

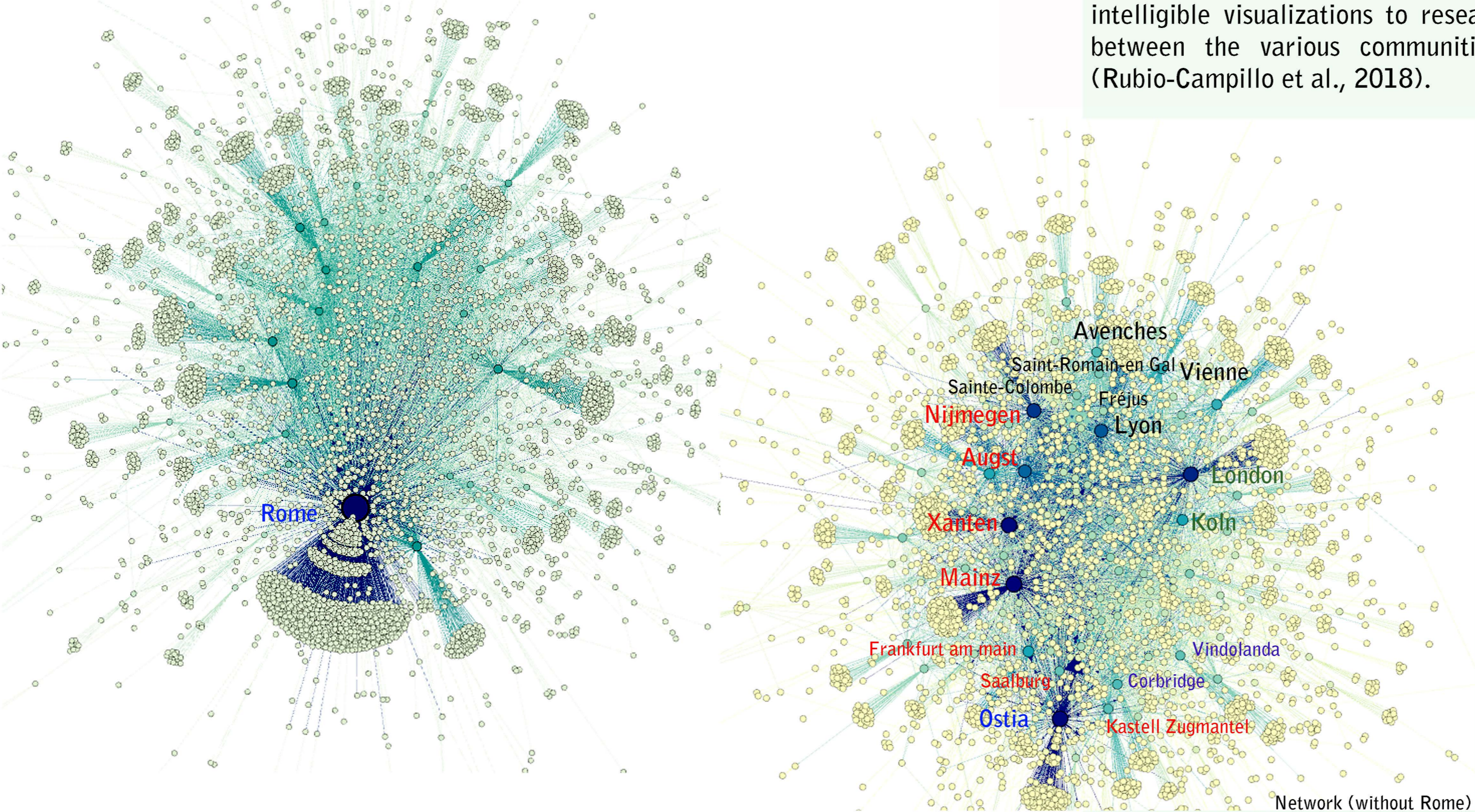
Visualizing consumption: food distribution networks and pottery production

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The **interdisciplinary collaboration** between network scientists and experts of the case study provide, arguably, the most interesting and reliable results. One of the results of the collaboration between the Humanities (History and Archeology), Physics and Mathematics was developed throughout the EPNet project, the results of which have allowed us to know the different production systems of the amphoric industry (eg Rubio-Campillo et al., 2017; Coto-Sarmiento et al., 2017; Moros Díaz 2019; Moros Díaz, Remesal 2019), as well as the various food distribution routes (Rubio-Campillo et al., 2018).

