

SOME OBSERVATIONS ON THE METAL COMPOSITION OF THE MOLDOVAN GROATS MINTED BY STEPHEN IV

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Abstract: *The article at hand discusses seven coins minted by Stephen IV, kept in various Ukrainian collections. The elemental compositions of metal alloys of these groats were investigated. According to the metallographic results, all the items have a high content of copper, mercury and silver, with additions of lead, zinc, arsenic, antimony, tin, nickel, indium, thallium and so on. The presence of mercury indicates the usage of amalgam in the silvering process of the copper blanks. The collected data complete the information about other 15 pieces also investigated by XRF method and kept in the C. Secășanu and R. Zăveanu collections. Thus, all the 22 coins investigated until now indicate a single method used in the production of Stephen's coins. Pieces struck from other metals or using other silvering method were not identified.*

Rezumat: *Subiectul acestui articol îl reprezintă emisiunile lui Ștefan al IV-lea, păstrate în diferite colecții ucrainene, pentru care au fost întreprinse analize de fluorescență de raze X. În baza datelor obținute s-a constatat că cei șapte groși în discuție au un conținut ridicat de cupru, mercur și argint, cu adaosuri de plumb, zinc, arsenic, antimoniu, staniu, nichel, indiu, taliiu și altele. Prezența mercurului indică folosirea metodei de amalgamare în procesul de argintare a blaturilor monetare realizate din cupru. Datele obținute completează informațiile despre alte 15 piese ale lui Ștefan IV supuse analizelor metalografice, care provin din colecțiile lui C. Secășanu și R. Zăveanu. Astfel, cele 22 de piese analizate până în prezent indică o singură metodă folosită în producerea monedelor lui Ștefan al IV-lea. Piese bătute din alte metale sau folosind alte metode de argintare nu au fost identificate.*

Quite a little has been written about the coins of Stephen IV, the son of Bogdan III and the nephew of Stephen III the Great. There is only one proposal for the typology of his issues, made by G. Severeanu¹ and used in the numismatic catalogue of Moldovan coins². However, it does not solve the problem of the relative chronology of his issues, as they continue to be placed throughout his reign, from 1517 to 1527. The monetary system of Stephen IV is also extremely briefly discussed. The main emphasis is laid on the idea that the metrological system from the time of Stephen IV continued the

* Numismatic Cabinet of the Library of the Romanian Academy.

** "Museum of Money" of the National Bank of Ukraine.

¹ Severeanu 1905, p. 59-62.

² MBR, p. 86-87.

metrological standards existed during the reign of his predecessor – Bogdan III. Groats and half groats of bad quality continued to be minted from silver, from a lower alloy, as well as from bronze³ or brass⁴. The catalogue of Moldovan coins specify that beside the specimens struck from silver and billon, those made from copper and brass were silvered sometimes⁵. The lower quality of the coins reflected the bad economic and financial situation in the country, the circumstances which led to the increasing number of forgeries⁶. These are the most relevant opinions about the monetary situation in the reign of Stephen IV.

In order to complete the list of monetary issues and to help identify the quality of the metal used in the coin production, a small collection of Stephen's coins was analysed. It consists of seven groats kept in various Ukrainian private collections. Thanks to the efforts of one of the authors of this article (A. Bojko-Gagarin) they were identified and studied. Information on the place of discovery of any of these specimens is missing. But, we have enough reasons to believe that they were found on the territory of contemporary Ukraine.

The coins are presented as follows: there are seven epigraphic groats with the image of the ox's head in the asymmetric shield on the obverse and double patriarchal cross in the shield of the same shape on the reverse. The circular legend, which begins on the obverse and continues on the reverse, is written in the Slavonic language. From the legend results that these coins are of Stephen Voivode, *gospodar* (prince) of the Moldovan Land (the description of each piece can be found in the catalogue below and on the plate I). The coins are in a relatively poor state of preservation: one piece is broken from the edges, actually it is a fragment (no. 7), three others have perforations – two or only one each (respectively no. 1, 4 and no. 5). The weight of the coins, calculated for five items, varies between 0,96 and 0,70 grams, with a diameter set between 19 and 17 mm.

