The Maritime Mobility of Individuals and Objects: Networks and Entanglements

Workshop "Theory and Models", SPP 1630

„Häfen von der Römischen Kaiserzeit bis zum Mittelalter“

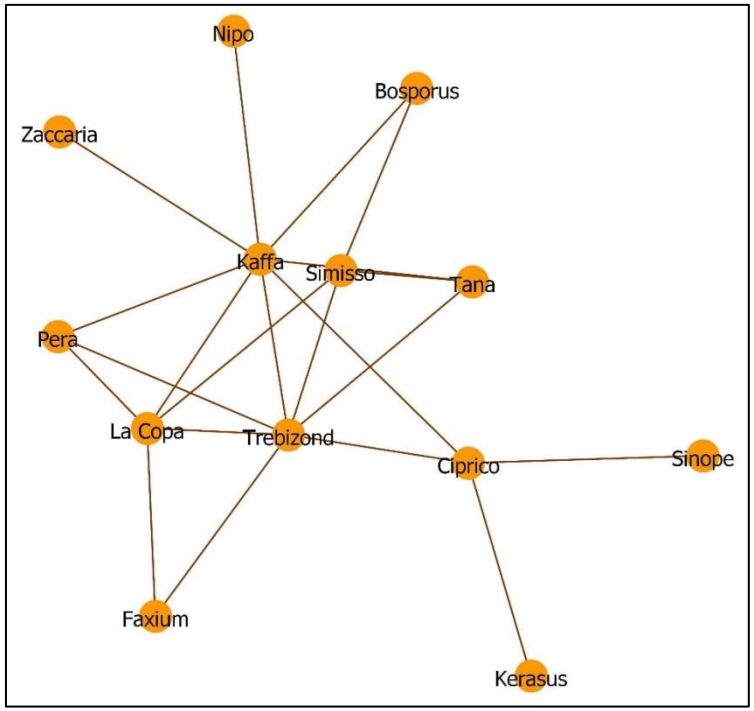
Johannes Preiser-Kapeller,

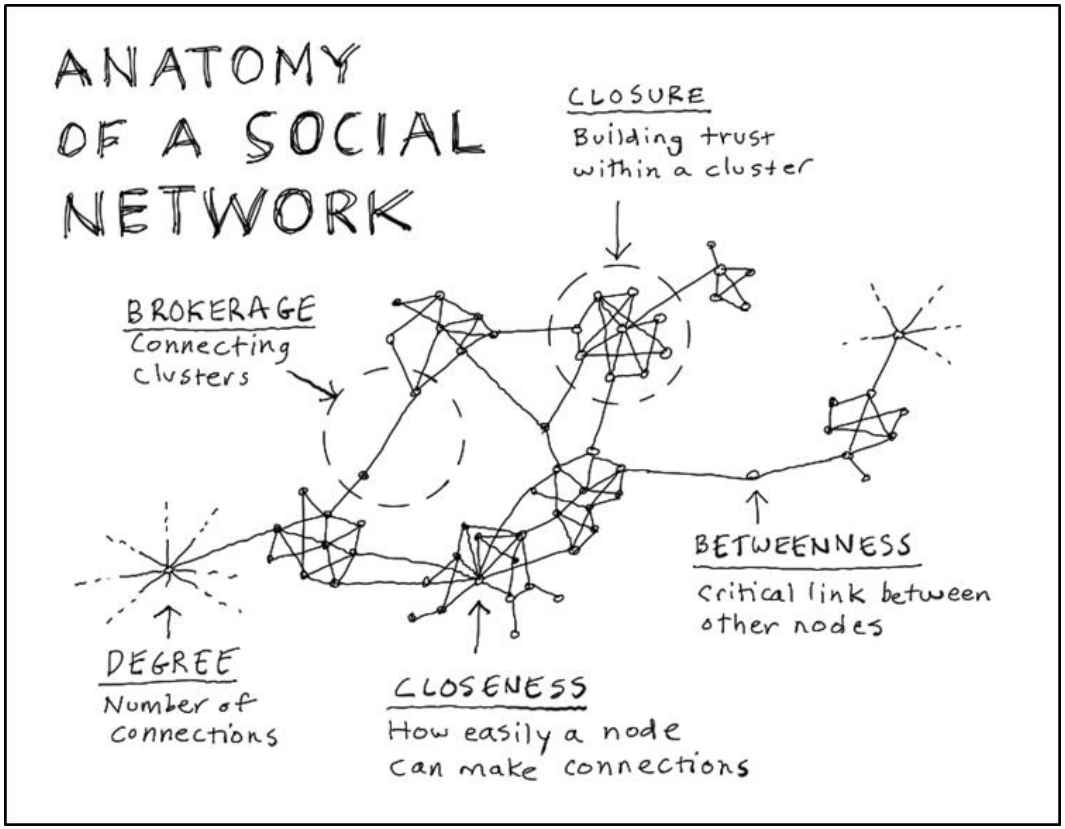
RGZM/ÖAW

Outline of presentation

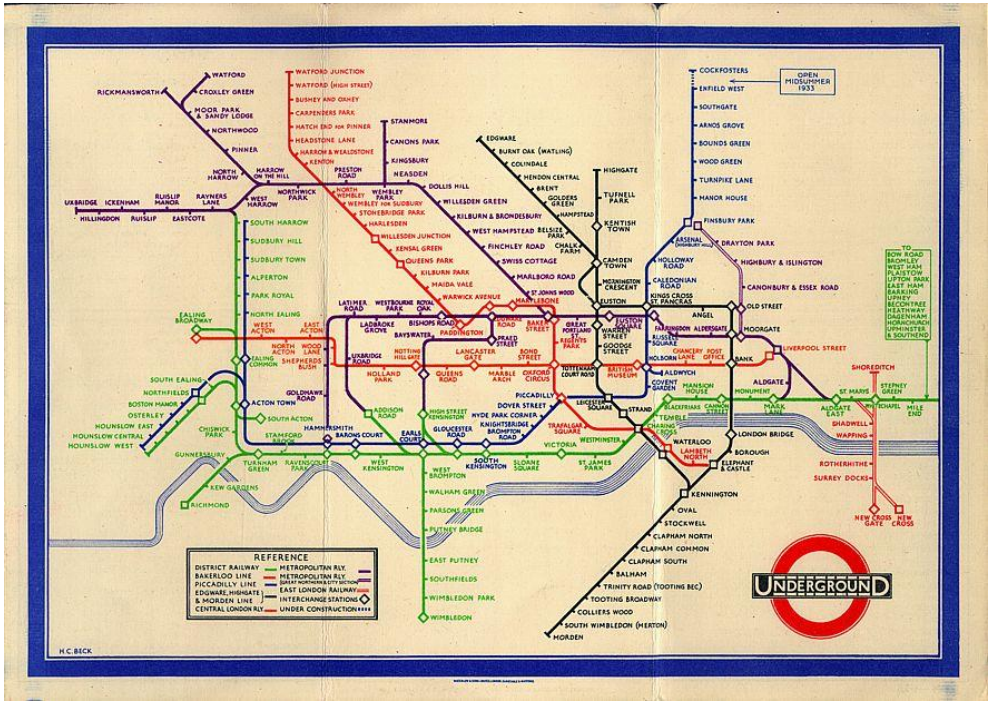
- **Networks and Space: a short introduction**
- **Connecting ports: one ship (entangling individuals and objects in the Middle Ages)**
- **Connecting ports: 60 ships (Genoese maritime traffic in the Black Sea, 1290)**
- **Connecting ports: trading diasporas (the mercantile community of Ragusa/Dubrovnik, 1250-1450)**
- **Connecting ports: 792 anchorages, harbours and ports (a model of cabotage and connectivity in the ancient and medieval Aegean)**
- **Conclusion**

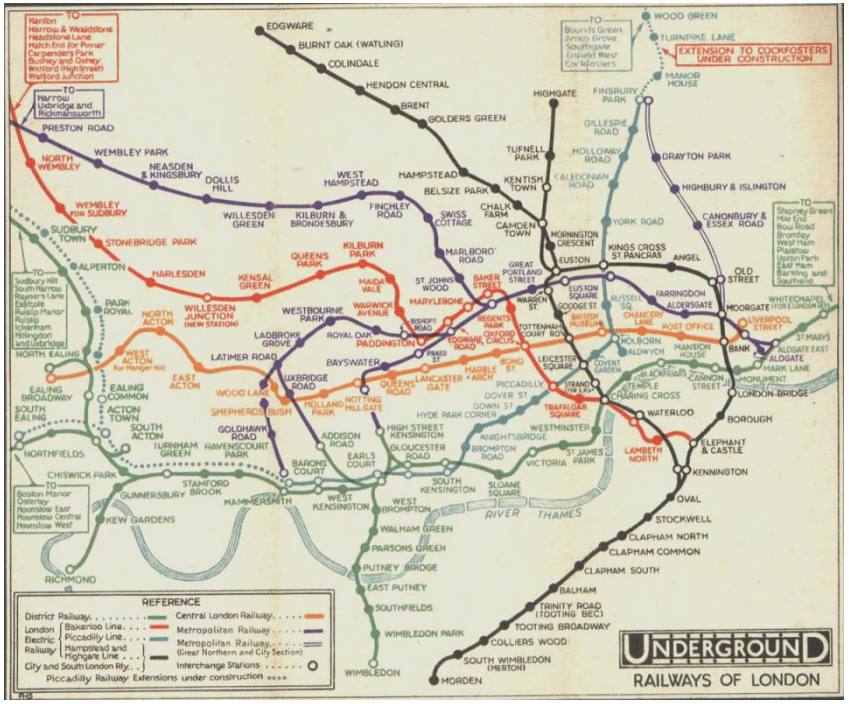
Networks and space: a short introduction



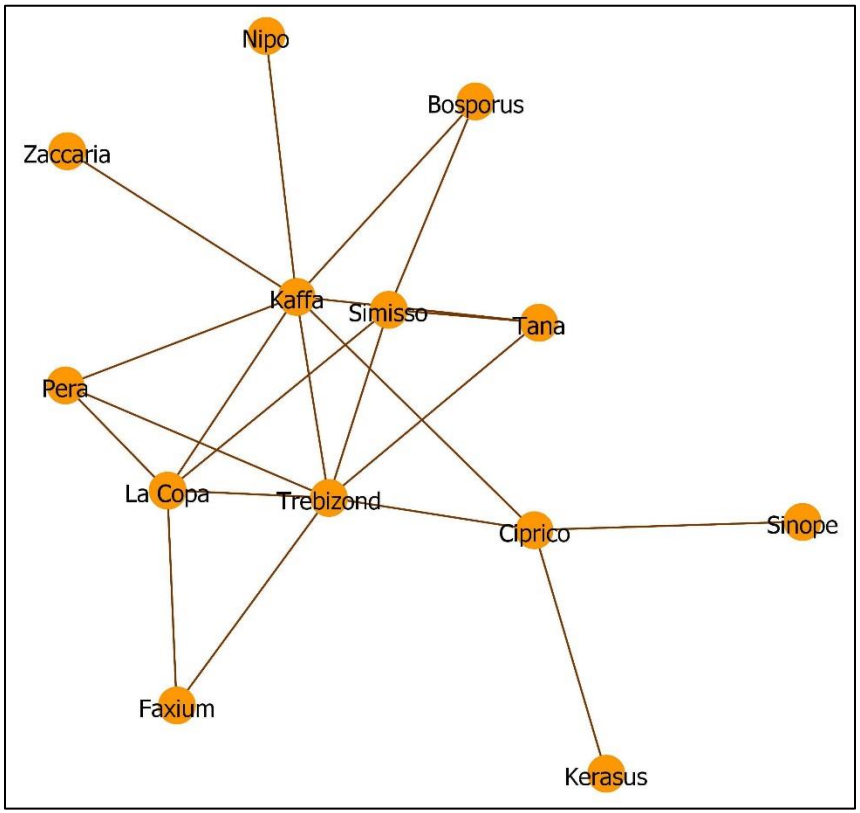


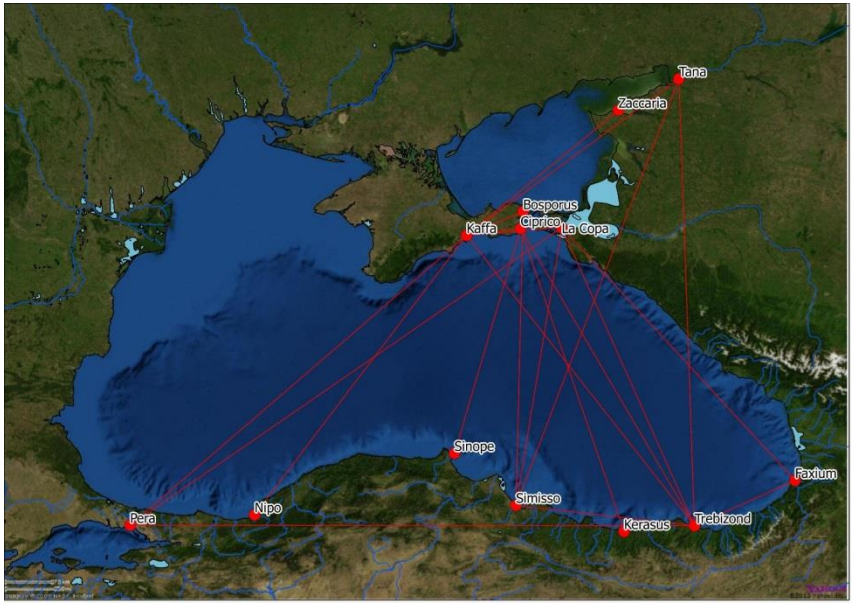
Topological and topographical model





Networks and spatial distance





Connecting ports: one ship.

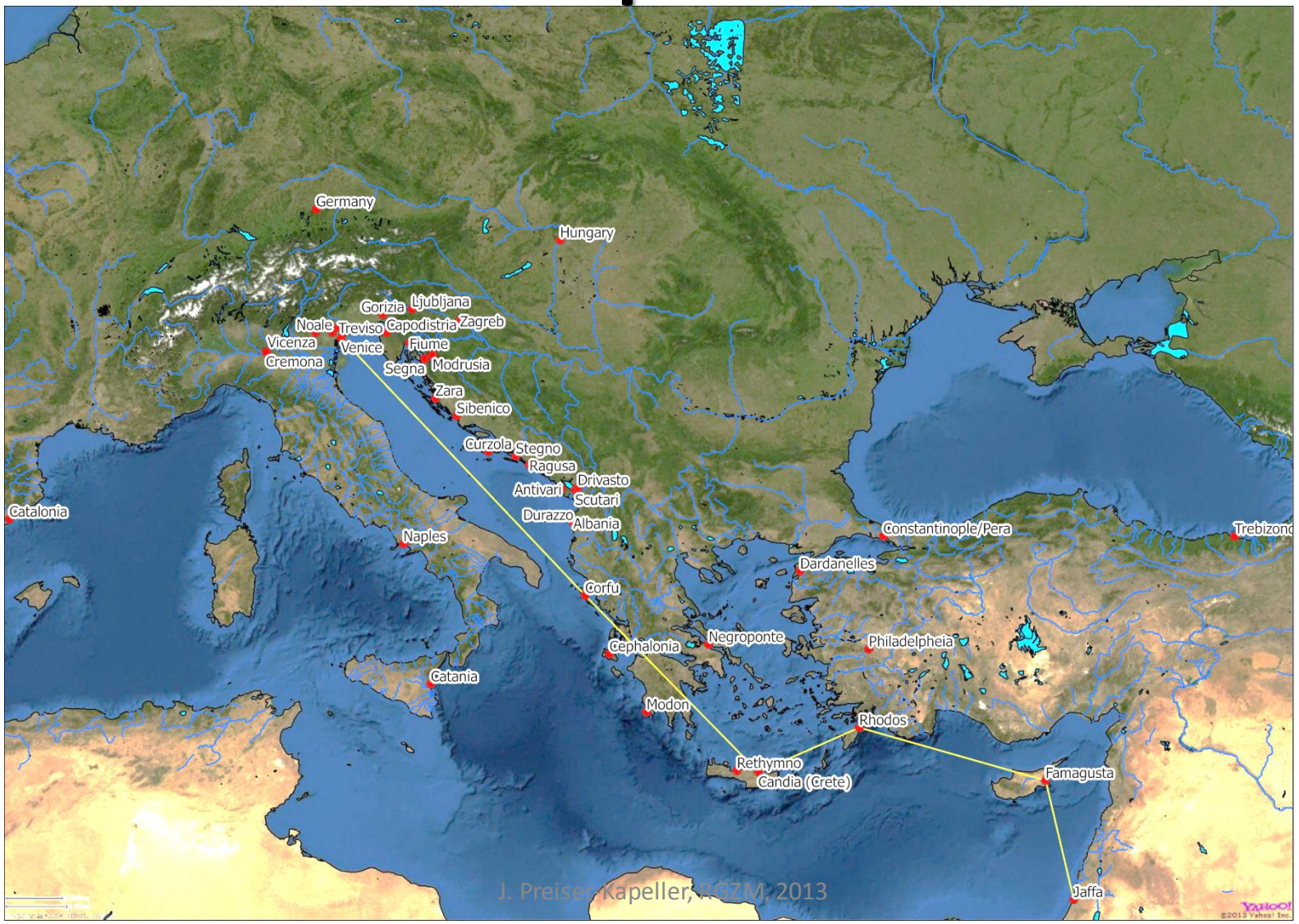
The mobile social network

of a Venetian ship (1414)

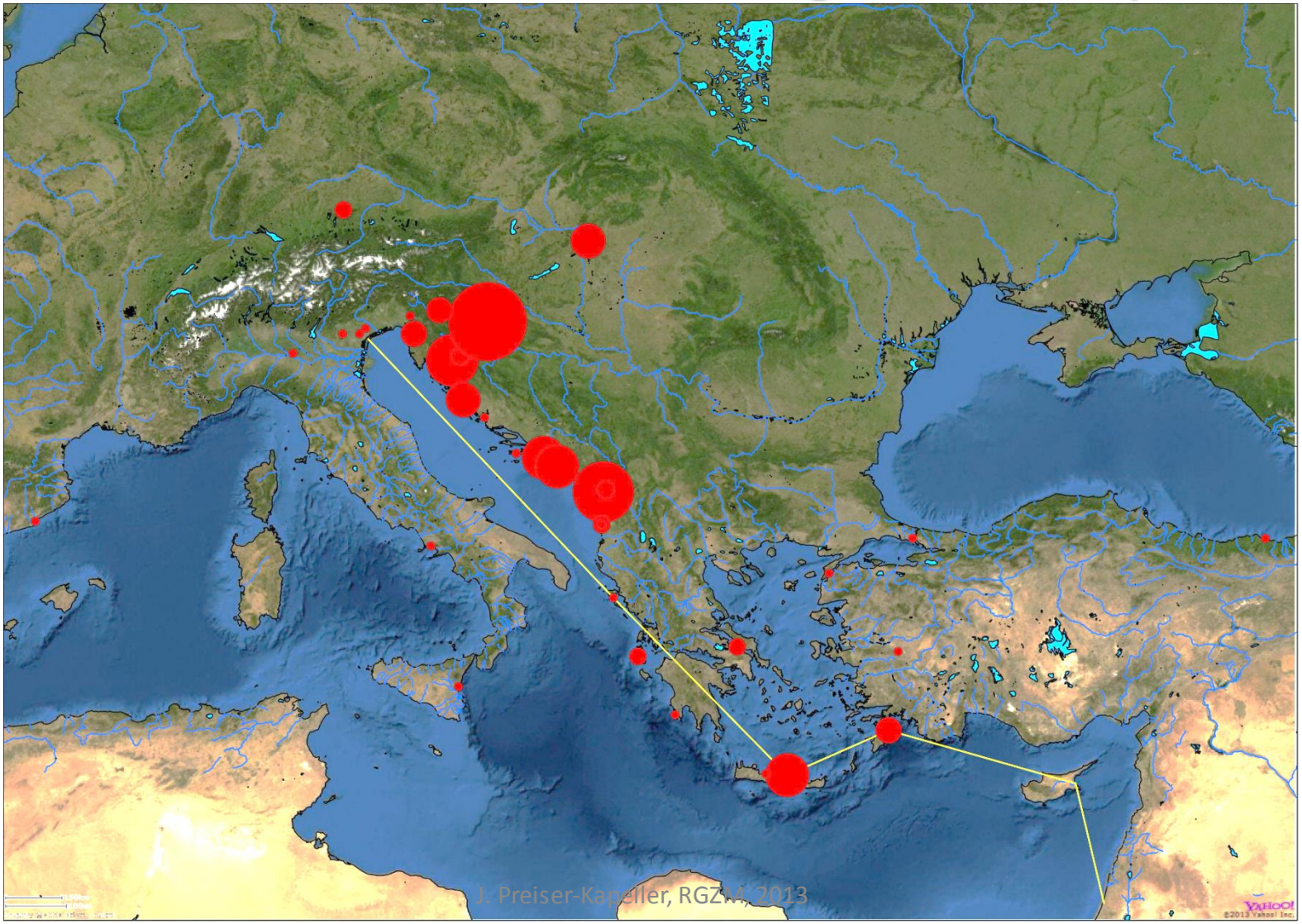
(Illustration: a 15th century Venetian "Galley of the Romania" as described by Michael of Rhodes, cf. http://brunelleschi.imss.fi.it/michaelofrhodes/ships_galleys.html)

The route of the ship of 1414 from Venice to Jaffa

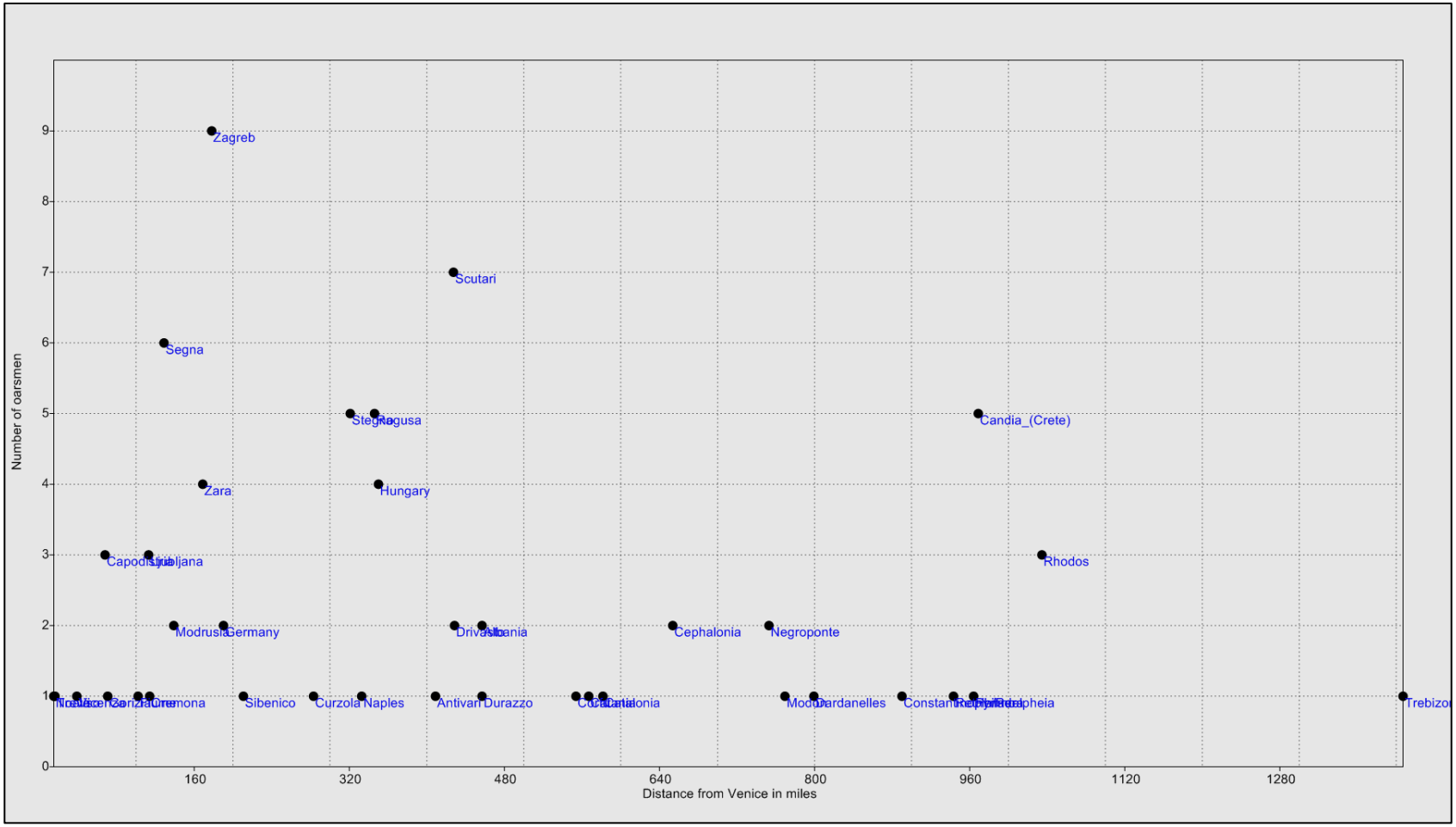
Places of origin of oarsmen serving on the ship in 1414



The route of the ship from Venice to Jaffa and the places of origin of the oarsmen (scaled according to the number of men coming from there)



The distance of localities to Venice and the respective number of oarsmen coming from there



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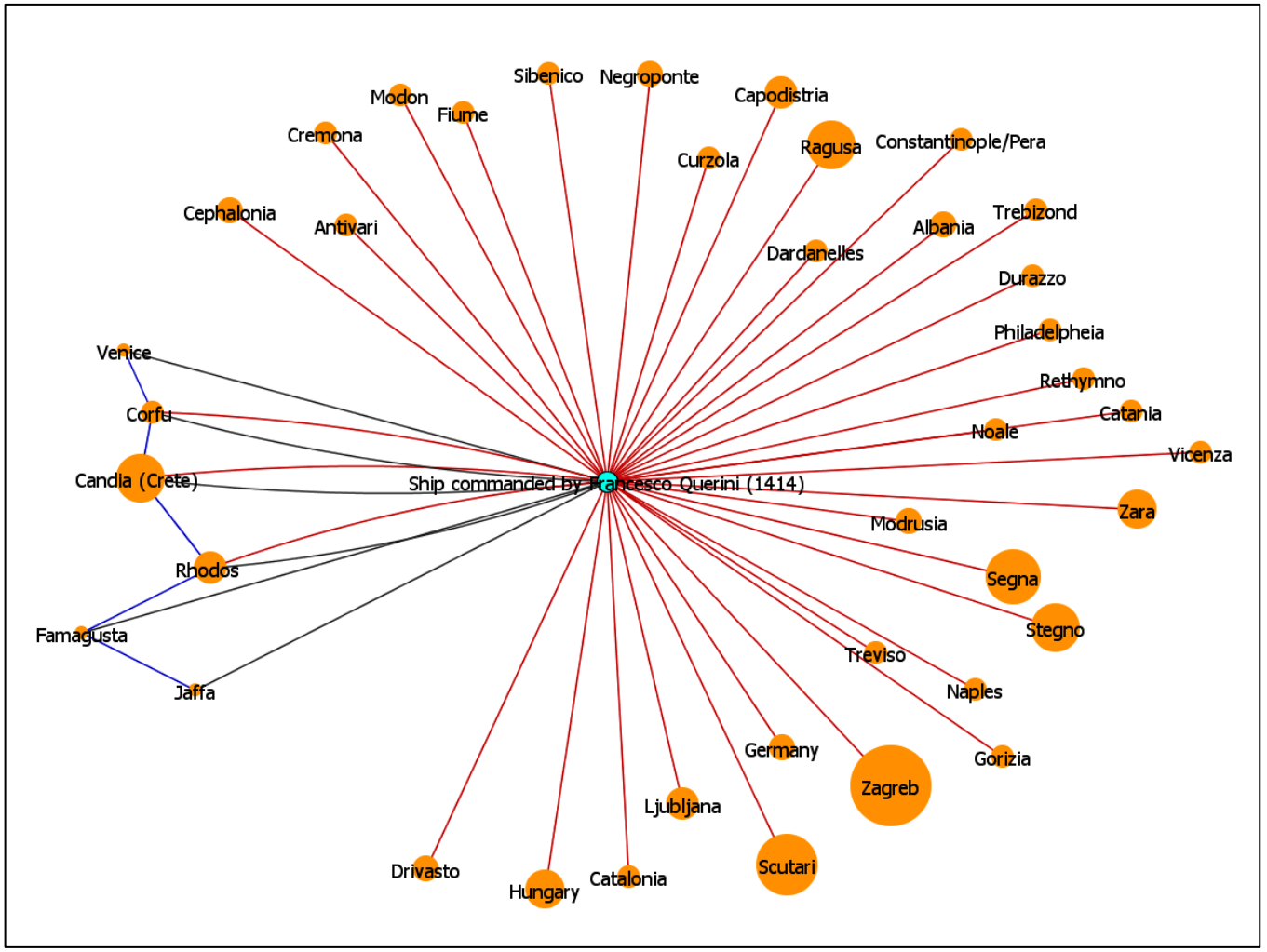
“The ship as the heterotopia par excellence”

- ***“juxtaposing different places that are in themselves incompatible in a single real place”*** **(Foucault; cf. Van de Noort, 2011)**

Visualisation of the network of localities assembled on and by the ship of 1414 on the basis of the places of origin (nodes scale according to the number of men coming from there) of the oarsmen and the ports on its route (blue links) from Venice to Jaffa



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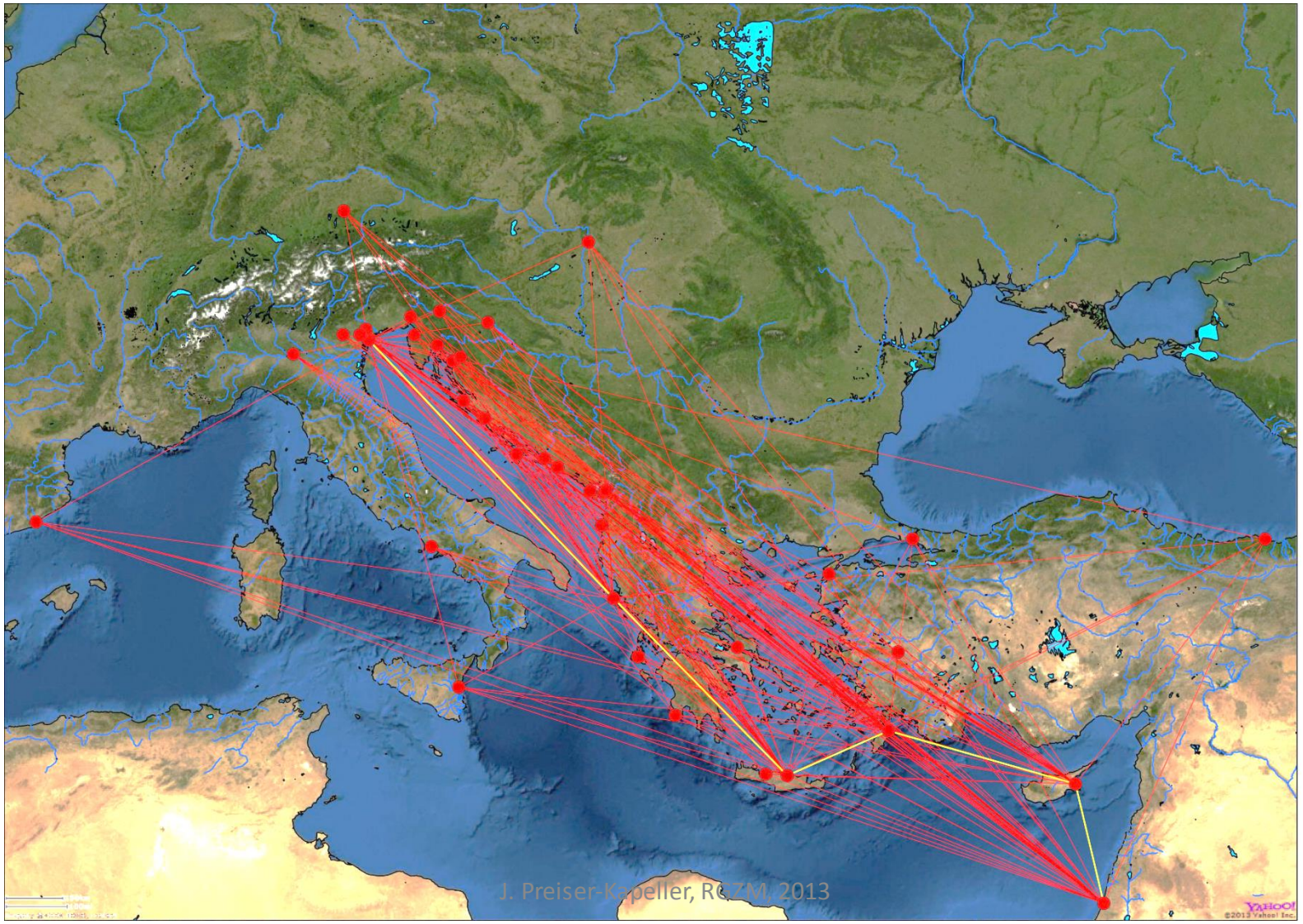
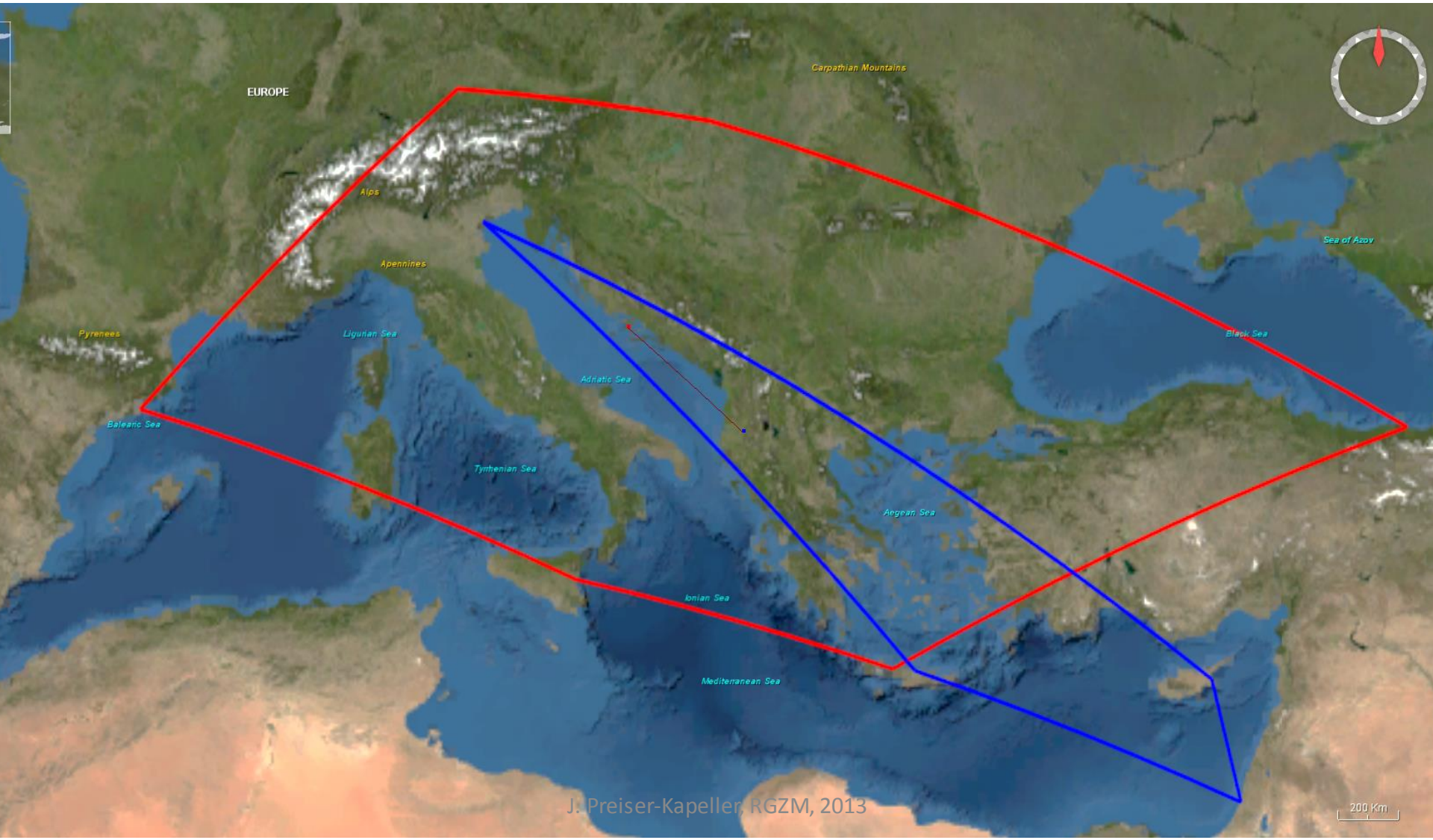
The web of entanglements created by the ship on the basis of the mobility of its crew and of the ship itself



