# MODEL OF THE MONEY CIRCULATION IN THE BULGARIAN LANDS DURING THE ANTIQUITY AND THE MIDDLE AGES

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***Abstract****: This article presents a model of the money circulation in Bulgaria, based on the data about coins, excavated in Bulgaria and published in the Proceedings of the (Bulgarian) Archaeological Society (PAS) during the period 1910-1920 and in the Proceedings of the (Bulgarian) Archaeological Institute (PAI) during the period 1921-1959. We construct the Chronological Distribution of these coins and its graph using computer technology (the package MS Excel in our case). The studied material consists of over 280000 coins, which in our view is large enough to give an adequate picture in a first approximation of the chronological distribution of all coins excavated in the Bulgarian lands during the period 1910-1959. We think that it also gives a plausible picture of the monetary circulation in the eastern part of the Balkan Peninsula during the different historical periods. We discuss some considerable anomalies of the obtained chronological distribution. The results of the analysis juxtaposed with a peculiarity of the Chronological Distribution of Byzantine coins noticed by A. Kazhdan leads us to the hypothesis that there are probably certain mistakes in the accepted dating of some ancient coins.*

***Keywords****: model; money circulation; coin finds; chronological distribution*

***ACM Classification Keywords:*** *I.6 Simulation and Modeling, I.6.3 Applications*

## 1. Introduction: Is it true that patterns in finds of accidentally lost coins mirror to a useful extent those of the coins in circulation at the time?

The old coins excavated in a given country are important source of information about its past. They bring information about the welfare of its population, its trade centers, trade relations with other countries, religion, the names and the titles of its rulers, etc. The well known specialist in Byzantine history A. Kazhdan wrote:

*"The coin, that has been a means for trade in ancient times, in the hands of historian nowadays becomes evidence of the intensity of the trade: the abundance of coins excavated in a given old city can serve as a serious argument, which proves the existence of manufactory in this city. The chronological definiteness inherent to the numismatic material advantageously distinguishes it from many other kinds of historical sources. And at last the coin finds give a mass material, which is more or less uniformly distributed over the time and the space"* ([Kazhdan, 1954]).

We ought to add to the above that the coins are a reliable "dating element" for other archaeological evidence, found together with them. Therefore the old coins are object of special interest not only for numismatic collectors, but also for archaeologists and historians.

Is it possible the quantity of the found coins, struck by a given ruler, to give us certain objective information about the monetary circulation during his reign, and thus about the intensity of the trade relations in his country and between it and other countries? In the cited article [Kazhdan, 1954] A. Kazhdan gives positive answer to this question with some reservations of little importance.

A. Gandhi [Gândilă, 2009] points to the D. M. Metcalf [Metcalf, 1958; Metcalf, 1960] as one of the pioneers in the application of statistical methods for the study of monetary circulation in the Byzantine Empire, and adds the names of V. E. Metcalf and S. Morrisson [Morrisson, 1980; Morrisson, 1981]. According to him, after 1980, there has been a real "explosion" in the use of more or less sophisticated statistical approaches.

But especially to justify the claim that the number of found old coins of a certain period of the past can serve as an indicator for the amount of monetary circulation, a special place is taken by the study of Douglas Newton [Newton, 2006]. Comparing the extant information on the quantities of coins minted in the past in a certain region with the archaeological data he established a correlation with a large coefficient of Pearson (about 0.9) between the numbers of "minted" and "found" coins [Newton, 2006]. Such a correlation gives us the opportunity to "measure" the changes in economic activity in the city, region or state by applying quantitative analysis of the found in the respective territory of old coins.

Hence to build a respective model of the money circulation one has to handle in a proper way the data about the coin finds. We do this here, applying the modern computing technology to the ideas of A. T. Fomenko about his concept of the so called “volume function” introduced in [Fomenko, 1981a] and [Fomenko, 1981b] (for more details see [Fomenko & Rachev, 1990]. We ought to stress that it is spoken about a research involving hundreds of thousands of coins; it is clear that the past attempts of the scientists to make such investigations have raised problems. To achieve our goals we used the Chronological Distribution of Coins (abbreviated CDC) described in [Tabov, 2003], which is similar to the “volume function” of A. T. Fomenko.

