



# PIXE–PIGE investigation of Roman Imperial vessels and window glass from Mt. Kosmaj, Serbia (Moesia Superior)



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## ABSTRACT

Vessel and window glass fragments from the Roman archeological site at Mt. Kosmaj, Serbia, were investigated by means of PIXE and PIGE techniques. Window glass was also investigated by optical microscopy. Results show soda-lime-silica composition of all samples. Statistical evaluation was conducted by cluster analysis. Comparison was made with well-defined glass groups from other sites of the Roman Empire, including in the Balkans. This revealed the greatest similarity with Levantine materials. Glasses of similar composition can be found on the main trade routes coming from the region of Adria from the west or from the coast of the Black Sea at east.

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## 1. Introduction

With the formation of the eastern provinces of Moesia Superior and Minor, during the 1st century AD, most of present day Serbia became part of the Roman Empire. First, not numerous, glass products on the territory of Serbia are dated to the same period. The provincial economy becomes focused on mining activities of iron, lead, silver, copper minerals. One of the sites with pronounced lead–silver ore mining was at Mt. Kosmaj. From the beginning of exploitation it was under direct Imperial administration reaching the full capacity at the beginning of 2nd century AD during the rule of Trajan and Marcus Aurelius (Dušanić, 1976). Besides the mines at Iberian Peninsula, the lead mining centre at Mt. Kosmaj was one of the biggest in the Empire (Domergue, 2008, 20–21: carte 3). Unlike the majority of sites in Western Europe, it was active during the 4th century AD (Dušanić, 2004). Intensive exploitation of the ore supported by the deportation of the labour force, administration and army troops (Dušanić, 2000; Merkel, 2007), made this site connected with the network of roads and trade routes with the rest of the Empire.

Archeological investigations at Mt. Kosmaj were performed on several occasions during the 20th century. The first excavation in the early 20th century, was done by N. Vulić (Veličković, 1958) at the

village of Stojnik where there was a fortress (Stojnik castrum) and the seat of administration. This site was recognised as antique Demessius by Dušanić (2004). The nearby necropolis was excavated during 60s on the location of Rt; 10 graves with remains of cremations were excavated. The other parts of necropolis were devastated by erosion and non-legal works. Systematic excavations on a larger scale were done in the years 1960–1978 at the necropolis of Guberevac–Gomilice, north-west from the fortress and in the vicinity of the necropolis at Rt (Fig. 1). At this site 361 graves (Glumac, 2005) with intentionally burnt sidewalls were discovered. In the literature they are known as Small Kopašnica–Sase (Jovanović, 1984; Pešić, 2010), here dated from the 1st to the 3rd century AD. Glass vessels, predominantly balsamaria have been found in 144 graves. Latest excavation at Stojnik castrum and locality Reka (north-east from the necropolis Gomilice and Rt) with tombs of the type area maceria cincta (Glumac, 2013a) were investigated in a joint project organized by National Museum in Belgrade, Archaeological Institute in Belgrade, Belgrade City Institute for the Protection of Cultural Monuments and State University Albany, NY (V. Kondić, M. Verner campaign 1983–1988). In the region of fortress and in tombs, more luxurious objects were found like frescos, mosaics, jewellery and fragments of window panes. Glass vessels are very fragmented, so it is impossible to give their exact number and detailed typological reconstruction. It is possible that the fine vessel glass was imported from other parts of the Empire, but it also seems reasonable to believe that the balsamaria where of local production. They are not

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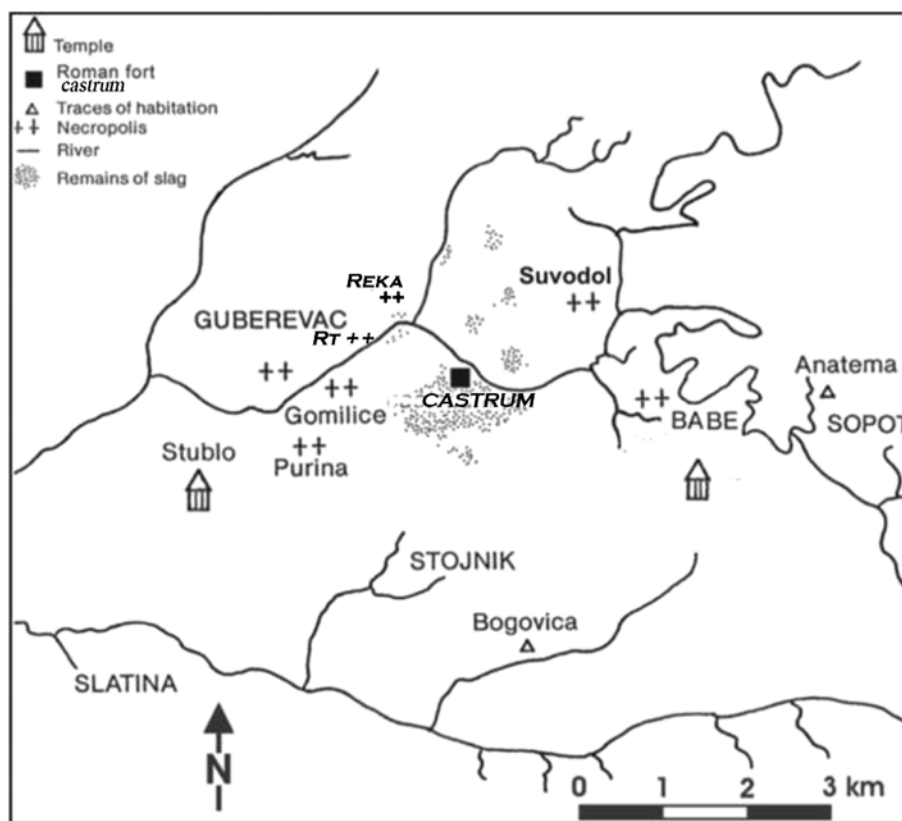


