

Coinage networks in fifth-century BCE Ionia

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Abstract

This article revisits ‘the problem of Classical Ionia’, the long-persisting idea put forward by John Manuel Cook in 1961 that Ionia experienced regional economic impoverishment in the fifth century BCE. By looking comprehensively at the dataset of coinage available from fifth-century Ionia, this article argues that there is actually significant evidence for regional networking in Classical Ionia, and that various communities, even if not continually emitting new coinages at all points in the fifth century, adopted various strategies for maintaining their economic reach and extending their network of trading partners. Formal network analysis is applied to the coinage dataset, taking the shared weight standards to which communities minted their coins as indicative of participation in common economic networks. The network patterns are tested against two other patterns, specifically the distribution of fifth-century Chian and Samian amphoras, and the pattern of Ionian-coin-containing hoards from within and beyond Ionia. Together, these patterns strengthen the case for a high-level Ionian economic resilience, offering a radically different position to Cook and reaffirming that continuing economic networking was crucial to the activities of fifth-century Ionian states.

Özet

Bu makale, John Manuel Cook tarafından 1961 yılında ortaya atılan ve uzun süredir devam eden, Ionia'nın MÖ beşinci yüzyılda bölgesel ekonomik fakirleşme yaşadığı fikrini, yani ‘Klasik dönem Ionia sorununu’ yeniden ele almaktadır. Beşinci yüzyıl Ionia'sına ait sikke veri setini kapsamlı bir şekilde inceleyen bu makale, Klasik dönem Ionia'da bölgesel ağlar kurulduğuna dair önemli kanıtlar olduğunu ve çeşitli toplulukların, beşinci yüzyılda her noktada sürekli olarak yeni sikkeler basmasalar bile, ekonomik erişimlerini sürdürmek ve ticaret ağlarını genişletmek için çeşitli stratejiler benimsediklerini savunmaktadır. Toplulukların sikkelerini bastıkları ortak ağırlık standartlarını, ortak ekonomik ağlara katılımın göstergesi olarak kabul ederek sikke veri setine biçimsel ağ analizi uygulanmıştır. Ağ modelleri, özellikle beşinci yüzyıl Khios ve Samos amforalarının dağılım modeli ve Ionia'nın içinden ve dışından ele geçmiş Ionia sikkesi içeren define modeli olmak üzere diğer iki modelle karşılaştırılmıştır. Bu modeller hep birlikte, Cook'tan tamamen farklı bir yorum sunarak ve devam eden ekonomik ağların beşinci yüzyıl Ionia devletlerinin faaliyetleri için çok önemli olduğunu yeniden teyit ederek, üst düzey bir Ionia ekonomik dayanıklılığına ilişkin durumu güçlendirmektedir.

The Archaic period in Ionia has long been considered a ‘Golden Age’ in recognition of the wealth, knowledge and power concentrated along the western Anatolian littoral of the sixth century BCE. From the effervescence of scientific and philosophical thinking to the production of high art, and from monumental construction projects to extensive trade networks pushing all the way into central Anatolia and the Black Sea, most ancient scholars and

contemporary scholars consider this place and time to have been an ‘age of enlightenment’ (cf. Hdt. 1.141–3, 5.109; Akurgal 1962; and much more recent synthesis in Cevizoğlu 2022; Cevizoğlu, Tanrıver 2022).

But the story of prosperity changed in the fifth century BCE. After the failed revolt of 494 BCE (Hdt. 5.28–55, 97–126; 6.1–42), all settlements of the region save for Samos lay in ruins, sacked by the Achaemenid Empire and,

until the liberation of Ionia at the battle of Mycale in 479 BCE, lived under threat of further invasion. Persian devastation was reportedly widespread, a period of complete abandonment at the ransacked Miletus (Hdt. 6.25.1; cf. Graham 1992; Guth 2017: 2–20; contra Herda 2019; Lohmann 2021). That many Ionians migrated out of the region is historically documented (Hdt. 6.22–4), with the result not only of a widespread depopulation of Ionia but also, as per recent proposals (Slawisch 2022: 498), of a ‘brain-drain’ of its technical and skilled minds. The second half of the fifth century was no less tumultuous. Once integrated into the Delian League, a number of Ionian states staged (largely unsuccessful) revolts against Athens between 454 and 449 BCE, resulting in the requirement that these communities give large tributes back to Athens, hefty payments from an already impoverished region. And it is against this backdrop of conflict and instability, of depopulation and political subordination, of wealth flowing out of the region that lacunae in the fifth-century material record often are interpreted as indicative of an Ionian ‘Dark Age’: a century of poverty during which Ionians lacked the wealth and resources, or were too otherwise occupied, to produce things as they had a century earlier – not the monumental temple of Apollo at Didyma, not the characteristic sculpture, not the Fikellura pottery of Miletus.

This characterisation (or caricature) of Ionia has been created almost *ex nihilo*, and as new archaeological evidence is discovered, published and synthesised, the idea of a ‘Dark Age’ must progressively be revised. In Anglophone scholarship, what became known as ‘the problem of Classical Ionia’ owes much to an article of the same name published in 1961 by John Manuel Cook (cf. Cook 1962: 122). Cook took particular issue with the Ionians of the fifth century failing, as outlined above, to build in the way that their predecessors of the sixth century had done. He argued that a dearth of monumental building projects could be attributed to general economic decline and an unavailability of ‘good land ... to support comfortable and dignified urban life’, noting ‘a common level of degradation and, to some extent, economic paralysis’ – why else could the Ionians of the sixth century construct the temple of Apollo at Didyma or the Artemision at Ephesus, but not the Ionians of the fifth century? This model certainly convinced a generation of scholars (e.g. Pritchett 1971; Meiggs 1972; Balcer 1984), and even now (Kunish 2016: 65–66, contra Nudell 2023: 184ff.) it is still considered as a serious possibility in critical discussions of the region’s history. Robin Osborne (1999), now over 30 years ago, has been the most direct challenger of Cook’s thesis, demonstrating that the dearth of building was not particularly Ionian of the fifth century but is a common non-Athenian pattern across the Aegean. It was Delos alone that enjoyed

substantial new building throughout the fifth century, finishing monumental building projects at the Archageion, Prytaneion and Thesomophorion, and installing four Treasuries; aside from Athens under the Periclean building programme, no other Greek community of the fifth century BCE is observed to have been so prolific in construction activity. But whereas Osborne’s focus was on the temple building itself as a marker of the economy’s health, this article turns attention to the cause rather than the effect, to other forms of supposed economic inactivity of the fifth century in general, and to the case of Ionia in particular.

As new material evidence becomes available, Cook’s model of economic inertia in Ionia is becoming less and less convincing, with the scholarly conversation having now pivoted towards revisionist histories of fifth-century Ionia. At the level of the site (Ehrardt 2003; Herda 2019) and across the wider region (Loy, Slawisch 2021), a new wave of scholarship synthesising Ionia’s Classical history aims to take greater account of the abundance of archaeological data that has come to light since Cook’s time (much of it still unpublished or relatively under-deployed in secondary scholarship). That different cities had different strategies for recovery and reorganisation not directly in-step with one another, and that local histories were significant, are important emerging views (Slawisch, forthcoming).

This article aims to provide further evidence for just this alternative. By looking at the pattern of coinage across fifth-century Ionia, it will be argued that, even though there were gaps in the emissions of certain Ionian cities, viewed in the longer-*durée* across the whole of the fifth century, there is fairly substantial evidence for economic networking – and, thereby, a case *against* economic inertia. The first part of this article considers what constitutes the evidence for the coinage of the fifth century, reviewing not only what the largest museum collections tell us about the size of emissions and about denominational composition, but discussing, also, that even though there are problems in the chronology of this dataset, the weight of the data is still very much stacked against Cook’s model of inertia. The main discussion applies formal network analysis to the dataset, considering how the distribution of weight standards in Ionia provides evidence for economic networking and exchange systems, networks that shift throughout the fifth century but remained fairly resilient in the face of turbulent political events. This section will suggest that, contrary to Cook’s thesis, there was greater contraction of economic networking at the Aegean level than at the Ionian level. Thereafter, this pattern will be tested against two other Mediterranean-level patterns: the distribution of transport amphoras from Chios and Samos, and the pattern of Ionian-coin-containing hoards. While the former gives context for how Ionian communities

adopted strategies of resilience for maintaining and extending their networks, the latter tells us more about the circulation of Ionian coinage and the ‘longevity’ with which Ionian coins (even those struck in the archaic period) continued to be used locally, regionally and supra-regionally. Ultimately, this study challenges the notion of the Ionian ‘Dark Age’, reaffirming that economic networking remained active among fifth-century Ionian states.

The coins of fifth-century Ionia

Among the successes of the sixth century and Ionia’s ‘Golden Age’, a strong regional economy is understood from the quantity and range of coinage produced in this place at this time. The first Aegean coinage is attributed to Ionian communities, with the suggested emergence of this new technology being between the late seventh and mid-sixth centuries BCE (Weidauer 1975; Furtwängler 1982; Kroll, Waggoner 1984; Wallace 1987; Carradice, Price 1988: 20; Bammer 1990; 1991; Williams 1991; Howgego 1995; Weissl 2002; 2005; Wartenberg, Fischer-Bossert 2016); the latest research puts the first coinage of Ionia in the seventh century, at 650–625 BCE (Kerschner 2020; Kerschner, Konuk 2020; cf. Rutter 2021). This first coinage was electrum, a man-made alloy of gold and silver based on technology developed by the Lydians, but that largely ceded to pure gold and silver coinages from the mid-sixth century BCE. At least nine Ionian communities were minting their own coins by the end of the sixth century (Chios, Clazomenai, Colophon, Ephesus, Miletus,

Phocaea, Samos, Smyrna and Teos, Fig. 1), each with distinct iconographies or *parasema*; many of these became closely associated with local community identity and persisted into the Classical period (Killen 2017, building on Zeuner 1963; Spier 1990). While a substantial number of communities minted their coins to the Lydo-Milesian weight standard (or the Phocaeans to their own local standard) some looked to technologies used elsewhere in the Aegean, such as the Teians minting to an Aeginetan standard or the Samians striking coins to a mixture of standards including the Euboean, Lydo-Milesian, Persian and a local Samian standard. This enabled communities to extend their economic networks further into the Aegean and to increase potential for economic interaction with their neighbours (cf. Loy 2023: 176–78).

The evidence for fifth-century coinage comes from a mixture of museum collections and hoards.¹ Among the largest collections comprising Ionian coinage, the fifth century is well represented (Tab. 1, Fig. 2) by the collections of the American Numismatic Society (429 specimens), British Museum (404 specimens), Danish National Museum (87 specimens), Boston Museum of Fine Arts (51 specimens), and Hunterian Museum (14 specimens).² While new syntheses of the western Anatolian coin series are currently in preparation, one of the best (albeit extremely dated) syntheses for known coin types remains Barclay Head’s *Historia Numorum* (1887; 1911), which documents and describes at least 43 distinct series for the region. The total number of coins available for analysis is fairly low, however, with some sites such as Magnesia on the Meander and Old Smyrna being repre-

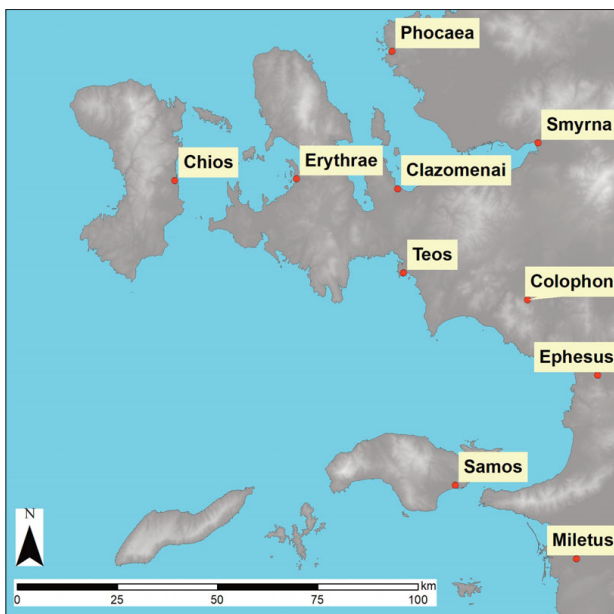


Figure 1. Communities of Ionia either minting coins or to whom we attribute weight standards for the fifth-century BCE (map by author).

1 This qualitative study is concerned with coin types rather than with the specific context of individual objects. For items discussed, acquisition to museum collections and the excavation of any hoards predates 1970. This work supports the position that objects illegally excavated, acquired or transferred out of country of origin since 1970 must not be discussed or published, consistent with the 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property. This work acknowledges that private coin collections continue to exploit non-licit excavations and unprovenanced sales; but, in the present article, every effort has been made to build and analyse a dataset according to ethical practice.

2 Data from the American Numismatic Society and from the British Museum were accessed via the collections’ online catalogues, downloaded March 2022. The others are sourced through print catalogues: MacDonald (1899), Brett et al. (1974) SNG Danish National Museum vol. 5 (1982). The project ‘Historia Numorum Online’, funded by the Laboratoire des Sciences Archéologiques de Bordeaux, aims to record and publish all types and varieties of the coins minted before the Roman period (ca 650–630 BCE), with the first volume on Caria now completed. *The Handbook of Greek Coinage Series* from Oliver Hoover, with its synthetic overview of coin types, has currently published 10 volumes of a planned 13-volume set. And a typology of all Greek coinages has recently been published online by Andrew Meadows: <https://www.greekcoinage.org/arch/>.

sented by only single-digit counts of coins. Rather than conducting a purely quantitative study, therefore, much more sensible in trying to identify regional patterns across a large area is to look qualitatively at the dataset, examining coin types and series rather than single coins.

Of the ANS coins, 374 can be considered small change: fractional coins, *hektai* or lighter denominations. From the remaining coins, there are then 29 drachms, 11 didrachms and 6 staters. Of the heavier coins, all are struck to the

Milesian standard, the most (26 of 46) from Clazomenai, then 11 from Erythrae. The pattern is similar for the denominations of the BM coins. Of 394 coins whose denomination is recorded, 273 are fractional coins, then 21 drachms, 18 didrachms and 82 staters. The majority of the heavy coins originate from Samos (64 specimens) or Chios (23 specimens), minted to the local weight standards of these islands. While there is, of course, a collection bias for both the ANS and BM collections, there is a significant

	ANS	BM	HN	BFA	Hunterian	SNG	Total
Chios	1	25	7	6	5	17	61
Clazomenai	273	21	8	3	1	12	318
Colophon	27	44	2	4		8	85
Ephesus	10	27	11	7	1	6	62
Erythrae	24	35	8	8		12	87
Magnesia ad Maeandrum	1		1				2
Miletus	21	31	7	4		14	77
Phocaea	103	73	9	27		8	220
Samos		142		1	2	13	158
Smyrna		2	2				4
Teos	22	1	10	8	6	10	57
Uncertain Ionian	10	167	15				192
Total	492	568	80	68	15	100	1323

Table 1. Number of Ionian coins per city as found in the various collections used in this study.