Variations of this concept and its construction techniques were used for building specific "historical distributions": of coins ([Tabov et al, 2003; Tabov & Panayotova, 2011]), of old manuscripts ([Tabov et al, 2004a]) and museum exhibits ([Hristova & Dobreva, 2004]) and others.

Here we use essentially the same procedure for the construction of the function of the chronological distribution and its graph.

## 2. Data Description

Our sources of information are the Proceedings of the (Bulgarian) Archaeological Society (PAS) during the period 1910-1920 [PAS, 1910-1920] and the Proceedings of the (Bulgarian) Archaeological Institute (PAI) during the period 1921-1959 [PAI, 1910-1920] (in a certain sense PAS has been continued by PAI). For the studied period these journals were the only scientific ones, in which regular reports of Bulgarian archaeologists on excavations and finds in Bulgaria have been published. We have extracted data about more than 280000 old coins grouped in more than 1050 finds from these journals. The high scientific verification of our data is based on this approach. There are no repeatedly reported finds, which might occur if for example additional information from newspapers or other journals is used.

We denote by CFBP-1910-1959 (Coins Found in Bulgaria and Published 1910-1959) the set of coins, excavated in Bulgaria and published in the above Proceedings during the period 1921-1959.

The rulers, who struck the respective coins, are usually given in the reports of the archaeologists. We use their time of reign for dating the coins. For about 20% of the coin finds there are given neither the rulers, nor some approximate dating – for example “there were found 70 gold Byzantine coins. I saw 4 of them”. Such a peace of data is ill suited for use in this study because of uncertainty of the dating and therefore has been left out.

The data about the quantities of the coins for several coins finds in PAS and PAI is given in kilos or pots. We assumed that each kilo equals 50 coins and that a pot contains approximately 500 coins and below we will stick to this dimension.

Admittedly there were also found other ancient coins during this 50-year period (1910-1959), which have been published neither in PAS, nor in PAI. Many times some coins were found by treasure-hunters and then sold to private collectors without the civil authorities or any scientist to be informed about it. But the "split" of coins to "identified and published" and to "not published" has a random character. Furthermore the quantity of the identified and published coins is very large (more than 280000 items) and for this reason it will be plausible to suppose that our sample is representative for all the coins found in Bulgaria. Therefore we assume that our conclusions for CFBP-1910-1959 hold with a high probability for all coins found in Bulgaria.

## 3. Construction of the Chronological Distribution of Coins Found in Bulgaria and Published 1910-1959

We construct the Chronological Distribution (CDCFBP-1910-1959) of the set CFBP-1910-1959. The procedure of constructing this chronological distribution follows the standard procedure, described e.g. in [Tabov et al, 2004] and [Tabov et al, 2005]. The result is represented in Figure 1.

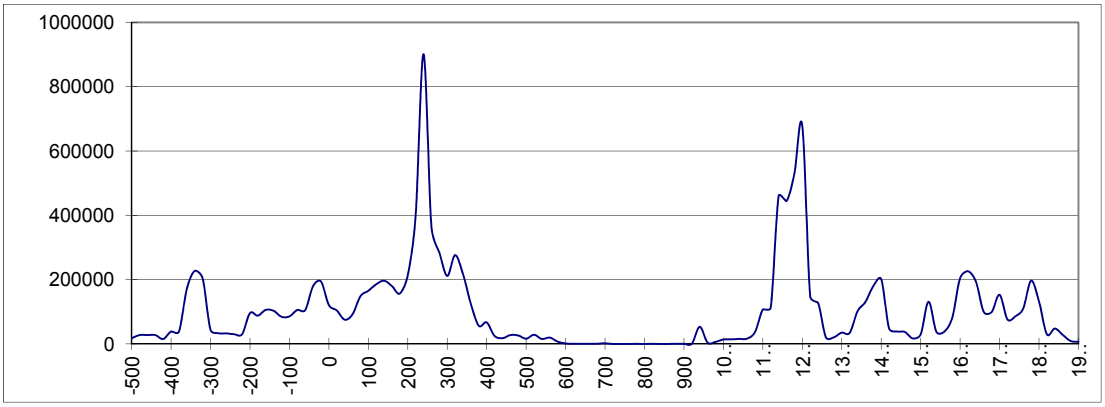


**Figure 1.** The graph of the Chronological Distribution of Coins Found in Bulgaria and Published 1910-1959

The above explanation gives us the opportunity to consider this graph as a model of the money circulation in the lands of modern Bulgaria.

