

From Luxury Product to Mass Commodity:
Glass Production and Consumption in the Hellenistic World

by

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Dedication

For Mom and Dad

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Abstract

In the second and early first millennium BCE, glass was exclusively a luxury product employed by high status elites, but by the Roman period, glass wares were regularly used as everyday objects. This dramatic change in the scale and context of glass use has long been attributed to the revolutionary invention of glass blowing in the first century BCE and its subsequent spread during the early Roman empire. This dissertation argues that the conceptual and functional origins of glass as a common, everyday product occurred earlier, during the late Hellenistic period, when producers and consumers began to treat glass tablewares and small objects as quotidian, mass-produced commodities rather than luxuries reserved for rhetorical manipulation by elites.

This dissertation compiles previously published information on glass objects from archaeological contexts dated from c. 350-50 BCE in the Mediterranean basin, Black Sea, and Western Asia in order to demonstrate a dramatic rise in the quantity of glass available to consumers and its integration into urban and domestic life over the course of the Hellenistic period. In most regions, consumption of luxury glass products continued unabated from the first millennium BCE into the Roman period. However, within the eastern Mediterranean and Syro-Palestine, an expanding number of glass workshops served local consumer markets, and consumers began to adopt glass tablewares, adornment, gaming pieces, and tools for household use.

This change in glass production and consumption occurred within a broader political, economic, and cultural environment in which increasing wealth was vested in the hands of aggrandizing middle elites. As the hegemonic control of Hellenistic empires waned in the late second and early first centuries BCE, ambitious and moderately wealthy individuals engaged in elite identity practices involving glasswares, including conspicuous consumption and elaborate drinking and dining. Producers responded to growing consumer demand by exploiting natural resources to manufacture raw glass, simplifying manufacturing processes, and opening new workshops, which trained more workers and reached additional markets. Such experimental and entrepreneurial workshop behavior facilitated the technological innovation of glass blowing by which glass was fully transformed from a luxury product into a mass commodity.

Chapter 1.

Glass and the Hellenistic World

Before the Revolution: The Significance of Hellenistic Glass

The significance of the Hellenistic period, defined as the roughly three centuries from Alexander of Macedon's conquest of the territory of the Achaemenid Persian empire in the 330s-320s to the rise of Roman and Parthian control of those regions in the mid-first century, for the history of glass has been overlooked for a long time, even in the specialist field of glass studies.¹ The contributions of glass have been undervalued in synthetic surveys of Hellenistic art,² and the large quantities of archaeological glasswares in the Roman and Byzantine period make the preceding period appear meager in quality and quantity of finds.³ While monographs about Bronze Age, Iron Age, Islamic, Venetian, and especially Roman glass abound, there is to date no single book length study or edited volume exclusively dedicated to glass from the Hellenistic

¹ All dates in this dissertation are BCE unless otherwise noted or in obvious reference to contemporary archaeological discoveries and scholarship (19th, 20th, and 21st centuries CE). My use of the term Hellenistic is primarily as a convenient shorthand to the chronological period of c. 330-30 BCE, even in areas which were not directly impacted by the conquests of Alexander. The Hellenic root word is not intended to suggest any intrinsic Greekness or particular Greek influence during these years in the areas discussed.

² E.g. Pollitt 1986; Erlich 2009; Stewart 2014.

³ For example, the Hellenistic period warranted a mere sentence in a several page summary of glass technology from the Early Bronze Age to the present, at the end of a paragraph on Iron Age and Classical production techniques including mosaic, casting, and molding: "These traditions continued through the Hellenistic period" (McCray and Kingery 1998, 5). Less extremely, Whitehouse's recent *Glass: A Short History* dedicated just under two pages to the Hellenistic and early Roman period (323 BC – c. 50 AD), in contrast to over three pages for the Late Bronze Age, two pages for 900-300 BCE, and ten for Roman glass, and the discussion was limited to a small subset of Hellenistic glasswares, the Canosa Group, and a single speculative center of production, Alexandria (Whitehouse 2012, 27-28). The British Museum publication *5000 Years of Glass* is somewhat better in terms of quantity of treatment and continuity from the Hellenistic to Roman industry, with 12 pages about Hellenistic and non-blown Roman glass (compared to five for Early-Middle Bronze Age, 12 for Late Bronze Age Egypt, nine for 900-300 BCE, and 36 for Roman glass) (Tait 2012).

period.⁴ Objects made from glass, including tableware, cosmetic vessels, personal adornments, furniture decoration, and gaming pieces that date to the Hellenistic period are commonly relegated to brief and insubstantial mention in handbooks of glass history and technology. Hellenistic glasswares are typically considered the terminal end of the first historical stage of glass production, in which glass was an Egyptian and Middle Eastern luxury material used by the elite in burials and palatial courts, rather than the direct antecedent to the second iteration of glass as a ubiquitous, common tableware throughout the Mediterranean. The ostensible reason for this conceptual division has been that glass blowing, invented during the first century BCE, enabled glass to be made more cheaply, efficiently, and quickly than had previously been possible. Exacerbating the divide is the traditional, near-absolute separation between Pre-Roman (i.e. non-blown) and Roman (i.e. blown) glass in publication of museum catalogues and technological histories of glass, thereby creating a structural barrier which is reinforced by a perceived political, cultural, and technological gap.⁵

The invention of glass blowing has almost always been described in previous scholarship as a ‘revolution,’ although the ascribed causes and consequences of that revolution are somewhat varied. Dan Barag, for example, claimed that “the revolutionary invention of glass-blowing changed the entire course and scope of glass making.”⁶ Some have pointed out the shift in consumption habits revealed by the adoption of glass vessels in daily life, notably De Carolis

⁴ Marie-Dominique Nenna’s 1999 publication of the glass from Delos, in which Nenna gathered comparative evidence from contemporary sites throughout the Mediterranean and Black Sea, is perhaps the closest, but the nature of the publication as a site-specific finds catalogue precluded much more holistic analysis beyond the relevance to the Delian finds (Nenna 1999).

⁵ This historiographic tradition dates back at least to Fossing’s seminal *Glass Vessels Before Glass-Blowing* and its Roman period counterpart, Isings’ *Roman glass from Dated Finds* (Fossing 1940; Isings 1957). The Corning Museum of Glass, the Toledo Museum of Art, and the Ernesto Wolf Collection publications are all arranged along this chronological and technological divide. For Corning, Goldstein 1979; Whitehouse 1997; for Toledo, Grose 1989; Stern 1995; for Wolf Collection, Stern and Schlick-Nolte 1994; Stern 2001. See also Chapter 6.

⁶ Barag 1985, 89. He continued: “It furnished a technique which made it possible to produce glass vessels in an almost inexhaustible repertory of shapes at a relatively small cost.”

who commented on a “revolution” in habit: “presque une révolution des habitudes, qu'a connu la vaisselle en verre dans les différentes classes de la société romaine en prenant une place prépondérante parmi les ustensiles d'usage quotidien.”⁷ Similarly, Kahn described “the revolution in culinary habits” which inspired a shift away from ceramic, wood, and metal drinking vessels to glass.⁸ Occasionally, the success of glass blowing has been affiliated with the concurrent economic and political stability in the Mediterranean initiated by Augustus and the nascent Roman empire,⁹ and, in extreme cases, scholars have suggested that glass blowing facilitated the Romanization of the provinces.¹⁰

Most often, however, the scholarly understanding of this “revolution” has been an economic one, in which blown glass is understood to have been cheaper to produce and acquire than non-blown glass had been in previous periods. This cheapening, according to the scholarship, can be attributed to a competitive advantage blowing had over the earlier casting, sagging, and core-forming methods by decreasing the labor time and/or raw glass required per object.¹¹ Glass blowing, therefore, was “a true technological revolution that simplified the

⁷ De Carolis 2006, 73.

⁸ Kahn 2014, 130.

⁹ For example, McCray and Kingery 1998, 5, who said, "More or less simultaneous with the conquest of Egypt in 30 B.C. and establishment of Roman hegemony over the entire Mediterranean area, glass blowing was invented in the Near East. This irrevocably transformed the nature of glass production...The relative political and economic stability of the time certainly contributed to the rapid dissemination of glass technology."

¹⁰ E.g. Stern 2008a, 535. “The discovery that glass can be blown revolutionized the entire glass industry...Blown glass tableware played an important role in bringing Roman culture to the provinces of the empire."

¹¹ Stern, especially, advanced this position, recently in a summary of glass technology in antiquity in which she stated: “The invention of the blowpipe meant that hollow objects and vessels that previously required labor intensive operations could be made in a fraction of the time, and that less glass was needed per object“ (Stern 2008a, 535). Similarly, in the “Glass Production” section, Humphrey et al described glass blowing as a technology which “speeded up production enormously and made most glass relatively cheap” (Humphrey, Oleson, and Sherwood 1998, 379).

production of glass objects making them more quickly and less costly."¹² As a result, more people could afford to purchase and use glass vessels as tableware.¹³

Despite this prevailing opinion within glass scholarship, a few glass scholars who have worked closely with Hellenistic material have recognized the significance of developments in that era to the later Roman glass industry. In the 1980s David Grose repeatedly argued against glass blowing as the most important factor in this expansion of the Roman glass industry, most succinctly in *Early Ancient Glass*, where he wrote:

Contrary to long-held belief, the initial achievement of the Roman industry was not based on the blow-pipe and related inflation technology. Instead, it depended entirely on the able exploitation of a number of casting, sagging, and allied heat-forming techniques inherited from the Hellenistic Age.... These older forming methods, combined with larger factory facilities and improved marketing, resulted in the wealth of cast tablewares that introduced the Roman populace to the virtues and advantages of glass vessels. These techniques were displaced by blowing only gradually during the course of the first half of the first century A.D.¹⁴

Similarly, in her short summation of the evidence for Late Hellenistic glass from Syro-Palestine, Ruth Jackson-Tal proposed that the shift "from small numbers of luxury cosmetic core-formed vessels to the mass production of simpler cast drinking vessels" may have been due to changes in production techniques, a cheaper way of manufacturing raw glass, and shifting consumption patterns.¹⁵ Most recently, Julian Henderson has also noted the increasing scale of the Hellenistic glass industry as a significant factor towards the expansion of the Roman industry. He too suggested that "the high demand for glass by the second to first centuries B.C. in the Levant

¹² Di Pasquale 2004, 34.

¹³ E.g. "the invention of glass blowing therefore revolutionized glass vessel production, eventually making glass *available to all levels of society* for the first time over a broad geographical area" (Henderson 2013, 204), and "the discovery of glass-blowing was undoubtedly a revolution in the history of glass, transforming a very expensive ware, often compared to gold, into a *relatively cheap ware*" (Seefried 1986, 145) (emphases added). Similarly, Cool and Baxter, citing Petronius' *Satyricon* (Appendix, Text 6), stated: "with the advent of blowing, the price [of glass] fell" (Cool and Baxter 1999, 72).

¹⁴ Grose 1989, 241. See also Grose 1983, 45; 1984a; 1986b, 73-77.

¹⁵ Jackson-Tal 2004, 27.

must have helped to create the conditions in which glassblowing was invented.”¹⁶ Still, a systematic and rigorous analysis of the Hellenistic glass industry as a whole is missing. Consequently, a primary goal of this dissertation is to redress this bias in the scholarship by focusing on the Hellenistic glass industry as a crucial transition between two vastly different production modes, when glass was truly transformed from a luxury product used in elite burials and royal feasts in the fourth and third centuries to a ubiquitous part of household assemblages of the Roman empire by the end of the first century CE.

Hellenization and the Hellenistic World

The transformation which occurred in glass production and consumption did not transpire in a vacuum but rather in the vibrant political, economic, and cultural environment of the Hellenistic period. The first modern treatment of the years between Alexander the Great and the victory of Octavian at Actium as a singular phenomenon distinct from Greek and Roman history was Johann Droysen’s *Geschichte des Hellenismus*.¹⁷ Droysen considered the period, which had somewhat ambiguous chronological and geographical boundaries, as characterized by a fusion of Greek and non-Greek elements, a legacy which has impacted study of the Hellenistic period ever since.¹⁸ The dominant narrative has been one of unidirectional cultural transference, with historically non-Greek peoples in Asia Minor, Syria, Egypt, Mesopotamia, and as far east as Bactria adopting Greek architecture, Greek civic institutions, Greek art, and, most of all, Greek language while under the political hegemony and colonizing regimes of Macedonian dynasts. This approach found its basis in ancient Greek self-definition, in which *ἑλληνίζειν* (to Hellenize)

¹⁶ Henderson 2013, 250. A similar sentiment has been expressed by O’Hea: around 150, "the technological change that allowed this mass-production of glass drinking bowls [sagging] was a deliberate strategy to supply a large and eager market for them" (O’Hea 2006/2007, 145).

¹⁷ Droysen 1836.

¹⁸ Prag and Quinn 2013a, 4.

was first a linguistic, and secondarily a cultural, adaptation.¹⁹ Nor was this process morally neutral: Hellenization, in the world of the 19th and early 20th centuries, was a model for modern cultural imperialism and the ‘civilization’ of barbaric peoples by the enlightened West; Droysen himself considered *Hellenismus* as a necessary precursor to the birth and spread of Christianity.

Post-colonial studies of the 1980s, led by Amélie Kuhrt and Susan Sherwin-White, reacted against this Eurocentric view by emphasizing the persistence of indigenous traditions, particularly in the Seleucid empire.²⁰ Alternatively, scholars like Peter Green espoused a paradigm of non-interaction, in which Greek and Near Eastern ethnic groups maintained distinctive, separate identities.²¹ More recently, unilateral searches for “Greek” or “native” elements have given way to models of hybridization and hybridity, in which individuals negotiate cross-culturally by creating forms of material culture which combine elements from multiple traditions.²² Ideas of entanglement, as espoused by Ian Hodder, may soon gain more traction than they currently bear in regards to the Hellenistic world.²³

This obsession with the Greek/non-Greek origins of particular elements in Hellenistic political, economic, and cultural systems has long obfuscated analysis of Hellenistic societies in their own right for their own sake, as Strootman has observed.²⁴ While hybridity and other forms of post-colonial studies emphasize local responses to imperial domination, they tend to obscure similarity across boundaries and emphasize heterogeneity and discrepant identities over

¹⁹ Hornblower 2012, citing Thucydides 2.68, 2 Maccabees 4.13, and Acts 6.1.

²⁰ Kuhrt and Sherwin-White 1987; Sherwin-White and Kuhrt 1993. On Hellenism in Egypt, see Moyer 2011. On the “limits of Hellenization” in Syro-Palestine, see Herbert 1993.

²¹ Green 1990, 312-318.

²² Langin-Hooper 2007; Connelly 2009; Kouremenos, Chandrasekaran, and Rossi 2011. This turn toward cultural hybridity was largely influenced – directly or indirectly – by Homi Bhabha’s *The Location of Culture* (Bhabha 1994). A useful recent discussion of the problems with hybridity in archaeological applications is Silliman 2015, in which Silliman argued that the concept has lost its theoretical and rhetorical impact since it has been defined erratically.

²³ Hodder 2011, 2012. For an application of entanglement to a particular form of Hellenistic material culture, see Langin-Hooper 2013

²⁴ Strootman 2014, 26.

homogeneity and shared material expression.²⁵ This paradox is particularly problematic in the Hellenistic context, in which the architecture, sculpture, wall painting, ceramics, figurines, and lamps used in Athens would have been fundamentally recognizable to the inhabitants of Jebel Khalid, Ai Khanoum, Alexandria, Pergamon, Morgantina, or almost any other major metropolitan area in the Mediterranean and Near East during the final few centuries BCE. Certain of these products, like terracotta figurines, were made close to local markets using broadly similar production technologies and artistic styles. Others, like Eastern Sigillata A fineware pottery, were centrally manufactured and widely distributed, with the effect that certain elements of household assemblages looked remarkably similar over a wide geographic range.²⁶ Prag and Quinn called this process one of “creeping cultural convergence” (steadfastly avoiding the term “Hellenization”) which is marked by the “increasing dissemination and homogenization of the available cultural language(s).”²⁷ Ironically, this very homogeneity helped give rise to the concept of “Hellenization” in the first place, and its robust scholarly investigation has been discarded along with its colonial and racist legacy. In other words, the baby has gone out with the bathwater. While the intrinsic “Greekness” (and, for that matter, “indigenesness”) of Hellenistic material culture can no longer serve as an explanatory device, the more universal aspects of particular material remains should be examined in light of local, individualized responses to such homogeneity.

²⁵ E.g. Mattingly 2010.

²⁶ This paradox was summarized neatly by John Davies in an early handbook on the Hellenistic world: "Hellenistic pottery therefore shows a paradox: while there developed an artistic *koine* (comparable to the linguistic *koine*) which produced a very similar range of fabrics and allowed a very rapid circulation of ideas, that *koine* came to be served by many local schools and workshops whose products therefore seem on the whole to have travelled much less far than the classic wares had done" (Davies 1984, 275).

²⁷ Prag and Quinn 2013a, 12.

Economic Growth

Another significant phenomenon in the Hellenistic era, which continued into the Roman period, was the overall rise in and broader distribution of wealth in individual hands and the increased scale of the Mediterranean economy. These trends toward economic growth, larger incomes and increased capital investment, and overall connectivity have long been a focus of study in the Roman empire,²⁸ but recent work has increasingly recognized the antecedents of the Roman economy in the connected world of the Hellenistic period Mediterranean. The emerging picture of Late Hellenistic economic development points to a world of increasing overall wealth, greater distribution of that wealth in the hands of individuals rather than states, and, in some areas, a desire to showcase personal wealth with conspicuous private displays. The degree of integration among local, regional, and global economies is still subject to debate,²⁹ and the following broad generalizations from particularistic forms of evidence certainly did not apply equally in all regions. Circumstances at the local scale, bounded by historical, political, and cultural systems, likely superseded the more globalizing phenomena. Still, at the largest scale, some trends are evident.

While precise numbers equivalent to modern Gross Domestic Products do not exist from antiquity, a number of proxies have been suggested to document overall economic growth in the ancient Mediterranean. Each indexes a slightly different variable, but together they may be indicative of a greater economic pattern. Ian Morris proposed that the five-fold increase in the size of Greek houses between 800-300 and corresponding increase in standards of living

²⁸ Scholarship on growth in the Roman empire is vast. Influential early scholars to advocate against the Finleyan view of stagnation and lack of development in the ancient (Roman) economy were Keith Hopkins, from an economic and sociological viewpoint, and Kevin Greene, from an archaeological and technological perspective (Hopkins 1980; Greene 1986), and the mantle has been picked up by Walter Scheidel, Ian Morris, and others. On the somewhat current state of the field, see the relevant contributions in Scheidel, Morris, and Saller 2007, as well as Hitchner 2005; Saller 2005; Scheidel and Friesen 2009.

²⁹ Cf. the work of Gary Reger on the economy of early Hellenistic Delos (Reger 1994, 2002 (1997)).

indicated sustained economic growth and development over this period, even accounting for cultural factors like increased investment in personal property.³⁰ A variety of other metrics have indicated a surge in economic development which began in the second century, coinciding with the advent of Roman intervention in the eastern Mediterranean. One measure is the number of shipwrecks as an index of overall Mediterranean trade and connectivity: David Gibbins tallied the numbers of recorded Mediterranean shipwrecks by century from 2500 BCE-1500 CE. The four centuries between 200 BCE-200 CE yielded over 150 wrecks each, in contrast to the fewer than 90 wrecks documented from each other century, indicating unprecedented levels of maritime activity during those four centuries.³¹ Another measure of probable economic growth was taxation. Keith Hopkins modeled modest but significant growth in the per capita Gross Domestic Product of the Roman system from 200 BCE-1 CE, stagnation from 1-100 CE, and gradual decline from 100-300 CE.³² Although he attributed this activity to policies of Roman imperial taxation, the peak periods of growth occurred during the last centuries BCE and not during the primary years of Roman imperial expansion and territorial holdings.

Based on the evidence of coins, the economies of the Hellenistic world also became increasingly monetized. Monetization facilitated market exchange and remote business transactions as well as providing linkages across regional economic systems.³³ Coinage increased not only in sheer numbers, but, as Meadows argued, innovations including wide

³⁰ Morris 2005.

³¹ Gibbins 2001, fig. 10.2. Shipwrecks are an imperfect proxy for overall trade volume due to various factors including deposit conditions, archaeological recovery rates (including over representation of the western Mediterranean in the data set), and the size of ship and cargo, but the orders of magnitude of difference which occur in the centuries of the late Hellenistic and early Roman period undoubtedly indicate that *something* different is going on during this period, which we know to coincide with great prosperity in the Mediterranean. See also Davies 2006, 84-85 for additional remarks on this same data.

³² Hopkins 2002, data reproduced and discussed Saller 2005, 230-231, fig 11.2; Saller emphasized the modest and unsustainable rates of growth.

³³ Bresson 2005; Davies 2006; Grandjean 2006. This boost to trade may have been an unintended consequence of a fiscal policy originally intended to pay for wars and other public expenses.

adoption of the Attic weight standard and suppression of local currencies, the establishment of new mints, and diversification of coinage to include smaller units all helped encourage widespread economic development.³⁴ Gary Reger has argued that large scale public payments (like military wages) as well as certain private transactions were monetized in or by the Hellenistic period, although some barter and other forms of non-monetary exchange certainly persisted.³⁵ Alongside the development in bronze coinage was a proliferation of manufactured silver in the form of both coins and commodities.³⁶

One major reason for increased circulation of wealth and associated economic growth during the Hellenistic period was a direct consequence of Alexander's conquest. Alexander's sack of the Persian treasuries at Persepolis, Susa, Ekbatana, Babylon, and Sardis provided an infusion of wealth which had previously been locked away in imperial coffers. The value of this war booty was described by later Greek and Roman authors, who reported the contents of the Persepolis treasury as worth 120,000 talents and the smaller treasuries at 40,000-50,000 talents each.³⁷ Nicholas Cahill has argued that the contents of the Persepolis Treasury in particular had been tribute gifts from occupied territories which were held in trust for their symbolic value rather than redistributed to other territories as economic goods, effectively removing the wealth from circulation.³⁸ The influx of silver from the treasuries provided metal for the newly established mints, possibly resulting in short term price inflation in Babylonia between 330 and 300.³⁹ Additional wealth was distributed among Alexander's generals and armies, who spent it profligately during the wars of the successors, effectively distributing it among soldiers and

³⁴ Meadows 2014.

³⁵ Reger 2003, 347-349.

³⁶ Panagopoulou 2007.

³⁷ The primary source texts (Arrian, Quintus Curtius, Diodorus Siculus, Plutarch, and Strabo) are much later than the sack itself and therefore prone to their own issues of pro-Western bias and selectivity. For discussion, see Schmidt 1953, 155-157; Cahill 1985, 374-375; Callatay 1989.

³⁸ Cahill 1985.

³⁹ Van der Spek 2011, 411-413.

mercenaries, merchants, food suppliers, camp followers, and the other profiteers of war. Green suggested that this largesse “ended up adorning wives or mistresses in the shape of necklaces, earrings, bracelets, and pendants,” and indeed, third century jewelry was quite spectacular in its use of polychromy, richness of materials including gold, and intricacy of craftsmanship.⁴⁰ This is not to say that redistribution of wealth from the capital to the periphery did not occur during the preceding Achaemenid Persian period, but rather that the geographic configuration of that redistribution shifted and that the one-time influx of cash from Achaemenid treasuries may have had substantial short and middle term impact on the larger economic system.

Equally important to the growth of systemic wealth was its distribution among individuals. John Bintliff has summarized the argument that the imperial systems of the large Hellenistic states and the Roman empire delegated the management of cities and their countryside to local elites, although his discussion was limited to evidence from the Greek mainland and Aegean.⁴¹ The Hellenistic empires inherited this system of distributed governance from their Achaemenid Persian predecessors. As a result, daily life and governance in areas historically under Persian control, including Egypt, Syro-Palestine, Mesopotamia, and central and eastern Asia Minor, changed little.⁴² By contrast, in the previously independent Greek territories, local elites were bolstered by infusions of cash, land, gifts, and other forms of investment from kings and governors.⁴³ G.G. Apherghis has argued that the Seleucids founded cities in order to

⁴⁰ Green 1990, 100; Stewart 2014, 221-226.

⁴¹ Bintliff 2013, 287-289. In Bintliff’s view, this localization of power helps explain the regional variability seen in Greece, where some areas were wealthy and prosperous while others (presumably suffering under poor management) experienced poverty and decline.

⁴² The imperial administration center at Tel Kedesh is an example of this general continuity in imperial practice from the Persian to Hellenistic systems (Herbert and Berlin 2003b; Berlin and Herbert 2013). The role of imperial government in Hellenistic Syro-Palestine is further discussed in Chapter 5.

⁴³ One major way this occurred was by royal land grants to members of the ruling class, soldiers, and even peasants, with the expectation that taxes on the land would be paid back to the government. This system seems to have been widespread throughout the Hellenistic empires. For case studies from Asia Minor, Egypt, and Syro-Palestine, see

intensify economic activity and generate revenue, a policy which met with moderate success.⁴⁴

The appearance of Rome on the scene in the first half of the second century brought additional wealth and investment; Bintliff envisioned the wealthy Roman *negotiatores* as predatory lenders, buying up property and lending money to civic institutions, marrying into the local ruling class, and establishing craft workshops and commercial networks. Perhaps not coincidentally, domestic glass tablewares first appeared in Thessaloniki at the end of the first century, about the time an Italian community of *negotiatores* settled in the area. In places like Cosa, Morgantina, and Corinth, glass tablewares increased dramatically after the settlements became Roman colonies in the mid-first century, likely due to the influx of new settlers and accompanying wealth.⁴⁵

The increased amounts of wealth in circulation probably also helped elevate more families to higher economic statuses, effectively facilitating social mobility. As Goldthwaite has argued, a society with a high degree of social mobility and greater distribution of wealth downward from the very top levels of society helps spur demand and consumerist tendencies within the population.⁴⁶ Although specific case studies for the Hellenistic period are still rare, the weight of the evidence indicates an overall environment in which upward social and economic mobility was possible for enterprising individuals. One way this occurred was through military spending. Inscriptional records from Athens document the payment of liturgies in the third century by cavalymen with no prior record of wealth. Their families continued to prosper in the second and first centuries, demonstrating that “new families with recent wealth penetrated

Landau 1966; Ma 2002; Manning 2010, 160-161. The king also advanced bonds with members of his court and with local elites through gift-exchange and patronage (Strootman 2014, 152-164).

⁴⁴ Aperghis 2004, 2005

⁴⁵ Antonaras 2009.

⁴⁶ Goldthwaite 1993, 41-52.

the elite institutions of the Athenian *polis*.”⁴⁷ The reliance on pirates and mercenaries in the third century wars of the successor states enabled some individuals to rise through the ranks from humble beginnings.⁴⁸ Local civic elites also enjoyed economic and status advancement under the Hellenistic kings. Strootman has argued that this social group, whose power was rooted in the cities of the Hellenistic world, served as a vital intermediary between royal court society and the local citizenry. Local elites were the beneficiaries of gifts and land, and they participated in the customs and material practices of royal society in order to bolster their own position at home and abroad.⁴⁹ Not only did the possibility of upward social mobility put wealth in the hands of new individuals and families, these *nouveau riche* were motivated by different ideas regarding appropriate patterns of consumption and were eager to display their newfound wealth and status.

Hellenistic Households and Material Culture

With more wealth held in private hands, individuals of the Hellenistic world also chose to spend, distribute, and display that wealth in different ways. Beginning in the fourth century and continuing through the Hellenistic period, domestic spaces in the Greek world became increasingly elaborate in terms of size, architecture, architectural decoration, and household furnishings. Although the strict egalitarianism of houses in the Classical Greek world, for instance in Athens and Olynthus, has been called into question,⁵⁰ comparison between Classical period and early Hellenistic houses shows a clear trajectory toward larger and more elaborate

⁴⁷ Oliver 2011, 354-355, citing Bugh, G.R. 1988. *The Horsemen of Athens*. Princeton. Pp 202-204.

⁴⁸ Gabbert 1986. She concluded: “a man of ability might dare what his father or grandfather would not; he had as examples the Hellenistic kings themselves, who were not born to their great rank and who ruled kingdoms which they created by their own efforts” (162).

⁴⁹ Strootman 2014.

⁵⁰ For the standard argument regarding *isonomia* in houses and town planning reflecting Greek democratic values, see Hoepfner and Schwandner 1986. But at Olynthus, careful examination of household objects and small architectural modifications suggests disparities in wealth and selective individualism between individual houses, despite their architectural similarities and standardized footprint, although abandonment conditions may also have been a factor (Cahill 2002).

private space. By the third century, houses in cities like Pella, Halos, and Priene contained features previously reserved for use only in public architecture, including peristyle courtyards, sculpture, and wall painting. This trend toward private display may be indicative of a growing inclination to conduct business in private rather than public spaces and for the wealthy to differentiate themselves from the less wealthy.⁵¹ Delos, with its large and elaborate houses with mosaic floors, painted wall decoration, large scale private sculpture, and abundance of small finds is the epitome of Late Hellenistic urban development and domestic space in this period. Similar household assemblages from the second and first centuries come from all over the Hellenistic eastern Mediterranean, in places like Marisa, Dor, Ephesus, and Jebel Khalid.⁵² Large rural villas and agricultural estates like Tel Anafa in Israel and Tria Platania in Greece, comparable to their urban counterparts in form but with more rooms for agricultural tasks, also participated in this conspicuous display and consumption.⁵³ With a greater proportion of the house dedicated to public entertainment and dining areas relative to Classical period houses, entertaining was an important consideration in the architectural and visual design of the home.⁵⁴ Private display of wealth also probably became more generally acceptable.

The architectural expression of wealth was also encoded in more portable forms of material culture, which also indicate a degree of homogenization within an increasingly cosmopolitan society in the Mediterranean basin and parts of the Near East. While local differences are certainly identifiable, the remarkable convergence and standardization of some aspects of material culture into a common material language occurred in a wide range of public

⁵¹ Walter-Karydi 1998; Nevett 1999; 2007, 216-219.

⁵² Berlin 1997a, 6-8; Thür 2010; Wurmser 2010; Jackson 2014.

⁵³ Herbert 1994; Poulaki 2003; Margaritis and Jones 2008. For general comment on the phenomenon of the Hellenistic rural estate, especially in Greece, see Alcock 1993, 63-71; 1994. Alcock connected the emergence of large wealthy villas in later Hellenistic and Roman Greece to the restructuring of landholding patterns, but she also comments on the parallel “shift in attitudes to wealth and its display” (1993, 70-71).

⁵⁴ Westgate 2000; Westgate 2011.

and private media, including architecture, sculpture, mosaic, ceramic fine wares, terracotta figurines and lamps, personal adornment, and glass.⁵⁵ This assemblage has been called the Hellenistic *koine*, the term borrowed from the convergence of Greek dialects into a single common vernacular which served as the *lingua franca* of the Hellenistic and Roman worlds.⁵⁶ Other material *koines* have been documented in the ancient world: for instance, Marian Feldman expanded Kantor's "Mycenaean koine" to include the entirety of Late Bronze Age palatial economy.⁵⁷ However, the Hellenistic period was distinct from the Bronze Age *koine* material because it extended beyond elite art, luxury objects, and the imperial court setting into household goods which belonged to a broader segment of the population not defined by ethnicity, wealth, or class.⁵⁸

One of the hallmarks of the Hellenistic *koine* was the characteristic set of forms, decorations, and styles which appeared in multiple media and over a wide geographic area. The use of molds in metal, ceramic, and glass production facilitated repetition of decorative elements and iconographic motifs and helped unify craft producers who used related modes of production.⁵⁹ The products of the *koine* were not centrally produced and distributed from core to periphery. Rather, independent and geographically remote workshops came to manufacture highly similar products for mostly local consumption.⁶⁰ The operational mechanisms and underlying reasons behind this cultural convergence are still not well understood.

⁵⁵ Davies 1984; Pollitt 1986; Grose 2012, 7-8. For specific case studies, see Fenn and Römer-Strehl 2013 (pottery), Jeammet 2010 (figurines), Jockey 1998 (sculpture), Stewart 2006, 178-180 (jewelry), and Panagopoulou 2007 (silver tableware).

⁵⁶ Thomson 1960, 34-36; Colvin 2011.

⁵⁷ Kantor 1947; Feldman 2006.

⁵⁸ *Contra* Erlich 2009, 7: "Although there were various streams of Hellenistic culture, the most influential over a period of a millennium in cultural affairs – language, art, entertainment, dress, etc. – is the Hellenistic koine, perhaps precisely because it was associated with the rulers and wealthy class." I tackle this problem directly in Chapter 4.

⁵⁹ Rotroff 1982; Muller 2000; Mairs 2014. See also Chapter 4.

⁶⁰ Davies 1984, 275.

Hellenization as Globalization

One theoretical framework which may help illuminate the processes of material convergences such as are seen in the Hellenistic period is globalization, which has recently been used as a model for the phenomenon formerly known as Romanization.⁶¹ Although in the 21st century context, globalization is driven by economic opportunity and capitalism, the sense of globalization as a flat world in which goods, knowledge, technology, and images move freely and rapidly within an integrated communications network has great resonance for understanding the transformations occurring in the Hellenistic world.⁶² Globalization as a theoretical framework has begun to be adopted in historical contexts to study the tensions between global and local, homogeneity and heterogeneity, integration and resistance.⁶³ Unlike hybridity and world systems theory, globalization as a theoretical construct encompasses global homogenization of material culture and local heterogeneous responses. In this sense, the Hellenistic world may be approached from a perspective of cultural approaches to globalization that emphasize disjunctures as well as conjunctures.

In the midst of the debate over Hellenization, the word “Hellenistic” has lost rhetorical and explanatory force, since the defining attributes of the centuries after Alexander are certainly not (only) Greek: nor are they Persian, Semitic, Egyptian, or so on. If we now agree that the Hellenistic world was not defined by Hellenization, we must now ask what were its defining properties, and how can we study it as a cultural as well as political (and, I would add, economic) phenomenon? If we take “Hellenistic” simply as a chronological parameter to define the years from 333 (or 323, or even 300) to 63 (or 31), then what is the utility of using political events to

⁶¹ On Romanization generally, see the important works by Millett and Woolf, who emphasize local strategies of response to Roman imperial control in Britain and Gaul, respectively (Millett 1992; Woolf 1998). On globalization in the Roman world, Pitts and Versluys 2015.

⁶² Cf. Friedman 2005.

⁶³ Robertson 1995; Hodos 2010a, 2010b; Jennings 2011; Geller 2014; Hodos 2014; Stek 2014.

examine archaeological phenomena?⁶⁴ As Erskine has commented, the Hellenistic *period* “is defined and bounded by political events,” but the Hellenistic *world* was a cultural phenomenon.⁶⁵ Indeed, it is this very tension between global political events and their material expression on the ground which makes the three hundred years after Alexander fascinating as a focus of study.

The explosion in glass tablewares and small objects which occurred in the second and first centuries is a prime example of the forms of cultural convergence of a common Hellenistic *ethos* as expressed in material culture. With the fading specter of Hellenization perpetually lurking in the background, this dissertation will explore changes in production and consumption practices within a wide range of local contexts, as expressed in the adoption of a single material from a luxury product of court societies to a mass produced commodity enjoyed by an enterprising, emergent class of aggrandizing local elites.

Overview of the Dissertation

Methodology

The raw data used in this dissertation come almost exclusively from published archaeological site reports, which range in degree of specificity from full catalogues of finds to preliminary reports that refer generically to the presence of unknown quantities and types of glass.⁶⁶ Due to this range of publication types, as well as the familiarity of individual authors with technical terminology, the state of the field at the time of publication, local publication standards, and a number of other factors, the available documented information varies widely.

⁶⁴ And how do the parameters of periodization – the victory at Issus or death of Alexander? the arrival of Pompey or victory of Octavian? – impact these considerations? The contributions in Prag and Quinn 2013b define the chronological parameters of the Hellenistic variously, depending on local conditions.

⁶⁵ Erskine 2003, 2-3.

⁶⁶ Also included in this study is unpublished material from the American School Excavations at Ancient Corinth, which I examined in Summer 2013, and Tel Kedesh, Israel, for which I relied on research notes and inventory information compiled by Andrea Berlin in Summer 2010. The catalogues of glass from Cosa and Gordion were also available to me (Grose forthcoming; Jones forthcoming). I thank Elaine Gazda and Janet Jones for sharing these unpublished manuscripts and allowing me to discuss them here.

Despite certain deficiencies in published detail, the inclusion of brief accounts and provisional publications was crucial to my goal of documenting as wide a spectrum of glass found at Hellenistic sites as possible and demonstrating the permeation of glass into daily life in the Late Hellenistic eastern Mediterranean beyond the major recognized sites like Delos and Tel Anafa. Therefore, even poorly published information has been included here to the extent possible with the view that some information is better than none.

Prior scholarly treatments of glass belong to one of three types: museum catalogues, archaeological site reports, and scientific analyses. A primary goal of this dissertation is to bring all three of these threads together into a single cultural history, in order to tell the story of those who made and used glass.⁶⁷ I draw on a wide range of anthropological theory, technological analysis, object autopsy, experimental archaeology, and comparative evidence from other historical periods. In addition, I incorporate an examination of all forms of glass vessels alongside small glass objects including beads, inlays, gaming pieces, and implements, rather than artificially separating the two categories. I present not a single theoretical approach to the entire body of material but rather a spectrum of ideas applied as appropriate to certain subsets or the whole, each of which tells separate, but complementary, stories.

Scope

The dataset aims to be summative and representative, but not comprehensive. The scalar nature of the presentation means that the most precise and comprehensive data comes from the area of Syro-Palestine, where periodicals and preliminary excavation reports were examined individually for evidence of Hellenistic glass, with lesser specificity in the rest of the eastern Mediterranean and Aegean, and lesser still in the western Mediterranean, Black Sea, and

⁶⁷ For similar synthetic approaches, which may be leading the way for more synthetic and cultural investigations of glass objects in the ancient world, see now Henderson 2013; Ingemark 2014.

Mesopotamia, where only well known major sites and publications were consulted. Back issues of the *Journal of Glass Studies (JGS)*, the conference proceedings of the *Association Internationale pour l'Histoire du Verre (AnnAIHV)*, as well as the major national and regional periodicals of archaeological work in the country (*'Atiqot and Excavations and Surveys in Israel, Archaologikon Deltion, Bulletin d'archeologie et d'architecture libanaises*), were individually examined for references to glass from Hellenistic sites. Objects from major museum and private collections were included if they had any indication of provenance, but were not systematically inventoried.⁶⁸ Lists of comparanda in the major recent publications were also used to find additional published evidence, and the original publication was consulted whenever possible.⁶⁹ Additional bibliographic searches were conducted in English, French, and German on Google Scholar, the Rakow Research Library Catalog, WorldCat, and numerous smaller indices including Dyabola, JStor, and the University of Michigan Mirlyn system.⁷⁰

The temporal scope of glass documented systematically includes the three hundred years from the mid-fourth century to the mid-first century. There are several reasons for these years as approximate cut offs. First, it was important to document the state of the ancient glass industry before and after the conquests of Alexander in order to determine continuities of practice from the fourth into the third century and later. Second, many important assemblages of fourth century glasswares, notably those from the Macedonian burials, Gordion, Halicarnassus, Ephesus, and Persepolis, cannot be dated narrowly within the fourth century. Discussions of

⁶⁸ The collections of the British Museum and Louvre, which contain scientifically excavated material from the later 19th and early 20th centuries, were more systematically examined and included in the dataset (Cooney 1976; Harden 1981; Barag 1985; Arveiller-Dulong and Nenna 2000, 2011).

⁶⁹ A few, particularly Russian, sources have been impossible to obtain, most notably Alekseeva 1975, an important publication of glass beads from the Black Sea which is referenced often by Spaer 2001. In the case of objects and collections which have been published multiple times – for example, Hellenistic glass from the Athenian Agora Weinberg 1961; Weinberg and Stern 2009 – the later publication was favored, but the earlier preliminary publication also checked for additional information.

⁷⁰ Gail Bardhan at the Rakow Research Library helped identify several lesser known publications and site reports, greatly expanding the scope of the data.

material which likely predate c. 350 are more synthetic than quantitative, and no effort was made to document and discuss every known site and object. Third, regarding the end date, the mid-first century (c. 50) was chosen as a general concluding point due to the explosion of ribbed glass bowls in the second half of the first century and the emergence of western Mediterranean markets, although certain important contexts and deposits such as the early Augustan Tradelière shipwreck are discussed in some detail. Including a thorough documentation of ribbed bowls and associated glasswares of the late first century would very rapidly have become unwieldy but would not contribute substantively to the main argument regarding the shifting markets and production technologies over the course of the Hellenistic period: rather, the second half of the first century represents the final culmination and success of the Hellenistic glass industry. The coexistence of and competition between glass sagging and glass blowing workshops during the second half of the first century BCE and first century CE is an extremely interesting and underexplored topic in the history of glass; however, a synthetic investigation would constitute another dissertation topic.⁷¹ A brief framing of the major issues and relevant data are briefly discussed in Chapter 6.

⁷¹ Indeed, Jonathan Prior at the University of Durham has recently completed such a dissertation, in which he addressed the relationship between non-blown and blown glass beginning c. 50 BCE (Prior 2015). Prior employed a limited number of case studies, all from the western Roman empire (Usk, Nijmegen, Xanten Vetera, and Herculaneum and Pompeii) and concluded that non-blown glasswares persisted alongside blown glass, even in non-elite contexts, through the first century CE; therefore, both technologies must have been equally affordable. For the period before glass blowing, Prior limited his discussion to Tel Anafa, which he used to demonstrate “that glass vessel use was expanding before glassblowing, and therefore the new technology could not be entirely responsible for the democratisation of glass use” (337). Prior’s dissertation thus picks up approximately where this one leaves off, but we come to similar conclusions in the areas in which discussion overlaps.

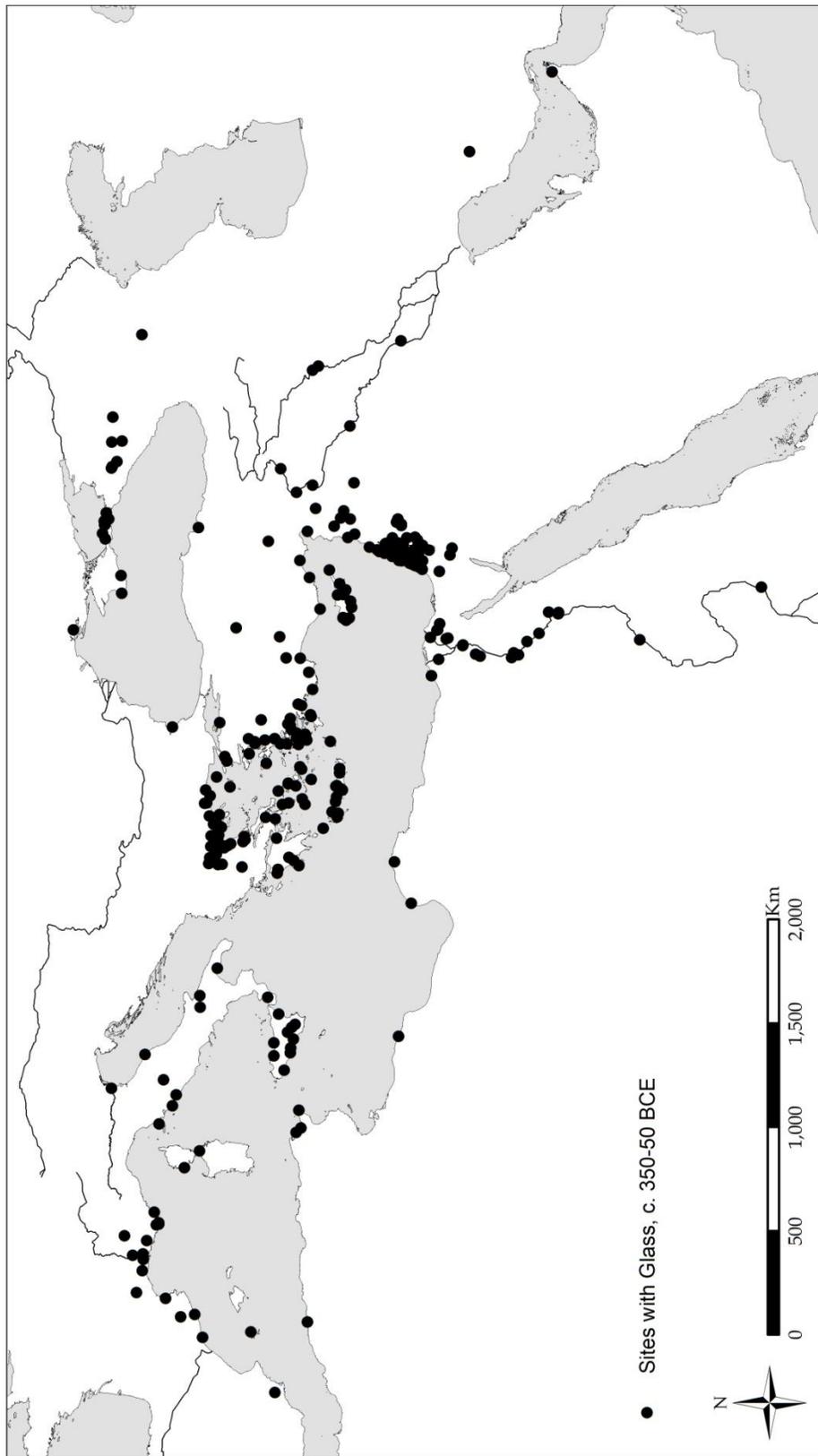


Figure 1. Sites yielding glass finds, c. 350-50 BCE

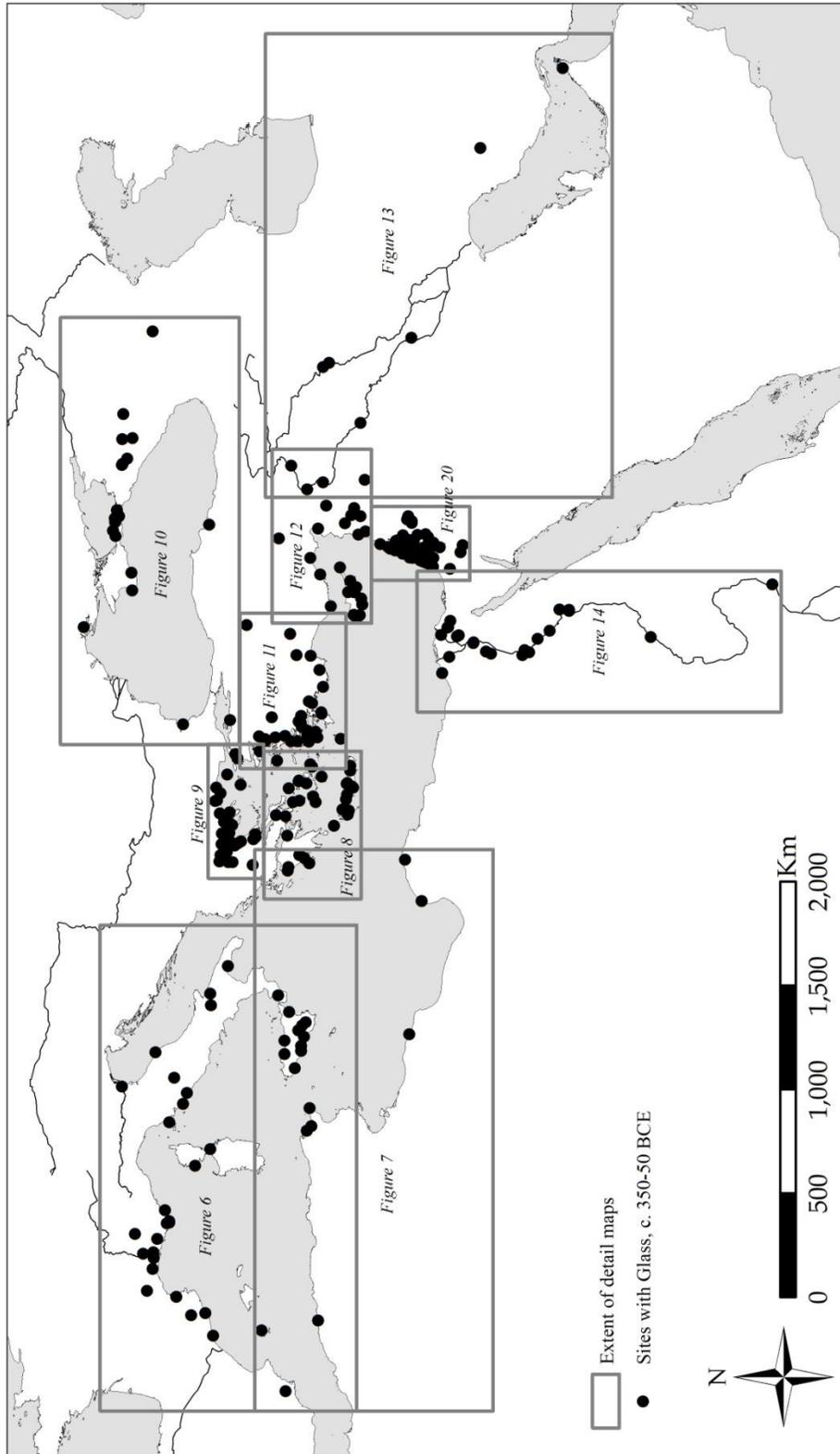


Figure 2. Extents of regional maps (Figures 6-14, 20, infra)

The geographic scope of the dissertation is principally the Mediterranean basin and western Asia, encompassing Punic North Africa, the Greek and indigenous settlements of the northwest Mediterranean, Republican Italy, mainland Greece including Macedonia, the Aegean islands, Asia Minor, Syro-Palestine, and Egypt (Figure 1, Figure 2). Beyond these areas, glass which was either manufactured in, inspired by, or typologically related to Mediterranean glass – notably from the Black Sea basin, the Near East, and Kush – is also included and discussed in detail. The indigenous glass working cultures of Iron Age Europe are not discussed.⁷² I do not claim that the resulting dataset is entirely comprehensive of all published glass from the designated period, but it does aspire to be representative of the current state of research, encompassing the full spectrum of publication types, regions, and history of scholarship.⁷³

⁷² For which see Haevernick 1960; Feugère 1989b; Roymans and Verniers 2013. Recent scientific analysis has indicated that La Tène glass bracelets were likely manufactured from glass imported from the eastern Mediterranean, reaching central Europe via the Adriatic Sea or southern France (Roymans et al. 2014). Roymans and Verniers have suggested that glass bracelets were not limited to elite consumption but were accessible to a broad range of society, despite the long distance trade required (Roymans and Verniers 2013).

⁷³ The following sources only became known or available to me after I finished actively collecting data in June 2015: Gorin-Rosen 2005; Jones 2013; Barag 2014; Israeli 2014; Spaer 2014. They are discussed in the body of the text when judged particularly important but are not included in the maps and tables.

Region	Number of Sites	Number of Glass Objects	Average Glass per Site
Aegean	18	2617	145
Asia Minor	30	222	7.4
Black Sea	20	145	7.3
Crete	11	153	14
Cyprus	13	118	9.1
Egypt	21	385	18
Italy	10	163	16
Kush	1	373	373
Near East	7	43	6.1
North Africa	7	87	12
Northern Greece	42	383	9.1
Northwestern Mediterranean	19	69	3.6
Sicily	10	41	4.1
Southern Greece	10	82	8.2
Southern Syro-Palestine	60	2124	35
TOTAL	279	7005	25

Table 1. Quantities of sites and catalogued glass objects, by region

The total number of glass vessels and small objects dating from c. 350-50 BCE in the ancient Mediterranean world documented to date includes over 7,000 items from 279 sites (Table 1).⁷⁴ Table 1 reports the number of objects and number of sites recorded by region.⁷⁵ A simple calculation of average number of glass objects recorded per site in each region is also given, but it is important to note that this number represents the structure of the *data* and the state of publication rather than intensity of glass use in any particular region. The Aegean in particular is skewed in this regard, since the glasswares from Delos and Rhodes are both extensively published and thus massively overrepresented, while glass from several other Aegean islands is

⁷⁴ The following publications only became available to me after this closure of the data collection and are not included in these quantities. They are discussed in the appropriate regional context: Cima and Tomei 2012; Barag 2014; Israeli 2014; Spaer 2014; Triantafyllidis 2014.

⁷⁵ A “site” in this case may refer to a museum collection or general region from which the object is reported to have been found. For discussion of regional groupings, see Chapters 3-5.

known only from oblique and non-specific references.⁷⁶ High numbers of published glass from the cemeteries at Meroe similarly inflate the average number of objects per site in Kush. Despite these biases, it is evident that the overall quantities of known sites and densities of Hellenistic glass objects are significantly higher in Syro-Palestine and the Aegean than anywhere else in the ancient Mediterranean. After an overview of glass production in Chapter 2, the glass from Africa, Asia Minor, the Black Sea, Italy, Near East, North Africa, Northern Greece, Northwestern Mediterranean, Sicily, and Southern Greece is discussed in Chapter 3; Chapter 4 examines the finds from the Aegean (the Cyclades and Dodecanese island groups), Crete, Cyprus, and Egypt; finally, Chapter 5 focuses on Syro-Palestine.

Region	Cosmetic Vessels	Drinking Vessels	Eating Vessels	Adornment	Furniture	Gaming	Implement	Manufacture
Aegean	64	1108	24	543	34	527	54	263
Asia Minor	93	118	1	8	1	1	0	0
Black Sea	3	69	0	66	4	4	0	0
Crete	20	122	0	4	0	6	0	1
Cyprus	20	81	0	16	0	0	0	1
Egypt	10	19	1	31	287	0	0	37
Italy	13	62	14	1	23	50	0	0
Kush	0	33	0	302	17	7	1	1
Near East	11	27	1	2	0	1	1	0
North Africa	33	13	3	25	1	9	0	3
Northern Greece	67	48	1	79	96	90	1	1
Northwestern Mediterranean	13	21	0	28	0	1	0	6
Sicily	28	7	3	3	0	0	0	0
Southern Greece	15	38	1	8	0	20	0	0
Syro-Palestine	147	1339	7	163	6	218	62	182
TOTAL	537	3105	56	1279	469	934	119	495

Table 2. Quantities of glass objects, by region and function

⁷⁶ See especially Triantafyllidis 2006a, 151-152 for a list of Aegean sites where grooved bowls have been found, many of which are unpublished.

Table 2 tabulates the total quantities of documented glass items by region and functional group. Function is defined according to the presumed use as judged by form and design of the object (although objects need not necessarily have been used as intended by the maker – spindle whorls and seals, for example, are functional implements as well as adornments). Functions are classified according to the following definitions, which are used consistently throughout this dissertation.⁷⁷ *Cosmetic* vessels store and transport small quantities of cosmetics, perfumes, and other unguents. Types of cosmetic vessels include almost all core-form vessels, including unguentaria and alabastra, as well as pyxides. *Drinking* vessels, the largest group by quantity, are used for consuming liquid directly from the lip or rim of the vessel; they have open shapes and relatively deep bodies relative to diameter and may or may not be footed. Examples of drinking vessels are cups, bowls, beakers, kantharoi, and skyphoi. A select number of closed vessels used to hold and serve wine, such as the Berlin Amphora from Pontic Olbia and a lagynos from Jerusalem, are also considered with drinking vessels since they were part of the drinking service. *Eating* vessels are used to serve and consume solid or saucy foodstuffs, or possibly, in the case of phialai, in libation offerings. They are also open, but are more shallow (typically with a depth less than 5 cm) than drinking vessels and may or may not be footed. Eating vessels are plates, phialai, and other flat dishes.

Non-vessel small objects made from glass during the Hellenistic period are quite varied in scope. The most common are objects of *adornment* which decorate the body. They may also have an apotropaic or utilitarian purpose, as is the case for amulets and seals. Objects of adornment include beads, pendants, bracelets, rings, and seals. *Furniture* glass consists of inlays of various shapes and sizes which are flat on one side in order to be set into furniture, walls, small objects such as wooden boxes, or other architectural decorations. Glass used for *gaming* is

⁷⁷ The major technologies and forms of these object types are discussed in greater detail in Chapter 2.

primarily intended for recreation and play and includes astragaloi as well as counters and gaming pieces. The latter are often morphologically similar to furniture inlays and their function can best be determined by context, size, and color. *Implements* are tools designed to perform a specific task, including spindle whorls and cosmetic sticks. Finally, glass for *manufacturing* consists of the residual material from glass production, including raw glass, wasters, and intermediary products like mosaic canes, monochrome rods, and flattened plaques.

Region	Domestic	Secular Public	Occupation	Religious	Funerary	Industrial	Shipwreck	Museum
Aegean	852	13	1332	34	28	331	25	2
Asia Minor	32	0	91	11	39	0	0	49
Black Sea	0	0	1	55	86	0	0	3
Crete	119	0	13	0	6	0	0	15
Cyprus	0	0	47	40	26	1	0	4
Egypt	12	1	12	9	37	291	0	23
Italy	2	0	2	2	149	0	4	4
Kush	0	0	0	0	373	0	0	0
Near East	3	0	26	4	9	0	0	1
North Africa	6	0	37	3	36	0	0	5
Northern Greece	15	0	36	28	284	0	0	20
Northwestern Mediterranean	3	0	11	0	24	18	13	0
Sicily	0	0	35	0	1	0	0	5
Southern Greece	6	47	14	0	10	0	0	5
Syro-Palestine	733	148	817	17	9	389	0	11
TOTAL	1783	209	2474	203	1117	1030	42	147

Table 3. Quantities of glass objects, by region and context type

Glass objects were also characterized according to the nature of the context or site in which they were found. The tallies of context type by region are summarized in Table 3. A *domestic* context is a residential unit, typically a house. A *secular public* context represents a site or area of a non-religious civic, political, or commercial space within a city, such as agoras,

shops, and administrative buildings. *Occupation* refers to a general urban or rural context with indistinct stratigraphy, identification of the structure, or generalized fill of uncertain origin. Each of these three context types is typically a non-structured deposit type which generally indicates a casual disposal of material, which is usually broken and fragmentary. *Religious* contexts, by contrast, are typically those in which glass was deposited intentionally as a gift, votive, or decoration. Religious contexts include temples and other forms of cult site. *Funerary* contexts, the most deliberate form of artifact deposition, are tombs and cemeteries in which glass and other objects were interred alongside the dead. Objects from funerary contexts are typically better preserved than those from habitation contexts, unless the burial was disturbed in antiquity. The last two forms of archaeological context are *industrial*, representing glass which was found in the context of an identifiable glass workshop, and *shipwreck*, in which glass was found in the remains of a vessel lost at sea. Both represent different life stages of the object than those found in other context types: objects from industrial contexts represent the early stages of object manufacture, while those in shipwrecks are an index of the transport and shipment of glass vessels from manufacturing to use site.⁷⁸ Finally, a *museum* context represents an object acquired on the antiquities market and housed in a public or private collection whose precise archaeological origins are unknown. The region, and sometimes site, of objects in museum collections may be conjectured from purchase location and sale records or by comparison with other, better provenanced objects. Museum objects without good archaeological context are only discussed when no adequate provenanced example of the type is known from better contexts, and it is assumed that most come from funerary contexts, given that most of the better published examples have a high level of preservation and are quite elaborate in form and decoration.

⁷⁸ Some glass objects found in shipwrecks, for instance the small ithyphallic pendant found in the Antikythera wreck (Gadolou 2012, No. 19), may have been the personal effects of sailors rather than cargo.

Limitations

Before launching into the remainder of the discussion, it is important to state what this research does not do. Documenting specific technological sequences of production and comparing them across geographically dispersed sites has proven unfeasible due to the absence of detailed information about technological processes in most published reports and a lack of consistency in terminology and attention to minor detail, even in the better catalogued material. For example, in mold-made pendants in the round, bale attachment techniques vary, even on objects of the same formal type, suggesting the possibility of different locales of production, or at least different *chaîne opératoire* production sequences.⁷⁹ But the rear side of these pendants, where the bale was usually attached, is illustrated very rarely, rendering comparison among objects from different sites impossible and meaningless. Other technological features, such as manufacturing method for beads, the direction of rotation for core-form bottles, and rotary polishing marks on sagged bowls, are also irregularly documented.⁸⁰ Therefore, the only way to determine specifics of production process would be to examine each item in person and given the scale of the project, such a primary study of most materials was logistically impossible. Instead, my goal in this dissertation is to document the overall presence of objects of glass over a wide geographic and cultural area, taking advantage of what is known and published in order to identify areas of particular interest for future study. Scientific analysis of glass composition, also suited to answering many of the questions identified here and testing some of the arguments is also outside the primary scope and agenda of this dissertation but provides fertile ground for future work.⁸¹

⁷⁹ See further discussion, Chapter 2.

⁸⁰ For the significance of each of these techniques, see Lierke 1993; Stern 1996; Spaer 2001; Larson forthcoming-a.

⁸¹ For a recent summary of scientific studies of Hellenistic glass, which are quite few in number, see Henderson 2013. The University College London Institute of Archaeology is in the midst of a project to analyze samples of

Additional limitations stem from the nature of glass publications and archaeological recovery. Many sites are multi-phase, and the glass finds often do not come from well-dated or precise contexts; alternatively, they are not sufficiently published with specific discussion regarding the evidence for their date. The completeness of recovery and publication also varies greatly from site to site and region to region, and it is not always clear what percentage of the glass from a given site has been catalogued. Generally, the material analyzed here by definition only includes glass vessels and objects and does not examine the use of glass relative to other materials, such as overall contrasts and changes in ceramic and metal table services and cosmetic vessels, or stone objects of adornment, or of other materials in burial assemblages, although significant changes in other materials are discussed when possible and most relevant. An examination of changes in quantity and quality, and not just typology, of ceramic tablewares as glass becomes a more popular and common product, would be a highly worthwhile future investigation but must be left aside for the time being.

Despite these inherent limitations – many of which are endemic to the archaeological enterprise – meaningful results have been extracted in similar studies of Roman glass, particularly in the west and especially in Britain. The earliest such quantitative study to my knowledge is that of Sophia van Lith and Klaus Randsborg, who examined functional groupings of Roman glass from the settlement sites of the northwest Mediterranean.⁸² Cool and Baxter and Ingemark have followed with similar analyses of Roman glass in Britain and Scotland, respectively.⁸³ Their collective results have substantiated many ‘intuitive’ prior claims and also advanced new theories that can be further tested and explored with subsequent study and newly

glass from throughout the Hellenistic world in order to determine the number of raw glass production centers (primary workshops). For preliminary results, see Connolly et al. 2012.

⁸² van Lith and Randsborg 1985.

⁸³ Cool and Baxter 1999; Ingemark 2014.

uncovered and published material. Therefore, this dissertation aspires to lay the groundwork to examine Hellenistic glass not only in terms of changing production locations and technologies, but also to introduce a more social historical perspective of the changing meanings of glass objects in an increasingly cosmopolitan and globalized society. A central tenet of this dissertation is that it was this changing attitude towards glass, coupled with technological advances in both the manufacture of raw glass and in glass products, rather than the invention of glass blowing, which precipitated the exponential explosion of glasswares in the early Roman period.

Organization and Summary

After the present chapter, in which I offer the basic outline of current scholarship on the significance Hellenistic and early Roman glass, the cultural and economic environment of the Hellenistic period, and overall method, scope, and argument of the dissertation has been given, Chapter 2 provides background information concerning the organization of production of glass in antiquity into primary and secondary workshop contexts and the evidence for each, followed by the basic forms and types of glass produced by these workshops. Each remaining chapter then investigates a particular issue of glass production and consumption during the Hellenistic and early Roman period. Chapters 3, 4, and 5 take a scalar approach to examine how glass functioned in different geographic areas with different inflections of local and global meaning. Each of the three chapters looks at some aspect of how glass functioned in Hellenistic society – as a luxury product in the wide Hellenistic world, as a mass commodity in the eastern Mediterranean basin, as a productive/innovative medium for craftsmen in Syro-Palestine. Chapter 6 then re-contextualizes the invention of glass blowing in light of the vigor and

innovative energy of the Hellenistic glass workers and increasing consumer desire for glass vessels.

Together, my comprehensive examination of the production and consumption of glass during the Hellenistic period advances three major intersecting arguments.

First, I suggest that the glass practices of the Late Hellenistic period, from the production technologies (sagging), practices of consumption (drinking), and decorative motifs (ribs, flutes, rays, and grooves), were inherited directly from the customs of the Macedonian and satrapal Achaemenid royal courts of the fourth century.

Second, despite superficial similarities, a significant shift in the quantity and scale of the glass industry over these three centuries from the mid fourth to mid first centuries reflects a fundamental shift in attitudes towards glass. I characterize this shift as the transformation from glass as an elite luxury item into an object of mass consumption. Luxury items, restricted to use by elites, were controlled, curated, scarce, and conspicuous, whereas mass commodities were routine, discarded, numerous, and modest. While certain forms of glass continued to be a luxury in many regions of the Mediterranean until the Roman period, in the eastern Mediterranean, and especially in Syro-Palestine, the use and disposal contexts, quantity of material, and types of object (which became much more standardized) reflects a culture of mass production and consumption surrounding glass vessels and small objects.

Third and finally, although the invention of glass blowing in the early first century is typically credited with the democratization of glass in the Roman world, I argue that the necessary foundations for this so-called “revolution” – most notably the creation of a consumer market and the encouragement of innovative practices in glass workshops – lay in the preceding Hellenistic period. Indeed, the relatively slow adoption of blown glass in the east, in contrast to

the rapid adoption in the western Mediterranean, reflects the legacy of appropriate glass usage established by fourth century Greek and Eastern royal court societies, in which glass was primarily used for drinking. The extant first millennium BCE technologies of sagging were sufficient to manufacture the large, open drinking bowls used in elite drinking parties for over half a millennium, so technologies did not have to drastically change in order to meet demand. The new invention of glass blowing was more suitable for creating closed vessels like perfume containers, jugs and jars, and large storage containers which were more in demand in western markets which lacked an established pattern of glass consumption habits. Thus, glass blowing became popularized among newly trained glass workers in the western Mediterranean who served mostly western clients, while glass working traditions in the eastern Mediterranean continued without substantive change until the later first century CE. The true revolution in glass, therefore, was not one of technological invention but of mass production and consumption.

Chapter 2.

Glass Workshops and Objects in the Hellenistic Period

Changes in the Hellenistic Glass Industry: A Matter of Scale

The major changes in glass production and consumption that occurred over the course of the Hellenistic period were not new technological discoveries about the working properties of glass or new methods of manufacture: all the technologies used to manufacture vessels and objects in the Hellenistic period were extant in glass production by the fourth century if not earlier. Even the types of object produced are quite similar, with the ubiquitous sagged drinking bowls of the late Hellenistic period mimicking Achaemenid bowls and phialai and Macedonian colorless skyphoi in technology and function. What did change, however, was the sheer quantity of glass that characterized Hellenistic assemblages compared to those of earlier periods. As described by Henderson:

The principal technological change in glassmaking that occurred between the middle and late Hellenistic period is one of increasing scale...although the mass production of cast vessels might be regarded as rather narrow and somewhat conservative in terms of the vessel forms produced, innovation would nevertheless have been involved in restructuring the scale of production.⁸⁴

This increase of scale in turn points to several cultural and economic developments: increased supply of raw glass, increased efficiency in primary and especially secondary production, and a shift in consumer habits in which glass became more integrated into the daily life of a wider spectrum of society, no longer just for burial, ritual, or super-elite consumption. This chapter

⁸⁴ Henderson 2013, 223.

provides the framework for the rest of the dissertation by examining the basic nature of ancient glass, the structure of the ancient glass industry, and the major forms of glass and technologies used to produce them which were available to producers by the Late Hellenistic period. The technical terms, basic chronologies, and major typologies as defined and explained here serve as the basis for the remainder of the dissertation.

What is Glass? Composition and Scientific Analysis

Glass is perhaps the earliest completely man-made material in which the final product bears no resemblance to its constituent ingredients.⁸⁵ Ancient glass was composed of three principal ingredients.⁸⁶ The most important was silica (SiO_2), sourced from silicate-rich beach sands; most ancient glasses have silica levels of 65-70%. Sand is not a chemically coherent material but rather eroded grains from larger rocks, particularly silicates. Naturally occurring sand suitable for glass making was difficult to acquire. The ratio of silica to other minerals and trace elements found in sand greatly affected the success of the glass melt and its final working properties. The optimal sand for ancient glass making had high quantities of silica dioxide and relatively low concentrations of other chemicals commonly found in sands like aluminum oxide (Al_2O_3) and ferrous oxide (Fe_2O_3).⁸⁷ Calcium carbonate (CaCO_3), commonly known as lime, was also necessary to proper formation of glass. Some silicate sands, such as those near the Belus River, may have been sufficiently lime-bearing as to not require additional modifications to the glass melt.⁸⁸ The majority of other sands could only have been made into glass with

⁸⁵ Volcanic glasses, like obsidian, occur naturally and were highly valuable before the introduction of metal.

⁸⁶ The following is based on the following synthetic and accessible discussions of ancient glass technology and composition: Henderson 2002; Freestone 2004; C.M. Jackson 2012; Henderson 2013. Thilo Rehren and Ian Freestone have recently published a useful state of the field article on the history and future possibilities of scientific analysis of ancient glass (Rehren and Freestone 2015).

⁸⁷ A Belgian research team lead by Dieter Brems has established tolerance ranges of component minerals for Roman glass (Brems, Boyen, et al. 2012; Brems, Degryse, Ganio, et al. 2012, Table 1).

⁸⁸ Brill 1988, 265-266.

additional shell or limestone. Unlike clay, which was found in sufficient quantities and quality for ceramic production in many places around the Mediterranean, sand suitable for glass making was a more limited resource. Brems et al. tested 178 beach sands from the Mediterranean coasts of Spain, France, and Italy and discovered only six which were appropriate for glass manufacture.⁸⁹ The quantities of sand required to manufacture glass mean it would have made far more sense to make glass at the sand source and then export the raw glass, rather than to export the sand itself for manufacturing raw glass at a distant location.⁹⁰ Therefore, ancient primary glass makers almost certainly located their melting furnaces near their sand source, preferring to import the more available and lighter natron. Similarly, archaeological and ethnographic studies have indicated that potters typically located their kilns near clay beds and fuel sources and brought additional, lighter weight materials from more remote locations.⁹¹

The second ingredient of ancient glass was some form of soda (Na_2O) which was used as a flux to reduce the melting temperature of raw silica and composes between 12-20% of the glass melt. The higher the quantity of soda, the lower the melting temperature of the glass, thereby affecting its working properties and associated fuel costs. Soda in the ancient world came from one of two sources: plant ash, primarily used before c. 800 BCE and again after c. 800 CE, and mineral natron, which was used in most Iron Age, Classical, Hellenistic, and Roman glasses.⁹²

⁸⁹ Brems, Degryse, Ganio, et al. 2012. The top three sands came from southern Italy: the region of Basilicata in southeastern Italy, Puglia, and Toscana. The sands requiring additional lime were found at the Guadiana River and near Aguilas in Spain, and the Bay of Hyere in Provence, France. I know of no similar study conducted in the eastern Mediterranean, but the traditional manufacture of glass in the east suggests eastern Mediterranean sands suitable for glass manufacture are probably more numerous.

⁹⁰ For discussion, see Fischer 2008, 16-21. She calculated that each batch of a large Byzantine glass installation would have required 6-7 tons of sand, which would have made the cost of transporting sand to a distant melting furnace quite prohibitive.

⁹¹ Arnold 1981; Michelaki, Braun, and Hancock 2014.

⁹² While mineral natron was once thought to be the only sodium source for Roman glasses, recent scientific analysis has indicated that plant ash probably continued to be used in certain glasses during the Roman period, as indicated by relatively high concentrations of magnesium, potassium, and phosphorus (Nenna and Gratuze 2009; C.M. Jackson 2012). A variety of reasons, from environmental to political, have been suggested for why glass makers

Natron was sourced from evaporative deposits in arid regions, most famously the eponymous Wadi Natrun in Egypt, but other sources were exploited as well.⁹³ According to Pliny, the purest source was Lake Chalastra in Macedonia, a sentiment also expressed by Plato 500 years earlier.⁹⁴ A customs account papyrus found at Elephantine and dated to the reign of Xerxes (c. 475) documented the export of mineral natron from Egypt by Greek merchants in large quantities during the fifth century.⁹⁵ Pliny's account of the origins of glass, in which he describes the discovery of glass by natron merchants traversing the Phoenician coast, similarly attests to trade of this mineral outside the parameters of glass manufacture.⁹⁶ Natron was also used for a variety of other purposes, including dyeing, embalming, bread making, and preserving vegetables, as well as medicinally for skin diseases, deodorant, mouthwash, and other antiseptic functions.⁹⁷ The extensive trade in natron was therefore not necessarily linked to glass production, although it does indicate that local glass makers probably had regular access to the mineral even if they did not live in a natron producing region.

The third component of ancient glass was lime (CaO). Lime is not technically required to manufacture glass but provides additional durability and stability to the material, without which the glass would dissolve in water.⁹⁸ Lime, in the form of shells, may have been either a deliberate addition or accidental inclusion in the glass melt. Pliny knew that shell was

fully abandoned the use of mineral natron in the 9th century CE; for discussion, see Saguí 2008; Henderson 2013, 97-103.

⁹³ On the identification of natron sources at Wadi Natrun, see Nenna, Picon, and Vichy 2000; Nenna et al. 2005; Shortland et al. 2011.

⁹⁴ Plato *Republic* 430a; Pliny *Natural History* 31.46. Additional natron sources listed by Pliny include Media in Thrace, Lydia, and Chalcis, all of which he denigrated as inferior quality. Lake Pikrolimni, north of Thessaloniki, has now been identified as ancient Chalastra based on isotopic and geochemical evidence which confirms the suitability of the lake chemistry for producing mineral natron (Dotsika et al. 2009; Dotsika et al. 2012).

⁹⁵ Porten and Yardeni 1993, No. C3.7; Briant and Descat 1998. My thanks to Henry Colburn for drawing my attention to this document and sharing the associated bibliography.

⁹⁶ Appendix, Text 5. See also Bresciani 1996.

⁹⁷ Pliny *Natural History* 31.46; Ignatiadou et al. 2005.

⁹⁸ Henderson 2013, 5. Glasses without sufficient amounts of lime may also have been produced and used in the ancient world but do not survive archaeologically. Such deterioration may be responsible for the lack of surviving glasses from c. 1100-800 (Reade, Freestone, and Simpson 2005).

occasionally added to glass batches, but he only lists sand and soda in his discussion of glass composition.⁹⁹ Three of the six viable western Mediterranean glass making sands identified by Brems et al. required to addition of extra lime in order to be viable.¹⁰⁰ Sands from Egypt and coastal Lebanon and Israel are more suitable for glass making and appear to have been more commonly used in antiquity.¹⁰¹ Sand, ash or natron, and possibly lime were heated together in large crucibles in which they chemically react to form a new, chemically stable material which could be repeatedly remelted without losing coherence or changing properties.¹⁰² Roman and other ancient glasses are known as soda-lime-silica glasses after their principal ingredients; other chemical formulations of glass include optical lead glass invented in the late 17th century CE and heat resistant borosilicate glass used for modern cookware.

The natural color of a soda-lime-silica glass is a transparent pale to light yellow, green, or blue, depending on trace minerals in the sand and firing conditions.¹⁰³ In antiquity, various opacifiers, colorants, and decolorizers were then used to adjust the color of the glass. Early Bronze and Iron Age glasses were mostly opaque, due to the presence of incompletely reacted materials forming a crystalline structure in the glass, which inhibits the transmission of light. Opacifiers were also added deliberately; tin oxide for opaque white and lead-tin oxide for opaque yellow were the most commonly used opacifiers after the second century.¹⁰⁴ The major glass colorants used in antiquity were iron, manganese, copper, and cobalt. After the second century,

⁹⁹ Appendix, Text 5. (*Natural History* 36).

¹⁰⁰ Brems, Degryse, Ganio, et al. 2012.

¹⁰¹ Brems, Boyen, et al. 2012

¹⁰² The melting temperature of glass depends on the amount of flux (soda). According to Henderson, the quantities of flux present in ancient glasses reduced the melting temperature of silica from between 1710-1730° Celsius to around 1150° Celsius (Henderson 2013, 5).

¹⁰³ The same glass batch becomes more yellow or brown in a reducing atmosphere with additional carbon present in the environment, while an oxidizing condition with sufficient available oxygen results in more green tones (Paynter 2004-2005, 300).

¹⁰⁴ Henderson 2013, 76-77.

manganese replaced antimony as the primary decolorizer.¹⁰⁵ If not fully incorporated, manganese can also create a rich purple; several glasses of the late Hellenistic and early Roman period are colorless with faint swirls of purple, displaying incomplete mixing of manganese into the glass melt.

The earliest archaeometric studies of glass composition focused on identifying provenience of raw glass materials, on analogy with petrographic studies of ceramics which could isolate production location based on the chemical composition of clays.¹⁰⁶ However, glass recipes, particularly in the Roman period, turned out to be extremely homogeneous, with only minor differences in composition which are thought to be associated with either Egyptian or Syro-Palestinian origins.¹⁰⁷ Furthermore, glass is a eutectic material, meaning that its manufacture yields a homogeneous final product regardless of the original chemical compositions of the ingredients, and non-reacted chemicals separate out from the glass itself; in other words, what goes into the melt is not what comes out.¹⁰⁸ Recycling practices further complicate the problem of identifying distinct origins and may result in fuzzy or indistinct chemical signatures.¹⁰⁹ Recent work on trace elements and strontium (Sr) and neodymium (Nd) isotopic signatures has begun to show some promise toward identifying subgroups,¹¹⁰ but sufficient comparative work is still to be done, and very little glass from the Iron Age to the Hellenistic period has been subject to chemical analysis and interpretation of any kind.¹¹¹ To

¹⁰⁵ Brill 1994, 11.

¹⁰⁶ E.g. Brill 1988; Henderson 1989.

¹⁰⁷ Freestone 2004.

¹⁰⁸ Rehren 2000.

¹⁰⁹ E.g. the heterogeneous composition of glass made at Early Byzantine Sagalassos, which is thought to result from mixing raw glass cullet with recycled vessels (Lauwers, Degryse, and Waelkens 2007b, 44-45).

¹¹⁰ E.g. Degryse and Schneider 2008; Brems, Boyen, et al. 2012; Ganio et al. 2012; Brems et al. 2013.

¹¹¹ A recent synthetic article by Rehren and Freestone does not discuss the Hellenistic period, although they acknowledge this lacunae in knowledge (Rehren and Freestone 2015, 239). Publications of chemical analysis on Hellenistic period glass vessels and objects are from Pherai, Thessaly (Connolly et al. 2012), Delos (Mirtsou, Kessissoglou, and Nenna 1999), Rhodes (Rehren, Spencer, and Triantafyllidis 2005), Pergamon (Rehren et al.

date, the field is too undeveloped to allow substantive conclusions. This is slowly changing, first for the Roman glass industry and later, one hopes, for the earlier periods as well.¹¹²

Primary and Secondary Workshops

The unsuccessful attempts of later 20th century scholars to provenance glasses based on their chemical composition did, however, shed light on the organizational structure of the ancient glass industry. For glass, manufacture was a two stage process: primary glass workshops manufactured raw glass from its component ingredients of sand, soda, and lime, and secondary glass workshops then used raw glass to create saleable goods such as vessels, beads, and other objects. *Primary glass workshops* and *glass makers* refer to the location and individuals responsible for the creation of raw glass, while *secondary glass workshops* and *glass workers* refer to the transformation of raw material to object. Which workshop context was responsible for coloring of glass is an outstanding question.¹¹³

With the possible exception of Rhodes,¹¹⁴ there are no known primary glass manufacturing centers dated between the eighth and first centuries BCE (Figure 3). Egypt and coastal Syro-Palestine may have manufactured raw glass in the Hellenistic period, but this hypothesis is based upon somewhat later literary sources¹¹⁵ and later archaeological evidence.¹¹⁶

2015), and Beirut (Thirion-Merle 2005; Henderson 2013). Additionally, Robert Brill conducted analysis on a select number of samples from Tel Anafa, Delos, and Jerusalem (Grose 2012, 83-84). However, the problem is that forms and contexts of specific objects are rarely published along with their chemical compositions, and cross-site comparisons are absent.

¹¹² For a recent summary and analysis of chemical composition from late Hellenistic-early Roman sites, and potential avenues for future investigation, see Henderson 2013, 235-251.

¹¹³ Finds from the Kakoula property at Rhodes included imported glass ingots and chunks of raw glass as well as pigments, lead, shallow melting pans, and ceramic cooking pots with layers of adhered glass, possibly indicating that glass was colored in this secondary workshop (Triantafyllidis 2000c, 194).

¹¹⁴ Rehren, Spencer, and Triantafyllidis 2005; see further discussion in Chapter 4.

¹¹⁵ E.g. Pliny *Natural History* 5.75, 36.65-66, and 66.193; Strabo 16.2.25; Cicero *Pro Rabirio Postumo* 14. 40). Many other ancient sources also associate these eastern Mediterranean places with glass manufacture: see Trowbridge 1930 for a comprehensive list and discussion which has recently been updated and revised by Stern Stern 2007, 2012a.

The implications of this bifurcation of the industry for issues such as knowledge production, technological transfer, and the suitability of raw materials with particular working properties required by different technologies, have not previously been explored, particularly for the Hellenistic period.

Locations of secondary glass workshops during this period (c. 350-50 BCE) are somewhat better known, although many proposed workshops are still speculative (Figure 3). One thing that is clear is that even before the innovation of glass blowing glass workshops, especially those producing non-vessel objects, were much more common than had long been thought. In the 1960s, Gladys Weinberg and Paul Perrot set out to locate and excavate an ancient glass factory. Their work at Jalame in northern Israel was the first scientific exploration and documentation of a glass workshop.¹¹⁷ Since then, dozens of secondary glass manufacturing sites have been identified in the ancient Mediterranean, spanning from the Bronze Age through Islamic period and later.¹¹⁸ Secondary glass workshops from the later part of the first millennium BCE, by contrast, are still relatively few in number and poorly documented. Securely identified glass workshops dating to the first half of the Hellenistic period (c. 300-150) include the temporary temple workshops in Egypt specializing in furniture and sarcophagi inlays at Gumaiyama and Tebtynis, both dated to the early third century,¹¹⁹ and the Kakoula site in

¹¹⁶ Primary glass workshops of the first millennium CE have been identified at several locations in Wadi Natrun and around Lake Mariout (Taposiris Magna and Marea) in Egypt (Nenna, Picon, and Vichy 2000; Nenna et al. 2005). Recent excavations at three primary glass manufacturing sites in Wadi Natrun has indicated that the sites may date as early as the late second century BCE, and all went out of use around the end of the second century CE (Nenna 2015, 18-19). Other evidence of primary manufacture comes from Beirut (site 015) (Kowatli et al. 2006), and Bet Eli'ezer, Bet She'arim, and Apollonia in Israel (Brill 1967; Gorin-Rosen 2000). The earliest Beirut production is said to pre-date 50 BCE, but the evidence is inconclusive and incompletely published (see also Henderson 2013, 215-222).

¹¹⁷ G.D. Weinberg 1988. See also Slane and Magness 2005 for a redating of the site's occupation.

¹¹⁸ See, for example, the edited volumes pulling such evidence together: Nenna 2000b; Foy and Nenna 2003.

¹¹⁹ Petrie, Griffith, and Murray 1888, 42-44; Nenna 1998; Nenna, Picon, and Vichy 2000

Rhodes, where beads and vessels in gold glass and mosaic were made (late third-early second centuries).¹²⁰

More secondary glass workshops have been identified or hypothesized from the later Hellenistic period (c. 150-50). Glass objects were likely manufactured at Delos, where wasters, polychrome mosaic canes, and workshop defects have been found in three disparate contexts, but there is no direct evidence to date of vessel manufacture on the island.¹²¹ In the western Mediterranean, hundreds of wasters and finished beads were found in a domestic debris deposit dated to the late second century BCE at Aix-en-Provence, although no associated furnaces were identified.¹²² The major products of the mid-first century workshop in Jerusalem were open sagged vessels and small inlays, along with the earliest documented examples of blown glass.¹²³

¹²⁰ Weinberg 1969; G.D. Weinberg 1973; Triantafyllidis 2000a, 2003b.

¹²¹ Nenna 1999. Four retail locations for vessels (presumably) imported from elsewhere in the eastern Mediterranean were also identified; bead workshops are also thought to have doubled as sales locations. See also Stern 2002, 468.

¹²² Foy and Nenna 2001, 47.

¹²³ Avigad 1972a; Israeli 2005; Israeli and Katsnelson 2006.

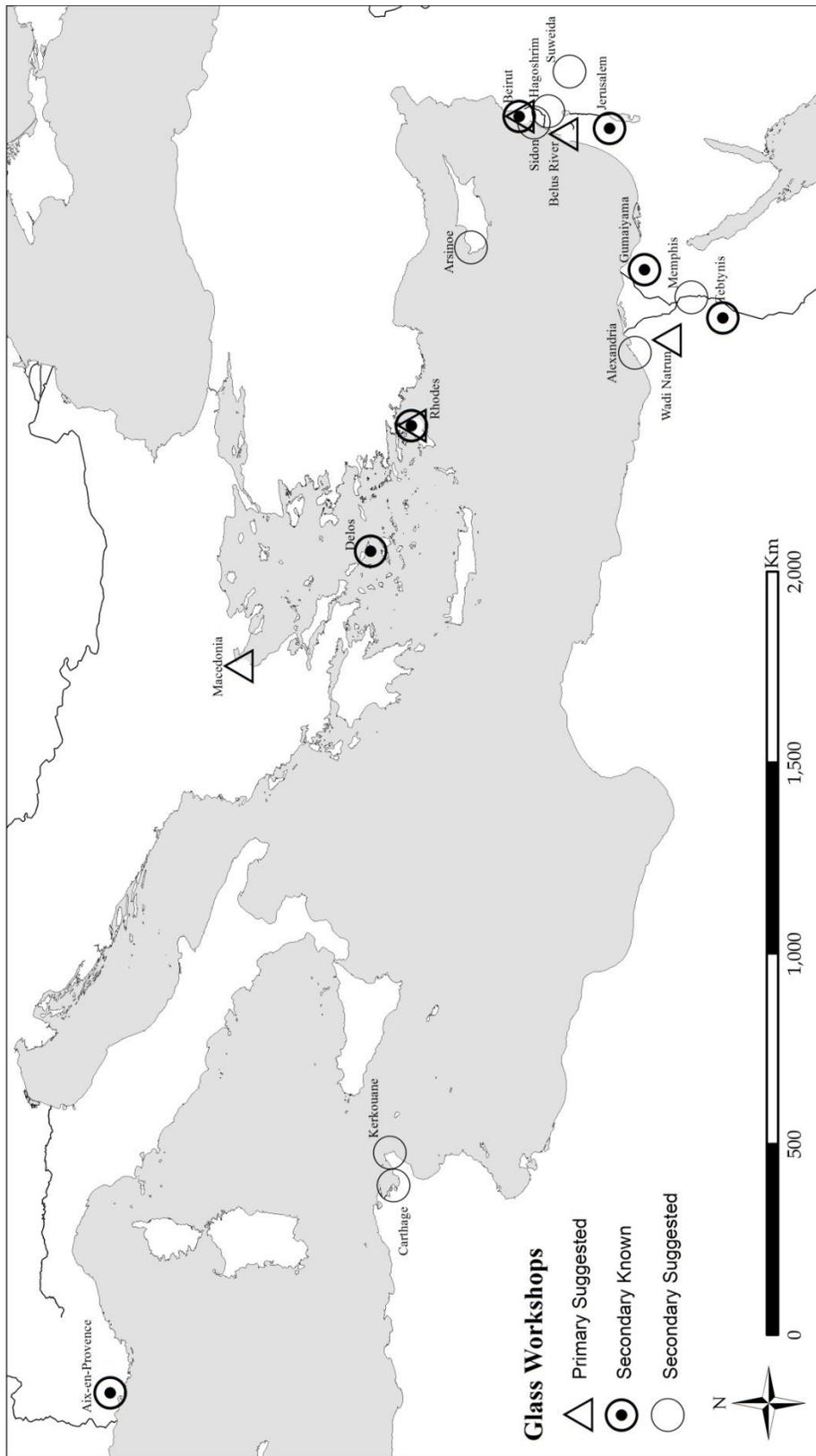


Figure 3. Known and suggested primary and secondary glass workshops, c. 350-50 BCE

Other suggestions for locations of secondary glass workshops are more provisional. The most convincing case, although the dating is uncertain, is Beirut site 015, which may have been a primary or secondary workshop by the mid-first century or earlier.¹²⁴ Sagged vessels, core-form bottles, and assorted small objects may have been made at Rhodes in the second century, based on the presence of some cullet and “overlapped walls of vessels, drops, deformed fragment of glass vessels during manufacture (sic), core-formed vessels of the Mediterranean Group III, as well as deformed core-formed alabastra and transparent bowls.”¹²⁵ At Suweida (ancient Dionysias) in modern Syria, an ash layer containing glass slag, a coin dated to the end of the third to early second century, and a fragment of a molded glass bowl of the second-first century were found in the area of the Odeon. Odile Dussart suggested this material indicates a glass workshop in this location which was built over by the monumental structure in the late first-early second century CE; the Hellenistic dating of the workshop is therefore very tenuous.¹²⁶ Weinberg proposed a production site at Hagoshrim, a few kilometers north of Tel Anafa, based on a few days of surface survey. The finds included dozens of fragments of grooved and ribbed vessels of more diverse types but comparable colors to those excavated at Anafa, along with several deformed pieces which Weinberg interpreted as wasters.¹²⁷ During recent Princeton University excavations in the Hellenistic town of Arsinoe (Polis Chrysochous), Area E.F2, on Cyprus, clay lined pits containing slag and waste contained debris which may be from secondary glass

¹²⁴ Kowatli et al. 2006; Henderson 2013, 215-222. BEY 002 has also produced evidence for glass production during the Roman high empire (second half first to third century CE) and again in the Islamic period (Foy 2000, 2005; Foy, Picon, and Thirion-Merle 2007).

¹²⁵ Triantafyllidis 2003b, 136-137.

¹²⁶ Dussart 2000.

¹²⁷ A few days of subsequent excavation at the ‘Three Trees’ site nearby yielded no additional evidence for glass manufacture (G.D. Weinberg 1973). It is worth noting the possibility that the deformed glass fragments were due to exposure to high temperatures of a fire rather than misshapen during initial manufacture.

manufacture.¹²⁸ Finally, glass workshops have been summarily reported from North Africa, at the Sanctuary of Jupiter Ammon in Carthage (dated between the third to second century) and the Maison du Sphinx at Kerkouane (first half of the third century).¹²⁹ Unfortunately, all these workshop materials were found in secondary contexts and were identified by the presence of glass wasters, molds, and prefabricated elements such as mosaic canes. The location of the workshop itself and configuration of the furnace and working spaces are unknown.

¹²⁸ Najbjerg 2012, 237. Also worth noting are “baked clay circles” embedded with slag and vitrified brick which were found nearby during the Department of Antiquities work in the town (Najbjerg 2012, 247 n. 12).

¹²⁹ Gauckler 1915, 10; Morel 1969, 480-482. See also Nenna 1999, 167.

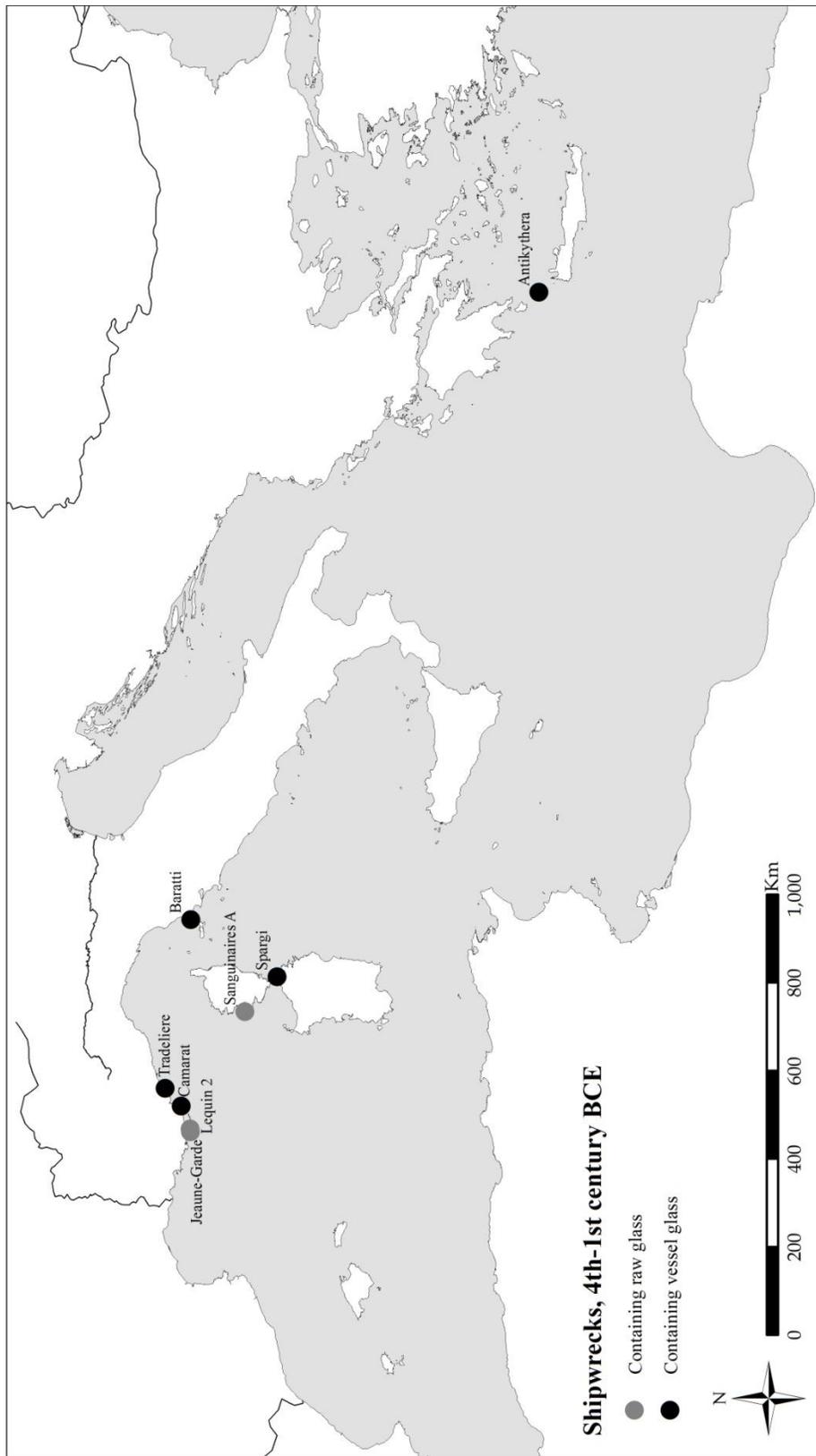


Figure 4. Mediterranean shipwrecks containing raw and finished glass, fourth-first centuries BCE

Five shipwrecks from the Hellenistic period contained glass. They attest to the trade in raw material and finished vessels from east to west and suggest possible routes these ships may have taken from the glass houses of the eastern Mediterranean to consumption sites in the west (Figure 4). With its cargo of 550 kilograms of raw glass, the third century Sanguinaires A shipwreck near Corsica demonstrates that raw glass was traded on a large scale.¹³⁰ Raw glass was also found in the late third to early second century Lequin 2 shipwreck and the first century Jeune-Garde wreck, both in the western Mediterranean,¹³¹ and a sizable piece of uncertain date was retrieved by a fisherman off the southern coast of Crete.¹³² Arveiller-Dulong and Nenna suggested that ships such as the Sanguinaires wreck supplied the small bead, bracelet, and pendant workshops at Carthage, Aix-en-Provence, and elsewhere in western Europe with eastern-made glass.¹³³

The Forms and Technologies of Hellenistic Glass

This section outlines the major technologies and forms of glass products available to consumers by the late Hellenistic period. I particularly focus on continuity of tradition from earlier periods to emphasize that the changes that occurred during the Hellenistic period were a matter of increased scale of production and diversity of use. By the first century, consumers could purchase glass in a wide range of forms. There were glass containers to hold perfumes and unguents, and glass cups to display in table settings and from which to drink wine. Glass beads and pendants adorned the necks and wrists of men, women, and children in life and the afterlife. Glass insets were used to add decorative color and brilliance to furniture, boxes, and wall paintings. Glass astragaloi and counters served as gaming pieces. Women could spin thread

¹³⁰ Alfonsi and Gandolfo 1997, 66-68.

¹³¹ Foy and Nenna 2001, 102-103.

¹³² Weinberg 1962b, 51-52. This piece is now on display in the Chania Museum.

¹³³ Arveiller-Dulong and Nenna 2000, 18.

with glass whorls, or apply cosmetics with glass sticks. In sum, glass entered a variety of contexts of daily life in the ancient Mediterranean world and became a standard component of the Hellenistic material *koine*.

Core-form Cosmetic Vessels

Core-forming, named after the sand, clay, or dung core which was used as a mold for the vessel interior, is the oldest technology for manufacturing glass vessels in the Mediterranean, with roots dating back to the Late Bronze Age. Core-formed vessels tended to be small closed shapes, usually with handles or feet. Their morphological similarity to ceramic vessels suggests they were used to store perfumes and unguents, although this has not been confirmed with residue analysis or another form of empirical investigation. During the Bronze and Iron Ages, core-form vessels were made by adhering crushed glass to a sand core and then heating it in the fire, a process known as sintering.¹³⁴ By the Hellenistic period, small decorative glass unguentaria and other small perfume or ointment bottles were likely made by winding heated and softened glass around the formed core. Faint traces of spiral winding marks appear on some of these vessels by the fifth century or so.¹³⁵ Application of the hot glass to the wet core caused the inner material to steam, releasing it from the glass. After the glass cooled, the core material could then easily be removed by dissolving it in water and filing out the interior.

Core-form vessels were produced for over a millennium and a half and were used throughout the Mediterranean and Near East, beginning with the products of Bronze Age Egypt

¹³⁴ This technique was tested and verified at the Toledo Museum of Art by Marianne Stern, with the collaboration of modern glass artist Dudley Giberson, in the 1990s (Giberson 2004). Stern believed the technique to have developed from faience glazing techniques (Stern 1998, 186-188).

¹³⁵ Stern and Schlick-Nolte 1994, 39-40; Bianchi et al. 2002; Lierke 2009, 24. Bill Gudenrath (personal communication, April 2015) does not believe that core-form vessels were ever wound.

and Mesopotamia.¹³⁶ The first substantive typology for Mediterranean core-formed vessels of the sixth to first centuries was devised by Harden.¹³⁷ Mediterranean Groups I, II, and III are distinct chronologically and are characterized by different shapes and colors, geographic distributions, and probably production centers. Group I began in the mid-sixth century and ends, somewhat abruptly, at the end of the fifth century. Objects of this type included typical Greek ceramic forms of alabastra, amphoriskoi, oinochoi, and aryballoi manufactured from dark glass and decorated with white, yellow, or pale blue threads in straight lines or zigzags. The concentration of finds on Rhodes, along with “the thoroughly Hellenic character of the earliest forms” and provisional evidence of glass production there in the Classical period, has led to the assertion that this group of vessels was manufactured exclusively on that island.¹³⁸

Around the mid-fourth century, core-form glass vessels began to appear in different shapes and decorative schemes, marking the beginning of Mediterranean Group II. The origins of this new group are uncertain. In his inventory of vessels from datable contexts, Murray McClellan noted the near complete absence of core-form glass vessels from contexts dated between 400-350. McClellan rightfully noted the improbability of the complete collapse of an industry only to be refounded again fifty years later using much the same technologies. Instead, he suggested that this gap in the evidence, along with a shift in distribution patterns and forms between the late fifth and late fourth century, indicated the foundation of new production centers by artists trained in Group I workshops.¹³⁹ Alternatively, Grose preferred to attribute the inception of Group II to the rise of Macedon and tentatively suggested that Group II could be

¹³⁶ Barag 1988 (1970); von Saldern 1988 (1970); Stern and Schlick-Nolte 1994, 30-37. The relationship between the Egyptian and Mesopotamian industries is still not clear.

¹³⁷ Harden 1981. These groups were initially proposed and discussed by Fossing 1940. Additional discussion and refinements can be found in: McClellan 1984; Grose 1989, 109-174; Stern and Schlick-Nolte 1994, 37-44.

¹³⁸ Grose 1989, 110. For possible evidence of a fifth century workshop on Rhodes, see Triantafyllidis 2000b, 2003b.

¹³⁹ McClellan 1984, 77-78.

considered “the first flowering of glassmaking in the Hellenistic era.”¹⁴⁰ It seems likely that *production* of core-form vessels might not have ceased (although it certainly might have diminished in scale), but *deposition* of core-form vessels, predominantly as grave goods, for some reason was put to a halt. Trade networks from Rhodes may have been disrupted, and war and economic instability on mainland Greece may have led to a decline in conspicuous consumption of wealth or change in burial practices. Another possibility might be a slight change in the glass recipe in this period which made the glass more subject to decomposition in the soil.¹⁴¹

Vessels of Group II appeared in much smaller quantities in the Aegean, Egypt, Syro-Palestine, and Asia than did Group I; instead, Group II vessels have been found in Magna Graecia, the Black Sea, and Macedonia, all of which were peripheral to the earlier market.¹⁴² The number and variety of forms and decorative schemes also increased. One possible explanation is that Group II vessels were produced in multiple workshops, perhaps located closer to the primary consumption locations.¹⁴³ Still, as Henderson has correctly pointed out, raw glass for these objects had to be sourced from a primary workshop, regardless of the location of secondary manufacture. Since no scientific analyses on these glasses have been done, the location of glass making workshops and their relation to secondary manufacturing centers is still uncertain. Such information might provide evidence regarding the spread of technology and

¹⁴⁰ Grose 1989, 115.

¹⁴¹ Reade, Freestone, and Simpson 2005.

¹⁴² As claimed by Harden, McClellan, and Grose. However, recently published finds from Athens, where Group II vessels comprise half the inventoried fragments of core-form vessels calls this geographic exclusion somewhat into question (Weinberg and Stern 2009, 20-21).

¹⁴³ McClellan 1984, 322-325; Grose 1989, 116. Artemios Oikonomou of the University of Nottingham has identified a cluster of Group II vessels from a votive deposit at the sanctuary of Mater Matuta in Satricum, Italy which have a distinctive chemical signature matching the composition of Italian sands. He has suggested that this may indicate short-lived primary glass manufacture in fourth century Italy, but the results are still quite preliminary (Oikonomou et al. 2015).

establishment of trade routes between the source of the raw glass and communities of glass production and consumption.¹⁴⁴

The status of the core-forming industry from the mid-third to mid-second century is, like that of the first half of the fourth century, unclear. Harden, operating on the assumption of linear progression of forms and chronologically significant variations in nuances of shape and decoration, assumed a cessation of Group II in the early third century and its subsequent replacement by Group III,¹⁴⁵ but Grose, followed by Stern, suggested that Group II vessels may have continued to be made through the course of the third century but only in old forms.¹⁴⁶ Grose, whose typology and chronology was based on archaeological context rather than formal relationships, argued that Group III vessels did not appear in the archaeological record “in appreciable numbers” until the second half of the second century, with the earliest securely dated example coming from a foundation deposit at Cosa dated c. 140.¹⁴⁷ There were, however, a few intermediary forms and classes of material which indicate some continuity in manufacture from Group II to Group III during the third century.¹⁴⁸

Group III has the narrowest repertoire of shapes – only alabastra and amphoriskoi – and, like other core-form bottles, consists of predominantly blue or dark colored bodies with light yellow, white, or light blue trailed decoration. However, Group III vessels differ from their predecessors in that they are original forms, not related to contemporary pottery shapes, and the handles, bases, and rims are made from applied translucent glass rather than pulled out from the

¹⁴⁴ Henderson 2013, 225.

¹⁴⁵ Harden 1981, 53-54.

¹⁴⁶ Grose 1989, 122; Weinberg and Stern 2009, 21.

¹⁴⁷ Grose 1973, 176-177, fig. 1. See also Grose 1989, 124; Arthurs 2012; Grose 2012, 20.

¹⁴⁸ Grose 1989, 122-123, Class III:A and III:B. McClellan argues for two subphases within Group III: the first, much smaller but more diverse and dating c. 250-150, and the second, larger in scale but more homogeneous in classic Group III forms, which runs from c. 150-1. He also attributes the second phase to the birth of a new production center in Cyprus. Jones reasonably argued that Grose’s Classes II:G and III:A are sufficiently consistent typologically and chronologically to be considered a distinct group of the early Hellenistic period Jones 1995.

body of the vessel. These translucent fabrics are similar to those used to manufacture contemporary sagged bowls, suggesting a similar source of raw glass. Many are lopsided, careless, or even sloppy in the application of bases, handles, and decoration.¹⁴⁹ Group III vessels are known throughout the eastern Mediterranean and Italy, although they are rare on mainland Greece,¹⁵⁰ and Grose noted that “their presence ought to be anticipated on all eastern Mediterranean, south Italian, and Tyrrhenian sites with strata dating from ca. 125 to 70 BCE.”¹⁵¹ Group III vessels continued to appear in burial and settlement contexts through the Augustan period and the early decades of the first century CE, at which point they were probably heirlooms.

