

PETRO-MINERALOGICAL AND GEOCHEMICAL CHARACTERIZATION OF MIDDLE NEOLITHIC BÜKK CULTURE FINE WARE (HUNGARY)

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'OLD-NEW' DAAD-MÖB PROJECT ON BÜKK FINE WARE

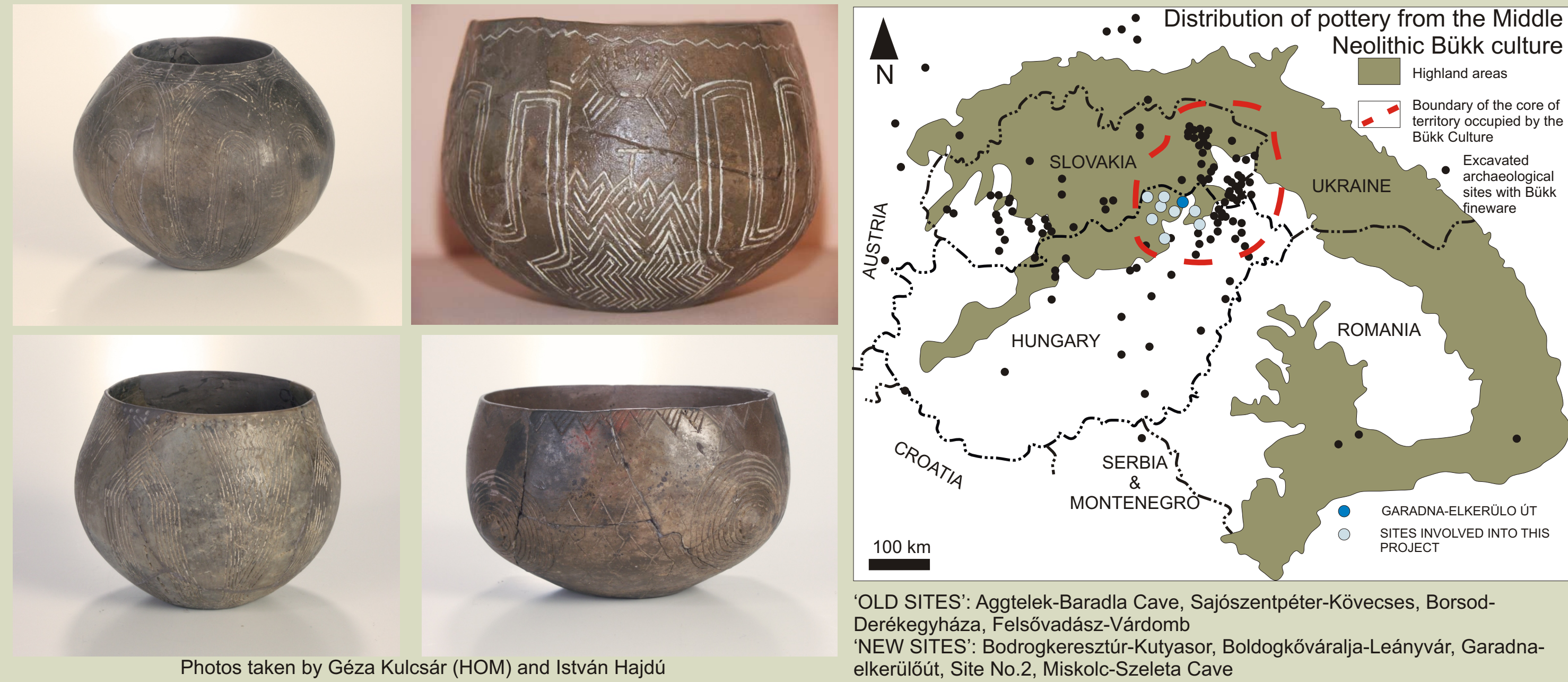
Based on the results of a previous (2005-2006) collaboration (<http://www.ace.hu/daad/daad2/>) the complex topic of the prehistoric long distance trade of ceramics is investigated (<http://www.ace.hu/daad/daad3/objectives.html>).