Two zones of connectivity: the route of the ship and the entanglements of the crew



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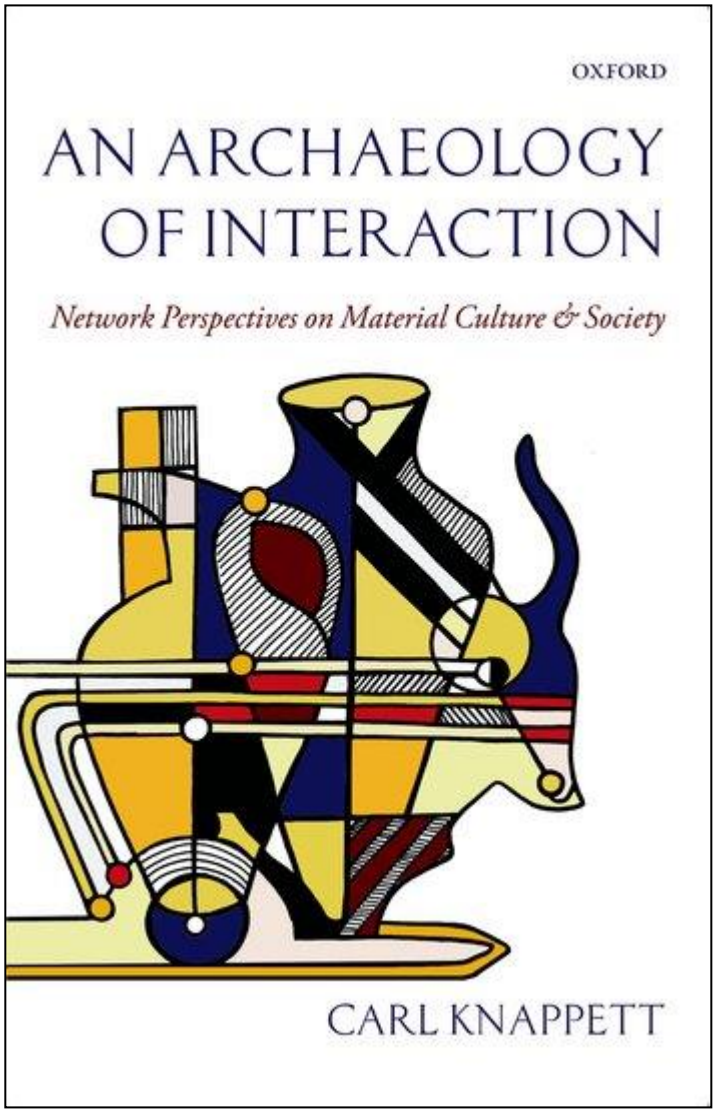
Globalising the Local – Localising the Global

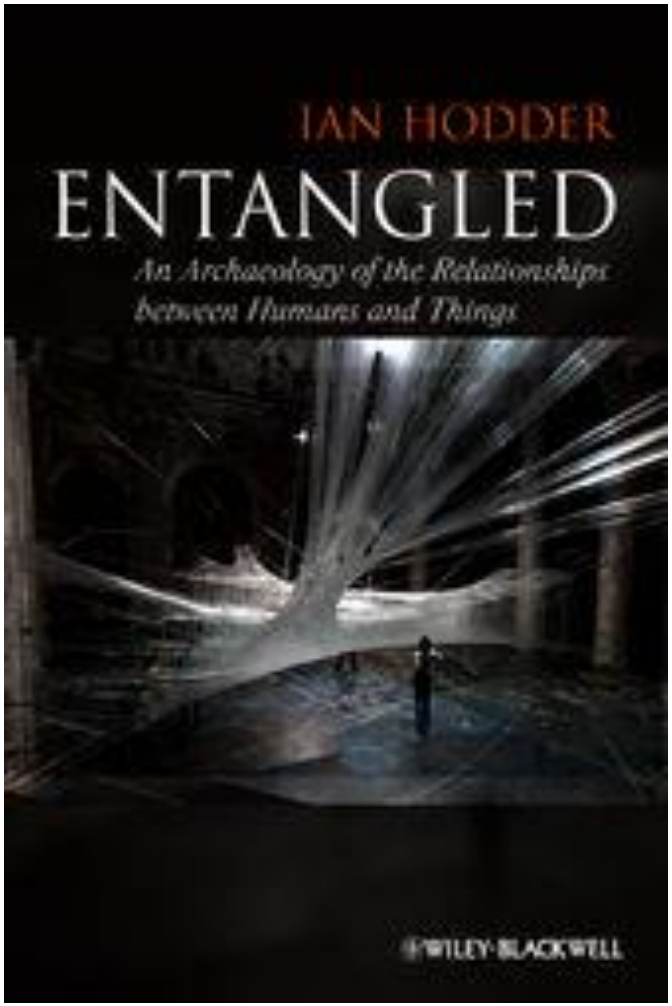
- "*we have to lay continuous connections leading from one local interaction to the other places, times, and agencies through which a local site is made to do something. (…) If we do this, we will render visible the long chains of actors linking sites to one another without missing a single step. It might be empirically hard but we should not expect major theoretical hurdles*." (Bruno LATOUR, *Reassembling the Social. An Introduction to Actor-Network-Theory*. Oxford 2005, p. 173)
- "*assemblages as groups of artefacts that serve to span space and time*" (KNAPPETT 2011, p. 104)

Globalising the Local – Localising the Global

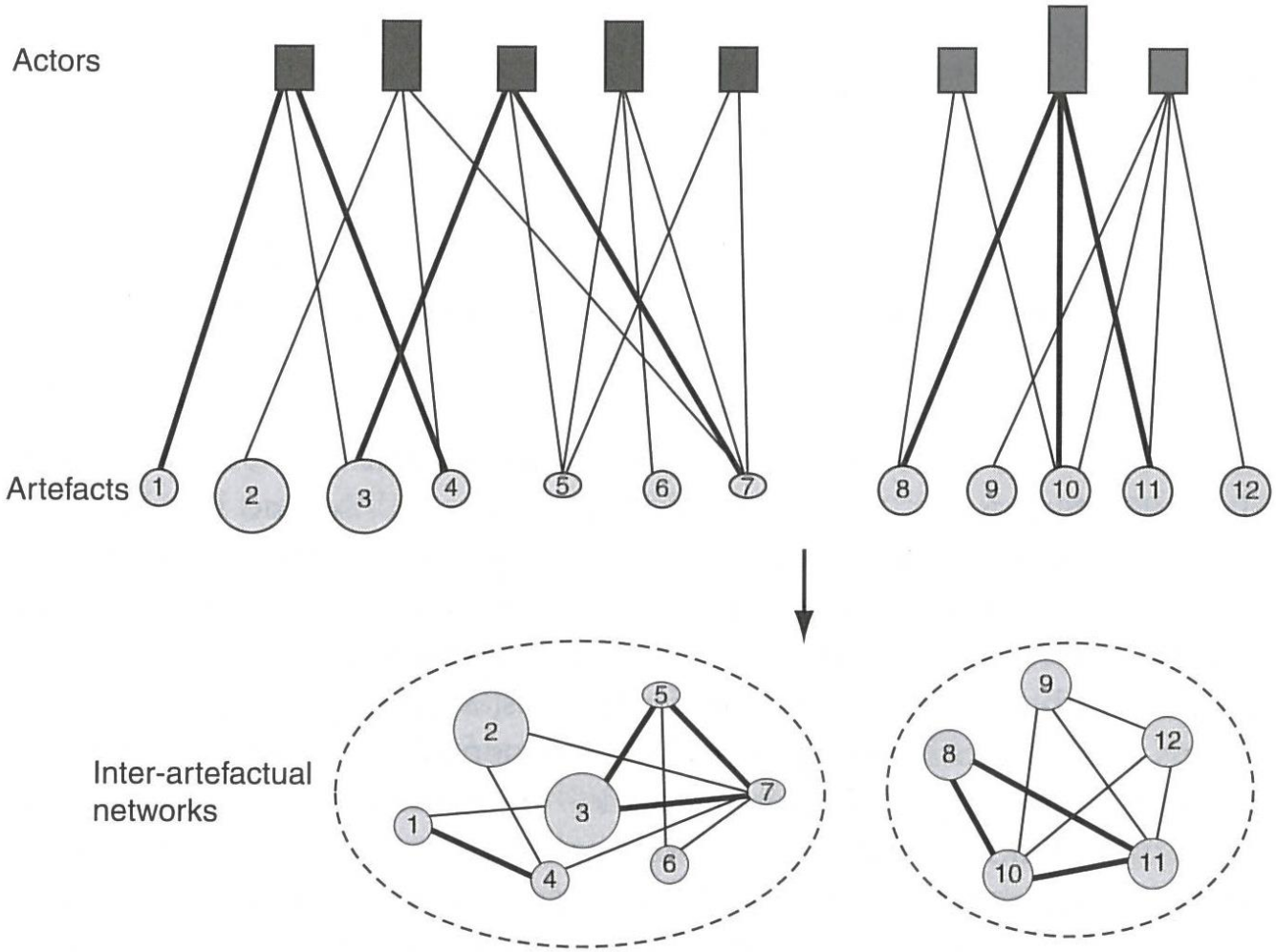
"*First, no interaction is what could be called isotopic. What is acting at the same moment in any place is coming from many other places, many distant materials, and many faraway actors. If we wanted to project on a standard geographical map the connections established between a lecture hall and all the places that are acting in it at the same time, we would have to draw bushy arrows in order to include, for instance, the forest out of which the desk is coming, the management office in charge of classroom planning, the workshop that printed the schedule that has helped us find the room, the janitor that tends the place, and so on. And this would not be some idle exercise, since each of these faraway sites has, in some indispensable way, anticipated and preformatted this hall by transporting, through many different sorts of media, the mass of templates that have made it a suitable local—and that are still propping it up. Second, no interaction is synchronic. The desk might be made of a tree seeded in the 1950s that was felled two years ago; the cloth of the teacher's dress was woven five years ago, while the firing of neurons in her head might be a millisecond old and the area of the brain devoted to speech has been around for a good hundred thousands years (…)Time is always folded. (…) No wonder interactions provided social scientists with the strong impression that they were overflowing in all directions. They are! That does not mean that some solid overarching context holds them solidly in place through the grip of some hidden structural force. It means that a bewildering array of participants is simultaneously at work in them and which are dislocating their neat boundaries in all sorts of ways, redistributing them away and making it impossible to start anywhere that can be said to be 'local'.*" (LATOUR 2005, p. 200-202)

ANT and Archaeology





Visualising entanglements with bi/multimodal network models (cf. Knappett)



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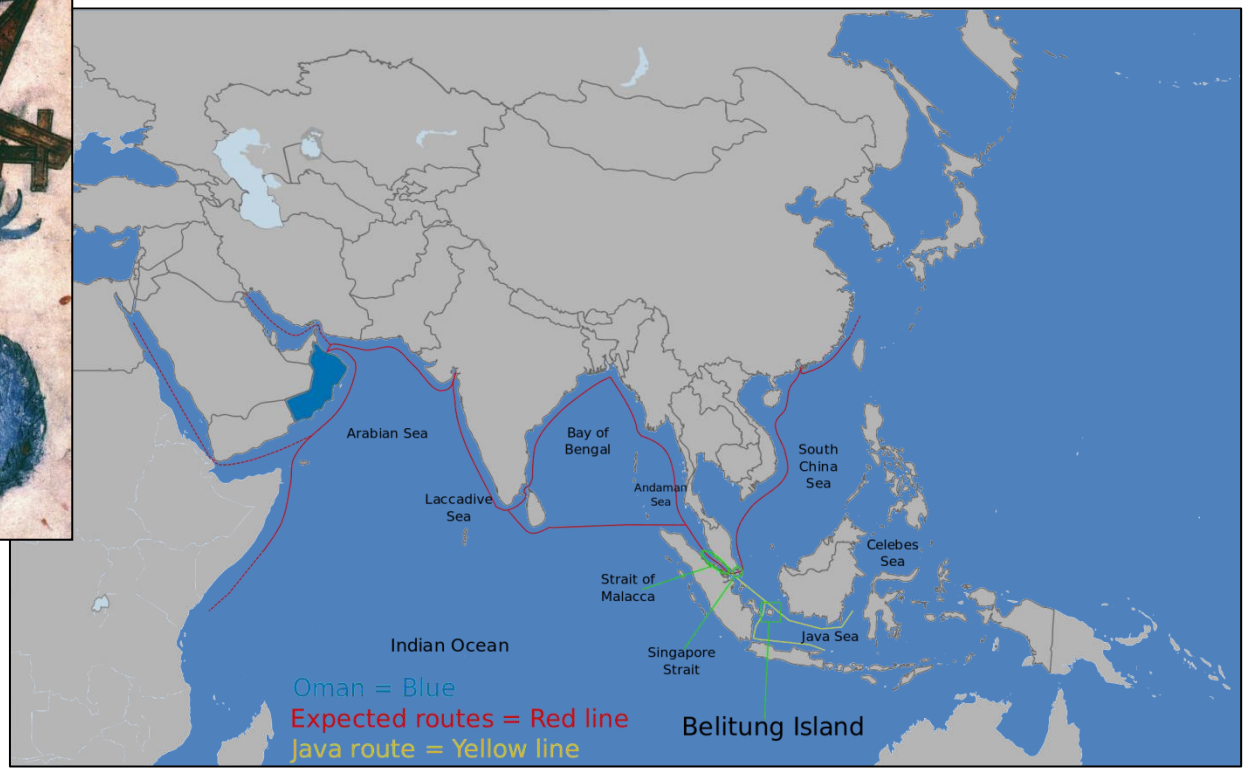
Connecting ports: one ship.
The enormous assemblage of the Belitung Shipwreck (825-850 CE)



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Chinese ceramics and other objects on an Arab ship (60,000 objects)

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The ship – a *dhow*, built with East African timber, repaired with South East Asian lumbers

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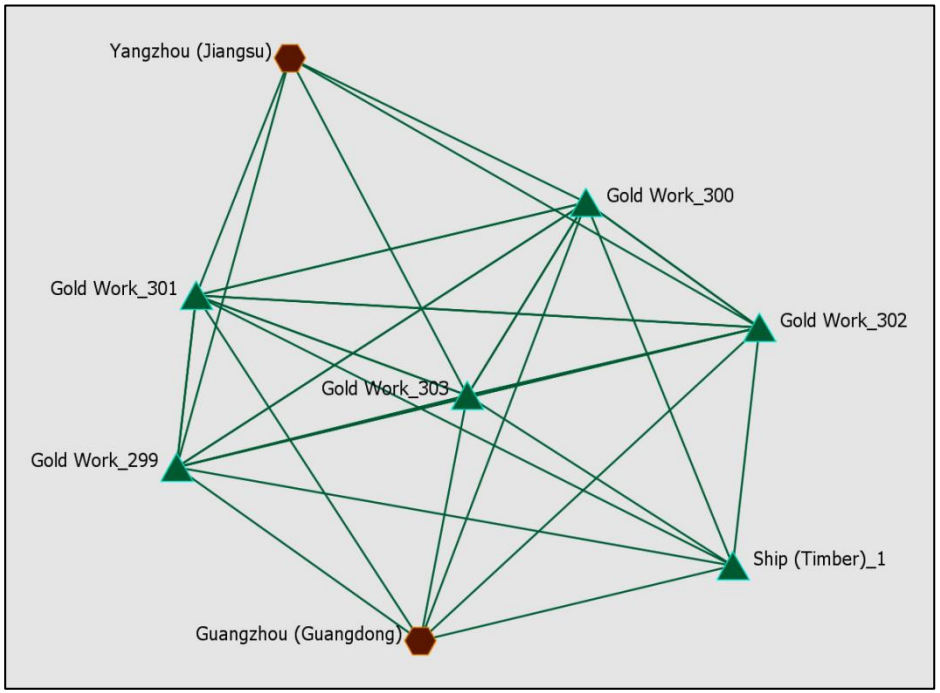
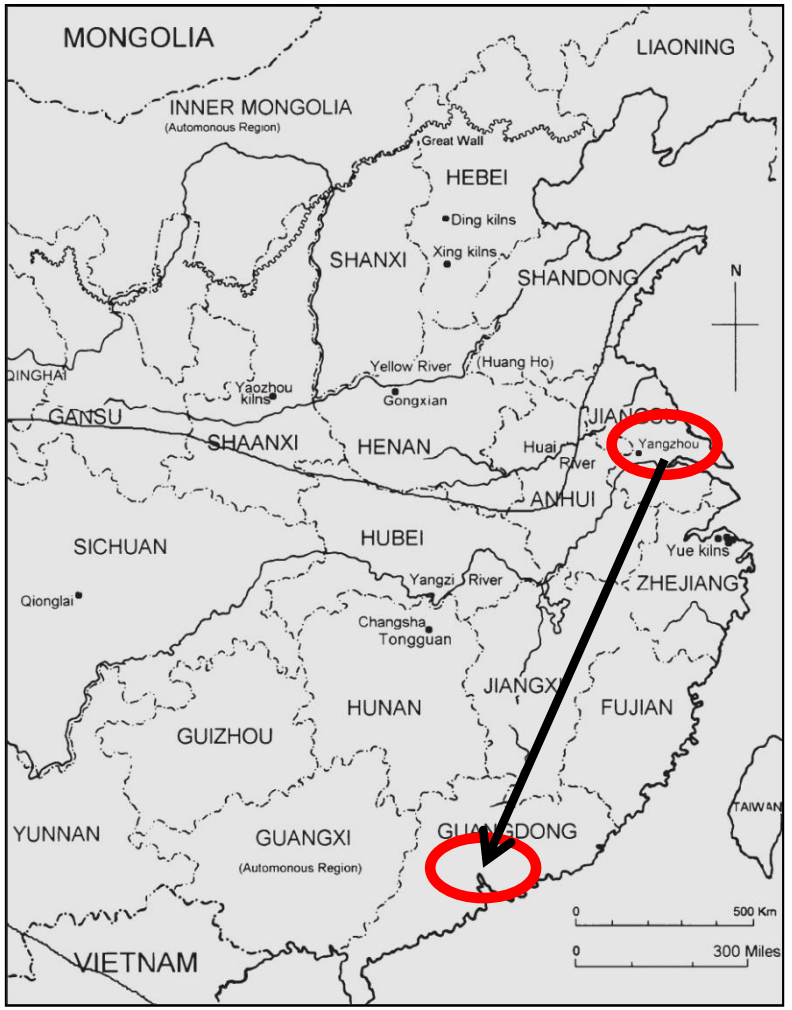
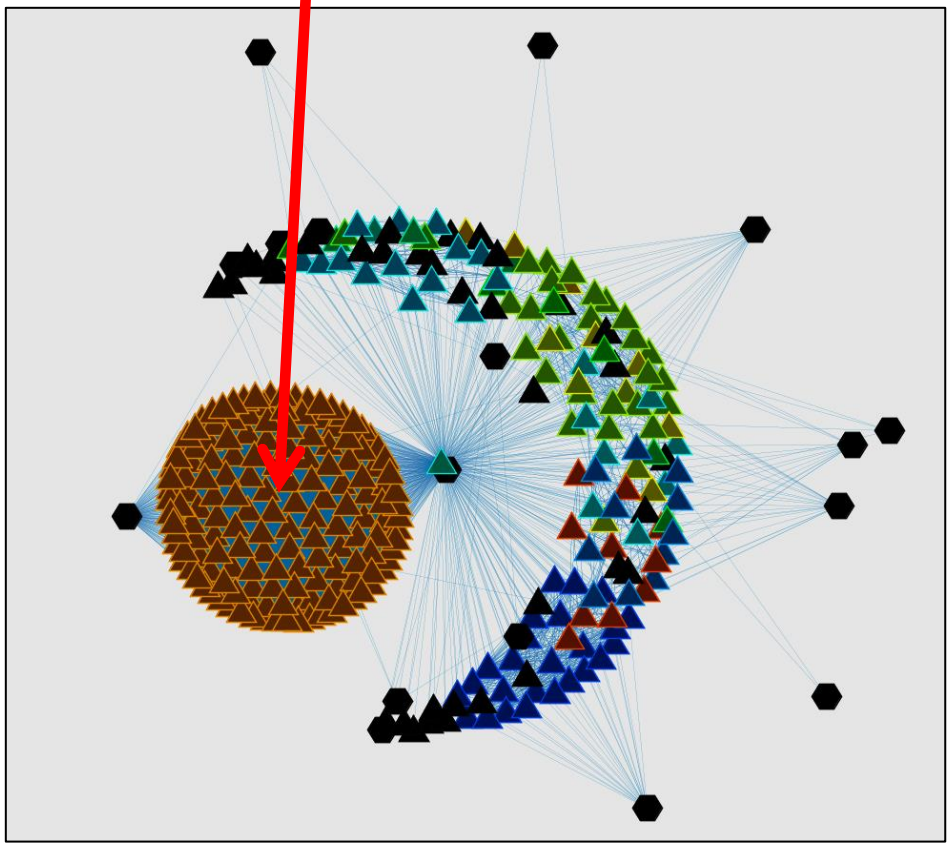
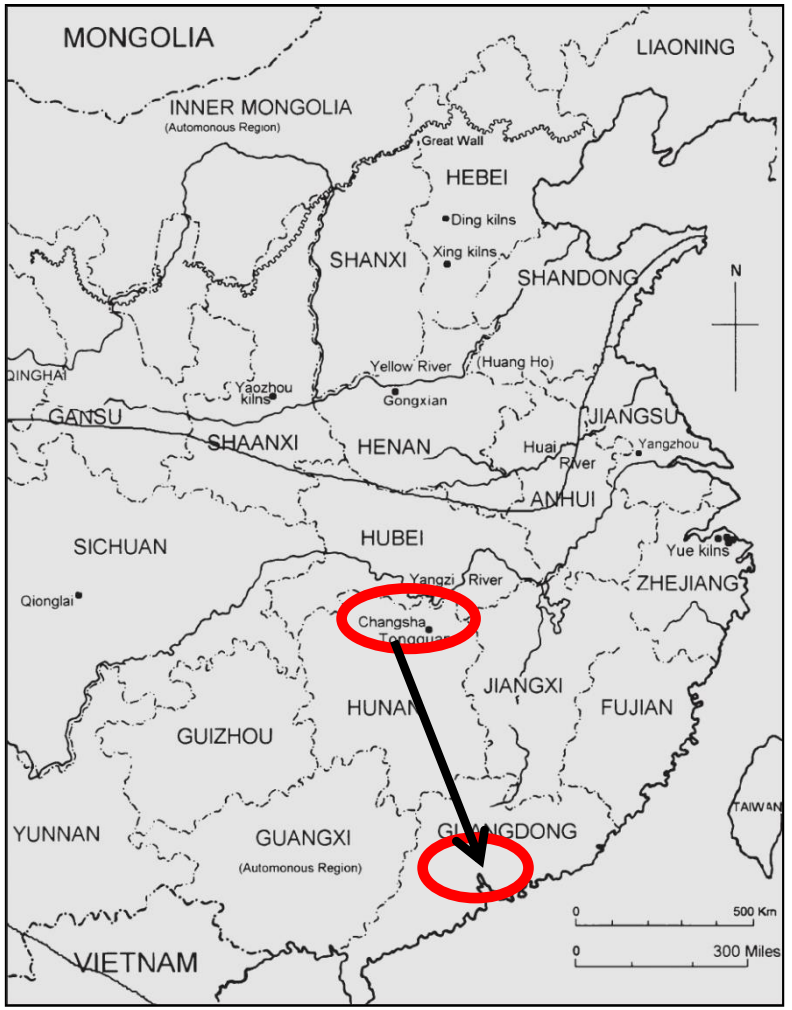
The network of a golden vessel





Changsha ware – mass production of ceramics for export





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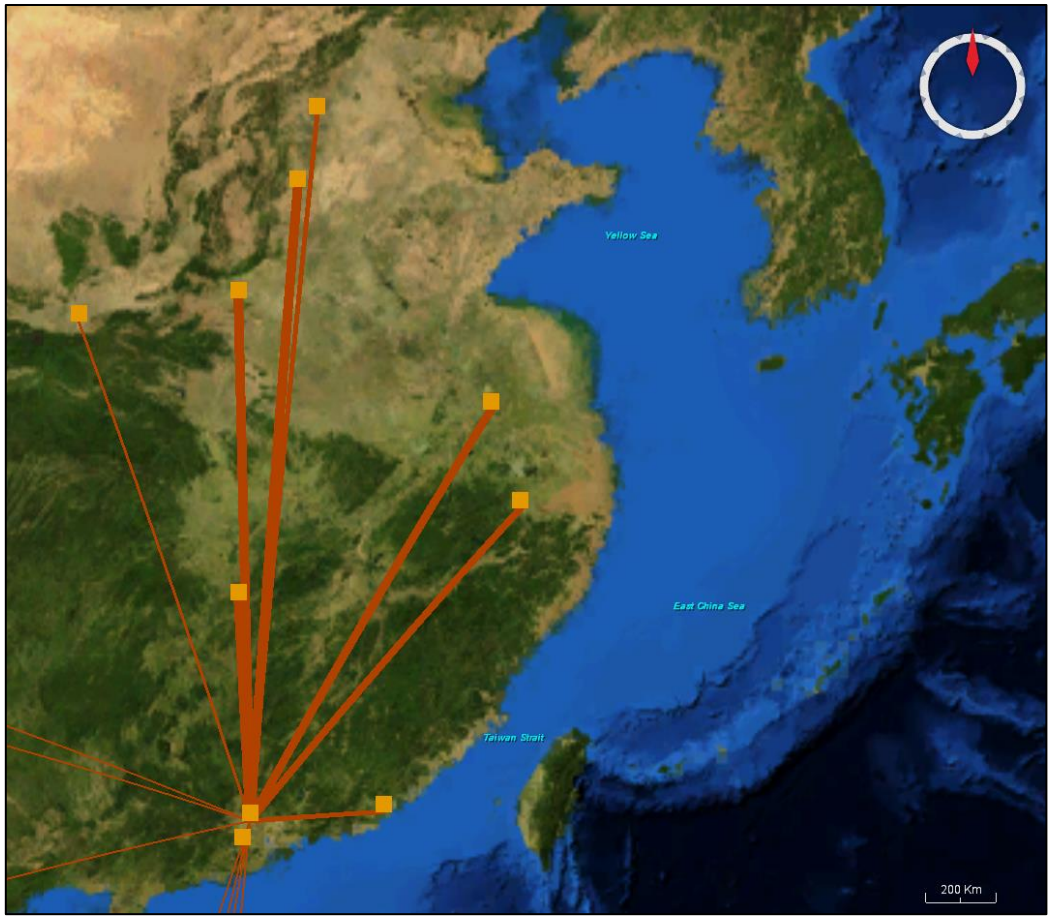
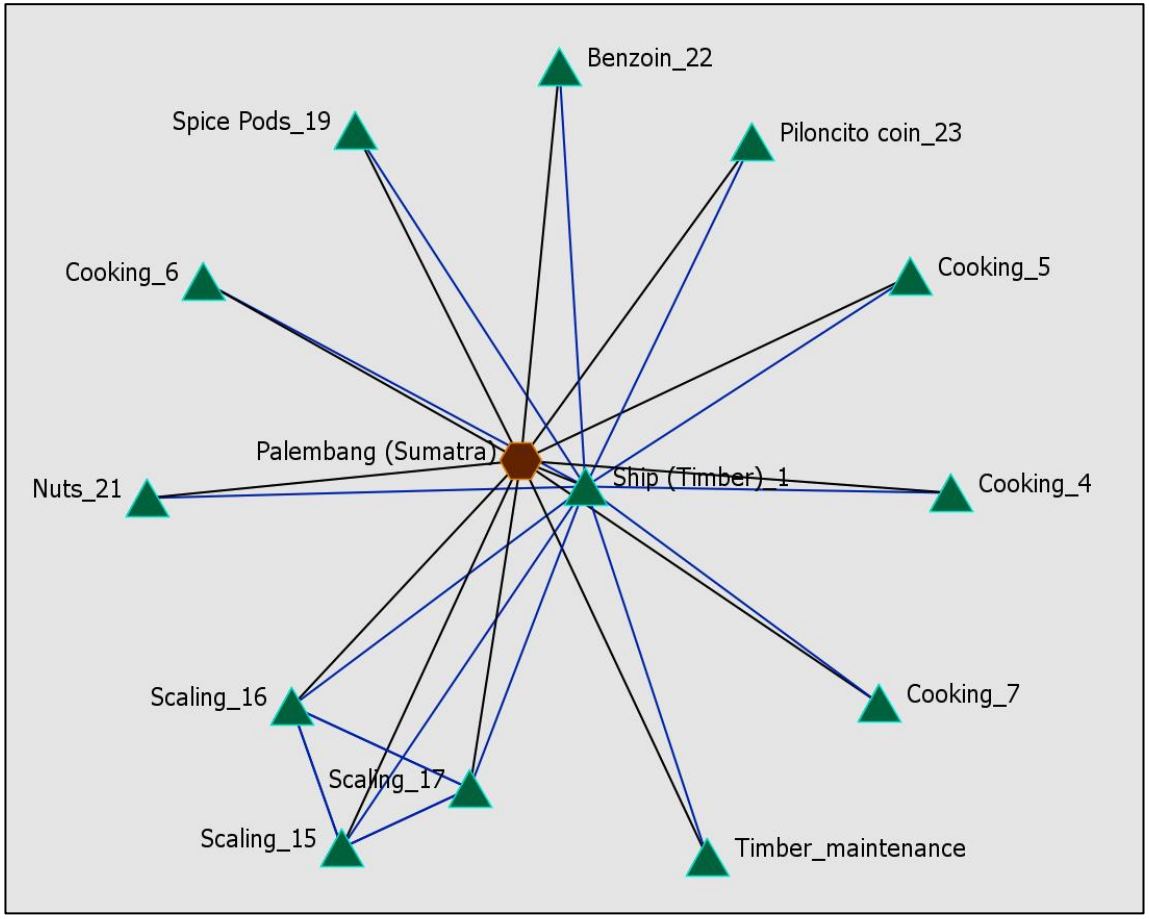
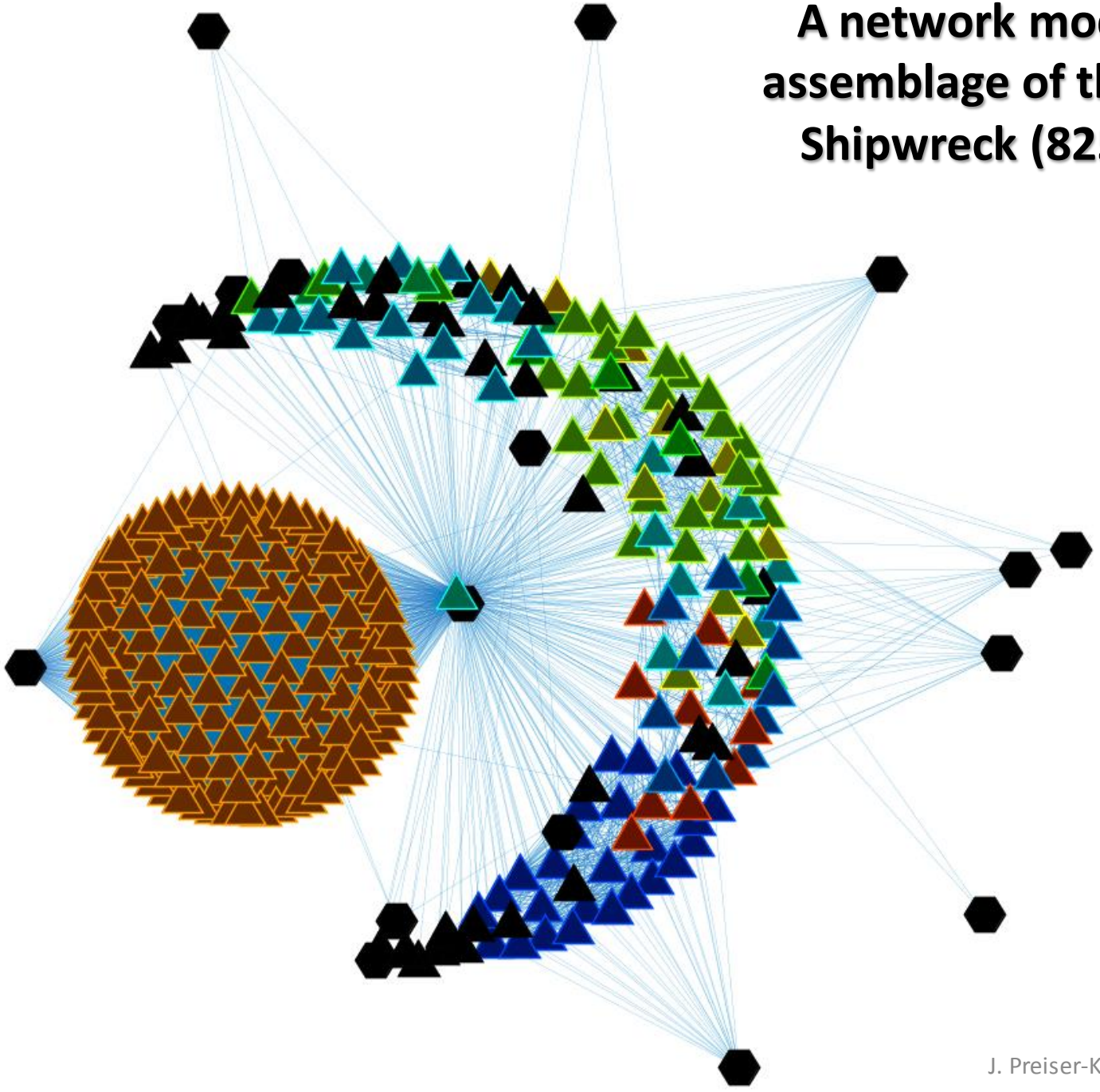
Assembling the cargo in the port of Guangzhou (Canton)



