

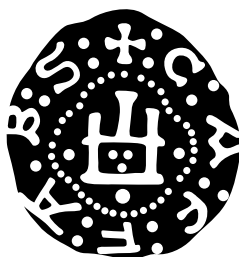
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ВОСТОЧНОЙ ЕВРОПЫ

ARCHAEOLOGICAL RECORDS
OF EASTERN EUROPE

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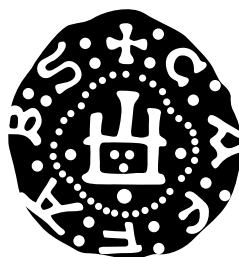
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GLAZED POTTERY OF THE MEDITERRANEAN AND THE BLACK SEA REGION, 10TH–18TH CENTURIES

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Early Medieval Glazed Ceramics Discovered in the Fortifications from Hârșova and Oltina (south-east of Romania)

Keywords: Romania, Dobrudja, Byzantine period, glazed ceramics, archaeometric investigations

Ключевые слова: Румыния, Добруджа, византийский период, поливная керамика, археометрические исследования

C. Paraschiv-Talmațchi

Early Medieval Glazed Ceramics Discovered in the Fortifications from Hârșova and Oltina (South-Eastern Romania)

This paper completes the information regarding the glazed pottery from 10th—11th century from the western region of the Black Sea, from Dobrudja. Majority of the new discoveries belongs to the group with monochrome glaze (green-olive), rarely polychrome (green-olive with yellow; greenish-yellow on a chestnut background). The material, mostly fragmentary, comes from jugs, pots and cups of different sizes. Among other finds, a glazed clay egg was discovered at Hârșova. Glazed pottery from the two analyzed settlements represents local productions and imports, several fragments were studied by using archaeometric analysis, some data regarding the glaze are presented at the end of the article.

К. Параскив-Талмацки

Поливная керамика раннего средневековья из укреплений Хыршова и Олтина в юго-восточной Румынии

Настоящая статья дополняет сведения о поливной керамике X—XI веков, найденной в западной части Причерноморья — в Добрудже. Новые находки по большей части принадлежат к группе монокромной поливы (зелено-оливковой), редко полихромной (оливково-зеленой с желтым; зеленовато-желтой на каштановом фоне). Материал представляет собой в основном фрагменты различного размера кувшинов, горшков и чашек. В Хыршове было также найдено глиняное поливное яйцо. Поливная керамика с двух изученных поселений является как местным производством, так и импортом. Несколько фрагментов были подвергнуты археометрическому исследованию, результаты которых представлены в конце статьи.

The researches conducted in the last two decades in the fortified settlements from Hârșova and Oltina (Constanța County) led to filling in the information relating the glazed pottery from 10th—11th century, from the western region of the Black Sea. The new discoveries belong in majority to the group with monochrome glaze (green-olive), rarely polychrome (green-olive with yellow; greenish-yellow on a chestnut background). Generally, the glazed pottery denotes, compared with the common use pottery, a greater attention to execution, consisting of a better preparation and cleaning of the paste, well-proportioned forms, a bolder decorative palette and a high

quality burning. Nevertheless, in frequent situations, it is slightly inferior to the pottery with golden engobe.

The beginnings of the early medieval fortified settlement from Hârșova is due to the returning of the Byzantine Empire at Lower Danube, at the end of 10th century and the beginning of the first one, with the inclusion of the city in the program of Emperor John Tsimiskes to reuse and rebuild the old Roman fortifications (Ciobanu 1970: 25; Baraschi 1991: 138), amid concerns of keeping the region under observation and influence. It seems that at Hârșova wasn't rebuild the entire ancient city, the Byzantines opting to raise a fun-

damentis a new smaller precinct, disposed in the central area of the plateau (Barnea, Ștefănescu 1971: 80; Damian 2015: 229—230). The habitation from here, developed initially under the protection of the rebuilt walls, then extended also in the *extra-muros* area (towards east were develops an crafts neighbourhood, west and north), was chronologically framed, in this stage of the researches, from the end of 10th century to the end of 11th century (Aricescu 1971: 355; Panait et al. 1995—1996: 121—134; Paraschiv-Talmațchi 2009: 421—438). The small border “city” shortly becomes a local centre, which draws the attention of merchants and craftsmen. As the majority of the fortifications from the right bank of the river, the settlement developed in stages gaining a semi urban character, facilitating also an active commercial live and ant the developing of some crafts.

In the fortified settlement from Hârșova were discovered until now 44 glazed fragments of pottery, an almost complete jug and an egg of burned clay. The glazed was laid directly on the body of the vessel and of the clay egg, without any support of engobe. In most cases, after burning the glaze become different shades of green-olive, sometimes with reddish or chestnut reflections. Exception makes the lower part of a jug on which predominates a yellow-greenish glaze on a chestnut background, colors that are also present on the egg of burned clay. Fifteen of the fragments, among which the lower part from two small jugs, were made at a slow wheel (fig. 1: 17, 18; 3: 14, 15). At 13 of these, most of them from pottery with embossed decor executed during modeling, quite a clean paste that has in compositions rare crushed shells, small gravel and vegetable carbonized during the burning process. The paste of the two bottoms of small jugs it's different, presenting in composition sand with small granulation. The other fragments were made at the fast wheel, generally from a fine paste. At some pieces, rarely, in composition appear crushed shells, small granules of white limestone or sand. Two of the fragments were made out of kaolin, with sand and small pebble. Of the total discoveries, 30 fragments come from reductant burned pottery, seven oxidant (most without depth) and seven uneven (in the fracture the ceramic wall its red only on the interior side in depth of about 0.1 cm, the rest being gray).

In terms of typology, the glazed fragments from the fortified settlement from Hârșova come from jugs, mugs and cups.

The jugs have the biggest frequency, representing almost 90% of the findings from this ceramic category. These were made at a fast or slow wheel, from clean paste with rare crushed

shells, small pebble and granules of limestone, respectively with more sand. These were burned reductant or oxidant, with or without depth or uneven. The thickness of the jugs varies between 0.44—1.3 cm, in the neck area thinning to 0.39 cm. Only one piece is made out of kaolin (fig. 1: 13; 3: 6).

Based on the fragments we can appreciate that some jugs from the fortified settlement from Hârșova had different sizes, from small vessels to large jugs. Their form was ovoidal or elongated ovoidal at the biggest ones. The mouth of the jugs was cylindrical or shaped as a funnel, with rounded lip (fig. 1: 1, 22; 3: 1, 17). Short neck, simple or delimited of the mouth by a threshold embossed during modeling.

