# Analysis of incrusted pottery from Vörs, southwest Hungary

K. GHERDÁN[1] ▮ K. T. BIRÓ[2] ▮ GY. SZAKMÁNY[1] ▮ M. TÓTH[3] ▮ K. G. SÓLYMOS[1]

**ABSTRACT** Incrustation is a specific pottery decoration technique used by several regional cultural groups in prehistory. The clay surface is incised to form a pattern and the coloured (typically, white) substance is pressed into the resulting lines. After burning, incrustation stays stable on the pottery and gives a very decorative type of ornamentation. Investigations were carried out on samples from the Late Copper Age, Kostolac culture and from the Early Bronze Age, Kisapostag culture from a multi-period habitation site, Vörs-Máriaasszony sziget, southwest Hungary. The investigations showed that in some cases the material used for the decoration of the ceramics has high phosphorus and calcium content. It was suggested that this material was made of bone. In this study attempts were made to prove this hypothesis and to identify the incrustation material of the remaining samples. X-ray diffraction analysis and SEM accompanied by electron microprobe analysis were used to achieve this goal. Petrographic analysis of the samples was used to examine the composition of the tempering material. It was found that temper fragments are mineral grains (monocrystalline quartz, feldspars, opaque minerals and accessories), rock fragments (argillaceous rock fragments, in one case volcanic rock fragments and in another case micritic limestone), clay pellets and grog fragments. Hiatal fabric and the presence of grog indicate deliberate tempering.

## 1. Introduction

Vörs is a village very rich in archaeological sites, located in southwest Hungary, southwest of Lake Balaton in the marshland of the Little Balaton (Fig. 1). Its archaeological investigation included generations of archaeologist. It was seemingly very popular for human inhabitation in all periods starting from the Early Neolithic. The site Máriaasszony-sziget was excavated in frames of the reconstruction project of the water protection system of Lake Balaton in the early nineties. The work was continued on the strength of the Early Neolithic material (Kalicz et al., 1998), and resulted evidence from several archaeological periods (Kalicz et al., 2002): Starčevo culture, Early Copper Age Lengyel III. culture, Middle Copper Age Balaton-Lasinja culture, Late Copper Age Kostolac culture, Early Bronze Age Kisapostag culture, Late Celtic and (Early-) Roman period, Early Mediaeval Árpád-dynasty period (Fig. 2).The samples investigated for the present study were decorated by incrustation. More or less deeply incised-imprinted patterns are deepened into the surface of the vessel and filled with, typically, white, colouring material (Fig. 3/a, b). This technique is used in several prehistoric cultures.

Former investigations by micro-pixe found differences in elemental composition of incrusted samples from various localities and cultures (Sziki et al., 2002).

The question was, what do we exactly see by PIXE?

FIG. 1 – Map of the region

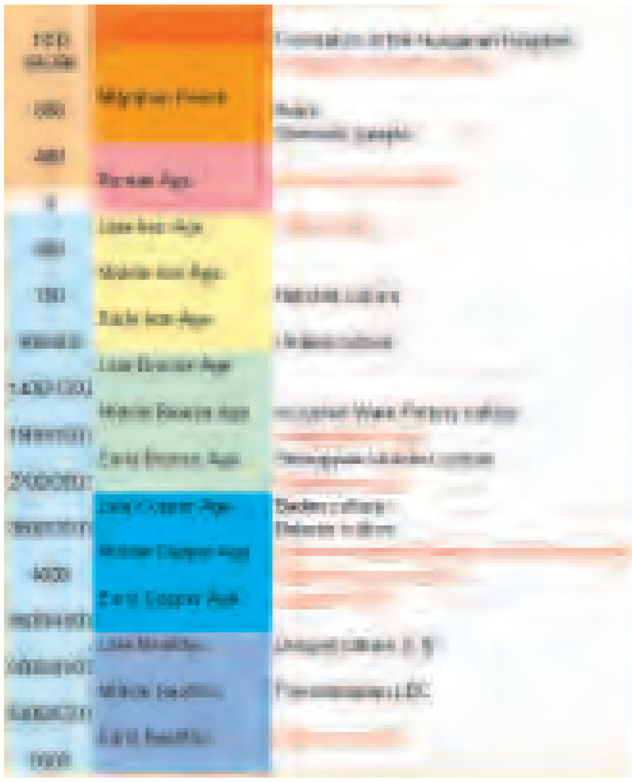

FIG. 2 – Chronological table of Transdanubian cultures (the periods found at Vörs-Máriaasszonysziget marked red).