In our previous project, we focused on the investigation of Early Neolithic pottery, potential raw materials and the characterization of site specific features in different geographic environments of Hungary. Neolithic pottery manufacturing is found to be usually local activity, the potters utilized raw materials deriving from local or near sources. **Long distance trade of pottery** can be hypothesized only for some outstandingly high quality ceramics. A limited set of such fine ware was already investigated from the **Middle Neolithic Bükk Culture (c. 5000 B.C.)** (Szilágyi et al., 2008). According to the suppositions of archaeological arguments, the long distance trade of this special ceramic type seemed to be probable.

Detailed archaeometrical investigation may help to decide whether different occurrences of the Bükk fine ware with the same quality, shapes and decorations derived from the same raw material or it was the knowledge of the handicraftspersons that was adapted in another cultural region using the local raw materials. In order to answer these questions, Bükk fine ware is systematically examined with coarse pottery and comparative geological samples (local clay/soil) by each archaeological site. Applying a combination of petro-mineralogical and geochemical investigations (PM, μ -XRD, μ - and FT-Raman, μ -ATR-FTIR, μ -XRF, XRF), complex information on the material of the pottery (fabric, tempering, surface decoration) could be gained.

Aims of our project

- (1) to reconsider the distribution map of the Bükk Culture fine ware by scientific investigations and to understand better the civilization that produce these archaeological objects by the gained arguments.
- (2) to determine and gather those (chemical, physical, petro-mineralogical) characteristics which specifically describe the Bükk Culture fine ware using mainly non-destructive methods
- (3) to investigate the surface treatments and materials of the Bükk Culture fine ware



