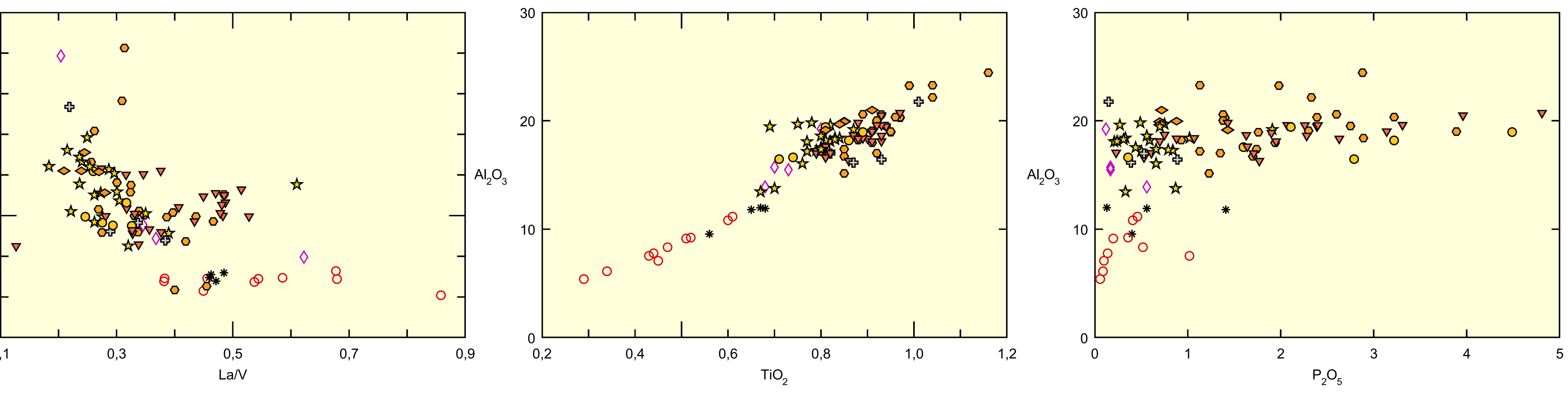


Fig. 7 - 9: Variation diagrams with Al, Ti, Zr, P and Cr, to show heterogeneity between different cultures at Vörs.

Sample Identification:

- Batthyánpuszta clay mine
- Vörs soil
- Vörs daub
- Pottery Keltic culture (0 - 400 BC)
- Pottery Kisapostag culture (1800 BC)
- Pottery Kostolac culture (2500 BC)
- Pottery Furchenstich culture (3800 BC)
- Pottery Lengyel culture (4500 BC)
- Pottery Starčevo culture (6000 BC)

Analytical error is always smaller than symbol size

ochemical conclusions and interpretation:

ifferent cultures from Vörs used different clay sources for pottery production. The nearby clay mine Batthyánpuszta is a possible source.
ome cultures produced pottery with homogeneous composition (Starčevo, Kisapostag, Furchenstich).
ome cultures produced pottery with heterogeneous and variable composition (Lengyel, Kostolac, Keltic).
lder cultures (e.g. Starčevo, Lengyel) added probably a significant amount of organic temper (leaves, etc.) which results in high concentrations of P.

Analytical Aspects

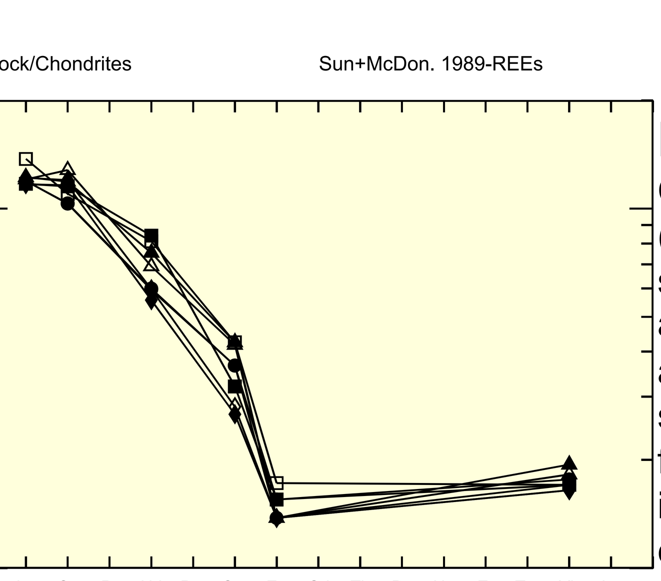


Fig. 10: Comparison of REE data (INAA data) from five samples between those fired at 700 °C (closed symbols) and raw material (open symbols) shows that the firing process does not influence element concentration significantly.

