

# CERAMICS IN CIRCULATION: NETWORK ANALYSIS FROM THE OTTOMAN BALKANS AND AEGEAN

*Tsveta Kodzhabasheva*

*Faculty of Archaeology, Leiden University, 2311 EZ Leiden, the Netherlands; tsveta.kodzhabasheva@gmail.com*

## ABSTRACT

This study addresses challenges in Ottoman archaeology, where sites and materials are often neglected due to the complex legacy of Ottoman heritage. The Ottoman Empire has left an lasting mark on the heritage of three continents. Yet, in many of the successor states, Ottoman heritage is seen as problematic, which has resulted in limited excavations and a sparse archaeological record for this period. In contrast, historical analyses of the Ottoman period provide significant insights into trade, economy, and global economic trends. Nevertheless, archaeology as a distinct discipline can reveal aspects otherwise inaccessible through historical analysis alone and has the potential to both support and challenge historical narratives.

This research examines the use of network analysis to reconstruct trade networks. Network models are constructed by using pottery from five cities: Belgrade, Sofia, and Varna in the Balkans and Mytilini and Izmir in the Aegean. They represent regions closest to the imperial capital of Istanbul and thus central to the Empire's economy. These models are analyzed and compared with historical scenario on economic trends and trade routes. The findings reveal that while both historical and archaeological data capture broad trade patterns and shifts, archaeology uniquely uncovers site-specific connections and fills gaps for periods that lack historical records. It provides physical evidence for regional interactions undocumented in texts, which allows for new analyses.

Limitations remain, however, since some trade relationships leave no material trace, and the roles of middlemen are archaeologically invisible. These gaps highlight the need for multidisciplinary approaches to fully reconstruct trade networks. This research not only offers insights into Ottoman economic networks but also into a broader methodological discourse in archaeology. It demonstrates how network analysis can be employed effectively with limited archaeological data to uncover specifics not present in the historical narratives. This approach offers future researchers a way to combine archaeological evidence with historical records, improving our understanding of less-studied periods.

**Keywords:** Ottoman archaeology, Ottoman pottery, the Balkans, the Aegean, trade networks, network analysis

## Introduction

The Ottoman period remains relatively understudied in archaeology, despite its proximity to the present. While historical research has extensively examined its economic transformations and political dimensions, the material culture of this era remains poorly understood. This paper aims to fill this gap by exploring the economic life of the Ottoman Empire through its material culture. To

achieve this, network models of both domestic and international Ottoman trade are developed, using pottery imports from five sites across the Balkans (Belgrade, Sofia, and Varna) and the Aegean (Mytilini and Izmir) that date from the 15<sup>th</sup> to the 18<sup>th</sup> c.

This paper also addresses the challenges posed by the particularly limited and unreliable archaeological data available for this study. A key aim is to assess whether network analysis can help overcome these limitations. The reconstructed trade networks are then analyzed and compared with historical sources to identify differences between the archaeological and historical narratives. The goal is to uncover the reasons behind these discrepancies and assess whether archaeological data, even when limited, can provide insights that historical sources cannot.

From its foundation in the 14<sup>th</sup> c. to its dissolution in the early 20<sup>th</sup> c., the Ottoman Empire left a lasting mark on the heritage of many modern states in the Mediterranean and the Balkans. Ottoman heritage is often regarded as problematic, however, as the modern Balkan nations commonly perceive it as colonial exploitation that led to a period of backwardness and economic decay in the region (İnalçık 1996, 18; Todorova 1996, 62). For this reason, Ottoman archaeology remains relatively underdeveloped, as sites from that period are rarely excavated and the material is often neglected (Baram, Carroll 2000b, 5). This results in a sparse archaeological record that restricts our understanding of material culture in the period.

It is, however, important to properly investigate the material legacy of the Ottoman Empire, since it is one of the most influential empires of the early modern period. The Ottomans were also part of the global trade during that period, connecting Europe, Asia, and Africa. By studying their trade characteristics, we can better understand how early global trade developed and changed. Archaeological research can not only provide new perspectives on the Ottoman period but can also deepen our understanding of how empires functioned as political systems.

While the origins of Ottoman archaeology can be dated back to the late 18<sup>th</sup> c., scholars during that period predominantly emphasized on monumental structures such as mosques, marketplaces, and public baths. It is only in recent decades that the focus has expanded to include non-elite material culture (Vroom 2017; Vroom 2019). Some of the few recent large-scale studies on Ottoman archaeology especially relevant for this research are: Baram, Carroll 2000a; Bikić 2003; Georgopolou, Thanasakis 2019; and ПЛЕТНЬОВ 2004a.

In contrast to the archaeological work, historical analyses provide significant insights into Ottoman period trade, economy, and global economic trends. Some of the most influential historical analyses of the Ottoman Empire are: Brown 1996; Faroqhi 1984; İnalçık 1997; İnalçık, Quataert 1994; Stoianovich 1960. Historical sources cannot always be taken at face value, however, as they may disregard certain details or reflect subjective perspectives. This research aims to explore the potential of archaeology to reveal specific details that could both support and challenge historical narratives.

### **Methodology: Network modeling**

The pottery data is analyzed using network modeling. In simple terms, a network model can be described as simplified abstractions of real-world connections (Brughmans 2012, 645; Orton 1980, 45). These models allow researchers to focus on specific patterns or dynamics that would otherwise be too complex to analyze. The network modeling approach is especially useful for tracing relations in archaeology. For a detailed introduction of network methods in archaeology, see Brughmans, Peeples 2023.

Network models are most commonly visualized as network graphs (fig. 1), where the entities are represented as a set of *nodes* or *vertices*. In this research, the network includes five sites in the

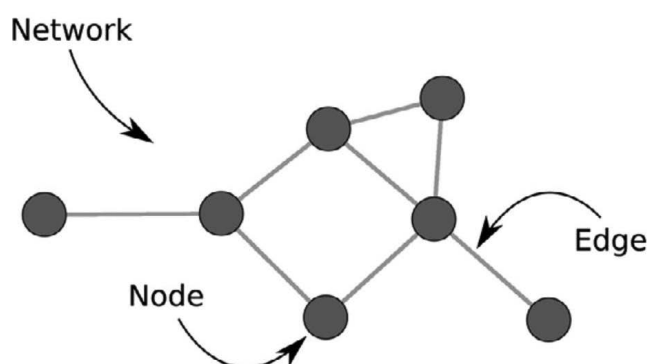


Fig. 1. Example of a simple network with nodes and edges (after Brughmans, Peeples 2023, fig. 1.2)  
 Обр. 1. Пример на опростена мрежа с възли и рѣбове (по Brughmans, Peeples 2023, fig. 1.2)

Balkans and the Aegean—Belgrade, Sofia, Varna, Mytilini, and Izmir—as well as the pottery production centers whose imports have been found in these cities. The five target sites were selected on data availability and their location in regions closest to the imperial capital of Istanbul and thus central to the Empire’s economy.

It is important to note that although Belgrade is treated in this research as part of the Ottoman trade network from the 16<sup>th</sup> to the 18<sup>th</sup> c., the city was not under continuous Ottoman control. The Habsburgs captured it three times – from 1688 until 1690 AD, between 1717 and 1739 AD, and again from 1789 to 1791 AD (Bikić 2003, 10). Despite these interruptions, Belgrade is included in the study because of its relevance in illustrating shifts in governance and cultural influence. The city was under Ottoman rule for a long time prior to the Habsburg conquests, and thus it can be placed within the broader scope of this research despite its complex political history.

The nodes in the network models are connected by edges, represented as lines, which indicate relationships between the entities. In this case, the edges reflect the movement of imported pottery, pointing to a connection between the production center and the site where it was found. It should be noted that while all archaeological data is inherently biased and subject to uncertainty, the data used in this research is known to be an especially incomplete representation of the ceramic landscape at these sites during the Ottoman period, due to limited access to much of the material.

One of the main goals of this research is to test the effectiveness of network methods in addressing the challenges posed by incomplete and inconsistent archaeological data. In contexts like ceramic assemblages, where data is often fragmentary or non-representative, network analysis offers a shift in focus. Instead of relying on unreliable quantities, it emphasizes patterns of relationships between sites. This approach does not depend on precise counts. By using these methods, even limited data can reveal meaningful connections and broader patterns of interaction, not visible through traditional quantitative analyses (see Brughmans, Peeples 2023, Chapter 5: Quantifying Uncertainty in Archaeological Networks).

To further assess the usefulness of these models, the reconstructed trade networks are analyzed independently of the historical narrative. This approach helps avoid fitting the archaeological findings into a pre-determined framework. The results are then compared with historical sources to identify similarities and differences between the two narratives and to explore the reasons behind these discrepancies.

### Data collection

The data collected for this research is mainly based on sources that were publicly available and suitable for a broad analysis of Balkan Ottoman-period pottery (Table 1). For the sites Sofia, Belgrade, Varna, and Izmir, pottery data was collected based on available published materials that entail quantitative information on Ottoman pottery. The number of pottery vessels recorded in these publications was entered into a database. The types of ceramics included are tableware, kitchenware, and various household ceramic objects such as candlesticks, basins, lamps, etc. Pottery vessels without a clear origin were disregarded.

A large amount of unpublished material, as well as published work with limited access, is known to exist. If incorporated into the network, this material has the potential to influence analyses considerably. For this reason, the dataset is considered incomplete and potentially unreliable. This does not compromise the analyses presented, though, as the main focus of the research is the connection between the sites, not ceramic quantities.

| Site     | Total Imports |
|----------|---------------|
| Belgrade | 43            |
| Sofia    | 161           |
| Varna    | 70            |
| Mytilini | 95            |
| Izmir    | 1005          |

Table 1. Pottery imports by site in this research (Author: Ts. Kodzhabasheva)

Таблица 1. Вносна керамика по обекти от настоящото изследването (Автор: Цв. Коджабашева)

### Belgrade

The publications used for gathering the imported wares found in Belgrade (fig. 2) all concern pottery finds from the excavations at the Belgrade fortress – the former walled area of the established medieval town (Bikić 2012; Popović, Bikić 2004; Gajić-Kvašček et al. 2018; Živković et al. 2017). Since the Ottoman layer at the site is from the 16<sup>th</sup> to the 17<sup>th</sup> c., the majority of imported wares that are included in the dataset are from that period as well. There is an overlap of the imported pottery discussed in these publications, which has been taken into account.

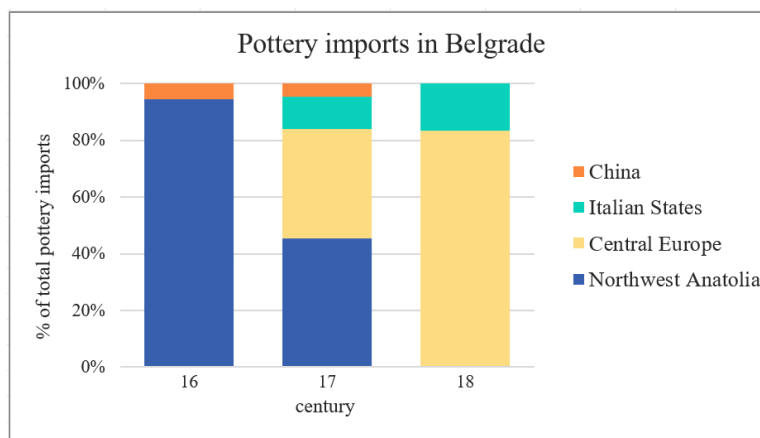


Fig. 2. Proportion of imported pottery types in Belgrade by century (Author: Ts. Kodzhabasheva)

Обр. 2. Съотношение между типовете вносна керамика в Белград по векове (Автор: Цв. Коджабашева)

Four types of imported ware from 16<sup>th</sup> – 18<sup>th</sup> c. Belgrade are included in the dataset. Iznik ware (Živković et al. 2017) and ‘Luxurious Turkish ware’ (Popović, Bikić 2004, 182 – 184) are grouped under the same production center of Northwest Anatolia. Haban ware (Bikić 2012; Gajić-Kvašček et al. 2018; Popović, Bikić 2004, 184) is generally associated with the region of the Czech Republic, Slovakia, and Hungary (Bikić 2012, 207) and thus is referred to as originating from Central Europe. Finally, there is Italian maiolica and Chinese porcelain (Popović, Bikić 2004, 185).