FIG. 3A – Small drinking cups decorated with incrustation, Vörs, Kisapostag culture.

FIG. 3B – The incrustation material.

## 2. Analytical methods

For studying the tempering material and the texture of the potteries petrographic analysis was used. This was coupled by X-ray diffraction analysis and electron microprobe analysis in order to identify the incrustation material and see the homogeneity of it.

## 3. Results

### *3.1. Petrography*

Petrographic analysis of the samples was used to examine the composition of the tempering material and the texture of the ceramics. Textural analysis included the examination of fabric (hiatal, serial), grain-size distribution, measurement of average and maximum grain-size, as well as the description of the roundness and sphericity of the grains.

Textural analysis showed that the fabric of all the examined ceramics is hiatal, the sorting of tempering fragments is fair or poor. Grain-size distribution can be characterized by two or three maxima.

There are four main types of temper fragments: *mineral grains, rock fragments, grog,* and in one case *clay pellets*.

*Mineral grains* are usually smaller than 250 μm and include quartz (mono- and polycrystalline), feldspars (both potassium feldspars and plagioclase), mica (muscovite), opaque minerals and accessories (epidote, garnet). Quartz grains are mainly low sphericity, angular, with some exceptions of high sphericity, subrounded, rounded fragments.

*Rock fragments* include argillaceous rock fragments, in one case (V5) volcanic rock fragments and in another case (V3) micritic limestone. Argillaceous rock fragments in most cases have equant or prolate shape, with a size of 500-1500 μm. Polycrystalline quartz fragments are mainly low sphericity, angular or subrounded, with a size of 200-300 μm. Volcanic rock fragments are high sphericity, well rounded grains, with a size of about 300 μm. Micritic limestone fragments are low sphericity, well rounded grains, with a diameter of 300–400 or 1500 μm. There are no signs — visible by the polarizing microscope — of alteration on the surface of these grains.

*Grog* is also present in the examined ceramics. Grog fragments are mostly equant or prolate in shape, have low birefringence and various size, between 500 and 2300 μm.

*Clay pellets* are low or high sphericity, well rounded grains, with a size of about 500 μm.

### *3.2 Electron microprobe analysis*

The white incrustation material of samples V2, V3 and V4 coupled by the white coating on the internal surface of sample V5 was removed from the ceramics and analysed by the electron microprobe. In case of samples V2, V3 and V4 the analysis revealed phosphorus, and calcium content, while in case of sample V5 only calcium was detected (Fig. 4/a, b). The composition of the samples in contrast to the observations of Sziki et al. (2002) did not prove to be heterogeneous.

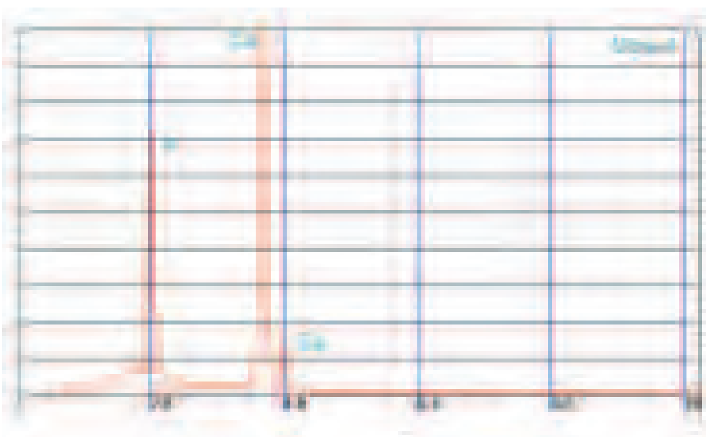

FIG. 4A – Chemical composition of the incrustation material of sample V4.

