

Shaping a future of painting: the early Neolithic pottery from Dzhulyunitsa, North Central Bulgaria

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ABSTRACT

This paper presents the somewhat unexpected findings of a preliminary archaeometric study of ‘painted’ early Neolithic pottery from the site of Dzhulyunitsa, north central Bulgaria. While there is still no consensus on the actual model of Neolithisation of this region, expectations are that there would have been a transfer of pottery technology and possible small quantities of painted pottery from the West Anatolian homeland to early Neolithic sites in Bulgaria. However, our findings confound these expectations. Pottery from the earliest levels of the site are all based on local materials: there are no imported wares. There is no evidence of the experimental phase that would be expected as migrant potters learned to adjust to local clays. Instead the pottery is of a very high quality from the outset, using naturally fine clays that do not require temper: though organic material is sometimes added, albeit often in non-functional quantities. What were thought to be dark-painted layers are shown to be simply the high-quality burnishes that can be developed using these micaceous local clays: in some cases with outer surfaces enhanced with ochre. White-slipped and white-on red decorated sherds from the second layer of the site continue to showcase a mastery of local materials, with white pigments base on nearby limestones and marls. But here, petrographic analysis identifies some white-painted wares which are clearly not local, with both bodies and paint compositions pointing to a different provenance and technology. As it continues, this project aims to establish the full range of Dzhulyunitsa pottery fabrics to reconstruct manufacturing technologies and raw material sourcing patterns, for comparison with contemporary sites across the region.

KEYWORDS

Early Neolithic, pottery, Dzhulyunitsa, petrography, SEM, Neolithisation

Introduction

Despite its importance, painted early Neolithic pottery from the focal region has not been the subject of interdisciplinary research. This paper represents the first archaeometric analysis of early Neolithic pottery from the first two layers of Dzhulyunitsa, a site located in north central Bulgaria (fig. 1)¹. This is very early material for present-day Bulgaria and is investigated here by focusing on fabrics and surface decorations to explore the technology of manufacture. Although still a work-in-progress, the preliminary observations of this project have already given interesting new insights into the production of early decorated pottery, demonstrating the potential of this research to contribute to the debate of how the

1 The illustrations included in the article are made by the authors.

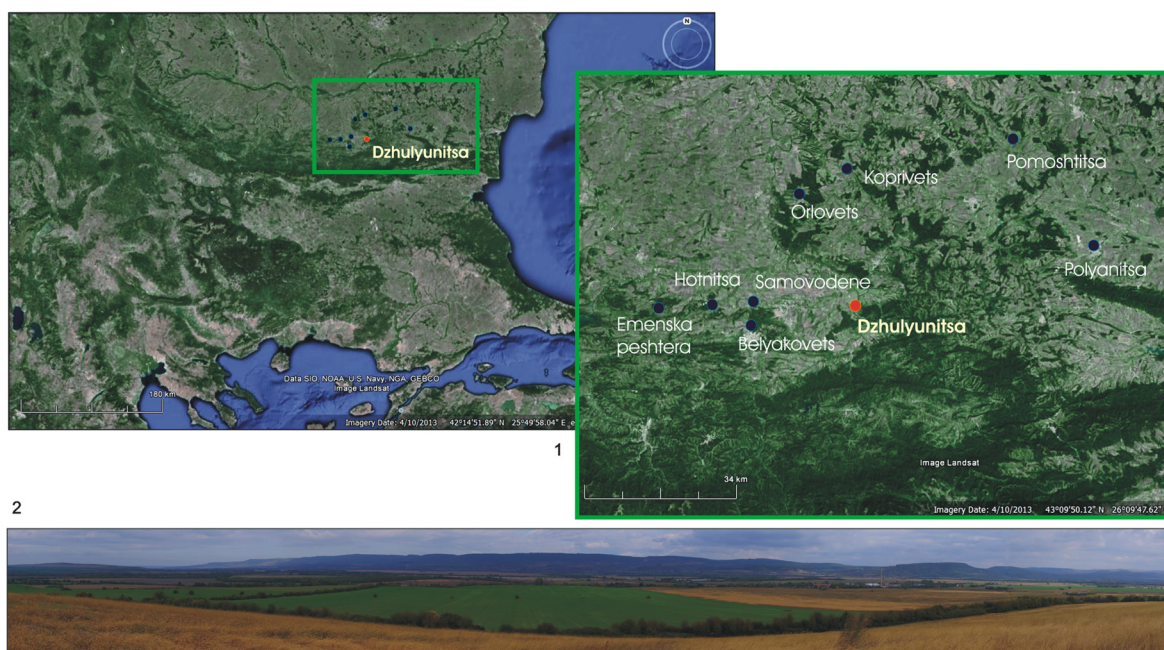


Fig. 1. Location of the site. 1.1. The area of North Central and NE Bulgaria: major early Neolithic sites. 1.2. The early Neolithic site of Dzhulyunitsa Smardesh (view from South)

Обр. 1. Разположение на обекта. 1.1. Раннонеолитни обекти от Централна Северна и Североизточна България. 1.2. Раннонеолитният обект до Джулюница, местността Смърдеш (поглед от юг)

spread of material technology relates to alternative models of Neolithisation.

Although found on only a very low percentage of pottery in the early Neolithic levels, the white-painted decoration is broadly considered as diagnostic for the Bulgarian EN period. It is considered to be the earliest known painted style in the region, and is present in the second Dzhulyunitsa layer. Surprisingly, however, the earlier Dzhulyunitsa 1 layer has also yielded decorated pottery, but this has a 'dark-painted' decoration (fig. 2). The questions this preliminary archaeometric study aims to address are: what is the nature of Dzhulyunitsa's dark-painted and white-painted wares and how are these related through raw materials and technology of manufacture.

Importance of the site and relation to other sites. The site has been excavated by N. Elenski from 2001 up to the present day (Еленски 2006; Krauß *et al.*, 2014) and is considered as part of the so-called 'Koprivets cultural group', the earliest known in Northern Bulgaria (fig. 3; Тодорова, Вайсов 1993; Попов 1996; Еленски 2004)². The settlements from this group, defined by many as a pre-Karanovo I cluster (preceding the white-on-red pottery horizon), have yielded materials similar to those of the early sites from the Aegean Sea region – at the mouth of Maritsa River (Hoca Çeşme), some belonging to the Fikirtepe group, and others located in West Anatolia (Ege Gübre, Ulucak, Çukuriçi Höyük) (Еленски 2008; *in print*).

With regard to the *site details*, it should be noted that although the site is investigated by ongoing excavations on only a limited area, clearly distinguished stratigraphic layers can be recognised in a number of trenches from various zones of the site. Furthermore, the stratigraphic differentiation corresponds to the observed stylistic variation. The oldest phases at Dzhulyunitsa (1 and 2) are recorded along the entire northern edge of the

2 The same group has also been designated by others as Orlovets culture (Станев 2008).

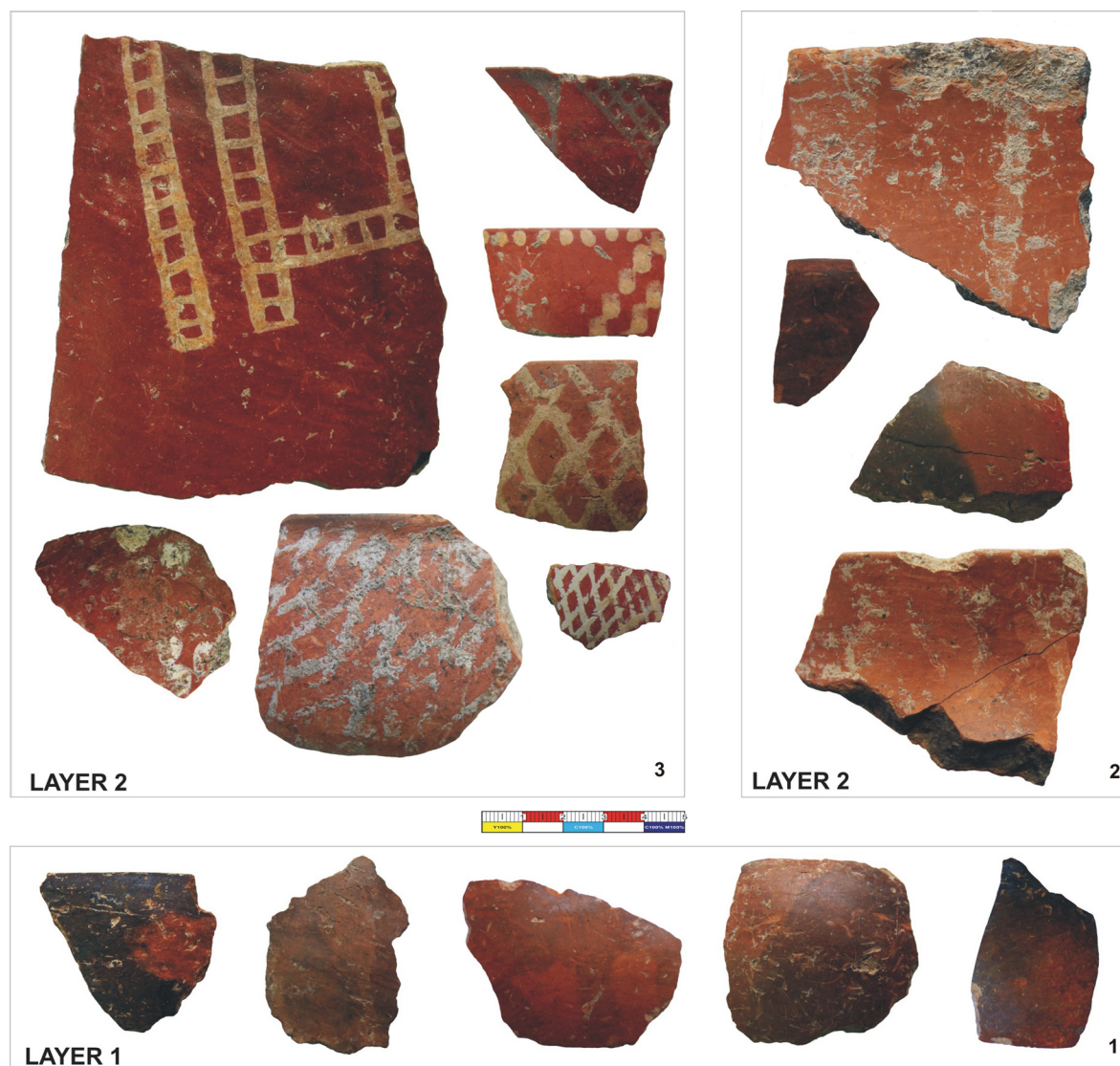


Fig. 2. Decorated EN pottery from the site of Dzhulyunitsa. 2.1. 'Dark-painted' pottery from layer 1. 2.2. 'Dark-painted' pottery from layer 2. 2.3. White-painted pottery from layer 2.