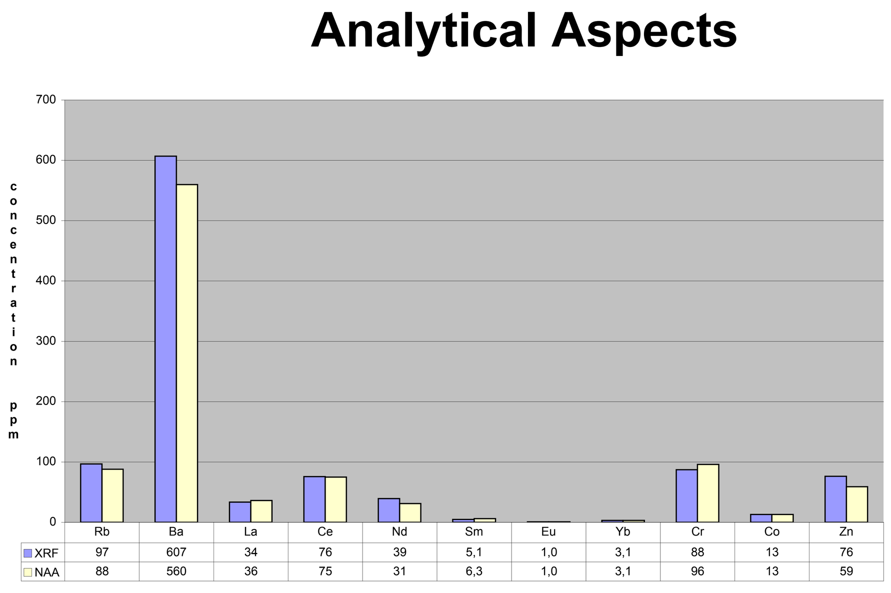
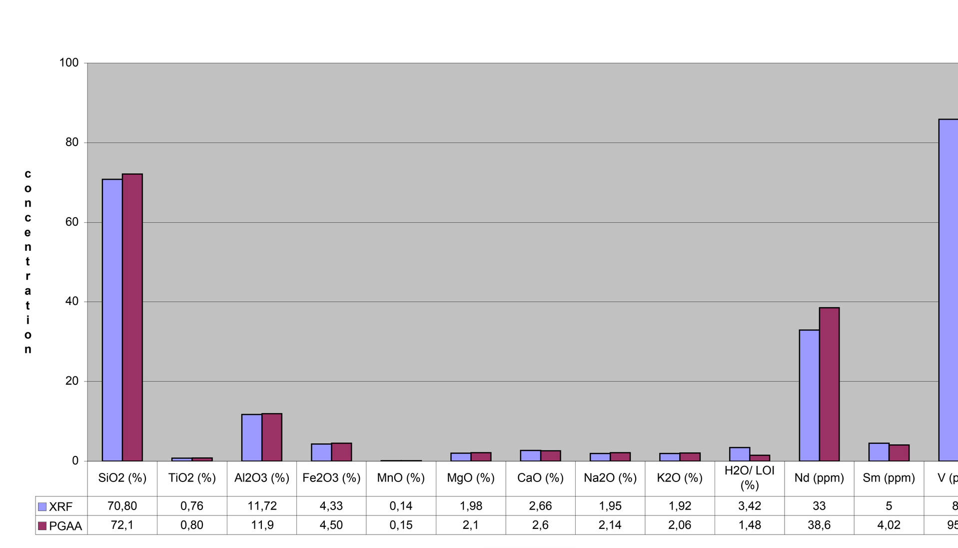


Fig. 11, 12: These two diagrams show the correlation between XRF and NAA analysis (left) and XRF and PGAA analysis (right) methods on pottery and soil samples and demonstrate the applicability of these three different principles.



Summary of geochemical data

reliminary results from geochemical data provide interesting new facts about pottery production and possible raw materials from a selection of neolithic excavation sites throughout Hungary. Both, sediments and pottery can easily be distinguishe y their geochemical composition. In places where the original soil was of good quality (mainly those in the East, Szarvas-Endröd, etc.) they used the clay rich variation of the local sediment, however, when the sediment was too sandy (e.g. Vör ney used different sources (e.g. clay mine Batthyánpuszta in the nearer surroundings). Different sources always resulted in a higher variability of chemical pottery composition. On the other hand, for daub always the local sediment was used as vas. Apart from this it can be seen, that pottery is always enriched in Ba, P, Ti, Cr and Fe compared to local sediments. The reason for this phenomenon has to be discussed. The strong heterogeneity within Vörs pottery samples is probably due ifferent cultures at this site. The variation can be explained by use of temper from older cultures and different clay sources from the nearer and farer surroundings. The application of three different analytical methods proved the qualification RF, INAA and PGAA for the analyses of ceramic samples and raw materials and brought interesting new element data (e.g. B from PGAA).