Polychrome Tablewares

Mosaic Vessels

Like core-forming, polychrome mosaic glass originated near the beginnings of glass vessel production in Late Bronze Age Near East.¹⁵² The earliest mosaic vessels were formed by arranging slices from a monochrome rod onto a core, then heating the segments until they softened and bonded against each other, forming a fused pattern.¹⁵³ Polychrome mosaic canes and inlays appeared at about the same time. Such canes can either be assembled while the glass

¹⁴⁹ Grose 1989, 122.

¹⁵⁰ Two examples from Athens are exceptional Weinberg and Stern 2009, No. 9-10.

¹⁵¹ Grose 2012, 20.

¹⁵² This use of mosaic is not to be confused with the use of individual monochrome glass tesserae to form a mosaic surface. Ancient mosaic glass has also historically been called “millefiori” based on its similarities to Venetian polychrome glasses with floral patterns, but this is terminological misappropriation (Grose 1989, 30; Spaer 2001, 120).

¹⁵³ Examples of simply shaped vessels formed using this method include fragments from Tel al-Rima dated to c. 1500 BCE, and beakers from the Assyrian sites of Marklik and Hasanlu, dated to the twelfth-eleventh and ninth (or thirteenth) centuries respectively (von Saldern 1966c, 1988 (1970); Marcus 1991). Lierke suggested that the anticipated difficulty of fusing differently colored glasses together was overcome by use of the same (uncolored) raw glass to create different colored batches (Lierke 2009, 19). See also Stern and Schlick-Nolte 1994, 46-47; O’Hea 2011a.

is hot and molten or bundled into patterns while the glass is cold.¹⁵⁴ Glass workers produced hot worked elements by layering gobbs of hot glass over each other, winding color B around color A or draping a thick layer of color B over color A; this process could be repeated a number of times. The resulting core of glass was further shaped on a hard, heat resistant surface called a marver. For cold working, solid rods of monochrome glass were bundled together to form the desired pattern in cross section, then heated to fuse. In both hot and cold working of canes, the craftsman used pliers to pull out the heat-softened bubble of material, creating a long rod of glass with a polychrome pattern.¹⁵⁵ The pattern of the final product was thus smaller in section than the original size due to a constriction of diameter of the rod as it gained length. The rod was then sectioned into discs, which could be inset into other glass or laid side by side and fused together. Alternatively, the mosaic rods could be left intact as long rods which could themselves be fused together to make long strips called ribbon glass.

Although mosaic technology of fusing multiple colors of glass to make patterns had been known since the Late Bronze Age, Hellenistic glassworkers expanded and experimented with the basic principle of mosaic glass by diversifying the range of object and vessel types and making individual objects more complex. Hellenistic mosaic glass can be distinguished from earlier and later forms based on the patterning of the mosaic cane section, which tended to be star or spiral patterned, and the use of more translucent and vivid colors than appeared in earlier periods.¹⁵⁶ The major Hellenistic form of mosaic vessel was a sagged bowl which may or may not have a foot. Plates and other open shapes are also known.

¹⁵⁴ For definitions, descriptions, and illustrations of mosaic cane forming methods, see Grose 1989, 33-35; Stern and Schlick-Nolte 1994, 54-63; Spaer 2001, 48-52.

¹⁵⁵ The more complex Hellenistic and Roman canes may have been drawn vertically rather than horizontally, using the weight of the glass itself to minimize distortion of the pattern Stern and Schlick-Nolte 1994, 56-57.

¹⁵⁶ Grose 1989, 189-193. The colors are similar to those used in monochrome bowls: purple, dark blue, amber, blue-green, and sometimes colorless.

Even after forming the canes, the production of mosaic vessels was a multistage process of heating and cooling. First, individual mosaic cane fragments, along with monochrome tesserae used to fill gaps, were fused together into a single circular plaque. The resulting disc was placed over a hemispherical molded form. The heated glass then slumped down to conform to the shape of the mold. This process may have taken place on a potter's wheel, the centrifugal force of which would help the glass slump uniformly. Lierke hypothesized that deep and shallow bowls were formed differently based on the type and shape of their rims.¹⁵⁷ Deep mosaic bowls, she suggested, were formed upside down over a convex mold and the contrasting spiral reticella trail was added to the rim afterwards, while shallow mosaic bowls were formed right side up over a concave mold, with the rim trail added to the flat disc prior to sagging. The same basic process of sagging into or onto a hemispherical mold was also used to manufacture monochrome glass bowls in this period. The foot, if present, was added either by using a second mold, as on the contemporary large monochrome footed bowls,¹⁵⁸ or by applying a simple trail of glass to the base.

Reticella bowls, though somewhat similar in appearance, were formed quite differently.¹⁵⁹ Unlike mosaic bowls, reticella canes were made by twisting together one or more opaque glasses with a colorless glass, creating the appearance of a three dimensional spiral set in a clear matrix. Rather than creating a flat plaque, the twisted cane was then applied directly to a convex mold set on a wheel. As the wheel turned, the glass pulled out from the cane and adhered to the vessel in a spiraling pattern. Another glass worker, possibly an apprentice, could smooth the interface between successive layers of spiral using a heat-resistant paddle, probably

¹⁵⁷ Lierke 2009, 41.

¹⁵⁸ Lierke 2009, 34.

¹⁵⁹ It is, however, entirely possible based on size and shape of mosaic and reticella bowls that the same hemispherical molds or mold prototypes were used for these two otherwise unrelated processes, indicating a degree of crossover in workshop methods.

of wood.¹⁶⁰ Like the mosaic cane bowls, reticella bowls also had an applied rim in a contrasting spiral pattern. This winding principle is conceptually much closer to glass forming methods used for core-form vessels and wound beads, both based on rotational principles, than for the sagging methods of mosaic cane and monochrome vessels. Nevertheless, similar spiral canes used for the rims indicates there was some crossover in workshop production.

The origins and chronologies of mosaic glass bowls are still unclear, despite attracting abundant scholarship. Egypt, and specifically Alexandria, has often been credited with the manufacture of these elaborate bowls.¹⁶¹ However, while mosaic techniques for inlays and beads were certainly practiced, there is no archaeological evidence whatsoever that indicates Alexandria or anywhere else in Egypt produced mosaic glass vessels during the Hellenistic period.¹⁶² It is also possible that they were manufactured in Italy, based on the relatively large number of excavated examples found in select burials along the Italian Adriatic coast, in Canosa and Todi.¹⁶³

Another open question in Hellenistic glass production is whether prefabricated, intermediary production elements such as mosaic canes and monochrome and polychrome blanks for sagging were made by primary glass makers or the secondary glass workers. Both monochrome and polychrome rods have been found in secondary workshop contexts at Delos, Rhodes, Beirut, and Jerusalem.¹⁶⁴ Monochrome rods from Jerusalem and Rhodes include

¹⁶⁰ Grose 1984a; Lierke 2009, 40.

¹⁶¹ E.g. Harden 1968b; Barag 1985, 87. The notion of exclusively Alexandrian production has been somewhat discounted in the glass scholarship but persists in non-specialist literature, e.g. Pollitt 1986, 256. See further, Chapter 4.

¹⁶² Nenna, Picon, and Vichy 2000, 107. See further discussion, Chapter 4.

¹⁶³ As suggested by O'Hea 2002, 257. The evidence of glass from Italy is discussed in Chapter 3.

¹⁶⁴ Delos: Nenna 1999, 160-166, No. F1-F89. Rhodes: Weinberg 1969, 149, Pl. 84. Beirut: Foy, Picon, and Thirion-Merle 2007. Jerusalem: Israeli and Katsnelson 2006, 417-419, No. GL59-GL67. Israeli and Katsnelson interpret these objects as stirring rods or cosmetic applicators (i.e. finished products) rather than fabrication elements, despite the unequivocal context of production. Some rods, especially those with heat rounded ends, may have indeed been

flattened end sections left over from where the end of the cane was pulled with pliers, suggesting that at least some intermediary production occurred in secondary workshops. More elaborate pieces, however, might have been exported from a few centers out to local secondary workshops. One possibility is that Egyptian workshops, which specialized in elaborate mosaic inlays throughout the Hellenistic and Roman period, exported mosaic glass canes along with raw glass. Regardless of whether prefabricated elements were manufactured in primary or secondary workshops, they required a complex, multi-staged manufacturing process in which the glass had to be heated, annealed, and cooled several times before the completion of the finished object. Such manufacturing methods required a significant investment of craftsman time and skill, fuel, and material resources. This complexity likely contributed to the perceived and intrinsic value of the final object.

Mosaic and reticella bowls of the Hellenistic period are limited to elite luxury contexts and are rare in domestic assemblages.¹⁶⁵ Indeed, a list of where Hellenistic mosaic vessels do *not* appear is revealing: none have been published from the Athenian Agora,¹⁶⁶ Beirut Souks area,¹⁶⁷ or Tel Anafa,¹⁶⁸ and they are also absent from almost all eastern Mediterranean islands, including Cyprus and Crete.¹⁶⁹ Elsewhere, mosaic or reticella vessel fragments appeared in very small quantities relative to the rest of the glass corpus. Examples include two bowl fragments

final products for sale, but those with tong impressions from pulling (GL 64) are almost certainly manufacturing debris.

¹⁶⁵ Many are also in museum or private collections, their findspots unknown (Goldstein 1979, No. 460-555. Many of these pieces are likely Early Roman, not Late Hellenistic.; Grose 1989, No. 184-209; Stern and Schlick-Nolte 1994, No. 73-77, 86-88). Since the vast majority of these pieces are intact, 'museum-quality' specimens, they most likely came from illegally excavated burials.

¹⁶⁶ Weinberg and Stern 2009, 2.

¹⁶⁷ Jennings 2004-2005, 54.

¹⁶⁸ Grose 2012. Three mosaic bowl fragments were found at the site, all in early Roman-period strata. They are unparalleled elsewhere and so assumed to be Roman, though Grose considers this date "quite tentative" (53).

¹⁶⁹ Other than the 89 examples from Delos (Nenna 1999, No. B1-B89), the only mosaic glass vessels published from the Aegean are single examples each from Minoa on Amorgos and from Kos (Triantafyllidis 1998, No. 14; 2006a, No. Y280).

from Maresha,¹⁷⁰ four from Jebel Khalid,¹⁷¹ and several from Cosa.¹⁷² By contrast, mosaic and reticella bowls were not uncommon at Delos, where they first appeared the end of the third century.¹⁷³ Other significant sites and contexts containing these polychrome pieces include burial groups from Canosa in Apulia (southern Italy)¹⁷⁴ and Tsopani Rachi near Pylos.¹⁷⁵ Exquisite pieces were also found in the Antikythera shipwreck, where they presumably belonged to the cargo load of the ship rather than the crew's personal goods.¹⁷⁶ No firm chronological development is yet established, as they are tied inextricably to the problem of the Canosa vessels. Current understandings are that Hellenistic mosaic vessels seem to have continued more or less without any major change from the mid-third to mid-first centuries.

Gold Glass Bowls

The earliest documented use of glass over thin gold foil was in the fifth century glass and chryselephantine workshop of Phidias at Olympia. Glass may have helped preserve the gold and magnify its luminescent properties, effectively achieving more with less.¹⁷⁷ In the fourth century, Macedonian workshops made elaborate small scale narrative figures with gold foil and covered them with glass, then set them as inlays for funerary couches and in bezels for finger rings.¹⁷⁸ It has been widely assumed that Athenaeus' description of two *ύάλινα διάχρυσσα* ("gold-

¹⁷⁰ Jackson-Tal 2004, 24; Jackson-Tal 2005, 51, fig. 2.3.

¹⁷¹ GN.31, GN.39, GN.22, and GN.15. The first three are from the Acropolis, the other from the Domestic Quarter (O'Hea 2002, 257-259). O'Hea has speculated that the presence of mosaic bowls at Jebel Khalid was due to Seleucid military contacts with the Mediterranean (O'Hea 2005, 46).

¹⁷² A select few examples (e.g. No. 12) are dated prior to 25/15 BCE, but many of the polychrome bowls from Cosa are likely to be early Roman (Grose 2012).

¹⁷³ Nenna 1999, 35-55, No. B1-B52.

¹⁷⁴ Harden 1968b.

¹⁷⁵ Papathanasopoulos, Papathanasopoulos, and Hardy 2000, 36. This bowl, found with two monochrome pieces of similar shape, is now in the Pylos Regional Museum.

¹⁷⁶ Weinberg 1965; 1992, 103-110; Avronidaki 2012. The Antikythera vessels exhibit diverse decorative techniques, but their common base ring indicates they were produced in a single or closely related workshops.

¹⁷⁷ Schiering, Letsch, and Noll 1991; Schiering 1999. Stern (2008) tentatively credits Phidias with this innovation. Barag suggested that the eighth century painted glass inlay plaques from Nimrud were backed with gold foil, but there is no firm support for this theory (Barag 1990).

¹⁷⁸ Barag 1990; Ignatiadou 2002a; Adam-Veleni and Ignatiadou 2010.

embellished glasses”) in a procession sponsored by Ptolemy II Philadelphus, probably in 274, referred to gold glass bowls and therefore reflect their Alexandrian origins.¹⁷⁹ Stern and Schlick-Nolte, however, have argued that this date is too early for gold glass bowls, and the text instead refers to large plaques or trays of glass with gold similar to the finds from Macedonia, which were well-established by this time.¹⁸⁰

The process of manufacturing sandwich gold-glass vessels, in which the gold foil was completely encased in transparent glass, has been difficult to ascertain. For a long time, gold-glass bowls were thought to have been formed by independently casting or cutting two bowls, one smaller than the other, then fusing them together with a layer of gold patterning in between.¹⁸¹ The mechanics of this process would, of course, be quite challenging as the inner and outer bowls would have to be very close in size.¹⁸² Lierke has pointed out the extreme difficulties of this proposed method and its inability to adequately explain all observed features of the surviving fragments (especially the inward folded lip of the outer layer and the lack of bubbles between the glass layers). Instead, she proposed, glass workers created gold glass bowls using a multi-stage plunging process related to the pressing methods used to create bowls and cosmetic palettes as early as the eighth century.¹⁸³ Therefore, as in other modes of Hellenistic glass production, gold-glass bowl manufacture was developed from extant technologies and

¹⁷⁹ Athenaeus 5.199; Appendix, Text 1. For the passage as early evidence for gold glass vessels, see Harden 1968b, 41; Rotroff 1982, 329; Spaer 1993.

¹⁸⁰ Stern and Schlick-Nolte 1994, 109-110. Grose 1989, 351 also suggested that Athenaeus was referring to furniture or plaques with gold leaf.

¹⁸¹ This process is described most succinctly in Goldstein 1989.

¹⁸² In the words of von Saldern: “The outside dimensions of the inner bowl had to be equal to the inside dimensions of the outer one. (The difficulties of this sentence are nothing compared to the difficulties of making these two bowls)” (von Saldern 1959, 46).

¹⁸³ Lierke 2009, 38, cf. 27 for pressed objects. It is worth noting that this technique has yet to produce successful experimental results; during tests, the gold between glass layers disintegrates in the compressed heat of the glasses, which Lierke attributed to the nature of thin, commercially produced modern gold foil.

known working principles of glass and gold, adapted and adjusted to create new working methods and new forms.

Although the first quarter of the third century, as implied from the Athenaeus text, may be somewhat early for fully developed gold-glass vessels, they do first appear archaeologically in the third century, for instance in third century burial contexts at Gordion and Canosa.¹⁸⁴

Additional items without secure archaeological dates come from Mozdok in the Caucasus and Olbia in the Black Sea.¹⁸⁵ Two fragments from gold-glass bowls, including one possible waster, were found at the Kakoula site in Rhodes and dated to the late third century, although Weinberg noted that these fragments have much simpler patterns than the elaborate designs known from elsewhere, implying they may be earlier in the sequence or represent a different production tradition.¹⁸⁶ The only other known examples of Hellenistic gold glass vessels from archaeological contexts are a bowl with geometric and vegetal designs which was purchased in Jerusalem in the early 20th century and said to be from Maresha and a small wall fragment with gold-leaf sandwich design also found at Maresha.¹⁸⁷ Since so few fragments are known from secure contexts, the geographic distribution and chronological development of this important luxury item are still obscure.

Monochrome Tablewares

Colorless Vessels of the Fourth-Third Century

Transparent, colorless open tablewares were the glass vessels of choice in the fourth to early third century. Handleless shallow phialai and deeper skyphoi were the most common forms, but kantharoi, kalyxes, and occasional closed forms for cosmetic use (alabastra and

¹⁸⁴ Gordion: von Saldern 1959, 45, fig. 31; Jones forthcoming, No. G172. Canosa: Harden 1968b, No. 38, 39; De Juliis, Alessio, and Di Puolo 1989. See also Oliver 1969 with references.

¹⁸⁵ Adriani 1967; Kunina 1997, No. 48-49.

¹⁸⁶ Weinberg 1969, 147.

¹⁸⁷ Jackson-Tal 2004, 26; Jackson-Tal 2005, 52.

pyxides) were also manufactured. The shapes were typically curvilinear, with rounded bottoms, full bodies, somewhat constricted openings, and outward flaring rims. The exteriors were decorated with some combination of an omphalos base, floral petals, lanceolate leaves, rays, or almond lobes on the lower half to two-thirds of the body, and incised grooves which articulated the neck.

Pre-Roman colorless vessels were long considered to have been manufactured in closed molds, either by pouring molten glass into the mold or by placing chips of glass into the mold and heating it up. Both processes are known as casting, which is similar to ancient metallurgical practices.¹⁸⁸ Based on close autopsy of surviving vessels and experimental reconstructions of technology, Rosemary Lierke has argued that they were instead made by sagging a disc of glass over a rotating wheel.¹⁸⁹ Faint, roughly concentric, horizontal scratches on the interior and, less often, exterior surfaces of open vessels, she argued, are rotational marks from the surface of the mold, rather than cold-polishing marks. Although her theory has not been universally accepted, various finds from the secondary glass workshop at Rhodes – clay discs comparable to potter's wheels, metal, clay, and stone tools, and a burner to heat glass outside of a furnace – are best explained using her technological reconstruction.¹⁹⁰ After annealing, decoration was added to the exterior surface using cold cutting techniques.¹⁹¹

Despina Ignatiadou has documented around 110 known examples of colorless late Classical/Achaemenid and early Hellenistic (fourth-early third century) vessels. Of these, 87 have a secure or reasonably secure provenance, and only four predate the fourth century. The

¹⁸⁸ For description and illustrations of casting, see Stern and Schlick-Nolte 1994, 48-53. Transparent Assyrian glasses of the eighth-sixth centuries, like the Sargon Vase (a transparent light green jar inscribed with the name of Sargon II and found in the Northwest Palace at Nimrud) and related alabastron, were most likely cast (for a listing of Iron Age Assyrian glass vessels, see von Saldern 1959, 25-34).

¹⁸⁹ Lierke 1993, 1999, 2009; see also Stern 2011.

¹⁹⁰ Triantafyllidis 2000c, 194-195.

¹⁹¹ According to Bill Gudenrath (personal communication), cold cutting of glass was probably comparable to that of stone. See Mutz 1972; Ogden 1982, 144-150 for descriptions of this technique.

provenanced examples come from burials, temple deposits, and palace treasuries in Macedonia, Rhodes, Anatolia, and Mesopotamia with each group displaying distinct properties suggestive of regionalized production.¹⁹² An abundance of material from the Black Sea, particularly around the Kerch peninsula, may have been imported from any or all of these regional workshops.¹⁹³

Such decentralization of glass production as occurred in the fourth century, with several regional workshops supplying regional markets, is an important predecessor to the Hellenistic industries, as are the technologies, forms, and cultural behaviors employed in crafting glass drinking vessels. Colorless glass vessels manufactured in Macedonia or Rhodes were probably the first glass vessels to be made by sagging. These vessels were decorated with grooves, leaves, petals, and rays.¹⁹⁴ The functional form of these vessels – open bowls with no handles and rounded bottoms – also resumed as the primary shape of glass vessels of the late Hellenistic period. Macedonian and Rhodian production of colorless vessels appears to have stopped early in the third century, while the major Hellenistic glass vessel industry did not begin until the mid-second century. Despite this 150 year gap, the technologies, forms, and decorative patterns of Macedonian, Rhodian, and Syro-Palestinian sagged bowls are remarkably similar. A similar gap in the core-formed vessel sequence (see above) suggests that the apparent gap may have more to do with the current state of our data, with few well-dated deposits from the third century and the lack of a strong typology to enable identification of third-century glasswares when found out of context, than to a real discontinuity in the ancient world. Still, sagged glass manufacture certainly seems to have slowed in the third century relative to the proliferation of materials which can be firmly dated to the fourth century or later second century.

¹⁹² Triantafyllidis 2003a; Ignatiadou 2010, 422, Tables 39.1-2. For further discussion of the Macedonian industry, see Ignatiadou 2002a and Chapter 3, and of the Rhodian industry, see Triantafyllidis 2000b, 2000c, 2003b and Chapter 4.

¹⁹³ For the Black Sea material, see Chapter 3.

¹⁹⁴ See Ignatiadou 2009 for discussion of symbolic continuity of one of these motifs.

Early Hellenistic Monochrome Tablewares

Monochrome glass tablewares of the third through second century are poorly understood, due in part to the lack of firmly dated materials and partially to the absence of a robust typology by which to identify and describe these pieces. A select number of plain glass vessels have been found in burial assemblages of the third and second centuries alongside gold glass and mosaic bowls. The monochrome vessels of this so-called “Canosa Group” have received much less attention than their polychrome counterparts, despite their common co-occurrence.¹⁹⁵ Grose estimated that about 60 such vessels in about a dozen forms, thought to date to the third and second century, had been documented from Italy, Greece, Asia Minor, and the Black Sea.¹⁹⁶ The majority are plain hemispherical bowls, broad shallow plates, and footed skyphoi with and without handles; rarer forms are a lidded glass amphora now in the Antikenmuseum, Berlin, said to have been acquired in Olbia on the Black Sea,¹⁹⁷ and square cosmetic palates or plates with flat rims and concave depressions. The dates and find spots of most vessels in this group are poorly documented at best, but the few well provenanced examples indicate that they had a Mediterranean-wide distribution and cannot be limited to a particular production location or cultural group. The footed skyphoi, for instance, independently vary in color, the shape of the bowl, the angle of the rim, the size and detail of the foot, and the shape of the molded handle.¹⁹⁸

¹⁹⁵ Major treatments of the Canosa Group are: Harden 1968b; Oliver 1968b; Stern and Schlick-Nolte 1994, 97-115. Harden claimed that the monochrome vessels from the Canosa tomb group “require little discussion...(because) the shape is a natural and obvious one,” so they were of little help in identifying the date or provenance of this controversial group of glass vessels (Harden 1968b, 45). These issues are further discussed in Chapter 3.

¹⁹⁶ Grose 1989, 185-189, fig. 92.

¹⁹⁷ Platz-Horster 1995.

¹⁹⁸ As clearly documented by Harden 1980 in his discussion of a footed skyphos acquired by the Toledo Museum of Art in 1980. To his list of known examples in museum collections at the Metropolitan Museum of Art, Corning Museum of Glass, and Hamburg Museum, add one from the Izmir Museum found on Knidos (Lightfoot 1990, fig. 3), one from the Louvre (Arveiller-Dulong and Nenna 2000, No. 203), and three from tombs in the Kurgan region of the Caucasus, now in the Hermitage Museum (Kunina 1997, No. 59-61).

They indicate continuity from the fourth century colorless glass traditions to the later Hellenistic and early Roman common tablewares.

In addition to the elaborate shapes of monochrome vessels found in Canosa-style burials are simpler forms of bowls with thick walls, curvilinear sides, and outward flaring rims. One such example is an intact bowl from Corinth with wide exterior grooves.¹⁹⁹ Other examples of irregularly formed glass bowls dated before c. 150 come from Delos, Gordion, and Kedesh.²⁰⁰ These vessels have not been well studied or recognized in the literature, but they represent an important intermediary stage in glass manufacture between the colorless tablewares of the fourth century and the later second century Syro-Palestinian bowls. Their significance, as Grose has emphasized, is that “they document the first concerted effort by ancient glassmakers to manufacture entire dinner services from glass, both serving and drinking pieces.”²⁰¹ As such, they demonstrate experimentation with form by producers and an inclination by consumers for an expanded repertoire of functions.

Late Hellenistic Syro-Palestinian Bowls

Around the middle of the second century, glass vessels began to appear more commonly in urban and domestic assemblages throughout the eastern Mediterranean. These new products were distinct from their predecessors in the standardization of their shape, color, and decorative technique. They were first identified in large quantities during the 1960s and 1970s excavations at Tel Anafa in northern Israel, where thousands of fragments, representing hundreds of vessels, were found in stratified contexts dated between 125-75 and the late first century BCE-CE.²⁰²

¹⁹⁹ Davidson 1952, No. 584

²⁰⁰ Nenna 1999, No. C1-C5; Jones forthcoming; Larson, Berlin, and Herbert in preparation.

²⁰¹ Grose 1989, 187.

²⁰² For the initial discovery and publication of this important glass assemblage, see Weinberg 1970. Final publications of the site and the glass, respectively, are: Herbert 1994; Grose 2012. The Anafa evidence is discussed in greater detail in Chapter 5.

The first major typology of this class of drinking bowls was put forward by David Grose in 1979 in a highly influential article.²⁰³ Grose identified four major types: grooved bowls (Group A), fluted bowls (Group B), ribbed bowls (Group C), and linear cut bowls (Group D) (Figure 5). Group A grooved bowls are hemispherical, conical, or ovoid in shape with rounded bottoms and a variable number of horizontal incised grooves cut into the interior or, less often, exterior of the vessel. Group B fluted bowls are usually hemispherical, with vertical rounded flutes cut or molded on their exteriors. Both Groups A and B are made from a similar range of natural glass colors, most commonly amber, greenish yellow, light green, blue, and colorless, and they are found in contexts of similar date, beginning in the second century. Grose concluded that these forms were products of a Syro-Palestinian glass industry which was “either inaugurated or greatly expanded” during the second and first centuries.²⁰⁴ Groups C and D are somewhat later, and do not seem to predate the mid-first century. They are differentiated from Groups A and B by their flattened bases, increased range of forms, and more vibrant colors, although naturally occurring colors also continued. Linear cut, and especially ribbed, bowls are now commonly recognized at early Roman sites and were manufactured in numerous workshops in the eastern and western Mediterranean.²⁰⁵

²⁰³ Grose 1979. Modifications to or subdivisions of Grose’s basic four part scheme have been put forward by Marie-Dominique Nenna, Sarah Jennings, and Daniele Foy, among others, but their typologies are site-specific and therefore not universally applicable (Nenna 1999; Jennings 2004-2005; Foy 2005; see also the comments in Nenna 2007a).

²⁰⁴ Grose 1979, 65.

²⁰⁵ Even fragments of ribbed bowls are quite distinctive, and their thick walls facilitate survival and identification. Fragments of linear cut bowls, on the other hand, are difficult to distinguish from grooved bowls, and as a result it is often unclear whether the simpler forms of conical and hemispherical grooved bowls continued to be manufactured into the first century CE alongside flat bottomed deep and shallow hemispherical linear cut bowls. Some archaeological reports now suggest that grooved bowls did continue into the Roman period and were not universally replaced by ribbed or linear cut bowls.

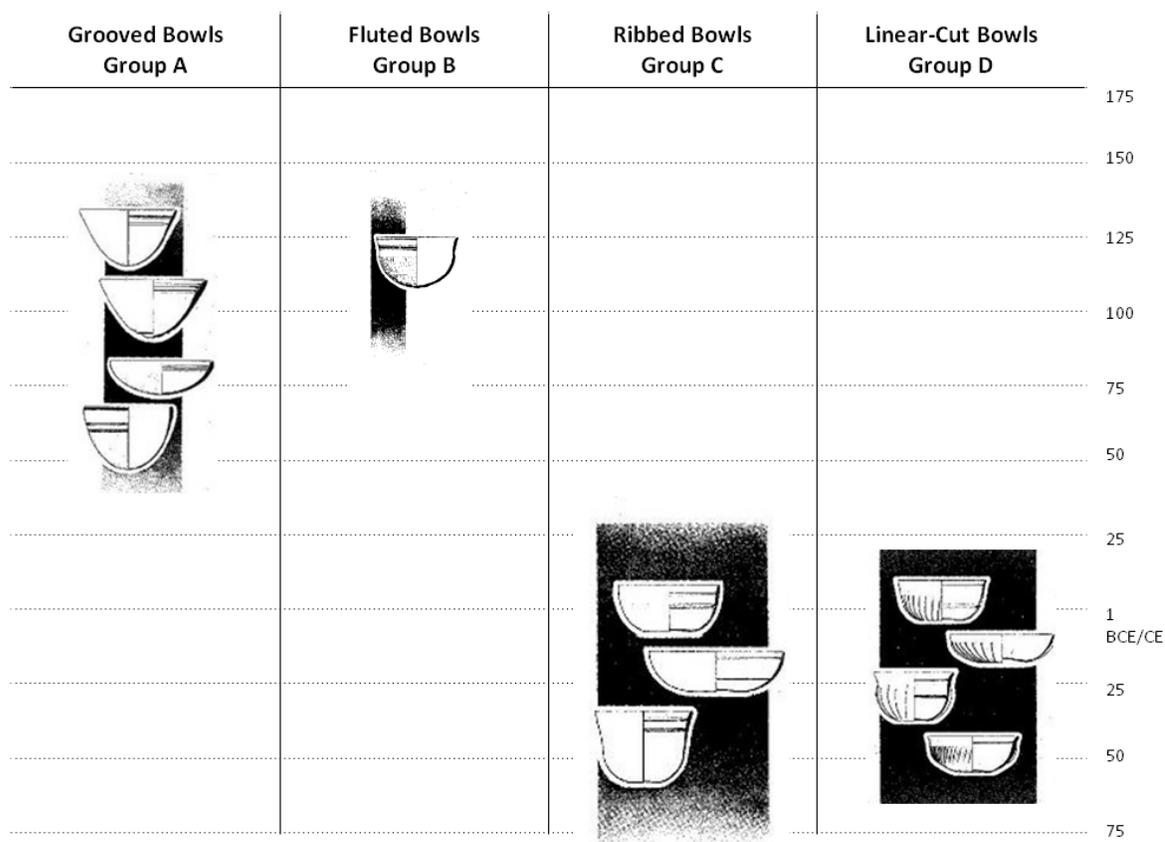


Figure 5. Forms and dates of Grose's Syro-Palestinian bowls (after Grose 1979, 56)

The dating of Grose's Groups A and B in the later part of the second and early first centuries places them in the heart of the Late Hellenistic period, and grooved bowls in particular are recognized as signature type finds of the era.²⁰⁶ Since Grose's initial identification based on preliminary work on the Anafa assemblage, additional decorative styles have been identified, including beaded bowls with linear hatched patterns, floral bowls with petal and leaf exterior decorations, and other variant, non-standardized, exterior cuttings, all of which still adhere to the general shapes, colors, and dates of Groups A and B. The strong association of the vessels with

²⁰⁶ Jackson-Tal 2004, 17; Grose 2012, 14.

Syro-Palestinian production has also withstood the publication and synthesis of additional finds.²⁰⁷ Distribution patterns, literary evidence, and the tentative identification of first century workshop sites in Beirut and Jerusalem indicate that these bowls were almost certainly produced in multiple cities in Syro-Palestine, but additional workshops outside this region cannot be ruled out.

Site and Context	Context Date (BCE)	Evidence for Dating	Glass Forms and Quantities
Amman, Third Terrace	3 rd century	Unknown	Hemispherical grooved bowl (1)
Athens Agora, Middle Stoa building fill (H-K 12-14)	4 th century-180, with some "late Hellenistic"	Numismatic, ceramic	Colorless kantharos (1); fluted bowl (1); hemispherical(?) exterior grooved bowl (1)
Athens Agora, pit below Stoa of Attalos (R 12:5)	Before 145/2 nd century	Historical	Hemispherical grooved bowl (1)
Ashdod, Stratum 4b	Before 147	Historical, ceramic	Hemispherical grooved bowl (1)
Akko, Montmusard	225-125	Ceramic	Deep hemispherical exterior grooved bowl (1)
Athens Agora, cistern filling (F 15:2)	150-110	Ceramic, stamped amphorae	Ovoid grooved bowl (1)
Baratti B shipwreck	140-120	Ceramic	Deep hemispherical grooved bowl (4)
Yavneh-Yam, Area A	138-110	Historical, numismatic	Grooved bowl (1)
Tel Kedesh, Squatter period	c. 135-125	Numismatic, stamped amphorae, ceramic	Conical (1), ovoid (5), and hemispherical (2) grooved bowls
Tel Anafa, Hell 2A	c. 130/125-110	Numismatic, stamped amphorae	Conical grooved bowls (>4); Fluted and floral bowls (2)
Maresha	Before 111/108	Historical, numismatic	Grooved bowls (13); Fluted bowls (6); floral bowls (2)
Tel Anafa, Hell 2B-C	c. 110-75	Numismatic	Conical (33), hemispherical (16) and ovoid (15) grooved bowls; fluted and floral bowls (6)

Table 4. Pre-100 BCE deposits containing Syro-Palestinian type bowls

²⁰⁷ Jackson-Tal 2004. The evidence for a Late Hellenistic Syro-Palestinian glass industry is discussed extensively in Chapters 5 and 6.

Table 4 shows all known attestations of Late Hellenistic glass bowls of Groups A and B in contexts dated before circa 100. Notable omissions here are glasswares from Delos, Beirut, and Jerusalem, all of which had glass bowls in second century contexts but their stratigraphic dates are often quite broad, either spanning the entire century or extending into the first. The earliest occurrence is a hemispherical grooved bowl from Amman, Jordan, said to come from a third century context.²⁰⁸ Better data come from a series of deposits in the Athenian Agora; however, although three vessels of the relevant type are attested in fills dated before 150, there is good reason now to suspect these fills were not entirely sealed or as closely dated as was initially claimed.²⁰⁹ The most robust and regionally appropriate data comes from several sites in Israel with destruction layers associated with the conquests of the Hasmonean dynasts of Judaea in the second half of the second and early first centuries. Three southern Syro-Palestinian sites have yielded glass from Hasmonean destruction levels: Ashdod, dated before 147, Yavneh-Yam, dated between 138-110, and Maresha, dated before 108.²¹⁰ By far, the greatest quantity and diversity of material comes from Maresha, which was the latest to be abandoned. This picture is confirmed by the assemblage from Tel Anafa, where glass bowls are present after about 130 and appear in ever greater quantities in the following decades.²¹¹ However, except for Tel Anafa, the stratigraphic dates for these assemblages are largely based on written accounts of Hasmonean

²⁰⁸ From the 'third terrace', locus 1.10.02 (Dussart 1998, No. 1.8).

²⁰⁹ The fill under the Middle Stoa, which was constructed around 180 BCE, contained several glass vessels; this context has often been cited as an early date for the types, but the recent publication by Weinberg and Stern makes clear that there was some "late Hellenistic" contamination in the fill, so 180 cannot be taken as a firm date (Deposit H-K 12-14, Weinberg and Stern 2009, No. 13, 17, 36). The same is true for the pit below the Stoa of Attalos, which has been variously dated in Agora publications to before 145 or the 2nd century Deposit R 12:5 (Weinberg and Stern 2009, No. 22). According to their deposit summary (pg 185), this deposit is dated to the 2nd century in Agora XXVII, p. 232 but to before ca. 145 in the List of Deposits in the Agora Office. Better is an ovoid bowl from a cistern context dated from 150-110 BCE (Deposit F 15:2, Weinberg and Stern 2009, No. 18). This is "Hellenistic Group E" (for which see most recently Rotroff 1997, 450).

²¹⁰ Ashdod: Barag 1967, 1971. Yavneh-Yam: Fischer and Jackson-Tal 2003, 35, n. 5. Maresha: Levine 2003b, 2003a; Jackson-Tal 2005.

²¹¹ Grose 2012, 4-5.

destructions, the historicity of which has lately come under scrutiny.²¹² The best near-continuous sequence for glass vessel use in second century Syro-Palestine comes from Tel Kedesh, less than 10 kilometers from Tel Anafa, where a precise stratigraphic sequence from the mid-second century indicates that grooved drinking bowls became available to inland Levantine markets sometime during the 130s.²¹³

Like other forms of pre-Roman monochrome glass bowls, Syro-Palestinian bowls of Groups A and B were manufactured by sagging a disc of glass over a concave or convex mold. Keith Cummings was the first scholar to suggest that sagging was used to manufacture late Hellenistic bowls.²¹⁴ While this technology is now commonly accepted, the erroneous term “casting” (and the French equivalent “moulée”) is still widely used.²¹⁵ Monochrome glass plaques, in contrast to polychrome mosaic plaques, were quite simple to manufacture and took advantage of the natural tensile properties of glass. To form the plaque, a chunk of unworked glass was heated to about 850° Celsius, at which point it would slowly melt into a flat disc. The viscosity and surface tension of the glass ensured that, no matter the original shape of the chunk, the resulting disc would be near to circular with smooth and even edges.²¹⁶ After cooling to below 830° (or reheated to above 625°), the resulting disc was then placed over a concave or convex mold, over which the glass slowly sagged into shape. Decoration could be done in multiple ways: the flutes of Group B vessels were probably molded from the mold itself; the ribs

²¹² Ma 2013; Honigman 2014.

²¹³ Larson, Berlin, and Herbert in preparation.

²¹⁴ Cummings 1980, 23-36.

²¹⁵ Grose 1984a; Tait 2012, 52-54. David Grose and Marianne Stern both changed their minds about production techniques used for these vessels when presented with new experimental data. In 1979, Grose still considered Syro-Palestinian bowls to have been chip cast in two part molds (Grose 1979, 57), and as late as 1994, Stern did not think sagging was used on vessels until the mid-second century (Stern and Schlick-Nolte 1994, 110).

²¹⁶ Stern 2008a, fig. 21.3; Lierke 2009, 7. This technique was the same as that used to make plain glass counters, discussed below.

of Group C were hot worked with a tool; and the grooves of Groups A and D were ground with abrasives once the glass had fully cooled back to a solid state.

Since the basic idea of sagging glass over a mold to make open vessels was already extant by the fourth century, the major innovation of the mid-second century, then, was not a technological one, but one of increased scale and simplicity of production. Syro-Palestinian drinking vessels, as noted by David Grose, are thus “the first glass vessels commonly used for tableware in antiquity.”²¹⁷ As such, Syro-Palestinian bowls are a key, though not exclusive, form of Hellenistic glass by which to investigate the transition of glass from a luxury good into a (relatively) common tableware in households of the Late Hellenistic period.

Non-Vessel Objects

Closed glass cosmetic containers and open glass tablewares were not the only forms of glass circulating in the Hellenistic world. Glass as a material also came to be used in a wide variety of non-vessel objects over the course of the last few centuries BCE.

Adornment: Beads and Pendants

Beads, pendants, and other objects of personal adornment were the most common non-vessel glass objects of the Hellenistic period. Although beads were among the first objects manufactured from glass after its invention in the Early Bronze Age, glass beads remained rare relative to other materials until the Hellenistic period, when they became much more popular. Glass beads outnumbered their stone and bone counterparts at key Hellenistic sites of the eastern Mediterranean and Near East from which appropriate data has been published: at Jebel Khalid, roughly two-thirds of all beads were of glass or faience;²¹⁸ at Tel Anafa, 73% of inventoried

²¹⁷ Grose 1979, 54.

²¹⁸ O'Hea 2002, 261.

beads and pendants were made of glass (100 of 143 beads and 13 of 14 pendants);²¹⁹ and Crowfoot anecdotally reported that the Hellenistic and Roman beads from Samaria, “as far as they can be placed [chronologically], seem to be mostly of glass with a few cornelians and agates.”²²⁰ In contrast, the few areas from which comparative data is available indicate that glass beads were not widely used before the Hellenistic period. At Tel Michal, only 12% of the beads from the Persian period cemetery were made of glass, whereas 71% of the beads from Hellenistic and later strata were glass.²²¹ In Egypt, glass beads replaced faience beads at some point during the Ptolemaic period. In the University College London collection of Egyptian beads (most of which are from Petrie’s expeditions) glass composes only 0.7% of Ptolemaic but 73.3% of Roman and Coptic period beads, while faience beads account for 84.8% of Ptolemaic but only 4.5% of Roman and Coptic beads.²²² Spaer has suggested that the rise in numbers of glass beads relative to faience beads in Egypt is due to the reduced cost of glass which put glass objects “within the reach of almost everybody.”²²³

This proliferation of production quantity was facilitated not just by the increased availability of raw glass in the market place, but also by the growing variety of manufacturing techniques used to manufacture beads. The earliest method was winding. Wound beads are made by heating the end of a glass rod to a molten state, then wrapping the softened glass around a cylindrical implement called a mandrel, which when removed forms the perforation hole of the

²¹⁹ Larson forthcoming-a.

²²⁰ Crowfoot 1957, 391.

²²¹ Kertesz 1989a, 374. Of about 250 beads from the Persian period, 85 (57%) are described as frit, 64 (26%) stone, 34 (13%) plaster, and 30 (12%) glass; the rest are bone or shell. Only seven total beads, five of which were glass, were recovered from strata dated later than c. 300 BCE, so the overall quantity is not significant although the pattern corresponds to the evidence from other Syro-Palestinian sites.

²²² Xia 2014, 139. Xianai suggests the demarcation is probably not so stark as it seems, as some of the “Roman” beads are likely to be Ptolemaic but are classified as Roman. Regardless of specific quantities and the absence of precise chronology, it seems certain that glass effectively replaced faience as the major material used for beads in Egypt over the course of the Ptolemaic to early Roman period.

²²³ Spaer 2001, 30.

bead. Wound beads may have a ‘tail’ of glass from where the source glass was detached from the finished bead, slight ridges or bumps in the body of the bead, or a raised area around the perforation due to uneven application of the glass along the mandrel. A second technique was drawing, in which a bundle of molten glass is formed on the end of a rod, punctured with a tool, and then pulled out to form a long hollow cylinder. This cylinder is then sectioned into individual beads either by hand or using a segmenting mold such as the one found at Kom el-Dikka in Alexandria.²²⁴ Maud Spaer has suggested that the introduction of drawing as a bead-making technology during the Hellenistic period was a mass production technique which helped glass outcompete faience.²²⁵ The third method of bead making in the Hellenistic period was by folding. Folded beads were made by wrapping a monochrome or polychrome flattened plaque around a mandrel. They are readily identifiable by the presence of a seam on the bead parallel to the perforation.

Folding, winding, and drawing were all practiced in the late third to early second century bead factory at the Kakoula site in Rhodes, proving that diverse manufacturing techniques could be employed in a single workshop.²²⁶ I have suggested elsewhere that a correlation between the shape of the bead and its preferred manufacturing technique helped optimize production speed and costs.²²⁷ Spherical and other rounded beads tended to be wound or drawn, while elongated cylindrical beads were often folded.

While the majority of ancient glass beads were simple monochrome colors and basic shapes, Hellenistic period beads were also decorated in much the same ways as contemporary vessels. Perhaps the oldest type of decorated bead (still common today in the eastern

²²⁴ For a detailed description of the process, see Spaer 2001, 46-48; for the Kom el-Dikka mold, which is late Roman, Rodziewicz 1984, 239-243, Pl. 72.

²²⁵ Spaer 2014, 210, n. 6.

²²⁶ Weinberg 1969. See full discussion, Chapter 4.

²²⁷ Larson forthcoming-a.

Mediterranean and Near East) was the eye bead, named for patterns of concentric circles resembling eyes. Traditionally, the eyes were predominantly made by sequentially applying two or more dots of contrasting colors to the surface of the bead. In the Hellenistic period, possibly in the third century, segments of mosaic canes began to be used for the eyes, although bead makers continued to use the earlier stratified technique as well.²²⁸ Other patterns of mosaic cane decoration on beads do not seem to have been used before the second half of the first century, after which mosaic faces, flowers, checkerboards, and millefiori canes came to be popular early Roman bead types.²²⁹ Trailed beads, made by applying contrasting colors to the body of the bead, were a particularly popular Late Hellenistic type.²³⁰ Late Hellenistic trailed beads resemble Group III core-form vessels in their blue, yellow, and white colors and dragged festooned, feathered, or spiral patterns. The final form of bead decoration was gold glass. Beads made with gold have a similar composition to vessel gold glass, with gold foil sandwiched between layers of colorless glass. Although about 200 gold glass beads were found in the Kakoula bead workshop at Rhodes, where they were probably manufactured, they are rarely reported from other eastern Mediterranean Hellenistic sites.²³¹ Gold glass beads have been documented in third century contexts in the Black Sea, and they also appear in second and first century burials at Meroe.²³² Spaer has suggested that they were more numerous in the

²²⁸ Spaer 1987b; 2001, 77-87. Mosaic vessels decorated with eye canes have been found at Meroe, Zeugma, Delos, and Petra, mostly in contexts of the first century Dunham 1957, 87, fig. 59; Keller 1997, No. 2; Nenna 1999, No. B79; Grossmann 2013, No. G6.

²²⁹ Spaer 2001, 118-122. Other than eye beads, mosaic cane beads are absent from late Hellenistic type sites, and may have been a product of the emergent Italian glass industry of the Augustan period.

²³⁰ Spaer 2001, 99-105. Trailed beads have been published from Hellenistic period contexts at Rhodes, Delos, and Tel Anafa Weinberg 1969, 145-146, Pl. 79b; Nenna 1999, No. E39-E41, E73-E75, E183-E190; Larson forthcoming-a, No. BD44-BD54, among others.

²³¹ Weinberg 1969, 146, Pl 79d.

²³² Dunham 1957, 78, 83, 95, 105, 109, fig. 51 and 71; Alekseeva 1978, 27-32. See also Spaer 1993, 18-19 for other find spots, including a list of several unpublished examples from sites in Israel,

Hellenistic and early Roman period than their publication record indicates: they may have been heavily weathered or not properly identified by excavators.²³³

Pendants are differentiated from beads by their asymmetrical mode of suspension, by which the object was suspended rather than centrally perforated. The most characteristic form of late Hellenistic pendant was manufactured in the round in a two-part mold that left a distinctive seam along the sides and base of the pendant.²³⁴ These small pendants, typically one and a half to three centimeters tall, are known in a wide variety of shapes. Examples include a head with the physiognomy of a black African, the Egyptian deities Baubo, Bes, and Harpokrates, the goddess Cybele seated on a lion's head throne, a cluster of grapes which has been thought to represent Dionysius, and a bull's head with star, possibly indicating a sacrifice to Serapis. The most common color is dark blue or purple appearing almost black; shades of yellow, lighter blue, and colorless glass are also present. Recent excavation and publication of examples from narrowly dated contexts at Tel Anafa, Yavneh-Yam, Jebel Khalid, and Delos position the type firmly in the late second to early first century.

Similarities in production technique and style have led to a widespread consensus among scholars that all pendants from this group were made in a single as yet unknown production center. Barag suggested the Phoenician coast, based on the concentration of pendants in the eastern Mediterranean;²³⁵ Arveiller-Dulong and Nenna similarly proposed southern Syro-Palestine, because the color of the glass used in the pendants is similar to the colors of glass bowls which are also thought to have been made in this region at that time.²³⁶ Others have

²³³ Spaer 1993; 2001, 130-135.

²³⁴ Polychrome, rod formed anthropomorphic and zoomorphic pendants and beads were relatively common Mediterranean objects after the sixth century, but they do not seem to have been manufactured after the late fourth or early third century. For a full typology and discussion of this "Phoenician-Punic" type, see Seefried 1982.

²³⁵ Barag 1985.

²³⁶ Arveiller-Dulong and Nenna 2011.

suggested Egypt, and specifically Alexandria, as the probable locale of production due to the Egyptian motifs and amuletic style of certain of the pendants.²³⁷ Also in support of this argument is the fact that Egyptian glass workshops in the Hellenistic period seem to have specialized in molded production of small glass objects, particularly inlays and amulets.²³⁸ On the other hand, interest in Egyptian deities and Egyptianizing motifs was quite widespread throughout the Hellenistic world, and not at all limited to Egypt itself.²³⁹

However, mold-made pendants may have been made in multiple workshops in the Mediterranean basin. This hypothesis is supported by the various methods used to make the suspension loop on these otherwise similarly manufactured objects. Suspension loops on mold-made pendants were created using at least three distinct techniques: molding, pulling, and attaching. These techniques appear variously on different pendant types, with no one to one correspondence between pendant style and bale formation method. For molded bales, the distinguishing feature is the sharpness and regularity of the bale.²⁴⁰ The suspension hole was either part of the mold or, more likely, later drilled through the cooled glass. Drawn bales were hand-made by pulling excess glass from the top of the molded pendant, or possibly adding an extra dollop of softened glass and then shaping it.²⁴¹ The hole was then formed either by pulling and piercing, as the Freer example seems to be, or pulled out, looped around, and reattached to the pendant body leaving an opening in the middle, as on the Anafa head. A third way of

²³⁷ Spaer 2001; Fischer and Jackson-Tal 2003.

²³⁸ See Chapter 4.

²³⁹ E.g. Barrett 2011.

²⁴⁰ Examples of molded bales identifiable from the published images or drawings are: a colorless Cybele with unknown provenance (Arveiller-Dulong and Nenna 2011 no. 29), a green grape cluster said to be from Izmir (Arveiller-Dulong and Nenna 2011 no. 40), and an African head pendant now in the Toledo Museum of Art (Grose 1989, No. 645).

²⁴¹ Identifiable examples of drawn bales include: an African head from Tel Anafa in a dark glass (Larson forthcoming-a, No. BD 84), another African head in dark glass now in the Freer Museum of Art (Ettinghausen 1962, fig. 60), and a dark blue cluster of grapes possibly from Syria but now in the Louvre (Arveiller-Dulong and Nenna 2011, No. 41).

creating a suspension loop was to form the bale separately, either by hand or in a mold, and then attach it to the pendant.²⁴² Bales made in this way tend to be somewhat asymmetrically placed on the pendant, or ‘flop over’, likely because the glass was too hot when attached. These loops also tend to have larger perforations than those made in a mold. Therefore, despite basic similarities in production, mold-made pendants were likely made in multiple workshops, by individuals trained in different production practices.

Furniture Inlays

Glass was also used for decorative inlays in religious, funerary, and domestic furniture during the second half of the first millennium. Inlays were made in open, reusable stone or terracotta molds. These molds could have been filled in one of three ways: by pouring molten glass into the open mold (sometimes called casting, but more properly a ‘hot pour’); by placing crushed, cold glass frit in the mold and then putting the mold into a kiln for the glass to melt and fuse (‘chip casting’); or, an intermediary method, by placing large, semi-heated, flat glass slabs over the mold and using a tool to press the glass into the mold shape (‘sagging’). Stern has argued against the hot pouring method for ancient glass due to the technical complexity of mitigating the temperatures of the glass and the mold to prevent adhesion, and the requirement that glass must be at 1150° or higher to be adequately poured, a temperature only marginally attainable using ancient fuels.²⁴³ Chip casting, probably also used for other mold-made products like pendants and astragaloï, was probably the preferred method due to low fuel costs and minimal waste of raw materials.²⁴⁴

²⁴² Identifiable examples of attached bales include: an Harpokrates from Yavneh-Yam (Fischer and Jackson-Tal 2003), and a Bes pendant found at Utica and now in the Louvre (Arveiller-Dulong and Nenna 2011, No. 31).

²⁴³ Stern and Schlick-Nolte 1994, 48; Stern 1995, 35, fig. 17b.

²⁴⁴ For further discussion of glass working temperatures, waste, and the importance of fuel conservation in ancient glassworking, see Chapter 6.

Prior to the Hellenistic period, elaborate polychrome glass inlays were used in furniture and architectural fittings in palatial, religious, and funerary contexts of Mesopotamia, Syria, Greece, and Macedonia throughout the Bronze and Iron Ages. Polychrome rods, probably core-formed and trail decorated, are thought to have been inset into monumental doors at the thirteenth century Elamite site of Tchoga Zanbil near Susa.²⁴⁵ Mosaic plaques and inlays set into ivory have been found in eighth and seventh century levels in palaces at Arslan-Tash and Nimrud in Assyria and Megiddo and Samaria in Palestine.²⁴⁶ In Greece, the earliest known examples, which include terracotta molds, glass cullet, and glass wasters used to produce small, simple inlays of petals and drapery folds, have been credited to the sculptor Phidias' work on the chryselephantine statue of Zeus at Olympia in the late fifth century.²⁴⁷ In the fourth century, Macedonians used colorless glass inlays on wooden funerary couches, chests, sarcophagi, and the wooden shield from Vergina.²⁴⁸

Glass inlays had a different trajectory in Egypt, where they were made from richly colored, opaque, and polychrome glass. The earliest true cut cane, fused mosaics appear on inlay panels during the mid-fourth century.²⁴⁹ Several workshops producing glass plaques and inlays are known from mid-late first millennium Egypt. Three are temporary workshops in temple complexes, producing opaque and mosaic inlays for use in temple *naoi*: Ayn Manawir, dated to the second half of the fifth century, and Tebtunis in the Fayum and Gumaiyama near Tanis, both

²⁴⁵ Ghirshman 1966, Pl. 78, 98; Goldstein 1979, No. 5-7.

²⁴⁶ von Saldern 1966a, 632; Barag 1985; Grose 1989, 76; Barag 1993. These inlays have occasionally been associated with Phoenician craftsmanship, although there is no clear evidence for this. See discussion, Chapter 5.

²⁴⁷ Schiering, Letsch, and Noll 1991; Schiering 1999.

²⁴⁸ Ignatiadou 2002a, 18-20.

²⁴⁹ Nenna 1995; see further Chapter 4.

dated to the early third century.²⁵⁰ Similar materials were found in the three bead workshops at Delos and in the first century glass blowing workshop in Jerusalem.²⁵¹

Gaming Pieces: Counters and Astragaloi

One of the most common glass finds on Hellenistic domestic sites, both urban and rural, are oval shaped glass drops with a flat underside and rounded top. Indeed, they are so common as to be rarely inventoried, saved, or fully published, and are therefore not well studied or understood. At least some were used as gaming pieces, based on the fact that they have often been found in sets with two contrasting colors. Single finds, larger objects, and more brightly colored examples might also have been used as decorative furniture inlays or even imitation stone bezels in rings. They typically range in size from 0.8-2.0 cm in diameter and occur in a wide variety of colored as well as colorless glass.²⁵² They are perhaps the simplest of all glass objects to make, requiring only small quantities of glass and a hot fire to melt small glass chunks into rounded objects, similar to the process used to create monochrome plaques for sagging vessels.²⁵³

Although they are commonly assumed to be Roman, glass gaming pieces were certainly in use by the fourth century and became more common over the course of the Hellenistic period. Several sets of glass counters with two or three colors, along with a few bone dice and roof tiles with the pattern of the game have been found in male burials at Pydna in northern Greece.²⁵⁴ Weinberg notes “about 850” examples in various colors, including a few with polychrome stripes

²⁵⁰ Nenna, Picon, and Vichy 2000, 107. Gumaiyama was identified and excavated by Petrie in the late 19th century. Petrie, Griffith, and Murray 1888, 42-44; Cooney 1976, 112-123. Evidence of production includes limestone and terracotta molds, along with waste glass, mosaic bars, and anthropomorphic and hieroglyphic inlays.

²⁵¹ Nenna 1999, 147-156; Israeli and Katsnelson 2006, No. GL82-GL87.

²⁵² Spaer 2001, No. 548.

²⁵³ Lierke 2009, 7.

²⁵⁴ Ignatiadou 1999; 2002a, 22.

or spots, and a range of sizes from the factory debris at the Kakoula site in Rhodes.²⁵⁵ Eighteen glass discs were found together with five molded glass astragaloi and a terracotta Eros figurine in a deposit dated before 145 in the Persian and Hellenistic Administrative Building at Tel Kedesh.²⁵⁶ They also appear in varying quantities in Hellenistic contexts from the South Stoa at Corinth, a sanctuary near Sidon, burials at Canosa, and various domestic and urban spaces at Delos, Amorgos, Knossos, Kos, Jebel Khalid, Tel Anafa, and Samaria.²⁵⁷

The other common form of glass gaming token was the astragalus, made in imitation of animal knucklebones which were used like dice for gaming.²⁵⁸ Like the mold-made pendants discussed above, glass astragaloi were manufactured using a two part mold which left a seam around the circumference of the object. One of the earliest known examples comes from the late third to early second century factory debris at Rhodes.²⁵⁹ They are typically found in burials in association with sets of glass counters, as well as in civic and domestic sites where games would have been played. Several glass astragaloi and counters were found, for example, in pre-146 well deposits in the South Stoa and Southeast Building at Corinth.²⁶⁰ Hellenistic burials containing one or more glass astragaloi and multiple gaming counters have been excavated at Ibiza, Cyrene, Apollonia Pontica, and Samothrace.²⁶¹

²⁵⁵ Weinberg 1969, 146, Pl. 80b.

²⁵⁶ Adi Erlich is working on the publication of this group.

²⁵⁷ Corinth: Several unpublished from the South Stoa well deposits (MF 8410, MF 8411, MF 8417, MF 8947, MF 8955, MF 8981, MF 9182, MF 9186, MF 9193), and others which seem not to have been saved based on notebook information. Sidon: Dunand 1978. Canosa: De Juliis, Alessio, and Di Puolo 1989, 393, 490. Delos: Nenna 1999, 148-151, No. E216-E246. Amorgos: Triantafyllidis 1998, No. 107-120. Knossos: Price 1992, 454. Kos: Triantafyllidis 2006a, 160, Group 14. Jebel Khalid: O'Hea 2002, 259-260. Anafa: Larson forthcoming-b. Samaria: Reisner, Fisher, and Lyon 1924, 332.

²⁵⁸ See Greaves 2012, 183-191 for a useful discussion of the physical properties of bone astragaloi and their use in divination.

²⁵⁹ Weinberg 1969, Pl. 80a.

²⁶⁰ Romano 1994, No. 112-113 (astragaloi) and No. 114 (counter); Jackson-Tal 2008, 126.

²⁶¹ Ibiza: Vives y Escudero 1917, Pl. 34. Cyrene: Thorn 2005, 601-602, fig. 325-327. Apollonia Pontica: Mladenova 1963, No. 999a-d. Samothrace: Dusenbery 1998, 1136.

Implements: Stirring Rods, Cosmetic Sticks, and Spindle Whorls

While more common in the Roman period, glass rods and other cosmetic implements began to appear in the Hellenistic period, although their precise function at this early date is unclear.²⁶² Fragmentary bits of straight and spiral, and polychrome and monochrome rods are known from several Hellenistic sites. Based on find spots of these objects in the manufacturing debris at Rhodes, Delos, and Jerusalem, they were more likely used in manufacture and production than for cosmetic purposes.²⁶³ There do not seem to be any glass cosmetic rods, spoons, or other similar implements from well-dated contexts at late Hellenistic domestic type sites like Tel Anafa or Jebel Khalid.

Glass spindle whorls, both decorated and undecorated, also began to appear in the Hellenistic period although they became more common during the Roman period.²⁶⁴ Like beads, they were made by winding soft glass around a mandrel, but they are differentiated from beads by their flat bottom, rounded dome top, and wide diameter. Examples of glass spindle whorls from stratified Hellenistic contexts include several from Delos and Jerusalem and single examples from Tel Anafa and Jebel Khalid.²⁶⁵

Mosaic Pavements and Glass Tesserae

Not to be confused with fused polychrome mosaic vessels, mosaic pavements containing small fragments of glass were displayed in the wealthy houses of the Mediterranean world during the Hellenistic and Roman periods. Glass tesserae have been identified in houses and civic buildings at Dor, Delos, Rhodes, Samos, Pergamon, Alexandria, Carthage and Kerkouane,

²⁶² Spaer 2001, 262.

²⁶³ Weinberg 1969, Pl. 81a; Nenna 1999, No. E262-E269; Israeli and Katsnelson 2006, No. GL59-67.

²⁶⁴ Spaer 2001, 259-260.

²⁶⁵ Nenna 1999, No. E115-E123; Israeli and Katsnelson 2006, No. GL72-GL81; O'Hea 2011b, No. GN.74; Larson and Erdman forthcoming.

Malta, Empuries in Spain beginning around the end of the third century.²⁶⁶ They are in general excluded from my study, since mosaic makers required no pyrotechnic knowledge to set glass chunks into mortar, and therefore the makers of mosaic pavements operated in a different technological frame than those making other forms of glass objects. Mosaic pavement making may, however, be entwined with discard and recycling stages in the life cycle of glass; broken fragments from glass vessels, especially brightly colored ones, could easily have been collected, chipped, and polished to size for use in a mosaic. The use of recycled (or repurposed) broken glass in mosaic pavements may have been a low cost alternative to imported colored stones. Glass tesserae for mosaics could also have been made from cut pieces of monochrome canes. At Delos, all the colors of glass present in mosaic pavements were also attested in monochrome canes found at the site.²⁶⁷

Tradition and Innovation

From this review of the nature of raw glass, organization of workshops into primary and secondary production, and the major technologies and forms of glass vessels and small objects in the second half of the first millennium, several important trends in the industry as a whole can be identified. First, many of the major products of Hellenistic glass were anticipated in their technologies and functions by the Macedonian glass industry of the fourth century, although the contexts of use and deposit were often quite different. Sagged glass vessels with grooved, vegetal, and ray motifs are hallmarks of Macedonian production. Vessels with comparable decoration and manufacturing methods were the signature objects of the late Hellenistic period, along with glass furniture inlays and gaming counters made in open molds. The question of

²⁶⁶ For Carthage and Kerkouane, Yacoub 2000; for Dor, Wootton 2012; for all others, Guimier-Sorbets and Nenna 1992, with sources. See also Guimier-Sorbets and Nenna 1995; Boschetti et al. 2008.

²⁶⁷ Guimier-Sorbets and Nenna 1992, 1995; see also Boschetti et al. 2008

revival or continuity between the fourth and second centuries remains open due to the historical and archaeological uncertainties of the third century and lack of good, datable eastern Mediterranean contexts.

Second, similarities in decorative methods and forming technologies between certain classes of vessels and objects suggest that vessel and object workshops may have been more closely associated than has previously been recognized. Technologies of winding around a rod or a core, melting glass into rounded discs or plaques, sagging into a mold, and two-part molding were used to create a wide variety of objects, which were also decorated with similar forms of mosaic plaques and canes, sandwich gold glass, and dragged and spiral trails. These similarities are borne up by excavated workshops at Rhodes and Jerusalem, where vessels were manufactured alongside beads, inlays, and other small objects. Furthermore, both vessel and bead secondary workshops would have been supplied with raw glass from primary workshops, implying a degree of connectivity between geographically remote areas which may also have facilitated communication and the spread of trends, such as molded glass pendants, from region to region.

Third, Hellenistic glass workers seem to have been conservative in their use and adoption of technology but innovative in their application of those base technologies to new types of product. Certain forms of later Hellenistic glass were much less carefully and deliberately crafted than the products of the preceding centuries, although the more elaborate forms continued to find a market alongside the more ubiquitous forms. The variety and quantity of glass objects available to consumers in the mid-first century, particularly those living in the eastern Mediterranean, compared to those of the fourth and third century was staggering.

With the basic structure of the types and nature of the evidence and relationships between the objects themselves in mind, the following chapters present region by region and site by site examinations of how glass objects were manufactured, used, and deposited by the peoples of the Hellenistic world. Chapter 3 explores the largest geographic but smallest quantitative scale: the luxury glass market which served elite consumers throughout the ancient Mediterranean world and beyond.

Chapter 3.

Glass as Luxury Object: The Hellenistic Mediterranean and Beyond

Trade in Glassware during the First Century BCE

In 1900, sponge divers found remains of a shipwreck just off the island of Antikythera, midway between the southern end of the Peloponnese and Crete. Underwater excavations by the Greek state from 1900-1901, and again by a team led by Jacques Cousteau in 1976, revealed objects for trade and daily life including sculpture, pottery, jewelry, games, amphorae, glassware, and the eponymous Antikythera Mechanism, on a ship in route from the eastern Mediterranean to, presumably, Rome. Although initial investigations placed the date of the wreck in the second half of the first century, a thorough study of the pottery and utilitarian objects pushed the date back to the second quarter of the first century, with the majority of the evidence (stamped amphora handles, pottery, and the mechanism itself) pointing to a date early in that range, probably before 70.²⁶⁸

The glass vessels from the Antikythera wreck have been described as “exceptionally rare and beautiful...luxury wares which, like the other works of art the ship was transporting, were probably destined for the markets of Rome.”²⁶⁹ Twenty different glass vessels, ranging in preservation level from intact to solitary fragments, have been identified from Antikythera to

²⁶⁸ Weinberg et al. 1965. The cessation of Delos, thought to have been one of the ship’s ports of call before its wreck, as a major Roman free port in 69 also suggests a date prior to that year.

²⁶⁹ Avronidaki 2012, 132.

date. They include one core-form Group III alabastron,²⁷⁰ eight monochrome vessels, and eleven polychrome mosaic footed bowls.²⁷¹ The polychrome bowls, including five vessels decorated with spiral mosaic canes, four network bowls, and one striped mosaic bowl, are relatively homogeneous in size, color, and manufacturing technique. With the exception of one cane mosaic bowl with a widely flaring rim, all of the vessels also share the same shape of a plain rounded rim, small hemispherical body, and conical applied ring base. Colors throughout the assemblage are largely homogeneous as well, with almost all vessels including some combination of blue, purple, opaque white, opaque yellow, and colorless glass. Several of the cane mosaic bowls also include large ‘tesserae’ filler segments of a turquoise color which was created by sandwiching blue-green glass around a white center. Two of the mosaic vessels were patched with a twisted trail in order to fill the gap between the body of the vessel, which has sagged unevenly, and the applied rim.²⁷² Based on the above criteria, all of the polychrome vessels were most likely manufactured in a single workshop.

The eight monochrome vessels consist of two Grose Group A grooved bowls, a Group B fluted bowl, three footed skyphoi, a wide petal decorated bowl with lobes, and a unique molded bowl with olive leaves emerging from a stylized vase.²⁷³ Unlike the mosaic bowls, the

²⁷⁰ The core-form piece may have been part of the crew or a passenger’s personal items rather than a trade good. The ship probably carried passengers based on the remains of at least one woman identified in the skeletal material recovered from the wreck (Kaltsas, Vlachogianni, and Bouyia 2012, 60). Also present on the ship were several small objects in glass which likely belonged to the crew or passengers, among them an anthropomorphic ithyphallic pendant (No. 19) and four counters (No. 16a), thought to have been used for gaming rather than as furniture insets (Gadolou 2012). These attest to the presence of small scale glass objects integrated into the daily lives and routines of sailors.

²⁷¹ Avronidaki 2012. Weinberg initially identified and published 11 vessels (Weinberg 1965), but this number has been augmented by the recovery of additional material by the Cousteau expedition and subsequent study which re-designated a few fragments as distinct vessels. Renewed explorations of the site in 2014-2015 by Woods Hole Oceanographic Institute and the Greek Ephoria of Underwater Antiquities reportedly have uncovered more fragments of glass vessels as well as a piece described as a “glass ‘chessman’ board game element” (*Marine Archaeologists Excavate Greek Antikythera Shipwreck* 2015).

²⁷² Avronidaki 2012, No. 105 and 114. See Lierke 2009, 40-41 for parallels and full description of this technique.

²⁷³ While lacking parallels in glass, Weinberg identified several similar metal bowls which are also dated to the first half of the first century BCE (Weinberg 1965, No. 1).

monochrome vessels are quite diverse, with a wide range of shapes (skyphoi, shallow hemispherical, deep hemispherical, and conical), sizes (rim diameters range from 10-24 cm), colors (emerald green, amber, blue-green, and colorless), and manufacturing techniques (interior grooves, applied handles and bases on the skyphoi, lobed decoration, and an array of mold-pressed motifs including lanceolate leaves, olive leaves, fluting, and both rosettes and stars on the bases). Even the finishing on the rims is different: the skyphoi appear to be roughly ground, while the conical grooved bowl has a softer, fire-finished rounded look. Christina Avronidaki, the most recent scholar to study and publish the Antikythera glass vessels, followed conventional wisdom in proposing that the monochrome vessels were manufactured in Syro-Palestine while the polychrome vessels originated in Egypt, presumably Alexandria.²⁷⁴ However, she also noted the similarities of the vessels found on the ship to those found in excavations in the city of Delos and suggested that all vessels may have come onto the ship at Delos, which served as a transshipment port for objects originating in the eastern Mediterranean and destined for western Mediterranean markets.

The Antikythera shipwreck provides a firm chronological foundation of glass objects manufactured in the second quarter of the first century and demonstrates that such glasswares were exported from eastern Mediterranean production centers to (presumably) the western Mediterranean. The small quantities of comparable glass found in the west indicate that this transport was not a major commercial activity, but rather small-scale importation of a specialty product. By contrast, the early Augustan period Tradelière shipwreck off the southern coast of France contained at least 200 monochrome Syro-Palestinian type glass bowls.²⁷⁵ Are the

²⁷⁴ Avronidaki 2012, 133. Weinberg also, very tentatively, suggested Alexandria as the “likeliest place” for the manufacture of the mosaic vessels, apparently due to a paucity of other options (Weinberg 1965, 34).

²⁷⁵ Feugère and Leyge 1989. The main forms are Grose Group A and D grooved and linear cut hemispherical bowls, ribbed bowls, and a small number of plain S-walled bowls and straight sided beakers. The homogeneity of the cargo

differences in cargos between these two wrecks, dated less than half a century apart, simply an accident of recovery, or did the nature of trade, exchange, and glass itself change over the course of the first century? The Antikythera and Tradelière shipwrecks represent the two faces of the glass industry in the late Hellenistic period: one looking backward to the first 1500 years of glass as a relatively rare and expensive luxury, and the other looking forward to the Roman and Byzantine glass industry which made glass a common consumer product, accessible to anyone who could afford pottery.

This chapter examines the origins and status of glass as a luxury product in regions with direct or indirect connections to the glass manufacturing centers of the eastern Mediterranean during the fourth to first century. My goal is to examine the types of glass objects which functioned as luxury consumer products, to identify their contexts of production and consumption, to determine actual and ideological functions, and finally to trace changes in any of the above over time or space. Who had access to luxury forms of glass? How was it used? Are there geographic or chronological changes in use patterns which suggest a shared cultural system, or does the presence of glass simply indicate shared trade networks?

I first investigate the nature of luxury products and how to identify them archaeologically. I contend that luxury goods are by definition scarce, curated, controlled, and conspicuous, and I employ both the characteristics of the object itself and its archaeological context to investigate attitudes toward the object in its original production and use contexts. This definition will be used to identify sites, regions, and contexts in which glass was consumed luxuriously, beginning with the origins of glass as a luxury product in the Bronze, Iron, and Classical periods and culminating in the glass workshops of fourth century Macedonia. I then

in size (approximately 12 centimeter diameters) and color (yellow and yellowish) is consistent with a single origin for the glass.

survey areas in which glass objects were consumed luxuriously from the mid-fourth to mid-first centuries, including the Northwestern Mediterranean, North Africa, Italy, mainland Greece, the Black Sea, Asia Minor, the Near East, and Kush. I use this evidence to identify patterns of use and deposit contexts, functional groups, and chronological and geographic variability in luxury glasswares, and finish with a consideration of luxury glass as an expression of a cosmopolitan elite identity.

Defining Luxury

The identification of luxury objects in the archaeological record has often been colored by the problems of circularity and modern bias. Rarely defined explicitly, luxury objects have been implicitly identified as those found in particular types of contexts, considered aesthetically pleasing to the modern eye, and/or made from materials perceived to be valuable. Any object which meets one or more these criteria is defined as a luxury object, and its presence is considered to be indicative of elite activity and meaning. In other words, a luxury object is something used by elite individuals and elite individuals are those who use luxury objects.²⁷⁶ When we find one, we find the other. The controversy regarding the economic and social value of painted pottery aptly demonstrates just how little we know about the ascribed and economic values of objects in the ancient world and how easily modern aesthetics influence scholarship on Classical art relative to the ancient value of objects.²⁷⁷

²⁷⁶ One example of this circularity is the large quantity of glass found at the rural residence of Tel Anafa in northern Israel. The presence of thousands of Late Hellenistic glass vessel fragments led the early excavators to identify the site as a luxury elite villa, but subsequent work on the small finds indicates that Anafa was also a working farmstead. It has long been assumed that the abundant glass vessels were used exclusively by the wealthy elite villa owners, not by their slaves or servants, *simply because they are glass*, but the large quantity of vessels consumed over a short amount of time suggests the picture may be more complex. The glass at Tel Anafa is discussed further in Chapter 5.

²⁷⁷ Vickers 1987; Boardman 1988; Gill 1991. See also Poblome 2004 on the relative costs of Roman sigillatas.

Luxury has been defined in opposition to necessity in historical and philosophical paradigms.²⁷⁸ This characterization has been criticized as overly reductionist, as any material good which provides more than simple food, water, and shelter needs would be considered a luxury by this definition. However, economists and anthropologists have long recognized that the basic requirements of human survival and appropriate standards of living are culturally as well as biologically determined. Other definitions of luxury have embraced such contingencies, relating luxuries to an established cultural living standard as well as personal preference.²⁷⁹ For instance, most modern Americans now consider running water and electricity to be a basic expectation of sanitation in their homes, but less than 100 years ago these were only available to the wealthy. Worldwide, the majority of contemporary people still do not have clean running water or reliable electricity.²⁸⁰ Therefore, luxuries are highly relative and culturally variable, and objects and services which originate as luxuries for a wealthy elite few commonly ‘trickle down’ to a wider range of society, at which point they become commonplace and eventually standard.

In an archaeological context, definitions of luxury are few.²⁸¹ The most explicit is that drawn from the writings of sociocultural anthropologist Arjun Appadurai, who distinguished luxury objects “as goods whose principal use is *rhetorical* and *social*” (italics original).²⁸² These uses are signaled by at least one of the following characteristics: 1) restriction to elites, 2)

²⁷⁸ Berry 1994.

²⁷⁹ See discussion in Csaba 2008, based largely on Mandeville 1729; Sombart 1922.

²⁸⁰ See Vanek 1978. In 2014, an estimated 1.6 million Americans (less than 1%) did not have indoor plumbing. There is cultural patterning to the data: households without running water were largely geographically isolated, in very poor communities, or located on Indian reservations (Ingraham 2014). By contrast, a United Nations Human Development Report in 2006 estimated that 2.6 billion people (40% of the world population) lived without indoor plumbing and proper sanitation facilities.

²⁸¹ Also falling under the mantle of “luxury” are exotic, prestige, and inalienable goods. *Exotic* objects are those which are unfamiliar or foreign to the user or acquired over a distance. *Inalienable* objects lack commodity status, and their value is vested in their removal from the exchange system. *Prestige* goods carry a heightened social status which is transferred from the object to its owner by virtue of association. Gifts, votives, and dedications are luxury goods deployed for specific rhetorical purposes (Mauss 1925; Weiner 1985; Appadurai 1986b; Gregory 2015). As I take it here, the term luxury serves as an overarching term which includes all these intersecting facets of meaning. See also Lesure 1999

²⁸² Appadurai 1986a, 38.

difficult or complex to acquire, resulting in perceived or actual scarcity, 3) capacity to signal complex social messages (“semiotic virtuosity”), 4) appropriate consumption patterns which require specialized knowledge, and 5) linkage with body, person, and personality. According to Appadurai, luxury is vested not so much in a certain type of thing as the way a thing is perceived and consumed. Similarly (and in the same influential volume), Colin Renfrew defined value as “a property that is assigned to an object in a manner that arises from the social context in question, and it is to some, usually significant, extent arbitrary.”²⁸³ This definition emphasized the social and rhetorical value of luxury objects over inherent material properties.

Appadurai’s working definition has received general acceptance among archaeologists and anthropologists,²⁸⁴ but I know of no explicit application of his characteristics to a specific body of archaeological material. One reason for this neglect may be that Appadurai and Renfrew’s culturally relativist definitions present certain logistical problems for the archaeologist. If the identification of luxury goods is context dependent instead of embedded in intrinsic attributes of the object itself, then the identification of any given object as a luxury requires its excavation context to be known. However, many ancient luxury goods have become modern luxury commodities, and their modern economic value has made them fodder for museum and private collections with the result that their original provenance has been lost.

Finding Luxury in the Archaeological Record

In order to identify luxury objects in the archaeological record, the broad definitions of Appadurai and Renfrew must be applied to specific, archaeologically identifiable characteristics of objects. An operational approach provides a middle range connection between theoretical abstractions and specific forms of material evidence in order to make explicit the criteria by

²⁸³ Renfrew 1986.

²⁸⁴ E.g. Ferguson 1988; Flad and Hruby 2007.

which a concept can be identified and then interpreted. Only in this way can the problem of circularity be avoided: in this case, defining luxury products as those used by elites, and in turn identifying elites by the presence of presumed luxury products. Appadurai's characteristics of luxury can be operationalized by identifying archaeological correlates for the five characteristics of luxury goods he identified.²⁸⁵ I suggest that luxury objects in the archaeological record exhibit one or more of the following four characteristics:

- 1) Luxury objects are *scarce*. This rarity is exhibited both quantitatively (in regards to the volume of material and objects) and qualitatively (by the relative inaccessibility of the object due to its consumption within a limited range of functional spheres).
- 2) Luxury objects are *curated*. They are treated with deliberation and care during their use life and especially in their disposal. In accordance with their economic, social, and political value, they most often enter the archaeological record intentionally in funerary assemblages, dedications, or deposits. Unless that deposit is later disturbed, curated objects are often recovered intact by archaeologists. Heirlooms are another form of curated object.
- 3) Luxury objects are *controlled*. Such control can occur at any stage in the life history of an object. The raw material used to produce objects may be regulated, specialist producer knowledge may be held secretly, objects may not be available for sale in an open market, and use may be restricted legislatively or socially.²⁸⁶

²⁸⁵ My approach is somewhat inspired by and modeled upon Katina Lillios' critical and operational examination of heirlooms in the archaeological record, not just as something "old" but rather carrying a range of possible meanings which should in some way be expressed through the object itself and/or its find context (Lillios 1999).

²⁸⁶ Sumptuary laws of fourth century Greece and Augustan period Rome indicate that governments of the ancient world controlled certain forms of display (Berry 1994, 63-86).

- 4) Luxury objects are *conspicuous*.²⁸⁷ They stand out from their surroundings, either by virtue of their inherent properties (aesthetics, size, shine, or color) or their prominent display during ceremonies and rituals.

While some of these characteristics of luxury objects may be intrinsic to the object itself, it bears noting that luxury items are also expected to be relative and mutable between cultural contexts. Like indoor plumbing or (possibly) Greek vases, a luxury in one region or context may not be a luxury in another; the same object, or type of object, can be sacred or mundane depending on its treatment. For this reason, context is paramount, and an object ought not *prima facie* be labeled as a luxury object based on its fundamental properties such as material, aesthetics, or level of craftsmanship. Nor can these properties be entirely overlooked, for objects which represent an investment of skill, time, energy, and rare materials are more *likely* to be treated as luxury objects than objects which are the product of less skill, time, energy, and common materials.

With these characteristics in mind, I turn now to an examination of glass vessels and objects in the archaeological record which display these features and may therefore be identified as luxuries. I begin with a brief overview of the historical contexts of luxury glass from its origins in the Early Bronze Age to the fourth century. I then examine a variety of geographic regions and sites that display luxury patterns of glass consumption with technological and stylistic connections to the eastern Mediterranean production centers.

Luxury Glass in the Bronze, Iron, and Classical Periods

Bronze Age Glass Objects

Based on its scarcity, curation, control, and conspicuousness, glass was exclusively a luxury product during the Bronze and Iron Ages. The earliest known man made glasses are

²⁸⁷ See Veblen 1899 (2000).

chunks of raw glass from late third millennium contexts at the Sumerian sites of Eridu and Eshnunna.²⁸⁸ The genesis of the material itself likely resulted from experimentation with faience, a vitreous substance made from powdered quartz, and vitreous glazes, which were used to cover tiles, bricks, and pottery.²⁸⁹ Absent many finds or any textual references, very little is known about the first 800 or so years of glass manufacture. The few known objects suggest that these very early glasses shared two characteristics: they were colored and formed in ways which resembled semi-precious and precious stones (especially lapis lazuli, turquoise, and carnelian), and they were found in palaces or other areas with explicit royal connections. The royal association suggests that the materials and knowledge of glass working may have been attached to the palace economy. The resemblance to stone is somewhat more ambiguous in meaning, and it is unclear whether glass was considered more or less of a prestige object than its stone correlates.²⁹⁰

These early trends continued into the Late Bronze Age, when the first glass vessels appeared. They were probably made in northern Mesopotamia.²⁹¹ Early glass vessel makers experimented with and developed many techniques of manufacture which continued to be used for over a millennium, including core-forming, mosaic fusing, and trail decoration. According to Grose, the homogeneity of colors, shapes, decorative patterns, and technologies of sixteenth-fifteenth century Mesopotamian glasswares, which have been found almost exclusively in

²⁸⁸ Oppenheim et al. 1988 (1970), 83.

²⁸⁹ Grose 1989, 45; Henderson 2013, 14-16. The circumstances of the discovery of glass are ambiguous; Henderson remarked that Bronze Age glass production was "very much an elite pursuit," while its technological origins in metal and faience production were not (17); Nicholson, on the other hand, has suggested that glass and faience workers were either the same individuals or considered members of the same craft (Nicholson et al. 2007). Faience contains the same raw materials as glass but is fired at a lower temperature, with the material and the object both crafted in a single stage, rather than the two-stage process necessary for glass.

²⁹⁰ Akkadian cuneiform tablets referred to "lapis lazuli from the mountain" and "lapis lazuli from the kiln", suggesting that stone and glass occupied similar semantic fields as well as artistic production modes (Oppenheim 1988 (1970), 9-15).

²⁹¹ Sixteenth-fifteenth century glass objects have been found at Nuzi, Tel al-Fakhar, Tel al-Rimah, Tek Brak, Assur, and Nineveh, as well as Atchana/Alalakh, Ur, Babylon, and Dur-Kurigalzu (for a summary of sites with bibliography, see Oppenheim 1988 (1970), 83; Grose 1989, 46).

temples, residential palaces, and graves, indicated that they were luxury objects “made by an elite corps of craftsmen for an aristocratic or priestly clientele.”²⁹²

Further confirmation that Mesopotamian glass craftsmen were attached to the royal palace economy comes from cuneiform tablets from the library of Assurbanipal at Nineveh. These texts are dated to the mid-seventh century but were probably copied from late second millennium Assyrian texts, themselves possibly adopted from Old Babylonian traditions. The texts detailed the ritual procedures and technical steps used to manufacture raw and colored glasses. With the exception of these “glass texts,” glassmakers do not appear in administrative records of the Near Eastern kingdoms, and little is known about the actual conditions of their workshops. Leo Oppenheim suggested that this lack of evidence for administrative oversight indicated that the material itself was not regulated by the royal palace, or that glassmaking and glassmakers operated at such a small scale that they attracted minimal bureaucratic attention.²⁹³ However, glass, glass products, and possibly glass workers almost certainly circulated among the palaces of the Late Bronze Age as prestige gifts, fostering goodwill among rulers and creating a suite of luxury goods with similar materials and iconography which Marian Feldman has called an “international artistic *koine*.”²⁹⁴

From Syria, glass vessel technology spread to Egypt by the mid-fifteenth century, where it may have been introduced by glassmakers taken captive by Egyptian forces during campaigns to Syria during the reign of Tuthmosis III (r. 1479-1425).²⁹⁵ Egyptian glass workers adopted the techniques of the Mesopotamians to create typically Egyptian shapes and forms which had been well established in pottery, faience, and stone. Most vessels were closed shapes, used to hold

²⁹² Grose 1989, 46-47.

²⁹³ Oppenheim 1988 (1970).

²⁹⁴ Feldman 2006. See also Henderson 2013, 130-144.

²⁹⁵ Suggested by Harden 1968a, 48 and repeated Grose 1989, 49; Whitehouse 2012, 14.

oils, perfumes, incense, and cosmetics for religious ceremonies, anointing, and treatment of the dead.²⁹⁶ Workshop sites from this period have been identified in the palaces at Thebes and Amarna, signaling attached production and careful control of the raw material, production knowledge, and/or manufactured object by the royal court.²⁹⁷ In addition to vessels, glass objects manufactured in the Bronze Age included furniture and wall inlays, jewelry insets, cylinder seals, molded beads and pendants, and small figurines: objects quite similar to the functional forms and technological traditions of the Hellenistic period one thousand years later.²⁹⁸

Some trade in raw glass occurred during the Late Bronze Age, as indicated by the presence of over 150 blue glass ingots on the Ulu Burun shipwreck, which sank in the fourteenth century off the southern coast of Turkey.²⁹⁹ One possible destination for the cargo was mainland Greece, where a local tradition of open casting of glass flat ornaments emerged in the Late Helladic II-III period. These ornaments were transversely perforated, flattened beads with geometric or floral patterns in molded relief on the front and plain backs from the open mold. Preliminary chemical analyses have suggested that the raw glass was imported from Egypt and Mesopotamia, most likely as a royal gift.³⁰⁰ Mycenaean glass objects entered quotidian non-royal or ritual contexts more frequently than glass objects elsewhere in the Late Bronze Age world, perhaps because the Mycenaean Greeks were not acquainted with “appropriate” consumption habits as were established in Egypt and the Near East and failed to restrict or

²⁹⁶ Grose 1989, 50-51.

²⁹⁷ On the workshop at Amarna, see Nicholson et al. 2007; on New Kingdom Egyptian glass production as a royal monopoly, see Cooney 1976.

²⁹⁸ Cf. McCray and Kingery 1998, 5: “these traditions [of core-forming, mosaic, molding, and casting] continued through the Hellenistic period.”

²⁹⁹ The cargo also included an assortment of numerous other “luxury items” of the Late Bronze Age world: ivory, ostrich eggs, gold vessels, cylinder seals, amber, gold, and silver jewelry, bronze weapons, tin and copper ingots, and pottery from Canaan, Cyprus, and Mycenae (Bass 1986; Özet 2000).

³⁰⁰ Bass 1986, 282; Walton et al. 2009.

control access.³⁰¹ As in Mesopotamia, textual evidence suggests that glassworkers may have been attached to the palace: a set of tablets found at Mycenae recorded the distribution of an unknown commodity to assorted professionals, including fullers, augers, and glassworkers. The word for glass (kyanos) also appears in the Linear B archive from Pylos, referring to its use as an inlay on weapons and palace furnishings, along with gold and ivory.³⁰²

Iron Age and Classical Glass Objects

Like most long distance trade goods and luxury products, glass virtually disappeared from the archaeological record after the Late Bronze Age collapse. Although current work on the Late Bronze Age-Early Iron Age transition is closing the “Dark Age” gap (c. 1200-900),³⁰³ the only surviving glass products from this period are scattered and poorly dated evidence from Mesopotamia. In post-Amarna Egypt, glass making and working ceased altogether. Glass products only reappeared on a limited scale in Egypt after c. 600, and a distinctive local industry only emerged around the 30th Dynasty (c. 380-343).³⁰⁴ Plain monochrome glass beads continued to appear in deposits around the Mediterranean, and trailed eye beads in triangular shapes are the most common readily identifiable glass object of the Iron Age.³⁰⁵ Larger, conspicuous luxury vessels were almost entirely absent.

The first trace of an Iron Age glass renaissance comes from ninth century Hasanlu.

Inlays and beads recovered from the site demonstrate knowledge of mosaic glass fusion

³⁰¹ Nightingale claimed that small glass ornaments have been “found practically everywhere” where Mycenaean goods are present including the Peloponnese, Crete, and Thessaly, but they are quite rare finds in the Cyclades (Nightingale 1998, 217).

³⁰² On Mycenaean glass production, see Vermeule 1967; Nightingale 1998. Spaer has suggested that the small objects industry in Mycenaean Greece was much more significant than has typically been recognized (Spaer 2001, 60-62).

³⁰³ E.g. Langdon 2008 for the renaissance of the Dark Age in Greece. For the Dark Age gap in glass production, Barag 1985; 1988 (1970), 193-194; to my knowledge, no major new evidence has since appeared.

³⁰⁴ Cooney 1976. See Chapter 4 for the revival of Egyptian glass production in the fourth century.

³⁰⁵ Spaer 2001, 79-81. Three such examples were found in Geometric (eighth century) levels in the Temple of Apollo Daphnephoros at Eretria (Verdan 2013, 134-135, No. 443-445).

techniques, suggestive of some continuity of tradition from the Late Bronze Age. By the seventh and sixth centuries, several small scale, regionally distinctive glass traditions associated with different cultural and political groups emerged in Syria, Phrygia, Rhodes, Carthage, and Etruria.³⁰⁶ In the Near East, these industries were almost certainly attached to palaces, as they had been in the Bronze Age; find spots are limited to palaces and temples.³⁰⁷

The circumstances of the Mediterranean industries, where imperial regimes were less robust, were different. First millennium glass was once thought to have Phoenician origins based on literary evidence from the Roman period and the scattered appearance of glass in areas known to have been in contact with Phoenician traders during the eighth and seventh centuries. This hypothesis is now largely out of favor due to a near complete absence of glass objects in the Phoenician homeland in this period.³⁰⁸ The few surviving objects and their over-representation in museum collections relative to scientifically excavated materials indicates that most of these Iron Age and Classical glasswares were scarce and curated, reserved for elite use and deposited in burials or temple deposits where they remained intact until found by later excavators.

In Syria, a new glass production industry emerged in the eighth century. This industry was probably at least semi-attached to the royal courts of the Neo-Assyrians and, later, the Achaemenid Persians. Glass workers produced plain open hemispherical bowls and phialai along with closed forms of alabastra and jugs, including the famous Sargon Vase found in the

³⁰⁶ For regional glass industries of the Iron Age, see Grose 1989, 73-84 with references. Janet Jones (Jones 2005) has also argued strongly for an Iron Age glass workshop at Gordion. The confluence of political, cultural, and economic circumstances which resulted in emergence of numerous glass centers in this time period is fascinating but at present little understood.

³⁰⁷ As also suggested by Moorey 1999, 202, primarily on the basis of the Nimrud finds.

³⁰⁸ The biggest advocate for Phoenician influence on glass manufacture in the first half of the first millennium has been Dan Barag (see especially Barag 1985); for arguments against Phoenician origins, see recent discussion in O'Hea 2011a and an earlier argument in Fossing 1940, 78-82. The role of Phoenicia in first millennium glass production is discussed extensively in Chapter 5.

northwest palace at Nimrud, now in the British Museum.³⁰⁹ These monochrome, often colorless, pieces were once thought to have been chip cast in multipart molds, then ground and polished when cold using techniques comparable to the lost wax method of metal working. However, Rosemary Lierke has suggested that they were pressed into a plaster mold and a plunger was used to form the interior cavity.³¹⁰ Later forms possessed more elaborate decorative molded patterning which probably imitated contemporary metal vessels, as glass workers became more sophisticated in their craft. Vessels belonging to this group have been found in Iran, Mesopotamia, Asia Minor, Syro-Palestine, and Cyrenaica, in either palatial or religious contexts.³¹¹

The other main technology of glass manufacture in the later Iron Age and Classical period was core-forming. Unlike the monochrome vessels of the eastern royal courts which were cast in closed molds, core-form vessels of Mediterranean Group I (seventh-fifth century) have primarily been found in graves and, less commonly, in sanctuaries.³¹² These opaque, trail-decorated perfume vessels were widespread throughout the Mediterranean coastal world, although are most commonly found in Rhodes and Italy, which have both been suggested as production locations.³¹³ While glass cosmetic vessels of the sixth and fifth centuries were less scarce than contemporary glass tablewares, their largely ceremonial find contexts and limited

³⁰⁹ Barag 1985, No. 26. This 8.8 cm tall, transparent light green alabastron was found in the North-West Palace at Nimrud. A cuneiform incised inscription reads “Palace of Sargon” on the front and “King of Assyria” on the back, dating the manufacture before 705. For an overview of Assyrian cast vessels of the eight to seventh centuries and compilation of known objects associated with this industry, see von Saldern 1959, 25-34; 1966a, 1988 (1970).

³¹⁰ Lierke 2009, 26-27. Tatton-Brown has said that Assyrian glass bowls “were no doubt made by the slumping process” (Tait 2012, 39). See also Chapter 2.

³¹¹ For a list of sites, see Barag 1985, 58.

³¹² McClellan 1984, 412-414. McClellan observed that while core-form vessels are found regularly in the graves of both men and women, as temple dedications they appear to be limited to female deities (particularly Demeter and Kore, Athena, and Hera). In red-figure vase painting, core-form glass vessels were used exclusively in genre scenes of women at their toilet. For the techniques and decoration of Group I, see Chapter 2.

³¹³ For a recent review of the evidence for Rhodes as a core-form manufacturing center by the mid-sixth century, see Triantafyllidis 2009.

functional utility as small perfume vessels indicate that core-form glass occupied relatively limited semantic range which was to some extent conspicuous and controlled.

Given the absence of centralized royal court systems in mainland Greece, glass use in the area during the fifth and fourth centuries seems to have been largely limited to temples, where it was used as both a decoration and a dedication. Phidias used colorless cast inlays to decorate the statue of Zeus at Olympia during the mid-fifth century; remains of this temporary workshop have been excavated by the German team at Olympia.³¹⁴ Only slightly later, the architects of the Erechtheion on the Athenian Acropolis inserted colored glass plaques into the elaborately carved guilloche capitals of the north porch, and Agorakritos, a student of Phidias, inlaid colored glass in the base of the sculpture of Nemesis at Rhamnous.³¹⁵

Glass objects of all varieties were also regular dedications in Athenian temples, as documented in the surviving epigraphic evidence. Inventory lists from the Parthenon and the Asklepieion on the south slope of the Acropolis, dating from the mid-fifth to late fourth centuries, include raw glass, a (cast?) glass ear, several seals and gems, and numerous colorless tableware pieces including an *exaleiptron*, a *kylichnis*, a *hydria*, and a *rhyton*.³¹⁶ No such objects have yet been attested archaeologically in or around Athens; they must have been exceptional items for primary use as dedications to a particular god or goddess.³¹⁷ Glass used as dedications therefore conforms to the four criteria for luxury goods I identified above: it was

³¹⁴ Schiering, Letsch, and Noll 1991; Schiering 1999.

³¹⁵ Stern 1985b, 1989. Stern suggested that Agorakritos, or another pupil of Phidias, was likely involved in the design of the Erechtheion on account of these similarities, which are an anomaly in fifth century Athenian art.

³¹⁶ Aleshire 1989; Harris 1995; Stern 1999a.

³¹⁷ In the Agora, the only Athenian site from which glass has been reliably published, only three tiny core-form fragments and one cast glass stand have been found, and no colorless tablewares are attested (Weinberg and Stern 2009, 2). One small, plain, hemispherical bowl with unknown provenance, now in the National Archaeological Museum, Athens, is dated to the 8th or 7th century based on a parallel from a burial at Knossos, but Weinberg does not refer to any other glass tablewares from Greece before the fourth century (Weinberg 1992, 18-21, No. 3).

scarce, controlled, curated (for these objects were preserved in the temple treasuries for at least a few hundred years), and conspicuous.

In sum, from their origins down to the fourth century, Mesopotamian, Egyptian, and Greek glass making traditions were almost exclusively limited to luxury forms of production and consumption. As recorded in epigraphic and literary texts, the raw materials were managed (if not outright controlled) by royal administrators or temple officials. Archaeologically, glass has been found in particular types of contexts and in small quantities – in temples, palaces, and tomb groups – indicating limited availability to non-royal patrons and a semantic range which was restricted to palatial consumption, temple decorations and dedications, and burial as grave goods. Furthermore, only particular object types appear in each of these contexts, indicating that only certain objects were appropriate for certain forms of consumption. Appropriate objects for royal court consumption included elaborately decorated large open drinking vessels imitating metal and rock crystal and small, transparent closed jars such as the Sargon Vase, probably used for cosmetics.³¹⁸ Such objects also made their way into temple treasuries in Mesopotamia, Ionia, and mainland Greece. In mid-fifth century southern Greece, glass was used in decorative inlays for temple architecture and sculpture.³¹⁹ Opaque polychrome perfume vessels were interred with the dead from the Iberian Peninsula to Carthage to Rhodes. By contrast, very little glass was used in domestic contexts at any level of society, with the exception of occasional core-form perfume vessels, and no glass tablewares were manufactured other than those for use by gods, kings, or those with close ties to a royal court.

³¹⁸ But not, it is worth noting, in the “Greek” symposium style.

³¹⁹ Possibly glass was here used as a cheaper alternative to colored stone, the supply of which was cut off due to frictions with the Achaemenid empire. Alternatively, it was an innovative use of an exotic material and would have been especially conspicuous to Athenian and foreign audiences for its novelty.

The Fourth Century Macedonian Glass Industry: An Example of Attached Production

The colorless glass industry of Macedonia exemplified luxury glass production and consumption at the dawn of the Hellenistic period. Colorless glass vessels, furniture inlays, ring bezels, and gaming counters began to appear in Macedonia during the mid-fourth century. Of the 19 colorless vessels identified as products of this workshop to date, most were shapes suitable for drinking, including calyces, skyphoi, kantharoi, and a beaker (kalathos), and they were typically decorated with lobes, leaves, and omphaloi. In addition to the vessels, colorless glass was also used in inlays on wooden funerary couches somewhat more regularly, with over 60 excavated burials containing such couches localized in Macedonia. Despina Ignatiadou has convincingly argued that these distinctive products are evidence for a short-lived industry which operated for about a single generation during the mid- to late fourth century.³²⁰ The Macedonian colorless glasswares appeared in the archaeological record somewhat later than similar vessels from Rhodes and Anatolia, and it is possible that glass workers from eastern regimes came to Macedon in its ascendancy, either as a form of diplomatic exchange or in free enterprise. Ignatiadou has further identified the appearance of a different aesthetic evident the later fourth century Macedonian products. In the later examples, elaborate decoration was diminished in favor of plainer shapes like the kantharos and hemispherical skyphos, both of which were also popular in contemporary Greek metal and ceramic forms. These shapes continued to influence Hellenistic ceramic and glass vessels for the following centuries.³²¹

The fourth century Macedonian glass industry is the best documented example of an attached glass industry from the ancient world due to its finite geographical range, well-documented and consistent products and contexts of deposition, and specific historical context.

³²⁰ Ignatiadou 2002b, 2002a, 2010.

³²¹ Ignatiadou 2002a, 17.

Attached specialization, as first defined by Brumfiel and Earle and expanded by Costin, refers to a workshop or industry “in which elites sponsor the productive process in order to control the distribution and consumption of high-value, high-status goods.”³²² As such, attached production is inherently political, and the products of attached workshops are “goods with extrinsic, extra-utilitarian functions that can be exploited only by a subset of the population.”³²³ Following this definition, Louise Steel emphasized that the attached craft specialists may not be fully controlled and operated by the palatial economy, but they “create objects which are intended exclusively for their elite patrons...to enhance the authority, power, and prestige of the patrons.”³²⁴ Attached specialists crafting luxury products can be identified by the use of symbols, cosmologies, and iconographies associated with the ruling class.

In the case of Macedonian glass production, the radiate rosettes and flowers, almond lobes, and even the shape of the vessels themselves reflect esoteric symbols and appropriate patterns of consumption, some of which may have been borrowed from the Achaemenid Persian court.³²⁵ Elaborately molded glass was inlaid on funerary couches in symbolic shapes of palmettes, eyes, and acanthus leaves, and glass ring bezels depicted a variety of religious motifs, mainly images of gods or myths, which would have required a certain degree of erudition and prestige to interpret appropriately.³²⁶ The use of gold as embellishment further enriched the intrinsic value and conspicuous display. Colorless glasswares were also deposited exclusively in

³²² Costin 1991, 7, with discussion of earlier sources. See also Costin 2001, 297-301.

³²³ Costin 2001, 298. According to Costin, this definition is more complex than a simple binary between luxury and utilitarian products, since attached workshops can produce inexpensive and utilitarian goods as well. The significance is instead based on access and symbolic value – both of which are embedded in my definition of “luxury” as described above.

³²⁴ Steel 2013, 158.

³²⁵ The symbology of Macedonian glass vessels has been repeatedly examined and asserted by Ignatiadou (Ignatiadou 2009, 2010, 2012).

³²⁶ Ignatiadou 2002a, 18-20; 2003; Adam-Veleni and Ignatiadou 2010, 97, e.g. No. 66-67, 83-86, 106, 108-109.

This is not to say those of lower status could not use ring seals, just that their full symbolic range of meanings may have been restricted.

elite graves, indicative of limited access both visually, since the objects were no longer viewable after burial, and socially, since only select members of society were buried with glass objects. Appropriate consumption habits were exhibited not only in the exclusive use of glass in funerary deposits, but also in the gender patterning of those assemblages. According to Ignatiadou, transparent colorless glass vessels have mostly been found in female burials, and she has suggested that they were libation vessels of priestesses. Glass counters and game boards belonged only to male burials, while glass jewelry and furniture and wreaths with glass inlays accompanied both male and female internments.³²⁷

Finding Hellenistic Luxury Glass

By the second half of the fourth century, glass vessels and other objects were long established as luxury items. To identify luxury glass products of the last few centuries of the first millennium, we should expect continuity with these traditions: closed perfume containers in graves, elite – possibly royal – drinking vessels, temple dedications of perfume and drinking vessels, and the use of glass for decorative purposes in inlays in graves, elite drinking ceremonies, and religious dedications. Each of these contexts and objects is a form of glass which is scarce, curated, controlled, and conspicuous. And indeed, throughout the Mediterranean and beyond, this pattern continued in the third and second centuries, with one important difference: for the first time, glass objects also began to be found in a different functional sphere which did not follow patterns of production and consumption established and reinforced since origins of glass in the Bronze Age.

In order to properly understand the context and reason for this shift, I first look at the continuity of luxury uses of glass into the Hellenistic period. In general, Hellenistic luxury glass

³²⁷ Ignatiadou and Antonaras 2010; Ignatiadou 2012. Outside of Macedonia, glass vessels are more common in royal male burials, such as in the burial of the Carian king Mausolus at Halicarnassus (Ignatiadou 2005).

was relatively scarce, limited in semantic range (as evidenced by their careful curation and deliberate contexts of deposition), and conspicuous in its placement and aesthetic properties. Luxury glass wares became even more conspicuous in this period with the introduction of mosaic polychromy. Such attention to more richly colored and decorated materials may result from changing technological capacity along with heightened differentiation between polychrome luxury glasswares and monochrome non-luxury objects. Glass itself – by virtue of its material – was no longer sufficiently conspicuous, so luxury glass objects became more elaborate in their decoration, shape, and colors at the same time that plain glasswares became more commonplace. Examples of such luxury glass vessels and other objects are found scattered throughout the Mediterranean and in the territories of the Near East conquered by Alexander the Great and ruled by his successor kings. Glass manufactured in or inspired by Mediterranean traditions also began to appear in more far-flung areas in this period, as far south as Kush, as far east as the eastern shores of India, as far north as the Caucasus mountains and Ukraine, and as far west as the Iberian peninsula, the result of direct exchange or down-the-line trade. Although these glasswares may have taken different forms and possessed differing degrees of local meaning, they were treated as luxury products within a diverse array of cultural traditions.

Regions of Luxury Glass Consumption during the Hellenistic Period

The following section details the geographically diverse regions in which glass vessels and small objects manufactured in the eastern Mediterranean were used almost exclusively as luxuries until the beginning of the Roman period. Their identification as luxury products is based upon their adherence to the above principles of controlled access, scarcity, curation, and conspicuousness. To an extent, many of these products were also mutable, since – as will be demonstrated in the following chapters – similar objects were treated differently in the regions in

which they were manufactured, indicating that they carried different, context-specific, forms of cultural relevancy.

