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REPORT ON RESULTS OF ARCHAEOMETRIC ANALYSIS OF TWO SAMPLES FOUND IN NOVAE

Abstract: Laboratory-based archaeometric analysis was carried out on two fragments of Gothic ceramic vessels recovered from an archaeological complex in Novae. The analytical methods employed encompassed: chemical analysis by wavelength-dispersive X-ray fluorescence (WD-XRF), MGR-analysis (Matrix Group by Refiring) and thin-section studies using a polarising microscope. Both of the analysed ceramic fragments were made from different ceramic bodies and differ markedly from the previously analysed Gothic pottery from Novae.

Keywords: Gothic pottery, Novae, WD-XRF, MGR-analysis, thin-section studies

Laboratory archaeometric analysis was carried out on two fragments of Gothic ceramic vessels recovered from an archaeological complex in Novae. Analysis was performed in order to determine whether these ceramics are homogeneous or non-homogeneous in terms of the raw materials used to make them (both clay and non-plastic components), and also to ascertain to what degree it is possible to establish their provenance. With these goals in mind, the analytical methods employed encompassed: chemical analysis by wavelength-dispersive X-ray fluorescence (WD-XRF), MGR-analysis (Matrix Group by Refiring) and thin-section studies using a polarising microscope.[1]

Analysed samples are shown in Fig. 1: numbers with the prefix MD denote entry numbers in the Schneider/Daszkiewicz database, and these are the only numbers used to identify samples throughout this report (MD7131 = sample 282; MD7132 = sample 344/324).

One of the ceramic fragments (MD7131) came from a below-the-rim sherd with handle. When taking samples for analysis from this sherd we had to bear in mind that the handle is often made from a raw material that differs to a greater or lesser degree from that used for the body of a vessel. It was for this reason that samples for chemical analysis, thin-section and MGR-analysis were taken from the vessel wall (MD7131). An additional sample (MD7131h) was taken from the handle and subjected to abridged MGR-analysis, i.e. refiring at 1200^{o}C only.

[1] For a description of methodology, see Daszkiewicz 2014; Daszkiewicz, Schneider 2021. Detailed descriptions of individual analytical procedures can be found in the appendix of Daszkiewicz, Schneider 2021 and in Daszkiewicz, Maritan 2017.

Fig. 1. Analysed samples (compiled by M. Daszkiewicz, H. Baranowska)

Results of analysis

The results of MGR-analysis showed that both the handle and the body of the vessel MD7131 were made from the same ceramic body [Fig. 2].

Sample MD7132 differs significantly in thermal behaviour from both of the samples taken from the sherd with handle (MD7131 and MD7131h). It has a very different matrix type (the surface of the sample is over-melted) and also takes on a different brownish shade after refirng at 1200°C [Fig. 2]. This means that these two vessels were made from different plastic raw materials.

Only the number, size and sorting of non-plastic particles was estimated during macroscopic examination of the fabric structure. The field of vision during this assessment was the surface of each specimen removed for MGR-analysis and refired at 1100°C (macroscopic analysis error is reduced when temper particles are described based on optical examination of the flat surface of a refired specimen). Macroscopic analysis revealed that each of these samples represents a different clastic material group [Fig. 3]. Studies of thin sections in a polarising microscope fully confirmed the macroscopic observations. Microphotographs of typical images of thin sections are shown in Figs. 4 and 5. Grains of quartz are clearly prevalent among the non-plastic particles in both samples, but these sherds differ from each other in the grain size of the fine quartz.

The results of chemical analysis by WD-XRF are presented in Table 1. These two samples are similar to each other in chemical composition but not identical. They both have a typically high silica content due to the very large quantity of fine grains of quartz seen both in thin sections and macroscopically. But the silica module is different, as is the correlation of Si content to Zr content.

The chemical composition of both samples attributes them to earlier analysed, non-calcareous, iron-rich pottery from Novae. But multivariate attribution is reasonable only for sample MD7132, which belongs to a group that includes legionary ware but also three clay samples and two samples of kiln walls from Novae [Fig. 6].

Both of the analysed ceramic fragments discussed in this report differ markedly from the previously analysed Gothic pottery from Novae.

