

Jordan Tabov, Kliment Vasilev, Asen Velchev
(Institute of Mathematics and Informatics,
Bulgarian Academy of Sciences, Sofia)

CHRONOLOGICAL DISTRIBUTION OF THE COIN FINDS IN BULGARIA REPORTED IN THE SCIENTIFIC LITERATURE FOR A QUARTER CENTURY (1910–1934)

Abstract. We put together the data for coin finds, reported in the early Bulgarian archaeological journals in the period 1910–1934. We suggest a method for constructing appropriate *function of the chronological distribution of coins*. Its graph, obtained by standard computer software tools (Microsoft Excel), provides a good visual presentation of the function. The method follows the ideas of the *volume function* introduced by A. Fomenko. Our investigations show a large-scale anomaly: the too large percent coins in a quite distant from us epoch – the period (–200, 370) and the unacceptably small, practically insignificant percent coins during the following, later interval (370; 970).

Key words: digitization, coin finds, chronological distribution.

1. Introduction

The old coins, found in any country, are important information source about the past of this country. Conclusions can be made about the economy status of its population, trade relations, religion, about the names and the titles of the respective rulers, etc. in different historical periods. The coins are sometimes also a “dating” element of linked archaeological monuments. Therefore the coin finds are an object of attention both for archaeologists and historians. The presentation of the quantities and dating of all excavated in a given region coins can be (in our view) a basic element in investigations of the development of the respective region during different historical epochs. Surveys of this type are rare; we should mention in Bulgarian historical publications the comprehensive article of Zdravko Plyakov [8], devoted to coin finds in Bulgaria from the period of the 13th and the 14th centuries.

Chronological distribution of the coins (CDC), for the coins described in [8], is constructed and visualised via graph and then used for modelling of the monetary circulation in Mediaeval Bulgaria in the articles [12] and [13]. C. Gazdac visualised quantitative data on coin finds and their territorial distribution in [6]. The defining and using chronological distributions have roots in A. Fomenko’s “volume function”, introduced in [5] and [7]. Applications of “volume function” are described in details also in [11]–[13], etc. J. Tabov suggested a generalization and some modifications of the concept “volume function” in [11].

2. Data description

In this paper we study the data about more than 150000 coins, called further “Data set 1910–1934”. We extracted it from all the publications in the specialised rubrics for short messages on archaeological finds in the two Bulgarian archaeological periodicals “Proceedings of the Bulgarian Archaeological Society” [10] (published since 1910 till 1920) and “Proceedings of the Bulgarian Archaeological Institute” [9], published since 1921 till now. We included the data for the 25 years period 1910–1934. Thus we use scientifically verified information. We choose the earliest period of a systematical “scientific publication” with plans to continue the “CDC constructing” adding to “Data set 1910–1934” periods after 1934.

Some of the data are described in the periodicals mentioned above for a bit different purpose and they are not always complete from our viewpoint. Our methods demand both the number of coins in every coin find and an accurate attribution of each coin to the reign of a known ruler (or period). Therefore a small part of the data were dropped out from our research, for example “Hisarlaka (Kyustendil) – dozens of coins of Justin 1, Justinian 1 and other Byzantine coins (324–1460) and Serbian coins (1168–1868)” from volume 1 of “Proceedings of the Bulgarian Archaeological Society” [10].

3. Description of the method

Basic time unit: twenty years. We fix periods like 1201–1220, 1221–1240 as time units. In our earlier papers [12], [13] we used time units of 10 years. Our observations show that the present interval of 20 years is more convenient, since the time for putting the date in the computer is shorter. It is important to underline that the new unit of 20 years is approximately equal to the average duration of the reign of the kings, and therefore it does not significantly influence the exactness of the results in comparison with the case of using 10-year units.

Coins’ dating. Coins are usually related to the ruler stricken them. If a given coin is Bulgarian, from tsar Ivan Alexander (1330–1371 r.), it is dated to the same period namely: 1330–1371. This approach makes dating of the coins dependent on *their minting*.

“Round” periods of reign. Since we’ve chosen twenty-year period as a unit, we express the intervals of reign via such units. The basic interval of Tsar Ivan Alexander is 1321–1380. For Tsar Ivan Shishman (1371–1393) it is 1381–1400. The “rounding” of the reign intervals we also apply to the respective coins’ intervals.