Region	Site	Number of Objects	Map Reference
<i>Northwestern Mediterranean</i>			
	Aix-en-Provence	18	Figure 6
	Ambrussum	1	Figure 6
	Arles	3	Figure 6
	Badalona	1	Figure 6
	Camarat	6	Figure 6
	Els Munts	1	Figure 6
	Ibiza	19	Figure 6, Figure 7
	Jeune-Garde	1	Figure 6
	Lequin 2	1	Figure 6
	L'Hospitalet du Larzac	1	Figure 6
	Mouries	1	Figure 6
	Olbia	6	Figure 6
	Orange	1	Figure 6
	Ruscino	1	Figure 6
	Sanguinaires A	2	Figure 6
	Serre-La-Croix	1	Figure 6
	Spargi	3	Figure 6
	Tarragona	1	Figure 6
	Verdoly	1	Figure 6, Figure 7
<i>North Africa</i>			
	Berenice	14	Figure 7
	Carthage	30	Figure 7, Figure 6
	Cyrene	32	Figure 7
	Gouraya	5	Figure 7, Figure 6
	Kerkouane	1	Figure 7, Figure 6
	Leptis Magna	1	Figure 7
	Utica	3	Figure 7, Figure 6
<i>Sicily</i>			
	Agrigento	2	Figure 6, Figure 7
	Butera	1	Figure 6, Figure 7
	Cefalu	1	Figure 6, Figure 7

	Mineo	1	Figure 6, Figure 7
	Montagna di Marzo	3	Figure 6, Figure 7
	Morgantina	25	Figure 6, Figure 7
	Naro	1	Figure 6, Figure 7
	Naxos	1	Figure 6, Figure 7
	Pizzo Cannita	1	Figure 6, Figure 7
	Selinunte	1	Figure 6, Figure 7
<i>Italy</i>			
	Adria	9	Figure 6
	Ancona	3	Figure 6
	Ascoli Satriano	2	Figure 6
	Baratti	4	Figure 6
	Canosa	56	Figure 6
	Cosa	6	Figure 6
	Tarantum	73	Figure 6
	Tarquinia	2	Figure 6
	Todi	7	Figure 6
	Tresilico	1	Figure 6, Figure 7
<i>Southern Greece</i>			
	Antikythera	25	Figure 8
	Athens	39	Figure 8
	Corinth	33	Figure 8
	Elis	1	Figure 8, Figure 7
	Eretria	1	Figure 8
	Kalyvia Ilios	1	Figure 8, Figure 7
	Kokla	1	Figure 8
	Koryphasion	1	Figure 8, Figure 7
	Messene	1	Figure 8, Figure 7
	Tsopani Rachi	3	Figure 8, Figure 7
<i>Northern Greece</i>			
	Abdera	18	Figure 9
	Aghios Athanasios	15	Figure 9
	Aiginio	1	Figure 9
	Akanthos	5	Figure 9
	Amphipolis	17	Figure 9
	Apollonia	1	Figure 9

	Argilos	1	Figure 9
	Canakkale	1	Figure 9
	Chalkidiki	1	Figure 9
	Derverni	15	Figure 9
	Dion	1	Figure 9
	Edessa	1	Figure 9
	Homolion	4	Figure 9
	Elaeus	1	Figure 9
	Karytsa	1	Figure 9
	Katerini	7	Figure 9
	Kavala	1	Figure 9
	Korinos	6	Figure 9
	Lefkadia	3	Figure 9
	Lemnos	1	Figure 9
	Lete	1	Figure 9
	Mavropigi	1	Figure 9
	Mesimeri	10	Figure 9
	Mieza	2	Figure 9
	Mytilene (Lesbos)	17	Figure 9
	Nea Anchialos	1	Figure 9
	Nea Michaniona	19	Figure 9
	Olynthos	20	Figure 9
	Palaiokastro	3	Figure 9
	Pella	8	Figure 9
	Pherai	4	Figure 9
	Philippi	6	Figure 9
	Pydna	72	Figure 9
	Samothrace	52	Figure 9
	Sevasti	6	Figure 9
	Soros	1	Figure 9
	Thasos	3	Figure 9
	Thermi	5	Figure 9
	Thessaloniki	21	Figure 9
	Tria Platania	1	Figure 9
	Vergina	9	Figure 9
	Veroia	3	Figure 9
<i>Black Sea</i>			
	Amisos	2	Figure 10
	Apollonia Pontica	18	Figure 10
	Armavir	1	Figure 10
	Artiukhovsky	2	Figure 10

	Bliznitza	2	Figure 10
	Cernysev	41	Figure 10
	Chersonesos	1	Figure 10
	Gurzuf Saddle	55	Figure 10
	Kerch	2	Figure 10
	Krasnodar	3	Figure 10
	Kul Oba	1	Figure 10
	Maikop	1	Figure 10
	Mozdok	1	Figure 10
	Novokubansk	1	Figure 10
	Pantikapaion	6	Figure 10
	Pavlovsky	1	Figure 10
	Pontic Olbia	3	Figure 10
	Stanica Mihajlovskaja	1	Figure 10
	Teucezskij	1	Figure 10
	Zolotoe	3	Figure 10
<i>Asia Minor</i>			
	Ak Burun	1	Figure 11
	Anemurium	1	Figure 12
	Antalya	8	Figure 11
	Arykanda	15	Figure 11
	Chios	1	Figure 11, Figure 8
	Cremna	1	Figure 11
	Cyzicus	7	Figure 10
	Elaiussa Sebaste	24	Figure 12
	Gordion	65	Figure 11
	Halicarnassos	14	Figure 11
	Huseyinli	1	Figure 12
	Iasos	1	Figure 11
	Iskenderun	1	Figure 12
	Izmir	7	Figure 11
	Kaunos	1	Figure 11
	Klaros	10	Figure 11
	Knidos	1	Figure 11
	Koycegiz	1	Figure 11
	Kyme	3	Figure 11
	Labraunda	1	Figure 11
	Milas	1	Figure 11
	Myndos	1	Figure 11
	Myrina	24	Figure 11

	Notion	1	Figure 11
	Pergamon	6	Figure 11
	Samos	2	Figure 11
	Sardis	11	Figure 11
	Stratonikeia	1	Figure 11
	Tarsus	11	Figure 12
	Xanthos	1	Figure 11
<i>Near East</i>			
	Babylon	2	Figure 13
	Dura Europos	7	Figure 13

	ed-Dur	23	Figure 13
	Nimrud	2	Figure 13
	Nineveh	2	Figure 13
	Palmyra	6	Figure 13, Figure 12
	Qasr-i Abu Nasr	1	Figure 13
<i>Kush</i>			
	Meroe	273	Figure 14

Table 5. List of sites discussed in Chapter 3 with quantities of published glass objects from c. 350-50 BCE, by region.

Individual site-based find contexts are grouped loosely by region and described generally from west to east and north to south (

Table 5).³²⁸ The regional boundaries are not intended to reify modern political systems, impose presumptions regarding ethnic or cultural boundaries on the ancient world, or suggest any particular homogeneity of practice among sites within a given regional designation. Rather, the purpose of these designations is as an organizing principle, based primarily on the accessibility and comprehensiveness of modern study and secondarily on perceived natural dividing lines based on the nature of the assemblage and broad historical considerations.³²⁹ Indeed, within many regional units, glass consumption habits were quite variable. For example, the local elites of Canosa and Adria, along the Adriatic coast of Italy, buried large numbers of elaborate glass vessels as grave goods, a practice rarely seen elsewhere in pre-Roman Italy.

³²⁸ Not all sites listed in the table are discussed explicitly or in detail, although most are. All can be found in the associated maps. As discussed in Chapter 1, the numbers of glass objects reported per site are more often an index of the completeness of publication than of ancient use. For instance, only four objects have been adequately published from Pherai in Thessaly (Adam-Veleni and Ignatiadou 2010, No. 108-111), but the work of Connolly et al to chemically test the Hellenistic glasses of Pherai implies there were many more, although the nature of these finds is completely undocumented in print (Connolly et al. 2012). Still, these numbers are illustrative of the general scope and richness of the evidence for each site and region.

³²⁹ Cf. Alcock 1994 for the effects of heterogeneous archaeological studies, much of which is guided by modern geopolitical considerations, on our inconsistent understanding of the widely dispersed Hellenistic world.

Citizens of the southern coast of Asia Minor, by contrast, had greater access to plain glass tablewares, which they used in their homes in similar fashion to Aegean elites, unlike the inhabitants of the Ionian cities where glass tablewares did not enter daily life until the first century CE. Such diversities of practice are considered in their regional systems to the extent possible, but this brief survey is intended to document and describe only broad patterns of luxury glass consumption in the ancient world. More comprehensive, systematic engagement in each individual region would undoubtedly uncover greater distinctions and illuminate local responses to the global Mediterranean markets.³³⁰ The eastern Mediterranean, including Egypt, mainland Greece, and the Aegean islands, will be discussed in detail in Chapter 4, and Chapter 5 further narrows the lens to Syro-Palestine.

³³⁰ Recent work by Justin Walsh on variable local responses to imported Athenian pottery in the western Greek colonies and indigenous settlements serves as an example for how consumption patterns of globalized products may be examined at a local level (Walsh 2011-2012, 2013, 2014).

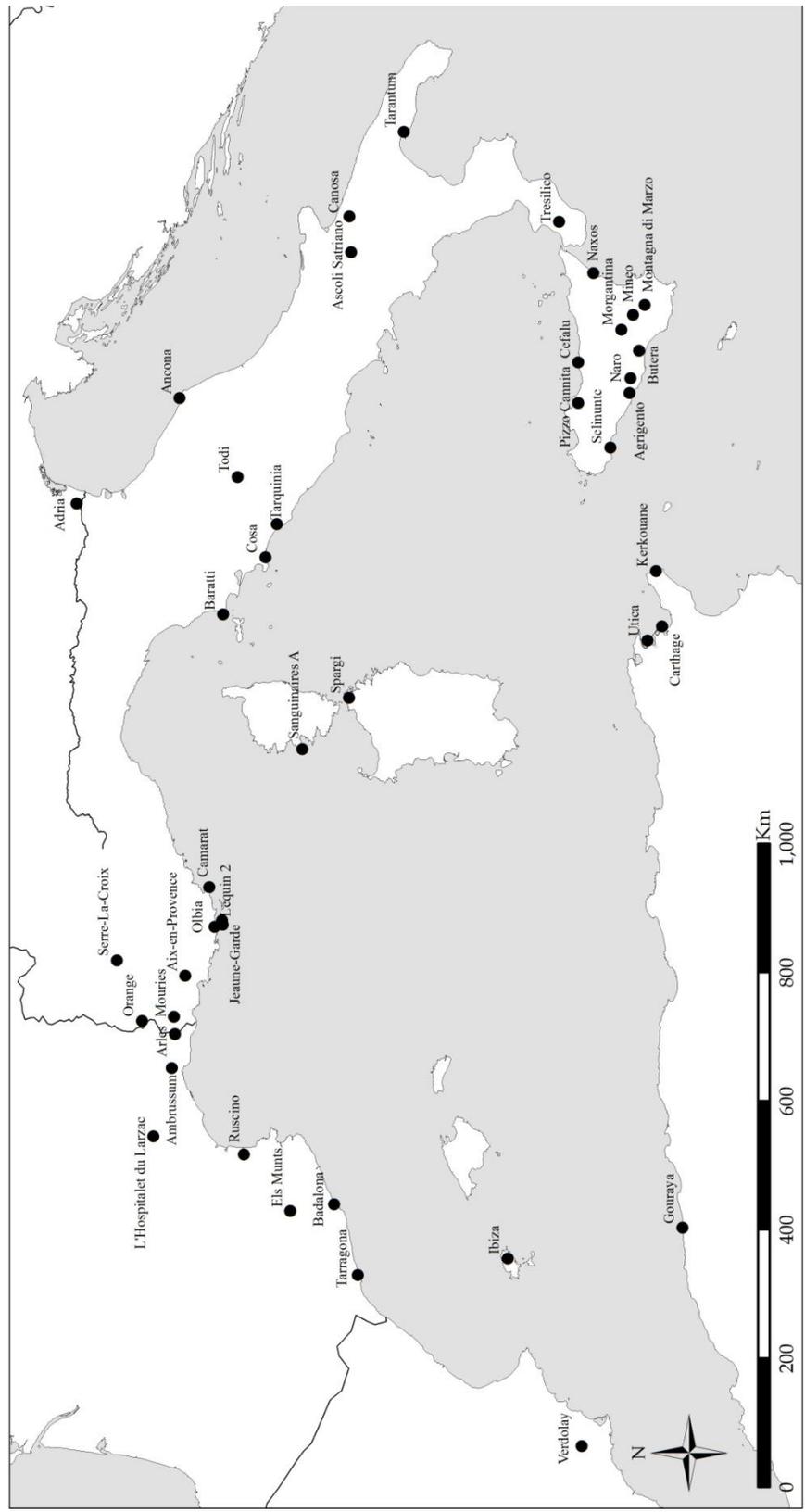


Figure 6. Sites with glass in the western Mediterranean, including the northwest Mediterranean, North Africa (partial), Sicily, and Italy, c. 350-50 BCE

Northwestern Mediterranean

Imported glasswares from the eastern Mediterranean are largely absent from sites in the northwestern Mediterranean, including the territories of modern France, Spain, and Portugal, during the last few centuries BCE (Figure 6). Although core-form vessels of Groups I and II have been somewhat regularly found in burials from earlier periods, these small glass perfume containers were probably functionally replaced with ceramic unguentaria during the third century, although scattered fragments and unidentifiable glass vessels did continue to appear into the first century CE at the necropolis sites such as Verdolay and Larzac.³³¹ The one place with consistent presence of imported glass in this period were the necropoleis on the island of Ibiza, perhaps due to its central location and status as an entrepôt among the Punic, Italian, and Greek worlds. Glass items found in the Ibiza necropolis have included several mold-made pendants, in the forms of a cluster of grapes and the Egyptian gods Baubo, Bes, Hecate, and Harpokrates, a mold-made astragalus, and several Mediterranean Group III alabastra.³³²

Several shipwrecks containing raw glass have been found off the southern coast of France and around the island of Sardinia, indicating some degree of exchange of raw material from the eastern Mediterranean primary workshops to the west in this period (Figure 4).³³³ The earliest and largest was the wreck of Sanguinaires A, dated to the second half of the third century or very early second century, which contained at least 550 kilograms of raw glass. The light and some dark blue glass was shaped into large blocks, several of which preserve the shape of the mold.³³⁴ This glass was probably intended for use by the local glass industries specializing in beads and other forms of adornment, such as the late second century workshop at Aix-en-

³³¹ Feugère 1989a. Feugère documented 218 total core-form vessels from the region, of which only seven are clearly Group III.

³³² Vives y Escudero 1917, pl. 32, 34; Feugère 1989b, No. 43.

³³³ For a summary of the known shipwrecks from this period containing glass, see Foy and Nenna 2001, 102-105.

³³⁴ Alfonsi and Gandolfo 1997, 66-68; Cibecchini 2012.

Provence, which is known only from a debris deposit containing a few chunks of raw blue glass and 745 beads and wasters in various colors.³³⁵ Lesser quantities of raw glass have been found in shipwrecks at Lequin 2 and Jeune-Garde. These shipwrecks typically contained amphorae from around the Mediterranean (e.g. Rhodes, North Africa, and Italy), Campanian fineware ceramics, and ceramic mold-made bowls from the Aegean, indicative of tramping boats which made numerous ports of call around the Mediterranean shores.³³⁶

Monochrome and polychrome vessels of the Canosa group and Late Hellenistic floral, grooved, and mosaic bowls, were all virtually unknown in the Hellenistic period in the northwestern Mediterranean. The pattern dramatically shifted around the middle of the first century, when conical grooved bowls (Group A) and ribbed bowls (Group C) began to appear at domestic contexts in coastal sites and became increasingly common over the course of the Augustan period. Their penetration to inland sites, such as up the Rhone Valley, was much slower.³³⁷ Olbia was a barometer of this shift; although the town was founded in the fourth century, glass did not appear in domestic areas until the Augustan period, when grooved, linear cut, and ribbed bowls were used in some quantity.³³⁸ The early Augustan Tradelière shipwreck with its hundreds of ribbed and linear cut glass bowls is a further index of this transition to more

³³⁵ Foy and Nenna 2001, 47. Both Iron Age Britain and the European Celtic cultures had native glass traditions specializing in beads, bracelets, and other items of adornment which are mostly known from burials (Haevernick 1960; Henderson 1989; Spaer 2001, 29-30). Preliminary scientific work indicates that the European industries produced their own raw glasses using local ingredients and were not supplied by eastern Mediterranean primary glass making workshops (Purowski et al. 2012), but the shipwreck evidence indicates the situation must have been more complex.

³³⁶ Foy and Nenna 2001, 102-103.

³³⁷ Foy 2005, 29.

³³⁸ Fontaine 2004. The presence of Group A grooved bowls, which were once thought to have ended by the mid-first century, suggests some earlier glass may have reached Olbia, although none has been found in a pre-Augustan context. Alternatively, the production of Group A bowls may have continued longer than was previously thought.

regular, mainstream glass tableware consumption in the western Mediterranean in the later first century, a process which had been well underway in the eastern Mediterranean for a century.³³⁹

³³⁹ Feugère and Leyge 1989, discussed in the introduction above.

North Africa

Hellenistic period glass was sparse in Punic North Africa, with only a few mosaic vessels, glass drinking bowls, and molded jewelry and insets having been found and published (Figure 7). In the preceding Archaic and Classical (“Phoenician”) periods, Carthage and the surrounding regions had participated extensively in glass consumption, trade, and production.³⁴⁰ The primary products of this earlier exchange were rod-formed anthropomorphic and zoomorphic polychrome beads and pendants, generally dated from the late seventh through third century.³⁴¹ In the later Roman and Byzantine periods, glass from North Africa consisted of typical western Mediterranean types, and there is no direct evidence for primary or secondary glass working in the region.³⁴² Punic North Africa therefore apparently lost its major glass working industry at some point early in the Hellenistic period and the knowledge was never recovered.

Carthage and Kerkouane each yielded putative evidence of glass workshops which may date to the early Hellenistic period.³⁴³ The Carthage workshop, published only in a few brief sentences without reference to any associated finds, consisted of an oval kiln, enclosed at the top, with the interior coated in what the excavator described as burned and vitrified greenish-white sand.³⁴⁴ The kiln was located within the Sanctuary of Jupiter Ammon, which was itself built over a Punic necropolis abandoned in the fourth century. Monique Seefried dated the glass

³⁴⁰ See Yacoub 2000.

³⁴¹ Tatton-Brown 1981; Seefried 1982; contra Barag 1985. Certain types of rod-formed pendants were deposited in third-second century contexts, although they may cease production as early as the fourth century. For this reason, I have excluded them from study here.

³⁴² Foy 2003. The only evidence is indirect, based on a few odd forms which are not known outside of North Africa. In the Quartier du Kram at Carthage, a few undatable raw glass blocks and canes were found (Foy 2003, 84).

³⁴³ There is also scant evidence of glassworking at Carthage during the fifth century: a teardrop shaped green glass waster was found in the University of Amsterdam Bir Messaouda excavations with pottery dated from the fifth to fourth centuries, and the University of Hamburg excavations below the Decumanus Maximus yielded six similar grayish-green drops from a context dated 480-425 (Docter and Sonneveld 2009, 132).

³⁴⁴ “sable ignifié et vitrifié, cristallisé blanc verdâtre” (Gauckler 1915, 10).

furnace to the third or second century.³⁴⁵ The particular placement of a kiln within a sanctuary is paralleled by other temporary workshops which produced glass objects to be used as fittings, inlays, and other adornment for the religious space, such as the fifth century Workshop of Phidias at Olympia and third century sanctuary workshops at Tebtynis and Gumaiyama in Egypt.³⁴⁶ However, Gauckler did not refer to any such glass furnishings found during excavation of the sanctuary. Other material, particularly ceramic, can vitrify in the intense heat of a kiln, meaning that vitrified material does not necessarily indicate glass working.³⁴⁷ With insufficient publication, unclear dating, and uncertain product, the Carthage workshop must therefore be considered provisional as evidence for glassmaking in Punic North Africa.

A possible glass workshop at the Maison du Sphinx at Kerkouane was excavated by Jean-Paul Morel in the 1960s.³⁴⁸ As at Carthage, only the architectural remains were reported. The evidence for a glass workshop consisted of a circular clay disc in the corner of a room in the house, with a pile of sand, molten dark green glass, lime, and a green colorant. The debris belonged to the final phase of occupation of the house, which was destroyed in the first half of the third century. Although Morel initially identified the house as a metal workshop, Nenna included it in her list of Hellenistic glass workshops.³⁴⁹ Based on the reported remains, the Maison du Sphinx are more consistent with a primary workshop for the manufacture of raw glass instead of a secondary workshop which made glass objects. If confirmed, the manufacture and coloring of glass within North Africa during the early Hellenistic period would be indicative of an earlier tradition of Punic glass manufacture.

³⁴⁵ Seefried 1982, 38-39; see also Nenna 1999, 167.

³⁴⁶ Nenna 1998. These finds are discussed in Chapters 2 and 4.

³⁴⁷ The presence of raw glass, glass wasters, crucibles, and other assorted manufacturing debris are considered necessary components of identifying a glass workshop; a kiln alone is insufficient, since multiple industries used kiln technology (Nenna 1999; Fischer 2015).

³⁴⁸ Morel 1969, 480-482.

³⁴⁹ Nenna 1999, 167.

Glass consumption in Hellenistic North Africa was also somewhat circumscribed and largely limited to religious and funerary contexts. Only two glass objects dated to the Hellenistic period have been documented at the Extramural Sanctuary of Demeter and Persephone at Cyrene. This lack of evidence contrasts with the earlier and later periods during which glass was a common sanctuary dedication: late sixth to early fourth century core-form (Group I and II) vessels and rod-formed pendants and eye beads, and late first BCE to second century CE sagged (linear cut and ribbed) and blown forms were deposited in large quantities.³⁵⁰ The Hellenistic objects are a fragment from a spiral mosaic bowl and an enigmatic molded head, possibly from a figurine or the protome of a glass vessel.³⁵¹ The sanctuary was in use throughout the Hellenistic period, as attested by a large dump of ceramic eating and drinking vessels used for large group feasts.³⁵² Either glass vessels were not considered appropriate for such occasions or they were out of the economic reach of sanctuary visitors.

Hellenistic burials from the region of Cyrenaica were also largely devoid of glass vessels, particularly the core-form bottles of Groups II and III that were used in burials elsewhere in the Mediterranean.³⁵³ The exception was a single burial containing nine glass beads, five

³⁵⁰ Oliver 1990.

³⁵¹ This object, Cat. No. 174, the fragmentary face of a woman with detailed facial features and distinctive hairstyle, is apparently unique in the Hellenistic world. Made from fine quality greenish, almost colorless glass, it was probably cast in a mold of some form. In an appendix to Oliver's study of the vessel glass, Price described grinding and polishing marks on the surface and the "shaft" behind the face as drilled; she compared the manufacturing method to west Asiatic glass production such as the Sargon Vase. She further suggested that it may have been made in Egypt, due to a small but persistent tradition of anthropomorphic glass statuary there. Since it came from a dump of pottery with material spanning from the sixth to late first centuries, the date of this object is far from certain, but I am inclined to agree with Price's Hellenistic date based on the color of glass and technique of production. Further stylistic analysis – difficult to do given the poor quality of the photograph – would be worth pursuing, as would the possible analogies with bivalve molded pendants in the shape of heads.

³⁵² White 1984, 92-93; 1990, xxviii.

³⁵³ Brown 1948; Thorn 2005. Brown noted the presence of glass bottles of "thick heavy glass" as well as other bottles of "light thin glass" in burials dated by the accompanying ceramics to the third and second centuries. Without any images or other discussion, it is impossible to know what these vessels are, but it seems unlikely they are decorated core-form pieces, as the polychromy of these vessels tends to be noted even in otherwise terse publications.

hemispherical counters, and one mold-made astragalus along with coins and pottery dated generally to the Hellenistic period.³⁵⁴

The situation at neighboring Berenice (ancient Eusperides, modern Benghazi) is only slightly better; according to Jennifer Price, glass was not commonly used in the region before the later first century, when ribbed and linear cut bowls (Grose Groups C and D) began to appear in large quantities.³⁵⁵ Fewer than five examples each of core-form vessels, colorless plates of the “Canosa” type, and fluted and grooved bowls have been documented from the city. Glass was a rare luxury product at Berenice in this period, imported from the east and available only to a select few. The somewhat higher number of vessels in an urban context indicates that Hellenistic Berenice was more eastward looking in its glass consumption habits than other North African cities.

Carthage, as befits an imperial capital, may have been more cosmopolitan in its glass consumption. According to a recent analysis by Roald Docter and Janien Sonneveld of all glass from Punic period (760-146) Carthage, the apparent paucity of glass from this period was the product of deposition patterns of garbage disposal and recycling of glass, not an absence of glass usage in the city.³⁵⁶ As evidence for this pattern, they noted that of 315 published settlement contexts, only eight (2.5%) of them contained glass, but of those eight, six (75%) contained more than one glass object.³⁵⁷ In other words, a vast majority of contexts did not contain glass, but those that did had some quantity of the material, therefore indicating a selective disposal pattern.

³⁵⁴ Burial N198, Assemblage XXIV. The three coins in the burial are dated to the late 4th century, 246-222, and 145-116. Ceramic material includes fusiform unguentaria and mold-made lamps (Thorn 2005, fig. 325-327).

³⁵⁵ Of the 730 fragments of non-blown glass (representing almost 14% of the total 5,300 fragments of vessel glass found at the site, spanning over a millennium of occupation from the Hellenistic to 9th/10th centuries CE), 600 (82%) of them belong to Groups C/D. Presumably, the others were either polychrome cast glasses or belong to the earlier Groups A/B, but she only cited a couple examples of each (Price 1985).

³⁵⁶ Docter and Sonneveld 2009. This study was limited to glass found in the settlement, particularly the excavations of the University of Amsterdam at Bir Messaouda, as well as previously published glass from other excavations, including those published in Tatton-Brown 1994; Fünfschilling 1999.

³⁵⁷ Docter and Sonneveld 2009, 140.

They also detected a gradual increase in the use of glass of all varieties over the course of the Punic period, with twice as much glass coming from Late Punic (300-146) Carthage as from the previous two hundred years. However, absolute numbers for this material are still quite small relative to those of the eastern Mediterranean: only 18 total Late Punic objects can clearly be identified.³⁵⁸ Such absence would not be entirely surprising, however, if Carthage was indeed destroyed and depopulated by the Romans in 146, about the time that glass began to appear widely in domestic contexts of the eastern Mediterranean.³⁵⁹

Thus, Hellenistic period North Africa participated somewhat in the luxury exchange of Mediterranean glassware and did not engage in extensive domestic glass consumption until late in the first century, when the rest of the western Mediterranean basin also began to use mass-produced glass cups and bowls. Throughout the early Roman period, North Africa was much more closely tied to western Mediterranean glass industries than to the east.³⁶⁰ But, unlike the other regions of the western Mediterranean, Punic North Africa had a glass making heritage and ethnic affinity with the eastern Mediterranean production sources: indeed, with the precise region where the mass-production of glass began in the second half of the second century. If ethnic associations and affiliations were still common between western and eastern Phoenicians, and if glass was to signal a specifically “Phoenician” identity, we might expect to find early domestic glass products in at least some North African contexts before the end of the first century. This did not occur. Given the lack of glass from western Phoenician sites, the nascent second century glass industry in the Phoenician homeland cannot have been inspired by a revival of historical manufacturing technologies. Glass use was not an ethnic marker of tribal or ancestral

³⁵⁸ Docter and Sonneveld 2009, 141, fig. 13.

³⁵⁹ The destruction and depopulation may not have been as thorough the Roman documentarians lead us to believe (Ridley 1986). Corinth, for instance, continued to be populated after its supposed destruction in the same year, but its regional importance was certainly diminished (Gebhard and Dickie 2003).

³⁶⁰ Baratte 1989; Foy 2003.

association, but rather pointed to the emergence of a different sort of identity group: one based on class and ascribed social and financial status.

Sicily

During the last few centuries BCE, the island of Sicily sat uneasily between the Italian peninsula and Punic North Africa, increasingly under the hegemony of Rome and disconnected from its former associations with North Africa and Greece. According to R.J.A. Wilson, sub-regions of the island responded differently to the changing political landscape, with western and central Italy most strongly influenced by Rome after the First Punic War (c. 241).³⁶¹ The glass finds, however, indicate that Sicily was more similar to Punic North Africa in its glass consumption habits and access to imported glass objects than it was to mainland Italy (Figure 6, Figure 7). While large quantities of Group I and II core-form vessels have been found in burials on Sicily (with 140 and 26 vessels known, respectively), reflecting the eastern Greek orientation of the island in the sixth through fourth centuries, Group III vessels were quite rare (only 11 documented examples), just as they were in North Africa.³⁶² The few core-form Group III vessels, according to Spanò Giammellaro, came from areas with more Carthaginian than eastern or Phoenician influence, such as Cefalu, Butera, Agrigento, and Montagna di Marzo.³⁶³ The other primary type of glass objects documented from Hellenistic Sicily were bi-valve molded pendants: a purple African head and blue cluster of grapes from Montagna di Marzo, and a colorless Baubo from Pizzo Cannita.³⁶⁴ These scattered remains are typical pan-Mediterranean items which were widely traded in the second and first centuries and found in a wide range of sites, never in large quantities, along the Mediterranean coastlines. Except for Morgantina

³⁶¹ Wilson 2013.

³⁶² Spanò Giammellaro 2008, 102-103.

³⁶³ Spanò Giammellaro 2008, 56, 68.

³⁶⁴ Spanò Giammellaro 2008, No. 98-100.

(discussed below), the only pre-Roman glass tableware bowl from Sicily was an almost colorless hemispherical bowl with two exterior grooves below the rim, found in the burial of a middle-aged man, along with fusiform ceramic unguentaria and a bronze strigil at Naxos on the northeastern shore.³⁶⁵ The burial has not been more closely dated than to the Hellenistic period, but the bowl is closely related to Syro-Palestinian types so probably dates after the mid-second century.

Aside from the scattered evidence collected by Spanò Giamellaro, the only well documented glass from a Hellenistic Sicilian settlement is that of Morgantina, which does look more like contemporary Italian and especially eastern Mediterranean settlements than the remainder of the island. The settlement flourished during the later fourth and third centuries, before destruction and partial depopulation in 211 at the hands of the Romans, a punishment to the city for siding with Carthage during the Punic Wars. Still, coins, ceramics, and glass indicate persistence of habitation, albeit at a smaller scale, into the first quarter of the first century CE.³⁶⁶ Only sixteen small fragments of Mediterranean Group II or III core-form vessels were found in the living areas of the city, although a large unexcavated cemetery may contain many more.³⁶⁷ A few examples each of colorless tablewares of the Canosa type and Grose Group A grooved bowls were also found, along with several fragments of polychrome mosaic tablewares of the first century. None of these were present in great quantity, but they do indicate some connection to the production centers of the Eastern Mediterranean and desire for luxury glass products. This pattern of small scale elite consumption during the third to first centuries contrasts with the

³⁶⁵ Bacci Spigo 1984.

³⁶⁶ Stone 2015.

³⁶⁷ As noted by Grose (Grose 1984b, 23), who suggested that core-form bottles were limited to use in burials and were not intended for household consumption.

explosion of monochrome drinking cups found at Morgantina from the last quarter of the first century BCE and early first century CE, when the city was otherwise dying.³⁶⁸

Italy

Glass vessels of the Hellenistic (Republican) period in Italy have been found almost exclusively in grave groups and burials (Figure 6). While there was probably short-lived Italian glass industry centered in Etruria in the Iron Age,³⁶⁹ and northern Italy became an important center of glass blowing in the first century CE,³⁷⁰ there is no evidence, either direct or circumstantial, that glass was made or worked in Italy during the second half of the first millennium. All glass from this period must have been imported from Punic North Africa or the eastern Mediterranean, and the presence of glasswares indicates trade connections to these territories.

The most well-known Italian glass tablewares of the last three centuries BCE are the vessels of the so-called “Canosa Group,” named for a set of vessels now in the British Museum which were reportedly found together in a tomb near Canosa di Puglia in southeastern Italy.³⁷¹ This set of ten glass objects, which included two sandwich gold-glass bowls, two spiral mosaic cane plates, a network mosaic hemispherical bowl, a lobed bowl with rosettes, a painted and gilded plate, and three monochrome vessels (a hemispherical bowl, a skyphos, and a flat dish), were purchased from a vendor in Naples in 1871. Since then, they have been a cause of contention regarding their date and origin, a debate which has not lessened with the archaeological discovery of similar hoards and appearance on the art market of additional poorly

³⁶⁸ Grose identified 29 linear-cut (Group D) and 25 ribbed (Group C) bowls, along with an unknown number of blown *zarte rippenschalen* dating from this period (Grose 1984b, 26-28). He considers these to be the products of a nascent Roman-Italian glass industry, which is discussed in Chapter 6.

³⁶⁹ Goldstein 1979, 122; Harden 1981, 138-139; Grose 1989, 81-82, with references. The main products of this industry were a distinctive group of core-form oinochoai and lagynoi with pinched scales, largely found in burials.

³⁷⁰ See Stern 1999b and below, Chapter 6.

³⁷¹ The primary publication and discussion of the British Museum Canosa Group is Harden 1968b.

provenanced material said to be from Canosa or Italy. As a result, absent good contextual information and meaningful parallels, vessels attributed to the group have been variously dated from the early third century BCE to as late as the first century CE. Although the conventional date of most of the original British Museum types is still Harden's proposed late third century BCE, it is not impossible that polychrome and monochrome glass vessels continued to be deposited in Italian burials into the second and first centuries.³⁷²

Vessels similar to the original Canosa group have been found in tombs throughout Italy, and in particular the southwestern Adriatic coast near Canosa and Tarentum. The largest hoard from Canosa itself came from the *Tomba degli Ori*, found in 1928 and now in the National Archaeological Museum of Tarentum. It contained 23 glass vessels including sandwich gold glass, spiral reticella, core-form Group II, and monochrome eating and drinking vessels, along with gold jewelry, silver, and South Italian painted pottery.³⁷³ Three more vessels, including two spiral mosaic cane pieces, were found with a female burial in excavations on the Scocchero property in the Mandorletto-Grotticelle district. Pottery found in the tomb spanned from the late fourth century to the first half of the third.³⁷⁴ Another 12 glass objects, including a sandwich gold-glass hemispherical bowl, three floral decorated bowls, a network bowl, two Group II core-form unguentaria, and several plain or grooved monochrome pieces, were found in a chamber

³⁷² The most recent thorough examination of parallels and dates of the Canosa Group is Stern and Schlick-Nolte 1994, 97-115. Several examples from the Wolf Collection which were said to have been found together in a tomb group at Canosa and acquired together, however, seem somewhat later than the groups with more trustworthy provenance, although there are indeed parallels and overlap. The main chronological problem has to do with the relationship between the "Canosa" group and the "Antikythera" group of spiral reticella and mosaic cane vessels, the latter of which tend to be smaller with a ring base and contain no sandwich gold glass. A date of late third century for the former and c. 80-70 for the latter creates a gap in knowledge for mosaic vessel typology and technology of over a century. With relatively few firmly dated and well studied parallels, the stylistic development of mosaic bowls during the Hellenistic period is an open question (cf. Nenna 1999, 36-52). An additional complicating factor is the difference between creation date and deposit date, since so many Canosa-ascribed pieces likely come from cemeteries where they may have been heirlooms. The presence of hemispherical grooved bowls related to Grose Group A in several of the Canosa groups also points to a somewhat later date of deposit, into the later second and first century.

³⁷³ De Juliis, Alessio, and Di Puolo 1989, 446-453; Stern and Schlick-Nolte 1994, 98.

³⁷⁴ Harden 1968b, 30, with references.

tomb on the road from Canosa to Cerignola with jewelry and silver dating to the first half of the third century.³⁷⁵ Additional glass vessels reportedly from Canosa are a mosaic plate with star canes and a network cane bowl said to have been found together,³⁷⁶ and ten vessels in the Hamburg Museum für Kunst und Gewerbe, said to have been found together in a grave along with third century jewelry and a stone alabastron.³⁷⁷ Except for one hemispherical network bowl, all the Hamburg vessels are monochrome and all but two are a similar greenish, almost colorless, fabric. Shapes include a footed bowl, two flat plates, two shallow dishes, and four hemispherical bowls with two exterior grooves below the rim.

Outside the immediate vicinity of Canosa, polychrome and elaborate monochrome glasswares have also been found in northern Italy. Hellenistic tombs recently excavated at Todi in northern Italy yielded monochrome hemispherical bowls with grooves, flat colorless dishes, and spiral mosaic cane bowls. These vessels were found with grave goods, including coins, dated from the mid to late second century, thereby filling an important gap of dated glass material from Italian tombs.³⁷⁸ In the territory of Adria, several excavated tombs yielded single core-form bottles of Mediterranean Groups II and III, found alongside ceramic tablewares and storage vessels.³⁷⁹

³⁷⁵ Harden 1968b, 30-31, with references.

³⁷⁶ Harden 1968b, 31-32, with references. These formerly Sangiorgi Collection bowls are now in the Corning Museum of Glass (Goldstein 1979, No. 460, 462).

³⁷⁷ von Saldern 1975. These vessels appeared as fragments on the art market in 1975.

³⁷⁸ I thank Laura Banducci for bringing these vessels to my attention and sending me extremely useful images. The excavator, Dorica Manconi, has called them “Canosa group” glasses, according to the abstract of a lecture given at the Römisch-Germanisches Zentralmuseum in May 2014 (<http://web.rgzm.de/a/article/the-hellenistic-necropolis-of-todi-perugia.html>, recovered January 28, 2015). A preliminary catalogue of three spiral cane hemispherical bowls, an externally grooved purple conical bowl, four colorless grooved bowls, two colorless plates, one greenish-blue and one bright blue hemispherical grooved bowl have been published by Giorgi and Manconi 2012, where they are dated to the second half of the third-early second century. This date seems to be based on that of the Canosa vessels rather than associated archaeological material, which was not mentioned by the authors. The shapes and colors of the vessels, however, with the exception of the plates and the purple bowl, more closely resemble the Antikythera group than they do the Canosa group. Missing are gold glass and the more elaborate, detailed molded shapes which are typical of third-early second century Canosa group vessels.

³⁷⁹ Bonomi 1996.

Therefore, of the objects with a clear or reported provenance, several patterns emerge regarding the deposition of glasswares in elite burials of late first millennium Italy. First, if graves contained glass at all – and the vast majority, even of wealthy burials, did not – they contained multiple vessels, often in a variety of shapes, technologies, and decorative patterns.³⁸⁰ But this variation occurred in quite predictable configurations, with certain shapes and decorations appearing in almost all groups. Von Saldern aptly summarized the pattern: "if one were asked to assess the contents of a grave of the early or mid-Hellenistic period that should contain rich glass finds, the list would include plain bowls and dishes, hemispherical bowls of laced and/or millefiori glass, one or more of the flat millefiori dishes, one or more segmental bowls with cut decoration, perhaps a gold-glass bowl and/or a skyphos."³⁸¹ Second, when the associated material is known, elaborate jewelry, gold and silver plate, and large painted ceramic vessels were also found in the burials, indicative of high levels of deposited wealth. Many burials seem to be female, as well, although this gendering may be based on accompanying grave goods (like the jewelry) rather than skeletal morphology. These specific types of context, deposition patterns, and associated objects indicate that glass was treated as a luxury in all senses in Republican Italy: exclusive access, appropriate use, specific semiotic meaning, conspicuously consumed, and carefully curated (especially if some objects were heirlooms when buried, as seems likely).

Core-form vessels, however, were treated somewhat differently. Although a few tomb groups contained core-form bottles as well as Canosa-style tablewares (e.g. the Tomba degli

³⁸⁰ Large hoards of glass in Italian tombs are unquestionably the exception rather than the rule. Fewer than a dozen such hoards have so far been found, compared to hundreds and hundreds of tombs and burials. For instance, a catalogue of grave goods housed in the National Archaeological Museum at Tarentum documented over a hundred wealthy tombs from the region, only one of which contained glass vessels (De Juliis, Alessio, and Di Puolo 1989).

³⁸¹ von Saldern 1975, 45. It is curious that the glasswares found in the Antikythera shipwreck have a similar configuration. Could they have been shipped as an assemblage specifically for use in a burial?

Ori), the cosmetic bottles are more commonly found as single glass items in burials in which the only other grave goods were ceramic. The tombs near Adria, which yielded about one glass object each even into the Roman period, are examples of this phenomenon. Core-form vessels, therefore, were probably less exclusive than glass tablewares. Their significance as burial goods may have been for their contents rather than for the vessel itself.

Unlike funerary contexts, where glass vessels were deployed extravagantly and strategically in certain elite burials, glass tablewares and small objects were almost unknown from Republican domestic sites in Italy. The only Italian settlement at which glass has been documented before the Augustan period is Cosa, on the Etruscan coast.³⁸² Cosa was a flourishing port town of Republican Italy from its foundation as a Latin colony in 273 until its apparent destruction around 70. The port reached its height of influence and wealth during the late second to early first century, when the powerful Sestius family exported wine, garum, and other fish products throughout the Mediterranean. At some point in the early Augustan period (between 25-15 BCE) the settlement was refounded as a Roman *colonia* and thrived for several centuries thereafter.³⁸³ Only about 30 non-blown glass fragments dating prior to the *colonia* have been identified by Grose. These stand in stark contrast to the hundreds of sagged and blown fragments dated to the fifty year period immediately afterward.³⁸⁴ Of the six catalogued pre-Roman vessel glasswares, two are core-form, two are grooved bowls of Group A, and two are network mosaic bowls; Canosa group vessels are wholly absent. One fragment of a core-form Group III fusiform alabastron was included in a foundation deposit of the forum basilica around

³⁸² Grose forthcoming. Thank you to Darby Scott and Elaine Gazda for sharing Grose's unpublished monograph on the glass from Cosa and allowing me to discuss it here. On Republican period Cosa generally, see Brown 1980; McCann and Bourgeois 1987; McCann 2002.

³⁸³ For a brief summary of the excavations and occupational history of the town and port, see McCann and Bourgeois 1987; McCann 2002.

³⁸⁴ Grose 1977, 9. This statistic has been repeated by, among others, Kahn 2014, who used this data as evidence of a rapid shift from ceramic to glass tablewares during the late first century BCE and early first century CE.

150/140, signifying its consequence; the other core-form fragment, also an amphoriskos, was found in a house.³⁸⁵ Both mosaic bowls were found in deep soundings in uncertain contexts.³⁸⁶ One grooved bowl came from a house deposit dated prior to the destruction of 70, while the other was found unstratified in Temple B.³⁸⁷

The fact that so little glass was found from pre-Roman Cosa is quite telling regarding the rarity and status of glasswares in Italian cities. This scarcity contrasts dramatically with the major ports and trading centers of the eastern Mediterranean, where glass tableware use exploded in the same period. Grooved and fluted sagged bowls clearly were not traded in large quantities to the western markets in the first half of the first century. This makes the sudden appearance of glass tablewares in the Augustan period all the more profound.

³⁸⁵ Grose forthcoming, No. 1-2.

³⁸⁶ Grose forthcoming, No. 3-4.

³⁸⁷ Grose forthcoming, No. 92-93.

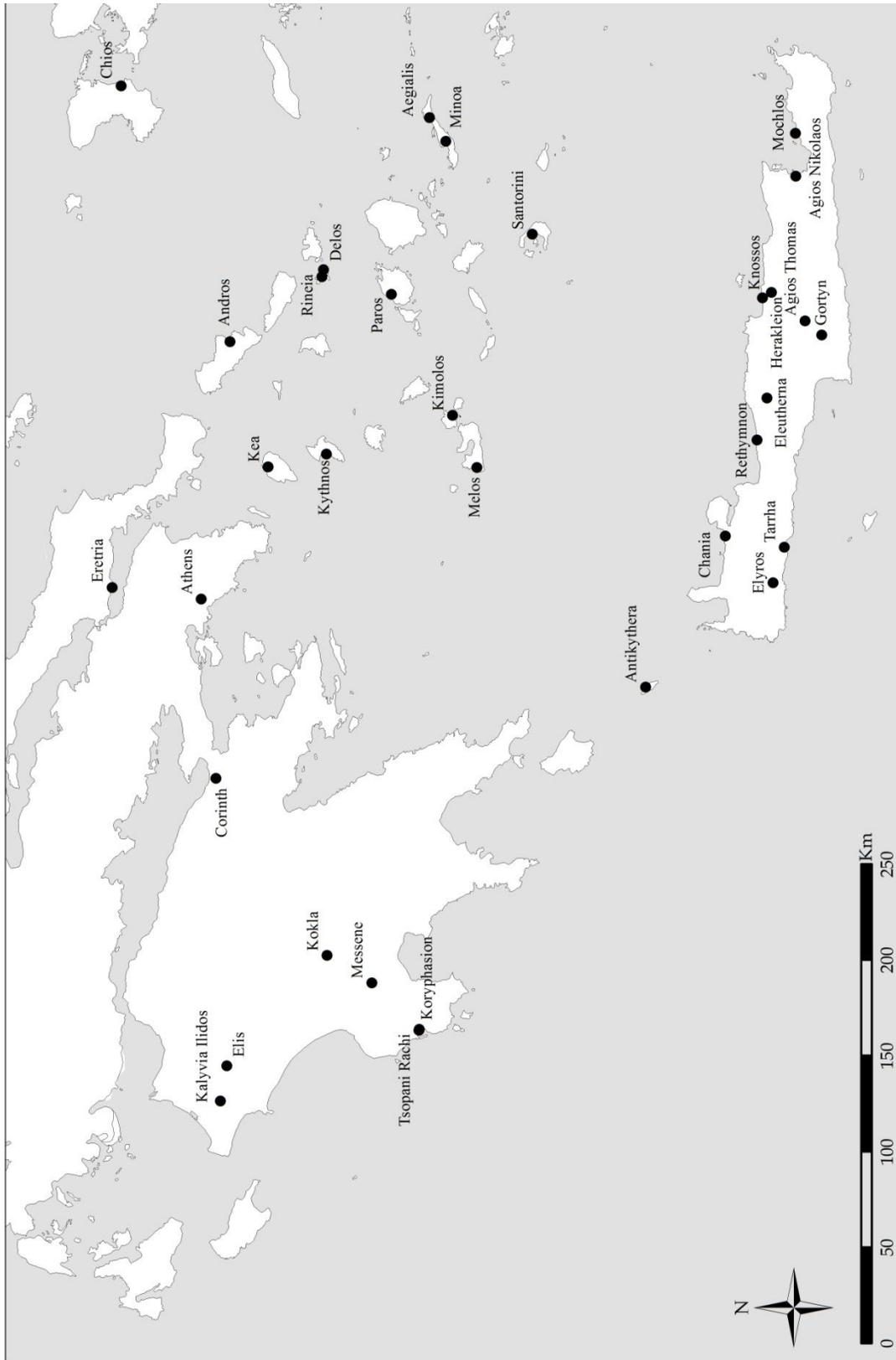


Figure 8. Sites with glass in southern Greece, Cyclades, and Crete, c. 350-50 BCE

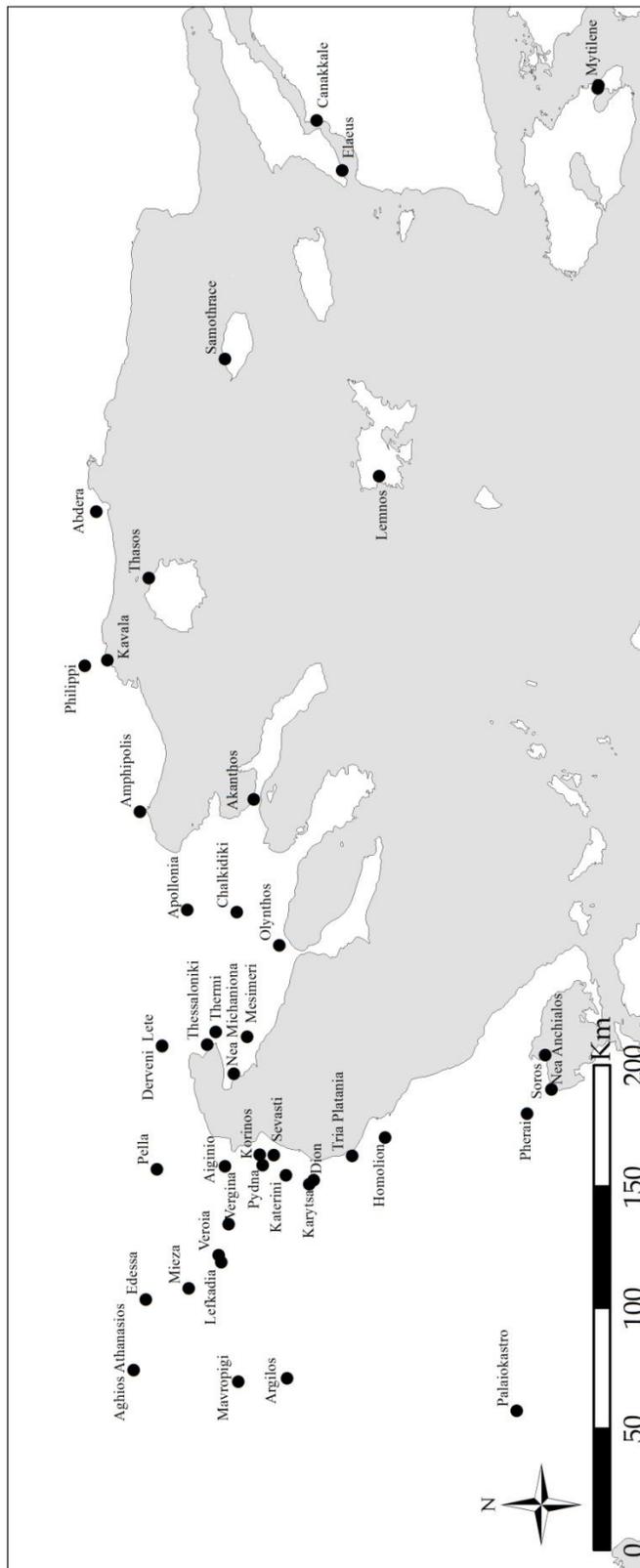


Figure 9. Sites with glass in northern Greece and North Aegean, c. 350-50 BCE

Mainland Greece

Glass vessels and small objects were quite rare in mainland Greece during the Hellenistic period, especially in contrast to the Aegean islands (discussed in Chapter 4). While Hellenistic Greece was not as depopulated and destitute as once thought,³⁸⁸ the scarcity of glass as well as other forms of portable Hellenistic material culture in formerly cosmopolitan and historically wealthy cities such as Athens and Corinth indicated a region no longer at the center of commercial exchange and political power (Figure 8). Even in Macedonian northern Greece, where secondary and possibly primary glass production occurred in the fourth and early third centuries, glass finds of the later Hellenistic period have been rare (Figure 9). Some tablewares and core-form vessels as well as other small objects like beads and counters did reach the mainland in small quantities, where they have been found in domestic and urban contexts as well as funerary and sanctuary debris. Specialized items such as finger rings and engraved seals were occasional burial goods. This overall absence of large quantities of glasswares and the primary context of deposition in burials indicates that glass, for the most part, was a luxury product in mainland Greece during the Hellenistic period, despite their historical and economic ties to the glass manufacturing regions of the Aegean and Palestine.

Southern Greece

Glass finds in southern Greece, including Attica and the Peloponnesus, are quite rare and mostly limited to luxury funerary material which was imported on a limited scale from eastern Mediterranean glass workshops (Figure 8). Very little glass of the Hellenistic period has been identified and published from Athens, with the exception of the recent volume on glass found in

³⁸⁸ Alcock 1993, 1994. Mainland Greece in general and Athens in particular have largely been considered peripheral to the major political and cultural action of the Hellenistic period which took place in cities like Pergamon, Delos, Alexandria, and Seleucia.

the Agora excavations.³⁸⁹ This volume only discussed inventoried items excavated from 1931-1972, and no attempt was made by either Weinberg or Stern to examine the context materials.³⁹⁰ Consequently, the Agora glass cannot be internally quantified or compared with glass from elsewhere in any meaningful manner. However, the long occupational history of the site extending back to the Archaic period and the global perspective of the volume's authors does offer somewhat of a *longue durée* synthesis of glass history in Athens. Core-form glass of all first millennium groups was quite rare, as was appropriate for a non-funerary site. Although the temple inventories preserved in inscriptions from the Parthenon and Asklepieion document dedications of glass vessels, jewelry, and possibly an ingot around 400, vessel glass from this period was entirely absent in the more quotidian spaces of the Agora; Weinberg and Stern were particularly struck by its absence from the Tholos building, which served as the official dining establishment for the Classical Athenian polis.³⁹¹ The sumptuary laws passed in 317 to limit conspicuous display by aggrandizing elites in the ostensibly democratic society of Athens may have limited conspicuous display of portable items like glass tableware as they did funerary monuments and sculpture.³⁹² Glass tablewares first appeared in the Agora in the second half of the second century, when grooved and fluted bowls of Syro-Palestinian type first appeared in modest quantities.³⁹³ Although Andrew Oliver indicated that a fragment from a mosaic bowl had

³⁸⁹ Weinberg and Stern 2009. For a preliminary report, much of which is reproduced in the full volume, see also Weinberg 1961.

³⁹⁰ Weinberg and Stern 2009, 10

³⁹¹ Weinberg and Stern 2009, 2. For the temple inventories, see above, "Iron Age and Classical Glass Objects."

³⁹² Cf. Stewart 1990; Small 1995, 62-63.

³⁹³ Weinberg and Stern 2009, No. 12-35. Three catalogued items are said to come from contexts dated prior to 145 BCE: Nos. 13 and 17, fluted and exterior grooved bowl fragments respectively, from a fill in the Middle Stoa with material dated from the 4th century to 180 with some late Hellenistic contamination, and No. 22, a standard hemispherical grooved bowl from a pit below the Stoa of Attalos, the construction of which is historically dated to 145. For further discussion, see Chapter 2.

been found in the Agora,³⁹⁴ Weinberg and Stern refuted this claim and insisted that no Hellenistic period mosaic glass had been inventoried from the site.³⁹⁵ Outside of the Agora, the only glasswares documented from Hellenistic Athens came from burials: a monochrome square plate related to those from the Canosa burials which was excavated from the Kerameikos cemetery, and several pyxides of Cretan manufacture.³⁹⁶

Glass therefore was of minimal importance in Hellenistic Athens, either as luxury object or in daily life. Athenians – at least those resident in and around the Agora – imported select glasswares from the production centers of Syro-Palestine for use as tableware and discarded broken fragments in refuse pits and fills. This adaptation was a significant one, as no prior tradition of glass tableware was extant in Athens before the mid-second century, but it seems to not to have occurred on nearly the same scale as in the contemporary Aegean islands and Syro-Palestine.³⁹⁷ Previously, glass – especially colorless glass – was reserved for temple dedications and decoration and was not employed in elite dining or funerary practices.

In the Peloponnesian peninsula, glass tablewares before the Roman period were almost exclusively found in burials. There is greater evidence for the use of glass beads and gaming counters. Glass was extremely rare in Hellenistic contexts at Corinth, with materials limited to scattered beads, counters, and occasional core-form vessels.³⁹⁸ The pre-Roman funerary

³⁹⁴ Oliver 1968a, 63, repeated by and cited in Nenna 1999, 50 n. 50 as evidence of mosaic glass in Hellenistic Athens.

³⁹⁵ Weinberg and Stern 2009, 2. Oliver was likely referring to fragment(s) from mosaic vessels later determined to be early Roman, not Hellenistic (Weinberg and Stern 2009, No. 63-74). It is worth remembering, however, that Weinberg and Stern only examined material found and inventoried before 1972.

³⁹⁶ Weinberg 1959, No. 4, 15-17; 1992, No. 39, 42, 47.

³⁹⁷ See Chapters 4 and 5.

³⁹⁸ During April-May 2013, I examined the evidence for Hellenistic period glass at Corinth, which has never been systematically investigated; other than *Corinth XII* (Davidson 1952), which included fragments from a few core-form vessels and a nearly intact cast or sagged bowl, glass objects from pre-Roman Corinth have only been mentioned incidentally in publications of well-dated deposits (Pemberton 1985, No. 6, 14; Romano 1994, No. 112-114). My approach was twofold: to identify visually potentially Hellenistic objects from among the inventoried finds and to search archival and publication records for discrete Hellenistic deposits to see whether they contained any mention of glass vessels or objects found within them, for which I relied heavily upon the Hellenistic deposits

contexts, where core-form vessels of Groups I and II are commonly found elsewhere in the Mediterranean, were almost devoid of glass containers; Corinthians preferred their own locally manufactured ceramic aryballoi and unguentaria as perfume vessels.³⁹⁹ The most concentrated area of Hellenistic glassware was in the South Stoa and the Southeast Building, where beads and several small counters have been found, always in isolation (i.e. the counters are not found in sets). The numbers of counters in use level deposits help support Broneer's identification of the South Stoa as a feasting, gambling, and convivial space for Hellenistic-period Corinthians.⁴⁰⁰

While the city is traditionally thought to have been entirely abandoned after its destruction at the hands of the Roman general Lucius Mummius in 146, the most recent generation of scholarship has identified discrete deposits, re-evaluated previously excavated material, and conducted close analysis of literary sources to locate continued occupation at Corinth, albeit of a smaller and more isolated population, during the so-called 'Interim Period' between 146 and 44, at which point Corinth was re-founded as a Roman colony.⁴⁰¹ Only two glass bowls which need predate the Roman colony foundation in 44 have been found at Corinth: a bowl which may be an early predecessor of the standard grooved forms of Grose Group A (with a distinctly flared rim, shallow hemispherical shape, and wide exterior grooves midway down the vessel wall),⁴⁰² and a standard Grose Group A hemispherical amber bowl, which came from an interim period context with no associated architecture in the southwest area of the

identified by Roger Edwards and Sarah James (Edwards 1975; James 2010). My thanks to Ioulia Tzonou-Herbst for facilitating my stay at Corinth and helping me access the necessary materials and records.

³⁹⁹ Of the dozens of excavated and published pre-Roman graves in the area of Corinth, only a few graves yielded glass vessels: Grave C 8 on the Lechaion Road (late sixth-early fifth century) (Eliot and Eliot 1968, No. 9). Glass beads were somewhat more common, but far from prevalent. None of the Hellenistic graves discussed by Pemberton contained core-form glass, although two – 1963-9 and 1976-4 – contained glass beads and an unidentified transparent yellow glass vessel, respectively (Pemberton 1985).

⁴⁰⁰ See James 2010, 197-200 for discussion.

⁴⁰¹ Williams 1978; Romano 1994; Gebhard and Dickie 2003; James 2010, 2014.

⁴⁰² Davidson 1952, No. 584 (MF 666). The excavation context of this vessel, which is almost complete, is unclear both in Davidson's narrative and in the archival records. The suggested 'early' date of the third or early second century here is based on the primitive shape, thick walls, and lack of later Hellenistic glass at Corinth.

forum.⁴⁰³ Most imports to Corinth during the interim period probably came from Italy and the west rather than the trade networks of the eastern Mediterranean. The signature items of eastern Mediterranean late Hellenistic trade (Rhodian amphorae, Syro-Palestinian glass bowls, and ESA) are nearly absent before 44, but Knidian wine amphorae, Attic and Italian fine ware pottery and coins, and mold-made bowls are present in moderate quantities.⁴⁰⁴ In short, Corinth did maintain external trade relations during the late second and early first centuries, but not with any of the glass producing centers of the eastern Mediterranean. By contrast, ribbed and linear cut bowls were quite common during the first century of the Roman colony (mid first century BCE-mid first century CE).⁴⁰⁵

In Patras and the surrounding region, along the northwest coast of the Peloponnesian peninsula, no Hellenistic period glass has been found at all, although earlier core-form vessels and Roman period blown objects were common finds in cemeteries.⁴⁰⁶ Combined with the negative evidence from Corinth, glass products of the Hellenistic east coming from the Aegean Islands, Syro-Palestinian coast, and Egypt almost certainly did not pass through the Isthmus into the Corinthian Gulf in this period; the location of the Antikythera shipwreck further supports the idea that such cargo was transported around rather than through the Peloponnesus.

Further south, near Pylos, three glass vessels were found in a series of five graves at the tumulus of Tsopani Rachi.⁴⁰⁷ These standard Late Hellenistic types – one polychrome mosaic

⁴⁰³ Williams 1978, No. 28 (MF 1977-36). The bowl is described in the publication as olive green, but it now appears amber.

⁴⁰⁴ By one count, roughly 85% of interim period amphorae at Corinth are Knidian Gebhard and Dickie 2003, 267, citing observational data by Williams from the late 1970s.

⁴⁰⁵ Four of the five glass vessels from a floor deposit dated to the Tiberian period are cast or sagged, not blown (Wright 1980, No. 122-127). In *Corinth XII*, Davidson discussed a deposit of glass from behind the South Stoa which contained a wide variety of cast, mold-blown, and free-blown glass (Davidson 1952, 78).

⁴⁰⁶ Kolonas 2002. Kolonas attributes the lack of Hellenistic glasses to the instability of the region during this period, including wars with the Galatians and the Aetolians.

⁴⁰⁷ Papathanasopoulos 1966; Harden 1968b, 35-36; Papathanasopoulos, Papathanasopoulos, and Hardy 2000, fig. 54-56. For the Canosa group, see above.

bowl with spiral canes, one hemispherical fluted amber colored bowl of Group B, and one conical grooved olive colored bowl of Group A – were found in wealthy tomb groups which also contained gold fillets, silver bowls, bronze coins, lamps, and over 100 ceramic objects, signaling their stature as luxury objects. Papathanasopoulos dated the glass bowls to late third-early second century based on the lamps and coins found in the burials, a dating which Harden then used to confirm his proposed date for the Canosa groups from Italy. But the vessel types of the glass as well as ceramic objects are much more comfortable a century later, in the late second-early first century.⁴⁰⁸ Additional monochrome grooved and fluted bowls, possibly imported from Syro-Palestine, have also been found in wealthy second-first century burials at Elis,⁴⁰⁹ Kalyvia Ilios,⁴¹⁰ Koryphasion,⁴¹¹ Kokla,⁴¹² and Messene.⁴¹³ The Tsopani Rachi and other southern Peloponnesian treatments of glass vessels demonstrate that glass vessels of the very same types as were used for common tablewares in Delos, Rhodes, Beirut, Anafa, and elsewhere were still considered elite luxury goods in many parts of the Mediterranean world.

Northern Greece

Glass in all forms was much rarer in most areas of northern Greece during the third to first centuries than it had been during the fourth century, when a local industry specializing in colorless vessels, inlays, and jewelry furnished elite burials (Figure 9). A small group of luxury glass from burials dating to the second century were found near Palaiokastro in central Greece in the early twentieth century, although circumstances of recovery are ambiguous. The

⁴⁰⁸ As acknowledged by Harden Harden 1968b, 36, n. 27a and also asserted by Weinberg Weinberg 1992, 27-28.

⁴⁰⁹ Weinberg 1992, No. 56. Although the original context for this vessel, now in the National Archaeological Museum, is not known, its intact condition suggests it came from a grave.

⁴¹⁰ Parlama 1973, pl. 167. This hemispherical bowl has a slightly upturned rim, similar to the Corinth example, and may be somewhat earlier.

⁴¹¹ Gialouris 1966, pl. 163.

⁴¹² Triantafyllidis 2006a, 152 n. 24. The context and preservation level of this glass vessel is not discussed.

⁴¹³ Themelis 2000, 117, fig. 105.

“Palaiokastros Treasure” included gold, silver, and bronze jewelry and vessels along with two mosaic and one monochrome amphoriskos, which were cast in two parts and held together with metal rivets.⁴¹⁴ Like the burials in Italy and the Peloponnese, the inclusion of rare and conspicuous glass objects in wealthy burials is indicative of the luxury status of these glass objects in Hellenistic Thessaly.

One exception to the lack of large quantities of Hellenistic glassware from the Hellenistic period Greek mainland was Pherai, located in Thessaly near Volos.⁴¹⁵ Early in the second century, Pherai rose in prominence; excavations have revealed the ancient agora, private houses, ceramic workshops, and necropolis of the city. Abandoned in the early Roman period, Pherai thus has a relatively tight sequence of occupation. Preliminary scientific analysis of 20 glass samples from the city indicates compositional similarity of the Pherai glass with those from Vergina and Rhodes but divergence from the glass found at Tel Anafa, suggesting that Pheraen glass probably came from Rhodes or Macedonia rather than Egypt or Syro-Palestine. However, the forms, types, shapes, colors, find spots, and all other identifying information about these glass objects are still unpublished, so it is unclear whether the Pherai was truly participating in the eastern Mediterranean glass *koine*.⁴¹⁶

Further north, after the florescence of glass production and consumption in fourth and early third century Macedonia, glass finds in northern Greece became quite rare, and were limited to isolated examples of imported core-form vessels and select small objects from mostly funerary contexts. Nenna reported no evidence of monochrome or polychrome cast or sagged

⁴¹⁴ Weinberg 1992, 23-25, No. 48-51. On the find circumstances, date, and archaeological interpretation of the Treasure, which was allegedly uncovered by local farmers in 1909, see Miller 1979.

⁴¹⁵ Weinberg has suggested that a local glass industry specializing in unguentaria with a flaring base was established in this region in the late 2nd-3rd century CE Weinberg 1962a.

⁴¹⁶ Connolly et al. 2012. They only list the compositions of each of the 20 samples, with no information about the observational form of the glass they are sampling. This publication therefore serves as a good example of the ways in which scientific analyses and traditional archaeological analyses need to be better integrated.

vessels from northern Greece except for four otherwise unpublished fragments from Philippi.⁴¹⁷ Heightened scholarly focus over the last decade on glass from northern Greece, particularly by Despina Ignatiadou and Antassios Antonaras, has not changed this picture.⁴¹⁸ Ignatiadou and Antonaras have suggested that the paucity of Late Hellenistic glass in northern Greece may be tied to the Roman conquest of the region in the mid-second century which “deprived” the region of the flourishing glass trade.⁴¹⁹ The city of Thessaloniki was a case in point: founded by Cassander in 315 as a synoikism of surrounding towns, by the second and first centuries Thessaloniki had become a favorite city of Rome, receiving significant benefactions. However, glass did not appear in the urban environment until the end of the first century, further demonstrating the westward rather than eastward orientation of the city. Antonaras suggested that the earliest domestic glasswares in the city, which included colorless drinking bowls, a plate, and a tray along with a few bluish ribbed bowls, were probably imported from Italy rather than from the glasshouses of the eastern Mediterranean.⁴²⁰ Thessaloniki, therefore, like Corinth, was more a recipient of the early western Roman glass tradition than a participant in the eastern Hellenistic one, and further confirms the lack of engagement of the northern Aegean with southern Aegean islands and communities during the Hellenistic period.

Similarly, the islands of the north Aegean display minimal connectivity with the glass producing areas further south, and also limited their glass consumption to luxury forms of use and deposition until the Roman period. The best demonstration of this phenomenon is provided by the New York University excavations of the necropoleis on the island of Samothrace, in use

⁴¹⁷ Nenna 1999, 68, n. 20.

⁴¹⁸ A synthetic exhibition on glass in northern Greece from the Bronze Age to 4th century CE was held at the Archaeological Museum of Thessaloniki in 2010, and the accompanying exhibition catalogue includes many unpublished or only published in Greek objects found in the region Adam-Veleni and Ignatiadou 2010. The 18th Congress of the Association International pour l’Histoire du Verre, also held in Thessaloniki, also facilitated the dissemination of local work by the Greek Ephoria to the academic glass community Ignatiadou and Antonaras 2012.

⁴¹⁹ Ignatiadou and Antonaras 2010, 123.

⁴²⁰ Antonaras 2009.

continuously from the seventh century BCE through the second century CE. These cemeteries have yielded significant quantities of blown glass from the last quarter of the first century BCE (among the earliest known in the east) but almost no core-form and cast or sagged glass vessels.⁴²¹ Of the few non-blown bowls published, only one, found in fill rather than a burial, likely dates prior to the second half of the first century.⁴²² Glass jewelry was also scant, with only four glass beads from the Hellenistic period identified, all from a single burial.⁴²³ Counters are the only type of glass which appears in any quantity at all, with one grave dated to the second quarter of the third century yielding thirty-five hemispherical and ovoid counters in dark and light colors, ranging in size from 1-2 cm in diameter.⁴²⁴ Given the funerary context, the lack of core-form glass vessels is especially surprising.⁴²⁵ However, beginning around 25, glass beads, counters, and astragaloi along with Group III amphoriskoi, ribbed bowls, and blown glass bottles were deposited in multiple graves.

While Classical and Hellenistic Samothrace has long been considered impoverished and peripheral compared to its larger neighbor to the west, Thasos, recent historical and epigraphical studies, coupled with archaeological excavation in the Sanctuary of the Great Gods, have suggested that Samothrace benefited from abundant attention and patronage by Macedonian dynasts, with the Winged Nike now in the Louvre being the best known modern example.⁴²⁶ Such benefactions do not seem to have led to high levels of trade and exchange of Samothrace with its southerly neighbors in the Aegean and eastern Mediterranean, however, at least not on

⁴²¹ Dusenbery 1967, 1998.

⁴²² Dusenbery 1998, 1072, No. XS-516, a pale yellowish green conical bowl with no preserved decoration. The other sagged bowls belong to Grose Groups C (ribbed) and D (linear cut).

⁴²³ Dusenbery 1998, 997, No. S138-27, four oblate and opaque glass beads which were likely strung with the cylindrical gold beads and gold amphora pendant with which they were found.

⁴²⁴ Dusenbery 1998, 1135, No. S130-32.

⁴²⁵ A few Group I and II vessels were found intact in inhumation burials dated prior to the Hellenistic period, but at Samothrace, most core-form vessels instead seem to have been deposited outside the burial, warped by heat and disposed after use in funerary rituals (Dusenbery 1998, 1063).

⁴²⁶ For a brief summary, see Archibald 2013a, 268-269. See also Cole 1984, 20-25.

the evidence from the necropoleis. Instead, the Samothracians consumed local or regional imitations of Hellenistic *koine* styles, including fusiform unguentaria, mold-made bowls, lamps, and terracotta figurines, and the aforementioned filigreed earrings.⁴²⁷ However, when this situation changed, it changed abruptly and concurrently with the new political regime of Augustus. Trade networks – or local consumer preferences – seem to have shifted sufficiently to allow these goods to reach Samothrace in quantity for the first time.

A similar circumstance may have occurred at Mytilene on Lesbos, where seven fragments of ribbed and plain sagged bowls and nine fragments of unidentifiable core-form vessels were found at the Sanctuary of Demeter and Kore on the acropolis. The Classical and Hellenistic sanctuary was abandoned and destroyed sometime in the first century, only to be covered by an extensive refuse deposit with material mostly from the second quarter of the first century CE, which included over 3,000 fragments of sagged, mold-blown, and free-blown vessels, most of which were cups and bowls.⁴²⁸ From the preliminary report, it is unclear whether this refuse represented a cleaning and ritual deposit of sanctuary dedications or a generalized urban midden. Were they religious dedications, it would be an unusual adoption of these mass produced tablewares in a sanctuary context. Triantafyllidis has indicated that there are additional unpublished grooved bowls from Lesbos, the context of which is unknown.⁴²⁹ The north Aegean islands were largely excluded from the Late Hellenistic glass trade, a situation which rapidly changed with the advent of Roman *imperium* in the second half of the first century.

⁴²⁷ Dusenbery 1998.

⁴²⁸ Price and Cottam 2000.

⁴²⁹ Triantafyllidis 2006a, 152.

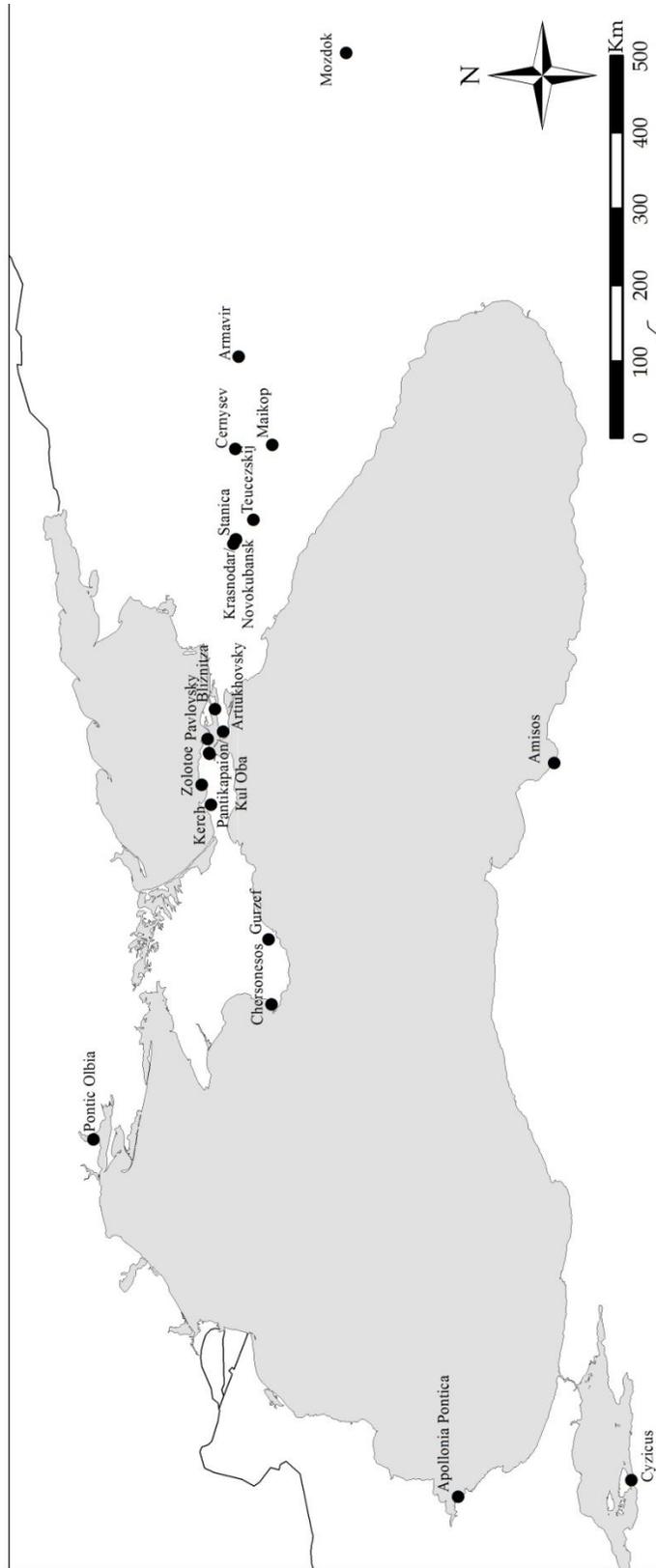


Figure 10. Sites with glass in the Black Sea, c. 350-50 BCE

The Black Sea

With one notable exception (discussed below), all pre-Roman glass from the areas of Bulgaria, Ukraine, Russia, the Caucasus, and northern Turkey has been found in rich elite burials, often accompanied by large quantities of gold and silver jewelry, metal vessels, and ceramics, a hallmark of luxury consumption (Figure 10). Glass did not become widespread in the region until well into the first few centuries CE.⁴³⁰

Although never common, a variety of types of Mediterranean manufactured glasswares did reach the Black Sea from the fifth to third centuries. At the coastal site of the Pichvnari in Georgia, dozens of Mediterranean Group I vessels and beads dated to the second half of the fifth century were found in the so-called “Greek” cemetery.⁴³¹ Based on chemical analysis, Rhodes was the likely supplier of the cosmetic bottles and some beads. A few plant-ash based glass beads may have been imported from the east, possibly as far as India, where plant-ash continued to be used occasionally as an alkali source throughout the first millennia BCE and CE.⁴³² Beads and a core-form vessel from the Greek colony of Apollonia Pontica in Bulgaria, dated broadly from the fifth to third centuries, are also chemically comparable to similar objects found at Rhodes, and were presumably made there.⁴³³

Colorless vessels of the Achaemenid or Macedonian type appear in burials around the Black Sea as well. At the site of Saikhe in Georgia, a large bowl with outsplayed rim and petal decorated lower body was found in an ashy deposit adjacent to wealthy burials; the deposit was

⁴³⁰ Trofimova 2007, 33.

⁴³¹ Two contemporary cemeteries of the second half of the fifth century with around 300 burials each have been excavated at Pichvnari. The North, or Colchian, Cemetery yielded few imports but contained local silver coins and some glass eye beads. The West, or Greek, Cemetery contained imported ceramic tablewares and amphorae and utilized different burial customs. Whether or not internment was arranged by ethnicity or another socio-economic identity, it is clear that only a certain group of the population had access to or desire for glass cosmetic vessels in their burials for an overview of the cemeteries and their contents, see Vickers and Kakhidze 2001.

⁴³² Shortland and Schroeder 2009.

⁴³³ Lyubomirova et al. 2014.

dated to the mid-fifth century using carbon dating.⁴³⁴ A similarly shaped colorless bowl with almond lobes instead of lotus petals was found in a burial at nearby Algeti.

Imported luxury glasswares continued to reach the Black Sea during the fourth and third centuries, especially in the areas of the Kerch peninsula and Kuban plain, north of the Caucasus. A particularly fine conical gold glass bowl, probably of the third century, was excavated from Mozdok and is now in the Hermitage Museum.⁴³⁵ A few later examples of monochrome and gold glass vessels of the Canosa group in private or museum collections supposedly came from the northern Black Sea, but none are well provenienced.⁴³⁶ Finally, colorless glass inlays, presumably belonging to funeral couches of the Macedonian style, have been found in fourth century burials at Kul Oba and Great Bliznitsa.⁴³⁷

At the port city of Amisos in northern Turkey, two additional colorless vessels – a skyphos bowl and a phiale – were found with an elaborate female burial in a tomb complex. The glasswares themselves are typical of fourth century Macedonian production, and other grave goods can be dated stylistically from the second half of the fourth to early second century, suggesting a deposit date sometime in the second century. This tomb group has recently been interpreted as belonging to a family of local elites, possibly tied to the court of Mithradates VI Eupator, who had an “appreciation” for Greek gold and other materials.⁴³⁸ The wealth and style of materials contained in the burial is anomalous in its local context and may represent a last-

⁴³⁴ Makharadze and Saginashvili 1999.

⁴³⁵ Picard 1946; Adriani 1967.

⁴³⁶ Canosa style vessels attributed to Black Sea locations include: a lidded amphora said to have been acquired in Olbia, now in the Antikenmuseum, Berlin (Platz-Horster 1976, 16-20; 1995, 2002); a pale green glass skyphos from a Russian collection, said to be from the Black Sea, which was recently sold by Bonhams (Auction 15940, Lot 122; <https://www.bonhams.com/auctions/15940/lot/122/>, accessed February 10, 2015); and several vessels in the Hermitage Collection (Kunina 1997, No. 46-62).

⁴³⁷ Ignatiadou 2002a, 20, with references.

⁴³⁸ Erciyas 2005; M.M. Jackson 2012.

ditch effort by a family to demonstrate its affluence through the performative burial of carefully curated family heirlooms: the very definition of luxury products.

By contrast to the fourth and third centuries, later glass forms of the second and first centuries BCE were virtually unknown in the Black Sea. McClellan identified only nine Mediterranean Group III vessels from the Black Sea and Thrace region, compared to 64 known examples of Group I.⁴³⁹ The only polychrome glass vessel documented in the Black Sea is a fragment which was reused as a setting in a gold half-moon shaped pendant, found in a funerary context at Černyšev, in the Kuban plain.⁴⁴⁰ Monochrome grooved and fluted bowls of Syro-Palestinian type are virtually unknown; combined with the evidence from northern Greece, they seem not to have been traded to the markets of the north Aegean, Thrace, and Black Sea.⁴⁴¹ On the other hand, several ring handled and base ring skyphoi and taller footed kantharoi have been found in second and first century burials in the Kuban and Kurgani plains.⁴⁴² Similar to monochrome vessels from the Canosa group, they may have been heirlooms. The distribution pattern of glass vessels presumed to be of Mediterranean production in the Black Sea from the fourth to first century maps closely onto the known distribution patterns of other “Greek” materials at Olbia, Chersonesos, and most especially Panticapaeum and the surrounding area on the Kerch peninsula, the location of the Bosporan Kingdom.⁴⁴³

⁴³⁹ However, Group I and II vessels have much wider distributions overall than does Group III, which are most abundant in Cyprus and the surrounding areas (McClellan 1984, 138-139 and Appendix IV; see also Nenna 1999, 32 n. 46).

⁴⁴⁰ *I Tesori dei kurgani del Caucaso settentrionale: nuove scoperte degli archeologi sovietici nell'Adygeja e nell'Ossezia settentrionale* 1990, 57, No. 246. The piece is dated third-second century in the catalogue.

⁴⁴¹ Nenna 1999, 68, pl. 41. The Hermitage Museum glass collection includes three grooved bowls in assorted shapes, but two of those were collected by Peter Saburov, the Russian ambassador to Greece during the 1870s and prominent collector of Greek antiquities, so they were almost certainly found and purchased in Greece, not Russia (Kunina 1997, No. 50-52).

⁴⁴² Leskov, Lapushnian, and Nabatchikov 1987, No. 109-110; *I Tesori dei kurgani del Caucaso settentrionale: nuove scoperte degli archeologi sovietici nell'Adygeja e nell'Ossezia settentrionale* 1990, No. 211; Kunina 1997, No. 57-62.

⁴⁴³ Alcock, Gates, and Rempel 2003; Müller 2013.

In light of this overall scarcity of Mediterranean glass imports to the Black Sea during the second-first centuries, the recently discovered assemblage of sagged and mosaic bowls from the sanctuary in the Gurzaf Saddle Pass is quite unexpected. This religious site in the interior mountainous regions of the Crimean Peninsula began to receive dedications of imported materials during the fourth century. The practice expanded during the second and first centuries to include amphorae from Thasos, Rhodes, and Knidos, metal utensils, weapons, military equipment, and 50 monochrome sagged glass bowls. Natalia Novičenkova has described the monochrome glass as “of different types” comparable to the vessels found at Tel Anafa, and compared the unknown quantity of mosaic vessels to those recovered from the Antikythera shipwreck.⁴⁴⁴

The site, with its wealth of imported objects from the Mediterranean, is difficult to explain. Located inland from the Black Sea littoral and occupied by Taurian tribes, this mountainous region did not regularly partake in the conspicuous consumption of Greek and Roman goods, unlike the occupants of coastal sites and Greek *entrepôts* like Apollonia, Olbia, or Pantikapaion, who had more regularized trade contacts. Novičenkova reasonably suggested that the region may have been opened to long distance trade with the Mediterranean by Mithradates VI Eupator in the first half of the first century, and the wealth of goods inland may reflect new investment in and attention paid to the remote territory. Literary sources indicate that the Taurians participated in the Mithridatic wars against Rome, possibly as mercenaries bought off with the types of goods deposited in the sanctuary.⁴⁴⁵ Regardless, the deposition of so many

⁴⁴⁴ Novičenkova 2008, 290. It is unclear from Novičenkova’s description whether the Gurzaf Saddle examples are the earlier Hellenistic grooved and fluted (A and B) types or the later linear-cut and ribbed (C and D) bowls, since both appear at Anafa. Their attributed date in the late second to early first centuries suggests that they are most likely conical and/or hemispherical grooved bowls.

⁴⁴⁵ Novičenkova 2008, 299. According to Novičenkova, the closest regional parallel to the assemblage of materials from the Gurzef Saddle sanctuary are second century Sarmatian burials in southern Russia and Ukraine which contained Iron and bronze helmets, La-Tene style weapons, bronze vessels, horse harnesses, sagged glass vessels,

monochrome sagged glass bowls, which would have been entirely foreign to local populations when introduced, indicates that these objects were conspicuous, controlled, and carefully curated. The use of monochrome and polychrome bowls as votive dedications in a sanctuary represented an appropriation of trade goods for alternative symbolic displays than those employed in the Mediterranean. In this limited context, glass was presumably connected with elite display, but in locally appropriate forms of removal from the commodity sphere through deposition in a sanctuary or burial, rather than in consumption and display in dining, as occurred in their areas of production.⁴⁴⁶

necklaces with butterfly pendants, unguentaria, black and early red gloss ceramics, Rhodian amphorae, terracotta figurines, cast glass kantharoi, and bronze furniture fittings.

⁴⁴⁶ For removal from the commodity sphere, see Appadurai 1986b. Of course, it is entirely possible that the glass bowls were used for ritual feasting *in situ* at the sanctuary or prior to their deposit; the presence of amphorae, suggesting wine, and metal utensils, indicating service, lends credence to this. However, the drinking would have taken place in a very different environment than that recognized by Mediterranean elites.

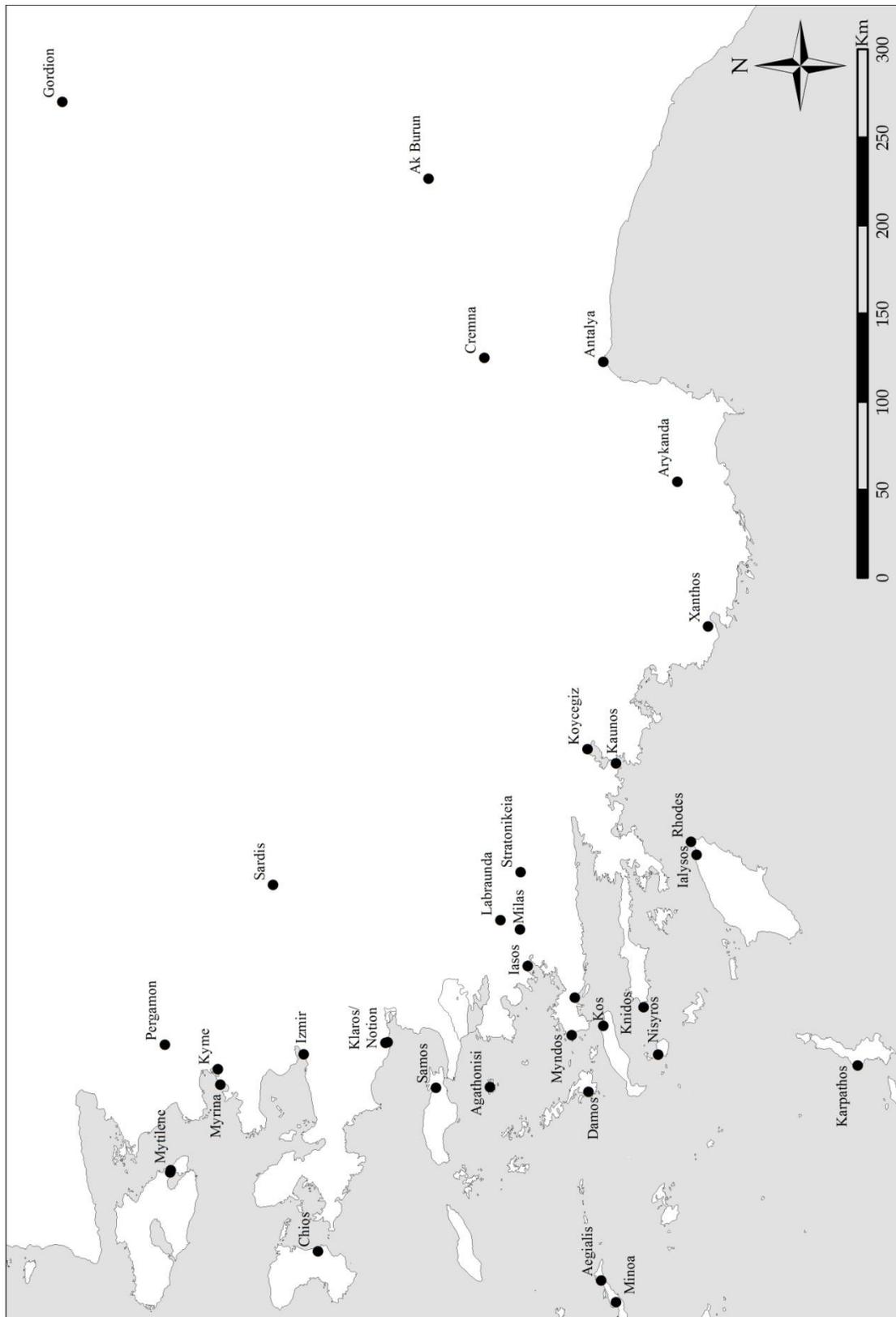


Figure 11. Sites with glass in Ionia, Caria, Lycia, and Dodecanese islands, c. 350-50 BCE

Asia Minor

Asia Minor (modern Turkey) was a major glass manufacturing region during the Bronze and Iron Age and again in the late Roman and Byzantine periods. In contrast, evidence for the production and consumption of glass is extremely slim for the Hellenistic period.⁴⁴⁷ Several Achaemenid or Macedonian style colorless glass vessels dating to the fifth-fourth century have been found in royal palaces and tombs as well as religious sanctuaries, several of which can be firmly dated in the mid to late fourth century before the conquests of Alexander.⁴⁴⁸ Eight pieces of various vessel shapes were found in a cutting associated with a tomb robbing in the Mausoleum of Halicarnassus.⁴⁴⁹ This mid-fourth century *terminus ante quem* for colorless glass tablewares in southern coastal Asia Minor is confirmed by a colorless phiale from the temple depository at the Artemision at Ephesus, burned in 356.⁴⁵⁰ Fifteen Achaemenid/Macedonian style colorless vessels dating to the fourth-third century have also been identified at Gordion, including phialai, kalyxes, and a beaker decorated with the standard decorative motifs of petals, almonds, and grooves.⁴⁵¹ Several Mediterranean Group II cosmetic vessels have been found in fourth and third century burials at Myrina and Tarsus. Group III alabaster were used in the second and first centuries though in much lesser quantities.⁴⁵²

Standard glass forms of the Hellenistic *koine* were largely absent in the large urbanized cities of Hellenistic Ionia and Caria (Figure 11). Many sites have only yielded one or two objects, usually deposited in burials or sanctuaries. Examples of this practice include a spiral

⁴⁴⁷ For an overview of the evidence of glassworking in Anatolia in all periods, see Lauwers, Degryse, and Waelkens 2007b.

⁴⁴⁸ For a full discussion, see Ignatiadou 2010.

⁴⁴⁹ Ignatiadou 2005.

⁴⁵⁰ Barag 1985.

⁴⁵¹ Jones 2005. Scientific sampling has identified no appreciable difference in glass composition between the Gordion glasses and those from Greece, including Rhodes, all of which are low-magnesia, low-potash soda-lime-silica glasses (Reade, Jones, and Privat 2012), but Jones believes secondary production occurred at Gordion at some point during the first millennium BCE (Jones forthcoming).

⁴⁵² Examples published in Atik 1990; Arveiller-Dulong and Nenna 2000.

mosaic bowl from the sanctuary at Labraunda,⁴⁵³ a grooved hemispherical bowl from a burial at Kaunos,⁴⁵⁴ a carinated almond lobe bowl from a tomb at Xanthos,⁴⁵⁵ and a skyphos found in a sarcophagus at Cyme.⁴⁵⁶ No Hellenistic period glass vessels have been published from the houses or urban spaces at Priene⁴⁵⁷ or Ephesus.⁴⁵⁸ Nor have late Hellenistic polychrome and monochrome glasswares been found further inland at Gordion, but this is to be expected given the presumed 189 destruction and abandonment of the site.⁴⁵⁹ The limited quantities and conspicuous appearances – all are polychrome or elaborately decorated monochrome – of glasswares in these areas ensured their status as luxury objects.

General access to and consumption of glass in western Asia Minor during the Hellenistic period is best illustrated by the examples of Sardis and Pergamon. Sardis was an important satrapal capital during the Persian period, but the nature of Hellenistic Sardis is still somewhat obscure.⁴⁶⁰ As of 1980, only 28 small fragments of pre-Roman glass had been identified from the site, none from well-stratified contexts.⁴⁶¹ Of the 14 fully catalogued fragments, the objects likely to be Hellenistic in date are two core-form bottoms and nine grooved bowls. With the exception of one bowl found in a pit in the synagogue, and one core-form piece which was found

⁴⁵³ This fragment could be Hellenistic or Roman. Core-form vessels are entirely absent from Labraunda. Although no good Hellenistic deposits have been identified, Hellenistic pottery – including West Slope ware, lagynoi, and mold-made bowls – is present, indicating some activity at the site and its participation in the *koine* (Hellström 1965, 1-3; for glass, 53).

⁴⁵⁴ Özet 2000, No. 13.

⁴⁵⁵ Harden 1968b; Lightfoot 1990, 85.

⁴⁵⁶ Bouzek and Marsa 1971. The skyphos is an unusual pale blue in color, and the associated lamps date from the later second to early first century, suggesting this skyphos may have been an heirloom when it was buried.

⁴⁵⁷ Cf. Wiegand and Schrader 1904. The only glass published in the 1904 report was a set of blown glass unguentaria found in a grave in the area of the gymnasium (278-279, abb. 286). No glass was listed in the publication of finds held in the Berliner Antikemuseum, which do include other *koine* objects such as mold-made bowls and lamps and Tanagra-type figurines (Raeder 1984). If glass was found at Priene, it has not been documented.

⁴⁵⁸ A half-dozen conical and hemispherical grooved bowls were found in the Hanghaus 1 complex, but none from contexts earlier than Augustan (Czurda-Ruth 2007). In Hanghaus 2, ribbed and linear-cut bowls were the most common glass vessels of the early Imperial period, but the overall quantity of glass tablewares relative to ceramic tended to remain low at Ephesus until the early third century CE (Schätzschock 2010).

⁴⁵⁹ Jones forthcoming.

⁴⁶⁰ For Hellenistic Sardis, see Rotroff and Oliver 2003; Ratté 2008.

⁴⁶¹ von Saldern 1962, 1980.

in the nearby cemetery of Bin Tepe, all glass of this period was found in the area of the House of Bronzes, with several bowls found in a single fill in Room 9. The elite inhabitants of the House of the Bronzes used standard grooved bowls as luxury tablewares; they were apparently the only household with access to and control of glass drinking vessels, and they were carefully curated within a single area of the house.

At the Attalid capital of Pergamon, glass vessels were extremely rare before the first century. Rehren et al. have connected the rise in glass consumption at Pergamon with its integration into the Roman Empire after the death of Attalus III in 133. To date, only a few mosaic, core-form, and grooved bowls found at Pergamon have been adequately published, so any further statement about Pergamon's access to Mediterranean glass markets must await final publication.⁴⁶²

⁴⁶² Rehren et al. 2015. See also Schwarzer and Rehren In press; Schwarzer's publication *Antikes, byzantinisches und islamisches Glas aus Pergamon* is reportedly in preparation.

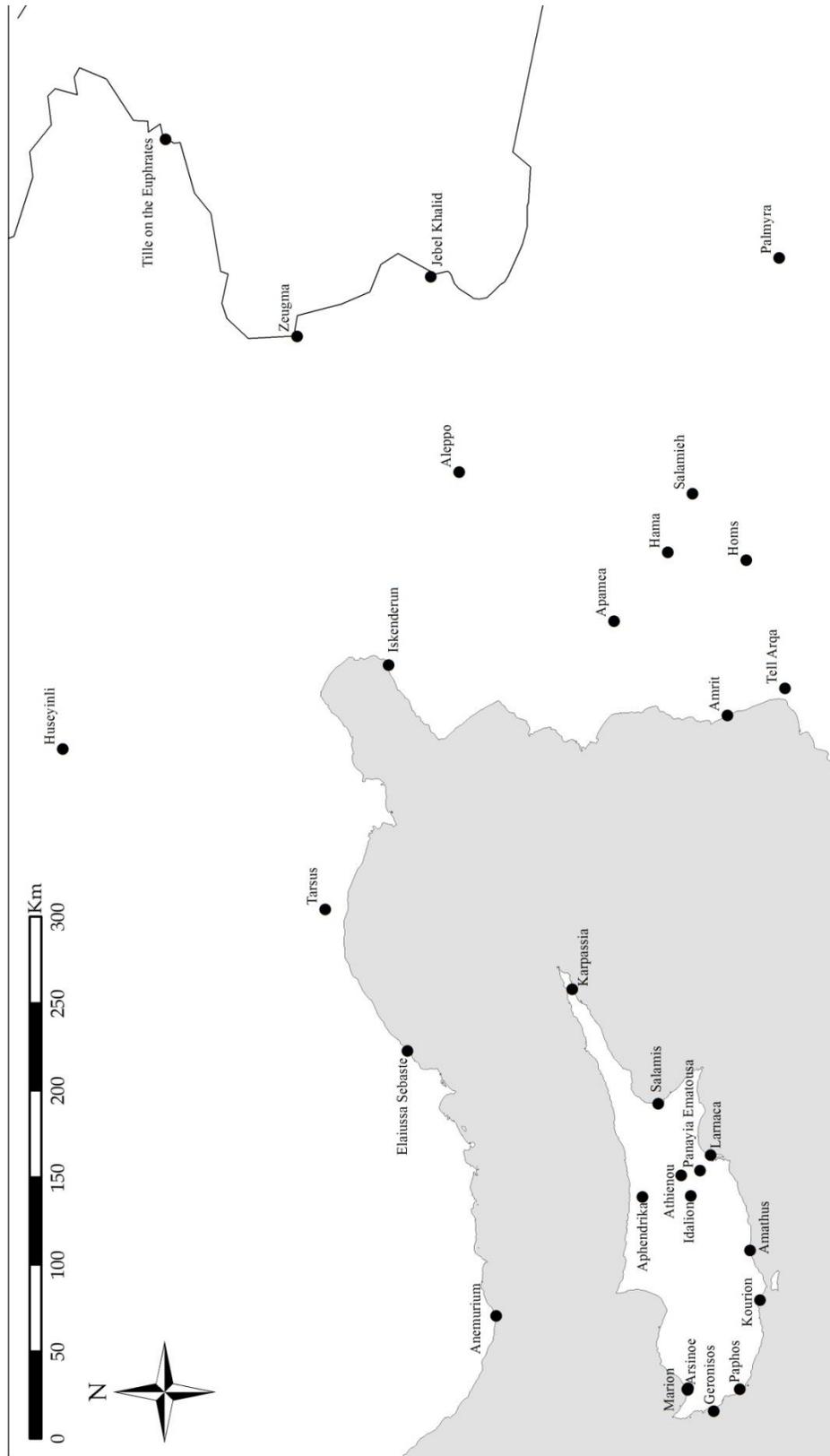


Figure 12. Sites with glass in southeastern Asia Minor (Cilicia), Cyprus, and Syria, c. 350-50 BCE

By contrast, domestic urban sites along the southern coast of Asia Minor, in Lycia and Cilicia, have yielded some quantities of Late Hellenistic glass tablewares, although they are relatively poorly known in English language scholarship (Figure 12). Several fragments of mosaic glass vessels were found in Hellenistic and early Roman levels at Arykanda.⁴⁶³ Eight grooved and plain bowls now in the Antalya Museum are unprovenienced, but were presumably found somewhat locally.⁴⁶⁴ Stern reported that late Hellenistic glass was found at Anemurium, but did not comment on the quantities or types of vessels found.⁴⁶⁵ At Elaiussa Sebaste, twenty Group A grooved bowls, plus one Group B fluted bowl, two Group III amphoriskoi and a skyphos, have been found in contexts as early as the first half of the first century.⁴⁶⁶ The proximity of these cities to Cyprus and their participation in Syro-Palestinian exchange networks may account for this distinction between western and southern coastal cities of Asia Minor.

To summarize the evidence from Asia Minor: colorless and other glasswares of the Assyrian and Achaemenid periods (eighth-fourth centuries) were relatively common in the royal palaces, sanctuaries, and courtly burials of the satrapal capitals, and Gordion and Sardis may have even supported local secondary glass workshops. After the fourth century, glass consumption in Asia Minor dramatically declined except in the cities along the southern coast, which may have been better connected to Cypriot and Syro-Palestinian influences. In the more strongly held cities of the Attalid Empire, only the elites at Gordion, Sardis, and probably Pergamon possessed and used the glass tablewares. In Hellenistic Asia Minor, the contexts and

⁴⁶³ Tek 2013. Tek catalogued 42 mosaic fragments from the site, of which about 15 use eye, floral, and spiral canes and may be Hellenistic (pre-50) rather than early Roman. Other than the piece from Labraudna, the Arykanda vessels are the only examples of mosaic tablewares known from Asia Minor, and the large quantity of 42 examples is unprecedented outside of Italian funerary contexts.

⁴⁶⁴ Lightfoot 1993b.

⁴⁶⁵ Stern 1985a. She refers to “a vast quantity of glass...ranging from late Hellenistic to Byzantine times” but provides no other information on the nature of the late Hellenistic material, focusing instead on the Byzantine finds. The final report on the glass from Anemurium has been submitted by Stern and is awaiting publication (Marianne Stern, personal communication, September 2015).

⁴⁶⁶ Gençler 2009, No. 1-23, 40.

quantities of glass demonstrated continuity with earlier periods rather than an embrace of more modern forms of mass consumption.

Near East

During the Assyrian and Achaemenid periods, Mesopotamia was a center of glass manufacturing and technology. Both traditions were apparently attached to the royal court on the basis of the distribution of finds and use of courtly style, similarly to the fourth century Macedonian workshop discussed above. Assyrian glass workers of the eighth-seventh centuries produced sophisticated open and closed shapes, probably using metal casting technologies. The best documented objects from this tradition are the finds from Nimrud. In addition to the well-known Sargon Vase (a cast glass alabastron inscribed with the name of Sargon II (r. 722-705)), von Saldern estimated that fragments of 110-140 plain hemispherical bowls with diameters around 15 cm along with several glass inlays in ivory furniture settings had been found at the site, mostly in the Burnt Palace.⁴⁶⁷ Raw glass and kilns found in the south side of Room 47 of the Burnt Palace have been suggested as evidence of glass working in the palace by Von Saldern and Mallowan, followed by Moorey.⁴⁶⁸ This abundance of material is in sharp contrast to the absence of glass finds elsewhere in the Assyrian empire and attests to the royal control, careful curation within the palace, and conspicuous consumption of glass by Assyrian dynasts.

After an apparent hiatus in Mesopotamian glass manufacture from the sixth to fifth centuries, glass vessels again appeared at Achaemenid Persian imperial sites in the fourth century, though in small quantities. Colorless glass vessels in the form of kalyx bowls and

⁴⁶⁷ von Saldern 1966b. See also Mallowan 1966, 209-210; Barag 1985, 51-54; Reade, Freestone, and Simpson 2005; O'Hea 2011a. Barag's suggestion that Phoenician glass workers manufactured Assyrian glasswares is discussed in Chapter 5.

⁴⁶⁸ Moorey 1999, 202-203

shallow phiale with outturned rims have been found at Persepolis,⁴⁶⁹ Nippur,⁴⁷⁰ and Qaleh Kali.⁴⁷¹ Their decorative schemes of grooves, flutes, and central bosses resemble those of the earlier Assyrian and Phrygian objects as well as later Hellenistic vessels. The Achaemenid glass vessels, along with their metal and stone counterparts, functioned as objects of courtly gift and exchange among various entities of the Achaemenid imperial program. Once thought to have been produced in the Mesopotamian heartland of the Persian empire and diffused outward to regional satrapies, glass vessels of the Achaemenid period are now thought to have been made in multiple workshops in Rhodes, Phrygia/Ionia, and Macedonia as well as Mesopotamia.⁴⁷² Different regional styles, workshop craft traditions, and shapes indicate some desire to serve local customers or regionalized training of producers, but the general similarities in the glass itself, functional shapes, and types of deposit are indications of an interconnected system with global and local conjunctures and disjunctures. Luxury consumption of glasswares in the Hellenistic period continued this practice.

By contrast, glass was extremely rare in Mesopotamia under the Hellenistic Seleucid empire (Figure 13). The Hellenistic glass finds from Dura Europa were limited to core-form vessels of Groups II and III, none of which were found in burial contexts like they were in the Mediterranean.⁴⁷³ Two core-form vessels, however, were found in much later (second-third

⁴⁶⁹ Schmidt 1957, 91-93, Pl. 66-67. According to Schmidt, the only other glassware from the Persepolis buildings was a chalice found in the courtyard of the Apadana above floor level. It is probably later than the Alexander destruction.

⁴⁷⁰ Barag 1968.

⁴⁷¹ McCall, Dusting, and McRae 2015. These fragments preserve almost the complete profile of a calyx cup or ovoid beaker, the closest parallel to which comes from the Halicarnassus Mausoleum. They were found in a post-Achaemenid fill which was cut into the foundation levels of an Achaemenid structure. The excavators are uncertain whether the glass originated in the Achaemenid building or was brought from outside as an heirloom by the post-Achaemenid builders.

⁴⁷² Oliver 1970; Triantafyllidis 2003a; Ignatiadou 2010.

⁴⁷³ According to Clairmont, burials dating as early as the third century have been excavated in the necropolis, but none contained glass until the first century CE. Glass was never a popular burial item at Dura Europos, even in the second and third centuries CE, an absence which Clairmont suggested may have as much to do with local burial customs as economic factors (Clairmont 1963).

century CE) deposits in the Temple of Gaddè, where they may have been used in ritual continuously for a few hundred years. An inscription from the Temple of Bel also included glass objects of an unspecified nature in its inventory list.⁴⁷⁴ Glass drinking vessels were absent at Hellenistic Dura Europos; the inhabitants of the city generally were slower than others to adopt glass tablewares, which only slowly began to appear in the city over the course of the first century CE. At Palmyra, glass tablewares were not used until the later first century, when ribbed bowls were introduced.⁴⁷⁵ In the third and second centuries, glass had been exclusively limited to burial goods, as attested by three glass bowls found in graves below the later sanctuary of Baalshamin.⁴⁷⁶ No clearly identifiable Hellenistic glass of any variety has been published from Uruk.⁴⁷⁷

Therefore, in Hellenistic Mesopotamia, glass only appeared in very select contexts, mostly as religious dedications, and was not regularly used for tableware until ribbed bowls appeared at the end of the first century BCE and early first century CE. Although the major cities of the Tigris and Euphrates Valleys were “Hellenized” in architecture and some forms of material culture,⁴⁷⁸ glass vessels of the types used in the Greek-speaking areas closer to the Mediterranean were not adopted until the Roman period. A few factors, both political and economic, may have contributed to this absence. First, the Parthian expansion in the eastern territories may have cut off trade with the Mediterranean glass houses at about the time when

⁴⁷⁴ Clairmont 1963, 147. The inscription reads, in part: “ἀγγεῖα ἰάλια δύο τρία”. ἰάλια is probably a misspelling of ὑάλαα. No actual glass was found in the Temple of Bel excavations. The inscription was first published by Cumont in *Fouilles de Doura-Europos* (1922/1923), No. 13, 372-375.