### Sofia

The data collected for Sofia comes from various publications related to excavations in the historical center of Sofia (fig. 3). The late professor Magdalina Stancheva did some of the earliest and most extensive research on Ottoman material culture in Bulgaria. About thirty imported porcelain cups from Meissen, Thuringia, Vienna, and England are presented in the article by Stancheva and Shalганова (Станчева, Шалганова 1989). Further, Stancheva gives information about ninety-seven Iznik and Kütahya wares from Sofia (Станчева 1960), and about Italian maiolica as well (Станчева 1962).

More imported ceramics from Sofia are taken from the works of Guergana Guionova (Guionova 2005; Guionova 2015). These include imported ceramics coming from Spain, Southern Hungary, Ephesus, the Levant, as well as Ottoman luxurious ware, Italian maiolica, and Chinese porcelain. Some of the vessels presented by Guionova (Guionova 2015) are already discussed in Stancheva’s publications, which have been taken into account when combining the data.

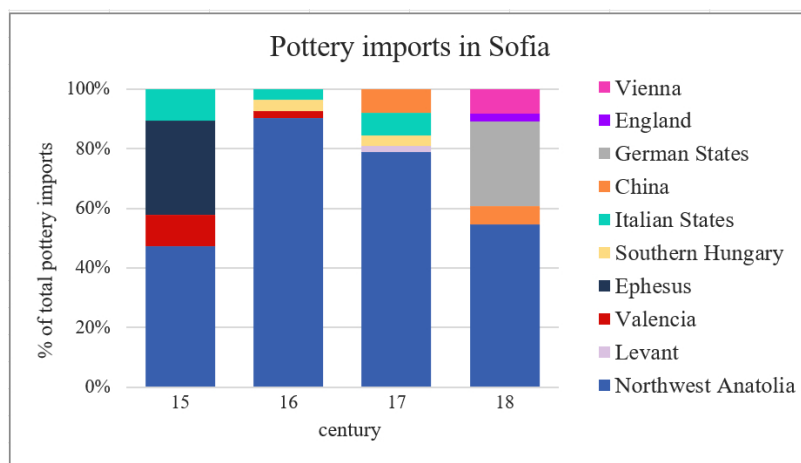


Fig. 3. Proportion of imported pottery types in Sofia by century (Author: Ts. Kodzhabasheva)

Обр. 3. Съотношение между типовете вносна керамика в София по векове (Автор: Цв. Коджабашева)

### Varna

Several publications by the late professor Valentin Pletnyov were used for quantifying the data for Ottoman Varna (fig. 4). The pottery data was gathered from multiple rescue excavations and digs across Varna’s historical center (Плетньов 2004а, 13). Pletnyov presents some of the finest examples of excavated Miletus ware and Iznik, Kütahya, and Çanakkale pottery from Varna (Плетньов 2002; Плетньов 2002 – 2003). However, this represents only a small fraction of the large number of excavated vessels. Similarly, in another work he presents selected examples of excavated Italian maiolica and European and Chinese porcelain (Плетньов 2005). Additional information on Italian maiolica can also be found (Плетньов 2004b). Unfortunately, the total number of excavated imported pottery vessels is not available.

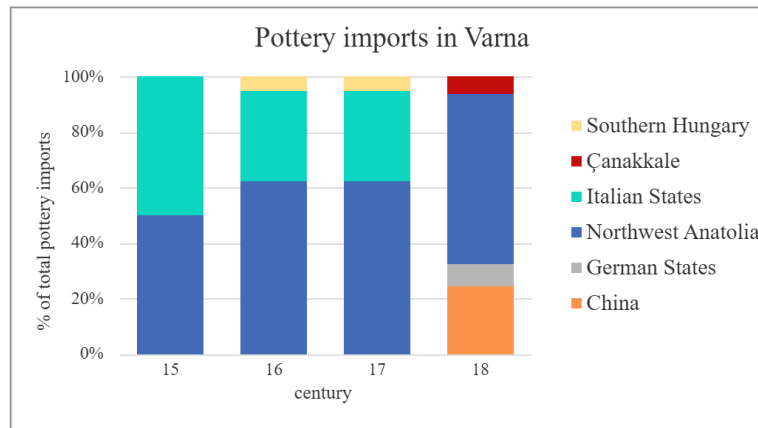


Fig. 4. Proportion of imported pottery types in Varna by century (Author: Ts. Kodzhabasheva)

Обр. 4. Съотношение между типовете вносна керамика във Варна по векове (Автор: Цв. Коджабашева)

Information on imported wares was also collected (ПЛЕТНЬОВ 2004а). Although the book mainly focuses on locally produced ceramics, it also includes information on Iznik, Kütahya, and Çanakkale pottery. Additionally, there are three plates from Akçaalan, a site near Iznik, as well as two metallic grey ware jugs from southern Hungary.

### Izmir

The data for this site is collected from the publication of François and Ersoy (François, Ersoy 2011), which analyzes the material found at one 18<sup>th</sup> c. house in Izmir (fig. 5). This site has the largest number of published pottery in comparison to all other sites that are included in this paper (see Table 1). The domestic imports include vessels from the domestic centers of Didymoteicho, Çanakkale, and Kütahya. For the sake of simplification, the grey ware imports identified as coming from the domestic center of ‘Provinces arabes’ are instead recorded as coming from the Levant in the final database. Several production centers of Italian imports are mentioned in the publication, which are all noted as coming from the Italian states. There are also imports from France, Delft, England, Meissen, and China.

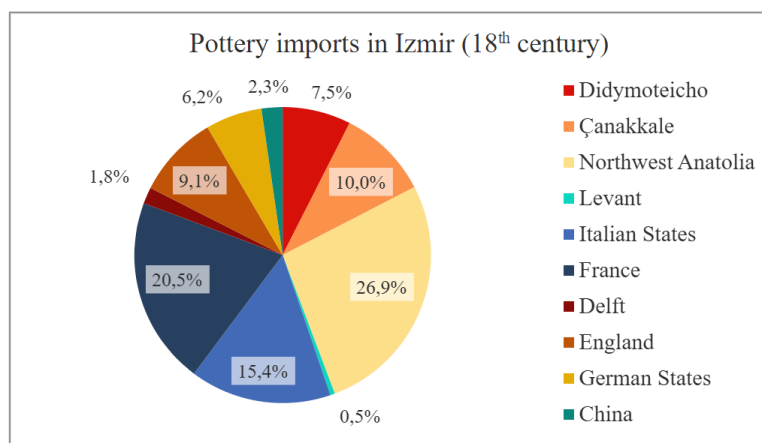


Fig. 5. Proportion of imported pottery types in Izmir for the 18<sup>th</sup> c. (Author: Ts. Kodzhabasheva)

Обр. 5. Съотношение между типовете вносна керамика в Измир през XVIII в. (Автор: Цв. Коджабашева)

### Mytilini

The pottery data for Mytilini (fig. 6) was obtained from excavations by the University of British Columbia between 1983 and 1990 under Prof. Dr. Hector Williams. The excavation focused on the most prominent sites in Mytilini, but all Ottoman period pottery comes from the castle – Kastro (Williams 2009). The initial analysis of the medieval and post-medieval pottery fragments was done in 2013 by Prof. Dr. Joanita Vroom and her team – Dr. Jose Carvajal Lopez, Elena Salinas, Janine van Noorden, Emma Schaap, and Ischa Schepers. Further analysis was also conducted on the recorded ceramics. The main sources used to identify the pottery sherds listed in the data sheet include: Atasoy, Raby 1989 – for Iznik ware; Charleston, Ayers 1971 – for European porcelain; and Hayes 1992 and Vroom 2005 for various types.

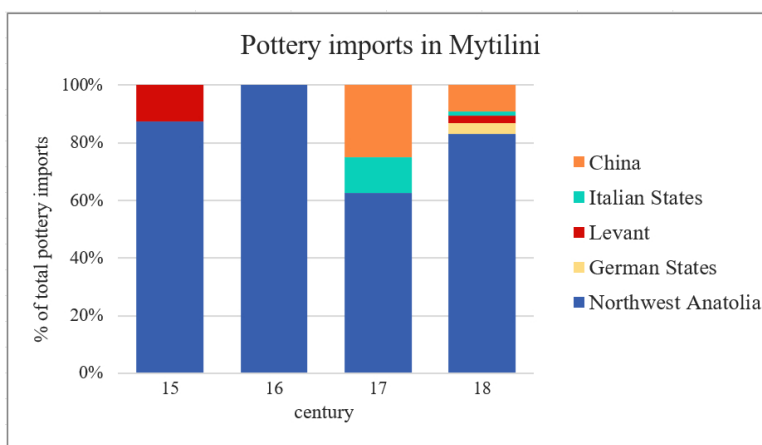


Fig. 6. Proportion of imported pottery types in Mytilini by century (Author: Ts. Kodzhabasheva)

Обр. 6. Съотношение между типовете вносна керамика в Митилини по векове (Автор: Цв. Коджабашева)

### Pottery types

For the purposes of the analysis, the collected pottery data is divided into two main categories: Ottoman production and Imported ware.

#### Ottoman production

Ottoman production is further classified into two groups – centralized production from Northwest Anatolia, and Other Ottoman production centers. Pottery from Northwest Anatolia includes Miletus ware (fig. 7) as well as pottery from Iznik (fig. 8), Kütahya (fig. 9), and, in a few examples, Akçaalan. This pottery was mass-produced, and its production was highly centralized under Ottoman state control. It was mainly intended for the tables of the middle and upper classes. From the 16<sup>th</sup> to the end of the 18<sup>th</sup> c., Iznik and Kütahya became the most widely traded types of glazed ceramics both within and beyond the Ottoman Empire. Their trade was tightly controlled by the state through a system of concessions that were practically licenses sold to merchants to allow them to deal in these wares. The sale of these concessions generated revenue for the state. To maintain control over the flow of goods, the Ottoman authorities also imposed various restrictions, bans, and sanctions (Vroom 2017, 907).

The pottery from other Ottoman production centers mainly include: Çanakkale ware (fig. 10), produced on the Dardanelles and exported especially in the 18<sup>th</sup> c.; pottery from Didymoteicho (fig. 11) – central Thrace, where pottery production spiked between the 17<sup>th</sup> and the 19<sup>th</sup> c. (see Liaros 2018, 203); and some imports from the Levant, Ephesus (fig. 12), and Ottoman Hungary (fig. 13).



