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Graph based modelling of prosopographical datasets. Case study: Romans 1by1

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Abstract

In this paper, we present and discuss a promising research avenue, that is the use of graph-based models and software for prosopographical data sets. Our case study will be constituted by Romans 1by1 (http://romans1by1.com/), a digital-born prosopography focusing on people attested in classical era inscriptions; it presently hosts approximately 18,000 open access persons files. The project aimed at employing new techniques and methodologies that come from other fields (i.e. computer science), in order to approach the study of ancient population in an innovative way, to ease the research, and to create an open-access tool, available for the academic community. In the scope of this paper, we use Romans1by1 as an example to explore the perspectives of ingesting the information from a prosopographical relational database into a graph database.

I. Introduction

Prosopography is a branch of historical research that emerged during the 19th century and soon became of major interest for the researchers of Antiquity. It is supposed to be “a study that identifies and relates a group of persons or characters within a particular historical or literary context”.[1] As for historical prosopography, K. Keats-Rohan canonically defines it as being“ about what the analysis of the sum of data about many individuals can tell us about the different types of connection between them, and hence about how they operated within and upon the institutions — social, political, legal, economic, intellectual — of their time” [Keats-Rohan 2000]. While it was initially oriented towards well-known elite personalities of the past, on whom information is rich, it has nowadays turned more and more towards the “normal people” of the ancient world, thus going into the depths of the socio-economic fabric of societies, revealed through micro-networks and the connections between them. 1

In this paper, we present and discuss a promising research avenue, that is the use of graph-based models and software for prosopographical data sets. Our case study will be constituted by Romans 1by1 (http://romans1by1.com/), a digital-born prosopography focusing on people attested in classical era inscriptions; it presently hosts approximately 18,000 open access persons files. The project aimed at employing new techniques and methodologies that come from other fields (i.e. computer science), in order to approach the study of ancient population in an innovative way, to ease the research, and to create an open-access tool, available for the academic community. In the scope of this paper, we use Romans1by1 as an example to explore the perspectives of ingesting the information from a prosopographical relational database into a graph database. 2

Most digital prosopographies are built as relational databases using SQL or similar query languages. Nowadays there is a trend toward exploring new approaches and new software. One example in this context is SPEAR, a project which translates factoid data into XML schemata [Schwartz et al. 2022], and our current research comes as a new undertaking in the said direction. 3

II. Graphs – a new way of insight into historical sources

Over the past years, a great number of human cultural records have been digitized. They have been scanned, annotated, enriched with metadata and compiled in the form of digital collections. Henceforward domain experts strive to inspect these collections from multiple perspectives in order to understand their structure and inner correlations. Yet, the most efficient ways of studying this new amount of digital information still remain unclear. Traditional keyword or faceted searches rendering list and table views allow approaching the collections in the spirit of a data repository but they provide only little insight into patterns such as coverage, interconnections, co-occurrences or dynamics over time. As a consequence, they are often of only limited value, especially for exploratory data analysis. 4

Graph models are a promising complementary approach to the exploration of such digital collections, by considering the data as a network of connected information through nodes and edges. The edges represent relationships between the nodes and their properties. By using graph models it is not only possible to apply network analysis metrics and algorithms to investigate the characteristics of the given data set. Furthermore, force-directed placement algorithms [Fruchterman and Reingold 1991] allow generating visual layouts where highly connected nodes are placed close together. Looking at these visualizations can help theresearcher to spot hidden implicit structures such as ego-networks, cliques, and central nodes which may point to historically relevant insights. 5

A number of universal tools are readily available and widely used for graph analysis and visualization. Prominent examples include Gephi [Bastian, Heymann, and Jacomy 2009], Cytoscape [Shannon et al. 2003] and Palladio (https://hdlab.stanford.edu/palladio). The advantage of these off-the-shelf solutions lies in the fact that the graphs to be studied can be generated from any data source, as they are imported via pre-formatted files. However, the spreadsheets have to be structured and the considered data has to be limited in such a manner as to answer certain predetermined research questions. 6

As an example, the user may be interested in the people cited in a set of documents and sets up the graph of all persons linked to the documents they are mentioned in. If a cluster of persons stands out for their high number of coappearances, the user may want to understand their family relationships, or learn more about the network of organizations and events they are connected to. However each follow-up graph requires exporting specific data from the database, and preparing and importing further spreadsheets. The resulting workflow is rather clumsy and not appropriate for exploratory studies with open questions. Moreover, when dealing with evolving data collections which are at times enriched or corrected, as is also the case with Romans1by1, it is more advisable to work with visualisations directly extracted from the original database and not via exported files that may become obsolete. 7

Therefore, to keep the workflow swift and the visualisations up-to-date, the DH community started turning in the last years to the use of graph databases, i.e. dedicated database solutions where the information is from the outset inherently stored in the form of a graph. These solutions also typically come with built-in tools allowing the user to inspect their dataset in an interactive way via queries and straightforward visualizations. The next section discusses the conceptual key differences between traditional relational and graph databases, and presents several projects where a graph database have already been successfully applied. 8

III. Relational databases vs. Graph databases

Relational databases, simply defined as databases structured to save and recognize relationships between stored items, are extensively used in all scientific, industrial and commercial domains, and they continue as such to this day because of their efficient and non-redundant data storage and manipulation [Rob and Coronel 2000]. The relational database model organizes data into one or more tables of columns and rows, with a unique key identifying each row, called a primary key. The tabular structure is a good choice for many list like business-related records such as accounting or customer data management. However, relationships between data elements are often poorly represented in such databases. They have to be computed at query time by matching primary and foreign keys of all rows in the connected tables. These operations have exponential costs in calculus and memory footprint, so that relational databases tend to struggle with computing relationships efficiently [Kleppmann 2017]. Moreover, the rigid schemas of 9 tabular data models makes it difficult to add new or different kinds of relationships.