⁴⁷⁵ Ployer 2012. The only glass object dated prior to the (late?) first century is a glass rod with spiral trail decoration which was found in a second half of the second century context. The precise context dates and forms of the first century types are impossible to discern in this preliminary report.

⁴⁷⁶ Fellmann 1970, 93-95.

⁴⁷⁷ Van Ess and Pedde 1992. The corpus jumps ahead from three fragments of Neobabylonian (eighth-sixth century) glass to blown glass flasks and cups of the first-second century CE.

⁴⁷⁸ Kuhrt and Sherwin-White 1987. See further, Chapter 1.

glass production was rapidly increasing in scale.⁴⁷⁹ Second, shipment of glass vessels over land was likely expensive, difficult, and risky due to their fragility; it is probably not a coincidence that the largest glass consumers of the second and first centuries were residents of coastal sites. Finally, as Despina Ignatiadou has argued, Achaemenid glass production may have been much less significant than was once thought.⁴⁸⁰ After the fall of the empire at the hands of Alexander, local glass making and working knowledge disappeared absent a strong central court culture for attached production.

⁴⁷⁹ The decline of Seleucid power and subsequent power vacuum not only facilitated Parthian incursions, but may also have contributed to the rise of the Phoenician glass industry. See Chapter 5.

⁴⁸⁰ Ignatiadou 2010. Contemporary workshops in the Aegean also produced cast colorless vessels (Triantafyllidis 2000c; Ignatiadou 2002a).

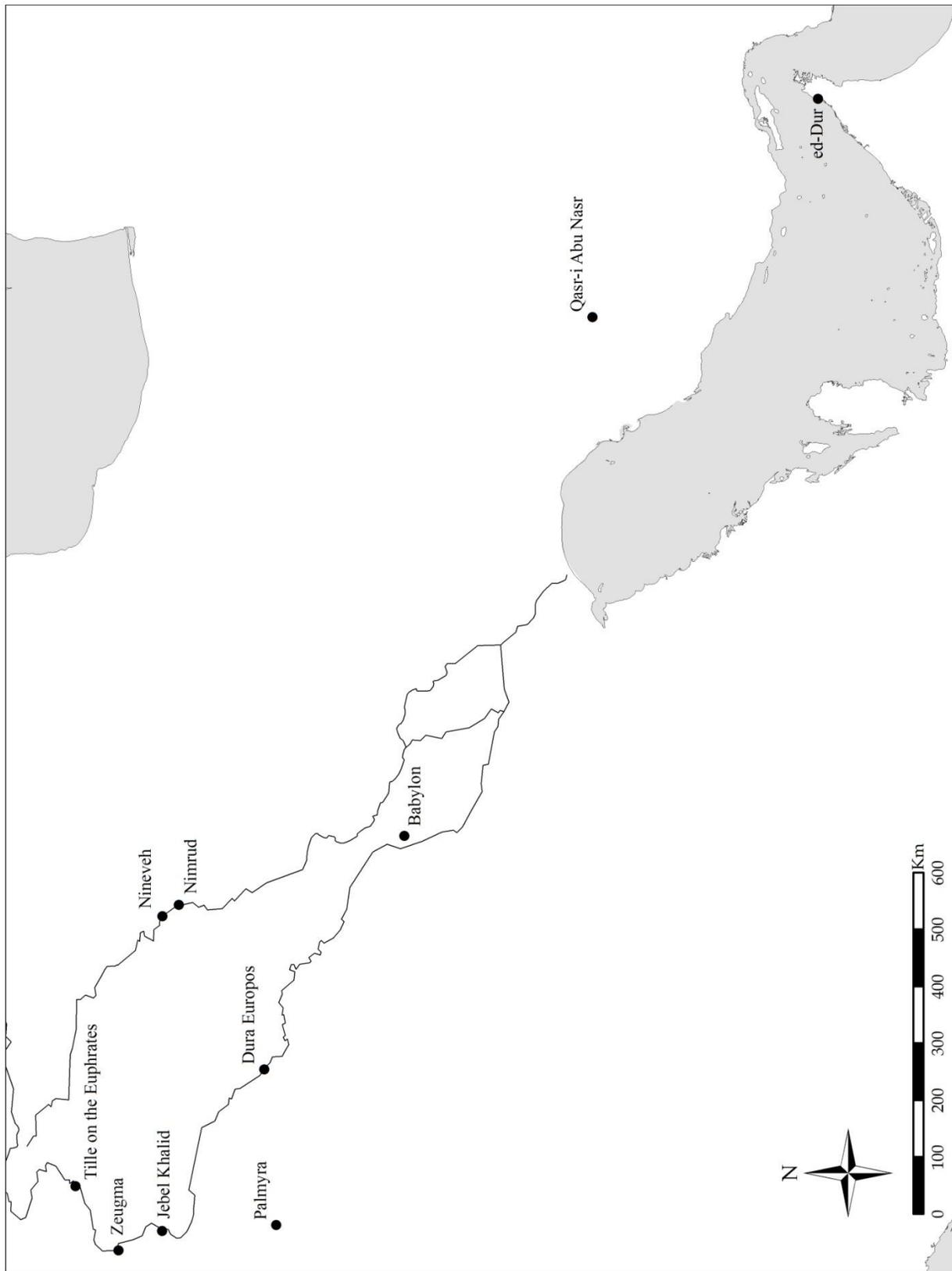


Figure 13. Sites with glass in the Near East, c. 350-50 BCE

Kush and Beyond

Meroe

Glass was used in royal and elite burials of the Meroitic civilization, which flourished in Kush from the fourth century BCE to fifth century CE. According to Coralie Grabel, of 258 known sites associated with the almost 1000 years of Meroitic civilization, only 63 have yielded glass, almost all of which were funerary sites. Few graves contained more than a couple pieces of glass. While the Roman period pieces were more commonly found at a diversity of site types and in utilitarian shapes, the Hellenistic period glass consisted of elaborate polychrome or metallic shaped luxury vessels.⁴⁸¹ Therefore, their appearance and limited deposit contexts signal patterns of appropriate consumption, conspicuous display, and careful control.

Primary and secondary glass production may have taken place in Kush as well. Opaque red vessels with sharply defined edges and decoration, clearly imitating less pliable materials of metal and stone, were a characteristic object of Kushite royal burials. They have been found rarely outside of Kush.⁴⁸² Outside of Meroe, opaque red vessels have been recovered in very small quantities from several second and first century sites in Syro-Palestine and the Aegean. These finds include three bowls from Jerusalem,⁴⁸³ a shallow hemispherical bowl from Cypros,⁴⁸⁴ a bowl from Gamla,⁴⁸⁵ possibly two vessels from Anafa which are somewhat darker,⁴⁸⁶ a ribbed bowl from Knossos,⁴⁸⁷ a tray from Delos,⁴⁸⁸ and a bowl from Kos.⁴⁸⁹

⁴⁸¹ "À l'époque hellénistique, le verre est une production de luxe. Cette rareté est confirmée en contexte méroïtique par le peu d'objets retrouvés et les lieux de découvertes (tombes royales et nobiliaires du Gebel Barkal et Méroé). Les verres sont réservés à une élite et proviennent vraisemblablement d'échanges diplomatiques" (Gradel 2012, 118).

⁴⁸² Stern 1981, 48.

⁴⁸³ Gorin-Rosen 2003, No. G16; 2006, No. G55-G56.

⁴⁸⁴ Jackson-Tal 2013b, pl. 6.1:2.

⁴⁸⁵ Jackson-Tal 2009, 158.

⁴⁸⁶ Grose 2012, No. G240-G241.

⁴⁸⁷ Price 1992, No. 29. This piece is somewhat later, from a context of the first half of the first century CE.

Together, these ten vessels are somewhat fewer than the seventeen documented opaque red vessels from the cemeteries at Meroe.⁴⁹⁰ Opaque red glass objects are somewhat more common in quantity but still quite limited in their distribution; the most numerous are inlays and monochrome canes from the temple workshop at Gumaiyama.⁴⁹¹ Opaque red was also used occasionally and sparingly in mosaic vessels, but only at Delos.⁴⁹² Some preliminary chemical studies have indicated that these glasses may have been made with plant ash instead of mineral natron, suggesting a Middle Eastern or non-Mediterranean glass making tradition.⁴⁹³

Several scenarios are therefore possible for the production of Kushite glass in the Hellenistic period: 1) glass workers, possibly trained in Egypt, made opaque red raw glass and vessels in Kush and traded them to others on a limited basis; 2) opaque red glass was manufactured somewhere other than Kush,⁴⁹⁴ and secondary production took place at Meroe; or 3) both the raw glass and finished products were manufactured outside of Kush but for a distinctive Kushite market that purchased the majority of the products.⁴⁹⁵ Regardless of the specific circumstances, the glass industry of Kush was certainly an example of attached luxury production, with a limited range of objects manufactured in symbolically distinctive and rich colors, and deposited only in burials. The existence of a Meroitic glass industry spanning from

⁴⁸⁸ Nenna 1999, No. E270.

⁴⁸⁹ Triantafyllidis 2006a, No. Y332.

⁴⁹⁰ Dunham 1957, 34, 69, 93 (fig. 61), 111; Stern 1981, No. 2, 7-13, 15-18, 20.

⁴⁹¹ Cooney 1976.

⁴⁹² Nenna 1999, No. B7, B17, B48, B55, B66, B67. One of the few mosaic pieces from Meroe also employs red glass in the canes (Dunham 1957, 80, fig. 50).

⁴⁹³ Nenna and Gratuze 2009; C.M. Jackson 2012.

⁴⁹⁴ One of the territories around the Indian Ocean, possibly India itself, is a distinct possibility (see below).

⁴⁹⁵ Compare, for instance, the Attic vase painting industry of the sixth to fifth century, which may have largely served Italian markets.

the late Hellenistic to early Roman periods is further supported by the possibility of a second-third century CE industry, as has been suggested by Cool.⁴⁹⁶

Indian Ocean

Beyond Meroe, Mediterranean glasswares probably did not reach the Horn of Africa, Persian Gulf, and Indian Ocean until later in the first century BCE, at which point they quickly spread. Two first century CE written sources refer to glass manufacture and trade between Rome and India. The *Periplus Maris Erythraei* indicates trade in raw glass and glass vessels in the Red Sea and Indian Ocean during the first century CE, which has been confirmed by archaeological evidence of imported Roman glasswares in these regions.⁴⁹⁷ Pliny stated that Indian glass possessed a distinctive quality due to the “broken crystal” (*crystallo fracta*) used in them, indicating that raw glass was manufactured in India using a different recipe than that employed in the Roman world.⁴⁹⁸ A shipwreck recently identified off the coast of Sri Lanka, the remains of which have been radiocarbon dated between the second century BCE to second century CE, contained large bun-shaped blue ingots of raw glass. Chemical analysis to determine whether they originated in the Indian Ocean or the Mediterranean area has been inconclusive.⁴⁹⁹ At the furthest extent, Mediterranean produced glass may have reached as far as Arikamedu, a port site on the southeastern coast of India. The site has yielded amphorae, Arretine pottery, lamps, and a few glass vessels imported from the Mediterranean, indicative of

⁴⁹⁶ Cool 1996. The most readily identifiable products are vessels related to the forms of Meroitic ceramic vessels, as well as greater quantities of gilded and painted glasses, particularly flutes, than are found regularly in Mediterranean contexts. Cool also raises the possibility that, since Meroe consumed imported Mediterranean glasses as well as locally produced ones, they could well have exported their products. We should then think about glass trade as two-way rather than uni-directional.

⁴⁹⁷ Stern 1987; Meyer 1992; Stern 1993; Whitehouse 1998.

⁴⁹⁸ *Natural History* 36.66. Stern suggested that Pliny (or his sources) may be referring to use of pure mineral quartz rather than its indirect use in the form of sand, as practiced by glass houses in the Mediterranean (Stern 1987). Alternatively, “*crystallo fracta*” could refer to the silicates of obsidian, traces of which have been chemically identified in Indian glasses. This produced a rather stiff glass which would be well suited to making beads but almost impossible to blow.

⁴⁹⁹ Lawler 2012; Muthucumarana et al. 2014.

trade contact with the Roman world beginning by the late second century BCE and flourishing during the first and second centuries CE.⁵⁰⁰ During this period, Arikamedu was also a prolific stone and glass bead making site, and the relatively small quantities of translucent green, blue-green, and yellow raw glass may have been imported from the Mediterranean.⁵⁰¹

Elite Luxury Glass Consumption during the Hellenistic Period

This discussion of regions practicing luxury patterns of consumption during the Hellenistic Period has been intended to demonstrate that glasswares manufactured in the eastern Mediterranean were extensively traded and consumed in luxury modes throughout the ancient world: from the straits of Gibraltar to the Indian Ocean, from the Crimean peninsula to Kush. Their contexts of use largely continued Bronze, Iron, and Classical period consumer traditions, with workshops attached to palaces and temples, careful control of the raw material and finished product, elaborate manufacturing processes with complex *chaîne opératoire*, and limited deposit types. Burial goods, temple dedications and decorations, and palatial feasting were venues for appropriate consumption throughout this period, but domestic use of tablewares and the adoption of small glass objects for adornment, gaming, and instrumental purposes was rare in most areas.

However, not all glass use in these regions which were primarily importing their glass from the eastern Mediterranean production centers was exclusively luxury in nature. Certain Hellenistic cities – for instance Carthage in North Africa, Morgantina on Sicily, Elaiussa Sebaste in Cilicia, and probably Pherai in Thessaly – began to adopt glass tablewares on larger scales and in different, newly occupational, contexts, in ways similar to their contemporaries in the Aegean

⁵⁰⁰ Begley 1983; Ravitchandirane 2007. It is worth noting that this trade may not have been direct long distance contact, but rather down-the-line trade through Egypt, Kush, Mesopotamia, or other regions connected to Rome which bordered the Indian Ocean.

⁵⁰¹ Stern 1987; Francis 1991. Opaque red glasses, by far the most common color used in the Arikamedu bead workshop, have low lead levels and used potash rather than mineral natron, suggestive of more localized production. One distinct possibility is that Meroe and Arikamedu shared a single, as yet unidentified, supplier for opaque red glasses.

and Palestine. The causes of these differential responses at a more local scale are worthy of further investigation.

In regions with commercial trade contacts with the glass production centers of the eastern Mediterranean, elites used imported glass objects which signaled their prestige, wealth, and cosmopolitanism. Such displays no doubt had different local meanings and expressions particular to the audience and local politics. Glass was, in this sense, not especially significant in its own right but rather functioned alongside imported and locally produced luxury goods in a variety of other materials, including metal, ceramic, and potentially textiles or wood, to constitute and signal an elite identity which functioned locally to promote and express one's power. These objects also operated cross-culturally to signal participation in a globalizing, cosmopolitan system. The semiotic value of the objects was tied to their limited and exclusive access.

A similar luxury use of glass drinking vessels in Roman Scotland has been advanced by Dominic Ingemark. Although the glass tablewares in Scotland were imported from Roman production centers in southern England, where they were much more commonly used in domestic and military contexts, in Scotland these glass vessels became "objectified cultural capital, which in turn was strongly linked to cultural capital in the embodied state, i.e. they required knowledge to be used in an appropriate way. Thus glass was a potent weapon in the struggle for political influence."⁵⁰² This value was not intrinsically embedded in the glass itself, but rather its association with specific cultural practices. For this reason, its meaning may have been more mutable than those of the highest value materials such as precious metals and gemstones, which carried high prestige value in almost all cultural environments.

⁵⁰² Ingemark 2014, 225.

International Style

Although luxury glass vessels of the Hellenistic period may have had alternative semiotic and social meanings in different cultural and political contexts of their use, the fact that individuals over an extensive geographic network and diverse cultural systems used glass vessels of similar styles to signal elite identity marked the advent of a true international, hybrid style. Marian Feldman has defined international style as a fusion of artistic motifs, materials, and techniques used to produce a new form of material culture that is deliberately placeless. The difficulties modern scholars have in teasing out origins of particular objects is the result of intentional design features of the objects used to communicate and mediate among cross-cultural elites.⁵⁰³ Although elites around the Mediterranean probably did not participate in direct gift exchanges of glass and other Hellenistic luxury objects in the same ways as earlier Late Bronze Age rulers (although this is an intriguing possibility...), the material correlates are similar.

It has long been recognized that there was a synchronicity of style and form across media during the Hellenistic period, with glass, ceramic, and metal tablewares of similar shape and decorative pattern being produced in workshops throughout the eastern Mediterranean.⁵⁰⁴ What has been previously under-appreciated, however, is the Achaemenid imperial origins of many popular Hellenistic motifs, especially of the third century.⁵⁰⁵ Characteristic elements of this style include decorative motifs of leaves, grooves, almond bosses, and central raised omphaloi. Common shapes were the signature ‘Achaemenid bowl’, as depicted on the Apadana reliefs at Persepolis, with its flaring rim, carinated profile, and rounded bottom, as well as flatter phiale-

⁵⁰³ Feldman 2006. On the difficult relationship between style and ethnic identity, see Gates 2002.

⁵⁰⁴ For the fullest treatment of this phenomenon, see Rotroff 1982.

⁵⁰⁵ I use “Achaemenid” here in a way analogous to my use of “Hellenistic” throughout this dissertation, to indicate generally the chronological period of political and cultural dominance and, to a lesser extent, the geographic borders of that system.

style plates which also had a similar constriction below the rim.⁵⁰⁶ Despina Ignatiadou has convincingly demonstrated that many of the “Achaemenid” colorless glasswares of the fourth century were more likely made in Macedonia, Rhodes, and Anatolia than in the Persian heartland. They were products of the Achaemenid imperial experience. A. S. Melikian-Chirvani similarly suggested that silver vessels of Achaemenid style were produced not just in Iran, but also in Lydia and Armenia.⁵⁰⁷ Elspeth Dusinger argued that elites and non-elites at Sardis adopted and manufactured Achaemenid style bowls not simply as a form of acculturation, but as part of a process to construct new social identities within the imperial system.⁵⁰⁸ Achaemenid-style tablewares were probably also made in Egypt during the fourth century based on the sculptural reliefs found in the tomb of Petosiris at Tounah el-Gebel which depict a workshop, presumably in Egypt, engaged in the manufacture of Achaemenid-shaped vessels including cups, phialai, rhyta with protomes of griffins, and incense burners.⁵⁰⁹ The Tikh el-Quarmous treasure, deposited probably in the mid-third century, yielded a variety of Achaemenid style silver tablewares with strong parallels to the silver vessels found at Deve Hüyük necropolis in Syria.⁵¹⁰ Although metal vessels are difficult to date and may have circulated for a long time before their deposit, Achaemenid-style motifs in one form or another clearly persisted into the Hellenistic period. The lobed bowl with a central raised boss of the Canosa group has clear decorative motifs rooted in the Achaemenid products. Ignatiadou has even gone so far as to suggest that the

⁵⁰⁶ Gunter and Root 1998; Dusinger 1999; Dusinger 2003, 176-178 for description and history of the shapes and decorative motifs of Achaemenid bowls and phiale.

⁵⁰⁷ Melikian-Chirvani 1993; Ignatiadou 2010.

⁵⁰⁸ Dusinger 2003, 196-197.

⁵⁰⁹ Kozloff 1996, 254, fig. 7; Pfrommer 1996, 175. Petosiris also has a significant contribution to Egyptian glass history: see Chapter 4.

⁵¹⁰ Pfrommer 1996, 175, fig. 5.

ubiquitous early Roman ribbed bowl owes its origins to Achaemenid – or even Assyrian – almond and petal motifs.⁵¹¹

Such local responses to broadly globalizing historical forces were equally at play in the Hellenistic period, despite the apparent veneer of homogeneity. The presence of “Achaemenid” elements in the glass tablewares of the Hellenistic period, most notably in the rounded bottom shapes of drinking vessels and the forms of decoration, are further indication of the multicultural and polyvalent material world of the Hellenistic period. Perhaps some residual meaning of the historical origins of these elements were recognized by an erudite few, but their new association with the globalized, cosmopolitan Hellenistic international style was more immediately significant.

The Antikythera shipwreck, introduced at the beginning of this chapter, therefore reveals the shipment of eastern products to the western Mediterranean clients where they would be consumed as luxury products. The glass vessels from the wreck closely resembled the quantities, shapes, and decorative patterns of those occurring in Italian burial assemblages, for which they were likely destined. But these objects had different valences in the regions in which they were manufactured. To address this, I turn in Chapter 4 to a closer examination of the circumstances in the glass producing areas of the Aegean and Egypt, where new customs of glass production and consumption, not rooted in Bronze, Iron, and Classical patterns, emerged over the course of the second century.

⁵¹¹ Ignatiadou 2009.

Chapter 4.

Mass Production and Consumption: Egypt and the Aegean

A New Way to Consume

This chapter investigates a new pattern of glass consumption activity that developed during the last few centuries BCE, distinct from historical and ongoing use of fine glass objects in highly conspicuous luxury contexts discussed in the previous chapter. Glass tablewares and small objects began to appear in more quotidian contexts. While their heritage as luxury objects undoubtedly continued to drive consumption habits, the increased use of glass in domestic contexts is an index of shifting standards for appropriate consumption practices as well as increased market availability. The nature of production also changed (as will be discussed in Chapter 5), but it was the shifting habits of consumers that stimulated demand for new products. As noted by McCray, “there has been little investigation into the demand for luxury goods. Economists and historians have typically taken demand for granted, assuming an unlimited market for goods produced,” a comment which still largely holds true today despite an increasing interest in consumption as a topic of study.⁵¹² This chapter redresses this balance by examining the potential causes, motivations, and limitations of consumer demand on a commodity product.

The locus of change was centered in the large Greek houses of the eastern Mediterranean islands and coastal zones, where the Hellenistic kings exerted influence but not total control. These territories were historically “Greek” or Greek-speaking, with varying levels of Greek

⁵¹² McCray 1999, 27. Cf. Goldthwaite 1993, 4: “in our supply-sided economic world, with its culture of consumerism, consumption is viewed from the side of the producer, not the consumer.”

religious and political institutions and domestic practices. They were also highly cosmopolitan, in both the traditional sense of multicultural, urban, and outwardly oriented, and in the more specific manner defined by Pollitt, where the division between Greek and Barbarian became less absolute and there was a vested interest in exploring and examining the nature of difference.⁵¹³ As discussed in Chapter 1, the material manifestations of this shift in household consumption habits and the homogeneity of products on offer at places as geographically distant as Delos and Jebel Khalid went beyond the adoption of glass drinking bowls to include other objects of the Late Hellenistic material *koine*, such as mold-made ceramic drinking bowls and other red sigillata tablewares, Tanagra style figurines, masonry style wall painting, and imported – especially Rhodian – wine. While glass may have changed most dramatically in its increased intensity of use, it was embedded in a suite of associated products which reflected an overall cultural package used to communicate particular values and identities of culture and class.

Mass Production and The Rise of Consumerism

Defining Mass Production

The demarcation between luxury and mass produced glass in antiquity has never been adequately addressed in the modern literature. This has resulted in a variety of contradictory and unsubstantiated statements regarding when and where glass was mass produced in antiquity. Some scholars have argued that the earliest mass produced glass objects were core-form vessels: Julian Henderson called Bronze Age core-form vessels the first mass produced glass, and Dan Barag suggested that Mediterranean Groups I and II were “the first instance of an approach to mass-production of glass vessels in antiquity.”⁵¹⁴ Others, like Maud Spaer, have suggested that

⁵¹³ Pollitt 1986, 10-13.

⁵¹⁴ Barag 1985, 59; Henderson 2013, 20.

Syro-Palestinian sagged glass bowls were the earliest, since large numbers of these tablewares “imply the occurrence of mass-produced tableware already before the invention of blowing.”⁵¹⁵ On the contrary, Sarah Jennings insisted that late Hellenistic and early Roman glasswares continued to be luxury items because “the time consuming method of their manufacture and finishing precluded mass production.”⁵¹⁶ Most ancient glass scholars have asserted that the mass production of glass did not occur until the Roman period, following the invention of glass blowing.⁵¹⁷ Even a single author can make opposing claims in the same publication: Carol Meyer, when discussing the glass from Quseir al-Qadim in the Persian Gulf, initially stated that “glass as a mass production item was an innovation of the Roman imperial period that spread rapidly all around the Mediterranean basin,” but only three pages later asserts that the bowls of the mid-second century BCE “were the first mass produced and widely distributed types of glass vessels.”⁵¹⁸ In none of these publications has mass production been explicitly defined nor were its causes and effects explored. Mass production, at least in glass scholarship, is considered a phenomenon which just happened.

This confusion in the glass scholarship can partially be attributed to the general ambiguity in defining mass production, especially in ancient or archaeological contexts. Implied definitions often rely on relative quantities of objects, reproducibility and standardization, or are evaluated in opposition, with mass production juxtaposed against the production of individualized luxury goods. Christopher Gosden, for instance, has argued that art objects are singular, diverse and enchanting, while mass produced objects are standardized, homogeneous, and routine. Standardization in artifacts helps facilitate exchange, reduce uncertainty, and

⁵¹⁵ Spaer 1987a, 53.

⁵¹⁶ Jennings 2004-2005, 29.

⁵¹⁷ Examples of this claim are vast: e.g. Henderson 2002, 595. See further, Chapter 6.

⁵¹⁸ Meyer 1992, 12, 15.

regulate commercial, political, and cultural engagements in a geographically extensive system.⁵¹⁹ Monica Smith has argued that molded objects are objects of mass production and consumption, since no object is original or unique. In order to adopt molds and the objects they produced, consumers and producers underwent a cognitive shift in the meaning and value of objects away from one-of-a-kind (luxury) objects and towards duplicated materials.⁵²⁰ These few specific definitions stand in stark contrast to the many more publications in which “mass production” and “mass consumption” – just like luxury – are used without a working definition or discussion of their meaning in specific historical contexts.

My concept of mass production – as with luxury objects discussed in Chapter 3 – is based on inferred ancient attitudes toward objects, as encoded in the behaviors related to their production, use, and disposal, rather than any absolute quantitative measurement. In this sense, following Gosden, I contrast mass produced objects to singular ‘luxury’ items. Whereas luxury items are more singularized, controlled, and conspicuous, mass produced objects are routine and standardized, widely accessible, numerous, disposable, ordinary, and modest (Table 6). Because they are, by definition, produced in higher volumes, more craftspeople are involved in the process and less skill is invested per object than in luxury forms of production. Instead, much of the knowledge of production sequences is encoded in the technological operation itself rather than trusted to the whims and artistic license of the individual producer. The *chaîne opératoire* of mass produced objects is usually shorter and more straightforward, and individual expression is mediated by tools or technologies, such as molds and task-specific tools, which limit creative

⁵¹⁹ Gosden 2013. Gosden’s argument was particularly influenced by Seaford’s 2004 book *Money and the Early Greek Mind*, wherein Seaford proposed an inverse relationship between individuality of objects and persons (Seaford 2004). See also Gell 1992.

⁵²⁰ Smith 2015. “Consumers made a cognitive leap to accepting identical objects and reinforcing their production through mass consumption while demanding a diversity of designs in the finished product... Consumers acquired “unoriginal” items, but with the benefit of gaining access to stylish new goods at a fraction of the expense of traditional stone beads or metal pendants” (37).

opportunity.⁵²¹ Mass production de-enchants the productive process by removing agency from the artist and encoding it in technology.⁵²²

LUXURY	MASS PRODUCTION
Singular, diverse	Routine, standardized
Controlled; appropriate consumption	Accessible, uncontrolled; no inappropriate consumption
Scarce	Numerous
Curated, structured deposition	Discarded, disposed ⁵²³
Conspicuous	Ordinary, modest

Table 6. Attributes of luxury and mass produced goods.

Although I occasionally refer to mass produced and consumed objects as commodities as shorthand to distinguish them from luxuries, mass produced goods and commodities, in an anthropological sense, are not equivalent. Since Kopytoff, following a Marxist paradigm, scholars have commonly drawn a binary between commodities as objects with an explicit market exchange value and luxuries, whose value is social rather than monetary.⁵²⁴ I find this distinction to be overly dualistic and agree with Steel that goods carry both economic and social values which are mutually encoded.⁵²⁵ Moreover, luxury glass vessels of the first millennium BCE were traded on the open market and therefore, by definition, had exchange value. But they were not mass produced or consumed. My use of commodity, therefore, is intended to indicate that luxuries have a greater market and social value relative to mass produced commodities,

⁵²¹ Cf. Smith 2015.

⁵²² Cf. Gell 1992.

⁵²³ Greene especially considered disposal rates as a strong proxy for attitudes towards material objects, with high rates and cavalier conditions as indicative of a more consumer-driven society (see further below) (Greene 2008c, 70-71).

⁵²⁴ Kopytoff 1986.

⁵²⁵ Steel 2013, 123-124.

which are less valuable forms of economic and cultural capital. Additionally, commodities, unlike luxuries, are fungible and effectively interchangeable since they are not valued for their distinctive history, appearance, or other unique element.⁵²⁶

Mass Production in Hellenistic Glassware

Given this working definition, many glasswares of the later Hellenistic period are best understood as the products of mass production, in contrast to the more elaborate, complex, singular glasswares made in earlier periods. Grooved bowls, for instance, only required a few short steps to produce: melt the chunk of raw glass into a plaque, place the plaque over a former mold and heat until it conforms, cool and anneal, and finally engrave the grooves. The craftsman spent very little active time on the object, and its final form was dictated strictly by the behavior of the glass as it softened and the shape of the mold, minimizing individual agency. Only groove cutting allowed for creative and individual expression, and this may explain the diversity in grooved patterns during this hundred year span. Traditionally trained glass artisans (or their consumers) may have sought to bridge the gap between singular luxury objects and routinized mass production. (The less sophisticated Rhodian glass workers and consumers may have felt no such urge and accordingly left their bowls undecorated.) This method was also fast; experimental archaeology suggests that a basic sagged bowl could have taken as little as 60 seconds to make.⁵²⁷

Beads were also mass produced beginning in the Hellenistic period. At the glass bead workshop on Rhodes, large numbers of beads were made simply by drawing a tube and forming the beads using a segmented mold or by folding a plaque around a rod, constituting a much less

⁵²⁶ However, such fungible objects may acquire singular luxury status over the course of their biographies.

⁵²⁷ Stern 1998, 189. This is the time required to make a hot-worked ribbed bowl; a cold-cut grooved bowl would have been quicker to set up over the mold, but needed additional time to cut the grooves.

labor intensive and creative process than winding individual beads. Glass counters and inlays of the late Hellenistic period were also mass produced using molds or simply by melting chips of glass into amorphous blobs, their individual shapes unimportant.

The treatment of core-form glass perfume vessels further reflects the shift from luxury to mass production of glass over the course of the Hellenistic period. While core-form vessels of Groups I and II appeared throughout the Mediterranean in unprecedented high quantities from the sixth to fourth centuries, their unique decorative patterns, multi-stage and prolonged production process, and careful and deliberate disposal – typically in graves or temples – suggests they were considered luxury objects rather than mass commodities, despite their relatively high numbers. The late Hellenistic manner of manufacturing Group III vessels was much more cavalier. The forms became degraded and sloppy, and while many were still deposited in graves, fragments of Group III vessels have also been found in urban and domestic contexts where they were routinely broken and discarded.⁵²⁸ Forms were also simplified and streamlined to essential attributes. The wide range of seven shapes with at least four variants each available to fourth century consumers of Group II shrank to a mere two utilitarian forms, the alabastron and amphoriskos, by the advent of Group III.⁵²⁹

By contrast with the mass produced, standardized monochrome bowls of late Hellenistic type, Hellenistic polychrome vessels required the glass worker to create different patterns from monochrome plaques, mosaic cane segments, and gold leaf, reflecting a true luxury art. Even mosaic vessel manufacture became more regimented over time. The diverse array of Hellenistic

⁵²⁸ In the words of Donald Harden: “These Hellenistic core-formed glasses are often more carelessly fashioned and less graceful and artistic than their predecessors” (Harden 1981, 122). Similarly, Grose described many examples of Group III as “poorly crafted.” He went on: “Bodies are often lopsided, with carelessly fashioned rim-disks, handles, and bases and coarsely applied decorative trails. This results in a puzzling host of slightly different forms” (Grose 1989, 122).

⁵²⁹ Grose 1989, 122. Both forms were closely related to contemporary pottery and amphora shapes.

mosaic vessels in which seemingly random segments and plaques were set alongside one another, creating vessels unique in color and composition, gave way to a more narrow and specific set of motifs and accepted patterns in the Roman period. Such individuality in form and decoration was also characteristic of vessels made in fourth century Macedonian workshops. The free creative and individualistic expression embedded in singular luxury objects is particularly evident when the archaeologist tries and fails to create typologies or identify workshops based on such diversified attributes.⁵³⁰

Consumerism and the Middle Class

Mass production has historically been connected with increased globalization of markets and a generalized enhancement of wealth and living standards among non-elite classes. In other words, mass production goes hand-in-hand with mass consumption. Although cultural anthropologists and historical archaeologists have been interested in consumer and consumption habits since the 1970s,⁵³¹ archaeological approaches are still in infancy, with most scholarship published in the last decade or two.⁵³² This may be due, at least in part, to the strong association between (mass) consumerism and industrialization, capitalization, and modernity, at least in the modernist scholarship.⁵³³

⁵³⁰ E.g. Harden 1980.

⁵³¹ E.g. McKendrick, Brewer, and Plumb 1982; Miller 1987, 2001; Mullins 2004, 2011b.

⁵³² See Mullins 2011b for a history of consumption studies in archaeology, the vast majority of which are examples from historical archaeology, with particular emphasis on eighteenth and nineteenth century Colonial America and early Industrial Europe (e.g. Mukerji 1983; Martin 1996; Baudrillard 1998; Roche 2000; Berg 2004; Mullins 2011a; Berg 2012; Hodge 2014). Mullins concluded that too many consumption studies have focused on supply-side commodities, with little nuance of interpretation regarding how material goods were actually consumed.

⁵³³ The four volume multi-disciplinary anthology on consumption edited by Daniel Miller and published in 2001 began with Marx and contained no article dealing with consumption before the early Modern period (Miller 2001). A singular exception to the bibliographic divide between ancient and modern consumption studies is Davidson's essay on Athenian democracy and the "origins of western consumption" in a 2012 handbook on consumption studies (Davidson 2012), but this contribution is more in dialogue with classicists and ancient sources rather than an application of modern consumption models to the Athenian context.

Mass consumption in the ancient Mediterranean world has become a burgeoning field of interest in the last decade or so.⁵³⁴ Perhaps not accidentally, this nascent area of study has emerged in an intellectual environment in which Finley's claim to a fundamental difference between the primitive ancient economy and modern industrial economy has largely lost sway.⁵³⁵ More scholars have acknowledged that binary divisions between primitive/modern, pre-capitalist/capitalist, non-industrial/industrial societies are reductive, misleading, and unhelpful.⁵³⁶ Indeed, some economic historians have increasingly argued in favor of a market based economy in the ancient Mediterranean and the general applicability of market theory to the ancient world.⁵³⁷ John Bintliff, for instance, has called the Hellenistic and Roman Mediterranean a "proto-capitalist economy."⁵³⁸ Gary Reger, on the other hand, has argued that economic integration was far from complete, and local and regional economies, in which most of the population remained poor and immobile, operated largely independently.⁵³⁹ While the distinctions between the ancient and modern economy have yet to be resolved beyond a generalized rejection of the binary, and this is certainly not the place to do so, the arguments presented here draw broad parallels in individual and institutional behavior between ancient and modern societies by finding material, political, and economic correlations between the Hellenistic period and the better documented societies of the early Modern world.

⁵³⁴ Recent archaeological studies of the ancient Mediterranean which engaged directly with modernist consumption theory include: Martins 2005; Ray 2006; Greene 2008c; Vives-Ferrándiz 2008; Steel 2013. Notably, they span from the Bronze Age Aegean to the Iron Age western Mediterranean to Roman Britain. Others who have engaged with the concept of consumption or consumerism, defined more generally in opposition to production, include: Lund 2005; O'Hea 2006/2007; Walsh 2014.

⁵³⁵ Finley 1973. For comment on Finley's legacy and the state of the debate, albeit now fifteen years old, see Morris 1999; Greene 2000. A useful summary of the debate over the primitivist views of Finley contrasted with the modernist stance of Rostovtzeff, returning to the sources themselves, is Saller 2005.

⁵³⁶ Marx looms implicitly large over this entire discussion; Greene suggested that consumption has been relatively neglected by archaeologists as a theoretical perspective because consumption is viewed by Marxist economists and other scholars as a secondary byproduct of production practices; in other words, consumption is merely a side effect of the primary thing (i.e. production) rather than the thing itself (Greene 2008c, 64).

⁵³⁷ For instance, Temin 2013; Acton 2014; Jones 2014.

⁵³⁸ Bintliff 2013.

⁵³⁹ Reger 1994, 2003

One powerful motivator behind mass consumption, particularly of goods previously reserved for elite luxury consumption, is social emulation, in which “wealthy non-nobles imitate the ways of the nobility and seek to enter into its ranks.”⁵⁴⁰ Paul Mullins, followed by Christina Hodge, traced the idea of social emulation back to Veblen’s 1899 *The Theory of the Leisure Class*, an indictment of the materialism which was promoted among the Victorian leisure class as an avenue and expression of hierarchical competition for status and identity.⁵⁴¹ Similar ideas were developed in the mid-twentieth century by sociologists and historians such as George Duby, who observed that cultural development was often governed by “the popularization of aristocratic values in a slow, descending movement as the immediately inferior class, fascinated by the power and prestige of the elite, sought to imitate its ways.”⁵⁴² Louise Steel said emulation occurs when “socially or politically ambitious individuals might seek to improve their social capital and to raise their relative position within a hierarchical structure through the adoption of some symbol, style, or insignia associated with the elite.”⁵⁴³ A particularly notable early modern example of producers and retailers playing upon the desire for mass produced versions of elite luxury objects occurred in the eighteenth century, when Josiah Wedgwood intentionally marketed his creamware ceramic table service first to royalty, then nobility, then finally the common people, producing different levels of quality, decorative embellishment, and ranges of forms in a price scale catered to each consumer market.⁵⁴⁴

However, elite taste is not the only vehicle of cultural change, and non-elites may also be powerful drivers of consumerism and shifts in material culture. Andrew Trigg has characterized Veblen’s leisure class theory of consumerism as a “trickle-down” model in contrast to

⁵⁴⁰ As succinctly defined by Goldthwaite 1993, 3.

⁵⁴¹ Veblen 1899 (2000); Mullins 2004, 195; Hodge 2014.

⁵⁴² Goldthwaite 1993, 192.

⁵⁴³ Steel 2013, 126.

⁵⁴⁴ McKendrick, Brewer, and Plumb 1982, 100-145; Martin 1994, 173.

Bourdieu's "trickle-up" consideration of middle classes as the primary driver of consumer behavior.⁵⁴⁵ Christina Hodge has argued that a fluidly defined social and economic class of what she called the "middling sorts," consisting of shopkeepers, entrepreneurs, merchants, and bankers, participated in the creation of genteel eighteenth century Colonial American culture to an equal degree as the wealthier elite land owning class. Early modern consumerism can be understood as both upper and middling classes aspiring to a single shared ideal of gentility rather than unidirectional emulation of upper classes by the middling classes, as espoused by Duby and his ilk.⁵⁴⁶

Although alternative motivations may drive consumer culture in different cultural and historical environments, certain economic and social factors facilitated the adoption of mass produced consumer goods by a greater variety of consumers. Not only must mass market consumers desire elite goods, they also must have the resources to acquire them. According to Richard Goldthwaite, the development of secular art in Renaissance Italy was facilitated by the penetration of wealth further down into lower ranks of society and away from concentration in the hands of a few super-elites. More individuals possessed moderate degrees of wealth, which led to increased competition among them. High degrees of social mobility and uncertainty regarding social status further encouraged investment in art by lesser elites. With new consumers routinely entering the consumer class, those already in it had to continue to compete to maintain their status lest they find themselves left behind.⁵⁴⁷ While wealth is not necessarily equivalent to status, wealth can help *create* status through the accumulation of appropriate consumer goods. Similarly, the intentional marketing of lower quality versions of elite luxuries by entrepreneurs like Josiah Wedgwood helped make objects more accessible to non-elite

⁵⁴⁵ Trigg 2001.

⁵⁴⁶ Hodge 2014, xvii-xix.

⁵⁴⁷ Goldthwaite 1993, 46-52.

consumers. Ann Smart Martin suggested that ceramic tea cups, rather than plates, were purchased by more rural households because they were less expensive and more adaptable to local customs; as such, they were small, affordable luxuries that signaled a generalized adoption of tea drinking as social emulation without complete participation in the specific behaviors which accompanied tea parties and would have been considered appropriate consumption by urban elites.⁵⁴⁸

Therefore, models of consumption in the early modern period indicate that consumer habits are motivated by a wide variety of factors, which can vary from locally particularistic to universally common. Significantly, mass consumption is connected to the attitudes, values, and purchasing power not of the highest classes of society, but rather to the economic and social group which Hodge called “middling sorts.”

While this statement may seem self-evident – “mass” consumption reflects the behavior of the “masses” – it has profound historical and archaeological implications. We can productively define the middling sorts, middle class, local elites, and other such groups operationally as “those who participate in mass consumer culture.” While this definition is somewhat circular, it provides a way to begin to talk about an ill defined and poorly understood ancient social and economic demographic without imposing weighty assumptions regarding relative wealth and concordant social status. Thus defined, attributes of this group can begin to be discussed and debated based on the nature of the material evidence itself: were they cosmopolitan or local in their outlook? Urban or rural? Which behaviors are associated with global mass consumption habits, and which remained embedded in small scale, local economies? Were they emulating more wealthy (royal) elites and court society or striving toward a more generalized ideal?

⁵⁴⁸ Martin 1994.

Regions of Glass Production and Consumption in Egypt and the Aegean

As in Chapter 3, I turn now to a discussion of glass consumption sites by general region. Such discussion is intended to serve as a principle of organization rather than a reification of modernistic geographic boundaries (Table 7). My intention is to compare and contrast local responses to the increased availability of glass in the marketplace and examine whether eastern Mediterranean consumers had different local responses to glass products than did consumers further afield, where luxury consumption was exclusively practiced. The eastern Mediterranean is set apart as a locus of both primary and secondary glass production in this period. While not all areas would have had equal access to glass products, the similar material worlds of eastern Mediterranean consumers, as marked by the common presence of pottery, coinage, and architectural forms, indicated some degree of access to and participation in the Hellenistic material *koine*.

Region	Site	Number of Objects	Map Reference
<i>Egypt</i>			
	Akhmim	1	Figure 14
	Alexandria	24	Figure 14
	Antinoopolis	1	Figure 14
	Cusae	1	Figure 14
	Denderah	6	Figure 14
	El-Amarna	1	Figure 14
	El-Faiyum	1	Figure 14
	Faras	6	Figure 14
	Gumaiyama	291	Figure 14
	Karnak	2	Figure 14
	Memphis	1	Figure 14
	Mostagedda	4	Figure 14

	Naukratis	2	Figure 14
	Saqqara	1	Figure 14
	Tanis	9	Figure 14
	Tebtynis	15	Figure 14
	Tel Defenneh	2	Figure 14
	Tell Basta	1	Figure 14
	Tell el-Balamun	5	Figure 14
	Tell el-Yahudiyeh	3	Figure 14
	Thebes	6	Figure 14
	Tounah el-Gebel	2	Figure 14
<i>Cyclades</i>			
	Aegialis	9	Figure 15, Figure 16
	Andros	1	Figure 15
	Delos	1580	Figure 15
	Kea	1	Figure 15
	Kimolos	1	Figure 15

	Kythnos	1	Figure 15
	Melos	2	Figure 15
	Minoa	172	Figure 15, Figure 16
	Paros	1	Figure 15
	Rineia	1	Figure 15
	Santorini	1	Figure 15
<i>Dodecanese</i>			
	Damos	1	Figure 16
	Ialysos	1	Figure 16
	Karpathos	1	Figure 16
	Kastraki	1	Figure 16
	Kos	232	Figure 16
	Nisyros	3	Figure 16
	Rhodes	581	Figure 16
<i>Crete</i>			
	Agios Nikolaos	1	Figure 15
	Agios Thomas	2	Figure 15
	Chania	2	Figure 15
	Eleutherna	1	Figure 15
	Elyros	4	Figure 15

	Gortyn	8	Figure 15
	Herakleion	1	Figure 15
	Knossos	115	Figure 15
	Mochlos	5	Figure 15
	Rethymnon	1	Figure 15
	Tarrha	5	Figure 15
<i>Cyprus</i>			
	Amathus	25	Figure 17
	Aphendrika	1	Figure 17
	Arsinoe	4	Figure 17
	Athienou	1	Figure 17
	Geronisos	37	Figure 17
	Idalion	3	Figure 17
	Karpassia	1	Figure 17
	Kourion	4	Figure 17
	Larnaca	1	Figure 17
	Marion	3	Figure 17
	Panayia Ematousa	25	Figure 17
	Paphos	5	Figure 17
	Salamis	4	Figure 17

Table 7. List of sites discussed in Chapter 4 with quantities of published glass objects from c. 350-50 BCE, by region

Egypt

Greco-Roman Egypt has long been considered to have played a major role in the development of glass technology and production of glass objects for a variety of historical and historiographic reasons.⁵⁴⁹ First, Roman authors including Cicero, Strabo, and Pliny indicated that glass came from Egypt and specifically Alexandria.⁵⁵⁰ Second, the Egyptomania of the early twentieth century facilitated extensive work in the Egyptian temples and tombs, where the desert

⁵⁴⁹ Many recent sources and information in this section were identified with the assistance of Bagnall and Davoli's survey article on recent work in Hellenistic and Roman Egypt (Bagnall and Davoli 2011).

⁵⁵⁰ See Appendix, Texts 2, 3, and 5.

environment kept glass well preserved. As glass objects of the Hellenistic and Roman periods, as well as Pharaonic Egypt, were found, they seemed to confirm the literary accounts of a thriving glass industry.⁵⁵¹ Finally, as the distinction between primary and secondary workshops became better understood and elemental analyses of glass fabrics were conducted in the second half of the twentieth century, Egypt – and specifically Wadi Natrun – was recognized as a major center of primary glass making, or at least as a primary supply source for the mineral natron.⁵⁵² Outside the specialist area of glass scholarship, the assertion that Egypt – and specifically Alexandria – was the primary source of Hellenistic luxury glass wares, including gold glass, mosaic, and elaborate monochrome vessels was propagated by Rostovsteff and widely repeated.⁵⁵³

However, as excavations progressed during the later twentieth century in more urban and domestic areas in Egypt, and areas outside of Egypt also became better explored, some scholars began to note the relative paucity of glass vessels recovered from Ptolemaic and early Roman period Egypt relative to elsewhere in the Hellenistic and early Roman worlds. Marianne Stern and David Grose, for example, grew increasingly skeptical of the role of Alexandria in the Hellenistic glass industry,⁵⁵⁴ while Donald Harden, among others, became entrenched in their

⁵⁵¹ Harden's publication of the Late Roman period glass from Karanis was the first dedicated report of glass from a single site, further enhancing the relative importance of Egypt in archaeological scholarship (Harden 1936; see also Harden 1984 for the significance and impact of the Karanis publication).

⁵⁵² Surface prospection and survey undertaken by Marie-Dominique Nenna, Maurice Picon, and Valérie Thirion-Merle in the 1990s identified at least four sites in the Wadi Natrun valley where glass may have been made in primary workshops; dating of the sites is uncertain due to the paucity of evidence and nature of surface survey, but Late Roman material was found near them (Nenna, Picon, and Vichy 2000; Nenna et al. 2005). Chemical analyses on Roman glasses indicates that by the fourth century CE, if not sooner, almost all raw glass was produced in either Egypt or Syro-Palestine (Freestone 2004). Wadi Natrun was not the only source for mineral natron exploited in antiquity, although it was probably the largest and most productive. For natron sources in Macedonia and elsewhere, see Ignatiadou et al. 2005; Dotsika et al. 2009; Dotsika et al. 2012.

⁵⁵³ Rostovtzeff 1951, 370-374, repeated in Fraser 1972, 137. On the impact of Rostovtzeff in Hellenistic glass history, Grose 2012, 51.

⁵⁵⁴ Both discuss the issue several times, but see especially: Grose 1981, 64; Stern 1981, 47-48; Stern and Schlick-Nolte 1994, 108. Neither posited a true alternative, but they both noted the lack of evidence from Alexandria, especially for monochrome vessel technologies.

assertion of Alexandrian glass production.⁵⁵⁵ The argument often hinged specifically on the origins of the Canosa Group,⁵⁵⁶ but since the Canosa Group was seen as the forerunner of later Hellenistic technologies and forms, the issue extended to Late Hellenistic glasswares as well. In other words, if the Canosa vessels originated in Alexandria, then later Hellenistic glass objects were most likely to have been produced in or inspired by Alexandrian workshops as well.

The ambiguous role of Alexandria in Hellenistic arts and crafts is not limited to glass studies, but also extends to sculpture, architecture, and painting.⁵⁵⁷ J. J. Pollitt argued some time ago against the scholarly tendency to attribute all artistic achievement of the Hellenistic age to Alexandrian artists, noting that even the limited evidence from Alexandria indicated that Alexandrian sculptors, painters, and architects did not “diverge in any significant way from Hellenistic art elsewhere,” nor did they dominate artistic developments like Athens, Rhodes, Pergamon, and eventually Rome did.⁵⁵⁸ While he made an exception for decorative arts and tablewares in ceramic, metal, and glass, which he discussed in less detail than more monumental forms of artistic production,⁵⁵⁹ it seems unnecessary to think that Alexandrian potters, metal smiths, or glass workers were any more trendsetting than sculptors or architects.

A further hindrance to the question of the role of Egypt in general and Alexandria in particular is the lack of well published catalogues of glass from Egyptian sites of any period, and especially the Hellenistic. So many major Egyptian sites were excavated in the early twentieth century that the collections of major institutions like the British Museum must serve in lieu of

⁵⁵⁵ See especially Harden 1980.

⁵⁵⁶ See Chapter 3.

⁵⁵⁷ Alexandria and Alexandrianism: Papers Delivered at a Symposium Organized by the J. Paul Getty Museum and the Getty Center of the History of Art and the Humanities and Held at the Museum April 22-25, 1993 1996; Empereur 1998.

⁵⁵⁸ Pollitt 1986, 250.

⁵⁵⁹ Pollitt 1986, 256. His discussion of glass was limited to the putative Alexandrian invention of sandwich gold glass bowls based on the account of Kallixeinos and parade of Ptolemy II (Appendix, Text 1); see Chapter 2 for further discussion.

detailed site reports.⁵⁶⁰ The large collection of glass in the Greco-Roman Museum of Alexandria, which contains a large amount of material from excavations in and around Alexandria, is entirely unpublished; a preliminary catalogue of the material spanning from the 18th Dynasty to the Islamic period compiled by Leila Wente in the early 1980s has, to the best of my knowledge, never appeared in print.⁵⁶¹ Wente stated in a preliminary report that “it is apparent that there was indeed a thriving glass industry in Alexandria,” but she did not indicate the date, products, or evidence for this reputed production. However, her particular interest was in the origins of the later Roman opus sectile inlay panels with Egyptianizing and Nilotic themes,⁵⁶² so it is reasonable to suppose that her discussion was related to Roman(?) inlays, not Hellenistic vessels.

In the following discussion, I aggregate and evaluate the published evidence of glass from Ptolemaic period Egypt (Figure 14), in order to assess the technological as well as cultural and political role of Egypt in the innovations of Hellenistic glass.

⁵⁶⁰ E.g. Cooney 1976.

⁵⁶¹ Wente 1983.

⁵⁶² Cf. Ibrahim, Brill, and Scranton 1976.

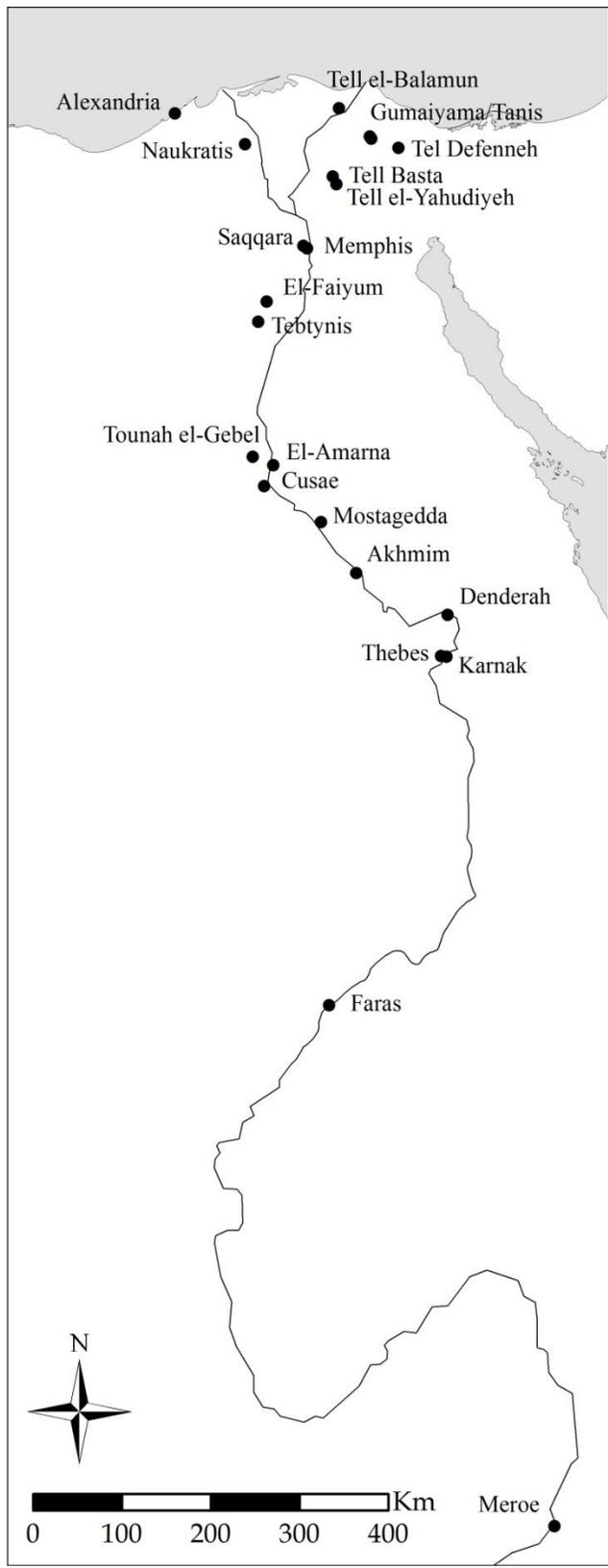


Figure 14. Sites with glass in Egypt, c. 350-50 BCE

Workshops

Two possible secondary glass workshops dating to the Hellenistic period have been identified in Egypt. Gumaiyama, located southwest of Tanis within the temenos of a temple precinct, was excavated by Flinders Petrie in the 1880s. Petrie discovered remains consistent with a glass workshop, including monochrome and polychrome mosaic glass canes, open terracotta molds (including some with glass adhered), wasters of mosaic canes, and assorted glass drops and raw glass fragments, which he interpreted as belonging to a temporary workshop established to adorn or repair decoration in the temple. The finds, many of which are now housed in the British Museum, were initially dated to around 300, a date which has been repeated without much justification in subsequent discussions. John Cooney, however, down-dated the workshop to the first century BCE-first century CE on the basis of the large quantity and sophistication of the mosaic canes and inlays.⁵⁶³ Nenna has subsequently and reasonably stated that Gumaiyama may have been an operating workshop longer than Petrie assumed, but it was too poorly excavated and preserved to distinguish phases after the fact.⁵⁶⁴ The Gumaiyama material, therefore, cannot validly be used to determine dates of mosaic glass or particularities of glass production under the Ptolemies, but it does demonstrate the kinds of materials – inlays, canes, and beads – and contexts – temples and furniture – which were prominent in Egyptian glass working generally during the Ptolemaic period.

A second, seemingly similar, temporary or short-lived workshop located within a temple precinct has been identified at Tebtynis in the Fayum, and also variously dated to either the early

⁵⁶³ Petrie, Griffith, and Murray 1888; Cooney 1976. Nenna, Picon and Vichy and Mahnke prefer Petrie's original third century date, and use it without comment (Nenna, Picon, and Vichy 2000 and Mahnke 2008).

⁵⁶⁴ Nenna 1995, 278.

third century or some point before the Roman period.⁵⁶⁵ While there is no substantive publication of the finds, excavations, or dating evidence to date, reported glass finds include three opaque glass busts wearing mosaic glass headdresses, mosaic glass inlays with checkerboard, oval, feather, and flower patterns, and mosaic bars, similar decorations to which were found on the wall of the associated temple *naos*, lending credence to the hypothesis that the workshop was specifically providing the temple furnishings.⁵⁶⁶

Memphis has also been occasionally included in lists of potential glass workshops of the Ptolemaic period, an assertion popularized by Dorothy Thompson. Thompson considered Memphis to have been self-sufficient for standard products such as ceramics and glass wares.⁵⁶⁷ She cited Petrie's excavation of kilns lined with vitreous glaze in the Kom Helul district at the southern end of the city as evidence for glass manufacture dating back at least to the late Ptolemaic period.⁵⁶⁸ These kilns have subsequently been re-explored by Paul Nicholson on behalf of the Egypt Exploration Society. Nicholson has firmly established that the major product of this workshop was faience vessels, not glass, and it reached its peak of operation in the Roman period, not the Ptolemaic as Petrie had thought.⁵⁶⁹ Other than a stray chunk of opaque red raw

⁵⁶⁵ The construction of the temple itself has now been dated to Ptolemy I (Rondot 2004), although the various fittings and decorations need not be that early.

⁵⁶⁶ The most detailed description of the finds from the Tebtynis workshop is in Nenna's Delos publication (Nenna 1999, 168). Nenna was working on the Tebtynis finds housed in the Turin Museum and Cairo Museum in the later 1990s; she discussed some finds from the domestic area found in 1988, but not the Italian workshop debris, in Nenna 2000a. Nevertheless, Tebtynis is frequently mentioned alongside Gumaiyama as an example of an early third century temporary workshop specializing in inlays and other temple decorations (Nenna 1998, 695; Nenna, Picon, and Vichy 2000, 107; Mahnke 2008, 34-36). On the excavation itself, Nenna, Picon, and Vichy cite Anti 1931, where no mention is made of either glass or a workshop.

⁵⁶⁷ Thompson 1988, 63.

⁵⁶⁸ Petrie 1911.

⁵⁶⁹ Nicholson 2003, 2013.

glass suggested to come from a Hellenistic context, no glass objects firmly or even potentially dated to the Hellenistic period from Memphis are known to me.⁵⁷⁰

The Ambiguous Case of Alexandria

As discussed above, Alexandria has long been thought to have been a center of glass production during the Hellenistic period, but the archaeological evidence on and in the ground has been scant. As Marianne Stern pointed out in 1981, "everyone knows how disappointing the glass finds from Alexandria are."⁵⁷¹ The situation over three decades later is not appreciably different. Only three areas in the entire city – the Kom el Dikka neighborhood, and the Shatby and Gabbari necropoli to the east and west of the ancient city, respectively – have yielded moderate quantities of glasswares from *any* period, and only the Shatby necropolis contained Hellenistic glass.

The archaeological excavations of Mieczyslaw Rodziewicz under the auspices of the Polish Archaeological Mission in the modern neighborhood of Kom el-Dikka have generated substantial information about the Late Roman city, but the Hellenistic period remains elusive. A likely glass workshop was found buried beneath the fourth to seventh century CE *auditoria* and identified on the basis of two circular red brick furnaces with coatings of green glass.⁵⁷² These remains could represent either a primary or secondary workshop; assuming they do not much antedate the *auditoria*, they would represent a standard urban glass workshop of the type which had become common by the third to fourth centuries CE across the Mediterranean. Therefore, the presence of a glass workshop in Late Roman Alexandria does not indicate any special status

⁵⁷⁰ The raw glass fragment is in the University College London collection (U.C. 22102) and mentioned by Stern 1981, 45. Nenna did not provide any examples from Memphis in her listing of Hellenistic glass finds and workshops (Nenna 1999).

⁵⁷¹ Stern 1981, 47.

⁵⁷² Kucharczyk 2007, 45-46.

of Alexandria in the glass industry dating back to an earlier period.⁵⁷³ Similarly, also in Kom el-Dikka, the remains of a Late Roman glass bead workshop and furnace were identified in the domestic block along Street R4. The evidence for workshop production included stone segmenting molds used to form a drawn glass tube into individual bead sections and segmented beads, some of which were still fused.⁵⁷⁴ The similarity of the Late Roman Alexandrian material to the drawn and segmented beads found in the mid-Hellenistic workshop at Rhodes attests to the continuity of bead making traditions in the eastern Mediterranean for over a half millennium.⁵⁷⁵

The earliest non-funerary glass finds from Alexandria are probably the remains of a chryselephantine statue with polychrome glass and semi-precious stone inlays. The life-sized figure, possibly a cult statue of Isis or Serapis based on the proximity of the finds to those sanctuaries, could have originated as early as the late Ptolemaic period, but the only firm archaeological date is its destruction and deposit in the third or fourth century CE.⁵⁷⁶

The only location in Alexandria where Hellenistic period glass vessels and small objects have been found in appreciable quantities is the Shatby necropolis east of the ancient city walls. The finds from the Italian mission, published summarily in 1912, included four mosaic bowls with spiral and rosette patterns, two purple bowls including one with exterior grooves, two core-form unguentaria fragments which could belong to Group III, four unillustrated mosaic inlay fragments and several rings, beads and other jewelry (which could be Roman period), and various mosaic plates and plaques which are certainly Roman based on the pattern and

⁵⁷³ In the mid third century CE, Athenaeus referred to a flourishing glass industry in Alexandria (Appendix, Text 1), but whether this is a continuation, revival, or completely new industry is unclear. See discussion in Stern 1981, 49.

⁵⁷⁴ Rodziewicz 1984, 242-243.

⁵⁷⁵ For the Rhodes workshop, Weinberg 1983. See further below.

⁵⁷⁶ Rodziewicz 1991. Nenna, Picon, and Vichy cited these remains as evidence for a mosaic inlay workshop in Alexandria dating sometime after the reign of Ptolemy IV at the end of the third century (Nenna, Picon, and Vichy 2000, 107).

complexity of their motifs.⁵⁷⁷ The date of the Shatby necropolis has been controversial, and current consensus points to a founding date of c. 315 and terminus of c. 240.⁵⁷⁸ At the Gabbari necropolis west of the city, which was used continuously from the early third century to c. 50, the only glass objects of any type dating to the Hellenistic period were two colorless glass rings from a single tomb chamber.⁵⁷⁹ The difference between the two necropoleis is striking, and suggests that only certain members of the population had access to or desire for glass items in their funerary practices.⁵⁸⁰

Therefore, there is at best only circumstantial evidence, almost all from literary sources, that glass manufacture and working occurred in Alexandria under the Ptolemies. The glass remains are not just “disappointing,” as characterized by Marianne Stern: they are almost entirely silent, notwithstanding the limited scale of excavations and uncertainty about museum material in and outside of Egypt. While not much archaeological work has been conducted, much less published, from Alexandria, and a skeptic such as Donald Harden might say the argument from archaeological silence could be eviscerated with a single discovery of a workshop site, the contrast between Alexandria and other contemporary cities where glass is known to have been worked is significant and striking. In Jerusalem, glass bowls, beads, small counters and inlays, and other stray objects have been found in contexts all over the ancient city, and in sufficient quantities and predictability as to serve as a type fossil for the Late Hellenistic period.⁵⁸¹ Similarly, at Beirut, excavations in three different sectors during the 1990s attested to the

⁵⁷⁷ Breccia 1912, 99-106, No. 312-347. There are also four probable Group I or II alabaster and oinochoai.

⁵⁷⁸ Coulson 1987. These are the dates used in Nenna 1993a.

⁵⁷⁹ Nenna 2001. Nenna even commented on the surprising absence of core-form perfume vases and monochrome vessels in the assemblage. The rings came from Chamber 11 of tomb B1.

⁵⁸⁰ For a discussion of funerary practices in Ptolemaic Alexandria, using the Shatby and Hadra necropoleis as case studies, see Landvatter 2013, 58-109. Landvatter examined quantity, diversity, and quality variability among individual burial assemblages but did not test for any differences between the two cemeteries.

⁵⁸¹ Late Hellenistic glasses published from Jerusalem: Johns 1950; Avigad 1972a; Ariel 1990; Gorin-Rosen 2003, 2006; Israeli and Katsnelson 2006. This evidence is further discussed in Chapter 5.

presence of a significant and continuous glass industry for over a millennium, dating back at least to the first century BCE.⁵⁸²

By contrast, the few publications of Alexandrian glasswares contain no reference to pre-Roman glass, with the exception of the Shatby necropolis. Tellingly, an early catalogue of Greco-Roman glass housed in the Cairo Museum only documented blown glass vessels, with no indication of any earlier material.⁵⁸³ A similar project based on the collections of the Greco-Roman Museum in Alexandria was also silent regarding glasswares prior to the Roman period,⁵⁸⁴ and Nenna, who was familiar with the unpublished Egyptian material and had been working in Egypt, only cited the Shatby material and a select few unpublished fragments from individual excavation areas.⁵⁸⁵ There are other reasons why glass might not appear in the archaeological record in Alexandria – climate and survival conditions, alternative patterns of use and disposal, or primary production for export markets⁵⁸⁶ – but it is clear that nothing of the significance or scale seen in Jerusalem and Beirut was happening in Alexandria. This picture has not changed in thirty years, and it seems unlikely to change in the next thirty.

Mosaic Plaques

Much of the difficulty isolating Egyptian glass production and consumption patterns has been due to the large quantities of material in museum collections, either acquired on the antiquities market or recovered in early excavations and not properly documented. Perhaps the

⁵⁸² Glass from Beirut: Jennings 2004-2005; Foy 2005; Kowatli et al. 2006; Foy, Picon, and Thirion-Merle 2007. This evidence is further discussed in Chapter 5.

⁵⁸³ Edgar 1905.

⁵⁸⁴ Wentz 1983.

⁵⁸⁵ Nenna 1999, 69 n. 63, 110 n. 124. These unpublished fragments are reportedly cast or sagged monochrome bowls from the salvage excavations in the area of the Caesareum and Roman pillar molded bowls from the 1993-1997 French excavations in the city center. Cf. Nenna 1995, where Nenna synthesized the over 400 pieces of monochrome and mosaic inlays, most of which are still unpublished, in the Greco-Roman Museum at Alexandria.

⁵⁸⁶ As suggested by Rostovtzeff (Rostovtzeff 1951, 374), among others. This is a possibility worth consideration and not without ancient parallels. Fifth and fourth century Athenian potters, for instance, manufactured certain painted ceramic vessels for western consumers as a luxury (Spivey 1991). It may also fit Ptolemaic economic habits, which emphasized exports and minimized imported objects (Kozloff 1996).

most significant class of objects from this group are mosaic glass plaques and inlays due to their uncertain relationship with mosaic glass vessels. The earliest firmly-dated examples of mosaic glass are inlay panels with names of mid-fourth century Egyptian personages. The first is an elaborate wooden furniture piece with glass inlays, which is now in the Brooklyn Museum.⁵⁸⁷ It bears the prenomens of Nectanebo II, pharaoh of Dynasty XXX, who reigned 359-341. Both monochrome and polychrome mosaic were set into the wooden panel; the fused polychrome glass consists of rectangular strips of cut canes with simple eye patterns. Dated slightly later is a set of wooden sarcophagi inlay panels belonging to the priest Petosiris and his brother Djed-Djehouty-iouefankh, said to have been found at Tounah el-Gebel and now housed in the Egyptian Museum, Turin.⁵⁸⁸ Like the Nectanebo inlay, both panels feature monochrome and polychrome glass insets in a variety of geometric and figural shapes, although the mosaic pieces in the later sarcophagi panels are more sophisticated in their use of polychromy, with ovolo-style elements depicting feathers on the wings of owls, and hatched and checkerboard patterns used for axe handles and bowls. It is unclear which mosaic technique was used in the Nectanebo panel, but the Petosiris and Djed-Djehouty-iouefankh sarcophagi, with their complex and miniaturized designs seem to be true composite mosaics.

Harden suggested that this use of mosaic fusing was brought to Alexandria from Mesopotamia after the arrival of Alexander,⁵⁸⁹ but the Nectanebo piece (which was known to Harden) indicates that this technological transfer – if that is indeed what we see here – must have occurred earlier. While fusing of different segments of glass into a pattern was practiced in

⁵⁸⁷ Acc. No. 37.258E, from Abusir, formerly the Abbott Collection. Published Riefstahl 1968, No. 69. For the significance of this inlay for Egyptian and mosaic glasses, see Nenna 1993a, 1995.

⁵⁸⁸ Aldred 1980, 76, fig. 57 and 195, fig. 182; for the significance, see Arveiller-Dulong and Nenna 2000, 17. Aldred dated both panels to c. 330. The tomb of Petosiris is usually dated to the final quarter of the fourth century, and the funerary inscription includes a probable reference to the Persian ruler Artaxerxes III (Colburn 2014, 401-403).

⁵⁸⁹ Harden 1967.

Mesopotamian glass working from the fourteenth to seventh centuries, a gap in the sequence and the distinctly different production technique of the later mosaics, in which composite glasses are fused into a pattern then cut and set into a ground, suggest a discontinuity of tradition.⁵⁹⁰ Later fused glasses therefore were either an entirely new invention or an attempted revival of an earlier technology.

Together, these three inlaid pieces illustrate that by the mid-fourth century, Egyptian glass workers were experimenting with glass technology and polychromy. The products of this budding industry were inlays for religious and funerary furniture. The aesthetic, functional, and ideological purposes of the Egyptian tradition were therefore quite distinct from contemporary Macedonian and western Asiatic glass production. While Egyptian glass was opaque, brightly colored, and used in small inlays, Macedonian glass was transparent, colorless tablewares used to set the royal table. Glass was used in inlays, particularly in funerary couches, in Macedonia as well, but with the same transparent colorless glass as used in the tablewares. Additionally, the shapes of the inlays were always individually rectilinear and geometric shapes which were then arranged into more elaborate patterns, in contrast to the colorful Egyptian inlays in which the figurative decoration was self-contained in the inlay itself through the use of shape and color.

The simple cane mosaic geometric patterns and open molded monochrome inlays of the Ptolemaic period gave rise to elaborate floral, vegetal, and figural mosaic decorations by the second half of the first century BCE to first century CE. The eight plaques from the Shatby necropolis, which consist of floral and composite cane sections set into a dark background matrix in the pattern of a larger vegetal motif, would be the earliest dated examples of non-geometric

⁵⁹⁰ For Iron Age mosaic vessels from Mesopotamia, see von Saldern 1966c. For the distinction in technology between the Iron Age and Hellenistic mosaic glasses, see Grose 1989, 76, 189.

mosaics if they date to the earliest phase of cemetery use in the early third century.⁵⁹¹ All examples of this type with known provenance have been found in Egypt, with the exception of a single fragment from Hagoshrim in northern Galilee.⁵⁹² None has come from a securely dated or well excavated context, so their dating is unclear. By the end of the Ptolemaic period, opaque mosaic plaques in the style of figural, geometric, and floral motifs were in use in the Ras el Tin necropolis, at the tip of the island of Pharos. The use of this cemetery has been dated to the end of the Ptolemaic and early Roman period based on tomb architecture and ceramics, and it anchors the date of “Roman” style mosaic faces, figures, animals, and Nilotic scenes in the early first century CE.⁵⁹³

Domestic Sites

While finds from Alexandria have so far yielded no evidence of Hellenistic period glass outside the Shatby necropolis, there are a few domestic and village sites in Egypt where glass vessels were used in daily life. Tell el-Balamun, located in the eastern Nile Delta and probably at or near the coast in antiquity, was a major settlement from the early Pharaonic period (c. 2600 BCE) to the sixth century CE. In the Ptolemaic period, Tell el-Balamun seems to have been a small settlement established on top of Late Period temples, possibly in the third century. Subsequent Roman occupation left little intact from the Ptolemaic period, but four or five monochrome grooved hemispherical bowls, comparable to Grose Group A, were found in survey, along with a few fragments of imported Eastern Sigillata A and Egyptian-produced

⁵⁹¹ As suggested by Nenna (Nenna 1993b, 46-47).

⁵⁹² G.D. Weinberg 1973, 45-51. The reported Egyptian findspots are Asyut, Antinoöpolis, Alexandria, Oxyrhynchos, and possibly Dendera (Grose 1989, 355-356), but all were early finds and are now in museum collections.

⁵⁹³ Nenna 1993a, 48-51. For mosaic glass face inlays, see Mahnke 2008. Mahnke argues in favor of their Alexandrian origins and a narrow dating to the Late Hellenistic (c. 50 BCE?) period, with the majority of pieces deposited during the first half of the first century CE.

echinus bowls and spindle bottles dating from the third to first centuries.⁵⁹⁴ The bowls are pale to nearly colorless blues and greens, hemispherical with one or two interior grooves preserved below the rim; one conical bowl attributed by the excavators to the Roman period probably belongs to an earlier phase.⁵⁹⁵ As a coastal, and possibly port, site, Tell el-Balamun would have had access to vessels engaged in maritime trade in Egypt, and the low quantity of finds suggests such an exchange might have been a single occurrence. Still, their presence is significant here as it indicates a willingness by at least one Egyptian population to use glass tablewares.

The other domestic site in Egypt where pre-Roman glass tablewares have been found is Tebtynis in the Fayum. In addition to the workshop remains discussed above, a small domestic quarter located east of the Temple of Soknebtynis generated eight fragments of Group III core-form alabastra and/or amphoriskoi, 15 monochrome bowls with grooved, fluted, and ribbed decorations in both translucent and opaque blue, and one fragment of a spiral network (reticella) bowl.⁵⁹⁶ Two unpublished bivalve molded pendants, one of Harpokrates and one of Bes, were also found during the French-Italian excavations.⁵⁹⁷ According to Nenna, the vessels were found in a stratum dated from the end of the fourth to end of the second century; additional glass vessels belong to later phases of occupation.⁵⁹⁸ Nenna described the monochrome bowls as belonging to the Tel Anafa-Delos (i.e. Syro-Palestinian) type. Their opaque blue color is unusual and uncharacteristic for this class, but other examples of bowls in this color (at least as

⁵⁹⁴ Spencer 1996, 18. See also Spencer 2009.

⁵⁹⁵ Spencer 1996, hemispherical bowls: pl. 87.19, 89.2, 89.4; conical bowl: pl. 89.6.

⁵⁹⁶ For the core-form and monochrome vessels, Nenna 2000a, 22. The vessels are unillustrated, and Nenna gives no breakdown of decoration or color by quantity. The network bowl fragment is referenced in Nenna 1999, 51, n. 60 but is otherwise unpublished.

⁵⁹⁷ Referenced Arveiller-Dulong and Nenna 2011, 38, n. 10 and n. 15.

⁵⁹⁸ For the architecture, stratigraphy, and ceramics from this area, see now Hadji-Minaglou 2007; Ballet et al. 2012. To date, the other finds remain largely unpublished.

described) have been reported from Delos, Anafa, Jerash, and Knossos.⁵⁹⁹ Monochrome glass bowls have also reputedly been found at Tell el-Herr and Pelusium at the far eastern fringes of the Nile delta.⁶⁰⁰

In contrast to this short list is a longer list of Egyptian cities and towns where no canonical Hellenistic types have been found. The port and emporium of Naucratis has yielded no fragments of glass vessels or mosaic glasswares dated before the Roman period, only small monochrome beads, amulets, and a few fragments of core-form vessels.⁶⁰¹ The Hellenistic houses at Naucratis were poor in ceramic imports as well, indicative perhaps of a general lack of interest and participation in broader eastern Mediterranean drinking and dining habits.⁶⁰² No glass tablewares were identified in the festival and domestic assemblages at Coptos, either, despite the connectivity of the site to the Nile and Red Sea during the Ptolemaic and Roman periods and the emulation of Hellenistic Greek style tableware in the ceramic corpus.⁶⁰³ Nor did the residents of Hellenistic Memphis, as discussed above, seem to have used glass tablewares.⁶⁰⁴

⁵⁹⁹ Delos: Nenna 1999, No. C259-C267. Anafa: Grose 2012, No. G38. Jerash: Dussart 1998, No. 1.9. Knossos: Price 1992, No. 27.

⁶⁰⁰ The fragments are unpublished, but included in Nenna's list of sites where cast and sagged monochrome vessels of the Hellenistic period have been found (Nenna 1999, 69, n. 65-66). I have not been able to find any subsequent publication, and as a result they have not been included in this study.

⁶⁰¹ http://www.britishmuseum.org/research/online_research_catalogues/ng/naucratis_greeks_in_egypt.aspx. Search conducted 5/21/2015 of material glass with a production date between 400-1 BCE returned 40 objects, mostly beads. This online, in progress research database contains over 17,000 objects excavated at Naucratis by W. F. Petrie which are now housed in over 75 museums worldwide. However, plain glass may also not have been saved by the original excavators, as suggested by Villing et al, since even Roman and Late Roman glass is only represented by a half dozen fragments (Villing et al. 2015, section 2.6).

⁶⁰² Berlin 1997c, 2001. A single fragment of cast blue-green glass with grooves, probably from a plate, was found in an unstratified context at Kom Ge'if (Leonard 2001, 205, No. 66).

⁶⁰³ Herbert and Berlin 2003a, especially 23-24, 44-45.

⁶⁰⁴ Faience vessels are known from Memphis, Alexandria, and other Ptolemaic sites, where they were probably a major local industry (Fraser 1972, 140); it would be interesting to compare shapes and uses to see if faience was preferred to glass for some reason, possibly related to tradition or access. The colors of faience are also more akin to those used in Egyptian glass inlays and beads – opaque, bright, and vivid – in comparison to the more muted colors of most glassware in this period. Cf. El-Din and Nenna 1994; Shortland and Tite 2005.

Glass Production and Consumption in Ptolemaic Egypt

The implications for this lack of glass tableware in Egypt are significant when considering the role of Egypt, and specifically Alexandria, in the innovations of the Hellenistic glass industry. Certainly, there *was* a glass industry in Ptolemaic Egypt, as represented by sites such as Gumaiyama and Tebtynis, but it produced small objects for personal and architectural adornment, not vessels. Only 24 vessels have been identified and published from Ptolemaic period Egyptian sites, compared to a very significant quantity of small amulets and inlays which are too numerous (and too dubiously dated) to discuss in any detail here (they are listed in Table 7 and Figure 14)⁶⁰⁵ Probably raw glass was made in Egypt as well, but only for the local industries; beads, amulets, and inlays found in Egyptian sites tend to be opaque with bright, intense coloration, in contrast to the transparent pale yellows, blues, and greens typical of Syro-Palestinian finds (see Chapter 5). Egyptian producers and consumers were interested almost exclusively in vibrantly colored monochrome and polychrome amulets, inlays, and personal adornment which were used in funerary activities and deposited with the dead. The residents of only a few coastal sites in the eastern Nile Delta – and Tebtynis, which is an anomaly – employed imported glass vessels in their domestic activities.

This detail is significant because the mosaic glass industry of Egypt has often been credited with the innovations of mosaic glass vessels as found in the Canosa burials and the Antikythera shipwreck. Marianne Stern has been most explicit about how the application of mosaic technology to vessel manufacture might have occurred in Alexandria. She observed that mosaic glass vessels reflected three independent traditions of glass working: mosaic canes from Egypt, sagging from Syro-Palestine, and sandwich gold glass (from Rhodes?). The technique of

⁶⁰⁵ Tanis, Tel Defenneh, Tell Basta, Saqqara, El-Faiyum, Cusae, Mostagedda, Akhmim, Denderah, Karnak, Thebes, Faras (Petrie, Griffith, and Murray 1888; Cooney 1976; Auth 2012). When find contexts are known, almost all are from temples.

making mosaic glass bowls would therefore have been developed in a location with exposure to all three, and she posited the most likely historical circumstances occurred in second century Egypt, possibly when Jews fled the repressive Seleucid empire for the “international atmosphere” and relative religious freedom of Egypt.⁶⁰⁶

However, there are several problems to this tidy account, many of which Stern herself acknowledged. The biggest, as extensively discussed already, is the lack of datable mosaic glass vessels of any kind from Egypt before the early Roman period; with the exception of the unstratified Shatby fragments, the only other African examples are from the Royal Cemetery at Meroe, where one hemispherical floral mosaic bowl comes from a late second to early first century burial, and two hemispherical bowl fragments from a tomb dated between 21-13.⁶⁰⁷ Second, some vessels from the Canosa group, although certainly not all, do seem to have been deposited by the second half of the third century,⁶⁰⁸ effectively negating the historical argument put forth by Stern. Third and finally, and perhaps most significantly, the motifs, styles, and aesthetics of mosaic glass vessels are quite distinct from those of the inlays produced in Egypt at the time, from the color of glass used to the patterns achieved. The earliest mosaic vessels were limited to a finite set of compositions based on only three cane designs: spiral, rosette/star, and occasionally eye and stripe.⁶⁰⁹ Indeed, it is this limited range which readily distinguishes Hellenistic mosaic vessels from the more diverse products of Roman mosaic glass. By contrast – especially if we accept that floral plaques of the type found at Shatby and Hagoshrim were made during the Hellenistic period – Egyptian mosaic inlays of the period, such as the Nectanebo inlay

⁶⁰⁶ Stern and Schlick-Nolte 1994, 112. Cf. also Nenna, Picon, and Vichy 2000, 107, who surmised that Egypt must have played a role in the development of mosaic vessels, despite the lack of archaeological evidence for vessel glass in Hellenistic Egypt, because the fabrication of opaque and polychrome elements was an Egyptian technique.

⁶⁰⁷ Stern 1981, No. 2-4, originally published Dunham 1957, 80, fig. 50, and 87, fig. 59.

⁶⁰⁸ Harden 1968b. This issue of dating the Canosa group of mosaic glasses is discussed in Chapter 3.

⁶⁰⁹ Grose 1989, 189-192.

and Gumaiyama remains, are much more varied in their use of patterning and not as reliant on cut canes to form fused polychrome patterns. Stern dismissed this detail by suggesting that Egyptian glassworkers must not have divulged all the details of their techniques to the immigrants, which only begs the question of why the Egyptians would share some but not all of their trade secrets.

One possibility is that mosaic vessels were not made in Egypt, but mosaic canes were. The canes would then have been exported to secondary glass workshops, where local glassworkers in places like Delos and Rhodes could have experimented with the materials using familiar techniques. Rhodes, with its long heritage of glass manufacture and strong economic ties to Ptolemaic Egypt (see below), is a particularly promising candidate. The differences in form and in composition and technology between the Egyptian mosaic inlays and mosaic vessels suggest that it may not have been individual craftsmen who operated as the mode of knowledge exchange, but rather the intermediary materials themselves. Future compositional analysis of polychrome vessels and canes with monochrome vessels and canes from a single site such as Delos might help tease out some of these intermediary stages of manufacture and isolate where and at what production stage various forms of glass were traded. The Syro-Palestinian and Cypriot workshops, by contrast, never picked up the mosaic tradition, despite their status as territorial Ptolemaic possessions during the third century; no mosaic glass inlays or vessels have been identified on Cyprus, and mosaic vessels are extremely rare in Syro-Palestine.⁶¹⁰ Egyptian glass workers likely did have a role in the development of mosaic vessel technology, due to its similarities to the indigenous inlay panels, but that interaction need not have occurred in Egypt and, in fact, probably did not. Given the current archaeological evidence, it appears far more

⁶¹⁰ See below for Cyprus and Chapter 5 for Syro-Palestine.

likely that Egyptian glass workers, or possibly products themselves, left Egypt rather than that Greek or Syro-Palestinian workers came to Alexandria.

The difference between Egypt and the rest of the Hellenistic eastern Mediterranean world then is a significant difference of manner but not kind. Egyptians of the Hellenistic period did mass consume glass objects although they did not participate in the Hellenistic glass *koine*, a important disjuncture from the globalizing elements of some Hellenistic markets and reminder that local conditions often dictate adoption. Instead of the rounded bottom bowls of Syro-Palestinian type, core-form cosmetic bottles, beads, and gaming pieces, the Egyptians utilized glass in the form of molded, brightly colored inlays and amulets in a set range of forms which were integrated into the funerary and religious spheres. In addition, unlike other areas of the Mediterranean, the use of glass as funerary goods or temple decoration was widespread, standardized, and quite rote in Egypt by the first century BCE.

Previous scholars have noted that Egypt was slow to adopt blown glass both as a technique and as a product, since it is not found in appreciable quantities before the second century CE.⁶¹¹ This conservatism can be traced back into the Hellenistic period, when residents of Egypt neither developed nor adopted the glass tablewares which were being rapidly adopted by their counterparts in other parts of the Hellenistic world. If glass tablewares were not made and used in Ptolemaic Egypt, then where were they made and who was responsible for the innovations of the Hellenistic glass industry? In the remainder of this chapter and the next, I examine the roles of the Aegean islands and Syro-Palestine in this process.

⁶¹¹ Harden 1936, 40; Isings 1957, 2; Stern 1999b, 443. Stern has suggested that the Alexandrian glass industry was put out of business by the Italian workshops of the early Roman period, possibly even due to emigration of glass workers from Egypt to be closer to the burgeoning Roman market (Stern 1981, 49).

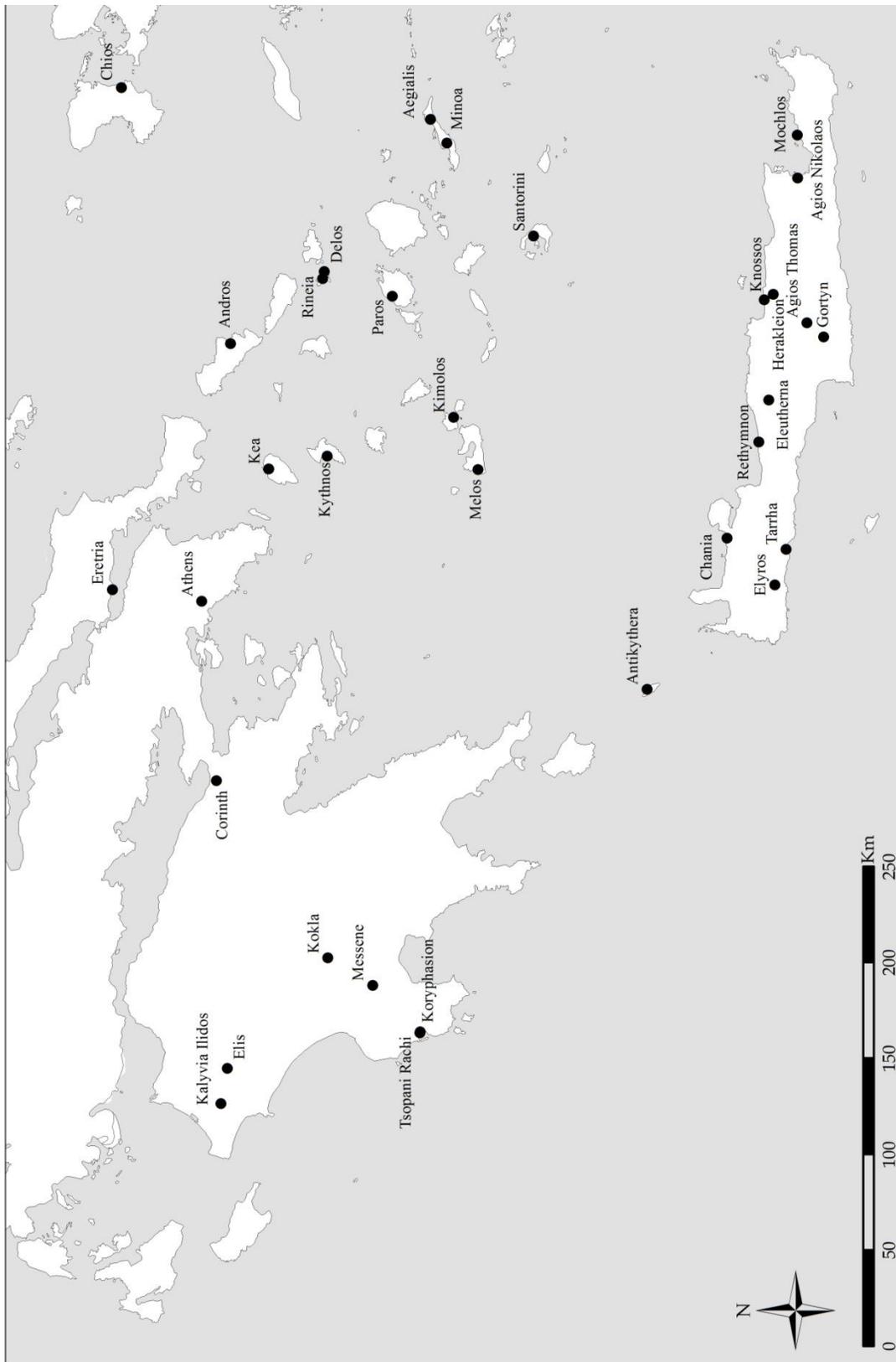


Figure 15. Sites with glass in southern Greece, Cyclades, and Crete, c. 350-50 BCE

Aegean Islands

Delos and the Cyclades

While glass objects have been documented at several sites in the Cyclades (Figure 15), no other site in the entire Hellenistic world surpasses Delos for quantity, variety, and overall richness of glass finds. Marie-Dominique Nenna's publication of glass vessels and objects from Delos is the most comprehensive study of the glass industry in the Hellenistic period.⁶¹² The significance of Delos for glass history, both as a site and a publication, cannot be overstated. First, the island underwent great economic development and rapid urbanization after Rome sanctioned it as a free port in 166, but much of the city went into disuse and the wealth of the occupants decreased after the sack of the city first by Mithradates in 88 and again by pirates in 69.⁶¹³ Most of the glass, as a result, dates to the late second and early first centuries.⁶¹⁴ Second, the scale and duration of French excavations on the island have resulted in a great diversity of knowledge about the site, including domestic space as well as shops, warehouses, commercial areas, and religious spaces, with the glass from each area having been documented by Nenna. Since so many houses have been excavated – all of which contained glass – consumption habits of the entire city, rather than select, possibly idiosyncratic, households, may be addressed.⁶¹⁵ Third, Nenna examined vessels as well as beads, inlays, and furniture pieces, so the full range of functional niches occupied by glass is represented. Fourth and finally, Delos was a production

⁶¹² Nenna 1999.

⁶¹³ Zarmakoupi has summarized the evidence for the urbanization and development of Delos after 167 (Zarmakoupi 2014).

⁶¹⁴ Of the thousands of glass fragments found at Delos, only 120 were from blown vessels. These pieces are in relatively isolated and specific places, all of which were reoccupied after the sack of 69 (Nenna 1999, 115).

⁶¹⁵ Nenna is, however, cautious to make many comparative claims about differential glass use in individual houses or city blocks, careful to note that different excavation methods were employed in each area. The *Maison des sceaux* is the case in point: it yielded the widest variety of glass types, but the relative proportions of each are comparable to the site as a whole, so it is tenuous to make any specific claims about the difference or richness of the house relative to others (Nenna 1999, 188-191).

site as well as a large consumption site. Direct evidence for bead manufacture has been identified in three different areas (the Magasins to the east of the Maison des stucs, the area south of the Samothrakeion, and a building in the upper valley of Inopos) where intermediary products and wasters have been found. The products of Delian bead workshops were exclusively for local consumption, a situation which Nenna asserted was much more common than has been recognized in the archaeological literature.⁶¹⁶ Less direct evidence for vessel manufacture comes from two distinctive forms of glass tablewares which are unknown outside the island, but the location of vessel production has yet to be identified.

Glass consumption at Delos incorporated both locally produced objects and objects imported from other regions. The locally made items presumably reflect local interests and tastes. Objects without parallel beyond Delos, likely made on the island itself, were ribbon beads made from plaques with fused colors, beads with double perforations, and tooled African head beads.⁶¹⁷ All these examples are versions of more popular and global forms of standard Hellenistic *koine* types. The Delos variants were relatively simple to produce and imitable by local craftspeople who may only have seen a comparable, finished product rather than interacting directly with another craftsman. Other beads and pendants were probably imported: bivalve molded monochrome pendants, trailed beads with feathered decoration, and mosaic beads.⁶¹⁸ Each of these types requires additional *chaîne opératoire* steps (e.g. pulling the applied trailed threads to make a feather pattern), manufacturing materials (e.g. molds for the pendants), or heightened technological complexity (e.g. fusing mosaic canes against other mosaic canes, rather

⁶¹⁶ Nenna 1999, 159-166, see also 177.

⁶¹⁷ Opaque blue cups and plates: No. C258-C264; ribbon beads: No. E42-E72; double perforated beads: No. E80-E82; African head beads: No. E108-E109.

⁶¹⁸ Bivalve molded pendants: No. E168-E182; feather trailed beads: No. E183-E190; mosaic beads: No. E191-E192. The use of leftover mosaic canes from vessel manufacture for bead making suggests that mosaic vessels and beads were made in the same or related workshops, although the location of said workshop remains unknown.

than setting them into semi-molten glass as is done in eye beads). These distinctive patterns of manufacture suggest that Delos bead makers were somewhat isolated from the rest of the glass-making world. Their techniques and forms did not spread beyond Delos, either as trade goods or knowledge, nor did they have more than a rudimentary knowledge of glass working techniques used elsewhere in the eastern Mediterranean.

This assessment of local bead manufacture is paralleled by two groups of vessels which are not known outside the island and therefore may indicate local production: the opaque blue cups and plates and a group of greenish colored, medium quality glasswares.⁶¹⁹ These objects, which include two conical bowls, one deep hemispherical bowl, two shallow carinated bowls, and a plate, somewhat resemble other forms of late Hellenistic glass. However, they are much less sophisticated in their shaping and lack any decoration. Furthermore, from the quality of the glass itself to the lack of regularity and symmetry in shape to the absence of heat polishing on the exterior, these vessels are of a lesser quality than their imported counterparts. The particular giveaway, however, is the folded interiors, as if the glassworker started from a flat plaque of glass, softened it over a mold, but was unable or unwilling to complete the melting process for the glass to re-absorb the folds. All these vessels were found in the Îlot des masques, leading Nenna to speculate that this area may have been another workshop area, possibly in business when the area was occupied after the first destruction of the city in 88.⁶²⁰ Might local glassmakers have experimented with the sagging technique (and failed) in order to seize upon an opportunity to duplicate locally a product for which there was a strong market, after the imported goods became more difficult to acquire following the port's decline in prominence?

⁶¹⁹ Opaque blue tablewares: No. C258-C267; greenish tablewares: No. F84-F89. Three blocks of opaque blue glassy slag (F1-F3) also support the idea that this color of glass was worked *en masse* at Delos (rather than in canes or plaques as the beads were). Nenna, however, noted that the chemical analysis is inconclusive and could have resulted from metallurgical, rather than vitreous, production (Nenna 1999, 165).

⁶²⁰ Nenna 1999, 166.

Although Delos was almost certainly the largest consumer and major producer of glass vessels and objects in the Cyclades island network, residents of other island cities and towns consumed glass much more regularly, and in mass consumption forms, during the Hellenistic period than did their contemporaries on the mainland of Greece. At the site of Minoa on Amorgos, dozens of grooved bowls, along with core-form vessels, beads, and counters from the second and first centuries have been found in civic and domestic contexts throughout the site, including the theater, gymnasium, and lower city.⁶²¹ According to Triantafyllidis, Late Hellenistic type grooved bowls have also been found on Kea, Kythnos, Andros, Kimolos, Paros, and Santorini, but they are as yet unpublished.⁶²² Finally, two grooved bowls of Syro-Palestinian Grose Group A type, which are now in the National Archaeological Museum in Athens, were found on the island of Melos.⁶²³ Although specific contexts of many of these vessels are unclear, the quantities and types of object, which are mostly monochrome, and their presumed function as drinking vessels, are more indicative of mass than luxury forms of consumption.

⁶²¹ Triantafyllidis 1998.

⁶²² Triantafyllidis 2006a, 152, n. 33.

⁶²³ Weinberg 1992, No. 52-53.

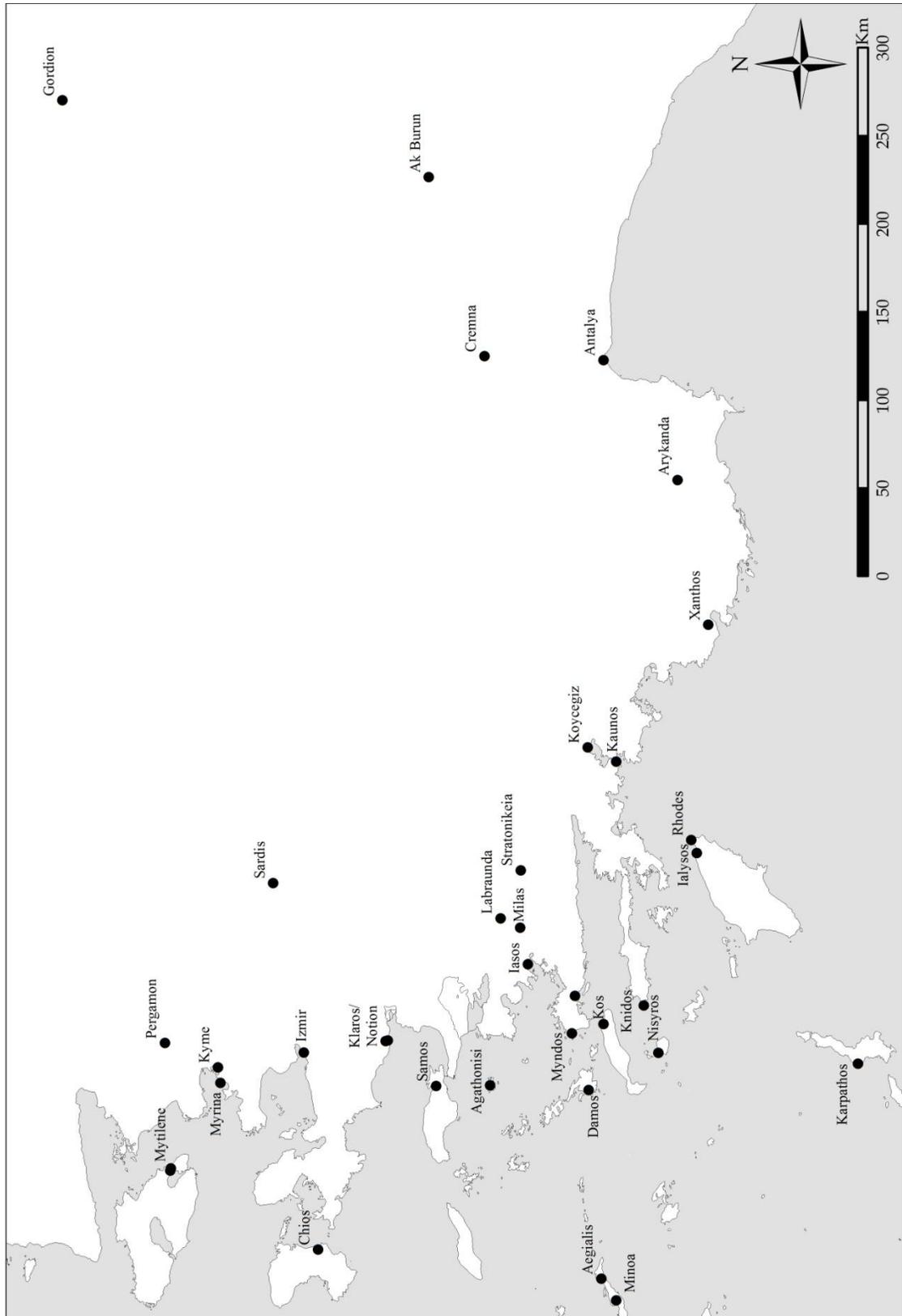


Figure 16. Sites with glass in Ionia, Caria, Lycia, and Dodecanese islands, c. 350-50 BCE

Rhodes and the Dodecanese

Glass was also more extensively consumed in the Dodecanese islands than in nearby sites of the mainland (Figure 16), perhaps in part due to the sizable and longstanding glass production site of Rhodes. Rhodes has long been recognized for its significant role in glass manufacture during the first millennium BCE. A faience factory, possibly established by Egyptian or Mesopotamian artisans, initiated the local industry for vitrified materials in the early seventh century.⁶²⁴ Mediterranean Group I, the earliest Iron Age core-form glass to be produced and distributed on a somewhat large scale, probably originated at Rhodes as well, based on the large number of vessels found in the cemeteries on the island. This industry began sometime during the sixth century and continued to the end of the fifth.⁶²⁵

During the fourth century, glass workers on Rhodes manufactured a series of colorless bowls related to the contemporary Macedonian and Achaemenid types, and they may have manufactured Group II core-form vessels as well. Kalyxes with S-shaped profiles, phialai with flat bases and lanceolate leaves and fluted motifs, skyphoi, alabastra, and undecorated phialai have been found in burials on Rhodes dated from the late fifth to early third century. Pavlos Triantafyllidis' argument for these vessels as products of a local primary as well as secondary industry, rather than imports from Macedonia or Asia Minor, was based on stylistic and typological differences between the Rhodian vessels and other contemporary forms, the

⁶²⁴ Oppenheim et al. 1988 (1970), 195. Triantafyllidis has suggested that the tradition of glass manufacture on Rhodes may in fact go as far back as the Late Bronze Age, based on Mycenaean style open molded beads found on the island (Triantafyllidis 2002).

⁶²⁵ Harden 1981; McClellan 1984; Barag 1985; Grose 1989, 110. Triantafyllidis has recently argued that Group I vessels did not appear on Rhodes until the mid-sixth century, possibly due to a shift in burial practices from cremation to inhumation (Triantafyllidis 2009).

homogeneity of the chemical composition of glass found at Rhodes, and the similarity in composition of the raw glass, cullet, and finished products.⁶²⁶

The Rhodian tradition of glass making and glass working continued into the Hellenistic period. In the mid-1960s, rescue excavations conducted by the Greek Ephoria revealed a large dump of glass working debris which had been used as fill for a house. The site became known as the Kakoula site after the property's modern owner. The material, preliminarily published by Gladys Weinberg, included over 10,000 glass beads and associated bead-making debris, including pieces still adhered to rods, beads fused together, mosaic canes, and monochrome tubes, along with lesser quantities of gold-glass and monochrome bowls.⁶²⁷ Weinberg initially proposed a date for the workshop in the third century, possibly into the second, based on the accompanying pottery, amphora stamps, and lamps, although the dates of coins "from significant contexts" are somewhat later, including one dated to 166 or later. (The presence of ribbed glass bowls in the deposit, which are otherwise unknown before the second quarter of the first century, presented a problem for this chronology, however.) Over a decade later, in a one page progress report, Weinberg affirmed the primary nature of factory activity in the second half of the third century, and suggested that both the factory and the house in which the remains were found might have been destroyed in the 226 earthquake; the *deposit* of the material, therefore, occurred sometime after 226 when the house was remodeled.⁶²⁸ Triantafyllidis has accepted this hypothesis and date,⁶²⁹ but a full publication of the glass and associated finds from the Kakoula workshop has yet to appear.

⁶²⁶ Triantafyllidis 2000c. See also Ignatiadou 2010.

⁶²⁷ Weinberg 1969.

⁶²⁸ Weinberg 1983.

⁶²⁹ Triantafyllidis 2003b.

Subsequent work in the area northwest of the Kakoula site by the 22nd Ephorate of Prehistoric and Classical Antiquities revealed additional evidence for glass manufacture and glass working. The Arfara property yielded what Triantafyllidis has described as ““a complex of underground rock-cut tanks and small overground (sic) built cisterns...covered by huge deposits of quartz sand, calcium materials, glass frits and raw glass which have successive silicious and calcite layers, originating from successful or unsuccessful production processes.”⁶³⁰ The fill inside the tanks included pottery dated to the late fourth-early third century, when the tanks went out of use and were buried, an incident possibly related to Demetrius Poliorcetes’ siege of the city in 305/304.⁶³¹ There seems to be some continuity in the use of this area for glass working, however; Triantafyllidis also reported the presence of built tanks, supposedly comparable in function with their underground antecedents, at a higher stratigraphic level. These glass making tanks may have been contemporary with the Kakoula material published by Weinberg. Triantafyllidis has interpreted these tank structures and accompanying industrial materials as evidence for primary glass production in the city.⁶³²

Triantafyllidis has also suggested that Rhodes produced bowls of Syro-Palestinian style during the later second to first centuries. These bowls differed from their grooved counterparts in that they entirely lacked decoration and had unfinished, uneven rims without polishing. Although the colors are similar to those popular in Syro-Palestine – transparent greenish, light blue, amber, and colorless – the glass itself is purportedly of inferior quality. About 50 intact

⁶³⁰ Triantafyllidis 2000c, 193.