Note. For the sake of convenience we will further call a rounded (basic) interval just “interval”. Each basic interval consists of an integer number of units.

Individual unit coin’s function (IUCF). To every coin we associate a function, equal to 1 in the “coin’s” interval, and to 0 out of it. For instance a coin, minted by Tsar Ivan Shishman (1371–1393), is in the interval 1381–1400, which has a unit “length”. The IUCF of this coin equals 1 in this interval and 0 out of it. The respective graph is presented in Fig. 1.

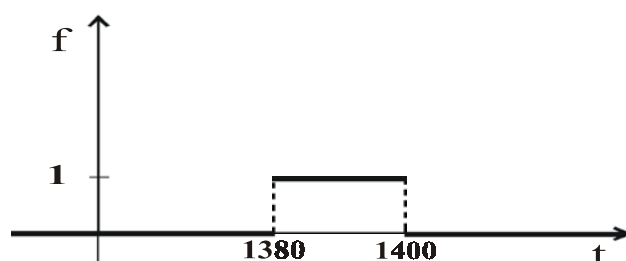


Fig. 1. *IUCF* of coin, struck by Tsar Ivan Shishman (1371–1393).

Chronological distribution of coins (CDC). The new function we obtain summing up the *IUCF* of the coins from a given sample, multiplied in advance by *calibration coefficient* (*CC*), equal to $60/n$, where n is the number of units in the ruler's interval. For example a coin, struck by tsar Ivan Shishman (1371–1393), has a “rounded” (basic) interval 1381–1400. It includes one unit, therefore the *CC* equals to 60. Thus *IUCF* has to be multiplied by 60 before summarizing. For the coins of Emperor John Palaeologus (1341–1391) the interval is 1341–1400. It includes 3 time units, therefore *CC* is $60/3=20$.

The role of *CC*. Let us consider the *CDC* of set of coins, which includes:

1. A coin struck by Tsar Mikhail Shishman (1323–1330);
2. A coin struck by Tsar Ivan Alexander (1330–1371).

Without the *CC* in *CDC* both the coins would have “contribution” of 1 for each time unit. For the first coin this contribution is over the unit 1321–1340; for the second one it is over three units, i.e., the total “contribution” of the second one is three times greater than the “contribution” of the first coin. Introducing the *CC* in *CDC* guarantees multiplying the *IUCF* of the second coin by a coefficient, 3 times smaller than the coefficient of the first coin. I.e. *CC* establishes “equipollency” to all coins, *no matter how long* was ruling the respective ruler. For the sake of convenience we use here the number 60 since it is divisible by 2, 3, 4, 5 and 6, which effects on *CC* to be integer.

Chronological distribution of coins (*CDC*) has the property: its value on every unit equals to the number of coins, struck during this unit, multiplied by 60. If the interval of a ruler is several units “long”, we assume that his coins were minted constantly during all of them).

4. *CDC* construction for “Data set 1910–1934”

It is obtained using electronic spreadsheet Microsoft Excel. Details of the respective methods can be found in [12] and [13].

To keep the trace of the character of the changes of the function *CDC* when “new” data is added to data set, we present “intermediate results”, obtained for a shorter interval, gradually reaching the whole interval 1910–1934. The first stage is construction of *CDC* for the subinterval 1910–1918 (Fig. 2). In Fig. 3 is shown the final *CDC* for “Data set 1910–1934”.

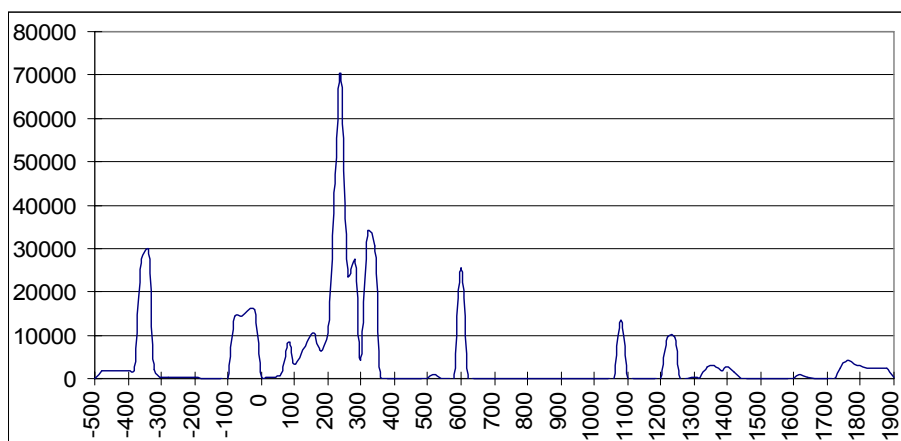


Fig. 2. *CDC* - “medial results” for the subinterval 1910–1918.