Fig. 7. Miletus ceramics (14<sup>th</sup> – 15<sup>th</sup> c.) found in Sofia (after Guionova 2015, fig. 1.11, 13)  
Обр. 7. Керамика от Милет (XIV – XV в.), открита в София (по Guionova 2015, fig. 1.11, 13)



Fig. 8. Iznik pottery (16<sup>th</sup> – 17<sup>th</sup> c.) found at the Belgrade fortress (after Živković et al. 2017, fig. 3 – 4, fig. 6 – 7)  
Обр. 8. Керамика от Изник (XVI – XVII в.), открита в Белградската крепост (по Živković et al. 2017, fig. 3 – 4, fig. 6 – 7)



Fig. 9. Kütahya coffee cups (18<sup>th</sup> c.) found in Izmir (after François, Ersoy 2011, fig. 10; without scale)  
 Обр. 9. Чашки за кафе от Кютахя (XVIII в.), открити в Измир (no François, Ersoy 2011, fig. 10; без мащаб)



Fig. 10. Example of a Çanakkale dish (18<sup>th</sup> c.) found in Izmir (after François, Ersoy 2011, fig. 9.8; without scale)  
 Обр. 10. Пример за чиния от Чанаккале (XVIII в.), открити в Измир (no François, Ersoy 2011, fig. 9.8; без мащаб)

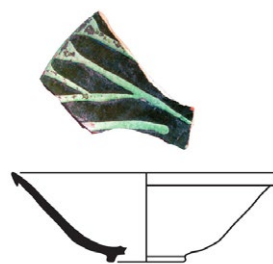


Fig. 11. Example of a Didymoteicho dish (18<sup>th</sup> c.) found in Izmir (after François, Ersoy 2011, fig. 9.9; without scale)  
 Обр. 11. Пример за чиния от Димотица (XVIII в.), открити в Измир (no François, Ersoy 2011, fig. 9.9; без мащаб)



Fig. 12. Some imports from Ephesus (15<sup>th</sup> – 16<sup>th</sup> c.) found in Sofia (after Guionova 2015, fig. 3.1; without scale)  
 Обр. 12. Вносни съдове от Ефес (XV – XVI в.), открити в София (no Guionova 2015, fig. 3.1; без мащаб)



Fig. 13. Gray metallic ware (16<sup>th</sup> – 17<sup>th</sup> c.) coming from Serbia and Hungary and found in Sofia (after Guionova 2015, fig. 4.2, 3)  
Обр. 13. Сива метализирана керамика (XVI – XVII в.) от Сърбия и Унгария, открита в София (по Guionova 2015, fig. 4.2, 3)

### Imported pottery

Porcelain from China started being produced as early as the 6<sup>th</sup> c. It was not until the 17<sup>th</sup> – 18<sup>th</sup> c., however, when porcelain specific for the European market started being produced in Jingdezhen (fig. 14). This ware was considered highly luxurious and had a major influence on ceramic production in every region it reached. The technique first spread to potters in Korea, Vietnam, and Japan (Vainker 1991, 134). Local potters in Europe and the Middle East also started to imitate Chinese porcelain. Although these attempts started early, it wasn't until the 18<sup>th</sup> c. that potters in England and Germany were able to make porcelain close in quality to the Chinese original (Vainker 1991, 134).



Fig. 14. Chinese porcelain cups (17<sup>th</sup> – 18<sup>th</sup> c.) found in Sofia (after Guionova 2015, fig. 5.11, 15)

Обр. 14. Китайски порцеланови чашки (XVII – XVIII в.), открита в София (по Guionova 2015, fig. 5.11, 15)



Fig. 15. A maiolica jug (16<sup>th</sup> – 17<sup>th</sup> c.) found in Varna (after Плетньов 2004b, обр. 2; without scale)

Обр. 15. Кана, майолика (XVI – XVII в.), открита във Варна (по Плетньов 2004b, обр. 2; без мащаб)

Italian maiolica (fig. 15) is tin-glazed earthenware with a peak of production between 1420 and 1565 AD. Maiolica was widely exported all over Northwestern Europe, Italy and the Adriatic, as well as the Balkans, the Aegean, and Western Anatolia, mostly during the 15<sup>th</sup> – 16<sup>th</sup> c. (Vroom 2005, 147). Maiolica was produced in nearly all Italian states.

The “secret” of hard-paste European porcelain (fig. 16) was discovered at the end of the 17<sup>th</sup> – beginning of the 18<sup>th</sup> c. This marked the beginning of the first large-scale porcelain production outside Jingdezhen (Faÿ-Hallé et al. 1983, 12; Vainker 1991, 134). European porcelain centers include Meissen, Thuringia, England, France, Delft, and Vienna. Other pottery imports present in the dataset include Haban ware from Central Europe (fig. 17) and ceramics imported from Spain (fig. 18).



Fig. 16. Porcelain cups from Saxony (18<sup>th</sup> c.) found in Izmir (after François, Ersoy 2011, fig. 10; without scale)

Обр. 16. Порцеланови чашки от Саксония (XVIII в.), открити в Измир (по François, Ersoy 2011, fig. 10; без мащаб)



Fig. 17. Blue and white Haban pottery (17<sup>th</sup> – 18<sup>th</sup> c.) found in Belgrade (after Bikić 2012, fig. 5)

Обр. 17. Хабанска керамика в синьо и бяло (XVII – XVIII в.), открити в Белград (по Bikić 2012, fig. 5)

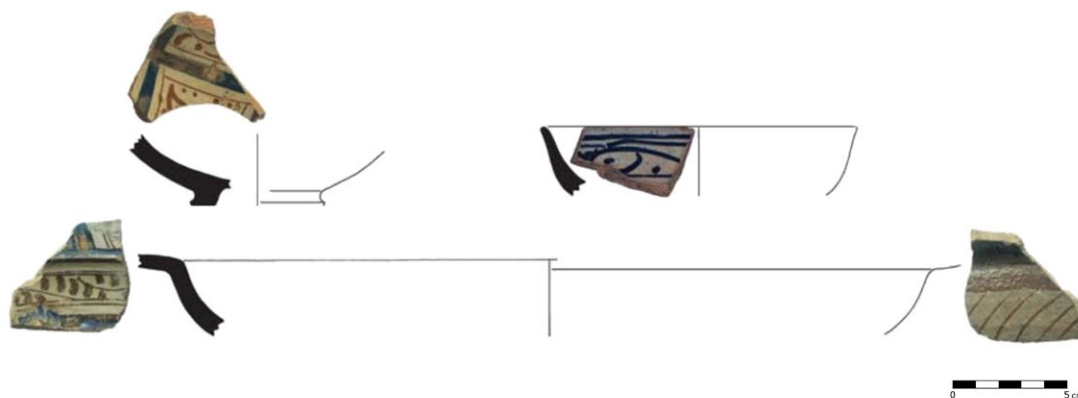


Fig. 18. Spanish pottery from Valencian workshops (14<sup>th</sup> – 16<sup>th</sup> c.) found in Sofia (after Guionova 2015, fig. 1.5, 7, 8)

Обр. 18. Испанска керамика от ателиетата във Валенсия (XIV – XVI в.), открити в София (по Guionova 2015, fig. 1.5, 7, 8)

### Data preprocessing

In the final dataset, the collected pottery data is divided by find location, production center, and production period. The networks are divided by century, from the 15<sup>th</sup> to the 18<sup>th</sup>, as a means of standardizing the data. Although this chronological division may oversimplify the dating of certain imports for which more precise information is available, it is necessary to maintain consistency across the dataset. A significant proportion of pottery finds are characterized by uncertain or wide-ranging dating. Organizing the data by century provides the most detailed and consistent structure possible, given these limitations. To tackle the issue of uncertain dating for some pottery, the aoristic sum method is applied. This approach aims to distribute the uncertainty of an event (or artifact's dating) over the range in which it could have occurred (see Crema 2012; Fischer-Ausserer et al. 2004).

The aoristic analysis applied to this database is simple and straightforward due to many unknown contextual details concerning the pottery. The method assumes an equal probability of a sherd's date across its uncertain range. For instance, two sherds dated between the 16<sup>th</sup> and 17<sup>th</sup> c. would each carry a 0.5 probability for either century, resulting in an aoristic sum of 1 per century (0.5 + 0.5). This approach is applied to all sherds in the dataset with uncertain dating. Since some sites have significantly larger quantities of pottery than others (see Table 1), the data is further normalized by converting absolute values into percentages of total imports per site. Normalizing these amounts ensures a fairer comparison and prevents sites with larger assemblages from disproportionately influencing the overall data (Carlson 2017, 126).

Before the data is analyzed with the network approach, it is further simplified for clearer visualization and better interpretation. Since many imports originate from the same economic sphere or geographical area, the pottery data is grouped into broader categories. These are usually production centers that are geographically close and produce similar types of ceramics. In many cases, it is not possible to link the pottery to a specific site (e.g. Iznik/Kütahya).

Furthermore, separating unidentified Italian production centers, for example, from known city-states could distort their apparent influence, especially since some unidentified centers may overlap with known ones. Similarly, Miletus, Iznik, and Kütahya wares were produced at multiple sites in Northwest Anatolia, complicating the analysis. Grouping the production centers simplifies the network and allows for a more accurate and meaningful representation. This grouping is visible in Table 2.

| Northwest Anatolia | Italian States | German States |
|--------------------|----------------|---------------|
| Miletus            | Italian States | German States |
| Iznik              | South Italy    | Meissen       |
| Iznik/ Kütahya     | Abisola        | Thuringia     |
| Kütahya            | Montelupo      |               |
| Akçaalan           | Orvieto        |               |
|                    | Liguria        |               |
|                    | Florence       |               |
|                    | Tuscany        |               |
|                    | Faenza         |               |

Table 2. Groupings of pottery production centers in this article (Author: Ts. Kodzhabasheva)

Таблица 2. Групиране на керамичните производствени центрове, представени в статията (Автор: Цв. Коджабашева)

### Creating the networks

Although network models are commonly associated with network graphs, which is the most common form of network visualization, these are not an essential component (Brughmans 2012, 628). Network methods mainly focus on calculating various statistics to measure different aspects of the network structure, nodes, and edges. Visualization, however, remains important as it provides an initial impression of the network model's key characteristics. It also helps place the model in a more understandable context, making it less abstract and easier to understand.

This network has several important features, one of which is that it is a directed network. This indicates a one-way interaction between the source nodes (the sites) and the target nodes (production centers), as the edges connecting them have a fixed orientation. The edges have also another important attribute – weight. The weight attribute is a numerical value that represents the strength of the connection between two nodes. For this network, the weight is determined by the proportion of a specific import type compared to all imported pottery at a site. It is represented by the transparency (alpha value) of the edge lines. This value ranges from 0.3 to 1, where 0 indicates full transparency and 1 represents a completely solid color. The weight is used only in visualization, complimenting but not directly influencing the network analysis due to the inaccuracy of the data.

| Algorithm                           | min-max values | Developed by     | Description   |
|-------------------------------------|----------------|------------------|---|
| In-degree and Out-degree Centrality | 0-1            | Freeman 1979     | It refers to how many edges are adjacent to a node. For directed networks, in-degree and out-degree centrality are used to distinguish between incoming and outgoing connections.   |
| PageRank                            | 0-1            | Page et al. 1999 | It ranks nodes based on the structure of their incoming links. Highly influential nodes do not exert stronger influence on their connected nodes. This is important, as prominent pottery production centers do not necessarily make the sites they export to more influential within the network.  |
| HITS Algorithm                      | 0-1            | Kleinberg 1999   | It assigns two values to each node in the network: a <i>hub</i> score and an <i>authority</i> score. The authority score is based on incoming links, while the hub score is determined by outgoing links. Both values depend on the hub and authority scores of a node's neighbors.   |
| Average Neighbor Degree             | 0 - (N-1)      | -                | It calculates the average degree of a node's neighbors, indicating how well-connected they are. For this directed network, the focus is on the source nodes (predecessors) that export to a given target node. A higher value suggests that the target node is well-integrated into the network, which means that its suppliers (source nodes) are highly interconnected. |

Table 3. Algorithms used in the analysis of created networks and their descriptions (Author: Ts. Kodzhabasheva)

Таблица 3. Използвани алгоритми за анализа на създадените мрежи и тяхното описание (Автор: Цв. Коджабашева)

The pottery data and the code used for building the network are open-access and available on GitHub (Repository: <https://github.com/wkllc/archeo-geo-graph>), with contributions from Dimitar Dimitrov (<https://github.com/dimitarcodes>). This is carried out in accordance with the FAIR principles (see Wilkinson et al. 2016), which aim to improve the accessibility, transparency and reuse of data. Researchers can use this code to reproduce the network graphs and analyses and to include additional sites and pottery.