⁶³¹ Triantafyllidis 2003b.

⁶³² According to chemical analysis, uncolored cullet from the Kakoula site was high in silica and lime and low in soda relative to other Hellenistic and Roman SLS (sodium-lime-silica) glasses. Additionally, several fragments of what appears to be failed glass melt due to insufficient natron (as indicated by low sodium levels) suggest that raw glass was produced locally, as it is difficult to imagine a situation in which unusable materials would have been imported any distance. The colored glasses from the site, however, are more consistent with the chemical compositions of contemporary SLS glasses from elsewhere than they are with the uncolored raw glass from Rhodes (Rehren, Spencer, and Triantafyllidis 2005).

and 3000 fragments of such bowls have so far been identified in the city. Triantafyllidis characterizes these vessels as tablewares of inferior or secondary quality, akin to the Rhodian-produced Macedonian/Achaemenid style bowls of two centuries prior.⁶³³

Despite the lack of chronological and artifactual detail, several conclusions regarding the nature of glass working at Rhodes may be advanced:

- 1) Rhodes had a long, probably continuous, tradition of secondary glass working from the mid-sixth century into the Hellenistic period. Primary glass making may also have taken place.⁶³⁴ The products of this industry included most major types of first millennium BCE glass: core-form cosmetic bottles, transparent and colorless bowls, and small objects like beads. Rhodian glassworkers possibly also manufactured gold glass beads and bowls.
- 2) Glass workers at Rhodes probably colored at least some their own glass during the late Classical to early Hellenistic period, and perhaps later as well, based on the finds of crucibles and the distinctive chemical signature.
- 3) The amount of glass found just in these limited areas at Hellenistic Rhodes is, by any standard, large (over 10,000 beads and 3,000 fragments of vessels). Such abundant quantities are paralleled only at Tel Anafa and, to a lesser extent, Delos.
- 4) Production of beads, and perhaps vessels as well, at Rhodes was technologically variable. Bead makers used a diverse array of bead forming techniques, particularly in shaping beads. They also used hollow glass tubes, like the early glass blowers and bead makers

⁶³³ Triantafyllidis 2002, 2003b.

⁶³⁴ Henderson has been skeptical of Triantafyllidis' claims of primary glass manufacture at Rhodes based on the Arfara evidence. He has asserted: "'The only solid evidence for primary glass production is raw glass attached to *in situ* or dumped furnace fragments, lumps of (overheated) glass frit, or glass frit attached to the vessels in which it was made, but none of these have been found on Rhodes" (Henderson 2013, 215). He was more confident in the evidence for glass coloring at the site.

in Jerusalem, and mosaic canes, although these seem to have been exclusively used to manufacture eye beads and not mosaic vessels.

Combined, these elements offer important insights into the operation of the Hellenistic glass industry on a local scale. Excluding the possible gold-glass bowls, Rhodian products have yet to be identified outside of the immediate area of the Dodecanese, indicating that the Rhodian industry was exclusively producing for local markets. Even so, Rhodian glass was not distinguished from its counterparts by anything except a somewhat lesser quality – both of the raw glass and the final product. Rhodian glass workers participated fully in the cosmopolitan Hellenistic culture.

Glass vessels have also been found in Hellenistic contexts on other islands of the Dodecanese. On Kos, a large pit deposit near the city wall stratigraphically dated from the mid-second century to c. 29, with most of the contents belonging to the later second century to the third quarter of the first century. Among the finds were 236 fragments of glass tablewares along with copious quantities of Koan and Rhodian amphorae, Koan and Knidian cups, terra sigillata (ESA and ESB), fusiform unguentaria, lagynoi, lamps, and coarsewares as well as loom weights, figurines, bone objects, colorants, and coins.⁶³⁵ The vast majority (84.5%) were grooved bowls closely related to Grose Group A (although a few could belong to Group D).⁶³⁶ The second largest group was ribbed bowls (10%) of a rather primitive form with short, angled, asymmetrical ribs. These presumably came from the latest phase of the pit deposit, confirming a third quarter of the first century origin date for ribbed bowls.⁶³⁷ Fluted and vegetal (Group B)

⁶³⁵ Triantafyllidis 2006a, 147-148, tables 1-2. On the excavation, Kantzia 1988.

⁶³⁶ Triantafyllidis 2006a, 156-158, Groups 1-2.

⁶³⁷ Triantafyllidis 2006a, 159, Group 8, fig. 11. This early date is also supported by the ribbed bowls in the Tradelière shipwreck and in a deposit at Olbia in Provence, but had yet to be established in the east (Feugère and Leyge 1989, 173-175; Fontaine 2004, 6-7). Grose thought ribbed bowls did not begin until the last decades of the first century BCE, although he admitted they may have begun as early as 50 (Grose 1979, 62-63).

bowls, footed bowls, gaming pieces, and single examples of opaque red and mosaic stripe bowls constituted the remainder of the assemblage. Since they were dumped into a pit, little to nothing is known about their original context. However, the other objects found with the glass vessels point to standard domestic consumption and dining habits of the Late Hellenistic period.

Triantafyllidis associated the wealth of Syro-Palestinian style tablewares found on Kos with the Jewish diaspora community located on the island, but the predominance of glass throughout the Aegean and not just in Jewish communities, makes this connection unnecessary.⁶³⁸

As in the Cyclades, a number of selectively published glass items have been documented in the Hellenistic Dodecanese, mostly by Triantafyllidis. A conical amber colored grooved bowl was found in a context dated prior to 84/83 at the ancient fortress at the site of Kastraki on the small island of Agathonisi.⁶³⁹ Triantafyllidis has also referred to unpublished Late Hellenistic grooved bowls from Nisyros and Karpathos.⁶⁴⁰ Based on his limited description, these vessels were probably Syro-Palestinian rather than Rhodian products.⁶⁴¹ An unusual bowl with thirty-five horizontal flutes, found at the site of Damos on Kalymnos, is somewhat similar to Achaemenid metalwork in decoration but its hemispherical shape and amber color are characteristically late Hellenistic.⁶⁴² Found among the remains of a robbed grave, its distinctive and conspicuous appearance and deposition in a burial attests to the continuity of luxury consumption habits alongside increasingly common forms of domestic mass consumption.

If the published deposits from Delos, Kos, Minoa, and Rhodes are at all representative of the types of vessels and contextual functions of the unpublished or nominally published remains,

⁶³⁸ The Jewish community on Kos is attested in 1 Maccabees as well as in inscriptions found on the island (Triantafyllidis 2006a, 156). For further discussion on the relationship between Jews and glass, see Chapter 5.

⁶³⁹ Triantafyllidis 2014.

⁶⁴⁰ Triantafyllidis 2006a, 152, n. 33.

⁶⁴¹ For Rhodian production of sagged Syro-Palestinian type bowls, see above and Triantafyllidis 2002, 49; 2003b, 136.

⁶⁴² Triantafyllidis 2006b.

the production and use of glass tablewares, objects of adornment, and gaming pieces in the Aegean islands was much more geographically extensive and intensive than has previously been recognized. Monochrome grooved bowls were also regularly imported from Syro-Palestine. However, polychrome mosaic vessels were extremely rare in the Aegean islands of the Cyclades and Dodecanese, despite their prevalence at Delos and in the Antikythera shipwreck. Single examples of mosaic vessels are published from Kos,⁶⁴³ Amorgos,⁶⁴⁴ Rhodes,⁶⁴⁵ and Tarrha on Crete⁶⁴⁶ and additional unpublished fragments from Naxos, Knossos, and Herakleion on display in their local museums are cited by Nenna.⁶⁴⁷ This list is significantly shorter than that of the published and unpublished find spots of monochrome grooved bowls found in the Aegean, and suggests that the two major forms of Late Hellenistic glass were decoupled in availability and distribution, notwithstanding the exceptional evidence from Delos, which is anomalous for a variety of historical and economic reasons and further reminder of the essentially local conditions beneath the veneer of homogeneity.

Crete

As in the Cyclades and Dodecanese, glass objects for limited local consumption came into use over the course of the Hellenistic period alongside other objects, particularly Syro-Palestinian bowls, which were more selectively imported (Figure 15). In the 1950s, Gladys Weinberg examined a set of 26 glass pyxides and lids located in various museums and private collections and concluded that they were the product of a Cretan glass industry during the

⁶⁴³ Triantafyllidis 2006a, 160, Group 13. Context dated late 2nd-3rd quarter of the first century. The piece is not illustrated and the description is unclear, but is said to be a striped bowl, which would make this fragment an early example of a type commonly associated with Roman mosaic production.

⁶⁴⁴ Triantafyllidis 1998, No. 14. Described as a “millefiori” (cut cane with either a floral or star pattern) bowl with spiral cane rim.

⁶⁴⁵ Weinberg 1969, 148. Context second half of the third century, described as “millefiori” bowl of unknown shape.

⁶⁴⁶ Buechner 1960, No. 20. A bowl of unknown shape, misshapen by heat.

⁶⁴⁷ Nenna 1999, 50-51.

Hellenistic period. All 15 with some indication of modern provenance were acquired in Greece: 11 in Crete, and four – three of which are from one private collection – said to be from Elyros.⁶⁴⁸ The pyxides are distinct not only in form, but also in fabric, which Weinberg described as “muddy” with a “soap-like texture.”⁶⁴⁹ A subsequent attempt to locate a possible workshop for these vessels at the nearby coastal site of Tarrha (modern Agia Roumeli) failed to find conclusive evidence for glass manufacture, but did locate dozens of warped glass fragments which had been exposed to heat. The fragments, which did not include any examples of pyxides, were found scattered throughout the site with no particular stratigraphy or distribution. They dated broadly from the late Hellenistic through Roman periods (second/first century BCE – fourth century CE).⁶⁵⁰ While Weinberg and Buechner clearly stated the lack of evidence for a workshop at Tarrha and suggested that the large quantities of glass may have been collected as cullet for recycling, possibly even at a remote location,⁶⁵¹ the idea of a glass workshop at Tarrha has been repeated in general archaeology scholarship on Roman Crete, often with major implications for discussion of trade and economy.⁶⁵² Nenna rejected Weinberg’s hypothesis of Cretan production and considered it more likely that pyxides were products of Syro-Palestine workshops.⁶⁵³ But despite the large quantities of glass found and published from Hellenistic Syro-Palestine, no fragment can even be tentatively identified with a pyxis, and the shape is

⁶⁴⁸ Weinberg 1959.

⁶⁴⁹ A few other pyxides in addition to those listed by Weinberg have been suggested. The British Museum holds two, both from Babylon (Barag 1985, No. 107-108). One is cobalt blue and the other is gold glass with an elaborate motif, neither of which is paralleled in the examples of the type identified by Weinberg. Nor do they have grooves of the type commonly found on lids accompanying the pyxides. These British Museum examples are much more likely to be wide bowls, a possibility also noted by Barag. Another example, purchased on the art market, is in the Ernesto Wolf Collection (Stern and Schlick-Nolte 1994, No. 78).

⁶⁵⁰ Buechner 1960; Weinberg 1960.

⁶⁵¹ The large quantity of fragmentary glass found in the 11th century CE Serçe Limani shipwreck, though much later, demonstrates that glass was transported long distances for recycling (Bass 1984; Whitehouse 2000, 3).

⁶⁵² E.g. Sanders 1982; Sweetman 2013. The presence of a glass workshop at Tarrha is also indicated on museum signage at the Archaeological Museum of Chania (as of February 2013).

⁶⁵³ Nenna 1999, 99. One pyxis was found at Delos (C268), but it is of a different type from the presumed Cretan group. The Delos piece, which has no known parallel, is small and very delicately manufactured, with a cylindrical body and ring base and elaborate grooved decoration.

much more closely related to Greek than Eastern styles, so an Aegean or Greek, if not Cretan, origin is still the most likely.

Because of the lack of clear provenance and excavated contexts for any of these pyxides, their date is quite uncertain; Weinberg tentatively proposed sometime between the third and first centuries, presumably based on the date of marble pyxides with a similar limited distribution, which were made in the fifth and fourth centuries or later.⁶⁵⁴ This date also seems to be in accordance with glass technology and taste in the early to mid Hellenistic period. Lierke has demonstrated that the Cretan pyxides could readily be made on a rotating wheel with use of a plunger and paddle, accounting for their ‘polishing’ on interior and exterior surfaces.⁶⁵⁵ Weinberg argued that the glass pyxides were intentional imitations of marble containers, inspired either by a decline in marble availability or a desire for a related but cheaper product.⁶⁵⁶

If the pyxides were indeed a local limited production of southwestern Crete during the Hellenistic period, two additional issues remain: first, where the raw glass material used on Crete was sourced, and second, how the Cretan glassworkers acquired their glass working knowledge. Regarding the supply of raw material, Weinberg noted that Tarrha, despite its lack of a substantial port, may have been a stopping point for boats traveling between Alexandria and European ports to the west, sailing around the western side of Crete.⁶⁵⁷ The small quantities of material needed to create the fewer than 30 known pyxides could readily have been purchased from these traders; indeed, the presence of ships bearing glass may have been the impetus for experimentation by local craftsmen.⁶⁵⁸ This experimentation is further suggested by the

⁶⁵⁴ Weinberg 1959.

⁶⁵⁵ Lierke 2009, 32.

⁶⁵⁶ Weinberg 1959, 19.

⁶⁵⁷ Weinberg 1960, 91.

⁶⁵⁸ The one pyxis with a suggested provenance outside of Crete is from a tomb in Attica (Weinberg 1959, No. 20) – perhaps brought there as a novelty by one of these traders after stopping at Tarrha and continuing on to Athens, where it was sold. These traders may also be responsible for bringing completed glass bowls to western Crete, where

unorthodox glass working method, which was closely related to ceramic technology and would have been a highly dangerous method for working hot, molten glass. The Cretan glass workers may have been potters who occasionally or experimentally also worked with glass. The Cretan pyxides workshop was probably a ‘failed’ innovation with a specific and locally unique set of circumstances including supply of material, ability of craftsmen, and local market. The glass working potters lacked the motivation or connections to share their method outside the local area – and trained glass workers are unlikely to have adopted the dangerous and foreign sequence anyway – and the consumer base was also local.

Other than the possible production of glass pyxides on Hellenistic Crete, imported glass vessels and small objects reached Cretan settlements in moderate quantities. The largest assemblage of Hellenistic vessel glass published from Crete is that of the Unexplored Mansion site at Knossos, which was occupied nearly continuously for over a millennium from the Subminoan to Severan period. The earliest glass from the site is third/second to first century types of Group III alabastra and amphoriskoi and sagged monochrome grooved and fluted vessels, presumably imported from Syro-Palestine.⁶⁵⁹ These finds included eight core-form fragments, 64 grooved conical and hemispherical bowls of Grose Group A, and 36 exterior fluted and banded bowls related to Grose Group B, as well as assorted glass counters and beads from second century BCE to second century CE levels.⁶⁶⁰ These bowls were the earliest glass tablewares used by the residents of Knossos, but once the market was established it continued to grow: Group D linear cut and Group C ribbed bowls of the later first century BCE and early first

they were likely used as funerary – rather than domestic – items as evidenced by the nine intact bowls of various sizes, colors, and decoration on display in the Archaeological Museum of Chania.

⁶⁵⁹ Price 1990, 1992. During the later second-third centuries CE, the site was used either as a glass workshop or a dump for glassworking debris; assorted drips, trails, distorted vessels, melted lumps and chips of glass, and vitrified clay were found in Hadrianic and later contexts (Price 1992, 458-461).

⁶⁶⁰ Price 1992. 39 total counters and gaming pieces were found, of which 6 came from Hellenistic contexts; of the 17 glass beads, four were found in Hellenistic levels.

century CE appear in somewhat larger quantities, with 89 and 126 fragments respectively.

Although the Hellenistic period at the Unexplored Mansion was rich in glass and other Hellenistic material, it was less so in architecture, with most of the remains coming from pits, wells, and wash debris with few stratified deposits; the nature of the occupation is therefore unclear, but it seems to be generally urban with some evidence of industrial production.

Hellenistic period Knossos was a significant commercial center on the island with a stone building program and several local industries, although it lost significance relative to Gortyn, which was favored by Rome, over the second to first centuries.⁶⁶¹ The occurrence of significant quantities of glass tablewares in this moderately sized but well-connected town indicates full participation in the Hellenistic daily lifestyle by residents who were not necessarily powerful beyond their local communities but chose to integrate glass drinking vessels into their daily routines, discarding them without ceremony when they broke or went out of fashion.

Elsewhere on Crete, a few scattered remains of glass bowls, presumably made in Syro-Palestine, and other glass objects have been identified. Fragments of four conical grooved bowls and one ring footed bowl were found in the residential areas of the Late Hellenistic beam press complex at Mochlos, just off the northern shore of eastern Crete. The site was established at the end of the second century and abandoned in the second quarter of the first century.⁶⁶² Two core-form Group III vessels and six Group A grooved bowls are on display in the Archaeological Museum of Chania with no information as to their provenience, although they are intact and therefore likely came from graves in the surrounding region.⁶⁶³ Late Hellenistic grooved bowls

⁶⁶¹ Sackett 1992. For glass from Gortyn, Matteis and Tommaso 2001.

⁶⁶² Vogeikoff-Brogan, Soles, and Davaras 2014, 66.

⁶⁶³ As identified during a visit to the museum in February 2013. The display also includes two Group C and one Group D bowl. Price also briefly discusses these vessels (Price 1992, 419).

have also been found at Gortyn, Rethymnon, and Agios Nikolaos.⁶⁶⁴ Group III fusiform alabastra have been found at Eleutherna, presumably in burials.⁶⁶⁵

Other objects of typical Hellenistic classes did not reach Crete. Like Cyprus (below), polychrome mosaic vessels seem to be missing from the island in this period.⁶⁶⁶ Beads were also relatively rare; as Jennifer Price observed, the paucity of glass beads from the Unexplored Mansion site is also reflected in the general lack of glass beads exhibited in Cretan museums, indicating that “glass beads were not generally in common use in the region.”⁶⁶⁷ Possibly no local bead workshop was ever established on the island, and the few beads which did reach Crete came through incidental exchange rather than deliberate trade, since beads seem not to have been traded methodically over long distances. No glass inlays, astragaloi, spindle whorls, or other small objects have been recorded from Hellenistic Crete.

⁶⁶⁴ Davaras 1974, pl. 699a; Matteis and Tommaso 2001, Type 1.3.1; Triantafyllidis 2006a, 152 no. 43, with sources.

⁶⁶⁵ Reportedly housed in the Herakleion Museum (Weinberg 1962b, 48). The early Imperial Roman through early Byzantine glasses from Eleutherna are being studied by Kalliopi Nikita and will be published in a forthcoming monograph titled *Eleutherna-Sector I: The Glass Finds* (<https://www.nottingham.ac.uk/archaeology/research/projects/current/eleutherna.aspx>, accessed June 13, 2015).

⁶⁶⁶ A few early Roman period mosaic vessels, probably made in Italy, were found in first century CE contexts at Knossos, and one mosaic bowl was found at Tarrha (Buechner 1960, No. 20; Price 1992, No. 9-12).

⁶⁶⁷ Price 1992, 456.

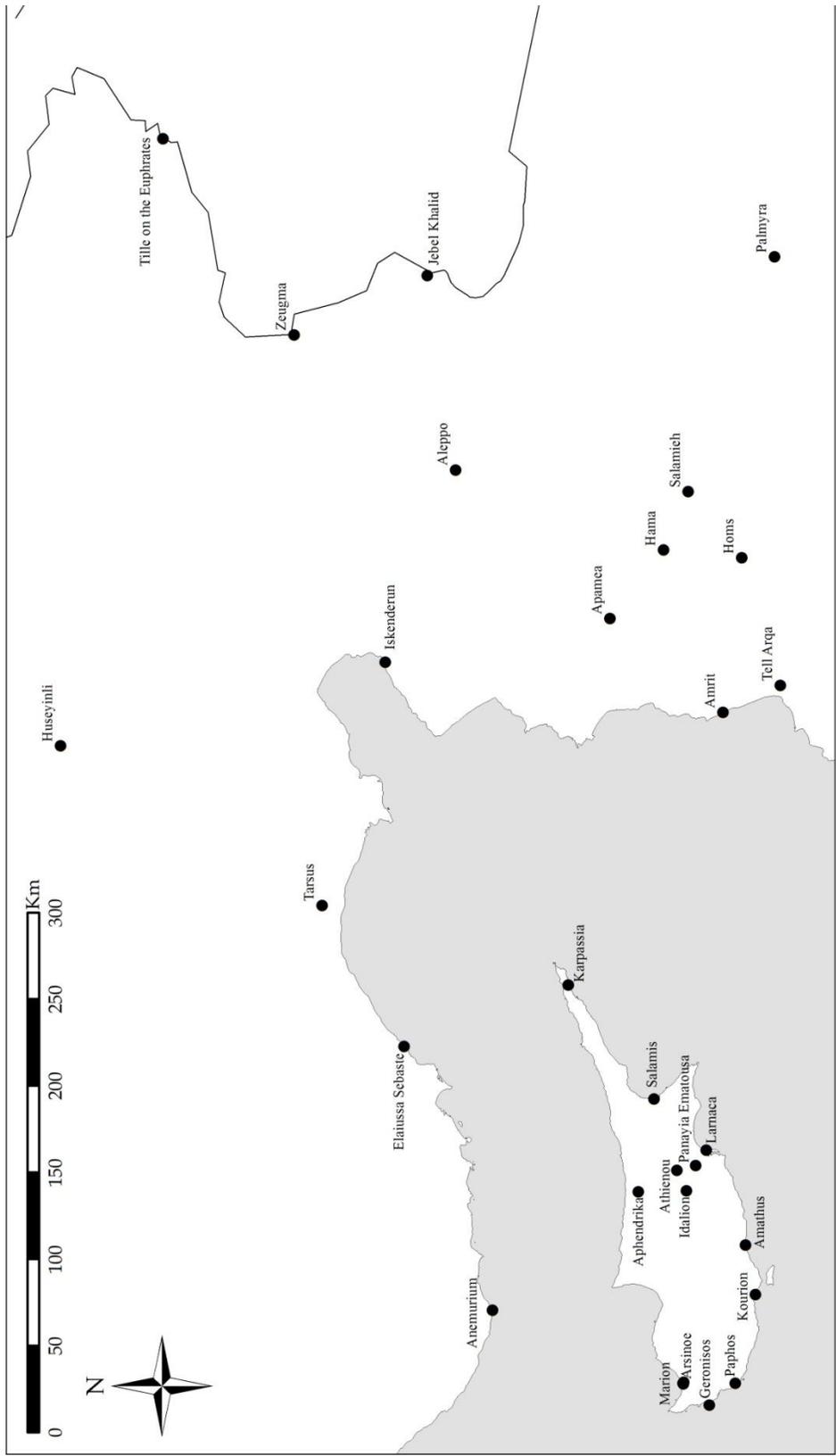


Figure 17. Sites with glass in southeastern Asia Minor (Cilicia), Cyprus, and Syria, c. 350-50 BCE

Cyprus

Perhaps more than any other region, the role of Cyprus in the history of ancient glass is the least well understood relative to its reputed prominence (Figure 17). The only publication approaching a dedicated diachronic study is a five page review article by Monique Seefried, published in 1986, in which she lamented the lack of any systematic study of Cypriot glass before the Roman period.⁶⁶⁸ This condition has not appreciably changed in the last two decades. Sources on archaeologically excavated glass from Cyprus belong to one of three categories: material “excavated” by Luigi Palma di Cesnola and others in the late 19th century and subsequently distributed among museums of Europe and the United States⁶⁶⁹; mid-century site reports, the most important being the publication of the Swedish Cyprus Expedition, in which glass vessels and objects are listed along with other finds from their contexts with little to no detailed description or analysis of their own;⁶⁷⁰ and short dedicated studies of glass from a single site, usually quite brief.⁶⁷¹ Almost all of these publications report only one or two examples of objects from the Hellenistic period, and list as comparanda materials from well known and established excavations outside of Cyprus with little to no comment on the local situation. Compounding the difficulty is the common amalgamation of the island of Cyprus with the Syro-Palestinian coast into a single supra-regional unit alternately called “Syro-Cypriot” or “Levantine,” despite the fact that – as shall be shortly demonstrated – their glass histories were quite divergent during the Hellenistic period.⁶⁷² As a result, a synthetic understanding the glass

⁶⁶⁸ Seefried 1986. The study of Roman blown glass from Cyprus to which she refers is: Vessberg 1952.

⁶⁶⁹ E.g. Cesnola and Birch 1882; Karageorghis, Vassilika, and Wilson 1999; Karageorghis, Mertens, and Rose 2000.

⁶⁷⁰ E.g. Gjerstad et al. 1934; Vessberg 1956. To this category also add short notices published in the *Bulletin de Correspondance hellénique*, usually from rescue excavations, e.g. Christou 1994.

⁶⁷¹ E.g. Grose 1986a; Oliver 1992; Burdajawicz 2009b.

⁶⁷² E.g. Harden 1981, 34; Jackson-Tal 2004, 26. The agglutination is neither entirely specious nor limited to the study of glass. For instance, the close geological and cultural relationship between eastern Cyprus and coastal areas around Tyre, Dor, and Akko led to much debate in the 1980s about the origins of Eastern Sigillata A; petrographic

from Hellenistic Cyprus is in its infancy. The following discussion will be limited to preliminary observations based on the state of the readily available published data, noting where additional work can and should be done.

As on Rhodes, glass may have been manufactured in secondary, possibly even primary, workshops on Cyprus on and off throughout antiquity, beginning in the Bronze Age and continuing into the Byzantine period.⁶⁷³ A set of pomegranate shaped core-form containers from the Late Bronze Age has been attributed to Cypriot production on the basis of the pomegranate shape and its variation from standard Egyptian forms.⁶⁷⁴ Core-form vessels of Mediterranean Groups I, II, and III appeared quite frequently on Cyprus throughout the first millennium, although examples from Group II are comparatively scarce. Numerous intact examples currently or formerly in private collections likely came from cemetery contexts, although their Cypriot origins is tenuous.⁶⁷⁵ Harden initially proposed the establishment of a new core-form glass industry on Cyprus during the Hellenistic period based on the concentrated distribution of certain form variants to the island and nearby Syria.⁶⁷⁶ McClellan also argued strongly for Cypriot involvement in Group III production on the basis of a concentration of finds from the island, as well as the introduction of new variant forms.⁶⁷⁷ This assertion has been widely accepted in the

analysis initially suggested it was made in Cyprus, although concentration of finds and other indications pointed toward a mainland Levantine origin (Slane et al. 1994).

⁶⁷³ For the evidence supporting Roman and Byzantine glass manufacture on Cyprus, see the overview and discussion in Seefried 1986, 148-149; Young 2007, 485-486, 511-512.

⁶⁷⁴ Harden 1981, 37.

⁶⁷⁵ Core-form vessels reportedly from Cyprus without clearly documented provenance include: Jaffe 1978, No. 27a-c, 28a-c, from Cesnola and Ransom collections; Goldstein 1979, No. 268-269; Harden 1981, No. 355A, 356, plus several from Turner bequest excavations at Amathus. Seefried (1986) listed the Cesnola, Gréau, and de Clercq collections as containing core-form glass from Cyprus. It is worth noting that, just as the Canosa vessels (see above, Chapter 3), Cyprus may be overrepresented in these collections due both to historical circumstances of recovery as well as power-law effects of the antiquities market. Because early finds came from the island, dealers may have invented provenances which matched those of better documented objects.

⁶⁷⁶ Harden 1981, 53, 129-130. He specifically suggested that amphoriskoi of Harden's Group 3.B.iii, iv, and v were made on Cyprus.

⁶⁷⁷ McClellan 1984, 326-328. He documented 146 examples with known provenance, of which 69 were from Cyprus and 25 from Syro-Palestine.

scholarship, and numerous museum and site catalogues cite Cyprus as probable place of manufacture.⁶⁷⁸ Tatton-Brown and Seefried have further suggested that rod-formed polychrome beads and pendants were made on Cyprus, particularly in the mid-first millennium BCE.⁶⁷⁹ Pendants made in a bivalve mold are also quite numerous on the island, with 12 of the known 81 examples said to have been found there.

Certain of the Group III amphoriskoi attributed to Cypriot workshops have attached handles and bases made from translucent amber or bluish-green glass. These are quite distinct from the bases, handles, and rims of earlier core-form vessels which were fashioned from the same fabric as the body, possibly even by pulling glass from the body itself rather than adding on additional material.⁶⁸⁰ The apparent similarity of fabric color and transparency between the core-form handles and knob bases and those of Syro-Palestinian sagged grooved bowls, along with a similar date range of mid-second to mid-first century, has led Grose and others to the reasonable deduction that they were manufactured in the same or related workshops.⁶⁸¹ However, the visual similarity between transparent core-form glass and sagged bowls has yet to be tested scientifically, and the two known workshops for sagged bowl manufacture at Beirut and Jerusalem did not yield any evidence of core-forming. Furthermore, given the division of ancient glass workshops among primary and secondary producers, core-form specialists and sagging specialists need not have been in the same city, much less the same workshop, in order to have used the same glass fabric; instead, they may have been supplied by the same primary glass-making facility.

⁶⁷⁸ E.g. Hayes 1975, No. 34-38; Price 1992, No. 1-8; Stern and Schlick-Nolte 1994, 39, No. 57-62.

⁶⁷⁹ Tatton-Brown 1981; Seefried 1982; Tatton-Brown 1990.

⁶⁸⁰ Giberson 2004.

⁶⁸¹ Although Harden and others had documented the translucent handles, Grose was the first to make the connection with Syro-Palestinian vessels (Grose 1989, 124). Grose was apparently agnostic on the idea of Cypriot production, neither arguing strongly for or against it. See also Jackson-Tal 2004, 26.

Perhaps more interesting is the question of why core-form glass workers would have adopted a new and different glass for specific and limited use in applied handles and base knobs. One possibility is that the coarse blue glasses and frits used in core-forming were insufficiently pliable at low temperatures to easily and quickly add as handles to the vessel body. Alternatively, the translucent glasses may have been less expensive since they did not require the addition of expensive mineral colorants. Whatever the reason for this adoption on the production end, the aesthetic choice was a dramatic one which consumers seem not to have minded. The general deterioration of quality in core-form vessels around this time may also suggest that core-form glass perfume containers were no longer highly valued items, but instead perhaps one-off burial dedications or incidental perfume containers.

Possible remains of glass manufacture have been found in the Hellenistic settlement of Arsinoe (Polis Chrysochous), where the Princeton University Excavations identified clay lined pits containing slag and waste from metal smelting in Area E.F2. One such pit “had been exposed to great heat, possibly for the manufacture of glass.”⁶⁸² However, a vitrified pit alone is insufficient evidence of a glass workshop, since many materials can turn glassy when heated to high temperatures and be mistaken for glass waste.⁶⁸³ Still, the putative workshop has picked up some caché in the secondary literature, in which the certitude of glass manufacture at Arsinoe during the Hellenistic period has been claimed.⁶⁸⁴ Should the hypothesis be substantiated, it would validate earlier claims of glass working on the island, which is not at all unlikely given the modest but notable number of glass finds. However, at the current state of knowledge and publication, the possibility of a glass workshop at Arsinoe must be treated as just that: a

⁶⁸² Najbjerg 2012, 237. It is worth noting that the preliminary report for the excavation of this area does not mention the possibility of glass working, only metal (Childs 1999, 233-234).

⁶⁸³ Fischer 2015.

⁶⁸⁴ Childs et al. 2012, 17; Gordon 2013, 257.

possibility, not a certainty. Similarly, with relatively few examples from clear archaeological contexts and absent any clear workshop remains, the overall role of Cyprus in core-form vessel and object manufacture during the Hellenistic period is far from certain. Further study based on well-dated archaeological assemblages is required.

Setting aside possible glass production on Cyprus during the Hellenistic period, Cypriot consumers constituted a distinct community of practice in regards to their access to and use of glass vessels and small objects. Cyprus especially stands out in contrast with the nearby Syro-Palestinian coast. Unlike in Syro-Palestine, glass cosmetic vessels, beads, and occasional sagged bowls were regularly used in Hellenistic period burials on Cyprus; of the 114 glasses documented from Cyprus, 26 (23%) came from funerary contexts at Amathus, Arsinoe, Athienou, Idalion, and Paphos.⁶⁸⁵ The inclusion of glass wares was limited to a select number of tombs (as it was in Italy and the Black Sea), suggesting somewhat restricted or selective access, although the overall quantities of material, diversity of object types, and number of sites indicate a wider range of the population accessed and used glass than in those true luxury consumption regions. At Amathus, for instance, only six tombs of the Hellenistic period contained core-form glass vessels: four yielded one example each, one contained two fragments, and the final tomb four different vessels.⁶⁸⁶ In large tombs spanning the Hellenistic to early Roman periods, Roman period (first century CE and later) burials commonly contain large quantities of blown glass beakers, bowls, and unguentaria, but the earlier remains do not include glass of any sort and are often limited to pottery and coins.⁶⁸⁷

⁶⁸⁵ Amathus: Tatton-Brown 1990, pl. XXII d-f; Oliver 1992. Idalion: Cesnola 1903, pl. 18.2, 4-5. Arsinoe: Vessberg 1956, 2, 6.

⁶⁸⁶ Tombs 147, 156, 180, and 385 contained one each, Tomb 163 had two, and Tomb 219 contained four. It is unclear how many tombs total dating to the Hellenistic period were excavated (Oliver 1992).

⁶⁸⁷ Two examples are Tomb 12 at Episkopi and Tomb 4 at Eurychou-Phoenikas, both of which contained abundant blown glass but no Hellenistic core-form, cast, or sagged glasses (Oliver 1983; Nicolaou 1984). The Episkopi tomb

Sagged glass grooved bowls of Grose Group A also made their way to Cyprus, especially by the first half of the first century. Seefried and Nenna both have indicated that sagged glass bowls were “quite frequent” on Cyprus in the first centuries BCE and CE,⁶⁸⁸ although the later forms of linear cut (Group D) and ribbed (Group C) bowls were much more common and penetrate further inland than their predecessor grooved bowls. Group A grooved bowls have been found in urban and rural everyday contexts at Kourion (Episcopal Precinct and Saranda Kolones), Amathus, Salamis, Karpassia, and Panayia Ematousa, but as isolated and poorly published examples.⁶⁸⁹

The largest published glass assemblages of late Hellenistic period Cyprus, however, all come from religious structures, not domestic areas or houses. The largest such assemblage is from the Sanctuary to Apollo on Geronisos Island, located north of Paphos on the western shore of Cyprus. Twenty-seven sagged glass grooved bowls, of which 16 were hemispherical and 5 conical, were found at the site, mostly in the major ceremonial area of the Central South Complex. Ceramic and numismatic evidence points to a short span of occupation at the Sanctuary between c. 80 and 30. Drinking, probably for ceremonial or ritual purposes, was a major activity performed by pilgrims to the site based on the large numbers of hemispherical bowls in Eastern Sigillata, Cypriot Sigillata, and another unidentified sigillata as well as in glass.⁶⁹⁰ The sanctuary at Geronisos was a cultural and historical aberration, since the establishment of an entirely new cult was unique on Cyprus, and the use of large quantities of drinking vessels here needs to be viewed in this context. Joan Connelly, the excavator, has

did yield one fragment from the base of a cast or sagged vessel (No. 49), but its flat rather than convex rounded shape puts it in the later period of production

⁶⁸⁸ Seefried 1986, 147; Nenna 1999, pl. 41-42.

⁶⁸⁹ Jaffe 1978, No. 30a-c, 31a-b; Frederiksen 2006, fig. 198; Young 2007, 487 No. 3, n. 25. The bowls in the Fitzwilliam Museum are intact and probably come from graves, rather than domestic areas.

⁶⁹⁰ On the site and its ceramics, Connelly 2002; Mlynarczyz 2009; for the glass vessels, Burdajawicz 2009b.

suggested that many of the ceramics and amulets found on site were hybridized forms integrating native Cypriot and Ptolemaic Egyptian traditions.⁶⁹¹ However, glass drinking vessels were not customary in either cultural context; perhaps they were simply readily available vessels which conformed to an appropriate shape.⁶⁹²

Grose Group A grooved bowls have also been identified from two other sanctuaries dedicated to Apollo on Cyprus: two fragments were recovered from the Sanctuary of Apollo Hylates at Kourion and one from the so-called “Garrison’s Camp” at Paphos, which has been identified as the Sanctuary of Apollo Toumballos.⁶⁹³ Interestingly, all three are amber colored and similar in size (12 cm diameter) and decoration (one interior groove below the rim; the Paphos piece is better preserved, and has a pair of grooves partway down the wall). Might they have arrived at Cyprus from Delos, and therefore been especially associated with Apollo, his sanctuary being considered the most appropriate context for consumption and deposition? Of the over 7,000 objects in the assembled dataset (Table 1), only 13 are bowls with horizontal grooves, 12 cm diameters, and amber color: the three from Kourion and Paphos, one from a temple at Amrit in Lebanon, and nine from the Hellenistic houses at Delos.⁶⁹⁴ All belong to Grose Group A, although they vary in shape with some ovoid and hemispherical as well as conical examples.

In short, glass use on Cyprus was largely limited to funerary and sanctuary contexts. Nonetheless, the products were standard Hellenistic *koine* types. Furthermore, no polychrome mosaic glass has yet been identified, either in vessels or inlays, from Cyprus. None are listed in the Cesnola collections at the Fitzwilliam Museum, Metropolitan Museum, or elsewhere, nor

⁶⁹¹ Connelly 2009. The glass vessels do not feature in her argument, although their ceramic equivalents do.

⁶⁹² Connelly suggested that the deep hemispherical *mastos* may have had ceremonial function, as the sanctuary is thought to be dedicated to young boys who would have been weaning from their mothers (Connelly 2009, 760).

⁶⁹³ Kourion: Grose 1986a, No. 1-2. Paphos: Giudice 1996, fig. 32.1. On the identification of the Paphos site as a sanctuary of Apollo, see Papantoniou 2012, 226-227.

⁶⁹⁴ Amrit: Saliby 1981, fig. 2.9. Delos: Nenna 1999, No. C84-86, C89, C118-119, C151, C153.

were any found in the Swedish Cyprus Expedition.⁶⁹⁵ Given the conspicuousness of mosaic glasswares, which tend to be more frequently collected and published than their monochrome counterparts, the lack of mosaic glass on Cyprus is likely to be real. In this respect, Cypriot glass wares were more closely related to those of Syro-Palestine (where mosaic glass was rare, but not unknown) than to Delos or Egypt, with which it more closely shared glass consumption habits. Glass consumption habits can therefore be added to the various other ways by which the residents of Hellenistic Cyprus negotiated hybridized identities among Ptolemaic, Egyptian, Greek, and indigenous traditions.⁶⁹⁶ Their glass wares were Syro-Palestinian; their consumption habits were Ptolemaic.

Mass Production and Consumption in the Hellenistic World

Over the course of the second and first centuries, glass moved increasingly into quotidian consumption spaces, no longer limited to elite luxury contexts. Vessels decreased in elaborateness, with monochrome vessels decorated with simple grooves and plain profiles replacing polychrome mosaic and gold glasswares and complex shapes such as phialai and skyphoi made from multiple constituent elements. Glass beads, counters, and inlays became more popular than stone in jewelry, gaming, and furniture settings. The glass versions of these objects embraced the materiality of glass itself with rounded edges and natural colors, no longer imitating stone or metal in colors and shapes.⁶⁹⁷ Polychrome beads borrowed their appearance and manufacturing techniques from vessels, with combed and trailed decorations similar to

⁶⁹⁵ Cf. Cesnola and Birch 1882; Cesnola 1903; Vessberg 1956; Jaffe 1978. Nenna also did not record any mosaic glass from Cyprus (Nenna 1999, 50-51, pl. 40).

⁶⁹⁶ On hybridization of cultural elements in Hellenistic Cyprus, see: Papantoniou 2012; Gordon 2014.

⁶⁹⁷ By the Roman period, glass was generally recognized as a low value material for beads and jewelry. According to Swift's study of bead necklaces and bracelets from Late Roman graves in northwestern Europe, glass and copper alloy beads emulated the appearance and color of more expensive precious metals and stone (Swift 2003). The contrast here with, for instance, the use of brightly colored glass inlays in the architectural decoration of the fifth century Erechtheion in Athens is noteworthy.

contemporary core-form vessels. Mosaic cane technologies came to be used to make eye beads replacing the earlier stratified technique. Two-part molds were used to make gaming pieces and pendants in the round; these technologies were embraced a century later by the makers of mold-blown vessels (discussed in Chapter 6). Each of these shifts in the consumption context, appearance, and technology of glass objects is indicative of a shift in the glass industry itself from elite, highly specialized workshops to mass produced objects accessible to a wider range of consumers. But who were these consumers? How were they able to access a new range of products? And why glass?

Most scholarship has concentrated on the conspicuous and non-portable aspects of increased private display, which appeared with increased regularity in houses of the Hellenistic period.⁶⁹⁸ As discussed in Chapter 1, the greater elaboration of household size and decoration and the greater emphasis placed on private versus public space in the cities of the eastern Mediterranean has served as an index of increased personal wealth as well as a desire to enhance prestige by showcasing that wealth in the home beginning in the fourth century. With so much space given over to dining and entertainment areas, and so much investment in the fixed decorations like wall paintings and mosaics, the objects used in these spaces must have been equally considered and fashionable. Sculpture began to appear more regularly in domestic contexts rather than exclusively in secular and religious public spaces. Elaborate metal, ceramic,

⁶⁹⁸ This is with good reason, as a variety of depositional and post-depositional factors, as well as archaeological publication paradigms, affect the reliability of comparative data based on portable goods. Unlike wall paintings, mosaics, and colonnades, valuable items like tablewares, candelabras, and beds were not nailed to the walls and were typically removed by owners when they left, affecting archaeological recovery rates and making them inadequate proxies for economic interpretation (Morris 2005, 117-122). However, Morris concluded – and I agree – that the aggregated and impressionistic evidence can still be revealing, even if it can't be quantified, especially if orders of magnitude of difference are involved and particularistic cultural or depositional factors can be omitted (e.g. discounting Pompeii from comparative analysis).

and glass tablewares formed the dining apparatus, filled with imported wine from Rhodes and the Black Sea, and individuals adorned themselves with cosmetics and elaborate jewelry.⁶⁹⁹

The appearance of glass tablewares in domestic contexts of the late Hellenistic eastern Mediterranean, therefore, is in keeping with a broader cultural phenomenon in which conspicuous luxury objects and materials were prominently displayed in private contexts by an increasingly large number of people, although these adoptions were locally contingent in areas like Egypt and Cyprus. Indeed, the various constituent elements of the Hellenistic material *koine* discussed in Chapter 1 are all reflections of this increased private display at all levels of society. As in Colonial America, middle-level non-elites emulated the consumption habits of the wealthiest by purchasing, displaying, and using more affordable mass-produced versions of elite objects.

For their part, Hellenistic period producers worked to meet the heightened purchasing power of a greater range of the population by developing and adopting technologies which allowed them to make similar objects more quickly and efficiently. The Hellenistic period was a time of great innovation, experimentation, and discovery in architecture, sculpture, arts, and crafts as well as in science, technology, and medicine and in military and warfare.⁷⁰⁰ Cross-craft interaction was particularly fertile in this period; Greene has suggested that the innovation of lead glazed pottery in the first century BCE was inspired by interactions among potters, glassworkers, and metal workers, pointing to similarities in production methods and cognitive synchronization of production technologies across multiple media.⁷⁰¹

⁶⁹⁹ On Hellenistic tablewares: Rotroff 1982; Zimmer 1996; Lund 2005. For the Hellenistic wine trade: Lund 1999; Rauh 1999. On Hellenistic jewelry and personal adornment: Stewart 2006, 178-180, with sources; 2014, 221-226.

⁷⁰⁰ Levy 1990; Flemming 2003; Bugh 2006; Keyser and Irby-Massie 2006; Stewart 2006.

⁷⁰¹ Greene 2007. For further discussion of the innovation process, see Chapter 6.

One particular innovation of this period was the widespread use of molds for a range of materials. Molds enabled craft producers to transfer a pattern or image from one medium into another and then replicate that pattern repeatedly. Molds facilitated mass production by creating a standardized, numerous, and (typically) more modest product. Efficiencies in production allowed mold-made objects to be more accessible to a greater number of people, which in turn created a shared material culture across a wide geographic expanse in multiple levels of society.⁷⁰² Hellenistic potters employed one and two-part molds to make household ceramic tablewares, terracotta figurines, and lamps beginning in the later third and early second century.⁷⁰³ As Rotroff has argued, both the appearance and the technology of ceramic mold-made bowls (conventionally known as Megarian bowls) were inspired by luxury metal and gold glass tablewares. Their ceramic – and, I would add, monochrome glass – counterparts catered to a more general market, facilitated by the production technology itself.⁷⁰⁴ This devaluation and standardization of objects made in repetitive molds may have contributed to the middling status of the craftsperson themselves, as Adi Erlich has suggested for coroplasts, who reused molds to make terracotta figurines and thus bridged the realms of art and craft.⁷⁰⁵

Was the movement toward mass production and mass consumption of glass vessels and objects in the late Hellenistic period driven by middle class desire to emulate elite culture or by non-elite customs and values which finally garnered sufficient market share to stimulate widespread change in productive processes? Most likely both. The use of translucent molded

⁷⁰² On the use of molds as a form of “copying”, and its effects on both production and consumption habits, see Smith 2015.

⁷⁰³ The literature on Megarian mold-made bowls is vast. On molds and workshops themselves in diverse areas of the Hellenistic world, see e.g. Grandjouan, Markson, and Rotroff 1989; Rogl 2001; Mairs 2014. On the use of two-part molds in lamp manufacture, Howland 1958, 5; Levy 1990, 5-6. Greek coroplasts used molds as early as the seventh century and achieved widespread use in the sixth; during the Hellenistic period, the double-mold technology was adopted selectively in workshops throughout the Hellenistic empires (Higgins 1967; Muller 2000; Langin-Hooper 2007).

⁷⁰⁴ Rotroff 1982, 2006.

⁷⁰⁵ Erlich 2002; 2009, 41.

glass drinking vessels was a custom which extended back to the imperial regimes of the Achaemenids and Macedonians and was accordingly tied to elite culture. Both the decoration and shape of late Hellenistic vessels have eastern Achaemenid precedents, but reflect a simplification of form and technique. Many of the standard decorative motifs used in fourth and third century glass drinking vessels were connected to motifs of the International Achaemenid Style, including leaf decoration, grooves, almonds, and omphaloi.⁷⁰⁶ As Despina Ignatiadou has suggested, by the late Hellenistic period these elaborate motifs had largely transformed into plainer, more linear, and less elaborate decorative patterns, although their original symbolic value may not have been maintained.⁷⁰⁷ The simplification of motifs decreased the expertise and time needed to produce such vessels, so the producer did not have to spend as much time learning the trade or working on a single object. The standard monochrome glass bowls of Grose Groups A and B were also more oriented toward the east in their shapes, lacking the feet and handles customary in Classical Greek drinking vessels and early Hellenistic forms like skyphoi and other luxury vessels of the Canosa Group.⁷⁰⁸ Most drinking vessels with Near Eastern origins, by contrast, were handleless.⁷⁰⁹ Again, this simplification of shape would have eased production appreciably. The elaborately molded handles and feet on skyphoi required a high level of skill not only to shape the sharp metallic forms of rims, handles, and feet in glass, but also to fuse two hot glass pieces while maintaining the clean lines and angles of their form.

Removing the feet and handles from drinking vessels must also have resulted in changes in drinking practice: the rounded bottoms of glass bowls meant they could not be sat down or

⁷⁰⁶ On the International Achaemenid Style, see Melikian-Chirvani 1993. On its application to glass drinking vessels, particularly those produced in Macedon, see Ignatiadou 2010.

⁷⁰⁷ Ignatiadou 2009. See also Chapter 3.

⁷⁰⁸ As initially suggested by Jackson-Tal 2004, 28.

⁷⁰⁹ Tal 2003. See also O'Hea 2011a, 157-159 for the Iron Age parallels of deep hemispherical drinking bowls in glass and other media, which she characterizes as "a long-lived, widespread Levantine form of drinking cup, yet one associated with elite rather than everyday use" (158).

stand upright while holding liquid, and without handles, traditional Greek drinking games like kottabos could not be played. Drinking practices of the Late Hellenistic eastern Aegean may have already evolved away from the customs of the canonical Classical Greek symposium, and handles and feet on drinking vessels were more like vestigial relics than functional necessities. This plain hemispherical or conical mastos shape was not at all limited to glass in this period: it was also a standard tableware bowl shape in metal and ceramic (especially Eastern Sigillata A), and a few examples survive in wood.⁷¹⁰ Glass vessels and their skeuomorphic relatives in other materials are therefore another index for shifting drinking customs in the Hellenistic period away from the Greek symposium toward more cosmopolitan practices. Further investigation is required on complex assemblages of drinking ware in order to determine the degree of local variability in Hellenistic drinking habits. New drinking customs may have facilitated the turn toward mass production of vessels by requiring less time and skill to manufacture – or, consumer drinking habits may have been modified in response to the newly available and affordable mass produced drinking bowls.

While sagged glass drinking bowls were the most conspicuous and numerically dominant class of late Hellenistic mass produced glass, a wide bevy of small objects were made and used along with them. The assorted functions – personal adornment (beads, pendants, finger rings, and cosmetic implements), gaming (counters and skeuomorphic knucklebones), and furniture design and decoration (inlays and insets) – reflected elite concerns related to personal identity, private display, and activities of the leisure class. Glass spindle whorls also appeared for the first time during the Hellenistic period. Although technically a functional tool to be used in textile production, spinning in the ancient world was widely considered an appropriate and necessary

⁷¹⁰ For the shape generally, see S.S. Weinberg 1988. Wooden examples have been found in second-first century tombs at Ein Gedi (Hadas 1994, 5*, fig. 15).

domestic activity for elite adult women, not unlike the needlework and sewing practiced by aristocratic British women of the Victorian period and earlier.⁷¹¹ Spindle whorls and rods could be highly decorative display pieces, not simply utilitarian objects.⁷¹² Just like the vessels, small glass objects which became popular over the course of the Hellenistic period exhibited the concerns and customs of a cosmopolitan and wealthy group who aspired to a nebulous ideal of elite society, reflecting the particular blend of Greek and Near Eastern habits which epitomized the Hellenistic period.

All Consumption is Local

Hellenistic consumers desired luxury products for private display. Political, economic, and social conditions enabled them to procure material wealth on a larger scale than had been possible under the democratically ruled Greek cities or centralized imperial systems, neither of which encouraged or, often, even allowed, such conspicuous private consumption, even codifying such restrictions into law.⁷¹³ But the growth of trade within and between the Mediterranean and the Near East, a political system which promoted local and decentralized power, and the potential for social mobility created conditions which allowed higher participation in local political and economic systems by a broader range of the population than had previously been possible under the Achaemenid and other imperial systems, coupled with a more widespread distribution of wealth. These social circumstances were already underway in the fourth century, but they began to reach full fruition in the late Hellenistic period with the waning of hegemonic empires and increase in private wealth. Taken together, inhabitants of the Greek world under the Hellenistic dynasts found themselves both with money to spend and with

⁷¹¹ Barber 1994; Scheidel 1995.

⁷¹² Cf. Crewe 1998.

⁷¹³ On the 317 sumptuary law in Athens and its effect on funerary display, see Small 1995.

the ability to spend it in a manner which could advance their standing in the community. The desire for glass tablewares, spurred by their association with courtly dining practices and a general emphasis on private entertainment in the household, was a manifestation of this new opportunity for conspicuous private display of wealth. In regions where power was negotiated not in the private household but through public benefaction (as in the cities of Asia Minor) or money was more centralized in the imperial economy (as in Ptolemaic Egypt), domestic glass wares were less commonly adopted. It was only in the semi-autonomous and marginal territories, with strong local economies bolstered by the merchant class, where glass tablewares were most desirable and accessible. This included the communities of Delos, Rhodes, the Syro-Palestine coast, and, to a lesser extent, Crete, and Cyprus.

In an interconnected market in which goods are freely circulated, there is tension between the systemic influence of mass production and local consumer habits and preferences.⁷¹⁴ This tension also reflects an archaeology truism, that there is no guarantee that the same object, or form of object, appearing in geographically and culturally remote societies was interpreted and used in the same way in its consumption context as it was in its production area. Each participant group of the Hellenistic *koine* responded in distinctive ways to this climate of global development, creating local patterns of consumption based on its particular political, economic, and cultural circumstances. Even though the consumer goods may have been standardized products of mass production embodying a globalized Hellenistic society, the responses to this onslaught of products were still highly localized and embedded in the trading ports, workshops, markets, and houses of local consumers. A close investigation of the particular circumstances “on the ground” in one of these communities of practice, where glass was both produced and consumed in previously unprecedented quantities, is the focus of the next chapter.

⁷¹⁴ Hodos 2008; Vives-Ferrándiz 2008; Mullins 2011b.

Chapter 5.

A New Glass Industry: Hellenistic Syro-Palestine

From the Regional to the Local

The pan-Mediterranean conditions of a proto-capitalist economy, higher levels of wealth, the expansion of mass-produced consumer goods, and increase in personal conspicuous consumption over the course of the Hellenistic period were preconditions – not causes – for the sudden emergence and explosive growth of glass as a major form of material culture beginning in the second half of the second century. This ground shift occurred almost overnight in archaeological terms – within a single generation. Mass produced glass vessels were actually one of the last forms of the Hellenistic material *koine* to appear. Although certain types of small glass objects, notably beads, inlays, and astragaloi, began to appear more regularly during the third century, grooved bowls only show up in the archaeological record after c. 150. By contrast, other *koine* items, such as mold-made ceramic bowls and lamps and high quality black and red gloss pottery, first appeared a half century earlier in the later third and early second centuries. They increased in quality and quantity throughout the second and first centuries. Glass, then, was a late addition to Hellenistic table service.

Scholars of Hellenistic glass have established the general origin, types, and distribution of the so-called “Syro-Palestinian bowl,”⁷¹⁵ but the particular significance of mid-second century Phoenicia and Syro-Palestine has gone largely unexamined. How and why did mass produced

⁷¹⁵ Weinberg 1970; Grose 1979, 1981; Nenna 1999; Jennings 2004-2005; Grose 2012. For a summary of the evidence and discussion of its implications, see Jackson-Tal 2004.

glass vessels appear in this particular place at this particular historical and cultural moment?

Why did this development occur in southern coastal Syro-Palestine, rather than areas with better established glass industries such as Rhodes or Egypt?

This chapter argues that the globalizing trend toward mass production and consumption of glass vessels and other small objects, facilitated by the growth of the late Hellenistic economy, can be traced especially to the particularistic historical, economic, and cultural circumstances of mid-second century Syro-Palestine, especially in the Phoenician heartland. Recognized by Roman authors for its contributions to glass manufacture, Phoenicia and the surrounding land of Syro-Palestine boasted the highest numbers of glass vessels and the greatest diversity of sites in this transitional period. Glass drinking vessels even permeated into rural, extra-urban sites in small quantities, a phenomenon which did not occur in other glass producing areas until later in the Roman period. The Phoenician connection, with its strong historical orientation toward the eastern Persian empires rather than the Greek world, also helps explain the form these earliest mass produced glass bowls took, which was decidedly Achaemenid rather than Greek.⁷¹⁶ Abundant natural resources and a cosmopolitan client base further facilitated the development of the industry. Although late Hellenistic Phoenicia is undoubtedly important in glass history, a detailed historical and cultural analysis of glass production and consumption patterns in any of the regions discussed in Chapters 3 and 4 would likely be just as fruitful. This chapter is therefore a model of the type of local case study which might profitably be conducted in other areas.

⁷¹⁶ Jackson-Tal 2004; Ignatiadou 2010; see also Chapter 4.

Tel Anafa: A Type Site for Syro-Palestinian Glasswares

The glass finds from Tel Anafa are significant enough archaeologically and historiographically that they deserve special introduction at the forefront of the following discussion, since most subsequent explorations of glass in Syro-Palestine have been in some way reactive to those of Tel Anafa.⁷¹⁷ As Grose elegantly stated in his foreword to the glass catalogue in the final excavation report:

It is now easy to forget that when the Weinbergs first uncovered the glass bowls at Anafa, these vessels were an archaeological sensation, virtually unknown and unstudied within the realm of classical, biblical, or Mediterranean archaeology. Not only was the abundance of the glass unprecedented in such an early context, but the forms and classes were largely undocumented. This was truly *terra incognita*.⁷¹⁸

Located in the modern Hula Valley of northern Israel, Tel Anafa was excavated over ten seasons from 1968 to 1986 by Saul Weinberg and Sharon Herbert. Tel Anafa has become a type site for Syro-Palestinian glass bowls and other common products of the late Hellenistic *koine*. Among the numerous ceramic tablewares, cooking pots, transport amphorae, lamps, terracotta figurines were over 4,000 fragments of sagged glass vessels, including 1,116 grooved bowl fragments belonging to Grose Group A (75% of the identifiable glass fragments).⁷¹⁹ The glass assemblage itself was highly homogeneous, with upright rims, convex bottoms, and tapered walls. Just under half (46%) of the grooved bowls were colorless, followed by golden brown (amber) (31%) and light green or greenish-yellow (22%). A plurality (52%) were conical in shape, 41% are hemispherical, and only 6% are ovoid with external grooves. Most of the conical bowls have

⁷¹⁷ Initial publications and discussions of the glass assemblage found at Tel Anafa in the late 1960s and early 1970s are: Weinberg 1970; Weinberg 1971; Grose 1979, 1981. Final reports on the site and its glass vessels have now been published as Herbert 1994; Grose 2012, respectively. On the historiographic significance of the Anafa glass, see Nenna 2013.

⁷¹⁸ Grose 2012, xiii. The initial report on the Hellenistic glass from Tel Anafa is Weinberg 1970.

⁷¹⁹ On Anafa as a type site, Herbert 1994, 1. For quantities, forms, and colors of glass from Tel Anafa, Grose 2012, 27-28. About 1,500 of the 4,000 vessels were identifiable by type. However, these numbers are those of actual fragments of glass, not a calculation of minimum number estimate of vessels (as emphasized in Nenna 2013), and it is plausible that an MNE would be much lower. Cf. O'Hea 2005, where she cites an MNE of 165 drinking bowls at Jebel Khalid and 159 at Pella.

three interior grooves below the rim; a decoration of two grooves below the rim was more common in hemispherical bowls. In addition to monochrome sagged glass vessels, roughly 150 glass gaming counters and dozens of glass beads, ranging from plain monochrome to trail decorated beads and molded and tool formed pendants were also recovered, left behind by the LHSB residents when they abandoned the site around 75.⁷²⁰ No polychrome glass vessels have been found in Hellenistic strata; the mere three documented examples are probably from the later Roman period occupation in the late first century BCE-early first century CE.⁷²¹

Given the early importance of Tel Anafa to the history of pre-Roman glass studies, it is time to reassess the actual importance of Tel Anafa as a glass consumption site in antiquity. While the high quantity of glass found at Tel Anafa is certainly exceptional for the late Hellenistic period, increased recognition and publication of Hellenistic glass wares has made Anafa less anomalous than it seemed a few decades ago. For instance, Triantafyllidis has reported that over 3,000 fragments and 50 intact examples of sagged bowls have been found in the city of Rhodes, probably products of a local workshop.⁷²² Other sites in the region of the Galilee and southern Syro-Palestine have also generated large quantities of material – notably Gamla, Pella, Jerusalem, Maresha, and Jebel Khalid (see *infra*). Anafa sits more comfortably in its regional landscape than it once did.

Furthermore, the understanding and interpretation of the site itself has progressed since the 1970s with the completion of final stratigraphic and specialist reports in the 1990s and 2000s. Examination of the wide range of small finds collected at Tel Anafa has revealed it to be a

⁷²⁰ Larson forthcoming-a, forthcoming-b. Although these finds have not yet been fully published (although the manuscripts were completed by the present author in 2009), S. Weinberg published a handful of beads and pendants in one of his preliminary reports (S.S. Weinberg 1973, 12 fig. 10). These objects, especially a bivalve molded African head pendant, have subsequently been cited as parallels in the Delos and Israel Museum reports among others (Nenna 1999, 143; Spaer 2001, 162).

⁷²¹ Grose 2012, 53-54, No. G243-G245. According to Grose, these three fragments are atypical of Hellenistic, Early Roman, or Egyptian traditions and may belong to a short lived local industry.

⁷²² Triantafyllidis 2002, 48, fig. 10.

working residence as well as a luxury villa, whose inhabitants engaged in agricultural production, animal husbandry, and textile manufacture.⁷²³ While the Anafa residents were undoubtedly connected to cosmopolitan coastal markets and Late Hellenistic consumption habits, the site itself now appears to be more in line with a working farmstead of a wealthy landowner than a luxury villa retreat.⁷²⁴

While it has often been suggested that the exceptional quantity of glass finds (along with the imported pottery, bath, and painted plaster) is evidence of the extreme wealth and luxury lifestyle enjoyed at the site, the residents of Tel Anafa displayed mass consumption – not luxury – habits in their glass usage. First, the Anafa glass tablewares are exceptional in *quantity* but not in *quality*. There was nothing particularly special, unique, or unusual about any of the Anafa glass; polychrome and elaborately decorated or shaped monochrome vessels were entirely absent in the Hellenistic period assemblage, and even the fluted and floral bowls of Group B are small in number and relatively plain in appearance. In this way, the Anafa finds were distinct from those at Delos, where only 1,400 fragments of glass have been documented but “more ornate or unusual” objects like opaque tablewares, beaded rim bowls, and beads, inlays, and other small objects make up a higher percentage of the total assemblage.⁷²⁵ Second, the large number of glass fragments, their haphazard deposit, and domestic nature of the site are also characteristic of mass, rather than luxury, consumption practices. The Anafa residents used glass drinking vessels often, in large quantities, in plain and repetitive shapes and decorations, and discarded them without ceremony. This is not to say that the Tel Anafa residents and their neighbors did not conspicuously consume or did not intend to advance an elite identity by engaging in such

⁷²³ Redding 1994; Merker 2012; Wells et al. 2012.

⁷²⁴ I have presented this thesis in papers given at the Archaeological Institute of American Annual Meeting (2015) and the conference Tradition and Transition: Population and Culture in Galilean Societies (2012).

⁷²⁵ Grose 2012, 7-8, citing Nenna 1993b, 1999.

practices. Indeed, I would argue that the residents of Anafa are a prime example of an aggrandizing middle elite who seized upon the power vacuum of post-imperial Syro-Palestine to advance their own prestige and economic and cultural position.

The Tel Anafa residents and other consumers of Late Hellenistic glass in Syro-Palestine abided by similar consumption habits as those elsewhere in the eastern Mediterranean, expressing their social aspirations through their material practices. But it was not just the consumers of Syro-Palestine who changed their practices. Glass producers did as well, establishing a new industry in which glass vessels and small objects were mass produced. After a brief historical introduction to the region, with particular focus on Phoenicia, this chapter will discuss in detail the evidence for primary and secondary glass working in Syro-Palestine, followed by discussion of the various sites in the region where glass has been found in a consumption context. The final section will address the potential reasons for and implications of the establishment of a major new industry at this time, concluding that the abundant natural resources and knowledgeable workforce helped jumpstart the industry which rapidly took hold in the region.

A Brief History of Hellenistic Syro-Palestine

Shifting political currents in Hellenistic Syro-Palestine affected the region's economic and cultural systems (Figure 18). Over the three hundred year course of the Hellenistic period, Syro-Palestine was the scene of several altercations between major and minor imperial regimes and, as a result, changed hands numerous times.⁷²⁶ Before the turbulence of the Hellenistic and

⁷²⁶ The following historical summary is based largely on: Green 1990; Berlin 1997a; Sartre 2005, 1-53; Grainger 2010, with additional references noted as appropriate. Handbook style syntheses of the local history of Syro-Palestine in the Hellenistic period are rare, as it tends to fall between the cracks of traditional categorical subdivisions based on political (the Seleucid and Ptolemaic empires) and geographic (Near East, Asia Minor, Egypt, Greece) designations. One important exception to this is the frequent use of southern Syro-Palestine and specifically Judaea as a case-study for local dynamics under Hellenistic imperial and cultural systems.

early Roman periods, Syro-Palestine had been under more or less stable imperial control since the sixth century Babylonian conquest, after which it passed into Achaemenid Persian control, until Alexander's march through the region and the siege of the city of Tyre in 332. Following thirty years of uncertainty during the Wars of the Successors, after the Battle of Ipsus in 301 Syro-Palestine south of the Eleuthernus River officially became a Ptolemaic possession while the territory north of the Eleuthernus River belonged to the Seleucids. Neither empire was fully satisfied with this territorial allotment, however, and a series of battles and skirmishes known as the Syrian Wars between the two kingdoms transpired over the next century, with central Syro-Palestine serving as the primary battleground. To the Ptolemies, this region was an important buffer between their heartland of Egypt and the Seleucid empire. To the Seleucids, the territory represented additional access to the Mediterranean and to southern trade routes. Some sources have suggested that there was an emigration (forced or unforced) of population from Judaea to Egypt in the early years of Ptolemaic occupation.⁷²⁷ Despite considerable fieldwork, the material remains of Syro-Palestine under Ptolemaic control have been rather difficult to identify and date, perhaps indicative of generalized stagnation, poverty, and lack of development.⁷²⁸

⁷²⁷ *Letter of Aristeas* 4, 22; Josephus *Antiquities* XII.7.

⁷²⁸ Smith 1990; contra Berlin 1997a, 4-5. Regardless of the interpretation, the material evidence of the third century is elusive in both excavation and survey, due largely to the lack of clearly diagnostic pottery (Meyers, Strange, and Groh 1978; Frankel et al. 2001). The so-called "Long Third Century" in southern Syro-Palestine is the subject of a forthcoming book based on a conference of the same name in 2014 (Lipschits et al. forthcoming).

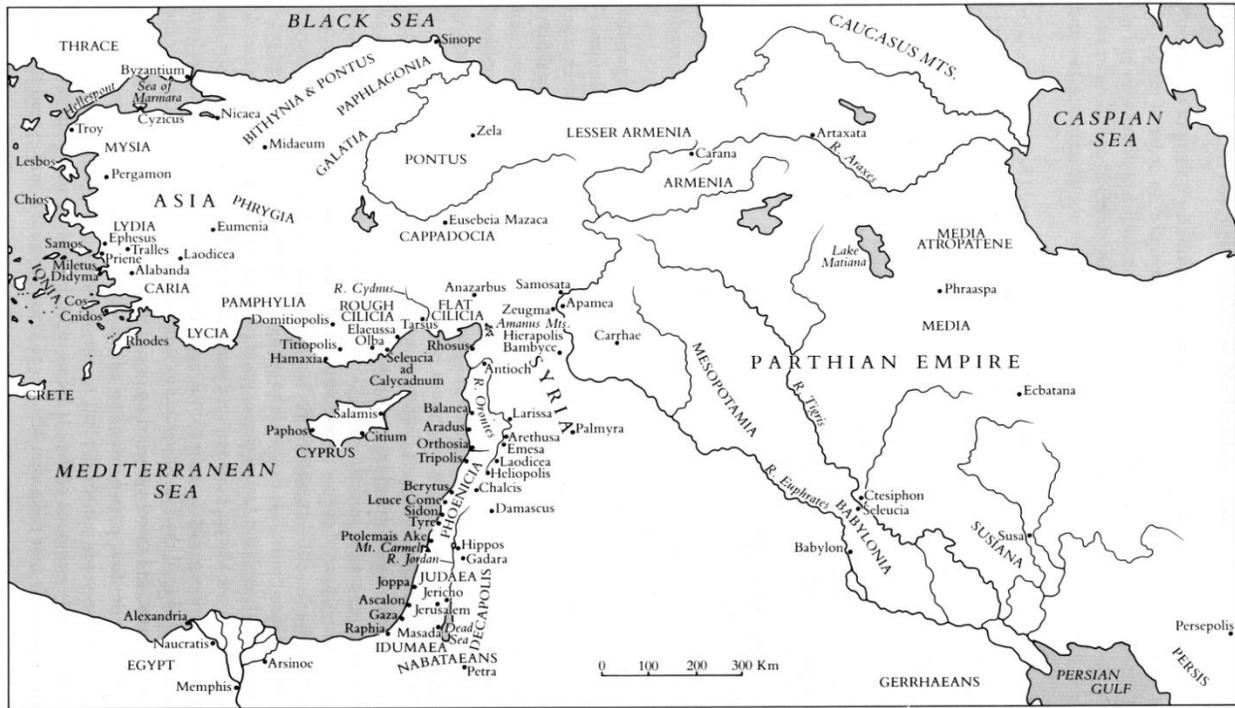


Figure 18. Syro-Palestine and the East, c. 145 BCE (from Green 1990, 532, Map 26).

The Seleucids finally triumphed – at least as far as Syro-Palestine was concerned – at the Battle at the Panium (Banias) in 199/8, when all of Syro-Palestine came under the control of Antiochus III. The cities and hinterlands of Syro-Palestine gained more connectivity to coastal and Mediterranean markets during the first half of the second century, based on the rising numbers of imported ceramic finewares and amphorae. According to the literary sources, the local ruling elite of Judaea was displeased by the Hellenizing policies and interference from the Seleucid government under Antiochus IV Epiphanes (r. 174-164), and a small guerrilla insurgency broke out in Jerusalem under the leadership of Mattathias and his son Judah Maccabee in the 160s.⁷²⁹ This conflict escalated to a full scale war between armies by the 140s. A succession of Jewish generals from the Maccabean clan besieged and destroyed numerous

⁷²⁹ The primary source for this conflict is the Jewish text of 1-2 Maccabees, which are apologetic texts for the Hasmonean dynasty. Scholars have recently begun to question the legitimacy of the anti-Seleucid claims made by the propaganda machine of the Judaeian rulers (Aperghis 2011; Honigman 2014).

cities throughout southern Syro-Palestine during the second half of the second century.

Archaeologically, this has resulted in clear destruction layers at sites such as Ashdod, Samaria, and Maresha, which allow firm chronological dating as well as evidence of a population which had become quite cosmopolitan. In the meantime, the Seleucid empire was beginning to collapse both inside and out, as a succession of pretenders to the throne fought among themselves for power after the death of Antiochus IV, alternately backed by Rome and the Ptolemies. The Parthians, taking advantage of this internal weakness, took control of the eastern extent of the empire, including Mesopotamia and Babylonia.

Throughout this period, Rome loomed on the western horizon, its legates providing legitimacy and financial support to the Hasmonean dynasty, as well as any others which undermined Seleucid authority. The slow collapse of the Hellenistic empires of the Seleucids and Attalids over the second and early first centuries and attendant regional instability contributed to a rise in piracy and emergence of local territorial states in the eastern Mediterranean. Most notable of these was that of Mithradates, who at one point controlled the Black Sea and parts of Asia Minor, the Aegean, and mainland Greece.⁷³⁰ Although Sulla dealt with the immediate Mithradatic threat in 87-86, the resulting power vacuum caused political instability in the entire region, although commerce seems to have continued uninterrupted. Still, fearful for their economic and trade networks, Rome eventually sent Pompey to the eastern Mediterranean in 65 to make peace and annex what was left of the Seleucid empire. Pompey's settlement at Damascus in 63 effectively ended Hellenistic imperial control of Syro-Palestine, much of which became subsumed under one form of Roman *imperium* or another. In southern Syro-Palestine, the Hasmoneans, followed by the Herodians, continued largely autonomously as

⁷³⁰ McGing 2003.

client kings through the first century CE, although their degree of independence, never large, diminished over time.

The main points from this very brief and general overview are that the inhabitants of Syro-Palestine effectively lived in contested territory for centuries, as various regimes exerted greater and lesser degrees of control over different areas. The written histories only take us so far in understanding how these shifting imperial dynamics, civil wars, and conflicts affected daily life in the cities, towns, and countryside. In southern Syro-Palestine, including Phoenicia, Judaea, and Idumaea, the third century and first third of the second were relatively stable, with regular administration and stable governmental oversight of taxes, trade, and land grants, even if the region lacked the infrastructural development seen in other third century Hellenistic areas like Asia Minor and Babylonia. By the middle of the second century, however, the Seleucid hold on the region had greatly diminished, due perhaps as much to international political dynamics as any particular local military success of the Maccabees.

Although the Seleucid empire limped along for almost another hundred years, their diminished hegemony and the resulting political void is reflected in the emergence of material, economic, and political states and associations, many of them tribally or ethnically based, in the later second and early first centuries.⁷³¹ This “rise in local autonomy,” according to Sartre, occurred when “local populations took advantage of the dynastic crisis to distance themselves from royal authority and to wangle their “freedom” in exchange for promising support to various competitors; in some cases, they simply filled the vacuum left by the disappearance of the royal administration.”⁷³² Among these emergent polities were the Hellenized cities of the Decapolis in

⁷³¹ Erickson and Ramsey 2011 is a stimulating collection of papers which investigate local causes and responses to the gradual dissolution of the Seleucid empire.

⁷³² Sartre 2005, 11.

southern Syria,⁷³³ the Nabataeans in the southern desert and Transjordan,⁷³⁴ the Hasmoneans in Judaea,⁷³⁵ the Ituraeans in the Biqa' Valley and Hermon,⁷³⁶ and the Phoenicians along the coast.⁷³⁷ These entities functioned more or less as states but are largely undocumented historically except on the occasions they directly encountered Rome. Their surviving material correlates include locally minted coins, inscriptions in native local languages, localized pottery production and use, a boom in rural settlement and land use, and major urban development. At the same time, Mediterranean imports including fine ware pottery and Aegean wine amphorae began to reach inland territories in greater numbers, suggestive of “the essentially economic, rather than military, interests of the various polities of the later second century BCE.”⁷³⁸

That this surge in new forms of material culture, proliferation of trade and exchange, and expansion of consumer markets and producer activity occurred during a period of diminished imperial oversight and collapse of powerful regimes is not coincidental. Comparative studies of cultural environments in the wake of collapsed empires or otherwise outside of imperial control often show a florescence of economic entrepreneurship and artistic activity, as individuals and communities strive to establish themselves in the sudden vacuum or are able to engage in free enterprise without concern for state interference. For instance, according to a study by Faroqhi, artisans under the Ottoman Empire were able to express a greater degree of initiative and creativity the further they were from the imperial capital of Istanbul.⁷³⁹ When the Ming Dynasty

⁷³³ Parker 1975; Graf 1992; Kennedy 2013.

⁷³⁴ Sartre 2005, 16-22. The Nabataean state may date as early as the third century, and it was firmly established by the late second/early first century. Sartre dated its major expansion and consolidation to the years between 160-150, when the Seleucids were especially weak.

⁷³⁵ Secondary scholarship on the Hasmoneans and the Jewish state, especially in relation to the Greeks and Romans, is vast compared to the other minor states which arose in Syro-Palestine in the wake of the collapsing Seleucid empire. General overviews include: Bickerman 1947; Schürer 1973; Green 1990, 497-524; Regev 2013.

⁷³⁶ Dar 1993; Myers 2010.

⁷³⁷ Grainger 1991; Berlin 1997b; Duyrat 2003; Millar 2006 (1983).

⁷³⁸ Berlin 1997a, 24.

⁷³⁹ Faroqhi 2009.

curtailed the export of porcelain from China in the fourteenth and fifteenth centuries CE, potters in Southeast Asia intensified levels of production and export to meet international demand.⁷⁴⁰ Archaeologists using network theory have repeatedly discovered that the lack of a central hegemonic authority facilitated the opening of commercial and knowledge based networks in which products, ideas, and technology could flow more freely.⁷⁴¹ Furthermore, artists and craftsmen who had previously been employed within palatial economies and catered to court society suddenly found themselves without patronage. While they were equipped with skills and training, they lost their primary client base and had to seek out a new one among the lesser elites of local city and town administration.

Hellenistic Phoenicia

Among the emergent polities which took advantage of the political instability in Syro-Palestine during the Late Hellenistic period were the city states of Phoenicia. Under Achaemenid rule, Phoenician kings operated more or less autonomously provided they paid appropriate taxes to the regime.⁷⁴² During the wars of the successors after the death of Alexander, the kings of Sidon, Tyre, and Arados seem to have stayed in power, at least in name, perhaps as late as the first decades of the third century. Around 280 in Sidon, 275 in Tyre, and 259 in Arados, the coinages of each city no longer carried the names of local kings and instead were dated by a new era of the people of Sidon, of the people of Tyre, and so forth.⁷⁴³ The events which precipitated the new eras are not known, but most scholars have accepted that they

⁷⁴⁰ Brown 2009.

⁷⁴¹ Graham 2006; Sommer 2009; Larson 2013.

⁷⁴² Elayi 1980; Markoe 2000; contra Stern 1990, who believes Dor was the capital of a Persian satrapy. The power of the Phoenician naval fleets perhaps ensured their autonomy, for their military importance in Mediterranean engagements of the Persians is well documented in Greek sources: the kings of Sidon and Tyre were in the retinues of Xerxes (Herodotus *Histories* 8.67), and they were also called upon during the late fifth century Peloponnesian War (Thucydides 8.87; see Lateiner 1976). Tyre probably assumed the preeminent position of the cities of Phoenicia after Sidon was destroyed in 351 (Elayi 1982, 93-97).

⁷⁴³ Millar 2006 (1983), 41.

were related to some sort of administrative restructuring or reassignment by the Ptolemies and Seleucids.⁷⁴⁴

Affairs in Phoenicia continued more or less apace with those in the rest of Syro-Palestine until the mid-second century, when the Phoenician cities were caught between the rival Seleucid claimants Alexander Balas and Demetrios I after the death of Antiochus IV, as well as the pesky Ptolemies and insurgent Maccabees. Each of the Phoenician cities changed hands several times. Grainger, following Strabo (*Geography* XVI.2.19), claimed that Beirut was destroyed in 144. The peace and prosperity enjoyed by the region, first under the Ptolemies and later under the Seleucids, eroded away as the Phoenician cities quarreled among themselves for land.⁷⁴⁵ Around 125, Tyre once again reset the clock on their history when the city was granted free and independent status, probably by the Seleucids. Grainger has suggested that Tyre built a friendship with the Ituraeans to the east and Jewish state to the south, to mutual benefit.⁷⁴⁶ This alliance may have been particularly important when Sidon achieved its own independence in 111-110.

Archaeology tells a sometimes different, sometimes complementary story. Excavations at Beirut have revealed no mid-second century destruction layer, but rather increased prosperity and local development, signified by increases in local production and the abundance of imports.⁷⁴⁷ Andrea Berlin has connected the presence of semifine ceramic vessels to Phoenician, and specifically Tyrian, trade markets, indicating the continued relevance of the Phoenician cities to Syro-Palestinian economic activity. Perhaps most significantly, the Tyrian standard of weight

⁷⁴⁴ Nothing about this sequence of events is certain and almost all of it is speculative based on numismatic and inscriptional evidence. For two alternative accounts: Grainger 1991, 53-65; Millar 2006 (1983), 41-43. Millar has rejected the administrative explanation, because Arados was controlled by the Seleucids while the other two cities were under Ptolemaic authority, but Grainger rightly noted the correspondence of these dates to the First Syrian War; perhaps some sort of treaty or settlement was reached among the involved parties.

⁷⁴⁵ Grainger 1991, 122-127.

⁷⁴⁶ Grainger 1991, 141-147.

⁷⁴⁷ Aubert 2003.

measurement and Tyrian coinage became the *koine* of economic exchange in Hellenistic southern Syro-Palestine, as demonstrated by the work of Gerald Finkielsztein.⁷⁴⁸ Sharon Herbert has argued that the inhabitants of the inland sites of Tel Anafa and Tel Kedesh maintained a distinct Phoenician cultural and ethnic identity over the course of the Hellenistic period.⁷⁴⁹

During the collapse of the Seleucid empire and the rise of local polities, novel techniques of production were explored by entrepreneurial craftsmen. At the same time, a new class of local clients emerged who were unaffiliated with the imperial court but desired to emulate its luxury habits of consumption. Together, these conditions facilitated an environment in which glass workers worked to satisfy demands of local aggrandizing elites who considered glass tablewares the height of noble fashion. They created a standard bowl shape which was much quicker and easier to produce and looked like the traditional drinking bowls of Near Eastern and Syro-Palestinian elite society, but could be used in Greek drinking customs. These glass bowls furnished the tables in elaborately decorated Greek style dining rooms replete with wall paintings and mosaics, set off peristyle courtyards. The villa farm of Phoenician settlers at Tel Anafa is the paradigmatic example of this phenomenon. As I describe below, this type of consumption occurred throughout southern Syro-Palestine in the later second and early first centuries.

Glass in Syro-Palestine: Sites of Production and Consumption

Glass in Syro-Palestine before the Hellenistic Period

By the early Roman period, southern Syro-Palestine was a major manufacturer of raw glass and secondary glass vessels, and the industry continued to thrive until Late Antiquity.⁷⁵⁰

Roman period written sources strongly associated the coast of Syro-Palestine, in particular the

⁷⁴⁸ Finkielsztein 2007; Wolff and Finkielsztein 2009.

⁷⁴⁹ Herbert 2003; see also Herbert 1994; Herbert and Berlin 2003b.

⁷⁵⁰ See Chapter 6 for early Roman glass in Syro-Palestine. The number of Roman and Byzantine period glass workshops is vast; for an overview, see Freestone, Gorin-Rosen, and Hughes 2000; Gorin-Rosen 2000.

area near the Belus River, with primary glass manufacture. The late first century BCE geographer Strabo described a sand source located between Acco and Tyre, the products of which were exported to Sidon for transformation into raw glass (primary production).⁷⁵¹ According to Pliny, writing in the third quarter of the first century CE, glass was discovered when natron merchants camping at the mouth of the Belus River, near Acco-Ptolemais, brought blocks of natron onto the sandy beach to support their cooking vessels. When the natron blended with the hot sand in the fire, streams of transparent vitreous material formed, and glass was discovered. Pliny added that a five mile stretch of the Belus River, near Acco-Ptolemais, was “for many ages the only spot that afforded the material for making glass (tantum multa per saecula gignendo fuit vitro).”⁷⁵² His is the only account that mentions the longevity of the Phoenician glass industry. Like Strabo, Pliny noted that Sidon was famous for glass working, although his use of the modifier *quondam* (once) suggests it was less prominent in the later first century CE than it had been in Strabo’s time.⁷⁵³ Josephus, the Jewish historian of the late first century CE, and Tacitus, the Roman historian of the early second century CE, also claimed that Belus River sand was used in primary glassmaking.⁷⁵⁴

Despite Pliny’s claim that glass was first invented in Phoenicia and Belus River sand was used exclusively in glass manufacture for a long time thereafter, the role of Phoenicia in first millennium BCE glass manufacture is not well supported archaeologically. As early as 1940, Fossing recognized that glass was not invented by Phoenicians, and subsequent work has indeed proven that glass was probably invented and developed in Bronze Age northern Mesopotamia.⁷⁵⁵

⁷⁵¹ *Geography* 16.2.25. For text and translation, see Appendix, Text 3. He added that the sand of Sidon might also be suitable for glass making.

⁷⁵² *Natural History* 36.65. For text and translation, see Appendix, Text 5.

⁷⁵³ For further discussion, see Stern 1995, 66-69.

⁷⁵⁴ Josephus *The Jewish War* II.10.2, Appendix, Text 7; Tacitus *Histories* 5.7, Appendix, Text 8.

⁷⁵⁵ Fossing 1940, 78. For Bronze and Iron Age glass, see Chapter 3. It is possible that Pliny is instead describing the discovery of natron (as opposed to plant ash) glass, which occurred in the Iron Age. The significance of Pliny’s

Scholars have associated Phoenician glass workers with multiple glass industries of the Iron Age: the ninth-eighth century translucent cast vessels found in Nimrud, composite polychrome bar inlays which first appear in early eighth century northern Syria, and seventh to fifth century Mediterranean Group I core-form vessels.⁷⁵⁶

The idea that Phoenician glass workers operated in Assyrian palaces has been more or less universally accepted, despite the fact that there has been no glass whatsoever found on Phoenician sites before the seventh century. When made explicit, the argument as espoused by Barag and others was based the presence of glass inlays from Assyrian sites with stylistic parallels with “Phoenician” ivories and typological parallels with stone and ceramic from Phoenicia. However, the Phoenician craftsmanship of these ivories and other materials has been largely discredited.⁷⁵⁷ Margaret O’Hea has systematically dismantled arguments that Phoenician craftsmen made Assyrian glass tablewares, noting that the most common forms of these glass vessels had Egyptian or Mesopotamian models.⁷⁵⁸ Nor did the raw glass of the Iron Age come from Phoenicia: the Nimrud cast vessels consisted of three discrete compositional groups: two traditional Mesopotamian plant ash glasses and the other one an Egyptian natron glass.⁷⁵⁹ Nothing, therefore, connects Iron Age glass to Phoenician workshops, Phoenician sites, or Phoenician craftspeople. If Phoenicians were making glass during the Iron Age, they were doing

description as natron glass was first noted by Trowbridge and has been repeated recently by Henderson (Trowbridge 1930, 96; Henderson 2013, 51).

⁷⁵⁶ von Saldern 1966a; Barag 1985, 54; von Saldern 1988 (1970), 209-211; Barag 1990, 1993; Stern and Schlick-Nolte 1994, 59; Tait 2012, 38-40. Fossing and Harden suggested that Phoenicians may have had a role in the distribution, if not the manufacture, of Mediterranean Group I core-form vessels, but this idea has been subsequently rejected by Barag and McClellan (Harden 1962b, 154; McClellan 1984, 321-322; Barag 1988 (1970), 196).

⁷⁵⁷ Winter 1976; Feldman 2014, 13-18. In the view of Feldman, ivories and other forms of Assyrian artistic production were culturally blurred and reflect distinct communities of practice rather than ethnically restricted production workshops.

⁷⁵⁸ O’Hea 2011a.

⁷⁵⁹ Reade, Freestone, and Simpson 2005; see also O’Hea 2011a, 155. O’Hea stated that Phoenicia was a primary glass producer in the Late Bronze Age “because of the quality of its sand,” but I can find no source to support this, nor did she cite one.

it as attached laborers to the Assyrian court, not in their own homelands, begging the question of what would be “Phoenician” about so-called Phoenician glass.⁷⁶⁰

The essential issue, therefore, is when Syro-Palestine in general, and Phoenicia in particular, began to produce raw glass using the natural resources of the local coastal sands and to transform that product into finished objects in secondary workshops. Clearly, Syro-Palestine was manufacturing glass by the early Roman period, but there is no evidence of glass manufacture in Syro-Palestine during the Persian period, and only circumstantial evidence of earlier Iron Age manufacture. But there is an ever-expanding preponderance of evidence for glass production and consumption in Syro-Palestine beginning during the Hellenistic period, particularly around the mid-second century BCE.

⁷⁶⁰ Cf. Gates 2002.

Production Sites in Hellenistic Syro-Palestine

The first category of evidence pointing to the emergence of primary glass manufacture and secondary glass production in Syro-Palestine during the second-first centuries is the appearance of production sites themselves (Figure 19). No workshops are known from the region before the Late Hellenistic period, but by the early Roman period, several definite and putative glass workshops had been established. The following discussion outlines those sites at which glass manufacture has been identified either with certainty or speculatively, with particular focus on their date and products.

Beirut

Glass from the Late Hellenistic period has been excavated and published from three areas of excavation in ancient Beirut: BEY 002,⁷⁶¹ BEY 015,⁷⁶² and BEY 006, 007, and 045 (collectively known as the Souks).⁷⁶³ These areas were excavated during the 1990s by various multinational universities and organizations under the auspices of a UNESCO initiative to investigate the archaeological remains of the war torn city prior to redevelopment and construction of the city center. As a result, publication of materials has been somewhat idiosyncratic, and there is no summative assessment of cumulative evidence for glass consumption and production in any period. However, even a brief survey of the bibliography quickly makes clear that Beirut had a significant glass industry for over one thousand years, based on the prominence of glass material in excavated assemblages, the diachronic evidence for glass production in the city, and the relative continuity of these patterns from the first century

⁷⁶¹ Foy 2005; Foy, Picon, and Thirion-Merle 2007.

⁷⁶² Kowatli et al. 2006; Henderson 2013.

⁷⁶³ Jennings 2000, 2002, 2004-2005.

BCE through the medieval Islamic period (12th-13th centuries CE). By contrast, very little evidence of glass dating prior to the second century has been published.

In the early Hellenistic period, Beirut underwent a large scale expansion. Much of this early Hellenistic construction was disturbed by later deep Roman building projects, leaving few primary deposits behind. Nonetheless, it is clear that in the late fourth and third centuries, the city proper expanded to the west. New city walls and large fortification towers enlarged the city, and houses and streets were built over extramural Iron Age cemeteries.⁷⁶⁴ The first appearance of glass at Beirut was small core-formed unguent vessels found in select funerary and urban areas.⁷⁶⁵ No core-form or other glass vessels have been reported from the Iron Age burials laying under the Hellenistic city; glass perfume containers were either not available or not considered appropriate or necessary for funerary practice in Beirut in the first half of the first millennium. The only other documented glass from Beirut prior to the second half of the second century is a single fragment of a colorless, thin walled cast or sagged bowl with exterior engraved lines, possibly in the form of hexagons, found in a context of the third-second centuries.⁷⁶⁶

Before the late first century, the evidence for both primary and secondary manufacture of glass and glass objects at Beirut is circumstantial. It is nonetheless significant, based on a combination of inferences from later literary and archaeological evidence and telltale indicators of local manufacturing practices in this period. In other words, while there is no ‘smoking gun’

⁷⁶⁴ Perring, Reynolds, and Thorpe 2003. The precise construction date of the fortifications is unclear, but the masonry styles are presumed Hellenistic based on parallels from Samaria, Caesarea, and Tiberias.

⁷⁶⁵ Jennings 2004-2005, 27-28. Core-formed objects have only been published from the Souks area; they are not mentioned in the publications of glass debris from BEY 002 and BEY 015, but the publication of those areas is incomplete and focused on evidence for production in later periods, so it is unknown whether earlier glass objects were found in these areas, either in levels dated prior to the second century or as residual material. The small quantities at the Souks are telling: only six total fragments of core-form glass were identified, all from BEY 006, and only two of which are from stratified contexts.

⁷⁶⁶ Jennings 2004-2005, 30, fig. 2.3.

of glass production at Beirut which can be definitively dated to this period (raw material, a furnace and tools, prefabricated elements such as mosaic canes, or glass wasters and slag), such have been found in refuse deposits dated to the first century CE. Moreover, the overall quantity of glass wares from the first century BCE is a likely proxy for the presence of an emerging industry somewhere in the vicinity. Jennings tentatively suggested that differences in color and manufacturing technique between the Beirut and Anafa glasses point to a different production source operating in the same regional tradition as that which was supplying contemporary Tel Anafa.⁷⁶⁷ Deep yellow glass was particularly common in the Beirut Souks and likely a marker of the local industry there, a suggestion which has been borne up by the discovery of quantities of raw yellow and amber glass at BEY 002.⁷⁶⁸ Scientific analysis undertaken on the so-called ‘brown’ glasses from the Beirut Souks excavations indicated that the yellow color was achieved not through the addition of specific colorants or decolorizers, but through a reducing environment in the furnace, either by adding carbon to the raw glass or maintaining a smoky atmosphere in the kiln.⁷⁶⁹

BEY 002 and BEY 015 have both yielded evidence for glass manufacturing by the final decades of the first century: at BEY 015, facilities for primary glass production, including a sequence of glass melting tanks with adhered glass along with raw glass chunks and drawn rods and threads, and at BEY 002, a dump of material including raw glass, glass slag, and mosaic canes.⁷⁷⁰ BEY 015 was therefore certainly a glass manufacturing site, while glass manufacturing, either primary or secondary, took place somewhere in the vicinity of BEY 002.

⁷⁶⁷ Jennings 2004-2005, 54.

⁷⁶⁸ Foy 2005.

⁷⁶⁹ The glass was analyzed with an energy dispersive spectrometer attached to a scanning electron microscope (EDS-SEM). Small amounts of iron and sulphur need be present in glass for the yellowing effect to occur, but Paynter believed these elements to have been incidental contaminants in the raw glass mixture which were not intentionally added (Paynter 2004-2005, 303).

⁷⁷⁰ For BEY 015, see Kowatli et al. 2006; Henderson 2013, 216-222. For BEY 002, see Foy 2005; Foy, Picon, and Thirion-Merle 2007.

The proximity of the two sites and similarities of date and assemblage suggest that that the material from BEY 002 may have originated in the area of BEY 015, from which it was swept up and used as building fill. Both areas yielded yellow, amber, green, purple, and blue raw glasses with conchoidal fractures, indicating they were broken off larger slabs, along with polychrome rods and glassy slag stuck to ceramic or plaster material. The glass finds were mixed with ceramics and amphorae from the second half of the first century BCE through the first half of the first century CE. The results of chemical analysis on the raw glass and finished glass bowls are consistent with later glasswares known to have been produced on the Syro-Palestinian coast (e.g. Jalame, as well as later periods at Beirut itself); all glass was manufactured from mineral natron and a similar sand source.⁷⁷¹ Notably, glass vessel wasters, molds, or other indications of *secondary* glass manufacture have not been reported from either BEY 002 or BEY 015.⁷⁷²

The internal dating evidence for both BEY 002 and 015 is scant, and glass production waste is not itself intrinsically datable.⁷⁷³ Many deposits from BEY 002 contained Grose Type A grooved bowls and manufacturing debris, particularly raw glass, in contexts variously dated to the Hellenistic period, first century, or mixed.⁷⁷⁴ The dates of three architectural phases of tank furnaces at BEY 015 are even more nebulous. According to Kowalti, the only dating evidence for the furnaces was a pottery production site built directly over the glass tank complex. Because the products of that facility were amphorae which circulated between 50-150 CE, the glass tank

⁷⁷¹ For discussion of the results of various scientific analyses, see Thirion-Merle 2005; Foy, Picon, and Thirion-Merle 2007; Henderson 2013, 235-239. The Belus River suggestion is, to date, unsubstantiated and based exclusively on the written sources of the first century CE discussed above.

⁷⁷² Foy argued that ribbed and linear cut bowls were manufactured at BEY 002 beginning in the middle of the first century, but this argument is based on the known dates and quantities of these two types rather than any finds directly associated with manufacture (Foy 2005).

⁷⁷³ Mosaic canes may be somewhat more datable; spiral patterns on canes from BEY 002 match those on mosaic vessels dated to the first half of the first century at Jebel Khalid (O'Hea 2002, No. GN 31, GN 39). However, the pattern continued into the early Roman period, so these canes *could* be early first century but need not be.

⁷⁷⁴ Foy 2005, 17.

complex has a firm *terminus ante quem* of the mid-first century CE.⁷⁷⁵ Henderson claimed that the earliest phase of the furnace complex dates to before 50 BCE. However, he admitted that neither the first nor second phase of the furnace complex had any associated and identifiable floor or soil deposits, so a first century BCE date for primary glass production at Beirut must be considered extremely provisional.⁷⁷⁶ Still, even given the ambiguous start date, the *ante quem* of 50 CE makes Beirut the earliest primary glass manufacturing location identified in Syro-Palestine to date. The evidence for secondary manufacture at Beirut at this date is less certain, but the large number of ribbed and linear cut vessels, along with their distinctive coloring, probably mean that primary and secondary glass working occurred in concert.

Sidon

The best attested glass workshop from the early Roman documentary record is Sidon. In addition to the accounts of Strabo and Pliny, the names of Sidonian glass workers are known from toponymic signatures stamped on the handles of blown cups dated to the early to mid first century CE.⁷⁷⁷ But archaeological evidence of production, much less consumption, before the early Roman period has been less forthcoming at Sidon than at Beirut. The earliest published glass from Sidon dates to the first century CE.⁷⁷⁸ Of 599 glass fragments from the College Site, only 15 were non-blown sagged vessels; this low proportion of sagged to blown vessels is anomalous for early first century CE sites in the eastern Mediterranean, although more typical of

⁷⁷⁵ Kowatli et al. 2006. It is unclear what economic/market circumstances and social interactions might have been involved in the transition of this site from glass to pottery manufacture. Perhaps the market for raw glass had dried up, or the Berytan product become non-competitive in the increasingly expanding glass industry of the first century CE; alternatively, the glass makers could have moved to a larger area where they could manufacture more glass.

⁷⁷⁶ Henderson 2013, 216.

⁷⁷⁷ Lightfoot 2014, 31-32. Individuals using the toponym of Sidon include Annios, Ariston, Artas, Eirenaios, Neikon, and Philippos. Several other workers of mold blown glasses, whose names were embedded in the molds but without a toponym, are also thought to have been Sidonian, including Ennion, Jason, Neikais, and Aristreas. Stern credited Sidonians with bringing glass blowing technology to Rome (Stern 1999b, 444; 2004).

⁷⁷⁸ Zaven 2011.

assemblages by the end of the century.⁷⁷⁹ Most of the sagged vessels belong to the later first century forms of linear cut, flat bottomed, thin walled types of Grose Group D, and not the late Hellenistic rounded bottom grooved bowls of Group A.⁷⁸⁰ Glass slag, vitrified surfaces, and raw glass chunks also found at the College Site may indicate that glass was manufactured at Sidon during the first century CE, although without wasters, Zaven's claim that all the sagged and blown vessels recovered from Sidon were made locally and not imported is difficult to substantiate.

Based on the limited archaeological record, Sidonian glass production probably escalated during the early first century CE, possibly outcompeting the Beirut industry (at least the one located at BEY 015) and driving it out of business by the middle of the century. The Sidonians specialized in blown glasswares, unlike the sagging industry of Beirut. This is somewhat difficult to reconcile with the written sources, as Strabo attested to a thriving glass industry at Sidon by the late first century BCE, which Pliny indicated had passed its heyday less than a century later. One possibility is that the Roman authors highlighted Sidonian blown glass work, with which they were more familiar. The free and mold blown glass wares of Sidon (or Sidonian craftspeople) were more popular in Italy and the west than in Syro-Palestine and the east in the late first BCE/early first CE transitional phase.⁷⁸¹ Further discussion of the antecedents of the early Roman Sidonian glass industry must await additional study and publication of the pre-Roman material from the city.

⁷⁷⁹ For comparative assemblages, see Chapter 6. Much of the College Site material was found in residual contexts.

⁷⁸⁰ Zaven 2011, pl. 1.1-1.2. Both are from contexts dated to the first half of the first century CE, where they are probably residual.

⁷⁸¹ The differential adoption of blown glass technology in the west is discussed in much greater detail in Chapter 6.

Hagoshrim and the Hula Valley

Inspired by the abundance of glass found at Tel Anafa and local reports of surface material, Gladys Weinberg led a short surface survey and brief excavation season at Kibbutz Hagoshrim in the northern Hula Valley during 1970 with the goal of ascertaining whether glass manufacture had taken place in the area.⁷⁸² The team found abundant quantities of sagged glass bowls, including several interior grooved conical bowls, deep and shallow linear cut bowls, and ribbed bowls. Among the finds was a single waster from a ribbed bowl, deformed with tool marks. The main phase of the site was probably the late first century BCE and early first century CE (contemporary to the early Roman, not the Hellenistic, phase of occupation at Anafa) based on the prominence of ribbed bowls in the assemblage.⁷⁸³ Five days of excavation in the so-called Three Trees area yielded mixed Arab and Roman pottery with a bit of Hellenistic material, in addition to undatable marble revetment, grindstones, and a lime floor. A mosaic glass inlay plaque with floral, Nilotic scenes, which Weinberg initially suggested may have been brought by the Ptolemies during their campaign against the Seleucids at nearby Banias in 200, is more typical of early Roman than Hellenistic craftsmanship. Subsequently, residents of the Kibbutz Hagoshrim have reportedly collected thousands of glass fragments, including vessels, beads, raw and melted glass, and furniture pieces from farmland on their property, but these finds lack context and are unpublished.⁷⁸⁴ As in the coastal cities, glass production at Hagoshrim in the early Roman period seems plausible, but late Hellenistic manufacture is still unconfirmed. Still, given the large glass consumption market at late Hellenistic Tel Anafa and the cost and risk of transporting intact glass vessels over land, local secondary vessel manufacture in the Hula Valley

⁷⁸² G.D. Weinberg 1973.

⁷⁸³ Ribbed bowls, with their thicker sides, robust structure, and easily identifiable attributes, may also be over-represented in surface assemblages relative to thinner or less identifiable glasses.

⁷⁸⁴ Kurinsky 1991, 194-204.

with imported raw glass (which was easier to transport and less vulnerable to breakage) is quite plausible. There is also indirect evidence of local manufacture of glass beads in this period, based on the localized distribution of unique bead types such as the double trailed cylindrical blue beads, polychrome chevron beads, and spiral pendants imitating shells.⁷⁸⁵ Glass bead and vessel makers could have used the same suppliers, shared workshop materials, and catered to similar consumers.

Suweida

Another Syro-Palestinian site with possible evidence of glass manufacture is Suweida (ancient Dionysias), located about 30 kilometers northeast of Bosra. Excavations in the Odeon have uncovered an ash layer containing glassy slag which predated the construction of the Odeon in the end of the first century CE. Also found were a coin dated to the late third/early second century BCE and fragments of sagged glass bowls typical of late Hellenistic production. A deep ash level below the area of the orchestra contained another Hellenistic sagged bowl. Dussart proposed that this debris belonged to a Hellenistic glass workshop which was covered at the end of the first century CE by the construction of the Odeon, but she stressed that the stratigraphic data was still quite preliminary and the finds lacked proper study.⁷⁸⁶ Nenna suggested this material should rather be dated to the first century CE.⁷⁸⁷ If the Suweida secondary glass workshop finds are verified, the site would be the only known location of a Hellenistic period glass workshop in Jordan or Syria.

⁷⁸⁵ Larson forthcoming-a. The first two types from Anafa have local parallels at Kedesh and Bethsaida but are unknown elsewhere; the spiral pendants are entirely distinctive to Anafa.

⁷⁸⁶ Dussart 2000, 91-92.

⁷⁸⁷ Nenna 2007b, 130.

Jerusalem

The best documented and published, and arguably most significant, glass workshop from Hellenistic Syro-Palestine is the refuse of a glass workshop found in Area J in the Jewish Quarter of the Old City of Jerusalem in 1971.⁷⁸⁸ The debris was found as a single 70 cm thick layer, dumped at an angle into a stepped plaster pool (miqvah) in a domestic area. It contained abundant charcoal, about one hundred coins, and hundreds of glass objects.⁷⁸⁹ All of the identifiable coins, as examined by Donald Ariel, are those of Alexander Jannaeus (r. 104-76), most from the last years of his reign. The deposit was covered by earthen fill and sealed by large stone slabs belonging to a large pavement dated to the early years of King Herod (r. 37-4). The Jerusalem workshop therefore is firmly dated to the middle of the first century by a *terminus post quem* of c. 76 and a *terminus ante quem* in the 30s. Although no architectural remains, furnaces, or kilns have been identified (and archaeological work in the area has been extensive), the debris is thought to have come from a nearby glass workshop, the remains of which were swept up and deposited in the pool as trash.

The glass debris from Area J consisted of a collapsed blown glass flask, blown tubes and necks of blown bottles, glass rods and cosmetic sticks, inlays and decorative pieces, spindle whorls, over a hundred fragments of sagged glass vessels, raw glass, and assorted wasters representing a variety of production techniques. The fragments and wasters from blown bottles were made by folding a sheet of glass into a hollow tube, pinching the end, and inflating the closed end with air.⁷⁹⁰ However, although the evidence of blown glass objects and debris have attracted the most scholarly attention, the main product of the workshop was sagged glass bowls.

⁷⁸⁸ Avigad 1972b, 198-200; Israeli 1991, 2005; Israeli and Katsnelson 2006.

⁷⁸⁹ Several intact ceramic vessels were found on the bottom of the miqvah below the glass deposit. To my knowledge, these vessels have not been published, and there is no information given as to their date (Israeli and Katsnelson 2006, 411).

⁷⁹⁰ This process is discussed in more detail in Chapter 6.

Wasters of these bowls were found in two types: those which were warped or misshapen while in the hot forming stages, and those which were damaged during the subsequent cold groove cutting.⁷⁹¹ Of the fragments of finished grooved bowls, most (about 70% of the identifiable shapes) were conical, and the remainder were hemispherical. When the surface was sufficiently preserved to determine color, colorless or natural greenish-blue and yellow glasswares, typical of Late Hellenistic glass production, predominated. Lesser quantities of bowls included a set with carinated profile and vertical flutes, related to a type common at Delos, a few vessels which could belong to linear-cut Group D based on their wider and deeper shape than the earlier grooved bowls, and one small fragment of a ribbed bowl.⁷⁹² A single molded ring handle from a skyphos is the only example of a handled skyphos documented from Syro-Palestine, though the type is well established in luxury contexts elsewhere in the Mediterranean.⁷⁹³ Israeli and Katsnelson proposed that these rarer forms were manufactured elsewhere and imported to the Jerusalem workshop, from which they were sold to local consumers. This possibility provides a glimpse into the way remote workshops may have cooperated and interacted, even at a distance.

