

## **TRACES OF METALLURGICAL ACTIVITIES IN LATE ROMAN ROMULIANA: RESULTS OF RECENT INVESTIGATIONS**

SOFIJA PETKOVIĆ<sup>1</sup>, MAJA ŽIVIĆ<sup>2</sup>

<sup>1</sup>*Institute of Archaeology, Belgrade, Serbia,*

<sup>2</sup>*National Museum, Zaječar, Serbia*

### **ABSTRACT**

During the recent archaeological investigations in 2002 – 2005, on Gamzigrad – *Romuliana*, the palace of emperor *Galerius* from the beginning of 4<sup>th</sup> century A.D, traces of metallurgical activities in Late Roman horizons, from the end of 4<sup>th</sup> to 6<sup>th</sup> century A. D. were noticed.

Some preliminary physical and chemical analysis of the ore, slag and charcoal from the large smelting furnace was done by Prof. Dragana Živković and Prof. Nada Štrbac with associates on Technical faculty in Bor.

**Keywords:** Eastern Serbia, Gamzigrad, *Romuliana*, Late Roman period, metallurgy of iron

Archaeological investigations conducted from 2002 to 2005 at Gamzigrad yielded new data about metallurgical activities in the Late Roman *Romuliana* from the final quarter of the 4<sup>th</sup> to the middle of the 6<sup>th</sup> century (Fig. 1).<sup>1</sup>

Excavations in the south tower (tower 19) of the west gate of later fortification that started in 1996 were completed in 2002 (Fig. 2). Within segment II of the mentioned tower were investigated two horizons dated in the final quarter of the 4<sup>th</sup> century. In this two horizons were encountered workshops and in the workshops were discovered four blacksmith's furnaces and one smelting furnace. Some of these furnaces had been renovated.

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<sup>1</sup> Excavations were realized by Institute of Archaeology in Belgrade as part of the project of the Committee for Archaeology of Serbian Academy of Sciences and Arts. Director of Project is academician Slobodan Dušanić and coordinator is Dr. Miloje Vasić, director of the Institute of Archaeology in Belgrade. Members of archaeological team were Sofija Petković, MA, Institute of Archaeology in Belgrade, Maja Živić, MA, National Museum in Zaječar, Dr. Miroslav Vujović, Faculty of Philosophy in Belgrade, Pero Praštalo, Regional Museum in Knjaževac and students.