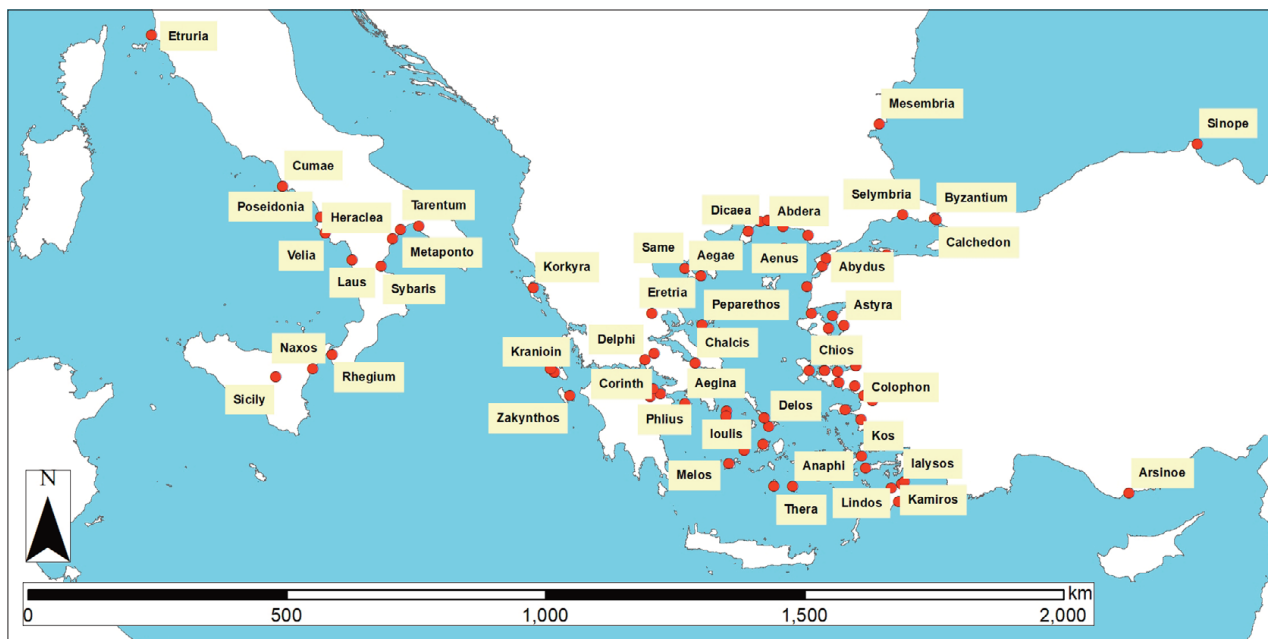
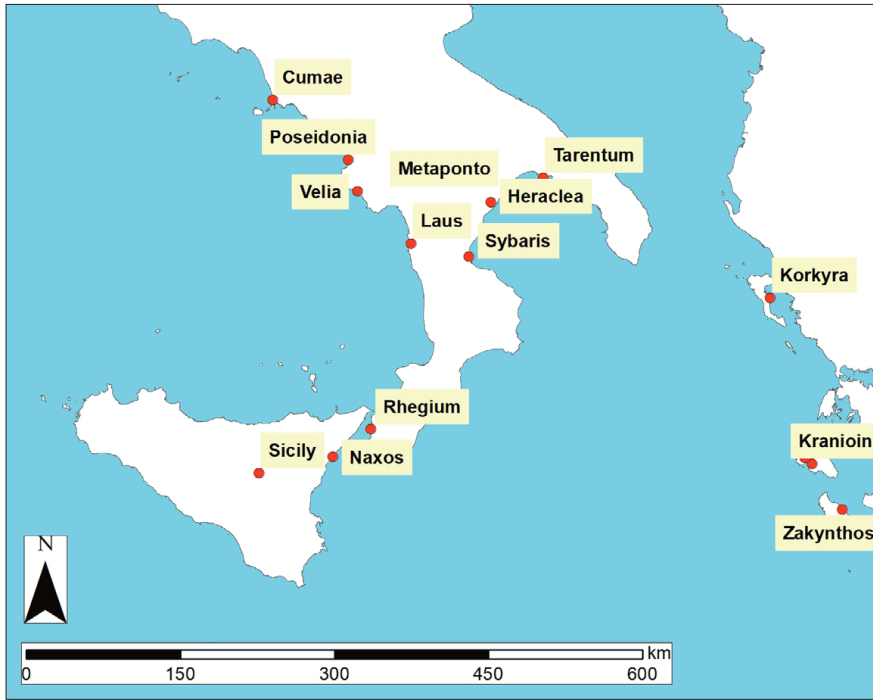


Figure 2a–c (cont. on next page). Communities within and beyond the Aegean minting their own coins in the fifth century BCE, as discussed in this text (maps by author).



similarity. That is, for the most part the evidence is for low-value and smaller-fraction coins. If this is indeed representative of an historical reality, it would suggest that of transactions taking place in fifth-century Ionia there was buoyant merchant activity, of networking and exchange at fairly low levels. There is evidence (although more exceptionally) for higher-level payments, notably by Chios and Samos, who will be discussed in greater detail below with regard to their more aggressive networking strategies from the mid-fifth century BCE.

Of coin hoards, 40 contexts containing Ionian coins are published in *IGCH* dated between 500 and 400 BCE (Tab. 2, Fig. 3); of these, ten were found in Ionia, fourteen across the Anatolian mainland more generally, ten in Egypt, five in the Aegean and one from the west Mediterranean. The total number of coins in each hoard ranges between 10 (*IGCH* 1199, Samos ca 400 BCE) and 2130 coins (*IGCH* 21, Auriol ca 450 BCE); 10 hoards have only a single Ionian coin in their assemblage (representing a range of 0.3%–25.0% of their total assemblages), while four hoards (originating from Chios or from Samos) comprise solely Ionian coins.

A significant number of coins minted in Ionia in the fifth century were made of silver. Phocaea, which chose to continue minting with electrum alongside silver, was an exception. A number of electrum coins of Teian origin are attested too, which were struck to Phocaeian weight and measurement systems. The widespread minting of bronze began in Ionia in the fourth century, and it is likely that the first bronze coins were already being produced at the end of the fifth century (see Phygela hoard, *SNG* Kayhan I: 761 and Konuk 2010b; cf. Ashton 2006 on bronze issues from Kamiros, Rhodes, Idyma, Kaunos, Halikarnassos, Iasos and Mylasa). Coins were minted to at least eight different weight-standard patterns (Aeginetan, Attic, Chian, Euboean, Lydo-Milesian, Persian, Phocaeian and Samian, Tab. 3) with some communities using multiple weight standards at the same time. These patterns will be analysed below. Heavier denominations could be used for large or one-off payments (e.g. military expenses or tribute payments), whereas lower-denomination coins likely circulated more widely for everyday transaction (Kim, Kroll 2008; van Allen 2012). Whether mints were regularly producing coins of high and low values, or whether minting took place periodically according to the changing needs of issuing authorities is an issue that can be explored by quantitative and die studies; this is a separate issue and unanswerable by the qualitative methods employed in this paper.

Dating Ionian coins precisely within the fifth century proves difficult. Different coin catalogues express the uncertainty around coin dating in different ways: for some, the chronology of coins of uncertain date might be left

IGCH	Location	Total coins	Ionian coins
6	Melos	145	5
7	Thera	760	48
21	Koumares	36	1
1165	Asia Minor, western	76	28
1166	Smyrna	20	14
1167	Clazomenai	38	35
1168	Asia Minor, western	200	42
1171	Chios	13	4
1172	Chios	9	7
1175	Asia Minor, western	64	3
1177	Asia Minor, southern	38	1
1179	Chios	26	26
1182	Asia Minor, western	50	1
1183	Colophon	181	140
1184	Erythrae	95	27
1185	Rhodes	41	1
1188	Troas	22	1
1189	Asia Minor, western	11	8
1190	Asia Minor, western	10	9
1191	Chios	59	59
1195	Ionia	22	21
1196	Asia Minor, western	14	14
1198	Chios	10	10
1199	Ionia	24	19
1234	Asia Minor, western	341	1
1252	Samos	32	4
1482	Asia Minor, southern	113	9
1483	Baetocaece	100	1
1636	Mit Rahineh	23	1
1637	Dime-n-Hor	165	28
1638	Delta	30	8
1639	Xhios	72	9
1640	Athribis	92	2
1643	Memphis	4	1
1644	Lycopolis	681	35
1645	Bubastis	84	5
1646	Fayum	5	1
1647	Naucratis	15	4
2352	Auriol	2130	2

Table 2. Coin hoards dated to the fifth century BCE containing Ionian coins.

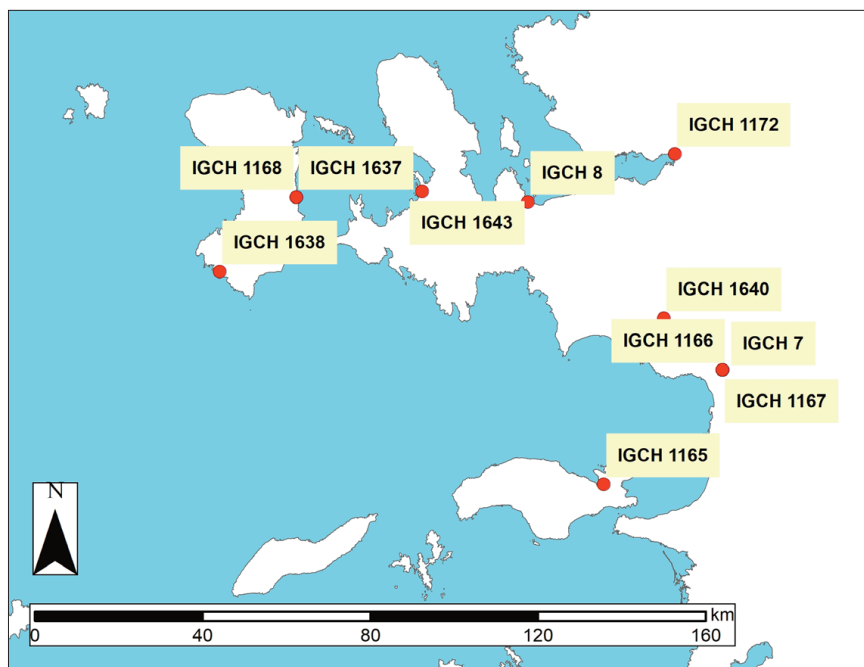
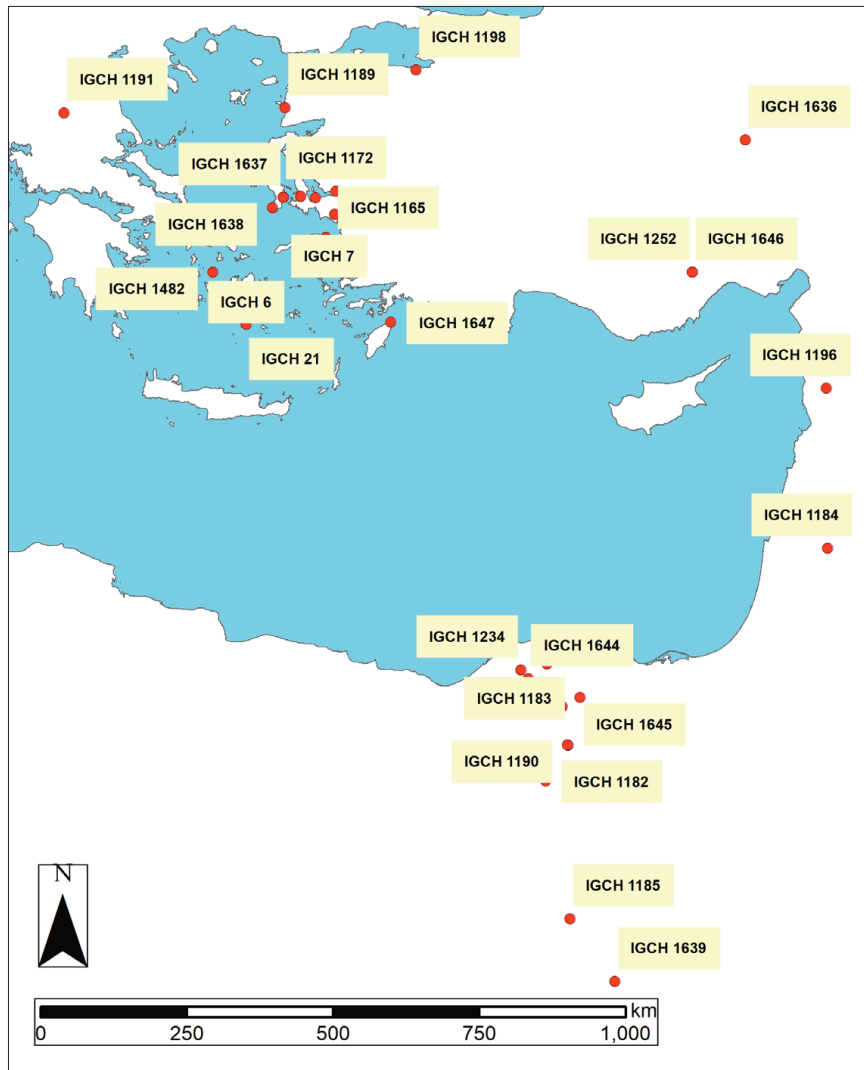


Figure 3a-b. Location of hoards discussed within the text (maps by author).

Site	500–480 BCE	479–455 BCE	454–420 BCE	419–400 BCE	Standards
Abdera	x	x	x	x	Aeginetan, Milesian, Persic
Abydus	x	x			Milesian, Persic
Aegae	x	x	x	x	Aeginetan
Aegina	x	x	x	x	Aeginetan
Aenus			x	x	Euboean-Attic
Anaphi		x			Milesian
Arsinoe	x	x			Aignetic
Astypalia		x			Astypalaian
Astyra	x	x	x	x	Babylonian
Athens	x	x	x	x	Attic
Byzantium				x	Persic
Calchedon			x	x	Attic
Chalcis	x				Euboean
Chersonesus	x	x	x	x	Euboean, Aeginetan
Chios	x	x	x	x	Chian, Milesian, Samian, Euboean
Clazomenai	x	x	x	x	Aeginetan, Attic, Milesian
Colophon	x				Persic
Corinth	x	x	x	x	Corinthian
Cos	x	x	x	x	Phocaeen, Persic
Cumae	x	x	x		Aeginetan, Euboean, Phocaeen
Cyzicus	x	x	x	x	Persic
Delos	x	x	x	x	Attic-Euboean
Delphi	x	x	x	x	Aeginetan
Dicaea	x				Macedonian
Ephesus	x	x			Milesian
Eretria				x	Aeginetan
Erythrae	x	x	x	x	Milesian, Persic
Etruria	x	x	x	x	Euboean
Heraclea			x	x	Italic-Tarentine
Ialysos	x	x	x	x	Ialysian
Ioulis	x	x			Aignetic
Kamiroi	x	x	x	x	Aignetic
Karthaia	x	x			Aignetic
Knidus	x	x	x	x	Aeginetan
Korkyra	x	x	x	x	Korkyrian
Kranioin		x	x	x	Korkyrian
Kythnos	x	x			Aignetic
Laus	x	x			Italic-Tarentine
Lindos		x	x	x	Milesian
Magnesia		x	x		Attic

Site	500–480 BCE	479–455 BCE	454–420 BCE	419–400 BCE	Standards
Maroneia	x	x	x	x	Macedonian
Melos	x	x	x	x	Milesian
Mesembria			x	x	Rhodian
Metaponto	x	x	x	x	Italic-Tarentine
Methymna	x	x	x	x	Samian, Attic-Euboean
Mytilene	x	x	x		Phocaeen
Nasos Pordosilene			x	x	Phocaeen
Naxos	x				Aignetic
Paleis			x	x	Korkyrian
Paros	x	x			Aignetic
Peparethos	x				Attic-Euboean
Phlius			x		Aeginetan, Euboean
Phocis	x	x	x		Aeginetan
Phocaea	x	x	x	x	Phocaeen
Poseidon	x				Milesian
Poseidonia	x	x	x	x	Campanian
Rhegium	x				Aeginetan, Attic
Rhodos				x	Chian, Persic
Same				x	Korkyrian
Samos	x	x	x	x	Attic, Persic, Samian, Euboean, Milesian
Samothrace	x	x			Attic-Euboean
Selymbria	x	x			Persic
Seriphos	x	x			Aignetic
Sicily	x	x	x	x	Attic-Euboean, Aeginetan
Sikyon	x	x	x	x	Corinthian
Sinope	x	x	x	x	Milesian
Siphnos	x	x			Aignetic
Skyros	x				Attic-Euboean
Tarentum	x	x	x	x	Italic-Tarentine
Tenedos	x		x	x	Samian, Phocaeen
Tenos	x				Aignetic
Teos	x	x	x	x	Aeginetan, Milesian
Termera	x				Persic
Thasos	x	x	x	x	Chian, Macedonian, Thasian
Thera	x				Aeginetan
Troezen			x	x	Attic
Velia	x	x	x	x	Italic-Tarentine
Zakynthos			x	x	Korkyrian

Table 3 (cont. from previous page). Summary of which cities were minting their own coins in different periods of the fifth century BCE, and the standards to which these emissions were struck.

blank, while for others a ‘long-range’ date might be written, for example ‘fifth century’ or ‘500–400 BCE’ (on the expression of aoristic uncertainty, see Cream 2012; Daems et al. 2023). Furthermore, many of the chronologies used assume *a priori* a connection between sets of coins and historical events, are assigned on the basis of style or are subject to a ‘circular’ logic based on our preconception of when, on looking at other sources (Head 1911: 584–86 and Rubinstein 2004: 1008 on the circularity of dating Milesian coinage), we view it as plausible that certain communities could have been minting. As an example, Friedrich Bodenstedt (1976) in his study of the coinage of Phocaea, gives a continuous chronology from 600–325 BCE, but this is based solely on style progression. He defines three main style groups (600–525, 525–325 and 475–325 BCE) and chronologies for three different alloys, scientifically defined (600–522, 521–478 and 477–326 BCE), for which he claims there are enough coins with subtle variations between their iconography that one could assume there is new minting every few years. Such issues of chronology are not unique to Ionia (nor to the fifth century), and this level of difficulty should not be surprising for a dataset that comes from largely decontextualised private collections or from hoards whose exact provenance and archaeological details were not always recorded.