The Model Analyzer Expert 3L W108U was used to investigate the metallographic composition of the coins. The analyses were made by the Institute of Physics of the National Academy of Sciences of Ukraine in Kiev (see Table on the Plate II, results are given in percent values). Based on the results of analyses the following observations can be made:

- Copper was identified in a major percentage in the composition of all pieces. The element with the highest percentage indicates the metal of the blanks. And, as we can see from Plate II and images of the coins, copper was used in the blanks' production. The presence of mercury on the surface of the coins indicates the usage of amalgam in the silvering process of the copper blanks (no. 3 with 24,3%, no. 7 with 13,8%, no. 6 with 10,9%,). The amount of mercury on the surface of items nos. 1-2 and 5 is lower (1,29%, 1,8% and 1,45%) because of the destruction of the surface under the influence of the soil.

- The presence of arsenic (nos. 1-7), antimony (nos. 1-3, 5), indium (no. 2) and nickel (nos. 1-2, 4-7) in the alloy is caused by their presence in the composition of the silver ores. The extraction of these elements was rather difficult in the studied period.

³ Iliescu 1970, p. 33-34.

⁴ Iliescu 1997, p. 96.

⁵ MBR, p. 86.

⁶ MBR, p. 86.

- The lead is presented in all coins. In the metallurgy of the Middle Age it was used to make the melting of alloy more easily.

- The biggest percentage of zinc on the surface can be the result of the segregation of this metal closer toward the surface in the cooling process of the coins in the water, happen quickly (no. 1, 3, and specially no. 4-7).

- The high percentage of chlorine and iodine can point to the long term process of keeping coin no. 3 in the sea water.

- The presence of thallium (no. 5), potassium and calcium (nos. 1-3, 7, and specially, nos. 4-5) is caused by the presence of the dirt on the coin's surface.

This short presentation of the elements found in the metal composition of the coins points to another important conclusion. The weight of the coins is directly related to the content of the metals the coins were made from. The heaviest are the items that contain the highest percentage of copper.

Thus, the specimens with the weight of 0.96 and 0.89 grams contain copper of 94.7% and 90.5%, respectively (nos. 1-2), and those weighing between 0.78 and 0.70 grams contain copper that fluctuates between 80.5% and 69.8% (no. 4-6). The exception to this rule is the coin no. 3, weighing 0.88 grams, which has in addition to copper of 37.7% a higher percentage of mercury of 24.3% and silver of 13.5%. The next observation refers to the silver content of the pieces. The silver was detected in higher percentage only on the surface of the coins, which have a high percentage of mercury content (cf. nos. 3, 6-7 with nos. 1-2, 4-5).

As a result, the metallographic analyses show that all seven coins were struck exclusively from copper blanks, which were silvered by the amalgam method. They came to complete the results recently published by Katiușa Pârvan, based on two groups of coins kept in the collections of C. Secășanu⁷ (11 items) and R. Zăveanu⁸ (4 items). According to the information delivered by K. Pârvan, the 15 analysed pieces have a high percentage of copper, mercury and silver, attesting the same process of covering copper blanks with silver. In conclusion, the analysis of these three groups of coins, consisting of 22 items in total, did not reveal any coins struck from silver or billon, as well as usage of other silvering methods.

CATALOGUE

Principality of Moldova

Stephen IV (1517-1527)

Groats

Obverse. Ox's head in an asymmetrical shield, a five-pointed star between the horns, rosette dextra, a crescent senestra; pearl circle. Circular legend in the external pearl circle.

Reverse. The double cross in an asymmetrical shield; rosette to the left and to the right side of the shield; pearl circle. Circular legend in the external pearl circle.

Severeanu 1905, p. 60, subdivision b; MBR, p. 87, b, cf. no. 769-779.

⁷ Pârvan, Constantinescu 2006-2007, p. 385-386; p. 395-396, nr. 63-73.

⁸ Pârvan 2008, p. 365-366; p. 371-372, nr. 30-33.