## 4. Stability of the graph and representativeness of the studied data

Since the coins' excavation is a random process, it is natural to expect that after entering large enough quantity of data the shape of the graph of the CDC would become stable. This expectation proved to be true. To show this fact we consider the graphs in Figure 2 and Figure 3, which present respectively the Chronological Distribution of parts of CFBP-1910-1959, namely the Chronological Distribution of the coins found during the first 25 years of the studied period (published in [Tabov et al, 2004], and the Chronological Distribution of the coins found in 1910-1950. Comparing them to the graph in Figure 1, we conclude that the differences between the shapes of the

three graphs are very small: the high peaks and the deep downs are distributed in the same way. It might be checked that the sequence of the CDC for the first 26, 27, …, 40, …, 49 years "approaches" the CDCFBP-1910-1959.

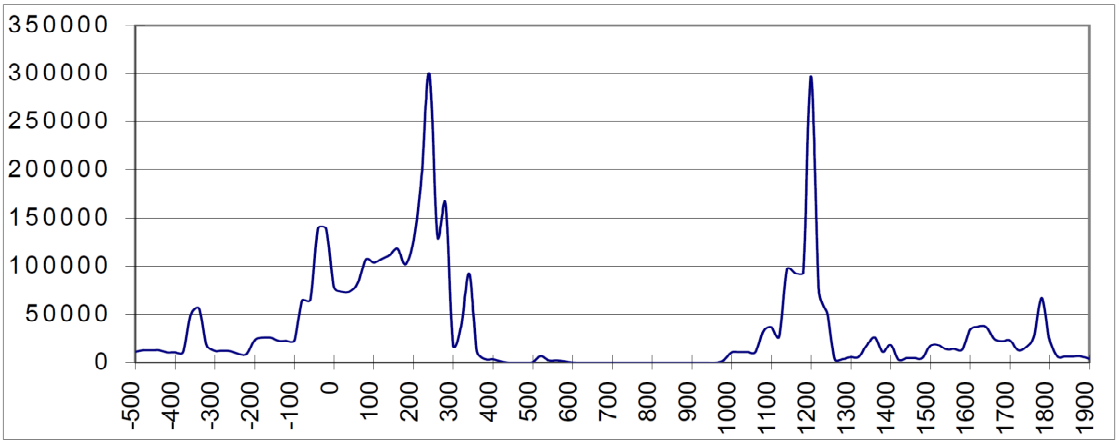


**Figure 2.** Chronological Distribution of Coins Found in Bulgaria and Published 1910-1934

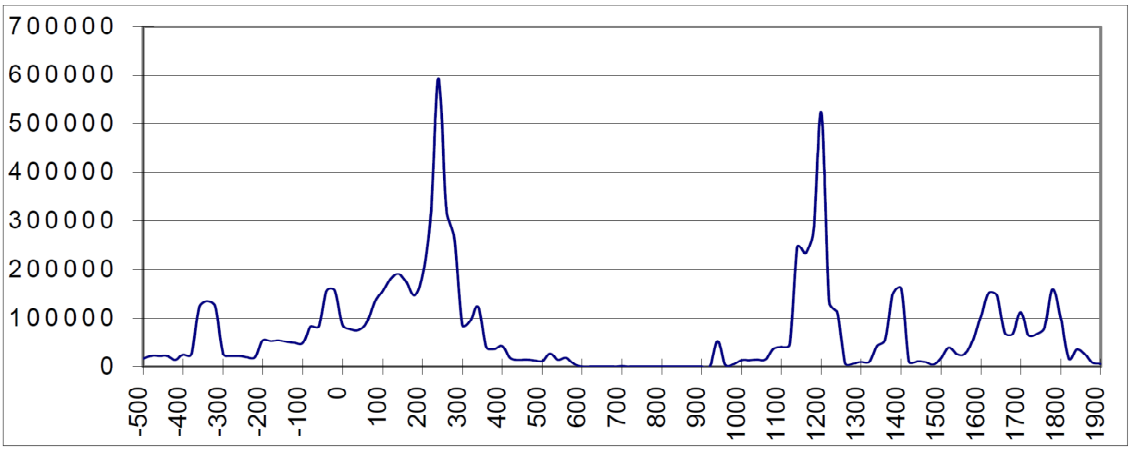


**Figure 3.** Chronological Distribution of Coins Found in Bulgaria and Published 1910-1950

On the basis of this observation it is natural to expect that:

1. Further data adding would not change the main properties of the graph in Figure 1, especially the distribution of the minima and maxima and the ratio between their values.
2. The CDCFBP-1910-1959 gives us an adequate picture for all excavated coins, including those, which were not published. The adding of non-published coins would not significantly change the graph in Figure 1.