On the other hand, graph databases use particular graph-oriented data models with the concept of nodes and edges to 10
store connections directly alongside the data. Nodes are the entities in the graph. They can hold any number of properties in the form of key-value pairs. Edges represent directed and named relationships between two nodes. Like nodes, edges can also have properties. In most cases, these are quantitative properties, such as weights, costs, or distances. It is important to understand that a graph data model cannot capture fundamentally new information compared to a relational data model. The key difference lies in the way data is organized and accessed. Where relational databases use indexing through unique keys to model relationships, graph databases, on the other hand, store edges through pointers allowing to rapidly find the neighbours of a node. Graph databases are therefore an efficient solution when dealing with volumes of highly connected data. As an example, the following relational table-based and graph based data models implement the same schema:

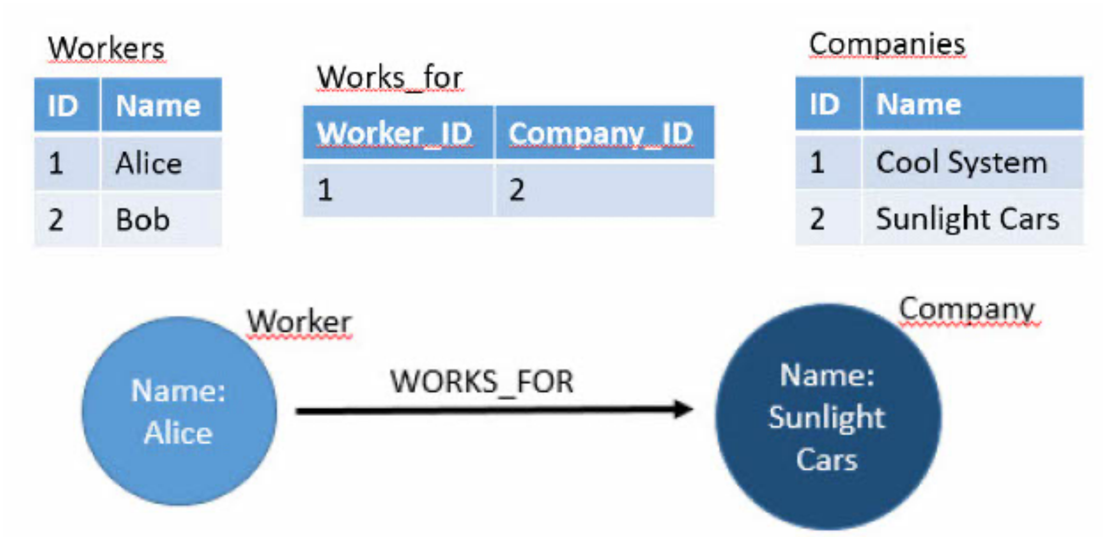

Figure 1. Example of a relational table-based and the equivalent graph-based data model

Although two isolated connected nodes look like a triple of the form “subject-verb-object”, note that a graph-based 11
dataset is not organized in triples. Each node has a unique instance in the database and can be connected to many other nodes.

A number of well-established graph databases is readily available, such as Neo4j (https://neo4j.com), ArangoDB 12
(https://www.arangodb.com), DGraph (https://dgraph.io) and OrientDB (https://orientdb.org). Existing relational databases of digital historical collections have been imported or converted, partially or entirely, into such databases. A typical example is the project *Regesta Imperii* (http://www.regesta-imperii.de/regesten/suche.html), a vast collection of charters documenting the activities of Roman-German kings and emperors, as well as of the popes from the Middle Ages. Parts of this collection, divided into subcollections containing charters issued by a given emperor, have been transferred to graph databasesThe resulting visualizations allow for much easier comprehension of the connections between the appearing entities such as persons, places, actions, dates and events ([Kuczera 2017]; [Kuczera 2019]).

The histoGraph project has been conducted at the Centre Virtuel de la Connaissance sur l’Europe (CVCE), a former 13
research and documentation center that in 2016 was integrated into the University of Luxembourg. The project aimed at designing tools for exploratory investigation and analysis of an existing historical multimedia collection compiled by the CVCE (https://www.cvce.eu/epublications). The documents were processed via named entity recognition, and the links between the documents and the detected entities were stored in a graph database. As a key functionality, histoGraph implements an interactive graph visualization revealing co-occurrences of persons or locations in the collection ([Novak et al. 2014]; [Guido et al. 2016]).

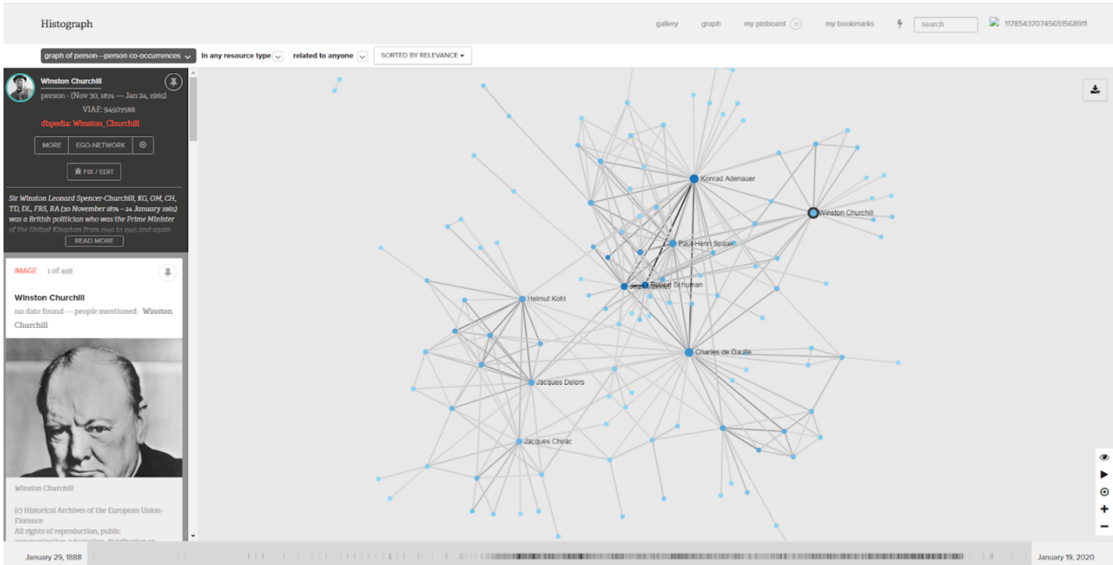

Figure 2. Histograph screenshot representing the network between prominent politicians in the database. A click on a node shows additional information to the left (http://histograph.eu)

14 A subset of the histograph dataset was reused in the BLIZAAR project whose objective was the design of innovative prototypes for the exploration of complex graph scenarios. Among other results, the interactive visualization platform Intergraph [Bornhofen and During 2020] has been implemented and connected to the database. Intergraph offers a way to navigate through the data especially for users having no or very limited experience with database manipulation and graph theory.