Network analysis involves calculating various statistics to quantify its structure. The focus is on understanding trade flow and the strength of connections between sites by identifying key nodes and tightly connected groups. Changes in these relationships are then tracked over time. To do this, a range of node-based metrics, such as centrality measures and average neighbor degree, are used to assess the importance and connectivity of individual nodes. All algorithms discussed in Table 3 are part of the NetworkX documentation (<https://networkx.org/documentation>). These algorithms are based solely on the presence of connections between nodes and do not take into account the quantity of ceramic imports.

## **Results**

The presentation and interpretation of archaeological evidence is conducted independently from the established historical periodization of the Ottoman period. For this reason, the analysis is organized by century rather than following traditional historical divisions. The main aim is to examine the results of the network analyses without the influence of pre-existing historical narratives. This approach is intended to prevent the archaeological evidence from being forced to fit into existing historical frameworks. It should be noted, however, that some aspects of the analysis are certainly limited by the availability of the data. Despite these limitations and by formulating archaeological interpretation separately and only afterwards comparing it with the historical context, a more balanced and informative understanding of the data has been sought.

### **15<sup>th</sup> century**

The network analysis of the 15<sup>th</sup> c. network (fig. 19) is summarized in Table 4 and Table 5. Sofia stands out as the site receiving the largest variety of imports as it is ranked highest by all centrality measures. Its last position in the Average Neighbor Degree ranking, highlights the site's role as an important trade hub, as it connects to ceramic production centers that are not well integrated into the Ottoman international trade network, such as Ephesus and Valencia.

Domestic ceramic trade in the 15<sup>th</sup> c. Ottoman Empire is represented solely by the production centers of Northwest Anatolia. These ceramics play a significant role in the overall trade during that period since the source node is ranked first in connectivity (Table 5). What stands out is that Sofia has the weakest connection with the domestic center of Northwest Anatolia when compared to all other sites. This further supports the role of Sofia as a big trade hub that maintained its own independent trade network.

International trade is very diverse; the Italian states are ranked second in connectivity as production centers since they were key trade partners of the Ottomans. Varna's strong connection with the imperial heartland in Northwest Anatolia, and the site's excessive trade with the Italians suggest good integration into the Ottoman trade system and a lack of independent trade planning.

The least influential pottery production center is the Levant, which is placed last according to the HITS algorithm. At the time of the 15<sup>th</sup> c., the Levant is not yet part of the Ottoman Empire, as the Ottomans conquered the region only in 1516 AD. This could suggest that the connection between Mytilini and the Levant is part of a trade network in the Eastern Mediterranean established way before the Ottomans.

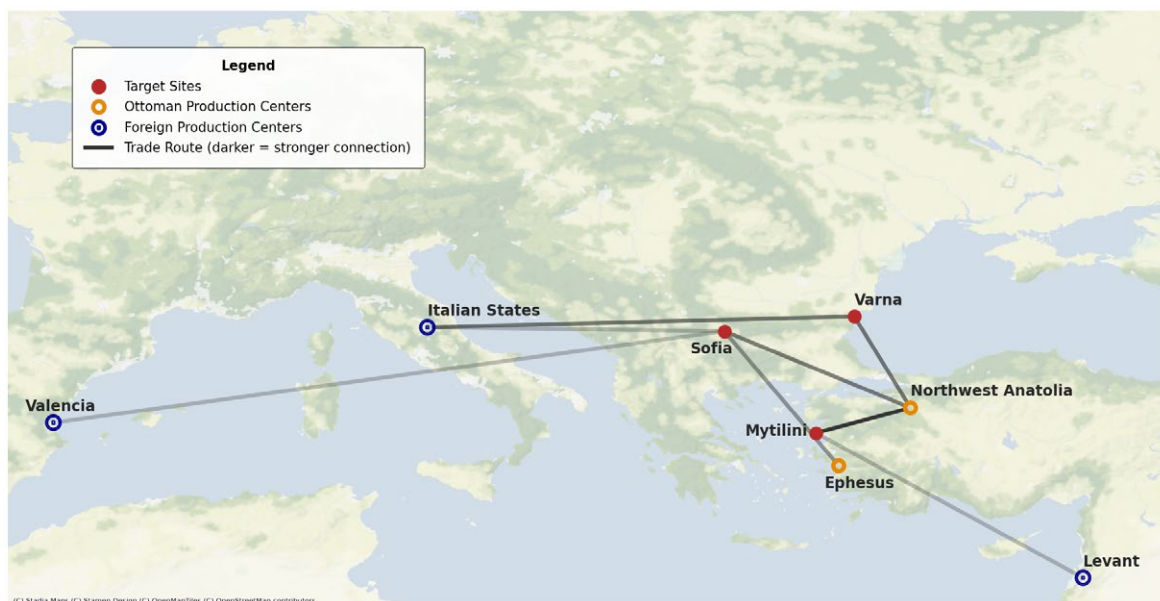


Fig. 19. Geospatial network model of Ottoman trade relations – 15<sup>th</sup> c. (Author: Ts. Kodzhabasheva; Map source: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

Обр. 19. Геопространствен мрежови модел на османските търговски връзки – XV в. (Автор: Цв. Коджабашева; Картен източник: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

| Node     | PageRank | In-Degree Centrality | HITS Authority | Avg. Neighbor Degree |
|----------|----------|----------------------|----------------|----------------------|
| Sofia    | 0.28     | 0.57                 | 0.48           | 1.75                 |
| Mytilini | 0.17     | 0.29                 | 0.21           | 2.00                 |
| Varna    | 0.14     | 0.29                 | 0.31           | 2.50                 |

Table 4. Centrality and connectivity metrics of the target nodes from the 15<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 4. Метрики за централност и свързаност на целевите възли на търговската мрежа през XV в. (Автор: Цв. Коджабашева)

| Node               | Out-Degree Centrality | HITS Hub |
|--------------------|-----------------------|----------|
| Northwest Anatolia | 0.43                  | 0.34     |
| Italian States     | 0.29                  | 0.27     |
| Ephesus            | 0.14                  | 0.16     |
| Valencia           | 0.14                  | 0.16     |
| Levant             | 0.14                  | 0.07     |

Table 5. Centrality and connectivity metrics of the source nodes from the 15<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 5. Метрики за централност и свързаност на изходните възли на търговската мрежа през XV в. (Автор: Цв. Коджабашева)

### **16<sup>th</sup> century**

The 16<sup>th</sup> c. trade network (fig. 20) is expanded with one more target node – Belgrade. Sofia still ranks as the most significant and best-connected node in the network, with the lowest score on the Average Neighbor Degree metric and connecting to sites that export to few target nodes (Table 6). The site clearly maintains its position as the city with the most diverse connections to pottery production centers. Varna's importance increases compared to the previous century, followed by Belgrade and lastly Mytilini.

Domestic exports remain dominated almost entirely by production centers in Northwest Anatolia. This region maintains its position as the node with the highest number of connections (Table 7). The site's influence increases significantly, as it now accounts for a huge majority of the total imports of all cities.

The presence of this luxurious Ottoman ware indicates the presence of a wealthy urban class in the cities that could afford such ceramics. This big increase of Northwest Anatolian pottery suggests a strengthening of the connection and control of the imperial heartland, as the overall trade in the 16<sup>th</sup> c. becomes almost entirely domestic. Mytilini's connections are limited only to Northwest Anatolia, as there is no evidence of any international trade ties in the 16<sup>th</sup> c.

Another Ottoman domestic production center that emerges is Southern Hungary, which is connected to Sofia and Varna. Interestingly, despite its geographical proximity to Belgrade, there is no recorded connection between Southern Hungary and the city. This absence may be explained by the categorization of imports from that region as local in the data analysis for Belgrade.

The Italian states remain the biggest non-domestic trade partner for Ottoman cities. International trade remains very diverse, despite it accounting for a smaller share of ceramic imports compared to the 15<sup>th</sup> c. This indicates that while Ottoman centralization grew, many sites—particularly Sofia and Varna—retained strong international connections.

Varna's Average Neighbor Degree score remains relatively high. This reflects the city's continued strong connections with the imperial heartland and domestic Ottoman production centers. This also indicates that Varna remained well-integrated into the broader Ottoman trade network.

The Belgrade-China link is particularly interesting as it marks the earliest Chinese import in the studied networks. Unlike Sofia, Belgrade does not appear to function as a major trade hub, based on its position in the network centrality rankings. It is therefore likely that these Chinese imports reached the city through individual movement or personal exchange rather than through established trade routes.

### **17<sup>th</sup> century**

In the 17<sup>th</sup> c. network (fig. 21), Sofia remains a key receiver of ceramics from production centers with few connections to other sites. This pattern, evident since the 15<sup>th</sup> c., suggests Sofia was a crossroads of major trade routes, facilitating the flow of goods and traders to and from the imperial capital.

As seen in Table 8, Belgrade's influence has grown and surpassed both Varna and Mytilini. Further, the site has a relatively low Average Neighbor Degree score compared to the other two, suggesting that Belgrade engages in a more independent pattern of trade within the network.

It is interesting to note that, although Varna's trade practices remain largely unchanged, its relative importance within the network declines as other sites experience an increase in international imports. Mytilini also continues to hold a relatively minor position in the network, maintaining its strongest connection with Northwest Anatolia. However, the city has now established new links



Fig. 20. Geospatial network model of Ottoman trade relations – 16<sup>th</sup> c. (Author: Ts. Kodzhabasheva; Map source: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

Обр. 20. Геопространствен мрежови модел на османските търговски връзки – XVI в. (Автор: Цв. Коджабашева; Картен източник: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

| Node     | PageRank | In-Degree Centrality | HITS Authority | Avg. Neighbor Degree |
|----------|----------|----------------------|----------------|----------------------|
| Sofia    | 0.22     | 0.50                 | 0.38           | 2.25                 |
| Varna    | 0.16     | 0.38                 | 0.33           | 2.67                 |
| Belgrade | 0.16     | 0.25                 | 0.16           | 2.50                 |
| Mytilini | 0.09     | 0.13                 | 0.14           | 4.00                 |

Table 6. Centrality and connectivity metrics of the target nodes from the 16<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 6. Метрики за централност и свързаност на целевите възли на търговската мрежа през XVI в. (Автор: Цв. Коджабашева)

| Node               | Out-Degree Centrality | HITS Hub |
|--------------------|-----------------------|----------|
| Northwest Anatolia | 0.50                  | 0.34     |
| Southern Hungary   | 0.25                  | 0.24     |
| Italian States     | 0.25                  | 0.24     |
| Valencia           | 0.13                  | 0.13     |
| China              | 0.13                  | 0.05     |

Table 7. Centrality and connectivity metrics of the source nodes from the 16<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 7. Метрики за централност и свързаност на изходните възли на търговската мрежа през XVI в. (Автор: Цв. Коджабашева)