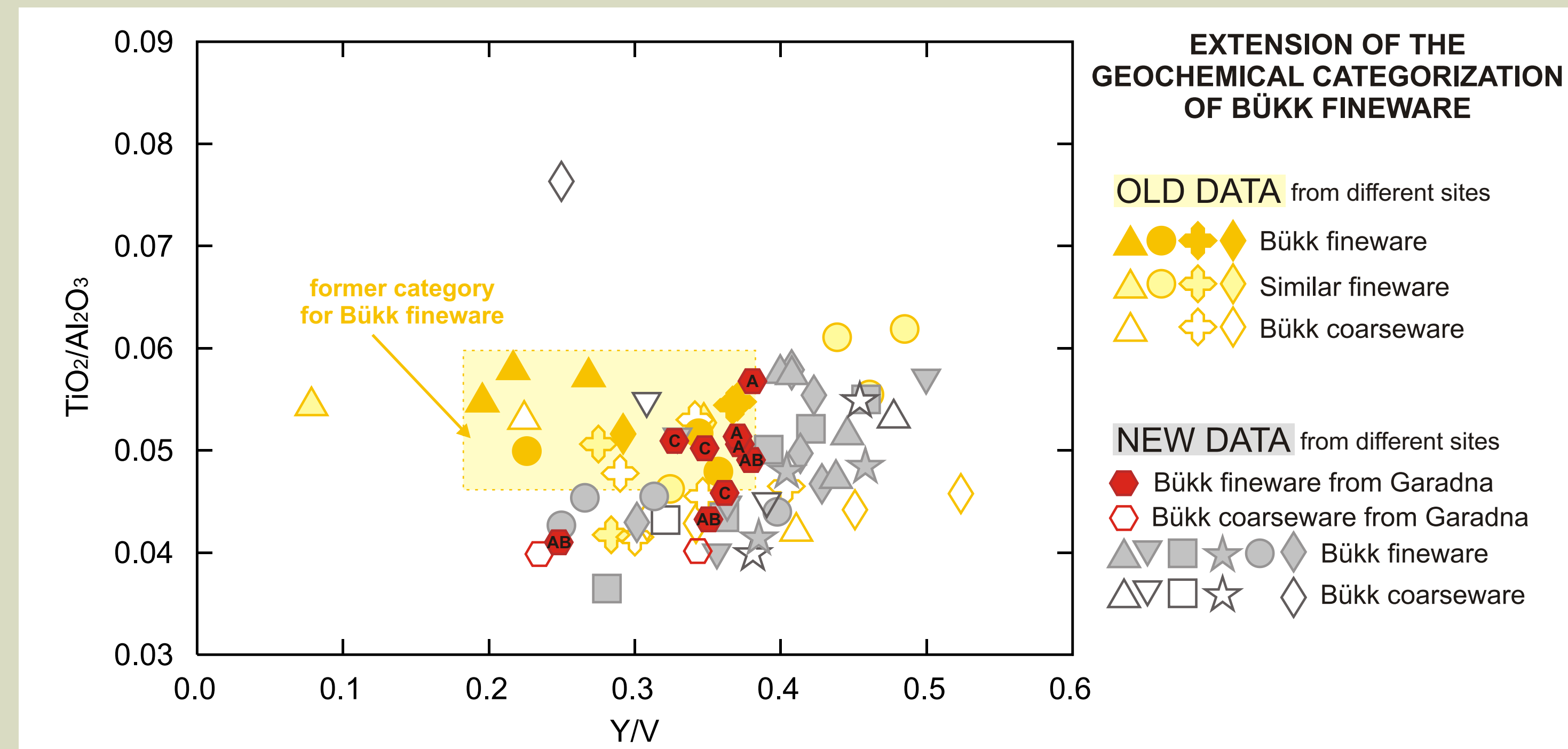
GARADNA - ELKERÜLŐ ÚT, SITE NO. 2: A LONG TIME HABITATION OF THE BÜKK CULTURE

As an ideal example for tracking of changes of the pottery manufacturing of the Bükk Culture in time, Garadna - elkerülő út, No. 2 site was selected to present our results. Garadna is situated in the valley of Hernád river, Northern Mountain Range, NE Hungary. The excavation, which was lead by P. Csengeri in 2003, extended to 2.000 m² on the top and slope of a slightly risen hill near to the river. According to the archaeological processing of the excavated finds, the settlement was inhabited from the earliest Bükk 'A' phase (or the latest Tiszadob Culture). Evidence of continuous settling comes from ceramic finds of the preclassical 'AB', the classical 'B' and the late 'C' phases. The most significant feature of the earliest phase's settlement is a large-sized pit complex. The later phases are associated with storing and refuse pits, hearths, kilns and 13 burials.

About half of the excavated 15.000 ceramic pieces of the Bükk Culture was fine ware with thin walls, incised and/or incrustated decoration, and polished surface.