The jugs handles, oval in section, flat or thicker, were attached at one end of the neck (fig. 1: 25) and descends to the shoulder or on the highlighted part of the body. On some pieces are present some longitudinal ribs, slightly highlighted, respectively a dent made by pressing with the finger in the superior part (fig. 1: 26, 27; 3: 19).

The base of the jugs it's straight or slightly widened towards the exterior, its diameter varying between 5.3—12 cm, and its thickness between 0.4—0.94 cm (fig. 1: 17—21; 3: 10—15).

The glaze that covers the surface of the jugs discovered at Hârșova it's mainly green-olive, with shades that oscillates from light green-olive to dark green-olive. It is shiny, sometimes with reddish or brownish reflections, generally being laid almost uniform. Some fragments that went through fires presents a baked glaze, vitrified and mat, others just mat and cracked. The glaze covers partially the interior side of the lip, almost integral the handles, respectively total or partial the bottom of the vessel. An exception makes a jug from which it's preserved only the inferior part, on which predominate the yellow-greenish glaze on chestnut background.

The only almost complete vessel (it's missing the lip) which was discovered at Hârșova it's a middle size jug, with the kept height of 23.2 cm, that has an ovoidal body, with a maximum diameter of 11 cm (fig. 1: 1; 3: 1). The vessel was made at the fast wheel from a clean paste and burned reductant. Has a cylindrical neck, with a diameter of 4.66 cm, presents a strong rib made during modelling. From the rib area starts a flattened handle (wide of 2.86 cm and thick of 1 cm), that stops on the highlighted part of the body. On the exterior, the neck was decorated with horizontal groves orderly arranged, and on the shoulder and in the lower part of the body (at 5.5 cm higher from the bottom) were laid two strips of three, respectively two groves. More accidentally, almost half of the surface of the jug was covered with



Fig. 1. Glazed pottery from Hârșova (photo by C. Paraschiv-Talmațchi).

Рис. 1. Поливная керамика из Хыршовы (фото К. Параскив-Талмацки).

glaze green-olive, as spotting of various dimensions and different thickness of the layer. There are smaller spots where the glaze is thicker and shinier, respectively bigger where it is thinner and matte. The glaze was laid directly on the surface of the vessel, without a support of engobe. The bottom, which retains traces of detachment with

a rope from the wheel, has a diameter of 9.2 cm. the jug was discovered in the north sector, in the area *extra-muros* of the small precinct (by dr. Constantin Nicolae, to which we thank that he offered it us for processing), in a dwelling dated based on the inventory in 11th century. Analogies for the jug from Hârșova, but with glaze on the



Fig. 2. Glazed pottery from Oltina (photo by C. Paraschiv-Talmațchi).

Рис. 2. Поливная керамика из Олтины (фото К. Параскив-Талмацки).

whole kept surface, we find at Dinogetia-Garvăn (Barnea 1967: 233, fig. 143: 2). Likewise, it presents similarities with the red pottery of superior facture, unglazed, and with that with golden engobe, from 11th century, from the fortified settlement from the island Păcuilui Soare (Diaconu, Vîlceanu 1972: 108—110, 114, fig. 49: 2).

Few fragments that come from jugs bodies' don't present decor. These are from the upper

part of the shoulder, or have small dimensions. The majority, including those from kaolin, presents ribs (fig. 1: 6—16; 3: 6—9), more or less embossed, narrower or wider, executed during the modelling of the vessels, decorative element we met also in the neck area (fig. 1: 12; 3: 8), as was observed also at the complete jug. Some fragments presents decor made through the technique of incision in the crude paste. Stands out one that

