Teresa Stawiarska, *Roman and early Byzantine glass from Romania and northern Bulgaria. Archaeological and technological study*, Polish Academy of Sciences. Institute of Archaeology and Ethnology, Warsaw, 2014, 151 p., 37 fig.

The bibliography about ancient glass artifacts discovered in Romania and Bulgaria is quite poor. The papers of Mihai Bucovală[1] and Atanas Minčev[2] are the only monographic works on the glassware produced in the Greek cities of the province of Moesia Inferior. Next to them, there are two general articles about ancient glassworks in Bulgaria[3]. For Dacia, there are the papers of Cloşca Băluţă[4] and Doina Benea[5]. Recently, there were also published some works which provide an overview of the main types of glass vessels from the early Roman age that were discovered in the area between Olbia and Byzantium[6].

Chemical composition of glass artefacts can reveal important information about the technology and raw materials used for their production. Chronological and geographical differentiations of ancient glass objects are reflected in distinct compositional categories.

Up to now, archaeometric studies of glass artifacts excavated in Romania and Bulgaria were rather scarce[7].

Therefore, we can safely assume that the recently published study by Teresa Stawiarska fills, to some extent, a gap, with the help of chemical analyses.

The contents of the book is organized as follows: Preface (p. 7) 1. Glass production of Dacia and Lower Moesia in the Roman and Early Byzantine period (p. 9–80); 2. Roman luxury glass vessels from Dacia and Lower Moesia subjected to technological analyses (p. 81–90); 3. Glasses from Sântana de Mureş-Černjachov and the Carpi cultures subjected to technological analyses (p. 91–100); Appendix 1 Catalogue of physico-chemically analyzed glass finds (p. 103–120); Appendix 2 Results of physico-chemical analyses of the glass finds (p. 121–130);

[1] Bucovală, M., *Vasele antice de sticlă la Tomis,* Constanţa, 1968.

[2] Minčev, A., *Antično staklo ot Zapadnoto Černomorie (I-VI v.), Kupi i panicki,* Izvestija Varna 20 (35), 1984, p. 5–21; Minčev, A., *Antično staklo ot Zapadnoto Černomorie (I–VI v.), Kani*, IzvestijaVarna 25 (40), 1989, p. 13–26; Minčev, A., *Antično staklo ot Zapadnoto Černomorie (I–VI v.), Butilki,* IzvestijaVarna 26 (41), 1990, p. 56–78.

[3] Djingov, G., *Drevnoto staklo i stakloproizvodstvo v Bălgarija*, Archeologija Sofia 7, 1965, 4, p. 11–20; Belivanova, A., *Early Roman Glass from Bulgaria (1st century-the first half of the 2nd century)*, ArchBulg 3, 1999, 1, p. 35–49.

[4] e.g. Băluţă, C.L. *Considération sur la production et la diffusion du verre dans la Dacie Supérieure*, AIHV 7, 1978, p. 97–109.

[5] e.g. Benea, D., *Die römische Perlenwerstätten aus Tibiscum,* Timişoara, 2004.

[6] Chiriac, C., Boţan, S.-P., *Sticlăria elenistică şi romană din Pontul Euxin. Între producţie şi import*, in Panait-Bîrzescu, F., Bîrzescu, I., Matei-Popescu, F., Robu, A. (eds.), *Poleis în Marea Neagră: relaţii interpontice şi producţii locale*, Bucureşti, 2013, p. 278–318; Chiriac, C., Boţan, S.-P., *Roman Glass Vessels in the Western Pontic Area (1st–3rd Centuries CE). General Remarks*, in Cojocaru, V., Coşkun, A., Dana, M. (eds.), *Interconnectivity in the Mediterranean and Pontic World during the Hellenistic and Roman Periods*, Cluj-Napoca, 2014, p. 525–555.

[7] Mănucu-Adameşteanu, Gh., Poll, I., *Bracelets en verre découverts en Roumanie*, in de Boe, G., Verhaeghe, F. (eds.), *Material Culture in Medieval Europe. Papers of the 'Medieval Europe Brugge 1997' Conference*, vol.7, Instituut voor het Archeologisch Patrimonium, Zellik/Asse, 1997, p. 345–351; Bugoi, R., Poll, I., Mănucu-Adameşteanu, G., Calligaro, T., Pichon, L., Neelmeijer, C., Eder, F., *Ion Beam Analysis studies of ancient glass bracelets discovered in Bucharest*. Rom Rep Phys 63, 2011, 4, p. 912–922; Bugoi, R., Poll, I., Mănucu-Adameşteanu, Gh., Neelmeijer, C., Eder, F., *Investigations of Byzantine glass bracelets from Nufaru, Romania using external PIXE-PIGE methods*, J.Arch.Sci. 40, 2013, p. 2881–2891; Olczak, J., *Produkcja szkła w rzymskim i wczesnobizantyjskim Novae w świetle źródeł archeologicznych* (Mezja Dolna), Toruń, 1998.

Polish summary (p. 131–142); Bibliography (p. 143–151).

The source material for the studies presented in Chapter 1 consists of assemblages of glass production (such as furnaces, "foam" and production waste, fragments of finishing products and remains from forming the products), for the most part unpublished. A Catalogue of all the glass production waste and finished products discussed in Chapters 1–3 appears in Appendix 1. The results of the physico-chemical analyses are presented in Appendix 2.

The study was conducted as a part of the research program of the Institute of Archaeology and Ethnology of the Polish Academy of Sciences in Warsaw. It was made possible through Institute of Archaeology and Ethnology of the Polish Academy of Sciences travel grants. Specialist examination of glasses was completed in the Bio- and Archaeometry Laboratory of the Institute of Archaeology and Ethnology in Warsaw.