NOTES ON THE CHRONOLOGY OF THE BÜKK CULTURE

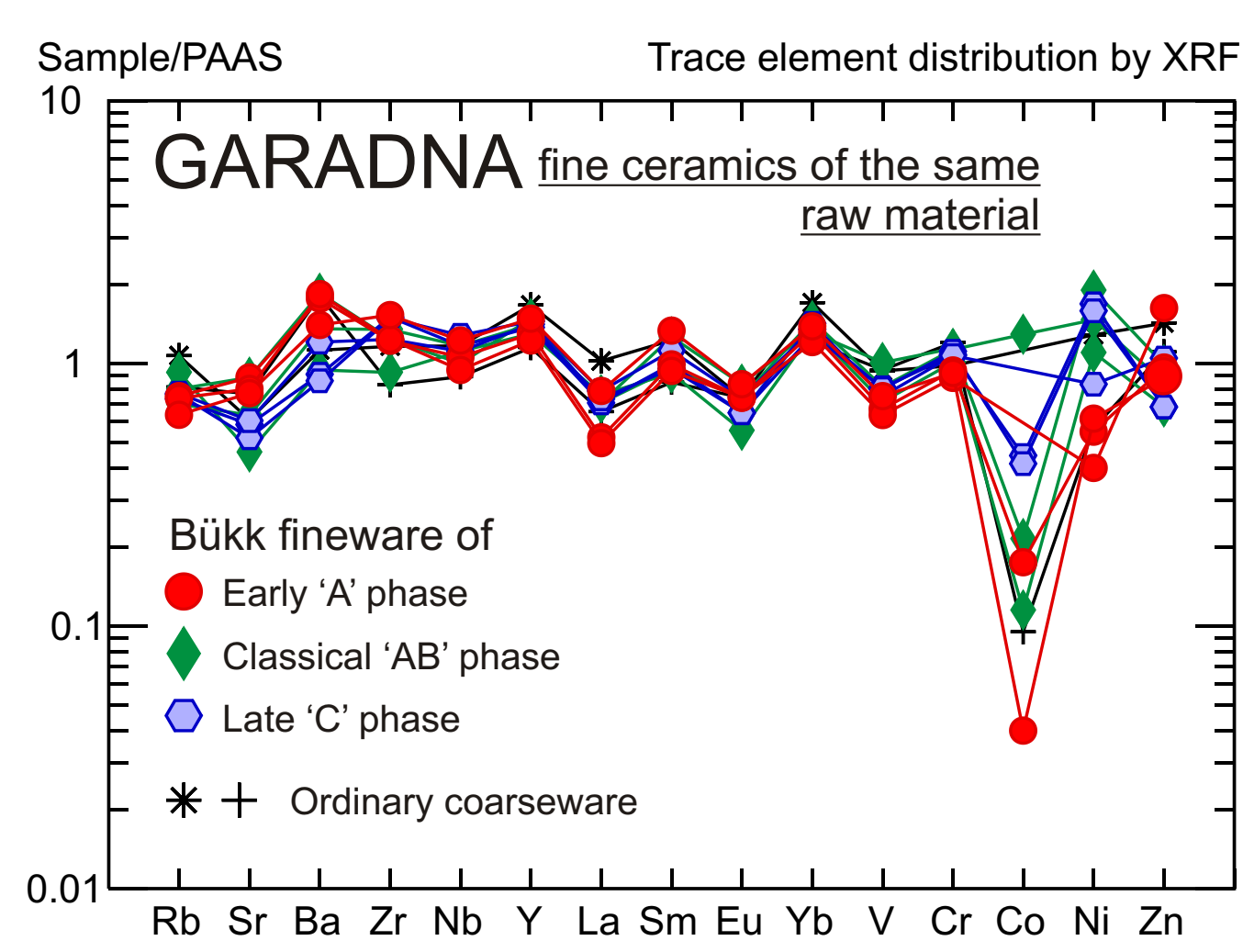
Internal chronology of the Bükk Culture has not been cleared up so far. Temporal divisions have been based on the changes of engraved motifs (Lichardus, 1974: Bükk 'A'-'AB'-'B'-'C' phases; Kalicz & Makkay, 1977: Bükk I-II-III phases; Siska, 1995). There are no radiocarbon dates for proving the coincidence of these 'ceramic phases' with time intervals.