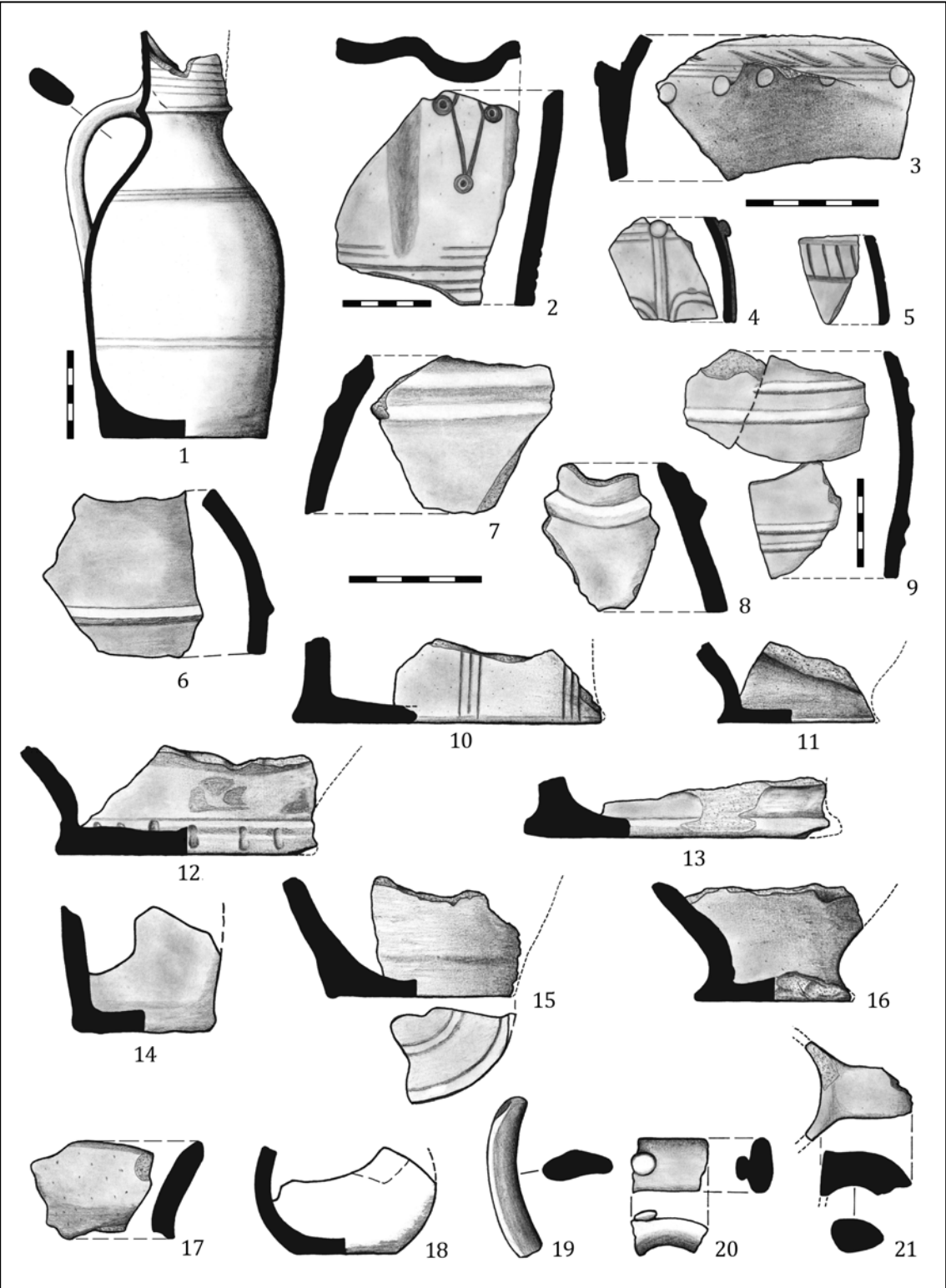


Fig. 3. Glazed pottery from Hârșova (drawing by C. Paraschiv-Talmațchi).

Рис. 3. Поливная керамика из Хыршовы (рис. К. Параскив-Талмацки).

came probably from a jug with the horizontal section almost square (with four lobes), similar to one discovered at Păcuiul lui Soare, in the level of 11th century (Diaconu, Vîlceanu 1972: 90,

fig. 34: 1). The fragment, made at the fast wheel, from paste with sporadic small granules of white limestone, was burned reductant and has a thickness of 0.8—0.9 cm. In the lobate part was deco-

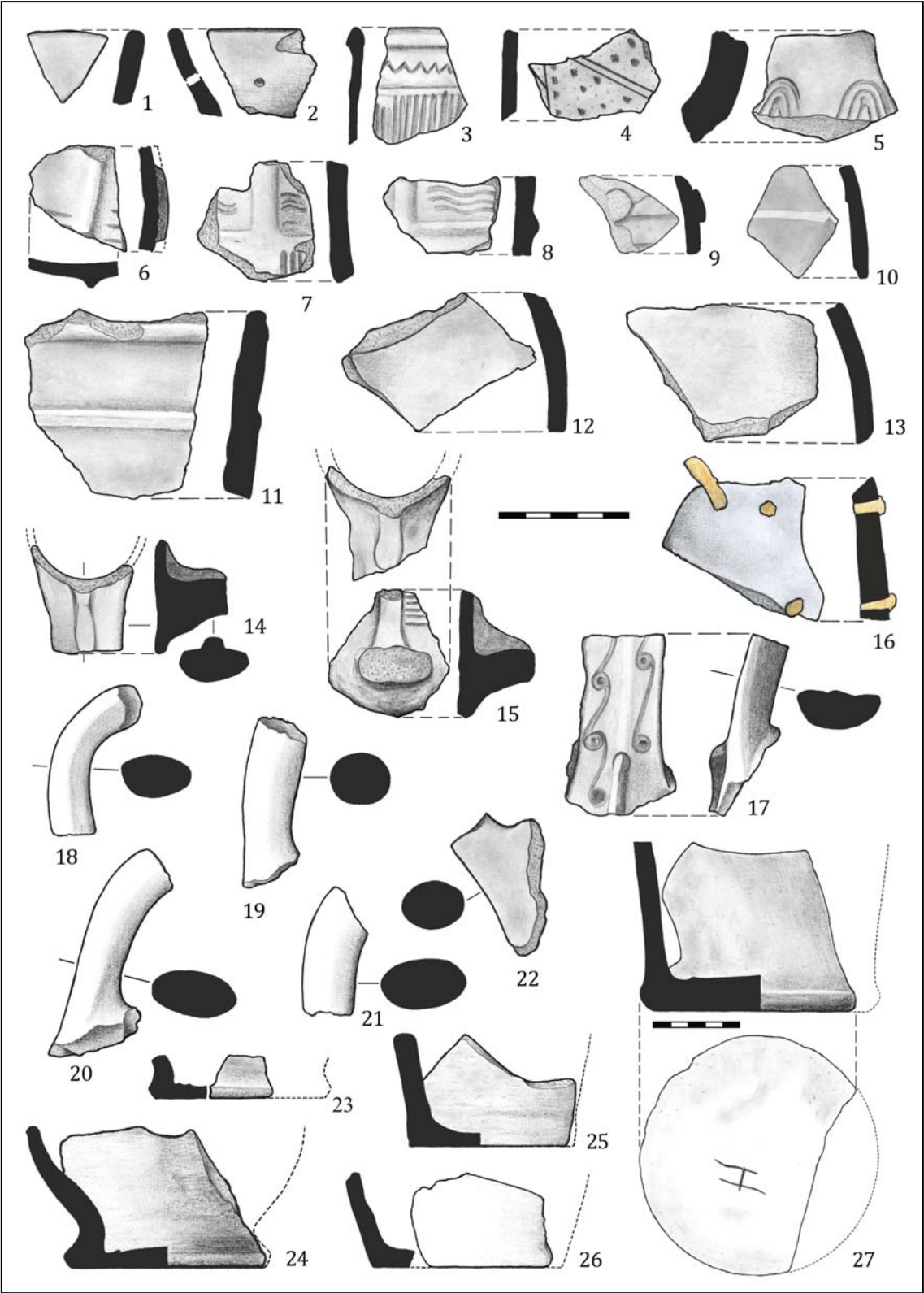


Fig. 4. Glazed pottery from Oltina (drawing by C. Paraschiv-Talmaçhi).

Рис. 4. Поливная керамика из Олтины (рис. К. Параскив-Талмацки).

rated with a rhomb that presents in the corners a circle with a point in the middle, and in the inferior part a strip of three grooves (fig. 1: 2; 3: 2).

Subsequently making the incised decor, the exterior surface of the jug was covered with glaze, that after burning become green-olive, bright. The

fragment was discovered in a dwelling inside the early medieval precinct (Complex 1/2008), along with the handle that has an impression made with the finger (fig. 1: 26). Its inventory, quite rich, was made of a grindstone, a tapered weight of clay, spindle whorls of bone and clay, numerous ceramic fragments from common use pottery and from kaolin, but also two jugs with golden engobe, respectively from two amphorae, one spheroidal and one piriform with collar, as well as a Byzantine coin (Roman III, cls. B).

