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PhD THESIS ABSTRACT

NEOLITHIC AND ENEOLITHIC PAINTED POTTERY PRODUCTION FROM TRANSYLVANIA: ARCHAEOLOGICAL DATA, ARCHAEOMETRIC AND EXPERIMENTAL INVESTIGATIONS

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CONTENTS

Chapter 1.
REASONING AND OPPORTUNITY OF RESEARCH TOPIC

By having the Neolithic and Eneolithic painted pottery from Transylvania as a topic of study, the present dissertation – through its proposed research method - aims to join new directions in Romanian archaeological research with modern analytical investigation techniques.

Making use of the benchmarks provided by the bibliographical study on the subject, our research aims to make a contribution onto *shaping the real, overall image* of the Neolithic and Eneolithic painted pottery. The study of this pottery, a subject of great interest over time – addresses considerable aspects, especially on typological and stylistic analysis and also on cultural and chronological framing. However, this study still remains an open subject, far from being exhausted, especially in regards to manufacturing, decoration and firing methods.

Consequently, a generous part of this research has been aimed towards archaeometric analyses (ATR-FTIR and SEM-EDS), conducted at the Institute of Multidisciplinary Research for Science and Technology, Valahia University of Târgoviște, concerning painted pottery fragments from the Lumea Nouă and Foeni cultural groups as well as the Petrești culture. These analyses made use of both the ceramic material from the archaeological collections of the „1 Decembrie 1918" University of Alba Iulia, as well as on the new materials recovered from systematic and preventive archaeological excavations at Alba Iulia - *Lumea Nouă* site, attended by us as member of the research team on the duration of these doctoral studies. The samples analysed in terms of composition were compared to potential clay sources thus aiming to identify the provenance of the main raw material (a clay source used long ago), but also in determining the chemical composition of pigments, as found on the surfaces decorated by painting.

The experimental approach became the subject of an entire chapter, with both the archaeometric analyses conducted so far on Lumea Nouă, Foeni și Petrești pottery types, and the observations made on archaeological material preserved within the archaeological collection of the „1 Decembrie 1918" University. The focus of this direction of research was to explore the chained operational sequences in the production of pottery, of great archaeological interest, while also identifying the analogies in this process, useful for trace analysis of ceramic technology discovered on site, as present on Neolithic and Eneolithic

painted artefacts in Transylvania. The chapter gathers experimental projects done during doctoral studies and reflects our constant preoccupation to adapt ceramic artefacts research to the set of normatives and rules imposed by reference experiments in the field.

Chapter 2.
TRANSYLVANIAN NEOLITHIC AND ENEOLITHIC PAINTED POTTERY CULTURES. HISTORY AND CURRENT STATE OF RESEARCH

We considered necessary that the starting point of our undertaking to be a description and a unitary, updated analysis of main Neolithic and Eneolithic painted pottery cultures. They include the culture groups of the intra-Carpathian territory – Starčevo-Criș, Pișcolt, Lumea Nouă, Turdaș, Iclod, Suplacu de Barcău, Herpály, Foeni, Ariușd, Petrești și Bodrogkerestúr - Handles with discoid attachments horizon – as outlined in current state of research. Therefore, in the making of this chapter, we aimed mainly to address the characteristic aspects related to the way Neolithic cultures are defined, their cultural and chronological delimitation, stages and their cultural expansion in Transylvania. This was done especially by capitalizing on that element of material culture – *painted pottery*, the object of our studies, from both the archaeometric and the experimental perspective, in the following chapters. Detailed descriptions of painted pottery, with specificity to each concerned cultural aspect, is accompanied by relevant plates, some outlining the unpublished painted ceramic materials belonging to the Lumea Nouă, Foeni, Iclod cultural groups and the Petrești culture.

At this point, linked to the documentation stage, the text is complemented by a repertoire of archaeological sites with specific findings of painted pottery. The approach was not meant to be a repertoire in the strict sense of the term, but it has addressed exclusively the findings of painted pottery that had clear bibliographical references and these were used to generate useful and representative maps – for this current state of research – in regards to spatial distribution of the researched cultural phenomena.

Chapter 3.