15 The above projects feature large and complex datasets with multiple types of connected entities (Persons, Places, Organizations, Things, Events, Dates, Actions, etc.). The Romans1by1 database stands out for its simplicity and allows showcasing the migration from relational to graph databases through a straightforward model procedure which can be readily adapted to many other uncomplicated historical datasets.

IV. Romans 1by1 – from Relational to Graph database

16 Most large datasets of ancient names or persons are not prosopographies in the technical sense, but *corpora* (defined as *a collection of recorded utterances used as a basis for analysis)*. Nonetheless, some of them must be quoted for their role in the development of prosopographic research. So are *Prosopographia Imperii Romani* (PIR), *Prosopography of the Byzantine World* (PBW), and *Hellenistic Babylonia: Texts, Images, Names* (HBTIN), which tend to focus on specific and delimited time and place, and social class or categories of person. Equally valuable however, is the *Lexicon of Greek Personal Names* (LGPN), which does not gather the biographical data and other information typical of a prosopography, but identifies individuals and core information about them, including relationships with others. While these *corpora* were paper-born, they have currently migrated to the digital environment. This phenomenon, the emergence of digital humanities in various forms, changes the shape of and perception on the non-elites prosopography for Antiquity.

17 In the digital era, building prosopographies for the ancient world is very much tributary to the model suggested by John Bradley and his research group at King's College London, which marked the shift from narrative descriptions to information on persons as structured data (https://www.kcl.ac.uk/factoid-prosopography). Working mainly on the *Prosopography of Anglo-Saxon England* (PASE), Bradley theorized the concept of prosopographical "factoids" – small pieces of data about persons (name variants, occupations, places of residence, events in which they played a role, personal and professional relationships, possessions, etc.) provided by the sources, which are not exactly facts as we cannot verify their veracity ([Bradley 2005]; [Bradley and Short 2005]). Factoid prosopographers took these pieces of information and registered them into a relational database that reflected their connections and relationships. One of the main advantages of this model lies in the fact that it offers the opportunity to stay true to the source – a necessity when

we are sometimes dealing with inconsistent or even antagonistic sources.

Romans1by1 has been documented before ([Varga 2017a, 333–341], and far more detailed, [Varga 2017b, 44–59]), thus we will only schematically present its architecture and the metadata. No doubt, one of the most important features is the creation of a born-digital prosopographical *corpus*, constantly updated. Another advantage is given by the fact that the database was built in order to be very user-friendly and adaptable to the research question one has; more precisely, we speak of the search filters in each main category which allow the user to request a specific set of information from the database. In this manner, at a click distance, we can find, for example, who all members of private associations were, or who the attested governors of the provinces were. Moreover, all the information of our choice can be easily downloaded in an excel file and scientifically processed later on. 18

Technically speaking, Romans 1by1 is a relational database, built in MySQL and following the best practice models for population databases [Mandemakers and Dillon 2004]. The metadata is structured into four major tables (*Inscriptions*, *Bibliography*, *Personal Data* and *Personal relationships* – summing up to more than 100 separate attributes). 19

The first table to be filled in is the file of the source – *Inscriptions*. To begin with, each inscription gets an identification code, formed of 5 digits and an acronym of the province's name (D for Dacia, MS for Moesia Superior, MI for Moesia Inferior) – so we have, for example 00001MS. In this section, certain fields are linked to other existing resources, in order to obtain maximum efficiency for the users. The texts of the inscriptions are linked to the Epigraphische Datenbank Heidelberg (http://edh-www.adw.uni-heidelberg.de/home), Clauss-Slaby (http://www.manfredclauss.de/) and/or Packhum (https://epigraphy.packhum.org/) databases, while the places have been referenced to Pleiades (https://pleiades.stoa.org/) or Trismegistos (http://www.trismegistos.org/). The *Bibliography* section was conceived in a way so that extracting complete or selective bibliographical lists would be possible. Thus, a normalization table includes all bibliographical titles referred to and being quoted; with the help of a value list, one can choose one *Bibliography abbreviation* for which the full reference, detailed information and comments are then displayed. Of course, all data are linked to the *Inscription code*, selected as well from a value list. 20

The core of the database is a table used for recording data about individual persons (labelled *Personal data*), around which the entire network of relations is built. Each new entry represents a singular epigraphic attestation of an individual, and a unique ID is generated, which will help link the character within the various components of the database and with other database entries. The person is also manually linked to the source using a value list of the inscriptions` codes. In the case of one person being attested by multiple epigraphic sources, each attestation will be represented by a new entry, to which a new unique ID will be assigned and which will be doubled during linkage procedures by a common ID for all instances of the same person. Expectedly, this metadata is the most volatile one, being in a continuous process of modification and enlargement. As a principle, we are trying to remain faithful to the source and to record during the first phase only the minimum of deduced information. The first section of fields from this table includes personal identification information on the person: *Praenomen*, *Nomen*, *Cognomen/Personal name*, *Father/Master name*, *Agnomen*, *Signum*, *Natione*, *Ethnicity*, *Origo*, *Domus, Local citizenship, Gender, Juridical status, Occupation*, *Deities*, *Age* (at death), *Details of life/death and Observations*. For *Collegium/Association* and *Religious position* we opted for check boxes, which open a series of fields. For the associative forms we have three free text boxes: *Type of association*, *Position within the association*, *Activities within the association*, which allow for certain flexibility and the possibility to accommodate information and realities from both Roman and Greek inscriptions. In the case of *Religious position*, the situation is a bit more complex: when checking this option, a drop down list of *Sacerdotal office* opens whose values are (at the moment) *Augur*, *Flamen* and *Pontifex* and a series of further check-boxes: *Coloniae / Municipii sacerdos*, *Military sacerdos*, *Imperial priest*, *Divinity priest*, *Laurentium Lavinatium*. All of them, with the exception of the last one, open a *Details* text field for description ([Varga 2017b, 48–49]). 21