A fragment of small dimensions, from the shoulder of a jug made at fast wheel and burned reductant, was decorated with short oblique lines laid between two horizontal lines (fig. 1: 4; 3: 5). Sometimes, the incised decor lowers to the base of the vessel. Thus, on a fragment made at the fast wheel from clean paste and burned reductant, appears as a strip of vertical lines (fig. 1: 20; 3: 10), and on the one with glaze yellow-greenish on chestnut background, made at fast wheel from paste with sand in composition and burned oxidant without depth, appears as short parallel lines, laid vertical at the base (fig. 1: 19; 3: 12).

On two fragments the incised decor was combined with elements of embossed decor, added after the modelling of the vessel. One, with the thickness of 0.69 cm, came from the shoulder of a jug made at the fast wheel from paste with rare crushed shells, which was burned reductant. This was decorated through the technique of incision with a strip of horizontal lines over which were applied a series of sinkings executed with the teeth's tip of a comb. Under the strip, sometimes even on its inferior part, were applied pellets in relief, then the surface of the jug was covered with glaze, which after burning became green-olive, shining (fig. 1: 3; 3: 3). On another fragment, made at the slow wheel from clean paste, burned reductant and having a thickness of 0.45 cm, a strip of incised lines partially overlaid by elements of applied decor, consisting of a vertical baguette with a sharp edge, with a small pellet in the superior end, from which starts two semi-circular arcades in section (fig. 1: 5; 3: 4).

On one of the fragments that went through fire, made at the slow wheel from paste with sand in composition, still keeps part of a weakly embossed mark potter, representing a circle (fig. 3: 15). One specimen appeared at Capidava (Cursaru-Herlea 2012: 332) and Murfatlar (Barnea, Bilciurescu 1959: 551—552), others being mentioned at Preslav (Dončeva-Petkova 1977: 182, no. 273—275).

The jugs with green-olive glaze similar with those from the fortified settlement from Hârșova, as much as we can appreciate based on the state of the material, mostly fragmentary, were dis-

covered in numerous sites from south-east of Romania (Dobrudja region) and north-east of Bulgaria. In Dobrudja, the closest analogies (chronologically framed between 10th-11th centuries) exist at Capidava, where are present both the earlier jugs, made at the slow wheel and decorated at most with ribs or a few grooves, and the later ones ornate with incised or applied decor (Florescu 1956: 291; Florescu et al. 1959: 560; Cursaru-Herlea 2012: 332—334, pl. I—II). Other similar findings came especially from the settlements from the Danube's line: Nufăru (Baraschi, Damian 1993: 238—239, fig. 2), Tulcea (Vasilii, Mănușcu-Adameșteanu 1984: 149, pl. XXI: 5), Dinogetia-Garvăn (Barnea 1967: 230—238), Troesmis (Mănușcu-Adameșteanu 1980: 242), Cernavodă (Barnea 1960: 77—78, pl. I: 4—7), Hinog (Florescu 1956: 291), Păcuilui lui Soare (Diaconu, Vîlceanu 1972: 89—107). To these we add the discoveries from two other sites inland the territory between Danube and the Black Sea, Murfatlar (Barnea 1962: 362, fig. 7) and Valu lui Traian (unpublished material), but also numerous sites from Bulgaria, like Silistra (Koleva 2009: 276, fig. I: 14, 16, 18), Car Asen (Dimitrov 1993: 101—104, pl. XIX: 1, XX: 6), Skala (Jotov, Atanasov 1998: 77—78, pl. LXVII: 4, 5, 13), Odărca (Dončeva-Petkova, Ninov, Parușev 1999: 71, fig. 116: 144, 147), Preslav (Dončeva-Petkova 1977: 187, no. 311, 188, no. 313, 314, 316), Chuma (Rašev, Stanilov 1987: 64—65, pl. XLIV), Djadovo (Borisov 1989: 221—224).

Generally, the jugs similar to those from Hârșova are dated in the second half of 10th century — 11th century, existing sites in which they continue to appear also in 12th century, but with a much lower frequency. For part of the mentioned ceramic material, referring at the jugs made at the slow wheel and the fragments decorated with ribs during the modelling of the vessels, we can assume, based on analogies (Barnea 1967: 232; Dončeva-Petkova 1977: 188, no. 313) that they belong to the beginnings of habitation from here. Others, as we mentioned, belong to some dwellings dated to 11th century, starting with the second quarter.

From the fragments with glaze discovered at Hârșova, a small number came from other types of pottery, such as mugs and cups. The mugs were made at the fast wheel from paste with rare small granules of limestone and were uneven burned. Their body, strongly highlighted, had thick walls, of 0.7—0.8 cm, and was sustained by a leg with a straight base widened towards the exterior (fig. 1: 31; 3: 16), with a diameter of 5.76 cm. In the preserved parts the mugs doesn't present decorative elements made through incision or applied, being only covered with light green-olive glaze,

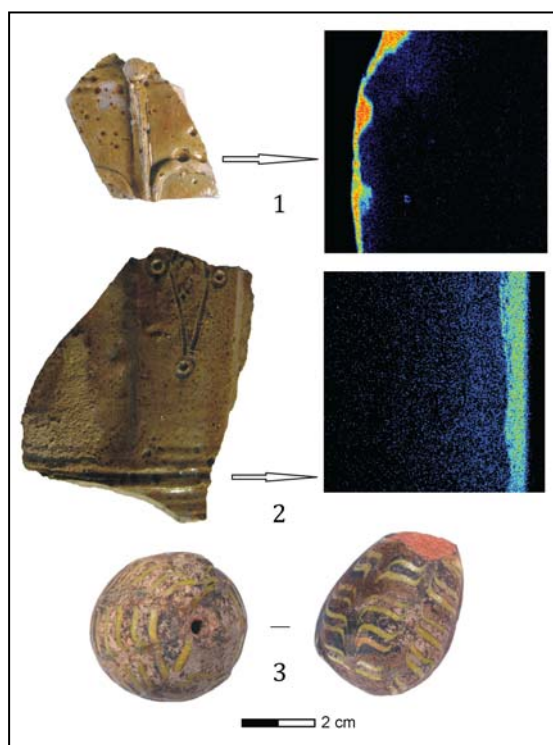


Fig. 5. 1, 2 — Micro PIXE Pb La map of the interface between the green-olive glaze (by Daniele Ceccato) and the ceramic body (by Cristina Paraschiv-Talmațchi) for shard no. 7 and no. 9 Hârșova; 3 — Egg of burned clay, glazed, discovered at Hârșova (after Paraschiv-Talmațchi, Talmațchi 2013: 349, fig. 3: 8b-c).