INVESTIGATING THE MANUFACTURING TECHNOLOGY FOR NEOLITHIC AND ENEOLITHIC PAINTED POTTERY FROM TRANSYLVANIA WITH THE USE OF ARCHAEOMETRIC METHODS

Known under the generic term of "archaeometry", these interdisciplinary analyses have made up both a morphological and a typology and stylistic study of archaeological artefacts, providing mineralogical and petrography information, in the end clarifying issues of great interest to archaeological research. Unlike the European space, where the application of analytical methods specific to exact sciences in archaeological research began half a century earlier, in Romania the number of interdisciplinary studies that approached painted pottery in terms of composition, structure and texture - with the aim of delivering conclusions of historical significance - is smaller. One of the best researched civilisations in the Romanian area is the Cucuteni Eneolithic culture, with physical and chemical analyses being performed on significant ceramic lots and using complementary archaeometric methods.

A brief look at the history of research for the Transylvanian area reveals a relatively small number of archaeometric analyses being performed in the study of painted pottery. Most of these were focused on the Lumea Nouă painted pottery type, from two important archaeological sites, where it appears in significant quantities, respectively Alba Iulia - *Lumea Nouă* (Alba county) and Zau de Câmpie - *La Grădiniță* (Mureș county).

Archaeometric analyses on painted pottery at the Alba Iulia-*Lumea Nouă* archaeological site

In this reasearch, two complementary analytical techniques were applied on three separate lots of painted pottery, belonging to the Lumea Nouă and Foeni cultural groups and the Petrești culture. A total number of 51 fragments originating from Alba Iulia-*Lumea Nouă* site were first analyzed to establish possible correlations between the potential sources of raw material and the composition of the ceramic body. In regards to the study of the chemical nature of mineral pigments used in decorating surfaces by painting, the Lumea Nouă, Foeni and Petrești pottery has not been the subject of archaeometric research until now. The research also pursued to obtain relevant data on the provenance and nature of some raw materials used in the technological process of manufacturing painted pottery.

Description of materials and of the archaeological context of provenance

The selection of samples used to establish provenance was based on the materials that originated from well-defined archaeological contexts, both in old and recent excavations, with the aim to obtain representative results across the entire site. The painted fragments belong to various categories - respectively pot rims and bottoms or vessel body fragments – both fine or semi-fine ware.

The clay samples (C3, C4, C5 and C6) at Alba Iulia-*Lumea Nouă* archaeological site were collected from an average depth of 1m below the current soil surface, a depth reached generally by Neolithic pit structures. It is not excluded that some of these features were originally pits dug to obtain the raw material used in the manufacturing of ceramics. Two other samples were gathered from the surrounding area, (C1 – at 1,5 km towards NE, nearby Bărăbanț, Alba county and C2 – at 6 km towards S, nearby Limba, Ciugud, Alba county respectively), from areas that have a high potential sources of raw material at the disposal of human communities in the Lumea Nouă settlement in the Neolithic age.

Analysis methods

For the study of clay and pottery samples the Vertex 80v (Bruker) spectometer was used, equipped with a diamond ATR (Attenuated Total Reflection) crystal accessory (ATR-FTIR), which absorbs the radiation IR in the interval 600-8000 cm^{-1} with a spectral high resolution (0,2 cm^{-1}) and an accuracy of 0,1 %T. Further, both clay sources and pottery samples were investigated using a SU-70 (Hitachi) scanning electron microscope (SEM) coupled with an UltraDry (Thermo Scientific)[1] energy dispersion spectrometer.

Results and discussions

According to the spectral data belonging to both categories investigated in comparison (raw material and ceramics), we can conclude that we are dealing with similar chemical compositions (hydroxyl, carbonyl, aliphatic groups and silicates). These data are fully consistent with the EDS analysis and statistical results.

The FTIR spectral data, consolidated with images of SEM morphology, allowed for considerations on estimating the firing temperature of the analysed ceramic fragments. The data obtained, together with the determination of the type of clay in relation to Ca content (Ca> 5%) and by observing the vitrification stage in SEM morphology images, allow us to

[1] Analyses were conducted at Institute of Multidisciplinary Research for Science and Technology, Valahia University of Targoviste, based on the research contract no. 747/24.10. 2016.

conclude on estimating the firing temperature for the Lumea Nouă pottery type as being a large interval, starting with 650° C up to 800°C (Pl. LIX/1-LIX/2), unlike the interval 850-900°C obtained from Foeni pottery analysis, which is narrower. For Petrești pottery, temperature approximation most often indicates temperatures between 800 and 900°C.

Cluster analysis

The dendrograms that resulted from the data processing provided by the analysis of the 3 pottery samples show good correlations with the clay sources C3/C4 and respectively C5/C6. Lack of any link to C1/C2 reinforces the conclusion that clay was used from local sources when manufacturing the fragments investigated.