Alongside vessels, numerous small glass objects were also found in the Jerusalem Area J workshop debris. Among the objects manufactured in the workshop were monochrome straight and twisted cosmetic applicators or stirring rods with rounded and pointed ends, poorly formed canes used in blown glass production, and pinched ends with tool marks leftover from drawing a soft ball of hot glass into a long, thin stick. Pierced domed objects, probably spindle whorls, flat geometric inlays, conical gaming tokens, and plano-convex counters may also have been made in

⁷⁹¹ Israeli and Katsnelson 2006, No. 226-227. Although catalogued together, each entry includes a number of damaged vessels. The actual damage of these vessels and implications for production technology are not discussed.

⁷⁹² Israeli and Katsnelson 2006, 422-423. The parallels from Delos are discussed in Nenna 1999, 90-97.

⁷⁹³ Ring handled skyphoi of similar date come from the Antikythera shipwreck (Avronidaki 2012, No. 96), assorted areas at Delos (Nenna 1999, No. C271-C273), and funerary deposits in Asia Minor and the Black Sea (Bouzek and Marsa 1971; *I Tesori dei kurgani del Caucaso settentrionale: nuove scoperte degli archeologi sovietici nell'Adygeja e nell'Ossezia settentrionale* 1990, No. 211; Kunina 1997, No. 57-58).

the shop. A few fragments of raw glass, flat sheets of glass (possibly blanks for sagged bowls), and assorted glass drops, lumps, and threads, some of which were overfired, testify to the various stages and elements of production. Absent are core-form vessels and beads and pendants.

The Jerusalem workshop has garnered wide attention as the earliest evidence of blown glass. That this evidence came from a workshop, rather than consumption context, is perhaps not merely serendipitous. Instead, I consider it revelatory about the highly experimental nature of glass blowing technology in the early first century: unlike the sagged bowls, there was no viable merchandise of blown glass found in the excavations but only wasters and otherwise failed objects.⁷⁹⁴ Raw glass was not made by the workshop, but rather imported from a primary workshop, presumably, but not necessarily, on the coast.⁷⁹⁵ The main products of the workshop were grooved bowls of standard Grose Group A type. The assorted smaller objects like whorls, inlays, and gaming tokens may have been manufactured using assorted scraps and other debris. This correspondence may go some way towards explaining why and how small glass objects greatly increased in quantity during the late Hellenistic period, as glass tablewares became more popular. Workshops, initially filling the desire for glass tablewares, saw a potential market for other items made from glass and began to use scraps and workshop debris which would otherwise have been discarded to manufacture smaller objects using extant technologies.

Summary of the Workshop Evidence

The five sites discussed above – Beirut, Sidon, Hagoshrim, Suweida, and Jerusalem – constitute the most definitive evidence of glass workshops in Hellenistic Syro-Palestine. O’Hea

⁷⁹⁴ The next earliest blown glass, dated to c. 40, is a small blown bottle found in a cave at nearby Ein Gedi, located east of Jerusalem near the Dead Sea (Avigad 1962, 180-183). The blown glass remains from the Area J workshop and their significance to glass history are discussed in much more detail in Chapter 6.

⁷⁹⁵ It would be tempting to suggest the primary workshop at Beirut, discussed above, as a source for the raw glass used in Jerusalem, but chemical and other forms of analysis will be needed to test this hypothesis.

has also suggested the tentative possibility of glass production at Pella, where one chunk of translucent yellow-green raw glass cullet was found in a first century house context,⁷⁹⁶ but there is little else to corroborate this suggestion, and the raw glass may itself have been a commodity rather than an intermediary product. The evidence provided by these workshop sites is uneven: Beirut has the physical structure of a primary workshop, but lacks a clear date; the Sidon and Suweida remains are scattered, poorly dated, and poorly published; the date and products of Hagoshrim are also speculative, since they are based on non-contextualized material; Jerusalem has the best date and most comprehensive material, but it is preserved as an urban fill layer rather than in situ structural remains. Though scattered, the emerging picture of late Hellenistic and early Roman glass manufacture in Syro-Palestine is one of relatively local production, with many cities boasting their own glass workshop which produced glass for the local elite and well-to-do population. These workshops were typically located in domestic areas of larger cities, the exception being the putative glass working area at Hagoshrim, located in a non-urbanized but still relatively cosmopolitan and well connected area.

Combining the archaeological evidence with the circumstantial literary evidence, we can reasonably push primary and secondary glass production in Syro-Palestine from the late first century BCE/early first century CE back to the early first century BCE, when a proliferation of glass workshops produced a standard repertoire of drinking bowls and assorted small objects for personal adornment, gaming, and interior decoration in keeping with the standard late Hellenistic glass repertoire of mass produced objects reflecting elite, cosmopolitan activities. But a firm beginning date for this thriving industry is still not forthcoming based on production evidence alone. For that, I turn to the extensive evidence from Syro-Palestinian consumption sites.

⁷⁹⁶ O'Hea 1992, 254.

Consumption Sites in Hellenistic Syro-Palestine

The heart of glass consumption in the late Hellenistic period was southern Syro-Palestine, where glass has been found at almost all inland and coastal, urban and rural, Jewish and non-Jewish excavated sites occupied at some point during the last 150 years before the common era.⁷⁹⁷ Furthermore, at urban sites such as Jerusalem and Maresha, where multiple domestic zones have been explored, glass appears indiscriminately in several areas of the settlement, with no apparent variation in distribution or type of objects found across the site.⁷⁹⁸ Although glass tablewares have been the most recognized and well published of glass finds, small glass objects like beads and other jewelry, gaming pieces, furniture, and cosmetic implements also began to appear in greater quantities in a wide range of forms ranging from simple to complex. The following section reviews the major and minor sites of glass use in Syro-Palestine during the second half of the first millennium, particularly drawing attention to change over time and local responses to this new medium. Because political and ethnic boundaries shifted so quickly, sites will be discussed roughly geographically by region, from north to south and east to west, beginning along the central Phoenician coast at Beirut and concluding with the sites of the southern Judaeian desert (Table 8, Figure 20). These general geographic designations are not intended suggest regional groupings of glass consumption practices; rather, they serve merely as an organizing principle by which to discuss the large number and variety of sites where glass has been found. Indeed, as will be demonstrated, glass consumption practices within southern Syro-Palestine show very little regionality and a large degree of homogeneity of types and practices

⁷⁹⁷ This section includes much of the same material presented by Ruth Jackson-Tal in her important 2004 article in the *Journal of Glass Studies*, but the emphasis here is on site-based, contextual interpretation rather than a type-based survey of particular forms. Our conclusions regarding the chronology and scope of the emergent Late Hellenistic glass industry in Syro-Palestine are much the same.

⁷⁹⁸ Jackson-Tal 2004, 27-28. Again, as Jackson-Tal also emphasizes, Israel is overrepresented in archaeological fieldwork and publication relative to Lebanon and Syria to the north.

across supposed regional and ethnic boundaries after the mid-second century. The exception is in northern Syria and Phoenicia, discussed at the end of the section. In these areas a distinctly different consumption pattern from the southern sites shows more commonality with Asia Minor and the Aegean and continuity from the earlier Hellenistic period.

<i>Region</i>	<i>Site</i>	<i># Objects</i>	<i>Map Reference</i>
<i>Southern Phoenicia</i>			
	Akko	12	Figure 20
	Beirut	138	Figure 20
	Sarepta	11	Figure 20
	Sidon	8	Figure 20
	Umm el-Amed	1	Figure 20
<i>Galilee and the Golan Heights</i>			
	Bethsaida	24	Figure 20
	Gamla	33	Figure 20
	Hagoshrim	18	Figure 20
	Kedesh	47	Figure 20
	Khisfin	1	Figure 20
	Khirbet Shema	4	Figure 20
	Meiron	14	Figure 20
	Tel Anafa	449	Figure 20
<i>Decapolis and Southern Syria</i>			
	Amman	19	Figure 20
	Beth Shean	3	Figure 20
	Bosra	1	Figure 20
	Hauran	1	Figure 20
	Hesban	17	Figure 20
	Jerash	11	Figure 20
	Pella	175	Figure 20
	Si	9	Figure 20
	Suweida	2	Figure 20
	Umm Qeis	7	Figure 20
<i>Coastal Plain</i>			
	Ashdod	33	Figure 20
	Caesarea Maritima	10	Figure 20
	Dor	6	Figure 20
	Horbat Rozez	3	Figure 20
	Jaffa	3	Figure 20
	Ramat Hanadiv	33	Figure 20
	Tel Michal	19	Figure 20

	Tell Qasile	1	Figure 20
	Yavneh-Yam	4	Figure 20
	Ziqim	1	Figure 20
<i>Jezreel Valley and Central Hills</i>			
	Gerizim	2	Figure 20
	Geva	1	Figure 20
	Samaria	59	Figure 20
	Sha'ar-Ha'amakim	21	Figure 20
	Tel Qashish	1	Figure 20
	Tel Zahara	1	Figure 20
	Tell Sailun	1	Figure 20
<i>Judaea and Idumaea</i>			
	Ain ez-Zara	1	Figure 20
	Cypros	2	Figure 20
	Gezer	1	Figure 20
	Jericho	11	Figure 20
	Jerusalem	407	Figure 20
	Maresha	229	Figure 20
	Masada	1	Figure 20
<i>Southern Desert</i>			
	Moa	1	Figure 20
	Nessana	11	Figure 20
	Petra	1	Figure 20
<i>Northern Syria</i>			
	Aleppo	1	Figure 21
	Amrit	6	Figure 21
	Apamea	2	Figure 21
	Hama	16	Figure 21
	Homs	2	Figure 21
	Jebel Khalid	217	Figure 21, Figure 13
	Salamieh	1	Figure 21
	Tell Arqa	4	Figure 21
	Tille on the Euphrates	1	Figure 21, Figure 13
	Zeugma	6	Figure 21, Figure 13

Table 8. List of sites discussed in Chapter 5 with quantities of published glass objects from c.350-50 BCE, by subregion.

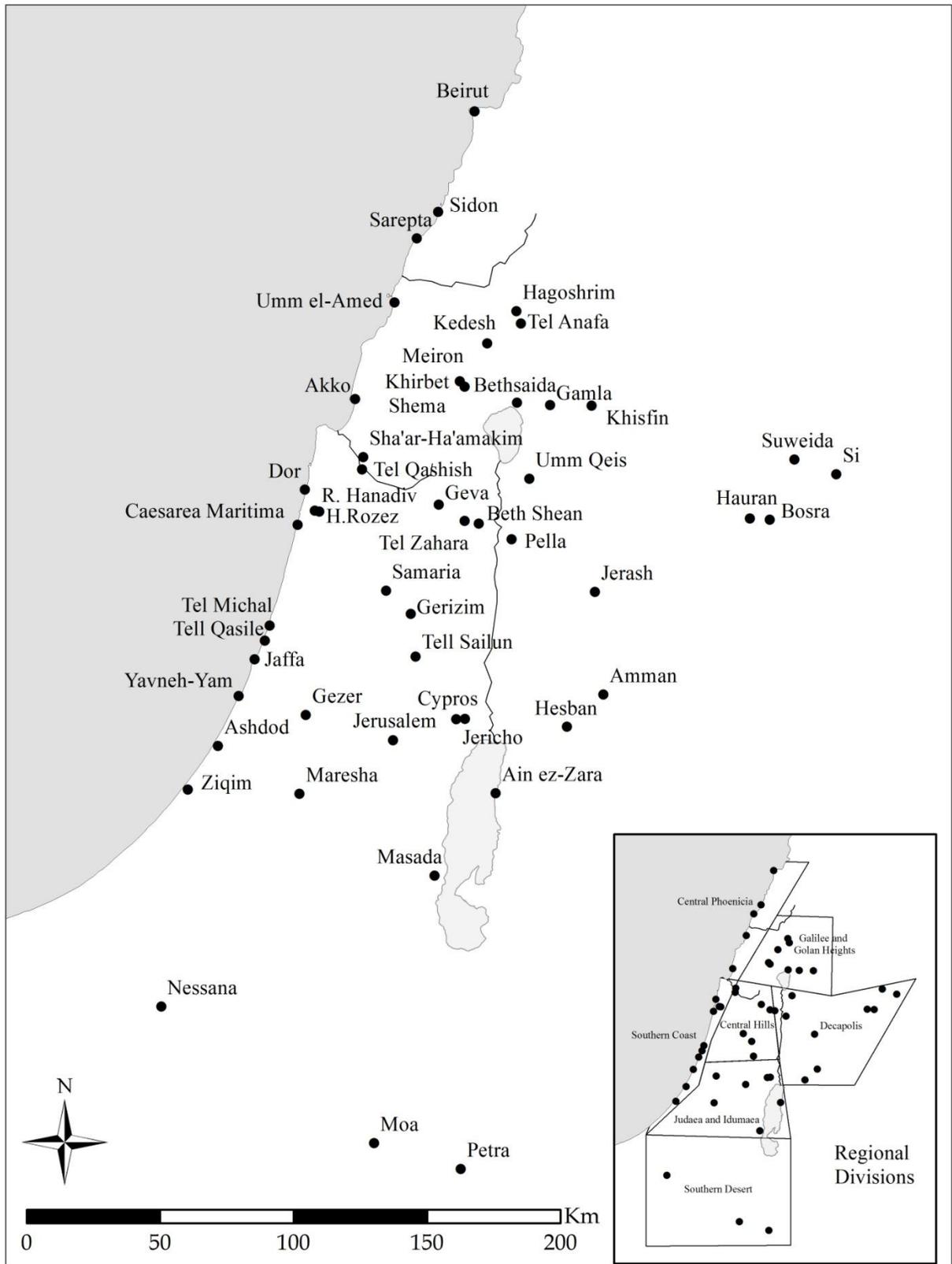


Figure 20. Sites with glass in southern Syro-Palestine, c. 350-50 BCE

Southern Phoenicia

Beirut and Sidon were discussed above as likely sites of primary and secondary glass production during the late Hellenistic period, but they were also consumer cities. At Beirut, the area of BEY 006 belonged to a Hellenistic and Roman urban neighborhood. The growth of the city to the west is demonstrated by the sequence of buildings, with new structures founded on previously empty land beginning in the late third-early second century and continuing into the first century. Larger courtyard houses and public facilities like baths and fountains were also added in the first century, indicating additional urban development and investment in this neighborhood.⁷⁹⁹ Thirty-one grooved bowls and five core-form cosmetic vessels (the only core-form known from the entire city) were found within the area of about three houses, for an average of around 10 glass bowls and one or two glass cosmetic vessels per house.⁸⁰⁰ Fluted and other more elaborately decorated monochrome vessels, as well as polychrome bowls and plates, were absent from the assemblage at Beirut. In Jennings' view, almost all the glass vessels found at Beirut were of local production, and very few imports were identifiable from all periods of occupation from the late Hellenistic to the Islamic period.⁸⁰¹ Catherine Aubert considered Beirut to have been a full participant in the Hellenic cultures of the late Hellenistic eastern Mediterranean, noting the prevalence of Berytans in the associations at Delos,⁸⁰² but the glass assemblages from Delos and Beirut were quite distinct. Delos may have imported glass wares or raw glass from Beirut, but that exchange seems to have been unilateral, with none of the Delian types reaching Beirut in return. Therefore, the late Hellenistic people of Beirut used and

⁷⁹⁹ Perring, Thorpe, and Williams 2004-2005, 25.

⁸⁰⁰ These numbers ought not to be taken too literally, as most of the glass was found in construction fills or unknown origin rather than primary use deposits (Perring, Thorpe, and Williams 2004-2005, 26). Although Jennings gave locus numbers for the glass finds, there is no discussion of the find context, distribution over the site, associated finds, or any other discussion to illuminate how these vessels may have been used and discarded.

⁸⁰¹ Jennings 2004-2005, 292.

⁸⁰² Aubert 2003.

discarded quite plainly decorated, probably locally produced, glass drinking cups with some regularity.

Further south, the Phoenician town and port of Sarepta was occupied from the Late Bronze Age into the Hellenistic period or later.⁸⁰³ The main publication of objects from Area II, X included dozens of Hellenistic imported and locally made pottery and lamps, along with several glass beads with close parallels to Tel Anafa.⁸⁰⁴ Glass and faience were the predominant materials for beads at Sarepta in all periods, vastly outnumbering stone. Of the 45 beads found at the site, 23 are glass and nine are likely to be Hellenistic based on style and stratigraphy, far more than any other material.⁸⁰⁵ A molded pendant with grapes has also been identified.⁸⁰⁶ No vessel glass was published by Pritchard, but Sarah Jennings has alluded to a “recent examination of an unpublished group of cast glass” from Sarepta which, she claimed, was more similar to the Anafa than the Beirut vessel glass assemblages.⁸⁰⁷

A smattering of evidence has been published from various other Hellenistic cities and towns located along the Lebanese Phoenician coast. Sidonians may have consumed glass drinking vessels in a similar fashion to the Berytans, although very little glass has been published from the excavations in the city. Catherine Apicella stated in 2003 that the only glass from the city dated to the Roman period, despite the prominence of Sidon in Hellenistic political and

⁸⁰³ Pritchard 1978.

⁸⁰⁴ Pritchard 1988. For the glass beads from Tel Anafa, see Larson forthcoming-a.

⁸⁰⁵ Tabulations based on Pritchard 1988, 80-92. Additionally, 95 faience and two glass beads were found at the Shrine of Tanit, which is thought to have been occupied from the eighth to fourth century.

⁸⁰⁶ Pritchard 1988, 108-109.

⁸⁰⁷ Jennings 2004-2005, 54. Jennings herself probably examined the Sarepta glass, but her untimely death prevented her from completing a full study and publication of the material; I have been unable to find any other published reference to non-blown glass from Sarepta. It is also worth noting that Jennings' only source for the Anafa material in the early 2000s was Weinberg's publication from 1970, and Jennings does not show familiarity with the stratigraphy or later interpretations of the site. Nenna has questioned the validity of regionalism in glass production in Syro-Palestine at this early date (Nenna 2007a, 669-670).

economic networks.⁸⁰⁸ Similarly, no glass of the Hellenistic period has been published from Tyre; this is particularly remarkable given the supposedly Tyrian association of the Phoenician inhabitants of inland Tel Kedesh and Tel Anafa, which were large glass consumers.⁸⁰⁹ Saliby mentioned the presence of grooved and ribbed bowls at the Hellenistic Phoenician site of Umm el-Amed, south of Tyre, but none were published by Dunant and Duru in their 1962 publication.⁸¹⁰

The state of knowledge is better in Akko, renamed Ptolemais in the early Hellenistic period. Akko-Ptolemais was the nearest Phoenician city to the mouth of the Belus River, although no datable archaeological material from the area has confirmed when exploitation of the local sand resource began. Sagged glass vessels have appeared routinely in salvage excavations conducted by the Israel Antiquities Authority in Akko. Excavations in the parking lot of the Courthouse have been most fruitful, yielding stratified Hellenistic material from the third to first centuries including Rhodian amphorae (mostly dated to the second century), a few fragments of grooved bowls, and a bivalve molded Baubo pendant, along with some Late Roman material.⁸¹¹ Additional sagged glass vessels have been found in Crusader period fills at the Crusader period bathhouse and at Montmusard castle, which was probably located within the Hellenistic period walls.⁸¹² Both areas also yielded glassy slags and raw glass of indeterminate

⁸⁰⁸ Apicella 2003, 140, n. 58. On the early Roman glass at Sidon, most of which is blown rather than sagged, see Zaven 2011. Sidon's lack of participation in the late second to early first century sagged glass culture of Syro-Palestine may also be reflected their rapid adoption of glass blowing and the role they played in early Roman glass production, as the lack of a preexisting investment in infrastructure and craft skill related to the production of sagged glass vessels would have made them more open to adopting and innovating a new manufacturing technique. See Chapter 6.

⁸⁰⁹ On Kedesh and Anafa, see below. On the other hand, almost nothing is known archaeologically from Hellenistic Tyre (cf. Jidejian 1969). Chéhab published finds from the Necropolis excavations conducted in the mid-20th century, but this publication is almost all Roman period (second-fourth century CE) burials (Chéhab 1986).

⁸¹⁰ Saliby 1981, 167, n. 8 citing Dunand and Duru 1962, 206, where the authors discussed the presence of Hellenistic vessels including Megarian and Pegamene bowls, Rhodian amphorae, and other standard Hellenistic ceramic types but make no mention of glass vessels.

⁸¹¹ Messika 1997; Avshalom-Gorni 1999.

⁸¹² Vitto 2005; Gorin-Rosen 2013.

periods, and mixed remains from these areas included some Hellenistic material.⁸¹³ The general presence of both production waste and finished glass vessels indicates a strong heritage of glass production and consumption at Akko from the Hellenistic through the Crusader period.⁸¹⁴

Galilee and the Golan Heights

Upper Galilee, north of the Sea of Galilee and inland from the coastal Phoenician cities discussed above, underwent a demographic boom in the late Hellenistic period, with several new settlements appearing in the region.⁸¹⁵ In addition to the consumption site of Tel Anafa, discussed at the beginning of the chapter, and the putative production site at Hagoshrim, glass has been documented in varying quantities at four additional consumption sites: Kedesh, Meiron/Khirbet Shema, Bethsaida, and Gamla, plus a fragment of a mosaic bowl in the Archaeological Museum of Damascus said to be from Khisfin (Figure 20). Combined, these small towns and regional centers offer important chronological information regarding the spread of glass tablewares and their adoption into daily life by a variety of consumers.

Tel Kedesh was a large administrative center of Persian and Hellenistic upper Galilee, active from the fifth century through the mid-second century. Although the administrative building was a signal of Persian, Ptolemaic, and Seleucid imperial hegemony over the territory,

⁸¹³ Vitto suggested the Montmusard debris may be indicative of Hellenistic or Roman period glass production (Vitto 2005, 173). The associated finds, which included imported amphorae from Rhodes, Chios, Kos, Knidos, Cyprus, and North Africa as well as the ceramic finewares Campania A, BSP, and ESA, are predominantly dated from the final third of the third century to the third quarter of the second century, which would point toward Hellenistic production.

⁸¹⁴ For Crusader period glass finds and production at Acco, see Gorin-Rosen 1997.

⁸¹⁵ Frankel et al. 2001, 108-110. The demographics of the Galilee in the Hellenistic period are a major scholarly question, rooted in the longstanding assumption from literary Jewish sources that the region was essentially depopulated after the sixth century Babylonian captivity but flourished as a center of Judaism in the Roman period. This debate, which encompasses religion, ethnicity, and identity, the relationship of historical and archaeological sources, and modern nationalism, is too complicated and fundamentally irrelevant to discuss in detail here (irrelevant because glass is found in generally equal measures at Phoenician, Ituraean, and Jewish sites; see discussion below under “Jews and Glass”). Suffice it to say that while the ethnic and religious identities and continuity of people living in this region during the Hellenistic period are still debatable, archaeological work has made clear that people *were* living in Galilee throughout the second half of the first millennium BCE. See Freyner 1980; Horsley 1995; Chancey 2002; Leibner 2009; Winger 2012.

recent excavations have indicated strong ties between the administrators in the building and the Phoenician coast in material culture and iconography. The excavators suggest the building may have been staffed primarily by Tyrian elites rather than foreign officers throughout its three and a half centuries of use.⁸¹⁶

A precise historical and stratigraphic sequence of occupation within the administrative building demonstrates changing practices of glass consumption from the Persian to late Hellenistic periods.⁸¹⁷ The only glass vessels used before 200 by the Achaemenid Persian and Ptolemaic administrative staff were core-form perfume vessels. The Seleucid administrators, however, had access to more luxury products, including a select number of undecorated and petal decorated colorless bowls. They treated these vessels with great regard, securing them in the building's archive room, where documents and rare imported ceramics were kept. The administrative building was abruptly abandoned in the 140s. Loci connected to the subsequent occupants of the building, who lived much more modestly than the administrators, contained grooved glass drinking cups as well as Eastern Sigillata A pottery, coins, and dated Rhodian amphora handles.⁸¹⁸ The datable remains of this occupation place it in the 130s-110s.

The earlier Seleucid administrators seem in all ways to have adopted the latest and greatest trends of the Greek Mediterranean world, including pottery, architectural decoration, and visual culture. Had glass tablewares been available to them in quantity, it is reasonable to think they would have used them. Indeed, the presence of a few luxury glass vessels indicates they did not have any opposition to the glass tablewares which would become so prevalent 50 years later: they simply were not available. By contrast, the subsequent residents (or other, wealthier

⁸¹⁶ On the administrative building at Kedesh and the Tyrian associations of its occupants, see Herbert 2003; Herbert and Berlin 2003b; Berlin and Herbert 2012; Berlin, Herbert, and Stone 2014.

⁸¹⁷ The following summarizes the conclusions from Larson, Berlin, and Herbert in preparation.

⁸¹⁸ Stone 2012; Winger 2012.

occupants residing near the administrative building in the second half of the second century) *did* use glass drinking vessels in some quantity, despite their generally poorer lifestyle. The most sensible distinction to account for this rapid shift is the appearance of a new product in the market suitable for mass consumption: the so-called Syro-Palestinian glass bowls.

The village of Meiron, located on the plateau south of Kedesh, is best known for its late Roman village and synagogue, but occupation began at some point during the mid-Hellenistic period. Though architecturally elusive, the Hellenistic period settlement (c. 200-50) still generated at least 11 sagged glass bowls, including seven conical grooved bowls typical of Grose Group A.⁸¹⁹ Additional sagged grooved bowls have been found in the excavations of the nearby synagogue at Khirbet Shema, where four grooved bowls and five fragments of ribbed bowls were found along with Hasmonean coins but no datable Hellenistic pottery.⁸²⁰ More recent rescue excavations down slope from the Meiron village site have located more abundant evidence of the Hellenistic settlement, including a pottery rich debris layer with Galilean Coarse Ware jars, one rim fragment of an unknown red sigillata, and two yellow conical grooved bowls, along with coins of Hasmonean issue.⁸²¹ Whether the new inhabitants of Meiron came from Judaea to the south, as Meyers has suggested,⁸²² or from elsewhere, it is clear that grooved glass bowls played a significant role in their drinking assemblage during the later second and first centuries, since more fragments of glass than fineware pottery have been identified from Hellenistic levels.

⁸¹⁹ Meyers, Strange, and Meyers 1981, 150, pl. 9.9.

⁸²⁰ Meyers, Kraabel, and Strange 1976, 245, pl. 8.4:1-9.

⁸²¹ Feig 2002, 91-92.

⁸²² Meyers has suggested that the presence of Hasmonean coins may be indicative of a small Jewish community which had migrated northward into Galilee during the Hasmonean period (Meyers, Strange, and Meyers 1981, xix). Syon has recently argued that coins of this period may signal ethnic and religious identities (Syon 2015); at the very least, they indicate economic and trade connections.

Villagers at late Hellenistic Bethsaida, located along the northern shore of the Sea of Galilee, also used sagged glass bowls routinely in their table settings. The village consisted of several courtyard buildings (probably houses) which were abandoned at some point in the early Roman period.⁸²³ At least 24 bowls with grooves and 12 ribbed bowls have been identified. Several tiny fragments of core-form containers indicate the Bethsaida residents also used glass perfume vessels. Finally, the glass beads from Bethsaida, which Rottloff assigned to the Roman or Byzantine period, have strong parallels to the beads found at Tel Anafa and Kedesh. Regional styles of a flattened chevron trail bead, blue with white and yellow trails, and a somewhat elongated blue bicone bead with two white trails around the middle,⁸²⁴ have been found at all three sites, confirming regional or local production of these small objects.

Further to the east, on a ridge high above the Sea of Galilee in the southern Golan Heights, the settlers at Gamla also used abundant numbers of grooved and ribbed bowls during the first century. Initially founded as a Seleucid fortress, the town is thought to have been captured by the Hasmonean king Alexander Jannaeus, after which it was settled by a Jewish population. Gamla's residents rebelled against Rome in the Jewish Revolt of 66-70 CE, and the site was destroyed by Vespasian's forces and abandoned. Altogether, over 5,000 glass items have been documented at Gamla, including core-formed, mosaic, sagged, free, and mold blown vessels along with gaming pieces, rods, pins, beads, and spindle whorls.⁸²⁵ The greatest concentration of late Hellenistic material came from Area B, a domestic neighborhood occupied throughout the first century BCE and abandoned early in the first century CE, earlier than

⁸²³ The glass has yet to be comprehensively published as a catalogue. These initial impressions are based on Rottloff 2000, 2009. Rottloff's written descriptions of the "molded bowls" from the site often do not correspond with the drawings, and it is unclear which is in error. Her "hemispherical" bowls (No. 8-16) are illustrated with straight sides, whereas her "conical" bowls (No. 17-27) have a slightly everted rim in the illustrations, and look more similar to deep linear cut bowls, which would be somewhat later.

⁸²⁴ Rottloff 2009, No. 159-160, 167; Larson forthcoming-a, No. BD 45-47, BD 53.

⁸²⁵ Jackson-Tal 2009, 159.

elsewhere in the town. Area B reportedly contained a “large amount” of sagged grooved and ribbed bowls, a small quantity of blown vessels, and Eastern Sigillata A fineware and a variety of other forms of first century service, cooking, and storage vessels.⁸²⁶ Grooved hemispherical and conical bowls in the standard range of colors (colorless, green, blue, and yellowish-brown) and ribbed bowls were the most common; linear cut and fluted types were also present in smaller quantities. Unusually for this region, Gamla residents also possessed mosaic vessels: four fragments of spiral and network mosaic bowls also came from Area B; the mosaic bowl reputedly from Khisfin and now in Damascus is additional evidence that mosaic wares penetrated the only to the western edge of the Golan Heights and not Galilee, perhaps coming in from the north.⁸²⁷ Nineteen fragments of core-form Group III vessels make up the remainder of the late Hellenistic glass assemblage from Gamla. Altogether, even in this small, out of the way Jewish village, residents were full participants in the Hellenistic material *koine* of glass consumption. With their connections to Jerusalem, the glass vessels at Gamla may have been imported either from the south or from the Phoenician cities to the west (along with the ESA).

Many modern scholars have drawn an ethnic and political boundary between the Phoenician sites of Kedesh and Anafa to the north and the probable Jewish villages of Meiron, Bethsaida, and Gamla further south. These maps, which draw a clear boundary between “Phoenicia” and “Galilee/Hasmonean/Jewish” territories are based on the distribution of various categories of material remains: Hasmonian coins, stone vessels, miqvah, pig bones, and other markers of supposed Jewish religious identity.⁸²⁸ But they obscure many fundamental

⁸²⁶ Jackson-Tal 2009, 157; the precise numbers are not quantified. The full catalogue of glass from Gamla has been submitted by Jackson-Tal and awaits publication (personal communication, September 2015). For the pottery from Area B, see Berlin 2006, 64-100.

⁸²⁷ Exposition des Verres Syriens a travers l'histoire 1964 No. 15

⁸²⁸ For coins: Syon 2015, 165, fig. 34. For semifine pottery: Berlin 1997b. For miq'vaot: Reich 2013. For stone vessels and the stone vessel industry of Jerusalem: Magen 2002. Liebner, using data from Syon's study of the distribution of Hasmonian coins, assumed Hasmonian political control over the area in first half 1st century (Leibner

similarities in material culture which crossed these boundaries without issue: portable goods like Eastern Sigillata A pottery, Rhodian amphorae, mold-made lamps and figurines, and sagged glass bowls, as well as architectural features like courtyard houses, wall paintings, and peristyles – items of the Hellenistic material *koine* which are found throughout the Mediterranean world in final two centuries BCE. Therefore, while some objects do appear to map onto religious or ethnic territories, others do not. Sagged glass bowls belong to the later group.

Decapolis and Southern Syria

To the east of Upper Galilee lay the cities of the Decapolis in southern Syria and the Trans-Jordan. According to Pliny, this confederation of independent cities spanned from Damascus in the north to Philadelphia (Amman) in the south, and also included Canatha, Dion, Raphana, Hippos-Sussita, Gadara (Umm Qeis), Scythopolis (Beth Shean), Pella, and Dios, along with their surrounding territories.⁸²⁹ Some of these cities may have been conquered, destroyed, or otherwise subjugated by the Hasmoneans in the early first century, but all were granted independent status by Pompey in 64. Although modern scholars debate whether the ancient term Decapolis referred to a general geographic area or an official political confederation of these mostly Greek populated cities to rival the surrounding ethnic states.⁸³⁰ O’Hea characterized the glass from the Decapolis cities as basic and utilitarian, with only minimal evidence of import and export, and suggested that the Decapolis cities established an adequate but somewhat isolated local glass industry by the early Roman period, if not earlier.⁸³¹ Of the ten Decapolis cities, five

2009, 329-331). Berlin and Magness have both proposed some degree of continuity in markers of Jewish material culture in the early Roman period, before and after the revolt against Rome and destruction of the temple (Berlin 2005; Magness 2011).

⁸²⁹ Pliny *Natural History* 5.16.74.

⁸³⁰ Schürer preferred to see the Decapolis as a geographic term only Schürer 1973, 126, while Jones argues for a league of cities (Jones 1971, 257). Sartre described the cities as “linked geographically and administratively rather than politically” (Sartre 2005, 42-43).

⁸³¹ O’Hea 1992.

– Scythopolis, Pella, Jerash, Gadara, and Philadelphia – have published glass from the late Hellenistic period, as do three other, smaller cities in the surrounding region – Sî, Suweida, and Bosra (Figure 20).

Odile Dussart has collected the excavated material from Jerash, Umm Qeis, Amman, Bosra, and Sî, along with objects in the museums of Bosra, Amman, and Kerak to form a typology of glass from southern Syria and Jordan spanning from the third century BCE to the seventh century CE.⁸³² Because her focus was typological, information on the specific find contexts and deposit type site by site is absent, but her publication is nevertheless invaluable as the only major publication of pre-Roman glass east of the Jordan River. A brief review of the published evidence indicates that sagged glass vessels, especially the grooved variety, were present in the Decapolis beginning in the late second-early first century.⁸³³ Grooved bowls (Dussart Type A.II) outnumbered ribbed bowls (Dussart Type A.III) by more than 4:1.⁸³⁴ The absence of fluted and variant cut bowls of Grose Group B and any form of polychrome vessel, including mosaic and gold glasswares, from Dussart's typology may indicate that they were absent in the Decapolis assemblages. At Jerash, the archaeological sequence of occupation began in the second half of the second century; eleven fragments of conical and hemispherical grooved bowls have been found near the south gate of the Sanctuary of Zeus and on the tel of the

⁸³² Dussart 1998. See also Dussart 2003 and Nenna 2007b, 134-138 on the state of publication of glasses from Syria and Jordan. Dussart Type AI is undecorated hemispherical bowls, Type AII.11 (hemispherical) and Type AII.4 (conical) are Grose Group A grooved bowls, Type AII.12, AII.2, and AII.3 are grooved variants of Grose Type D linear cut bowls, and Type A.III are ribbed bowls corresponding to Grose Group C.

⁸³³ Non-blown vessels were mostly found in first-second century CE construction fills and contexts, the result of urban development in the Decapolis cities in the early Roman period. Sagged glass is almost certainly residual in such fills, although Dussart tends to assign dates to types based on the dates of these fills. It is unclear how many good, isolated Hellenistic deposits have been identified in these excavations from which glass could be stratigraphically dated. Here, I assume that the type dates established in other areas are also applicable to the Decapolis, although it is conceivable that glass did not really appear in the Decapolis cities other than Philadelphia until after Pompey.

⁸³⁴ She only publishes 8 ribbed bowls, in contrast to 44 grooved bowls (Dussart 1998, 51-56).

city, mostly in contexts of the first century.⁸³⁵ Seven conical and hemispherical grooved bowls shapes have been identified at Umm Qeis, ancient Gadara.⁸³⁶ Nine total sagged vessels, including four undecorated and five grooved, none of which have a clear context, were excavated at Sî in southern Syria.⁸³⁷

The largest number of late Hellenistic glass vessel fragments from the Decapolis came from the terrace structures of the acropolis at Amman, ancient Philadelphia. Refounded by Ptolemy II in the first half of the third century, Philadelphia was one of the most established and oldest cities of the Decapolis: it makes sense that more glass would be found here. The so-called third terrace contained good Hellenistic levels which included standard finds of the second to first century Hellenistic *koine*, including painted stucco (red, yellow, and black), coins, and Rhodian amphorae, along with fourteen grooved bowls, most of which were conical. Comparable glass finds came from the higher first and second terraces.⁸³⁸ Yellowish-green and amber are the most prevalent colors. Additionally, Jackson-Tal cited unknown quantities of unpublished grooved and fluted bowls from Beth Shean, as well as – unusually – mosaic bowl(s) found in contexts dated to the third to second centuries.⁸³⁹

The substantial number of glass finds from Pella, just east of the Jordan River, may or may not be representative of glass in the other cities of the late Hellenistic Transjordan.⁸⁴⁰

O’Hea reported that only three vessel fragments found at Pella predate the late second century

⁸³⁵ Dussart 1998, pl. 1.9-11, 1.15, 1.17-18, 2.2, 2.4, 2.6, 2.10, and not illustrated.

⁸³⁶ Dussart 1998, pl. 1.7, 1.13, 1.20-21, 2.8, 2.11, 2.12.

⁸³⁷ Dussart 1998, pl. 1.1-5, 1.12, 1.16, 1.23, 2.9. The vessels have been found in the valley and on the hill, with no apparent distinction of location.

⁸³⁸ Dussart 1998, from the third terrace, pl. 1.6, 1.8, 1.14, 1.19, 2.5, 2.7, 2.13-14, and six unillustrated; from the first and second terrace, pl. 1.24, 2.3, 2.15-16, and one unillustrated.

⁸³⁹ Jackson-Tal 2004, 31-32.

⁸⁴⁰ The full catalogue of glass from Pella is in press and expected to come out in the *Final Report* of the University of Sydney Expedition to Pella by the end of 2015 (Margaret O’Hea, personal communication, May 2015), but is currently unavailable to me. The information presented here is based on the preliminary discussions in O’Hea 1992, 2005.

either by stratigraphy or style. By contrast, the late Hellenistic occupation on the main tel (Areas IVC and XXIII A) yielded a minimum number of 159 grooved bowls in a variety of types, conical and hemispherical being the most prominent.⁸⁴¹ Core-form vessel fragments were also found in much lesser quantities (minimum number estimate of 8 vessels). A distinctive conical petal decorated bowl – a unique find in the Decapolis – was found in a late Hellenistic house (Area XXIII A 5.2) along with delphiniform lamps, ceramic fish plates and Eastern Sigillata A plates, and vegetal wall paintings, suggesting a date in the first half of the first century. A potentially fruitful context for examining domestic glass use in the early first century came from a series of houses scattered over the site which were destroyed by fire, possibly during the incursions of Alexander Jannaeus around 82. These mud brick houses on rubble foundations contained abundant quantities of glass bowls when they were sealed beneath the mud brick collapse layer; when the final publication appears, it will be interesting to compare quantities and types of material among different household assemblages.⁸⁴²

Another major late Hellenistic settlement in this area where glass is surprisingly lacking is Araq el-Emir, the putative home of the enterprising Tobiad family of local elites which were rivals to the Hasmoneans for a brief period in the early first century.⁸⁴³ No non-blown glass was reported at the site in Lapp's publication of the finds, although two thick rims could be fragments from grooved bowls which were misidentified.⁸⁴⁴ Curiously, evidence of standard Hellenistic period ceramic types such as are commonly found with sagged glass bowls – notably fineware

⁸⁴¹ 36% conical, 32% hemispherical, 4% ovoid, 7% parabolic (deep hemispherical), 7% shallow hemispherical, and 16% shallow O'Hea 2005, 46, fig. 2. The first three types are typical of Grose Group A and the latter three of Grose Group D.

⁸⁴² For preliminary discussion and possible implications, O'Hea 2005, 45. O'Hea has indicated that, anecdotally, sagged glass bowls and mold-made ceramic bowls were mutually exclusive in the destruction levels of houses: houses which had glass bowls did not have ceramic bowls, and vice versa (personal communication, September 2015).

⁸⁴³ Berlin 1997a, 11-12.

⁸⁴⁴ Lapp 1980, fig. 20.3-4. Cohen (Cohen 2000b, 175, n. 7) cited these vessels as parallels for the material from Ramat Hanadiv.

pottery (especially ESA) and Rhodian amphorae – were also all but absent. The Tobiads seem therefore to have rejected (or lacked access to) Mediterranean imports from the coast, notwithstanding the elaborate stone and architecture of the site. The absence of glass at Araq el-Emir therefore is further evidence that glass was not produced in inland Syria and the Transjordan until later in the Roman period.

Glass in the cities of the Decapolis was less common than in the communities of Phoenicia, Galilee, and Judaea to the west, but this distinction was one of quantity and not kind. In all areas, glass was disposed haphazardly in fills and other general urban deposits. Simple, relatively unadorned glass forms seem to have been preferred east of the Jordan valley: mosaic, floral, fluted, and externally grooved ovoid bowls are almost entirely absent, and ribbed vessels – though not discussed here in detail – were also relatively rare. Sagged glass vessels of the Syro-Palestinian type were the earliest glass to have been used in the Decapolis cities, predating the introduction of blown glass by a century.

Southern Coastal Plain

Almost all excavated settlements along the southern coastal plain of Syro-Palestine have yielded moderate quantities of glass from their domestic areas (Figure 20). Most of these cities were occupied at least from the Bronze/Iron Ages and exhibited features of Canaanite and Phoenician affiliations until the Hellenistic period, when many adopted material cultural forms of the Hellenistic (“Greek”) world. The cities of the coastal plain were under the control of the Ptolemies during the third century and went over to the Seleucids in the second century after the Battle at Panieon. As in other areas of southern Syro-Palestine in the wake of Seleucid contraction, during the second half of the second century the southern coastal cities were briefly under the semi-autonomous purview of enterprising brigands and insurgents – in this case a man

named Zoilos of unknown origins who loosely controlled the area from Gaza to Dor before falling to the expanding Hasmonean state.⁸⁴⁵ Many of these sites have yielded archaeologically detectable destruction levels from about this time, which have been used as to date glass and ceramic forms. Whether these cities were resettled by their previous inhabitants or occupied by Jewish colonists after the Hasmonean conquests is unclear. Sites will be discussed in sequence from north to south.

Dor was extensively occupied during the Hellenistic period by a cosmopolitan community, as evidenced by the large circuit wall and gate, houses, olive presses, and abundant finds typical of the Hellenistic *koine* including ceramics, coins, and terracotta figurines.⁸⁴⁶ Plain sagged bowls and conical and hemispherical grooved bowls of Group A, along with at least one mosaic bowl composed of purple spiral canes, have been found in the Hellenistic city, but information regarding their quantities, contexts, and deposit dates has yet to be made publically available.⁸⁴⁷ Indirect evidence may place these finds sometime after the mid-second century: Stewart and Martin have published the contents of a pit which was likely closed in the mid to late second century, and not later than c. 100. The pit contained diagnostic pottery of the fourth, third, and early second centuries, including mold-made bowl fragments, but no Eastern Sigillata A and no glass.⁸⁴⁸ From Kedesh and elsewhere, it is clear that Syro-Palestinian type glass vessels and ESA appeared in archaeological contexts about the same time; their absence from the Dor pit may validate an early-mid second century deposit date. Light blue, dark blue, light

⁸⁴⁵ Josephus *Antiquities of the Jews* 13.324; Sartre 2005, 32.

⁸⁴⁶ Stewart and Martin 2003, 48-49; Erlich 2009; Wootton 2012.

⁸⁴⁷ Jackson-Tal 2004, fig. 6.3, 8.3-4, 9.1-2; for the mosaic bowl, 24-25. Jackson-Tal studied the glass from Dor in depth for her 2000 Masters Thesis at the Hebrew University of Jerusalem Jackson-Tal 2000, but this manuscript is not publically available and has not been seen by me. Reportedly, she has submitted the final manuscript catalogue, which is awaiting publication with the remainder of the finds.

⁸⁴⁸ Stewart and Martin 2003, 123-124. The contents of the pit, which also contained architectural fragments from a Doric structure, may be associated with either the siege of the town by Antiochus VII Sidetes and Simon Maccabee in 139/138 or the sack of the town by Alexander Jannaeus in 102-99 (Stewart and Martin 2003, 131-132). In light of the lack of ESA and glasswares, the earlier date is more likely.

bluish-green, dark green, and yellow glass tesserae were used in the mask and garland mosaic which Wootton has dated to the second half of the second century, though colored stones were the predominant material.⁸⁴⁹

The settlement at Ramat Hanadiv, located in the southern foothills of the Carmel range about five kilometers inland from Caesarea, has yielded glass fragments of the Hellenistic period from several small excavations focused on different areas of this spur of land just a couple kilometers from the coast. The largest occupation on the hill is at Horvat 'Eleq, where remains from the Hellenistic, early Roman, Byzantine, and Ottoman periods have been found. The Hellenistic occupation, which spanned from the fifth to late third century, consisted of scattered walls on the summit of the site representing a small farmstead or rural settlement. This settlement was replaced or expanded by a large fortified spring, bathhouse, and agricultural installations during the Herodian period. Cohen associated about 40 total glass vessels, including 20 grooved bowls, 19 ribbed bowls, and no blown glass, with the Herodian phase at the site, but some of the grooved bowls, particularly those with standard conical shapes typical of Group A, could be earlier.⁸⁵⁰

Contemporary to this infrastructural development and investment was a Herodian period (second half first century BCE to late first century CE) farmstead at nearby Horvat 'Aqav which yielded 14 fragments of non-blown vessel glass, three of which were ribbed and the others grooved with conical and hemispherical profiles.⁸⁵¹ The farmstead offers an interesting parallel to Tel Anafa, although it was somewhat later. Both sites were oriented around a large courtyard,

⁸⁴⁹ Wootton 2012, 223. In general, I have not documented glass tesserae such as were used in mosaics, since such usage was likely non-primary or secondary production, but relied instead on scraps of glass, possibly recycled from broken cullet, and required no knowledge of glass pyrotechnology. Still, the ever-expanding use of glass in mosaics which began in late Hellenistic period is further confirmation of a general increase in availability of glass in the marketplace at this time, and the well-dated Dor example is important evidence of this shift. See Chapter 2 for a brief discussion.

⁸⁵⁰ Cohen 2000a, especially No. 4, 7.

⁸⁵¹ Cohen 2000b.

with mosaic floors, agricultural fixtures, and a bath (the tub at 'Aqav is identified as a miqvah). A threshing floor and wine press, neither of which has been identified at Anafa, were found at 'Aqav. Despite the rural and working nature of both these country farmsteads, their residents were well equipped to participate in cosmopolitan Hellenistic lifestyles, of which glass drinking bowls were a part. Three small body fragments of "Hellenistic bowls" found in "Hellenistic contexts" have also been reported from the small site at Horbat Rozez on the southeastern slope of Ramat Hanadiv.⁸⁵²

Strato's Tower was a small coastal town during the Hellenistic period which Herod transformed into the major urban center of Caesarea Maritima in the final quarter of the first century. Although much of the city has been excavated to Herodian levels, only the glass from areas CC, KK, and NN has been thoroughly published. In these areas, no glass has been identified in contexts earlier than the first century CE, although some material might be earlier. In addition to the standard early Roman assemblage of linear cut and ribbed bowls and early forms of blown glass, excavators recovered late Hellenistic types of conical grooved (Group A) bowls and a beaded rim bowl which must be residual from the earlier town.⁸⁵³

Further south are a series of Bronze and Iron Age tel sites with continued occupation into the Hellenistic and early Roman periods. These large urban centers were historically oriented toward the sea and boasted significant ports, trade, and commercial connections. The glass from Tel Michal is the best documented. Persian, Hellenistic, and Hasmonean strata were all present, with each yielding glass remains typical of the period. The extensive Persian cemetery contained

⁸⁵² Winter 2010, 145; for the associated Hellenistic architecture and pottery, see Yannai 2010, 112-114, 122-126. Most of the pottery seems to be late fourth-early third century, so it is unclear what types of glass vessels would be present here.

⁸⁵³ Israeli 2008, No. 1-7; see also Jackson-Tal 2004. About one third of the early Roman vessels were sagged; the remaining two-thirds were blown.

no glass vessels and a few glass beads.⁸⁵⁴ Core-form bottles, found so often contemporary burials elsewhere in the Mediterranean, were not used as funerary goods at Tel Michal, but these cosmetic and perfume containers were found in small quantities in domestic areas in both Persian and Hellenistic strata.⁸⁵⁵ During the Hellenistic period, Michal contracted into a military fortress with a wine press and a few domestic areas. Over 50 fragments of grooved bowls, which Kertesz described as “abundant at the site,” were found in Hellenistic and Hasmonean strata.⁸⁵⁶ One Group III amphoriskos with zigzag trails has been found at Tell Qasile, and grooved, fluted, and floral decorated bowls were all present at Jaffa, near the modern city of Tel Aviv.⁸⁵⁷

Yavneh-Yam is another major coastal tel site which was likely destroyed by John Hyrcanus around 110. Destruction debris of a building in Area A contained coins of Antiochus VII (r. 138-129), stucco covered masonry, Rhodian amphorae, mold-made lamps, Eastern Sigillata A, and glass objects. The glass finds included a fluted bowl and a grooved bowl, the details of which have not been published, as well as a dark blue pendant in the shape of Harpokrates made in a two-part mold.⁸⁵⁸ The Yavneh-Yam deposit is significant for dating the appearance of grooved and fluted bowls in the cities of the coastal plain and gives firm evidence that the Hasmoneans did not come bearing glass, but rather that glass tablewares had already been adopted by Phoenician, Greek, Idumaeans, and other consumers in the mid to late second century before the arrival of the Jewish Hasmoneans.

⁸⁵⁴ Kertesz 1989a. About 240 total beads were found in the Persian cemetery, of which 30 (12.5%) were glass. This low percentage can be contrasted with the upwards of 60-70% glass in the bead assemblages at Hellenistic Anafa and Jebel Khalid.

⁸⁵⁵ Kertesz 1989b, 365-367. Of nine total pieces of core-form glass, five come from Persian strata and the remaining four from Hellenistic levels.

⁸⁵⁶ Kertesz 1989b, 367-368, fig. 33.1.1-9. The stratum dates for many of these vessels are almost certainly inaccurate. Bowls with ribs are reported from Strata IV-V (300-100), and grooved bowls with outward rims were reputedly found in Persian (fifth-fourth century) strata. These dates are entirely inconsistent with the data from any other site.

⁸⁵⁷ Jackson-Tal 2004, fig. 4 and 12.1.

⁸⁵⁸ The pendant is published fully in Fischer and Jackson-Tal 2003. The glass bowls are briefly described *idem*, 35 n. 5 and again in Jackson-Tal 2004, 30.

A similar, and potentially somewhat earlier, glass assemblage has been found at Ashdod.⁸⁵⁹ The Hellenistic phase of Area A consisted of an urban neighborhood with courtyard houses and a wide open area which may have served as a public gathering space.⁸⁶⁰ In addition to glass bowls, the identifiable Hellenistic materials from the domestic spaces at Ashdod included mold-made relief bowls, Eastern Sigillata, West Slope ware, Rhodian amphora stamps, and fish plates. One of the earliest fragments of grooved bowls by context from Syro-Palestine was a well-preserved olive colored hemispherical bowl with two interior grooves below the rim. The context is thought to be no later than the mid-second century, and most of the contents probably date from the first half of the second century.⁸⁶¹ A colorless conical beaded rim bowl from a second century context and one fluted bowl were also present, but grooved bowls are by far the most common type. Over 50 fragments from three seasons of excavation demonstrate that glass tablewares increased steadily in quantity in deposits of the second and first centuries, although most were found as residual material in later contexts. Again, it is worth emphasizing that grooved and fluted bowls of Grose Groups A and B were *the first* glass tablewares to appear at these long-lived sites, and they did so during the mid to late second century.

Finally, the southernmost coastal site from which glass of the Hellenistic period has been recognized is Ziqim, near Ashkelon, where a greenish-yellow fluted hemispherical bowl of Group B was found in the remains of a remote columbarium.⁸⁶² A hole in the groove under the rim may be a sign of mending or suspension of the bowl for storage. Most of the associated

⁸⁵⁹ Barag 1967, 1971.

⁸⁶⁰ Dothan 1971, 42-72.

⁸⁶¹ Barag 1971, No. 2. The bowl is assigned to Stratum 4b, the end of which Dothan assigns to the conquest of Jonathan in 147. Pottery of Stratum 4b begins in the second half of the third century, and 4a concludes with pottery from the last quarter of the second. It is unclear whether there is good archaeological reason to associate a break in the ceramic sequence with a putative historical event. Furthermore, a ribbed bowl with carinated sides (Barag 1971, No. 8) was also recovered from Stratum 4, and, as at Tel Michal, this date for this type is suspiciously early.

⁸⁶² Zissu and Rokach 1999, fig. 5.23. To the best of my knowledge, after an extensive bibliographic search, no glass of any period has been published from Ashkelon itself. The sole known pre-Roman glass object is an Iron Age “Phoenician” Scarab (Rahmani 1976). For the excavations generally, see Stager, Schloen, and Master 2008.

finds are dated from c. 200-125, including fragments of mold-made ceramic bowls. Like many other coastal settlements which flourished during the second century, Ziqim is thought to have been abandoned after the arrival of either Jonathan (in 147) or Hyrcanus (between 126-106) in the region.

Jezreel Valley and Central Hills

Current scholarly consensus is that the settlements of the central inland hills of Samaria were violently overthrown by Maccabean forces at the end of the second century. At this time, the Hellenizing Gentile populations were forced to leave, and the area was resettled with inward looking Jewish settlers whose material goods were locally produced, with economic and trade connections to the coast severed.⁸⁶³ However, select forms of glass vessels and small objects began to appear in some quantities in the central hills beginning in the late second century, just as they did in areas not subject to Hasmonean occupation (Figure 20). These areas could have been supplied from the coastal workshops to the north and west in Phoenician cities like Acco and Beirut, or from the south where the Jerusalem workshop specialized in sagged glass bowls and small objects. Certain political and economic configurations suggest the Central Hills and Lower Galilee would have been more oriented toward the south, but the forms and usages are also consistent with the patterns to the north and west. Both glass production and consumption, along with the usages of other products of the Hellenistic material *koine* like sigillata fineware pottery and Rhodian amphorae, turn out to be not an ethnic or political marker of Jews/Gentiles or Hasmonean/independent/Seleucid, but rather demonstrate participation in the elite drinking customs of the Hellenistic world, in which the relatively rural occupants of the Central Hills were still full participants. Aside from Samaria, which was urbanized by Herod the Great, this region

⁸⁶³ Berlin 1997a, 36.

was quite rural throughout antiquity, so the presence of glass vessels and small objects in these settlements beginning in the Hellenistic period testifies to the permeation of Hellenistic material culture and customs to non-cosmopolitan and rural sites. Although the quantities of glass vessels are relatively low compared to the larger cities in southern Syro-Palestine, population in the Central Hills was also almost certainly lower. Still, local elites demonstrated their cosmopolitanism through conspicuous consumption of imported goods like fine ware pottery and wine as well as glass. The patterns of use and discard suggest that glass was not considered a true luxury object with controlled access and curated value, but was rather used and discarded without ceremony. The following discussion moves generally west to east and north to south, beginning in the Jezreel valley before moving into the highlands of Samaria.

An ancient settlement site located on the land of Kibbutz Sha'ar Ha'amakim at the western edge of the Jezreel Valley spans from the Iron Age (seventh/sixth century) to the late Roman period (fourth century CE), with its major occupational phase in the Hellenistic and early Roman period. A modest building, 12x13 m in plan, has been tentatively identified as a fort, possibly built by the troops of Alexander Jannaeus in the late second or early first century.⁸⁶⁴ The earliest documented glass from the site was one small unidentifiable fragment of a core-form perfume vessel with zigzag trails, but the earliest glass tablewares were fifteen rim fragments from hemispherical grooved bowls of either Group A or Group D.⁸⁶⁵ While most of these came from mixed or unstratified levels, one fragment was recovered from a context between two floors; the lower floor dated to the first half of the first century, and the upper floor to the

⁸⁶⁴ Segal et al. 2009. The idea of fortified settlements of settlers established by Alexander Jannaeus is based on Josephus' account (*Antiquities* 13.422). An architectural survey around the area of Samaria and the central hills conducted by Shimon Dar identified several similar small "forts" which Dar and Applebaum have associated with Hasmonean colonization (Applebaum 1986; Dar 1986).

⁸⁶⁵ Burdajawicz 2009a. Because only rim fragments were identified, the lower body shape which differentiates between the types is uncertain. However, based on the drawings, the upright rims and generally wide diameter are more typical of Group A than of Group D. Sagged ribbed bowls, 14 of which are published in the catalogue, were found in late first century BCE-early first century CE contexts.

Herodian period, thus confirming use of vessel glass at the site by the middle of the first century BCE.⁸⁶⁶ The Hellenistic settlement also yielded 46 hemispherical mold-made ceramic bowls and 37 stamped amphorae handles, of which about two-thirds were Rhodian. Non-blown glass bowls of unknown types have also been found at Tel Qashish about five kilometers the south; Jackson-Tal has suggested they are probably grooved.⁸⁶⁷

Further inland towards the Jordan Valley, a Group III festooned amphoriskos was found at Geva.⁸⁶⁸ A single fragment of glass likely to be Hellenistic was found at Tel Zahara, a small site in the Jordan Valley near Beth Shean which was occupied from the late third to late second century. The nature of occupation in the Hellenistic period is ambiguous due to the limited nature of the exposed architecture, but the ceramic assemblage (which included bag shaped storage jars, Rhodian and Koan amphorae, cookpots, mortaria, unguentaria, and fine wares including ESA), the rural location, and the later Roman farmstead or estate on the site all indicate that the Hellenistic occupation was most likely also a domestic farmstead of some sort.⁸⁶⁹ The glass fragment is a yellowish body sherd, likely from a Grose Group A grooved bowl, with three preserved interior grooves, found in the foundation layers for the Roman construction.⁸⁷⁰ The presence of ESA and eastern Mediterranean amphorae indicate that Zahara had direct or indirect connections to coastal suppliers, from which such a glass vessel may have originated.

Glass began to appear in the central highlands of Samaria in the later second and early first century. Hellenistic period finds from the long-lived city of Samaria included abundant Hellenizing style sculpture, imported West Slope and other fine ware pottery, molded lamps, and

⁸⁶⁶ Burdajawicz 2009a, No. 13.

⁸⁶⁷ Mentioned Ben-Tor 1993, 1203, discussed in Jackson-Tal 2004, 31.

⁸⁶⁸ Jackson-Tal 2004, fig. 5.

⁸⁶⁹ Cohen 2013. For the architecture and stratigraphy, pp 9-10; for the Hellenistic pottery, pp 48-73. The site is thought to have been destroyed or abandoned by 100, possibly concurrent with Hasmonean incursions and the destruction of Beth Shean in 107/8. For the glass from Beth Shean, see above.

⁸⁷⁰ Swan 2013, No. 50. This fragment is unillustrated and no measurements are given.

thousands of Rhodian stamped amphora handles along with monumental fortification walls and round towers. Parts of the town may have been partially destroyed by the Hasmoneans in 108/107, providing a possible *terminus ante quem* for the introduction of glass here, similar to those in coastal cities and Maresha. While Samaria was not entirely abandoned, the lack of coins and amphora stamps dated between 108 and the mid-first century indicates some decline in trade and international connections during the first half of the first century.⁸⁷¹ The Harvard excavations at Samaria in the 1950s recovered over 140 additional examples of sagged bowls, many of which were found together in datable contexts. Grooved bowls number around one hundred, with half of those apparently belonging to Group A (“in thick glass with rounded base”) and half to Group D (“in thinner glass with bases concave or flattened”).⁸⁷² The earliest stratified examples – presumably limited to those with rounded bases, although this is not explicitly stated – were found under the Herodian constructions of the Augusteum and forum, with a *terminus ante quem* around 30.⁸⁷³ Evidence for even earlier presence comes from the Reisner and Fisher excavations in the early 20th century, which found two grooved bowls in a cistern dated to the end of the second century, along with molded ceramic bowls and ESA.⁸⁷⁴ Glass was also increasingly used for small objects at Samaria during the Hellenistic period. Anecdotally, glass beads greatly outnumbered stone in the Hellenistic and Roman levels, and at least some of the several glass spindle whorls and hundreds of gaming counters may be Hellenistic.⁸⁷⁵

⁸⁷¹ For a very brief summary of the historical and archaeological evidence for Hellenistic Samaria, see Crowfoot, Crowfoot, and Kenyon 1957, 4-5.

⁸⁷² Crowfoot 1957, 407.

⁸⁷³ Areas Qf (area of Hellenistic settlement, under the Augusteum) and Bn (location of the Roman-period forum).

⁸⁷⁴ Reisner, Fisher, and Lyon 1924, fig. 203, II, 9 b,c; Crowfoot 1957, 403, 407, fig. 93.2.

⁸⁷⁵ Reisner, Fisher, and Lyon 1924, 332, 376; Crowfoot 1957, 391-392.

Less well documented are the glass vessels from the temple and settlement at Mount Gerizim, the holy site of the Samaritans, which written sources claim was destroyed by Hyrcanus around 110.⁸⁷⁶ Unknown quantities of both grooved and fluted bowls have been identified in excavations but have not been published apart from a brief reference by Jackson-Tal.⁸⁷⁷

The southernmost location in the Samarian hills with possible Hellenistic glass is Tell Sailun, identified as ancient Shiloh. The greenish grooved hemispherical bowl was found in fragments in a natural cave with a man-made bench, along with a late Herodian lamp and assorted Byzantine material. As drawn, it has a flat base, which would accord with Group D and a Herodian date, but the lower area is indicated as reconstructed and a flat base is not mentioned in the description.⁸⁷⁸

Judaea and Idumaea

Thanks to the discovery of the second quarter of the first century debris from a glass workshop in Jerusalem (discussed above), quite a bit is known about the glass industry in the Hasmonean capital and heartland during the late Hellenistic period (Figure 20).⁸⁷⁹ However, the contexts of use for glass vessels and objects, most of which have been found as debris in fills and dumps, are still not well understood despite a plethora of evidence, and attention has been focused on dates and general presence rather than a synthetic examination of the evidence. Considered in this light, glass was much more prevalent in the larger urban centers of Judaea and Idumaea (like Jerusalem and Maresha) than in either the outlying palaces of the Hasmoneans (at Jericho and Masada) or other more rural areas and villages. In this way it resembled glass

⁸⁷⁶ Josephus *War* 1.64-65, *Antiquities* 13.275-281.

⁸⁷⁷ Jackson-Tal 2004, 22, 31. Jackson-Tal identified the context as “urban”, indicating these vessels were not found in the area of the temple but rather in the surrounding settlement.

⁸⁷⁸ Andersen 1985, 96, pl. 13.224; on the cave context, 39, 41.

⁸⁷⁹ Kahn 2014.

consumption practices in other areas of southern Syro-Palestine and beyond, where glass drinking vessels were markers of cosmopolitan elite, but not dynastic royal, culture.

So much attention to late Hellenistic glass from Jerusalem has focused on the early evidence of glass blowing and the workshop remains from the miqvah in Area J (discussed above) that the large quantities of sagged glass tablewares found in domestic areas elsewhere in the city have been overlooked. Although late Hellenistic Jerusalem was the capital of the insular Hasmonean dynasty, many of its residents participated fully in Hellenistic material practices, as evidenced by the elite houses of the Herodian period which would be equally as at home in Delos, Alexandria, Rome, or other cosmopolitan late Hellenistic centers as they were in Jerusalem.⁸⁸⁰ Glass of just about every functional class – vessels, beads, inlays, counters, spindle whorls, rods, and gaming pieces – has been found in Hellenistic contexts throughout the ancient city: in domestic contexts in the Jewish Quarter and City of David, in construction fill of a fortification tower at the Citadel, and a family tomb of the first century.⁸⁸¹

The City of David material, excavated from 1978-1985, came exclusively from dumped midden layers located outside the Hellenistic and Roman period city walls. The glass finds, as published by Donald Ariel, spanned from the Persian period to 70 CE, with clearly stratified and continuous debris sequences from each major phase.⁸⁸² The Persian period material (sixth-fourth centuries, Stratum 9) consisted of one core-form vessel and four beads; the Hellenistic period remains (fourth-first centuries, Strata 8-7) were one sagged bowl and nine beads; and the Early Roman phase (37 BCE – 70 CE, Stratum 6) contained 12 sagged bowls, 56 free blown vessels,

⁸⁸⁰ Avigad 1989. Despite the *koine* style architecture and finds, Avigad emphasized that the residents, whom he considered to be members of priestly families, maintained purity laws.

⁸⁸¹ See Ariel 1990, 149 for a list of references to published glass from Jerusalem up to the mid-1980s.

⁸⁸² Ariel 1990. After the first season of excavation, this Hellenistic and Roman overburden was removed with bulldozers, and most material from these levels was not sorted or saved. Ariel therefore emphasized that absolute and relative quantities of material are not accurate, but he still considered the published sample to be representative of the types of material likely to have been found.

two mold blown vessels, and six beads. Most of the non-blown glass vessels, however, came from the final deposit (Stratum 5), which consisted of a more heterogeneous dump with mostly Hellenistic and some Roman material which was deposited after 70 CE and contained two core-form vessels, 91 sagged bowls, one mosaic bowl, three blown vessels, and six beads. In other words, sagged monochrome bowls (totaling 110 examples catalogued) were more prevalent in the total assemblage, but blown glass (totaling 97 examples, especially in forms of bowls and cosmetic bottles) was prominent in occupation levels of the first century CE. Blown glass was much more common in the first century CE from the City of David deposits (the origin of which is unclear) than in contemporary levels in the Jewish Quarter, where sagged glass continued to numerically dominate assemblages until the 70 CE destruction of the Temple (see below).⁸⁸³ Whether this was due to differential access or preference for different forms of glass vessels in different areas of the ancient city is unclear. About half the total catalogued sagged bowls were grooved bowls of Group A, while the other half of the assemblage consisted of ribbed (Group C) and linear cut (Group D) examples. Yellow (54 examples, 49%), was the most common color, followed by green (31, 28%) and colorless (18, 16%) bowls.⁸⁸⁴ Additionally, one greenish hemispherical counter or inlay, one trailed bead, and three monochrome beads were found in Hellenistic strata.

The most substantial Hellenistic glass remains from Jerusalem, in both quantity and quality of publication, are those of the Jewish Quarter excavations in the Old City of Jerusalem conducted by Nahman Avigad from 1969-1982.⁸⁸⁵ To date, glass vessels and small objects of the Hellenistic and early Roman period have been published from areas A, W, and X-2, E, and

⁸⁸³ See Chapter 6.

⁸⁸⁴ Ariel 1990, 151, table 14.

⁸⁸⁵ The publications of these excavations, both in interim reports and final publications, are vast and growing. For the final reports of various areas of excavation, see the series edited by Hillel Geva (Geva 2000).

J.⁸⁸⁶ Architectural features and material remains of the early Hellenistic (fourth-mid second centuries) period were mostly limited to cisterns and scattered ceramic coarseware jars and other utilitarian vessels; Geva described this phase as one of “periodic agricultural activity.”⁸⁸⁷ In the later part of the second century, concurrent with the emergence of the Hasmonean state, the area developed into a large residential quarter. Subsequent restructuring and remodeling during the Herodian period – including the construction of a large pavement under which many of the finds were sealed – meant that very few true occupation contexts have been identified. The vast majority of finds came from assorted fills and dumps. Fortunately, many of these fills contained chronologically homogeneous materials, the dates of which have been confirmed by coins and stamped amphorae handles. Table 9 summarizes the assigned stratum dates for all excavation areas in Jerusalem where Hellenistic period glass has been found. As is evident from the table, the best dated and most common materials date to the phases of Hasmonean and Herodian rule, while pre-Hasmonean glass is rare.

	City of David	Jewish Quarter A	Jewish Quarter W	Jewish Quarter X-2	Jewish Quarter E	Jewish Quarter J	Citadel	Jason's Tomb
4 th /3 rd -mid 2nd (early Hell)	8				5			
mid 2nd-mid 1st BCE (Hasmonean)	7	6	4, 5	5,6, 7	4		x	
second half 1st BCE (Herodian)			3a-b	4	3	3		x
late 1st BCE-70 CE (Early Roman)	6	4, 5			2			
To 70 CE (mixed)	5							

Table 9. Dates of strata for excavation areas in Jerusalem

⁸⁸⁶ Gorin-Rosen 2003, 2006; Israeli and Katsnelson 2006; Nenner-Soriano 2006; Israeli 2014.

⁸⁸⁷ Geva 2006, 14-15.

Hundreds of glass vessel fragments from the late Hellenistic and early Roman period have been found in Areas A, E, and J, in addition to the glass manufacturing debris from Area J discussed above (Table 10). Although discrete early Hellenistic strata are generally missing from Jerusalem, the paucity of early Hellenistic glass starkly contrasts with the proliferation of sagged glass bowls in the Hasmonean period.⁸⁸⁸ Core-form cosmetic vessels were also quite rare, with only four total published fragments from the entire city, two of which are probably Persian or Early Hellenistic (Mediterranean Group II). Mosaic bowls were also rare in the city, with only four small fragments identified from Area E.⁸⁸⁹ A select number of fluted and floral decorated bowls (Grose Group B) have been found in Areas E and J, but the most common varieties of glass vessels in all excavation areas were grooved and ribbed bowls.

	Core-form	Plain	Grooved	Fluted/Floral	Ribbed	Linear Cut	Blown
Area A	1	1	23		>23	27	>5 ("very few")
Areas W and X-2	1				1		
Area E ⁸⁹⁰		1	85	4	46	9	36
Area J			49	3	33	20	"very few"
City of David	2	3	54		31	22	97
Citadel			3				
Jason's Tomb			4		1		

Table 10. Documented glass vessels from late Hellenistic-early Roman Jerusalem, by excavation area

⁸⁸⁸ Unlike other areas of southern Syro-Palestine, there are no good *terminus ante quem* dates from Jerusalem before the second half of the first century Herodian period, so dating the introduction of glass vessels in Jerusalem is problematic. Certainly, they were present by the first half of the first century, and probably by the later second century, but this cannot yet be confirmed archaeologically

⁸⁸⁹ Gorin-Rosen 2006, No. G57-G60.

⁸⁹⁰ Gorin-Rosen 2006, 257 indicated that 280 sagged fragments were identified from excavations in Area E, and only 63 examples were published. However, this total number is inconsistent with the total quantities given elsewhere in the text.

While the entirety of the material from Jerusalem came from secondary dumps or fills – not primary deposits – different areas of the city show some degree of differential usage for glass wares. Gorin-Rosen noted that the vessels from Area E were more diverse in terms of type, decoration, and quality than those from Area A, with the former including some possibly imported glass vessels, while the Area A residents relied exclusively on local suppliers; Israeli similarly observed that the vessels from Area E were “richer and more numerous than those from Area J.”⁸⁹¹ Whether these distinctions resulted from different household consumption patterns (these three areas are within 50 meters of one another) or post-occupational disposal practices is uncertain.

In the Jerusalem Citadel, also known as the Tower of David, located adjacent to the Jaffa Gate at the southeast edge of the Old City, three yellowish grooved glass bowl fragments were found in the construction fill of the middle tower. The same fill also contained red slipped fine ware ceramics (possibly Eastern Sigillata) and a Rhodian amphora handle, along with coins of the second century and Alexander Jannaeus (r. 103-76).⁸⁹² The excavator, Johns, leaned toward a date early in the reign of Jannaeus for the construction of the tower, since most of the fill dated from the late second and early first centuries. Additional fragments of conical grooved bowls were found in a Herodian period fill with a *terminus ante quem* of 29.⁸⁹³ The inclusion of glass bowls as garbage debris in these construction fills, along with common domestic pottery and amphorae, is further indication of widespread use and disposal of sagged glass drinking bowls before the middle of the first century.

⁸⁹¹ Gorin-Rosen 2006, 257; Israeli 2014, 290.

⁸⁹² Johns 1950, 139, fig. 10. Johns suggests one fragment (10b) might be blown, since it is thinner with an everted rim, but the shape is not found in blown form until the first century CE, so it is more likely a thinner walled sagged object.

⁸⁹³ Johns 1950, 144.

To the west of the Old City, a large tomb complex known colloquially as “Jason’s Tomb” was first used in the early first century. Remains of about 35 individual burials were identified, along with around 80 cooking vessels and 50 ceramic bowls, most dated to the late Hellenistic period. These remains have been interpreted as a family tomb in use for two to three generations. Herodian period lamps and coins found on the porch and floor of tomb, rather than in the burials themselves, suggest possible robbing of the tomb soon after its primary use phase but before access was blocked some time after about 30 CE. Glass vessels found in association with the burials as grave gifts – a rare documented instance of funerary deposit for glass tablewares in Syro-Palestine – included fragments of two or three yellow grooved conical bowls, a grooved colorless bowl, and a greenish ribbed bowl.⁸⁹⁴ Two twisted glass rods with spiral threads found in association with the burials are rare examples of possible glass bracelets from this early period.⁸⁹⁵ However, twisted rods from the contemporary glass workshop refuse in Area J indicate that local glass workers were using this decorative technique around this time; a workshop which valued experimentation, as the Jerusalem workshop did (see Chapter 6), could readily have made such objects by connecting two ends of a twisted rod, even if the idea never really caught on. Other late Hellenistic bracelets with twisted or trailed decoration have been found in Jerusalem in a pre-30 context at the City of David and in a mid-first century context in Area E.⁸⁹⁶ Such bracelets must be a semi-local product with a short life span in the first centuries BCE and CE.

⁸⁹⁴ Rahmani 1967, 89, fig. 18.1.

⁸⁹⁵ Glass bracelets, made by fusing together the ends of a rod, did not become common in Syro-Palestine until the third century CE (Spaer 2001, 193-198). Rahmani suggested that the two bracelets from the tomb reached Jerusalem through Asia Minor, where Celtic peoples of the La Tene culture wore somewhat similar glass bracelets. This is a bit of an Occam’s Razor suggestion to me, in that it is overly complicated and essentially without parallel.

⁸⁹⁶ Ariel 1990, No. GL32; Gorin-Rosen 2006, No. G76. O’Hea has also identified two possible bracelet fragments from Jebel Khalid which would date before c. 60 (O’Hea 2002, No. GN.1, GN.20). She noted that Spaer dated similar objects to the Islamic period, but compares the patterns and colors of the bracelet fragments to spoon handle and another bracelet fragment from Late Hellenistic and Herodian contexts at Jerusalem. Spaer continued to be

To briefly summarize the evidence of glass consumption in Jerusalem during the Hellenistic period, glass vessels were rare before the Hasmonean period, and none can be firmly dated before c. 100. However, this situation changed rapidly over the course of the last century BCE. Monochrome bowls became ubiquitous and were discarded along with other forms of household waste. The more elaborate forms of fluted, variant cut, mosaic, and even core-form vessels were quite rare, and possibly limited to only a select few households. Small glass objects have been less well published than vessels, so no synthetic assessment is possible, but beads, inlays, gaming counters, and spindle whorls were all available.⁸⁹⁷ The near-complete lack of glass from pre-100 Jerusalem is further indication that the Area J glass blowing workshop was a quite new establishment in the city, possibly founded by migrant glass workers who valued experimentation (further discussed below and in Chapter 6). Finally, the large quantities of broken and disposed glassware may be indirect evidence for the lack of glass recycling in Jerusalem before 70 CE; were glass a valuable and limited resource which was able to be reused, probably not nearly as much of it would have been so summarily discarded, especially with a local operational glass workshop.

Outside of Jerusalem, evidence for glass consumption is less abundant elsewhere in Judaea. The Hasmonean and Herodian palaces, sprinkled throughout the region of Judaea and the Dead Sea, indicate a different form of glass consumption among the royal class. The so-called Winter Palaces at Jericho were excavated by Ehud Netzer in the 1970s and 1980s.⁸⁹⁸ The

skeptical about the presence of glass bracelets in Syro-Palestine before the late Roman period (see discussion Spaer 2001, 275, n. 12).

⁸⁹⁷ Beads: Ariel 1990, No. GL50-GL53; Israeli and Katsnelson 2006, No. GL88-GL90, GL96-GL102; Nenner-Soriano 2006, No. 4-5.

Inlays/counters: Ariel 1990, No. GL38; Gorin-Rosen 2003, No. G106; Israeli and Katsnelson 2006, No. GL91-GL95, GL103-GL110; Nenner-Soriano 2006, No. 10-14. Gorin-Rosen 2003, 388 remarks that glass gaming pieces or inlays are rare finds in Hellenistic and early Roman Jerusalem.

Spindle whorls: Israeli and Katsnelson 2006, No. GL71-GL81; Nenner-Soriano 2006, No. 28.

⁸⁹⁸For a summary of the architectural phases and major finds, see Netzer 2001.

Hasmonean phase, built by Hyrcanus in the late second century, was a lavish private residence with wall paintings, heated baths, and large pools and gardens, all of which were greatly expanded and elaborated under Herod. According to Jackson-Tal, 69 identifiable pieces of glass vessels were found in the Hasmonean (100-31) and Herodian (31 BCE-48 CE) phases of construction and occupation at the site, most of which belonged to the later Herodian phase. Only nine fragments came from Hasmonean levels or can be dated to the Hasmonean period: a mosaic bowl with spiral cane decoration, a colorless hemispherical floral decorated bowl, a colorless hemispherical fluted bowl of standard Group B, and four conical grooved bowls of Group A (three light green and one yellowish-brown).⁸⁹⁹ Several fragments of core-form glass vessels were found in first century CE contexts, where it is unclear whether they were residual debris, heirlooms, or recently manufactured.⁹⁰⁰ Linear cut (Group D) and ribbed (Group C) bowls did not appear in contexts dated before c. 15, affirming Grose's initial dates for the introduction of these types in the early Roman/Herodian period.⁹⁰¹

The most significant indication of attitudes and availability of glass vessels in the Hasmonean palaces was the relatively high ratio of more elaborate glass drinking vessels – polychrome and relief decorated styles – to the plainer grooved types, with three of the former and only four of the latter represented in the assemblage. Unlike grooved bowls, mosaic, floral, and fluted vessels were somewhat rarer in the urban and domestic contexts of southern Syro-Palestine and may not have been made in local workshops. Therefore, although the total *quantity* of glass vessels in the Hasmonean palaces at Jericho was quite low by late Hellenistic standards, the *quality* of the glasswares was higher than contemporary settlements. Perhaps the

⁸⁹⁹ Jackson-Tal 2013a, 101-103, pl. 3.1:2-8.

⁹⁰⁰ Jackson-Tal 2013a, 101, pl. 3.1:1. A Group III amphoriskos of Grose type III:2 was found in the first century burial of a child in the so-called Jewish Cemetery at Jericho (Hachlili and Killebrew 1999, fig. III.71:1). This is one of the few attestations of core-form glass from a funerary context in all Syro-Palestine.

⁹⁰¹ Jackson-Tal 2013a, 103-106, pl. 3.2-3.4.

royal house of the Hasmoneans considered standard grooved bowls somewhat gauche and plebian, and preferred to drink from metal vessels or more elaborately decorated glass bowls. Jackson-Tal has commented on the limited use of glass bowls as well as imported ceramic finewares by the Hasmoneans and Herodians, stating “the relatively small amounts of luxury ware is surprising, especially the absence of high-quality, mold blown vessels and other imported luxury wares, typical in palatial and well-to-do dwelling contexts of the Early Roman period.”⁹⁰² Either they lacked access to these products – an untenable hypothesis given the connectivity of other areas of their territory – or they instead used more elite forms of tablewares which do not survive well archaeologically, most notably metal. The standard forms of glass vessels which had become popular in households throughout southern Syro-Palestine in this period thus appear to be a middling sort of tableware, not appropriate for use in the highest royal court in the land; they were not luxury vessels at all. Confirming this pattern is the near absence of sagged glass tablewares from other Hasmonean and early Herodian palaces at Cypros, Masada, and Herodium (the only other palaces from which glass material has been published).⁹⁰³ This is in stark contrast to a century or two prior, when glass vessels were likely gifts from royal courts to local patrons and accordingly served as markers of high elite status and courtly connections.

The prominent site of Gezer, located in the foothills of the Judaeen Mountains about 30 kilometers northwest of Jerusalem, has been excavated intermittently by several institutions over the course of the twentieth century. While an important Canaanite city in the Bronze and Iron

⁹⁰² Jackson-Tal 2013a, 116.

⁹⁰³For Cypros, Jackson-Tal 2013b. This palatial fortress was constructed and occupied in the Hasmonean and Herodian periods, but yielded very few glass finds, mostly from the first century CE. No late Hellenistic types were identified, but four linear cut and one ribbed bowl were probably contemporary to Herod the Great. At Masada, a few fragments of core-formed amphoriskoi, early Roman mosaic glasses, and pillar-molded bowls were also found, presumably belonging to Herod’s palace (Barag 1991, 138), and Spaer alluded to gold-glass beads found at Masada, as well as Moa and Ein Gedi, which have not to my knowledge been published (Spaer 1993, 19; 2001, 133). A debris deposit from the area of Herod’s Tomb at Herodium likely came from the palace-fortress built by Herod in the late first century. It contained 20 linear cut bowls and no ribbed bowls, along with several free and mold blown bowls and beakers (Jackson-Tal 2015).

Ages, Hellenistic and Roman period occupation was more limited, although a few notable glass finds dated to the Persian and early Hellenistic periods (c. sixth/fifth – third centuries) suggest the continued significance of the site. One fragment of a mosaic bowl with star pattern, which seems likely to be Hellenistic, was published from Macalister's early twentieth century excavations.⁹⁰⁴ Several fragments of core-form vessels, including a Group II alabastron, have also been found at Gezer but their contexts are unclear.⁹⁰⁵ Stratified eye beads and one rod-formed polychrome pendant of Phoenician-Punic type, also generally datable from the Persian-early Hellenistic period, have also been found at Gezer, but Spaer identified no typical beads or pendants of Late Hellenistic-Roman types (e.g. trailed feathered beads, mosaic cane eyes, or molded pendants).⁹⁰⁶ Nor have any standard forms of Late Hellenistic and early Roman sagged bowls been published by Barag or Macalister, despite archaeological and literary evidence that a group of Hasmonean colonists settled at Gezer in the second half of the second century.⁹⁰⁷ Possible abandonment or near-abandonment in the first half of the first century may account for this absence, but in general it does seem that areas with the strongest Hasmonean connections did not adopt glass drinking vessels, possibly on account of anti-Hellenizing sentiment among strict religious groups.

South of Jerusalem and the Judaeian heartland lies the region of Idumaea with its major city, Maresha (Marisa). Although the upper settlement at Maresha was established in the Iron Age, the primary phase of occupation at the site was during the third-second centuries, when it flourished as a major cosmopolitan center and trading entrepôt with an ethnically and religiously

⁹⁰⁴ Macalister 1912, 240, fig. 393.2.

⁹⁰⁵ Barag 2014, No. 4. Macalister also referred to "some coloured scraps...with blue, white, and yellow zigzags alternating upon them, and similar simple patterns" which are almost certainly from core-form vessels (Macalister 1912, 240).

⁹⁰⁶ Spaer 2014, 211-212.

⁹⁰⁷ On Hasmonean occupation at Gezer, see Reich 1981; Rosenfeld 1988, 241-245.

diverse population which fully participated in the Hellenistic material and cultural *koine*. Courtyard-style houses with imported Mediterranean wine and ceramic tablewares, a central agora with evidence of Greek civic institutions and governmental practices, and wall paintings and inscriptions in underground burial chambers with a variety of ethnic names and toponyms attest to the cosmopolitan nature of the settlement with Greek, Egyptian, Phoenician, and Semitic inhabitants, customs, and iconography.⁹⁰⁸ Maresha was apparently destroyed during the Hasmonean conquests of John Hyrcanus in either 111 or 108, after which it was only sparsely populated, thereby providing a firm *terminus ante quem* for the material remains found in the city, which included sagged glass vessels.⁹⁰⁹

Jackson-Tal has thoroughly studied the glass vessels from the site, most of which have been found in the subterranean chambers of the lower settlement, but a full catalogue of remains with detailed context information has not yet been published.⁹¹⁰ Fragments from over 200 glass vessels have been found during the excavations under Amos Kloner since 1988,⁹¹¹ including 10 core-form fragments from Group III cosmetic vessels, 199 rims from monochrome bowls, four polychrome mosaic bowl fragments, and one fragment from a sandwich gold glass bowl. The gold glass fragment, which was a chance find without context, is unique in Syro-Palestine – no others are documented from the region. It signifies the particular wealth, importance, and

⁹⁰⁸ On Zenon's visit and an overview of the third century archaeological remains, see Berlin 1997a, 6-8, 15. On various aspects of material culture from Maresha as participating in Hellenistic material culture, see especially Erlich 2009. Greek-style civic institutions are attested at Maresha by an inscribed *sekoma* measuring table authorized by the two *agoranomoi* of the city in 143/2, which was found in the agora Finkielsztejn 1999.

⁹⁰⁹ As described by Josephus (*Antiquities* 13.257; *War* 1.63). On the destruction date of Maresha, see Finkielsztejn 1998.

⁹¹⁰ Jackson-Tal examined the glass from Maresha along with Dor for her 2000 MA thesis, which is not available publically (Jackson-Tal 2000 *non vivendi*). The following discussion is based largely on the preliminary overview and some quantitative data published in Jackson-Tal 2005.

⁹¹¹ According to Jackson-Tal, no glass was documented in the early 20th century Bliss and Macalister excavations.

connectivity of Maresha in the later third century.⁹¹² Together with the third and second century mosaic vessels and the colorless fluted and vegetal bowls, the presence of gold glass indicates that the inhabitants of Maresha were engaged in luxury glass consumption habits in the early Hellenistic period, unlike many of the other cities in the region where glass was not available until later in the second century.

True to their cosmopolitan practices, the population of Maresha also embraced the trend toward mass produced glass tablewares during the final generation of site occupation. The vast majority of their monochrome glass wares were standard Group A grooved bowls, about half of which were colorless and the others greenish or yellow-green.⁹¹³ According to Jackson-Tal, monochrome glass vessels were generally found in third to first century contexts, but it is unclear whether there is any chronological distinction among vessel types. Further dating evidence, as well as information about shapes and sizes of the glass bowls in use at Maresha in the years before and after its sack, must await further publication.

Maresha is the southernmost site of Syro-Palestine at which glass fulfilling the criteria of mass consumption behavior has been found. The outward orientation of the Hellenistic Maresha-ites may explain why they were particularly swift to adopt glass drinking customs which had only begun to catch on further to the north. Jackson-Tal has emphasized that there is no evidence for a glass industry at Maresha, so these vessels must have been imported from elsewhere, either through a transshipment center like Jerusalem or directly from Rhodes or Delos.

⁹¹² An intact gold-glass bowl from the Rothschild Collection, purchased in Israel, is also said to have been found at Maresha, likely in a burial context (first published Wuilleumier 1930, 29-31; the current location of this vessel is unknown). Based on stylistic similarities with contemporary metal and ceramic bowls, Rotroff suggested a possible manufacture at Rhodes and a date in the final quarter of the third century (Rotroff 1982, 333-335).

⁹¹³ Jackson-Tal 2005, Table 1.

Southern Desert

Very few glasswares reached the sites of the southern desert and Nabataea in the Hellenistic period, although this area became a large consumer of glass in the Roman period (Figure 20).⁹¹⁴ Nessana, possibly a fort built to protect the new Ptolemaic customs house at Gaza in the third century, was a stop on the caravan route between Nabataea and the Mediterranean during the Hellenistic and Roman periods.⁹¹⁵ The earliest glasswares to appear at the site are core-form amphoriskoi, grooved conical and hemispherical bowls (Group A), fluted bowls (Group B), and ribbed bowls (Group C), suggesting that glass was first used at the site in the late second or early first century. These early sagged glasswares only appear in yellow and green, standard colors of late Hellenistic Syro-Palestinian production.⁹¹⁶ They almost certainly reached Nessana from further north or west, and may have been direct imports to the site rather than intended for further trade, since such glass does not seem to have penetrated much further inland.

Only a few fragments of Hellenistic glass have been found further inland on the trade route. A piece of a Mediterranean Group III alabastron was found at the fortress/caravanserai at Moa. Four sagged vessels of unknown type dated before the mid-first century and a mosaic plate found at Petra in a house context dated to the third quarter of the first century constitute the entirety of published pre-Roman glass finds from Nabataea.⁹¹⁷ The Nabataean and early Roman

⁹¹⁴ Mediterranean glasswares probably reached Nabataea and the Transjordan via Aqaba and the Red Sea, or possibly the Persian Gulf, rather than over land from Judaea. See Chapter 3.

⁹¹⁵ Berlin 1997a, 6.

⁹¹⁶ Harden 1962a. No. 7, a hemispherical greenish grooved bowl, was found in a stratified context of the first century BCE or earlier.

⁹¹⁷ Keller 1997, No. 2; 2006. The information regarding the quantity and chronology of the Petra glass comes from Stern's review (Stern 2008b, 688) of Keller's monograph, which I have been unable to access. Nine blown vessels were reportedly also found in this early stratum; a date before 50 BCE for blown glass, especially in this quantity, would be quite significant. Blown glassware does always seem to outnumber non-blown glass at Petra, even at the earliest dates (cf. seven sagged and 16 blown vessels dating to the late first century), quite unusual for Syro-Palestine; the only other site where blown vessels outnumber non-blown tablewares at this early date is Sidon. It is a shame this publication has such a limited distribution, because the rarity of published late Hellenistic and early Roman glass from Nabataea and the implications of those dates are quite profound.

(c. 63 BCE-106 CE) glass objects from Humayma, which have yet to be published, have been described by Janet Jones as “luxury wares that probably originated in Egyptian workshops.”⁹¹⁸ She further observed that finds from neighboring Petra and Aila indicate that Nabataean elites seldom used glass tablewares and the few glass objects they did have were imported from Egypt (or the Western Mediterranean?) instead of Syro-Palestinian workshops. In sum, moderate quantities of the standard glass tablewares were reaching these southern inland sites, but in limited quantities. Tellingly, they are found as fragments in fills rather than carefully disposed in luxury contexts, suggesting attitudes toward these vessels were more in keeping with mass than luxury consumption habits, despite the relative rarity of glass at those sites.

⁹¹⁸ Jones 2013, 516. She added that a full catalogue of the Nabataean and early Roman finds, which were found in the areas of the Roman Fort and Nabataean Shrine is forthcoming.

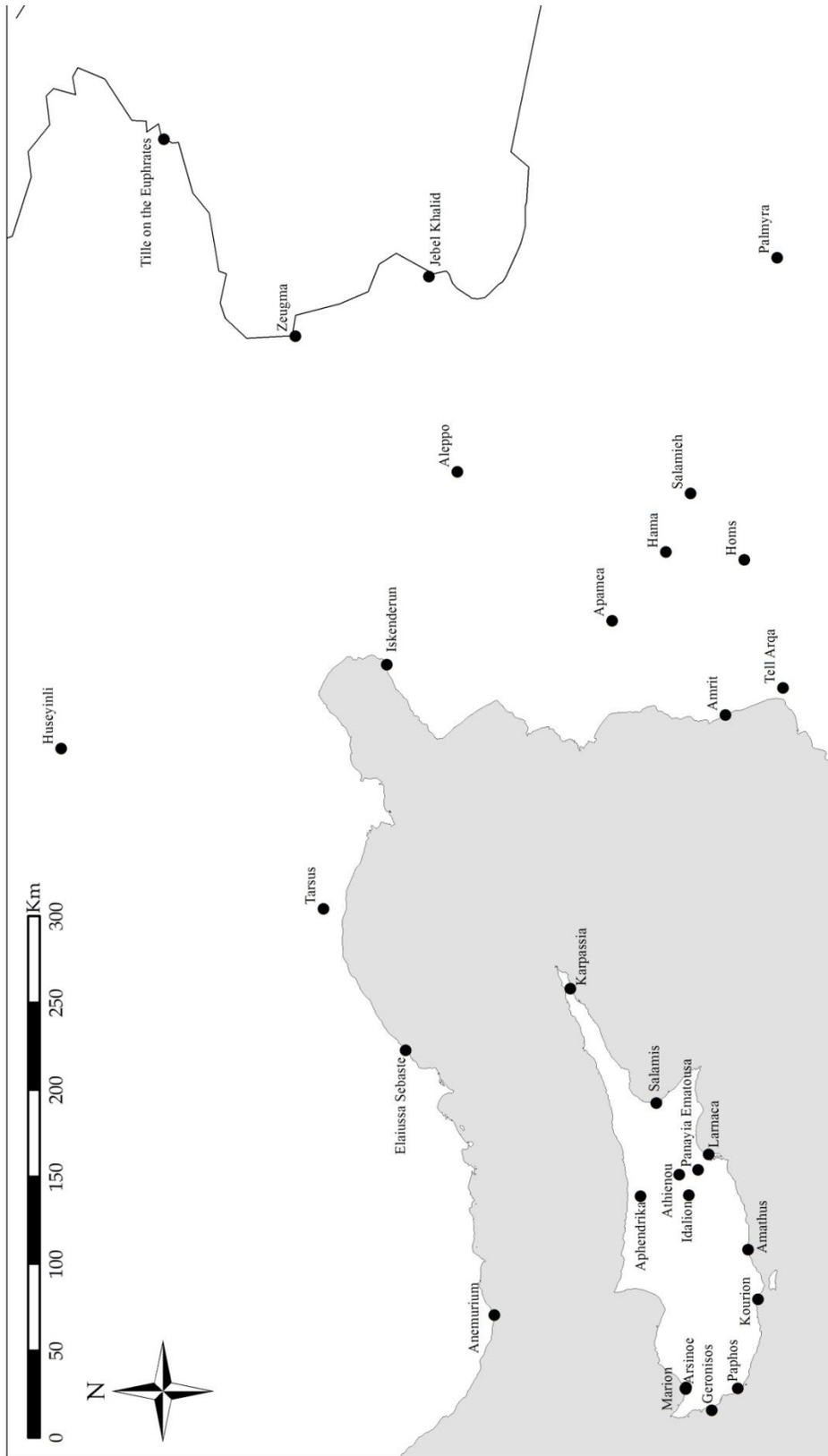


Figure 21. Sites with glass in southeastern Asia Minor (Cilicia), Cyprus, and Syria, c. 350-50 BCE

Northern Syria

In contrast to the south, northern Syria – north of the Litani River and Hermon Massif – was relatively poor in glass during the Hellenistic period (Figure 21). The published finds become increasingly sparse the further one moves to the north, appearing only along the coast and in major cities, in contrast to southern Syro-Palestine, where glass regularly reached more rural and isolated areas.⁹¹⁹ To the east, residents of the sites of Palmyra and Dura Europos did not mass-consume glass tablewares but treated glass as a luxury item, depositing core-form and sagged vessels in temples and burials in a manner typical of other Near Eastern sites where glass had to be transported over land across long distances, risking breakage and loss.⁹²⁰

Only scattered remains of late Hellenistic glass vessels have been documented from sites in the far north and inland areas, even when the glass from a site has been studied and published in detail. The Roman military site of Tille on the Euphrates has only yielded a single Group A grooved bowl.⁹²¹ Further to the south along the Euphrates, at the urban site of Zeugma, Grossman only identified one certain fragment of Hellenistic glass tableware: a conical grooved bowl found in the foundations of an early first century CE wall. Glass only began to be used as a tableware there in the second half of the first century Commagenian period: several ribbed bowls and a mosaic bowl of uncertain date were found in the wealthy House of the Bull in destruction contexts of the mid-third century CE, where they had possibly been kept as heirlooms.⁹²²

⁹¹⁹ Nenna 2007b. At least some of this absence of glass may likely be attributed to a lack of archaeological work focused on the Hellenistic period in this region (which mostly consists of modern Syria, as well as parts of Lebanon). The major sites – Apamea, Homs, Aleppo, etc – are known mostly from their Roman period urban development, and their Hellenistic levels are poorly preserved and not well understood.

⁹²⁰ See Chapter 3.

⁹²¹ Lightfoot 1993a, fig. 40. Lightfoot also documented 11 ribbed bowls and four fragments of core-form glass which are probably much earlier.

⁹²² Grossmann 2013. Interestingly, almost all of the glass tablewares found at Zeugma until the mid-second century CE were sagged rather than blown, possibly indicating relative conservatism in consumption practices; Zeugma may have been slow to adopt glass tablewares generally, but once they did, they seem to have preferred the vessels made using the traditional sagging method to the newfangled blown tablewares.

A few poorly published assemblages may indicate some generalized glass use in central Syria as early as the second or first century. At Apamea, an unknown quantity and style of glass tablewares, described only briefly by Pirling as a series of conical and hemispherical bowls comparable to Syro-Palestinian types, may date to the Hellenistic period. Core-form and polychrome mosaic vessels were absent.⁹²³ At Hama, which was reoccupied at some point during the Hellenistic period, several fragments of core-form amphoriskoi, grooved bowls, and monochrome glass beads were found in Hellenistic strata along with coins, lamps, loom weights, pottery, Rhodian amphora handles, and other products of the Mediterranean *koine*. An unillustrated pale blue pendant in the form of a bunch of grapes, found in a Byzantine level, may also date to the Hellenistic period.⁹²⁴ A group of mosaic bowls from Homs, Salamieh, and Aleppo along with Khisfin in the Golan Heights, now housed in the Archaeological Museum of Damascus, could be either Hellenistic or early Roman.⁹²⁵ If they are indeed Hellenistic, Syria would be one of the richest in mosaic glass vessels in this early period. Possibly adding credence to the density of mosaic bowls in central Syria is a footed network bowl said to have been found at Hama, now in the Art Institute of Chicago. This bowl is quite similar to the Antikythera network bowl and may be contemporary to it.⁹²⁶

⁹²³ Pirling 1978, 138. Pirling cited Harden 1969 for the date of these vessels, which are unillustrated. I have searched extensively for additional bibliography regarding these putative Hellenistic tablewares from Apamea, but other publications of glass from Apamea only discuss the Roman and later material (Donceel 1987; Nenna 2007b, 135).

⁹²⁴ Ploug 1985. Ploug's publication of the glass from the Danish excavations at Hama was, by her own admission, only a "modest selection" of the glass found at the site, much of which was uninventoried, lost in site flooding, or simply not documented properly. The studied and published material is only that which was brought to and kept in Copenhagen, and is therefore not representative of the full assemblage in terms of type or quantity.

⁹²⁵ Published provisionally in *Exposition des Verres Syriens a travers l'histoire* 1964, fig. 2, No. 13-20, as an exhibition arranged for the Third Congress of the *Journees Internatioales du Verre* (later the Association International pour l'Histoire du Verre) held in Damascus. Most are unillustrated. See also Zouhdi 1964, who documented 21 pieces of mosaic (millefiori) glass in the Musée National de Damas which he dated to the end of the Hellenistic-early Roman period.

⁹²⁶ Art Institute of Chicago Inv. No. 1947.888, discussed Grose 1989, 196, n. 51; Jackson-Tal 2004, 32.

The northernmost coastal Phoenician site with Hellenistic glass is the temple at Amrit, founded in the sixth century and probably dedicated to the Phoenician god Melqart. The temple may have ceased operations in the fourth century, but Hellenistic pottery, including mold-made relief bowls and Rhodian amphorae stamps, along with several fragments of glass grooved and ribbed hemispherical bowls have been found in the structure. However, the nature of this occupation is unclear.⁹²⁷ The grooved bowls are standard Syro-Palestinian production, colored amber and blue, with one to three interior grooves, and the ribbed bowls are probably an early variant of the type with short, irregularly spaced ribs. Without knowing the type of deposit (i.e. whether it was domestic or religious), whether they were deposited as luxury votive dedications or quotidian mass consumed tableware cannot be determined.

Excavations in the Phoenician city of Arqa (Arca), located just inland to the northeast of Tripolis, have yielded numerous fragments of glass grooved hemispherical bowls from Level 7, dated from the final quarter of the second century through the final quarter of the first century.⁹²⁸ Other finds from this stratum included ESA, Delphiniform lamps, mold-made ceramic bowls, and Rhodian amphorae: standard components of the late Hellenistic material culture in Syro-Palestine. Although not much has been published about the structure in which they were found, which was largely destroyed by later Byzantine construction, the domestic and occupational nature of the assemblage suggests that Tell Arqa was the northernmost of the coastal Syro-Palestinian sites to exhibit mass consumption habits of glass tablewares and other associated Hellenistic mass produced goods found in such abundance in sites to the south.

⁹²⁷ Saliby 1981, 134-137; Dunand and Saliby 1985, 50-53; Versluys 2008, 349. Versluys suggested that the finds were dedications for a water cult.

⁹²⁸ Thalmann 1978. For the glass, see page 67, fig. 42.3-6. Thalmann reported “numerous” fragments of such bowls, which he compared to the glass from Tel Anafa, but only a couple are pictured.

Intriguingly, according to both John Grainger and Maurice Sartre, Arqa marked the northern extent of the Ituraean principality which emerged in Lebanon in the wake of Seleucid collapse by the second quarter of the first century.⁹²⁹ If we accept this general territorial limit, it becomes clear that – with few exceptions – the quotidian use of glass tablewares was closely aligned with the limits of imperial control, and local elites achieved access to these mass produced vessels only when they were not under direct imperial oversight.⁹³⁰ Such “access” may be the result of multiple intersecting factors: an opening or stabilization of trade between the producer and consumer sites, a local desire to consume in order to promote and secure one’s elite status, and/or new ideas about appropriate consumption which emerged in the wake of regulatory states. Glass tablewares, once controlled by the state to be used in feasting and given away as a custom of court society, were suddenly economically and commercially accessible. With the memory of their courtly association still fresh in the minds of aggrandizing, cosmopolitan local elites, this group immediately sought out ways to emulate the courtly behaviors by purchasing readily available, but lower quality, merchandise.

There was, however, one notable exception to this general paucity of glass in northern Syria up to the limits of the contracting Seleucid empire: the military outpost and urban settlement at Jebel Khalid. Jebel Khalid was unique in its use of glass in Hellenistic northern Syria, perhaps due to its Mediterranean connectivity despite its remote location. In both quantity and type of glass vessels and small objects, Jebel Khalid more closely resembled the domestic

⁹²⁹ Grainger 1991, 154-155, map 4; Sartre 2005, 28. From this point, Arqa appears to have maintained relative autonomy, at least from Rome, as an Ituraean state until the late first century CE, when it was annexed along with the Emesene principate based in Emesa (modern Homs) to the Roman province of Syria (Sartre 2005, 76-77).

⁹³⁰ The obvious problem with this hypothesis is that Arqa alone of the Ituraean sites (which are, to be sure, very poorly documented) has yielded glass of the early first century BCE – none is known from Baalbeck and the Beqa valley or the other sites associated with this poorly understood political and cultural principate (cf. Myers 2010). Possibly Arqa’s location near the coast gave them better access to Mediterranean goods like glass, ceramic finewares, and amphorae than the more inland locations, but – unlike the cities to the north – they were not as regulated by the Seleucids and therefore could capitalize on their commercial trade access to import glasswares.

sites of southern Syro-Palestine, but the site also exhibited more differential access to glass tablewares than was evident to the south.⁹³¹ Located in modern Syria, on the west bank of the Euphrates River, Jebel Khalid was excavated in the 1980s and 1990s by an Australian team who have identified it as a single period Seleucid site, first occupied in the beginning of the third century and abandoned when the Seleucids lost control of the region in the 60s. The excavator, Graeme Clarke, typified Jebel Khalid as a “military colony” to monitor and control the river crossing.⁹³² The excavated areas of the site include a domestic insula, parts of the town fortification system, the necropolis, and the so-called “Governor’s Palace” on the site’s acropolis. The “Greek” cultural orientation, and possible origins, of the occupants of Jebel Khalid have been much remarked upon.⁹³³

A vast majority of the published glass from Jebel Khalid was found on the Acropolis on which was located the Governor’s Palace, a monumental military and administrative building with space for feasting and entertainments constructed in the third century and abandoned (following a brief squatter occupation) by the mid-first century.⁹³⁴ Several Mediterranean Group III core-formed bottles, particularly amphoriskoi, were found on the Acropolis, along with a large number and variety of sagged tableware bowls, including grooved, petal decorated, and fluted varieties.⁹³⁵ O’Hea suggested that the quantity of fluted bowls and their concentration on

⁹³¹ See also O’Hea 2005, who compares the assemblage from Jebel Khalid with those at Pella and Jerusalem. She argues that the types of vessels present at Jebel Khalid – many more polychrome, fluted, petal decorated, and colorless bowls – indicate they relied on a different, possibly Mediterranean-based, supplier than the southern settlements which may have been supplied by more local industries.

⁹³² Clarke 2002, ix.