The present study focuses on technological characteristics of glass finds from the production assemblages from Dacia and Lower Moesia. It reveals not only the influences of different glass-making traditions, but also the potential links between particular workshops from the investigated area. The author is also trying to identify the differences between techniques used during the Roman domination and those from the later period. Unfortunately, the study was limited both by the small number of discovered and published materials and by the technological examinations that have been carried out (p. 9–10).

In the introductory part of chapter 1, the author presents the geographical space and the chronological framework of the study on one hand, and the used research methods and procedures on the other. After presenting the area and the timeline of the study, together with a brief historical outline, the author does not discuss the state of research on glass-making in Dacia and Lower Moesia, making instead a brief summary about the local production centers and presumed locally made glassware from different sites. According to the author, production assemblages and local glass products from Lower Moesia are better known than those from Dacia, although there are important differences between the western Lower Moesia (Novae, Iatrus, Nicopolis ad Istrum and Oescus) and eastern Lower Moesia, with the Greek cities from the Black Sea coast and some Roman cities (Histria, Tomis, Tropaeum Traiani, Odessos, etc.) included. A considerable part of the finds was examined by the author, during two research visits in Romania and more than 80 samples of glasses, mostly unpublished, were provided for chemical analyses. Glass fragments have been examined by means of the spectral emission method combined with the flame photometry (p. 14–16). The author also presents some controversial research issues concerning glass chemical composition analyses and glass-making organization (p. 16–18).

After the introduction, the author presents the archaeological information at its disposal according to geographical criteria. For every Roman province, the archaeological sites are listed and the issues discussed for each of them are workshop remains and technological characteristics of the production remains. There is also a short conclusion for every site and a conclusion for each province (p. 19–78). The analyzed sites are: Sarmizegetusa Regia, Colonia Ulpia Traiana Augusta Dacica Sarmizegetusa, Tibiscum, Apulum, Dierna from Dacia Superior; Porolissum and other centres from Dacia Porolissensis; Romula and Sucidava from Dacia Inferior; Novae, Oescus, Iatrus and Nicopolis ad Istrum, Golemanovo Kale, Tomis, Ibida, Histria, Odessos from Moesia Inferior. For every province, there were also introduced into discussion for comparative purposes glass objects from contexts other than production assemblages (such as archaeological levels during systematic excavations), but suspected to have been produced at the same archeological site. The chemical composition for 78 samples (their descriptions is presented in appendix 1 - catalogue nos. 1–78) coming from some of this sites is presented in Appendix 2 (nos. 1–78).

According to the author, the small number of researched glass workshops influenced negatively the description of glass production in Dacia and Lower Moesia. Because of the reduced quantity of glass artefacts coming from archaeological excavations the analyses in technological terms are still reduced. Nevertheless, in general, one can say that both provinces had self-sufficient workshops capable of running the full production cycle. Initially, glass production was organized in small military *officinae*, like in other Roman provinces, but

there is still not enough evidence for this. Some workshops are attested in the Greek cities: Tomis, Histria and Odessos. In Dacia, only few production centers were discovered: Sarmizegetusa Regia, Ulpia Traiana, Tibiscum and Dierna, and other two possible at Apulum and Porolissum. With relatively few glass objects having been examined technologically, it is difficult to establish the range of locally made products. Even so, a comparison with Lower Moesia reveals that, in the latter province, a much larger assortment of glass objects was found. According to the technological studies, two categories can be distinguished: high-magnesium (HMG) and low-magnesium (LMG) glasses, meaning they were produced with different calcium magnesium raw materials, and discolored with manganese exclusively. Because of the state of the research, there is no possibility to estimate the range of local glass production. Still, one should assume extensive imports, including the luxurious products.

In Chapter 2, some Roman luxury glass vessels from Dacia and Lower Moesia are discussed. Some of them have been previously determined as imported glass vessels by the archaeologists. They are coming from Apulum, Napoca, Micia, Porolissum, Fântânele and Tropaeum Traiani. Most of them are unpublished. They belong to the cold cut types E 185, E 216 and related ones, probably used for drinking wine. All these colorless glasses were produced with the use of high technology, in which discoloration was performed with the use of antimony and high-alkaline RN: 2.8–3.5. The technology in which they were made and their chemical composition indicate that they were produced in specialized workshops following the Mesopotamian-Egyptian and east Syrian glass-making tradition.

In Chapter 4, the author presents some glass artifacts coming from Sântana de Mureş-Černjachov and the Carpi cultures. They were discovered in Mogoşani, Pietroasele, Poiana Dulceşti and Târgşoru Vechi (appendix 1 - catalogue no. 79–87, and appendix 2, for chemical analyses, no. 79–87). The typical forms are cold decorated beakers type E 230 and E 237–238. The discussed group of glass objects was undoubtedly made in the Early Byzantine workshops; it is difficult to point out exactly where, but definitely not in the *Barbaricum*. Maybe in some eastern workshops, because they do not present any of the typical features of the western products.

At the end of this short presentation, there are some observations to make. The chemical composition of glass objects was not analyzed on a wider scale. The adopted chronology of finds was based entirely on determinations made for particular sites by other researchers; not all the material is precisely dated. Methods of comparative analysis applied by the author can be described as chemical-technological, developed mainly by researchers from Central and Eastern Europe, in contrast with the statistical methods frequently applied by Western scholars. Even so, it is our opinion that this study will be a good working instrument for the archaeologists.

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