Spices, aromatic resin and tools from Sumatra



A network model of the assemblage of the Belitung Shipwreck (825-850 CE)



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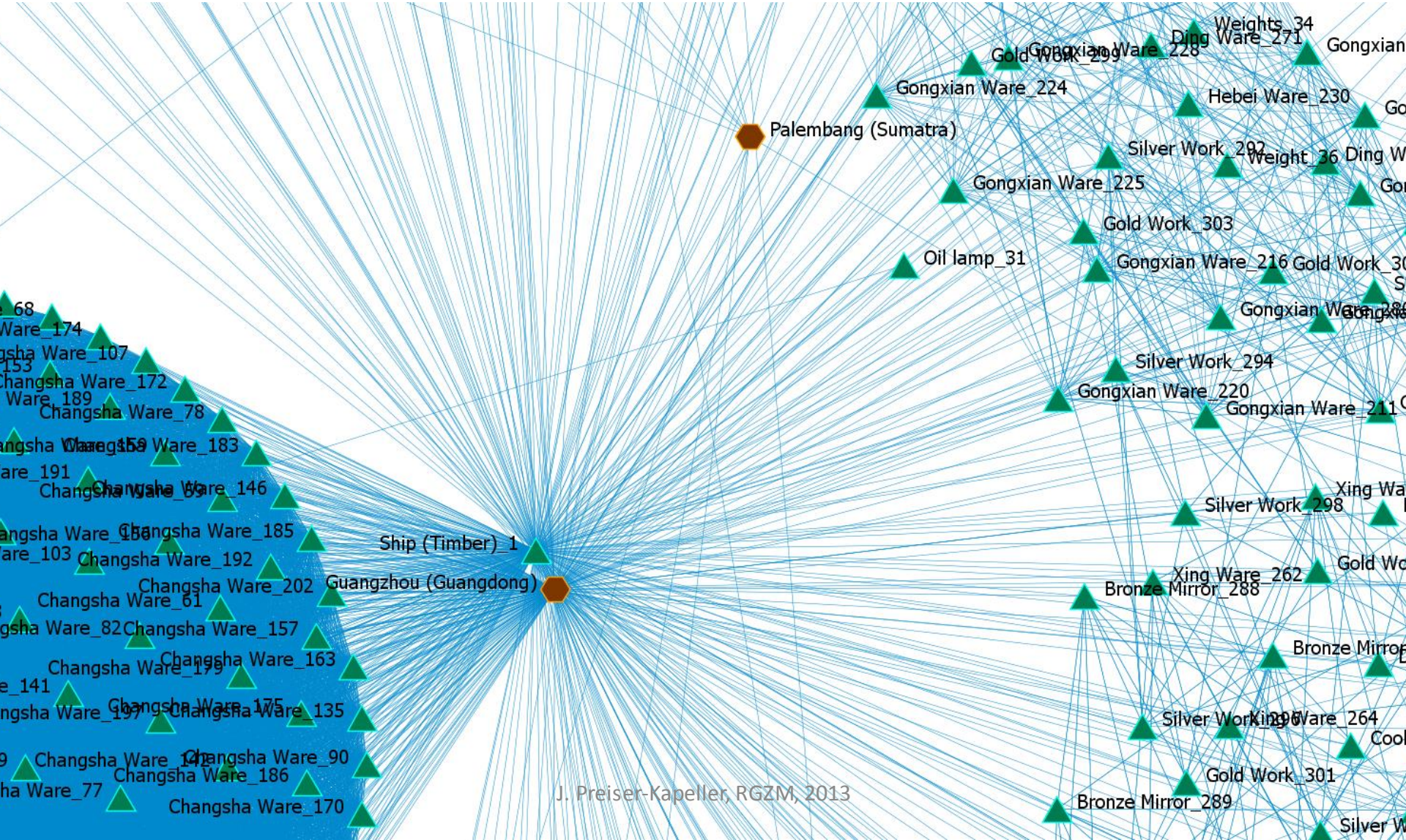

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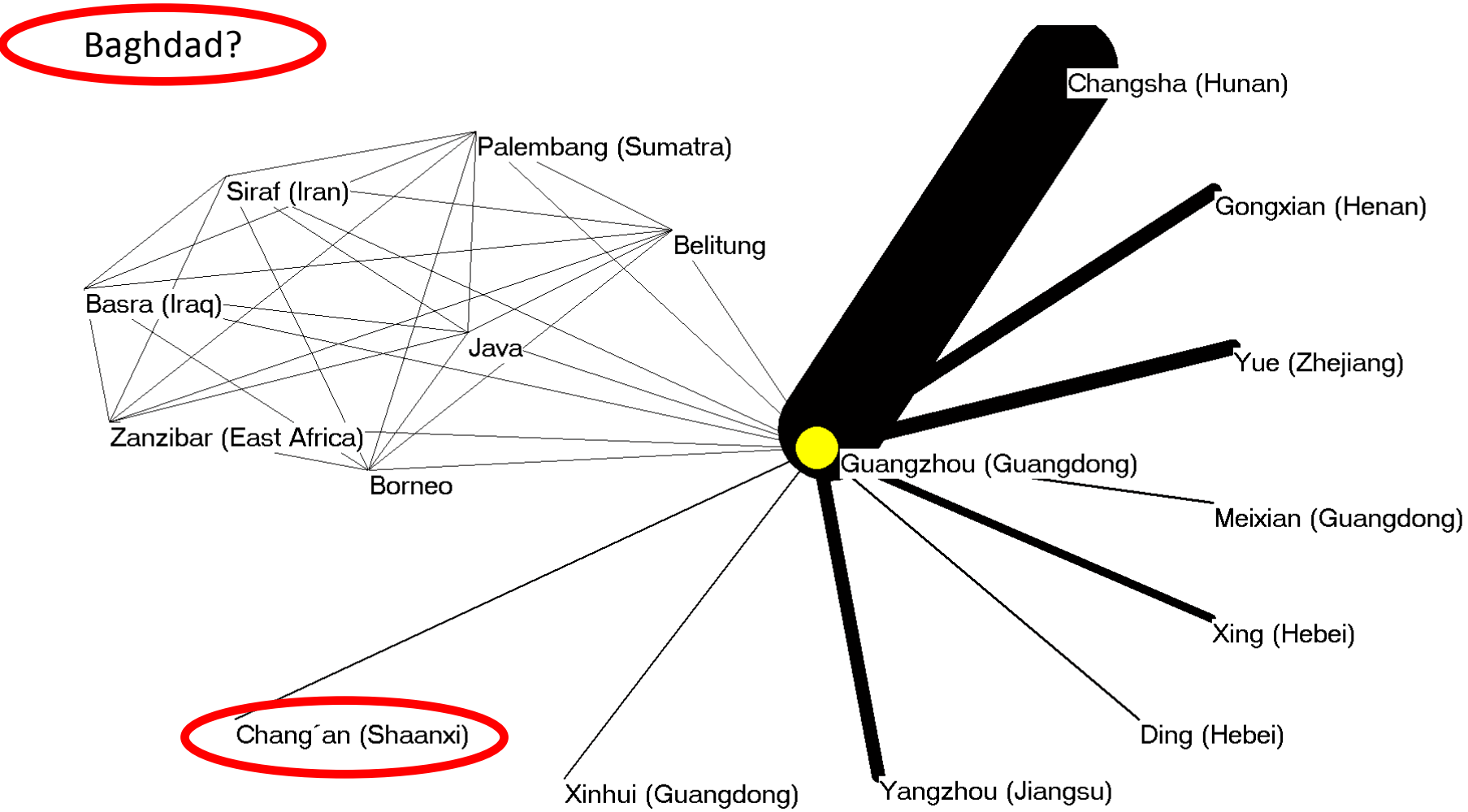
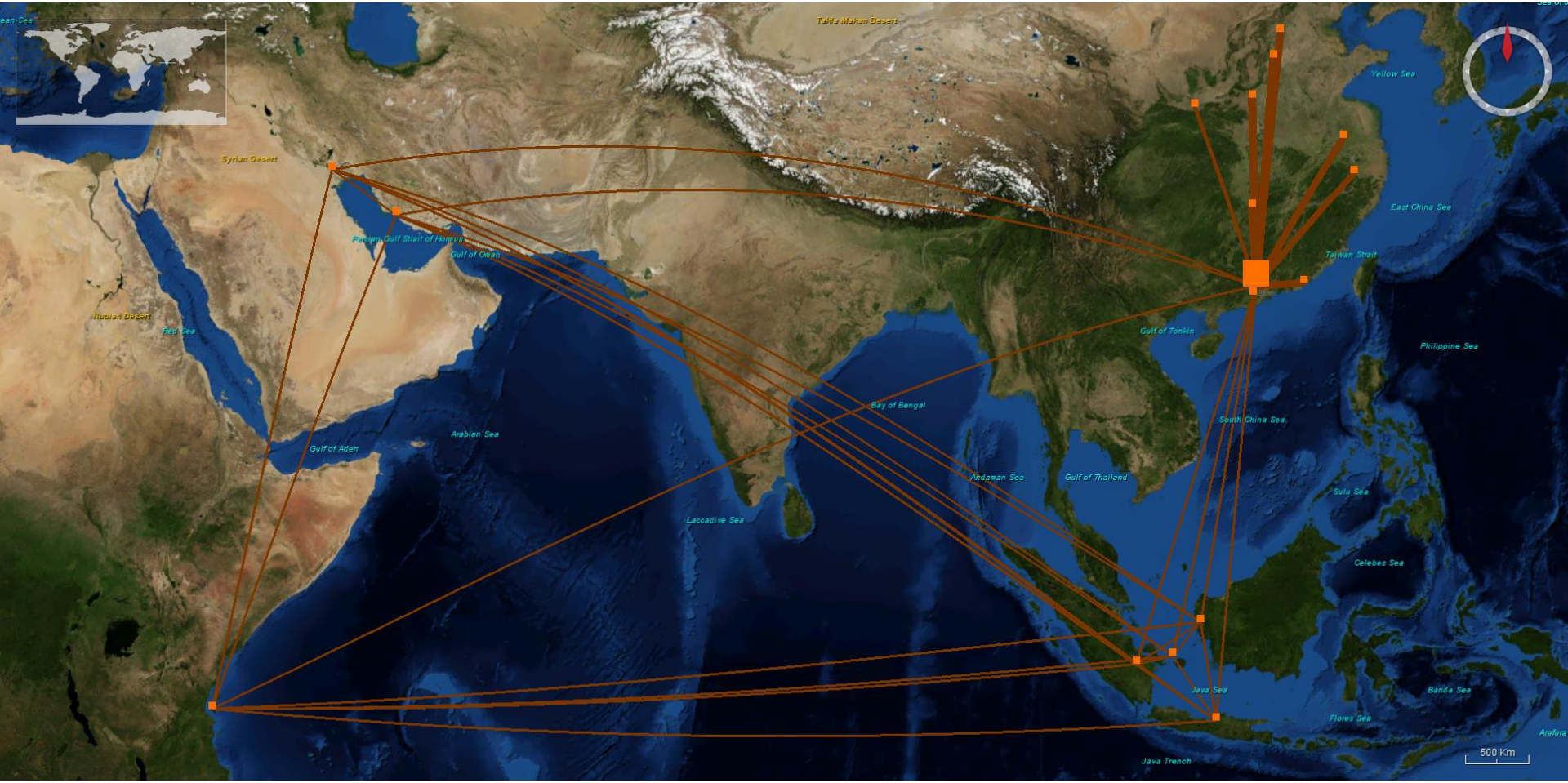
Centres and peripheries in the narrative of the Belitung-assemblage



Centres and peripheries in the spatial structure of the Belitung-narrative



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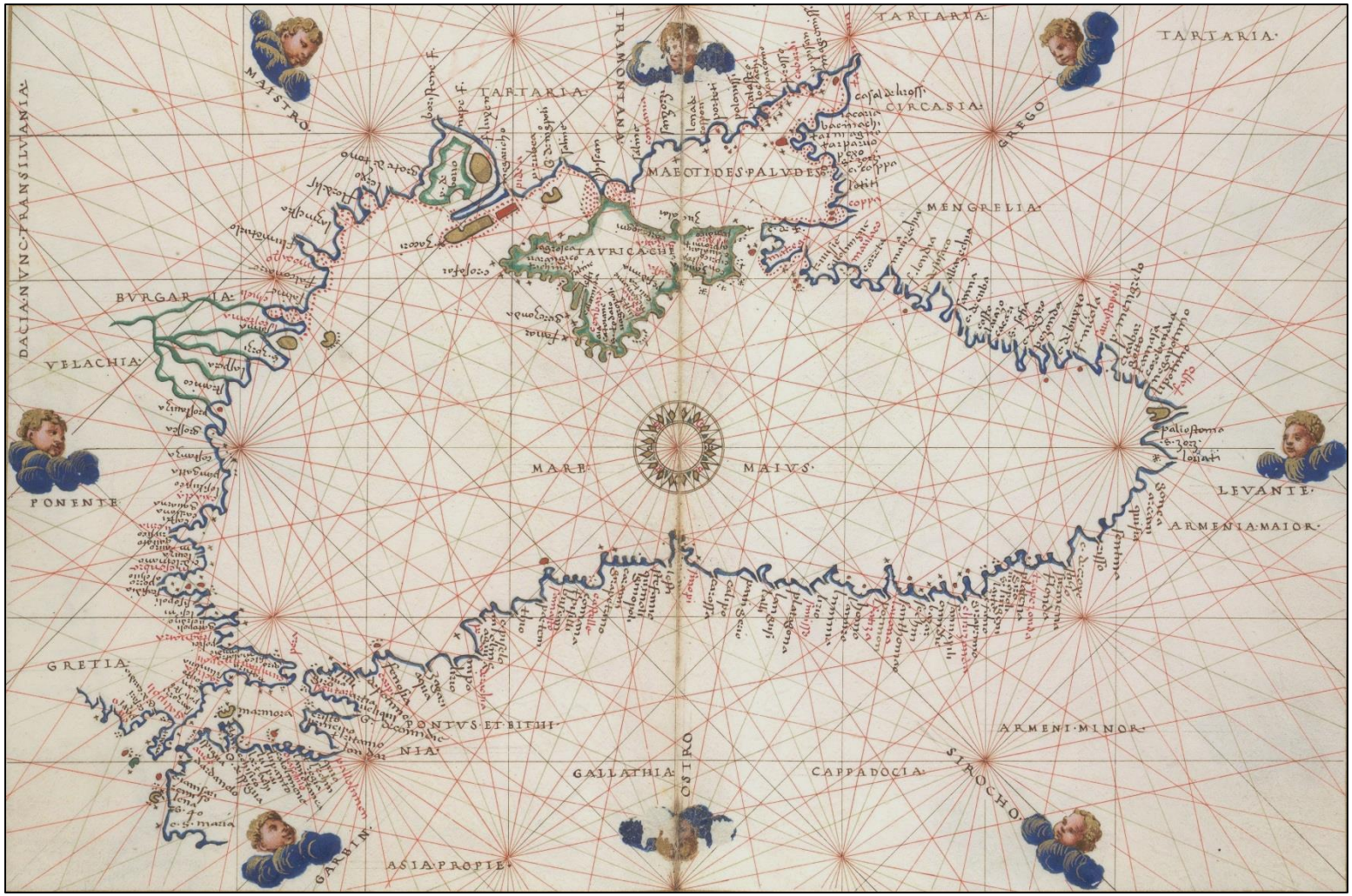
A narrative from a period of "foreign" preponderance in the trade with China before the 10th century

- *The ships from Basra, Siraf and Oman, India the islands of Zaabaj and Sanf came to the mouth of the river of Khanfu [Guangdong] with their merchandise and their cargo [before 877/8]. Then [the trader] went to sea to the land of Killah [west coast Malay peninsular, possibly Kedah or Perak] which is approximately half way to China. Today this town is the terminus for Muslim ships from Siraf and Oman, where they meet the ships which come down from China, but it was not so once … This trader then embarked at the city of Killah on a Chinese ship in order to go the port of Khanfu.* (Muruj al-Dhahab, written by Mas'udi (d. 956)
- *The land by the sea lies beyond the realm of civilization… And in the markets are the people of the sacred isles; Grasping jade, they have come to our land from afar, Offering pearls, they come to offer tribute.* (The eighth-century Chinese poet Bao He, *Sending the Esteemed Master Li to Quanzhou*)

Both citations from: John GUY, *Late Tang Ceramics and Asia's International Trade*, cf. http://nsc.iseas.edu.sg/documents/belitung/The%20Belitung%20Wreck/03_guy_056to073.pdf)

Connecting ports: 60 ships.
Genoese maritime traffic in the Black Sea, 1290



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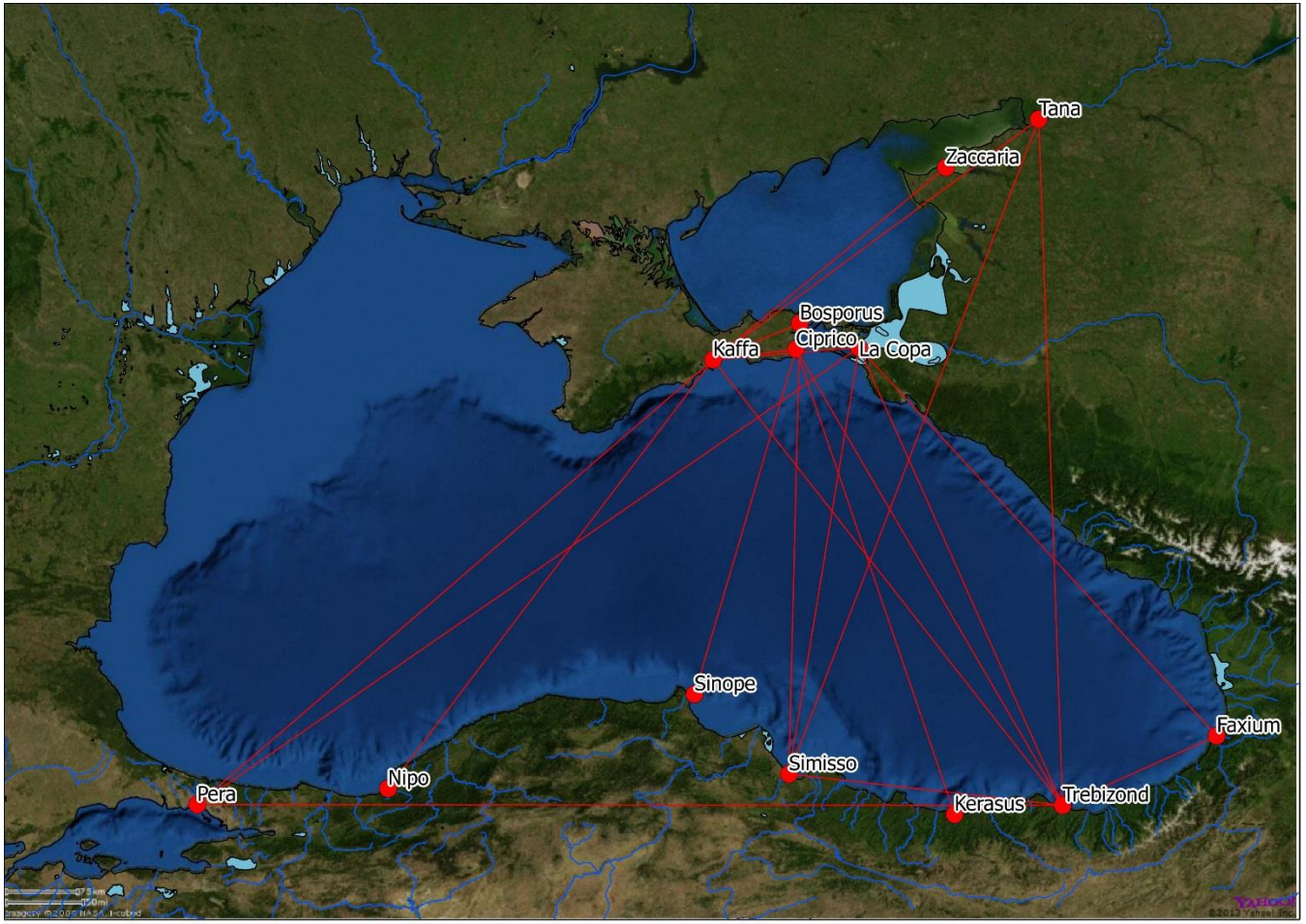
The routes of 60 Genoese ships in the Black Sea documented for 1290 (cf. Balard, 1978)



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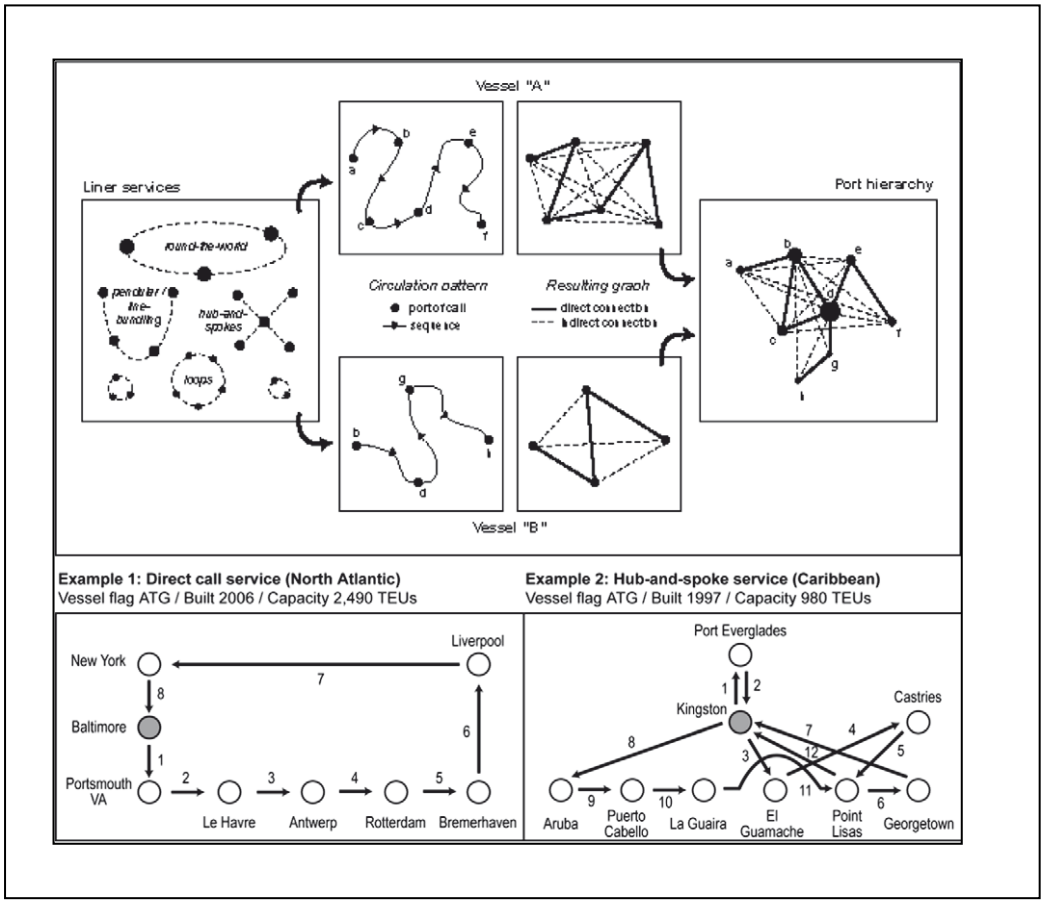
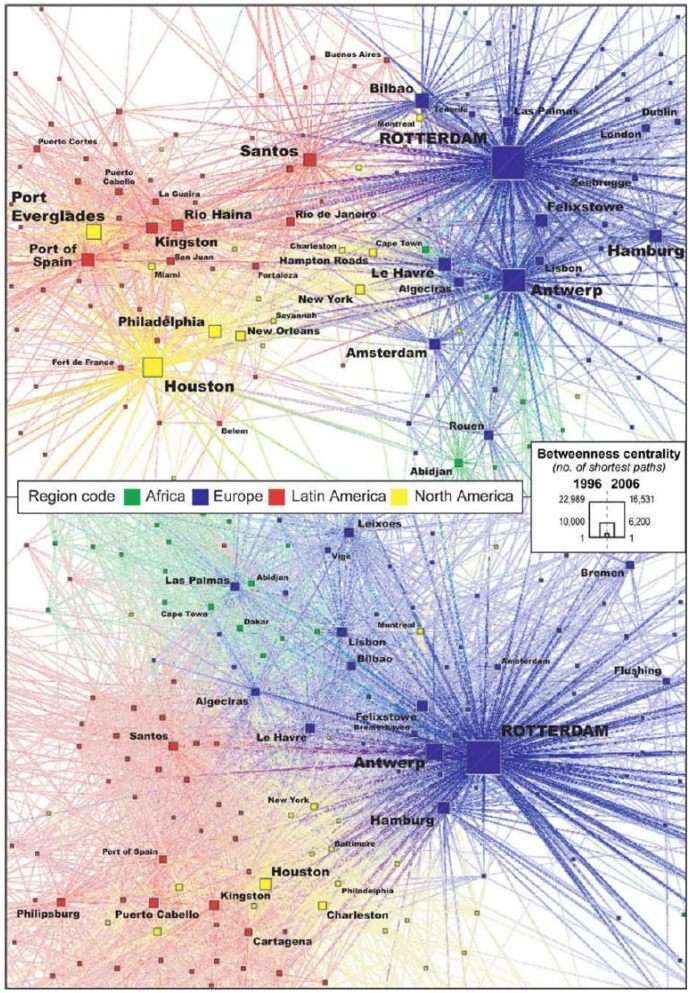
The overlapping of itineraries and the modelling of networks (from: Ducruet et. al., 2010)





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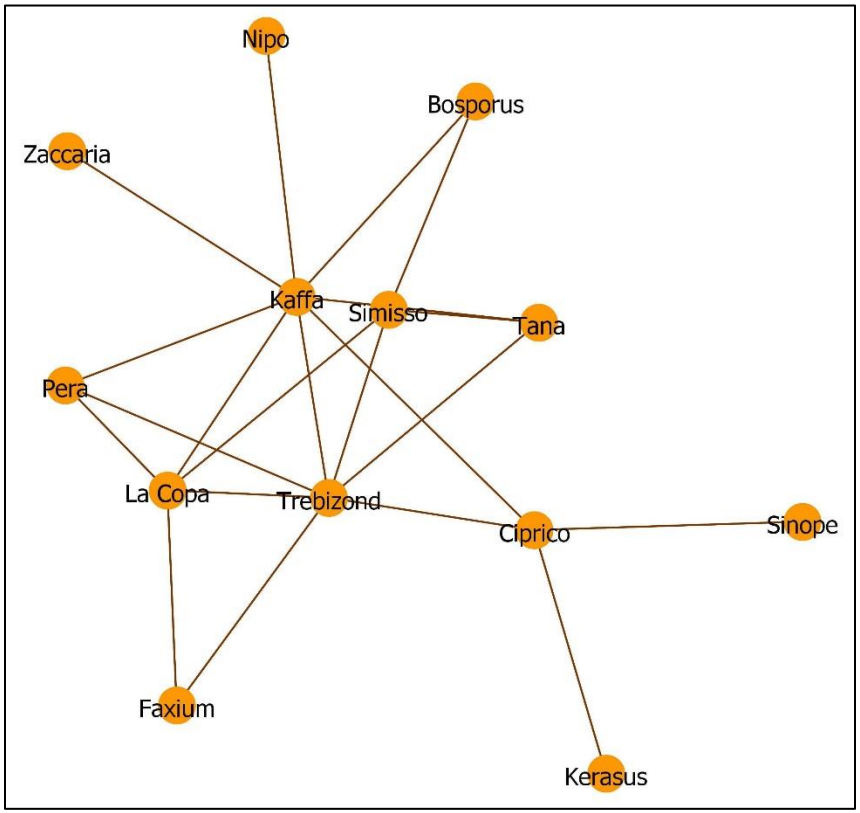
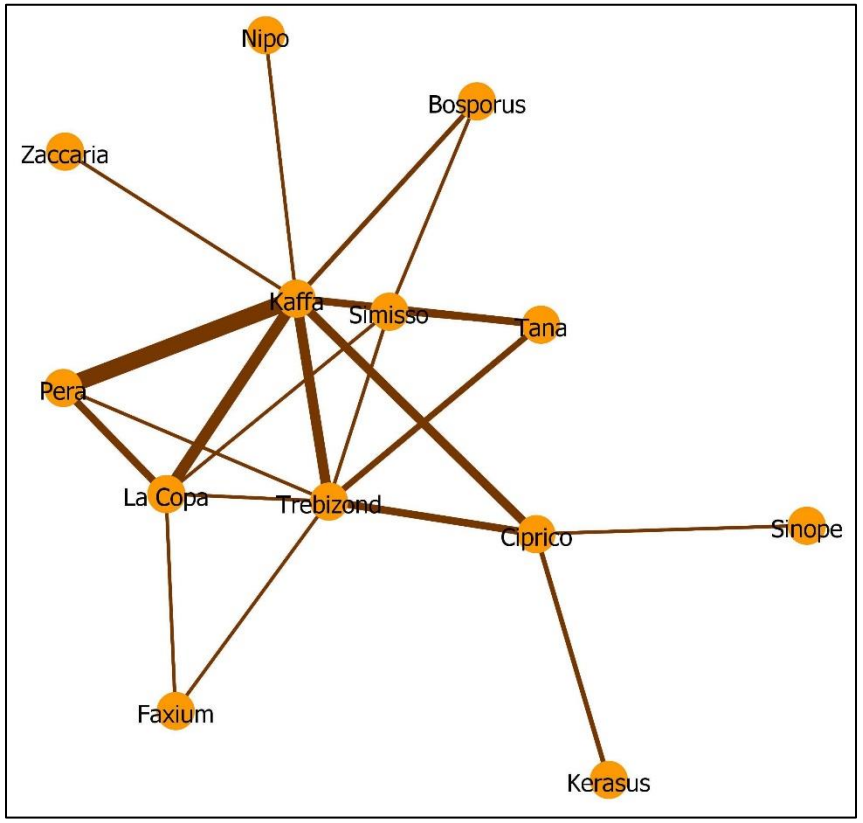
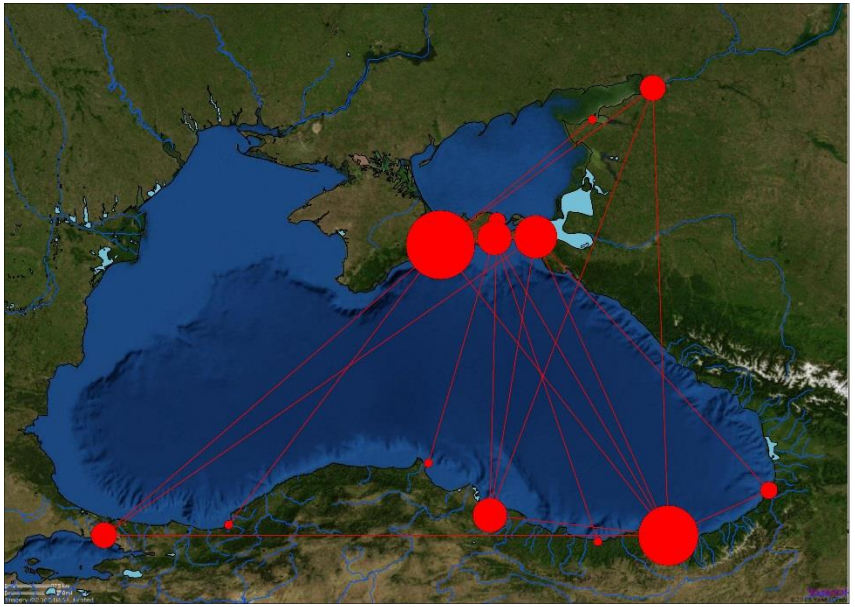
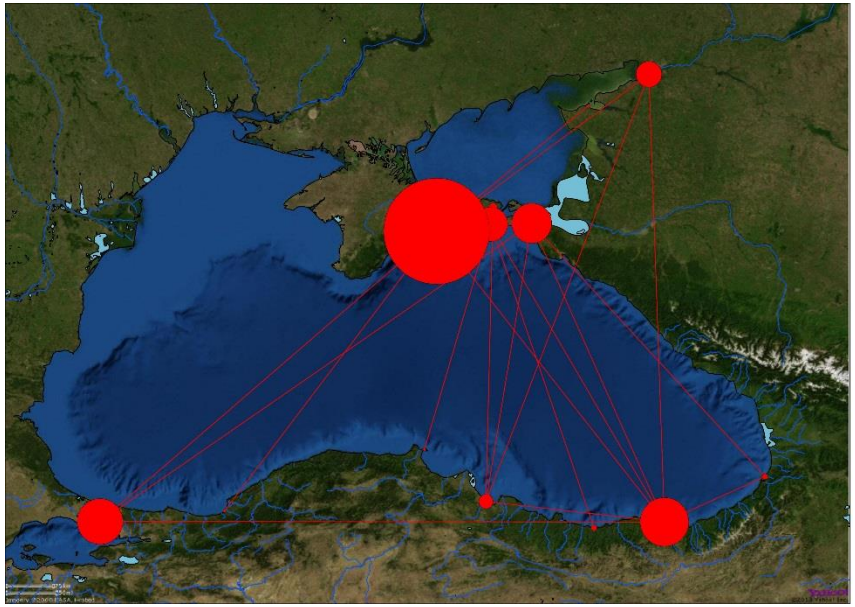
Integrating the frequency of connections into the network: the number of ships travelling between two ports