⁹³³ Clarke 2002, 45-46. Heather Jackson’s work on the housing insula has refined this notion in light of more progressive ideas about Hellenism and Hellenization (Jackson 2014).

⁹³⁴ Clarke 2002, 25-48.

⁹³⁵ Although the published material includes trench, locus, and excavation numbers, the glass objects are not identified discussed in terms of specific finds context or stratum, so the Jebel Khalid glass cannot at present be used to narrow the date for the appearance of different forms in this outpost region about which little has been published (Nenna 2007b, 134-137). O’Hea also noted that the glass published in 2002 is a “small sample” of the corpus aimed “to present some of the types present on the site” without statistical significance for fabric and form (O’Hea 2002,

the Acropolis may indicate that they were imported together as a drinking set.⁹³⁶ Several polychrome mosaic bowls, most of which were found in the Governor's Palace, are somewhat unusual finds in Syro-Palestine. O'Hea has suggested their appearance at Jebel Khalid may be due to the military presence at the site which provided direct contact with the Mediterranean.⁹³⁷ Sagged glass bowls clearly formed a significant component of the drinking ware assemblage in the Governor's Palace at Jebel Khalid; O'Hea estimated the minimum number of sagged drinking bowls found at Jebel Khalid at 536, comparable to the number found at Tel Anafa, although Tel Anafa is a much smaller site.⁹³⁸

Several objects of adornment, including a molded pendant in the shape of a Nubian head with a Phrygian cap and several trailed beads, were found in the Domestic Quarter, along with dozens of glass gaming counters. Since glass beads and counters appeared in both the Domestic Quarter and the Acropolis in generally comparable quantities and qualities, these small objects seem to have been equally accessible to different segments of the Jebel Khalid population, unlike the tablewares which were more exclusive to the elites living in the Governor's Palace on the Acropolis. Sagged glass bowls, such as were found on the Acropolis, were all but absent from the excavated houses. Unlike elsewhere in the Mediterranean but typical of Syro-Palestine, glass vessels – including core-form perfume containers – were not used as grave goods in any of the dozens of excavated burials.⁹³⁹

The large number of glass tablewares in the Governor's Palace, especially the more elaborate ones, may be a vestige of the type of tableware gift-giving and commemoration of

245). O'Hea 2005 provides some statistical analysis of the Jebel Khalid material, and O'Hea 2011b revised the estimated number of objects found based on more recent excavations.

⁹³⁶ O'Hea 2011b, 155.

⁹³⁷ O'Hea 2005, 46.

⁹³⁸ O'Hea 2011b.

⁹³⁹ As asserted in O'Hea 2011b, 160, contra O'Hea 2002. O'Hea determined that the fragments of glass found in the fills above the burials were more likely already in the fill than deposited as grave goods and later disturbed.

royal banquets as is evident in the few glass vessels found in the Persian and Hellenistic Administrative Building at Kedesh (see above). Alternatively, the ruling elite class at Jebel Khalid may have participated in the more generalized practice of mass consumption, motivated by emulation, as documented for other elites of the eastern Mediterranean and Syro-Palestine regions. The administrative building at Kedesh, moreover, was abandoned about a century prior to the Governor's Palace at Jebel Khalid, before Syro-Palestinian type glass bowls began to be produced on a larger scale.

The restriction of glass table vessels to a particular area of Jebel Khalid suggests some degree of limited access, either due to cost or regulation, which was more in keeping with a luxury model of consumption. In comparing vessel glass assemblages among Jebel Khalid, Pella, and Jerusalem, O'Hea observed that the Jebel Khalid assemblage was quite distinctive in color, decoration, and shape, with more colorless and polychrome mosaic vessels, and a strong preference for deep hemispherical bowls as opposed to the conical bowls which are more common at other Syro-Palestinian sites. O'Hea suggested these differences may reflect different suppliers, and that the glasswares at Jebel Khalid may have been coming from the Mediterranean production centers to the west (e.g. Delos or Rhodes) rather than from the Phoenician workshops to the south, perhaps facilitated by the military connection.⁹⁴⁰ Jebel Khalid, therefore, straddled luxury and mass forms of consumption, as might be expected from an outpost community at the edge of the Mediterranean trade network: they had access to glasswares of the Mediterranean but held more strongly to the notions of appropriate consumption typical of regions further east.

⁹⁴⁰ O'Hea 2005.

Summary of Glass Consumption in Late Hellenistic and Early Roman Syro-Palestine

Despite the prominence of the region in both ancient and contemporary literature on glass wares and glass production, the occupants of Syro-Palestine were not altogether different from the rest of the Hellenistic world in their adoption of glass wares from luxury to mass commodity over the course of the Hellenistic period, just earlier. Elaborate luxury glasswares like fluted and variant cut colorless and polychrome mosaic glass tablewares have occasionally been found in third-early second century contexts at sites with strong connections to imperial regimes and rich trade connections to the Mediterranean world, including Kedesh, Samaria, Jebel Khalid, and Maresha. In the mid-second century, grooved drinking bowls of hemispherical and conical types began to appear in coastal cities from Ashdod in the south to Amrit in the north. These grooved bowls were related morphologically and technically to earlier wares but were made more simply: the pale yellows, blues, and greens typical of these vessels are the natural color of glass without the addition of mineral colorants or decolorizers, and the basic grooved patterns required less investment of labor than the more elaborate flutes or patterned exterior cuttings. Small glass objects in a range of other functional categories, including adornment, gaming, and furniture decoration, also increased in quantity about this time. Many of the earliest sites where these mass-produced forms of glass appeared had historical or cultural ties to coastal Phoenicia.⁹⁴¹

Rural and urban inhabitants of non-Phoenician settlements were using glass vessels by the early to mid first century. A dramatic example of just how much glass consumption practices changed in the span of less than a century is the site of Tel Qiri in the lower Galilee near

⁹⁴¹ It is worth noting that Phoenicia is overrepresented in the earliest periods due to the Hasmonean destruction dates which provide a *terminus ante quem* in the second half of the second century for deposits containing glass at places like Dor, Ashdod, Yavneh-Yam, but other cities with destruction dates, including Samaria and Maresha, had grooved drinking bowls before their seizure. We are missing good early dates from “Jewish” sites, notably Jerusalem. At this point, it is impossible to determine whether this dating discrepancy is due to archaeological recovery or ancient practice.

Megiddo, where glass was absent from the main Hellenistic occupation at the site in the third and first half of the second centuries. After a century of general abandonment, glass suddenly appeared with reoccupation and increased activity in the last quarter of the first century.⁹⁴² The century or so of abandonment coincided with the century in which glass had become much more common in standard domestic assemblages. The early Hellenistic residents of Tel Qiri lacked access to glass tablewares, but their early Roman successors considered glass as a standard household object and brought glass tablewares with them when they settled the site. Similar patterns have been documented in cities, towns, and villages throughout southern Syro-Palestine: in the mid-second century, glass vessels were exceedingly rare. By the second half of the first century, broken glass fragments were discarded by the dozens, sometimes hundreds, in domestic dumps and construction fills. Significantly, these first domestic glass wares were not blown, but grooved and ribbed sagged bowls.

The Birth of an Industry

The dramatic shift in glass usage and disposal practices during the late Hellenistic period is linked chronologically – and perhaps causally – to the collapse of the large hegemonic Hellenistic states, especially the decline of the Seleucid empire and its influence in the region. Without imperial oversight, elites sought to enhance their status locally and regionally using the established vocabulary of wealth, power, and culture as expressed in courtly drinking practice, which included use of imported wine (especially from Rhodes), ceramic tablewares, and glass drinking vessels. This new consumer behavior must have been recognized by producers, who in turn increased their scales of production to meet consumer demand. The sudden appearance of

⁹⁴² Avissar 1987, 11-15; Barag 1987a. The 22 early Roman period glass vessel fragments primarily consisted of sagged linear cut and ribbed bowls (Groups C and D), and included only four blown vessels, further demonstrating that blowing technology was not singularly responsible for increased consumption of glass in the early Roman period. See further, Chapter 6.

glass production sites and written accounts of glass manufacture in southern Syro-Palestine during the late Hellenistic and early Roman period, where previously there had been none (as opposed to Rhodes, Egypt, and Greece, where definitive workshop remains can be dated to the third century or earlier), coupled with the sudden appearance of glass at urban and rural consumption sites throughout the region, gives strong support to the argument that glass manufacture began in Syro-Palestine in the mid-second century. The rest of this chapter will be dedicated to exploring how a new industry can emerge in a new location: where the production knowledge comes from, how raw material is sourced, and why this particular region may have attracted glass workers.

Jews and Glass? Glass as Identity Marker

Because glass drinking vessels and major innovations in glass technology, especially glass blowing, first appeared in areas with historical Jewish occupation, some scholars have argued that the emergence of early Roman glass technology and consumption habits ought to be connected to the presence of Jewish populations. Samuel Kurinsky has most strongly espoused the importance of Jewish people to the evolution and spread of glassmaking from the Bronze Age through the early Modern period, affirming the historical importance of Eretz Israel and associating Jewish diaspora communities with developments occurring outside of the region. He even suggested that Sidon, so lauded by Roman documentary sources, was a transshipment port for raw glass produced in the hinterlands by Israelite/Jewish tribes in Upper Galilee.⁹⁴³ Anita Engle, in her self-published series *Readings in Glass History*, has also strongly advocated for a significant role of Jews in the development of the early Roman glass industry.⁹⁴⁴ Jodi Magness and Tsiona Grossmark have emphasized the rabbinic writings on *halakhah* (Jewish ritual purity)

⁹⁴³ Kurinsky 1991, 127.

⁹⁴⁴ See especially Engle 1984.

which offer judgment on purity considerations for glass vessels, and they have associated larger quantities of locally produced utilitarian glasswares with Jewish concerns for purity at sites like Qumran and the Jewish Quarter houses in Jerusalem.⁹⁴⁵

However, this argument has never been widely acknowledged or accepted by scholars whose focus of study is not ancient Judaism.⁹⁴⁶ While glass was adopted quite rapidly by certain Jewish populations during the first centuries BCE and CE, and concerns about purity probably helped drive the expansion of glass vessels into Jewish markets, glass vessels were not an exclusively Jewish phenomenon nor did they appear first in Jewish contexts. The exact same vessel and object types have been found at Jewish and non-Jewish settlements, unlike other ethnic markers like stone vessels, miqvaot, Hasmonean coins, and lack of pig bones, which do map onto particular settlement types and regions. Furthermore, sites with strong Hasmonean political associations, including the Hasmonean palaces at Jericho and the settlement at Gezer, did not adopt and use mass produced glass drinking vessels.⁹⁴⁷ Glass was certainly used by some Jewish people, but, at least in the late Hellenistic and early Roman period (the Jewish late Second Temple period, before the destruction of the temple in Jerusalem in 70 CE), Jews and non-Jews used glass in indistinguishable ways.

Nor was glass a particularly Phoenician phenomenon, or that of any other ethnic group in Syro-Palestine. Although Adi Erlich has identified four main ethnic groups in southern Syro-Palestine in this period – Greeks, Phoenicians, Idumaeans, and Jews and Samaritans – which she

⁹⁴⁵ Grossmark 2010; Magness 2011, 66-70.

⁹⁴⁶ Kurinsky 1991, xiv implied, but did not outright state, that this failure to acknowledge “the substantial and significant contribution the Jews have made to Western civilization and to the world” was the result of lingering anti-Semitism.

⁹⁴⁷ Judaism in this period, however, was not monolithic: glass drinking vessels may have been used by some sectarian groups but not others, possibly due to their association with Hellenism (on heterogeneous Jewish responses to glass vessels as markers of Hellenization, see Grossmark 2010, 197-198).

considered to be identifiable through their art,⁹⁴⁸ glass transcended these divisions and was used by members of all ethnic groups. Instead, glass – along with Rhodian wine, red slipped tablewares, mold-made lamps and terracotta figurines, masonry style wall painting, and all other manner of the Hellenistic material *koine* – signified an identity which was trans-cultural and pan-Mediterranean. As an identity marker, it signaled participation in a globalized, cosmopolitan culture.

This is not to say that Jewish people, nor any other ethnic, religious, or cultural group in antiquity, did not adopt glass vessels and objects to serve local needs. The purity of glass in accordance with rabbinical law, for instance, likely played an important role in the use of glass in Jewish villages of Galilee beginning in the second century CE. But this logic underlying the adoption of glass would not have been recognized by outsiders of the culture and so would have been an unsuccessful etic identity signal, though it may have been recognized emically. Glass, especially in the late Hellenistic and early Roman period (c. 150 BCE-100 CE) was a true Mediterranean-wide globalizing phenomenon in its production and consumption. Indeed, as Grossmark has proposed, the fact that Jewish sages and rabbis began to issue *halakic* laws regarding the appropriate consumption of glass vessels in the second century is further indication of their rapidly increasing prominence in late Hellenistic and early Roman marketplaces.⁹⁴⁹

Raw Materials

If emic markers of religious or ethnic identity were not the motivating force behind the emergence of a scaled-up glass industry in the late Hellenistic period in the region, what factors in addition to consumer demand might have facilitated innovation in primary and secondary glass workshops? As demonstrated above, a new glass industry emerged in Syro-Palestine

⁹⁴⁸ Erlich 2009, 110-112.

⁹⁴⁹ Grossmark 2010.

during the second century. Was this industry based on primary glass making, secondary glass working, or both?

One possibility is that raw glass became easier or cheaper to manufacture in the second century, facilitating a dramatic increase in the scale of production. Several scholars, including Barag, Jackson-Tal, and Henderson, have tentatively suggested this as a possible reason for the vastly increased quantity of glass at this time.⁹⁵⁰ Their comments were speculative based on the evidence of more glass present in the archaeological record beginning about this time. However, they did not examine the mechanisms or reasons for such an expansion in raw glass production.

As discussed in Chapter 2, ancient glass manufacture required three ingredients: a suitable silica and lime bearing sand, soda in the form of mineral natron or plant ash, and sufficient fuel to heat the first two ingredients to 1100° Celsius in order to instigate the necessary chemical reaction. Relatively few areas in the Mediterranean basin boasted even one of these natural resources, much less all three. A select number of sand deposits in the western Mediterranean may have been adequate, but Pliny mentioned no natron sources further west than Greece. Macedonia may have had natron, but no appropriate sands from Greece are known.⁹⁵¹ The Nile Delta in Egypt, with its deposits at Wadi Natrun, contained mineral natron and adequate sand, but lacked fuel.⁹⁵² The coastal areas of Syro-Palestine contained silica-lime sands but no mineral natron.⁹⁵³

Compared to elsewhere in the Mediterranean, the sands of Egypt and Syro-Palestine were particularly good for glass making. Syro-Palestinian glass making sands originated as alluvial

⁹⁵⁰ Barag 1985, 59-60; Jackson-Tal 2004, 27; Henderson 2013, 222.

⁹⁵¹ Pliny, *Natural History* 31.46. See further, below.

⁹⁵² Nenna suggested that the most abundant fuel in the Wadi Natrun area was concentrated around lakes in the form of fast-growing reeds, which were also used to heat baths in Egypt (Nenna 2015, 17).

⁹⁵³ Sand from around the ancient Belus River (modern Nahr Na'aman, located between Haifa and Acco) has been repeatedly tested and found adequate to manufacture a stable and easily workable glass with the addition of soda (Turner 1956; Brill 1988; Brems, Degryse, Hasendoncks, et al. 2012, 2898).

sediments from the Nile River, which had been carried eastward by Mediterranean currents and deposited along the Egyptian and Israeli shores, perhaps as far north as Turkey. The resulting relative homogeneity in beach sands along the far eastern Mediterranean coast means discrete deposits cannot be isolated by their chemical signatures, but most of these sands would likely have been adequate to manufacture glass.⁹⁵⁴ The large number of primary manufacturing workshops up and down coastal Syro-Palestine testifies to the importance of this natural resource to the area by the late Roman and early Byzantine period.⁹⁵⁵

In addition to adequate sand, Syro-Palestine also possessed abundant fuel, particularly in the heartland of ancient Phoenicia (modern Lebanon). Phoenicians of the Iron Age were famous foresters and tradesmen of this natural resource, exporting locally grown wood to Egypt and Mesopotamia.⁹⁵⁶ Fuel was probably the most expensive of the three raw materials required to make glass and also the least portable based on volume alone.⁹⁵⁷ Taylor and Hill's reconstruction of a Roman period wood burning glass furnace consumed over 24 tons of wood during six weeks of intermittent firing; they estimated that continuously maintaining temperatures around 1050° Celsius for the same period of time would have required 40 tons of dried wood.⁹⁵⁸ Combined with Brill's estimate that it would have taken five to ten days at 1050° to fuse the raw glass slab at Bet She'arim,⁹⁵⁹ the energy required to manufacture raw glass was a substantial investment of resources. Fischer has suggested, based on pollen core data from the Sea of Galilee, that oak and pine trees provided the primary fuel used in glass furnaces in the late

⁹⁵⁴ Brems, Boyen, et al. 2012; Brems, Degryse, Hasendoncks, et al. 2012.

⁹⁵⁵ Gorin-Rosen 2000.

⁹⁵⁶ Mikesell 1969; Watson-Treumann 2000, 75-78.

⁹⁵⁷ *Contra* Kahn 2014, 132, who suggested that mineral natron was difficult to transport over sea since it was water soluble and corrosive, but the long distance trade of natron as early as the fifth century (if not earlier) means that this difficulty was not prohibitive (see Chapter 2).

⁹⁵⁸ Taylor and Hill 2008, 262. For other ethnoarchaeological reconstructions of wood burning glass furnaces and fuel expenditure, see Cable 1998; Fischer 2008, 63-82.

⁹⁵⁹ Brill 1967, 90, although the extraordinary size of the Bet She'arim slab suggests this scale was atypical.

Roman period, possibly supplemented with olive or pistachio wood.⁹⁶⁰ Over the course of antiquity, however, the forests of Lebanon as well as elsewhere in the Mediterranean became depleted due to extensive cultivation and deforestation.⁹⁶¹ Still, in the late Hellenistic and early Roman period, local supplies of both wood and sand probably helped Syro-Palestine outcompete rival raw glass suppliers like Egypt and Rhodes. Indeed, if the southern sands were more suitable to glass making, while timber resources were more abundant in the north, the ‘sweet spot’ along the coast might well have been in the area of Sidon and Beirut. The greater local availability of wood fuel may also have been the reason sand was shipped from the Belus River area up to Sidon, as described by Pliny, rather than being fused in situ.⁹⁶²

The innovation which made raw glass manufacture more economical in the second century may have been the exploitation of newly discovered sand sources in Syro-Palestine and establishment of a new primary glass industry in the region. Several forms of indirect evidence may be offered in support of this hypothesis.

First and foremost is the clear expansion of quantity of glass in the second and first centuries, indicating that an expanding number of primary as well as secondary furnaces must have been in operation. This increased availability was not limited to vessels, but can be seen in the increased use of glass for other small objects like beads, gaming pieces, and furniture decoration. While more glass could result from the intensification of production in one workshop or workshop tradition by adding workers, augmenting equipment, or otherwise scaling up production using the same core technologies, other differences in the glass around this time (as described below) suggest that this expansion did not result from strict continuity of tradition.

⁹⁶⁰ Fischer 2008, 19.

⁹⁶¹ Mikesell 1969; Vita-Finzi 1969; Thirgood 1981; Casana 2008.

⁹⁶² Appendix, Text 5.

Second, the color and clarity of glass vessels changed around this time, with naturally colored yellows, blues, and greens replacing the deliberately opacified, colored, or colorless vessels which were popular in the third century and earlier. For glasses which were artificially colored, new materials such as manganese as a decolorizer and tin and lead-tin oxides as opacifiers were introduced in the second century and largely replaced antimony and antimonates.⁹⁶³ The most straightforward explanation for this abrupt shift in practices is the foundation of a new primary workshop tradition, and the most obvious candidate for this new tradition is in Syro-Palestine.

Third, there is no archaeological or written evidence of any kind for either primary or secondary glass production activity in Syro-Palestine prior to the first century. This absence stands in dramatic contrast to the preponderance of sources for the following several centuries. Arguments *ex silentio* are always subject to being overturned with new evidence, but at present the silence of archaeological sources in particular is compelling, since we do have robust evidence of glass production *outside* of Syro-Palestine before the Roman period. The only way to fully confirm this hypothesis of a new primary glass source would be thorough scientific analysis of securely dated glass from several sites before, during, and after the crucial second century to determine the degree of continuity of use of raw sand sources, but such testing is beyond the reach of current research methodologies.⁹⁶⁴

The presence of abundant natural resources suitable for manufacturing raw glass begs the question why these resources were not exploited before the second century. Prevalence of sand and wood for fuel is not alone sufficient to account for the sudden appearance of glass in Syro-

⁹⁶³ Henderson 2013, 76-77.

⁹⁶⁴ The work by Brems et al on Sr/Nd isotopic signatures to identify sand sources has been a promising new lead in a field which has been somewhat stagnated, although to date they cannot distinguish between Egyptian, Syro-Palestinian, and other eastern Mediterranean sands (Brems, Boyen, et al. 2012; Brems, Degryse, Hasendoncks, et al. 2012).

Palestine during the late Hellenistic period. Other social and cultural factors must have been involved.

The Role of the Craftsman

Artist Mobility

I have argued this far that the conditions in place for the emergence of a new glass industry in southern Syro-Palestine, and the coastal cities of Phoenicia in particular, were consumer desire motivated by elite emulation and the raw ingredients to manufacture glass. A third factor was the recognition of these conditions and ability to exploit them. Such was the role of glass craftspeople, who had to possess the knowledge to manufacture glass from raw materials, transform raw materials into finished products, and market those products to eager consumers. The continuity of technology from Iron Age and Classical glass working practices, especially with Macedonia and Rhodes during the fourth and third centuries, to those used in Syro-Palestinian type bowls of the second and first centuries indicates that the founders of the Syro-Palestinian glass industry had been trained in traditional workshops but were able to apply their knowledge to new materials and markets. In other words, trained and knowledgeable glass craftspeople seem to have moved from established glass working centers to Syro-Palestine where they founded new workshops.⁹⁶⁵ While the trope of the mobile artist is a longstanding *deus ex machina* in the ancient world to explain the transfer of technological knowledge or aesthetic preference from one region to another,⁹⁶⁶ as a black box solution it fails to account for the

⁹⁶⁵ The other distinct possibility is that only a handful of highly knowledgeable individuals, perhaps as few as one or two, trained a new workforce of locals.

⁹⁶⁶ The invocation of the mobile craftsman is so common that a selection of even a few instances would be necessarily arbitrary and limited, so I will limit examples here to one early, influential example: Gordon Childe's itinerant metal smith from *The Dawn of European Civilization*, who was responsible for spreading metallurgy and bronze technology northward into Europe from the Mediterranean (Childe 1925; for a counter-argument, Gibson 1996).

motivations and mechanisms behind individual itinerancy.⁹⁶⁷ Glass workers did not simply decide to pick up one day and move to a new area; rather, numerous social and cultural systems influenced the pattern and scale of their movements. These systems as they applied to glass workers are reflected in general patterns of human mobility during the Hellenistic period, the search for new markets when old ones collapsed or became stagnated, and perceived opportunities for advancement.

The first factor affecting the movement of glass craftspeople in the late Hellenistic period was general mobility of the population as a whole. Evidence for geographic mobility during the Hellenistic period ranges from the dispensation of land and associated settlement of Seleucid and Ptolemaic mercenary soldiers as colonists in newly conquered territories, to papyri and other documentary sources which recorded multi-ethnic populations in the villages of Egypt, and to large numbers of foreign craftsmen working at Delos.⁹⁶⁸ Once a small group of immigrants was established in a new territory, they formed new communities based on shared kinship. Beginning in the later fourth century, merchant associations at Athens and Delos were based on common cities of origin, as were working relationships of sculptors on Rhodes.⁹⁶⁹ Communities sought talented workers and the money of elites, attracting such individuals through offers of citizenship, exemption from taxes, and inscribed honors for new residents.⁹⁷⁰ Potentially migrant glassworkers in the Hellenistic period lived in cosmopolitan and multiethnic communities, where they were exposed to the potential and ability for movement.

Historically, artists and craftspeople have often moved in order to find training or pursue new opportunities and markets. Young apprentices and journeymen with the least amount of

⁹⁶⁷ “The presumption of a professional class of mobile craftsmen has often stood as an unexamined ‘black box’ explanation when all else fails” (Winter 2005, 26).

⁹⁶⁸ These lines of evidence are summarized in Archibald 2011. On multiethnic craftsmen at Delos, see Feyel 2006.

⁹⁶⁹ Davies 1984, 283; Larson 2013.

⁹⁷⁰ Oliver 2011.

training and skill were the most likely to be peripatetic as they moved from city to city to gain knowledge and experience under a variety of master craftspeople, eventually locating a community where their skills were needed.⁹⁷¹ Master craftspeople, particularly in highly skilled specialty or luxury crafts, are more likely to be relatively non-mobile once they had established a physical workshop, set of skilled workers, and local reputation. However, several factors could motivate them to move: escape from persecution or poor economic conditions, incentives from the destination state in the form of tax breaks or cash rewards, or, in the case of attached craftsmen, a reciprocal or redistributive exchange authored by elite patrons.⁹⁷² Once established, assuming no rivals were present, emigrant craftsmen tended to be highly innovative, as cross-cultural encounters with local workers, industries, and consumers facilitated the development of new ideas.⁹⁷³

Rival glass producing centers of fourteenth to sixteenth century CE Europe can offer some insights into how the glass workshops of the late Hellenistic and early Roman period may have operated in competition or collaboration with each other. The famous glass workshops of Venice were founded in the thirteenth century CE using technology and raw materials sourced from the Islamic world, particularly imported ash from the *salicornia* (glasswort) plant grown in the coastal Levant. Around 1450 CE, Venetian glass artisans found a way to purify soda ash and introduce a stabilizing agent which resulted in a very pure, colorless glass known as *cristallo*. Soon thereafter, Venetian authorities gave the putative inventor of *cristallo*, Angelo Barovier, permission to establish a *cristallo* furnace at the Milanese court, thereby spreading the fame of

⁹⁷¹ Ehmer 1997; Archibald 2011.

⁹⁷² Zaccagnini 1983; Epstein 1998. According to Burford, many communities in the Classical Greek and Roman world lacked skilled craftspeople, whom they would try to lure with economic incentives (Burford 1972), similar to the way remote American communities attracted doctors and other skilled professions by paying for their education.

⁹⁷³ Schilling 1983; Archibald 2011.

the material and increasing demand for *façon de Venise* glass in European high society.⁹⁷⁴ About a century later, Venetian trained glassworkers began to migrate to other European markets, perhaps due to instability in the local Venetian industry.⁹⁷⁵ One beneficiary of this emigration was the fledgling glass industry in England, where glass workers from Antwerp and Venice established workshops during the third quarter of the sixteenth century CE,⁹⁷⁶ no doubt attracted by the emergent court society of Elizabeth I. Willmott has described the effect of this new industry thusly:

By the beginning of the 16th century, the use of glass in England was at its lowest point in 300 years. During the 1500s, however, this situation would be reversed, both by the importation of high-quality Venetian and *façon de Venise* wares and by the establishment of a successful native industry. So dramatic was this reversal that, by the middle of the 17th century, more glass was being used in England than ever before.⁹⁷⁷

This newly established local English industry was so successful that it eventually replaced Venetian and Venetian style glass in European markets. A new glass formula with 20-30% lead oxide, perfected by George Ravenscroft in the 1670s, led to major changes in the English and Continental glass industries which took advantage of the refractive and soft working properties of the new glass.⁹⁷⁸

The changing status of glass and its rapid emergence as dominant material for local consumption and large scale export in sixteenth and seventeenth century CE England could be applied equally well to late Hellenistic Syro-Palestine, and it is tempting to draw parallels between the two historical circumstances.

⁹⁷⁴ Page 2004, 5.

⁹⁷⁵ Page 2004, 17.

⁹⁷⁶ Willmott 2004, 278.

⁹⁷⁷ Willmott 2004, 271.

⁹⁷⁸ Charleston 1968; Page 2004, 19.

From Whence Syro-Palestinian Glass Makers?

If Syro-Palestine had no indigenous glass making or working tradition, and the industry developed fully formed within a short span of time with little evidence of experimental growing pains (such as are discussed in Chapter 6 for the innovation of glass blowing), the founders of the Syro-Palestinian glass industry must have come from elsewhere. The question therefore, is where. As stated above, the technologies and forms they used are more consistent with Greek traditions of Macedon and Rhodes, where translucent sagged vessels with linear decoration were made in the fourth and third centuries, than they were with Egyptian technologies, which lacked a tradition of vessel manufacture and polychrome and richly colored glasswares were preferred. The historical orientation of Syro-Palestine toward the Seleucids and Romans and away from the Ptolemies further suggests that Syro-Palestinian glassworkers did not come from Egypt.

One alternative possibility is that attached or semi-attached glass workers who had been supplying glass vessels to the Seleucid courts suddenly found themselves without patronage when the royal family and court society collapsed during the second century. Seeking steady employment and new markets, these artisans would have moved closer to the insurgent, aggrandizing elites of southern Syro-Palestine and adopted their luxury products to new markets. Absent royal oversight and imposed limitations on production or the control of the raw material, these new entrepreneurs could have rapidly expanded their business, marketing the same goods which 20 years prior had been limited to court society and royal gifts directly to lower level elites.

An alternative origin for the first Syro-Palestinian glass workers is Rhodes, with its longstanding glass working industry which included raw glass, sagged glass vessels, and small glass objects. That artistic exchange between the communities of Rhodes and Phoenicia took

place during the Hellenistic period is confirmed by families of Tyrian and Sidonian sculptors who were active on Rhodes in the second and first centuries.⁹⁷⁹ While it could be argued that Rhodian-made glass of the fourth and third century was of much lower quality than the Late Hellenistic Syro-Palestinian vessels, Rhodian glass workers were probably reliant on local sands which were not ideal for glass manufacture.⁹⁸⁰ If Rhodians, accustomed to using local sand resources to manufacture raw glass, moved to Syro-Palestine, they would have quickly discovered that local sands were much more suitable for making glass, and the quality of the product would have improved practically overnight. This new glass would have been easier to work at lower temperatures and been more aesthetically appealing to consumers, thus further advancing the nascent industry.

The evidence presented above strongly supports the hypothesis that a new glass industry was founded in the Phoenician cities of coastal Syro-Palestine at some point in the mid-second century by glass workers from the royal Seleucid courts and/or Rhodian glass workshops. The immigrant craftsmen may have been attracted by a burgeoning client base or incentives from local governments, perhaps to encourage economic development. The effect of this new industry on local economic growth must have been profound: in less than 100 years, Syro-Palestinian glasswares were shipped all over the Mediterranean, changing consumption habits as far away as southern France. The rapid success of innovative Syro-Palestinian glass workers, facilitated in part by the suitability of local natural resources, led to its diffusion into other cities of southern Syro-Palestine, like Jerusalem, and eventually to Rome and the western Mediterranean in the second half of the first century. The innovations of Late Hellenistic Syro-Palestinian glass workers and their profound effects on glass history are the subject of the following chapter.

⁹⁷⁹ Dow 1941; Goodlett 1991.

⁹⁸⁰ Rehren, Spencer, and Triantafyllidis 2005. Chromite granules found in samples of raw glasses found at Rhodes are typical of Rhodian sands but not Syro-Palestinian (or, presumably Egyptian) ones.

Chapter 6.

From Sagging to Blowing: The Blown Glass Revolution in Light of the Late Hellenistic Glass Industry

East versus West: The Early Origins of Blown Glass

As discussed in Chapter 1, the common narrative for the early stages of glass blowing is that it was revolutionary, immediate, and widespread, resulting in a cheaper and more ubiquitous product. Missing from this model, however, is any account of social, cultural, and technological factors which contributed to the eventual success of glass blowing, along with a nuanced account of how the dramatic change in *chaîne opératoire* from core-forming, casting, and sagging to blowing technologies operated ‘on the ground’ for both workers and consumers of glass products. As Michael Schiffer has said regarding a similar narrative of technological “revolution” – the transistor radio in the post-World War II era – “a change can only be judged revolutionary in relation to overall trends in that technology.”⁹⁸¹ Therefore, any proper understanding and interpretation of glass blowing as a major technological change must be contextualized in the productive and consumptive environment in which it originated.

The origins of glass blowing in the ancient Mediterranean have long been a focus of interest among scholars working on glass vessels and objects. In the first half of the twentieth century, glass blowing was thought to have originated in Ptolemaic Egypt, perhaps as early as

⁹⁸¹ Schiffer 1992, 95. Schiffer concluded that the transistor revolution *was* revolutionary in regards to cost-cutting and managing competition on behalf of the manufacturer, but did not involve significant progress in radio technology, design, or performance, i.e. the consumer use of radios.

the third century BCE.⁹⁸² However, by the middle of the twentieth century, subsequent excavation and refinement of chronologies made clear that examples of blown glass which could be firmly dated before the Augustan period, around last third of the first century BCE, were exceedingly rare.⁹⁸³ When evidence of a glass blowing workshop in Jerusalem dated to the first half of the first century BCE was announced, it was soon recognized as the earliest evidence of glass blowing known to date.⁹⁸⁴ The location of Jerusalem seemed to confirm a long history of literary sources and scholarly tradition which associated early glass technology and production with Syro-Palestine.⁹⁸⁵

Acceptance of the eastern evidence has been far from absolute however, and many have argued, to a greater or lesser degree, for the important role of the western Mediterranean and particularly Italy in the development of glass blowing. David Grose first published early evidence for blown glass from Italy and the western Mediterranean, concluding that small blown bottles first appeared in the archaeological record of the region during the final quarter of the first century BCE.⁹⁸⁶ Marianne Stern in particular has argued extensively for the expansion and

⁹⁸² As first argued by Eisen in 1916 and repeated by Fossing among others (Eisen 1916; Fossing 1940). A set of tomb paintings from Beni Hasan, Egypt dated to the 12th Dynasty, showing craftsman with long rods at the end of which were bulbous spheres over an open flame were initially thought to depict glass blowers and glass blowing, but Petrie convincingly argued that this painting instead shows metal or jewelry workers using mud-coated reeds to blow on a flame and thereby increase the heat. It is worth mentioning that Petrie also noted in the same article that no blown glass predating the Roman period had been identified (Petrie 1914).

⁹⁸³ Isings 1957. An important site for determining this chronological boundary, at least in Italy, was the site of Cosa on the Etrurian coast. The *colonia*, which was founded in the early third century and destroyed and depopulated around 70, yielded around 30 fragments of core-form and molded glass, while the Roman re-foundation, which occurred sometime in the early years of Augustus' reign, but no earlier than 30, produced hundreds of blown glass fragments from a few decades of occupation (Grose 1973, 1975, forthcoming). Blown glass beakers of Isings Form 37 are also reported to appear in deposits at Herculaneum dated 40-10 (Scatozza Höricht 1986, 42).

⁹⁸⁴ Avigad 1972b; Israeli 1991, 2005; Israeli and Katsnelson 2006. The material, which includes malformed primitive blown bottles and glass tubes for blowing, as well as rods, sagged vessels, and assorted small objects, was deposited as a fill in a stepped bath which was paved over early in the Herodian period (*ante* 30s) and contained 40 coins dated to the reign of Alexander Jannaeus (103-76). The Jerusalem workshop remains are discussed in more detail in Chapter 5.

⁹⁸⁵ See Chapter 5.

⁹⁸⁶ In addition to Cosa and Herculaneum (discussed above), the major sites are: 1) a drain under the Regia in the Roman Forum which was blocked in 37/6 and clogged with debris, the glass of which included seven sagged fragments, three blown pieces, one rod, and one cast window pane; 2) another drain under the House of Livia with

refinement of the glass blowing industry in the west soon thereafter, especially in the regions of northeastern Italy on the Adriatic coast. Compared to the earliest century or two of glass blowing in the east, blown vessels found in the west demonstrate a wider variety of shapes, decorative techniques, and functions. Stern noted several technological advances between the late first century BCE and the late first century CE, including a new furnace design with a horizontal heat chamber, the use of a hollow iron pipe to inflate and support the glass, and the development of the pontil technique, in which the blown vessel was transferred from the blowing tube to a solid rod, allowing the rim to be more carefully shaped. Archaeologically, these techniques appeared first in western Europe, particularly northern Italy.⁹⁸⁷ This distinction between the location of the earliest known application of the technology and its wider adoption, large scale investment, and dissemination has been a point of contention in determining where – and therefore who, when, why, and how – this important invention occurred.

In this chapter, I explore anthropological theories related to invention and innovation before applying these models to the case of Roman glass blowing as emergent from the extant Hellenistic industry. Current anthropological thinking prioritizes cultural contexts for innovation and considers innovation as a process rather than a singular moment of discovery. I will examine the evidence for changes in manufacturing cost and disprove the idea that blown glass is necessarily cheaper than non-blown glass, at least in the initial stages of technological development. I then reconstruct the evidence for the multi-stage innovative process of glass

ceramic material dating to the Late Republican/early Augustan period containing nine sagged pieces, three blown, and one uncertain handle; and 3) necropoli at Morgantina (Sicily), Contrada Diana (Lipari), Cosa (Etruria), Toscanella (central Italy), Ornavasso (northern Italy), Este (northern Italy), and Locarno (Switzerland) containing colored unguentaria (Grose 1977). See also Hayes 1975, 29 for a shorter but similar discussion, tying early blown glass to the west.

⁹⁸⁷ Stern 1999b. The inclination toward the west may, however, be a product of differential preservation, publication, and datability of sites in the west compared with the east during the same period, as has been suggested by Lightfoot (Lightfoot 2003). Lightfoot understood the early blowing industry as an empire-wide network of craftsmen not just of glass, but in other media as well.

blowing, from its probable invention in the east to the full investment in the technology in Italy and its eventual diffusion back eastward. I conclude with some thoughts on the particular economic and cultural conditions which precipitated the glass blowing innovation, and argue that the most important elements are the cost and availability of raw glass, the perception among consumers of glass as a luxury product, and new shapes and styles made possible by blowing technology.

Historiographic Aside: Modernity and Technological Progress

Before delving into the anthropological and sociological background of how innovation and material changes occur in a society, a few comments on why the narrative of revolution has so monopolized scholarship on ancient glass are in order. Generally, in the contemporary post-Industrial Revolution Western civilization, a high value has been placed on technological progress, new invention, and efficiency of production,⁹⁸⁸ all of which have apparent precursors in the revolutionary model of early Roman period glass blowing. Perhaps because of the simplicity and grandiosity of the presented narrative, non-glass specialists have also embraced glass blowing as a prime example of innovative capacity in ancient craft production (including some who are otherwise skeptical of diffusionist and teleological paradigms such as Kevin Greene).⁹⁸⁹

The historiographic trajectory of the field, particularly over the last few decades, has contributed to the idea that the invention of glass blowing was a major rupture point in the history of glass. In the last quarter of the 20th century, art historical catalogues of museum and private collections of glass became the dominant publication type for scholars of ancient glasswares. These widely cited volumes established the major types, typologies, styles, dating,

⁹⁸⁸ Schiffer 1992; Edgerton 1999, 126; Dobres 2000.

⁹⁸⁹ Greene 2007, 2008a. Other scholars generally interested in ancient technology who uncritically cite the case of glass blowing as either a paradigm for technological change or a potential case study for their theoretical position include: Schiffer 2008; Archibald 2013b.

and comparanda.⁹⁹⁰ This trend represented a significant shift from earlier, more archaeologically and contextually minded publication of ancient glass, which were still nevertheless focused primarily on developing typologies and chronologies.⁹⁹¹

Once the basic forms and dates had been established — absent contextual provenience information which would illuminate aspects of use, quantification, co-occurrence in assemblages, and so forth — scholarship turned to what could be said about ancient glass based on the objects themselves: namely their production methods. Reconstructing the technologies of glass has bordered on the obsessive for much of this most recent period of glass scholarship, with numerous conferences, edited volumes, experimental archaeologies, and summative photo essays dedicated to the topic.⁹⁹² The relatively recent interest and success in identifying ancient technologies can be demonstrated by the fact that in his 1984 review of glass scholarship, Harden considered the nominal research on manufacturing techniques and ancient glass technologies to date as largely unsuccessful and disappointing.⁹⁹³ The late 20th century preoccupation with forming methods may also be related to the rise of studio art glass in the same period, which led

⁹⁹⁰ Most influential have been the publications of the collections in the Royal Ontario Museum (Hayes 1975), the British Museum (Harden 1981; Barag 1985), the Toledo Museum of Art (Grose 1989; Stern 1995), the Corning Museum of Glass (Goldstein 1979; Whitehouse 1997), and the Ernesto Wolf Collection (Stern and Schlick-Nolte 1994; Stern 2001).

⁹⁹¹ For a historiography of glass scholarship up to the 1960s, see Harden 1984. Particularly notable, and still important, publications in what I am calling the archaeological style include: Harden 1936; Isings 1957; Fremersdorf 1958; Haevernick 1981.

⁹⁹² Publications on ancient glass technology are legion. To name a select but representative few book-length examples: McCray 1998; Lierke 1999; Foy and Nenna 2003. Scientific analyses of glasses also exploded during this time period and facilitated new kinds of questions about raw glass manufacture and trade (e.g. Oppenheim et al. 1988 (1970); Liritzis and Stevenson 2012). The archaeological investigation and identification of production sites, largely pioneered by G. Weinberg's excavations at Jalame in Israel, also increased in intensity beginning in the 1970s-80s (G.D. Weinberg 1988).

⁹⁹³ Harden 1984, 16-17. It is an interesting quirk of fate that this volume of the *Journal of Glass Studies* also includes Grose's landmark article "Glass-Forming Methods in Classical Antiquity: Some Considerations" (Grose 1984a).

to greater experimentation with the material by modern artists who were interested in resurrecting ancient techniques and applying them to their own artistic production.⁹⁹⁴

Significantly, catalogues of major glass collections are almost always subdivided into multiple volumes using the technological category of blown glass as a dividing line.⁹⁹⁵ The Toledo Museum of Art, Corning Museum of Glass, and Ernesto Wolf Collection all have publication strategies which reflect this deterministic division between blown glass and non-blown glass.⁹⁹⁶ Moreover, Roman-period non-blown vessels and objects have typically been published alongside their earlier technological equivalents instead of their blown vessel counterparts. In the preface to the 1979 *Pre-Roman and Early Roman Glass in the Corning Museum of Glass*, the first major catalogue to make this division, Goldstein justified the decision to study late non-blown vessels along with their technological rather than chronological counterparts as being “for the sake of continuity.”⁹⁹⁷

The result is that the study of contemporaneous objects by different individuals and contextualized in different volumes has created conceptual as well as bibliographic dividing lines in the intellectual sand. A casual reader flipping through such volumes could be forgiven for the impression that all “Roman” glass is blown and all blown glass is “Roman.”⁹⁹⁸ These

⁹⁹⁴ The studio art glass movement emerged in the 1960s at the Toledo Museum of Art. Its primary features are personal artistic studios and glassworker as artist rather than industrial factories and designer as craftsman or skiller laborer (Wittman 1966). Today, both the Toledo Museum of Art and the Corning Museum of Glass have studio glass facilities, demonstrations, and classes physically located within the exhibition galleries to demonstrate ancient and modern glassworking techniques. For examples of modern glass artists who have become engaged in experimental archaeological research, see the contributions by Rosemarie Lierke (Lierke 1993, 1999, 2009), Dudley Giberson (Giberson 2004), and Mark Taylor and David Hill (Taylor and Hill 2008; see also <http://www.romanglassmakers.co.uk/>).

⁹⁹⁵ Cf. Seefried 1986, 145: “There has been no continuity in the analysis of glass history. The invention of glass-blowing seems to produce a very strong barrier to scholars.”

⁹⁹⁶ See Chapter 1.

⁹⁹⁷ Goldstein 1979, 22.

⁹⁹⁸ Whitehouse did include 33 cast objects, of which only four are vessels, in his publication *Roman Glass in the Corning Museum of Glass* (Whitehouse 1997, No. 1-33). The vast majority of the non-blown glass in the collection, much of which has been dated to the first century CE, was published by Goldstein in *Pre-Roman and Early Roman Glass in the Corning Museum of Glass* (Goldstein 1979).

publication regimes, intentionally or not, suggest that casting and sagging became dead technologies immediately after the invention of blowing, ignoring that it persisted and even thrived for two more centuries.⁹⁹⁹

Cheap, Fast, and Good? Blown Glass Reconsidered

The key arguments and consequences of the commonly held paradigm of a Roman glass blowing revolution have been exemplified in an encyclopedia-style article on glass technology by Marianne Stern. She wrote:

The discovery that glass can be blown revolutionized the entire glass industry. The invention of the blowpipe meant that hollow objects and vessels that previously required labor intensive operations could be made in a fraction of the time, and that less glass was needed per object. Moreover, blowing permitted the production of new classes of items. Blown glass tableware played an important role in bringing Roman culture to the provinces of the empire.¹⁰⁰⁰

The narrative of a blown-glass revolution relies on the assumption that blown glass is cheaper to manufacture and that this lower cost was extended to the pricing of finished objects. This cheapness, argued to result from efficiencies of production including minimizing labor and raw material, is the competitive advantage blown glass is assumed to have had over sagging and molding technologies. This section will evaluate these claims in succession: Does glass blowing use less raw material and therefore result in a cheaper product? Does it save labor, and therefore time? Is glass blowing a fundamentally more efficient or “better” technology than sagging? I argue that the answer to all of the above questions is no, at least in the earliest stages of technological development. Consequently, alternative reasons for the eventual success of glass blowing in the workshop environment and consumer market must be sought.

⁹⁹⁹ On the general persistence of non-blown glass tablewares into the late first century CE, see Prior 2015.

¹⁰⁰⁰ Stern 2008a, 535.

Raw Material

One major argument in favor of the economy of glass blowing over sagging is that it used less glass per vessel, thereby lowering the cost to the producer who in turn passed the savings on to the consumer. This argument has been supported by Diocletian's Price Edict, issued in 301, the most comprehensive ancient source for the cost of raw glass and undecorated finished vessels. The Edict specifies maximum prices for six kinds of glass: Alexandrian and Judaeen raw glass, undecorated cups and vessels made with Alexandrian glass and Judaeen glass, and best and second quality window glass (Table 11).¹⁰⁰¹ Marianne Stern has crafted a detailed argument, based on the cost of glass and daily wages documented in the Edict and predictive time investment and loss of material in the production process from comparative data. She proposed that a typical glass worker would have had a very difficult time meeting costs of production after purchasing the raw glass, and would barely have been able to make a living after investing in raw material. According to Stern, then, reducing waste and recycling raw material would necessarily have been the top priority of the ancient glass worker.¹⁰⁰²

¹⁰⁰¹ The fragmentary text of the Price Edict relating to glass was found at Aphrodisias in the early 1970s (Erim and Reynolds 1973). Barag argued that "Alexandrian" and "Judaeen" glasses were not necessarily manufactured in those specific locations but rather represented general glass types of greater and lesser quality based on coloration, with Alexandrian glass being decolorized and Judaeen glass being the natural greenish color (Barag 1987), although this has been questioned by Whitehouse, who considers actual regional provenance more likely (Whitehouse 2004; for a response to Whitehouse, Barag 2005). The use of specific provenance of materials as a guarantee of quality and, accordingly, a higher price, is documented elsewhere in the Price Edict for products such as wool from Phrygia, Pontus and Cappadocia and linen from Tarsos (Poblome 2004, 493). Three poorly preserved lines at the end of the inscription may refer to colored and/or polychrome glasses (Stern 1999b, 466).

¹⁰⁰² Stern 1999b, 463-464. It is worth noting that the intention of the Price Edict was to set *maximum* prices across the empire, not establish *actual* prices (Ermantinger 1990), so glass workers may have been able to acquire raw glass for much less than the Price Edict value.

Line	Translation	
1a	Alexandrian glass one pound	24 denarii
2	Judaeen greenish glass one pound	13 denarii
3	Alexandrian glass cups and smooth vessels one pound	30 denarii
4	Judaeen glass cups and smooth vessels one pound	20 denarii
5	Window glass best (quality) one pound	8 denarii
6	[Window glass] second (quality) one pound	6 denarii

Table 11. Diocletian's Price Edict 16.1-6 (after Stern 1999, Table 1).

The Price Edict does not provide the absolute cost of glass items, but instead gives the information that glass vessels, like raw glass, were sold by the pound rather than on the basis of criteria such as quality, complexity, type, or aesthetics. One implication of this system was that glass workers could have maximized their profits by making each object heavier (Table 12, Table 13). Assuming that the cost of glass vessels was determined at least in part by weight,¹⁰⁰³ it would be in the best interest of the glass workshop to make vessels larger and heavier, not smaller and lighter. This would result in a higher profit margin per item sold even though they used more raw material.

Glass was not the only operational cost in a workshop: the daily wage for a skilled worker and general workshop overhead including tools, fuel, construction of the furnace and other infrastructure, rent, and waste are also factors.¹⁰⁰⁴ Still, we may reasonably assume for the sake of argument that these costs would be essentially equivalent regardless of the size, weight, and profitability of the finished vessel (which is, after all, the variable under consideration).

¹⁰⁰³ Stern allowed that the pricing of glass vessels by weight “may well have been common practice in the late Roman empire,” particularly for undecorated vessels (Stern 1999b, 461-462). Barag also accepted this as a basic ‘fact’ of the Price Edict and lists several examples of glass vessels sold by weight from the 12th century CE through the present (Barag 1987b, 116). If this practice was not customary prior to the medieval period, we have to ask when and why the pricing schema changed – an unanswerable, but not uninteresting, question.

¹⁰⁰⁴ According to the Price Edict (7.1-23), the daily wage for a skilled worker was 50 denarii, and this is the rate used by Stern (1999, 462-463) to calculate that an undecorated glass cup cost between half day and day’s worth of labor. Regarding other operational costs, to date, there are no useful models available for what these costs might have been, although I agree with Stern that the raw glass itself must be the primary investment made by the glass worker. It must be remembered, however, that the final profit per vessel suggested here is not an absolute number but a relative one.

Description	Calculation	Judaean Glass	Alexandrian Glass
Raw glass	Per Roman pound, in denarii	13	24
Vessel weight	1 Roman pound = 327 g	0.46	0.46
Cost of raw glass per vessel	0.46x13 (Judaean) 0.46x24 (Alexandrian)	5.98	11.04
Sale price per vessel	0.46x20 (Judaean) 0.46x30 (Alexandrian)	9.20	13.80
Total profit per vessel	Sale price minus raw glass price	3.22	2.76
Vessels produced per worker per day		100	100
Cost of glass, per worker per day	100 x 0.46 x 13 or 24	598	1104
Profit generated, per worker per day	100 x 0.46 x 20 or 30	920	1380
Total profit per day (100 vessels/day/worker)		322	276

Table 12. Rate of return on investment for 150g glass vessel, based on Diocletian's Price Edict

Description	Calculation	Judaean Glass	Alexandrian Glass
Raw glass	Per Roman pound, in denarii	13	24
Vessel weight	1 Roman pound = 327 g	1.07	1.07
Cost of raw glass per vessel	1.07x13 (Judaean) 1.07x24 (Alexandrian)	13.91	25.68
Sale price per vessel	1.07x20 (Judaean) 1.07x30 (Alexandrian)	21.40	32.10
Total profit per vessel	Sale price minus raw glass price	7.49	6.42
Vessels produced per worker per day		50	50
Cost of glass, per worker per day	50 x 1.07 x 13 or 24	695.5	1284
Profit generated, per worker per day	50 x 1.07 x 20 or 30	1070	1605
Total profit per day (50 vessels/day/worker)		374.5	321

Table 13. Rate of return on investment for 350g glass vessel, based on Diocletian's Price Edict

Table 12 and Table 13 summarize the rough costs for manufacturing and selling glass vessels of 150 grams and 350 grams, respectively, based on the values of Judaean and Alexandrian raw glass and undecorated finished glass vessels given by the Price Edict.¹⁰⁰⁵ At a sale price of 20 denarii per pound for Judaean vessels and 30 denarii per pound for Alexandrian vessels, a 150 g Judaean vessel would cost 5.98 denarii in raw material to make and sell for 9.20 denarii, a 150 g Alexandrian vessel would cost 11.04 denarii to make and sell for 13.80 denarii, a 350 g Judaean vessel would cost 13.91 denarii in raw material to make and sell for 21.40 denarii, and a 350 g Alexandrian vessel would cost 25.64 denarii to make and sell for 32.10 denarii.¹⁰⁰⁶ Therefore, the rate of return on investment, or ‘profit’, based on raw material alone for a 150 g vessel in Judaean glass would be 3.22 denarii, while that of an Alexandrian vessel would be slightly lower, at 2.76 denarii.¹⁰⁰⁷ For a heavier, 350 g vessel, the rate of return is more than double: 7.49 denarii for a Judaean glass object and 6.42 denarii for Alexandrian glass.

This huge disparity in profit per vessel between heavier and lighter vessels meant that workshops could be only half as productive each day and still generate more revenue by making heavier vessels. Heavier weights therefore could have allowed more complex and time consuming construction methods to still have been profitable. If a single glassblower could manufacture 100 simple, light vessels per day but only 50 complex, heavy vessels per day,¹⁰⁰⁸ the faster and lighter worker would generate 322 or 276 denarii of revenue for Judaean and

¹⁰⁰⁵ According to Stern, late Roman glass vessels typically ranged from 150-350g (Stern 1999b, 462), so these values are not arbitrary but rather reflect approximate low and high costs for a single vessel.

¹⁰⁰⁶ One Roman pound is roughly equivalent to 327 grams, so a 150g vessel weighs 0.46 Roman pounds and a 350g vessel weighs 1.07 Roman pounds.

¹⁰⁰⁷ The word ‘profit’ here is used to indicate the strict rate of return per pound of glass, in other words the difference between the investment cost of raw glass vs. the consumer price of that same glass in vessel form.

¹⁰⁰⁸ 100 vessels per day was the production rate in a workshop in Herat, Afghanistan during the 1970s, using a primitive furnace and minimal tools; this figure has been repeatedly used in calculations of productivity rates for individuals and workshops in antiquity (Erwitt 1979; Stern 1999b). Ethnographic study of glassworkers in Cairo indicated that larger and/or more complicated vessels take about 2.5 times as much labor time as small, simple vessels (Henein 1974, 38).

Alexandrian glass, respectively, for the workshop each day, while the glassworker who worked more slowly on heavier objects would generate 374.5 or 321 denarii of revenue per day. Both were profitable (again, these numbers cannot be considered absolute since they do not take account of costs other than the raw glass itself). However, the heavier vessels, even at half the production rate, still created a wider margin for the workshop to profit than did smaller, lighter, more quickly produced vessels. Therefore, the manufacture of lighter vessels does not seem to have been a sufficient incentive for glass workers to adopt glass blowing over sagging technologies, which produced heavier objects. The other implication of these calculations is that the less expensive Judaeian glass was always more profitable for the glass workshop than the more expensive, and presumably better quality, Alexandrian glass. Workshops may have been incentivized by the Price Edict to produce lower quality glasswares.

These calculations also have interesting implications for the market and sale of glass vessels from the consumer point of view. A lighter, thinner blown vessel would be cheaper, and therefore more accessible to the consumer than its heavier sagged counterpart. However, from the perspective of the workshop, there would be little incentive to lighten – and therefore reduce the price of – their product. Even if they sold more individual units, the glass worker would have to sell twice as many vessels if they were half the cost each in order to make the same profit, although flat costs such as workshop space and payment to workers would produce an economy of scale and somewhat lower the investment per object. If there were trends toward smaller, lighter, glass vessels, cost alone does not explain them, and additional explanations must be sought for these changing patterns in consumption and production.

Waste

In addition to decreasing the quantity of raw material in the finished vessel, the cost of raw glass which is lost as waste and cannot be reused or sold has been argued to be another determining factor in the adoption of new blowing technology. Henein, followed by Stern, calculated a loss of 40-45% of glass by weight during glass blowing in the primitive glass working operations at Cairo.¹⁰⁰⁹ Much of that loss – 20% – comes from the melting process itself, in which 1250 grams of solid glass yielded only 1000 grams of molten glass. Glass was also lost in the odd bits and pieces that adhere to tools, blowing pipes, and crucibles and cannot be fully reclaimed. That such loss occurred in all periods of antiquity is demonstrated by manufacturing debris with adhere glass found in workshop contexts including Rhodes, Beirut, Avenches, Sagalassos, Corinth, and Bet She'an, which must have been considered insufficiently valuable, impractical, or impossible to remelt.¹⁰¹⁰ However, the scale of this loss is difficult to quantify. Practices such as chunk blowing (discussed below) minimized both fuel use and glass waste and were likely in common practice by glass blowers. To my knowledge, no study to date quantifies glass waste in non-blowing technologies, but there is likely to have been less due to lower working temperatures which reduce adhesion of glass and the use of water-soluble separators in core-forming. Some glass could also have been lost in cold-working techniques, in which the glass was polished or ground while in a solid state, thereby producing a glass powder

¹⁰⁰⁹ Henein 1974, 20; Stern 1999b, 463.

¹⁰¹⁰ Rhodes, Kakoula property, third century BCE, workbench and tiles with glass (Triantafyllidis 2003b); Beirut, Second Tank Furnace Complex, c. 50 BCE-1 CE, plastered floors and assorted sandstone objects with glass (Henderson 2013, 216); Avenches, mid-first century CE, ceramic crucibles with glass (Amrein and Hochuli-Gysel 2000); Sagalassos, second half third century CE, ceramic blow pipe with glass at one end (Lauwers, Degryse, and Waelkens 2007a); Corinth, Gymnasium area, late fifth-early sixth century CE, moils and glass adhered to assorted clay fragments (Wiseman 1969 and Tassos Antonaras, personal communication, April 2013); Bet She'an: late Byzantine,moil of glass adhered to end of blowing rod (Gorin-Rosen 2000). Such objects as these are usually the primary evidence for the identification of glass workshops, although several well-known workshop contexts, including Jalame, have no such materials (G.D. Weinberg 1988). Perhaps they were better at recycling and reusing their materials?

which was not likely salvageable. However, cold-working seems to be much less common than was long assumed, particularly by the late Hellenistic period.¹⁰¹¹ As a fully developed technology, glass blowing may waste a greater percentage of raw material than other glass working methods, but the issue requires further study before final conclusions can be drawn.

Another variable is the degree to which glass was recycled in the ancient world, especially during the all-important first centuries BCE and CE when glass blowing was developed. Stern has argued that secondary producers did not know that glass could be fully remelted and reused until the early Flavian period; she considered the discovery of recyclability to have been “equally momentous” to glass blowing itself, possibly leading to the creation of secondary market for broken glass.¹⁰¹² The extent of recycling may also have influenced aesthetic preferences away from highly colored or polychrome glasswares and toward uncolored monochrome glasswares, which could more readily be remelted and recombined. But because pre-Roman glass workers almost certainly colored their own glass, manufactured glass blanks and monochrome and mosaic canes, and incorporated these intermediary products into final saleable materials, all of which require multiple cycles of heating and cooling, melting and annealing, the suggestion that they did not understand glass melting strains credulity. Scientific analysis of ancient glass in the last decade has detected compositionally mixed glasses which may indicate recycling beginning in the Hellenistic period.¹⁰¹³ Broken glass itself may have emerged as a commodity, collected for true recycling, around this time, given the increasing availability of broken glass in urban and domestic settings as glass became more commonly used

¹⁰¹¹ Lierke 2009.

¹⁰¹² Stern 1999b, 451. This conclusion is based on oblique references to remelting and recycling of glass by mid-first century Roman poets including Martial, Statius, and Juvenal, in contrast to Pliny’s apparent ignorance of this property a generation prior.

¹⁰¹³ Brems, Boyen, et al. 2012; Connolly et al. 2012; Rehren et al. 2015. Recycling habits have also been suggested as an explanation for the lack of glass from Punic period Carthage (Docter and Sonneveld 2009, 140), and the large quantity of glass workshop refuse from the workshop in Area J at Jerusalem may have been being collected for eventual remelting (Gorin-Rosen 2003, 386).

and less carefully curated. Recycling and the ability to reuse waste material may have been as important an innovation in glass making history as glass blowing for the affordability of glass vessels and objects.

Fuel Use and Glass Temperature

Another factor in the raw material investment related to glass blowing involves fuel and glass working temperatures. Unfortunately, little to nothing is known about the types of fuel ancient glass makers and workers used; they may have relied on wood, charcoal, or less expensive materials such as dung.¹⁰¹⁴ Minimizing fuel costs seems to have been a concern of glass workers in all periods, although most examinations of this variable are focused on glass making rather than glass working. Possibly, a new fuel source or lower fuel costs in the Hellenistic period helped cheapen the cost of raw glass.¹⁰¹⁵ Lack of available local fuel may have contributed to the decline of the glass factory at Jalame in the fourth century CE.¹⁰¹⁶ Henderson has suggested that the switch to plant ash from mineral natron as the source of alkali in the early Islamic period was partially motivated by the desire to lower melting temperatures of glass, which had been creeping upward as natron became more difficult to obtain.¹⁰¹⁷ A twelfth century CE treatise on glassmaking by Theophilus, a German Benedictine monk, indicated that the availability and cost of raw materials – sand and ash to make raw glass along with wood for fuel – were the primary constraints on the production of glass vessels, so medieval glass makers

¹⁰¹⁴ See Anderson and Ertug-Yaras 1996; McParland et al. 2009 on various fuel types used in premodern societies. Fischer suggested that wood (oak and pine, supplemented by olive and pistachio) was the primary fuel used in fourth-fifth century CE Galilee, with its overexploitation perhaps contributing to deforestation (Fischer 2001, 48). Charred olive pits, as were found in the glass workshop at Sepphoris, were also a likely fuel source (Fischer 2001, 90).

¹⁰¹⁵ As suggested by Henderson 2013, 212. See Chapter 5 for further discussion.

¹⁰¹⁶ G.D. Weinberg 1988, 19.

¹⁰¹⁷ Henderson 2002. More soda, or flux, in the glass batch lowers melting temperature and increases viscosity.

took advantage of preheating raw materials of ash and sand to minimize fuel use in a technique known as fritting.¹⁰¹⁸

Glass blowing is more fuel-intensive than any other glass shaping method performed in antiquity because it requires glass to be extremely hot, almost molten, at the top end of its working range. Stern has calculated, based on the composition of glass found at Jalame, that ancient soda-lime-silica glass could be blown between 970°-990°, compared to the 930°-965° required for drawing cane, 830°-875° for manufacturing blank discs, and mere 625°-830° for sagging (Figure 22).¹⁰¹⁹ But the highest temperature of all was that necessary to collect molten glass at the end of a blowing rod, as in modern glass blowing; this operation would have necessitated glass to be kept at temperatures over 1000°. For this reason, Stern has proposed that early glass blowers used a technique she called “chunk gathering” instead of hot gathering, in which a small “chunk” of raw glass was warmed to a temperature between 505°-590°, at which point it would adhere to the end of a heated ceramic or metal pipe.¹⁰²⁰ A Greek poem preserved on a papyrus from Oxyrhynchus, dating to the third or fourth century CE, describes this process: the glassworker “snatched from nearby a chunk of bright glass and placed it skillfully within the hollow furnace... The glass received the force of his breath and became swollen out around itself like a sphere before it.”¹⁰²¹ While this practice certainly saved on excess fuel used to heat raw glass, it did not change the fact that the chunk of glass still had to be heated further before it could be blown, as the Oxyrhynchus text clearly describes. Blowing was the most heat-intensive – and therefore fuel-intensive – glass working method in the ancient world.

¹⁰¹⁸ Smedley, Jackson, and Booth 1998. Frit is the grainy matter created after this first heating stage, which is subsequently ground and reheated to manufacture true glass. Note that this term is often misused to refer to other waste products, ground glass, or faience (Grose 1989, 30).

¹⁰¹⁹ Stern 1995, 34-36, fig. 17A-B; 2008a, 523-526, fig 21.2-3.

¹⁰²⁰ Stern 1995, 2012b.

¹⁰²¹ POxy 3536; Stern 1995, 36-37. See Appendix, Text 9 for full text and translation.

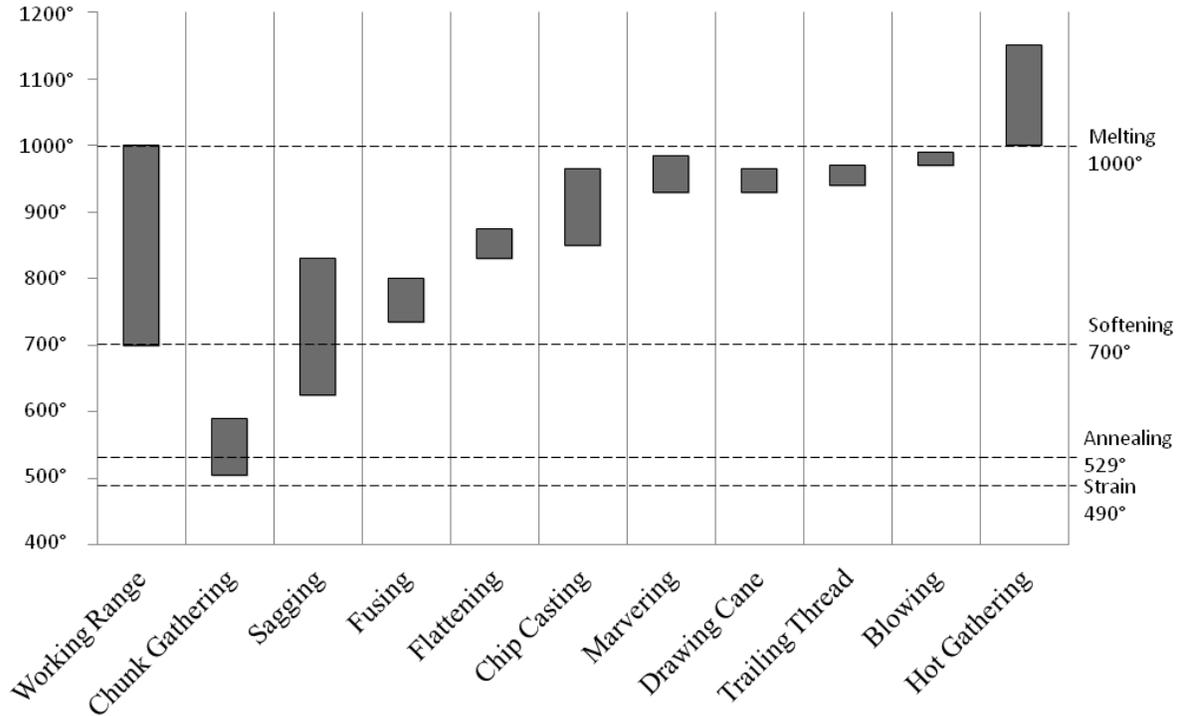


Figure 22. Estimated working temperatures of ancient glass (after Stern 2008, fig. 21.3)

Viscosity and working temperature of glass may have been a concern for early glass blowers. Scientific analyses performed on non-blown and blown glasswares of the early Roman period at both Beirut and Sepphoris have indicated that sagged glass had higher soda levels than blown glass.¹⁰²² Higher soda levels increased viscosity and lowered melting temperature; if the ability to blow glass at lower temperatures, and therefore use less fuel, was important to early glass blowers, it certainly was not prioritized in their selection of raw material. On the other

¹⁰²² At Sepphoris, tested non-blown glasses contain an average of 19% Na₂O (sodium oxide), while blown glasses of all periods average 14.5% (Fischer and McCray 1999). At Beirut, the difference is less pronounced, with all tested non-blown glass containing over 17% Na₂O, while half the tested blown vessels have soda levels between 16-17% (Thirion-Merle 2005; Henderson 2013, 244-245). The situation might be different in Asia Minor: Rehren et al have recently suggested that the glass suppliers to Pergamon did not use different glass recipes for molded vs. free-blown vessels (Rehren et al. 2015). However, close examination of their Figure 7 (a scatter plot comparing CaO and Na₂O levels between samples of the two groups) indicates a greater range of variation for free-blown than molded vessels. Free-blown objects range from 14-19% sodium oxide with a large cluster centered between 14-16%, while most mold-formed vessels contained between 16-18% sodium oxide.

hand, lower viscosity levels created more surface tension in the glass, which may have helped novice glass blowers avoid blow-outs in the bubble and create sharper shapes as they learned to work the glass in an entirely new way. The shift in the glass recipe may also indicate that the new technology of blowing in secondary workshops may have stimulated experimentation in primary workshops; glass makers may have been trying (and failing) to manufacture a glass more suitable for blowing. The variable quantities of soda and lack of a homogeneous recipe in this period may point to such experimentation, but much more comparative scientific analysis is required before any conclusive statement can be made.

Although the evidence is still scant and comparative study of non-blown and blown glasswares from the same site and time period minimal, these preliminary results suggest that glass batches may have been prepared specially for use either in sagging or blowing by primary glass makers. Alternatively, workers in secondary workshops may have tested raw glass batches individually and determined which of the available materials were more conducive to which technology; this experimental adaptive behavior may explain why there is no overall uniformity among different sites, as glass workers simply used what was available in the most appropriate manner. In such conditions, it would have taken time for a dedicated glass recipe suiting the particular needs of glass blowers to be developed and marketed with any consistency. That this “research and development” process was, in fact, taking place may be suggested by the high degree of variation in the composition of early blown compared to non-blown glass, which are much more internally consistent.¹⁰²³

¹⁰²³ For a summary of compositions of Hellenistic and early Roman glasses, see Henderson 2013. Henderson proposed an alternative interpretation of the evidence, speculating that the proportion of soda, and therefore viscosity and melting temperature, was more critical for casting and sagging than the blowing process (244).

Labor Efficiency

In addition to using less raw material per object, the other major adaptive advantage that blown glass is often said to have had over sagged glass is that it speeds up production time, allowing a single glass worker to make more vessels, faster. In the field of glass scholarship, this argument has often been couched in terms of efficiency of production which facilitated quicker and easier manufacture of vessels, and the mass-production made possible by glass blowing is contrasted with the labor intensive work of prior technologies.¹⁰²⁴ Although the notion of efficiency has seldom been explicitly defined, here I take it to mean that for each individual involved in the processes of production, more objects were produced *per capita* within a similar time frame. In other words, a ceramics workshop employing 10 people (including masters, apprentices, slaves, etc) and producing 100 vessels each day would be more efficient than 20 workers producing 100 vessels but less efficient than 10 people producing 200 vessels.

However, efficiency and labor saving in production technologies were not as universally valued in premodern, nonindustrial, noncapitalist societies as they are in the modern world. Moses Finley asserted that "the idea that efficiency, increased productivity, economic rationalism, and growth are good *per se* is very recent in human thinking," and went on to argue that other types of rationalistic thinking than economic ones prevailed in ancient societies.¹⁰²⁵ Although the legacy of Finley has been much debated among economic historians, and many of his suppositions, which largely privilege literary over archaeological testimonies, have not stood

¹⁰²⁴ E.g. Fischer and McCray 1999, 899; Hess and Wight 2005, ix; Stern 2008a, 535.

¹⁰²⁵ Finley 1965, 31. Similar arguments are repeated in Finley 1973. Finley used the Roman construction of the *Pont du Gard* in France as an example. He considered the construction as not economically necessary or efficient but rather a display of political power and valuing of recreational water use. Greene countered this argument, claiming that the aqueduct system in fact had practical application as an aid to food production and processing as well as in bathing and fountains (Greene 2000, 39).

the test of time,¹⁰²⁶ subsequent work both within and outside the Classical world has indicated that efficiency of production, especially in regard to minimizing labor, was not always a priority in workshop environments. Instead, the preservation of cultural systems and the protection of investment capital – which included both raw material and human skill – were favored in the decision to adopt technological change.

Carla Sinopoli criticized what she termed a ‘Fordist’ approach to preindustrial craft production, in which "output is increased through making production more efficient via investment in and expansion of production facilities and increased task differentiation" and the key to economic success was to maximize labor efficiency. As a case study, she examined the Vijayanagara empire of southern India, where increased demand increased numbers of workshops and producers, rather than the creation of larger workshops or adoption of technological innovations which would increase efficiency. Increased task differentiation and specialization also allowed workshops to generate more products without major changes in technology or social systems.¹⁰²⁷

Similarly, in a study of innovation in medieval and premodern Europe, S.R. Epstein demonstrated that craft guilds pursued strategies to protect labor and minimize technological changes that would devalue existing skill sets, which represented a large investment in the apprentice by the master. However, innovation did still occur, mostly in regard to saving capital and enhancing skills: he noted that while less than 20% of patents filed in England between 1660-1799 involved innovations that economized labor, those related to preserving capital and improving quality accounted for over 60%.¹⁰²⁸ While craft guilds and other private associations

¹⁰²⁶ For summaries of responses to Finley, see Morris 1999; Greene 2000.

¹⁰²⁷ Sinopoli 2003, 156-158.

¹⁰²⁸ Epstein 1998. Modern unions function similarly to protect the interests of the workforce and ensure their skills are economically valued.

operated quite differently economically and socially in the Hellenistic and Roman world, and knowledge was likely not as tightly controlled as it was in the medieval system, they did serve to represent and protect the financial and political interests of the group in wider networks.¹⁰²⁹

There is little evidence that technologies which prioritized efficiency were actively sought in the ancient Mediterranean world. The adoption of wheel-throwing in Middle and Late Bronze Age pottery workshops has been shown to be highly contingent: the technology was adopted as a response to cultural changes in society, such as increased political hierarchy in Minoan Crete or increasing specialization among potters in Syro-Palestine, rather than in response to any need or desire to increase scale of production.¹⁰³⁰ For the Greek and Roman periods too, efficiency as a *de facto* standard has also been invalidated as overly deterministic and not reflective of actual technologies in use for technological changes ranging from the catapult to lead glazed pottery.¹⁰³¹ Furthermore, labor rarely seems to have been a limiting factor in production capacity in the ancient world, so increasing individual productivity (i.e. efficiency) in and of itself could not have expanded an industry on the scale that we see in glass in the centuries after the introduction of blowing.¹⁰³² Based on comparative evidence, pre-industrial craft industries ‘scaled up’ not by increasing efficiency of individual workers or workshops, but by raising the numbers of specialists and production centers involved in production.¹⁰³³ It is

¹⁰²⁹ For guilds of the Roman period, see van Nijf 1997; Venticinque 2009. Guilds in the preceding Hellenistic era have been less well studied, but epigraphic and papyrological evidence from Delos and Egypt indicate that they likely operated similarly (Muhs 2001).

¹⁰³⁰ Carl Knappett has argued that palatial elites controlled wheel throwing technology in Minoan Crete in order to enhance their status through conspicuous display of finely made, eggshell thin pottery, while Valentine Roux generally emphasized the importance of individual agency and the degree of craft specialization in a population as the basis for adopting wheel-throwing technology (Knappett 1999; Roux 2003, 2013).

¹⁰³¹ Cuomo 2007; Greene 2007.

¹⁰³² On the supply of labor in the ancient world, see Finley 1973; Ekholm and Friedman 1982. Peter Acton, however, has made a common sense argument that labor savings were meaningful, even in a slave based economy, because slaves did cost money; saving labor time would therefore have been a Good Thing to the ancient business man and investor (Acton 2014, 24-25).

¹⁰³³ Greene 1986, 142-168; Sinopoli 2003; Acton 2014.

worth emphasizing again here that *all* kinds of glass manufacturing – not just blowing – expanded during the first centuries BCE and CE.

Despite these critiques, the notion of efficiency has persisted in the way scholars understand the adoption of glass blowing. Either glass blowing was somehow exceptional in the history of technology in general and the Classical world in particular (as Finley suggested¹⁰³⁴), or it has been undertheorized and misrepresented both in specialist and non-specialist literature. This is a shame, as the success of glass blowing technology, while not as swift, complete, or revolutionary as has been suggested, was remarkable in the history of technology and can provide much information about shifting political, economic, and social systems as well as artistic communication networks. In the next section, I will reevaluate the evidence for early glass blowing using culturally contingent models of innovation as process. In so doing, I seek to avoid resorting to technological determinism which portrays glass blowing as cheap, fast, and intrinsically good.

Anthropological Approaches to Technological Change

How and why technologies change has been a long-standing question in sociological and anthropological investigation. Beginning in the late 1970s and 1980s, anthropologists began to introduce evolutionary ideas to the study of cultures and cultural materials. In this neo-Darwinian view, technological change is structurally comparable to biological evolution, with each developmental stage leading to the next in a system of descent with modification. Just as in biological natural selection, the perceived positive benefits of a given technology would be

¹⁰³⁴ According to Finley, glass blowing – along with concrete, hollow bronze casting, the catapult, and a few other mechanical devices – was one of the “few new inventions” created by Greek and Roman civilization (Finley 1965, 29). Even Greene, usually more nuanced in his discussion of ancient technologies, seemed overawed by glass blowing: he described it as an innovation which transformed “a previously labor-intensive handicraft into an industry that could turn out unprecedented numbers of drinking, serving, and storage vessels” (Greene 2007, 655).

“selected for” and “outcompete” other technological options; like genetic mutations, the frequencies of appearance of new variations are affected by mutation, selection, and drift.¹⁰³⁵ The analogy could be extended further: all new ideas are the result of random mutations, and recombination of technological or stylistic elements leads eventually to new objects and forms. More recently, phylogenetics and cladistic trees have been explored as ways to trace evolutionary relationships and describe variation among types of material culture, with greater and lesser degrees of success.¹⁰³⁶ The evolutionary language of technological change has also been used more metaphorically. Shortland, for example, considered accidents and mistakes in production to be “hopeful monsters” born from the cultural equivalent of a genetic mutation: almost always a dead end, but every so often yielding a viable organism.¹⁰³⁷ While such approaches are still advocated by some archaeologists, particularly for cultures with strong traditional values and weak intercultural contact, the recognition that local social factors affect the formation and structure of such trees has led to the general consensus that cultural conditions matter, and “better” technologies are not always successful.¹⁰³⁸

By contrast, cultural approaches to technological change privilege local conditions, the role of individual agents, and social appropriateness over economic or technical advantage. Innovation did not just ‘happen’ because progress was an intrinsic good, but rather occurred in a

¹⁰³⁵ For summaries and discussion in favor of evolutionary approaches to technological change, see Neff 1992; Bentley and Shennan 2003; Kuhn 2004.

¹⁰³⁶ See Mace, Holden, and Shennan 2005; Tëmkin and Eldredge 2007.

¹⁰³⁷ Shortland 2004.

¹⁰³⁸ A modern example of an unsuccessful innovation which nevertheless exceeds its competition in all objective criteria is the Dvorak keyboard, which was designed in the early 1930s by August Dvorak to replace the QWERTY typewriter keyboard. QWERTY was introduced specifically to slow down typing back in the late 19th century when typewriters commonly jammed and most typists used a two-finger “hunt and peck” method. As the technology of typewriters improved, Dvorak saw a need to improve the interface and designed a new typewriter which positioned the most used letters on the middle row and most letter combinations to alternate left and right hands. The Dvorak keyboard has been proven to be much faster and typists have fewer instances of mental and physical tension. But once a typist has learned QWERTY, it takes about a week of dedicated time and training to adjust to Dvorak, and very few individuals or institutions were willing to make the change. The Dvorak keyboard example thus demonstrates that cultural inertia at an individual and corporate level can be prohibitive to the adoption of a new technology, no matter its objectively perceived benefits (Rogers 2003, 8-11).

complex web of social, political, cultural, and economic factors. Renfrew pioneered a social approach in his study of the invention and adoption of metalworking technology in the Balkans, concluding that “the decisive innovation in the development of a new commodity is generally social rather than technical.”¹⁰³⁹ For Renfrew, the salient question for early metallurgical technology was not why it was not embraced immediately but rather why it was developed and adopted at all, since the early products of metal working were less functional than extant forms of stone technology. Superior function as a tool therefore cannot account for the innovation of metallurgy. Historians have also long noted that technological advances can only be understood in the context of cultural systems.¹⁰⁴⁰ In the last two decades, socially and culturally contingent – rather than technological or evolutionary – studies of technological change and adoption have proliferated in scholarship.¹⁰⁴¹ As Monica Smith stated succinctly: “the mere availability of a known technology does not automatically result in its adoption.”¹⁰⁴² Two major themes have emerged from this body of literature: first, superior innovations do not necessarily replace extant traditions; second, technology is itself a cultural system, conditioned by social, political, and economic elements.

Toward a Process-Based Theory of Innovation

The prevailing model of technological innovation in modern and pre-modern societies, privileging as it does local cultural context, makes technology itself difficult to examine in a theoretically sophisticated manner, since the object of study (i.e. the technology) is neither the cause of itself nor a natural effect, but rather a byproduct of particular social, economic, and

¹⁰³⁹ Renfrew 1986, 146

¹⁰⁴⁰ White 1962.

¹⁰⁴¹ Dobres and Hoffman 1999; Knappett 1999; Roux 2013. The importance of culture and social interaction to the adoption of new technologies has also been picked up in popular media. See recently Gawande 2013.

¹⁰⁴² Smith 2015, 31.

political conditions. A technological discovery alone is considered insufficient to initiate technological adoption independent of cultural context. However, neither is cultural change alone sufficient to spark invention; hopeful monsters and Eureka moments occur spontaneously and organically without regard to the appropriateness of cultural conditions. The result is a natural chicken-or-egg conundrum, in which technological change and cultural context are both causes and effects; neither can adequately explain the other. As a result, models of technological change have come to draw explanations from other anthropological fields of inquiry, including identity,¹⁰⁴³ consumption and consumerism,¹⁰⁴⁴ and political economy,¹⁰⁴⁵ rather than examining the nature of technological change as a distinct phenomenon in and of itself.

While there is clear benefit to this contextual approach to technology, it has meant that innovation and technological progress as independent phenomena have been black-boxed: discarded from robust theoretical and analytical exploration due to lack of evidence or (perceived) relevance. The how and why of technological change has been considered less important than the fact of technological change. As a result, the conditions of the innovative process itself have been set aside in favor of an examination of the aftereffects of technological change.¹⁰⁴⁶ However, this black-box, in which processes and products are deliberately hidden away from view, can obscure many important stages which have a broad impact on the nature of the emergent technology itself. Prior skills, working knowledge, risk aversion of the innovator, the nature of the material itself, the availability of resources, consumer feedback, and many other factors can influence the ultimate form the technology has assumed by the time it emerges from the black-box of scholarly neglect.

¹⁰⁴³ Roux 2013; Walsh 2014.

¹⁰⁴⁴ Renfrew 1986; Dietler 2005.

¹⁰⁴⁵ Knappett 1999; Shortland 2004.

¹⁰⁴⁶ E.g. Cuomo 2007, 56.

One possible way out of this theoretical cul-de-sac is to adopt process based approaches to technological innovation. Process based approaches emphasize the multi-staged – but not evolutionary – nature of change. They differ from evolutionary and cultural-based models in that they are descriptive rather than proscriptive, analytical rather than explanatory. Examining individual steps of technological change helps differentiate later results from early motivations heuristically rather than teleologically; the end is not used to explain the beginning, but each stage of change is examined for its own sake. Michael Schiffer has advocated such a biographical approach to technology. He argued that recognition of processes of technological change is particularly important because “one cannot explain the occurrence of inventive activities by using models that account for the adoption of new technologies.”¹⁰⁴⁷ In other words, the act of invention itself cannot be explained by the final stage of the process, at which point the technology has been fully adopted and may or may not resemble its initial origins.

Similarly, studies of the diffusion of innovation have recognized innovation as a multi-staged process, with various factors affecting the rate of adoption. Partially drawing upon early anthropological work, innovation and diffusion studies became increasingly common in the mid-20th century and now represent a large interdisciplinary subfield bridging sociology, communication, and marketing.¹⁰⁴⁸ Several different models have been proposed to account for various phases of innovation, from the initial formation of a new idea through its development and dissemination to full adoption and eventual demise. However, many such studies have relied methodologically on data generated through informant interviews and complete datasets, so their application to an archaeological context has been limited.¹⁰⁴⁹

¹⁰⁴⁷ Schiffer 2008, 823.

¹⁰⁴⁸ On the influence of anthropology to sociological studies of diffusion, see Rogers 2003, 48-50.

¹⁰⁴⁹ Valente 1995; Rogers 2003; Valente 2005; see also Schiffer 2008. Whether modern models can be fruitfully applied to premodern (i.e. non-capitalist and non-industrial) social, economic, and production contexts at all is a

Frustrated by previous attempts of archaeologists to model technological change using quantitative methods, Spratt published a process model for the archaeological study of innovation using qualitative methods.¹⁰⁵⁰ He argued that innovation occurred in six stages: discovery, invention, development, investment, production and distribution, and obsolescence. While each of these stages may be difficult to isolate archaeologically, each must have occurred in some form. Spratt's model provides a structure and terminology for the often overlooked (or black-boxed) issues affecting the success of a technology between the initial 'Eureka' moment of discovery and its full-scale adoption. Rotroff has successfully applied Spratt's process model to the origins of mold-made ceramic bowls in the late third century BCE in order to account for the time lag between initial inspiration (discovery and invention) and deposition in large quantities in archaeological contexts.¹⁰⁵¹

An Innovation Model for the Origins of Glass Blowing

Spratt's stages of innovation (excluding obsolescence) may be constructively applied to the invention of glass blowing during the first centuries BCE and CE in order to examine the cognitive, structural, and cultural factors involved in the transformation of the glass industry from sagging to blowing.¹⁰⁵² Spratt's vocabulary helps isolate the key factors in the initial moment of discovery and its applied technical invention (Spratt's stages 1 and 2), the decision to further develop and invest in the technology (stages 3 and 4), and the final production and distribution of the new product to a consumer market (stage 5) (Figure 23). What were the circumstances of the earliest use of glass blowing? How did glass blowing assume the form it

separate matter. See, for example, Ekholm and Friedman 1982 for a discussion of capitalist systems in the ancient world, and Dietler 2010 and above, Chapter 4, for a defense of mass consumption practices in the ancient Mediterranean.

¹⁰⁵⁰ Spratt 1982, 1989.

¹⁰⁵¹ Rotroff 2006.

¹⁰⁵² The sixth stage, obsolescence, never occurred for glass blowing, which has remained a technology in use continuously since the first century BCE.

did? Why were Western producers and consumers so much more interested in blown glass than those in the Eastern Mediterranean? What other technologies did glass blowing help stimulate? If not due to concern over minimizing use of raw material, waste, and fuel or maximizing labor efficiency, why did glass blowing eventually outcompete the traditional modes of glass manufacture of core-forming and sagging? In the following section, I explore and offer possible answers to each of these questions, employing Spratt’s model and vocabulary.

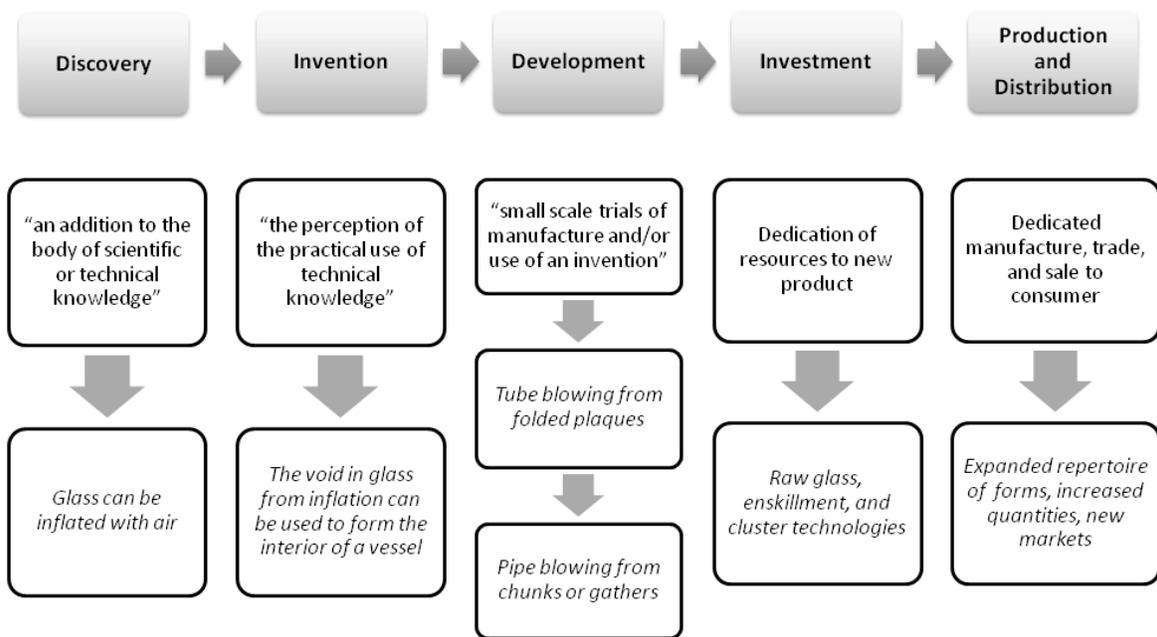


Figure 23. An innovation model for glass blowing

Discovery and Invention

Spratt defined discovery as “an addition to the body of technical or scientific knowledge” and invention as “the perception of the practical use of technical knowledge, either as a product

or technique,” in other words, the application of the discovered knowledge.¹⁰⁵³ The discovery and invention stages of innovation have often been conflated in ancient technology studies; in the case of glass blowing, it is quite possible that the *discovery* that glass can be inflated with air preceded the *invention* of applying that inflation to the interior of a vessel by years if not generations. Indeed, the discovery of inflation could have taken place by chance multiple times without any sense of use or application for this property of glass.¹⁰⁵⁴

The early evidence of the glass blowing workshop in Jerusalem can provide some insight into how the discovery of inflation may have occurred. As Stern has correctly observed, tube blowing more closely resembled bead manufacturing technologies than it did the open molding methods used to make vessels.¹⁰⁵⁵ The initial *chaîne opératoire* steps for both folded bead manufacture and tube blowing were to create flat glass plaques, then to fold the plaques into long hollow tubes. For beads, the tube was then sectioned into individual beads, possibly with the aid of a mold.¹⁰⁵⁶ In tube blowing, the rod was pinched closed at one end and inflated from the other, creating a small bubble at the pinched end which became the basis of the vessel’s body. If bead makers, not vessel makers, were the ones to initially discover glass blowing, an accidental discovery may not have necessarily led to the applied inventive idea of using the compressed air to create a large hollow void to make a vessel, since bead makers would have had no use for this concept. If this is the case, increased contact between bead makers and vessel makers in the

¹⁰⁵³ Spratt 1982, 80.

¹⁰⁵⁴ Smith expressed a very similar view, using almost the same language, in the 1950s: “it would doubtless be incorrect to speak of a ‘discovery’ [of glass blowing], for it seems improbable that no glassmaker would have noticed during the long preceding centuries of glass history that a tube could be introduced into a paraison and inflation effected. Probably the phenomenon had been repeatedly observed without anyone appreciating its possibilities, or to put it another way, the market was not ready for the innovation” (Smith 1957, 43-44). In other words, Smith thoughtfully noted that the technological discovery was not the essential element for the glass blowing revolution, but rather market readiness and the application of the discovery.

¹⁰⁵⁵ Stern 2008a, 536. The limited physical remains of workshops, colors of glass, required tools, and *chaîne opératoire* sequences suggest that open vessel sagging workshops and bead and small object workshops were geographically and conceptually isolated, and the craftsmen were not the same. Core-form vessel technologies do resemble bead working more closely, and likely had some overlap in production.

¹⁰⁵⁶ Spaer 2001, 30. See also Chapter 2.

early first century BCE may have precipitated the invention of glass blowing as vessel makers recognized the potential application of inflation to vessel formation.

Development

Development, according to Spratt, entailed “small scale trials of manufacture or use of an invention” as a proof of concept or model-making stage.¹⁰⁵⁷ Trial and error are used to develop workable, repeatable manufacturing processes; the desired end product may or may not be fully conceptualized at this stage. Tube blowing as practiced at Jerusalem was an experimental development, an attempt to apply the conceptual discovery of inflation to a particular product.¹⁰⁵⁸ This developmental technology turned out to be a failed innovation since it has not been attested outside first century BCE southern Syro-Palestine.¹⁰⁵⁹ Tube blowing was probably restricted by the inability to produce larger vessels due to weight, the waste of raw material used in the elongated tube, and the proximity of the glass worker to the heat. Accordingly, glassworkers must have experimented with other materials to extend their reach away from the hot glass. Dusenbery suggested that the thick and uniform necks of blown glass bottles found in the cemetery at Samothrace, dated to the final quarter of the first century BCE, were evidence for use of a metal pipe to extend the glass tube at the open end.¹⁰⁶⁰ This practice eventually led to chunk blowing, in which the glass blower picked up a warm, but not molten, piece of raw glass on the end of a ceramic or metal rod, further heated it to blowing temperature, then inflated and

¹⁰⁵⁷ Spratt 1982, 80

¹⁰⁵⁸ Liardet similarly concluded that the range of variation in the Jerusalem blown glass bottles indicates “a craft routine which was not yet established” (Liardet 2009, 188).

¹⁰⁵⁹ The single blown glass bottle from Ein Gedi may be tube blown; no details on its manufacturing technique or images of the vessel have been published (Avigad 1962, 180-183). Keller identified one tube blown vessel from Petra (Keller 2006 *non vivendi*; discussed in Stern 2008b).

¹⁰⁶⁰ Dusenbery 1998, 1060-1061.

shaped it.¹⁰⁶¹ This experimental development helped streamline the blowing process, eliminating the intermediate fabrication step of folded glass tubes.

The issue of waste would have been a primary concern during the initial innovative stages of experimentation, development, and training. Ethnoarchaeological studies of craft production have indicated that training of novices is often structured to minimize waste of raw material, especially when the material is expensive or non-recyclable. The early work of apprentices is often highly scaffolded by experienced craftsmen who provided support through detailed modeling of behaviors, verbal instructions, physical manipulation of the apprentice's body, and assistance in completing the more difficult steps.¹⁰⁶² Such scaffolding procedures are especially important in crafts which are dangerous or utilize expensive raw materials, both of which apply to glass working.¹⁰⁶³ Highly scaffolded learning environments are almost invisible archaeologically, since novices were not producing imperfect objects in workshop contexts which can later be identified and used to reconstruct skill and training mechanisms.¹⁰⁶⁴

The early evidence of glass blowing from Jerusalem may contain some failed experiments or trial pieces of glass workers trying to master the new technology: one complete bottle had collapsed in on itself after completion, and several deformed or poorly finished mouths of similar vessels may demonstrate that the early glass blowers were having difficulty with this stage of the process. Several blowing tubes, with one inflated bubble end and one broken end, also signal some early difficulties with the process.¹⁰⁶⁵ Such artifacts would result

¹⁰⁶¹ See recently Stern 2012b.

¹⁰⁶² Ferguson 2008. My personal experience with training in glass blowing was also highly scaffolded. According to my instructor, Annette Baron, physically guiding the movements of new students until they achieve competency at each task helps them both to learn more quickly in the long term and to be more successful in the short term, therefore encouraging repeat attempts (personal communication, January 2013).

¹⁰⁶³ For the physical hazards of glass blowing, see Fischer 2007.

¹⁰⁶⁴ For instance, a set of miniature sculptures found in the Athenian Agora are likely trial pieces produced by master sculptors as composition or modeling tests rather than apprentices' practice pieces (Stewart 2013).

¹⁰⁶⁵ Israeli and Katsnelson 2006, No. GL21-GL26.

from attempting to inflate glass which is not hot enough to properly blow; the outer surface would cool down quickly as it was exposed to air and lose its malleability. The early Jerusalem glass blower then may not have been conditioned to reheat the glass once the bubble had taken shape. These objects are unique indications of experimentation and an industry which had not yet reached maturity, absent experienced glass blowers who could scaffold training and prevent such misshapen objects which wasted the expensive raw material.¹⁰⁶⁶ This would have been the circumstance for all early, experimental glass blowing operations: without a large number of highly experienced ‘master’ craftsmen in the technology, scaffolding and other forms of training would have been incomplete, resulting in the waste of raw material as well as time: economic conditions which did not create a favorable environment for early glass blowing. Especially in the earliest stages, when the long term success of glass blowing was far from inevitable, blowing must have seemed like a more complicated, difficult, and wasteful technique to form vessels than the well-established molding, sagging, and especially core-forming industries (of which the earliest blown glass imitated in form and decorative technique).

Investment

In the investment stage, producers dedicated significant time and material resources to the new product and therefore away from the old product. It is this stage of technological innovation which prior scholarship on early glass blowing has especially overlooked, favoring instead the more archaeologically visible and familiar discovery/invention and production/distribution stages. Not all regions invested equally in the new technology, and,

¹⁰⁶⁶ The presence of wasters of the standard Grose Group A type grooved bowl (GL 226 and GL 227) in the workshop are a bit curious, since grooved bowls were a fully formed industry by this time. Possible explanations could be that Jerusalem workshop was a new establishment and all its workers were relatively inexperienced or that the cost of the raw material was so cheap that it was not worth recycling the failed objects. Remains of such objects were not recovered from either the Rhodes or the Beirut workshops.

although the evidence is scant, eastern and western workshops may have developed alternative strategies of development and investment in glass blowing.¹⁰⁶⁷ Unlike assemblages from the eastern Mediterranean, by the mid-first century CE glass in the western and northern Roman provinces was overwhelmingly free blown.¹⁰⁶⁸ For example, of seventy-six identifiable vessels from a deposit c. 40-45 CE near the Forum Basilica at Cosa, only seven were sagged, and three of these were likely residual.¹⁰⁶⁹ A deposit similarly dated to the second quarter of the first century CE from Pasaje Cobos in Tarragona yielded around 1500 vessel glass fragments, of which only 126 were sagged.¹⁰⁷⁰ In both these deposits, ribbed and linear cut bowls in the ‘Hellenistic’ tradition were absent, and only one or two mold-blown fragments were identified. At the Neronian period (c. 55-73 CE) fortress at Usk in southern Wales, over 2100 fragments of vessel glass were found, of which 94% were free blown, 5.5% non-blown (mostly pillar molded bowls), and 0.5% mold blown.¹⁰⁷¹

By contrast, non-blown glass vessels persisted in larger quantities relative to blown vessels longer in the eastern Mediterranean. A domestic deposit in Corinth, probably sealed by an earthquake in 22/23 CE, contained six glass cups, of which only one was blown.¹⁰⁷² Blown glass only appeared after 50 CE in the four early Roman deposits from Knossos published by Hayes; three deposits dated from 20 BCE-c. 50 CE cumulatively contained dozens of fragments

¹⁰⁶⁷ On the problem of dating and locating early technologies of glass blowing, see Lightfoot 2003. The issue is twofold. First, a majority of intact and well-published early Roman glassware is from unprovenanced museum and private collections, and not controlled archaeological excavations. Second, of the glass which is provenanced, the eastern examples are generally poorly dated within their archaeological contexts compared to the western examples, many of which are firmly dated by the foundation dates of military camps and *colonia* in the Roman provinces. See also above.

¹⁰⁶⁸ See also Prior 2015 for quantification of blown and non-blown glasses from the western Mediterranean sites of Usk, Nijmegen, Xanten Vetera, and Herculaneum and Pompeii. Prior emphasized the continuity of casting and sagging technology well into the first century CE, even at western sites.

¹⁰⁶⁹ Grose 1974.

¹⁰⁷⁰ Price 1987.

¹⁰⁷¹ Price 1993.

¹⁰⁷² Wright 1980, 163, No. 122-127.

of sagged and molded glass tablewares but no blown vessels.¹⁰⁷³ Similarly, at Gamla in northern Israel, destroyed and abandoned in 67 CE, glass objects generally were quite common but blown vessels only became integrated into daily life after about 50 CE.¹⁰⁷⁴

Glass blowing required much different bodily skills from the glass worker than sagging and molding, and producers who were already invested physically and skillfully in other glass forming techniques may have been unwilling or unable to adopt the new process. The Experience Curve, calculated for modern manufacturing, indicates that unit costs decline at a set and predictable rate each time the producer's experience doubles, meaning that experience in a skill is itself a large investment and one which was likely not abandoned easily.¹⁰⁷⁵ Mold-blowing, an alternative technology to free blowing which proliferated in the middle third of the first century CE, may represent a transitional technology, bridging the idea of inflation with the concept of forming glass within a restricted field. Mold pressing and mold blowing operate in similar conceptual frameworks – pressure, be it from air or the plunger, was applied from above and the glass expanded to fill the interior space of the mold, which gave it form and decoration.¹⁰⁷⁶ This forming process would have been more familiar to eastern Mediterranean glass workers who had been trained in sagging and molding workshops, and thus served as an intermediary stage of enskillment. Indeed, the earliest mold-blown vessels were small perfume bottles which have been found in Syro-Palestine and eastern Mediterranean, but not the west. Their successors, larger mold-blown tablewares, did reach the west in some quantities by the

¹⁰⁷³ Hayes 1971; Price 1992.

¹⁰⁷⁴ Jackson-Tal 2009.

¹⁰⁷⁵ Acton 2014, 30-31. Precise rates of declining costs are dependent on the specific business type. The Experience Curve is commonly used to demonstrate the efficiencies of specialization: if a worker only has to learn one or two specialized processes, they will accumulate cost-saving experience significantly faster than learning ten processes.

¹⁰⁷⁶ On the technologies of Roman mold-blown glass, see Stern 1995, 45-48.

30s-40s CE.¹⁰⁷⁷ The association with the coastal cities of Phoenicia is supported by the molded signatures of artists, most notably Ennion,¹⁰⁷⁸ and the popular iconography of palm trees and dates used in molds.¹⁰⁷⁹

In the western Mediterranean, several new technologies were developed during the first century CE which facilitated free blowing. Hughes, followed by Schiffer, noted that such “invention cascades” occur during the development of complex technological systems. Technologies with multiple elements, such as electrical power or later stage glass blowing, require multiple components to function effectively together in order for the technology to be successful. During development and investment, certain elements lagged or spurred new problems, creating bottlenecks in innovation. Efforts to correct or change the performance of a problematic element led to further invention; from this invention emerged further problems, stimulating more activity, and resulting in an invention cascade.¹⁰⁸⁰ Invention cascades as prerequisites for the successful development of a new technology also emphasize the potential pitfalls during each stage of the innovative process, countering diffusionist and teleological explanations of technological change: the initial discovery, so often emphasized as the most

¹⁰⁷⁷ The earliest dated fragment of mold-blown glass is a cup fragment with the name of Ennion from an Augustan (pre-14 CE) context at Magdalensberg, Austria (Stern 2000). This otherwise unprecedented early date, coupled with an unlikely location, strike me as erroneous; it seems more likely to me that the context was contaminated. On the dating, geographic distribution, and basic forms of mold blown glass, see Price 1991; Stern 1995; Lightfoot 2014.

¹⁰⁷⁸ Ennion is a Hellenized Semitic name. Although Ennion never signed with a toponym, he and his workshop have long been associated with Sidon based on the passage of Pliny discussed earlier in this chapter and the signatures of other glass blowers who do call themselves Sidonian. On Ennion, see Stern 1995, 69-72; Lightfoot 2014.

¹⁰⁷⁹ As discussed by Barag 1996. Barag has been the greatest defender of the role of the Phoenician cities in mold-blown glass production, despite push-back from scholars like Price and Stern who point to the western findspots of most Ennion and other pieces. Recently, however, Lightfoot has also indicated that Ennion’s entire career may have been in Sidon, and he never moved west (Lightfoot 2014).

¹⁰⁸⁰ Hughes 1983; Schiffer 2008. See also Rogers 2003, 161-164 on the tendency of technologies to emerge in clusters.

important stage of innovation, can in fact be the easiest to accomplish, while the development and investment stages may be much more complex and difficult.¹⁰⁸¹

The cascade technologies of glass blowing included blowing from a hollow iron or ceramic pipe instead of glass, a new furnace design with an enclosed heat chamber, use of the solid pontil rod to open and shape the rim of the vessel, and gathering molten glass from within the furnace chamber rather than in chunks. Altogether, this technological package enabled the glass blower to make larger and more intricate objects, conserve fuel, and streamline and speed up production. Most of these methods appeared first in the western Mediterranean, particularly northeastern Italy, over the course of the first century CE, where they became sufficiently familiar by the third quarter of the first century CE so as to appear on clay oil lamps found in Dalmatia and Ferrara.¹⁰⁸² Therefore, the greatest investment in glass blowing probably occurred in the western Mediterranean, not in the east, where established workshops continued to produce sagged cups and bowls until the end of the first century CE.

Production, Distribution, and Consumption

The stages of innovation before production and distribution are difficult to identify archaeologically since they typically occur on limited geographic scales, over shorter temporal durations, and leave few material remains, since most of the work is to develop *processes*, not material *products*.¹⁰⁸³ The initiation of the production and distribution phase, however, when experimentation has largely ended and the material began to be manufactured for consumers on a larger scale, is much more visible archaeologically. It was at this stage when objects with new forms, styles, and techniques began to appear regularly in both manufacturing and use contexts.

¹⁰⁸¹ Arnold 2007.

¹⁰⁸² For a summary of the experimental and archaeological evidence for the cluster technologies of early free blowing, see Stern 1999b, 444-450.

¹⁰⁸³ A point also made by Greene 2008b, 815.