Обр. 2. Украсена керамика от Джулюница. 2.1. 'Тъмнорисувана' керамика от първи пласт в Джулюница. 2.2. 'Тъмнорисувана' керамика от втори пласт в Джулюница. 2.3. Бялорисувана керамика от втори пласт в Джулюница

terrace, while the third and fourth levels are restricted to its central area. The AMS dates show highest concentration at the beginning of the 6th millennium, between 6100 and 5900 BC, according to which it is suggested that the first two phases have maximum duration of 100 years each (Krauß *et al.* 2014). However, it should be noted that a specific algorithm has been applied in the case of these AMS dates, instead of the conventional OxCal modelling approach.

Dzhulyunitsa was chosen as a test site for this local pilot study on painted wares for a number of reasons. It has the largest excavated area and contains the greatest number of materials compared to other sites in the north Bulgarian region, as well as highest percentage of decorated EN pottery. Furthermore, having four EN layers, it represents an excellent basis for analysis of the development of the pottery production and for further comparisons to other sites located in North Bulgaria and elsewhere.

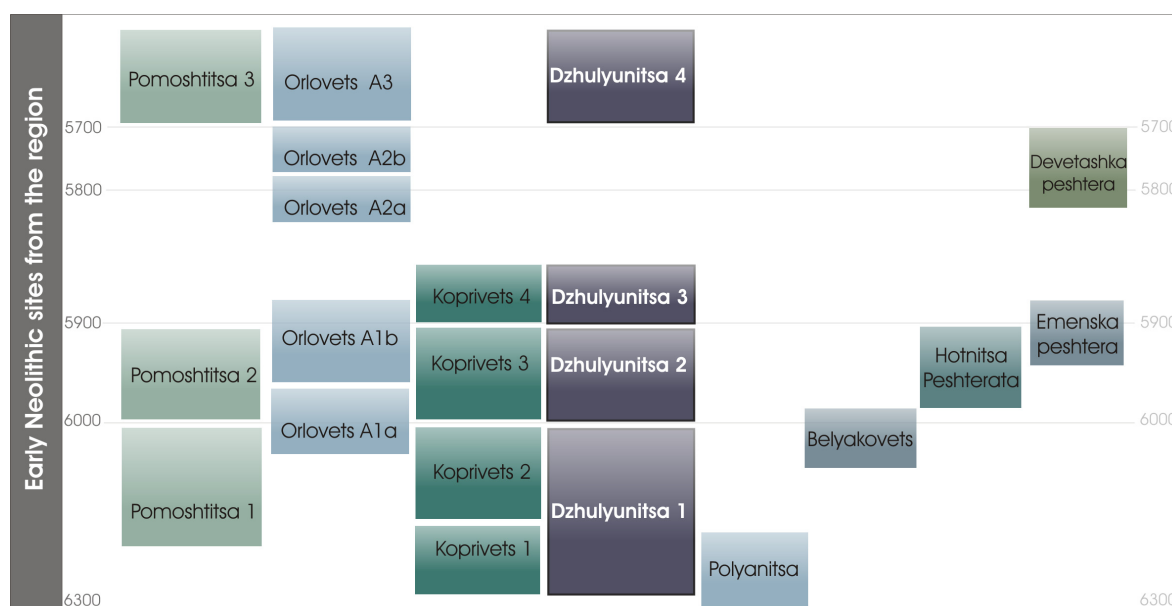


Fig. 3. Chronology of some early Neolithic sites (located in the central and eastern areas of North Bulgaria)

Обр. 3. Хронологическа таблица на селища от ранния неолит, разположени в Централна Северна и Североизточна България

Generally, the *Koprivets* group of sites represents not only cultural elements directly analogous to such known from Anatolian sites, but also an assemblage of similar technological and stylistic components (including surface finishing, 'engobe', temper specifics and various types of decoration), (Еленски 2006; 2008). However, Dzhulyunitsa in particular yields also some very specific elements, which further underlie the close relation to the Anatolian sites. Along with the presence of the early 'painted' decoration (so far known from other local, North Bulgarian sites as single fragments only) a number of specific objects, among which stone vessels, are also concentrated here (Еленски 2008; Krauß *et al.* 2014).

In addition to the close analogies between Dzhulyunitsa and Hoca Çeşme (perhaps the signatory site of the first Anatolian settlers in that region; Özdoğan 1998) suggested by N. Elenski, some tendencies established in Dzhulyunitsa correspond in part not only to sites of the region of West Anatolia (Ege Gübre) and Cilicia (Yümük Tepe-Mersin), but also to more remote settlements along the upper course of the Euphrates River (Mezraa Teleilat, Akarçay Tepe, see Еленски 2006; 2008; *in print*). As regards the relative chronology, at this stage the observations imply closer relationship between Dzhulyunitsa layer 1 and the regions of Cilicia and Euphrates, whereas Dzhulyunitsa layer 2 sees the advent of elements, characteristic of NW and West Anatolian sites (Еленски, *in print*).

Various models for *Neolithisation itineraries* have been developed that do not imply autochthonous development of the Neolithic way of life in the present-day Bulgarian lands. These include the river and land trajectories along the Struma, Mesta, Vardar, Morava, Iskar, Danube, Lom and Maritsa rivers, the Black Sea and some mountain passes (Николов 1986; Николов 1987; Nikolov 1989; 2007; Тодорова, Вайсов 1993; Бояджиев 2002; Станев 2008; Özdoğan 2006). For central North Bulgaria, there are three main theories. These imply Neolithisation: a) from west to east, along the Danube River (Тодорова, Вайсов 1993, 59-61; Станев 1994, 9); b) from the south, along the Bosphorus, the Dardanelles, Maritsa

and Tundzha, the Stara planina and Sredna gora passes, reaching the rivers Yantra and Roussenski Lom (Бояджиев 2002, 71-72; Станев 2002, 119-120; 2008, 40); and c) from east to west, from the Black Sea coastal area (see Özdoğan 2006) towards the Middle Yantra River basin. But in actuality the Neolithisation (including central North Bulgaria) was likely to have been a complex process, probably multidirectional in character, and comprising a number of stages (Özdoğan 2011). All suggestions indicate an early date of the Neolithic sites located in North central and NE Bulgaria.

As mentioned above, the very early Neolithic period in North Bulgaria has been associated with the Koprivets culture. The earliest phases of this group (apart from other single sites in West Bulgaria) are characterised by the so-called *monochrome pottery*, followed by the painted white-on-red style. Such definition for the earlier, pre-Karanovo or Koprivets phase implies the presence of dark-burnished wares and the lack of (white) painted decoration³. Since Dzhulyunitsa 1 contains pottery of this 'style', it has been considered by some authors as a key site coeval to the foundation of the Neolithisation processes in the region (Krauß et al. 2014). The very existence of a '*monochrome phase*' in Bulgaria is questioned by some authors (for example Stefanova 1996) due to limited excavations, the small percentage of painted pottery, a suggested resemblance between the ceramic complexes and uncertain ¹⁴C dates. However, the indicative Dzhulyunitsa stratigraphy should be underlined.

Neolithisation elements as regards the pottery. The dark burnished vessels known from the Koprivets group, the red-slipped ware known from the EN complexes and the introduction of the later (white-on-red) painted pottery are seen by many researchers as corresponding to the pulses of the Neolithisation process (Özdoğan 2011; Çilingiroğlu 2009; Krauß et al. 2014). The dark burnished ware (related to the *monochrome* horizon) has also been associated with the advent of the earliest 'pre-painted pottery stages' here (Özdoğan 1999). And if we are to accept that the first migrants came with a number of already developed skills and a range of elements of a 'Neolithised' economy, or even recipes, how this would have been reflected by everyday activities, such as pottery production in the new regions?

With regard to the surface variety, there were four general surface decorative styles established in the two earliest Dzhulyunitsa horizons: dark painted, red slipped and dark or black burnished wares occur in layer 1; while layer 2 sees the addition of white-on red painted vessels, the appearance of single sherds with creamy and white engobe (slip), and the gradual loss of the dark-painted decorative style (fig. 4). In this study, representative examples of each decorative type, and examples of unornamented wares, were analysed petrographically: as thin sections, using a Nikon Optiphot II polarising microscope; and as polished blocks, using a Jeol 5910 scanning electron microscope (SEM) equipped with an Oxford Instruments Inca 300 energy dispersive analyser (EDA) for chemical analysis.

Traditional characterization of the earliest EN Dzhulyunitsa pottery. The major characteristics of the pottery have already been presented (Еленски 2006; Krauß et al. 2014). According to these descriptions, the Dzhulyunitsa 1 layer yielded both thick- and thin-walled plain vessels (hemispherical bowls and jars with cylindrical necks), made of 'levigated clay' and

3 The designation of such monochrome pottery or horizon, having both chronological and stylistic bearing, is related to certain misconceptions when used in the context of the Balkan EN period. Being different from the original meaning suggested by Braidwoods with regard to the Anatolian-Levant early Neolithic pottery (where 'Dark Faced Burnished Ware' is used to distinguish it from the coloured North Syrian ware (see Özdoğan 2009, 27), the Balkan monochrome is mostly related to the simple lack of (white-on-red) painted decoration and not to the understanding about the monochrome pottery in the context of the Anatolian-Levant archaeology.