More broadly in the context of the Aegean coinages of the fifth century BCE, at issue is the question of who within the Delian League was minting and who was not. By tallying the number of issues produced across the Aegean in the shadow of Athenian imperialism, Thomas Figueira (1998; 2006) has demonstrated well that over the course of the century, fewer and fewer communities were minting their own coinages. A convincing interpretation for this pattern is that the Athenians, with the intensity of their mining at Laurion, were producing vast numbers of coins that went into the general economic system through payments of their naval expenses, such that enough coinage was already in circulation and the allies had little need to produce even more coins (Kroll 2009: 199–201; Kallet, Kroll 2020: 67–72). The debate on the fifth-century coinage of the allies, however, is often framed in terms of ‘were they even allowed to mint?’ on the basis of the existence of the fragmentary inscription known as the ‘standards decree’ (*IG* I3 1453 = *OR* 155), which appears to enforce a use by the allies of Athenian coinage, weights and measures. The most recent interpretations of the stone, however, hypothesise that fewer states were minting coins not because of enforcement of a decree, but rather that the decree codified the status quo, that fewer communities, by their own choice, were producing new emissions (Kallet, Kroll 2020: 119). This also revises the view that allies were prevented from making their own coins and were

compelled to pay tribute to the Athenians using an Athenian currency (contra Konuk 2011). In the context of the present study, the above is noted to state the case that there was indeed minting of coins of the Aegean in the fifth century, but that the pattern cannot be understood without keeping Athenian imperialism at least in orbit.

What sort of patterns does this dataset point us towards at the broadest level? If the numbers of coins found in contemporary collections can be treated as representative of the coins that once existed in antiquity, then it becomes difficult on even a quick overview of the dataset to support Cook’s view: there *were* still coins both produced and (presumably) used in Ionia in the fifth century BCE, and this sets the argument for general economic decline on difficult territory. Collections have their own biases and are barely representative of archaeological patterns, but one might superficially note that in the ANS collection there are 429 specimens marked as fifth-century Ionia vs 152 of the sixth century; for the BM the total is 404 specimens of the fifth century vs 502 specimens for the sixth century. Although the evidence would suggest that some communities did not mint at all throughout the fifth century (Miletus) this is in fact a minority pattern. A second group of communities was minting at various points in the fifth century, albeit with a break of a decade or two (Chios, Clazomenai, Colophon, Erythrae, Samos). At the broadest level, looking only at the counts of where coins were produced, one could accept Cook’s thesis if looking *only* at the productions of Miletus and extrapolating to the whole region; but this would be a fairly weak argument to make.

Two points emerge for further discussion. First, there is nuance within Ionia, and it is productive to look at the patterns at the level of the community rather than at the level of the region. Notably, different communities at different times decided that they needed to emit new coinages (or, conversely, there are, in the general pattern, ‘moments of pause’ in their minting habits, rather than a ‘general pause’ across the region). Geography does play some part, though, and there is some indication of an ‘island’ vs ‘mainland’ pattern. Chios and Samos of the sixth century had already plugged themselves into multiple different markets across the Aegean by adopting coinages of multiple weight standards, and it is worth discussing further the effect of this early strategy as a basis for resilience in the fifth century. It is also worth giving further thought as to whether *minting* and new emissions are the best proxy for economic activity, or whether a use (or reuse) of coins outside of production contexts can provide better evidence for economic activity. It is fairly simple to say that somewhere like Samos or Erythrae was still engaged in economic exchange with neighbours throughout the fifth century, as a process that clearly

demanded new coinage to be struck in continuation, but that Miletus failed to strike new coinage should not be used alone to demonstrate this community's inactivity. One cannot so simply rule out the possibility of recirculation, that Miletus continued to use its coins struck in the Archaic period, or that Miletus was engaging in similar economic exchanges as its neighbours but using the coins of other states. These factors, all indicative of Ionian economic activity in the fifth century and contrary to the notion of regional impoverishment, are not so easily measurable in the material record, but the possibility for each scenario will be discussed more fully below.

Coins in transaction: Weight standards

Weight standards are the fixed measures around which coins of a certain value are minted (Tab. 4). Between these standards, some levels of difference were relatively minimal (e.g. 16.5g vs 17.2g for the standard weight of Phocaeian and Milesian stater, respectively; or that Attic and Corinthian standards both mint to the same weight, with a stater of 8.6g), while sometimes the difference is much greater (e.g. 7.9g vs 17.39g for the weight of Chian vs Samian staters). Where data do exist and have been published, occasionally the weight catalogued might not be representative of a coin's original weight when the coin

was struck, owing to erosion and degradation of the specimen. A further caution: a qualitative view across the names of various standards might indicate more distance than there actually is between different coinages than a quantitative look at their weight values: the 'Athenian' and 'Corinthian' weight standards might appear qualitatively different, but their tetradrachms, for example, each weigh on average 17.2g. Standard values published in handbooks of numismatics are rough measures around which there is variation (cf. Ziemann 2013); and both the identification of coin standards and the labels that we use to describe these groups (e.g. 'Lydo-Milesian', 'Attic-Euboean') are our own contemporary descriptions rather than emic ascribed labels. Qualitative overview of these weight standards, the differences between them and their chronologies have variously been offered, alongside explanation of why communities might choose to adopt coinages with new weight standards or to replace old systems (Psoma 2016). This latter question is the main object of focus here, to be investigated using a more quantitative approach.

In this article, areas covered by communities sharing weight standards are equated for the purposes of discussion with economic zones. This is an essentially etic classification, taken as a heuristic in identifying large-scale patterns – but there is good evidence to suggest that weight standards can be related to types of economic transaction. First, there is the case from the start of Greek coinage, already back at the end of the seventh and start of the sixth centuries BCE. The value of ancient coinages is understood to have been proportional to the amount of precious metal that they contained (Crisà et al. 2019: 4–6; Loy 2023: 145–48), and weighing coins at the point of transaction was an important means of facilitating exchange (Tselekas 1996; Kroll 2008: 181; von Reden 2010: 19). The Colophon hoard too, as discussed above, provides excellent evidence for low-denomination coinages being used in everyday transaction. Second, at the end of the fifth century, the case can still be made fairly convincingly for the use of coins in widespread everyday, low-denomination payment. That is, the introduction of bronze coinage has been understood as a technology that began as a means of fulfilling a need for large quantities of low-value tokens (Konuk 2010a; Marcellesi 2010), useful in maintaining and extending economic spheres of influence. But the strongest evidence that coins were used in this way comes from the fact that coins of similar weight standards are usually found together in hoards right across the Aegean world (Bresson 2009; Loy 2023: 186–87). Using coins of different weight standards together was not impossible, but using the same standard as a neighbour facilitated transaction. The sharing of weight standards between communities, therefore, can be interpreted as indicating a higher

Name	Weight of stater (g)
Achaian	8.0
Aeginetan	12.2
Astypalaian	9.7
Attic	8.6
Babylonian	8.3 [shekel]
Chian	7.7
Corinthian	8.6
Euboean	17.2
Ialysian	14.8
Italic-Tarentine	8.0
Korkyrian	11.6
Macedonian	9.8
Milesian	14.1
Persian	8.4 [daric]
Phocaeian	16.1
Rhodian	6.8
Samian	6.5

Table 4. Comparison of the weight of stater for the various weight standards discussed in this article.

potential for (economic) interaction than between two communities not using coins of similar standards.³ And, by extension, those communities who minted coins to multiple different weight standards would have been better placed to facilitate communication with multiple neighbours at once (such patterns become even clearer when combined with other types of material networks, as will be discussed below in relation to amphora exchange networks).

One limitation of this type of analysis, though, is the potential to fall into linguistic traps. As noted above, the names assigned to weight-standard groups relate to our own labels: the ‘Milesian standard’ was not necessarily something that people in antiquity would have associated with the city of Miletus or with its immediate networks. Rather, this label is a shorthand for an *abstract* economic network, understood at a top level, relating to a type of coinage that was first struck and produced in large quantities by Miletus and its neighbours. Discussion of these economic zones and weight standards, therefore, must not slip into anachronistic association between coin types and their communities. The question of changing and maintaining weight standards, then, is investigated here by looking at the pattern of communities adopting the same weight standards as one another in the emission of their own coinages. Using coins of the same standard speeds up transaction by short-circuiting the need for systems of weighing, or of identifying equivalencies and establishing exchange rates, in a manner similar to using money of non-identical currencies in the modern world. Looking across the whole pattern of sharing, therefore, one can go from a series of bilateral agreements between communities to a network of equivalencies, of a sequence of communities better placed to trade with one another.

These patterns are investigated here by means of formal network analysis (Gillings et al. 2020; Brughmans, Peeples 2023), using the free and open-source graph visualisation platform Gephi. The formal application of such methods to ancient data is now well-practised (e.g. Mills et al. 2013; Iacono 2016), while more discursive discussions frequently extol how these methods could shed new

light on ancient historical case studies (Collar et al. 2015; Mills 2018; Brughmans, Wilson 2022). The network of shared standards is visualised here via abstract and a geographic network analysis, illustrating Aegean communities who were minting their own coins in the fifth century. Communities are represented by nodes, and ties are drawn between nodes where a common weight standard was in use. The workflow in Gephi involved producing separate CSV tables of nodes, labelled both with text and numerically, with longitude/latitude coordinates, and coded ‘0’ or ‘1’ on whether the community is known to have been part of the Athenian Empire and whether they were a community associated with the production of a weight standard (e.g. 01 - Phocaea - 38.6704 - 26.7532 - 0 - 1). A separate CSV table of non-directional edges was also produced, designating where links should be drawn between nodes based on the numeric label of nodes assigned in the first CSV table. If there was a link between Phocaea (community ‘01’) and Cos (community ‘02’), for instance, the CSV would read ‘01’ in its source column, and ‘02’ in the target column; if there was no link between these two communities, these numbers would simply be excluded from the CSV. Arranging the data thus allows for the network to be drawn automatically using Gephi’s in-built engine. For the ‘abstract’ network layout, Gephi’s in-built ‘Force Atlas’ engine was used (on default settings, with the image cleaned via the ‘Nooverlap’ and ‘Expansion’ filters); and for the geographic projections the ‘Geo Layout’ filter was used with a scale of 20,000. Finally, the size and colour of nodes was adjusted using Gephi’s ‘Appearance’ module, partitioning the data on the ‘Empire’ and ‘Standard’ attributes discussed above. No further exploratory statistics were run on the dataset.

As a more plain-text example, one can consider further the worked example of Phocaea and Cos. Both Phocaea and Cos were emitting coins based on the Phocaeian weight standard at various points in the course of the fifth century, so nodes representing these two communities would be tied. Even for places, like Miletus, who were not minting in the fifth century but around whose standards coins were still being struck elsewhere, the node for this community is visualised too; nodes for communities to whom we attribute weight standards with our own modern label (e.g. Miletus for the Milesian standard, Phocaea for the Phocaeian standard) are visualised larger than other nodes to facilitate interpretation, and nodes of Ionian communities are coloured grey in the abstract projection, again to facilitate identification. The network is drawn for four periods: 500–480, from the beginning of the century to the restoration of the region and the Battle of Mycale; 479–455, through the formation of the Delian League to its relocation in Athens; 454–421, until the issuing of the coinage decree, supposedly regulating that allies to the empire should not

3 The clearest evidence for economic collaboration between different Ionian states comes in the form of the Phocaea-Mylene decree, *IG XII 2,1*, which at lines 18–19 states that the two states would alternate on an annual basis on who would mint large quantities of electrum *hektai*, struck to the Phocaeian weight standard. Mackil and van Alfen (2006) make the case that this agreement helped to ‘[maximise] revenue while concurrently offsetting risk’ for the two communities, revising an older model of Head (1911: 83–84) that shared coinages between states could be neatly divided by economic, political, military or religious motivation. Although this is the only positive evidence for ‘collaborative coinage’ of the fifth century in Ionia, the sharing of weight standards is understood in the context of this article to have been similarly economically motivated.

mint their own coinages; and 420–400, down to the end of the century. Of the ‘standards decree’ (*IG I3 1454 = OR 155*) there remain questions of when to date the stone, not least because the text as written on one of the fragments from Cos (Pritchett, Georgiadès 1965) is written with a three-barred *sigma*. Although high dates in the 440s were first proposed (Rhodes 2008; Papazarkadas 2009) the most recent discussion with regard to contextual information has put the stone in the 420s (or even later at 415 BCE for Kallet 2001: 205–26; Kallet, Kroll 2020: 111–21; Lazar 2024). The exact dating of the stone is not crucial to the present argument, which looks at general broad-range patterns (e.g. ‘early’ fifth century vs ‘late’ fifth century); the selection of 420 BCE is almost arbitrary, therefore, and should be taken more as a shorthand for assessing the pattern at the end of the fifth century. The geographic focus of this study is on Ionia within the Aegean context, but, to avoid edge-effect in obscuring patterns, the Greek-speaking communities of the western Mediterranean, Black Sea region and Anatolia are included too.

At the start of the fifth century (Fig. 4), the main weight standards in use were the Aeginetan, Attic and Milesian. It was only in Magna Graecia and the North Aegean where local weight standards were preferred, and otherwise there was a fair degree of cross-community connection between all parts of the Aegean itself. Save for Cos (which used both Persian and Phocaeian standards) and Clazomenai (for both Attic and Aeginetan standards) there were few instances of communities emitting coins based on multiple different weight standards – a marked contrast to the situation at the end of the sixth century. At this time, Ionian communities were split between those who minted principally to a local standard (Chios, Phocaea, Samos) and those who used the standards of their neighbours (Clazomenai and Ephesus using the Lydo-Milesian standard; Colophon and Erythrae using the Persian standard; it was only Teos who used exclusively non-Ionian standards, basing its coinage instead on Aeginetan and Euboean weights).

There is fairly little difference from the start of the century in the distribution of the coinages after 480 BC (Fig. 5). The only distinguishable differences in the pattern is that there are fewer emissions in this period for island communities, both within the Cyclades (Tenos, Termera, Thera) and beyond (Astypalaia and Lindos on Rhodes). There is also little difference in the Ionian pattern. Right through the mid-fifth century, the Milesian standard continued to be used, not only by other Ionian communities, but also beyond, at Abdera, Anaphi, Melos and Sinope. The bigger contrast comes after 454 BC (Fig. 6), when there were noticeably fewer communities emitting their own coins. Apart from an overall reduction in number of minting communities, though, there was little qualita-

tive change in the pattern. The Milesian standard was still in use by a good range of communities, while standards that had only been locally used before (such as the Samian and Ialysian) standards were now in use by other communities (specifically at Methymna and Mesembria). Across the whole of Ionia by the end of this period, though, there was a certain fragmentation, with no two communities sharing the exact same distribution of weight standards to any of their Ionian neighbours.