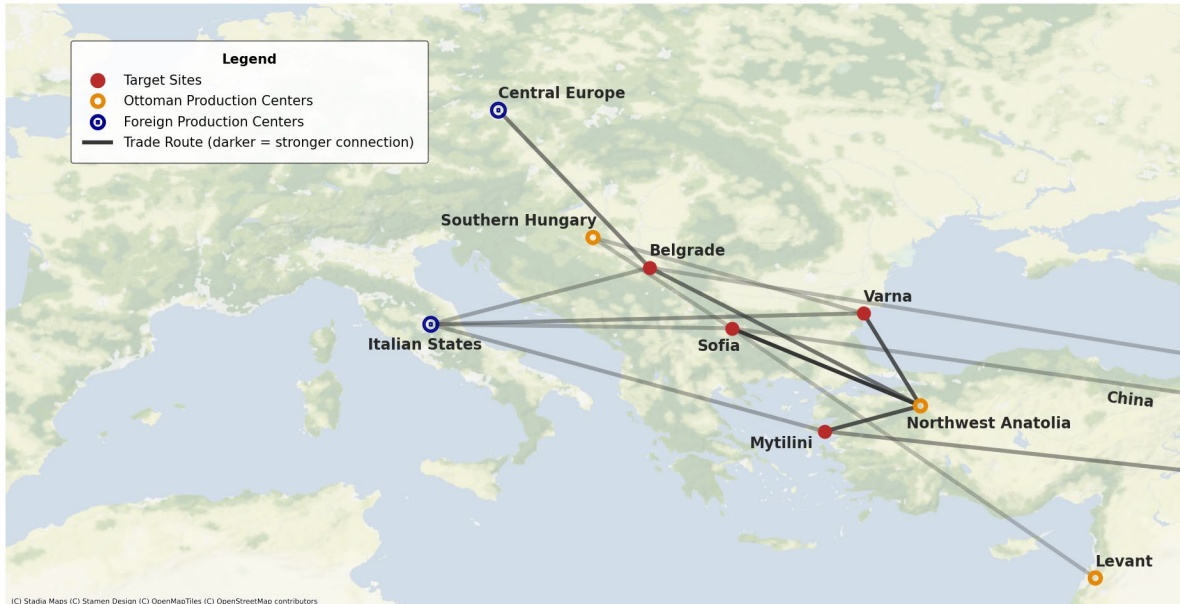


Fig. 21. Geospatial network model of Ottoman trade relations – 17<sup>th</sup> c. (Author: Ts. Kodzhabasheva; Map source: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

Обр. 21. Геопространствен мрежови модел на османските търговски връзки – XVII в. (Автор: Цв. Коджабашева; Картен източник: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

| Node     | Page Rank | In-Degree Centrality | HITS Authority | Avg. Neighbor Degree |
|----------|-----------|----------------------|----------------|----------------------|
| Sofia    | 0.20      | 0.56                 | 0.30           | 2.80                 |
| Belgrade | 0.17      | 0.44                 | 0.26           | 3.00                 |
| Varna    | 0.12      | 0.33                 | 0.21           | 3.33                 |
| Mytilini | 0.11      | 0.33                 | 0.23           | 3.67                 |

Table 8. Centrality and connectivity metrics of the target nodes from the 17<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 8. Метрики за централност и свързаност на целевите възли на търговската мрежа през XVII в. (Автор: Цв. Коджабашева)

| Node               | Out-Degree Centrality | HITS Hub |
|--------------------|-----------------------|----------|
| Northwest Anatolia | 0.44                  | 0.26     |
| Italian States     | 0.44                  | 0.26     |
| China              | 0.33                  | 0.21     |
| Southern Hungary   | 0.22                  | 0.13     |
| Levant             | 0.11                  | 0.08     |
| Central Europe     | 0.11                  | 0.07     |

Table 9. Centrality and connectivity metrics of the source nodes from the 17<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 9. Метрики за централност и свързаност на изходните възли на търговската мрежа през XVII в. (Автор: Цв. Коджабашева)

with Italy and China, though, which indicating a gradual shift towards greater engagement in international trade.

The ranking of source nodes is shown in Table 9. Trade patterns within the network have shifted, with the dominance of Northwest Anatolia declining compared to previous centuries. In contrast, the Italian states have expanded their influence to equal that of Northwest Anatolia as now they connect to all sites within the network. Southern Hungary maintains a high ranking in terms of connectivity while the other domestic production center, the Levant, is connected only to Sofia despite its proximity to Mytilini. This suggests that Sofia attracted a greater number of unique trade partners than Mytilini, likely reflecting its higher significance within the network. China has also risen in importance among the international trade connections, as Chinese imports became significantly more popular in the 17<sup>th</sup> c.

Notably, Belgrade has the weakest connection with Northwest Anatolia out of all other sites. This, along with the fact that Belgrade is the only site connected to Central Europe, may be linked to its location at the border with the Habsburg Empire. As already noted earlier, Belgrade was not consistently under Ottoman control. This might explain some of the differences in its trade patterns compared to other sites.

### 18<sup>th</sup> century

Izmir emerges as a target node only in the 18<sup>th</sup> c. (fig. 22 – 23), displacing Sofia as the most prominent hub with the largest volume of pottery imports from diverse and often somewhat marginal production centers. Notably, Izmir's ties to the international market are stronger than those to the domestic market. Still, the site's domestic network is very well developed since it connects to all domestic pottery production centers at the time.

Sofia and Mytilini rank next at approximately the same level of influence, followed by Varna and Belgrade (Table 10). While Sofia retains its characteristically diverse connections, its rel-

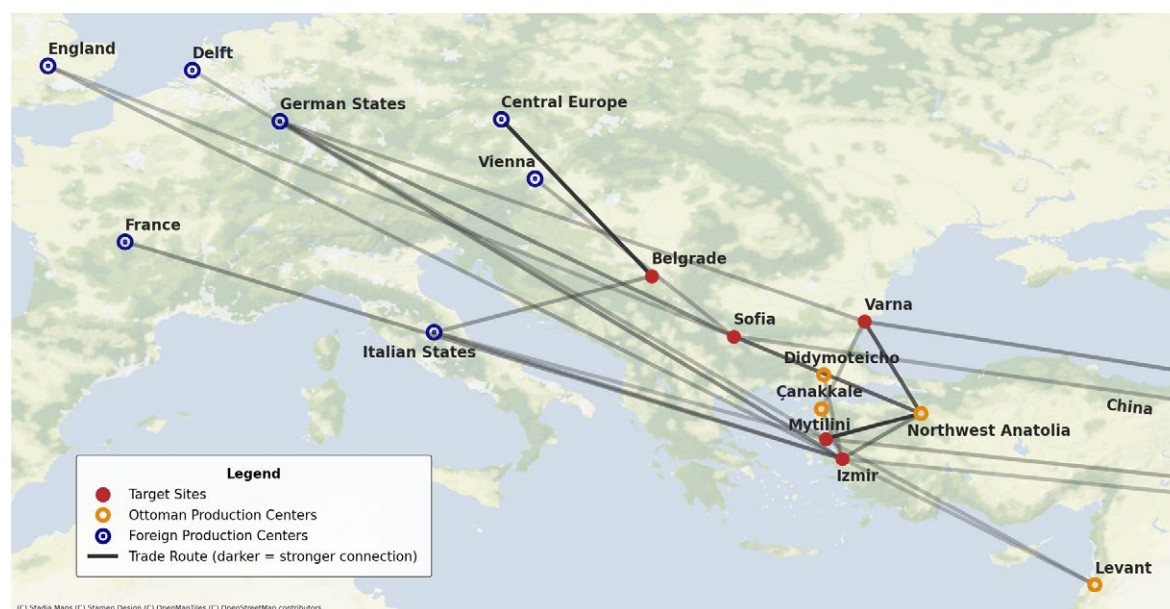


Fig. 22. Geospatial network model of Ottoman trade relations – 18<sup>th</sup> c. (Author: Ts. Kodzhabasheva; Map source: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

Обр. 22. Геопространствен мрежови модел на османските търговски връзки – XVIII в. (Автор: Цв. Коджабашева; Картен източник: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

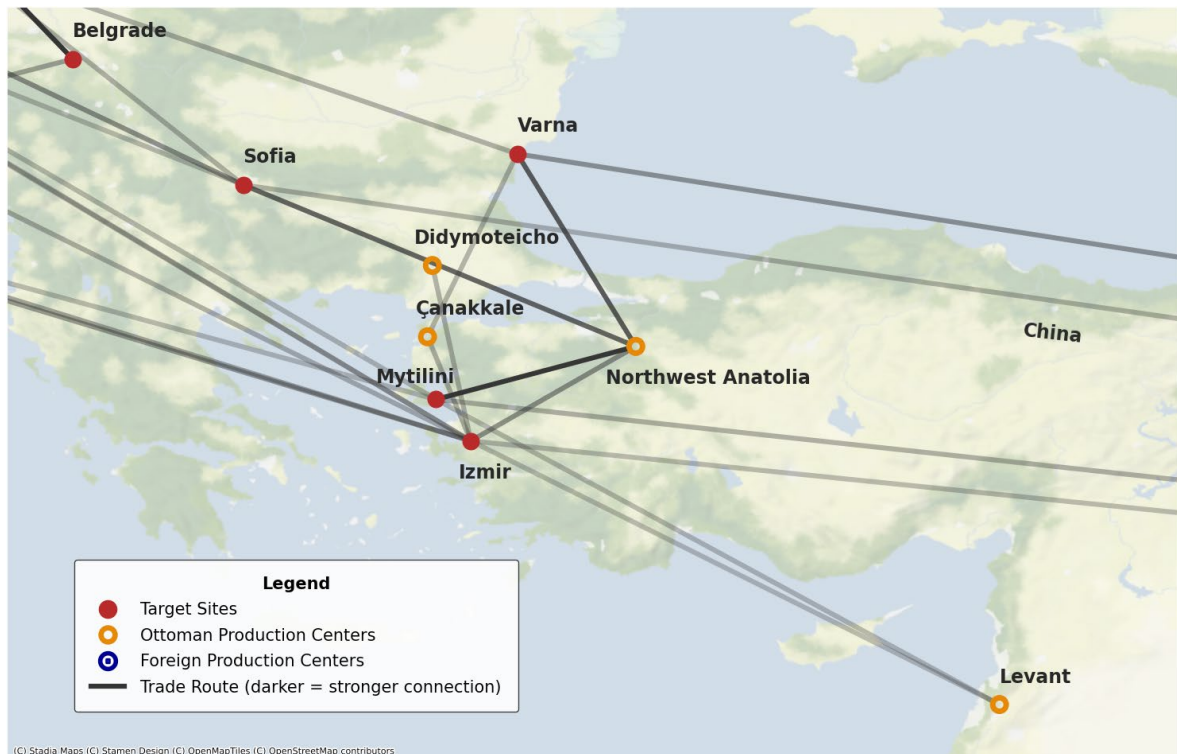


Fig. 23. Geospatial network model of Ottoman trade relations, focusing on the local production centers – 18<sup>th</sup> c. (Author: Ts. Kodzhabasheva; Map source: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

Обр. 23. Геопространствен мрежови модел на османските търговски връзки, с фокус върху местните производствени центрове – XVIII в. (Автор: Цв. Коджабашева; Картен източник: Stadia Maps, Stamen Design: <https://stadiamaps.com>)

| Node     | Page Rank | In-Degree Centrality | HITS Authority | Avg. Neighbor Degree |
|----------|-----------|----------------------|----------------|----------------------|
| Izmir    | 0.21      | 0.63                 | 0.34           | 2.40                 |
| Sofia    | 0.11      | 0.31                 | 0.20           | 3.00                 |
| Mytilini | 0.09      | 0.31                 | 0.23           | 3.40                 |
| Varna    | 0.08      | 0.25                 | 0.19           | 3.50                 |
| Belgrade | 0.08      | 0.13                 | 0.04           | 2.00                 |

Table 10. Centrality and connectivity metrics of the target nodes from the 18<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 10. Метрики за централност и свързаност на целевите възли на търговската мрежа през XVIII в. (Автор: Цв. Коджабашева)

ative influence within the network diminishes following Izmir’s emergence as the dominant hub. Mytilini remains the site with the strongest influence from the imperial heartland, and Varna is still well-integrated into the Ottoman trade network in dependence on well-established trade routes. This pattern is evidenced by Varna’s high Average Neighbor Degree score, which indicates connections to prominent production centers.

