Studies on Two Icons Oklads with the Representation of St. Great Martyr George

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Abstract. The work represents a comparative study of two icon oklads representing St. George killing the dragon: the first of Romanian origin according to the stamp with the silver title "12" - examples of Romanian oklads with this silver title can be found in the works of S.S. Duicu, and the second oklad with stamps that seem to be specific to Russian silverware workshops. The Romanian icon oklad depicting St. George killing the dragon has in the central-lower part two stamps - the first stamp represent the monogram of master controller or craftsman or silver master "КЛ", and the second represents the silver title "12". The initials of the master are written in Cyrillic letters, as well as the inscription from the upper part of the oklad “Ϲ.ГEОΠГIE”. The investigations on the two icons oklads were achieved through XRF analysis performed with a portable X-MET 5000 Oxford analyzer (Oxford X-MET 5000 Handheld XRF Analyzer) and SEM-EDX analyzes performed on a Phillips XL-30-ESEM electron microscope using a Quanta Inspect F50, with a field emission gun (FEG) with 1.2 nm resolution and an Energy Dispersive X-ray Spectrometer (EDXS) having 133 eV resolution at MnKα. Following the analyses it was observed that the silver title 84 stamped on the Russian icon oklad does not correspond to reality.

1. Introduction
Saint George was a Christian martyr during the reign of Diocletian [1], his history being recorded since the VII-VIII centuries in the early calendars and martyrologies (as for example in: the Irish Martyrology of Óengus, the Martyrology of Bede, and the Old English Martyrology) [2], its cult reaching its peak in the late Middle Ages [2]. He was born in Lydda, Syrian Palestine in 280 and was martyred on April 23, 303 in Nicomedia, Bithynia, Roman Empire [3, 4] for his beliefs, according to early accounts he came from Cappadocia, Central Turkey or even Nubia [5].

The legend of St. George killing the dragon is first recorded in an 11th-century Georgian manuscript kept at the Patriarchal Library in Jerusalem. Although the legend of St. George killing the dragon is considered to be fictitious [1], being included in the apocryphal writings by the Council of Nicaea [6] it has become very popular in both Western Europe - after being translated and printed by Claxon in The Golden Legend [2], as well as in Eastern Europe [7].

Saint Great Martyr George is considered one of the most important martyrs of the churches in Western and Eastern Europe, recognized and appreciated globally [5], he represents the personification of the ideals of the Christian chivalry [2], and the oldest representation of St. Great Martyr George dates from the 10th century, is on the facade of the Armenian Holy Cross Church on
Akdamar Island and depicts Saint George killing a man and not a dragon. The name St. George spread both in onomatology and in toponymy [8], he being also protector of cities, countries or even protector of the army [10].

From the 11th century, the Holy Great Martyr George is one of the military saints who are associated with the killing of the dragon with a spear. He is depicted on a white horse, killing the dragon that is the medieval symbol of evil [9, 11] and thus saving the princess sentenced to death. In Romanian mythology, the dragon is a snake with legs and wings [12], and in Russian and Greek iconography it is represented in small dimensions, the emphasis being obviously on the strong, victorious and savior image of St. George.

The revetment of icons with precious-metal sheets began in Constantinople, and in Russia it played a special role in the development of religious art. The decoration of the icons with oklads represents a connection between the brilliance offered by the material used in their realization (silver, gold or precious stones) and holiness [13].

2. Materials and Methods

2.1. Analysis of the two sets of icons oklads – front and back

Two sets of icons oklads were analyzed: St. George (Ro), with Romanian markings (Figure 1) and St. Martyr George (Russian), with Russian markings (Figure 2). On the surfaces the icons oklads is represented the scene of the dragon's murder by the Saint Great Martyr George. From the iconographic point of view, he is represented as a young man with curly hair, up to his ears, without a beard [10], dressed in armor specific to Romanian soldiers [5]. The image of the armors of the Romanian soldiers was used both in the case of the icon oklad that was supposed to be of Russian origin, and in that of the icon oklad that has stamped the mark "12", specific to some Romanian icons oklads [14, 15, 16].

![Figure 1. Saint George (Ro), with Romanian markings, general images – front and back.](image)

From the time of Peter the Great, Russian official religiosity has experienced a strong development based on elements specific to the Roman Empire. Both the images of saints and the portraits of tsars were attributed complex symbolic structures that had their origin in the "secondary mythology" of antiquity [17]. In turn, Romanian iconography was strongly influenced by the religious art of Kievan Rus'[18].
2.2. Significance of documents and markings

The identification of St. Great Martyr George was based on the incised inscriptions (in Slavic letters) on the two oklads and the specific iconography. Both oklads are made up of two detachable elements - the oklad and the riza. The riza has no punches or inscriptions, instead the actual oklads, in addition to the inscriptions regarding the identity of the saint represented also have a series of markings, specific to the oklads of Romanian and Russian icons, respectively.