The relative centrality of ports (degree = number of links) in the model without and with frequency-weighted links





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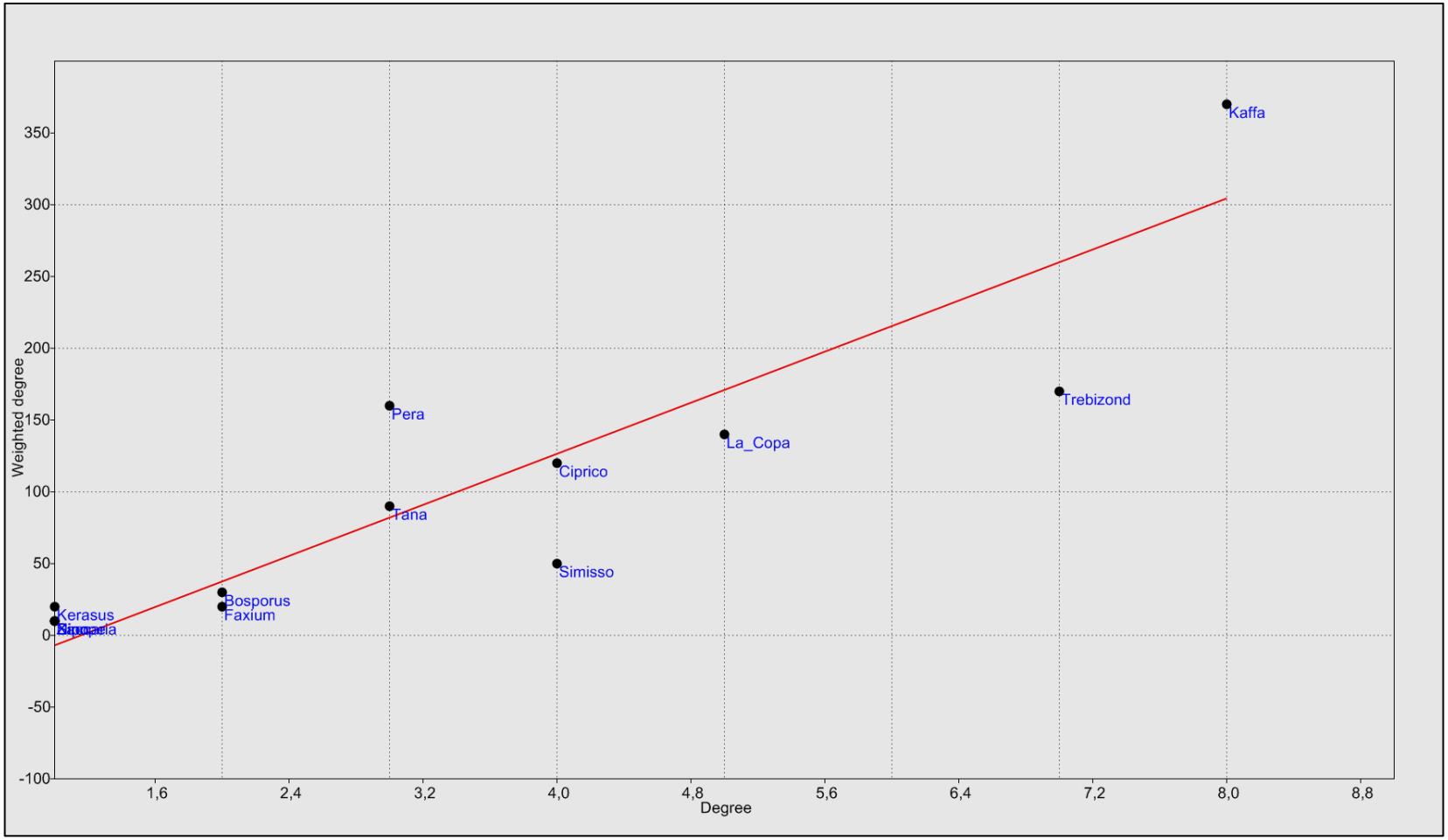
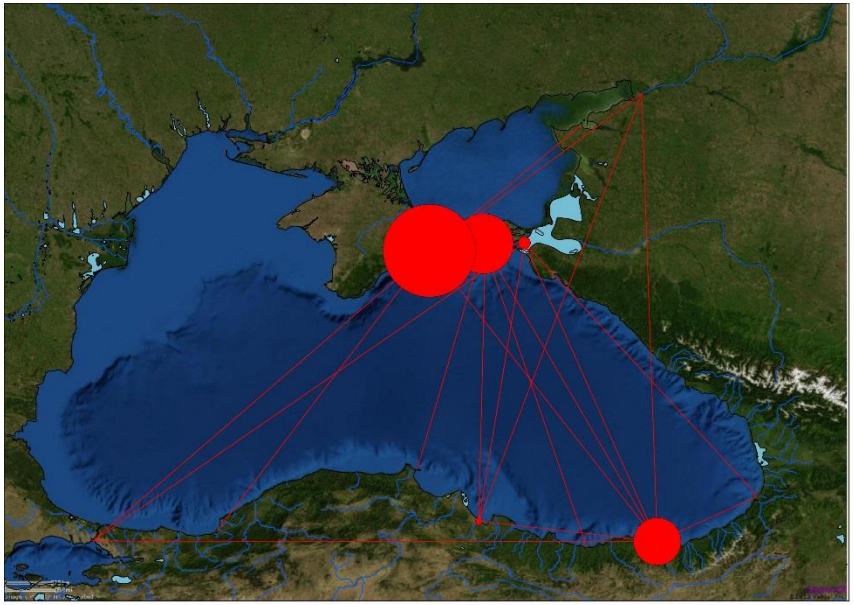
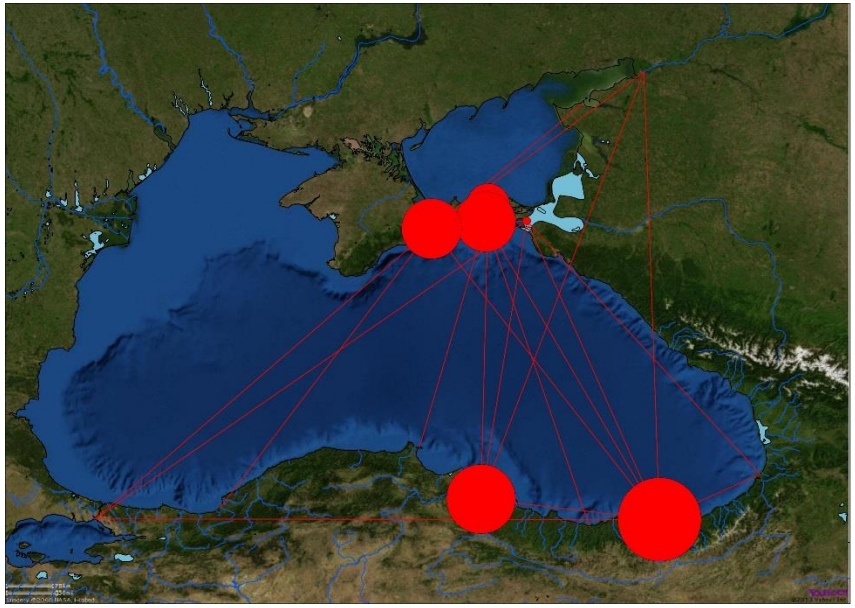


The relative centrality of ports (betweenness = potential for intermediation between unconnected nodes) in the model without and with frequency weighted links





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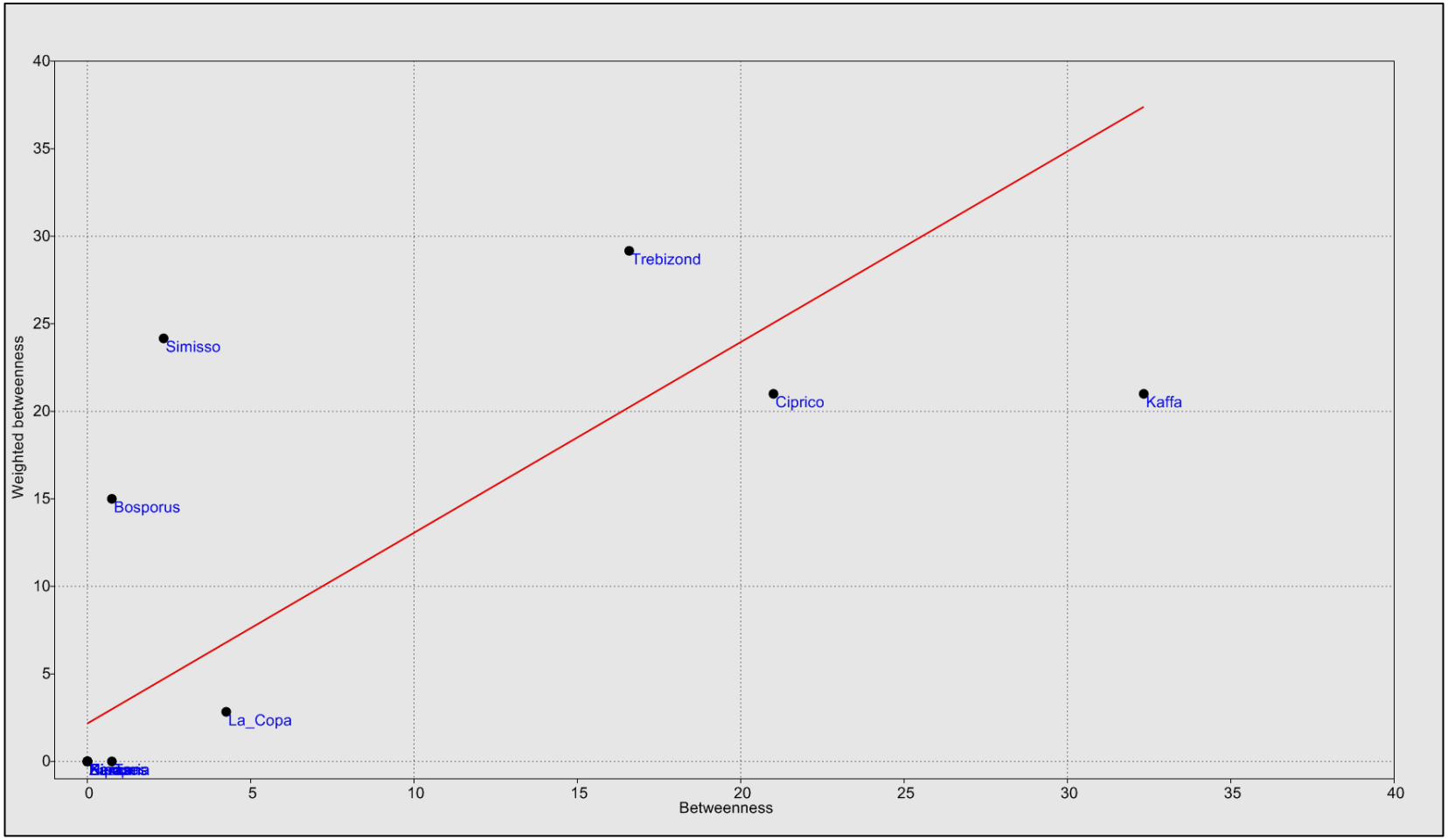
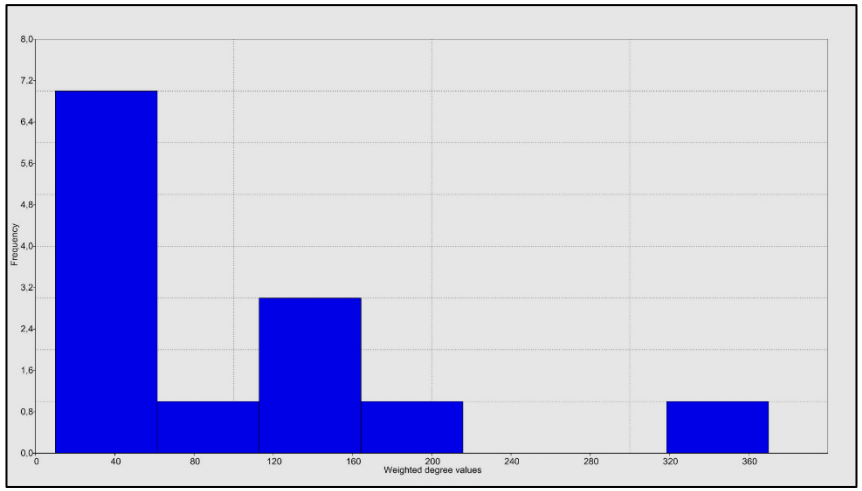
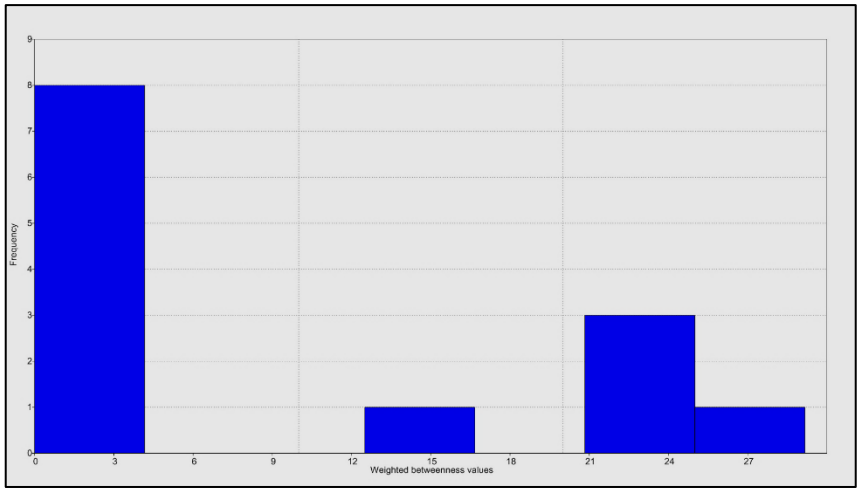
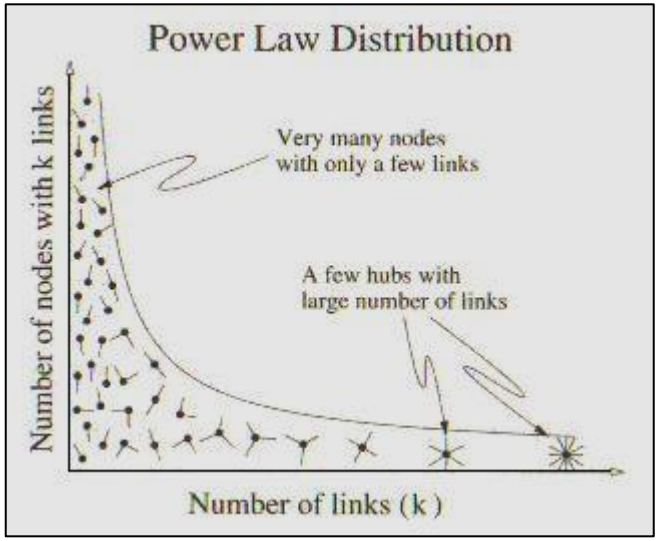


The frequency distribution of degree and betweenness values: the emergence of port hierarchies







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Connecting ports: trading diasporas [cf. Curtin 1984]. The mercantile community of Ragusa/Dubrovnik, 1250-1450

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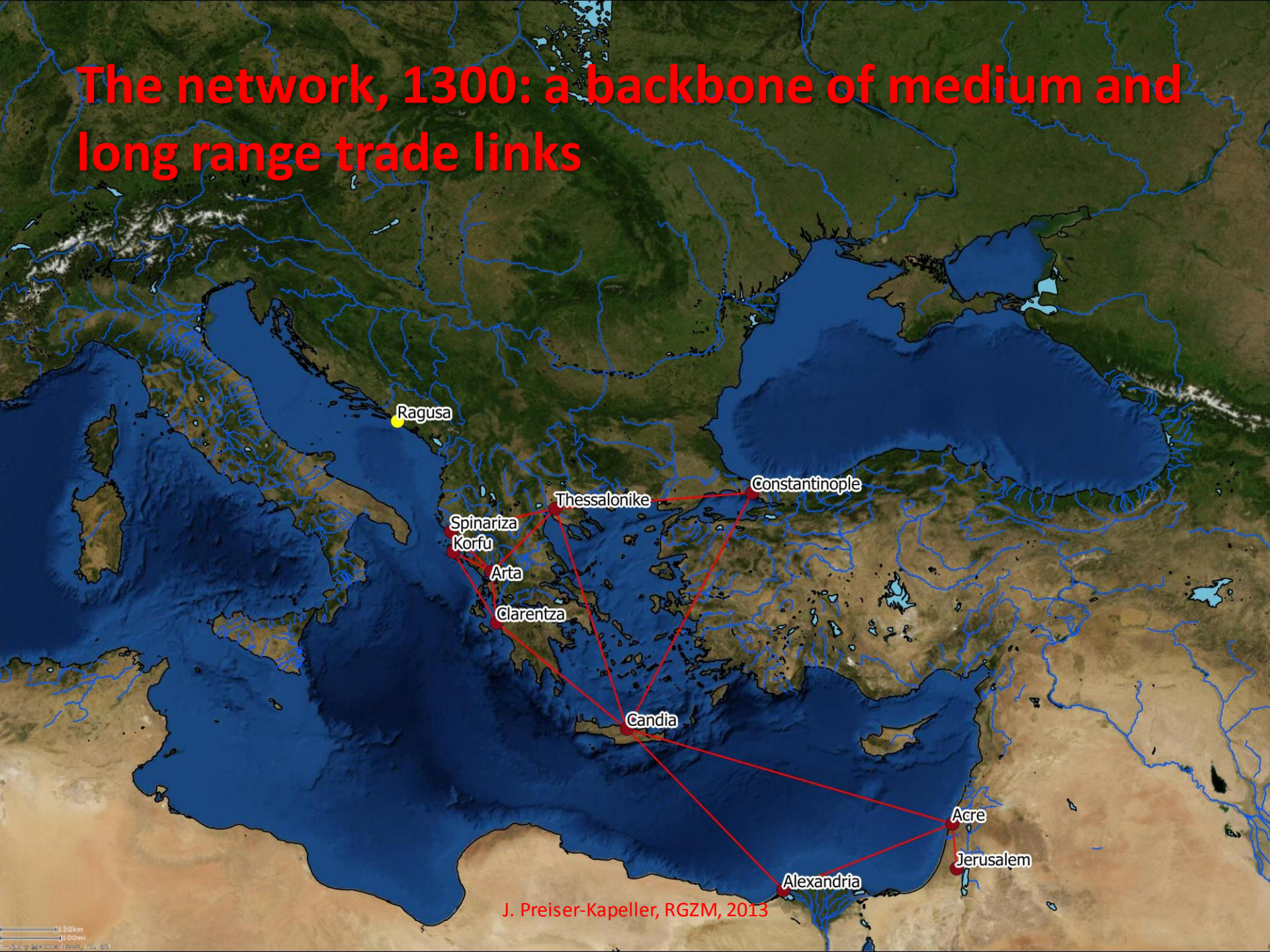
The trading network of Ragusa in 1450 (cf. Krekić, 1961)

The network, 1300: a backbone of medium and long range trade links



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The network, 1350: expansion towards the Black Sea and agglomeration in Greece

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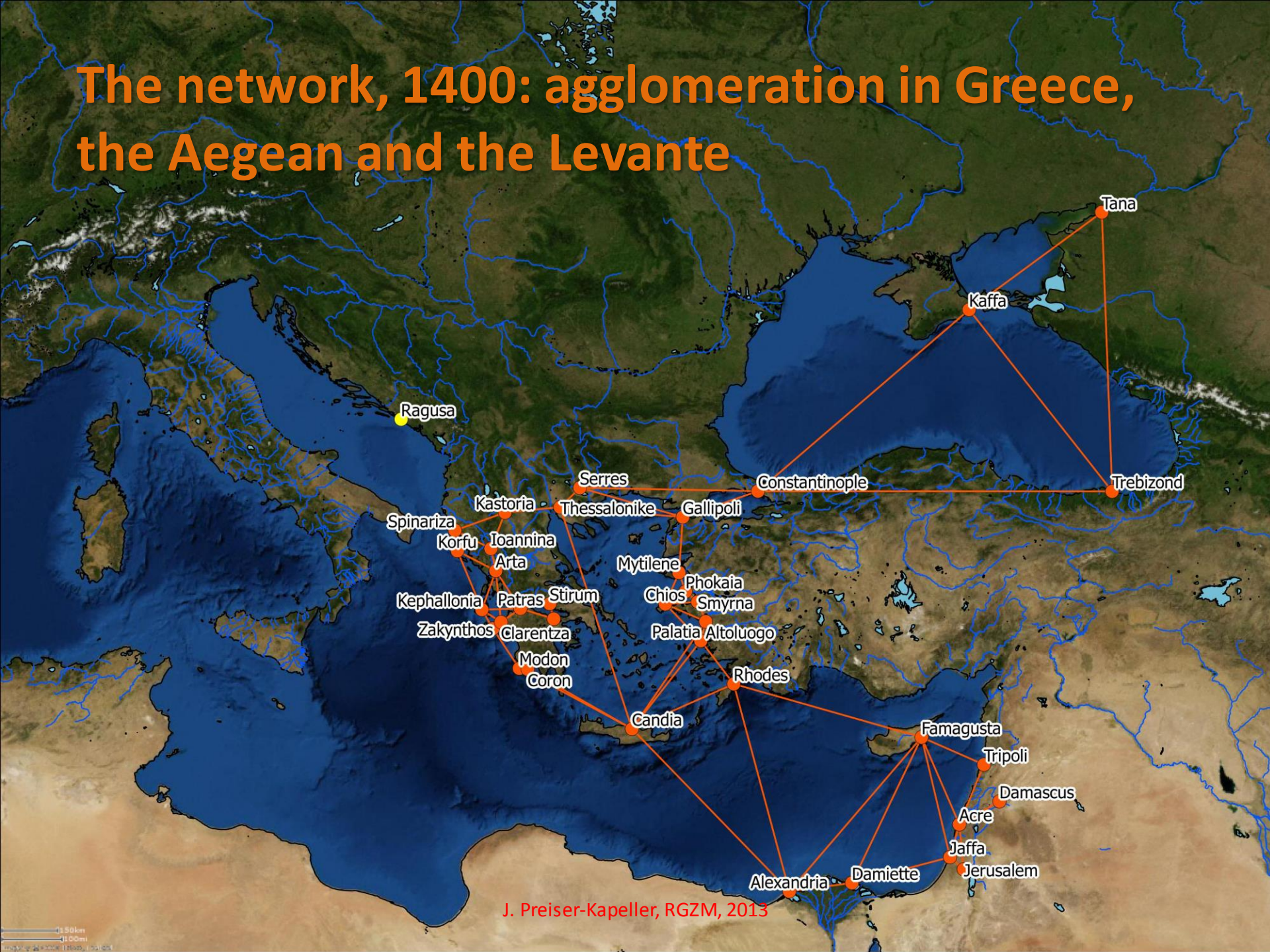
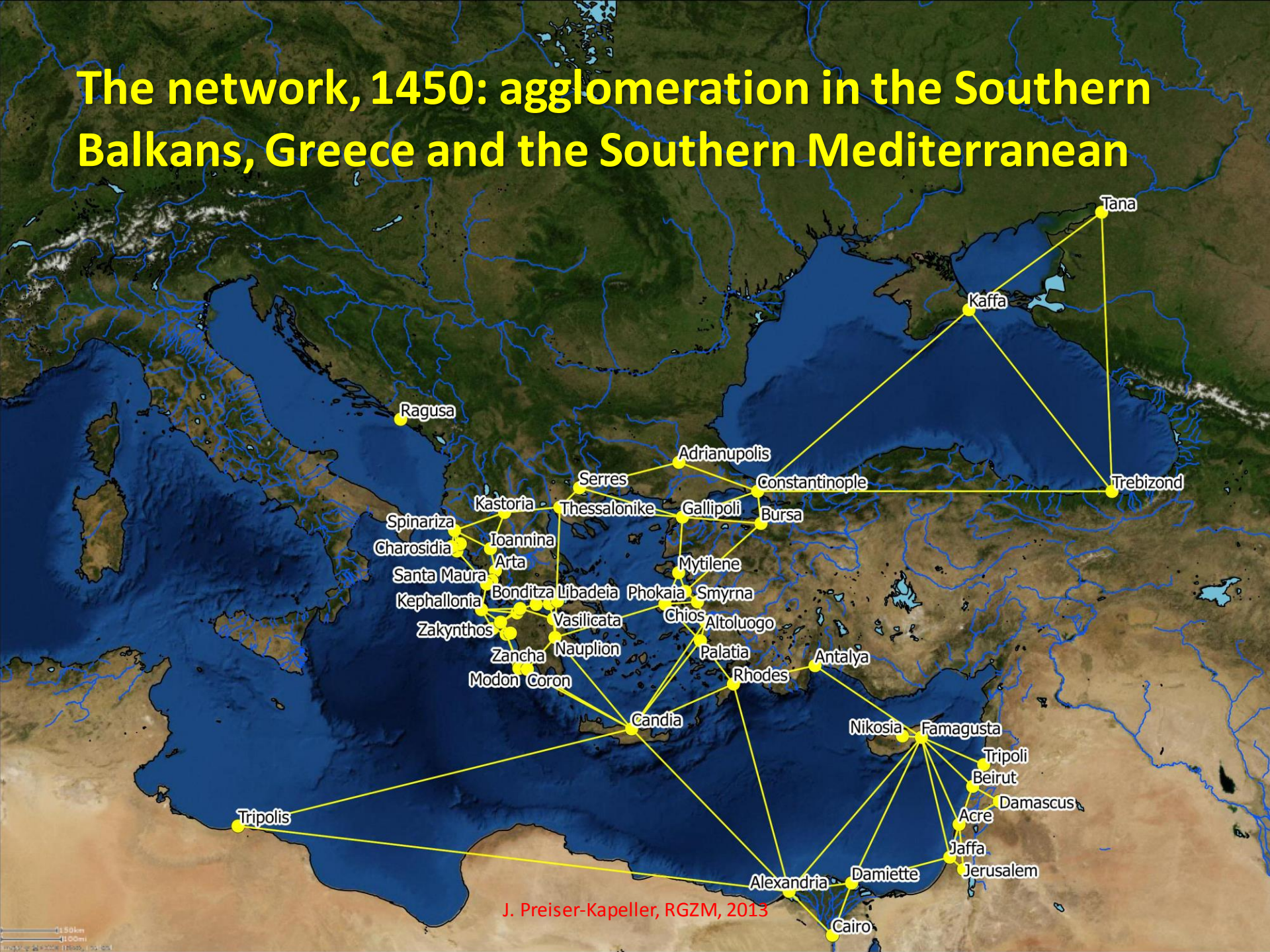
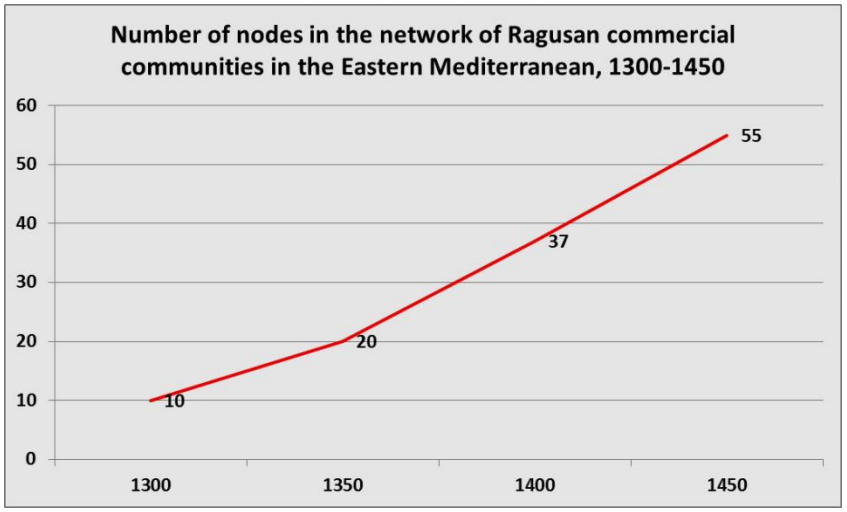
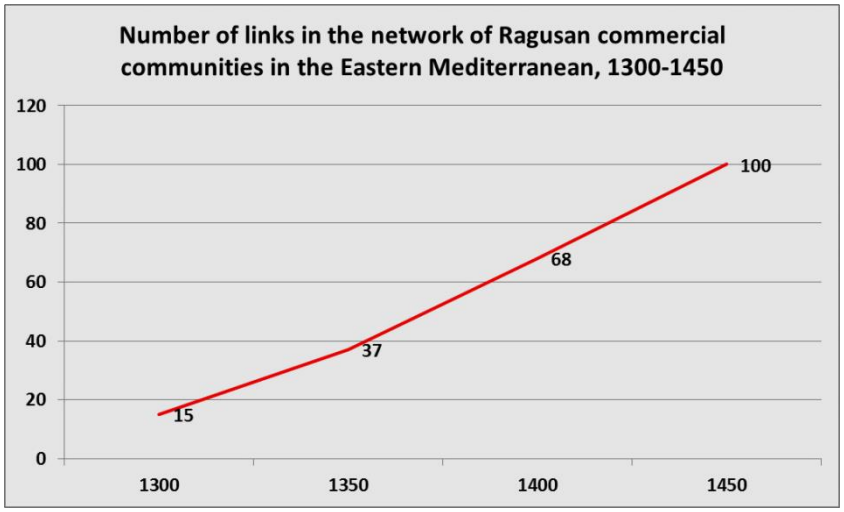
The network, 1400: agglomeration in Greece, the Aegean and the Levante

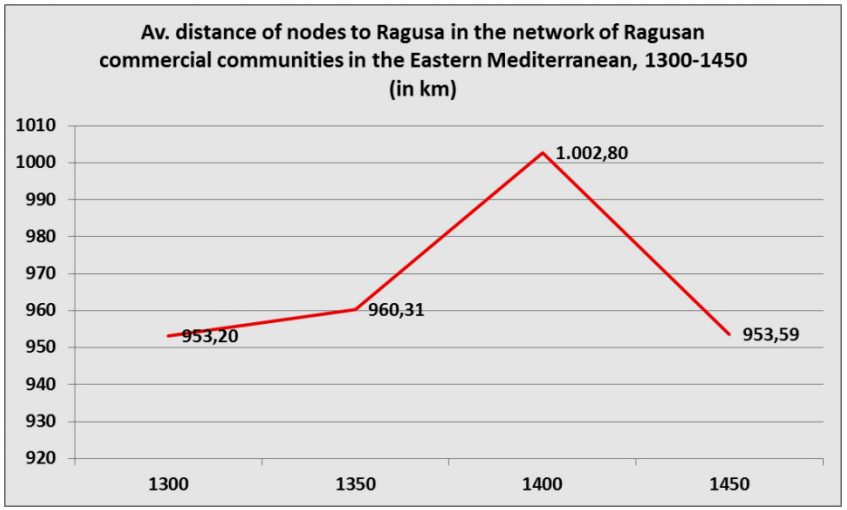


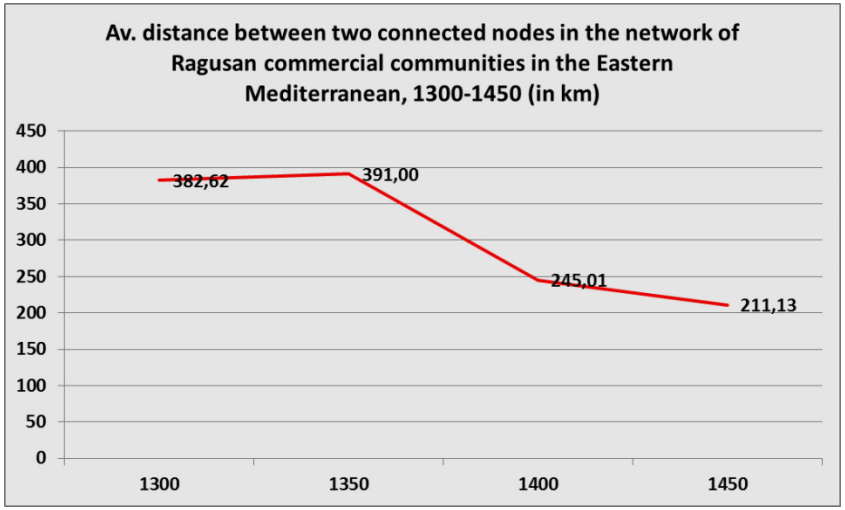
The network, 1450: agglomeration in the Southern Balkans, Greece and the Southern Mediterranean