Both local and international networks grew more diverse in the 18<sup>th</sup> c., incorporating several new pottery production centers. In the source node rankings (Table 11), Northwest Anatolia now shares first place with the German States and China, reflecting its diminished role compared to

| Node               | Out-Degree Centrality | HITS Hub |
|--------------------|-----------------------|----------|
| Northwest Anatolia | 0.25                  | 0.15     |
| German States      | 0.25                  | 0.15     |
| China              | 0.25                  | 0.15     |
| Italian States     | 0.19                  | 0.09     |
| Levant             | 0.13                  | 0.09     |
| England            | 0.13                  | 0.09     |
| Çanakkale          | 0.13                  | 0.08     |
| Didymoteicho       | 0.06                  | 0.05     |
| Delft              | 0.06                  | 0.05     |
| France             | 0.06                  | 0.05     |
| Vienna             | 0.06                  | 0.03     |
| Central Europe     | 0.06                  | 0.01     |

Table 11. Centrality and connectivity metrics of the source nodes from the 18<sup>th</sup> c. trade network (Author: Ts. Kodzhabasheva)  
Таблица 11. Метрики за централност и свързаност на изходните възли на търговската мрежа през XVIII в. (Автор: Цв. Коджабашева)

earlier centuries. While it remained a key export hub, its contribution to overall imports declined significantly. The domestic network also expanded in addition to the Levant, with new centers like Çanakkale and Didymoteicho. This shift suggests a decentralization in local authority, as the monopoly of state-controlled ceramics from Iznik and Kütahya gradually diminishes.

Italy, once dominant in international trade, is now much less influential. For the first time since the 15<sup>th</sup> c., Varna has no connection to the Italian states, instead linking to the German States. The presence of European ceramics in Varna further reaffirms the increasing economic role of European states in the 18<sup>th</sup> c., with centers like the German States, England, Delft, and France dominating Ottoman cities' international connections. Izmir and Sofia, for example, develop strong ties to Central and Western European pottery producers.

Belgrade is placed last in terms of connectivity and also has the lowest Average Neighbor Degree score, which indicates it is connected to less prominent nodes in the network. Combined with its low centrality ranking, this suggests that Belgrade is an outlier in the network. Its strong connection to Central Europe and a complete lack of Ottoman ceramics signals a reorientation from the Ottoman economic sphere towards European trade markets. In the 18<sup>th</sup> c., Belgrade remained under Habsburg influence for even longer periods than it had in the previous century.

### Discussion

It is important to note that ceramic imports represent only one aspect of the broader trade system. Many other traded goods are not included in the creation of this network, even though they could significantly influence the characteristics of the nodes and their trade connections. It is important to keep these limitations in mind when interpreting the results of the network analyses.

Historical information is available for all centuries of the Ottoman period, except for the 15<sup>th</sup> c., as sources from immediately after the Ottoman conquest are limited. This makes comparison between archaeological findings and historical records for that century difficult. For instance, the network analysis suggests that Sofia was a major trade hub in the 15<sup>th</sup> c., even before it became the capital of the Rumelia vilayet (province) in 1530 AD (see Иширков 1912). This indicates that the city was already integrated into a diverse trade network by the time of the Ottoman conquest in 1396 AD. However, this cannot be confirmed through available Ottoman historical sources.

Additionally, international links in the 15<sup>th</sup> c., such as Sofia's connection to Valencia and Ephesus, Mytilini's ties with the Levant, and Varna's connections to the Italian states are evident in the archaeological record but are not documented by contemporary historical sources. In the case when textual records are scarce, archaeological evidence plays a crucial role. Although Northwest Anatolian influence is clearly the most dominant in the network, as all sites are part of the Ottoman Empire, the presence of international trade connections can probably be attributed to the continuity of trade patterns established before the Ottoman period.

### **The Balkans**

In the Balkans, significant changes are visible in the 16<sup>th</sup> c. and marked by a sharp rise in the influence of Northwest Anatolian production centers across the network. This trend aligns with the production peak of Iznik ware (Atasoy 1989, 14). The spread of this state-monopolized ceramic reflects greater control of the Ottoman state over its domestic market. It also suggests the emergence of a wealthy urban class in the Balkan cities. This increased connection with the imperial heartland further supports historical accounts of Ottoman policies aimed at repopulating Balkan towns with Anatolian settlers (Eminov 1997, 27).

When it comes to international connections, Sofia remains the most influential within the network, signifying the site's important role as a trade hub. This is to be expected, as Sofia was not only the capital of Rumelia vilayet from mid-15<sup>th</sup> c. until early 19<sup>th</sup> c., but it was also strategically located at the crossroads of major international trade routes. This includes the key route from Istanbul to Budapest that passes through Edirne, Filibe, Sofia, Niš, and Belgrade (Faroghi 1994, 485).

One interesting aspect is that in historical sources, Dubrovnik merchants were important middlemen in the trade between Italy and the Balkans (İnalçık 1994, 262). These merchants' settlement in Sofia in the 16<sup>th</sup> c. is also well documented (Иширков 1912, 46). Although network analyses clearly show that Sofia remained well-connected to the Italian states until the 18<sup>th</sup> c., identifying the specific trade actors involved in this exchange is not possible. This reflects a broader challenge in archaeological research, as traded goods alone do not reveal who was involved in their movement.

While Dubrovnik merchants remained important for trade between the Balkans and the Italian states, by 1700 AD their importance had significantly declined due to the decrease of Venice's influence on the global market (Faroghi 1994, 512). A decline in Italy's influence is visible only in the 18<sup>th</sup> c., however, while in the 17<sup>th</sup> c. its influence is even expanded to all sites in the network.

In each network analyzed, Varna shows a strong connection to Northwest Anatolia and high integration into established Ottoman trade routes. This suggests that its trading practices closely followed broader Ottoman strategies, which in turn suggests limited commercial independence. This aligns with historical accounts, which emphasize that Varna's primary role was supplying grain to Istanbul in exchange for manufactured goods (Faroghi 1984, 77; Плетньов 2002 – 2003, 429).

Varna's strong connections to the capital and Sofia's role as an international trade hub suggest different functions for the two cities. Despite being just two sites from the eastern and western regions, this could point to a broader pattern across the Balkans. According to Stoianovich, two types of merchants emerged in the Ottoman Balkans after the 16<sup>th</sup> c. (Stoianovich 1960). Merchants in the western Balkan expanded in response to the Ottoman ambition to dominate international commerce while central and eastern merchants focused on supplying Istanbul. While the network results support this, further analysis and significantly more data are needed to explore this statement fully.

One discrepancy between the archaeological and historical narrative, however, is that historical sources point to the closure of the Black Sea for non-Ottoman ships in mid-16<sup>th</sup> c. (Stoianovich 1960, 240; Çelik 2010, 22). This, however, is not visible in the network because Varna's connection to the Italian states remains strong until the 18<sup>th</sup> c. This raises the issue of how Italian imports reached Varna. It is possible that these Italian imports arrived overland, through commerce hubs like Sofia. Given the relatively high percentage of these imports and the persistent connection between Italy and Varna until the 18<sup>th</sup> c., however, this does not fully explain the situation. There is no information in the historical accounts that can clarify this phenomenon.

In the 16<sup>th</sup> c., Belgrade's position in the network indicates strong connectivity to the Ottoman heartland but limited international links. This high level of integration is supported by the fact that, under Ottoman rule, Belgrade developed into a military stronghold where large numbers of Ottoman soldiers were stationed (Bikić 2003, 176).

The Habsburgs conquered Belgrade three times between the 17<sup>th</sup> and 18<sup>th</sup> c. These political shifts are reflected in the network models, where Belgrade appears as an outlier. It is important to note that the archaeological data from this period is particularly limited. Yet, clear changes can be observed. Trade with Northwest Anatolia is disrupted while connections with Central Europe increase significantly. The decline of Ottoman control over the city is evident.

### **The Aegean**

For the Aegean, network analyses largely align with the historical narrative on global economic trends. Mytilini and Izmir can be analyzed together since they are geographically very close and represent the same economic region.

In the network, Mytilini maintains strong ties with the imperial core in Northwest Anatolia from the beginning, and by the 16<sup>th</sup> c., its international connections disappear completely. This decline in international trade could be attributed to the decreased influence of the port of Chios, which was closely linked to Mytilini's economy (Faroqhi 1984, 115). Additionally, up until the 17<sup>th</sup> c., the Ottomans regarded Izmir and its region primarily as suppliers for the capital, with no significant plans for its development (Goffman 1999, 83 – 89).

This changed with the blooming of international trade in the Eastern Mediterranean in the early 17<sup>th</sup> c. and the increase of Izmir's role as an international trade hub. The positioning of Izmir on the global trade map in the late 16<sup>th</sup> – early 17<sup>th</sup> c. attracted migrant merchants to the region. (Goffman 1999, 83). Historical accounts about Mytilini during that period are scarce, but this economic shift in the region can be observed through the increased international connections of Mytilini in the network of the 17<sup>th</sup> c. The international trade network becomes even more diverse in the 18<sup>th</sup> c. Archaeological data compensates for the scarcity of historical information on Mytilini, offering a more detailed view of the city's economic development.

Izmir is only present in the 18<sup>th</sup> c. Its presence reflects well-established historical narratives of economic growth (Goffman 1999, 83 – 89; Kanberoğlu 2023, 609). Izmir is the most prominent

site in the network with the most diverse international connections and a wide range of imports from Europe. The city also has the smallest proportion of imports from Northwest Anatolia compared to other sites, most probably because of its economic strategy. Goffman notes that Izmir significantly reduced its trade with cities in the north and northeast, including Istanbul, in favor of trade with Europe (Goffman 1999, 89).

### **Overall Trends**

The network analysis of pottery production centers clearly reflects broader historical trends in the Ottoman Empire. By the 18<sup>th</sup> c., the decentralization of state authority frequently emphasized by historians (Anastasopoulos 2006, 11; Stoianovich 1960, 253) becomes evident in the material record. This is marked by the emergence of more regionally influential Ottoman production centers and a corresponding decline in the dominance of state-controlled ceramics from Northwest Anatolia.

In addition to the internal changes in the Ottoman Empire, there was a broader shift in the global commercial center during the 17<sup>th</sup> and 18<sup>th</sup> c. The Ottoman state underwent significant economic and administrative changes, as it struggled to keep pace with the rapid industrialization and population growth of Western Europe. As a result, the Empire was increasingly pushed into the role of a raw material supplier for European markets (Panzac 1992, 191). This drastic economic shift is clearly visible in the network analysis. By the 18<sup>th</sup> c., European production centers had overtaken Ottoman ones as the main suppliers of ceramics.

### **Conclusion**

This study highlights the complementary relationship between archaeological networks and historical sources in reconstructing Ottoman trade dynamics. While historical texts often focus on larger economic trends, archaeology can fill in the gaps, especially in periods with limited textual records. Discrepancies between the two demonstrate archaeology's capacity to challenge and refine historical narratives, as it offers much more detailed insights into the trade relationships of the sites. Ceramic evidence has the potential to further uncover regional developments, which in its turn can help refine and explain the broader economic picture.

Network methods proved to be very useful when dealing with scarce archaeological data. Shifting the focus from pottery quantities to network connections helped reconstruct trade relationships and patterns that otherwise were not easy to detect. Simplifying real-world trade networks further helps to focus on specific network dynamics, revealing changes of influence and trade routes over time. This method offers an interpretative layer beyond traditional pottery analysis.