The construction of the following networks elaborated with data from the CEIPAC database reveals visually some of the hypotheses with the greatest impact developed within the EPNet project. Thanks to the new data science in the Humanities, it is possible to generate the necessary datasets to capture the economic dynamics of the Roman Empire from a multiscale perspective, beyond specific case studies (eg Wilson, 2009). So far, many of the databases in the Humanities highlighted by the cumulative nature of them and thanks to the realization of these projects we can analyze for the first time thousands of data, converting them into intelligible visualizations to researchers, who testify more easily the similarity (or other) between the various communities that make up the networkfood distribution routes (Rubio-Campillo et al., 2018).



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Continuing with the classic construction developed in several works of EPNet where the 'Places of Finding' and 'Epigraphy' were found (in this case 'Stamps'), we can prove through these networks some results of the project and transfer the question to other productions (Prignano et al. 2017; Pérez et al. 2017).

Building the networks

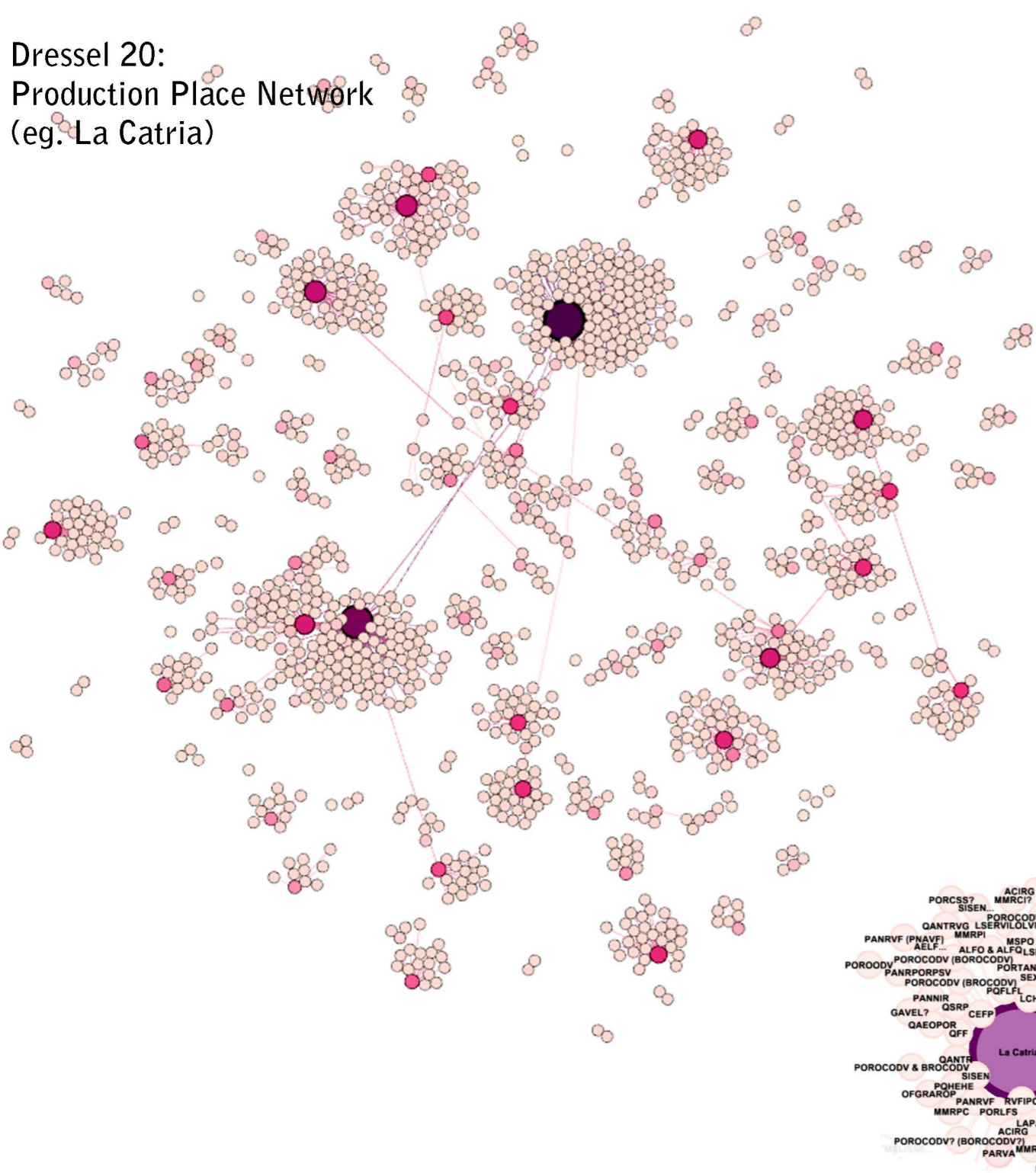
Roman Empire networks of places (sites) and stamp types (categorical attributes). Each node representing a place (in blue) is connected to stamp types (in green) that have been found in its assemblage and its size is proportional to the total number of elements (stamps) in it. The size of nodes representing place-types is proportional to the number of stamps in that category. The thickness of the links is proportional to the number of stamps of a given stamp