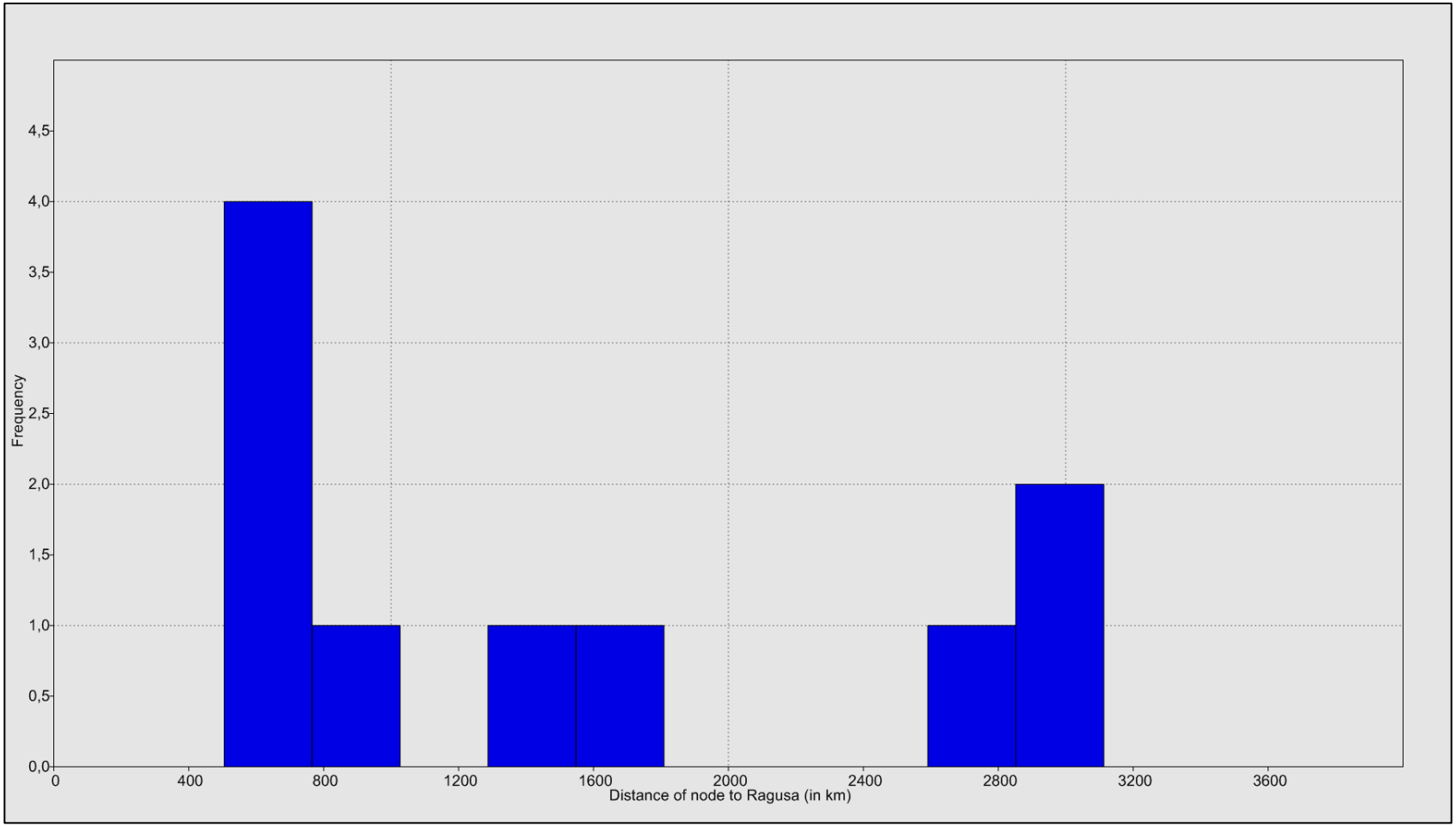

Number of nodes in the network of Ragusan commercial communities in the Eastern Mediterranean, 1300-1450
60
50
40
30
20
10
0
10
20
37
55
1300
1350
1400
1450


Number of links in the network of Ragusan commercial communities in the Eastern Mediterranean, 1300-1450
120
100
80
60
40
20
0
15
37
68
100
1300
1350
1400
1450


Av. distance of nodes to Ragusa in the network of Ragusan commercial communities in the Eastern Mediterranean, 1300-1450 (in km)
1010
1000
990
980
970
960
950
940
930
920
953,20
960,31
1.002,80
953,59
1300
1350
1400
1450


Av. distance between two connected nodes in the network of Ragusan commercial communities in the Eastern Mediterranean, 1300-1450 (in km)
450
400
350
300
250
200
150
100
50
0
382,62
391,00
245,01
211,13
1300
1350
1400
1450

The distribution of distances of nodes to Ragusa in 1300



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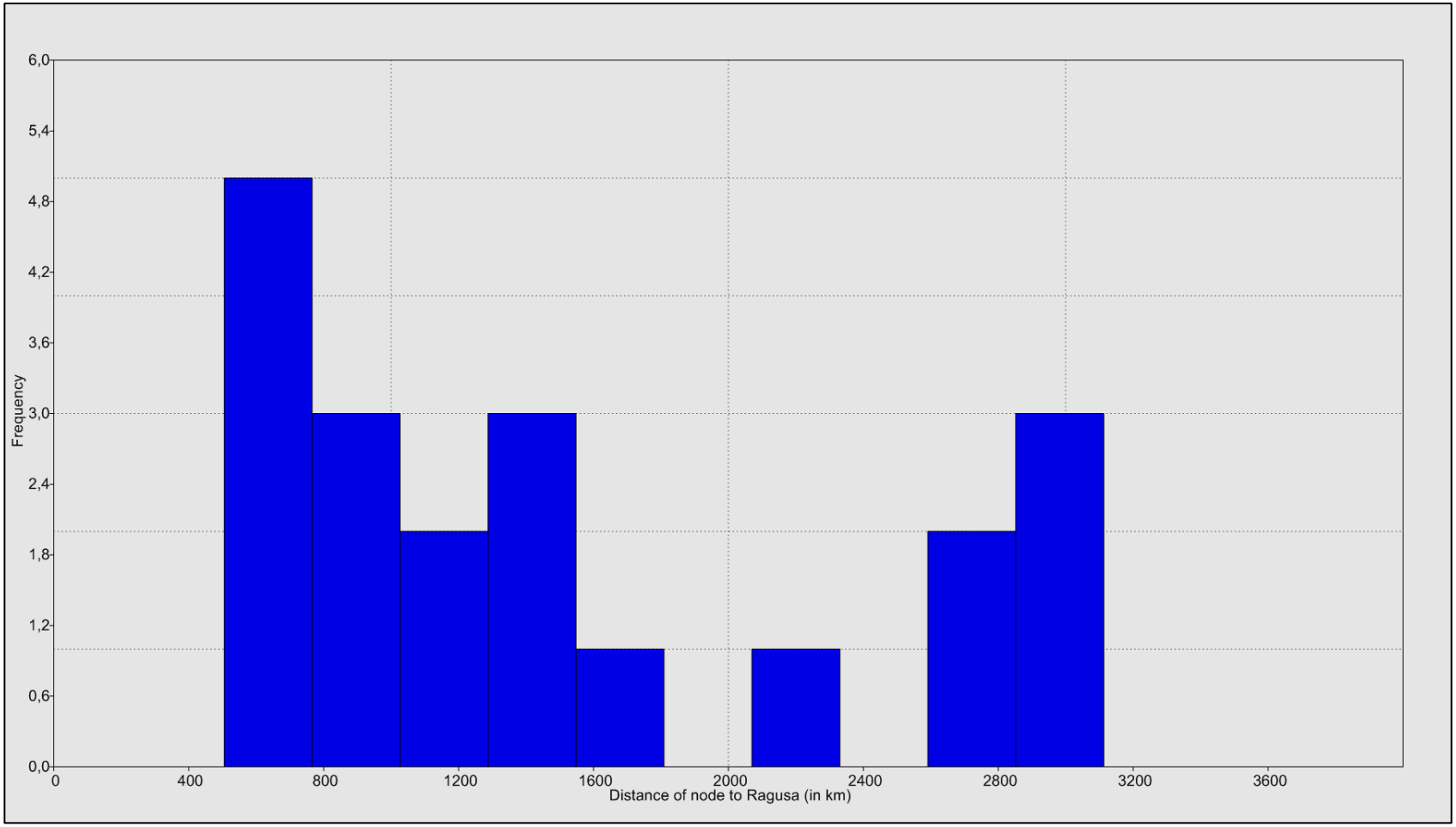
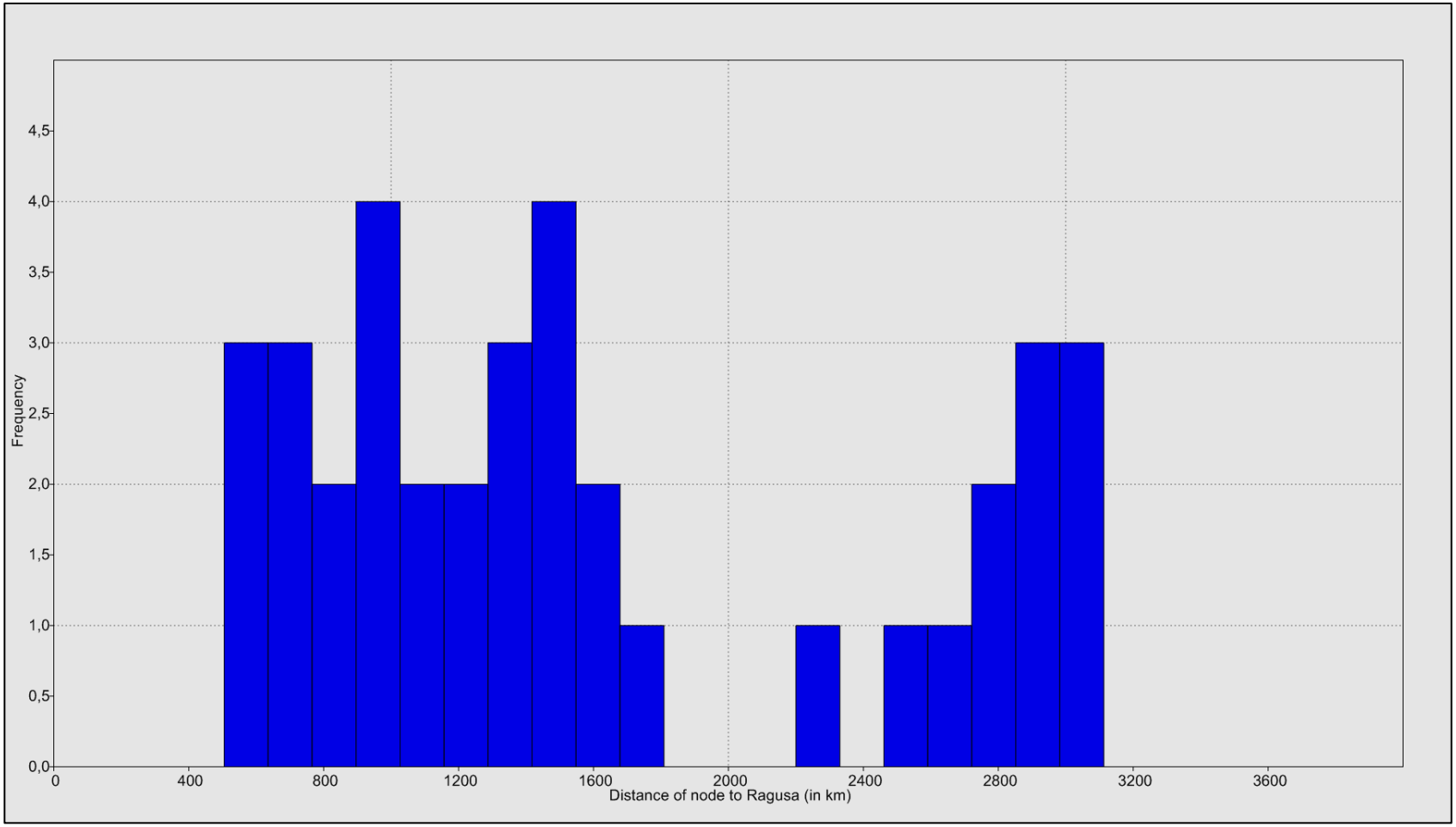
The distribution of distances of nodes to Ragusa in 1350



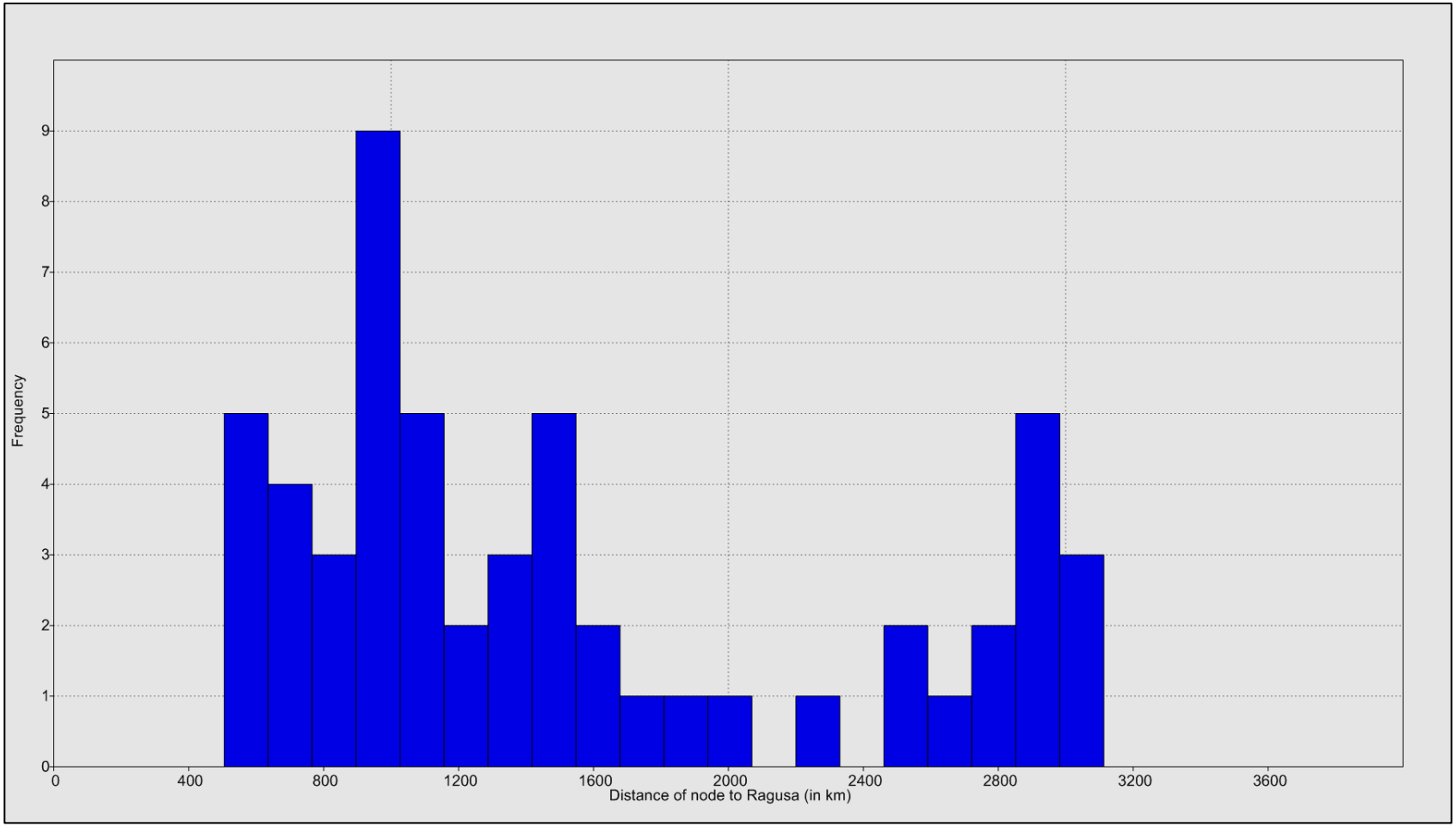
J. Preiser-Kapeller, RGZM, 2013

The distribution of distances of nodes to Ragusa in 1400



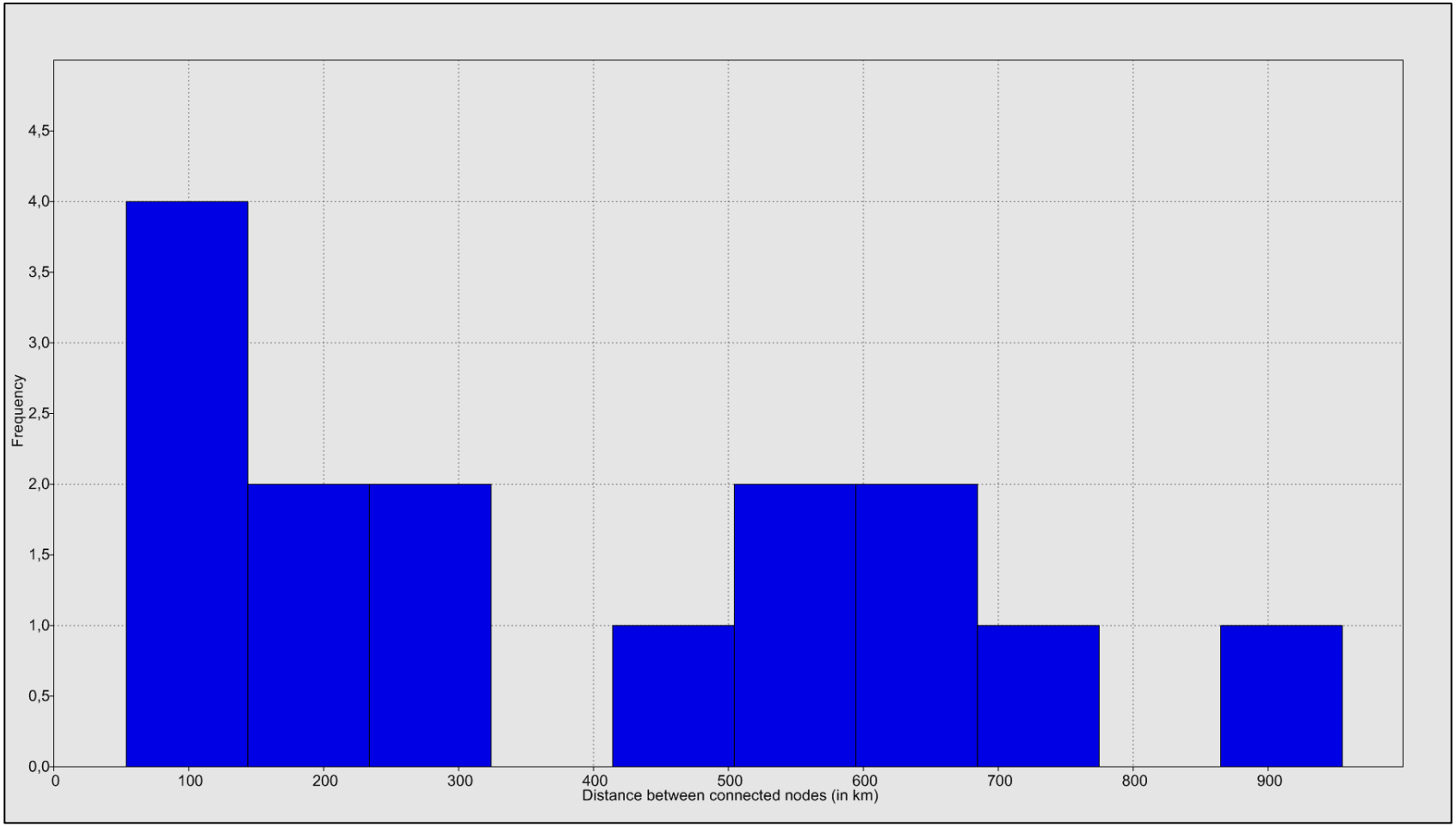
J. Preiser-Kapeller, RGZM, 2013

The distribution of distances of nodes to Ragusa in 1450



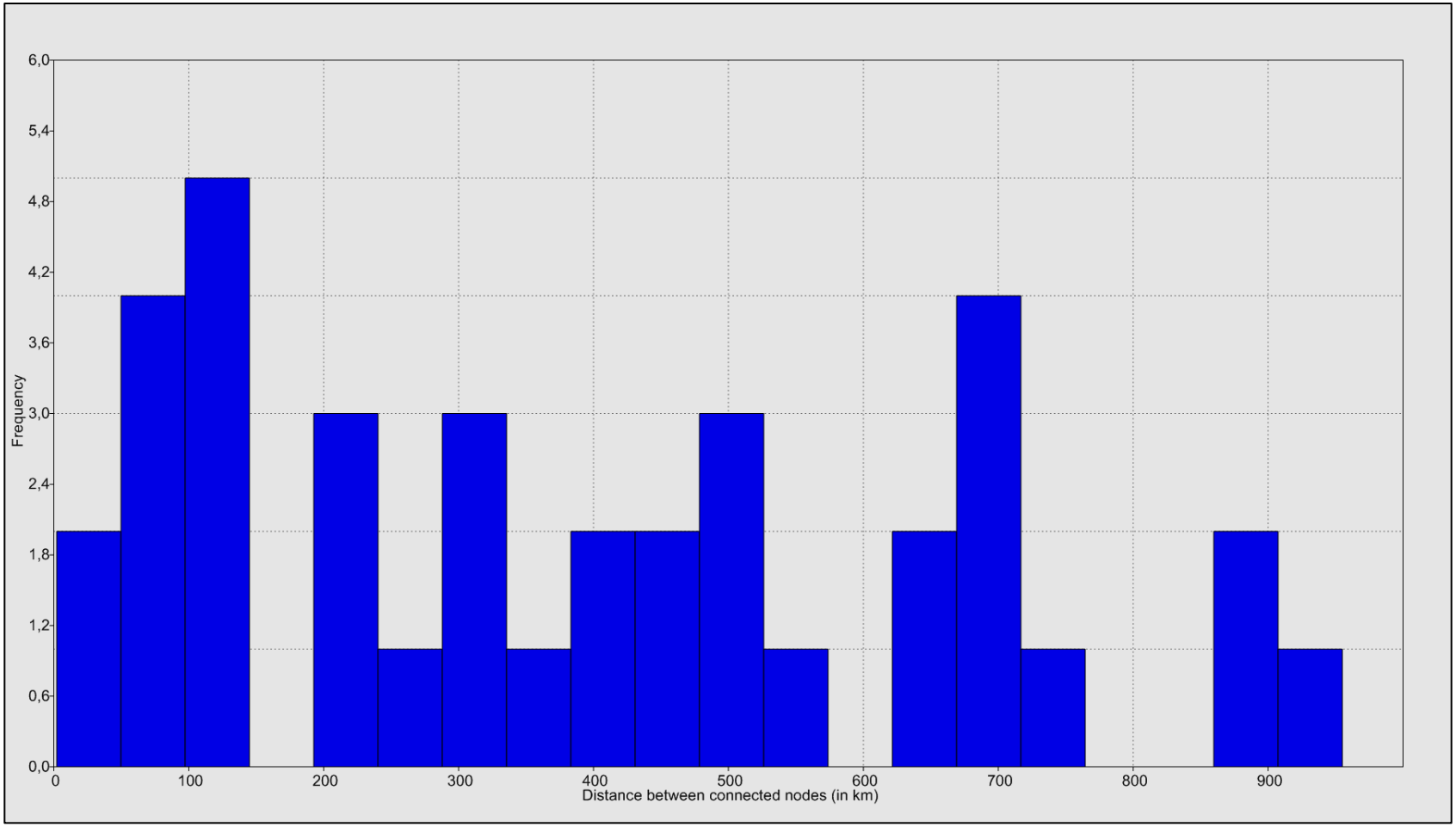
J. Preiser-Kapeller, RGZM, 2013

The distribution of distances between nodes in 1300



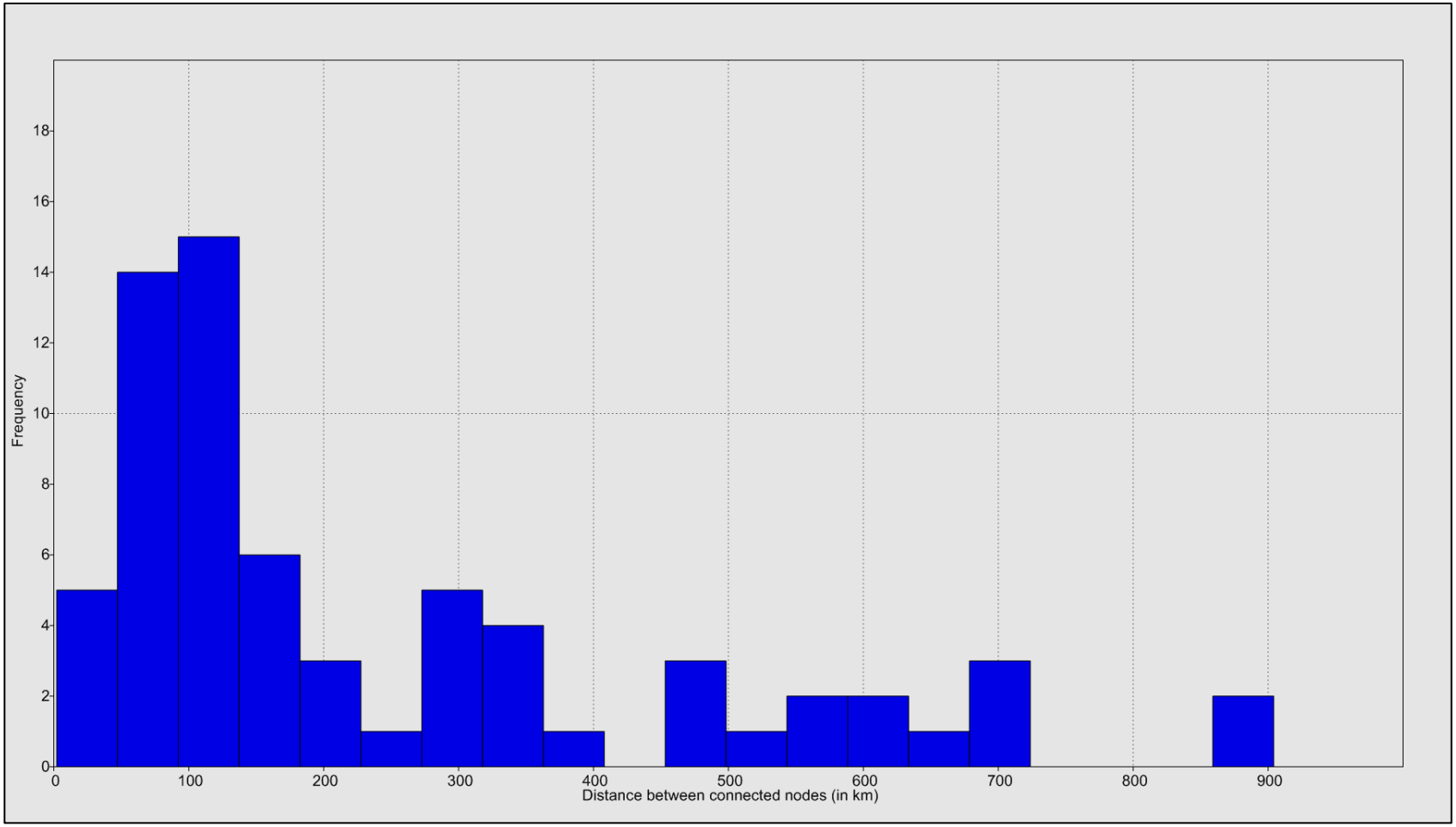
J. Preiser-Kapeller, RGZM, 2013

The distribution of distances between nodes in 1350



J. Preiser-Kapeller, RGZM, 2013

The distribution of distances between nodes in 1400



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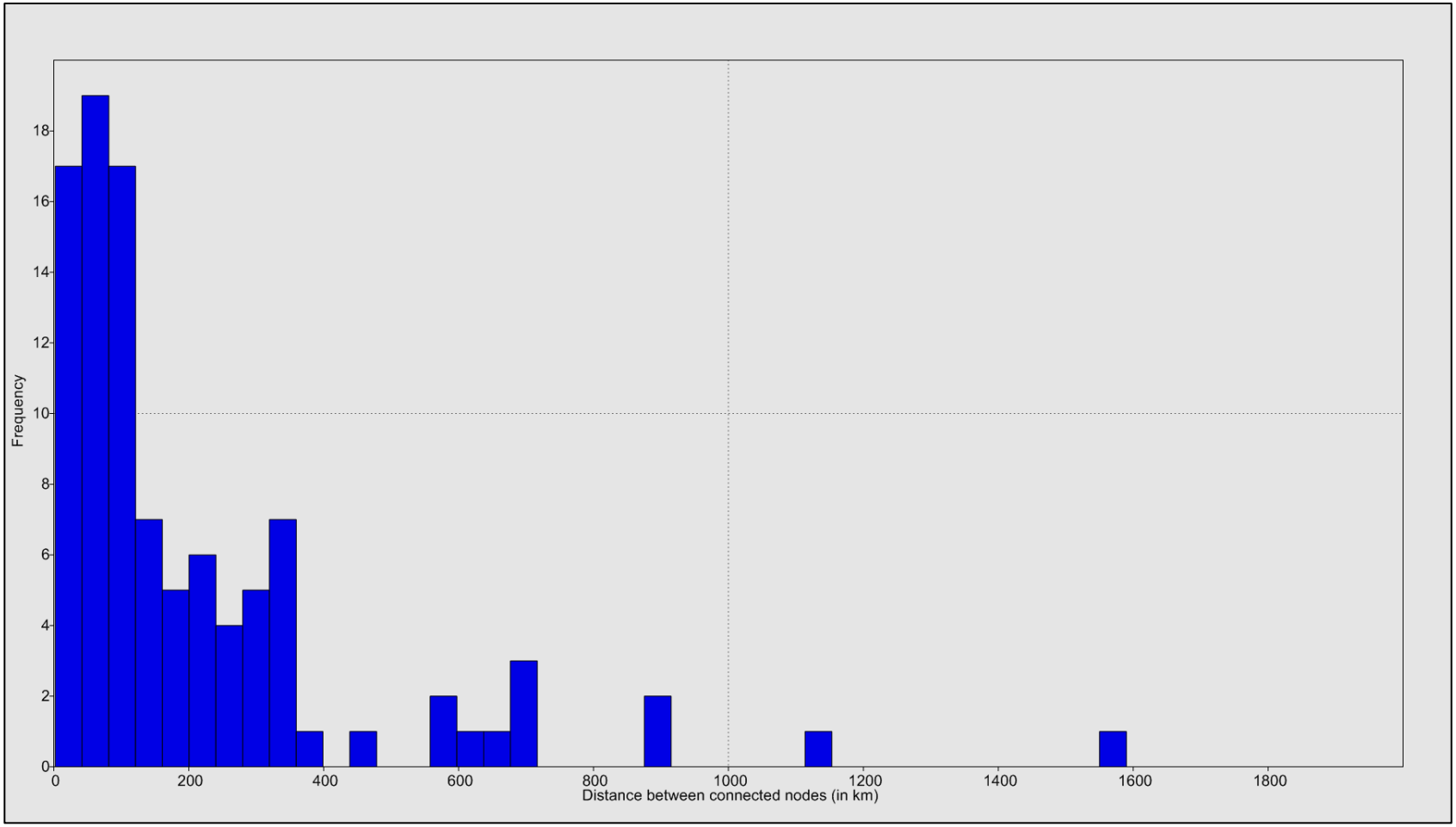
The distribution of distances between nodes in 1450