Fig. 5. 1, 2 — Микрокарта PIXE Pb La стыка между оливково-зеленой поливой (по Д. Чеккато) и керамическим корпусом (по К. Параскив-Талмачки), фрагменты № 7 и № 9 из Хыршова; 3 — яйцо из обожженной глины, поливное, найдено в Хыршова (по Paraschiv-Talmațchi, Talmațchi 2013: 349, fig. 3: 8b-c).

shiny, respectively through brown with a green-olive tint, mat, of poor quality. A handle, flat in section, presenting common characteristics with the fragment with shiny green-olive glaze, seems too came from the same vessel (fig. 1: 30). Unlike the jugs, this type of vessel has a low frequency in discoveries. A few pieces with glaze were mentioned at Dinogetia-Garvăn (Barnea 1967: 234), Murfatlar (Barnea 1962: 362), Car Asen (Dimitrov 1993: 104). Generally, they appeared in the levels from 11th—12th century.

Only one larger fragment came from a cup modelled at the fast wheel, from kaolin, burned reductant. Its body is globular, with a thickness of the wall of 0.72 cm, and a flat bottom (fig. 1: 24; 3: 18). It has the interior surface covered with green-olive glaze, slightly shiny, this being present also on the exterior as some spots of different sizes. Also to some cups belonged two handles, oval in section and covered with shiny glaze. The first, which came from a dwelling, has applied on the superior part an embossed pellet and it's cov-

ered with bright green-olive glaze (fig. 1: 29; 3: 20). The second one, that keeps part of the lip of which was attached (fig. 1: 28; 3: 21), presents a dark green-olive glaze, compact, which drops slightly on the interior side of the mouth. As the mugs, the cups have quite a low frequency in findings. They were mentioned at Dinogetia-Garvăn (Barnea 1967: 234; Barnea 1973: 297, fig. 5: 1), Capidava (Cursaru-Herlea 2012: 334), Păciul lui Soare (Diaconu, Vîlceanu 1972: 101), Car Asen (Dimitrov 1993: 104), Skala (Jotov, Atanasov 1998: 78, fig. 64), Pliska (Henning 2007: 685, no. 133), Odârți (Dončeva-Petkova, Ninov, Parușev 1999: 72, fig. 117: 150), Preslav (Dončeva-Petkova 1977: 190, no. 330, 332), where were dated in the second half of 10th century — 11th century.

On the same level as Complex 1/2008 (but in the layer), at 1.30 m south of the dwelling, appeared a clay egg (fig. 5: 3). It has in composition black sand of small granulation and was burned oxidant. Its exterior surface, glazed, was decorated with curly braces yellow-greenish on a chestnut background. The clay egg has a height of 4.75 cm and a maximum diameter of 3.60 cm. It presents slight humps on the surface and at the thicker end has a small hole. Inside keeps a small ball that makes noise when shaken. Based on analogies and on the archaeological context in which was discovered, we date it in 11th century. The clay egg from Hârșova completes the repertory of similar findings known in the Lower Danube area, like those from Dinogetia-Garvăn (Barnea 1967: 327), Isaccea (Vasiliu 1984: 109, 115, 135, 140), Nufăru (Jotov 2005: 145), Păciul lui Soare (unpublished material, information dr. Oana Damian) but also in the coastline area, at Varna (Jotov 2005: 145, fig. 41; 42). The glazed clay eggs have a wide range of spread, being met also in Poland, Caucasus, Sweden etc. The workshops in which were made such pieces were discovered in Kiev and in its surroundings (Rybakov 1948: 362), generally their existence in the mentioned territory being attributed to the commercial links with the centres from here (Barnea 1954: 198—199; Ștefan et al. 1967: 327).

The early medieval settlement from Oltina „Capul dealului” its part of the chain of known objectives for this period on the Danube's line, in Dobrudja. Situated on a hill, not far of Păciul lui Soare and Silistra, the settlement seem to be protected in the most exposed area by an earth wall with a kept height of 2—2.5 m and a ditch with a depth of 3 m, from the current ground level (Chiriac, Custurea 2002: 222). Unfortunately, in the area in which the survey was made weren't found enough artefacts to help us to a precise

chronological date regarding the moment of its construction. In this stage of researches, we assume that it belongs to an earlier stage of the settlement, earth fortifications being a known practice in north-east of Bulgaria in 9th century (Atanasov et al. 2011: 221). The archaeological and monetary dates (over 200 coins and a small hoard), obtained during the researches conducted until now shows an early medieval habitation which started probably in 9th century, knew a good development in the first decades of 11th century, was affected by the Pecenegs invasion from 1036, afterwards evolving until towards the end of 11th century (Mănușcu-Adameșteanu 2001: 39—40; Custurea 2009: 612—613).

At Oltina, on the excavated surface of about 380 m², were discovered 45 glazed fragments. Exception makes one fragment that presents a yellow strip accomplished by drawing on the vessel body of a line of white engobe later covered with glaze, on the others the glaze was applied directly on the pottery, after burning becoming green-olive with different shades, respectively reddish or brownish reflections. The glazed pottery found at Oltina was made mostly at the fast wheel (only four fragments belonged to some vessels made with the slow wheel), from clean paste, well prepared, with rare small pebble or white limestone with small granulation. They were burned reductant (at 32 fragments), oxidant (three pieces, at two the core being grey) or uneven (more often the fragments are grey with reddish spots of different sizes, both on the exterior and on the interior; other times, in the wall fracture it's just red only on the interior part on a depth of about 0.1 cm, the rest being grey). A fragment, burned oxidant, came from a vessel that was shaped at the slow wheel from a paste with sand and frequent pebble, similar to that of the common use pottery. We notice, that until now, weren't discovered any glazed pottery made out of kaolin.

From typological point of view, the glazed fragments from Oltina came from jugs and pots.

The jugs are well represented. These were made at the fast or slow wheel, from clean paste with rare pebble or pieces of limestone and were burned reductant, oxidant or uneven. The thickness of the walls varies between 0.54—1.15 cm, in the neck area thinning to 0.32—0.7 cm.

Unlike Hârșova, at Oltina was not discovered any complete jug, but based on the fragments we can appreciate that they were of different sizes, from small jugs to large amphoroidal jugs. Its shape was globular or ovoidal at the smaller pieces, respectively elongated ovoidal at the bigger ones. The jugs mouths had a cylindrical or a funnel shape, with the bevelled or rounded lip, sometimes thickened towards the exterior (fig. 2:

1—3; 4: 1—3). The neck was elongated or short, simple or decorated with incised lines vertical, horizontal or in wave (fig. 4: 3, 15).