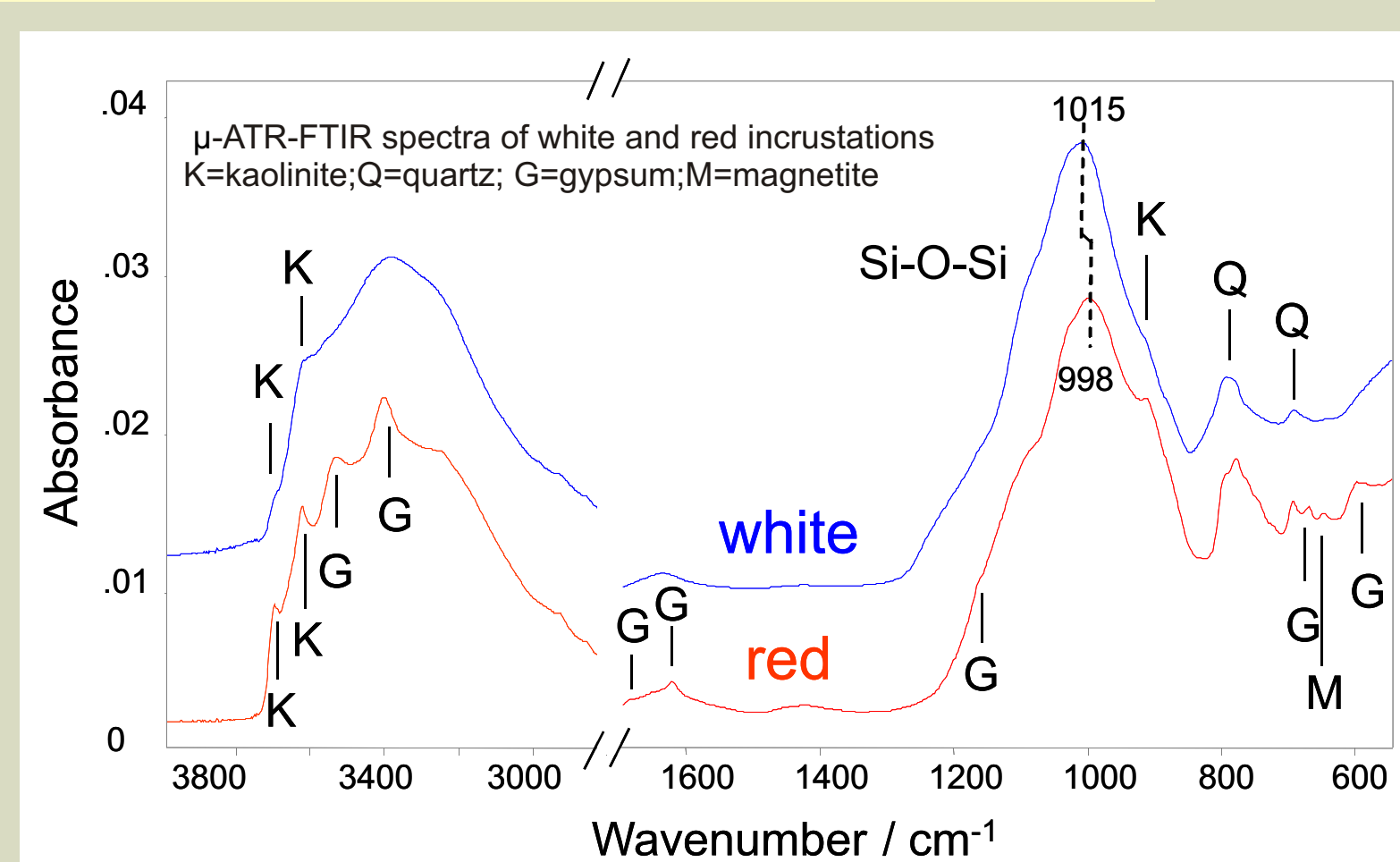
MINERALOGY OF INCRUSTS

For both white and red incrustations, the recorded μ -ATR-FTIR spectra resemble typical spectra of clays. The OH stretching bands of interlayer and inner O-H group at 3700 and 3620 cm⁻¹, respectively and the shoulder at 915 cm⁻¹ (due to Al-OH bending) reveal that the type of clay is disordered kaolinite. The absence of a well-structured layered aluminosilicate is reinforced also by XRD and Raman studies. It suggests (re)firing of the incrustated pottery >500-600°C.

In the μ -ATR-FTIR spectra of red incrustation, kaolinite, quartz and traces of gypsum were identified. The band at 647 cm⁻¹ belongs to magnetite (Fe₃O₄), usually present in natural hematite. The relative intensity of OH stretching bands and the shift of the main Si-O-Si band towards lower wavenumbers suggest a lower firing temperature compared to white-incrustated pots.



SAMPLE	NON-DESTRUCTIVE METHODS	QUASI-DESTRUCTIVE (2-3 µg)
WHITE INCRUST. (ph. 'AB')	μ -XRD: amorph. μ -Raman/FT-Raman: amorph. carbon μ -XRF: Fe, Ca, Si, K	clay mineral (disordered kaolinite)
RED INCRUST. (ph. 'C')	μ -XRD: amorph. μ -Raman/FT-Raman: amorph. carbon μ -XRF: Fe, Ca, Ti, K	clay mineral (disordered kaolinite), magnetite



CONCLUSIONS

Former and new **petrographic data** clearly indicate that raw materials of similar and relatively delimited physical properties were applied to manufacture Bükk fineware in different sites. This fact proves that Bükk Culture potters acted on a **special technological trick** when selecting raw material for manufacturing their unique fineware.