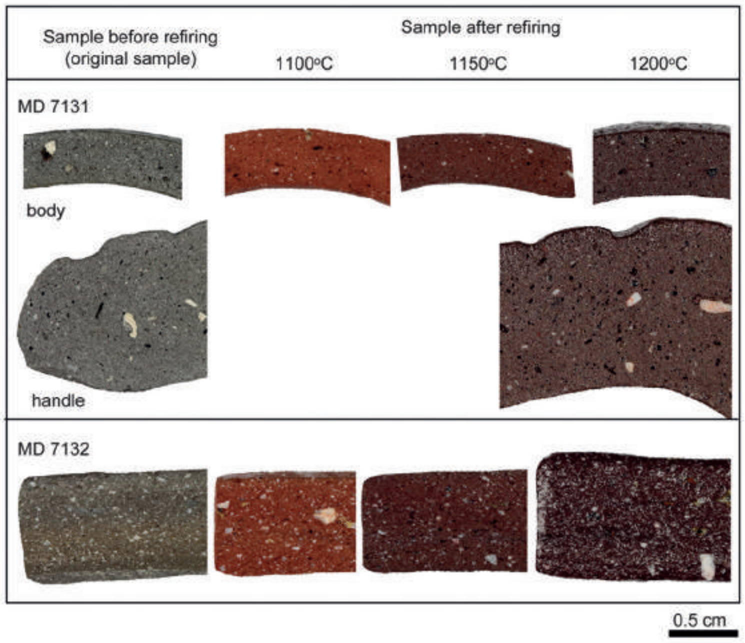

Fig. 2. Results of MGR-analysis
(compiled by M. Daszkiewicz, H. Baranowska)

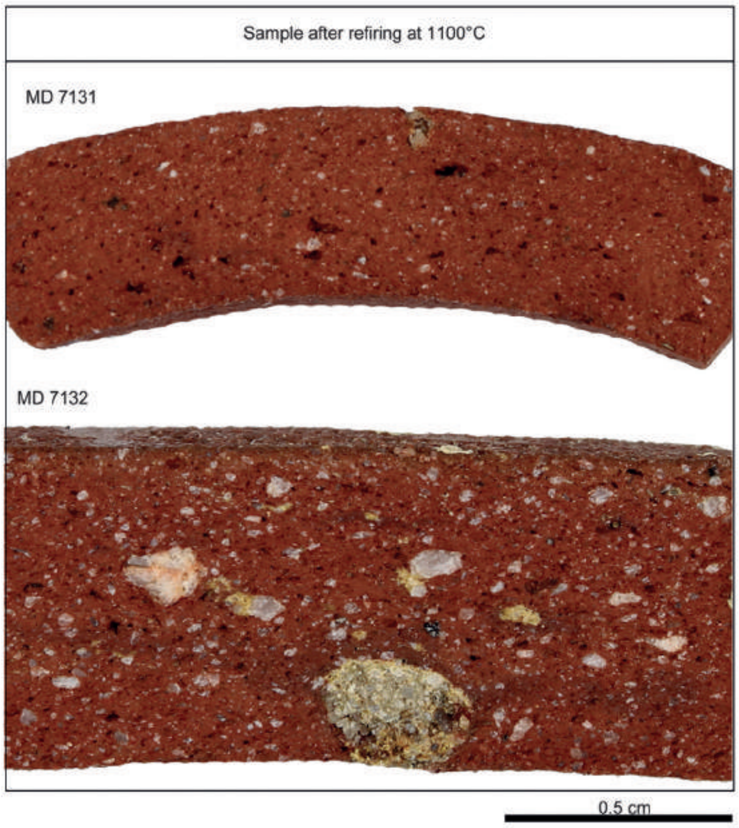

Fig. 3. Samples after refiring at 1100°C seen at 10× magnification.
Macroscopic analysis revealed that each of these samples
represents a different clastic material group
(compiled by M. Daszkiewicz, H. Baranowska)