The second half of the *Personal information* table is dedicated to political and social status. This part of the metadata consists of a series of checkboxes, each opening different categories of specialized attributes: *Ordo senatorius, Ordo equester*, *Provincial Governor*, *Procurator*, *Local magistrate*, *Decurionate*. The next information items cover *Imperial slave, Imperial freedman* and the *Military personnel*, all equipped with *Details* attributes. 22

23 Based on the personal ID given to each individual, the *Relationship* table will solely name the relationship between individuals (A to B and B to A) ([Varga 2017b, 50]), choosing from a drop-down menu. The relationship values have been encoded and we have tried to adjust the concepts to the SnapDrgn ontology (https://snapdrgn.net/ontology).

24 Very important for us was the search interface of the database. Built with Ruby-on-rails, it was designed to respond to the most manifold and complex search options. Every component of the database has search filters for every particular field, as well as a general search.

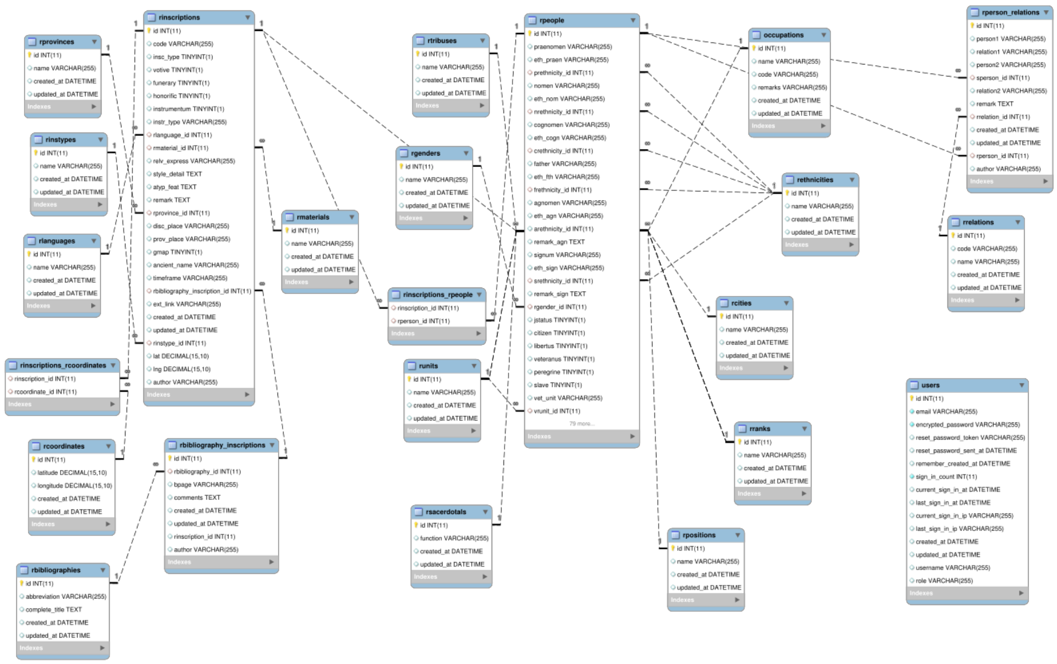

Figure 3. Diagram of the Romans1by1 metadata

25 Even though the schema seems complex due to the multitude of tables and fields, it is in fact straightforward. The main tables are the People (rpeople) and Inscriptions (rinscriptions), which are directly related, as people are attested solely and exclusively in inscriptions. Another possible relationship is between people, attested in the same sources. Based on these, the design of the corresponding graph data model has been easy to conceptualize:

- Persons and Inscriptions are graph nodes. Five Person types have been defined according to their province: Dacia, MoesiaInf, MoesiaSup, PannoniaSup, Dalmatia.
- Person-Person relationships and appearances of a Persons in an Inscription are graph edges. The *related_with* relationship between two persons can be miscellaneous such as HusbandOf, FatherOf, WifeOf, SlaveOf, etc.

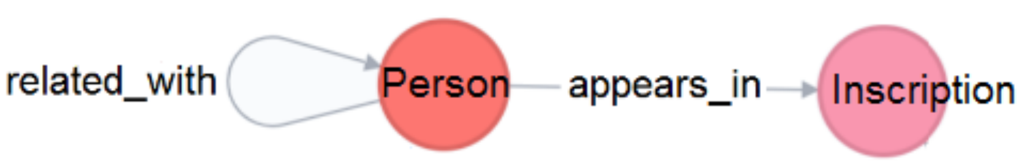

Figure 4. The graph data model for Romans1by1

26 We selected the Neo4j database for the Romans1by1 use case because Neo4j:

- Is an open-source native graph database publicly available since 2007
- Features Cypher, a declarative query language similar to SQL, but optimized for graphs
- Offers built-in tools for manipulating and visualizing data, such as the Neo4j Browser for developers and Neo4j Bloom for analysts
- Is used by companies and organizations in almost all industries
- Has an active graph community and sound documentation surrounding the technology
- Is free to use under the GPLv3 licence for non-commercial use cases (Neo4j Community Edition)
- Neo4j has been successfully used in other academic research projects ([Guido et al. 2016], [Kuczera 2017]).

The technical procedure for the data transfer of the relational to the graph database is the following: 27

1. In MySQL, export the tables from the relational database in csv formatted files
2. In Neo4j, write import scripts in Cypher language which read the csv files and create appropriate graph elements
    a. Create a node for each entry in the tables Person and Inscription. All table fields become node properties.
    b. Create an edge for each entry in the many-many relationship tables appears_in and related_with.