Fig. 1. Map of the Mt. Kosmaj archaeological sites from Dušanić (1976).

so skillfully made, a lot of bubbles are often captured in the glass material and mistakes made during manufacture resulted in irregular shapes. Actually the assemble that is investigated represents the most ordinary item found at the site. The finds of glass workshops in Serbia are known to be dated from the late 3rd century AD at Ulpiana and in Sirmium, probably also in Viminacium and Singidunum (Ružić, 1994). The chemical analyses of this material have not been performed yet.

Only recently some analytical data on Roman glass excavated in the Balkans are available. From Bulgaria (Kuleff and Djingova, 1999; Rehren and Cholakova, 2010; Lesigjarski et al., 2013), glass finds from the coast of Black Sea to the western part of the country (Via Militaria) dated from the 1st to 6th centuries AD were analysed and classified in comparison with well-defined compositional glass groups. From Albania, Roman glass from the northern part of the country (region of Rogozhina) dated from the 1st to 4th centuries AD (Šmit et al., 2013) and samples from archeological site at Butrinte (South Albania) from the 1st to 8th centuries AD (Shibille, 2011; Conte et al., 2014) were examined. From Serbia there are analytical data on Early Byzantine glass (Drauschke and Greiff, 2010) from the archeological site *Iustiniana Prima* (Caričin Grad), active only for a short period during the 6th and the beginning of 7th centuries AD. Among 14 chunks of raw glass majority was soda-lime glass, with exception of two samples that presumably resented early wood ash glass. However, these data do not take into account specific features that can be characteristic of glass composition found in the Balkans.

The aim of the present study is to characterize most common glass assembly from Mt. Kosmaj and to investigate the origin of raw materials, which can give us better insight into the trade routes and connections of this locality with the rest of the Roman Empire. Analyses of glass found at Mt. Kosmaj, are done by the PIXE and PIGE techniques and OM microscopy. Through statistical analyses of obtained results we will discuss the glass groups appearing at Mt. Kosmaj and possible origin of raw materials for their production, similarities and differences between this and other glasses found in the Balkans.

## 2. Archeological context, samples and methods

During the latest excavations of Stojnik castrum, from archeological evidence and movable finds it becomes clear that the fortress was functional from the 1st to 4th centuries AD. All the samples of widow glass panes were found here and were dated to the 2nd to 4th centuries, exhibiting the whole assembly of the kind.

In the graves of necropolises Gomilice and Rt, among other finds the coins from Nero to Septimius Severus were found extending from mid of the 1st–3rd centuries AD. The most abundant glass finds are balsamaria with conical recipient, long cylindrical neck, sloped rim and constriction at base (Isings (1957), form 28b, Fig. 2). The bottom of the balsamarium is flat or slightly concave and the rim is sometimes ring-like in section. They were used in everyday life in medicine, cosmetics and in burial practice. In graves they are often found filled with the remains of pine resin (analyses done by the Faculty of Chemistry in Belgrade). These balsamaria are typologically similar to the products

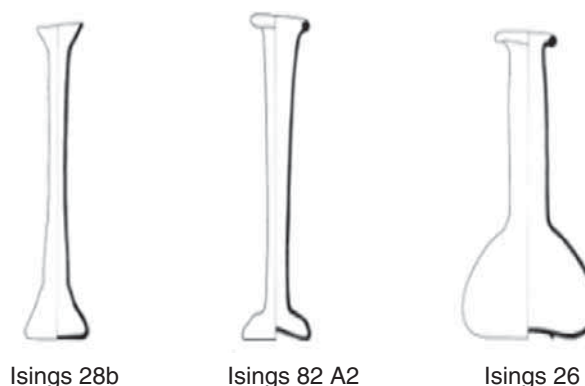


Fig. 2. Balsamarium forms of the most prominent occurrence at Mt. Kosmaj.

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