## 5. Anomalies in the Chronological Distribution of Coins Found in Bulgaria and Published 1910-1959

We will consider four anomalies, which leap to the eye and are the most significant in our view.

1. About 60% of all found coins belong to the interval (-400, 400].
2. The amount of coins dated to the period (400, 1050] is negligible.
3. The percent of the found Turkish coins from the period of the Turkish slavery, i.e. minted after 1400, is very small, which looks very strange for the epoch of 16th -18th century.
4. The periods (200, 260] and (1180, 1240] are represented with great amounts of coins.

The first two anomalies show that the mistakes in the dating of some old coins are quite probable.

We will consider at length the second one.

## 6. The problem with the Byzantine coins from 8th and 9th century

In his research on Byzantine towns, published in [Kazhdan, 1954], A. Kazhdan studied every peace of data on the old coins as objective archaeological material. He used sources of information of two types:

1. Catalogues of big museums.
2. Reports on coin find (excavations and collective finds).

Kazhdan wrote:

*"The catalogues of the big collections contain descriptions of hundreds of coins and provide opportunities to present more or less tentatively the minting intensity during one or another period of the Byzantine history*" [Kazhdan, 1954].

In other words, without restriction in the limits of Byzantium and its history, the analyses of information of big enough and randomly chosen quantity of coins delivers opportunities to model the intensity of the monetary minting in the past.

On the basis of the data on the Byzantine coins in the collection of the British Museum, published in [Wroth, 1908], Kazhdan created the table given in Table 1:

**Table 1.** Data on the Byzantine coins from the collection of the British Museum, tabulated by A. Kazhdan

| Period | Period in years, during which the coins were in circulation | Number of coins | Ratio of the number of coins to the years of circulation |
|---|---|---|---|
| From Anastasius I to Maurice (491-602) | 111 | 1349 | 12,3 |
| From Phocas to Constantine IV (602-685) | 83 | 1134 | 13,7 |
| From Justinian II to Michael II (685-829) | 144 | 423 | 2,9 |

| | | | |
|---|---|---|---|
| From Theophilus to Nicephorus II Phocas (829-969) | 140 | 226 | 1,6 |
| From John I Tzimisces to Nicephorus III (969-1081) | 112 | 283 | 2,5 |
| From Alexius I Comnenus to Alexius III (1081-1195) | 114 | 349 | 3,0 |

The right column of the table defines a function, which in fact is a simple version of what we call here Chronological Distribution of Coins (CDC). We distributed the data from the above table in 20-year time units in the manner described in § 3, put it in a new MS Excel's worksheet and made the graph of what we entered in the computer. The graph is shown in Figure 4.

This graph provides us information on the Chronological Distribution of the Byzantine coins from the period 491-1195 considered by Kazhdan.

Table 1 and the graph in Figure 4 represent (almost) the same information. Comparing them we notice the advantages of the visualised presentation in Fig. 4 in comparison with the systematized numerical information in Figure 4. Such an approach and the specialized software used for visualization of the data give our study various advantages.