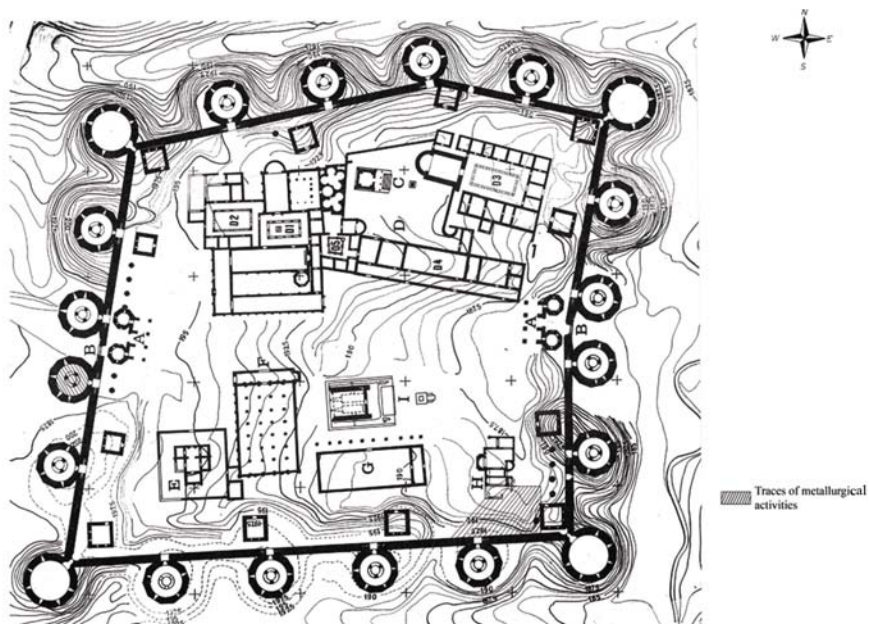


Fig. 1

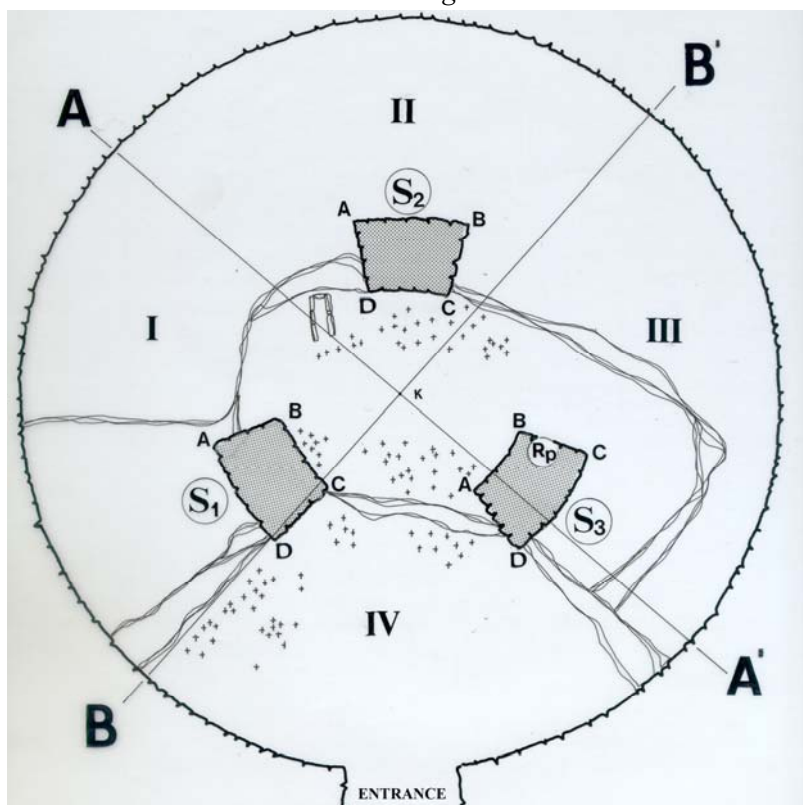


Fig. 2

Earlier level e in the tower 19 was established immediately on top of mortar substructure of the floor and it consists of rammed reddish-brown clayey soil with small pieces of mortar and it is 5 to 10 cm thick. This horizon was accumulated during final third or quarter of the 4<sup>th</sup> century, after AD 364 or AD 380, in the time of the resettling of Romuliana. The new inhabitants of Romuliana used the interior of tower 19 as workshops for metal working, smithies and the like. After leveling of debris, the interior of the tower was divided by dry masonry walls and porches were constructed. At this level we encountered many furnaces of rectangular or circular plan with floor paved with bricks and brick fragments and domed upper structure made of pieces of stone and brick bonded by clay. There were four such structures (hearths 3, 4, 5 and 6) in segment I, two (hearths 8 and 9) in segment III and four in segment II (furnaces 4, 5, 6 and 7).