The results of this research show that major economic events recorded in historical sources are also reflected in the archaeological networks. One example is the Ottoman dominance of trade in the 16<sup>th</sup> and 17<sup>th</sup> c. The gradual decline of centralized Ottoman control also becomes clear in the 18<sup>th</sup> c., as regional pottery production centers take on a bigger role in the network and western European merchants start to control the international market. These findings suggest that, despite uncertainty in the data, network methods can still provide meaningful insights in archaeological research.

One aspect that is difficult to detect archaeologically within a trade network is the identity of the traders themselves since they may have come from a different location than the goods they traded. This is the case of Dubrovnik merchants trading Italian goods in the Balkans; they remain largely invisible in the ceramic record.

It is important to note that the absence of a particular import at a site does not necessarily indicate a lack of connection. However, the presence of a ceramic import clearly points to some form

of interaction. For example, the presence of Italian pottery imports in Varna after the closure of the Black Sea raises important questions. Without archaeological analysis of the material from the site, we would not have questioned how the pottery got there, who the traders were, or how the trade route between Italy and Varna operated.

What becomes clear from this research is that neither archaeology nor history alone is sufficient to fully explain Ottoman economic systems. Combining both approaches helps to overcome their individual limitations and sparks discussions that might not have occurred otherwise. To further improve our understanding of the Ottoman period, however, more systematic research is necessary, especially in underrepresented regions.

In addition, more precise categorization of the pottery could offer valuable insights. Understanding regional Ottoman pottery production is as important as studying international centers, yet it remains relatively under-researched. Improvements in pottery periodization could also help narrow the chronological scope of network models, which can help identify subtle changes and better explain certain phenomena. This would significantly enhance our understanding of trade relations within the Ottoman Empire and their role in the wider context of global commerce.

### References/Цитирана литература

- Anastasopoulos 2006:** A. Anastasopoulos. Crisis and state intervention in late eighteenth-century Karaferye (mod. Veroia). – In: F. F. Anscombe (ed.). *The Ottoman Balkans, 1750 – 1830*. Princeton, 2006, 11 – 33.
- Atasoy 1989:** N. Atasoy. The survival of Iznik pottery in Turkey. – In: N. Atasoy, J. Raby (eds.). *Iznik: The Pottery of Ottoman Turkey*. London, 1989, 14 – 18.
- Atasoy, Raby 1989:** N. Atasoy, J. Raby (eds.). *Iznik: The pottery of Ottoman Turkey*. London, 1989.
- Baram, Carroll 2000a:** U. Baram, L. Carroll (eds.). *A Historical Archaeology of the Ottoman Empire: Breaking New Ground*. New York, 2000.
- Baram, Carroll 2000b:** U. Baram, L. Carroll. The future of the Ottoman past. – In: U. Baram, L. Carroll (eds.). *A Historical Archaeology of the Ottoman Empire: Breaking New Ground*. New York, 2000, 3 – 32.
- Bikić 2003:** V. Bikić. Gradska keramika Beograda (16 – 17. vek). (Arheološki institut Beograd. Monografija, 39). Beograd, 2003.
- Bikić 2012:** V. Bikić. The Haban pottery from the Belgrade fortress: Archaeological contexts, chronology, decorative designs. – *Starinar*, 62, 2012, 205 – 227.
- Brown 1996:** C. Brown (ed.). *Imperial Legacy: The Ottoman Imprint on the Balkans and the Middle East*. New York, 1996.
- Brughmans 2012:** T. Brughmans. Thinking through networks: A review of formal network methods in archaeology. – *Journal of Archaeological Method and Theory*, 20, 2012, 623 – 662.
- Brughmans, Peeples 2023:** T. Brughmans, M. A. Peeples. *Network science in archaeology*. Cambridge, 2023.
- Carlson 2017:** D. L. Carlson. *Quantitative Methods in Archaeology Using R*. Cambridge, 2017.
- Çelik 2010:** N. Çelik. Black Sea and the Balkans under Ottoman rule. – *Karadeniz Araştırmaları*, 6(24), 2010, 1 – 27.
- Charleston, Ayers 1971:** R. J. Charleston, J. G. Ayers. *Meissen and other European porcelain: A catalogue*. Lausanne – London, 1971.
- Crema 2012:** E. R. Crema. Modelling temporal uncertainty in archaeological analysis. – *Journal of Archaeological Method and Theory*, 19(4), 2012, 440 – 461.
- Eminov 1997:** A. Eminov. *Turkish and Other Muslim Minorities in Bulgaria*. London, 1997.
- Faroqhi 1984:** S. Faroqhi. *Towns and townsmen of Ottoman Anatolia: Trade, crafts, and food production in an urban setting, 1520 – 1650*. Cambridge, 1984.
- Faroqhi 1994:** S. Faroqhi. Crisis and change, 1590 – 1699. – In: H. İnalcık, D. Quataert (eds.). *An Economic and Social History of the Ottoman Empire, 1300 – 1914*. Cambridge, 1994, 411 – 636.
- Fay-Hallé et al. 1983:** A. Fay-Hallé, B. Mundt, A. Dawson. *Nineteenth-Century European Porcelain*. London, 1983.
- Fischer-Ausserer et al. 2004:** K. Fischer-Ausserer, W. Börner, M. Goriany. Aoristic analysis: Seeds of a new approach to mapping archaeological distributions through time. – In: *Magistrat der Stadt Wien, Referat Kulturelles Erbe*,

- Stadtarchäologie Wien (eds.). *Enter the Past: The e-Way into the Four Dimensions of Cultural Heritage*. CAA 2003. Computer Applications and Quantitative Methods in Archaeology. Proceeding of the 31<sup>st</sup> Conference, Vienna, Austria, April 2003. (British Archaeological Reports International Series, 1227). Oxford, 2004, 448 – 452.
- François, Ersoy 2011:** V. François, A. Ersoy. Fragments d'histoire: La vaisselle de terre dans une maison de Smyrne au XVIII<sup>e</sup> siècle. – *Bulletin de correspondance hellénique*, 135(1), 2011, 377 – 419.
- Freeman 1979:** L. C. Freeman. Centrality in social networks: Conceptual clarification. – *Social Networks*, 1(3), 1979, 215 – 239.
- Gajić-Kvašček et al. 2018:** M. Gajić-Kvašček, V. Bikić, V. Wright, I. E. Radosavljević, L. Damjanović-Vasilić. Archaeometric study of 17<sup>th</sup>/18<sup>th</sup> century painted pottery from the Belgrade Fortress. – *Journal of Cultural Heritage*, 32, 2018, 9 – 21.
- Georgopoulou, Thanasakis 2019:** M. Georgopoulou, K. Thanasakis (eds.). *Ottoman Athens: Archaeology, Topography, History*. Athens, 2019.
- Goffman 1999:** D. Goffman. Izmir: From village to colonial port city. – In: E. Eldem, D. Goffman, B. Masters (eds.). *The Ottoman City Between East and West*. Cambridge, 1999, 79 – 134.
- Guionova 2005:** G. Guionova. Le "Miletus ware" de Choumen. – *Archaeologia Bulgarica*, 3, 2005, 87 – 94.
- Guionova 2015:** G. Guionova. Céramique d'importation du XIV<sup>e</sup> au XVII<sup>e</sup> siècle en Bulgarie. – In: M. J. Gonçalves, S. Gómez-Martínez (eds.). *Actas do X Congresso Internacional a Cerâmica Medieval no Mediterrâneo*, Silves – Mértola, 22 a 27 outubro de 2012. Silves, 2015, 681 – 691.
- Hayes 1992:** J. W. Hayes. *Excavations at Saraçhane in Istanbul*, Vol. 2. The pottery. Princeton University Press, 1992.
- İnalçık 1994:** H. İnalçık. The Ottoman state: Economy and society, 1300 – 1600. – In: H. İnalçık, D. Quataert (eds.). *An Economic and Social History of the Ottoman Empire, 1300 – 1914*. Cambridge, 1994, 9 – 410.
- İnalçık 1996:** H. İnalçık. The meaning of legacy: The Ottoman case. – In: C. Brown (ed.). *Imperial Legacy: The Ottoman Imprint on the Balkans and the Middle East*. New York, 1996, 17 – 29.
- İnalçık 1997:** H. İnalçık. *An Economic and Social History of the Ottoman Empire*. Cambridge, 1997.
- İnalçık, Quataert 1994:** H. İnalçık, D. Quataert (eds.). *An Economic and Social History of the Ottoman Empire, 1300 – 1914*. Cambridge, 1994.
- Kanberoğlu 2023:** N. Kanberoğlu. Financial structure and transportation in Izmir (Smyrna) within Ottoman government reports. – *The International History Review*, 45(4), 2023, 607 – 622.
- Kleinberg 1999:** J. Kleinberg. Authoritative sources in a hyperlinked environment. – *Journal of the Association for Computing Machinery*, 46(5), 1999, 604 – 632.
- Liaros 2018:** N. Liaros. Late Ottoman tableware from Didymoteicho and some notes on pots' form, function, and identity. – In: F. Yenişehirlioğlu (ed.). *Proceedings of the XIth Congress AIECM3 on Medieval and Modern Period Mediterranean Ceramics*, Vol. 1. Ankara, 2018, 203 – 216.
- Orton 1980:** C. Orton. *Mathematics in Archaeology*. Cambridge, 1980.
- Page et al. 1999:** L. Page, S. Brin, R. Motwani, T. Winograd. *The PageRank Citation Ranking: Bringing Order to the Web*. – Technical Report 1999-66, Stanford InfoLab, November 1999.
- Panzac 1992:** D. Panzac. International and domestic maritime trade in the Ottoman Empire during the 18<sup>th</sup> century. – *International Journal of Middle East Studies*, 24(2), 1992, 189 – 206.
- Popović, Bikić 2004:** M. Popović, V. Bikić. Kompleks srednjovekovne mitropolije u Beogradu: Iskopavanje Donjeg grada Beogradske tvrđave. (Arheološki institut Beograd, Posebna izdanja, 41). Beograd, 2004.
- Stoianovich 1960:** T. Stoianovich. The conquering Balkan Orthodox merchant. – *The Journal of Economic History*, 20(2), 1960, 234 – 313.
- Todorova 1996:** M. Todorova. The Ottoman legacy in the Balkans. – In: C. Brown (ed.). *Imperial Legacy: The Ottoman Imprint on the Balkans and the Middle East*. New York, 1996, 17 – 29.
- Vainker 1991:** S. J. Vainker. *Chinese pottery and porcelain: From prehistory to the present*. London, 1991.
- Vroom 2005:** J. Vroom. *Byzantine to modern pottery in the Aegean: An introduction and field guide*. Athens, 2005.
- Vroom 2017:** J. Vroom. The Global Ottomans. – In: T. Hodon (ed.). *The Routledge Handbook of Archaeology and Globalization*. London, 2017, 899 – 917.
- Vroom 2019:** J. Vroom. Broken pots from Ottoman Athens: A new view from the Agora excavations. – In: M. Georgopoulou, K. Thanasakis (eds.). *Ottoman Athens: Archaeology, Topography, History*. Athens, 2019, 179 – 212.
- Wilkinson et al. 2016:** M. D. Wilkinson, M. Dumontier, I. J. Aalbersberg, G. Appleton, M. Axton, A. Baak, et al. The FAIR guiding principles for scientific data management and stewardship. – *Scientific Data*, 3, 2016, 160018.
- Williams 2009:** H. Williams. Medieval and Ottoman Mytilene. – In: J. Bintliff, H. Stöger (eds.). *Medieval and Post-Medieval Greece: The Corfu Papers*. Oxford, 2009, 107 – 114.
- Živković et al. 2017:** J. Živković, V. Bikić, M. Georgakopoulou. Archaeology of consumption in Ottoman urban