There was another decrease in the number of minting communities around the end of the fifth century (Fig. 7), with a drop from 49 to 46 minting communities since the mid-fifth century. By contrast, there was not a decrease in the number of standards in use: for the Aegean, standards used at the end of the fifth century included the Aeginetan, Attic, Chian, Euboean, Korkyran, Milesian, Persian, Rhodian and Thasian standards. In this relation between community and standard chosen, there is some pattern of geography: those communities who were issuing coins to their own standards were predominantly located in the southern Aegean in coastal or island areas. Of the Ionian standards, the Milesian and Phocaeian continued to be used by other Aegean communities, while the Samian and Chian standards were growing in adoption across other communities. Apart from the Attic weight standard to which Athens was minting, these were the standards that saw the greatest uptake in new communities minting to their weights in their period (but the Aeginetan and Euboean was still used by the greater number of communities).

These patterns become all the more clear in analysing the network structure, particularly the betweenness of the Ionian communities’ nodes (Tab. 5). Betweenness centrality is the measure of how many node-paths go through any given node, as a fraction of all paths across the whole network (Collar et al. 2015: 17–18): it provides a good measure, therefore, of the effectiveness of a node at transferring information across the network, either as a result of its own connections or by virtue of it being connected directly or indirectly to other highly integrated groups. Betweenness centrality has been calculated here using Gephi’s ‘Network diameter’ module under default settings. Of the Ionian communities, Clazomenai has a consistently high betweenness (as a percentage of total betweenness across the whole graph: 15.7%, 22.8%, 19.2%, 8.3%), by virtue of it staying connected to Aegina and to Athens, through which it gained access to much larger networks. For the communities with whom we associate standards, Miletus displays consistently high degrees of connectedness. For 500–480 BCE, this is a step higher than Athens (16.5% vs 11.5%), at 454–420 BCE there is parity with Athens (18.1%), while in 419–400 BCE Miletus is only by a mark seemingly less integrated to the Aegean-wide network than Athens (8.7% vs 14.9%). That

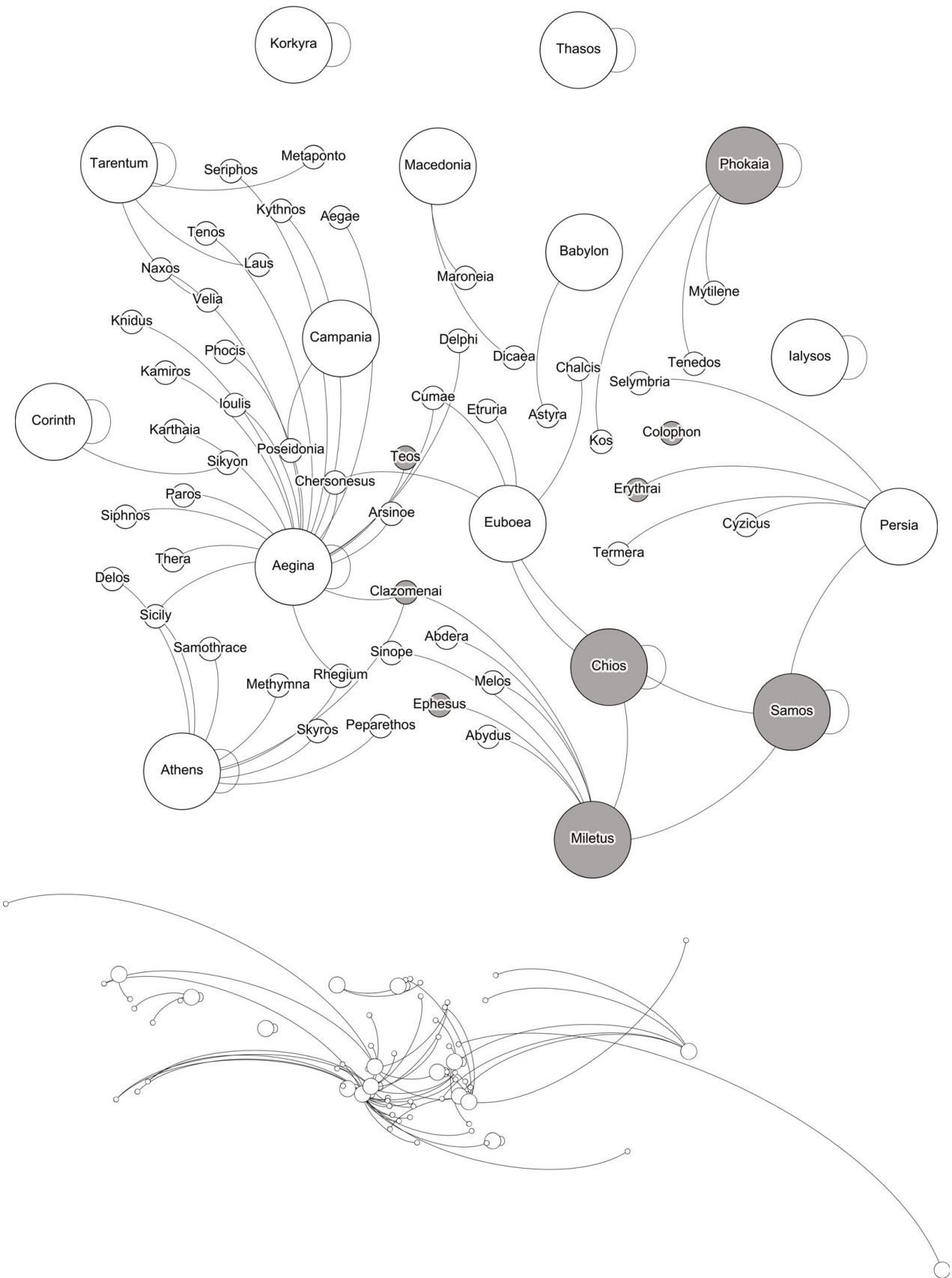


Figure 4a–b. Weight standard network visualised a) in abstract space, b) geographically. Larger nodes represent communities associated with certain weight standards; Ionian communities in the abstract projection are rendered in grey. 500–480 BC (rendered by author).

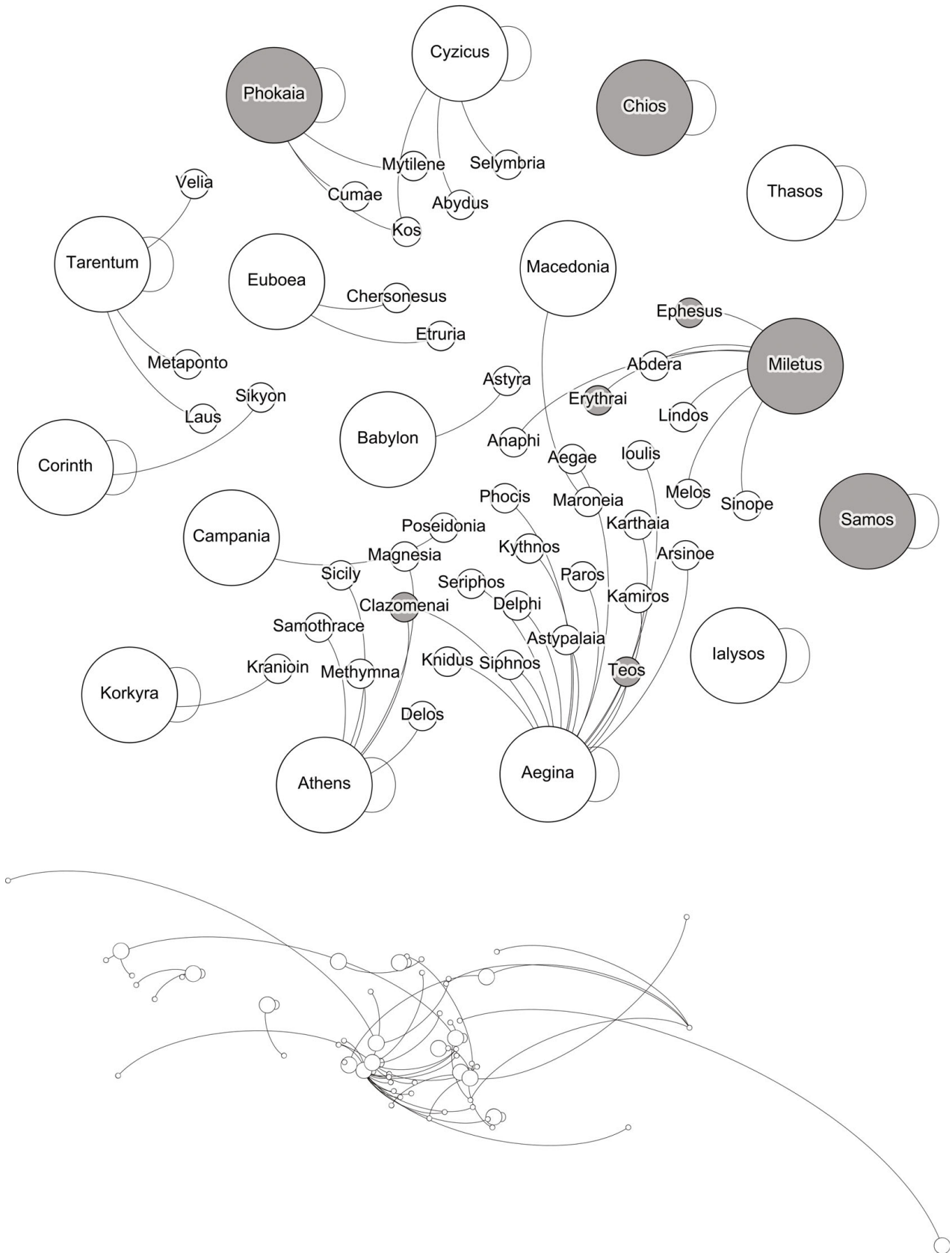


Figure 5a–b. Weight standard network visualised a) in abstract space, b) geographically. Larger nodes represent communities associated with certain weight standards; Ionian communities in the abstract projection are rendered in grey. 479–455 BC (rendered by author).

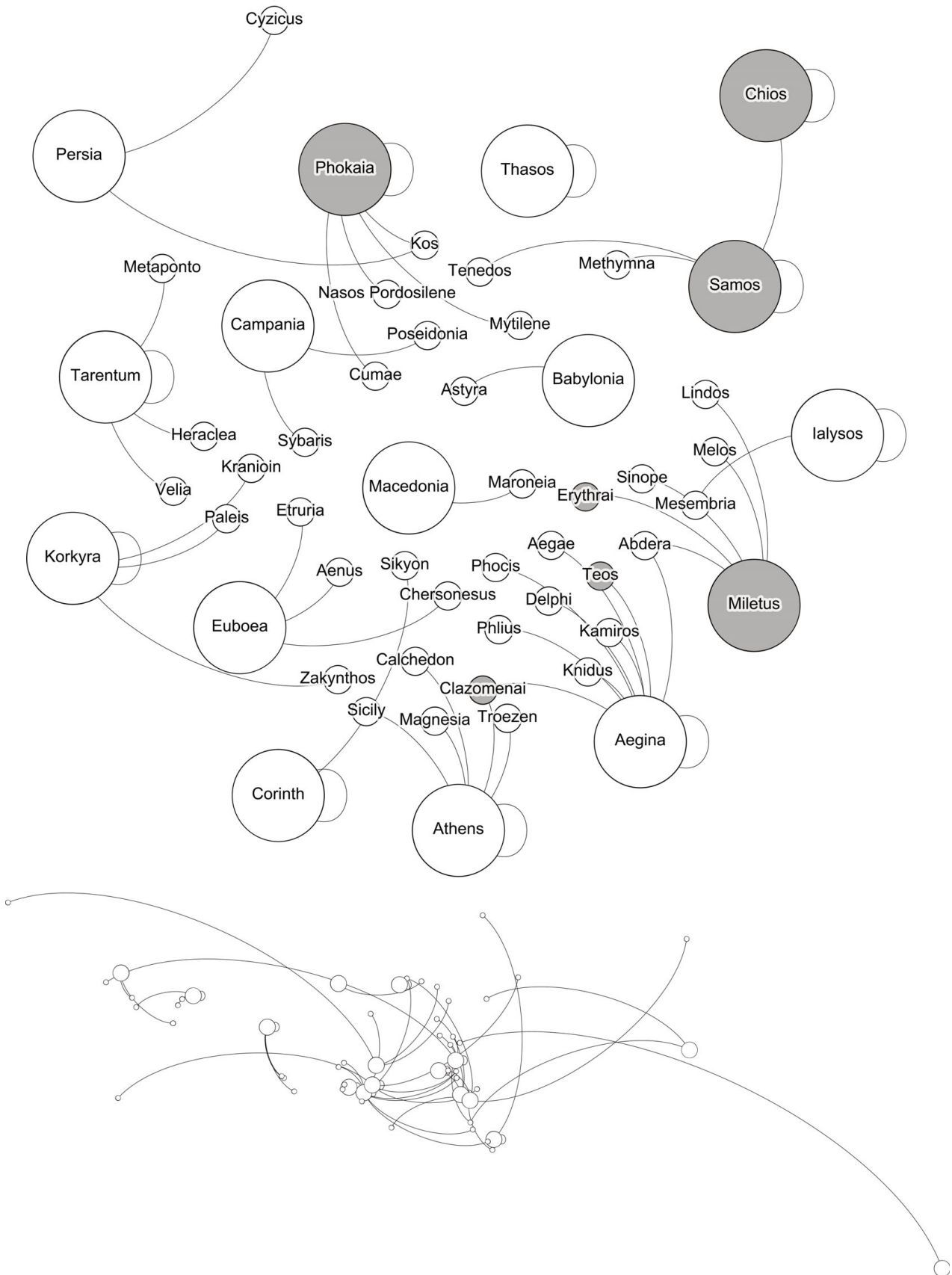


Figure 6a–b. Weight standard network visualised a) in abstract space, b) geographically. Larger nodes represent communities associated with certain weight standards; Ionian communities in the abstract projection are rendered in grey. 454–421 BC (rendered by author).

	500–480 BCE			479–455 BCE			454–420 BCE			419–400 BCE		
	ties	betweenness	% of total betweenness	ties	betweenness	% of total betweenness	ties	betweenness	% of total betweenness	ties	betweenness	% of total betweenness
Chios*	2	16.0	0.9	0	0	0	1	0	0	4	145.0	17.5
Clazomenai	3	289.7	15.7	2	90	22.8	2	70	19.2	2	68.5	8.3
Miletus*	6	304.7	16.5	7	21	5.3	5	66	18.1	4	72.0	8.7
Phocaea	3	3.0	0.2	-	-	-	4	12	3.3	2	1.0	0.1
Samos*	3	206.0	11.2	-	-	-	1	0	0	5	192.5	23.3
Aegina	21	613.5	33.3	15	189	48.0	9	141	38.6	8	139.5	16.9
Athens	8	211.0	11.5	6	90	22.8	5	66	18.1	5	123.0	14.9
Campania	1	0.0	0	1	0	0	2	1	0.3	1	0.0	0
Corinth	1	0.0	0	1	0	0	2	1	0.3	1	0.0	0
Euboea	4	194.8	10.6	2	1	0.3	3	3	0.8	3	3.0	0.4
Korkyra	0	0.0	0	-	-	-	3	3	0.8	4	6.0	0.7
Macedonia	2	1.0	0.1	1	0	0	1	0	0	2	25.0	3.0
Tarentum	3	3.0	0.2	3	3	0.8	3	3	0.8	3	3.0	0.4
Thasos	0	0.0	0	0	0	0	0	0	0	2	48.0	5.8
Total	57	1842.7		38	395		40	365		46	826.5	

Table 5. Betweenness centrality of some Ionian and non-Ionian communities by time, with centrality also expressed as a percentage of the total betweenness across the whole graph in any given period. Communities with whom we associate coin standards in Ionia are marked by an asterisk.

is, the Milesian standard remains not only, as observed above, present but, in fact, well-connected right across the fifth century; in no periods does its connectedness significantly decline, unlike that of Euboea, whose betweenness scores remain below 1.0% after 479 BCE. The connectedness of Samos and Chios grows almost exponentially between the start and end of the fifth century (500–480 BCE: Chios 0.9%, Samos 11.2%; 410–400 BCE: Chios 17.5%, Samos 23.3%), with Samos achieving a greater betweenness within the whole network by 400 BCE – but the step-change from that of Chios being much the greater. Again, this is a clear demonstration of growth in economic networking for the region, centralised around the island communities. Betweenness scores obviously do not tell the whole story, though: Phocaea has a consistently low betweenness as compared to other communities (0.2%, 3.3%, 0.1%) which, while indicating that this coinage was not as integrated into the much broader Aegean-wide pattern, should be read in light of a locally distinct production; furthermore, these figures say nothing of the scale or quantity of production, merely of the potential to connect

communities to one another on the basis of qualitative coin-type evidence.