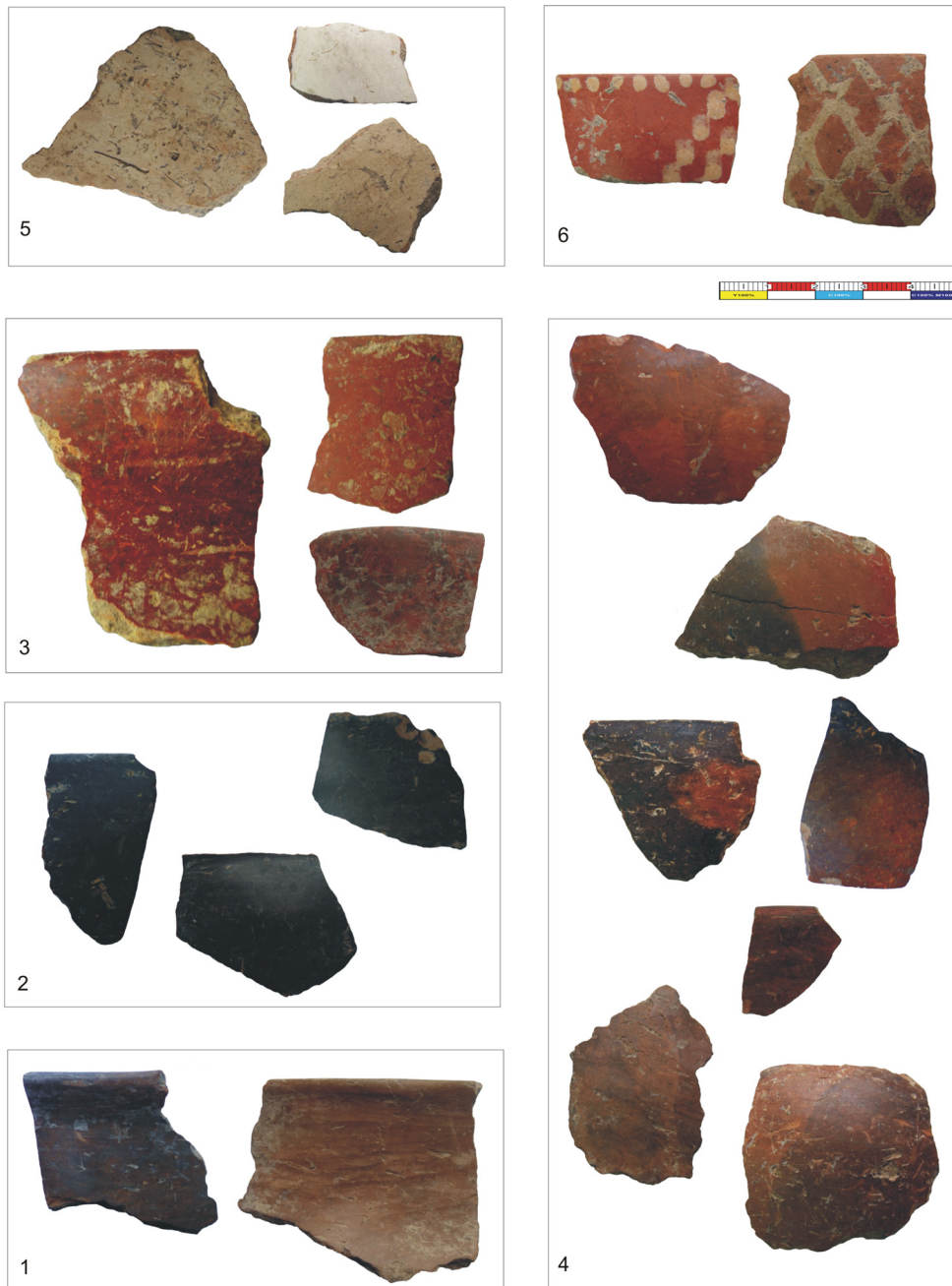


Fig. 4. The various surface treatments of Dzhulyunitsa pottery (layer 1 and 2). 4.1. 'Dark engobe' fragments from layers 1 and 2. 4.2. Black polished fragments from layers 1 and 2. 4.3. 'Red engobe' fragments from layers 1 and 2. 4.4. 'Dark painted' pottery from layers 1 and 2. 4.5. White and creamy engobe fragments from layer 2. 4.6. White-painted decorated pottery from layer 2

Обр. 4. Разнообразие от обработени повърхности на керамика от раннонеолитни пластове в Джулюница. 4.1. Фрагменти с тъмна повърхност, традиционно разглеждани като представляващи 'тъмна ангоба' (от пласт 1 и пласт 2). 4.2. Фрагменти с черна полирана повърхност (от пласт 1 и пласт 2). 4.3. Фрагменти с червена повърхност, традиционно разглеждани като представляващи 'червена ангоба' (от пласт 1 и пласт 2). 4.4. Фрагменти, традиционно разглеждани като представляващи 'тъмна рисувана украса' (от пласт 1 и пласт 2). 4.5. Фрагменти с бяла и кремава ангоба (пласт 2). 4.6. Фрагменти с бялорисувана украса (пласт 2)

tempered with organic material (chaff, sometimes described as finely cut chaff). The surface is considered to have been prepared to a high standard. Many, predominantly thin-walled vessels are described as coated with brown clay slip; or sometimes even having both engobe and fine dark-brown paint that covers the entire surface. Few pots from layer 1 show 'painting in a darker brown colour' and because of the early date of the site it is claimed that 'painted pottery' was present from the very beginning of the Neolithisation process in the region.

Dzhulyunitsa 2 and 3 show the same technological groups and very similar shapes, but with a bit more variation. The surface colour is identified as being black/brown/red polished and lustrous to yellowish (however, a closer inspection on better preserved vessels shows that a range of colours may be seen on one and the same vessel). Most of the fragments from Dzhulyunitsa 2 (and 3) are described as having an engobe, which is typically red. The new white-painted decoration on a red-slip surface (Dzhulyunitsa 2), presents various motifs, and includes colour nuances, such as pure white, greyish, creamy or ivory-whitish. Furthermore, there are three entirely white-painted shards. The white-painted decoration totals only 2% of the assemblage. The 'dark-painted', brown-reddish painted shards are even scarcer, just one tenth of all the painted fragments, and such are not present after the Dzhulyunitsa 2 layer. The material from the third layer is very similar to that of the second, whereas the fourth layer ceramics are completely different, comprising channelled pottery.

From the assumed movement of migrant groups into central North Bulgaria, and the expectation that they will have kept connections with the homeland, we might expect to see a relatively mature pottery technology at Dzhulyunitsa, perhaps with some imported vessels, especially in the first stratigraphic layer. The following sections summarise our preliminary findings.

Making of the vessels

Fabrics and fabric groups. Distinct fabric groups cannot be differentiated, but instead there is a fabric continuum with small variations in the proportions of a fixed mineral assemblage. These fabrics are all based on fine-alluvium clay with a variable content of re-worked loess. All are very fine grained and here is no suggestion that different clay deposits were being used as the local clay varies naturally. The fundamental fabric distinction is whether or not organic temper has been added (fig. 5). There is no correlation between fabric and form and no correlation between fabric and surface finish either (fig. 6). However, as many fabrics are untempered, the clays used were obviously suitable even without temper, at least in some cases.

Tempering. About two-thirds of the studied fragments are tempered. There is organic temper only (plant material) and its quantity is very variable. Fabrics that have a higher ratio of clay to silt and sand tend to have more temper, presumably to control their greater shrinkage, whereas more sandy fabrics typically have lower temper. However, this is not a consistent relationship. In some cases, only very small additions of chaff temper were added. These would have had very little impact on the forming, firing or use characteristics of the ware, and such additions should be seen as reflecting cultural preferences rather than practical requirements. There is no correlation between the use of temper and the quality of the surface finish.

The fine grain size of the clay has led to suggestions that the raw clay was *levigated*,

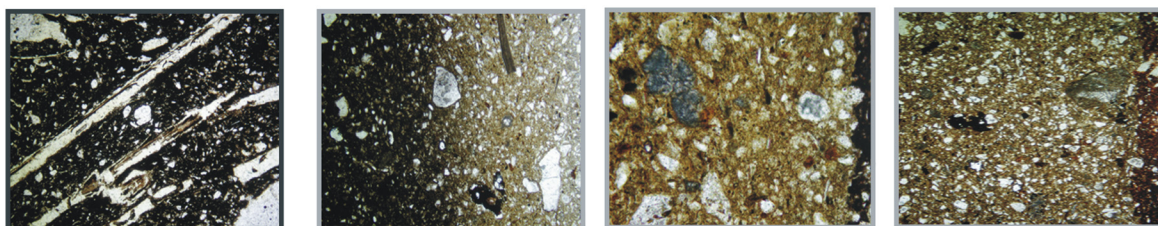


Fig. 5. Petrographic fabrics: indicating the use of local clays from Dzhulyunitsa. These are untempered except for the far left example, which has organic temper

Обр. 5. Петрографски определени суровини, които показват естествено разнообразие от използваните местни глинни в Джулюница. Примерите са за тесто без опоснител (с изключение на крайната лява снимка, която представя наличието на добавена органика)