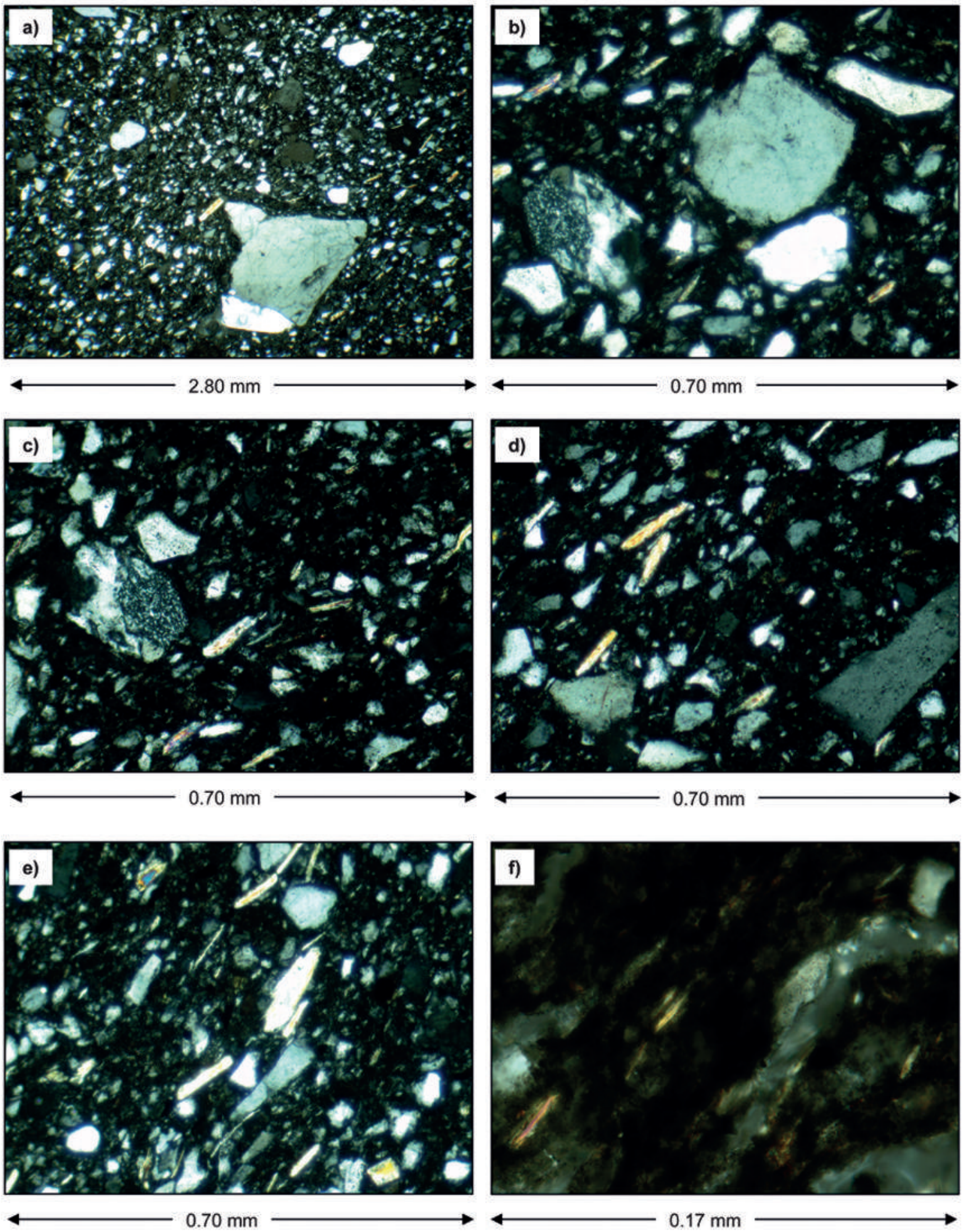

Fig. 4. Sample MD 7131, microphotographs of typical thin-section image, XPL:
a = silty-fine sandy clay with quartz and mica (< 0.2mm), one large inclusion of quartz (0.9 mm);
b–e = inclusions of quartz and mica, few feldspars (b, c); f = matrix with some mica
(microphotographs by G. Schneider, compiled by M. Daszkiewicz)