In the upper-central part of the icon oklad of Saint George (Ro) with Romanian markings the inscription “Ϲ. ΓΕΟΡΓΙЄ” (St. George) is incised, and in the upper-central part of the second icon oklad of Saint Martyr George (Russian) with Russian markings is incised the inscription “Ϲ Β ΜΥ ΓΕΟΡΓΙΗ” (St. Martyr George).

In the central-lower part of the Saint George (Ro) icon oklad, two adjacent markings are stamped (Figure 3a): the first mark represents the monogram of the master controller or of the silver master “КЈ”, and the second one signifies the standard silver title “12”.

![Figure 2](image2.png)

**Figure 2.** Saint Great Martyr George (Rus), with Russian markings, general images – front and back.

![Figure 3](image3.png)

**Figure 3.** a) Saint George (Ro), with Romanian markings and b) Saint Martyr George (Rus), with Russian markings (detail).
The silver title “12” (12 löthige) was used in Germany between 1600 -1800 [18], and from 1809 in the Hungarian District of Austria [19]. This “12” is found stamped on icons oklads from Romania [2, 21] and corresponds to 750/1000 parts pure silver, the equivalent of 75% pure silver and 25% copper or copper and other metals.

In the central-lower area of the icon oklad of Saint Martyr George (Russian) there are four types of markings: the marking with the initials of the craftsman “ИГ” (located above the series of three adjacent marks); the verification mark with the year of verification and the initials of the master controller “И А / 1858”; the marking of the silver title “84” and the mark of the city (in this case the coat of arms of Moscow).

On the Russian territory, starting with May 1, 1798, the silver title of “84” (84 zolotnik Russian silver) became a mandatory standard [22], and from the 19th century the revetment of icons was made by mechanical techniques such as lamination and punching [23, 24]. These techniques were also used in the manufacturing of Russian icons oklads with the representation of The Madonna and Child, probably made at the end of the 19th century [25].

Silver title “84” represents 875/1000 parts pure silver [21] equivalent to 87.5% purity of silver, and percentage represents the equivalent of 87.5% pure silver and 12.5% copper or other metals [25]. In the 18th and 19th centuries, especially in the northern part of the country, the Russian icons oklads are common [18, 27].

The methods of analysis and investigation were used to discover the differences between the materials used to make these icons, especially since one of them raised suspicions about it.

Thus, X-ray Fluorescence Spectrometry (XRF) was used, which was performed with the Oxford X-MET 5000 Portable XRF Analyzer (Oxford X-MET 5000 Handheld XRF Analyzer). Method parameters: RX tube current 10 μA, high tube voltage 40 kV, XRF SiPIN detector, dead time 10uS, analysis time 15 S. Type of calibration used: 1-EC (Empirical Calibration) - Calibration with standards, where the matrix allowed; 2-FP (Fundamental Parameter) - General calibration without standards. The spectrometer was previously checked with standards GBW 07236 and 316, Skyray instrument co., Ltd, TRH-801 for Pb in painting and Fe, Cr, Ni, Cu in metal alloys respectively.

The SEM-EDX investigations, made on a polished sample, were performed on a Phillips XL-30ESEM electron microscope using a Quanta Inspect F50, with a field emission gun (FEG) with 1.2 nm resolution and an Energy Dispersive X-ray Spectrometer (EDXS) having 133 eV resolution at MnKα.

3. Results and discussions
Following the XRF analyzes (Tables 1 and 2), a surprise appeared when the result for the Russian icon was displayed; the concentration of Ag was too low than that indicated by the mark inscribed on the punch.

Following some metallographic analyzes the thickness of the upper layer was determined [21]. Metallographic analyzes were performed using an optical microscope Reichert Univar, for this a sample of about 2 mm² was taken from an unimportant area (near the pin hole which supports the icon oklad) [21].

Investigations on the metallographic microscope reveals that the sample has a uniform layer (of about 25 μm) deposited on the base material. It was also observed that its microstructure is composed of polyhedron grains with different shades and crystallographic orientation which represent the typical structure of copper and copper alloys.

In this paper we continue the research to find out exactly the types of materials used to make icons oklads with the representation of Saint Great Martyr George. The XRF analysis in order to determine the chemical compositions was done on both sides of the icons oklads, namely the icon oklad of Saint George (Ro) and icon oklad of Saint Martyr George (Rus). The performed by means of XRF analysis are presented in Tables 1 and 2.
Table 1. Chemical composition analysis (XRF) of the icon oklad of St. George (Ro) – front and back.

| Side  | Chemical composition, % |
|-------|-------------------------|
|       | Ag  | Cu   | Zn   | Pb  |
| Front | 71.9175 | 26.5053 | 0.7410 | 0.8359 |
| Back  | 83.9011 | 15.0388 | 0.3609 | 0.6991 |

Table 2. Chemical composition analysis (XRF) of the icon oklad of St. Martyr George (Rus) – front and back.

| Side  | Chemical composition, % |
|-------|-------------------------|
|       | Cu  | Ag   | Zn   | Co  |
| Front | 74.1969 | 25.5789 | 0.2240 | - |
| Back  | 96.8998 | 3.0026 | - | 0.0389 |

After the XRF analyses, the sample were investigated by Scanning Electron Microscopy (Figure 4) in which the morphological aspect of the support material and the size of the deposited layer are observed and Energy-dispersive X-ray spectroscopy (Table 3) to determine more precisely the chemical composition of the two layers.