- centres: The case study of Iznik ware from the Belgrade Fortress in the 16<sup>th</sup> and 17<sup>th</sup> centuries. – *Post-Medieval Archaeology*, 51(1), 2017, 132 – 144.
- Иширков 1912:** А. Иширков. Градъ София през XVII век. София, 1912. [Ishirkov 1912: A. Ishirkov. Grada Sofiya prez XVII vek. Sofiya, 1912]
- Плетньов 2002:** В. Плетньов. Турски фаянс от Варна. Варна, 2002. [Pletnyov 2002: V. Pletnyov. Turski fayans ot Varna. Varna, 2002]
- Плетньов 2002 – 2003:** В. Плетньов. Ранен турски фаянс от Варна (края на XV – началото на XVI в.). – *Известия на Народния музей Варна*, 38 – 39 (53 – 54), 2002 – 2003, 429 – 437. [Pletnyov 2002 – 2003: V. Pletnyov. Ranen turski fayans ot Varna (kraya na XV – nachaloto na XVI v.). – *Izvestiya na Narodniya muzey Varna*, 38 – 39 (53 – 54), 2002 – 2003, 429 – 437]
- Плетньов 2004а:** В. Плетньов. Битова керамика във Варна XV – XVIII век. Варна, 2004. [Pletnyov 2004a: V. Pletnyov. Bitova keramika vav Varna XV – XVIII vek. Varna, 2004]
- Плетньов 2004б:** В. Плетньов. Италианска майолика от Варна (XIV – XVI в.). – *Известия на Народния музей Варна*, 40 (55), 2004, 249 – 255. [Pletnyov 2004b: V. Pletnyov. Italianska mayolika ot Varna (XIV – XVI v.). – *Izvestiya na Narodniya muzey Varna*, 40 (55), 2004, 249 – 255]
- Плетньов 2005:** В. Плетньов. Порцелан и майолика от Варна. Варна, 2005. [Pletnyov 2005: V. Pletnyov. Portselan i mayolika ot Varna. Varna, 2005]
- Станчева 1960:** М. Станчева. Турски фаянс от София. – *Известия на Археологическия институт*, 23, 1960, 111 – 143. [Stancheva 1960: M. Stancheva. Turski fayans ot Sofia. – *Izvestiya na Arheologicheskiya institut*, 23, 1960, 111 – 143]
- Станчева 1962:** М. Станчева. Флорентиска майолика от XV в., намерена в София. – *Известия на Института по изобразително изкуство*, 5, 1962, 161 – 165. [Stancheva 1962: M. Stancheva. Florentinska mayolika ot XV v., nameregna v Sofiya. – *Izvestiya na Instituta po izobrazitelno izkustvo*, 5, 1962, 161 – 165]
- Станчева, Шалганова 1989:** М. Станчева, Т. Шалганова. Археологически данни за внос на западен порцелан в София през XVIII и XIX век. – *Във: В. Велков (ред.). Сердика: Археологически материали и проучвания*, Т. 2. София, 1989, 125 – 132. [Stancheva, Shalganova 1989: M. Stancheva, T. Shalganova. Arheologicheski dannii za vnos na zapaden portselan v Sofiya prez XVIII i XIX vek. – *Vav: V. Velkov (ed.). Serdika: Arheologicheski materiali i prouchvaniya*, Т. 2. Sofiya, 1989, 125 – 132]

## КЕРАМИКА В ОБРАЩЕНИЕ: МРЕЖОВ АНАЛИЗ НА БАЛКАНСКИЯ ПОЛУОСТРОВ И ЕГЕЙСКИЯ РЕГИОН ПРЕЗ ОСМАНСКИЯ ПЕРИОД

*Цветя Коджабашева*

*Факултет по археология, Лайденски университет, Лайден 2311 EZ, Нидерландия;  
tsveta.kodzhabasheva@gmail.com*

### РЕЗЮМЕ

Изследването има за цел да разшири разбирането ни за Османския период, като се фокусира върху предизвикателствата, породени от ограничените археологически данни от тази епоха. Целта е да се оцени потенциалът на мрежовия анализ (*network analysis*), метод, произтичащ от теорията на графите (*graph theory*), за проследяване и възстановяване на търговски мрежи от времето на Османската империя. За тази цел са разработени мрежови модели на вътрешната и международната османска търговия, базирани на керамични находки от пет археологически обекта на Балканите (Белград, София и Варна) и в Егейския регион (Митилини и Измир), обхващащи периода от XV до XVIII век. Това насочва вниманието към връзките между производствените центрове и изследваните градове, както и към характеристиките на търговските мрежи. Мрежовият анализ е подходящ за изследване на търговски системи, тъй като по своята същност се фокусира върху взаимодействията между участници и разкрива динамиката на техните взаимоотношения.

Освен това този метод е изключително полезен, когато качеството на данните е компрометирано. В настоящето изследване наличните данни не са особено надеждни. Мрежовият модел предоставя възможност да се измести фокусът на анализа от количеството керамика към връзките между изследвани градове и производствените центрове, от които те получават внос.

Реконструираният търговски мрежи се анализират индивидуално и съпоставят с исторически източници, с цел да се установят различията между археологическите и историческите наративи. Анализът цели да проучи причините за несъответствията между двата типа данни, така и да прецени дали археологията може да предложи уникални интерпретации, които отсъстват в доминанти исторически теории.

Османската археология води началото си още от края на XVIII в., но едва в по-ново време вниманието се насочва и към материалната култура на обикновените хора, както и към по-малки населени места, селски райони и предмети от домашния бит.

За разлика от археологията, историческите анализи предоставят значими сведения за търговията, икономиката и глобалните икономически процеси през Османския период. Въпреки това историческите източници не бива да се възприемат като напълно надеждни, тъй като често пропускат важни детайли или отразяват субективни гледни точки. Докато историческият разказ предлага обобщения на макрониво, археологическите находки могат да внесат конкретика, която да допълни или дори да оспори тези интерпретации.

Градовете, включени в мрежовия анализ – Белград, София, Варна, Митилини и Измир – са подбрани въз основа на наличието на данни и тяхната близост до Истанбул, което ги поставя в икономическото ядро на Империята.

Важно е да се отбележи, че Белград, макар и да се разглежда като част от османската търговска мрежа от XVI до XVIII в., не е бил под непрекъснат османски контрол. Хабсбургите го завладяват три пъти в края на XVII и през XVIII в. Въпреки тези прекъсвания Белград е включен в изследването поради значението му за илюстриране на промените в управлението и културното влияние.

Данните за керамиката от София, Белград, Варна и Измир са събрани от публикувани източници с количествена информация, включително статии, книги и доклади. Информацията за Митилини е базирана на разкопки, ръководени от проф. д-р Хектор Уилямс и проведени от Университета на Британска Колумбия в периода 1983 – 1990 г.

Важно е да се отбележи, че керамиката представлява само един аспект от търговията и не обхваща цялостната ѝ картина. Множество други търгувани стоки не попадат в обхвата на мрежовия модел, а тяхното отсъствие може да повлияе върху начина, по който се характеризират възлите и връзките в търговската мрежа. Интерпретацията на резултатите е извършена с оглед на посочените ограничения. Въпреки това мрежовият анализ се оказва ценен инструмент, особено за периоди с оскъдна писмена документация, какъвто е XV в. (обр. 19, табл. 4 – 5). София се откроява като значим търговски център, с международни връзки – с Валенсия и Ефес – които не се споменават в писмените източници и вероятно отразяват търговски модели от времето преди османското управление.

През XVI в. Балканите претърпяват сериозно преструктуриране, отбелязано от увеличаване на внос на керамика от Северозападна Анатолия, особено изделия от Изник (обр. 20, табл. 6 – 7). Това може да се тълкува като знак за засилване на контрола от страна на Османската държава и утвърждаването на заможна градска прослойка, която може да си позволи закупуването на тази луксозна керамика. София запазва централната си търговска роля благодарение на стратегическото си разположение по важни маршрути като Истанбул – Буда (обр. 21, табл. 8 – 9). Дубровнишките търговци изиграват ключова роля в търговията между Балканите и Италия, особено в София, въпреки че тяхното присъствие не се открива в археологическия мрежов модел. Според историческите данни влиянието им отслабва през XVIII в., макар това да не се забелязва в мрежата (обр. 22 – 23, табл. 10 – 11). Варна запазва силни търговски връзки със Северозападна Анатолия в съответствие с историческата ѝ роля на доставчик на зърно за Истанбул. Въпреки че писмените източници сочат, че Черно море е било затворено за неосмански кораби от средата на XVI в., италиански стоки продължават да достигат Варна, макар конкретните механизми да остават неясни.

Белград изпълнява ролята на османска военна крепост срещу Хабсбургската империя – функция, която намира потвърждение и в археологическия мрежови модел. През XVII в. градът постепенно се преориентира към търговия с Централна Европа, отразявайки нарастващото влияние на Хабсбургите и постепенното отслабване на връзките с Османската империя, като през XVIII в. (обр. 22 – 23, табл. 9 – 10) връзката между Белград и Анатолия е напълно прекъсната в мрежовия модел.

В Егейския регион Митилини и Измир се разглеждат като част от обща икономическа зона. Митилини поддържа трайни връзки със Северозападна Анатолия до XVII в. в съответствие с по-широките икономически тенденции (обр. 21, табл. 8 – 9). Измир, който участва само в мрежата през XVIII в. (обр. 22 – 23, табл. 10 – 11), се утвърждава като най-глобално свързания обект, водещ активна търговия с Европа и същевременно ограничавайки контактите си с ядрото на Османската империя – развитието, което отразява добре документираната му икономическа ориентация.

Като цяло интерпретацията на археологическия мрежови анализ на керамиката съответства на ключови тенденции, описани в историческите източници. До XVIII в. отслабването на централния османски контрол личи в спада на анатолийската керамика и възхода на регионалните производствени центрове. Това подкрепя по-широките наративи за децентрализация и икономически упадък на империята. През XVIII в. европейският внос на керамика вече доминира, подчертавайки изместването на глобалната търговия извън османската орбита. Това показва, че при изследването на глобални тенденции, както историческите, така и археологическите данни, независимо от тяхната ограниченост, съществуват сходни модели и тенденции.

Мрежовият анализ се оказва изключително полезен при работа с ограничени археологически данни. Промяната на фокуса от количествата керамика към мрежовите връзки подпомага реконструкцията на търговските взаимоотношения. Опростената моделизация на реалните търговски мрежи допълнително улеснява разкриването на промени в търговските маршрути. Този метод добавя ново ниво на интерпретация, което надминава традиционния анализ на керамиката.

Настоящото изследване също подчертава допълващия се характер на археологическите мрежи и историческите извори при реконструкцията на търговската динамика в Османската империя. Нито един от методите не е самодостатъчен. Комбинирането им помага да се преодолеят техните индивидуални ограничения и стимулира дискусии, които в противен случай биха могли да не възникнат. За по-добро разбиране на османския период обаче е необходимо по-систематично археологическо изследване. Това включва и по-прецизна категоризация и периодизация на керамиката и би могло да допринесе за стесняване на хронологичния обхват на мрежовите модели, което би помогнало за по-добро обяснение на определени явления. Това значително ще подобри разбирането ни за търговските отношения в рамките на Османската империя и тяхната роля в по-широкия контекст на световната търговия.

**Ключови думи:** османска археология, османска керамика, Балканите, Егейско море, търговски връзки, мрежов анализ