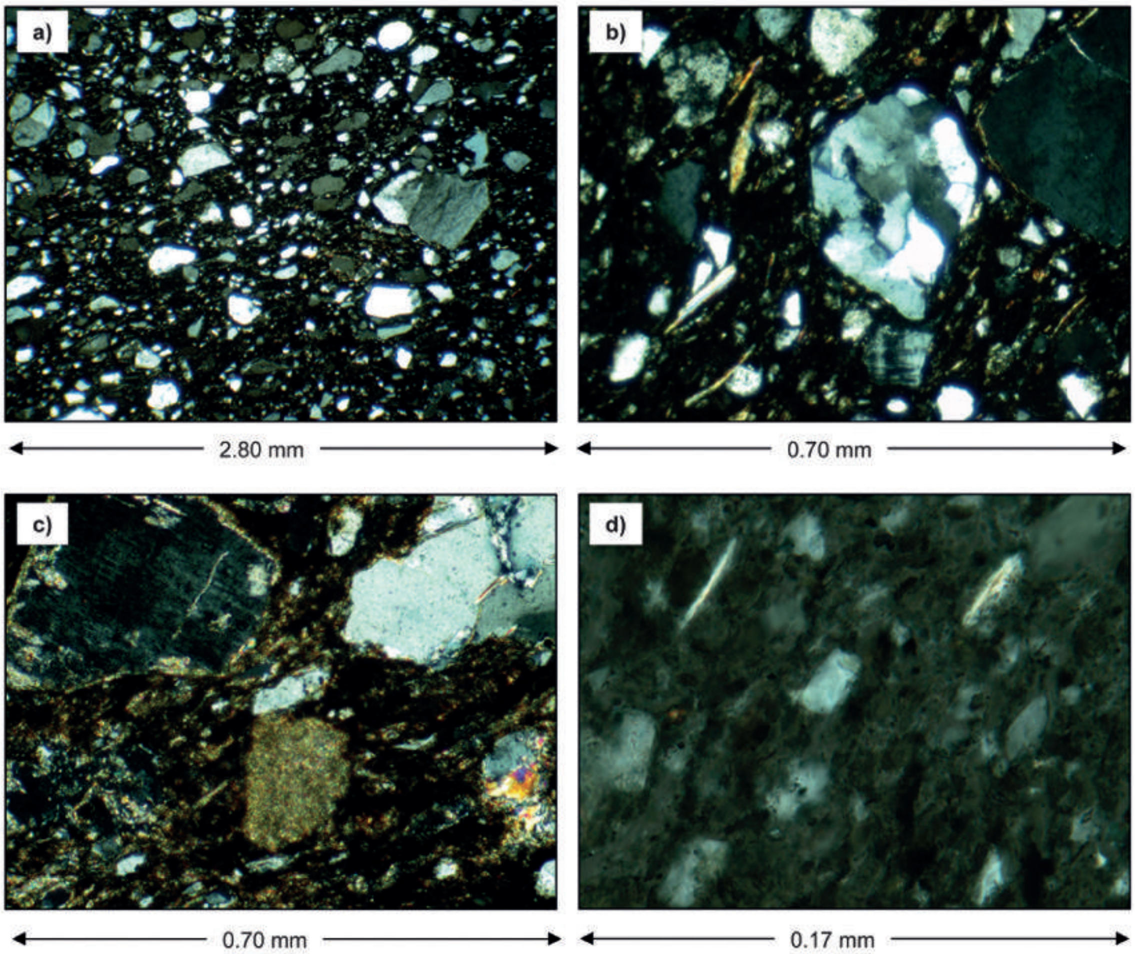

Fig. 5. Sample MD7132 , microphotographs of typical thin-section image, XPL:
a = silty-fine sandy clay with larger inclusions of quartz up to 0.5 mm; b = inclusion of polycrystalline quartz and, below, tiny microcline; c = inclusions of quartz (right), feldspar (left), carbonates (lower part); d = matrix with some mica and grains of quartz in very fine silt fraction (microphotographs by G. Schneider, compiled by M. Daszkiewicz)

Table 1. Results of chemical analysis by WD-XRF. Major elements are calculated as oxides and normalized to a constant sum of 100%. The element concentrations determined are valid for samples ignited at 900°C (specimens for measurements are melted after ignition) (compiled by M. Daszkiewicz, measurements using the calibration of the Arbeitsgruppe Archaeometrie performed by G. Schneider, courtesy of A. Schleicher, Deutsches GeoForschungsZentrum GFZ Potsdam)

Lab.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	V	Cr	Ni	(Cu)	Zn	Rb	Sr	Y	Zr	(Nb)	Ba	(La	Ce	Pb	Th)	l.o.i.	TOTAL
No.	% by weight										ppm															%	%
MD7131	70.54	0.87	16.05	5.08	0.07	1.70	2.32	0.87	2.32	0.18	106	120	45	16	69	119	134	32	322	19	376	39	77	20	13	0.29	100.2
MD7132	75.61	0.59	11.97	4.49	0.05	1.36	3.30	0.41	2.03	0.20	98	72	42	28	70	102	163	26	212	16	289	34	70	19	9	1.27	100.1

Fig. 6. Plot illustrating results of principal component analysis (PCA) of the first two principal components using the elements: Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K, V, Cr, Ni, Zn, Rb, Sr, Zr, and Ba:
C1 = samples MD7131 and MD7132;
C2 = samples found in Novae (see Baranowski, Daszkiewicz 2009);
C3 = various examples of legionary ware, group: clay 1
(unpublished report, samples submitted for analysis by P. Dyczek);
C4 = legionary ware (unpublished report, samples submitted for analysis by P. Dyczek);
C5 = ceramic building material (CBM): pipe fragments, imbrex, kiln wall fragments
(unpublished report, samples submitted for analysis by P. Dyczek);
C6 = various clay samples from the area around Novae
(unpublished report, samples submitted for analysis by P. Dyczek);
C7 = common ware, pottery fragments found in Novae
(unpublished report, samples submitted for analysis by P. Dyczek);
C8 = fragments of pottery and CBM
(unpublished report, samples submitted for analysis by T. Sarnowski);
C9 = samples found in Hotnica (see Daszkiewicz, Bobryk, Schneider 2006).
For all samples included in the PCA, chemical composition analysis was performed using the same procedures for both preparation and measurement (compiled by M. Daszkiewicz)

Conclusions

1. Both pottery vessels were made from different ceramic bodies.
2. Sample MD7132 is similar to legionary ware from Novae.

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