Figure 4. Electron microscopy image (x4000) for the Russian icon oklad.

The EDX analysis on the sample (Figure 4) was made for the both layer:
- EDX1 which belongs to the silver layer deposited on the copper substrate;
- EDX2 for the copper substrate.
Table 3. EDX analysis of the icon oklad of St. Martyr George (Rus).

| Analysis | Elem | Wt % | At % | K-Ratio | Z | A | F |
|----------|------|------|------|---------|---|---|---|
| EDX 1    | AgL  | 96.23| 93.80| 0.9493  | 0.9969 | 0.9897 | 1.0000 |
|          | CuK  | 2.78 | 4.60 | 0.0259  | 1.0649 | 0.8760 | 1.0000 |
|          | ZnK  | 0.99 | 1.60 | 0.0096  | 1.0710 | 0.9007 | 1.0000 |
|          | Total| 100.00| 100.00|         |        |        |     |
| EDX 2    | AgL  | 12.23| 7.59 | 0.0907  | 0.9368 | 0.7912 | 1.0000 |
|          | CuK  | 84.96| 89.53| 0.8402  | 1.0071 | 0.9819 | 1.0000 |
|          | ZnK  | 2.81 | 2.88 | 0.0281  | 1.0110 | 0.9893 | 1.0000 |
|          | Total| 100.00| 100.00|         |        |        |     |

The SEM-EDX electron microscopy analyses, performed on a slightly polished sample which led to the removal of the electrolytically deposited silver layer, are captured in Figures 5 and 6.

**Figure 5.** Electron microscopy image (x400) for a polished area of the Romanian icon oklad. The specific aspect of the polishing process is observed.

**Figure 6.** Sample investigation with the overall distribution of the elements per area analyzed - Romanian icon oklad.
According to the SEM-EDX analysis for the selected micro-zone, the distribution of each element is observed, with silver in high concentration. Then, the XRF analysis was repeated on a section from which the silver oxide layer (Figure 7a and Table 4) and the Ag layer (Figure 7b and Table 5) were removed.

**Figure 7.** Images of polished areas in order to remove the surface layer: a) Romanian icon oklad; b) Russian icon oklad.

| Side   | Chemical composition, % |
|--------|-------------------------|
|        | Ag  | Cu  | Zn  | Pb  |
| Back   | 70.0951 | 28.2537 | 0.6939 | 0.9571 |

**Table 4.** XRF results on the icon oklad of St. George (Ro) – back.

| Side   | Chemical composition, % |
|--------|-------------------------|
|        | Cu  | Ag  | Zn  | Co  |
| Back   | 96.8998 | 3.0026 | -  | 0.0389 |

**Table 5.** XRF of the icon oklad of St. Martyr George (Rus) – back.

The silver color remaining after polishing the layer of Romanian icon oklad leaves no doubt. The XRF analysis confirmed that it is a plastic deformed silver plate with a silver concentration between 70-80%, which corresponds to the inscribed mark.

After polishing the layer of Russian icon oklad was observed a reddish color that leaves no doubt. The XRF analysis confirmed that it was a copper substrate plate.

Following the investigations, it was found that the icon oklad is made of copper, which was then plated with silver.
4. Conclusion and perspectives
The two icons oklads have similar iconographic features (the representation of St. Great Martyr George killing the dragon with a spear).

On both oklads are silver title markings. In the first case, the silver title “12” is stamped, which is found stamped on a large part of the Romanian icon oklad, and in the second case, icon oklad with the silver title “84”, specific to Russian silverware workshops, have been circulating on Romanian territory since the 18th century.

The oklad with Romanian markings approaches the value of the silver title standard “12” which represents 750/1000 purity of silver, the percentage equivalent of 75% pure silver and the remaining 25% copper and/or other metals.

In the case of Russian oklad markings - with the stamp of the silver title “84” which would correspond to the values of the standard 84 zolotnik Russian silver which represents 875/1000 silver parts and which is the percentage equivalent of 87.5% pure silver and 12.5% copper or other metals, following metallographic analyzes, XRF and SEM-EDX investigations showed that it was a copper plate on which electrolytic Ag was deposited; the presence of markings specific to the Russian school on the oklad proves the intention to be false.

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