The jugs handles, oval in section, flat or thicker (fig. 2: 13—20; 4: 14, 15, 17—22), were attached with one end on the vessel neck and lowered to the superior part of the body. On some pieces are present longitudinal grooves, others were decorated with incised or applied elements.

In the lower part the jugs presents a straight base, widened more or less towards exterior (fig. 2: 23—27; 4: 23—27), of which diameter varies between 6.4—14 cm, and the thickness between 0.48—2 cm.

The glaze that covers the surface of the jugs found at Oltina its green-olive, with shades that oscillates from light green-olive, slightly yellowish, to dark green-olive. This can be mat or shiny, sometimes presenting reddish or brown shades, and was laid uniform or uneven. Some fragments which were secondary burned have a baked glaze, glassy and mat in some places. The glaze cover also the interior surface of the lip, lowering even towards the neck area, the handles on the entire surface, respectively total or partially the base of the vessel. On two of the bases it's also found on the interior as some big or small spots, and on another one on the entire surface, but being mat, darker and thinner then on the exterior of the vessel (fig. 2: 26). Among the fragments that came from jugs it's also one that is burned reductant, which has on the exterior surface a yellow line obtained through laying a wider horizontal line of engobe on the vessels body, previous of laying the glaze (fig. 2: 6; 4: 10). This is part of the inventory of a dwelling (Complex 2/2011), in which, among the common use pottery, appeared two others fragments with green-olive glaze (from the shoulder of a jug and a handle base) and one from a piriform amphorae with collar. The vessels with glaze green-olive and yellow strips appear rarely in the early medieval settlements from Lower Danube. A few analogies we find in the sites from Bulgaria, among which we mention Silistra (Koleva 2009: 279, 288), Car Asen (Dimitrov 1993: 104, pl. XX: 3) and Preslav (Dončeva-Petkova 1977: 188, no. 315).

Numerous fragments that came from jugs have a smooth surface, covered with green-olive glaze (fig. 2: 21, 25, 27; 4: 12, 13, 27), others present decorative elements made through the technique of incision or applied, before glazing. Were decorated the neck, handles and the body of the jugs. On a fragment from the neck of a jug with light green-olive glaze, under the exterior thickening of the lip was incised a line in wave, followed by a poorly embossed rib, then by verti-

cal incised lines (fig. 2: 3; 4: 3). This was made at the fast wheel, burned reductant and has a thickness of 0.32 cm. It was discovered in the filling of a dwelling (Complex 3/2011), along the base which was glazed on both size and a fragmentary handle which presents in the upper part a plastic decor, a baguette that starts from a handle and gets up vertically on the vessels neck (fig. 2: 13; 4: 14). This type of handle we also met in the site from Silistra (Koleva 2009: 276, fig. I: 17) and seem to have a reduced spreading area.

A similar handle with the one from Complex 3/2011 but bigger (fig. 2: 14; 4: 15), made in the same workshop (the vessels presents similar paste, were made at the fast wheel, have the same uneven burning, light green-olive glaze, respectively the same applied decor, and horizontal lines incised on the neck) was discovered in the filling of a burned dwelling (Complex 1/2008), along the fragment from a jug with green-olive glaze decorated with oblique incised lines and sinkings (fig. 2: 4; 4: 4). This last one, for which we don't know any analogies, was made at the fast wheel from clean paste, was burned reductant and has a thickness of 0.55 cm. From the floor of the same dwelling came other four fragments from the body of some jugs and a handle with dark green-olive glaze, all burned reductant, but also secondary. The handle it's flat and has longitudinal rib on the middle, over which in the inferior part was applied a short baguette. Laterally of the rib, on both sizes, were made, through incision, several circles with a point in the middle, the known motif "in eyes", uniform distributed and united through curved lines (fig. 2: 15; 4: 17). The other four fragments came from the body of two jugs. Of these, one was decorated with a strip of horizontal grooves, weekly incised, over which was applied a vertical embossed baguette, quasi triangular in section (fig. 2: 10; 4: 6). Other two fragments present embossed baguettes, rounded in the superior part and partially decorated with vertical incised lines, applied over incised lines in wave (fig. 2: 8, 9; 4: 7, 8). The last fragment was decorated only with green-olive glaze and did not keep any other decor. Among the pottery with green-olive glaze, from the inventory of this dwelling are part a medium size pot without handles, decorated through the incision technique with a strip of horizontal lines in the area of the maximum diameter over which are two strips in wave, a clay bucket ear and a whip handle of horn. Based on its inventory was dated towards the middle of 11th century, being probably set on fire during the Oghuz invasion from 1064—1065. Almost all glaze pottery fragments from Complex 1/2008 have analogies in the findings from Silistra (Koleva 2009: 276, fig. I: 9,

13, 17, 282; fig. IV: 3). Others we find in the settlements from Capidava (Cursaru-Herlea 2012: 342, pl. II: 14), Dinogetia-Garvăn (Barnea 1967: 233, fig. 143: 4, 9, 21, 237; fig. 145: 12, 13), Păcuil lui Soare (Diaconu, Vîlceanu 1972: 95, fig. 38: 2), Skala (Jotov, Atanasov 1998: 77—78, pl. LXVII: 10, 11).

From a dwelling (Complex 1/2004) came a small fragment, made at the fast wheel from a clean paste and burned reductant, which probably belonged to a jug. This was decorated with embossed horizontal grooves and buttons, over which was laid the glaze that after burning become light green-olive (fig. 2: 11; 4: 9). Besides the characteristic inventory, in this dwelling was found also a fragment of a jug with golden engobe.

From the layer came numerous fragments which, as in the settlement from Hârșova, but in a much smaller proportion, were decorated with strips of horizontal grooves or slightly embossed ribs made during the modelling of the vessels (fig. 2: 7; 4: 11). To them it adds the inferior parts of two jugs. One came from a medium size vessel made at the fast wheel from clean paste and uneven burned, of which exterior surface it's covered with shiny green-olive glaze, a few drops falling inside the vessel (fig. 2: 25; 4: 24). The jug's base is widened towards the exterior and has a diameter of 7.3 cm, but the thickness of the wall varies between 0.42—0.75 cm. The second one came from an amphoroidal jug made at the fast wheel from clean paste uneven burned, which has the exterior surface covered with green-olive glaze, with lighter spots or reddish reflections (fig. 2: 27; 4: 27). Its bottom, on which was incised a sign after burning, its partially glazed and has a diameter of 14 cm and the thickness of the vessel walls of 1—1.1 cm.