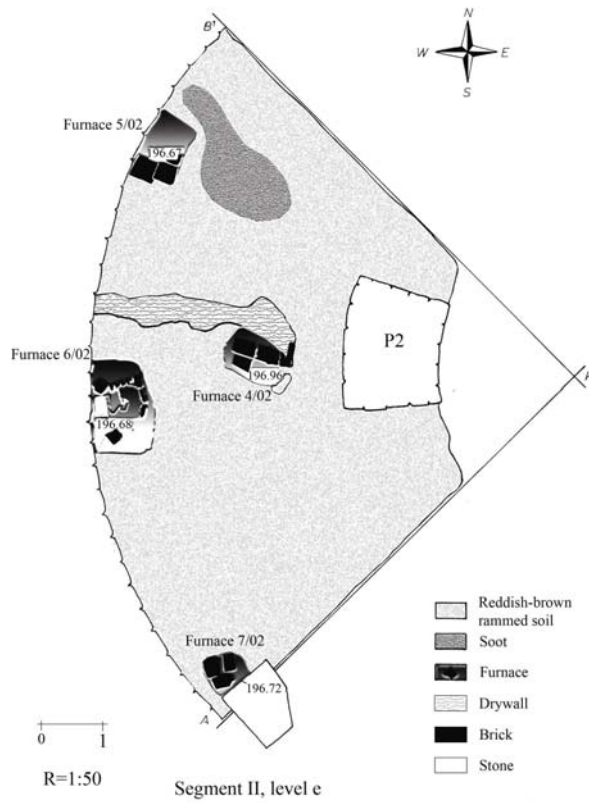


Fig. 3

At this level in segment II (Fig. 3) we investigated the remains of a structure of trapezoid plan that consisted of two walls, built of rough stones bonded by yellow clay, that were leaning on the tower wall in the west and to the pilaster 2 in the east. Two furnaces were found inside this structure: furnace 4 in the central area and furnace 6 next to the tower wall.

Furnace 4 is of rectangular plan (1.00 x 0.60 m) with firebox in the west. Domed roof was made of rough stones and bricks bonded by yellow clay and floor was paved with four tegulae. Upper segment of the furnaces collapsed in its interior, filled with soot and ash, where have been found fragments of pottery and glass vessels, fragment of whetstone and iron objects. Purpose of this furnace could not have been established.

In the same structure was encountered blacksmith's furnace 6/2002 leaning against the tower wall. This furnace with firebox in the east was of the circular plan, 1 meter in diameter, and most probably domed roof structure made of fragments of stone and brick bonded by yellow clay (Fig. 4). Furnace floor was paved with fragments of tegulae and an area covered with ash and soot was registered around the furnace. Under the floor of this furnace and 5 cm thick layer of burned earth were encountered the remains of an earlier floor also paved with tegulae. There were no finds in this furnace, which had been restored.



Fig. 4

At the same level but to the north of described structure and next to the tower wall was encountered furnace 5/2002 of rectangular plan (0.75 m x 1.25 m). Floor of this furnace was paved with tegulae and firebox was in the east. Unfortunately, there are no data about upper structure of this furnace. Inside the furnace were found many iron objects including chisel, borer, knife, wedges and clamps and their fragments so we can assume that it was blacksmith's furnace. Around the furnace 5/2002 was registered a zone of burned earth, ash and soot. Furnace 7/2002 was discovered to the south of structure with furnaces 4 and 6, between the tower wall and large stone block fallen from the tower gallery. This furnace had been restored twice. Initially it was of square plan ( $a = 0.75$  m), firebox was facing east and floor was paved with tegulae and overlaying mortar substructure of the tower. Subsequently the furnace of circular plan ( $R = 0.80$  m) paved with fragments of tegulae and with firebox in the north was constructed on the same spot. Finally, in the corner between stone block and tower wall was built furnace of circular plan ( $R = 0.60$  m) with floor paved with tegulae and firebox in the north. Between renovated floors of this furnace were

encountered 6 – 8 cm thick lenses of burned earth with ash and soot. Although we do not have data about their upper structure, we think on the basis of large amount of iron objects found at the floors and in their vicinity that these were blacksmith's furnaces.

Stratum E, around 60 cm thick overlays described level e. This is the layer of leveling after conflagration and could be dated according to the coins of Constantine I and his sons, Valentinian I, Valens and Gratian, iron and bronze fibulae<sup>2</sup> and antler combs with bell-shaped handle<sup>3</sup> in the final third or quarter of the 4<sup>th</sup> century.

Level d (Fig. 5) was established on top of this stratum and is characterized by floor of reddish-brown rammed earth that has been investigated in segment I, partially in segment II and in central area of the tower where was also registered the trace of rather large post, which probably supported the roof structure.