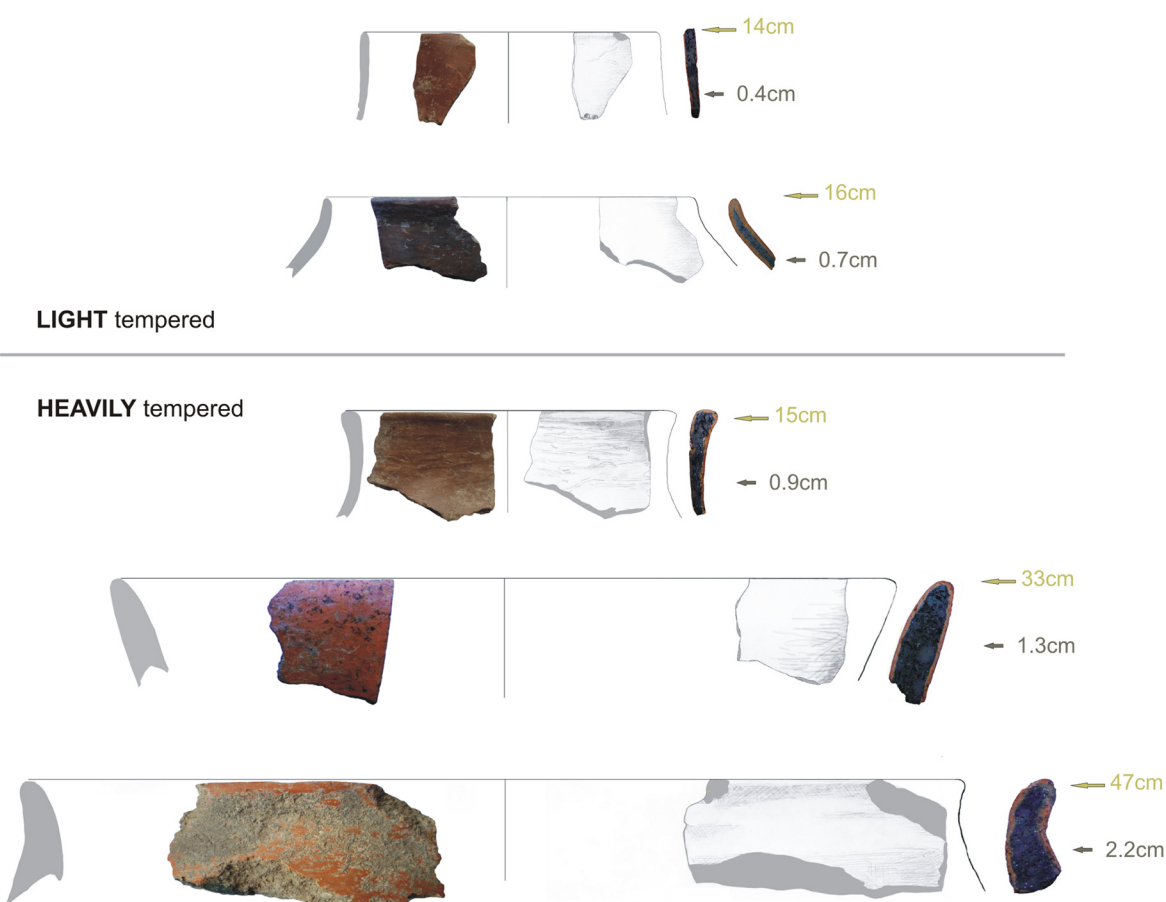


Fig. 6. Lack of any correspondence between the fabric, the amount of organic temper, the shape of the vessel (and diameter of the rim), the thickness of the walls and the surface treatment. Examples for vessels which are light (top) or heavily tempered (bottom) along with indications about the diameter of the rim (in brown) and the thickness of the walls (in gray)

Образ 6. Липса на взаимозависимост между използваното глинено тесто, наличието и количеството на органичен опоснител, формата и диаметъра на съда, дебелината на стените и обработката на повърхността. Примери за съдове с малко (горе) и значително (долу) добавен органичен опоснител, с указани размери за диаметър на устието (в кафяво) и дебелина на стената на съда (в сиво)

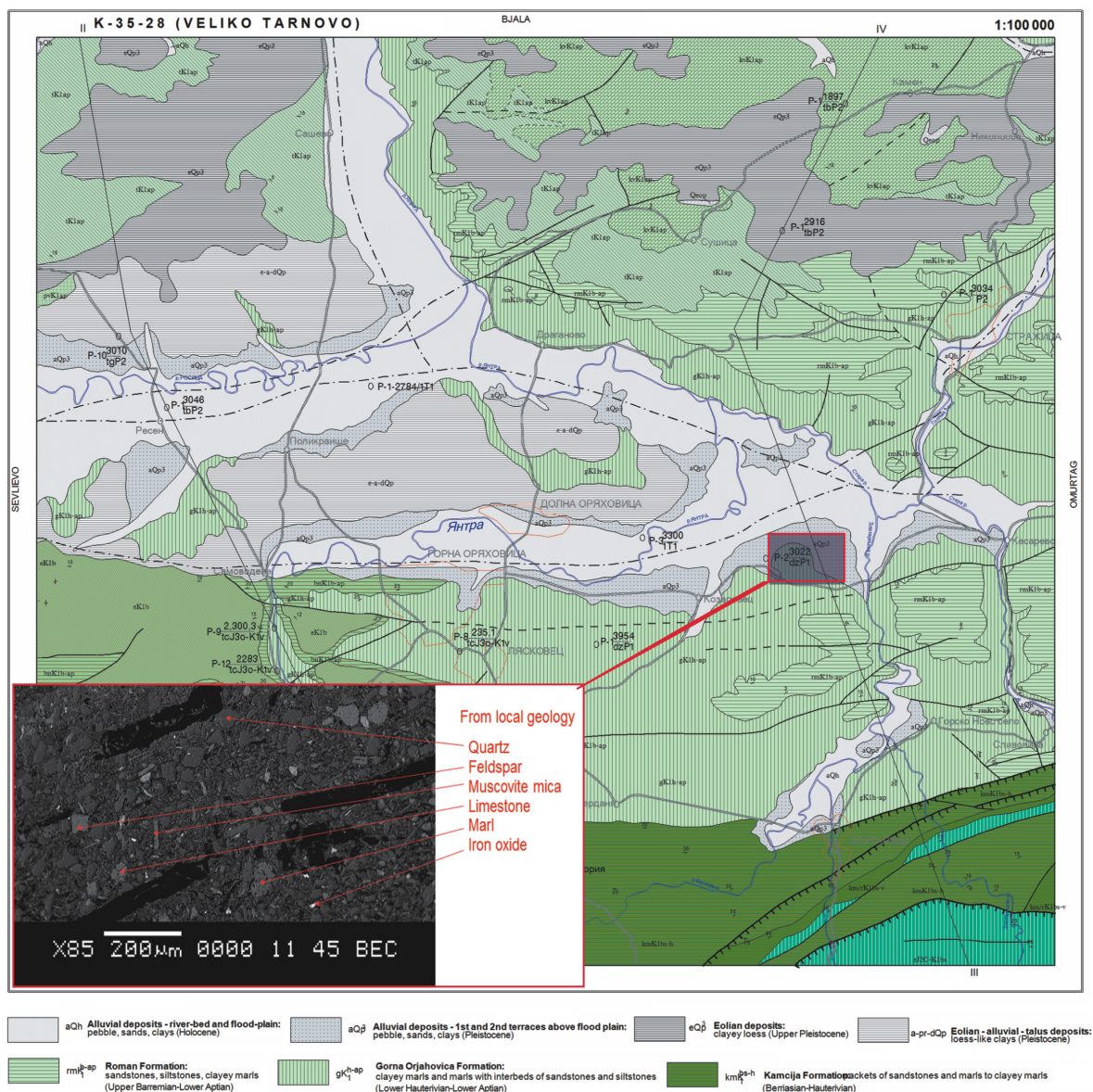


Fig. 7. Local geology (after Крисчев et al., 2010) and observed inclusions indicating local provenance of the Dzhulyunitsa fragments

Обр. 7. Геологическа карта на района (по Крисчев et al., 2010) и установени минерални примеси в керамиката, които показват местен произход на глината, използвана за съдовете от Джулюница

but such claims clearly have not considered the local geology. The clays around Dzhulyunitsa have been derived from the weathering of fine wind-blow loess, and so are themselves naturally fine. In both textural and mineralogical terms, the pottery fabrics perfectly match the natural sediments, proof that there has been no raw material processing beyond tempering with chaff.

Loessic sediments are the parent material for the black soils that form across the broader region, with contributions from the underlying Lower Cretaceous marls-limestone-sandstone facies, and from Pleistocene and Holocene alluvial and colluvial deposits (Фотакиева и др. 1976; Hristov et al. 2010). The loessic complex becomes progressively more clay-rich towards the lower reaches of the Danube River, where it forms loessic clays (Стоилов 1984, 53).

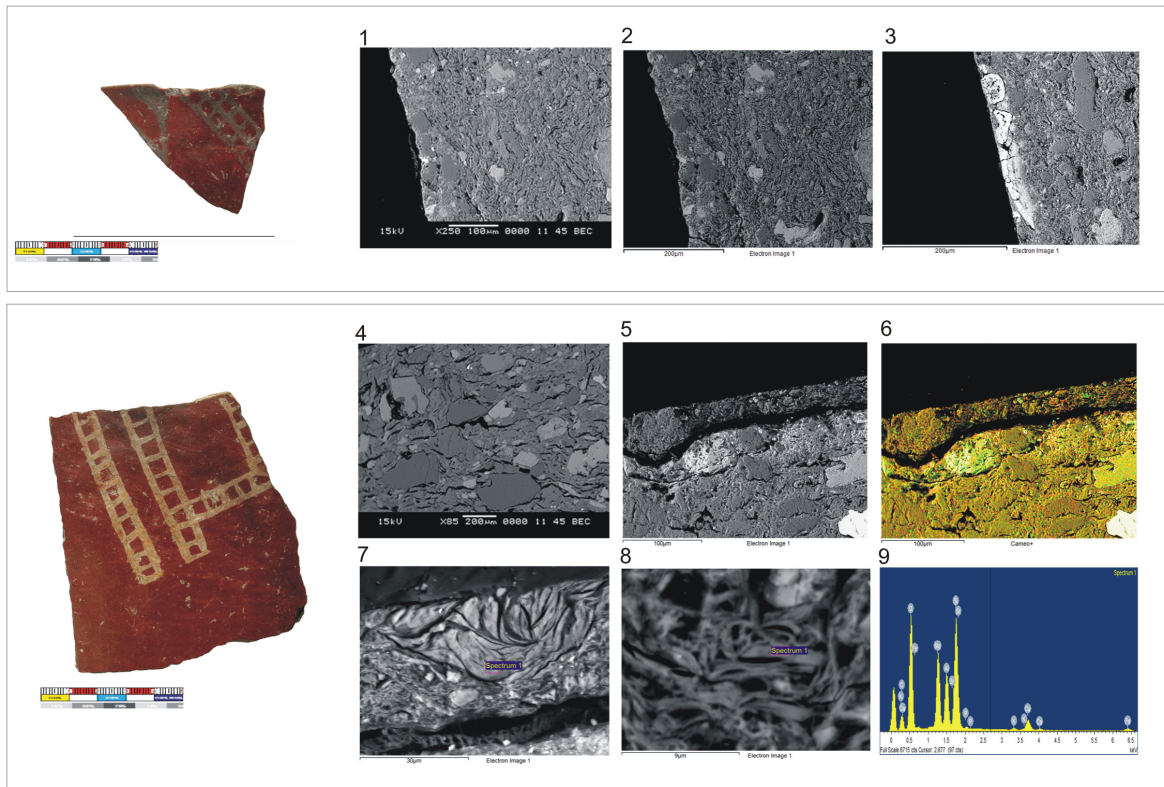


Fig. 8. Suggested non-local provenance for fragments found in Dzhulyunitsa, Layer 2. 8.1, 8.2. SEM image of the body, showing natural inclusions of granodiorite, sandstone and limestone 8.3. Unusual material used for the white paint, based on a white mica-schist. 8.4. Another example of non-local provenance: the inclusions here are of a single rock type (granodiorite). 8.5, 8.6. Different technique and material used for the white paint: unlike the local example, this is not based on ground limestone or marl. 8.7, 8.8. Fibrous white mineral, which the EDA plot (8.8) indicates to be a magnesium aluminosilicate. Identified as amesite-chrysotile with talc, this is basically white asbestos