Unlike the fragments presented above, most of them covered with high quality glaze, in the settlement from Oltina was discovered also the inferior part of a medium size jug, made at the slow wheel from a paste with sand of small granulation, oxidant burned without depth, and covered with lower quality glaze, uneven applied, mat and partially exfoliated (fig. 2: 24; 4: 25). In the areas where it's thicker, the glaze is green-olive and in those was its thinner is red-brownish. Two other fragments, made at the fast wheel, presents only spots of glaze green-olive towards yellowish (fig. 2: 22, 23).

The discovery of a jug fragment which came from a repaired exemplar through riveting with lead (fig. 2: 12; 4: 16) shows the importance accorded by the inhabitants of the settlement to glazed pottery.

Without coming back over the analogies presented above, we mention that the jugs with green-olive glaze were similar to those from the settlement from Oltina were found also at Murfatlar (Barnea 1962: 362, fig. 7: 3), Cernavodă (Barnea 1960: 77, pl. I: 5), Pliska (Henning 2007: 685—686, no. 134, 136). At Preslav some glazed jugs have on the bottom signs incised (Dončeva-Petkova 1977: 189, no. 318, 321, 323).

The pot with or without handle represents another type of pottery of which surface was covered with green-olive glaze, compact. Until now, appeared a single fragment from a pot made at the slow wheel, from clean paste, burned red-utnant. Previous to applying the glaze, it was decorated through the technique of incision with a strip of lines in wave on the shoulder (fig. 2: 5; 4: 5). Analogies for this type of pottery we met at Păcuilui lui Soare (Diaconu, Vîlceanu 1972: 101—102, fig. 43), Dinogetia-Garvăn (Barnea 1973: 297; Vasiliu 1991: 385), Nufăru (Baraschi, Damian 1993: 251, fig. 2: 2), Pliska, Preslav and Madara (Dončeva-Petkova 1977: 154—155, no. 50, 62—63), where were dated in the second half of 10th—11th century.

The glazed pottery from the settlement from Oltina belongs to the beginning of 10th–11th century. The jugs made at the slow wheel, those with ribs made during modelling the vessels and the pot are from the first part of this period.

The vessels with glaze discovered in the fortified settlements from Hârșova and Oltina presents the characteristics of a typological group specific to the area of Lower Danube, respectively north-east of Bulgaria. In the mentioned area, in the settlements of which inhabitation includes the second half of 10th century and the next one, the jugs are present everywhere, also recording the highest frequency. From the amphoroidal jug, from large dimensions to the miniature one, we can say that this type of pottery was preferred the entire period for decorating with glaze. In smaller proportion, along the jugs are present the mugs, cups, pots, bowls and plates, but, as was observed in the two analysed settlements, these types don't appear in all sites. Another characteristic of this ceramic group is the work technique. In the levels from the second half of 10th century and the beginning of 11th century are present vessels with glaze green olive made at the slow wheel, for that somewhere in the first quarter of 11th century these to be made exclusively at the fast wheel, unlike most of the common use pottery that continues to be made at the slow wheel (Diaconu, Vîlceanu 1972: 104—106). Well cleaned paste and carefully prepared, made at the fast wheel, more elegant shapes and without strong deformations, a neater decor and the presence of the

glaze represent some motifs that determined us to consider this category superior compared to the most of the ceramic material. Its relative rarity in a site, the presence of the glaze and the neater and bolder decor, especially the applied one, made that a good period its presence to be attributed to imports. The rise of the number of findings, calculated as number of researched sites not like frequency, remarking the lack of some series productions, and the lack of analogies in other regions of the Byzantine Empire (Diaconu, Vîlceanu 1972: 105), led us to assume that it's actually mostly a local production. It's difficult, in this stage of research, to locate the centre or the centres in which such pottery was made. But the broadcast area of this ceramic category make us to understand, for the moment, through "local production" those vessels with glaze made in the workshops from Dobruđja and north-east of Bulgaria. Dinogetia-Garvăn, Hârșova, Păcuilui lui Soare can represent centres of productions of the glazed pottery, in each of them being discovered pottery kilns (Paraschiv-Talmațchi 2006: 46—47), but also vessels with shapes and characteristic decor. Preslav and Silistra are two other possible centres of production, for the respective period both knowing a significant economic development. Also, at Preslav were discovered pottery kilns and various types of glazed vessels, dated especially in the second half of 10th century (Dončeva-Petkova 1977: 31).

Hoping that we will obtain more answers in this sense, the pottery from four early medieval settlements from Dobruđja it's subjected to archaeometric analyses using the Optical Microscopy (OM) and PIXE (Particle Induced X-ray Emission), most of the information still is being in processing. From the big batches analysed we extracted the samples corresponding to some vessels with glaze discovered at Hârșova and Oltina, about we will talk below, with special attention to glaze. We mention that in the tables the samples from Hârșova were marked with H and those from Oltina with O.

Compositional analyses of ceramic

Two batches of eight ceramic fragments with green-olive glaze discovered at Hârșova and eleven from Oltina, Constanța County, Romania, were investigated using Particle Induced X-ray Emission (PIXE) technique to determine their chemical composition, in order to get clues about the employed raw materials and manufacturing techniques (Bugoi et al. 2015: 296—301).

The measurements were made at AN2000 accelerator of Laboratori Nazionali din Legnaro

Table 1.
Chemical composition of the ceramic bodies for Hârşova and Oltina olive-green glazed shards