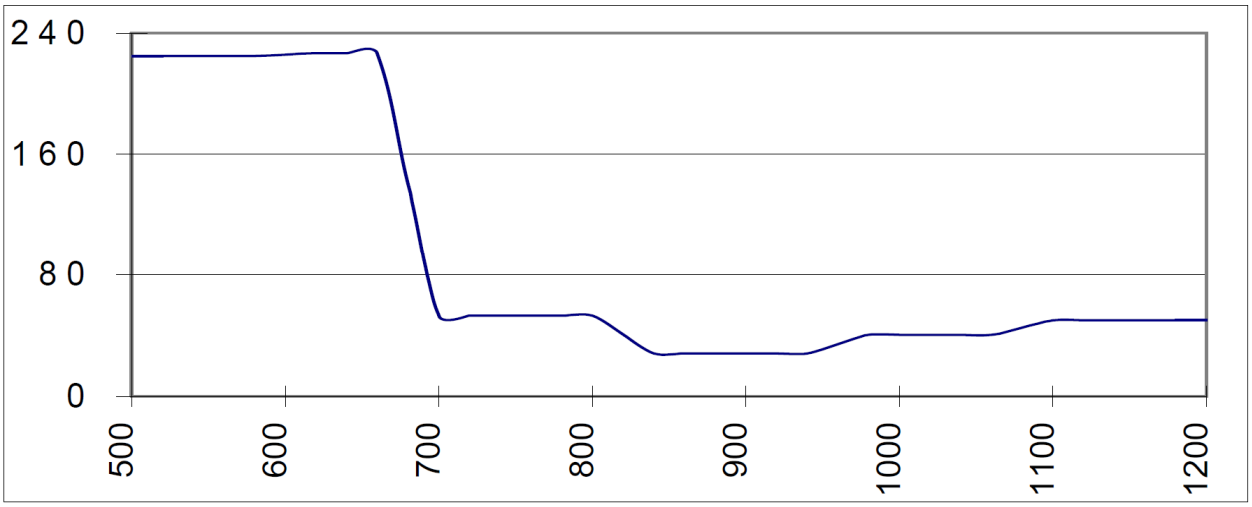


**Figure 4.** Chronological Distribution of Byzantine coins from the collection of the British Museum according to Kazhdan [Kazhdan, 1954]

Since the "basic intervals" in Table 1 (about 100 years and more) are longer than those used in our construction, the function in Figure 4 is rougher. Nevertheless the table gave Kazhdan the opportunity to notice a peculiarity: the period 8th-10th century is presented by lesser amounts of coins. The analogous table and graph in Table 2 and Figure 5 constructed for the Byzantine coins from the collection of count I. I. Tolstoy [Tolstoy, 1912-1914] show the same peculiarity.

**Table 2.** Data on the Byzantine coins from the collection of count I. I. Tolstoy, tabulated by A. P. Kazhdan

| Period | Period in years, during which the coins were in circulation | Number of coins | Ratio of the number of coins to the years of circulation |
|---|---|---|---|
| From Anastasius I to Maurice (491-602) | 111 | 1578 | 14,3 |
| From Phocas to Constantine IV (602-685) | 83 | 1129 | 13,6 |
| From Justinian II to Michael II (685-829) | 144 | 532 | 3,7 |
| From Theophilus to Michael III (829-867) | 38 | 72 | 1,9 |

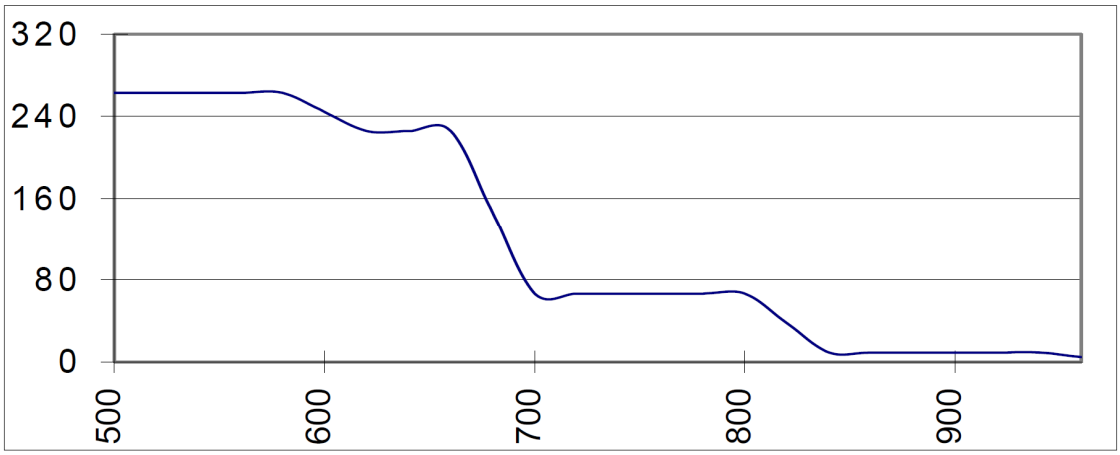


**Figure 5.** Chronological Distribution of the Byzantine coins included in the collection of count I. I. Tolstoy

Considering further the generalized data of finds of Byzantine coins Kazhdan makes the following conclusion:

*"Considering the data in these catalogues one may suppose that at the border between 7th and 8th century Byzantium had entered in a period of significant economical alterations, which found expression in diminishing the intensity of minting. This conclusion, however, remains hypothetical and should be seriously checked out. The matter is that the collections always have subjective and random character: in particular the more common is one or another kind of coins the minder is the collector's interest in it. Therefore there are mostly rare coins in the collections. Moreover the coins struck by the Comnens and Palaeologs during the last centuries of the empire are of minder interest for the collectors than the earlier ones. All these factors of course deform the picture and therefore the catalogue data should be verified with the data in the publications on archaeological excavations and collective coin finds… Having in mind all these facts, all the following reasoning and calculations might have preliminary and tentative character, even though it seems to me that the mass character of the coin finds is a*

*certain guarantee for the relevancy of the conclusions deduced on the base of analyses of the numismatic material"* [Kazhdan, 1954].

Following this logic Kazhdan directs his attention to publications on archaeological excavations and collective coin finds and uses their data to confirm his expectations that (this phrase deserves to be repeated) "*the mass character of the coin finds is a certain guarantee for the relevancy of the conclusions deduced on the base of analyses of the numismatic material*." Kazhdan finds out that the numismatic material found by excavations and treasure findings has the same property – negligible quantity of coins from 8th and 9th century. Details can be found by the readers in his article [Kazhdan, 1954]. It is important to notice that in his research he involves data for more than 50000 Byzantine coins; we put all them together and construct their Chronological Distribution in the interval (500, 1000]. Its graph is shown in Figure 6.

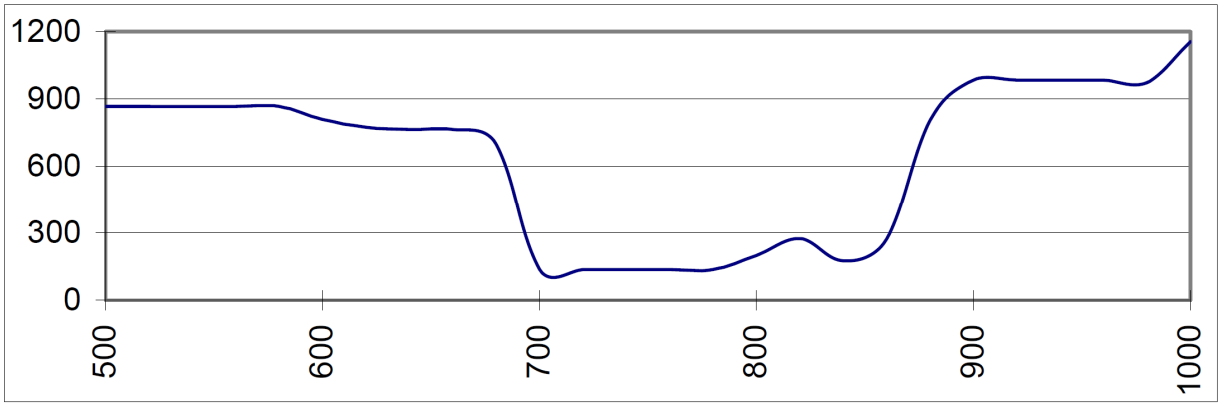


**Figure 6.** Chronological Distribution of all Byzantine coins considered in [Kazhdan, 1954]

Thus Kazhdan convincingly shows the existence of a "monetary crisis" in the Byzantine history. It comprises the period 8th-9th century. Similar conclusion is proved also by the data of R. Lazer [Lazer, 1980] (cited by A. Romanchuk in [Romanchuk, 2003] on Roman and early Byzantine coins (1641 coins in total) excavated in East Germany, and the results of V. Kropotkin [Kropotkin, 1961] and [Kropotkin, 1962] on finds of the same type coins on the territory of the ex-USSR and East Europe (11729 coins in total). The number (given by V. Kropotkin) of Byzantine coins found in East Europe and dated to 8th-9th century is clear enough: 2 coins from 8th century and 11 from 9th century [Kropotkin, 1962, Table 1].