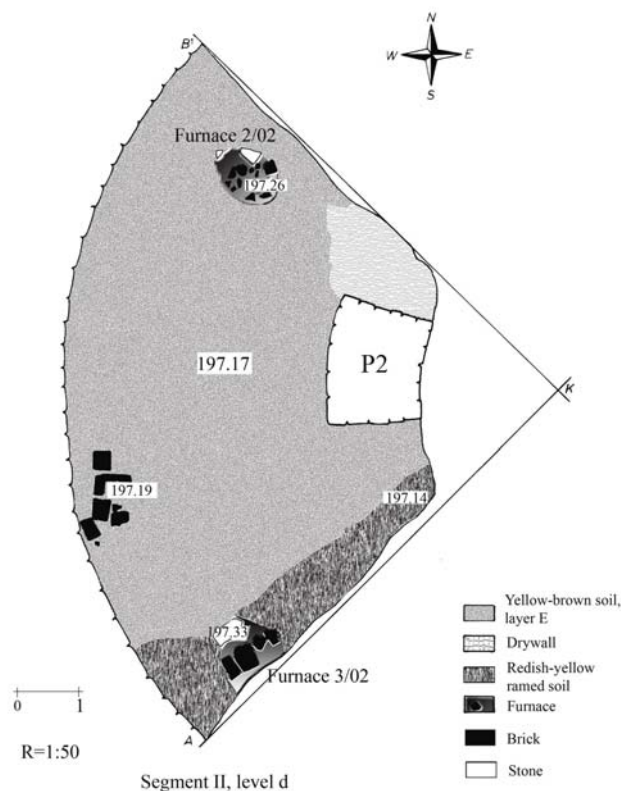


Fig. 5

<sup>2</sup> Ambroz 1966, 62 – 64, T. 11, 6 – 7, 9 – 10; Diaconu 1971; 351 – 353, T. VIII. Pröttel 1988, 349 – 353, Abb. 1.

<sup>3</sup> Petković 1995, 27 - 28, T. IX, 1; Petković 2003,37, Fig. 1 – 3.

Inside this structure was found the furnace 3/2002 that has rectangular floor, 1 x 0.75 m in size, consisting of arranged tegulae. The firebox was in the east and elements of upper structure were unfortunately not preserved. Inside the furnace were found many fragments of iron objects so it could be assumed that this was blacksmith's furnace.

Furnace 2/2002 was investigated to the north of described structure, in segment II by the profile B'K (Fig. 6). This furnace was of circular plan, around 1.25 meters in diameter and floor was paved with fragments of tegulae. Domed roof structure was made of rough stone and brick fragments bonded by clay. Firebox was in the west. Intensely burned earth under and around this furnace indicates exceptionally high temperatures and inside the furnace were found large amount of slag, ash and carbonized wood as well as objects of bronze and iron. It could be assumed that furnace 2 had been used for smelting metal. This furnace had been renovated two times as it is confirmed by lenses of burned earth evident in the cross-section.



Fig. 6

At level d were found the remains of still another structure in segment III and in the central area of tower 19 and furnace of rectangular plan (hearth 7) was discovered inside it.

Level d also perished in conflagration so the stratum D, around 30 cm thick, consists of yellow-brown earth with traces of fire, lenses of soot, ash and burned earth.

Finds from stratum D does not differ much from the finds from the preceding layer. In addition to the similar types of coins, fibulae and one antler combs already registered in layer E, worth mentioning is an exceptional comb with trilateral handle decorated with pair of horse's protomes and sheath decorated in the same manner.<sup>4</sup> Along with other finds this comb makes possible dating of layer D in the final decades of the 4<sup>th</sup> – beginning of the 5<sup>th</sup> century.

<sup>4</sup>Petković 1995, 26 – 27, T. VIII, 3 – 4; Petković 2003, 39, Fig.13.

Later layers in the tower 19 dating from the 5<sup>th</sup> and 6<sup>th</sup> century did not yield any information about metallurgical activities.

Archaeological investigations conducted in 2004 and 2005 in the sector of the *thermae* confirmed to the considerable extent already established stratigraphy in the southeast section of the fortified imperial palace and brought to light important economic structure leaning on the south façade of the Galerius' *thermae* dated from the end of the 4<sup>th</sup> to the beginning of the 7<sup>th</sup> century.

Traces of metallurgical activities were recorded to the west of this structure, at the level e, on top of which was accumulated stratum E containing material from the second half of the 4<sup>th</sup> and first half of the 5<sup>th</sup> century. At the bottom of this layer were found mortar floor and remains of the furnace (furnace 1/2004) of rectangular plan, 0.90 x 0.80 m in size and paved with *tegulae* (Fig. 7). Firebox was in the east. Upper structure of the furnace was not preserved but inside and around the furnace were encountered fragments of iron objects and iron slag mixed with ash and soot indicating the activities of a blacksmith.