The same patterns can be illustrated by a graphical projection of the betweenness scores (Fig. 8). Athens and Aegina follow a similar trajectory, with consistently high-scoring betweenness but a decline towards the end of the fifth century. This decline, though, still sees them as more integrated to the whole network than all other communities, save for Chios and Samos (the only two nodes which exhibit a higher betweenness percentage by 419–400 BCE). Indeed, the graphs make abundantly clear the Chian-Samian island ‘bounce’ at the end of the fifth century, a phenomenon that is not repeated elsewhere. For Macedonia there is a slight incremental rise in betweenness, indicating developing local networking for the region; but the scores for Campania, Euboea and Macedonia (chosen illustratively to indicate patterns across their whole regions) are consistently much lower than for Ionia. That is, at least on the basis of coin types, Ionia becomes much more connected to Aegean-level networks throughout the fifth century than other regions. The other

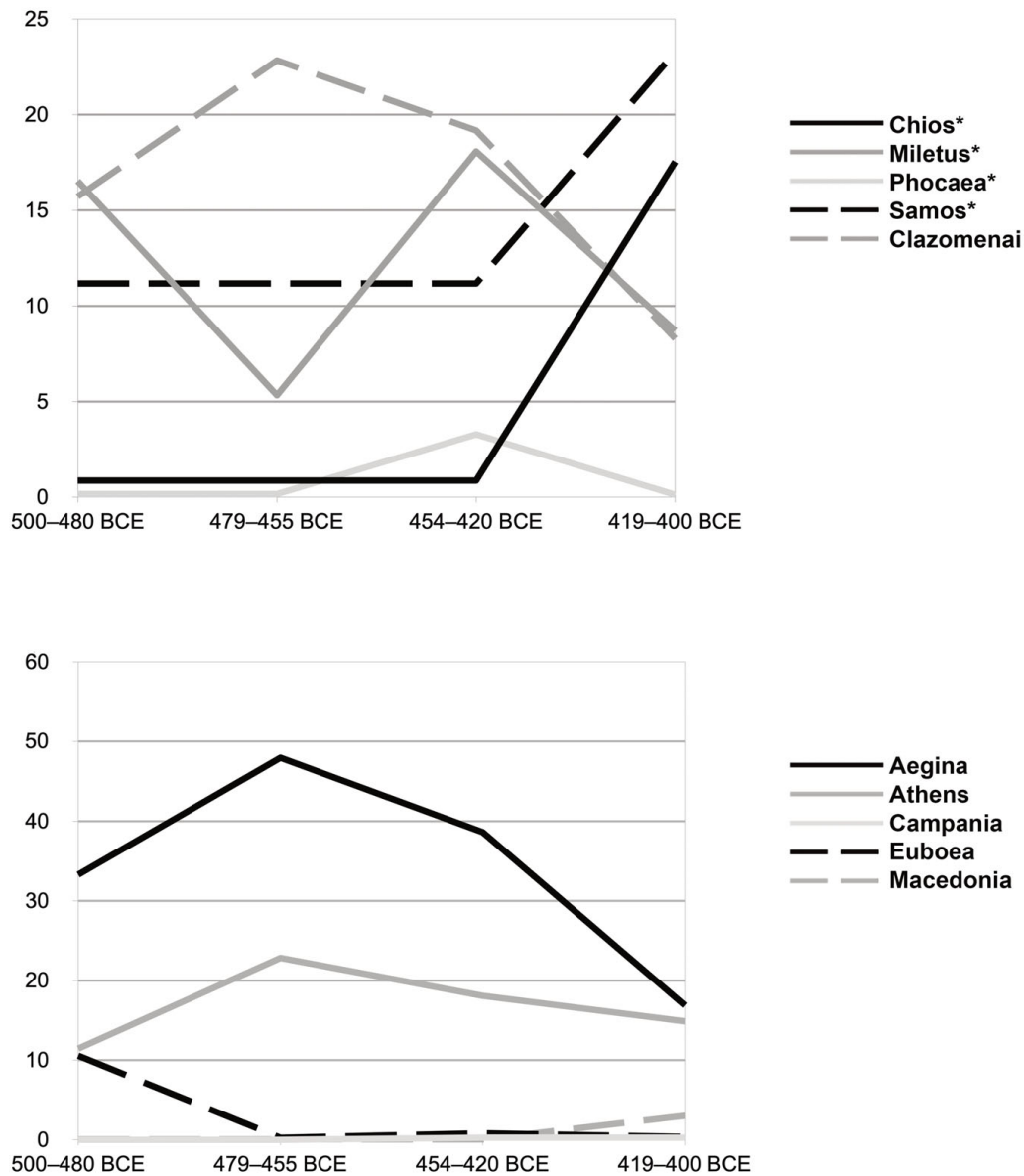


Figure 8a–b. Betweenness centrality of some a) Ionian and b) non-Ionian communities by time, where centrality is expressed as a percentage of the total betweenness across the whole graph in any given period. Communities with whom we associate coin standards in Ionia are marked by an asterisk (charts by author).

pattern that the graphs clearly define concerns the period 479–455 BCE, during which most communities experience a ‘spike’ in their connectedness – either positive or negative. While it is possible that this spike is, in-part at least, an artefact either of the somewhat arbitrary dating of coinage or of the date-mapping undertaken in the present study to group coinages into periods for analysis, there is an underlying point of historical interest here, too; namely, that following the Battle of Mycale and the formation of the Delian League, there was change in economic networking across the whole Aegean. It was not

until the relocation of the League to Athens that the general pattern ‘settled’ and there could be, in the case of Miletus and Phocaea, a recovery. Whether or not this acceleration in economic networking can be attributed to Athens and its imperial ambitions or whether these patterns should be seen as occurring *in spite of* Athens would require further contextualisation of the data. But at the broadest level, these measures indicate clearly both a continuation of economic networking in Ionia throughout the fifth century and a growth by Chios and Samos in the final years of the century.

To summarise the patterns identified so far: First, there is noticeably a reduction in the number of communities emitting new electrum and silver coinage by the end of the fifth century, but this is an Aegean pattern rather than an Ionian pattern. This is very similar to the situation identified by Osborne for building activity, that it was a reduction at the Aegean level rather than at the Ionian. Ironically, then, we might even go as far as to say that the reduction in minting and in the range of weight standards at play is not so great in Ionia as it is elsewhere. Second, there is a clear pattern of Ionian resilience and persistence. The weight standards of Ionia were still in use throughout the fifth century, and that counts too for those communities like Miletus who were not minting their own coins, or for those like Chios who had a temporary break in minting their own coins. This, then, implies economic growth rather than stagnation. Third, there is the island pattern. Chios and Samos minted to their own standard, connected themselves to neighbours by adopting coinages of other standards and had their standard taken up by other neighbours too. This is a similar pattern to other islands of the East Aegean (e.g. on Rhodes), but in contrast to the general island pattern as seen in the Cyclades, where the number of emissions greatly declined over the course of the fifth century. Fourth, there is the general coastal pattern of the Southern Aegean, that it was maritime-oriented communities that plugged themselves into using a range of different weight standards. This point, and the previous, are important reminders that any narratives made at the regional level about Ionian impoverishment are too generalising to be useful. Fifth, and somewhat beyond Cook's remit but eminently useful in thinking about fifth-century coinage in terms of other historical events of the fifth-century Aegean, the standards decree appears to have had little effect on the distribution of the weight standard pattern (cf. Driscoll et al., forthcoming). It is actually in the third period analysed, with the moving of the Delian League to Athens, that the pattern changes most.

Persistence and resilience

Returning to 'the problem of Classical Ionia', Cook linked the supposed economic inactivity of Ionia directly with (a lack of) production, but that coins and their standards were reused if not newly minted tells a different sort of story. Persistence of the Milesian standard is best understood on a case-by-case basis, and the cases of both of Melos and Sinope will be discussed here. That Melos was using the Milesian standard at all was probably motivated by trade, and by the opportunity to plug into an extensive and growing economic network based around the east Aegean. Melos, through adopting a Milesian standard widely used in the east Aegean, had been orientating its primary economic networks towards Miletus and its neighbours,

helping in the circulation of artistic goods both large and small – gems, jewellery, relief plaques, sculptures – already from the seventh and sixth century (cf. *BCH* 114.2 1990: 818–20, *ADelt* 64 2009, B2: 878–880). That is, the coinage types of Melos map well onto its wider economic interests in positioning the island towards networks of the east Aegean region, and the association of coins, weight standards and the principle economic zones of interest for a community like Melos is not surprising. It is also not surprising that Melos did not shift to striking coins to an Attic standard: Melos' primary economic networks were not pointing towards Athens, so there was little economic reason, nor was there any compelling political reason, given that Melos was not part of the Delian League (Thuc. 2.9.4, but appearing on the tribute list of 424/5 BCE to make a contribution of 15 talents, similar in size to Naxos and Andros). And as there was little motivation to re-orientate its networks, in fact changing standards could have disrupted well-established trading activities conducted elsewhere; so, even though Miletus itself was not minting, it was beneficial to Melos not to make changes to its own coins and risk unbalancing its own networks.

The case of Sinope, who struck coins on a Milesian standard right throughout the fifth century, is similar, but not quite the same. Sinope had been established as a Milesian colony possibly in the seventh century BCE (Hind 1988; Doonan 2004: 69ff.), and it is, therefore, unsurprising that it was using coins to the standard of its parent city. In fact, Sinope's first recorded coinage, silver staters emblazoned with the head of an eagle above a dolphin, date to around the start of the fifth century BCE, coins which were struck to the Milesian standard, ironically, despite Miletus already having halted production of its coins around the same time. Clearly, then, the existence of the Milesian weight standard cannot be tied singularly to the prosperity of Miletus the city. What this encourages one to consider, however, is what the Milesian weight standard *represented*, both earlier in the sixth century and onwards into the fifth century. The Milesian network had been wide-ranging, considered rich both for its contacts and for the goods that were moved around it; and by aligning one's weight standard and economic priorities to this group, one could align oneself with these regional priorities, with a network that had perhaps outlived Miletus the city and its own emissions. This was not the only connection between the Black Sea and Ionian regions through coinage, though. Beyond the minting activity of individual cities, large quantities of coins from Cyzicus circulated the Black Sea area and colony cities in the fifth century BCE (Fritze 1912; de Callatay 2020), understood to have played a major role in the facilitation of the grain trade for the area (Bresson 2007; Moreno 2007; Mielczarek 2020). The link with Ionia is

twofold, in that the electrum coinage of Cyzicus (the only electrum coinage of the Aegean of the fifth century apart from that of Phocaea and Mytilene) was minted to the Phocaean standard, divided into small fractions (1/6 staters [*hektai*], 1/12 staters [*hemiekta*], 1/24 staters and 1/48 staters) and staters, with the common motif of the tuna. And, second, hoards containing Cyzicene staters have been found fairly extensively from Ionia of the fifth century BCE (*IGCH* 1171, 1183, 1194, 1223, 1234). What, then, are the implications of this pattern? In the first case, it would appear that the Black Sea area was tapping into another well-established economic zone, to a network founded on the Phocaean standard. In the case of the latter, the presence of Cyzicene ‘small change’ in Ionia would suggest either (but not mutually exclusively) that this coinage played a role in facilitating payments even when local coinages were not being emitted, or (similar in nature to the weight-standard pattern) that there was a common economic zone extending between Ionia and the Black Sea. In any case, using coin types associated with a broader Ionian network permitted both Sinope and the wider region to invest in well-established and ‘strong’ economic networks, both the Cyzicene (whatever its connections with Phocaea) but also with Miletus. To do so gave these communities a natural advantage for establishing their own position by tapping into economic networks already established in previous generations. This strategy, along with others, contributed to the success of Sinope emerging as a critical node of exchange in relation to other Black Sea settlements in the Archaic and early Classical period (Monachov, Kuznetsova 2017; more generally Mattingly 1981; Monachov 1999). And as in the case of Melos, abandoning a weight standard previously instrumental in extending the community’s networks could have had a negative effect, and by keeping coins struck to Milesian weights Sinope could ensure the continuity of some of its trading activities. And with this one could comment that use of coinage was economically not politically motivated in the region, and with a view to maintaining the strength of a local economic network, contrary to the position of an Ionian economic decline.

So much for resilience; what about persistence? Beyond Miletus, it has been noted that the island pattern of Ionia was different to that of the mainland pattern. Samos is a good example for illustrating how and why this was the case. Apart from a break around 440 BCE in producing coinages when inhabitants of the island staged their failed revolt against Athens, there was almost continuous minting and new emissions from the island throughout the fifth century. Already beginning from a strong economic foundation at the end of the sixth century where Samos was in control of its own weight standard, and in a network that connected other Ionian and Aegean communities, Samos and its networks had space to flourish

in the fifth century, whereby, having evaded sack from the Persians, the Samians were permitted by Achaemenid forces to continue and extend their economic activities (cf. Slawisch 2019: 157–59). This allowed for a full range of coinages first in electrum and then in silver to be produced on Samos, variously emblazoned with the motifs of lions, bulls, winged boars and rams. Following a territory dispute over Priene in which Samos took the side of Miletus, Samos was garrisoned by Athens, with the obligation of paying large sums back to Athens and of awarding large parcels of land to Athenians (Thuc. 1.115; Plut. *Per.* 25). A break in Samian minting activity (perhaps circularly) is dated to this period, with the Samians minting to their own standard again by the 420s (illustratively: Barron 1966; Class VIII, no. 97), and then variously in silver coinage on the Attic and Chian standards in the final years of the fifth century.

That local coinage was important to the Samians and to their economic activities seems clear. Not only were the Samians producing coins on their own standard, but there is evidence that they, unlike some neighbours, used exclusively in some contexts their own coinages. The existence of a hoard from Pythagoreio that contains only Samian coins (*IGCH* 1198) would suggest a local importance to the island’s own coinage, this being only one of four known coin hoards from Ionia to contain coins struck from only one parent city (the other three being *IGCH* 1196, a fifth-century hoard of unspecified date comprising archaic Milesian coins and *IGCH* 1179 [ca 460 BCE] and 1191 [ca 440 BCE], both containing Chian coins, and both from the mid-fifth century and the heyday of Chian production and commercial activity); there is no further contextual archaeological information on this hoard (Barron 1966: 100). Why should the production of a local coinage be linked to economic resilience, and not just that the Samians had been largely left by the Persians then the Athenians to ‘do their own thing’? Distribution is key, in that Samian coinage turns up in hoards of the fifth century both locally and right across Anatolia and Egypt (*IGCH* 1167 Clazomenai [earliest possible date 490 BCE], 1183 Colophon [earliest possible date 450 BCE], 1638 Nile Delta [earliest possible date 500 BCE], 1639 Xoïs [earliest possible date 470 BCE], 1645 Bubastis [earliest possible date 470 BCE], 1647 Naukratis [earliest possible date 425 BCE]), suggesting the wide geographic extent of trading activities which the coinage was used to facilitate. And, given that Samian coins are found in hoards dating right down throughout the fifth century, it is fairly possible to argue for a continuous and wide usage of Samian coinage.