This phenomenon appears to be a serious scientific problem, because the life in a city, even a small one, is impossible without coins. The majority of the citizens do not produce agricultural products like bread, milk, meat, etc and they should purchase their food, needing money for this. It's known that in some countries instead of money were used leathers; but as far as it is known from the sources in Byzantium for "money" were used *only* coins. Hence in Constantinople and other big cities of the empire, especially in Serdica (Sofia) and Philippopolis (Plovdiv), which are in Bulgaria today, there should have been monetary circulation. Hence coins were struck in Byzantium for sure.

But where they are? Why the archaeologists don't find them in Bulgaria?

## 7. Why no coins came to us from 8th – 9th century?

Kazhdan suggests an answer, which likely follows from his research: during 8th-9th century there were decays and degradation of the towns. According to him all Byzantine towns had stopped to exist or became villages and some towns like Constantinople, Thessalonica and Nicaea survived but had lost their leading economical status. Kazhdan wrote in his article [Kazhdan, 1954]:

*"The material studied by us does not allow us to agree with the statement, wide-spread in the bourgeois historical literature, that Byzantine Empire has always been an urban country. Indeed with the fall of the slave-holder way of manufacture in the East Roman Empire gradually disappeared almost all slave-holder Antique pollises on Balkan Peninsula and in Asia Minor: the slave-holder polis had collapsed together with the slave-holder way of producing…Only a few towns besides Constantinople survived the fall of the slave-holder society, but they also had lost their economical functions"* [Kazhdan, 1954].

The wording here outwardly reminds the attacks on the "bourgeois historical literature" but the core idea is that the towns disappeared. It is in accordance with the concept of the "dark ages" – namely in the 8th, 9th and 10th centuries.

It is worth to pay a special attention to the "exceptions from the rule", i.e. to those towns, for which Kazhdan wrote that they had preserved their urban appearance. It makes at once the impression that for none of them Kazhdan gave any data about the number of the coins found in the respective town or in the surrounding area. Considering the catalogue data of the British Museum and the collection of count Tolstoy we see that the number of coins in the "survived" towns, which came to us from 8th and 9th centuries, is too little. Hence the quantity of the found coins with a high probability is small not only in the survived towns. Therefore no objective data is visible except probably of some written sources, which might allow making such "exceptions".

All this creates the feeling that Kazhdan had tried to soften the clear results from his research and thus partially to hide the contradiction between them and the generally accepted historical picture of the epoch 8th – 10th century.

Several years after the publication of the article of Kazhdan another soviet historian – I. V. Sokolova – suggested other explanation for the lack of coins during the period mentioned in her article [Sokolova, 1959] and tried to solve the problem stated by Kazhdan.

First of all we ought to point out that she had understood very well the meaning of the coin finds for the work of the historians and especially for the decay of the towns during 8th-9th century. Her position on it is expressed in the introduction of her article:

*"Coins are very rich, many-sided and interesting historical source. Designed for serving as a tool for trading they are in position to reflect to a considerable degree the state and the level of the economical development of a country during given period. Therefore the investigations of the coins themselves, of the monetary system, of the distribution and the content of the collective coin finds, random coin finds and the coin finds in cases of archaeological excavations as well create opportunities to make clear the picture of the monetary circulation, characterizing the economical centers and regions, the inner trade paths, international trade relations, etc"* [Sokolova, 1959].

But this acknowledgement of the role of the coin finds does not mean at all that she was ready to accept of Kazhdan's methodology and conclusions. This is clear from her words further down:

*"One has to take into consideration that the numismatic material can be valuable only when it is studied from all the sides, with correct methods and comparing it with the data from the written sources. The one-sided selective usage of it may lead to wrong conclusions"* [Sokolova, 1959].

This gives us the opportunity to see that Sokolova has seen well the contradiction between the conclusions of Kazhdan and the generally accepted picture of the past and in final account with many pieces of information from the narrative sources.

Sokolova puts the specific understanding of the concept *collective coin finds* in the root of her disagreement. Since the coins are frequently found "many on the same place" in sets of some or several hundreds or even thousands (namely for such coin sets she uses the term "collective coin finds"), she starts her criticism to the work of Kazhdan with the note:

*"Therefore Kazhdan is not right considering a collective coin find not as an overall memorial from the epoch of its burial but as a randomly accumulated material. Decomposing the finds in parts of coins from same centuries and then summarizing the respective parts of all the collective coin finds, A. P. Kazhdan compares the results thus obtained considering them as a measure of the intensity of coins' minting or their distribution in foreign countries during one or another historical period. At that he doesn't take into account the size of the minting area and the metal of the coins, which form the collective coin find"* [Sokolova, 1959].