*Fig 7*

In the structure of dry wall masonry, leaning on the south facade of the *thermae*, was also encountered the mortar floor at the level e. At this level was investigated the furnace (2/2004) of almost square plan, 0.55 x 0.58 m, and leaning on the wall of the *thermae*. Furnace had the firebox facing east and domed roof structure made of bricks bonded by clay (Fig. 8). Inside dry masonry structure was found at this level large amount of iron objects including also one anvil and iron slag so it had most probably been blacksmith's furnace and structure at this level was the workshop, i.e. smithy. The workshop perished in conflagration as in the leveling layer of this phase of the structure were registered intensive traces of fire – soot, ash and burned earth.

The most interesting find in the archaeological campaigns in the years 2004 and 2005 is large metallurgical workshop from the end of 5<sup>th</sup> – first half of the 6<sup>th</sup> century situated in the southeast corner of fortified Romuliana and most probably leaning on the south and west rampart.<sup>5</sup>

<sup>5</sup>Petković – Živić 2005, 101 – 108.

*Fig. 8*

This structure was discovered in 2004, at level c (Fig. 9), which was covered with layer of light brown soil with debris denoted as layer C. Within this layer was found large amount of slag, slag with iron particles, iron objects, fragments of vessels for pouring liquid iron and whetstones which indicates metallurgical activities of smelting, casting and forging of iron.

Level c is a floor of metallurgical structure the wall of which extending 7.30 meters in the northeast – southwest direction to the furnace (7/2004) for smelting iron. This wall, 0.60 m thick and preserved at some spots up to the height of 1.60 m was built of alternating courses of dresses and undressed stone and tegulae laid in light yellow clay (Fig. 10). Floor of rammed clay mixed with rough stone makes some kind of pavement to the north of the metallurgical structure.

Furnace 7/2004 (Fig. 11) is of horseshoe-shaped plan, 5.00 x 2.50 m, with foundation of rough stone laid in clay. Furnace interior was also lined with clay, which because of high temperature was burned and varies in color from orange and red to light red and white. Upper structure was most probably domed and built of bricks bonded with clay in the technique of corbelling as it could be seen in two preserved courses. Dome collapsed in the furnace interior and opening for discharging slag was at the northeast corner of the furnace. In the central area the floor of the furnace was dug into the ground and this ellipsoid zone was filled with ash, soot and carbonized wood. Remaining sections of the furnace were filled with slag and slag with iron particles.

In order to encounter layers in its interior we cross-sectioned the furnace 7/2004 in the east – west direction. Three layers were distinguished in the furnace (Fig. 12) of which first consists of slag, second of slag with iron particles mixed with charcoal, ash and soot and third consists of ash and soot mixed with sand and small gravel.





Fig. 9

*Fig. 10**Fig. 11*

Two pits with diameters around 2.50 m for disposal of slag were excavated from level c. They were near the furnace 7, pit 2 in sq. J" XXIV and pit 3 in sq. K" XXIV and their average depth was around 0.60 m (Fig. 13).



*Fig. 12*



*Fig. 13*

As because of intensive smelting of iron these two pits had been filled up the slag discharged from the furnace was running towards the northeast and its solidified remains were encountered in an approximate length of 12 m (Fig. 9) .

This slag layer was in places up to 1 m thick. Cross-section of this layer revealed various lenses (Fig. 14): layer 1 – slag, layer 2 – slag with iron particles, layer 3 – charcoal, soot and ash mixed with sand and layer 4 – sand and gravel with ash and soot.



*Fig. 14*

After investigation in 2004, it was evident that metallurgical workshop extended in the uninvestigated area, to the east, most probably, up to the west wall of square tower of earlier fortification (tower V) and to the north, partially in sq. K"XXI where earlier investigations revealed dry wall leaning on the east façade of the *thermae* and running in the northeast – southwest direction.<sup>6</sup>

In the course of archaeological investigations conducted in April of 2005, while constructing a scarp at eastern profile of excavations in the sector of the *thermae*, we encountered the extending of metallurgical structure to the west. From the mentioned furnace 7/2004 the wall of metallurgical structure extends 3 meters towards the southwest. This wall had been built in the identical manner as the wall investigated in the previous year. Also, it was concluded according to method of building that foundations of furnace 7/2004 and this wall had been constructed at the same time (Fig. 15).