	MgO (wt%)	Al ₂ O ₃ (wt%)	SiO ₂ (wt%)	P ₂ O ₅ (wt%)	K ₂ O (wt%)	CaO (wt%)	TiO ₂ (wt%)	Cr ₂ O ₃ (ppm)	MnO (ppm)	Fe ₂ O ₃ (wt%)	NiO (ppm)	CuO (ppm)	ZnO (ppm)	Ga ₂ O ₃ (ppm)	Rb ₂ O (ppm)	SrO (ppm)	ZrO ₂ (ppm)	PbO (wt%)
H7S	2,8	16,8	66,0	0,8	3,0	4,8	8,9	152	1220	4,5	57	19	112	20	109	114	281	0,2
H8S	2,4	15,1	58,4	4,0	3,0	2,6	9,1	138	328	4,4	193	63	134	1	70	162	119	5,8
H9S	2,5	17,2	69,4	0,5	2,7	1,3	8,8	152	674	4,5	72	11	81	19	93	107	371	0,3
H9P	2,4	17,2	66,7	0,2	2,8	1,4	9,6	275	767	4,8	143	45	97	37	90	97	345	3,4
H10S	2,7	16,4	66,9	0,7	3,1	2,4	11,1	134	519	5,6	79	35	129	31	189	265	775	0,1
H11S	3,4	15,2	56,5	4,6	2,6	4,7	7,5	120	618	3,5	171	77	93	1	0	77	225	4,8
H12S	2,2	14,7	52,7	5,3	2,8	2,3	6,6	122	362	3,9	306	233	69	1	83	119	0	9,9
H36P	2,7	17,7	62,9	0,6	3,3	3,1	9,7	275	784	5,2	152	52	111	0	92	127	132	3,4
O1	1,1	15,9	66,3	0,5	3,2	5,9	8,7	335	645	5,6	103	88	190	32	202	263	438	0,3
O2	1,8	17,4	65,9	0,7	3,2	4,0	9,1	330	739	5,7	93	71	202	35	201	258	349	0,1
O3	1,3	18,5	64,3	0,4	3,4	5,0	11,0	256	1057	5,5	69	109	176	29	235	315	327	0,0
O4	1,2	18,3	68,3	0,4	3,3	1,1	9,5	300	920	6,0	80	97	163	31	246	178	409	0,2
O5	1,5	18,3	68,7	0,3	3,0	1,3	8,9	239	863	5,7	88	76	163	31	218	152	317	0,2
O6	1,8	17,5	65,8	0,7	3,8	2,5	11,5	280	570	5,9	113	70	202	0	233	186	445	0,5
O7	1,4	13,3	73,2	0,2	2,3	1,3	6,0	198	420	7,4	83	95	205	30	180	183	723	0,1
O8S	2,2	17,9	69,2	0,3	2,7	0,9	10,2	0	732	5,1	75	0	116	0	143	107	310	0,2
O9	2,5	16,0	64,7	0,4	3,5	3,2	12,1	443	689	7,6	136	59	172	49	194	217	316	0,6
O10	2,1	13,8	72,1	0,4	2,7	1,3	8,1	233	945	6,3	80	25	169	36	151	207	446	0,2
O10ALT	2,4	16,5	63,0	0,7	3,6	4,6	10,5	323	998	7,7	139	46	199	22	178	240	271	0,2

Table 2.

Chemical composition of the olive-green glaze for Hârșova and Oltina shards

	MgO (wt%)	Al ₂ O ₃ (wt%)	SiO ₂ (wt%)	Cl (wt%)	K ₂ O (wt%)	CaO (wt%)	TiO ₂ (ppm)	MnO (ppm)	Fe ₂ O ₃ (wt%)	NiO (ppm)	CuO (ppm)	ZnO (ppm)	PbO (wt%)
H7	1,1	5,5	24,8	0	1,3	0,9	632	474	2,1	1694	1386	77	58,0
H8	1,1	6,9	25,4	0,9	2,5	6,8	3350	368	2,1	1610	1133	142	52,2
H9	1,1	6,3	25,9	0	1,4	0,8	4106	462	2,5	1857	1103	321	61,0
H10	1,6	6,0	23,6	1,3	1,2	1,7	0	196	2,6	1905	724	191	61,4
H11	4,4	5,3	28,4	0	1,0	6,1	2247	491	2,3	1558	1952	183	50,5
H12	4,2	5,6	29,0	0	0,9	6,3	0	0	2,4	1651	1961	174	50,9
O1	0	6,7	31,0	2,9	1,2	4,1	2149	212	2,2	1305	437	177	51,1
O2	0	4,4	20,2	4,2	0,9	3,5	0	502	2,7	1778	786	1055	63,6
O3	0	4,9	19,0	4,5	0,7	2,6	0	0	2,5	1823	544	298	65,4
O4	0	4,8	19,5	4,5	2,1	1,5	0	212	1,9	1796	420	118	65,6
O4 int	0	4,7	28,3	1,4	4,3	2,5	4412	0	3,1	1400	0	146	55,1
O5	0	2,0	7,4	5,8	0,8	11,7	0	262	1,6	1977	642	293	70,3
O6	0	2,8	16,2	3,3	3,6	13,1	0	0	3,2	1719	673	499	57,3
O7	0	2,6	12,0	4,5	1,2	13,7	0	394	2,0	1769	696	142	63,8
O8	0	2,9	28,0	0	2,8	7,5	3166	960	2,6	1529	837	559	54,7
O9	2,0	4,5	21,3	1,5	0,9	1,6	0	0	2,2	1889	1080	181	65,5
O10	0	4,2	19,2	4,0	1,4	9,1	0	284	1,3	1778	1104	213	60,3
O10'	2,0	4,2	21,1	0	1,4	7,1	0	450	2,4	1628	367	429	60,6

(LNL), in the frame and with the financial support of the FP7 ENSAR project (the research leading to these results has received funding from the European Union Seventh Framework Programme FP7/2007—2013 under Grant Agreement no. 262010 — ENSAR; the skilful technical contribution of Daniele Ceccato and Leonardo La Torre from LNL, INFN, Italy in realizing this experiment is gratefully acknowledged). The experiment was performed in vacuum using a 2 MeV proton beam. The ceramic paste composition was obtained from samples measured as pelletized powders, while the decorations were analyzed by directly hitting the shards with the proton beam (i. e. samples measured without any preparation).

The chemical composition of the analyzed ceramic fragments is given in tables 1 and 2 (we thank to dr. Roxana Bugoi for her suport in accomplishing and interpreting the informations). The major and minor element concentrations are provided as weight percent (wt%), while the trace element concentrations as parts per million (ppm). The overall combined uncertainties were

estimated to be 5 % for major and minor elements and 30 % for the detected trace-elements.

Micro-PIXE scans (beam dimensions: $5 \times 5 \mu\text{m}^2$) of small areas ($3200 \times 3200 \mu\text{m}^2$) of the interfaces between the green glazes and the underlying ceramic bodies were used to estimate the thickness of these decorations. It was noticed that some shards have an uneven glaze layer, bubbly structures being evidenced by the micro-beam scans. On average, glazing turned out to be tens up hundreds micrometers thick — more specifically, from $50 \mu\text{m}$ up to $400 \mu\text{m}$ — with a composition rich in lead oxide ($\sim 60 \text{ wt}\%$ on average) — see figure 5: 1—2 and table 2. The compositional data, particularly the high lead and the low alkali contents, suggest that the olive-green glaze is a high-lead glaze applied onto a non-calcareous body (Tite et al. 1998: 241—260).

Little amounts of CuO ($\sim 900 \text{ ppm}$ on average) were found in the green glaze. The overall compositional pattern suggests that the olive-green hues of the glaze were induced by combinations in different proportions of the ferrous (FeO) and ferric oxide (Fe_2O_3).

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