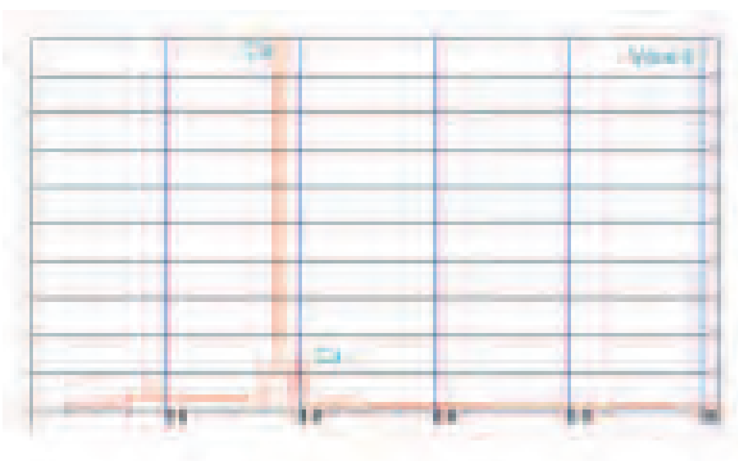

FIG. 4B – Chemical composition of the white coating on sample V5.

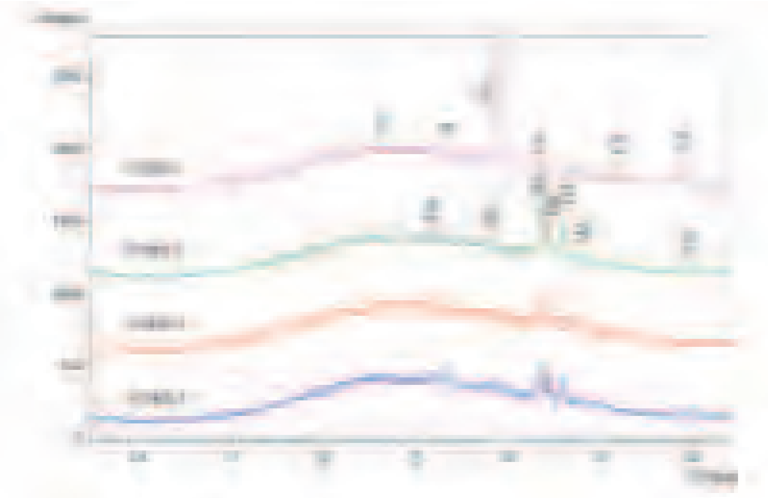

FIG. 5 – XRPD spectra of the investigated samples (V2, V3, V4, V5).

*3.3. X-ray diffraction analysis*

The incrustation material from the incised ceramics V2, V3 and V4, and the white coating on the internal surface of sample V5, was removed gently and subjected to X-ray diffraction analysis. The results can be seen on Fig. 5. In case of samples V2, V3 and V4 the examined material proved to be hydroxyapatite (Ha), while the internal coating on sample V5 was identified as calcite (Ca). These results are in good agreement with electron microprobe analysis.

## 4. Conclusions

The incrustation material of both Late Copper Age (Kostolac culture) and Early Bronze Age (Kisapostag culture) ceramics — in which high calcium and phosphorus content was detected by micro-pixe by Sziki et al. (2002) — proved to be hydroxyapatite. This fact suggests that the examined material was made of bone. Petrographic analysis showed that even when micritic limestone was used as tempering material the incrustation was hydroxyapatite.

The coating on the internal surface found on one Late Copper Age sample was identified as calcite.

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## NOTES

[1] Department of Petrology and Geochemistry, Eötvös Loránd University, Budapest Pázmány P. stny. 1/C, H–1117, Hungary, gherdankata@hotmail.com

[2] Hungarian National Museum, Budapest Múzeum krt. 14–16, H–1088, Hungary, tbk@ace.hu

[3] Research Center for Earth Sciences, Budapest Budaörsi út 45, H–1112, Hungary, totyi@geochem.hu

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