When applying a graph model to ancient epigraphic sources, as it is the case of Romans1by1, we have to take into consideration two main factors: the texts are not standardized in any form, the details they offer being altogether subjective and the information is generally scarce. Nonetheless, a graph database brings forth the possibility to visualize connections in a direct manner, which can constitute an important advantage, especially for people who get in contact with the information for the first time such as students or researchers unfamiliar with the area. 28

At this point, the main outcomes of our research can be divided in three general categories: source-connected, network-connected and diachronic distribution graphs. The relation of a given person to the sources and how he/she is represented in various texts is highly important, especially in the prosopography of Greek and Roman non-elite characters. Going a step further than the factoid model, we textualize individuals and individualize texts, meaning that the inscription itself - and the "factoids" it narrates - become part of the individual's ego-history [2] Thus, the link between individual and source is rendered as more important than initially imagined by traditional historiography. The network analyses refer to individual networks, but it also allows researchers to compare and superpose two (or more) persons' networks, as well as to visualize and investigate "immaterial" networks, connections between institutions, economic actors, etc. The diachronic distribution graphs show quantitative and qualitative changes that occur over time at the scale of epigraphic habits, network patterns and individual movement, in a certain region or micro-region. Correlating all these types of information and visualizing them comes with great analytic gains, as it reveals a more complex picture of the people we study and the fabric of their society. 29

V. Case studies and preliminary results

Working on a virtually exhaustive repository, such as Romans1by1 is, gives one the opportunity to undertake macro-analyses, to dwell not only in the prosopographic data offered by a certain province but also to place these data in a wider context and get to relevant conclusions. The possibility to compare between provinces is also a huge gain, creating context and offering answers to questions that do not even reveal themselves otherwise. 30

What additions do we get from transposing the database into a graph format? Mainly, we get an extra degree of clarity, the possibility of bird eye visualizations of the people and the sources attesting them, as well as the possibility to identify more connections and relationships than a flatter, table-structured model would allow. All these allow us to reconstruct networks and undertake prosopographic analyses with more insight and relevance. 31

For this section, we have selected a series of case studies to demonstrate how ingestion of information into a graph 32 database model and their subsequent analysis from a historian's perspective can improve our knowledge and understanding of ancient society. The first example is a selection of **all people attested in a certain settlement - in our case Napoca, from Roman Dacia**. In the graph below, the red nodes are our central entities, namely the attested people and the blue ones are the sources. Thus, here we can see not only the number of attested people but also the connection between them, as well as between them and the sources. Napoca was the first urban settlement of northern Dacia, became a *municipium* under Hadrian and a *colonia* during Marcus Aurelius' reign ([Ardevan 1998, 61–65]; [Voișian et al. 2000]; [Diaconescu 2004, 117–121]). As the administrative center of Dacia Porolissensis, it became the capital of the province and the seat of the *procuratores*, both praesidial (118/119-168) and financial (after 168). On the graphic representation, we have the chance to visualize the approx. 130 people of Napoca, their individual networks and pinpoint collective sources, which attest a multitude of persons implicitly connected. What is most striking at a first sight is an inscription attesting multiple people, thus creating a network. We are dealing with the list of members of the *spira Asianorum* (CIL III 870) from 235, a local association reuniting people from the province of Asia. We know that the association, besides its social and religious role, was also involved in commerce. Unfortunately, no other member of the *spira* is attested by a different inscription as well and the network remains circular. Nonetheless, it tells us something about epigraphic habits: the source attesting a network is an association list, a document typical rather to Greek epigraphy; Latin commemoration or adulation habits imply rather small, often familial groups.