The case can be made even stronger when combined with other datasets: the quantity of fifth-century amphoras found overseas (Fig. 9, after Bîrzescu 2012: fig. 92), and the provenance of imports found at the sanctuary of Hera

and more generally across Samos' rural landscapes attests a wide network of things being brought onto and off the island in the sixth and fifth centuries (Walter 1968; Webb 2016). That is, the material record as a whole sketches the extent and reach of broad-level exchange networks, while the systematic production of coinage was emblematic of those ambitions of Samos to expand (particularly maritime and overseas) trading activities – weight standards are just part of the evidence for an overall much broader pattern. Put simply, in both strength and stability, the economic networks of Samos developed throughout the fifth century in both local and supra-regional environments, such that it is not surprising that in the production of its coinage and distribution of its weight standards one sees a similar strong position.

The same is true of Chios, if not more so. Chios produced coins at a great rate right throughout the fifth century (490–425 BCE: four series represented by 748 specimens; 135 unique obverse dies and 492 reverse dies; Hardwick 2010), linked in to a network that connected it with communities using Milesian and Samian standards before developing a coinage on its own standard at the end of the fifth century that would be adopted much more widely. As elsewhere in Ionia, the early coinage of Chios was electrum, a material no longer in use at Chios by the end of the fifth century, when the main emissions were

silver. By the fourth century BCE, the Chian coinage would completely dominate across the region (Meadows 2011), including also in its emissions of the late-fifth-century rare electrum issues (Ellis-Evans 2016). The sphinx was the main emblem used on the Chian coins, but already from the start of the fifth century and before the Ionian revolt (illustratively: Hardwick 1991: 15–54, silver staters 510–494 BCE), Chios was striking coins that included the emblem of the amphora (Slawisch 2019); this was usually found in combination with the sphinx, but from the end of the fourth century the amphora is found on coins all on its own. The amphora is a fascinating choice for Chios, as the island was producing large numbers of transport amphoras throughout the fifth century which appear in great numbers both throughout the Ionia and further afield (Fig. 10, after Birzescu 2012: figs 78, 79), indicative of far-reaching trade activities at this time.

To some extent, Chios had the opportunity to 'fill a gap' in the market. Amphora production of the sixth century had been site-based but, following the period of disruption at the start of the fifth century, regional workshops of collaborating sites took their place (Lawall 1999; Sezgin 2012). The excavation and study of regional production centres in Ionia continues, but the pattern of amphora distribution indicates that locally-made material

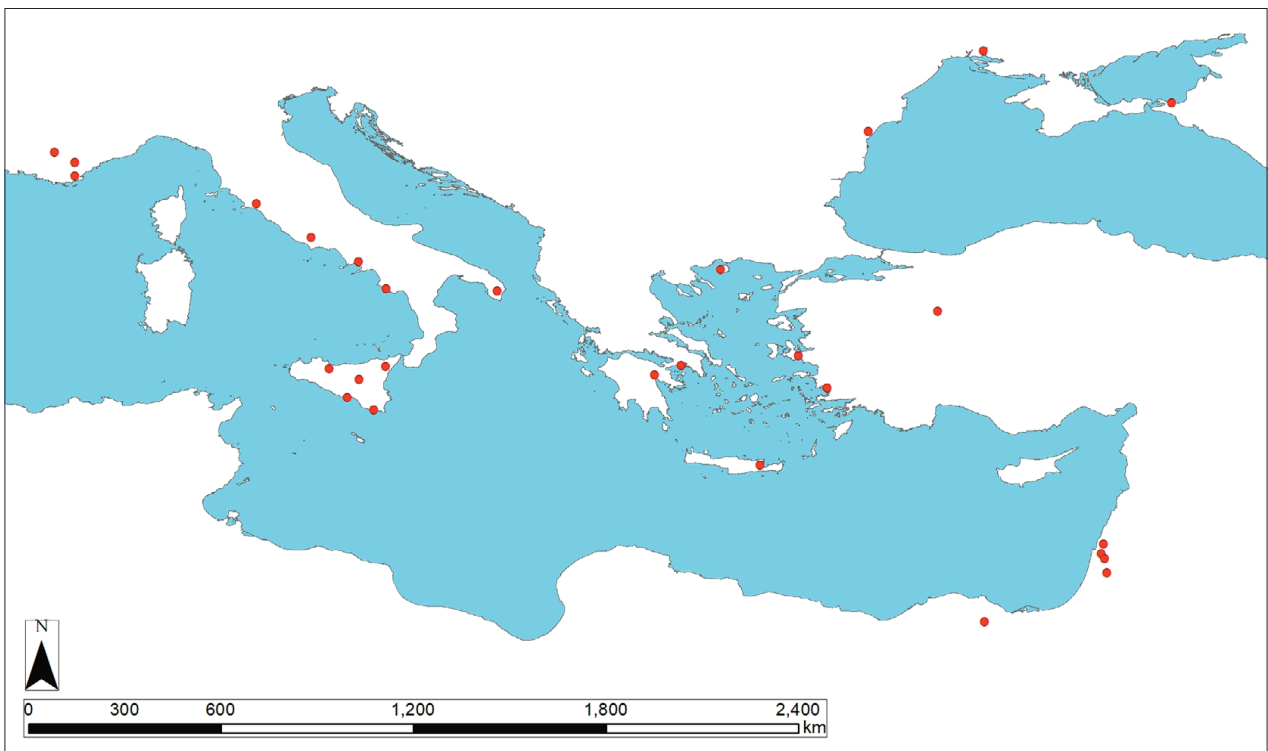


Figure 9. Distribution of Chios II-3 (490/480–450/440 BCE) and II-4 (450–425/420 BCE) transport amphoras, after Birzescu (2012), figs 78 and 79 (map by author).

was being shipped right across the Mediterranean throughout the large part of the fifth century, in particularly high quantities to the Black Sea area. The excavation of the Tektaş Burnu shipwreck off the coast of Teos provides evidence of this distribution in action, a fairly modest commercial ship loaded with amphoras from Chios, Samos and (possibly) Erythrae, and dating to the period 440–425 BCE, when both the evidence of the coinage and the distribution of amphoras would together suggest that there was buoyant economic activity in the region (Carlson 2003). A comparison of the basic distribution maps for Samian and Chian amphoras indicates that those made in Chios and north Ionia were shipped more widely than those made in the south and around Samos; and from areas where there is reliable quantitative data, north Ionian amphoras consistently turn up in higher quantity than those from south Ionia. Clearly, the position of Chios as an island node with ready access to maritime networks played in its favour, but this factor alone cannot be used to justify the success of its buoyant fifth-century economy. Why else would Samos, which was equally well-placed in terms of its network geography, not have its products distributed nearly as widely? What gave Chios the advantage? On the basis of currently available archaeological and historical evidence it is hard to say, but the production of coinage does, in fact, provide useful indicators for the economic

health of both islands. Samos had experienced in the latter part of the fifth century more turbulent political events than Chios, by its failed revolt and garrisoning by Athenian forces, with the result that there were breaks in its emissions. Chios, by contrast, continued (albeit with some but notably few interruptions) to emit right through the fifth century, and in fact by the end of the century had taken up its own weight standard that it offered in production to other communities too. That is, the fact that Chios was more prolific in producing its coinages than Samos should reassure that the former was an economic power greater than the latter in the fifth century, and that a wider distribution of its products should not be surprising: the coinages, their production and economic productivity were all intrinsically entangled, and the presence of one can be used to argue for the productivity of another.

Hoards and weight standards

Some of the best understanding of how coins and their weight standards were used comes from the evidence of hoards, indicative of how coins might have been in use locally at the time of the hoard burial. Of 40 coin hoards containing Ionian coins of the fifth century, 18 are from Ionia itself (Tab. 2). Why the over-representation of coin hoards from Ionia? This could be a pattern about exploration and discovery, with a greater quantity of unmoni-

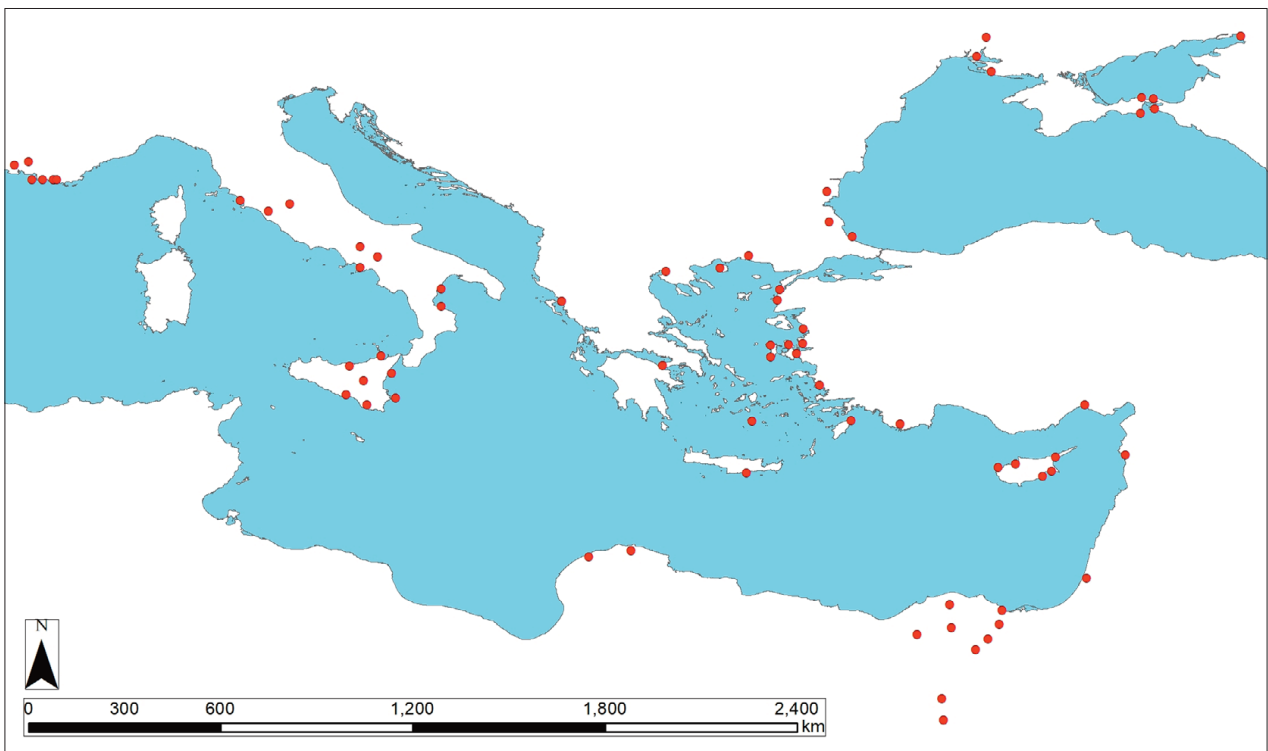


Figure 10. Distribution of Samian Type 3 (530–480/460 BCE) transport amphoras, after Birzescu (2012) fig. 92 (map by author).

tored digging activity taking place along the Anatolian littoral in the 18th and 19th century when these hoards originated. This could, in turn, have been driven by a desire for the acquisition of coins to build collections of a particular type. Or, perhaps, there is a more historical reason, that, for an area under the threat of attack from neighbouring superpowers in the sixth and fifth centuries, people in the Ionian region were more likely than elsewhere in the Aegean to make emergency deposits of their wealth and goods (cf. Duyrat 2011). Some find spots are recorded simply as ‘Ionia’ or ‘western Asia Minor’, but for those published more precisely, one finds hoards from Chios, Clazomenai, Colophon, Erythrae and Samos. In absolute numbers, these hoards contain on average fewer coins than hoards located elsewhere across the Aegean, but the number of specifically *Ionian* coins within the total assemblage is high. The next largest group comprises hoards found in Egypt, with Ionian coins also found as far afield as Italy, and further into Anatolia around the border

of Cilicia and Pamphilia, and in Bithynia. Twelve of the hoards from Ionia comprised Ionian coins for more than 70% of their total assemblages. But the distance from Ionia and the quantity of Ionian coins is not proportional: of the coin hoards found in the Aegean region of the fifth century, Ionian coins make up only a very small proportion, less than 10% of the total assemblage in any case. This is in contrast to those hoards of the Near East, where Ionian coins accounted for more than 15% of the total assemblage in 5 of 15 cases. Regarding the hoards from outside Ionia, Ionian coins continue to circulate continually throughout the fifth century (Tab. 6). The coins from Chios were in widest circulation (found in 13 hoards), with the coinage of Samos at a close second (found in 6 hoards), in and of itself providing further evidence of the strength and reach of these regional networks in the fifth century. There was a spread of cities whose coinage circulated: for Miletus, there was greater circulation down to 475 BCE, but also evidence that circulation continued (although the coinage

Hoard	Terminus ante quem	Athenian coins present?	Ionian coins present?
IGCH 6	500 BCE		Miletus
IGCH 1636	500 BCE		Chios
IGCH 1637	500 BCE		Chios, Miletus, Samos
IGCH 1638	500 BCE	x	Chios, Miletus, Samos
IGCH 7	490 BCE		Miletus
IGCH 1640	485 BCE	x	Chios
IGCH 1177	480 BCE	x	Chios
IGCH 1643	480 BCE		Teos
IGCH 1644	475 BCE	x	Chios, Miletus, Samos, Teos
IGCH 1639	470 BCE	x	Chios, Clazomenai, Colophon, Samos
IGCH 1645	470 BCE	x	Chios, Samos, Teos
IGCH 1234	460 BCE		Phocaea
IGCH 1646	460 BCE	x	Chios
IGCH 2352	460 BCE		Phocaea
IGCH 21	450 BCE		Chios
IGCH 1185	450 BCE		Phocaea
IGCH 1188	450 BCE		Teos
IGCH 1482	445 BCE	x	Chios, Clazomenai, Ephesus, Miletus
IGCH 1647	425 BCE		Chios, Samos
IGCH 1483	425 BCE	x	Chios

Table 6. Summary of Athenian and Ionian hoards present in hoards outside Ionia, providing evidence for supraregional circulation in the fifth century. Terminus ante quem is provided by the production date of the latest dated coin in each hoard.

is found in fewer places) until at least 445 BCE. There is no evidence that the circulation of Athenian coinage had an effect on the circulation of Ionian coinages outside of Ionia, as there is little correlation between the appearance of Athenian coins and the presence or absence of Ionian coins of certain cities.

Of the fifteen Ionian coin hoards, seven contain coins whose latest date of striking is between 500 and 480 BCE, another seven largely contain coins struck between 480 and 440 BCE, and four are reasonably undateable. Of hoards outside Ionia containing Ionian coins, nine date pre-480 BCE, nine more down to the mid-fifth century and only two from the final quarter. Neither these patterns themselves nor the difference between Ionian and non-Ionian hoards tells us much more than that Ionian coins were still in circulation (and, likely, in transaction) for most if not all of the fifth century, with a possible tail-off in the final decades. But given what has been noted above on the difficulty in assigning reliable dates to Ionian coins – a problem which becomes much amplified when dealing with hoards whose context is not usually recorded, or which appeared on the art market – the main discussion on hoards here focuses on the spatial rather than the chronological. What more can be said relates to the denomination of coins. Within Ionia, it is for the most part small fractions, obols and the Phocaeen or Cyzicene *hektai* that are found within the hoards of mixed Ionian coinages (e.g. *IGCH* 1165, 1166, 1168, 1183, 1189, 1190), suggesting that these low-denomination coins were used in transaction, perhaps by merchants. The heaviest coins tend to come from hoards of single-city issues (e.g. *IGCH* 1179 contains only Chian coins including staters, or *IGCH* 1190 with Chian didrachms). Athenian coins (primarily heavy coinage, most usually tetradrachms) are present in five of the Ionian hoards, always in low quantities and always alongside much higher quantities of local Ionian coins: this would suggest that Athenian coinage played little role in ‘supporting’ or ‘replacing’ payments in the region, even if Ionian cities were not themselves minting. Found in even fewer places in Ionia (three hoards) are the Persian sigloi. A hoard of unknown provenance possibly from western Asia Minor on which there is no bibliography (*IGCH* 1175) contained 39 sigloi, 14 Cyzicene fractions, 8 coins of unknown Lydian issue and only three Milesian coins; but in the other two cases (*IGCH* 1166 and 1252) local Ionian coins far outnumber the handful of sigloi found. This would suggest that, as in the case of the Attic coins, although there is positive evidence of extra-regional coinages circulating in Ionia during the fifth century, the main circulation was of locally produced issues.