However, our former geochemical conclusion, that a certain chemical composition (between tight limits) for Bükk fineware can be outlined, has changed. Getting more data in our database, it has to be stated that **more diverse chemical composition characterizes this special ceramic type**. Question of raw material sources and possible workshops can be better understood after the detailed investigation of sediments from the newly involved sites.

In the case of Garadna, Bükk fineware of consecutive chronological phases shows strong similarities both petrographically and geochemically. As they are geochemically similar to the coarseware, it is very probable that they were made from local raw material.

EARLY PHASE



Engraved linear and wavy pattern with white incrustation

Motifs show connection to the earlier Tiszadob Culture's decoration

(PRE)CLASSICAL PHASE



Dense engraving with white incrustation (zigzag and arched pattern)

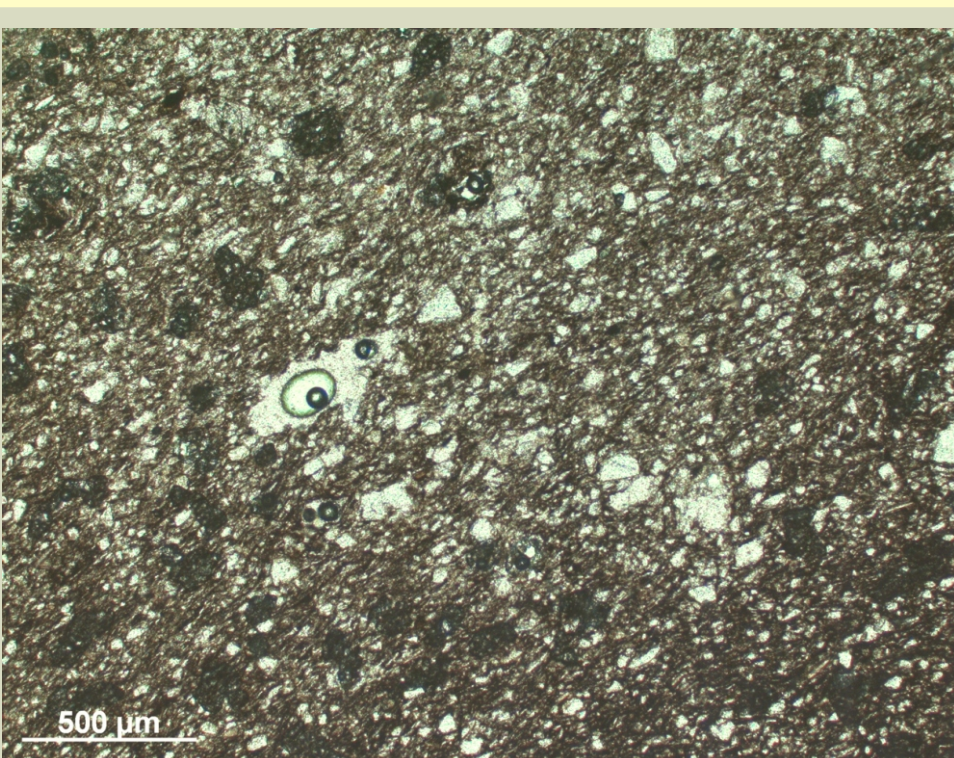
More dense decoration with common arched motifs