Обр. 8. Предполагам неместен произход за фрагменти от пласт 2 в Джулюница. 8.1-2. Пример за съд с неместен произход. Примеси в тялото на съда – гранодиорити, пясъчници и варовик. 8.3. Необичаен материал, използван за бялата рисунка на същия фрагмент: шист. 8.4. Друг пример за съд с неместен произход. Примеси в тялото на съда – само гранодиоритни. 8.5-8.6. Специфичен материал, използван за бялата рисунка и нехарактерна техника за нанасянето и. За разлика от местните техники, при този фрагмент не са използвани варовици или мергели. 8.7-8.8. Химичен анализ на материала, използван за бялата рисунка – амезит-хризотил, смесен с талк

The site is located on a natural prominence, a plateau-like terrace above the Zlatarishka River, in the catchment of the Yantra River, with a number of freshwater sources available immediately nearby. It is located at a place, where the river emerges on to the flat ground of a loess-filled depression. Since the river is eroding sandstones, limestones and marls (calcareous clays), local clay should have inclusions reflecting this upstream geology (fig. 7). These should be quartz, sand, limestone, shell and reworked clay from the river catchment, combined with weathered loess washed in from the hills (adding quartz, calcite, dolomite, mica, feldspar, amphiboles and minor pyroxenes (see Hristov et al. 2010). Except

for two fragments, these are the inclusions observed in all examined shards from the first two Dzhulyunitsa layers, clearly indicating a local origin.

Non-local wares. There are no imported sherds among the studied fragments from layer one, and the two fragments from layer two have fabrics that immediately identify them as non-local. One of them has igneous rock inclusions only (granodioritic), while the other shows a combination of granodioritic, sandstone and limestone inclusions. Both fragments are of the white-paint tradition, but the white paint raw materials are also different from the local types (fig. 8). The combination of body and slip materials will allow us to suggest possible non-local sources, once a detailed comparison has been made with the regional geology.

Firing. The studied Dzhulyunitsa fragments belong to low-fired wares. Most have dark cores indicating that the firing schedule was too short for the oxidised zone to extend beyond the outer few millimetres. Where present, calcareous inclusions show little evidence of thermal degradation, suggesting that the carbonate decomposition temperature (750-800°C) was not exceeded for any significant period of time. Together, these observations point to short, a low-temperature firing, probably in a simple bonfire.

Surfaces and surface decoration

As noted above, the four different surface decorative styles include dark-painted, red-slipped and black-burnished ware (layer 1); whereas layer 2 sees the addition of white-painted ware and the loss of dark-painted pottery (see fig. 4). We will first discuss the dark-painted ware, which most often has dark brown colour and glossy surface, a colour that suggests reduction firing of an iron-rich calcareous clay. As for the decorated, 'dark-painted' fragments, at least for some of these we can be sure that there is genuine decoration present (fig. 9).

1) Dark-painted ware. The dark-painted appearance may result from either: a) the presence of a separate slip, b) painting of the fired pot, or c) a simple burnish. Also included in this group are a few sherds showing traces of an applied decoration that covers only part of the surface. How might all of these painted surfaces have been produced?

Distinguishing burnish and slip/paint. The following criteria were used to distinguish between burnish and slip. A slip or paint layer would show a discrete boundary against the body. There may be pores or gaps along this boundary due to shrinkage and post-burial weathering but the boundary should be sharp, not diffuse. The slip or paint layer should be finer than the body and should not contain inclusions of the latter. The slip/paint should be compositionally distinct when viewed by using a scanning electron microscope (SEM), though this difference may be slight where the slip has been prepared from the body clay (fig. 10. 1).

In contrast a burnished surface may be coloured, but it will lack a sharp planar contact with the body. Instead the boundary will be diffuse, reflecting a gradual decrease in applied pressure away from the surface. There may be short sections of a sharp boundary identifying burnishing, produced by localised shearing of the outer surface during burnishing, but these will be discontinuous. Scanning electron microscopy will show the outer surface to have essentially the same composition as the body, except by having a slightly lower silica/alumina ratio. So a burnish (or burnish with dragging) should produce a discontinuous boundary (fig. 10. 2).

The results from the observations of the fragments and vessels, previously identified as

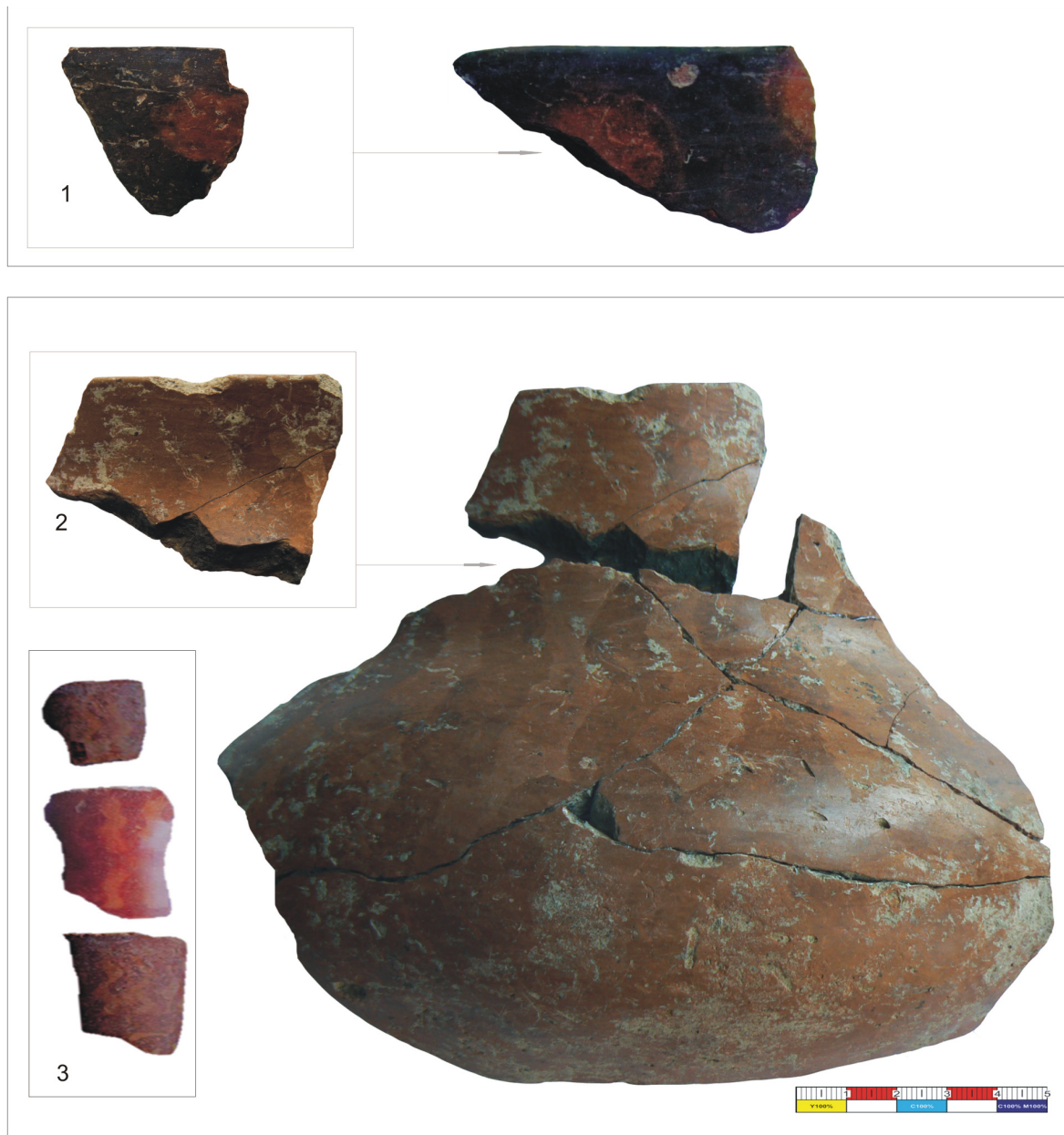


Fig. 9. Examples for the intentional decoration of some vessels found in Dzhulyunitsa. 9.1. Dark-painted pottery from Layer 1. 9.2. Dark-painted pottery from Layer 2. 9.3. Similar ornamentation, described as 'paint decorated pottery of thunderbolt pattern' (Özdoğan, 2011b, 260, fig. 69)

Обр. 9. Примери за преднамерена орнаментация на 'тъмнорисувана керамика' в Джулюница, от пласт 1 (9.1) и пласт 2 (9.2). Обр. 9.3. представя сходен декоративен мотив (Özdoğan, 2011 b, 260, fig. 69)

having dark engobe, clearly indicate that the studied dark-colour sherds are all burnished, rather than painted (fig. 11). But the quality of the finish is high, giving a glossy surface. This high quality surface is possible because of the very fine nature of the body clay and because of its mica-rich composition. The absence of coarser grains means that the surface can become very compact when burnished, without pores or coarse inclusions that would keep the surface matt rather than glossy. The very fine grained mica also provides an available source of potassium, a powerful flux that aids the development of a slight gloss on firing.

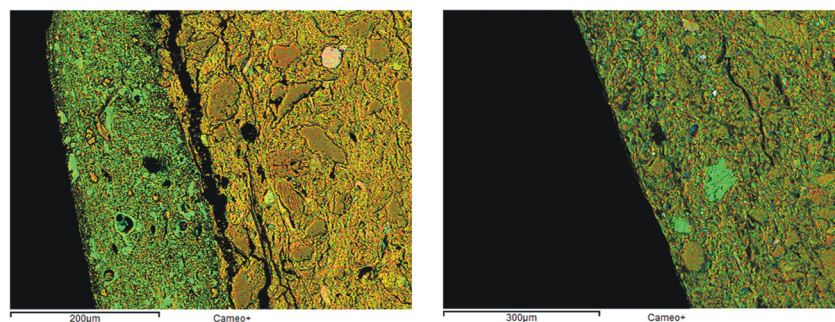


Fig. 10. SEM images confirming an engobe (left) and lack of such (right) of Dzhulyunitsa fragments

Обр. 10. СЕМ образи използвани като пример за наличие (ляво) и отсъствие (дясно) на ангоба върху фрагменти от Джулюница

Dark-painted decoration. With the sherds defined as having 'dark-painted decoration' the SEM cannot demonstrate any compositional or microtextural difference between the painted and unpainted areas (fig. 11. 1-6). This decorative effect can only have been produced by slight differential oxidation resulting from the use of a very thin non-permanent layer of an organic material (fat, wax, plant extract, etc.) that was applied before firing and has since been lost. The very sharp boundaries of the former 'paint' suggest that it was water insoluble (fat, wax, etc.), and further spectroscopic analysis (e.g. FTIR, Raman) will be used to test for organic residues.