Pigments analysis

The painted decoration, specific to Lumea Nouă pottery type, is chemically characterised by the presence of iron (Fe) in all analysed samples (LN1-LN15). The second basic element, frequently detected, is calcium (Ca), with significant concentrations (9.53% - 14.52%) in the composition of the paste, also applied in the red shades, as can be seen in the samples: LN4, LN6, LN8- LN9. The pigment samples collected from Foeni ceramic fragments (F1-F17) are characterised by high concentrations of Fe (<30.68%). The data obtained from the analysis of the pigments present on pottery belonging to Petrești culture (P1-P19) reveals firstly and mainly the use of Fe together with Mn in significant concentrations (5.15-17.77% Fe and 6.93-28, 81% Mn). The use of calcium (Ca) in decoration, as in the case of the Lumea Nouă pottery fragments, is not limited to this engobe-background but also to the preparation of the brown-brownish pigment.

Conclusions

At present, these analyses confirm, for this site, a constant and long-term use of local raw materials in the production of painted ceramics. Manufactured at different chronological levels, the ceramics of the three comparatively analysed archaeological cultures show, from this point of view, similar chemical composition characteristics.

The archeometric measurements made on the three types of painted decoration contributed to the identification of the chemical nature of the paste used to decorate the artefacts. The basic chemical elements highlighted by these analyses were Fe, Ca and Mn.

Specific for Lumea Nouă pottery type is a recipe with a relatively low and oscillating Fe content, frequently mixed with Ca. The profile of these artefacts is complemented by

highlighting the morphological characteristics of the samples, and thus proving, at a pyro-technology level, knowledge regarding the reaching of temperatures that do not exceed the initial stage of vitrification.

Taking into account the samples under analysis, the paintings done on Foeni cultural group pottery show a preference for a Fe-oxide recipe, in high concentration, reaching up to approx. 30%. For all fragments of this type, a firing temperature that exceeds 800 ° C was estimated.

The analysis of the black-brown painted decoration on the artefacts belonging to the Petreşti culture led to the identification of pigments based on Mn-Fe. Present in most samples in very variable proportions, the two elements are proof of the use of feromanganous ores by the bearers of this Eneolithic culture.

Chapter 4.
EXPERIMENTAL ARCHAEOLOGY ON THE MANUFACTURING, DECORATING AND FIRING OF NEOLITHIC AND ENEOLITHIC POTTERY

From the perspective provided by theoretical references, the scientific research project we proposed is part of experimental archaeology, being a complex approach into testing methods, techniques and hypotheses formulated on the basis of the archaeological data that constitutes a *primary reference*. Our work deals experimentally with several aspects of the technology of manufacturing, decorating and firing of Lumea Nouă Neolithic painted pottery type, as well as manufacturing and pressing blacktopped artefacts, overtaking, in the sense indicated by Michael B. Schiffer, the shortcomings of an experiment that is archaeologically isolated. From the point of view of the deployment circumstances, the present experiments should be classified as fieldwork as they use materials and techniques appropriate to the period and technology studied, in an environment that reflects to the fullest extent possible, how these processes could have been achieved in the past. The aspects of interest were carefully measured and recorded with modern equipment, and the systematic documentation ensured the repeatability of the results. Combined research of the sequences in the pottery manufacturing chain, embodied in individual experiments, had the clear purpose of identifying similarities in the production process that could then be used to interpret the traces of ceramic technology present on artefacts discovered in the excavations.

Experimental manufacturing of Neolithic pottery

The concept that illustrates how technology sums up and exceeds the material dimension of the object and provides a theoretical and methodological framework for the study of technology is undoubtedly the *chaîne opératoire*. Today it is considered a conceptual framework - a methodology that has the ability to highlight, explain and relate rigorously, the details of the technological context that gave rise to the ceramic object under study.

The specialized literature offers a comprehensive description of the operational chain related to ceramics manufacturing technology of archaeological interest, the most frequently mentioned being in the following sequence: 1) procurement of raw material; 2) paste preparation; 3) manufacturing of the ceramic object; 4) surface decoration; 5) drying; 6) firing.

Preparation of raw material. Tools

The preparation of raw materials for the painted decoration carried before firing, a central point of this work, was rigorously researched. The production of a very fine material was made by repeated levigation and decantation of the clay. The ochre lumps used were left to dry and then ground to obtain a finely powdered powder which was then dissolved in water. A suspension is thus produced by fractional sedimentation, which allows separation of the liquid with very fine pigment particles, away from impurities and sand granules.