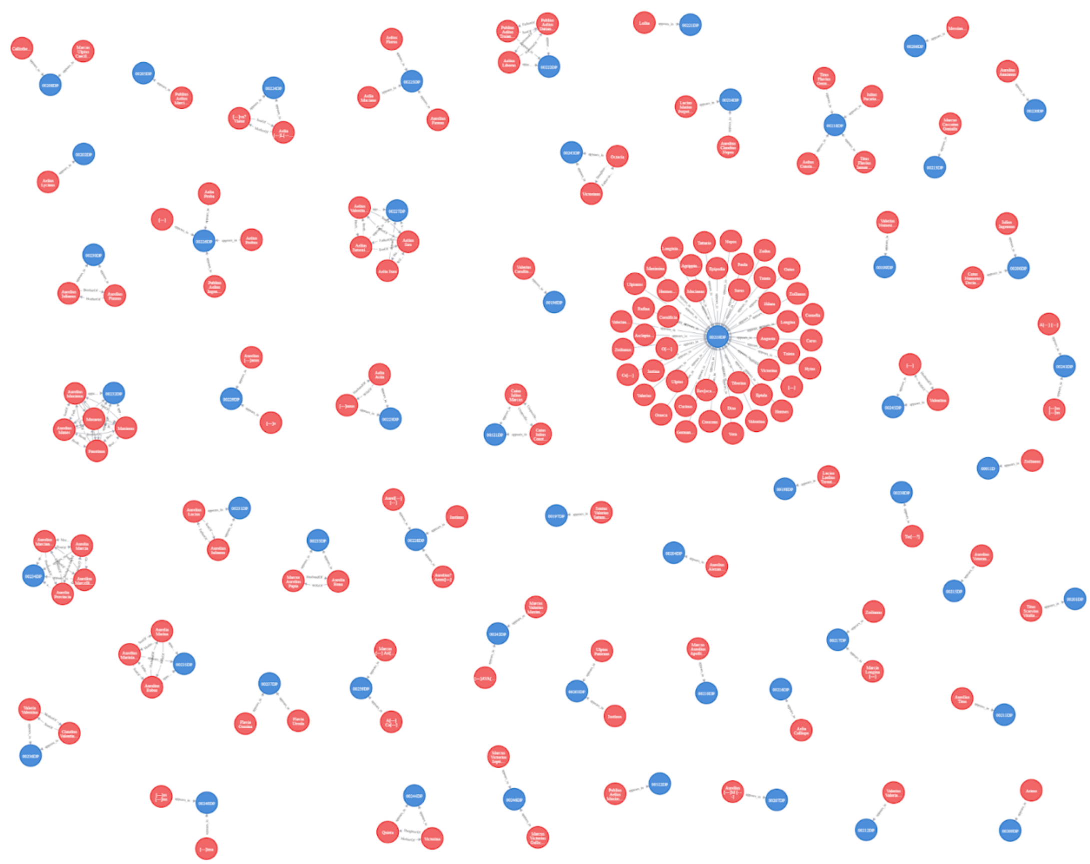

Figure 5. The people attested in Napoca and the sources

Another possible case study of historical population is focused on onomastics. Namely, we have concentrated on the people bearing a certain name, in a certain area. The graph below lists all *people bearing the nomen Claudius/Clodius in Pannonia Superior*. Here the interesting historical facts to take into account are, besides the number of name bearers in itself, the possibility to see relations and to observe if more members of the same family/group bear this *nomen*. In this case, we again mostly see small networks, but what strikes us in a few cases is the lack of explicit relationship between persons. For example, in one instance (CIL III 4244) we have two soldiers, named Tiberius Calusius Aplo and Tiberius Claudius Vanamius. The text explicates only the fact that Aplo is the heir of the deceased Vanamius, without revealing other potential relationship. Nonetheless, seeing them on an onomastic graph, the name similitude is much more obvious the possibility that the two were actually close relatives.

34 In the case of the previous two examples, migrating from table-form to graph has a number of important and relevant aspects: first, we are able to see at a glance the entirety of people and adjacent sources (inscriptions). Then, we have a clear and immediate vision of the connections: in both cases we can easily observe that almost none of the characters is attested by more than one source. This ascribes the networks to very limited circumstances. Nonetheless, we do have a notable exception, in the person of Tiberius Claudius Victorinus (AE 1998, 1049; AE 2003, 1353), attested by two monuments. The man was a decurion of Savaria and we get to know him and his family from his son's epitaph and from his own funerary monument. So, we have the representation of an elite family that doesn't go beyond first degree blood connections. Even so, it is interesting to note that he outlived his son, as well that they preferred separate monuments (maybe connected to separate burial locations) instead of a larger family monument.

35 As well, in both cases we see that we have a couple of major sources, attesting a multitude of people - more poignant in the first case, as we have the list of an association's members from Napoca. All these features strike us as obvious on a graph representation and give us an overview of the epigraphic situation.

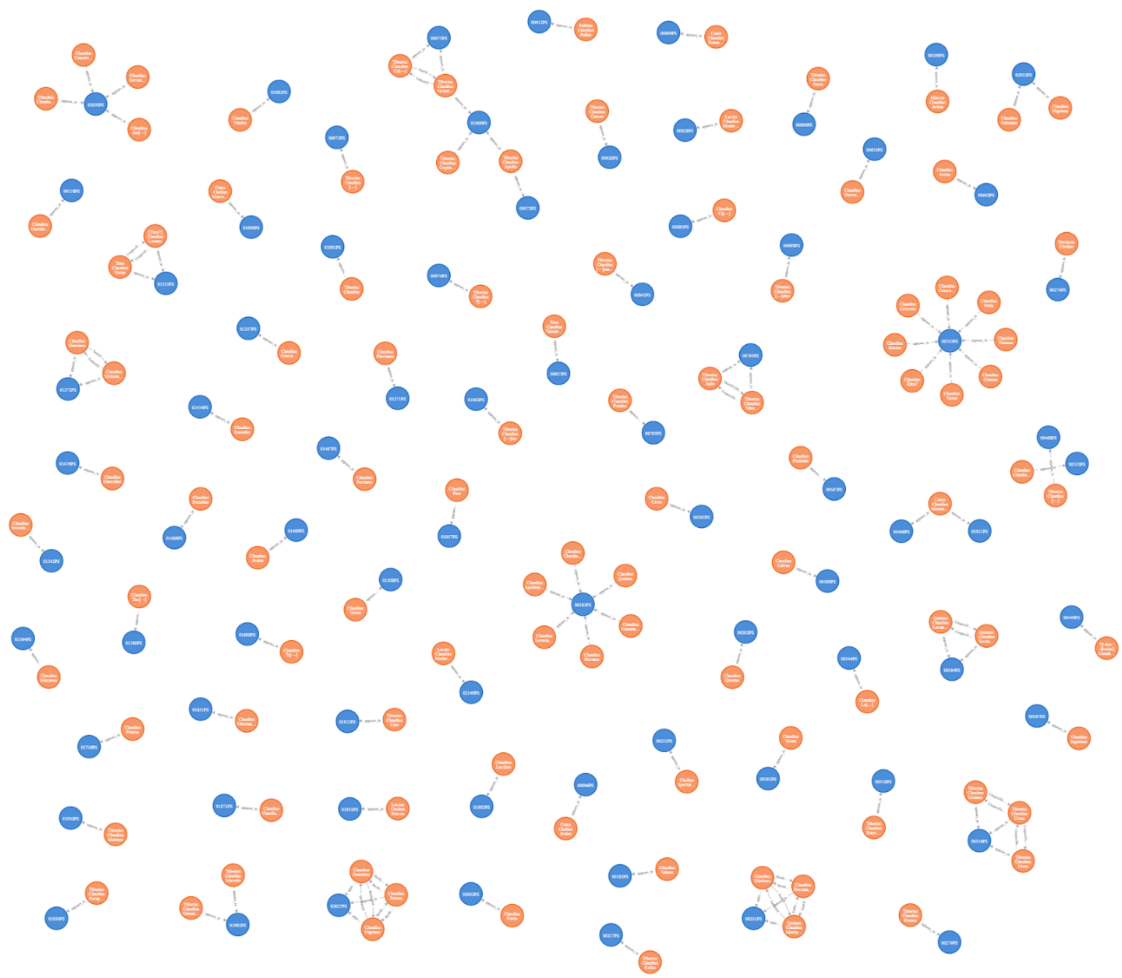

Figure 6. The people bearing the name Claudius/Clodius in Pannonia Superior

36 Slightly different is the construction of personal networks. In this case, the research questions asked and answered are of a different nature.