A slight variation of the 'dark-painted' approach is present on specific examples (fig. 11. 2), which can only have been produced by rubbing some kind of carbon, such as charcoal or graphite, into what were to become the dark areas immediately after firing, and while the pot was still hot. This is essentially the same technique used to produce the black-burnished ware.

2) Red-surfaced ware (known as 'red-slipped' or 'red-painted'). With regard to the red-'painted' wares there are 3 possibilities: (1) that a true red paint layer has been applied (compositionally distinct and with a clear boundary); (2) that the surface has simply been burnished, but oxidised to red during the late stages of firing (thus it will be compositionally indistinct from body, against which it will have a diffuse boundary); or (3) that the surface has been rubbed with red clay or ochre prior to burnishing (this would result in an indistinct boundary, but should be compositionally different from the body).

Two major variations have been identified. In some cases it was established that there is a *red-painted appearance, but not a slip*. Here, iron ochre has been applied to the outer surface of the body, which has then been polished. Thin section analysis shows that there is a grain-size continuity of the quartz inclusions from the body to the red layer. This is not a true slip (a paint layer), but an ochre-enhanced burnish (fig. 12. 1).

In other cases the 'red-painted' appearance (actually most red surfaces) represents an *oxidation only effect*. These are highly polished or burnished and fully oxidised. Even though there is a conspicuous outer reddish layer present, this is not sharply differentiated from the underlying zone. There is no layer of added ochre, but this colour difference is simply due to the oxidation of the burnished outer surface (fig. 12. 2).

3) Black-burnished/black-slipped ware. This type is known in both earliest EN layers. The black surface cannot simply be unmodified fire-reduced clay, as this would result in a dark brown surface (identical to the brown 'painted wares' or the 'dark-painted' wares). There

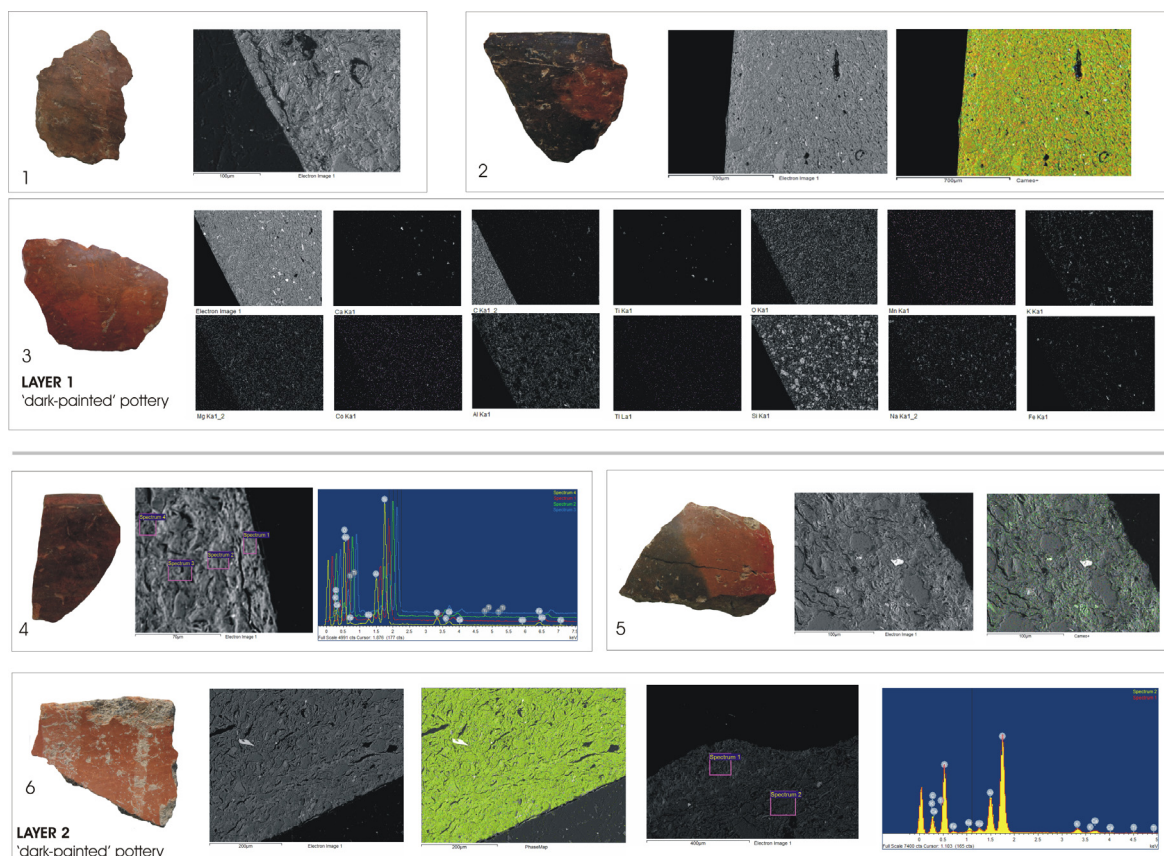


Fig. 11. 'Dark-painted' pottery from Dzhulyunitsa, Layer 1 (1-3) and Layer 2 (4-6) showing a lack of any compositional difference between body and surface. X-ray element maps are uniform from the body interior to the surface, and area analyses (EA plots) show body and surface to be the same

Обр. 11. 'Тъмнорисувана керамика' от пласт 1 (1-3) и пласт 2 (4-6) в Джулюница, която не показва разлики между тялото и повърхността на съда (липса на допълнително 'боядисана' прослойка, направена чрез нанасяне на боя или специална ангоба)

are two possible surface treatments that could produce a dark glossy surface. The first is the addition of an iron-rich slip combined with a reduction firing. This should be seen as a compositional difference between surface and body. The nature of the boundary will also discriminate the use of a slip from a burnished surface. The second is that the surface has been highly burnished with carbon, such as charcoal or graphite: this will not show a clear compositional difference in SEM (though graphitic material may be identified if impure).

None of the studied fragments showed any iron enrichment or any compositional difference between surface and body (fig. 13). From this we conclude that, whereas the variation seen in the brown-coloured dark-painted ware is simply due to the quality of the burnish, these very black examples were produced by rubbing the outer surface with carbon, probably charcoal or graphite, while the pot was still very hot.

4) White-painted and white paint decorated wares. The white-painted wares represent mainly white paint on red surface, but there are also three completely white specimens. The white paint could be based on either: (1) limestone, (2) dolomite, (3) magnesite, (4) marl, (5) china-clay (kaolinite), (6) calcined bone or (7) talc-steatite. These alternatives can be discriminated (by SEM). Since the local area is rich in limestone and marl, these are the

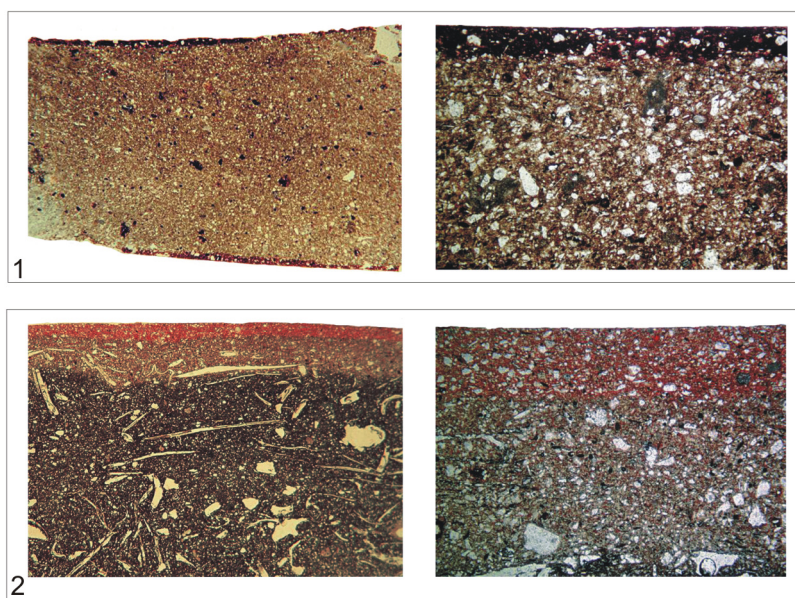


Fig. 12. Red-surface of Dzhulyunitsa fragments as result of additional rubbing of ochre (1) or of oxidation (2)

Образ 12. Червена повърхност на съдове, която е резултат от допълнителното добавяне на охра (1) или от условията на изпичане на съда (2)

expected white paint raw materials.

The *completely white shards* reveal a very fine granular slip (50 to 150 microns thick) applied to a coarse body, and represents a true white engobe of a very high quality of composition and application (fig. 14.1). The X-ray element maps show calcium enrichment in the white slip and the microtexture suggests the use of a crushed limestone. The white slip has a thickness of 150 microns, and has been built in layers.

The *creamy engobe* that is present on a few sherds is very similar to the white-surface fragments, but is less pure. The SEM-EDA analysis indicates significant silica and alumina in addition to calcium confirming that the slip is made of marl (a highly calcareous clay). Both of the creamy engobe fragments studied show conspicuous microfossils, which confirms that only a short, low temperature bonfire firing was used (fig. 14. 2, 14. 3). The white and creamy engobes have no underlying red slip, the white engobe is applied directly to the body, which has been left rough so that the engobe adheres better (fig. 14). Since fine-burnished whitish or light creamy fragments have been considered to be indicative of an Anatolian origin, it is perhaps initially surprising that the fragments analysed here show completely local pattern. But this observation alone suggest that such indicators of an Anatolian provenance must now be used cautiously.