Experimental methods for pottery manufacturing

Among the shapes that characterize Lumea Nouă painted pottery type, discovered in the eponymous site, we chose the experimental reconstruction of the hemispherical bowl, with rounded rim, 9.5 cm height and a maximum diameter of 13 cm. The main manufacturing techniques certified for the Neolithic period was applied in turn and one at a time: modelling done by hand for the entire vessel, the coiling technique and the pressing into shapes. We have concluded for this bowl that the manufacturing methods have been used in a combined manner: shaping done by hand hands for the lower part, possibly up to the maximum diameter, after which the shape was closed by adding successive rolls, which do not necessarily have cylindrical shape, but may also be flattened (by tapping) on a relatively straight surface. They are pressed together by hand, after which the contact surface is smoothed by scraping, done both inside and outside. In the end, the shape is perfected by beating it with a wide wooden tool (palette).

Vessel drying

Regarding the research on pottery with painting applied prior to firing, the essential aspect of the drying phase was to identify the right moment for the application of the slip (as support for the painting layer). Finally, the experimental pottery was left to dry for 3-4 days until a critical point in which they ceased to change their dimensions. After decorations, a second drying took place, which prepared the vessels for firing.

Experimental decoration of painted pottery.

Case study: Lumea Nouă pottery type

The aim here was to experiment with the technique of making a single type of painted decoration, one that is applied before firing, consisting of stripes of red and brown-chestnut lines, parallel, forming arches and converging towards a band that is parallel to the vessel's rim, all on a white-yellowish engobe background. In this type of decoration, the first one applied after drying, when the pot is of the right firmness, is the slip. Briefly, this term defines a watery fluid clay suspension, which ornate the whole vessel body, prior to firing. This layer adheres to the body of the vessel by means of polishing with a stone and it is then fixed by firing.

After an entire polishing of the vessels, the application of stripes of parallel lines forming the central element of the painted decor was started. The red paste was applied on the polished surface on the still damp slip using a hemp textile whose length and thickness were adjusted so that the trace left by it would be more similar to the original decoration. Each individual thin line was drawn, until this characteristic band was obtained, first around the rim, then the other registers, using vertical stripes, and finally the four arches were also marked. Polishing with the stone tool was gradually made on the freshly painted surface, with sections of it still wet, through ordered movements, not coming and going but following a particular direction of element orientation, which gives a gloss closest to the intended purpose.

Painted pottery experimental firing

As the firing installations discovered by excavation are still missing at the site, the pyrotechnical aspects were a very suitable object of study within the archaeological experiment, seen by us as a hypothetical-deductive process. A starting point in this direction was the fact that a macroscopic examination of the sections of pottery fragments that made the subject of this analysis revealed a „sandwich-like structure” as being quite characteristic.

Probably a result of incomplete combustion of organic clay compounds or a low temperature firing, this can be also the result of an initially reducing firing technique followed by a short oxidative firing. However, taking into account the reaching of temperatures up to 900ºC - according to the diffractometric analyses - this trace of incomplete combustion can now be seen as a result of a short but intense firing, which produces partial oxidation of the wall from the outside towards the inside.

Archaeological evidence of the use of simple and efficiently structured firing installations comes from the early Neolithic, in the area of the Starčevo-Criş pottery culture. The sunken kiln, with a fuel tunnel and access pit, is an installation which, through the arrangement of its components, allows a separation of fuel from the pottery load, yet remaining mainly single-chambered.

This type of installation has been chosen and tested experimentally in the firing of painted pottery due to the advantages that it presents: it is isolated from the outside environment, it does not require permanent maintenance in the form of clay patching, allows control of the temperature and firing atmosphere (both reducing and oxidising), offers a separation of fuel from pottery, it is built up easily without any special skills or the preparation and handling of large amounts of clay.

During the year 2016, two major firing experiments were carried out within the project, in order to illustrate the result of the short-term high temperature exposure of the painted pottery fragments. The main objective was to obtain an oxidising atmosphere, imposed by the painted surface, at an average temperature of 700-800° C, using a single-chamber kiln type. Simultaneously with these general objectives, the aim was to obtain the aforementioned sandwich structure, seen as a result of both the heating acquisition rate and of the exposure time at a maximum temperature.