37 The first network we are showcasing is that of **Caius Ovinius Tertullus**, governor of Moesia Inferior in 198-201. What's remarkable in this case is the fact that the many attestations don't bring forth a proportionate quantity of human connections. Most attestations come from official monuments, *milliaria*, and dedications made by the governor alone. Only few inscriptions place him in a social context: the dedication for the emperors' health made by a religious

association (ISM II 82), or dedications made for his own health by members of his staff and other minor officials (as it is the case of Raesius Pudens, a *primiscrinius officina* - CIL III 12370). So, what we get in this case is an important man, a local official, who doesn't necessarily manifest himself epigraphically at a personal level, doesn't dedicate to private deities and doesn't associate family members to his acts, but is very present in the organization of the roads system from the province, as well as in the urban landscape building.

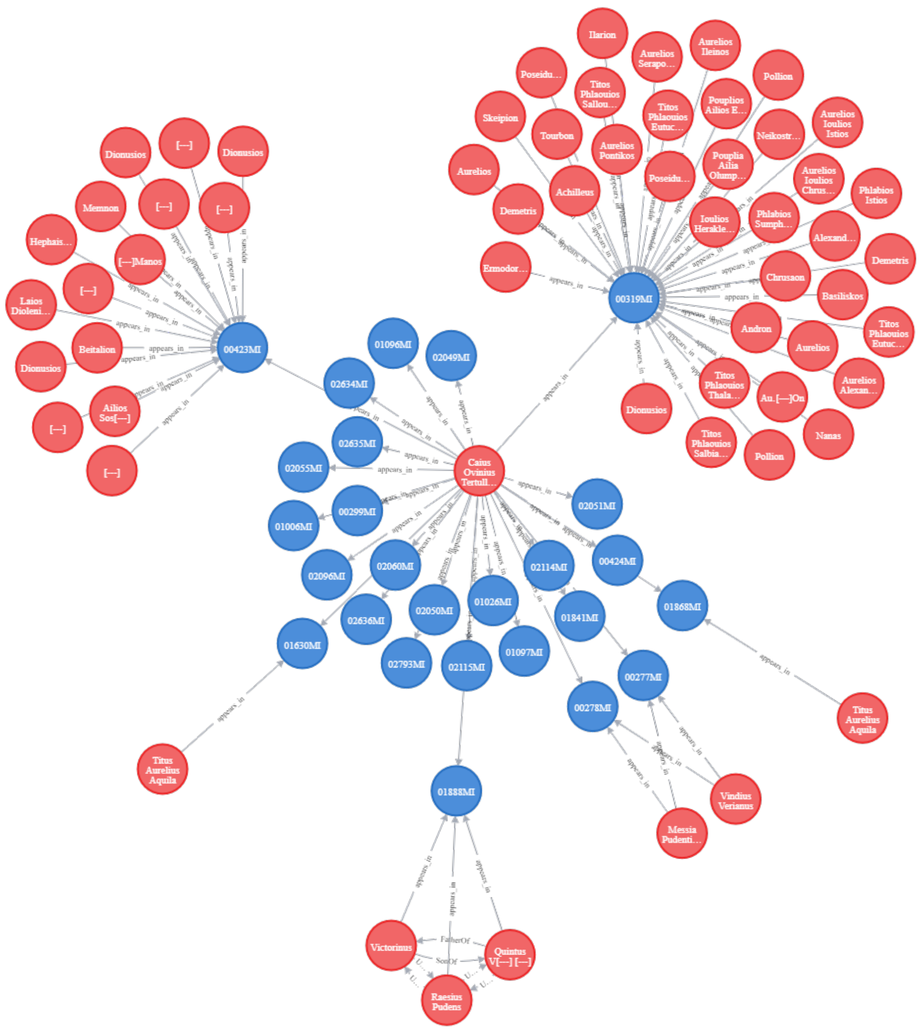

Figure 7. The network of Caius Ovinius Tertullus

The last account focuses on the story of a relocation, of a merchant who leaves Dacia to live in Dalmatia, but retains 38
links with his home province, around the year 200.

Aurelius Aquila's network brings to the fore several topics of discussion. We know Aquila from an inscription 39
discovered at Solin (ancient Salona, province of Dalmatia, in today's Croatia) and we learn that he was a merchant from the province of Dacia, former decurion of Potaissa. The inscription was placed on the front of a sarcophagus. The text of the inscription reveals the person buried in the sarcophagus: Valeria Ursina, daughter of Titus and wife of Aurelius Aquila. The husband, who dedicates the monument, tells us that the deceased was an "incomparable" wife and that they lived together for seven years without a single quarrel (CIL III 2086). The sarcophagus, simple as it may have been as an accomplishment, denotes the status of the family in society, as obviously not everyone could afford such a monument.

Aquila, however, is also known to us from an inscription from Split (Spalatum, near Salona). The two monuments have 40
not been associated until recently [Varga 2016], and it was not known that we could reconstruct more of this person's life from them. This second monument is also funerary, but this time a stela - a gravestone. Here Aquila is in the role of

'most unfortunate father', as he was burying his son, Titus Aurelius Apollonius, who died at the age of 33 at Sirmium (in Lower Pannonia, now Sremska Mitrovica in Serbia). The young man had followed a military career, most likely as a centurion in a military cohort in Pannonia. But the tomb is not only Aurelius Apollonius', Aquila also buried two friends here: Aurelius Flavus, a Syrian merchant who died at 55, and Aurelius Lucianus. Of course, Flavus' trade immediately brings to mind the other monument, to which we shall return.