Moreover, towards the west was encountered the existence of level c, some kind of pavement, which was actually the floor of the metallurgical structure (Fig. 9). Around two meters to the west of the corner of the wall encountered, but still within the perimeter of metallurgical structure, were registered two furnaces of rectangular plan, furnace 1/2005 and 2/2005 (Fig. 15).

Furnace 1/2005, 1.25 x 1.00 m in size, with dug out bottom was most probably smelting furnace. Its wall in the lower zone was built of broken bricks and stone laid in clay. Firebox was in the east as is confirmed by the zone of burned earth and ash. Upper structure of this furnace was not preserved.

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<sup>6</sup>Lalović – Jovanović – Ružić 1997, 201, Fig. 1.

Furnace 2/2005, 0.90 x 0.60 m in size, with floor paved with tegulae could had been the blacksmith's furnace. This furnace had been restored and between the floors was encountered the lense of soot, ash and burned earth. Its upper structure was not preserved.



*Fig. 15*

In summer 2005 , we continued the systematic investigation of metallurgical structure in sq. L" - M" XXIV and M" XXII – XXIII.

In sq. L" XXIV was discovered the northeastern corner of the room with dry wall of northeast – southwest direction encountered in 2004. Discovered dry wall with smelting furnace 7/2004 leaning on to it is the north wall of the mentioned room, which extends towards the south rampart. Large smelting furnace was built against the north face of this dry wall in the room adjacent to the southeast corner of the *thermae*. This area was confined in the north by the dry wall recorded earlier in sq. K" XXI <sup>7</sup>, in the west by east facade of the *thermae* and in the east by dry wall of north – south direction registered in sq. M" XXII – XXIII (Fig. 9). This area covering more than 150 square meters could have been some kind of yard as there were encountered deposits of slag discharged from the furnace 7/2004 and the floor consists of rammed earth with small stones and pebbles as some kind of pavement with lenses of sand and yellow clay.

However, to the east of the 'yard' was investigated another room of the metallurgical structure in sq. M" XXII – XXIII. It extends towards the east rampart, in the south it reaches the north wall of tower V, while in the west it is confined by the mentioned dry wall of very poor quality (Fig. 16). Floor of this room consists of low-quality yellowish mortar with partially preserved flooring of tegulae. In the southwest corner of this structure were encountered the

<sup>7</sup> See footnote 10.

remains of rather large metallurgical furnace of indefinite purpose. This furnace identified as furnace 7/2005 was of horseshoe-shaped plan, around 2 meters in diameter and it was filled with slag, slag with iron particles, charcoal and ash (Fig. 17). In the room interior are visible traces of high temperatures and fire that are possibly the results of metallurgical activities.



*Fig. 16*

In the sq. L" - M" XXIV was partially investigated another room of the metallurgical structure to the east of the room encountered in the year 2004. Its north wall, whose discovered length is 2.25 m and thickness 0.48 m, was built of alternating courses of bricks and stone laid in yellow clay and it was running in the northeast – southwest direction (Fig. 18). This wall leans in the west on the northeast corner of the room from sq. J"-K" XXIV. At the junction of these two walls in the southwest interior corner of the room there is rectangular structure 1 x 0.75 m in size and made of rather large ashlars. This structure was identified as furnace 6/2005 as in its interior were registered traces of fire, large amount of ash, soot and singed stone. Next to this structure, against the south face of the wall was explored rather small pit around 0.50 m in diameter and 0.30 m deep

that was filled iron slag and carbonized wood (Fig. 9). In this pit was also found the rim of large pithos decorated with stamped ornament. The mentioned room extends towards the south and the east, most probably as far as the tower V. Its floor was made of yellowish mortar of low quality (Fig. 18).



Fig. 17



Fig. 18

In this room were encountered two rows of rough stones 2.30 m and 0.80 m long and distance between them was about 0.70 m. These rows were running

perpendicularly to the mentioned tower V and their purpose was unclear. To the south of these structure was explored another small pit, 0.50 m in diameter and about 0.25 m deep, and filled with iron slag while to the north of it was a zone, 2.80 x 1.10 m in size, paved with tegulae, perhaps the remains of the floor pavement or some kind of working area (Fig. 18). In the layer of soot and burned earth immediately on top of mortar floor between the structure of rough stones and pavement of tegulae was found a golden coin, the tremissis of Justinus I (Fig. 19).