The experimental firings have produced six full, resonant and perfectly functional vessels. The painting layers has a glossy appearance and was preserved intact after firing, but each of them with hue variations, both in terms of the slip and of the red painting. It is important to note that such reductive side effects, which turn a red pigment (hematite) into brown shades (magnetite) can be observed also on the original artefact. In cross-section, the internal structure of the experimental pottery fragments is similar to that of many of the original fragments, proof that it may be the result of an intense but short-term firing that produces a partial oxidation of the wall from the outside towards the inside. In regards to the working methodology, this approach provided us with concrete data on how to achieve

controllable and repeatable results, thus becoming valid prerequisites for further research of this technological phenomenon.

As we have already shown, a variable of the method described remains the firing atmosphere. Unlike the monocameral firing installation, the two-chambered kiln, with a vertical arrangement, has proven to be a very useful tool in controlling the atmosphere and temperature throughout the firing process and thus contributed towards pointing out some essential aspects of the way in which the firing procedure seems to have taken place in ancient times, especially in regards to the firing of blacktopped pottery.

Conclusions

Archaeological experiments related to the manufacturing, decoration and firing of painted pottery revealed some key aspects of Neolithic ceramic production technology, seen as a specific set of processes, methods and techniques for transforming raw material into a finite product. The most complex sequence of the operating chain is the painted decoration done before firing. The present experiments allowed detailed observations on the various aspects of its creation. Identifying the right timing and the ways to apply and fix the painting on pottery requires strong skills and knowledge of the behaviour of all of the materials used. As a result, the painted decoration was considered from the very beginning as a conclusive indicator of the level of technical and artistic development of these human communities.

In regards to firing, our experiments with the monocameral sunken kiln type have shown that it is possible to obtain painted pottery using a single-chambered installation. This structure has the ability, size, components and adequate operating principle to produce painted ceramics. This fact draws attention to the possible use of simple but efficient installations and suggests researchers to reconsider the notion that good quality ceramics can only be obtained in elaborated two-chamber firing installations. A remarkable pyrotechnical aspect, which provided clues about the actual way of firing - in the case of Lumea Nouă pottery type - was the internal structure of numerous fragments, showing traces of incomplete firing in their cross-sections. The results of the experimental firing have shown that, judging by the efficiency of such an installation, which can easily reach high temperatures in a short time, this must be seen as a cultural choice made by the manufacturing communities and not necessarily as a natural or technological constraint.

This technological information that we acquired so far can easily be extended to several types of painted pottery in Transylvania, for both Neolithic and Eneolithic periods. Consolidated with the results of archaeometric analyses made on ceramic paste and pigments

and analysed in close connection with the archaeological context of the artefacts, experiments of this type can generate valuable results in identifying and deciphering technological traditions that have manifested locally or regionally in a certain historical period.

Chapter 5.
FINAL CONSIDERATIONS

The present thesis aimed to be an interdisciplinary approach, structured in accordance with the principles, objectives and directions of modern research, in the analysis and interpretation of archaeological ceramics. The entire construction of our work found a solid theoretical basis in the typological and stylistic criteria recorded by the traditional archaeological approach of the painted ceramics. But it also pursued, through analytical and experimental data, to highlight the complexity of the painted decoration as a sequence of the operational chain and its relevance in defining a level of technological development of the human communities in the intra-Carpathian area. These appear to be characterized by the presence of seemingly similar shapes in ornamentation, at least at the level of Neolithic and Eneolithic. Two complementary analytical techniques (ATR-FTIR and SEM-EDS) were applied on painted pottery lots from the site at Alba Iulia-*Lumea Nouă* (Alba county). The obtained results confirm the use of local raw materials in the manufacturing of painted pottery at Lumea Nouă, Foeni and Petreşti. This type of analytical approach to archaeological material complements the existing information corpus on the use of raw material of local origin in the Neolithic and Eneolithic pottery manufacturing technology in the Carpatho-Danubian space and neighbouring areas.

In the absence of archaeological discoveries such as kilns, areas for specialized production (pottery workshops), raw materials at various stages of processing, tools or characteristic wastes that certify a ceramic production in the site perimeter, the notions of local / non-local ceramics or local / non-local manufacturing, emphasized by the archaeometric analysis, still needs to be documented. In the current state of research, this criterion of classifying pottery remains rigid and limited to the number of archaeological and geological samples taken into account. Its full significance will only follow with the expansion of archaeometric investigations in the region. What is certain, however, at this stage of the research, is that the hypothesis of imports into the Mureş valley for Lumea Nouă painted pottery now has as counter-argument in the result of our archaeometric analyses that indicated a local production.