As we have already illustrated in previous works, the analysis of the epigraphy related to the Dressel 20 olive oil amphorae served us to reconstruct the routes by which the olive oil produced in Baetica was redistributed during the first to third centuries AD (Remesal Rodríguez, 1986, Funari, 1996, Remesal Rodríguez, 1998, Berni, 2008, Rubio-Campillo et al., 2017 and 2018). Although this work was developed using an approximation based on null hypotheses, the present networks would come to validate the results already obtained. Thus, the groupings of materials by similarity in these networks show how the settlements of the same province or region share similar epigraphs.

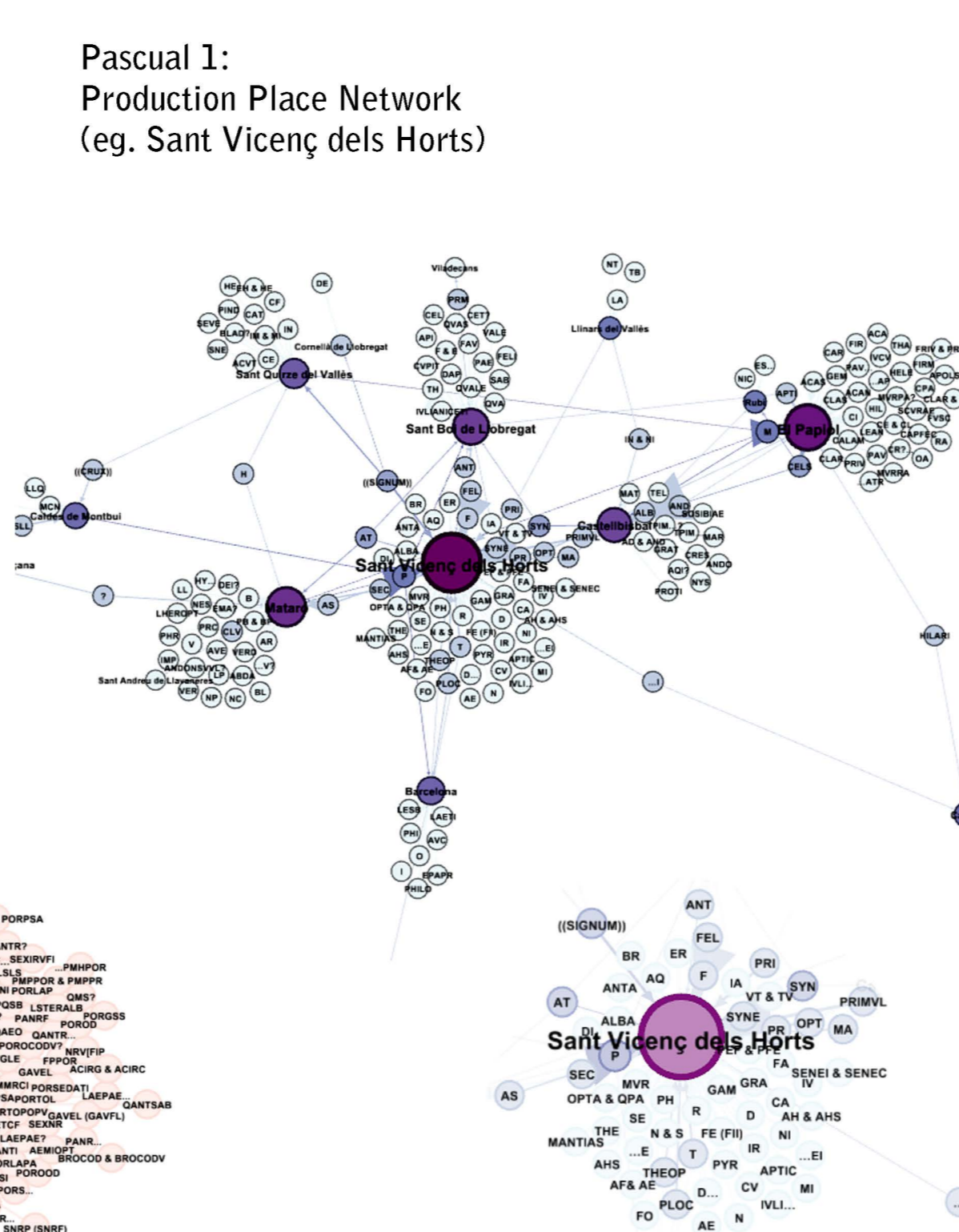
In a **second case study**, it has been proposed to analyze the possible organization of the Baetica producing workshops (Coto-Sarmiento et al., 2018; Coto-Sarmiento et al., In press) by studying the production of stamped amphoras. Transcending the typological study of the massive industrial production of the Dressel 20 that shows the similarity throughout the Guadalquivir valley, the study of the stamps of each pottery would confirm a system of own marking at the organizational level. This phenomenon is seen in the construction of the network, very independent of each other. This organizational network of the Baetica figurines could be transferred to other ceramic productions such as Pascual 1 in the Laietania region or the Brindisi amphoras in Brindisi.

In the **first network** we have ignored the materials found in the producing places of the Baetica. Likewise, in the first visualization we represent the total of DR20 collected in the CEIPAC database (+16,000), making itself present in Rome, an important consumer center where the largest number of amphoras with known epigraphy have been found (thanks to the excavations of Monte Testaccio). Next, the representation of this general network would show the groupings of these materials by regions, key for the development of the hypotheses of their distribution. The results of this case study confirm that the provincial structure had a relevant, if not decisive, weight in the organization of the olive oil trade. Particularly important is the pattern of similarities between the Atlantic provinces (Britannia, Germania Inferior, Germania Superior and Mauretania), in contrast to the supply route that would have the Rhone as the driving axis, perhaps more used in the first decades of the Roman expansion to the center of Europe or for other products. Hence, the network shows some approximation to the materials found in the area of Gaul where the Rhone runs, or in its vicinity.