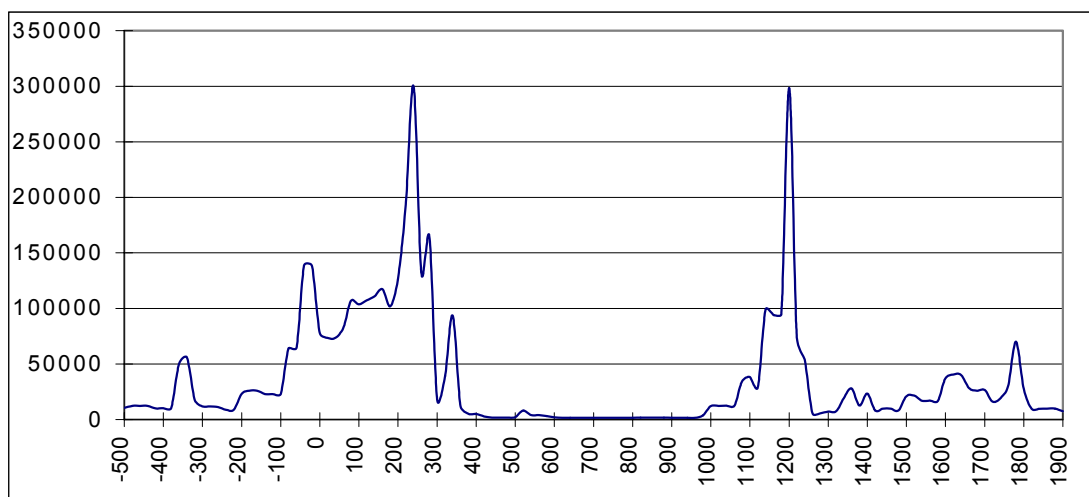


Fig. 3. *CDC* – final results for the interval 1910–1934.

5. Analyses and conclusions

The values of *CDC* shown in the above figures are approximately equal to 60 multiplied by the number of the included in “Data set 1910–1934” coins, stricken during the respective periods. Therefore to “high” graph on a given time unit corresponds a “large” number of coins and respectively to “low” graph – “small” number.

We note that the number of coins vary for the different periods in very wide intervals. Surprisingly about 2/3 of all the coins belong to the period $(-200; 370)$, i.e. between 200 year BC and 370 year AC. In the following longer period $(370; 970)$ there are no coins practically. About 1/3 of the coins falls into the period $(970; 1800)$. It is the latest and longest one (twice the length of the previous ones). A maximum is reached in it about 1200 year.

The analysis of the varying of *CDC* on the three graphs leads to the conclusion, that there is a certain kind of stability with respect to the adding of new data. For instance the high values of the graph of the *CDC* in the interval $(-200, 370)$, as well as the

low values in the interval (400, 970) appear clearly in the first graph for the data from 1910 till 1918 (see Figure 2). It preserves its character in the graph for the data since 1910 till 1934 (Figure 3). On the basis of these observations we can expect that the form of the graph will remain more or less the same if we include in our research the data not only for all the coins, reported in the scientific literature, but for all the coins found in Bulgaria.

This general view displays a large-scale anomaly: the too large percent coins in a quite distant from us epoch – 2000 years ago and the unacceptably small, practically insignificant percent coins during a following, later interval (370; 970). May we attach it to eventual “dark ages”, caused by the invasions of the Goths, Huns, Slavs and Bulgarians? Under the pressure of many facts the myth of the “dark ages” is abandoned by most of the historians. Furthermore with the dark ages cannot be explained the insignificant percent of coins during the first half of the 6th century, traditionally described as an epoch of religious and economical flourishing of the Balkans, signed by the creation of the famous Constantinople’s “St. Sofia”.

We suggest the following *hypothesis*: this anomaly can be caused by wrong attribution and dating of some coins, and consequently of the related with them historical persons and events.

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