An exact family reconstruction is impossible, and we have to wonder whether this son of Aquila is also the son of Valerius Ursina, or of a later wife of the decurion relocated to Dalmatia. There are, however, several clues suggesting that he is the son of Valeria. First, the name: the surname Titus is also that of the deceased wife's father. Then the age, 33 at the time of death, and the fact that the father was still fit, indicate the child was born in Aquila's youth. And finally, the lack of a mother to co-dedicate this funerary monument suggests her total absence from the landscape, and thus the death prior to that of the son. At this point, we must underline again the utility of a graph model, as the relationships, with or without a certain degree of ambiguity, appear visible, “clean”, and accurately connected to the sources, thus making interpretation easier and more to the point. 41

Returning to the other two deceased honoured by this monument: of Aurelius Lucianus we know nothing else, as he is only attested here. Aurelius Flavus, however, appears on another monument in the province of Dacia itself. In Dacia, at Apulum, our character is attested with the same name and description as a merchant, Syrian by origin, on a dedication to Jupiter Optimus Maximus Dolichenus. This dedication was made together with another merchant, a Syrian as well, Aurelius Alexander. 42

Aurelius Aquila, as decurion in Potaissa, was a member of the city's small local elite. It should be pointed out that Roman municipal elites were often actively engaged in local production and consumer markets, in commercial activities, lived and valued the same things as those who had a more or less similar economic position, but played no political role. At some point in his life, most likely while he was still quite young, our man moved to Dalmatia. We don't know his reasons, but they could be varied, ranging from better business opportunities offered by the Dalmatian coast to family reasons. We don't know if he came here married, or if he met Valeria Ursina in his new province of residence, but it is certain that after a few years of marriage the young woman died, leaving behind a son. The husband buries her with enough pomp to mark the family's position in society, and after this point we don't know what Aquila's life was like. We do know, however, that he remained in Salona and maintained his business ties with Dacia. Some of these ties overlap with personal ties of friendship. At one point, his and Valeria Ursina's son, a centurion in Pannonia, dies at the age of just 33, in circumstances unknown to us. At this point in his life we also find Aquila. But the Decurion honours not only the memory of his son by erecting a monument, but also of two friends, one of whom, Aurelius Flavus, a merchant from Dacia. Flavus, although he bears a very Latin name, is a Syrian merchant with connections in Dacia and Dalmatia, as the funerary monument shows. Aquila is in charge of the memory of these two friends, which leads us to believe that he also inherited them, at least in part, probably as a result of shared business and capital. 43

Aurelius Aquila's small family and social network gives us a glimpse of real life and provides concrete details of the great mobility of merchants in the Roman Empire, as well as how strong and enduring the bonds built between them could be. 44

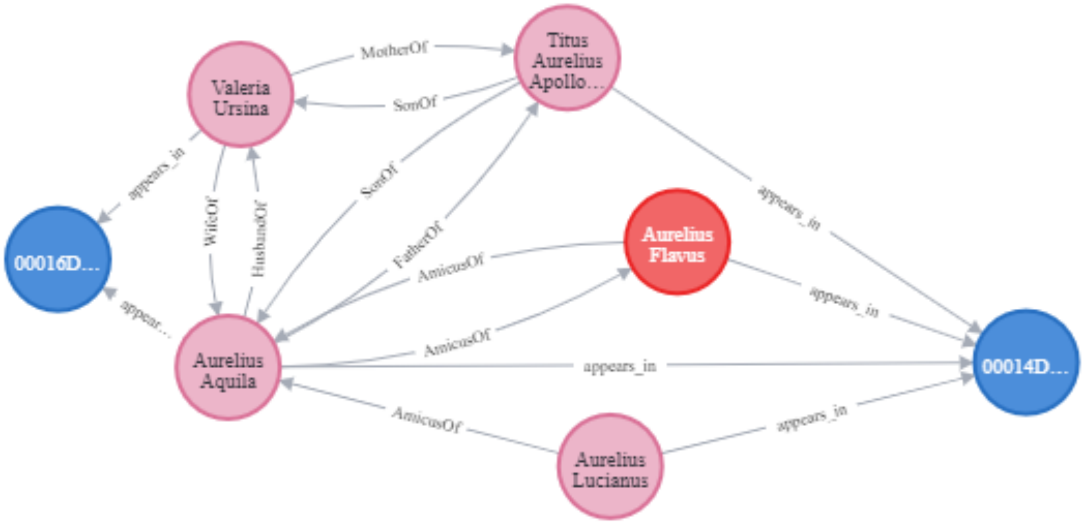

Figure 8. The network of Aurelius Aquila

VI. Concluding remarks

The research behind this paper is still a work in progress — unavoidably, as a database such as Romans1by1 is a dynamic tool, constantly updated and clearly software development is iterative and will expand and evolve over time. Nonetheless, the selected case studies reflect the entirety of the scientific context, as known today. Applying a graph based data model to Romans1by1 led to visualizing not only the networks as defined in SNA, but also the entirety of people attested in a certain area, or displaying certain common features. 45

As demonstrated, prosopographic researches for the ancient world have evolved greatly during the last few decades. The leap from paper to digital, followed by the implementation of the factoid model and its subsequent adapting to the needs of various projects, all represented great opportunities for researchers of the ancient world to gain new insight on their sources, as well as to present their results in a more synthetic and comprehensive manner. And while the historiography of the Roman Empire's elites has been developing on a different level and scale since the 19th century, the prosopography of the non-elites, of the Empire's middle classes, is very tributary to these recent developments. As the sources are scarce and practically unconnected, any possibility to connect them, to reveal patterns and understand social behaviours is a huge gain. 46

This last point is where our researches come, as while absolute novelty is hard to be revealed when working on the same, known sources. What we managed to highlight are particular social and epigraphic habits: the preponderance of small, family networks in Napoca, the un-explicitated possible family relations from Pannonia Superior, a magistrate's active involvement in the province's organization, but lack of personal epigraphic manifestations, and finally a story of mobility, relocation and conserved networks which offer us a look into the lives of merchants. 47

What our endeavour has proven is that new approaches take us a bit further into the social life of the Roman Empire, highlighting certain factual realities, as well as the possibilities the future holds for non-elite prosopography. 48

Notes

[1] Merriam Webster: https://www.merriam-webster.com/dictionary/prosopography.

[2] The methodology comes from the Lived Ancient Religion group: https://www.uni-erfurt.de/en/max-weber-centre/projects/cooperation-projects/lived-ancient-religion/.

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