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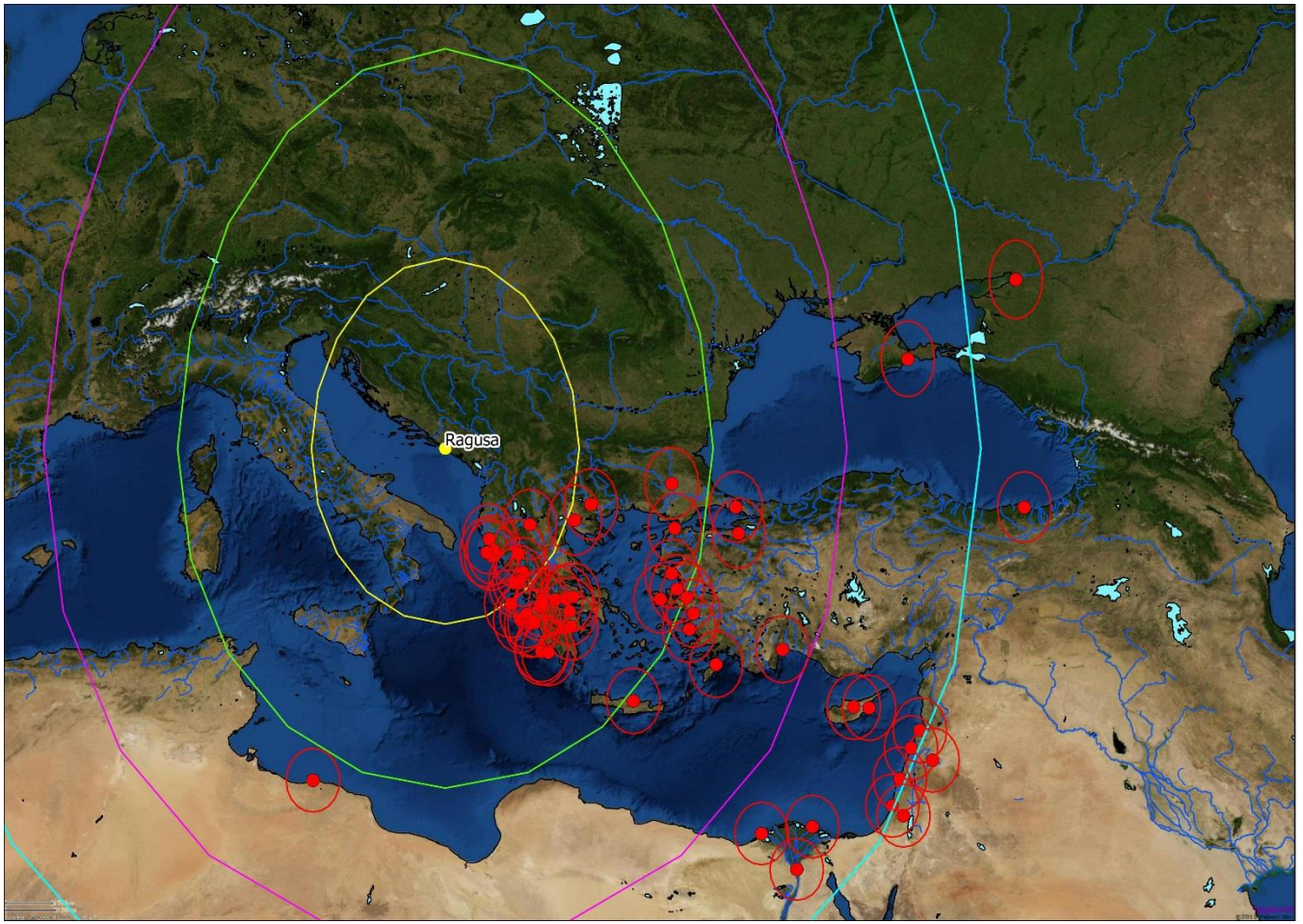
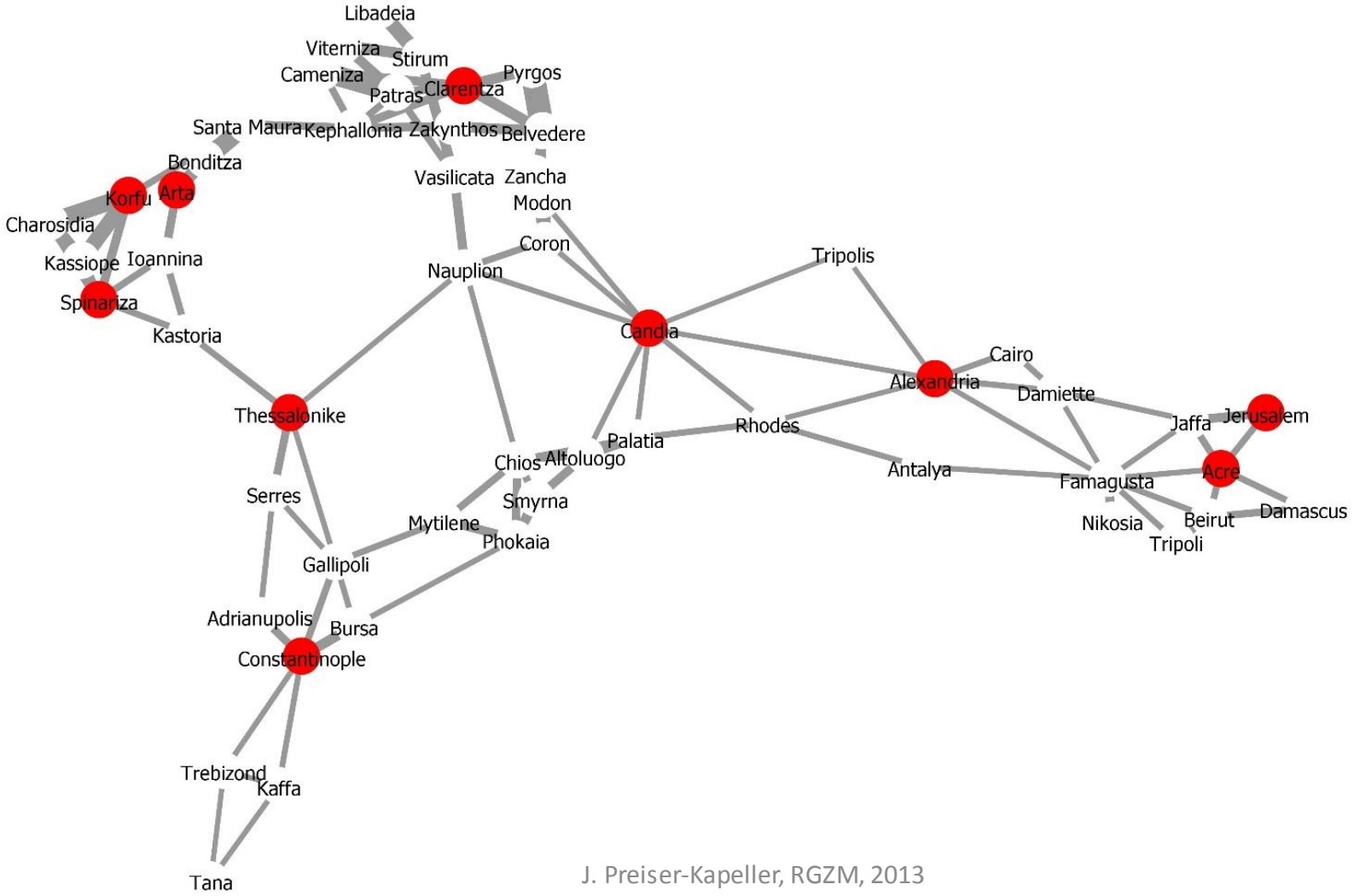
Distance from Ragusa and distances between nodes



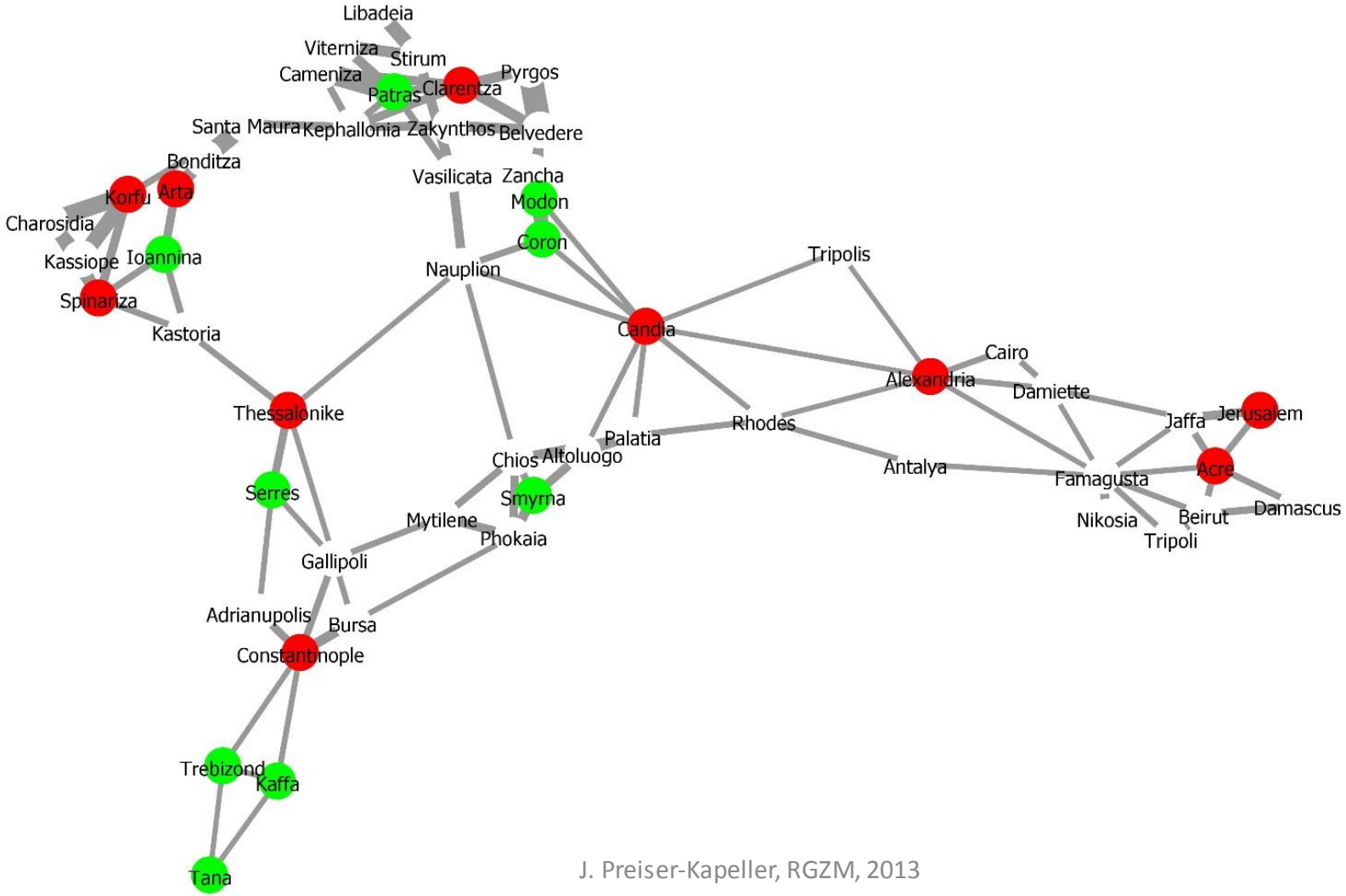
J. Preiser-Kapeller, RGZM, 2013

Diffusion along the routes: the network in 1300



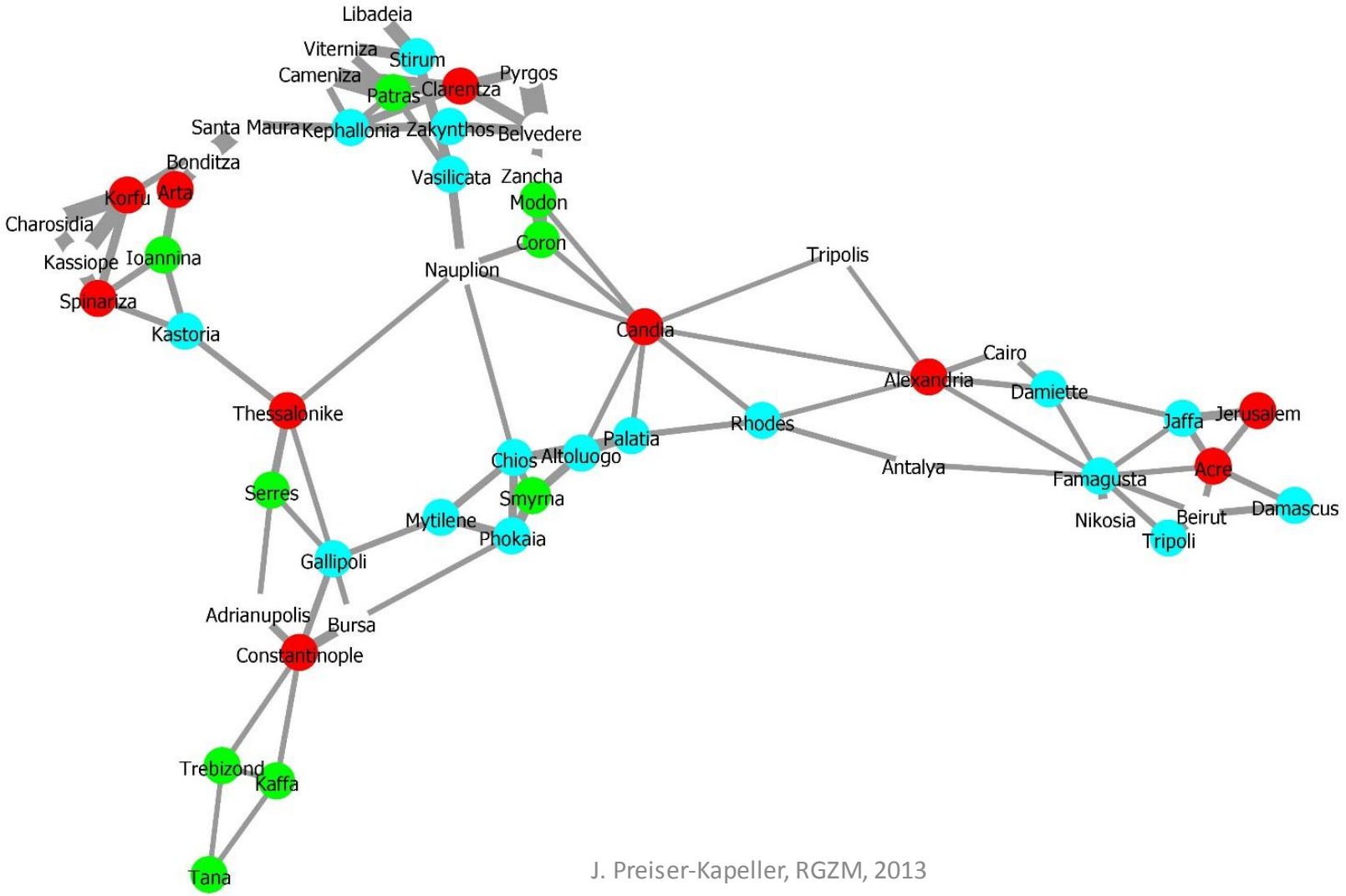
J. Preiser-Kapeller, RGZM, 2013

Diffusion along the routes: the network in 1350



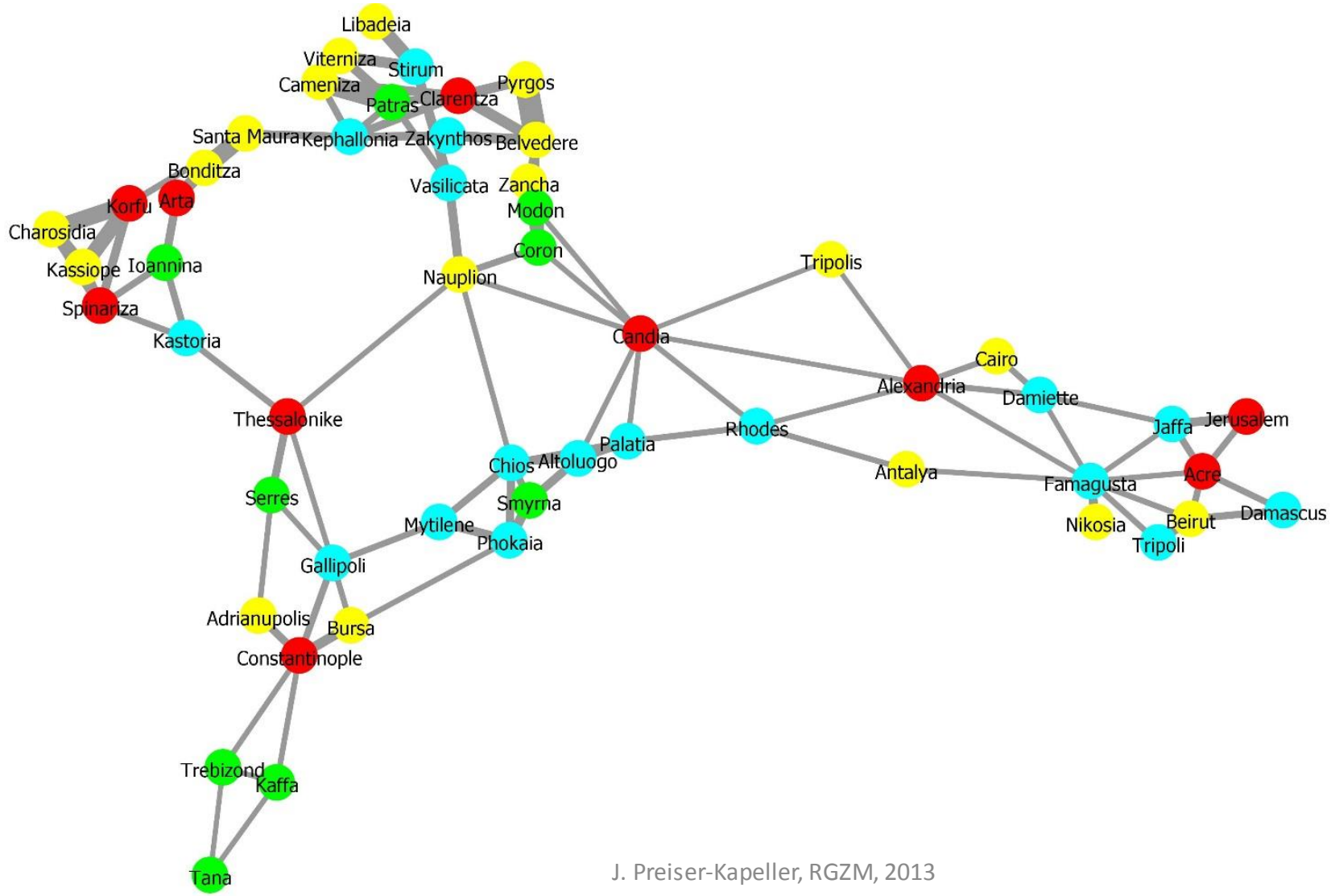
J. Preiser-Kapeller, RGZM, 2013

Diffusion along the routes: the network in 1400



J. Preiser-Kapeller, RGZM, 2013

Diffusion along the routes: the network in 1450



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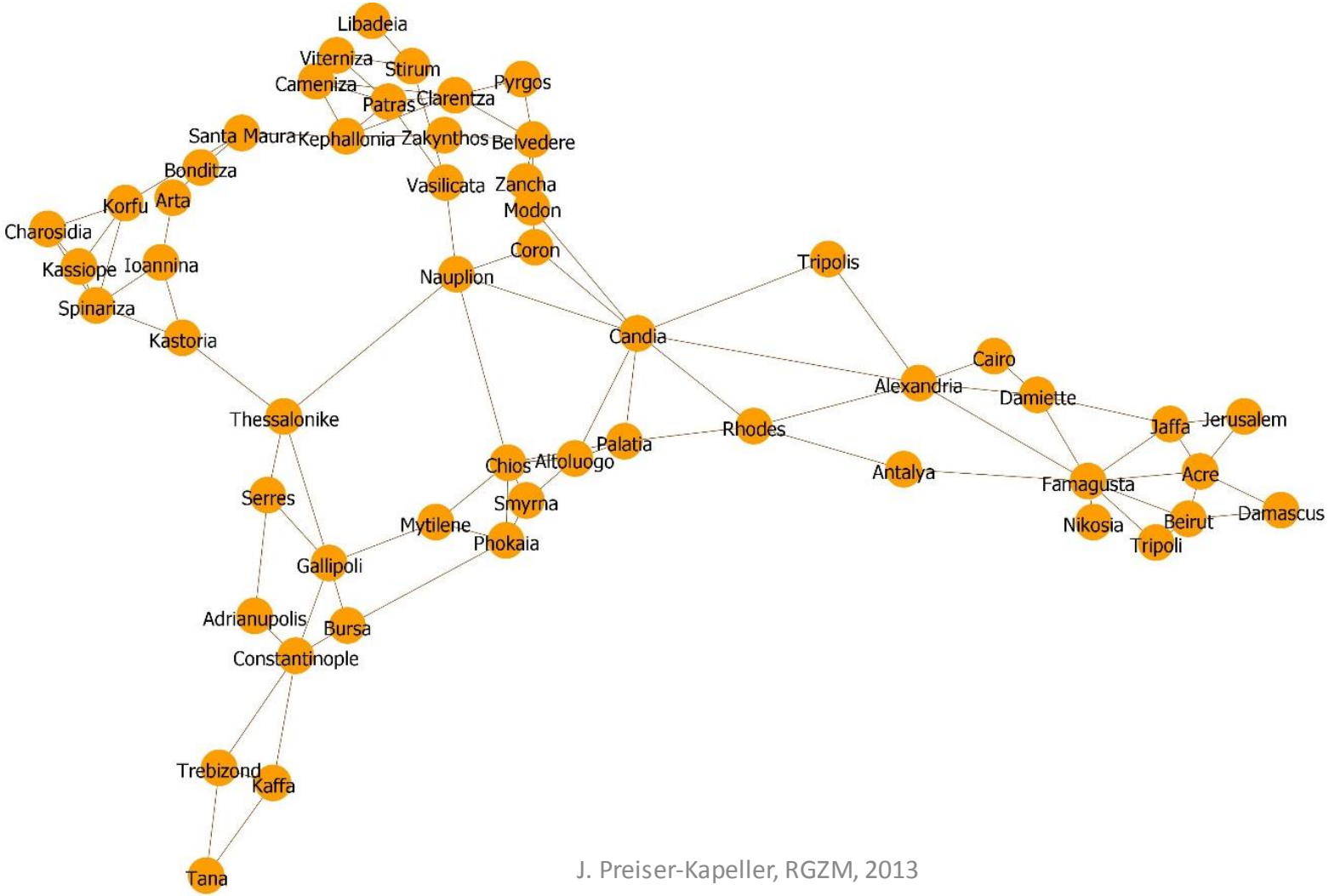
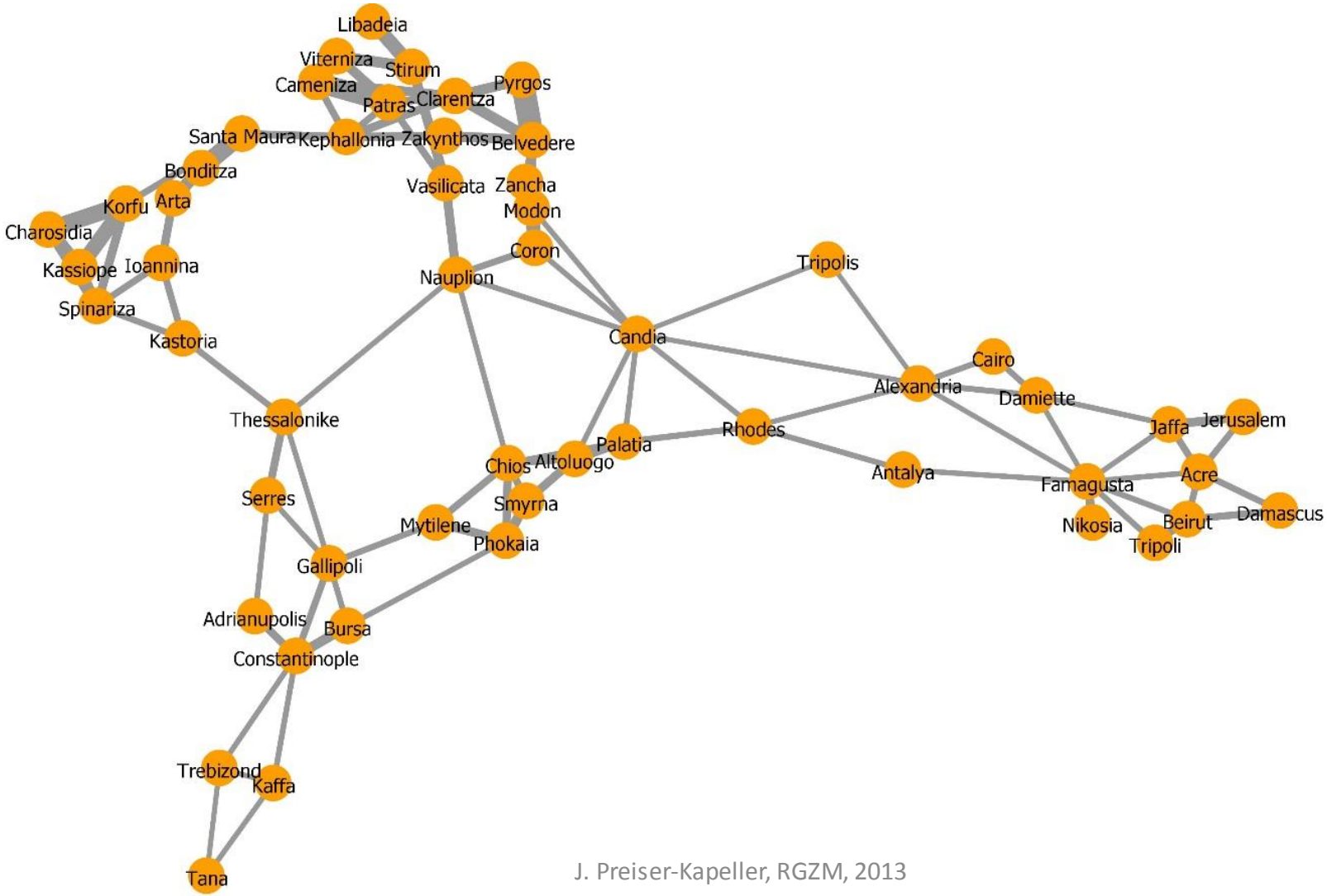
The topology of the Ragusa network



A model of weighted links of interactions based on distance



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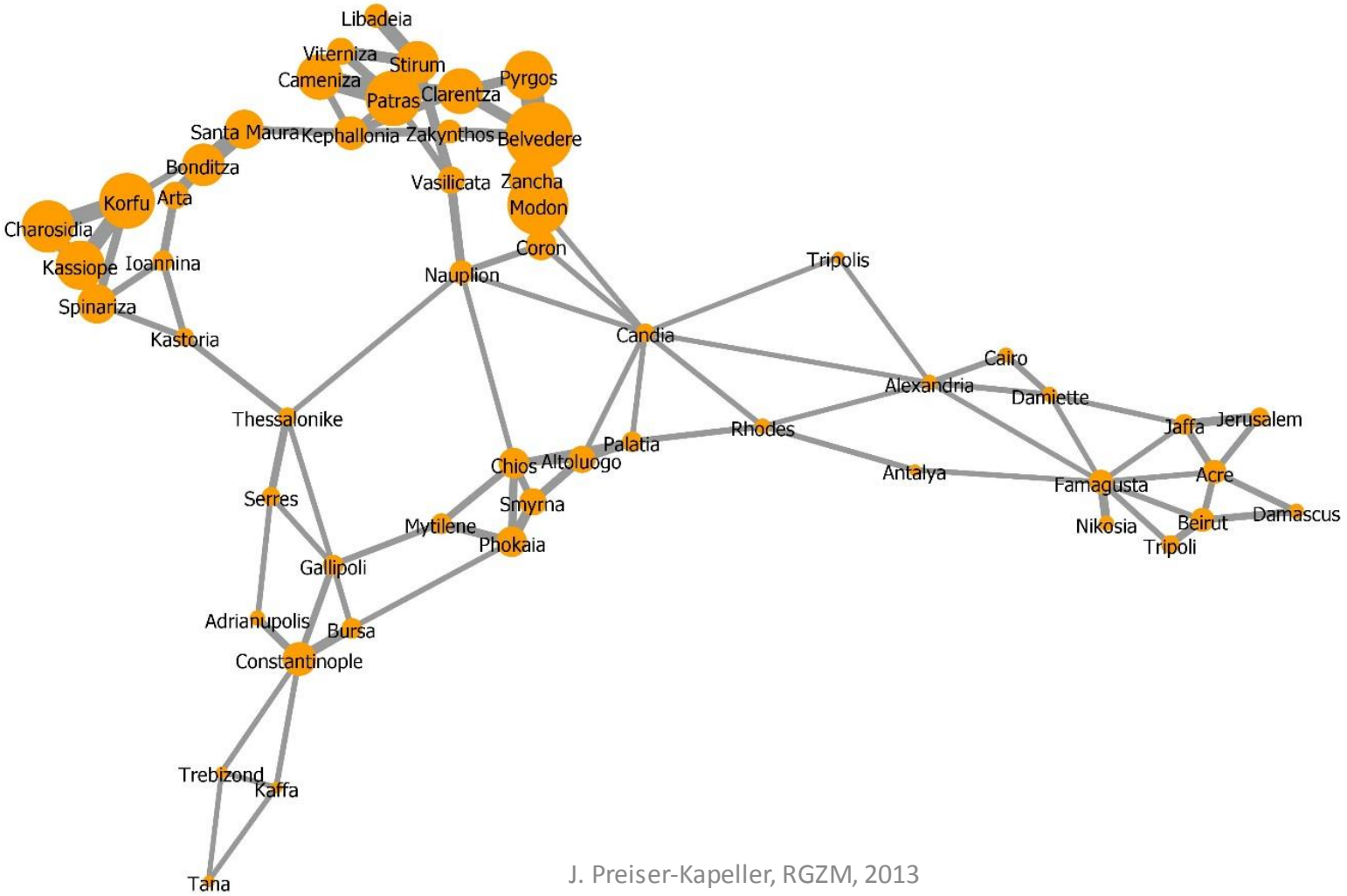
A model of weighted links of interactions based on distance: degree



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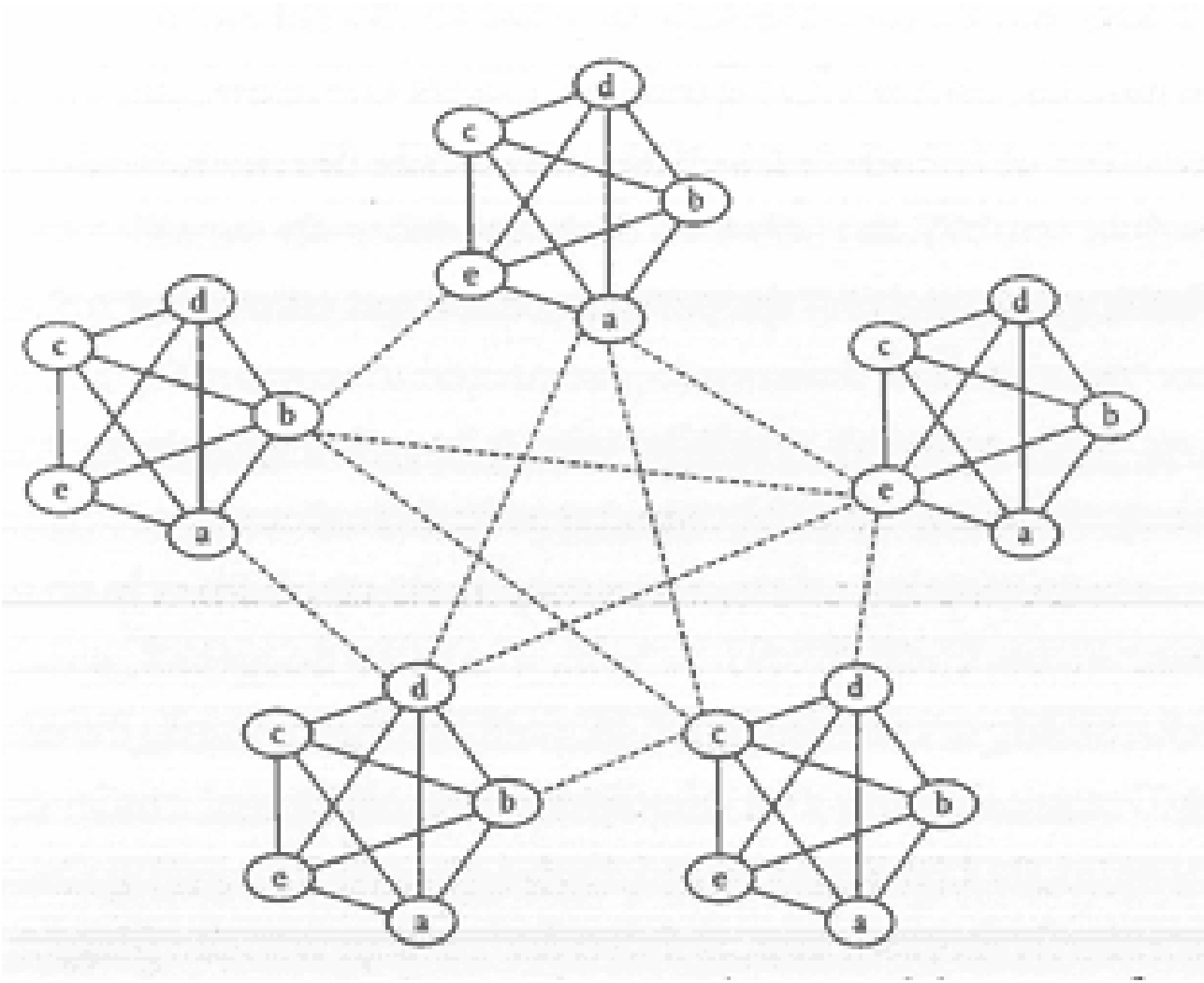
The emergence of dense clusters: small worlds