- 1.** AE silvered (Ag 0.55%, Cu 94.7%, Pb 1.43%, Fe 0.03%, Sb 0.57%, Zn 0.2%, As 0.36%, Ca 0.7%, Hg 1.29%, Ni 0.17%), 0.96 g, 18x17 mm, two round perforations.
Obverse. +IWC...AH...ВОДА*ГОСПО
Reverse. +ПОДАР*ЗЕМЛН...ОИ
- 2.** AE silvered (Ag 0.75%, Cu 90.5%, Pb 0.12%, Fe 0.53%, Sb 0.4%, As 0.12%, Ca 0.52%, Hg 1.8%, Ni 0.1%, S 4.7%, In 0.1%), 0.89 g, 19x18 mm, traces of corrosion.
Obverse. +IWCTEΦTA...O...CΠO
Reverse. +...P3EMJHM...CKOH
- 3.** AE silvered (Ag 13.5%, Cu 37.7%, Pb 0.7%, Fe 0.16%, Sb 0.6%, Sn 2.15%, Zn 0.9%, As 0.12%, Ca 0.6%, Hg 24.3%, Si 0.35%, I 0.5%, Cl 15.2%), 0.88 g, 18 mm, off-center strike of reverse.
Obverse. +IWCTEΦA...BOΔA*ΓOCΠO
Reverse. +ΔAP*3EMJHMOMΛΔAB...KOH
- 4.** AE silvered (Ag 1.22%, Cu 80.5%, Pb 2.1%, Fe 0.52%, Sn 0.87%, Zn 9.2%, As 0.2%, Ca 1.1%, Hg 4.14%, Ni 0.13%), 0.78 g, 19 mm, twice perforated, one hole is round, the other one of the triangle shape was made with a knife.
Obverse. +I...TEΦAHABOEBODA*ΓOCΠO
Reverse. +ΔAP*3E...CKOH
- 5.** AE silvered (Ag 1.74%, Cu 78.0%, Pb 3.32%, Fe 1.9%, Sb 0.12%, Sn 0.18%, Zn 8.5%, As 0.4%, Ca 5.1%, Hg 1.45%, Ni 0.1%, Ti 0.12%), 0.72 g, 18x17 mm, one round perforation.
Obverse. ...WCTEΦAH...ΔA*ΓOCΠ...
Reverse. ...ΔAP*3EM...ΔA...
- 6.** AE silvered (Ag 5.9%, Cu 69.8%, Pb 4.1%, Fe 1.96%, Zn 6.9%, As 0.32%, Hg 10.9%, Ni 0.12%), 0.70 g, 18x17 mm, strongly oxidized.
Obverse. +IWCTEΦA...O...ΓOC...
Reverse. +ΔAP*3EMJHMOMΛ...BCKOH
- 7.** AE silvered (Ag 5.14%, Cu 65.4%, Pb 7.0%, Fe 0.4%, Zn 7.17%, As 0.4%, Ca 0.4%, Hg 13.8%, Ni 0.1%), ? g, about 18 mm, fragment.
Obverse. ...BOΔ...
Reverse. ...KO...

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Plate I. The groats of Stephen IV, kept in various private Ukrainian collections.

| No. | Weight | Ca | Fe | Cu | Zn | As | Ag | Sn | Sb | Hg | Pb | Ni | Si | S | In | I | Ti | Cl |
|-----|--------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|------|------|
| 1. | 0.96 g | 0.7 | 0.03 | 94.7 | 0.2 | 0.36 | 0.55 | - | 0.57 | 1.29 | 1.43 | 0.17 | - | - | - | - | - | - |
| 2. | 0.89 g | 0.52 | 0.53 | 90.5 | - | 0.12 | 0.75 | - | 0.4 | 1.8 | 0.12 | 0.1 | - | 4.7 | 0.1 | - | - | - |
| 3. | 0.88 g | 0.6 | 0.16 | 37.7 | 0.9 | 0.12 | 13.5 | 2.15 | 0.6 | 24.3 | 0.7 | - | 0.35 | - | - | 0.5 | - | 15.2 |
| 4. | 0.78 g | 1.1 | 0.52 | 80.5 | 9.2 | 0.2 | 1.22 | 0.87 | - | 4.14 | 2.1 | 0.13 | - | - | - | - | - | - |
| 5. | 0.72 g | 5.1 | 1.9 | 78.0 | 8.5 | 0.4 | 1.74 | 0.18 | 0.12 | 1.45 | 3.32 | 0.1 | - | - | - | - | 0.12 | - |
| 6. | 0.70 g | - | 1.96 | 69.8 | 6.9 | 0.32 | 5.9 | - | - | 10.9 | 4.1 | 0.12 | - | - | - | - | - | - |
| 7. | - | 0.4 | 0.4 | 65.4 | 7.17 | 0.4 | 5.14 | - | - | 13.8 | 7.0 | 0.1 | - | - | - | - | - | - |

Plate II. Table with the elemental compositions of metal alloys of the goats, minted by Stefan IV (percentages).