Concerning the paste used for the painting of the Lumea Nouă characteristic decoration, a quantitative observation was made that focused on the content of Fe, which appears in varying and generally low proportions. The underlined aspect may indicate the use of varieties of naturally coloured clays, whose reddish nuance is due to the presence of Fe oxides in varied proportions. Our experiments in this direction have confirmed that such concentrations could have easily be obtained by prior ochre levigation and decantation operations, ending up with the separation of fine particles of the mineral pigment, apart from impurities and sand grains. Archaeometric analyses indicated the presence of Ca in the paste, along with Fe, giving an explanation for the chromatic diversity, the characteristic aspect of the slip, as well as the poor preservation status of the painted decoration observed in many cases.

The research of this ceramic type was complemented by the experimentation of the mixed manufacturing technique for the hemispherical bowl-type vessel with rounded rim, and the characteristic bi-chrome decoration type, applied before the firing, consisting of stripes of red lines, arranged in arches, on white-yellowish engobe background. The obtained results, both controllable and repeatable, have successfully added new information on the final temperature estimated by the analytical studies, giving details on aspects that could not be measured in the laboratory with the equipment used, mainly the firing rate and the drying time. The firing technique was experimentally validated and produced in the end vessels with an appearance and internal sandwich-like structure similar to the original artefacts. Observations made on the efficiency of the monocameral firing installation in reaching high temperatures eliminates the technological constraints that are generally illustrated by incomplete firing and let us foresee responsible choices taken as part of a controlled process.

The Foeni group's intense red and cherry shade painting, done with a high degree of uniformity, proves, in the light of our physical and chemical analyses, a technique based on a more advanced knowledge in identifying quality sources, preparing the painting paste and managing the firing process.

From the perspective of the analyses made so far, the painted decoration of the Petreşti Eneolithic culture appears as a complex synthesis (combination of advanced technological knowledge regarding the potential of the raw materials and firing technology) and denotes, at the same time, continuity and evolution. On the one hand, the tradition for the practice of preparing an iron oxide-based paste mixed with calcium, which is characteristic of the manifestations of local communities with painted ceramics inside the Carpathian arch from the middle Neolithic, is preserved. On the other hand, new technical knowledge is also

included, taken from the populations that penetrate the intra-Carpathian area from the south. The decoration is made with raw materials, whose chemical composition obviously reveals clear criteria for selecting sources, as well as specialised knowledge in obtaining (procuring) the raw materials. In this context, the bichromed painted decoration of the Petrești A-B phase analysed in this paper illustrates an evolution compared to the previous traditions, done mainly by restricting and stabilising the range of temperatures and by selectively procuring and using new raw materials (mostly with Mn, i.e. manganese). The latter is a material proof of a unitary preference, for our lot of materials, and therefore should be seen as a cultural option that may have spiritual, artistic or purely aesthetic meanings for these communities.

Based on the observations made on the composition and occurrence of the substances underlying the mineral mixture for the bichrome painted decoration in black-brown shades specific to the Petrești culture (A-B phase), at the current stage of research, we have the ferromanganese abundant deposits of the south-west Transylvanian Plateau, located in the Carpathian area (Sebeșului Mt., Lotru, Cibin, Semenic but also Metaliferi Mt., Zarandului Mt.). These mountain groups, displaced on either side of the Mureş valley corridor, may be considered as a possible procurement area for this type of raw material. With the extension towards the north of the Transylvanian Plateau, the whole area of the Apuseni Mountains could have served as a source of this material.

The spatial placement of discoveries with painted pottery - in spite of the restrictive selection criteria and the current research status - provided us with a relevant outline of the areas where some painted pottery types are predominantly present and at the same time provided clues on the movement range that these artefacts could have had at the time. Together with the technological aspects highlighted by archaeometric and experimental methods, such observations may be relevant towards the cultural transformations that arose from the contact between these civilizations. An in-depth look in this research direction, mainly by extending the number of samples used in the analysis with new Foeni, Petrești and Ariușd pottery could elucidate some aspects related to the genesis of these Eneolithic cultures in the intra-Carpathian area.

This interdisciplinary approach of studying the Neolithic and Eneolithic painted pottery cultures made use of the information provided by pottery discovered in archaeological contexts and therefore can offer a good insight in the study of prehistoric technology for the intra-Carpathian space. The thesis proves that establishing the chemical composition of ceramics is not limited solely to determining the nature of the raw material source as it can also be an effective way to widen the spectrum of scientific knowledge regarding

technological variability, the decoration technique and the sourcing of artefacts to a particular settlement.

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