What do these patterns mean? If we can assume that the presence of coins is indicative (even representative) of the coins used locally, then qualitatively these hoards can map

the extent of a network of Ionian coins, or, to put it provisionally, a wider economic zone.⁴ This network extended to the area of Cilicia and Pamphilia in the east, down along the coast of Tyre and in fairly abundant presences along the Nile. Is it fair to assume that this pattern represents the extent of a network, rather than an incidental distribution? On the one hand, there are hoards in which Ionian coins comprise large numbers, and it should be clear here that their presence is not accidental but indicative of a site nearby using coins like these as tools; for other hoards, like *IGCH* 1636 from Mit Rahineh, *IGCH* 1643 from Memphis, or *IGCH* 1646 from Fayum, Ionian coins might only make up a single coin of the total assemblage, but the distribution of hoards containing Ionian coins from nearby is dense enough that one could suggest these coins were in circulation regionally – even if not used in huge numbers at any one place. Specifically on the distribution of standards, though, patterns of both local and supraregional significance are apparent. Locally, the hoards of the fifth century indicate that, further to minting new coins on a variety of standards, Ionian communities were using a range of coin types that gave them access to an even wider network. Hoard *IGCH* 1167 from Clazomenai contains coins from Samos and Chios, providing links for the community with the networks of Persian and Euboean weight standards, that through the production of its own coinage alone it did not have. And similarly *IGCH* 1183, by virtue of coins within its assemblage from Clazomenai, Ephesus, Erythrae, Miletus, Phocaea, Teos and Samos, this community could connect itself to networks of all locally used weight standards, not just the Persian network that it connected to through the production of its own coinage. Supraregionally, the distribution of state coinage confirms patterns observed above. Some of the Ionian coinage most commonly found outside of Ionia originates from Chios and Samos, particularly at Naucratis and along the Nile valley. The presence of these coins might be used as further evidence for the reach of the trade network extended and sustained by these island communities throughout the latter course of the fifth century.

The coinage of Archaic Miletus is also abundant in the hoard record. Coins struck at Miletus during the sixth century are found in no fewer than 15 of the 40 hoards from the fifth century, a proportion far too great for this to

4 Grierson (1975: 134–59) outlines four reasons for hoarding: accidental losses, ‘emergency’ hoards, ‘savings’ hoards and abandoned hoards (cf. Reece 2002: 67–88). Bland (2018: 9), in focussing on hoards buried but not recovered, refines these categories to three: ‘accidental losses, hoards buried with the intention of recovery and hoards deliberately abandoned for a variety of reasons, including votive’. Contextual analysis of each hoard discussed here is beyond the scope of this paper, but some sense of ‘emergency’ hoarding is understood in that coins represented in the record are taken out of circulation and representative of coinage in action.

be an incidental pattern. Locally, archaic Milesian coins are found in high proportions for hoards of dates right down throughout the fifth century: for hoards all found (at unspecified locations within) western Asia Minor, *IGCH* 1196 (ca 400 BCE) contains exclusively Milesian coins, while *IGCH* 1195 (ca 400 BCE) has 21 Milesian coins with one Ialysian coin, and *IGCH* 1199 (ca 400 BCE) has 19 Milesian coins compared to five from Salamis. From the Aegean, Milesian coins are found alongside those from Cyzicus in a hoard from Melos (*IGCH* 6, ca 500 BCE) and alongside coins of the islands (particularly Aegina in high number) from Thera (*IGCH* 7, ca 490 BCE), with Milesian coins totalling 48: in both of these Aegean contexts, Milesian coins are the only coins of Ionia to be included in mixed hoard groups. Like the coins of Chios and Samos, Milesian coins appear in groups all down the Nile Valley, for instance at Dime-n-Hor (*IGCH* 1637, ca 500 BCE), on the Delta (*IGCH* 1638, ca 500 BCE), and at Asyut (*IGCH* 1644, ca 475 BCE).

What does this mean? The distribution and numbers of coins in these hoards point towards a positive pattern, and this looks like a pattern of reuse. That is, communities were reusing coins of Miletus that had been struck in the Archaic period, and the fact that Miletus was not striking new series in the fifth century did not prevent its coinage from previous generations continuing to circulate. Given what was noted above about the early strength of the Milesian economic area in the sixth century, this should not be surprising at the broadest top level: the network did not suddenly cease to exist because Miletus stopped striking its own coinage, and one of the strategies that could be used by other non-Milesian communities to continue participating in this network was simply to continue using pre-existing Milesian coinage, to keep their ties of economic affiliation close to one another. It has already been noted that new coinages, such as those at Sinope, were struck to this 'old' standard in order to tap into that pre-existing network, and here too the evidence of coins provides evidence of a second strategy. That Archaic Milesian coins appear in the highest quantities in Ionia itself is good evidence for this continuity: the economic network was strongest within the region, and the distribution of coins, therefore, maps onto the most active economic zone. But that there was a high quantity of Milesian coins found in the fifth century hoard of Melos provides further evidence, of this being a community still integrally linked to the Milesian-zone network, not only minting its own new coinages to the Milesian standard but also continuing to reuse old Milesian coins. That is, the example of Miletus provides a strong case for looking across coin distribution and coin standards to identify the shape of an economic network, and in some senses can give a more rounded picture of economic activity than in

looking at production alone. It is not just new coinages, but coinages old and new used in motion that give a different and more vibrant view of Milesian material culture and its neighbouring communities in the fifth century.

At this broad level, then, it would appear that Cook was looking the wrong way when he concluded that there was economic stagnation in Ionia of the fifth century. Economic activity cannot be measured by production rates alone, and both the case for the reuse of coins and the mapping of this pattern onto the distribution of weight standards imply resilient and buoyant economic activity in the region. Networks might have shifted away from the Aegean, and by measuring the presence of Ionian activity within the Aegean one gets a false impression of Ionian regional absence. But, as stated above, so much is to be expected against the general changes within the Aegean than for this to be a purely Ionian pattern.

Conclusion

This article began by considering the transition between 'Golden Age' and 'Dark Age' for the region of Ionia. While it is true that there was not the same effervescence of scientific thought and artistic creation in the fifth century as in the sixth century BCE, the caricature of a totally impoverished region is fairly strong in implying that there was total disruption in political life and inactivity in social, cultural and economic spheres *continually* throughout the whole century. But, as scholars of recent decades have noted, the data from Ionia considered holistically and contextually paint a rather different picture. Rather than a period of prolonged inactivity, fifth-century Ionia was characterised by 'pauses', moments in which individual communities consolidated their activities and formed new connections, sometimes rebuilding networks that had been established in the sixth century (or earlier), sometimes reaching out to new neighbours. In part, though, it is a pattern that has been distorted by archaeological visibility, something that can be challenged by taking a qualitative 'presence/absence' view of the material culture, as done here. And what one sees in taking this view is that there was not a single moment of pause across Ionia, rather different breathing points taken at different times by different states: this was not a 'Dark Age' for the region, but a series of marked hiatuses.

My argument has contributed another stack of evidence against John Manuel Cook's claim of general inactivity in the region of Ionia. While now 30 years ago Robin Osborne had refuted Cook's claims about building inactivity as a sign of Ionia's regional poverty, and while scholars have now quietly recognised that Cook's view might not be consistent with an emerging body of archaeological evidence, this study has aimed to go further by

addressing more directly claims about economic stagnation across the region. Specifically, this article has argued the case for models of persistence and growth, that while Cook based his claims on negative evidence, the positive evidence presented here shows a convincing pattern of economic hegemony.

Coinage has provided a productive way into thinking about the economy of the fifth century. This is despite perennial problems of precise chronology and thorny issues of reuse that are fairly invisible to the archaeological and historical record. The solution to these challenges has been to consider the dataset in terms of a century-long patterning, and to think about coins fairly qualitatively with reference to their weight standards and the networks that they represent, rather than to look at individual coins in precise transaction. The story of economic networking for fifth-century Ionia has not traditionally been considered from a material perspective, and so this study has aimed to frame the dataset, as it is currently understood, conscious of its limitations and lacunae, within a framework that can map patterning literally. The most surprising pattern generated through this approach has been to see the Ionian network patterns against those of other Aegean communities; that, particularly after the transfer of the Delian League to Athens in 454 BCE and following the issues of the standards decree, the Ionian communities displayed greater resilience and growth in their own local and supraregional networks than neighbouring groups, particularly those located in the islands. Ionian communities continued to mint and use coins on local weight standards first adopted in the sixth century, and did not pivot their networks towards Athens. This pattern is consistent when brought into dialogue with the amphora pattern, a familiar story (for north Ionia, at least) of growing networks in the Black Sea region and further into Anatolia: this is an archaeology of production and state interaction, which becomes all the more convincing in being materialised independently across two different datasets. This also demonstrates the utility of mobilising in a framework of mobility and interaction objects – like coins – that usually live in catalogues and that are studied typologically.

In terms of Ionian-specific patterning, the trajectory of three different communities has been of especial note. Milesian networks continued to operate outside of Miletus, both in a continuing use of the Milesian coin standard

(supporting existing and wide-reaching economic networks) and in an implied continuation in use of Milesian coins that had been minted at the end of the sixth century. That Miletus itself was not minting new coins demonstrates a different sort of economic activity than had been conducted in the sixth century, rather than an *absence* of economic networking. Chios, along with other communities of north Ionia, took the opportunity of the momentary ‘pauses’ across the region to emerge as the economic giant in the region, not only developing amphora workshops whose products would account for the greatest proportion of Ionian-manufactured material in assemblages overseas, but which also produced coin emissions on a local standard. This was a standard that would be adopted soon after by other neighbours, indicating a strength of the economic network that was emerging over the course of the fifth century. And for Samos the story was similar (but not the same) as on Chios, with the ‘island-pattern’ of Ionia looking quite different to that of the mainland communities. Samos had an autonomous coin standard from its early days of minting coins (a locally important standard, as evidenced through the presence of Samian coins in hoards from the island) but also used coin standards from other neighbours to extend the reach of its networks. Although Samian material culture was widespread in and beyond the Aegean (as indicated by the presence of Samian amphoras overseas) their quantity was not as great as that of Chian amphoras: Samian economic networking played a role, therefore, not solely in extending but also in merely maintaining its reach.

Overall, the coinage networks from Ionia indicate patterns of economic resilience (and even growth) throughout the course of the fifth century. That there *was* a pattern for fifth-century Ionia, though, is clear – and this pattern is a far-cry from ‘a common level of degradation and, to some extent, economic paralysis’.

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Bibliography

- Akurgal, E. 1962: 'The Early Period and the Golden Age of Ionia' *American Journal of Archaeology* 66: 369–79
- Ashton, R.H.J. 2006: 'The beginning of Bronze coinage in Karia and Lykia' *The Numismatic Chronicle* 166: 1–14
- Balcer, J.M. 1984: *Sparda by the Bitter Sea. Imperial Interaction in Western Anatolia*. Chico, Scholars Press
- Bammer, A. 1990: 'A peripteros of the geometric period in the Artemision of Ephesus' *Assyriological Studies* 40: 137–60
- 1991: 'Les sanctuaires des VIII^e et VII^e siècles à l'Artemision d'Éphèse' *Revue archéologique* 1: 63–84
- Barron, J.P. 1966: *The Silver Coins of Samos*. London, The Athlone Press
- Bîrzescu, I. 2012: *Die archaischen und frühklassischen Transportamphoren* (Histria 15: Ergebnisse der Ausgrabungen und Untersuchungen herausgegeben im Auftrag des Instituts). Bucharest, Editura Enciclopedică
- Bland, R. 2018: *Coin Hoards and Hoarding in Roman Britain AD 43–c.498*. London, The British Numismatic Society
- Bodenstedt, F. 1976: *Phokäisches Elektron-Geld von 600–326 v.Chr.* Mainz am Rhein, Zabern Verlag
- Bresson, A. 2007: 'La construction d'un espace d'approvisionnement: les cités égéennes et le grain de mer Noire' in A. Bresson, A. Ivantchik, J.-L. Ferrary (eds), *Une koinè pontique de littoral nord de la mer Noire (VII^e s.a.C. – III^e s. p.C.)*. Bordeaux, Ausonius éditions: 49–68
- 2009: 'Electrum coins, currency exchange and transaction costs in Archaic and Classical Greece' *Revue Belge de Numismatique et de Sigillographie* 140: 71–80
- Brett, A.B., Comstock, M.B., Vermeule, C.C. Jr. 1974: *Catalogue of Greek Coins*. New York, Attic Books
- Brughmans, T., Peeples, M.A. 2023: *Network Science in Archaeology*. Cambridge, Cambridge University Press
- Brughmans, T., Wilson, A. 2022: *Simulating Roman Economies: Theories, Methods and Computational Models*. Oxford, Oxford University Press
- Carlson, D. 2003: 'The Classical Greek shipwreck at Tektaş Burnu, Turkey' *American Journal of Archaeology* 107: 581–600
- Carradice, I., Price, M. 1988: *Coinage in the Greek World*. London, Seaby
- Cevizoglu, H. 2010: *Reliefkeramik archaischer Zeit aus Klazomenai*. Langenweißbach, Beier and Beran
- 2022: 'South Ionian city-states (Panionion, Samos, Ephesus, Priene, Myous and Miletus)' in Y. Ersoy, E. Koparal (eds), *Ionians. The Sages of the Aegean Shore*. Istanbul, Yapı Kredi Yayınları: 138–71
- Cevizoglu, H., Tanriver, C. 2022: 'City-states of northern Ionia (Phocaea, Smyrna, Clazomenae, Teos, Erythrae, Chios, Lebedus, Colophon)' in Y. Ersoy, E. Koparal (eds), *Ionians. The Sages of the Aegean Shore*. Istanbul, Yapı Kredi Yayınları: 114–37
- Collar, A., Coward, F., Brughmans, T., Mills, B.J. 2015: 'Networks in archaeology: Phenomena, abstraction, representation' *Journal of Archaeological Method and Theory* 22: 1–32
- Cook, J.M. 1961: 'The problem of Classical Ionia' *Proceedings of the Cambridge Philological Society* 187: 9–18
- 1962: *The Greeks in Ionia and the East*. London, Thames and Hudson
- Crema, E.R. 2012: 'Modelling temporal uncertainty in archaeological analysis' *Journal of Archaeological Method and Theory* 19: 440–61
- Crisà, A., Gkikaki, M., Rowan, C. 2019: 'Introduction' in A. Crisà, M. Gkikaki, C. Rowan (eds), *Tokens. Culture, Connections, Communities* (Special Publication 57). London, Royal Numismatic Society: 1–10
- Daems, D., Coco, E., Gillreath-Brown, A., Kafetzaki, D. 2023: 'The effects of time-averaging on archaeological networks' *Journal of Archaeological Method and Theory* 30: 1–39
- de Callatay, F. 2020: 'Prolegomena to a die study of the electrum coinage of Cyzicus' in P. van Alfen, U. Wartenberg (eds), *White Gold. Studies in Early Electrum Coinage*. New York, American Numismatic Society: 641–64
- Doonan, O. 2004: *Sinop Landscapes Exploring Connection in a Black Sea Hinterland*. Philadelphia, University of Pennsylvania Press
- Driscoll, E., Lazar, L., Loy, M., forthcoming: 'Introduction' in E. Driscoll, L. Lazar, M. Loy (eds), *Alternatives to Imperialism: Reactions and Regional Perspectives in the Athenian Empire*. Cambridge: Cambridge University Press
- Duyrat, F. 2011: 'Guerre et thésaurisation en Syrie hellénistique, IV^e–I^{er} s. av. J.-C.' in T. Faucher, M.-C. Marcellesi, O. Nomisma (eds), *La Circulation Monétaire Dans Le Monde Grec Antique. Colloque International, Athènes, 14–17 Avril 2010* (eds). Athens, Ecole française d'Athènes: 417–31
- Ehrhardt, N. 2003. 'Milet nach den Perserkriegen: Ein Neubeginn?' in E. Schwertheim (ed.), *Stadt und Stadtentwicklung in Kleinasien*. Bonn, Habelt: 1–19
- Ellis-Evans, A. 2016. 'Mytilene, Lampsakos, Chios and the financing of the Spartan fleet (406–404)' *Numismatic Chronicle* 176: 1–19
- Ersoy, Y., Koparal, E. (eds) 2022: *Ionians. The Sages of the Aegean Shore*. Istanbul, Yapı Kredi Yayınları
- Figueira, T. 1998: *The Power of Money: Coinage and Politics in the Athenian Empire*. Philadelphia, University of Pennsylvania Press
- 2006: 'Reconsidering the Athenian coinage decree' *Annali dell'Istituto Italiano di Numismatica* 52: 9–44