Kazhdan really has ignored the material of the coins and also a number of insignificant other things, which influence on the studied problem is relatively small in first approximation. For example for the minting area size Sokolova is not right, because Kazhdan considers a group of towns of the Byzantine Empire, which is representative for the latter and as such it gives completely adequate view on the economic life of the whole country.

But her main objection to the conclusions of Kazhdan is based on the following:

*"Influxes and refluxes in burying collective coin finds in one or another region depend directly on how much the population of these regions was threatened by war."* [Sokolova, 1959]

With other words she states that the people in the past had buried their money in the ground because of fear of enemy invasions. But then we must ask: what the people had done to hide money from their relatives – wife, children, and grand children? And from friends and enemies, from thieves and burglars? Put their money in Swiss banks? This concept of Sokolova is unacceptable. In the most cases people hide money not because of war danger but for other reasons.

But even if we suppose that Sokolova is right, then taking into account the frequent Bulgarian raids in Byzantium during the period 8$^{th}$ – 9$^{th}$ century, it is natural to expect that because of warlike danger in today's South Bulgaria lots of coin treasures have been buried there. However, as we have already seen, the archaeological data shows just the opposite.

So, the objections of Sokolova against the conclusions of Kazhdan are unacceptable. First because they are based on a wrong concept of the "peace" on the Balkans during the period 8$^{th}$ – 9$^{th}$ century, and second because they are not consistent with the logic of the people's behaviour when they try to hide their money from other's eyes and hands.

Recently in his article [Romanchuk, 2003] A. Romanchuk took a medium position between the described opinions of Kazhdan on one hand and Sokolova on the other about how far the quantities of the found old coins reflect the state of the coins' minting during different periods of time. He took a note of the fact that some coins were

probably in circulation during periods of time, considerably surpassing the period of reign of the ruler, who struck the respective coins. He advances arguments noticed by V. Kropotkin [Kropotkin, 1961] that in the archaeological finds of Roman coins from 3rd century there are always coins from 1st and 2nd century as well. If this is true, it points in our opinion to the fact that there are systematic errors in coins' dating.

## 8. The third and the fourth anomalies in CDCFBP-1910-1959

We will consider another two anomalies, pointed in § 5.

Let compare the quantities of the coins dated to the intervals (220, 320] and (1480, 1580]. From the modern historical point of view of the picture of the past there should be expected that the coins from the second interval are much more than these from the first one. We point two arguments pro this thesis:

1. The Roman reign on the Balkans was in crisis during the first half of the first period. The Barbarian raids lead to stagnation in many aspects of life over the territories of today's Bulgaria, especially in the field of economics. During (1480, 1580] the territories of today's Bulgaria were parts of the Ottoman Empire and undergo economical growth. The stories of travellers, who had crossed the Balkan Peninsula on their way to Constantinople, mention caravanserais and dozens and sometimes even hundreds of shops in each town (see for example the recent monograph of L. Klusakova ([Klusakova, 2002]), i.e. obvious signs for brisk trade.
2. The second interval is later and the percent of the extant coins should be greater (at least not lesser) than the same percent for the first interval. But from the graph in Fig. 2 it follows that the most intensive monetary circulation through; Bulgarian lands was namely in the period (220, 320]. It means ten times more coins in circulation than those in the period (1480, 1580]. Such levels, so high, are unrealistic, having in mind that a part of Balkan population was slaves during the 3rd century and they didn't partake in the monetary circulation.

## 9. Conclusions

The analysis of the graph of the CDCFBP-1910-1959 (chronological distribution of the coins found in Bulgaria and published during the period 1910-1959) from the point of view of today's historical science on the picture of the past points a number of contradictions. Their explanations have to be searched in different directions and the most natural of them is to propose that much of the discrepancies are due to certain incorrect dating of coins. ***The scale of the anomalies gives us merits to suspect that there are mistakes in the dating of some old coins.*** For the justification of this hypothesis further investigations are necessary.

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