LATE PHASE



Very dense engraving with yellow-red incrustation

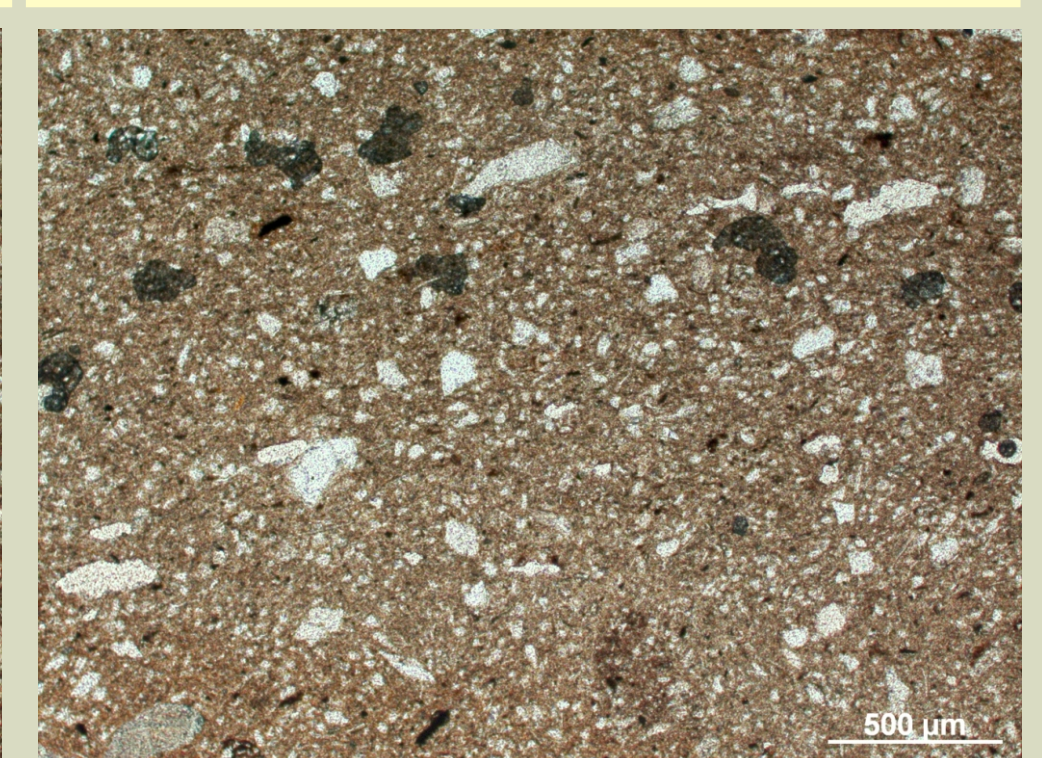
Refined decoration of dense-filigree lines and plain sectors



serial, fine-grained (fine silt) fabric
 metamorphic derived aplastic (Qtz, Ms)
 very dense, not too plastic/pure



weakly hiatal, fine-grained (fine-coarse silt) fabric
 metamorphic and volcanic derived aplastic (Qtz, Ms -- Pl, Opx, volcanic lithofr., glass shard)
 very dense, not too plastic/pure



hiatal, less fine-grained (coarse silt) fabric
 metamorphic derived aplastic (Qtz, Ms)
 very dense, not too plastic/pure

PETROGRAPHY AND GEOCHEMISTRY OF FINE CERAMICS

Although Bükk fine ware was made from fine-grained, very dense and not very plastic raw material - which was probably washed for getting such a paste - in the subsequent phases of the Bükk Culture, some differences can be outlined.

Finer-grained raw materials were used in the earlier periods: silt of metamorphic origin in the latest Tiszadob Culture (~ early 'A' phase) and later on, during the preclassical period ('AB' phase) similarly fine raw materials were applied but with two kinds of origin, volcanic (local) and metamorphic ones. In the latest ('C') phase the utilized fine sediment became coarser-grained and more homogeneous of metamorphic origin.

Opposed to previous suggestions (Szilágyi et al., 2008), samples of Bükk fine ware from Garadna site have more variable chemical composition. It means that it is not possible to determine one distinct source of the applied raw material for all vessels from different sites. It is more probable that they were manufactured from different raw materials.

Concerning only fine ceramic from Garadna, investigation of samples of metamorphic derived aplatrics indicated strong similarities to coarse pottery and to each other (regardless of the different chronological phases of Bükk Culture) in trace element composition.