Fig. 19

Rooms encountered in sq. L " - M " XXIV and in sq. M " XXII – XXIII were interconnected and were also opening to the 'yard' (Fig. 9).

Dating of the metallurgical structure in the end of 5<sup>th</sup> – beginning of the 6<sup>th</sup> century, i.e. in the time of emperors Anastasius and Justin I, is based first of all on entirely clear stratigraphic situation in the sector of the *thermae*. On top of layer C was established level b with corresponding cultural layer B, which could be dated on the basis of numerous finds of pottery, fibulae and few pieces of bronze coins in the second half of the 6<sup>th</sup> century. Under level c is cultural layer D into which were dug slag pits and foundations of the metallurgical structure. This layer contains concentrated building debris and archaeological finds dating from the end of 4<sup>th</sup> and first half of the 5<sup>th</sup> century.

In layer C fragments of pottery and glass vessels date from the middle of the 4<sup>th</sup> to the 6<sup>th</sup> century, fibulae are of the 5<sup>th</sup> – 6<sup>th</sup> century types<sup>8</sup> and comb sheath made of antler is dated in the turn of the 5<sup>th</sup> into 6<sup>th</sup> century.<sup>9</sup> In the structure were found coins of emperors Anastasius and Justinus I and one of them was the above mentioned golden coin (Fig. 19). Activity of the metallurgical workshop, where smaller iron objects were cast judging by the finds of molds, most probably commenced in the time of Anastasius (491 – 518) when life was intensely restored in *Dacia Ripensis*, which was deserted during the second half

<sup>8</sup> For bronze fibulae see Janković 1981, 1971 – 1973. On iron fibulae of the type *Viminacium – Novae* see Schulze – Dörlamm 1986, 605 - 608.

<sup>9</sup> Petković 1995, 25, T. X, 4 – 6.



of the 5<sup>th</sup> century, after invasion of Huns. It could be possible perhaps to relate the activity of this workshop to the restoration of the Danube frontier, if the military equipment had been produced there. In favor of this speak the arrowheads found in a layer on top of the floor of metallurgical structure as well as molds for buckles of military belts<sup>10</sup> found earlier in the sector of the *thermae*.

At this level of investigation it is not possible to speak with certainty about the size and function of the structure investigated in the very southeast corner of *Romuliana*, actually between the *thermae*, east and south rampart.

It is certain so far that furnace 7/2004 was used for smelting iron ore.<sup>11</sup> We did not find direct analogies in the scholarly literature first of all because of its large size. Nevertheless, it could be claimed that furnace 7/2004 is of the type of dug in furnaces with massive stone foundations and domed upper structure that is characteristic of Roman and early medieval period.<sup>12</sup> The most similar and chronologically closest are double furnaces investigated at the site Bellaire III and furnace from the site Boécourt in Jura, Switzerland and dated from the AD 500 to AD 650.<sup>13</sup>

We could not discuss with certainty, without physical and chemical analyses, the purpose of other furnaces (1/ 2005, 2/ 2005, 6/2005 and 7/2005) found at the level c. It is not certain if all these furnaces had been used for iron metallurgy or for the metal processing at all. However, some of them had probably been smelting or blacksmith's furnaces and this particularly relates to the furnaces 1/2005 and 2/2005 inside which has been found rather large quantity of slag and fragments of iron objects. Rooms partially investigated in the summer campaign could have been also the workshops for working nonmetals. Still, concentration of workshops of craftsmen within one 'quarter' of the settlement and next to the rampart was common in the Late Roman times.

In the course of archaeological investigations in the southeast section of *Romuliana* that are planned in the long-term plan of archaeological investigations at the site Gamzigrad – *Romuliana* (2005 – 2009) the metallurgical – artisan complex will be completely investigated so the interpretation of its function will be based on much stronger ground.

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<sup>10</sup> Živić 2003, 95 – 96, kat. 80 – 85.

<sup>11</sup> Živković – Štrbac et al. 2005, 128 – 129.

<sup>12</sup> Pleiner 2000, 179 sq.

<sup>13</sup> Pleiner 2000, 182 – 183, Fig. 20, Fig. 46, Pl. XIII.

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