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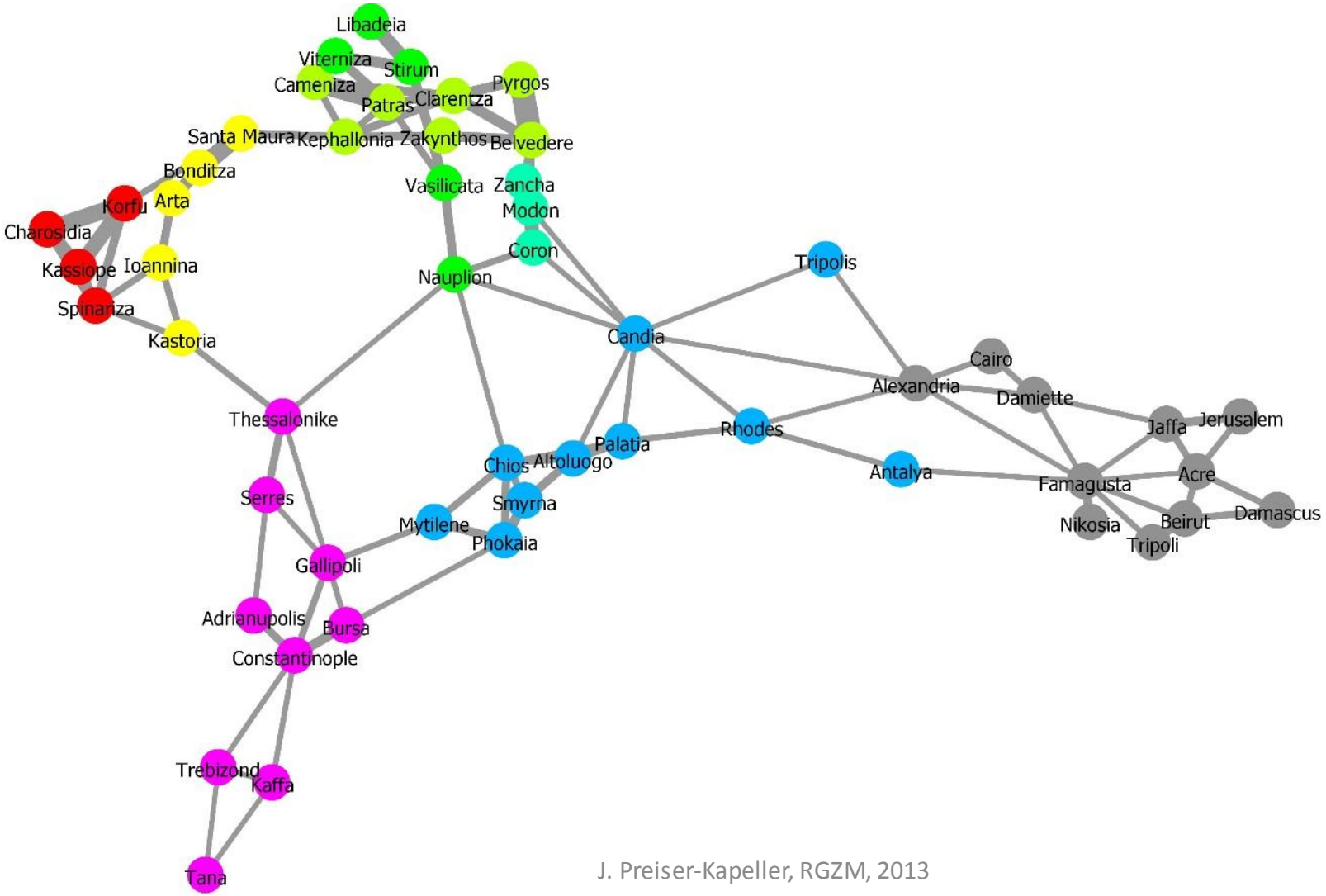
Detecting small worlds: the Newman algorithm



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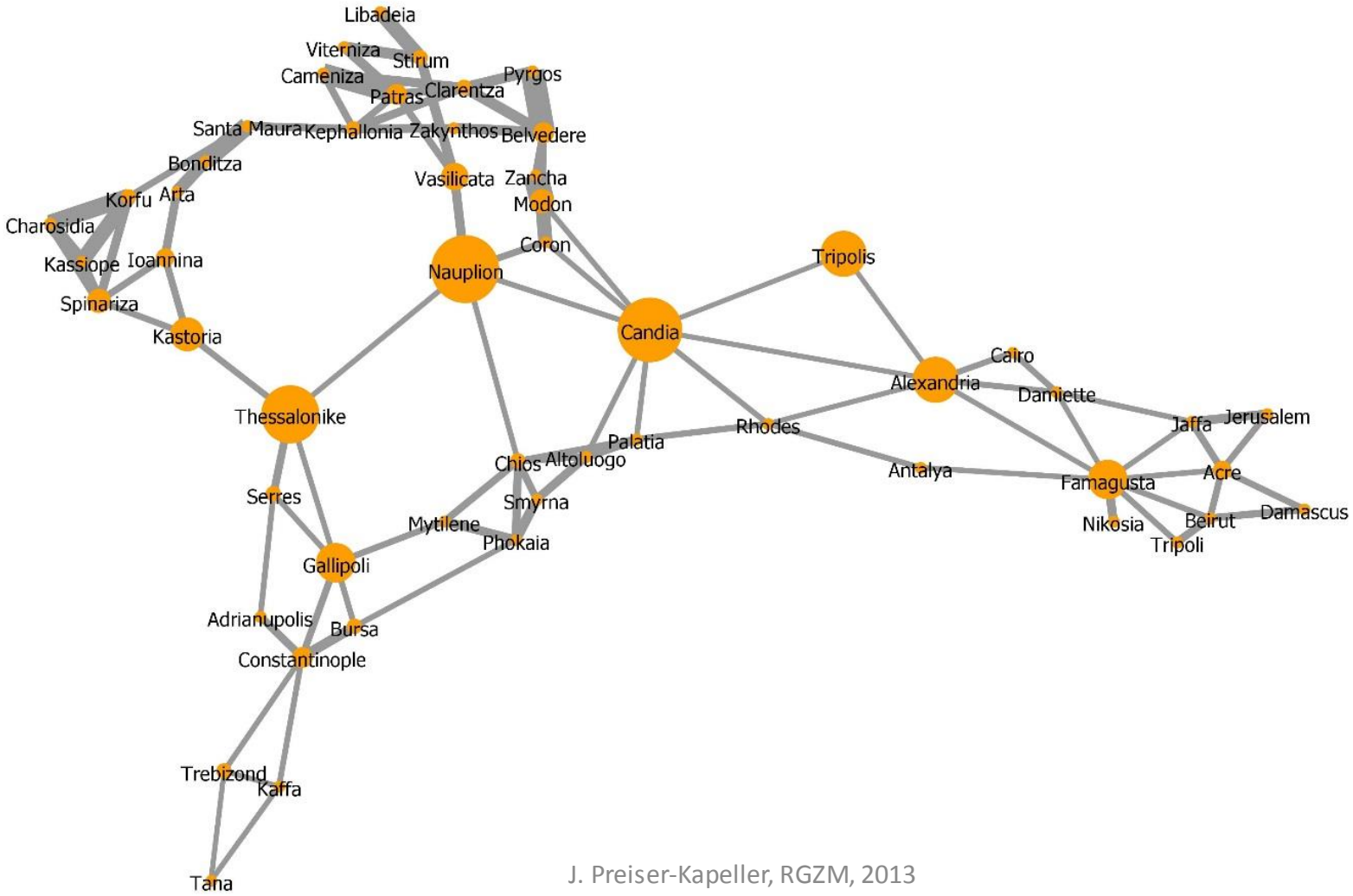
Intermediary nodes between small worlds (betweenness centrality)



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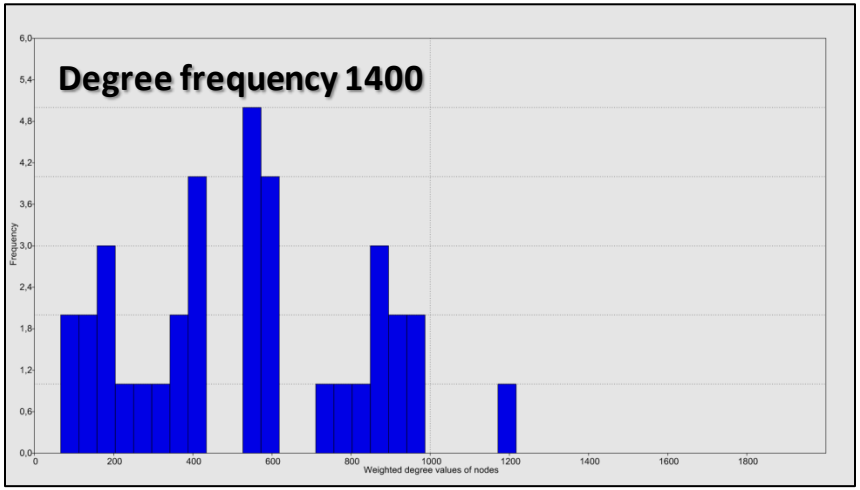
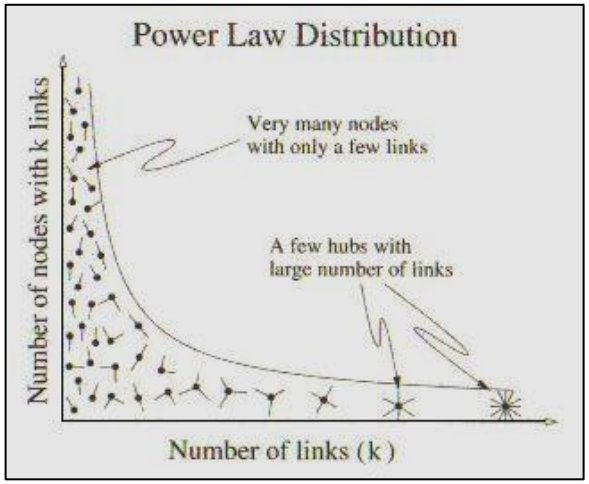
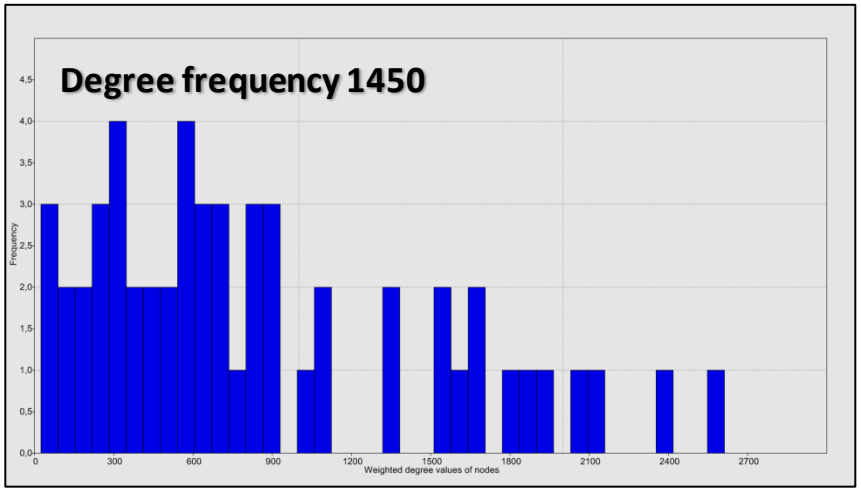
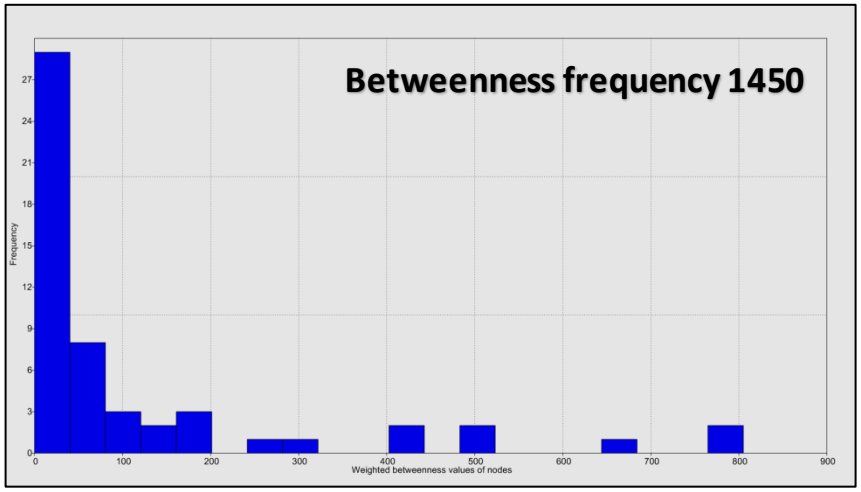
The emergence of signatures of complexity

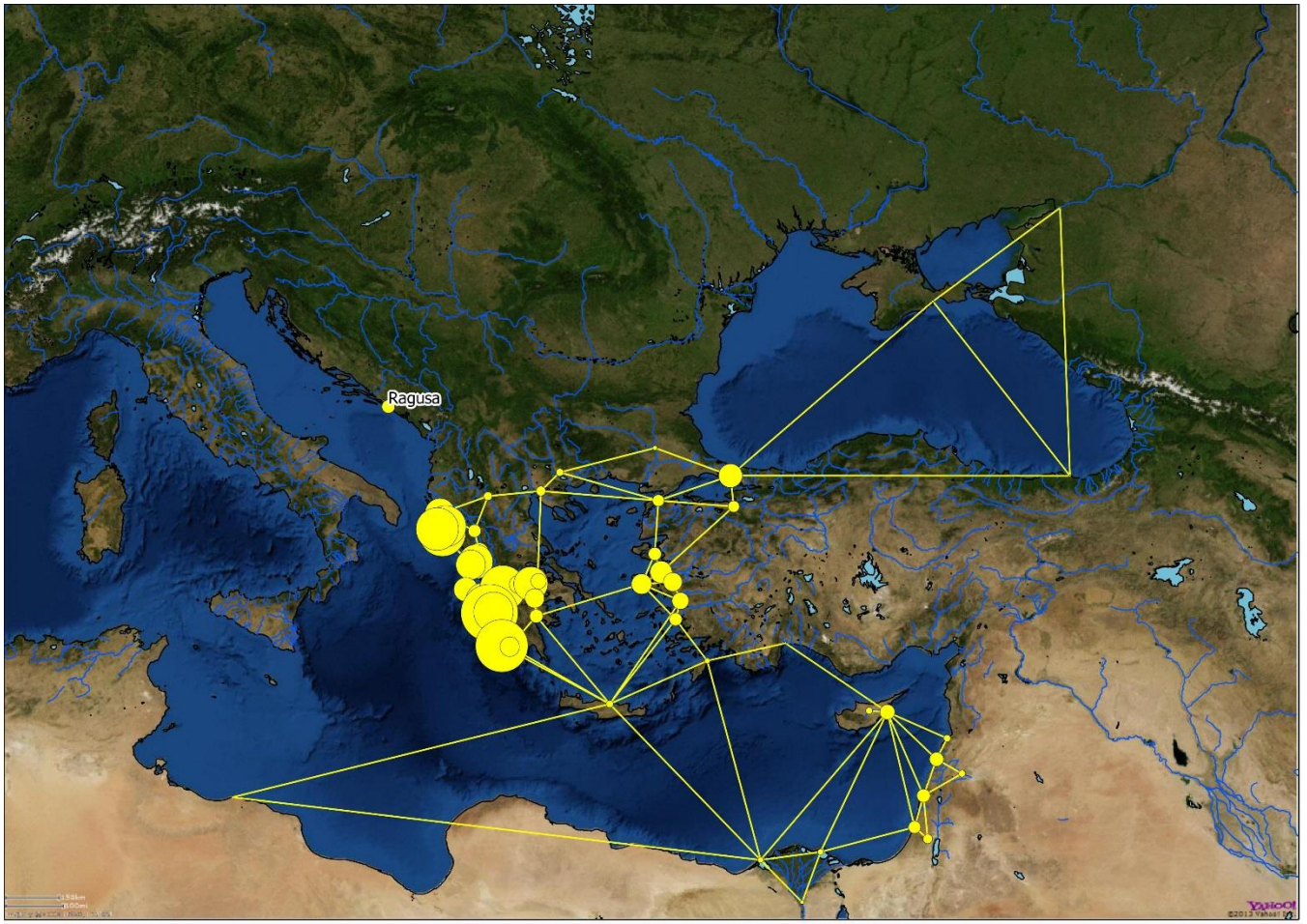








The spatial distribution of degree values 1450



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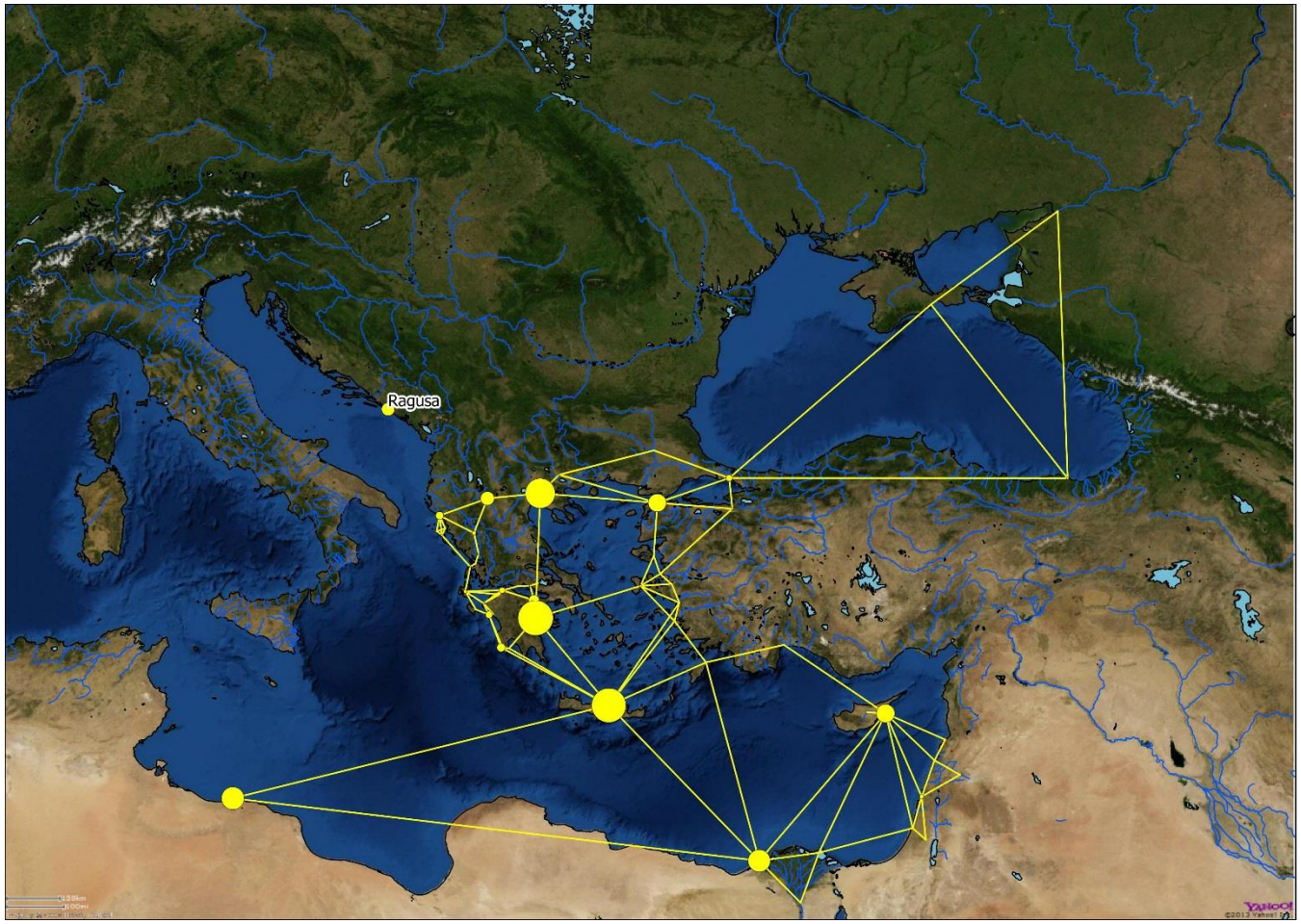
The spatial distribution of betweenness values 1450



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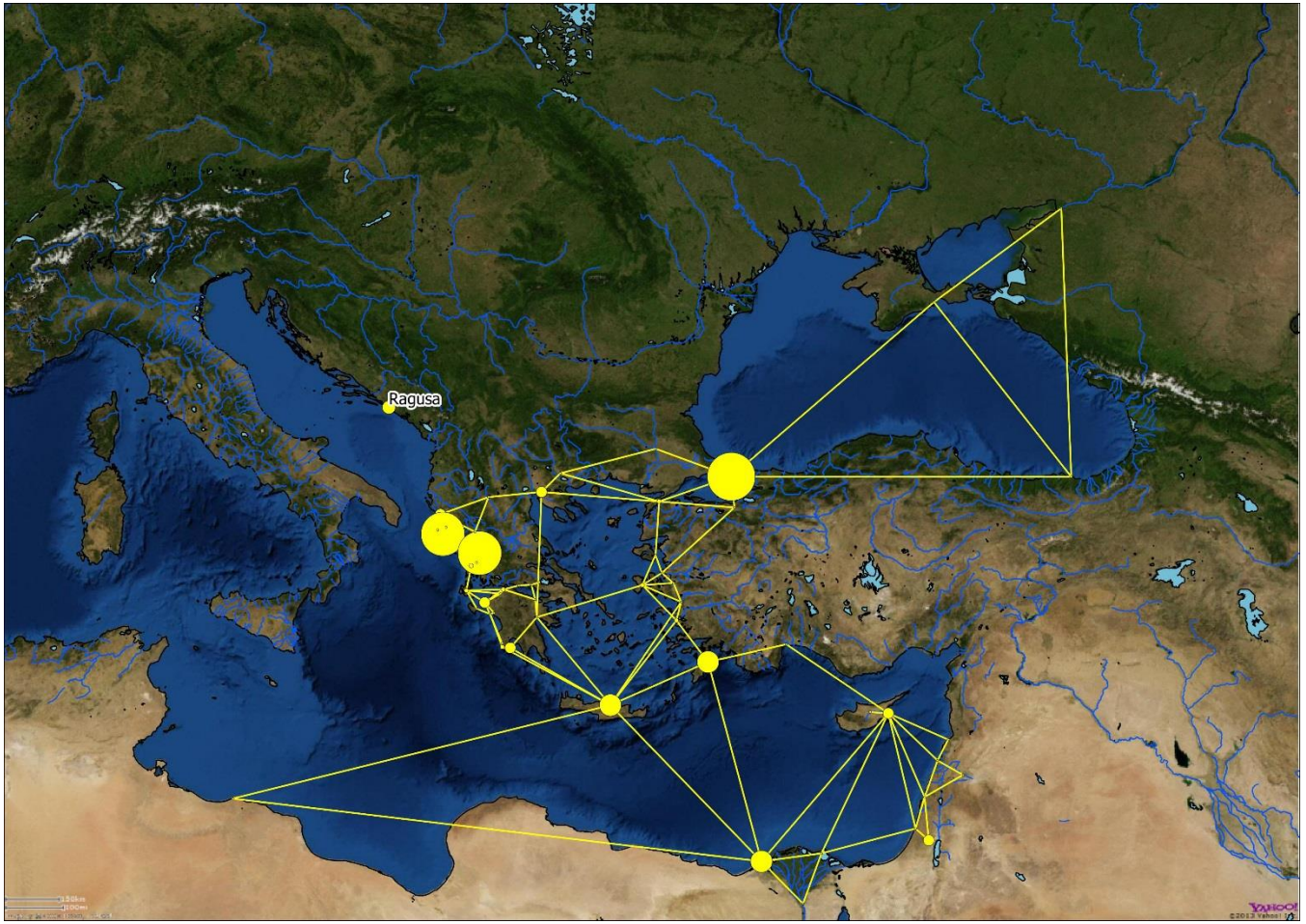
The spatial distribution of documented commercial activity of Ragusan merchants



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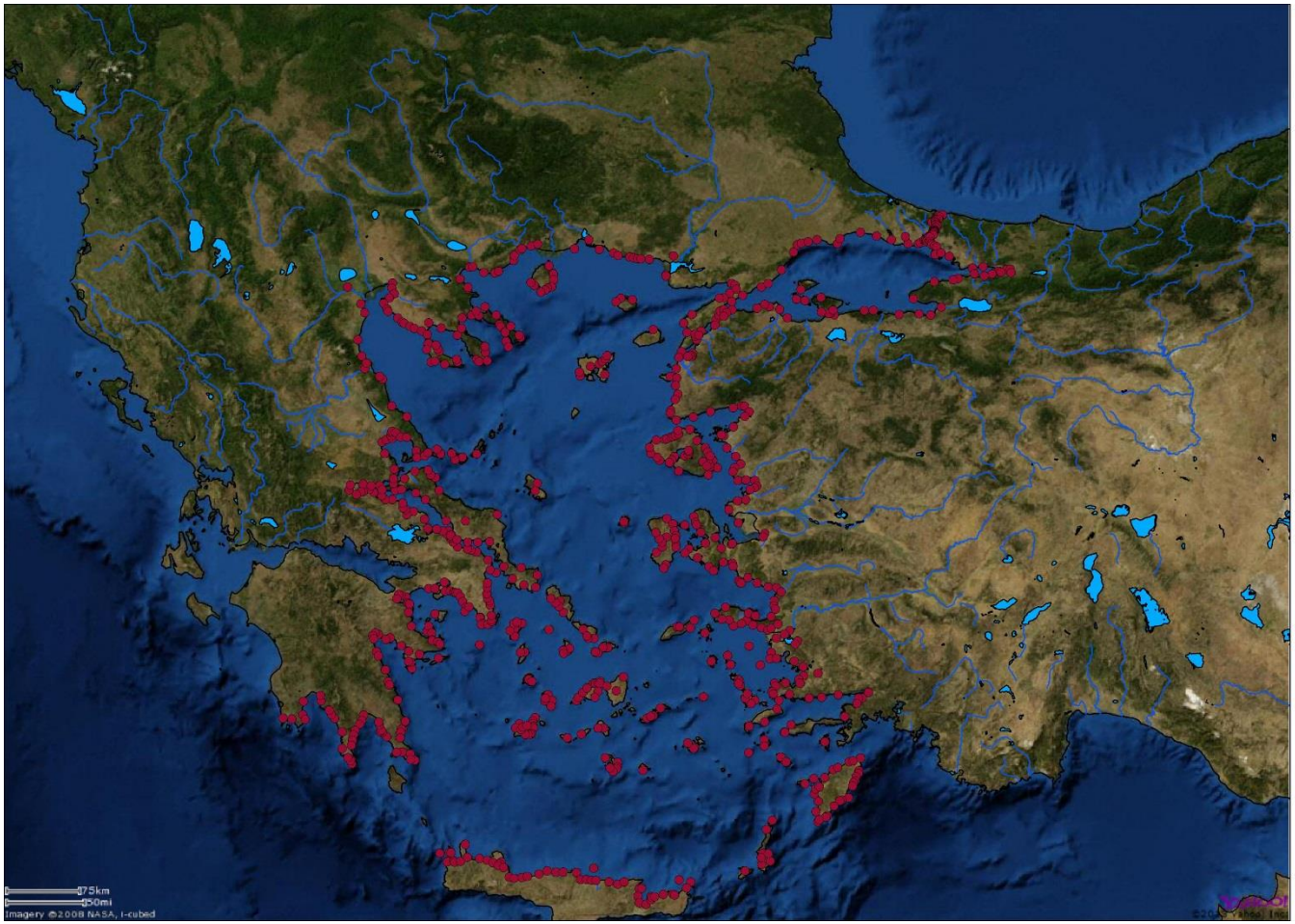
Connecting ports: 792 anchorages, harbours and ports (a model of cabotage and connectivity in the ancient and medieval Aegean)

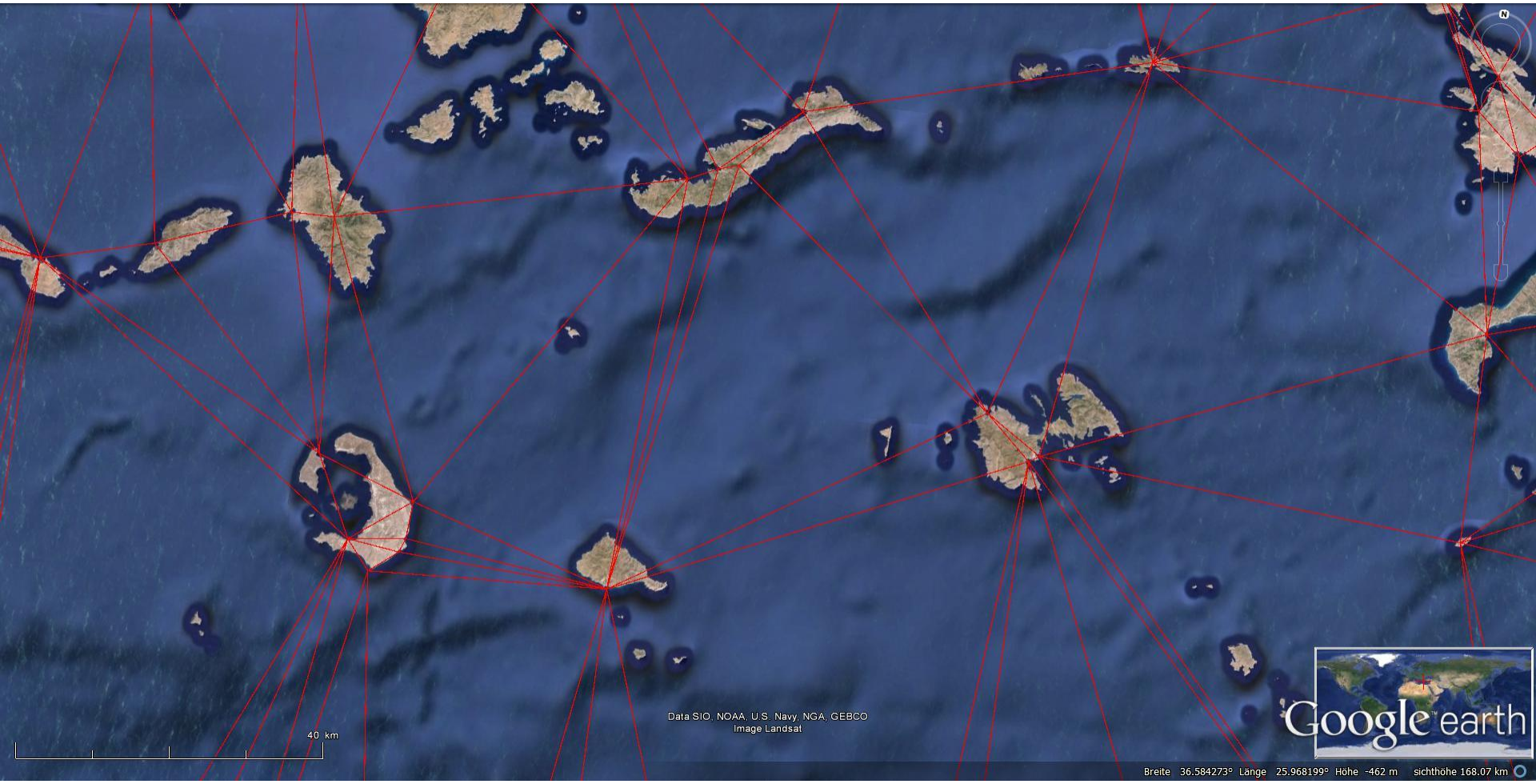
J. Preiser-Kapeller, RGZM, 2013

Anchorages, harbours and ports in the ancient Aegean

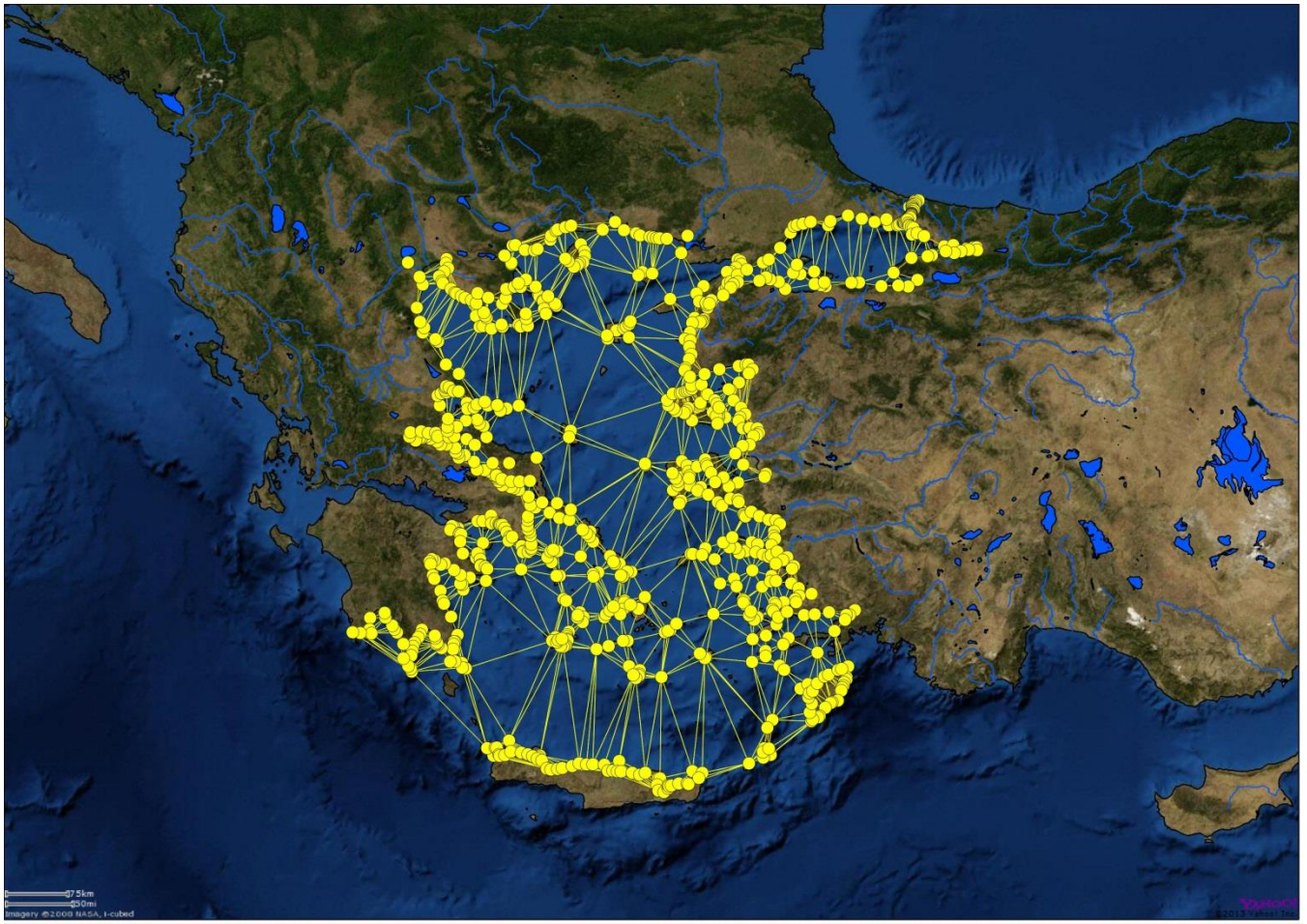
(A. DE GRAAUW 2013 - *Geodatabase of Ancient Ports and Harbors/ Digital Atlas of Roman and Medieval Civilization - DARMC*)