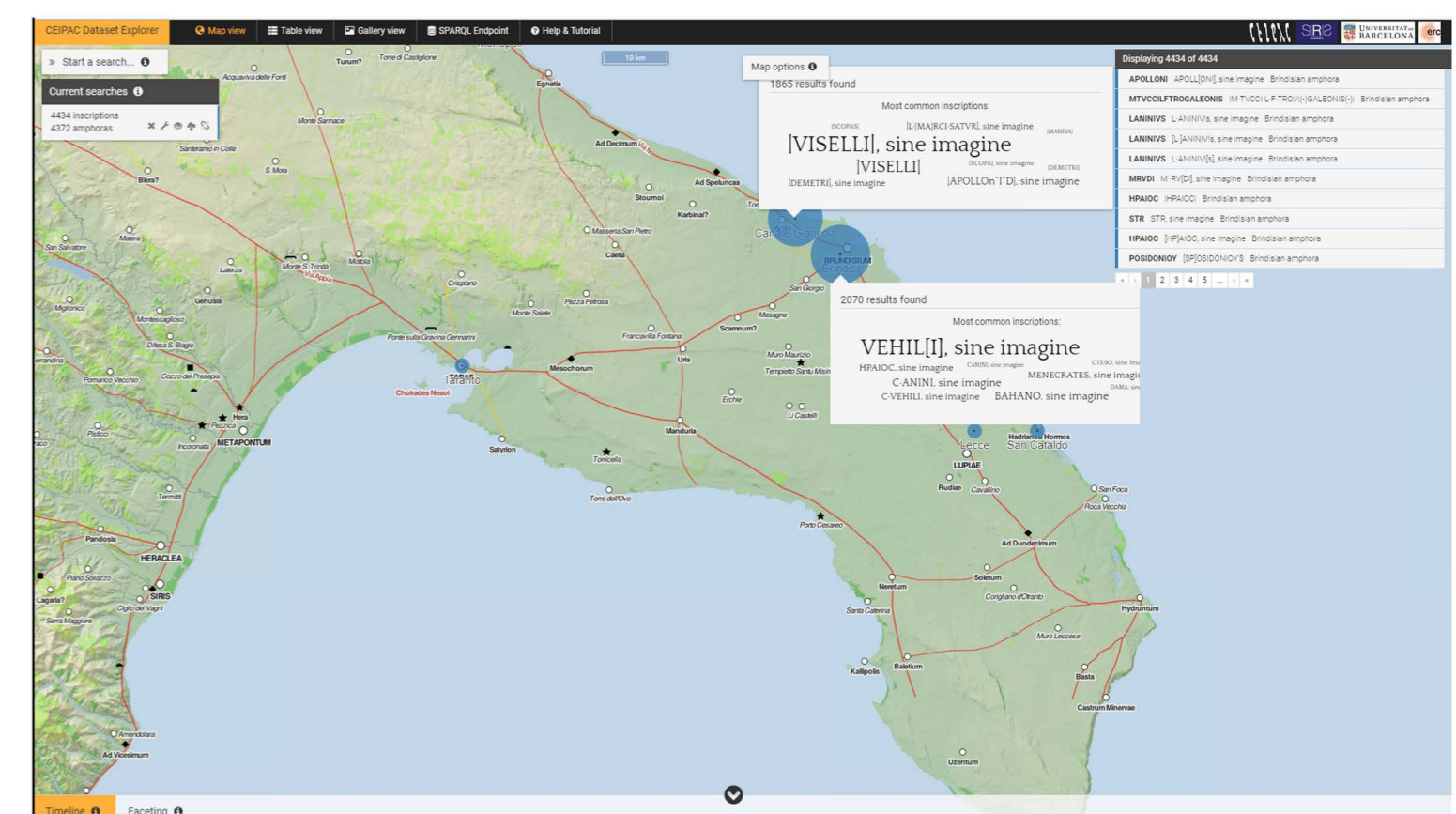
Dressel 20: Production Place Network (eg. La Catria)



Pascual 1: Production Place Network (eg. Sant Vicenç dels Horts)



Brindisi amphoras: Production Place Visualization (eg. Apani - Giancola)



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Project Founded

- Economic and Political Networks (EPNet Project) (ERC-2013-ADG-340828)
- Relaciones Interprovinciales en el Imperio Romano.
- Producción y comercio de alimentos hispanos (Provinciae Baetica et Tarraconensis) (HAR2017-85635-P)
- Centro para el Estudio de la Interdependencia Provincial en la Antigüedad Clásica (CEIPAC) (2017 SGR 512)
- Dinàmiques socioeconòmiques del món rural romà: formes d'habitat i cultura material al litoral central català (CLT009/18/00045)