- von Fritze, H. 1912: *Die Elektronprägung von Kyzikos*. Berlin, Mayer and Müller
- Furtwängler, A. 1982: ‘Griechische Vieltypenprägung und Münzbeamte’ *Schweizerische numismatische Rundschau* 61: 5–29
- Gillings, M., Hacigüzeller, P., Lock, G. 2020. *Archaeological Spatial Analysis: A Methodological Guide*. New York, Routledge
- Graham, A. 1992: ‘Abdera and Teos’ *The Journal of Hellenic Studies* 112: 44–73
- Guth, D. 2017: ‘The “rise and fall” of Archaic Miletus’ *Historia* 66: 2–20
- Hardwick, N.M.M. 1991: *The Coinage of Chios from the Sixth to the Fourth Century B.C.* PhD thesis, Oxford University
- 2010. ‘The coinage of Chios 600–300 BC: New research developments 1991–2008’ in P. Tselekas (ed.), *To νόμισμα στα νησιά του Αιγαίου : νομισματοκοπεία, κυκλοφορία, εικονογραφία, ιστορία : πρακτικά συνεδρίου της Ε’ Επιστημονικής Συνάντησης, Μυτιλήνη, 16–19 Σεπτεμβρίου 2006*. Athens, Friends of the Numismatic Museum: 217–45
- Head, B.V. 1887: *Historia Numorum. A Manual of Greek Numismatics*. Oxford, Clarendon Press
- 1911: *Historia Numorum. A Manual of Greek Numismatics* (new and enlarged edition). Oxford, Clarendon Press
- Herda, A. 2019: ‘Copy and paste? Miletus before and after the Persian Wars’ in E. Capet, C. Dogniez, M. Gorea, R. Koch-Piettre, F. Massa, H. Rouillard-Bonraisinet (eds), *Reconstruire les villes modes, motifs et récits*. Turnhout, Brepols: 91–120
- Hind, J.G.F. 1988: ‘The colonisation of Sinope and the south-east Black Sea area’ in O.D. Lordkipanidze (ed.), *Mestnie etno-politicheskie obedineniya prichernomor’ya v VII-IV vv. do n.e.* Tbilisi, Mecniereba: 207–23
- Howgego, C. 1995: *Ancient History from Coins*. London, Taylor & Francis
- Iacono, F. 2016: ‘From networks to society: Pottery style and hegemony in Bronze Age southern Italy’ *Cambridge Archaeological Journal* 26: 121–40
- Kallet, L. 2001: *Money and the Corrosion of Power in Thucydides: The Sicilian Expedition and Its Aftermath*. Berkeley, University of California Press
- Kallet, L., Kroll, J.H. 2020: *The Athenian Empire: Using Coins as Sources*. Cambridge, Cambridge University Press
- Kerschner, M. 2020. ‘The Archaic temples in the Artemesian of the “central basis”’ in P. van Alfen, U. Wartenberg (eds), *White Gold. Studies in Early Electrum Coinage*. New York, American Numismatic Society: 191–262
- Kerschner, M., Konuk, K. 2020: ‘Electrum coins and their archaeological context: The case of the Artemision of Ephesus’ in P. van Alfen, U. Wartenberg (eds), *White Gold. Studies in Early Electrum Coinage*. New York, American Numismatic Society: 83–190
- Killen, S. 2017: *Parasema: offizielle Symbole griechischer Poleis und Bundesstaaten*. Wiesbaden, Harrassowitz
- Kim, H., Kroll, J. 2008: ‘A hoard of Archaic coins of Colophon and unminted silver (CH I.3)’ *American Journal of Numismatics* 20: 53–103
- Konuk, K. 2010a: ‘The payment of the Ekklesiastikon at Iasos in light of new evidence’ in R. van Bremen, J.-M. Carbon (eds), *Hellenistic Karia*. Bordeaux, Ausonius: 59–67
- 2010b: ‘War tokens for silver? Quantifying the early bronze issues of Ionia’ in F. de Callatay (ed.), *Quantifying Monetary Production in Greco-Roman Times*. Bari, Edipuglia: 151–61
- 2011. ‘Des chouettes en Asie Mineure : quelques pistes de réflexion’ in T. Faucher, M.-C. Marcellesi, O. Picard (eds), *Nomisma. La circulation monétaire dans le monde grec antique. Actes du colloque international, Athènes, 14–17 avril 2010*. Athens, Ecole française d’Athènes: 53–77
- Kroll, J.H. 2008. ‘The monetary use of weighed bullion in Archaic Greece’ in W.V. Harris (ed.), *The Monetary Systems of the Greeks and Romans*. Oxford, Oxford University Press: 13–37
- 2009: ‘What about coinage?’ in J. Ma, N. Papazarkadas, R. Parker (eds), *Interpreting the Athenian Empire*. London, Bristol Classical Press: 195–209
- Kroll, J.H., Waggoner, N.M. 1984: ‘Dating the earliest coins of Athens, Corinth and Aegina’ *American Journal of Archaeology* 88: 325–40
- Kunisch, N. 2016: *Funde aus Milet V, Teil 3. Die Attische Importkeramik* (Milet: Ergebnisse der Ausgrabungen und Untersuchungen seit dem Jahre 1899. Band V. Funde aus Milet, Teil 3: Die Attische Importkeramik). Berlin, De Gruyter
- Lawall, M. 1999: ‘Amphoras and Aegean trade: Structure and goals for future research’ in R.F. Docter, E.M. Moorman (eds), *Proceedings of the XVth International Congress of Classical Archaeology, Amsterdam, July 12–17, 1998*. Amsterdam, Allard Pierson Museum: 229–32
- Lazar, L. 2024: *Athenian Power in the Fifth Century BC*. Oxford, Oxford University Press
- Lohmann, H. 2021: ‘Miletus after the disaster of 494 B.C. Refoundation or recovery?’ in S. Fachard, E.M. Harris (eds), *The Destruction of Cities in the Ancient World. Integrating the Archaeological and Literary Evidence*. Cambridge, Cambridge University Press: 50–69
- Loy, M. 2023: *Connecting Communities in Archaic Greece. Exploring Economic and Political Networks through Data Modelling*. Cambridge, Cambridge University Press

- Loy, M., Slawisch, A. 2021: 'Shedding light on the matter: Evaluating changing patterns of object dedication in Ionian sanctuaries (7th/6th – 5th/4th centuries BC) with lexicometrical analysis' *Journal of Greek Archaeology* 6, 166–99
- Lubos, M. 2009: 'Weihungen griechischer Söldner in Didyma' in R. Einicke, S. Lehmann, H. Löhr, A. Mehnert, A. Slawisch, F. Bertemes, R. Wünsche, R.A. Stucky, L. Summerer (eds), *Zurück zum Gegenstand. Festschrift für Andreas E. Furtwängler*. Langenweissbach, Beier & Beran: 405–11
- MacDonald, G. 1899: *Catalogue of Greek Coins in the Hunterian Collection*. Glasgow, Maclehose
- Mackil, E., van Alfen, P. 2006: 'Cooperative coinage' in P. van Alfen (ed.), *Agoronomia: Studies in Money and Exchange Presented to John H. Kroll*. New York, American Numismatic Society 201–47
- Marcellesi, M.-C. 2010. 'Adoption et diffusion de la monnaie de bronze dans le monde égéen' *Studi Hellenistic* 24, 255–71
- Mattingly, H.B. 1981: 'Coins and amphoras. Chios, Samos and Thasos in the fifth century B.C.' *Journal of Hellenic Studies* 101: 78–86
- Meadows, A. 2011: 'The Chian revolution: Changing patterns of hoarding in 4th-century BC western Asia Minor' in T. Faucher, M.-C. Marcellesi, O. Picard (eds), *Nomisma: La circulation monétaire dans le monde grec*. Athens, Ecole française d'Athènes: 273–95
- Meiggs, R. 1972: *The Athenian Empire*. Oxford, Clarendon Press
- Mielczarek, M. 2020: 'Cyzicene electrum coinage and the Black Sea grain trade' in P. van Alfen, U. Wartenberg (eds), *White Gold. Studies in Early Electrum Coinage*. New York, American Numismatic Society: 665–88
- Mills, B.J. 2018: 'Navigating Mediterranean archaeology's maritime networks' in J. Leidwanger, C. Knappett (eds), *Maritime Networks in the Ancient Mediterranean World*. Cambridge, Cambridge University Press: 238–56
- Mills, B.J., Clark, J.J., Peeples, M.A., Shackley, M.S. 2013: 'Transformation of social networks in the late pre-Hispanic US Southwest' *Proceedings of the National Academy of Sciences of the United States* 110.15: 5785–90
- Monachov, S. 1999. *Grecheskie amfory v Prichernomor'e: kompleksy keramicheskoi tary VII–II vv. do n.é.* Saratov, Grecheskie amfory v Prichernomor'e: kompleksy
- Monachov, S., Kuznetsova, E. 2017: 'Overseas trade in the Black Sea region from the Archaic to the Hellenistic period' in V. Kozlovskaya (ed.), *The Northern Black Sea in Antiquity. Networks, Connectivity, and Cultural Interactions*. Cambridge, Cambridge University Press: 55–99
- Moreno, A. 2007: 'Athenian Wheat-Tsars: Black Sea grain trade and elite culture' in V. Gabrielsen, J. Lund (eds), *The Black Sea in Antiquity: Regional and Interregional Economic Exchanges*. Aarhus, Aarhus University Press: 69–84
- Nudell, J.P. 2023: *Accustomed to obedience? Classical Ionia and the Aegean World, 480–294 BCE*. Ann Arbor, University of Michigan Press
- Osborne, R. 1999: 'Archaeology and the Athenian Empire' *Transactions of the American Philological Association* 129: 319–32
- Osborne, R., Rhodes, P.J. (eds) 2017: *Greek Historical Inscriptions 478–404 BC*. Oxford, Oxford University Press
- Papazarkadas, N. 2009: 'Introduction' in J. Ma, N. Papazarkadas, R. Parker (eds), *Interpreting the Athenian Empire*. London, Bristol Classical Press: 1–11
- Pritchett, W.K. 1971: *The Greek State at War XI*. Berkeley, University of California Press
- Pritchett, W.K., Georgiadès, A.N. 1965: 'The Koan Fragment of the monetary decree' *Bulletin de Correspondance Hellénique* 89, 400–40
- Psoma, S.E. 2016: 'Choosing and changing monetary standards in the Greek world during the archaic and the classical periods' in E.M. Harris, D.M. Lewis, M. Woolmer (eds), *The Ancient Greek Economy: Markets, Households and City-States*. Cambridge, Cambridge University Press: 90–115
- Reece, R. 2002. *The Coinage of Roman Britain*. Stroud, Tempus
- Rhodes, P.J. 2008: 'After the three-bar sigma controversy: The history of Athenian imperialism reassessed'. *The Classical Quarterly* 58: 501–06
- Rubinstein, L. 2004: 'Miletus' in M.H. Hansen, T.H. Nielsen (eds), *An Inventory of Archaic and Classical Poleis*. Oxford, Oxford University Press: 1082–88
- Rutter, K. 2021: 'Review: Peter van Alfen and Ute Wartenberg (eds) (with Wolfgang Fischer-Bossert, Haim Gitler, Koray Konuk, and Catharine C. Lorber), *White Gold: Studies in Early Electrum Coinage*. pp. x + 707, b/w and color plates, charts, maps and tabs. New York: The American Numismatic Society; Jerusalem: The Israel Museum, 2020. ISBN 978-0-89722-349-2, hardcover \$150' *Journal of Greek Archaeology* 6, 405–12
- Sezgin, Y. 2012: *Arkaik Dönem Ionia Üretim Ticari Amphoralar*. Istanbul, Ege Yayınları
- Slawisch, A. 2019a: 'Amphoren auf Amphoren. Wie Chios während einer Krisenzeit eine Marke einführt' *Antike Welt* 1: 8–16
- 2019b: 'Figures in motion: An Ionian perspective on the severe style' *Annual of the British School at Athens* 114: 145–65

- 2022: ‘Ionia during the 5th Century BC’ in Y. Ersoy, E. Koparal (eds), *Ionians. The Sages of the Aegean Shore*. Istanbul, Yapı Kredi Yayınları: 496–506
- forthcoming: ‘Archaeology and the Athenian Empire: Ionia in the fifth century’ in E. Driscoll, L. Lazar, M. Loy (eds), *Alternatives to Imperialism: Reactions and Regional Perspectives in the Athenian Empire*. Cambridge, Cambridge University Press
- Spier, J. 1990: ‘Emblems in Archaic Greece’ *Bulletin of the Institute of Classical Studies of the University of London* 37: 107–29
- Tselekas, P. 1996: *The Coinage of Acanthus*. Oxford, Oxford University Press
- van Alfen, P.G. 2012: ‘Problems in the political economy of Archaic Greek coinage’ *Notae Numisticae* 7: 13–36
- von Reden, S. 2010: *Money in Classical Antiquity*. Cambridge, Cambridge University Press
- Wallace, R.W. 1987: ‘The origin of electrum coinage’ *American Journal of Archaeology* 91: 385–97
- Walter, H. 1968: *Frühe samische Gefässe: Chronologie und Landschaftsstile ostgriechischer Gefässe, Samos*. Bonn, Habelt
- Wartenberg, U., Fischer-Bossert, W. 2016: ‘Early electrum coinage – innovation or continuity?’ *Ex Ionia Scientia – ‘Knowledge’ in Archaic Greece*. International Conference at the National and Kapodistrian University of Athens, Greece, 11–14 December 2016
- Webb, V. 2016: *Faience Material from the Samos Heraion Excavations*. Wiesbaden, Harrassowitz
- Weidauer, L. 1975: *Probleme der frühen Elektronprägung*. Fribourg, Office du livre
- Weissl, M. 2002: ‘Grundzüge der Bau- und Chichtenfolge im Artemision von Ephesos’ *Jahreshefte des Österreichischen archäologischen Instituts in Wien* 71, 313–46
- 2005: ‘Zur Datierung des “Foundation-Deposit” aus dem Artemision von Ephesos’ in B. Brandt, V. Gassner, S. Ladstätter (eds), *Synergia. Festschrift für Friedrich Krinzinger*. Vienna, Phoibos: 363–70
- Williams, D.J.R. 1991: ‘The “pot-hoard” pot from the Archaic Artemision at Ephesus’ *Bulletin of the Institute of Classical Studies* 38: 98–104:
- Zeuner, F.E. 1963: ‘Dolphins on coins of the classical period’ *Bulletin of the Institute of Classical Studies* 10: 97–103
- Ziesmann, S. 2013: ‘Metrologische Studien zu den Silbermünzen ägäischer Poleis des 5. Jh. v. Chr’ in A. Slawisch (ed.), *Handels- und Finanzgebaren in der Ägäis im 5. Jh. v. Chr.* Istanbul, Ege Yayınları: 207–28