The *white-painted decoration on red surface* is based on a 200-micron-thick white slip with microfossil shells, which also has been made from a highly calcareous clay (marl). Energy dispersive X-ray mapping using SEM confirms a marked compositional difference between body and the white paint (fig. 15). Another example however shows the use of white paint with a very different and somewhat unusual composition, not limestone or marl but a mixture of talc and amesite or chrysotile. This suggesting the use of a completely different source of raw materials, as this talc-rich mineral assemblage is not associated with the local limestone or marl geology. Together with the granodioritic body it points towards

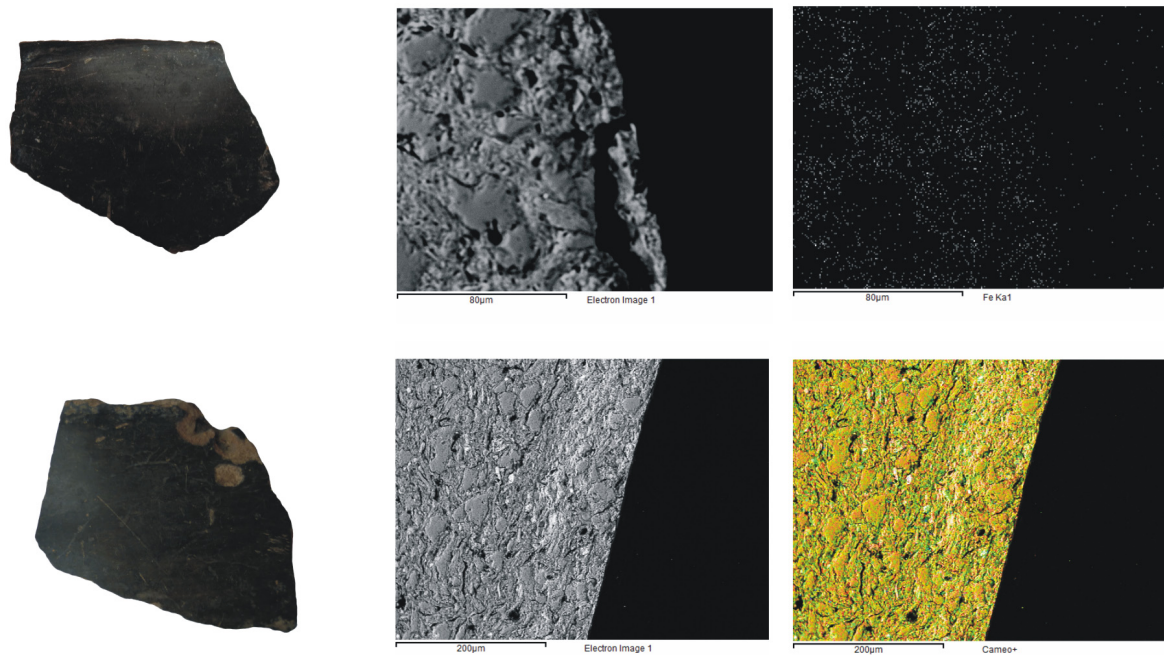


Fig. 13. Black polished fragments from Layer 1 and Layer 2 in Dzhulyunitsa, showing no compositional difference between the body and its surface. The black colour cannot be due to iron reduction (this would be dark brown) but implies that carbon (as charcoal or graphite) has been burnished in rubbed. Carbon enrichment is not measurable by SEM-EDA

Обр. 13. Фрагменти с черна полирана повърхност от пластове 1 и 2 в Джулюница, които не показват разлика между тялото на съда и повърхността

non-local provenance (see fig. 8. 7-9); one which has outcrops of granodiorite and greenstone (ophiolite) in relatively close proximity.

Another sherd suggests that paint based on mica and/or graphite may also imply the use of a graphite schist, which also represents different material combined with specific clay body (see fig. 8. 2-3).

Other examples where there appears to be the use of an off-white paint can be disregarded, because SEM-EDA shows the off-white 'paint' to be a post-depositional calcareous concretion and not the result of intentional process/activity (fig. 15. 2).

Synopsis

Summarized briefly, the preliminary findings of this study shows that a *highly advanced technology* had been established from the earliest Dzhulyunitsa layer, and that there is no evidence for an experimental stage or experimental fabrics.

The assumption that imported vessels are to be expected in this very early EN site had not been proved: no *imported wares* have been identified for layer one at this stage. Furthermore, those sherds suggested as being stylistically different (white and creamy engobe from layer 2) have been shown to have *local fabrics*. However, the opposing situation is demonstrated, that of sherds which are similar stylistically being shown to have used different technologies and, in some cases, non-local raw materials. At present such fragments have been found in the later Dzhulyunitsa layer 2 only and belong to the white-painted tradition. These observations indicate the greater complexity of the possible interpretation when based on simple stylistic comparisons or provenance suggestions.

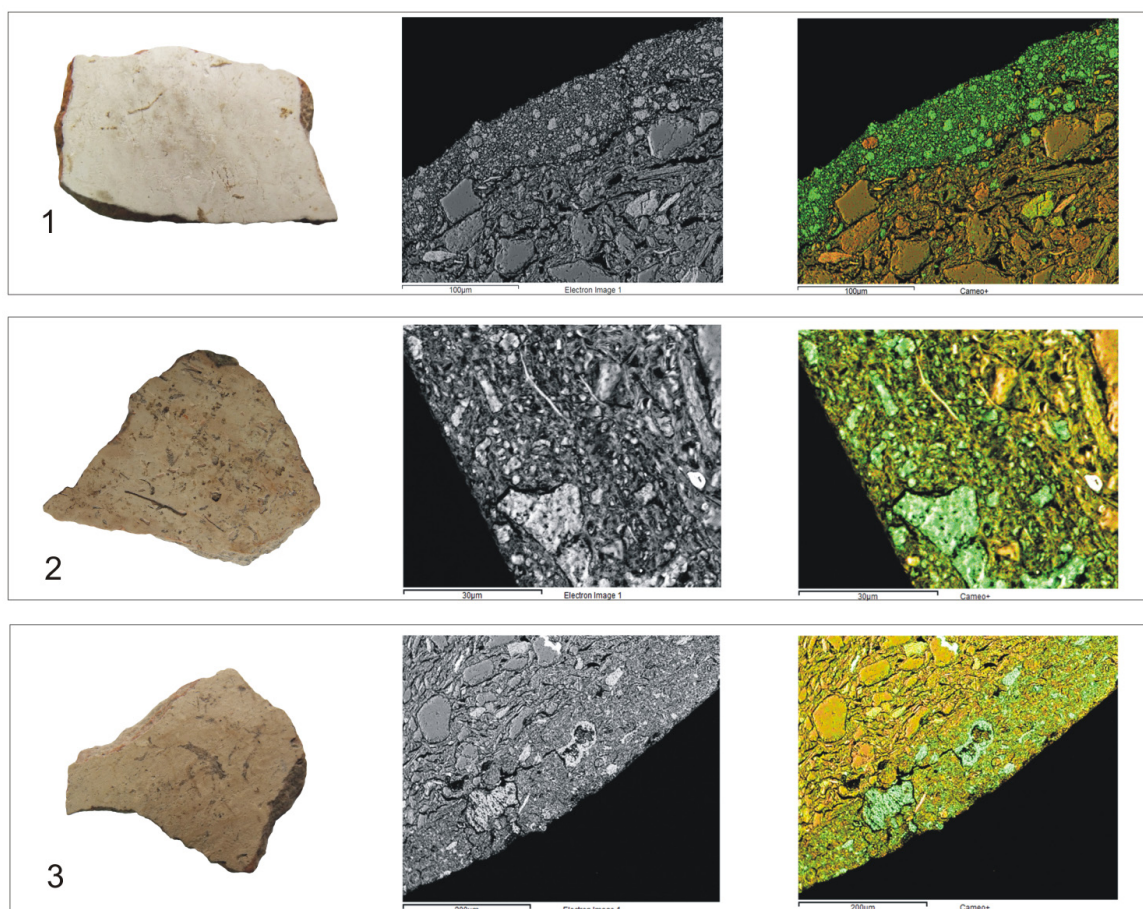


Fig. 14. Dzhulyunitsa fragments that have white and creamy engobe. 14.1. A fragment with white engobe showing clear compositional difference between body and surface. 14.2–3. Fragments with creamy engobe showing clear compositional difference between body and surface

Обр. 14. Фрагменти с бяла и кремава ангоба от Джулюница. 14.1. Фрагмент с бяла ангоба, който показва ясна разлика между тялото и повърхността на съда. 14.2–3. Фрагменти с кремава ангоба, които показват ясна разлика между тялото и повърхността на съда

As noted above, a number of pottery features (or styles) are usually considered as features signalling for various stages of the Neolithisation process. With regard to one such element, the presence of organic temper, it should be noted that the *organic temper* is not uniform in appearance or quantity, and is not strictly related to technological reasons or considerations. The rest include the burnished wares and such vessels and fragments that are 'dark'- or white-painted or have red 'engobe'.

Since all dark-burnished wares use the local loessic clays, which are naturally very fine clays rich in mica and so are easy to burnish, the burnish quality may also be due to slight variations in the clays used or the skill of the potter or both.

The red engobe is not always a genuine engobe, but may simply be the oxidised body, or in some case the outer surface enhanced by applying a little ochre before burnishing.

Analysis of outer surfaces showing darker layer previously considered as representing 'engobe' or 'paint' demonstrates that this is simply a burnish effect combined with a reduction firing: there is no 'paint' on the 'dark-painted' sherds.