A model of cabotage and “island hopping”: a nearest neighbour network of sites



A model of cabotage and “island hopping”: a nearest neighbour network of sites with 791 nodes, 2188 links



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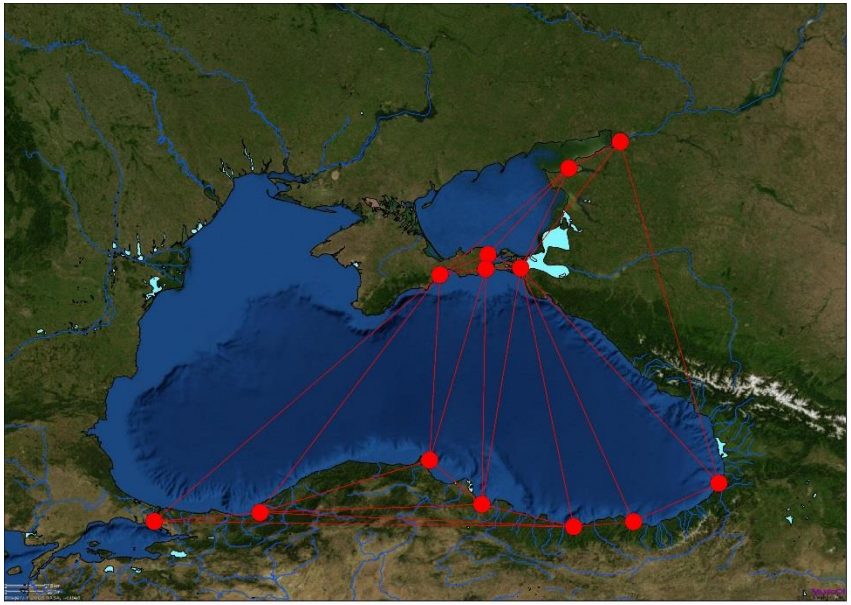
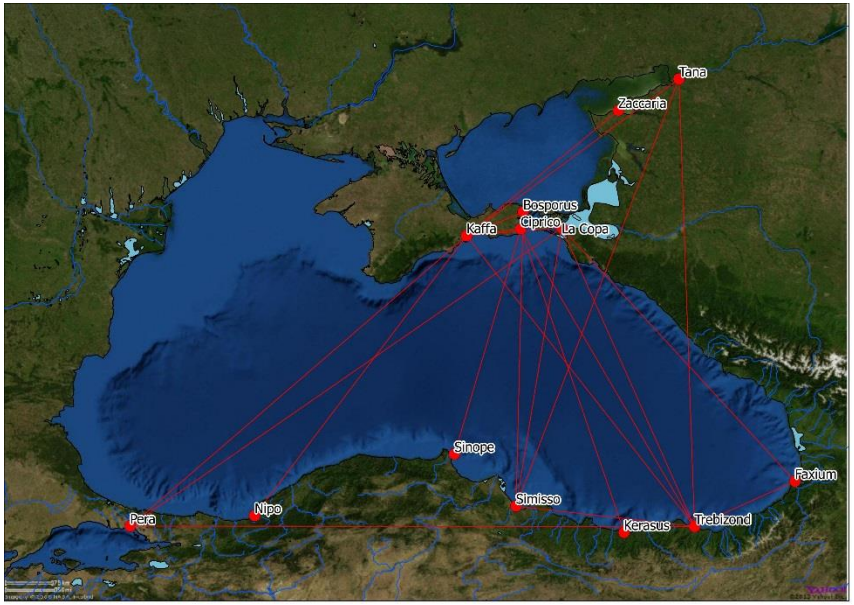
Model and historical evidence: the Black Sea, 1290 (left: Delaunay triangulation, right: routes documented in 1290)





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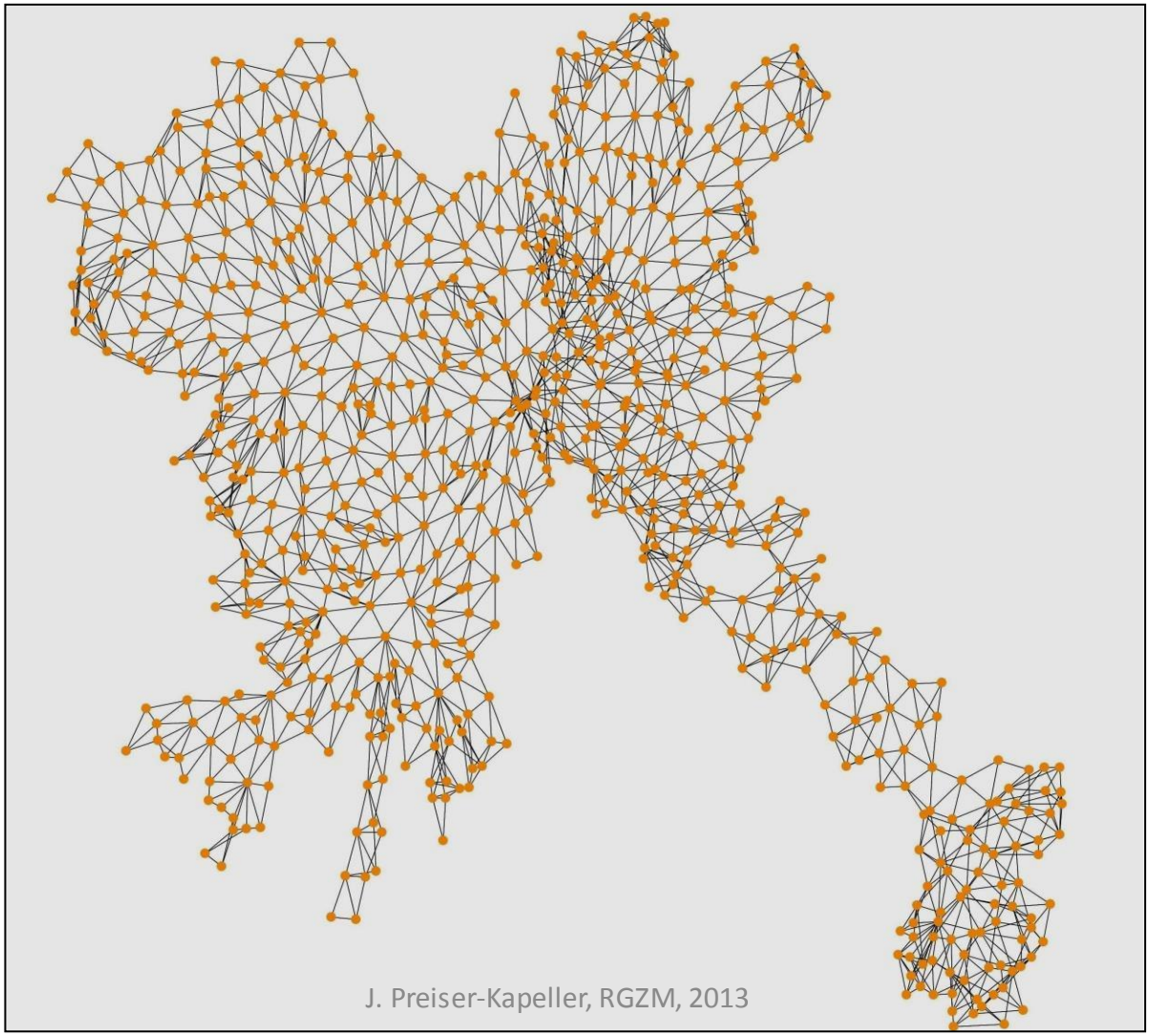
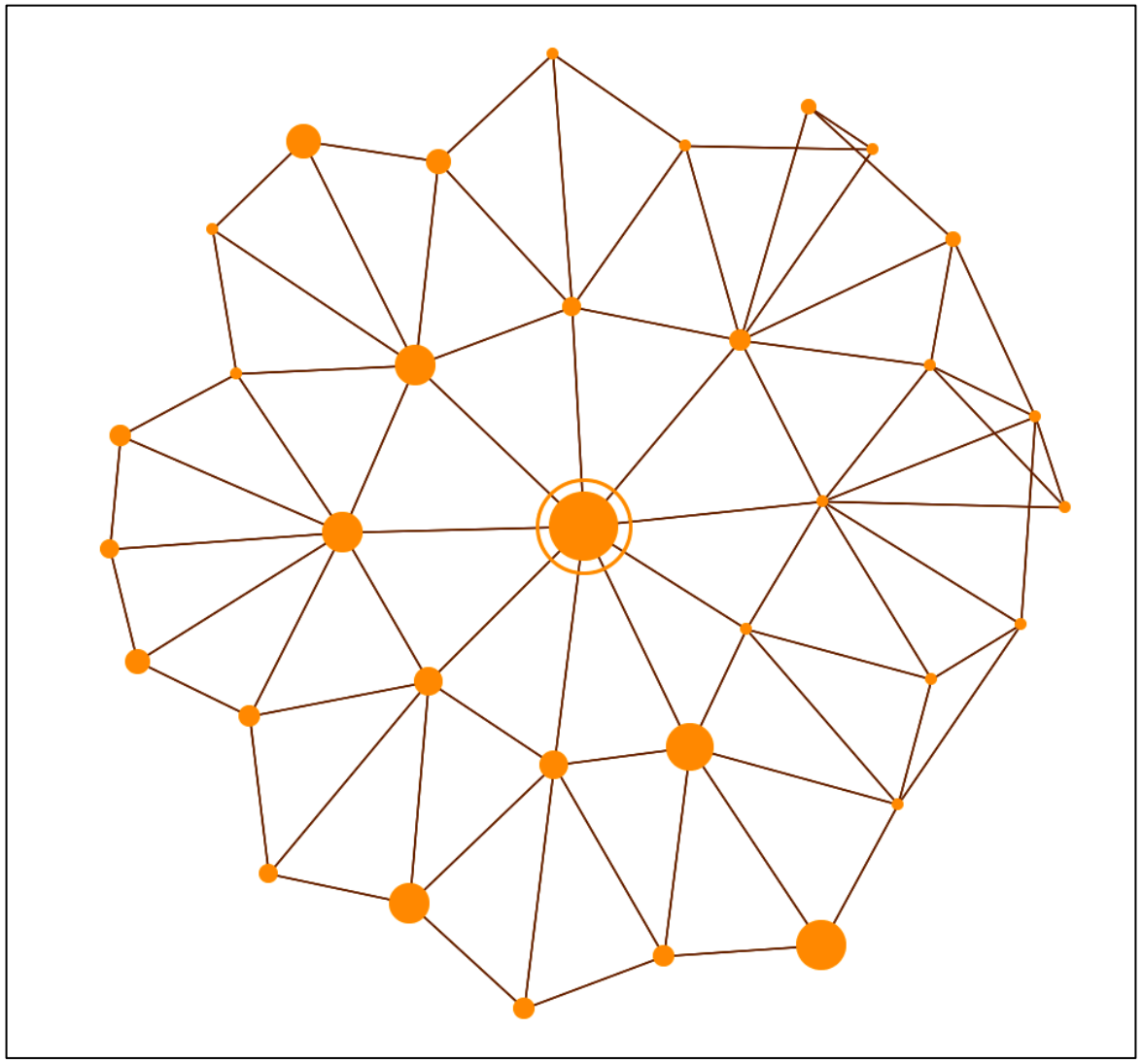
Topology of the Nearest neighbour network for the Aegean



Relative centrality of nodes within the network: *betweenness*



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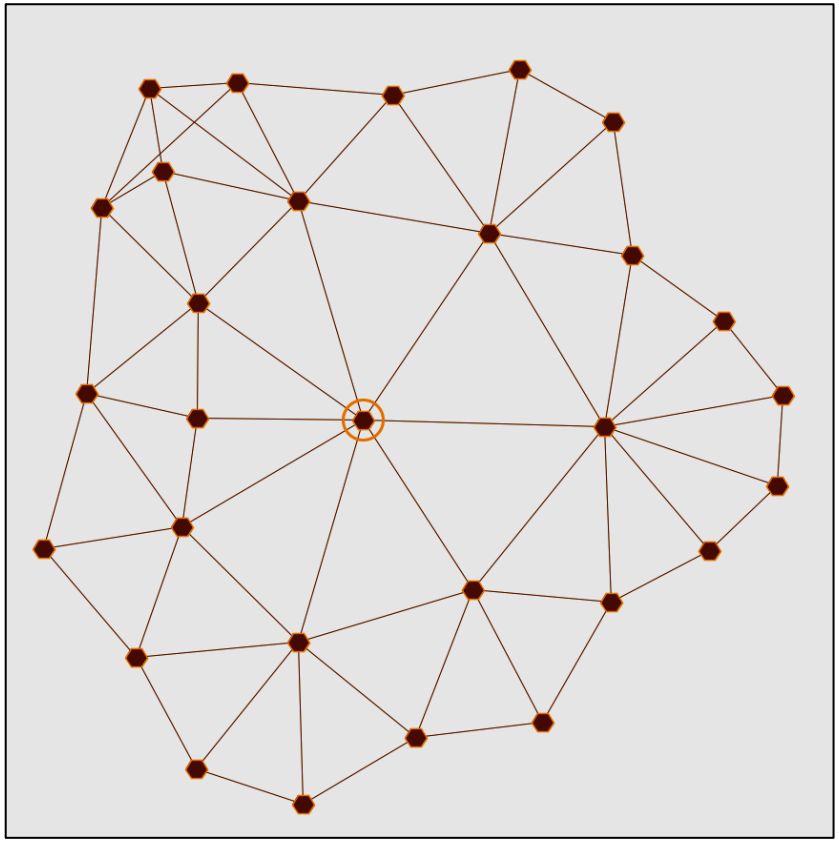
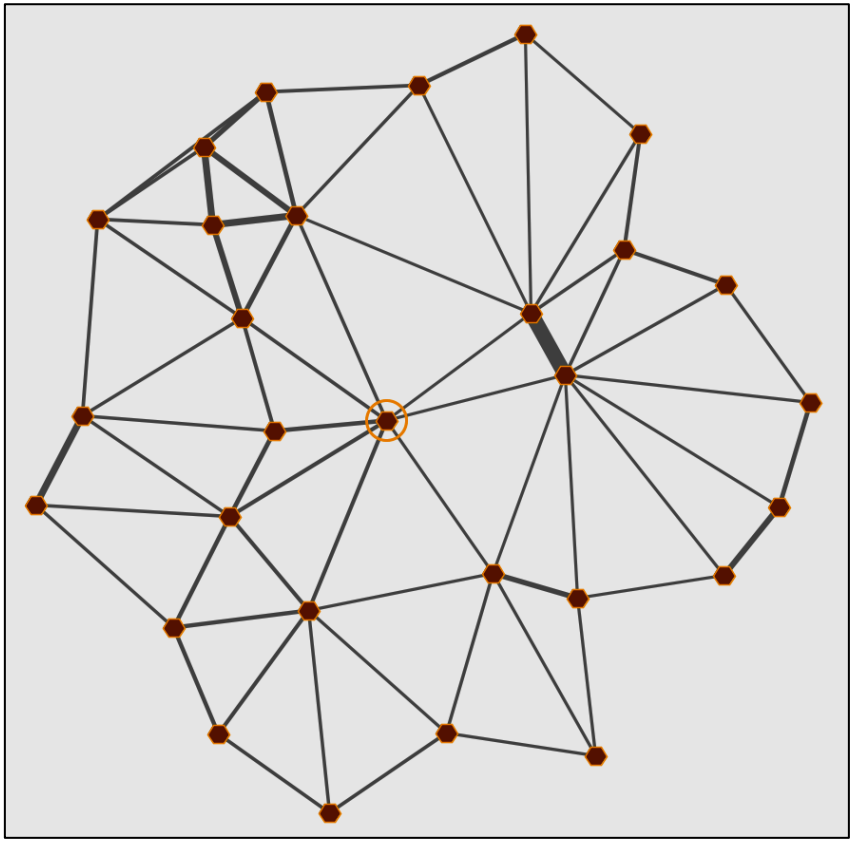
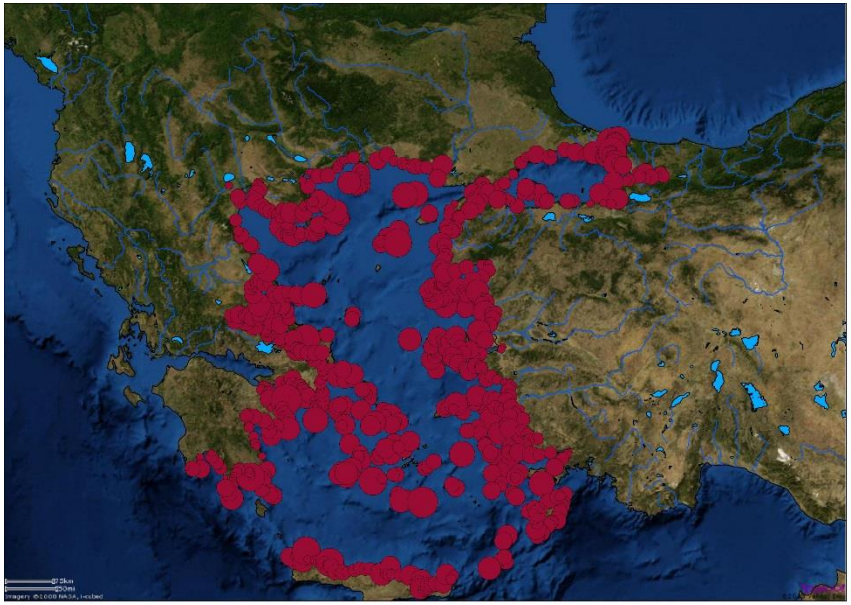
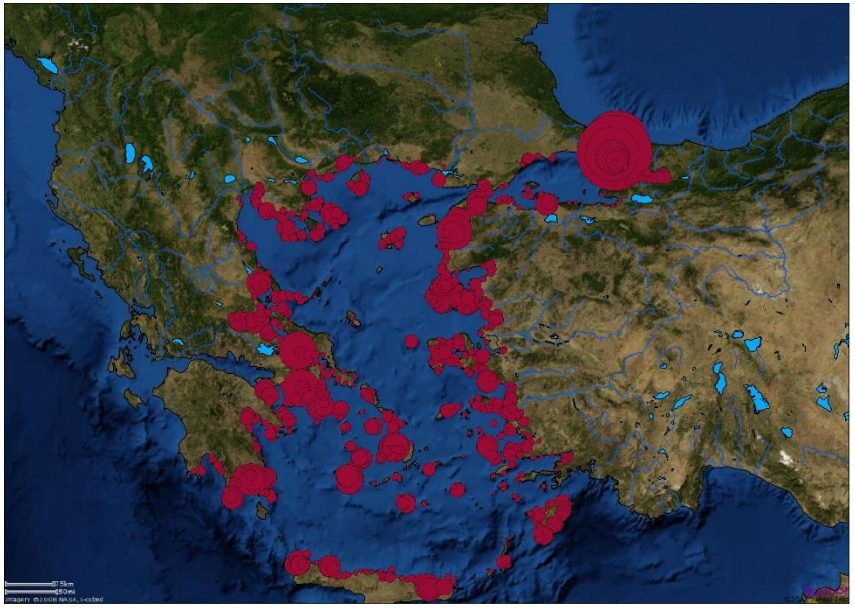
Integrating distance: small worlds and a weighted network model



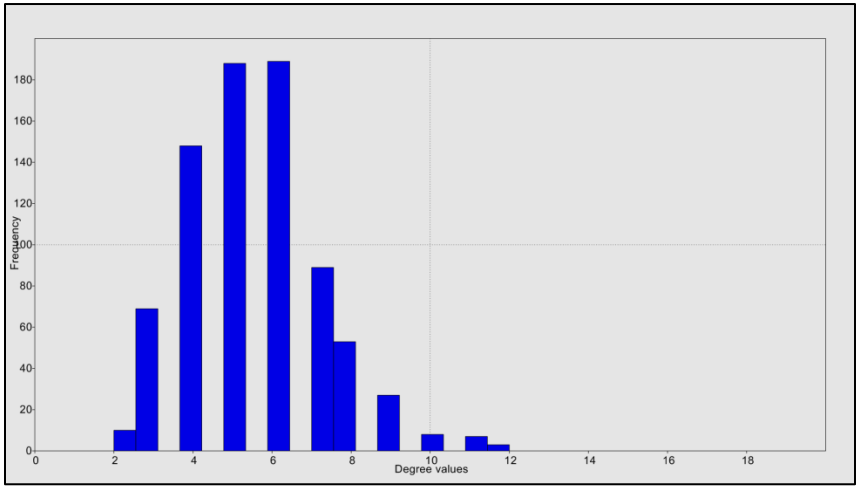


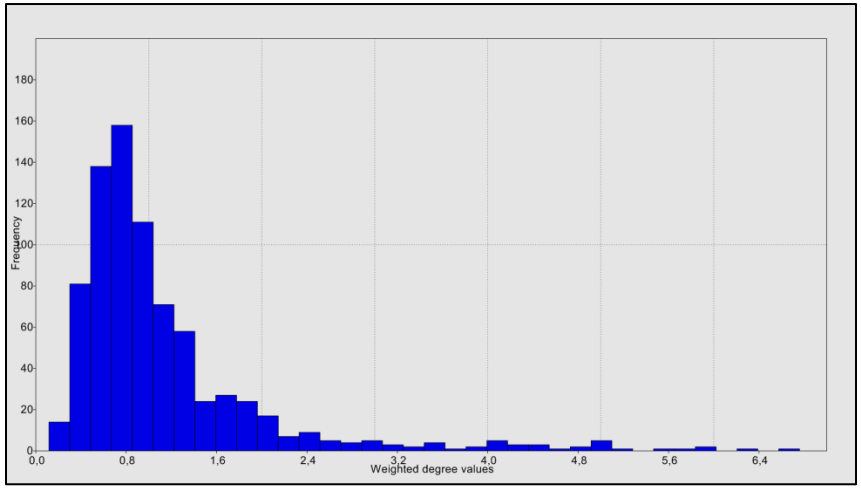
Spatial distribution of degree values in the unweighted (left) and weighted (right) network



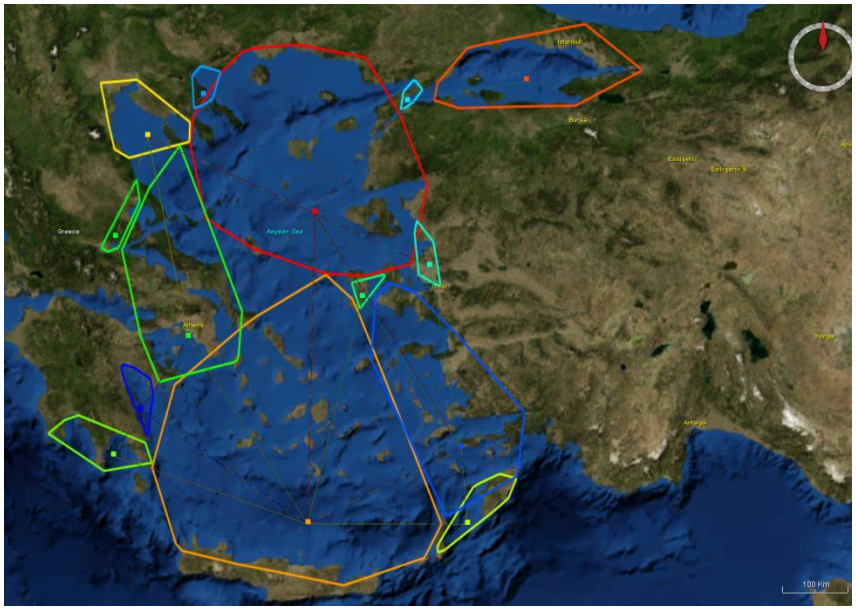


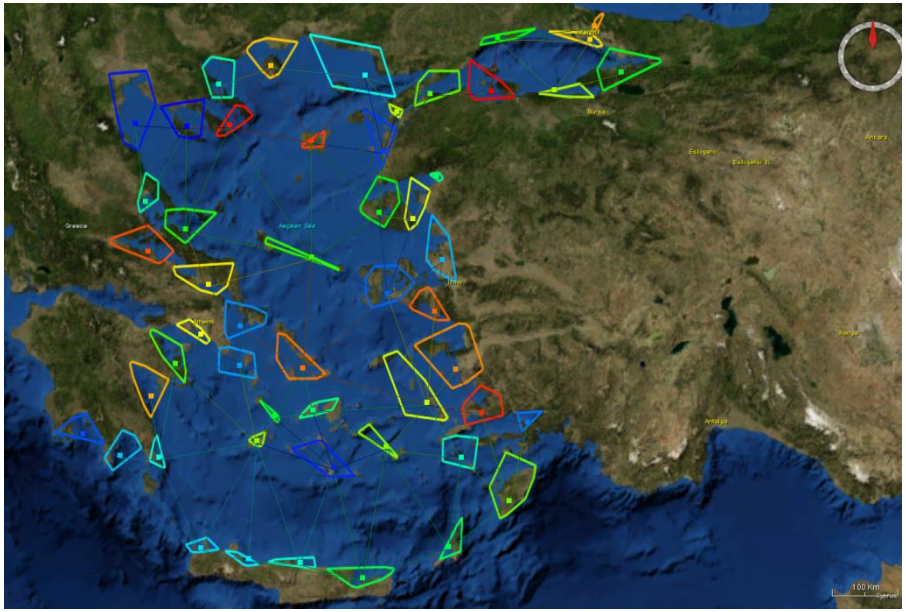
Signatures of complexity: the degree frequency distribution for the unweighted network (left) and for the weighted network (right)



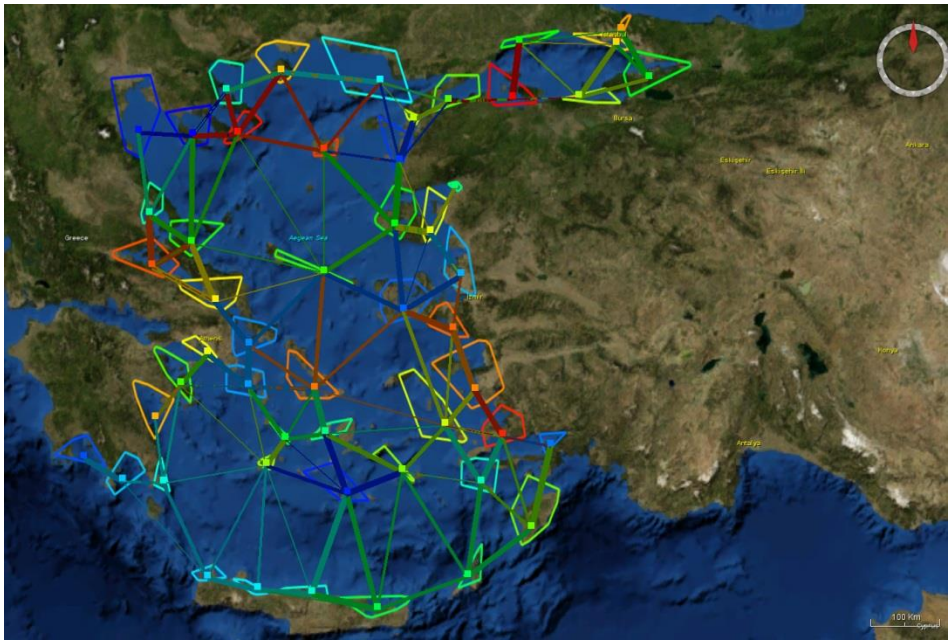


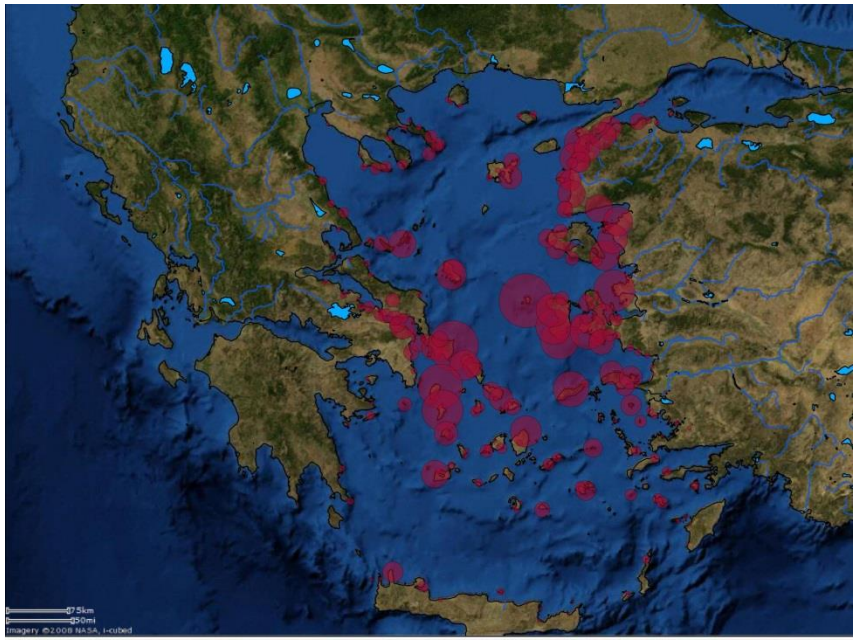
Detecting regional clusters and small worlds at different scales (Clustering by Newman algorithm for the unweighted network [left] and for the weighted network [right])





Connectivity between the small worlds, the spatial distribution of betweenness values in the weighted network and „optimal“ routes through the Aegean





827: the Arab conquest of Crete

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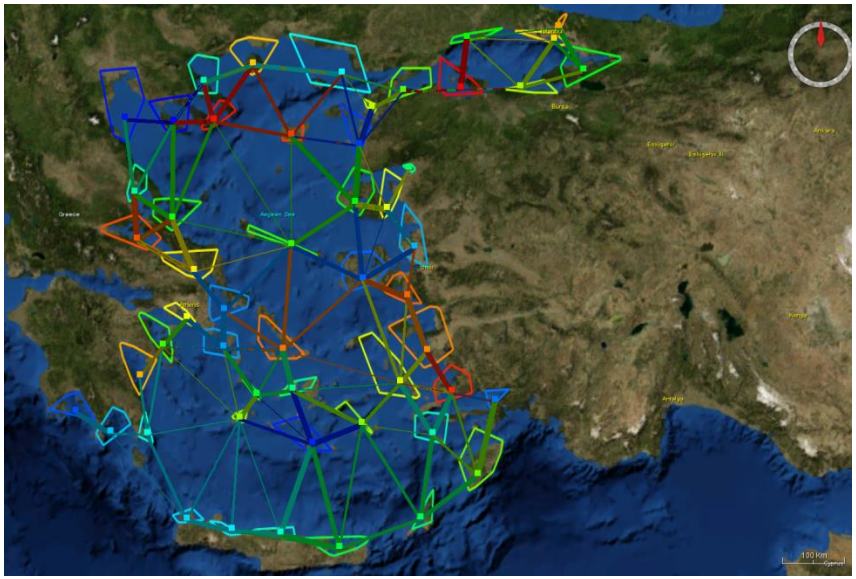
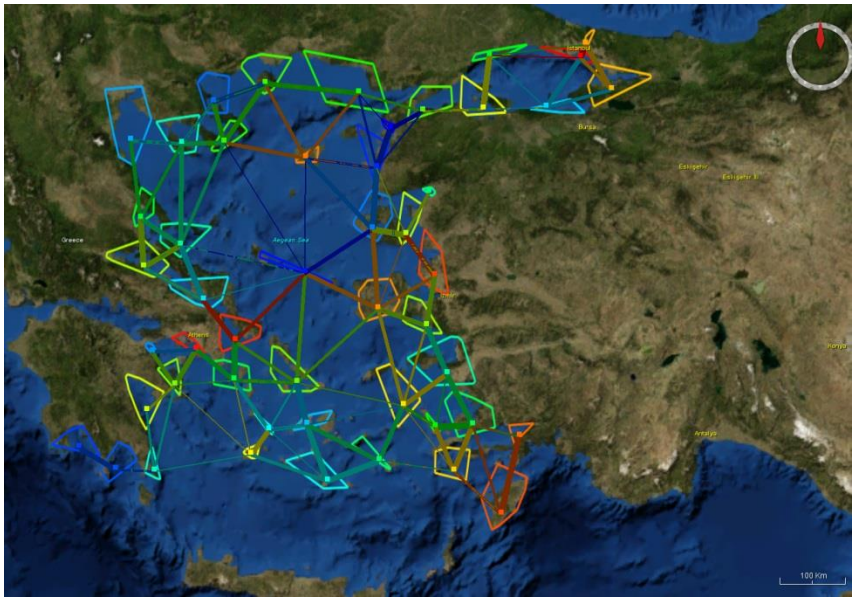
The network without Crete and the robustness of the Aegean small worlds





The significance of „small worlds“ and local maritime connections

- *More importantly, such long-distance connections were dwarfed in quantity by dense networks of local and regional maritime connections among Mycenaean communities. The latter routes and relationships have received little attention, but they must have dominated the use of anchorages, large and small, on Aegean coasts. There were many shades of activity in the spectrum between local and international interaction. Local and microregional maritime networks are best expressed by the concept of the “small world” (Broodbank 2000: 175–210), composed of communities bound together by intensive, habitual interactions due to geography, traditional kinship ties, or other factors. There may be a high level of interdependence and communities may come to think of themselves as forming a natural entity, defined by the dense web of connections that supports a combination of political, social, and economic relationships. Small worlds are nested within larger regional and interregional economic and sometimes political networks.* (from: Tartaron, 2013)

Conclusion – the potential of network analysis

- Surveying and mapping of effects of maritime mobility on connectivity
- Modelling and analysing the complexity of maritime networks
- Modelling and analysing the temporal dynamics of maritime networks
- Detecting of possible „small worlds“ and communities based on maritime mobility and connectivity

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