The decorative approach in the second layer is not a simple continuation of the earlier

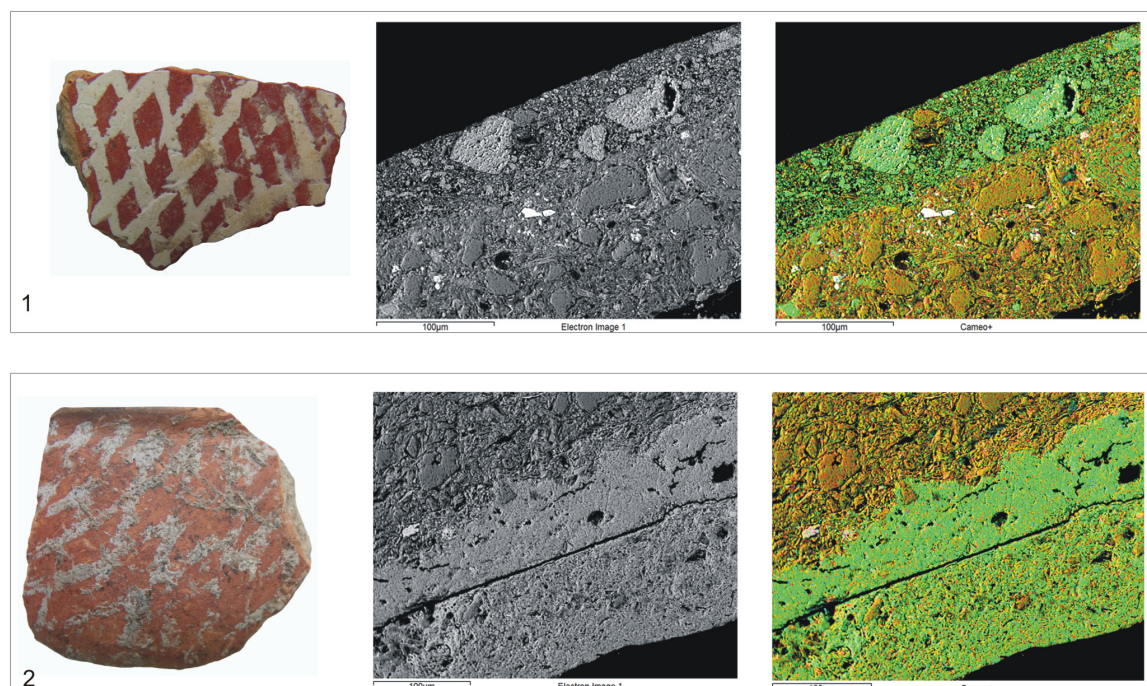


Fig. 15. Examples for white-painted decoration in Dzhulyunitsa. 1. The usual white-paint material. 2. Grayish nuance of the white, which however results from post-depositional effects (and is unintentional)

Обр. 15. Фрагменти с бялорисувана украса от Джулюница. 1 – характерна техника за нанасянето на бялата боя. 2 – замърсена повърхност, в резултат от което е получен сивкав нюанс на бялото (случаен ефект)

style of decoration in terms of either technological approach or materials, i.e. the dark-‘painted’ decoration wasn’t further developed or simply transformed into the white-painted one.

The *white paint*, on the other hand, was implemented in various modes and recipes. The shades of the white colour (as known on the studied fragments) are not intentional.

Discussion

The high quality surface finish of Dzhulyunitsa pottery is initially misleading as it seems to suggest careful processing of the body clay and the use of separate slip to achieve a high gloss finish. This seems a logical interpretation when first looking at this ware but brings with it a fundamental problem. The earliest level of Dzhulyunitsa show no evidence of an experimental phase, so how did such a technologically sophisticated pottery production begin? Since we have shown that local clays were used, there is no evidence that the earliest wares were brought in and then later copied. If the production of Dzhulyunitsa wares include technological innovation such as levigation of body clays and the formulation of a separate slip, these must have been tuned to local materials from the outset. This would be a remarkable achievement, but a problematic one. If the first potters were moving into the area, how did they immediately master these local materials?

Our preliminary study answers this paradox by recognizing the special qualities of the local loessic clays. Loessic clays are perfect for pottery-making in their natural state, and do not require temper. As they lack coarse grains, these clays are capable of giving a very

high quality burnish that is not dependent on high skill levels of the potter. Burnishing causes a layer of finer clay to be produced on the surface, and in the case of these mica-rich loessic clays, this outer layer is slightly richer in mica and therefore in potassium and iron. Both elements act as powerful fluxes and assist the 'natural' development of a fine glossy surface on firing. This behaviour underpins the very extensive use of loessic clays for highly burnished pottery in many other cultures.

In this sense, it is striking that Neolithic people moving into the central and eastern area of North Bulgaria have immediately found the perfect clay, and that they did not change this ideal fabric. As loess is not found in western Anatolia, this would have represented a new type of clay, but fortuitously one that was well suited to the pottery technology that was coming out of Anatolia. As such it would be interesting to compare Bulgarian Neolithic loessic pottery technology with the preceding non-loessic Anatolian technology, to test whether this is an uninterrupted technological transfer and also if there are changes with the advent of white paint.

With regard to the *organic temper*, it has also been considered to be a very significant feature, with its presence even being related to community mobility. Vessels with organic temper have been described as being up to 34% lighter than those with mineral temper (comments in Spataro 2005), though this hardly seems much of an advantage, particularly if only a few pots were in use. Furthermore, other regions where the white-painted tradition developed show variation in their use of temper, having no temper at all or more than three main types of temper (organic and mineral) identified by the researchers and furthermore the choice of the type, where present, is not identified as being dependent on the specific fabric (Spataro 2006). Such untempered fragments are interpreted as revealing the good qualities of the local material (Spataro 2006), and similar observations reported about sites located not far away, immediately to the north of the Danube River consider a preference to the local micaceous clay, and especially such that is suitable and allows for an easy making of the vessels (van As et al. 2005, 66-67).

Technology-typology. No shapes or sizes of the vessels are found to correspond to specific fabrics or inclusion, but instead technologically very similar fragments also belong to various shapes. Looking at the thin sections for jars, bigger spherical vessels and bowls there does not seem to be a consistent pattern – except that the larger spherical vessels have more organic temper (as expected for larger forms). The lack of a firm relation between the fabric/clay used and the shape/type/size of the vessel has also been registered in other regions (Spataro 2003; Biagi et al. 2005; Spataro 2006; 2009) and can be considered as revealing a tendency. Here it should be noted that the same observation also refers to the so-called 'painted' (decorated) thin- and thick-walled vessels.

The estimated *firing temperatures* also correspond to results gained by analysis of early Neolithic pottery from adjacent regions (see for example van As et al. 2004, 124). The low temperatures may reveal not simply impossibility to reach higher degrees. They rather imply an awareness of the very good quality (and firing properties) of the local clay and the lack of necessity to develop different firing technology in order to obtain higher firing temperature.

As regards the *surface treatment*, it should also be underlined that surfaces which sometimes look diligently worked (burnished or polished) do not always imply very special finishing technique because the loessic high-micaceous nature of the local fabrics means that they polish very easily. This highlights the need to consider raw material properties when directly comparing pottery production in different locations.

As noted above, the studied fragments, previously considered as being *painted/coated wares with 'dark engobe'*, do not show the presence of coating or engobe. Their surface is simply burnished to different extent. The observations on the *'red-slip'* pottery, a key early Neolithic feature seen as introduced from Anatolia or Western Turkey (and even from distant regions such as Ulucak), indicate that it should be considered in a greater complexity when used as a diagnostic element. The characteristics of the red surface, being a possible result of oxidation or rubbing of ochre, represent a technique different from the typical addition of the engobe. Thus the definition of red-surfaced ware as *'red-slipped'* or *'red-painted'* actually refers to very few true red slips, i.e. sherds where a distinct red outer layer (added ochre) and most red surfaces are in fact just highly polished (burnished) and fully oxidised.

As regards the best examples of added engobe, the *white- and creamy engobe fragments*, their suggested non-local origin was not confirmed. This may either imply local production of stylistically uncommon (rare) vessels. It should be noted that the white engobe sherds have no underlying red slip. The white engobe is applied directly to the body which has been left rough so that the engobe adheres better.

The early *painted decoration*, as known from the earliest examples, is considered very rare, representing *'thick bands made by different coloured slips'*, as known along the Aegean coast of Turkey (Özdoğan 2011). Decorated fragments with such technique however, were not present among the studied Dzhulyunitsa materials. Whether the probable organic material used to tone up the different colour of the ornamentation could actually be regarded as some kind of specific painting technique by the simple use of different colorant material will be considered in details elsewhere.

In order to establish more detailed characteristics of the detailed characteristics of the local clays, further analysis (minero-petrographic and chemical analysis, X-Ray diffraction) of soil samples collected from the site of Dzhulyunitsa and from various zones in its proximity (especially river sand samples) is envisaged.

Conclusion

Further details will be established with regard to this very promising study of the material from Dzhulyunitsa. It clearly questions many of the recent suppositions and raises new interesting questions for continued investigation. Further detailed and independent technological study on the Dzhulyunitsa material appears to be quite promising, especially with regard to the procurement of the raw materials, the specifics of certain technological choices and the significance of the presence of different approaches when the genuine painted decoration is considered. The observations will be considered with regard to the social implications and chronological specifics.

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(резюме)

Тази статия представя наблюдения, извършени при археометричното изследване на раннонеолитна керамика от обекта до Джулюница, местността Смърдеш, Великотърновско, които са доста неочаквани. Тук са поместени най-вече резултати от изследването на украсената керамика, при това – на така наречената ‘тъмнорисувана’ и бялорисувана керамика от двата най-ранни неолитни пласта на обекта. Изводите от направените петрографски и химически анализи са съпоставени с основни модели и възгледи, свързани с характеристиките на керамиката от този период – както в района, така и в по-отдалечени обекти и области. Разгледани са въпросите относно произхода на глината и характерните специфики на свойствата на местните материали. Посочени са и определени фрагменти от съдове, които не са с местен произход. Повдигнат е въпросът за наличието или отсъствието на експериментален етап при направата на съдовете и са представени съответните наблюдения по тази тема. Обширно са коментирани както качеството на направа на съдовете, така и необходимостта (или липсата на такава) от добавяне на опоснител. Подробно са разгледани въпросите, свързани с характеристиките на съдове, определени като тъмно- или червеноангобирани, черноангобирани, тъмнорисувани и други. Изяснени са условията за постигане на подобен ефект върху различните повърхности, а също така са коригирани редица неточности, установени в научната литература като устойчиви определения. Обърнато е внимание на характеристиките на бялорисуваните фрагменти от втория пласт на раннонеолитното селище. Установено е разнообразие във възможните материали, ползвани за нанасяне на белия цвят при ‘рисуване’ на съдовете от втория пласт в Джулюница и е подчертано високото качество на фрагментите със същинската, бяла и кремава ангоба. Именно сред бялорисуваните фрагменти са идентифицирани и такива, които не са с местен произход. От друга страна, такива, за които първоначално е предположен неместен характер, всъщност показват, че са направени от суровини, характерни за района. Установено е също така, че фрагменти украсени в по-късния декоративен стил представят и определени специфики на технологичното изпълнение. Въпреки че резултатите са предварителни, те представляват изключителен интерес, повдигат много нови въпроси и коригират голям брой наложени възгледи и широко употребявани определения. Тук е включена малка част от наблюденията, а с напредването на работата по проекта се подготвят нови публикации, в които скоро ще бъдат представени още резултати и интерпретации от проучването на различни аспекти по темата за раннонеолитната керамика, разгледани в културен и социален контекст.