Rotroff calculated about a 40 year gap between the initial stages of discovery and invention for ceramic mold-made bowls and the full scale commitment to their production and distribution as reflected in the archaeological record.¹⁰⁸⁴ This temporal lag was longer for glass blowing; even assuming that the Jerusalem evidence was the earliest experimental development of glass blowing in the third quarter of the first century BCE, blown glass vessels did not otherwise enter the archaeological record until the final quarter of the first century BCE, and only in larger quantities in the first half of the first century CE.¹⁰⁸⁵

The production and distribution stage of innovation constitute the period when a new product enters the commodity sphere, wherein it becomes ascribed with social potential and exchange value as a commodity.¹⁰⁸⁶ In the last decade or so, scholars have begun to examine the globalizing effects of consumption in both the modern and ancient worlds, as the local decisions to adopt a product have wide-ranging effects on trade and exchange, market economies, and mass production.¹⁰⁸⁷ The desire among elite Romans for eastern, and especially Greek, artistic luxury objects in this period is well established.¹⁰⁸⁸ This pattern of consumption indicates a perception that the Greek world was one of luxury and cosmopolitanism, and those who participated in it displayed similar sophistication. Glass vessels, therefore, would have been valued for their capacity to signal participation in Greek drinking customs. For a wealthy Roman, owning glass drinking vessels indicated both access to a rare or difficult to acquire

¹⁰⁸⁴ Rotroff 2006, 375.

¹⁰⁸⁵ As Rotroff observes, this lag time is significant for dating deposits containing these materials: the chances of a context containing blown glass to have been deposited in the first century BCE are quite slim, since finds are rare and the objects are clearly not being produced in large quantities. Contexts with considerable quantities of blown glass must be considered post-Augustan or later.

¹⁰⁸⁶ Appadurai 1986a; Kopytoff 1986.

¹⁰⁸⁷ Hodos 2008; Vives-Ferrándiz 2008; Hodos 2010a. See also Chapter 4.

¹⁰⁸⁸ E.g. Miles 2008. It was also in this period that the Roman poet Horace famously wrote “captive Greece took her captor [Rome] captive” (*Epistles* 2.1.156), referring to the inundation of Italy with Hellenic materials.

objects (possibly suggesting economic or political connections with the east) and knowledge about appropriate consumption habits.

Other advantages of glass drinking ware, in addition to its association with the Greek East, generally included inertness of the material, the aesthetics of transparency, and cleanliness and purity, which may especially have contributed to the early adoption of glass by Jewish consumers.¹⁰⁸⁹ Furthermore, the perception of glass as an elite luxury product, especially in the western Mediterranean, made it covetable for less wealthy consumers in Italy and the newly founded western Roman provinces, just as it was to aggrandizing middle elites in the second century eastern Mediterranean. However, all of these factors – from the association of glass with the Hellenic world to the aesthetic properties of glass to the consumer desire for elite emulation – apply to *all* glassware, not just blown glass.¹⁰⁹⁰ So why did free blown glass eventually out-compete other technologies in the Roman market?

The greatest advantage blown glass had over molded or sagged glass in the marketplace was the increased diversity of forms possible.¹⁰⁹¹ Large closed jars, jugs, and flasks made for holding and pouring liquids along with small cosmetic bottles were among the earliest blown glass types.¹⁰⁹² These serving and storage vessels completed the glassware drinking set, and allowed glass to fill new functional categories. Closed forms such as these were difficult and intensive to manufacture with sagging technologies, as the glass worker had to invert the sagged

¹⁰⁸⁹ Grossmark 2010. See also Chapter 5.

¹⁰⁹⁰ See Chapter 4.

¹⁰⁹¹ “The expansion of the range of forms is the expression of the productive potential of the technique” (Mollo and Framarin 2003, 16). Cool and Baxter also noted this new productive potential: “the discovery of blowing allowed the rapid production of a whole range of new forms, including the closed ones that had hitherto been difficult to produce” (Cool and Baxter 1999, 72).

¹⁰⁹² The old core-forming vessel industry, which had continued mostly uninterrupted since the Late Bronze Age, was already in its last gasps by the first half of the first century BCE and seems not to have continued at all into the Common Era (Grose 1989). Blown glass unguentaria do seem to have rapidly replaced core-form perfume vessels.

vessel while the glass was molten and use a tool to constrict the glass and form the neck.¹⁰⁹³ In blowing, however, the large void and narrow neck occur naturally as steps in the manufacturing process. Imitations of open sagged forms, including ribbed “zarte Rippenschalen” cups and linear cut “Hofheim” cups, comparable to contemporary ceramic shapes and Grose Groups C and D, were also common early blown vessels.¹⁰⁹⁴ The full implications of this observation for the significance of glass blowing technology are discussed below.

The X-Factor: Diffusion

Diffusion is defined as the spread of knowledge of a technology. Most discussions of ancient technology presume, implicitly or explicitly, that discovery, invention, development, and investment occurred together, and once the technology reached production stage, mobile craftsmen spread this packaged knowledge to different workshops and production centers which made only small adjustments in form or style to suit local conditions. However, Spratt noted that diffusion can occur at any stage of the innovation process, not just after the final stage of production; various constraints may help or hinder diffusion at each stage of development.¹⁰⁹⁵ Careful analysis and reconstruction of each stage and its geographic and chronological parameters can help identify when in the innovation process diffusion occurred. For glass blowing, diffusion from southern Syro-Palestine (possibly Judaea?) to Italy seems to have taken place sometime in the late first century BCE or early first century CE, between the stages of

¹⁰⁹³ On non-blown closed shapes, see Lierke 2009. A set of fusiform amphoriskoi, two mosaic and one monochrome, found at Palaiokastro in Thessaly, Greece demonstrates one of the ways Hellenistic glassworkers experimented, only moderately successfully, with making closed shapes based on existing glassforming technology. The vessel was made in two halves and small holes were drilled at the widest end. The ends could then be fit together to form the middle belly of the vessel and held together using metal rivets (Weinberg 1992, 24, No. 48-50).

¹⁰⁹⁴ See discussion in Weinberg and Stern 2009. Similarly, Jackson-Tal has written: “it is apparent that during the first half of the 1st century AD the consumer market of glass vessels demanded certain familiar shapes, and the glass artist provided these mostly by sagging and sometimes by blowing” (Jackson-Tal 2009, 160), and Lightfoot observed that the early blown glasses which imitated the forms of sagged bowls were created to fulfill Roman demand for these products (Lightfoot 1993b, 33).

¹⁰⁹⁵ Spratt 1982, 84.

development and investment. Evidence for this includes the Augustan period deposits of blown glass objects in Rome and the cluster technologies related especially to free blowing which seem to have developed in Italy over the course of the first century CE.¹⁰⁹⁶

The particular historical conditions of the second half of the first century BCE may shed some light on the manner by which glass blowing knowledge reached the west. The friendship and cultural exchange among the Roman emperor Augustus, his deputy Marcus Agrippa, and the client king of Judaea, Herod the Great, is well attested.¹⁰⁹⁷ Herod, who ruled an area with borders similar to those of modern Israel from 40-4 BCE, sponsored numerous construction projects in his territory. Three of them – a palace at Jericho, a temple (?) at Banias, and unidentified structures in Jerusalem – contained *opus reticulatum* walls, a form of concrete and masonry construction which originated in Italy in the mid-first century BCE but was otherwise unknown in the eastern Mediterranean at this early date. Netzer, followed by others, has hypothesized that Augustus sent a team of Italian builders to Herod sometime in the 20s or 10s BCE to enhance his prestige and assist with his building program.¹⁰⁹⁸ Italian wall painters may also have gone to Judaea to decorate Herod's palaces.¹⁰⁹⁹ Exchange of artists and craftsmen between palatial centers often took place in the ancient Mediterranean and Near Eastern world to signal goodwill, promote local artistic accomplishments, and keep skilled individuals employed.¹¹⁰⁰ The products of these exchanges – at least those most archaeologically visible –

¹⁰⁹⁶ Campus 1982 suggested that the glass industry in Rome began a generation earlier, during the late Republic (c. 80-50 BCE). His archaeological evidence – crates of mosaic and other non-blown glasses in the Museo Nazionale Romano which were found during the 19th century construction of embankments along the Tiber River – is unconvincing, but his suggestion that eastern glassworkers came to Rome in the retinues of the Roman statesmen like Pompey and Antony, as those rulers sought to model the behaviors of Hellenistic kings, is compelling. The means by which glassworkers from Palestine came to Rome, be it under Augustus or the earlier Roman *imperators*, would have been similar, but the date is impossible to pinpoint accurately with our current data.

¹⁰⁹⁷ Richardson 1999; Jacobson and Kokkinos 2008.

¹⁰⁹⁸ Netzer 2008, 56-57.

¹⁰⁹⁹ Rozenberg 2008.

¹¹⁰⁰ Zaccagnini 1983; Feldman 2006.

are luxury goods showcasing elaborate styles and innovative technologies. They are commonly associated with one particular cultural tradition and appear only in limited, usually palatial, contexts in foreign territories; “Minoan-style” frescos found at Tel Kabri, Israel, and Tel el-Dab’a, Egypt are an example of this form of artistic exchange.¹¹⁰¹ If Augustus sent masons and painters to Herod, Herod would have likely sent craftsmen to Augustus in Rome as well. What signature artistic tradition existed within his territory but nowhere else?¹¹⁰² The answer may well be glass blowing.¹¹⁰³

The fact that free-blown glasswares appeared as fully innovated products earlier in the west than mold-blown glasswares do in the east suggests that the western glass artists were more innovative at an earlier stage than their counterparts to the east. Why would this be? To answer this, I suggest again turning to the extant circumstances of glass manufacture in the late Hellenistic Mediterranean. Eastern glass workers had spent the last few hundred years perfecting core-forming, casting, and sagging technologies. They knew how to make small unguent bottles and wide drinking cups, and those products sold well in the market. By contrast, the western Mediterranean had no extant tradition of glass vessel manufacture in the first century BCE; all their glass was imported from the east.¹¹⁰⁴ With no prior infrastructural investment or encoded set of skills, entrepreneurial Italian craftsmen became early adopters who were unencumbered by past tradition and therefore may have been highly experimental. They could invest in glass

¹¹⁰¹ For an overview of the evidence, see Brysbaert 2008.

¹¹⁰² On the significance of Herod’s territory to glass production in the first century BCE, see Kahn 2014.

¹¹⁰³ The problem with this, of course, is that while blown glass objects do appear in the Houses of Augustus and Livia on the Palatine in the late first century BCE, they also are found in non-royal contexts like the military *colonia* at Cosa. Possibly Augustus’ careful cultivation of a non-kingly persona meant that he subverted the Near Eastern tradition of kingship and shared his Judaeian glass blowers. Also, unlike Third Style painting and *opus reticulatum*, glass blowing seems to have taken off in Italy, rather than being a limited enterprise – were glass blowers a permanent gift rather than short-term exchange?

¹¹⁰⁴ There may have been a core-form workshop in Sicily and Punic Carthage, and glass beads were made in continental Europe during the first millennium BCE (Feugère 1989b). An enigmatic vessel industry may have operated in Etruria from the eighth to sixth centuries, but seems to have collapsed well before the fourth/third century BCE and had no stylistic or technological effect on subsequent glassworking (Grose 1989, 81-82).

blowing technology because they did not have to sacrifice prior training, skill development, and physical infrastructure to do so; they happened to find themselves at the cutting edge of what would become a major Roman industry. Vessel glass manufacturers in the eastern Mediterranean began to lose their market share in the west around the second quarter of the first century CE. In response, they began their own sequence of development and investment based on the concept of inflation, even as they adhered to more familiar practices of vertical manufacture and use of molds in exterior shaping.

Early Blown Glass: A Luxury Object?

Conventional wisdom on early glass blowing has argued that the technology of inflation democratized the use of glass vessels, making them cheaper for mass production and consumption. When glass blowing began in the first century BCE, it was one of many technologies competing in an expanding market, all of which were moving toward simplified production processes and increasing scale of production. The first mass-produced glass tablewares, sagged grooved and ribbed bowls, continued to be manufactured and consumed widely in the Mediterranean world and especially Syro-Palestine long after glass blowing took hold in the west. From a Syro-Palestinian perspective however, the real revolution, in terms of increased scale of production and adoption of glass tablewares in domestic contexts, occurred when monochrome grooved bowls appeared in the late second century BCE. The availability of raw material and consumer desire for glass therefore stimulated the birth of the Roman glass blowing industry, rather than the serendipitous discovery of glass blowing causing glass to become a common product.

I suggest then that the earliest blown glasswares may well have been luxury goods rather than the common household wares they were to become by the end of the first century CE.

Small, featherweight unguentaria were perhaps considered enchantingly novel, almost miraculous in their delicacy, transparency (a first for perfume bottles), and small size.¹¹⁰⁵ Glass vessels, solely by their material, no longer signaled wealth and prestige as they had a century or two before, due to the inundation of the tableware market by relatively inexpensive and widely available sagged glass bowls. Early blown vessels may have restored aura and prestige to the material, at least into the early first century CE. The possibility that Herod sent glass blowers from Jerusalem to Augustus in Rome as a form of royal exchange further suggests the high prestige associated with early blowing as an elite technology.

Several other technologies of the ancient world once thought to have quotidian purpose now are considered to have been initially developed to enhance the status of elite classes. Renfrew proposed that early metal had a symbolic and aesthetic value and was used as ornamentation to attract or enhance prestige.¹¹⁰⁶ Similarly, very early pottery production in Upper Paleolithic Europe seems to have been a “prestige technology” rather than a practical one.¹¹⁰⁷ It was only later, after extended processes of innovation, including stable sources of raw material, establishment of skilled craftsmen, and intensification of production, that these prestige technologies became commonplace in the daily lives of large sectors of the population.

Likewise, blown glass did not originate *in order to* cheapen glass and facilitate mass production. Instead it may have first developed *in response to* the increased commoditization of glass vessels as a way to re-elevate the material for elite consumers. Martin has suggested that the power of luxury items, which is based on their rarity and expense, is stripped when they become accessible to those of lesser status. At that point, the elite will race to find new symbols

¹¹⁰⁵ Gell 1992; Bailey 2005.

¹¹⁰⁶ Renfrew 1986. The earliest iron objects found in the Caucasus were in fact personal adornment displayed in burials rather than tools for agriculture or other quotidian function (Erb-Satullo 2014).

¹¹⁰⁷ Rice 1999.

of privilege and status, driving swift changes in fashion and new forms of consumption.¹¹⁰⁸ The earliest contexts of blown glass in burials and elite residences (Augustan structures in Rome and the wealthy landowners and merchants of Pompeii) suggests that early blown objects were not the quotidian dining wares which sagged glass vessels had become, but rather something different. It was only after undergoing the full innovative and developmental process that the full capacity of the technology for lighter vessels in a fuller range of shapes, was realized.

The Push-Pull of Workshop Technology and Consumer Desire

Glass blowing did not succeed as a major technological innovation because it was cheaper, faster, and mass-producible, but rather emerged in response to a particular set of technological and cultural circumstances. The necessary preconditions for discovery and investment in new, unproved technologies had to exist within glass workshops, and the invented product had to be desirable in the consumer market. It was through this push-pull, iterative process that glass blowing gradually took shape as an industry over the course of the first centuries BCE and CE and primarily in the west.

A final way to summarize how this process took hold is to examine the variables of choice by both producers and consumers, given that multiple competing technologies and products of glass were available in the Late Hellenistic world. Schiffer described the process by which different communities make choices between competing technologies as ‘differential adoption.’ Differential adoption can be examined, and particular biases and choices determined, using a performance matrix, in which varying weights are assigned to each real or perceived performance characteristic of the new technology. The capacity of the technology to achieve adequate performance in each functional or ideological sphere is denoted with numerical values

¹¹⁰⁸ Martin 1994, 171. For a similar analysis from an more archaeological perspective, Pollock 1983

or presence/absence notation, and the results compared in tabular form. This approach is particularly appropriate for circumstances in which a new technology competed directly with an existing technology and the positive and negative attributes of each can be compared.¹¹⁰⁹ The weakness of this method is that it assumes perfect knowledge on behalf of both the ancient adopter, who may or may not have been aware of the different capacities of the technology at the moment of adoption, and the modern archaeologist, whose value systems and modern sensibilities may prejudice the ability to ascertain which characteristics are most relevant and what qualifies as adequate performance in each category. However, the performance matrix does help summarize the potential advantages and disadvantages of a technology, so long as it is not considered to be a literal method of decision making in the ancient mind.

¹¹⁰⁹ Schiffer 2005, 2008.

	Core-forming	Sagging	Mold-blowing	Free-blowing
Producer and Production Factors				
<i>Raw Materials and Tools</i>				
Fuel use low (low working temperatures)	+	+	-	-
Specific tools necessary (hollow ceramic or metal tubes, molds)	-	-	+	+
Can be made over open fire or non-dedicated furnace	+	+	-	-
Uses less raw glass as waste	+	+	-	-
Glasswares of appropriate viscosity and working temperature readily available on the market	+	+	-	-
<i>Economic Factors</i>				
Uses less raw glass in finished product	-	-	+	+
"Efficiency" - many vessels can be produced quickly by few glassworkers	-	+	?	+
<i>Skills and Training</i>				
Low technical skill and minimal training	-	+	-	-
Overlap with ceramic production in tools, skills	-	+	-	-
Overlap with metal production in tools, skills	-	-	?	-
Consumer and Consumption Factors				
<i>Function and use</i>				
Open tableware shapes (cups, bowls, plates)	-	+	-	+
Closed tableware shapes (jugs, flasks)	-	-	+	+
Closed personal shapes (unguentaria)	+	-	-	+
Large utility vessels (urns)	-	-	-	+
<i>Economic Factors</i>				
Inexpensive to purchase	-	+	-	?
<i>Social and Cultural Factors</i>				
Desirability of glass	+	+	+	+
Cosmopolitanism, appeal of eastern products	+	+	+	+
Transparency	-	+	+	+
Polychromy	+	-/+	-	+
"Enchanting" (size, shape, weight, detail)	-	-	+	+
Imitate metal vessels ¹¹¹⁰	-	?	+	-
Imitate stone vessels	-	?	-	+

Table 14. Performance matrix for glass technologies of the first century BCE to first century CE

¹¹¹⁰ According to Stern 2004, 112.

Table 14 is a summary matrix of the performance attributes of core-formed, sagged, mold-blown, and free-blown glasswares, based on characteristics and choices discussed earlier in this chapter. Each attribute of the technology has been assigned a positive or negative value based on its performance in that category either independently (e.g. availability of forms and functional categories) or relatively compared to the other technologies (e.g. fuel use and working temperatures). Theoretically, the more positive attributes possessed by a given technology, the more desirable the technology was and the community would be more likely adopt it. A potential disadvantage to this summary form of analysis is that certain assumptions must be made about economic and cultural values for what constitutes a better technology; for example, the minimization of waste during the production process is considered more desirable than more wasteful technologies, but cultural factors may have existed in which wasted raw material was perceived as less of an economic loss than a value-added social gain by enhancing the luxury status of the object. Still, the tabular form does aptly summarize the arguments and conclusions for a variety of factors in the decision by producers and consumers to adopt glass blowing technology.

The performance matrix makes clear that, based on the attributes so far identified, sagging was a more effective technology for producers, while consumers would have preferred free-blowing in all categories related to their consumption habits. The greatest benefit of free blowing at the consumer level was the diversity of shapes and forms of vessels which became available in the marketplace, with a second advantage possibly being the ‘enchanted’ novelty of both mold and free blown glasswares.

We can therefore, very cautiously, infer from the eventual success of blown glass and exclusion of workshop based economic factors that there was a strong desire among consumers

for glass vessels in a wide array of functional categories which were not met by the other technologies of glass manufacture. By the first half of the first century CE, glass blowing technology had placed a wider variety of glass wares, particularly those related to drinking and dining, in the consumer market than had ever been available before. Still, we should not mistake the final *effect* of blown glass objects in the marketplace with the initial *cause* of the early stages of discovery and invention in the workshop. The earliest blown glass objects from Jerusalem were small unguent bottles operating in the same functional field as their core-form counterparts, and other early blown glass objects are skeuomorphs of non-blown vessels, although they are more delicate and enchanting. Early glass blowers seem not to have set out deliberately to create a new technology which allowed them to expand their array of products or to manufacture those objects more cheaply and efficiently.

Glass in the Hellenistic World

Glass vessels at the dawn of the Roman period transcended the modern notional divide between “art” and “craft.” Like the production of artistic forms including sculpture, wall painting, and architecture, glass workers utilized specialized tools and materials which required specific training to use effectively, and their products instilled aesthetic wonder in the viewer based on their color, shape, and transparency. Yet, glass vessels increasingly entered the commodity stream over the course of the Hellenistic period and came to be used on a daily basis in a variety of household environments. Raw material was more widely available, and simplified production methods required less specialized craft knowledge.

Glass objects, and especially glass vessels, therefore can be investigated simultaneously as luxury art on par with sculpture, painting, and mosaics, and as a form of quotidian material culture which accompanied pottery, figurines, lamps, and other common domestic household

goods. Glass speaks to the high and the low, the sacred and the profane, the exceptional and the everyday. Residents of the Hellenistic world from Ibiza to Nimrud, from the Caucasus to Kush, toasted with glass vessels at drinking parties, applied perfumes and unguents from glass containers to their dead, sat on furniture decorated with vibrant glass inlays, and wore glass jewelry depicting personalized gods. Women spun wool with glass whorls, and men, women, and children played games with glass astragali. Glass was not so rare that it was not routinely discarded for later archaeologists to identify, nor was it so common that its ownership did not signify some degree of wealth and status.

The commentary of the Augustan-period Greek geographer Strabo on glass represents the final vestiges of the late Hellenistic glass industry as it transitioned into the Roman period, despite the more commonly held opinion that Strabo was heralding a new age.¹¹¹¹ The brief digression in which he discusses primary production, secondary production, new discoveries, and the cost of glass – all with the mentality of a geographer – is set within a more general discussion of the Phoenician cities and Ptolemais-Acco. Strabo first documented the presence of sand used in glassmaking found between Acco and Tyre (now identified as the Belus River), which was transported to Sidon for melting and casting (τὴν χωνεῖαν δέχεσθαι). He went on to describe to a “vitreous earth” (ὕαλιτιν γῆν) found in the vicinity of Alexandria – which may be a reference to mineral natron – before concluding with a discussion of discoveries (παρευρίσκεσθαι) at Rome, which have been interpreted as a reference to glass blowing. According to Grose, Strabo’s description of glass seems to reflect sagging or casting, not blowing, technologies because his

¹¹¹¹ E.g. Jennings 2004-2005, 289; De Carolis 2006, 75; Roberts et al. 2010, 20; Kahn 2014, 129. Grose has quite reasonably suggested that Strabo’s knowledge about the glass industry in the east likely came from his life in Alexandria in 25-19 and visit to Syria in 7, and therefore reflected the state of the glass industry in those regions at that time (Grose 1977), thereby marking the very end of the Hellenistic period and very beginning of direct Roman oversight in those regions.

vocabulary choices are metallurgical; if Strabo is aware of glassblowing, he says nothing directly or unequivocally about it.¹¹¹²

Strabo concluded with a comment on the low cost of glass drinking vessels in Rome, where a beaker or cup could be purchased for a single copper coin.¹¹¹³ This remark has often been taken to indicate the remarkably low cost of glass drinking cups *as a result of* the new discovery in Rome, in the last decades of the first century BCE and first decades CE. However, the most common glass objects throughout the Mediterranean at this time which might be described as cups or bowls (τρύβλιον) were the shallow ribbed and linear cut vessels of Grose Groups C-D. While a few examples of this type are blown, most were sagged over an convex mold.¹¹¹⁴ In the time of Strabo, blowing was used almost exclusively to produce closed shapes such as unguentaria and jugs, and the few early open blown forms clearly imitated their non-blown counterparts.¹¹¹⁵ Therefore, the language of Strabo himself and contemporary archaeological evidence make it highly unlikely that Strabo's vessel costing a copper coin was a blown vessel, meaning that blowing as a technology cannot have been responsible for the low cost of a glass drinking vessel in the late first century BCE. Instead, the remarkably inexpensive and common glass vessels which were making a splash in the Roman markets were the final culmination of a century and a half of innovation in productive capacity through investment in new materials and streamlining of production and consumer adoption into new quotidian

¹¹¹² Grose 1977, 14. Grose's interpretation was based on Strabo's use of the family of words χέω, χωνεία, χωνεύω to describe the glassmaking process at Sidon ("κομισθειῶσαν εἰς Σιδῶνα δὲ τὴν χωνείαν δέχεσθαι / is carried to Sidon and there melted and cast"). Herodotus, Diodorus Siculus, and Polybius all used similar vocabulary to discuss metallurgy, and the terms are commonly translated into English as "to pour" and "to melt."

¹¹¹³ Strabo *Geography* 16.2.25. For the full passage in Greek and translation, see Appendix, Text 3.

¹¹¹⁴ Blown ribbed bowls are called *zarte Rippenschalen* (the term is typically not translated) and do not predate the Tiberian period (c. 14 CE or after) (Haevernick 1967).

¹¹¹⁵ See above for relative numbers of blown and non-blown glass objects from late first century BCE-early first century CE deposits in Rome.

contexts of use. In short, Strabo was describing the new-to-Rome sensation of glass as a mass commodity.

The study of glass, as a physical raw material, a marker of status, an item of adornment, and a tableware, is a productive means by which to investigate the shifting dynamics of trade, wealth, and globalization during the late first millennium BCE. Both craftspeople and consumers dramatically increased their productive output and consumptive desire for glass products, a change which was not merely a matter of increased scale but also expressed in a wider diversity of manufacturing techniques, types of available product, and modes of use. The creativity and innovation displayed by Hellenistic glassmakers was almost ebullient, as a proliferation of new products, aesthetic choices, and range of styles appeared in what had been a highly conservative workshop and consumer environment.

In this dissertation, I have argued that there was a key change in the attitudes of individuals toward glass objects, and that the nature of these attitudes, as measured by the quantity of material, nature of use and deposition, the investment in worth (defined as costs of material, embedded skill of the craftsmen, and uniqueness of individual pieces) can be defined broadly as a shift from luxury goods to mass commodities. In emulating high elite or royal activities, lower elites, merchants, and landowners devalued the very thing they employed to demonstrate elite participation. For their part, producers met consumer demand by streamlining production practices, finding new sources of raw material, and simplifying consumer goods. True glass luxury products, such as polychrome mosaic cups, plates, and bottles (some even banded with gold), vividly colored plates, and feather-light blown glass bottles, still continued to reach elite markets, but over the course of the first century BCE, mass produced glasswares spread from Syro-Palestine and the eastern Mediterranean to new mass markets in Italy and

southern Gaul. A new technology – glass blowing – emerged about this time, resulting in the opening of new workshops and production centers in the western Mediterranean and allowing a greater variety of shapes to be manufactured with relatively low skill levels.

Work for the Future

This project has scratched the surface for a comprehensive social history of glass before, during, and after the Hellenistic period. It has also helped identify avenues where additional productive work can and should be conducted.

First, the inadequacy of much published data has been exposed. In order to conduct a robust quantitative study, we need more fully published data, with clear discussion regarding production technologies, quantities of material and estimated minimum vessel numbers, and representativeness of the published assemblage. Weights and thicknesses of well preserved objects and fragments could help determine production technologies as well as provide data for estimating how much glass was in circulation. More specifically, Hellenistic glass tablewares, especially the ubiquitous bowls, desperately need a more robust typology which accounts for forms, size, and decoration as well as chronology outside the parameters of a single site.¹¹¹⁶

Grose's Groups A-D began the classification process, but they do not adequately account for the range of variation in shape and decorative schemes which have since been identified. For glass tableware vessels before the mid-second century, no adequate framework for dating, describing, and identifying exists at all, with the result that such vessels are frequently misidentified, ignored, or summarily dismissed as insignificant. To better understand the second century glass

¹¹¹⁶ Typologies after Grose 1979 have been almost all site-specific rather than universal (Nenna 1999; Jennings 2004-2005; Foy 2005). The exception is Dussart 1998, a regional analysis of glass from Jordan and southern Syria. She divided sagged bowls into three groups (plain, grooved, and ribbed) with subdivisions based on vessel shape and rim angle. While the schema is a good start, it does not account for more elaborately decorated vessels (e.g. fluted, floral, or beaded bowls) nor any vessel prior to the second century BCE.

industry, we need to contextualize it with regards to the third century and to connect it to the Macedonian, Ionian, and Rhodian industries of the fourth. This process must begin with better typologies, in order to aid in the identification and dating of material with less than secure archaeological context.

Second, each geographic region could be mined more deeply for insight onto local responses to the increased availability of glass tableware and small objects in the local and global marketplace. As briefly discussed at the end of Chapter 3, certain populations in non-glass producing areas appear to have adopted glass tablewares more readily than others. The residents of Carthage, Morgantina, Pherai, and Elaiussa, for instance, all exhibited patterns of mass consumption of glass before their contemporaries in Berenice, Agrigento, Athens, or Ephesus. Are these local responses simply indices of access to imported trade goods, or are more deliberate actions related to identity and consumer choice involved? Close examination of particular historical and cultural contexts of these choices to become early adopters of domestic glasswares, such as are modeled in Chapter 5 for Syria and Palestine, could help illuminate local responses to the Hellenistic material *koine* in these regions as well.

Third and finally, the large quantity of data collected during the research of this dissertation can be selectively and cautiously mined for more quantitative forms of analysis. An early goal of my research was to advance the study of glass beyond a one-dimensional distribution map of finds,¹¹¹⁷ and instead to explore the connectivity and relationships between these communities in regards to the local choices made by consumers, participation in regional trade and communication networks, and awareness of non-local trends. While I make some overtures to these questions, my research made clear that more basic definitional and documentary work was necessary in order to adequately synthesize the contexts, quantities, and

¹¹¹⁷ Such as those produced by Nenna 1999 and Jackson-Tal 2004.

types of glass. As a result, my primary task became to evaluate my central thesis that glass was a much more common element of Hellenistic lifestyle and Hellenistic world, writ large, than had previously been identified. More deliberate quantitative and theoretical synthesis which takes advantage of this foundational grunt work is the clear next stage for this research. Multivariate statistical analysis, particularly correspondence analysis, is one promising method which has been successfully applied to compare Roman glass assemblages and make inferences about consumer choices.¹¹¹⁸ Another theoretical model, this time to explore multiscalar connectivity among glass producing and consuming sites, is network analysis, increasingly used for archaeological applications to evaluate relationships, trace innovations, and identify clusters.¹¹¹⁹

For too long, glass vessels have been studied in isolation: isolation from other glass objects which were part of the same system of production, isolation from other materials with which they shared the table, isolation from their historical as well as archaeological contexts. Just like any other form of material culture, glass objects can contribute vastly to our understanding of the ancient world through a careful examination of the objects themselves and the ways they were used and discarded in order to help archaeologists understand the means by which people ate and drank, adorned themselves, recreated, interacted with each other, displayed aspirational or proscribed identities, developed new technologies, made choices when shopping, participated in local and global fashions, increased economic activity, and generally went about their business in a historical context with expanding wealth, multicultural and cosmopolitan cities and towns, and trends toward homogenization of material culture. Glass is one of many windows into this world.

¹¹¹⁸ Cool and Baxter 1999. For general discussion of the use of correspondence analysis on archaeological datasets, see Baxter 1994, 100-139; Shennan 1997, 308-341; Baxter 2015, 133-147.

¹¹¹⁹ Brughmans 2010; Knappett 2013; Collar et al. 2015.

Appendix.

Select Ancient Sources on the Technology and Cost of Glass

This appendix includes a selection of ancient texts and translations of ancient documentary, literary, and historical sources of particular salience to the main text of the dissertation. They are ordered chronologically from earliest to latest. Loeb texts and translations are used whenever possible for sake of consistency and relative ease of access. For more complete lists of ancient texts about glass, see Trowbridge 1930 and Stern 2007.

Text 1. Athenaeus, *Deipnosophistai* 5.199f

...καὶ χρυσωματοθήκη χρυσῆ διάλιθος πηχῶν δέκα ὕψος, ἔχουσα βασμοὺς ἕξ, ἐν οἷς καὶ ζῶα τετραπάλαιστα ἐπιμελῶς πεποιημένα, πολλὰ τὸν ἀριθμὸν· καὶ κυλικεῖα δύο καὶ ὑάλινα διάχρυσα δύο· ἐγγυθῆκαι χρυσαῖ τετραπήχεις δύο, ἄλλαι ἐλάττους τρεῖς, ὑδρίαί δέκα, βωμὸς τρίπηχυσ, μαζονόμια εἴκοσι πέντε.¹¹²⁰

...Four large gold tripods followed in the procession; also a gold storage chest for gold vessels, which was set with precious stones and ten cubits tall, with six shelves on which were a large number of carefully executed figures four palms high. Also two cup-stands and two gilded vessels made of glass; two gold stands four cubits high, and three other smaller ones; ten water-jars; an altar three cubits long; and 25 platters.

¹¹²⁰ Olson, S. Douglas. *Athenaeus, The Learned Banqueters*. Loeb Classical Library 204. Harvard University Press.

Text 2. Cicero, Pro Rabirio Postumo 14.40

At permutata aliquando pecunia est; subductae naves Postumi Puteolis sunt; auditae visaeque merces fallaces quidem et fucosae, chartis et linteis et vitro delatis: quibus cum multae naves refertae fuissent.¹¹²¹

But in the end [Postumus] realized profits in commerce; ships belonging to him put in at Puteoli; merchandise of his was reported and seen there. It is true that the goods invoiced were only cheap showy articles of paper, linen, and glass; many ships were packed with these.

Text 3. Strabo, Geography, 16.2.25

Εἰθ' ἡ Πτολεμαῖς ἐστὶ μεγάλη πόλις ἣν Ἄκην ὠνόμαζον πρότερον, ἣ ἐχρῶντο ὀρμητηρίῳ πρὸς τὴν Αἴγυπτον οἱ Πέρσαι. μεταξὺ δὲ τῆς Ἄκης καὶ Τύρου θινώδης αἰγιαλός ἐστὶν ὁ φέρων τὴν ὑαλίτιν ἄμμον. ἐνταῦθα μὲν οὖν φασι μὴ χειῖσθαι, κομισθεῖσαν εἰς Σιδῶνα δὲ τὴν χωνεῖαν δέχεσθαι· τινὲς δὲ καὶ τοῖς Σιδωνίοις εἶναι τὴν ὑαλίτιν ψάμμον ἐπιτηδεῖαν εἰς χύσιν, οἱ δὲ πᾶσαν πανταχοῦ χειῖσθαί φασιν. ἤκουσα δ' ἐν τῇ Ἀλεξανδρείᾳ παρὰ τῶν ὑαλουργῶν εἶναί τινα καὶ κατ' Αἴγυπτον ὑαλίτιν γῆν, ἣς χωρὶς οὐχ οἷόν τε τὰς πολυχρόους καὶ πολυτελεῖς κατασκευὰς ἀποτελεσθῆναι, καθάπερ καὶ ἄλλοις ἄλλων μιγμάτων δεῖν· καὶ ἐν Ῥώμῃ δὲ πολλὰ παρευρίσκεσθαί φασι καὶ πρὸς τὰς χροᾶς καὶ πρὸς τὴν ῥαστώνην τῆς κατασκευῆς,

¹¹²¹ Watts, N.H. Cicero *Pro Rabirio Postumo*. Loeb Classical Library 252.

καθάπερ ἐπὶ τῶν κρυσταλλοφανῶν· ὅπου γε καὶ τρύβλιον χαλκοῦ πρίασθαι καὶ ἐκπωμάτιον ἔστιν.¹¹²²

Then one comes to Ptolemais, a large city, in earlier times named Acre; this city was used by the Persians as a base of operations against Egypt. Between Acre and Tyre is a sandy beach, which produces the sand used in making glass. Now the sand, it is said, is not fused here, but is carried to Sidon and there melted and cast. Some say that the Sidonians, among others, have the glass-sand that is adapted to fusing, though others say that any sand anywhere can be fused. I heard at Alexandria from the glassworkers that there was in Egypt a kind of vitreous earth without which many-colored and costly designs could not be executed, just as elsewhere different countries require different mixtures; and at Rome, also, it is said that many discoveries are made both for producing the colors and for facility in manufacture, as, for example, in the case of glassware, where one can buy a glass beaker or drinking-cup for a copper.

Text 4. Pliny, Natural History, 5.17

Hinc redeundum est ad oram atque Phoenicen ... iuxta Getta, Geba, rivus Pacida sive Belus, vitri fertiles harenas parvo litori miscens; ipse e palude Cendebia a radicibus Carmeli profluit. iuxta colonia Claudii Caesaris Ptolemais, quae quondam Acce, oppidum Ecdippa, promunturium Album. Tyros, quondam insula praealto mari dcc passibus divisa, nunc vero Alexandri oppugnantis operibus continens, olim partu clara urbibus genitis Lepti, Utica, et illa Romani imperii aemula terrarumque orbis avida Carthagine, etiam Gadibus extra orbem conditis: nunc omnis eius nobilitas conchylio atque purpura constat. circuitus xix est, in ora Palaetyro inclusa;

¹¹²² Jones, H. L. Strabo *Geography*. Loeb Classical Library 241.

oppidum ipsum xxii stadia optinet. inde Sarepta et Ornithon oppida et Sidon artifex vitri
Thebarumque Boeotiarum parens.¹¹²³

From this point we must go back to the coast and to Phoenicia... Next are Getta, Geba, and the river Pacida or Belus, which covers its narrow bank with sand of a kind used for making glass; the river itself flows out of the marsh of Cendebia at the foot of Mount Carmel. Close to this river is Ptolemais, a colony of the Emperor Claudius, formerly called Acce; and then the town of Ach-Zib, and the White Cape. Next Tyre, once an island separated from the mainland by a very deep sea-channel 700 yards wide, but now joined to it by the works constructed by Alexander when besieging the place, and formerly famous as the mother-city from which sprang the cities of Leptis, Utica and the great rival of Rome's empire in coveting world-sovereignty, Carthage, and also Cadiz, which she founded outside the confines of the world; but the entire renown of Tyre now consists in a shell-fish and a purple dye! The circumference of the city, including Old Tyre on the coast, measures 19 miles, the actual town covering 2½ miles. Next are Zarephath and Bird-town, and the mother-city of Thebes in Boeotia, Sidon, where glass is made.

Text 5. Pliny, Natural History, 36.65

Pars Syriae, quae Phoenice vocatur, finitima Iudaeae intra montis Carmeli radices paludem habet, quae vocatur Candebia. ex ea creditur nasci Belus amnis quinque milium passuum spatio in mare perfluens iuxta Ptolemaidem coloniam. lentus hic cursu, insaluber potu, sed caerimoniis sacer, limosus, vado profundus, non nisi refuso mari harenas fatetur; fluctibus enim volutatae nitescunt detritis sordibus. tunc et marino creduntur adstringi morsu, non prius utiles.

quingentorum est passuum non amplius litoris spatium, idque tantum multa per saecula gignendo

¹¹²³ Rackham, H. Pliny the Elder *Natural History*. Loeb Classical Library 352.

fuit vitro. fama est adpulsa nave mercatorum nitri, cum sparsi per litus epulas pararent nec esset cortinis attollendis lapidum occasio, glaebas nitri e nave subdidisse, quibus accensis, permixta harena litoris, tralucentes novi liquoris fluxisse rivos, et hanc fuisse originem vitri.

mox, ut est ingeniosa sollertia, non fuit contenta nitrum miscuisse; coeptus addi et magnes lapis, quoniam in se liquorem vitri quoque ut ferrum trahere creditur. simili modo et calculi splendentes multifariam coepti uri, dein conchae ac fossiles harenae. auctores sunt in India et crystallo fracta fieri et ob id nullum comparari Indico. levibus autem aridisque lignis coquitur addito Cyprio ac nitro, maxime Aegyptio. continuis fornacibus ut aes liquatur, massaeque fiunt colore pingui nigricantes. acies tanta est quacumque ut citra sensum ullum ad ossa consecet quidquid adflaverit corporis. ex massis rursus funditur in officinis tinguiturque, et aliud flatu figuratur, aliud torno teritur, aliud argenti modo caelatur, Sidone quondam his officinis nobili, siquidem etiam specula excogitaverat.

Haec fuit antiqua ratio vitri. iam vero et in Volturno amne Italiae harena alba nascens sex milium passuum litore inter Cumas atque Liternum, qua mollissima est, pila molave teritur. dein miscetur iii partibus nitri pondere vel mensura ac liquata in alias fornaces transfunditur. ibi fit massa quae vocatur hammonitrum atque haec recoquitur et fit vitrum purum ac massa vitri candidi. iam vero et per Gallias Hispaniasque simili modo harena temperatur. ferunt Tiberio principe excogitato vitri temperamento, ut flexile esset, totam officinam artificis eius abolitam ne aeris, argenti, auri metallis pretia detraherentur, eaque fama crebrior diu quam certior fuit. sed quid refert, Neronis principatu reperta vitri arte quae modicos calices duos quos appellabant petrotos HS VI venderet?¹¹²⁴

¹¹²⁴ Eichholz, D.E. Pliny the Elder *Natural History*. Loeb Classical Library 419.

That part of Syria which is known as Phoenicia and borders on Judaea contains a swamp called Candebia amid the lower slopes of Mount Carmel. This is supposed to be the source of the River Belus, which after traversing a distance of 5 miles flows into the sea near the colony of Ptolemais. Its current is sluggish and its waters are unwholesome to drink, although they are regarded as holy for ritual purposes. The river is muddy and flows in a deep channel, revealing its sands only when the tide ebbs. For it is not until they have been tossed by the waves and cleansed of impurities that they glisten. Moreover, it is only at that moment, when they are thought to be affected by the sharp, astringent properties of the brine, that they become fit for use. The beach stretches for not more than half a mile, and yet for many centuries the production of glass depended on this area alone. There is a story that once a ship belonging to some traders in natural soda put in here and that they scattered along the shore to prepare a meal. Since, however, no stones suitable for supporting their cauldrons were forthcoming, they rested them on lumps of soda from their cargo. When these became heated and were completely mingled with the sand on the beach a strange translucent liquid flowed forth in streams; and this, it is said, was the origin of glass.

Next, as was to be expected, Man's inventive skill was no longer content to mix only soda with the sand. He began to introduce the magnet stone also, since there is a belief that it attracts to itself molten glass no less than iron. Similarly, lustrous stones of many kinds came to be burnt with the melt and, then again, shells and quarry sand. Authorities state that in India glass is made also of broken rock-crystal and that for this reason no glass can compare with that of India. To resume, a fire of light, dry wood is used for preparing the melt, to which are added copper and soda, preferably Egyptian soda. Glass, like copper, is smelted in a series of furnaces, and dull black lumps are formed. Molten glass is everywhere so sharp that, before there is the least sensation, it cuts to the bone any part of the body on which it splutters. After being

reduced to lumps, the glass is again fused in the workshop and is tinted. Some of it is shaped by blowing, some machined on a lathe and some chased like silver. Sidon was once famous for its glassworks, since, apart from other achievements, glass mirrors were invented there.

This was the old method of producing glass. Now, however, in Italy too a white sand which forms in the River Volturno is found along 6 miles of the seashore between Cuma and Literno. Wherever it is softest, it is taken to be ground in a mortar or mill. Then it is mixed with three parts of soda, either by weight or by measure, and after being fused is taken in its molten state to other furnaces. There it forms a lump known in Greek as 'sand-soda.' This is again melted and forms pure glass, and is indeed a lump of clear colourless glass. Nowadays sand is similarly blended also in the Gallic and Spanish provinces. There is a story that in the reign of Tiberius there was invented a method of blending glass so as to render it flexible. The artist's workshop was completely destroyed for fear that the value of metals such as copper, silver and gold would otherwise be lowered. Such is the story, which, however, has for a long period been current through frequent repetition rather than authentic. But this is of little consequence, seeing that in Nero's principate there was discovered a technique of glass-making that resulted in two quite small cups of the kind then known as 'petroti' or 'stoneware' fetching a sum of 6000 sesterces.

Text 6. Petronius, Satyricon 50-51

Ignoscetis mihi, quod dixero: ego malo mihi vitrea, certe non olunt. Quod si non frangerentur, malletm mihi quam aurum; nunc autem vilia sunt. Fuit tamen faber qui fecit phialam vitream, quae non frangebatur. Admissus ergo Caesarem est cum suo munere, deinde fecit reporrigere Caesarem et illam in pavementum proiecit. Caesar non pote valdius quam expavit. At ille sustulit

phialam de terra; collisa erat tanquam vasum aeneum; deinde martiolum de sinu protulit et phialam otio belle correxit. Hoc facto putabat se solium Iovis tenere, utique postquam <Caesar> illi dixit: ‘Numquid alius scit hanc condituram vitreorum?’ vide modo. Postquam negavit, iussit illum Caesar decollari: quia enim, si scitum esset, aurum pro luto haberemus.¹¹²⁵

You will forgive me if I say that personally I prefer glass; glass at least does not smell. If it were not so breakable I should prefer it to gold; as it is, it is so cheap. But there was once a workman who made a glass cup that was unbreakable. So he was given an audience of the Emperor with his invention; he made Caesar give it back to him and then threw it on the floor. Caesar was as frightened as could be. But the man picked up his cup from the ground: it was dented like a bronze bowl; then he took a little hammer out of his pocket and made the cup quite sound again without any trouble. After doing this he thought he had himself seated on the throne of Jupiter, especially when Caesar said to him: ‘Does anyone else know how to blow glass like this?’ Just see what happened. He said not, and then Caesar had him beheaded. Why? Because if his invention were generally known we should treat gold like dirt.

Text 7. Josephus, The Jewish War II.10.2 (188-191)

Πόλις δ' ἐστὶν αὕτη τῆς Γαλιλαίας παράλιος κατὰ τὸ μέγα πεδῖον ἐκτισμένη, περιέχεται δὲ ὄρεσιν... τοῦ δ' ἄστεος ὅσον ἀπὸ δύο σταδίων ὁ καλούμενος Βήλεος ποταμὸς παραρρεῖ παντάπασιν ὀλίγος, παρ' ᾧ τὸ Μέμνονος μνημεῖον ἐστὶν ἔχον ἐγγὺς αὐτοῦ τόπον ἑκατονταπήχη θαύματος ἄξιον· κυκλοτερῆς μὲν γάρ ἐστιν καὶ

¹¹²⁵ Heseltine, M. and Rouse, W.H.D., revised by E.H. Warmington Petronius *Satyricon*. Loeb Classical Library 15. See also Stern 2007, text 3.

κοῖλος, ἀναδίδωσιν δὲ τὴν ὑελίνην ψάμμον, ἣν ὅταν ἐκκενώσῃ πολλὰ πλοῖα προσσχόντα, πάλιν ἀντιπληροῦται τὸ χωρίον, κατασυρόντων μὲν ὥσπερ ἐπίτηδες τότε τῶν ἀνέμων εἰς αὐτὸ τὴν ἕξωθεν ἀργὴν ψάμμον, τοῦ δὲ μετάλλου πᾶσαν εὐθέως μεταβάλλοντος εἰς ὑελον. θαυμασιώτερον [δὲ] τούτου μοι δοκεῖ τὸ τὴν ὑπερχυθεῖσαν ὑελον ἐκ τοῦ τόπου πάλιν ψάμμον γίνεσθαι εἰκαίαν. τὸ μὲν οὖν χωρίον τοῦτο τοιαύτην εἴληχεν φύσιν.¹¹²⁶

Ptolemais is a maritime town in Galilee, built at the entrance to the Great Plain, and encompassed with mountains... At a distance of about two furlongs from the town runs the diminutive river Belus; on its bank stands the tomb of Memnon, and close to it is a very remarkable region, a hundred cubits in extent. It consists of a circular basin which produces vitreous sand. Numerous boats put in to this spot and empty the basin of its sand, whereupon it is filled up again by the action of the winds, which, as if by design, drift into it the common sand outside, the latter being all promptly converted by this mine into vitreous matter. But the phenomenon which, to my mind, is even more remarkable, is that the excess particles of glass which overflow from the cavity become ordinary sand as before. Such are the curious properties of this spot.

Text 8. Tacitus, Histories 5.7

At Belus amnis Iudaico mari inlabitur, circa cuius os lectae harenae admixto nitro in vitrum excoquuntur. Modicum id litus et egerentibus inexhaustum.¹¹²⁷

¹¹²⁶ Thackeray, H. St. J. Josephus *The Jewish War*. Loeb Classical Library 203.

¹¹²⁷ Moore, Clifford H. and Jackson, John. Tacitus *Histories*. Loeb Classical Library 249.

The river Belus also empties into the Jewish Sea; around its mouth a kind of sand is gathered, which when mixed with soda is fused into glass. The beach is of moderate size, but it furnishes an inexhaustible supply.

Text 9. POxy 3536

[[τε]ύχων ἀνθρώποισι μ[ε. 6]...[
[πρ]ῶτα μ[έν] οὔν θέρμηνεν ἄκρην γλω[χίνα σιδήρου]
[ῆ]ρπασε δ' ἐγγύθι βῶλον ἀεργεννῆς [ύέλοιο]
[θῆ]κε δ' ἐπισταμένως κοίλης ἔντοσθε κ[αμίνου
5 [ῆ] δ' ἄρα γευσαμένη θαλεροῦ πυρὸς ηυτ[.]ρ[
[μ]αλθάχθη κρῦσταλλος ὑφ' Ἡφαίστοιο βο[λ]άων
[.] στ' ἀπὸ στομάτων διερῆν ἐνέπ[νεθς]εν ἀθμ[ήν]
[c.2]κυσ ἀνῆρ ὡς εἶ τε τέχνης πειρώ[με]ν[ο]ς αὐλ[οῦ]
[τ]ερπνοτάτης ὕελος δ' ἐπεδέξατο π[νεύματος ὄρμῆν]
10 [σ]φαιρηδὸν δὲ πάροισεν
ἐκυρτώθη πε[ρὶ αὐτόν]
ὄρμῆν δ' ἂν θείης ἐτέρην ἀνε
δέξ[ατ' ἀῦτμης]¹¹²⁸

¹¹²⁸ First published R.A. Coles 1983. *The Oxyrhynchus Papyri* 50: 58; discussed and reproduced in Stern 2007.

Fabricating for mankind

first he heated the very point [of the iron blowpipe]

then snatched from nearby a chunk of bright [glass]

and placed it skillfully within the hollow f[urnace].

5 As it tasted the heat of the fire

the crystal was softened by the strokes of Hephaistos

. . . he blew in from his mouth a quick breath

like a man essaying the art of the flute

most delightful (art). The glass received the force of his breath

10 and it became swollen out around itself like a sphere before it.

It would receive the divine breath

for like an oxherd his crook

swinging it (the pipe), he would breathe into . . . (end fragment)

Bibliography

- Acton, Peter Hampden. 2014. *Poiesis: Manufacturing in Classical Athens*. New York: Oxford University Press.
- Adam-Veleni, Polyxeni, and Despina Ignatiadou, eds. 2010. *Γυάλινος Κόσμος / Glass Cosmos*. Thessaloniki: Archaeological Museum of Thessaloniki.
- Adriani, Achille. 1967. Un vetro dorato alessandrino dal Caucaso. *Bulletin de la Société archéologique d'Alexandrie* 42: 105-127.
- Alcock, Susan E. 1993. *Graecia Capta: The Landscapes of Roman Greece*. Cambridge: Cambridge University Press.
- . 1994. Breaking Up the Hellenistic World: Survey and Society. *Classical Greece: Ancient Histories and Modern Archaeologies*. I. Morris ed. Cambridge: Cambridge University Press. Pp 171-190.
- Alcock, Susan E., Jennifer E. Gates, and Jane E. Rempel. 2003. Reading the Landscape: Survey Archaeology and the Hellenistic Oikoumene. *A Companion to the Hellenistic World*. A. Erskine ed. Oxford: Blackwell Publishing. Pp 354-372.
- Aldred, Cyril. 1980. *L'Égypte du crépuscule: de Tanis à Méroé, 1070 av. J.-C.-IVe siècle apr. J.-C.* Univers des formes 28. Paris: Gallimard.
- Alekseeva, Ekaterina M. 1975. *Ancient Beads of the Northern Black Sea Littoral, Vol 1 (in Russian)*. Archaeology of the USSR G1-12. Moscow.
- . 1978. *Ancient Beads of the Northern Black Sea Littoral, Vol 2 (in Russian)*. Archaeology of the USSR G1-12. Moscow.
- Aleshire, Sara B. 1989. *The Athenian Asklepieion: The people, their dedications, and the inventories*. Amsterdam: Gieben.
- Alexandria and Alexandrianism: Papers Delivered at a Symposium Organized by the J. Paul Getty Museum and the Getty Center of the History of Art and the Humanities and Held at the Museum April 22-25, 1993*. 1996. Malibu: J. Paul Getty Museum.
- Alfonsi, H., and P. Gandolfo. 1997. L'épave Sanguinaires A. *Cahiers d'Archéologie Subaquatique* 13: 35-74.
- Amrein, Heidi, and Anne Hochuli-Gysel. 2000. Le soufflage du verre. Attestations de la technique à Avenches (Suisse) et à Saintes (France) au Ier siècle ap.J.C. *Annales du 14e Congrès de l'Association internationale pour l'Histoire du Verre (Venice-Milan 1998)*. Lochem: International Association for the History of Glass. Pp 89-98.
- Andersen, Flemming Gorm. 1985. *Shiloh: the Danish excavations at Tall Sailun, Palestine, in 1926, 1929, 1932 and 1963*. Publications of the National Museum 23. Copenhagen: National Museum of Denmark.
- Anderson, Seona, and Fusün Ertug-Yaras. 1996. Fuel Fodder and Faeces: An Ethnographic and Botanical Study of Dung Fuel Use in Central Anatolia. *Environmental Archaeology* 1(1): 99-109.

- Anti, Carlo. 1931. Gli scavi della Missione archeologica italiana a Umm el Breighât (Tebtunis). *Aegyptus* 11(3): 389-391.
- Antonaras, Anastassios. 2009. Glass Vessels from Roman and Early Christian Thessaloniki and its Surroundings (1st Century BC-6th Century AD). *Annales du 17e Congrès de l'Association Internationale pour l'Histoire du Verre (Antwerp 2006)*. Brussels. Pp 74-79.
- Aperghis, G. G. 2004. *The Seleukid Royal Economy: The Finances and Financial Administration of the Seleukid Empire*. Cambridge: Cambridge University Press.
- . 2005. City Building and the Seleukid Royal Economy. *Making, Moving and Managing: the New World of Ancient Economies*. Z. Archibald, J. K. Davies and V. Gabrielsen eds. Oxford: Oxbow Books. Pp 27-43.
- . 2011. Antiochus IV and his Jewish Subjects: Political, Cultural and Religious Interaction. *Seleucid Dissolution: The Sinking of the Anchor*. K. Erickson and G. Ramsey eds. Philippika 50. Wiesbaden: Harrassowitz Verlag. Pp 67-81.
- Apicella, Catherine. 2003. Sidon à l'Époque Hellénistique: Quelques problèmes méconnus. *La Syrie hellénistique*. Topoi Supplément Supplement 4. Lyon: Topoi. Pp 125-147.
- Appadurai, Arjun. 1986a. Introduction: Commodities and the Politics of Value. *The Social Life of Things: Commodities in Cultural Perspective*. A. Appadurai ed. xiv, 329 p. Cambridge: Cambridge University Press. Pp 3-63.
- . 1986b. *The Social Life of Things: Commodities in Cultural Perspective*. xiv, 329 p. Cambridge: Cambridge University Press.
- Applebaum, Shimon. 1986. The Settlement Pattern of Western Samaria from Hellenistic to Byzantine Times: A Historical Commentary. *Landscape and Pattern: An Archaeological Survey of Samaria 800 B.C.E.-636 C.E.* BAR International Series 308. Oxford: Archaeopress. Pp 255-269.
- Archibald, Zosia H. 2011. Mobility and Innovation in Hellenistic Economies: The Causes and Consequences of Human Traffic. *The Economies of Hellenistic Societies, Third to First Centuries BC*. Z. Archibald ed. Oxford: Oxford University Press. Pp 42-65.
- . 2013a. *Ancient Economies of the Northern Aegean: Fifth to First Centuries BC*. Oxford: Oxford University Press.
- . 2013b. Innovation and the Transmission of Knowledge in Antiquity: A Look at Current Networking Models. *Regionalism and Globalism in Antiquity, Proceedings of the International Conference in Vancouver*. F. de Angelis ed. Colloquia Antiqua 7. Leuven: Peeters. Pp 21-38.
- Ariel, Donald T. 1990. The Glass. *Excavations at the City of David 1978-1985 Vol II*. Qedem 30. Jerusalem. Pp 149-166.
- Arnold, Dean E. 1981. A Model for the Identification of Non-Local Ceramic Distribution: A View from the Present. *Production and Distribution: A Ceramic Viewpoint*. H. Howard and E. L. Morris eds. British Archaeological Research International Series 120. Oxford: Archaeopress. Pp 31-44.
- Arnold, Jeanne E. 2007. Credit Where Credit is Due: The Chumash Ocean-Going Plank Canoe. *American Antiquity* 72: 196-209.
- Arthurs, Joshua. 2012. *Excavating Modernity: The Roman Past in Fascist Italy*. Ithaca: Cornell University Press.

- Arveiller-Dulong, Véronique, and Marie-Dominique Nenna. 2000. *Les Verres Antiques du Musée du Louvre I. Contenants à parfum en verre moulé sur noyau et vaisselle moulée (VIIe siècle avant J.-C. - Ier siècle après J.-C.)*. Paris: Réunion des musées nationaux.
- . 2011. *Les Verres Antiques du Musée du Louvre III. Parures, instruments et éléments d'incrustation*. Paris: Musée du Louvre.
- Atik, Şeniz. 1990. İç-kalıp tekniği ile yapılmış Anadolu kaynaklı cam kaplar (Anatolian core-formed glasses). *1st International Anatolian Glass Symposium, April 26th-27th 1988*. Istanbul. Pp 16-29.
- Aubert, Catherine. 2003. Phénomènes d'acculturation grecque en Phénicie: le cas de Beyrouth. *La Syrie hellénistique*. Topoi Supplément 4. Lyon: Topoi. Pp 111-124.
- Auth, Susan Handler. 2012. The Denderah Cache of Glass Inlays: A possible votive pectoral. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 109-113.
- Avigad, Nahman. 1962. The Expedition to the Judean Desert 1961. *Israel Exploration Journal* 12(3): 169-183.
- . 1972a. Excavations in the Jewish Quarter of the Old City of Jerusalem, 1971. *Israel Exploration Journal* 22: 193-200.
- . 1972b. Excavations in the Jewish Quarter of the Old City of Jerusalem, 1971 (Third Preliminary Report). *Israel Exploration Journal* 22(4): 193-200.
- . 1989. *The Herodian Quarter in Jerusalem (Wohl Archaeological Museum)*. Jerusalem: Keter.
- Avissar, M. 1987. The Medieval to Persian Periods: Architecture, Stratigraphy, and Finds. *Tell Qiri. A Village in the Jezreel Valley*. A. Ben-Tor ed. Qedem 34. Jerusalem: Israel Antiquities Authority. Pp 7-26.
- Avronidaki, Christina. 2012. The Glassware. *The Antikythera Shipwreck: the ship, the treasures, the mechanism*. N. Kaltsas, E. Vlachogianni and P. Bouyia eds. Athens: Hellenic Ministry of Culture and Tourism. Pp 132-145.
- Avshalom-Gorni, Dina. 1999. 'Akko, The Courthouse Parking Lot: Second Season, 1995. *Excavations and Surveys in Israel* 19: 12*-14*.
- Bacci Spigo, Giovanna Maria. 1984. Coppa vitrea ed oreficerie da sepoltura di età ellenistica e romana a Naxos. *Bollettino d'Arte* 6(25): 59-68.
- Bagnall, Roger S., and Paola Davoli. 2011. Archaeological Work on Hellenistic and Roman Egypt, 2000-2009. *American Journal of Archaeology* 115(1): 103-157.
- Bailey, Douglas W. 2005. *Prehistoric Figurines: Representation and corporeality in the Neolithic*. London: Routledge.
- Ballet, Pascale, Anna Południkiewicz, Khaled Zaza, and Hussein El-Chahat. 2012. *Tebtynis V: la céramique des époques hellénistique et impériale, campagnes 1988-1993; production consommation et réception dans le Fayoum méridional*. Cairo: Institut français d'archéologie orientale.
- Barag, Dan. 1967. The Glass Vessels. *Ashdod I. The First Season of Excavations, 1962*. M. Dothan and D. N. Freedman eds. Atiqot 7. Jerusalem. Pp 36-37.
- . 1968. An Unpublished Achaemenid Cut Glass Bowl from Nippur. *Journal of Glass Studies* 10: 17-20.

- . 1971. The Glass Vessels from Ashdod. *Ashdod Vols. II-III, The Second and Third Seasons of Excavations 1963, 1965, Sounding in 1967*. M. Dothan ed. 'Atiqot 9-10. Jerusalem. Pp 202-205.
- . 1985. *Catalogue of Western Asiatic Glass in the British Museum*. London: Trustees of the British Museum.
- . 1987a. The Glass. *Tell Qiri, a village in the Jezreel Valley: Report of the Archaeological Excavation 1975-1977: archaeological investigations in the valley of Jezreel, the Yoqne 'am regional project*. A. Ben-Tor ed. Qedem 24. Jerusalem: Hebrew University of Jerusalem. Pp 34-36, 48-49.
- . 1987b. Recent Important Epigraphic Discoveries Related to the History of Glassmaking in the Roman Period. *Annales du 10e Congrès de l'Association Internationale pour l'Histoire du Verre (Madrid 1985)*. Amsterdam. Pp 109-116.
- . 1988 (1970). Mesopotamian Core-Formed Glass Vessels (1500-500 B.C.). *Glass and Glassmaking in Ancient Mesopotamia: An edition of the cuneiform texts which contain instructions for glassmakers: with a catalogue of surviving objects*. Corning: Corning Museum of Glass Press. Pp 131-197.
- . 1990. The Prelude to Hellenistic Gold-glass. *Annales du 11e Congrès de l'Association Internationale pour l'Histoire du Verre (Basel 1988)*. Amsterdam. Pp 19-25.
- . 1991. The Contribution of Masada to the History of Early Roman Glass. *Roman Glass. Two Centuries of Art and Invention*. M. Newby and K. Painter eds. Occasional Papers of the Society of Antiquaries of London 13. London. Pp 137-140.
- . 1993. Glass Inlays in Phoenician Ivories, Glass and Stone Vessels. *Annales du 12e Congrès de l'Association Internationale pour l'Histoire du Verre (Vienna 1991)*. Amsterdam: Association Internationale pour l'Histoire du Verre. Pp 1-9.
- . 1996. Phoenicia and Mould-blowing in the Early Roman Period. *Annales du 13e Congrès de l'Association Internationale pour l'Histoire du Verre (Pays Bas 1995)*. Amsterdam. Pp 77-92.
- . 2005. Alexandrian and Judaeon Glass in the Price Edict of Diocletian. *Journal of Glass Studies* 47: 184-186.
- . 2014. Appendix D. The Glass Vessels from Gezer. *Gezer VI: the objects from Phases I and II (1964-1974)*. G. H. Gilmour ed. 10. Winona Lake, IN: Eisenbrauns. Pp 251-257.
- Baratte, F. 1989. La Verrerie dans l'Afrique romaine: Etat des questions. *Kölner Jahrbuch für Vor- und Frühgeschichte* 22: 141-149.
- Barber, Elizabeth Wayland. 1994. *Women's Work: The first 20,000 years. Women, cloth, and society in early times*. New York: WW Norton.
- Barrett, Caitlin E. 2011. *Egyptianizing Figurines from Delos: A Study in Hellenistic Religion*. Leiden: Brill.
- Bass, George F. 1984. The Nature of the Serçe Limani Glass. *Journal of Glass Studies* 26: 64-69.
- . 1986. A Bronze Age Shipwreck at Ulu Burun (Kaş): 1984 Season. *American Journal of Archaeology* 90: 269-296.
- Baudrillard, Jean. 1998. *The Consumer Society: myths and structures*. Societe de consommation. English x, 208 p. London: Sage.
- Baxter, Michael J. 1994. *Exploratory Multivariate Analysis in Archaeology*. Edinburgh: Edinburgh University PPress.

- . 2015. *Notes on Quantitative Archaeology and R* 2015 [accessed June 26 2015]. [https://www.academia.edu/12545743/Notes on Quantitative Archaeology and R](https://www.academia.edu/12545743/Notes_on_Quantitative_Archaeology_and_R).
- Begley, Vimala. 1983. Arikamedu Reconsidered. *American Journal of Archaeology* 87(4): 461-481.
- Ben-Tor, Amnon. 1993. Qashish, Tel. *New Encyclopedia of Archaeological Excavations in the Holy Land*. E. Stern ed. Jerusalem: Israel Exploration Society
- Bentley, R. Alexander, and Stephen J. Shennan. 2003. Cultural Transmission and Stochastic Network Growth. *American Antiquity* 68(3): 459-485.
- Berg, Maxine. 2004. In Pursuit of Luxury: Global History and British Consumer Goods in the Eighteenth Century. *Past & Present* (182): 85-142.
- . 2012. Luxury, the Luxury Trades, and the Roots of Industrial Growth. *The Oxford handbook of the history of consumption*. F. Trentmann ed. Oxford: Oxford University Press. Pp 173-191.
- Berlin, Andrea M. 1997a. Between Large Forces: Palestine in the Hellenistic Period. *The Biblical Archaeologist* 60(1): 2-51.
- . 1997b. From Monarchy to Markets: The Phoenicians in Hellenistic Palestine. *Bulletin of the American Schools of Oriental Research* (306): 75-88.
- . 1997c. The Pottery from the Northwest and North Areas. *Ancient Naukratis: Excavations at a Greek Emporium in Egypt, Part I: The excavations at Kom Ge'if*. A. Leonard, Jr. ed. Annual of the American Schools of Oriental Research 54. Pp 136-289.
- . 2001. Naukratis-Kom Hadid: A ceramic typology for Hellenistic Lower Egypt. *Ancient Naukratis: Excavations at a Greek Emporium in Egypt, Part II: The excavations at Kom Hadid*. A. Leonard, Jr. ed. Annual of the American Schools of Oriental Research 55. Pp 26-163.
- . 2005. Jewish Life before the Revolt: the archaeological evidence. *Journal for the Study of Judaism* 36(4): 417-470.
- . 2006. *Gamla I: The Pottery of the Second Temple Period*. IAA Reports 29. Jerusalem: Israel Antiquities Authority.
- Berlin, Andrea M., and Sharon C. Herbert. 2012. Excavating Tel Kedesh. *Archaeology* 65(3): 24-29.
- . 2013. Tel Kedesh. *Oxford Encyclopedia of the Bible and Archaeology*, edited by D. Master. Oxford: Oxford University Press. Pp 373-381.
- Berlin, Andrea M., Sharon C. Herbert, and Peter Stone. 2014. Dining in State: The Table Wares from the Persian-Hellenistic Administrative Building at Kedesh. *Pottery, Peoples and Places: Study and interpretation of Late Hellenistic Pottery*. P. G. Bilde and M. L. Lawall eds. Black Sea Studies 16. Aarhus: Aarhus University Press. Pp 307-321.
- Berry, Christopher J. 1994. *The Idea of Luxury: A conceptual and historical investigation*. Cambridge: Cambridge University Press.
- Bhabha, Homi K. 1994. *The Location of Culture*. London: Routledge.
- Bianchi, Robert Steven, Birgit Schlick-Nolte, G. Max Bernheimer, and Dan Barag. 2002. *Reflections on Ancient Glass from the Borowski Collection: Bible Lands Museum Jerusalem*. Mainz: Philip von Zabern.
- Bickerman, E.J. 1947. *The Maccabees: an Account of their History from the Beginnings to the Fall of the House of the Hasmoneans*. New York: Schocken Books.

- Bintliff, John. 2013. The Hellenistic to Roman Mediterranean: A Proto-capitalist revolution? *Economic Archaeology: From structure to performance in European Archaeology*. T. Kerig and A. Zimmerman eds. Bonn: Habelt. Pp 285-292.
- Boardman, John. 1988. Trade in Greek Decorated Pottery. *Oxford Journal of Archaeology* 7(1): 27-33.
- Bonomi, Simonetta. 1996. *Vetri antichi del Museo archeologico nazionale di Adria*. Corpus delle collezioni archeologiche del vetro nel Veneto 2. Murano: Giunta regionale del Veneto.
- Boschetti, Cristina, Cristina Leonelli, Michele Macchiarola, Paolo Veronesi, Anna Corradi, and Cinzia Sada. 2008. Early Evidences of Vitreous Materials in Roman Mosaics from Italy: An archaeological and archaeometric integrated study. *Journal of Cultural Heritage Supplement* 9: e21-e26.
- Bouzek, Jan, and Jiri Marsa. 1971. A Hellenistic Glass Skyphos from Cyme in Aeolis. *Listy filologické / Folia philologica* 94(2): 107-110.
- Breccia, Evaristo. 1912. *La necropoli di Sciatbi*. Musée des antiquités égyptiennes. Catalogue général 63-64. Cairo: Institut français d'archéologie orientale.
- Brems, D., M. Ganio, K. Latruwe, L. Balcaen, M. Carremans, D. Gimeno, A. Silvestri, F. Vanhaecke, P. Muchez, and P. Degryse. 2013. Isotopes on the Beach, Part 1: Strontium Isotope Ratios as a Provenance Indicator for Lime Raw Materials Used in Roman Glass-Making. *Archaeometry* 55(2): 214-234.
- Brems, Dieter, Sara Boyen, Monica Ganio, Patrick Degryse, and Marc Walton. 2012. Mediterranean Sand Deposits as a Raw Material for Glass Production in Antiquity. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 120-127.
- Brems, Dieter, Patrick Degryse, Monica Ganio, and Sara Boyen. 2012. The Production of Roman Glass with Western Mediterranean Sand Raw Materials: Preliminary Results. *Glass Technology: European Journal of Glass Science & Technology Part A* 53(4): 129-138.
- Brems, Dieter, Patrick Degryse, Femke Hasendoncks, Domingo Gimeno, Alberta Silvestri, Elvira Vassilieva, Steven Luypaers, and Johan Honings. 2012. Western Mediterranean Sand Deposits as a Raw Material for Roman Glass Production. *Journal of Archaeological Science* 39(9): 2897-2907.
- Bresciani, Edda. 1996. Plinio, il natron e le navi del Mediterraneo. *Alle soglie della classicità: il Mediterraneo tra tradizione e innovazione, Studi in onore di Sabatino Moscati*. E. Acquaro ed. Pisa: Istiuti editoriali e poligrafici internazionali. Pp 59-61.
- Bresson, Alain. 2005. Coinage and Money Supply in the Hellenistic Age. *Making, Moving and Managing: The New World of Ancient Economies 323-31 B.C.* Z. Archibald, J. K. Davies and V. Gabrielsen eds. Oxford: Oxbow. Pp 44-72.
- Briant, Pierre, and Raymond Descat. 1998. Un registre douanier de la satrapie d'Égypte à l'époque achéménide. *Le commerce en Égypte ancienne*. N.-C. Grimal and B. Menu eds. Cairo: Institut français d'archéologie orientale. Pp 59-104.
- Brill, Robert H. 1988. Scientific Investigations of the Jalame Glass and Related Finds. *Excavations at Jalame: site of a glass factory in late Roman Palestine*. Columbia: University of Missouri Press. Pp 257-294.
- Brill, Robert H. 1967. A Great Glass Slab from Ancient Galilee. *Archaeology* 20: 88-95.

- . 1994. Laboratory Studies of Some Glasses from Vergina. *Journal of Glass Studies* 36: 11-23.
- Brown, Frank E. 1980. *Cosa: The Making of a Roman Town*. Ann Arbor: University of Michigan.
- Brown, Roxanna M. 2009. *The Ming Gap and Shipwreck Ceramics in Southeast Asia: Towards a Chronology of Thai Trade Ware*. Bangkok: Siam Society.
- Brown, T. Burton. 1948. Hellenistic Burials from Cyrenaica. *The Journal of Hellenic Studies* 68: 148-152.
- Brughmans, Tom. 2010. Connecting the Dots: Towards Archaeological Network Analysis. *Oxford Journal of Archaeology* 29(3): 277-303.
- Brysaert, Ann. 2008. *The Power of Technology in the Bronze Age Eastern Mediterranean*. Monographs in Mediterranean Archaeology 12. London: Equinox.
- Buechner, Thomas S. 1960. The Glass from Tarrha. *Hesperia* 29(1): 109-117.
- Bugh, Glenn Richard. 2006. Hellenistic Military Developments. *The Cambridge Companion to the Hellenistic World*. G. R. Bugh ed. Cambridge: Cambridge University Press. Pp 265-294.
- Burdajawicz, Mariusz. 2009a. The Glass. *Excavations of the Hellenistic site in Kibbutz Sha'ar-Ha'Amakim (Gaba), 1984-1998: final report*. Haifa: Zinman Institute of Archaeology, University of Haifa. Pp 167-184.
- . 2009b. Glass Finds from Geronisos Island. *Report of the Department of Antiquities, Cyprus* 118(2): 365-388.
- Burford, Alison. 1972. *Craftsmen in Greek and Roman Society*. Aspects of Greek and Roman Life. London: Thames and Hudson.
- Cable, Michael. 1998. The Operation of Wood Fired Glass Melting Furnaces. *The Prehistory & History of Glassmaking Technology*. P. McCray ed. Westerville, OH: The American Ceramic Society. Pp 315-329.
- Cahill, Nicholas. 1985. The Treasury at Persepolis: Gift-Giving at the City of the Persians. *American Journal of Archaeology* 89(3): 373-389.
- . 2002. *Household and City Organization at Olynthus*. New Haven: Yale University Press.
- Callatay, François. 1989. Les trésors achéménides et les monnayages d'Alexandre: espèces immobilisées et espèces circulantes? *L'or perse et l'histoire grecque*. R. Descat ed. *Revue des Études Anciennes* 91(1-2). Pp 259-276.
- Campus, Lucrezia. 1982. I Vetri del Museo Nazionale Romano e la produzione del vetro a Roma nella tarda Repubblica. *Roma repubblicana fra il 509 e il 270 a.c.* *Archeologia e Storia a Roma*. Rome: Quasar. Pp 125-128.
- Casana, Jesse. 2008. Mediterranean Valleys Revisited: Linking soil erosion, land use and climate variability in the Northern Levant. *Geomorphology* 101(3): 429-442.
- Cesnola, A.P., and S. Birch. 1882. *Salamina (Cyprus): The history, treasures, & antiquities of Salamis in the island of Cyprus*. Whiting and Co.
- Cesnola, Luigi Palma di. 1903. *A Descriptive Atlas of the Cesnola Collection of Cypriote Antiquities in the Metropolitan Museum of Art, New York: Vol III*. Boston: J. R. Osgood.
- Chancey, Mark Alan. 2002. *The Myth of a Gentile Galilee*. Society for new Testament Studies Monograph Series 134. Cambridge: Cambridge University Press.
- Charleston, Robert J. 1968. George Ravenscroft: New Light on the Development of his 'Cristalline Glasses'. *Journal of Glass Studies* 10: 156-167.

- Chéhab, Maurice H. 1986. *Fouilles de Tyr. La Nécropole IV. Description des Fouilles*. Bulletin du Musée de Beyrouth 36. Paris.
- Childe, V. Gordon. 1925. *The Dawn of European Civilization*. New York: Knopf.
- Childs, William A. P. 1999. Princeton Excavations at Polis Chrysochous, 1994-1997: Interim Report. *Report of the Department of Antiquities, Cyprus*: 223-236.
- Childs, William A.P., Joanna S. Smith, J. Michael Padgett, and William R. Caraher. 2012. *City of Gold: The Archaeology of Polis Chrysochous, Cyprus*. Princeton: Princeton University Art Museum.
- Christou, Dimos. 1994. Chronique des fouilles et découvertes archéologiques à Chypre en 1993. *Bulletin de correspondance hellénique*: 647-693.
- Cibecchini, Fr. 2012. Nouvelles considérations sur la cargaison de l'épave des Sanguinaires A (Ajaccio, Corse du Dud). *Archaeonautica* 17: 31-70.
- Cima, Maddalena, and Maria Antonietta Tomei. 2012. *Vetri a Roma. Mostra di Roma, Curia Iulia al Foro Romano, 16 febbraio-16 settembre 2012*. Milan: Electa.
- Clairmont, Christoph W. 1963. *The Excavations at Dura-Europos Conducted by Yale University and the French Academy of Inscriptions and Letters 4.5: The Glass Vessels*. New Haven: Yale University Press.
- Clarke, Graeme, ed. 2002. *Jebel Khalid on the Euphrates: Report on Excavations 1986-1996 Vol I*. Mediterranean Archaeology 5. Sydney: University of Sydney.
- Cohen, Einat. 2000a. Early Roman Glass. *Ramat Hanadiv excavations: final report of the 1984-1998 seasons*. Y. Hirschfeld ed. Jerusalem: Israel Exploration Society. Pp 470-472.
- . 2000b. Roman and Byzantine Glass. *Ramat Hanadiv excavations: final report of the 1984-1998 seasons*. Y. Hirschfeld ed. Jerusalem: Israel Exploration Society. Pp 166-176.
- Cohen, Susan L., ed. 2013. *Excavations at Tel Zahara (2006-2009): The Hellenistic and Roman Strata*. BAR International Series 2554. Oxford: Archaeopress.
- Colburn, Henry Preater. 2014. *The Archaeology of Achaemenid Rule in Egypt*. Ph.D. Dissertation, University of Michigan, Ann Arbor.
- Cole, Susan Guettel. 1984. *Theoi Megaloi: The cult of the great gods at Samothrace*. Études préliminaires aux religions orientales dans l'Empire romain 96. Leiden: E.J. Brill.
- Collar, Anna, Fiona Coward, Tom Brughmans, and Barbara J. Mills. 2015. Networks in Archaeology: Phenomena, Abstraction, Representation. *Journal of Archaeological Method and Theory* 22: 1-32.
- Colvin, Stephen. 2011. The Koine: A New Language for a New World. *Creating a Hellenistic World*. A. Erskine and L. Llewellyn-Jones eds. Swansea: Classical Press of Wales. Pp 31-45.
- Connelly, Joan Breton. 2002. Excavations on Geronisos (1990-1997): First Report. *Report of the Department of Antiquities of Cyprus* 2002: 245-268.
- . 2009. Hybridity and Identity on Late Ptolemaic Yeronisos. *Cahiers du Centre d'Études Chypriotes* 39: 69-88.
- Connolly, Philip, Thilo Rehren, Argyroula Doulgieri-Intzesiloglou, and Polyxeni Arachoviti. 2012. The Hellenistic Glass of Pherai, Thessaly. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 91-97.

- Cool, H. E. M. 1996. Sedeinga and the Glass Vessels of the Kingdom of Meroe. *Annales du 13e Congrès de l'Association Internationale pour l'Histoire du Verre (Pays Bas 1995)*. Amsterdam. Pp 201-212.
- Cool, H. E. M., and M. J. Baxter. 1999. Peeling the Onion: An approach to comparing vessel glass assemblages. *Journal of Roman Archaeology* 12: 72-100.
- Cooney, John D. 1976. *Glass*. Catalogue of Egyptian Antiquities in the British Museum 4. London: Trustees of the British Museum.
- Costin, Cathy Lynn. 1991. Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. *Archaeological Method and Theory Volume 3*. M. B. Schiffer ed. Tucson: University of Arizona. Pp 1-56.
- . 2001. Craft Production Systems. *Archaeology at the Millennium: A Sourcebook*. G. M. Feinman and T. D. Price eds. New York: Kluwer Academic. Pp 273-327.
- Coulson, William D.E. 1987. Chatby Reconsidered. *Journal of Egyptian Archaeology* 73: 234-236.
- Crewe, Lindy. 1998. *Spindle Whorls: A Study of Form, Function and Decoration in Prehistoric Bronze Age Cyprus*. Jonsered, Sweden: P. Åström.
- Crowfoot, G. M. 1957. Glass. *The Objects from Samaria III*. J. W. Crowfoot, G. M. Crowfoot and K. Kenyon eds. London: Palestine Exploration Fund. Pp 403-438.
- Crowfoot, J. W., G. M. Crowfoot, and Kathleen Kenyon, eds. 1957. *The Objects from Samaria III*. London: Palestine Exploration Fund.
- Csaba, Fabian Faurholt. 2008. Redefining Luxury: A Review Essay. *Creative Encounters Working Paper 15*, <http://hdl.handle.net/10398/7765>.
- Cummings, Keith. 1980. *The Technique of Glass Forming*. London: Batsford.
- Cuomo, Serafina. 2007. *Technology and Culture in Greek and Roman Antiquity*. Key Themes in Ancient History. Cambridge: Cambridge University Press.
- Czurda-Ruth, Barbara. 2007. *Hanghaus 1 in Ephesos: die Gläser*. Forschungen in Ephesos 8.7. Vienna: Österreichischen Akademie der Wissenschaften.
- Dar, Shimon. 1986. *Landscape and Pattern: An Archaeological Survey of Samaria 800 B.C.E.-636 C.E.* BAR International Series 308. Oxford: Archaeopress.
- . 1993. *Settlements and Cult Sites on Mount Hermon*. British Archaeological Reports International Series 308. Oxford: Archaeopress.
- Davaras, Kostas. 1974. 'Αγιος Νικόλαος. *Archaiologikon Deltion* 29(B3): 931.
- Davidson, Gladys R. 1952. *Corinth XII: The Minor Objects*. Princeton: American School of Classical Studies at Athens.
- Davidson, James. 2012. Citizen Consumers: The Athenian Democracy and the Origins of Western Consumption. *The Oxford Handbook of the History of Consumption*. F. Trentmann ed. Oxford: Oxford University Press. Pp 23-46.
- Davies, John K. 1984. Cultural, Social and Economic Features of the Hellenistic World. *The Hellenistic World*. W. F. Walbank, E. A. Astin, W. M. Frederiksen and M. R. Ogilvie eds. The Cambridge Ancient History 7.1. Cambridge: Cambridge University Press. Pp 257-320.
- . 2006. Hellenistic Economies. *The Cambridge Companion to the Hellenistic World*. G. R. Bugh ed. Cambridge: Cambridge University Press. Pp 73-92.
- De Carolis, Ernesto. 2006. Le verre dans la vie quotidienne. *Le verre dans l'empire romain (translation of Vitrum. Il vetro fra arte e scienza nel mondo romano)*. M. Beretta and G. Di Pasquale eds. Firenze: Giunti. Pp 73-81.

- De Juliis, Ettore M., Arcangelo Alessio, and Maurizio Di Puolo. 1989. *Gli ori di Taranto in età ellenistica: "Brera 2," Milano, dicembre 1984-marzo 1985*. Milan: A. Mondadori.
- Degryse, Patrick, and Jens Schneider. 2008. Pliny the Elder and Sr–Nd isotopes: tracing the provenance of raw materials for Roman glass production. *Journal of Archaeological Science* 35(7): 1993-2000.
- Di Pasquale, Giovanni. 2004. Scientific and Technological Use of Glass in Graeco-Roman Antiquity. *When Glass Matters: studies in the history of science and art from Graeco-Roman antiquity to early modern era*. M. Beretta ed. Biblioteca di Nuncius. Studi e testi 53. Firenze: Leo S. Olschki. Pp 31-76.
- Dietler, Michael. 2005. The Archaeology of Colonial Encounters: Comparative Perspectives. *School of American Research Advanced Seminar Series*. G. Stein ed. Santa Fe: School of American Research Press
- . 2010. Consumption. *The Oxford Handbook of Material Culture Studies*. M. C. Beaudry and D. Hicks eds. Oxford: Oxford University Press. Pp 207-226.
- Dobres, Marcia-Anne. 2000. *Technology and Social Agency: Outlining a practice framework for archaeology*. Social archaeology. Oxford: Blackwell Publishers.
- Dobres, Marcia-Anne, and Christopher R. Hoffman. 1999. *The Social Dynamics of Technology: Practice, politics, and world views*. Washington: Smithsonian Institution Press.
- Docter, Roald, and Janien Sonneveld. 2009. Punic Glass from Carthaginian Settlement Excavations. *Carthage Studies* 3: 125-146.
- Donceel, Robert. 1987. Un fragment de verre de l'atelier d'Ennion à Apamée. *Revue des Archéologues et Historiens d'Art de Louvain* 20: 36-49.
- Dothan, M. 1971. *Ashdod II-III: The second and third seasons of excavations, 1963, 1965, soundings in 1967*. 2 v. Jerusalem: Israel Exploration Society.
- Dotsika, E., D. Poutoukis, I. Tzavidopoulos, Y. Maniatis, D. Ignatiadou, and B. Raco. 2009. A Natron Source at Pikrolimni Lake in Greece? Geochemical evidence. *Journal of Geochemical Exploration* 103(2–3): 133-143.
- Dotsika, Elissavet, Ilias Tzavidopoulos, Dimitrios Poutoukis, Brunella Raco, Yannis Maniatis, and Despoina Ignatiadou. 2012. Isotope Contents, Cl/Br Ratio and Origin of Water at Pikrolimni Lake: A natron source in Greece, as archive of past environmental conditions. *Quaternary International* 266: 74-80.
- Dow, Sterling. 1941. A Family of Sculptors from Tyre. *Hesperia: The Journal of the American School of Classical Studies at Athens* 10(4): 351-360.
- Droysen, Johann Gustav. 1836. *Geschichte des Hellenismus*. Hamburg: F. Perthes.
- Dunand, Maurice. 1978. Verroterie d'enfants dans le temple d'Echmoun à Sidon. *Bulletin du Musée de Beyrouth* 30: 47-50.
- Dunand, Maurice, and Raymond Duru. 1962. *Oumm el-'Amed, une ville de l'époque hellénistique aux échelles de Tyr*. Paris: Librairie d'Amérique et d'Orient.
- Dunand, Maurice, and Nassib Saliby. 1985. *Le temple d'Amrith dans la Pérée d'Aradus*. Bibliothèque archéologique et historique 121. Paris: P. Geuthner.
- Dunham, Dows. 1957. *The Royal Cemeteries of Kush IV. The Royal Tombs at Meroë and Barkal*. Cambridge: Museum of Fine Arts.
- Dusenbery, Elsbeth B. 1967. Ancient Glass from the Cemeteries of Samothrace. *Journal of Glass Studies* 9: 34-49.
- . 1998. *The Nekropoleis*. Samothrace, Excavations Conducted by the Institute of Fine Arts, New York University 11. New York: Pantheon Books.

- Dusinberre, Elspeth R. M. 1999. Satrapal Sardis: Achaemenid bowls in an Achaemenid capital. *American Journal of Archaeology* 103(1): 73-102.
- Dusinberre, Elspeth R.M. 2003. *Aspects of Empire in Achaemenid Sardis*. Cambridge: Cambridge University Press.
- Dussart, Odile. 1998. *Le verre en Jordanie et en Syrie du Sud*. Bibliothèque archéologique et historique 152. Beyrouth: Institut français d'archéologie du Proche-Orient.
- . 2000. Quelques indices d'ateliers de verriers en Jordanie et en Syrie du Sud de la fin de l'époque hellénistique à l'époque islamique. *La Route du Verre. Ateliers primaires et secondaires du second millénaire av. J.-C. au Moyen Âge*. M.-D. Nenna ed. Travaux de la Maison de l'Orient Méditerranéen 33. Lyon: Maison de l'Orient. Pp 91-96.
- . 2003. La verrerie de la fin de l'époque Hellénistique en Syrie du sud. *La Syrie hellénistique*. Topoi Supplément 4. Lyon: Topoi. Pp 499-512.
- Duyrat, Frédérique. 2003. La Phénicie hellénistique. *Royaumes et cités hellénistiques: des années 323-55 av. J.-C.* O. Picard, F. Callatay, F. Duyrat, G. Gorre and D. Prévot eds. Regards sur l'histoire. Histoire ancienne. Paris: SEDES. Pp 83-96.
- Edgar, C. C. 1905. *Catalogue Général des Antiquités Egyptiennes du Musée du Caire [Nos. 32401-32800] Graeco-Roman Egyptian Glass*. Cairo.
- Edgerton, D. 1999. From Innovation to Use: Ten (eclectic) theses on the history of technology. *History and Technology* 16: 1-26.
- Edwards, G. Roger. 1975. *Corinth VII.3: Corinthian Hellenistic Pottery*. Princeton: American School of Classical Studies at Athens.
- Ehmer, Josef. 1997. Worlds of Mobility: Migration Patterns of Viennese Artisans in the 18th Century. *The Artisan and the European Town, 1500-1900*. G. Crossick ed. Aldershot: Scolar Press. Pp 172-199.
- Eisen, Gustavus. 1916. The Origin of Glass Blowing. *American Journal of Archaeology* 20(2): 134-143.
- Ekholm, Kajsa, and Jonathan Friedman. 1982. "Capital" Imperialism and Exploitation in Ancient World-Systems. *Review (Fernand Braudel Center)* 6(1): 87-109.
- El-Din, Mervat Seif, and Marie-Dominique Nenna. 1994. La petite plastique en faïence du musée gréco-romain d'Alexandrie. *Bulletin de correspondance hellénique* 118(2): 291-320.
- Elayi, Josette. 1980. The Phoenician Cities in the Persian Period. *Journal of the Ancient Near Eastern Society* 12: 13-28.
- . 1982. Studies in Phoenician geography during the Persian period. *Journal of Near Eastern Studies* 41: 83-110.
- Eliot, C. W. J., and Mary Eliot. 1968. The Lechaion Cemetery near Corinth. *Hesperia* 37(4): 345-367.
- Empereur, J. Y. 1998. *Commerce et artisanat dans l'Alexandrie hellénistique et romaine: Actes du colloque d'Athènes, organisé par le CNRS, le Laboratoire de céramologie de Lyon et l'Ecole française d'Athènes, 11-12 décembre 1988*. Actes du colloque d'Athènes ix, 499 p. Athens: Ecole française d'Athènes.
- Engle, Anita. 1984. Glassmaking in Ancient Jerusalem. *Readings in Glass History* 18: 9-15.
- Epstein, S. R. 1998. Craft Guilds, Apprenticeship, and Technological Change in Preindustrial Europe. *The Journal of Economic History* 58(3): 684-713.
- Erb-Satullo, Nathaniel. 2014. The Adoption of Iron in the Near East: The View from the Southern Caucasus. *American Schools of Oriental Research Annual Meeting*. San Diego.

- Erciyas, Deniz Burcu. 2005. *Wealth, Aristocracy and Royal Propaganda under the Hellenistic Kingdom of the Mithradatids in the Central Black Sea Region in Turkey*. Colloquia pontica 12. Leiden: Brill.
- Erickson, Kyle, and Gillian Ramsey, eds. 2011. *Seleucid Dissolution: The Sinking of the Anchor*. Philippika 50. Wiesbaden: Harrassowitz Verlag.
- Erim, K. T., and Joyce Reynolds. 1973. The Aphrodisias Copy of Diocletian's Edict on Maximum Prices. *The Journal of Roman Studies* 63: 99-110.
- Erlich, Adi. 2002. Terracotta Figurines of Hellenistic Maresha: Between Art and Craft. *Assaph* 7: 1-16.
- . 2009. *The Art of Hellenistic Palestine*. BAR International Series 2010. Oxford: Archaeopress.
- Ermantinger, Wolfgang. 1990. Diocletian's Economic Revolution. *Münstersche Beiträge zur Antiken Handelgeschichte* 9(1): 45-49.
- Erskine, Andrew. 2003. Approaching the Hellenistic World. *A Companion to the Hellenistic World*. A. Erskine ed. Oxford: Blackwell Publishing. Pp 1-15.
- Erwitt, Elliot. 1979. *The Glassmakers of Herat*. Corning: Corning Museum of Glass. Video.
- Ettinghausen, Richard. 1962. *Ancient Glass in the Freer Gallery of Art*. Washington: Smithsonian Institution.
- Exposition des Verres Syriens a travers l'histoire. 1964. Damascus: Générale des Antiquités Musées de la République Arabe Syrienne. Pp
- Faroqhi, Suraiya. 2009. *Artisans of Empire: Crafts and craftspeople under the Ottomans*. Library of Ottoman Studies 17. London: I.B. Tauris.
- Feig, Nurit. 2002. Salvage Excavations at Meron. *Atiqot* 43: 87-107.
- Feldman, Marian H. 2006. *Diplomacy by Design: Luxury arts and an "international style" in the ancient Near East, 1400-1200 BCE*. xvii, 278 p., [16] p. of plates. Chicago: University of Chicago Press.
- . 2014. *Communities of Style: Portable luxury arts, identity, and collective memory in the Iron Age Levant*. Chicago: University of Chicago Press.
- Fellmann, Rudolf. 1970. *Le sanctuaire de Baalshamin à Palmyre 5. Die Grabanlage*. Bibliotheca Helvetica Romana 10.5. Rome: Institut Suisse de Rome.
- Fenn, Nina, and Christiane Römer-Strehl, eds. 2013. *Networks in the Hellenistic World, according to the pottery in the Eastern Mediterranean and beyond*. BAR International Series 2539. Archaeopress.
- Ferguson, James. 1988. Cultural Exchange: New Developments in the Anthropology of Commodities. *Cultural Anthropology* 3(4): 488-513.
- Ferguson, Jeffrey. 2008. The When, Where, and How of Novices in Craft Production. *Journal of Archaeological Method and Theory* 15(1): 51-67.
- Feugère, Michel. 1989a. Les vases en verre sur noyau d'argile en Méditerranée nord-occidentale. *Le verre préromain en Europe occidentale*. M. Feugère ed. Montagnac: Monique Mergoïl. Pp 29-62.
- , ed. 1989b. *Le verre préromain en Europe occidentale*. Montagnac: Monique Mergoïl.
- Feugère, Michel, and F. Leyge. 1989. La cargaison de verrerie augustéenne de l'épave de la Tradelière (Iles de Lérins). *Le verre préromain en Europe occidentale*. M. Feugère ed. Montagnac: Monique Mergoïl. Pp 169-176.

- Feyel, Christophe. 2006. *Les artisans dans les sanctuaires grecs aux époques classique et hellénistique à travers la documentation financière en Grèce*. Bibliothèque des écoles françaises d'Athènes et de Rome 318. Athens: Ecole française d'Athènes.
- Finkielsztejn, Gerald. 1998. More Evidence on John Hyrcanus I's Conquests: Lead Weights and Rhodian Amphora Stamps. *Bulletin of the Anglo-Israel Archaeological Society* 16: 33-63.
- . 1999. A Standard of Volumes for Liquids from Hellenistic Marisa. *Atiqot* 38: 51-64.
- . 2007. Pods de plomb inscrits du Levant: une réforme d'Antiochos IV? *Productions et échanges en Syrie hellénistique et romaine (Tours, juin 2003)*. M. Sartre ed. Topoi Supplément 8. Lyon: Maison de l'orient méditerranéen. Pp 35-60.
- Finley, M. I. 1965. Technical Innovation and Economic Progress in the Ancient World. *The Economic History Review* 18(1): 29-45.
- . 1973. *The Ancient Economy*. Sather classical lectures 43. Berkeley: University of California Press.
- Fischer, Alysia. 2001. Integrating Anthropology in Pursuit of the Byzantine Period Glass Industry in Northern Israel. Ph.D. Dissertation, Anthropology, The University of Arizona.
- . 2007. The Lives of Glass-Workers at Sepphoris. *The Archaeology of Difference: Gender, ethnicity, class and the "other" in antiquity: studies in honor of Eric M. Meyers*. E. M. Meyers, D. R. Edwards and C. T. McCollough eds. Annual of the American Schools of Oriental Research 60/61. Boston, MA: American Schools of Oriental Research. Pp 301-310.
- . 2008. *Hot Pursuit: Integrating Anthropology in Search of Ancient Glass-blowers*. Lanham, MD: Lexington Books.
- . 2015. A Brief Glass Guide for Field Archaeologists. *Unpublished manuscript*. Oxford, OH: Miami University. Pp 1-13.
- Fischer, Alysia, and W. Patrick McCray. 1999. Glass Production Activities as Practised at Sepphoris, Israel (37 BC-AD 1516). *Journal of Archaeological Science* 26: 893-905.
- Fischer, Moshe, and Ruth E. Jackson-Tal. 2003. A Glass Pendant in the Shape of Harpokrates from Yavneh-Yam, Israel. *Journal of Glass Studies* 45: 35-40.
- Flad, Rowan K., and Zachary X. Hruby. 2007. "Specialized" Production in Archaeological Contexts: Rethinking Specialization, the Social Value of Products, and the Practice of Production. *Archeological Papers of the American Anthropological Association* 17(1): 1-19.
- Flemming, Rebecca. 2003. Empires of Knowledge: Medicine and Health in the Hellenistic World. *A Companion to the Hellenistic World*. A. Erskine ed. Oxford: Blackwell Publishing. Pp 447-463.
- Fontaine, Souen D. 2004. Olbia de Provence: Les Verres moulés monochromes pré-augustéens et augustéens. *Bulletin de l'Association Française pour l'Archéologie du Verre*: 4-8.
- Fossing, Poul. 1940. *Glass Vessels before Glass-blowing*. Copenhagen: E. Munksgaard.
- Foy, Danièle. 2000. Un Atelier de Verrier à Beyrouth au Début de la Conquête Islamique. *Syria* 77: 239-290.
- . 2003. Le Verre en Tunisie: L'Apport des fouilles récentes tuniso-françaises. *Journal of Glass Studies* 45: 59-89.
- . 2005. Une production de bols moulés à Beyrouth à la fin de l'époque hellénistique et le commerce de ces verres en Méditerranée occidentale. *Journal of Glass Studies* 47: 11-35.

- Foy, Danièle, and Marie-Dominique Nenna. 2001. *Tout Feu Tout Sable: mille ans de verre antique dans le Midi de la France*. Mille ans de verre antique dans le Midi de la France. Marseille: Musées de Marseille.
- , eds. 2003. *Échanges et commerce du verre dans le monde antique*. Monographies instrumentum 24. Montagnac: Editions Monique Mergoil.
- Foy, Danièle, Maurice Picon, and Valérie Thirion-Merle. 2007. L'atelier de verrier de Beyrouth et la diffusion du verre syro-palestinien en Méditerranée occidentale à la fin de l'époque hellénistique. *Topoi* Suppl. 8: 93-121.
- Francis, Peter. 1991. Beadmaking at Arikamedu and Beyond. *World Archaeology* 23(1): 28-43.
- Frankel, Rafael, Nimrod Getzov, Mordechai Aviam, and Avi Degani. 2001. *Settlement Dynamics and Regional Diversity in Ancient Upper Galilee*. IAA Reports 14. Jerusalem: Israel Antiquities Authority.
- Fraser, Peter M. 1972. *Ptolemaic Alexandria*. Oxford: Oxford University Press.
- Frederiksen, Rune. 2006. The Glass. *Panayia Ematousa I*. L. W. Sørensen and K. Winther-Jacobsen eds. Monographs of the Danish Institute at Athens 6.1. Athens: Danish Institute at Athens. Pp 361-368.
- Freestone, Ian C. 2004. The Provenance of Ancient Glass through Compositional Analysis. *Materials Issues in Art and Archaeology VII: Materials Research Society Symposium, held November 30-December 3, 2004, Boston, Mass.: proceedings*. Materials Research Society. Pp 195-208.
- Freestone, Ian, Yael Gorin-Rosen, and Michael J. Hughes. 2000. Primary Glass from Israel and the Production of Glass in Late Antiquity and the Early Islamic Period. *La Route du Verre. Ateliers primaires et secondaires du second millénaire av. J.-C. au Moyen Âge*. M.-D. Nenna ed. Travaux de la Maison de l'Orient Méditerranéen 33. Lyon: Maison de l'Orient. Pp 65-83.
- Fremersdorf, Fritz. 1958. *Römisches Buntglas in Köln*. Denkmäler des Römischen Köln 3. Köln: Verlag der Löwe.
- Freyne, Sean. 1980. *Galilee from Alexander the Great to Hadrian 323 B.C.E. to 135 C.E.* University of Notre Dame Center for the Study of Judaism and Christianity in Antiquity 5. Wilmington: Michael Glazier, Inc.
- Friedman, Thomas L. 2005. *The World is Flat: A Brief History of the Twenty-first Century*. New York: Farrar, Straus and Giroux.
- Fünfschilling, Sylvia. 1999. Gläser aus den Grabungen des Deutschen Archäologischen Instituts in Karthago die Grabungen "Quartier Magon" und rue Ibn Chabâat sowie kleinere Sondagen. *Karthago Vol. 3*. F. Rakob ed. Mainz am Rhein: Philip von Zabern. Pp 435-529.
- Gabbert, Janice J. 1986. Piracy in the Early Hellenistic Period: a Career Open to Talents. *Greece and Rome* 33(2): 156-163.
- Gadolou, Anastasia. 2012. Life on Board. *The Antikythera Shipwreck: the ship, the treasures, the mechanism*. N. Kaltsas, E. Vlachogianni and P. Bouyia eds. Athens: Hellenic Ministry of Culture and Tourism. Pp 50-56.
- Ganio, M., Sara Boyen, D. Brems, R. Scott, Danièle Foy, K. Latruwe, G. Molin, A. Silvestri, F. Vanhaecke, and P. Degryse. 2012. Trade Routes across the Mediterranean: a Sr/Nd isotopic investigation on Roman colourless glass. *Glass Technology: European Journal of Glass Science and Technology* 53(5): 217-224.

- Gates, Jennifer. 2002. The Ethnicity Name Game: What Lies behind "Greco-Persian"? *Medes and Persians: Reflections on Elusive Empires*. M. C. Root ed. *Ars Orientalis* 32. Pp 105-132.
- Gauckler, Paul. 1915. *Nécropoles puniques de Carthage I*. 2 v. Paris: A. Picard.
- Gawande, Atul. 2013. *Slow Ideas*. *The New Yorker*. 2013 [accessed July 23, 2013].
http://www.newyorker.com/reporting/2013/07/29/130729fa_fact_gawande?currentPage=all.
- Gebhard, Elizabeth R., and Matthew W. Dickie. 2003. The View from the Isthmus, ca. 200 to 44 B.C. *Corinth XX: The Centenary 1896-1996*. C. K. Williams and N. Bookidis eds.: The American School of Classical Studies at Athens. Pp 261-278.
- Gell, Alfred. 1992. The Technology of Enchantment and the Enchantment of Technology. *Anthropology, Art, and Aesthetics*. J. Coote and A. Shelton eds. Oxford: Clarendon Press. Pp 40-66.
- Geller, Markham J., ed. 2014. *Melammu: The Ancient World in an Age of Globalization*. Max Planck Research Library for the History and Development of Knowledge Proceedings 7. Edition Open Access.
- Gençler, Çiğdem. 2009. Elaiussa Sebaste antik yerleşimi cam buluntuları. Ph.D. Dissertation, Ankara University, Ankara.
- Geva, Hillel. 2006. Stratigraphy and Architecture. *Jewish Quarter Excavations in the Old City of Jerusalem Conducted by Nahman Avigad, 1969-1982. Voi. III: Area E and Other Studies*. H. Geva ed. Jerusalem: Israel Exploration Society. Pp 1-78.
- , ed. 2000. *Jewish Quarter Excavations in the Old City of Jerusalem: conducted by Nahman Avigad, 1969-1982*. 5 vols Jerusalem: Israel Exploration Society.
- Ghirshman, Roman. 1966. *Tchoga Zanbil I, Temple*. *Memoires de la Délégation Archeologique en Iran* 39. Paris: P. Geuthner.
- Gialouris, N. 1966. Ελληνιστικον Νεκρπταρειον Γιαλοβης Παλαιοναυαρινου (Κορυφασιον). *Archaiologikon Deltion* 21(B.1): 164-165.
- Gibbins, David. 2001. Shipwrecks and Hellenistic Trade. *Hellenistic Economies*. Z. Archibald, J. K. Davies, V. Gabrielsen and G. J. Oliver eds. New York: Routledge. Pp 273-312.
- Giberson, Dudley. 2004. Dudley Giberson's core vessel video 2004 [videorecording]. Joppa Press. Pp 35 min.
- Gibson, D. Blair. 1996. Death of a Salesman: Childe's Itinerant Craftsman in the Light of Present Knowledge of Late Prehistoric European Craft Production. *Craft Specialization and Social Evolution: In Memory of V. Gordon Childe*. B. Wailes ed. University Museum Monograph 93. Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology. Pp 107-119.
- Gill, David W. J. 1991. Pots and Trade: Spacefillers or Objets D'art? *The Journal of Hellenic Studies* 111: 29-47.
- Giorgi, Fr., and Dorica Manconi. 2012. Todi: I vetri dalla necropoli di Via Orvietana. *Vetri a Roma. Mostra di Roma, Curia Iulia al Foro Romano, 16 febbraio-16 settembre 2012*. M. Cima and M. A. Tomei eds. Milan: Electa. Pp 91-95.
- Giudice, Filippo. 1996. Paphos, Garrison's Camp, Campagna 1991. *Report of the Department of Antiquities, Cyprus*.
- Gjerstad, Einar, John Lindros, Erik Sjöqvist, and Alfred Westholm. 1934. *The Swedish Cyprus expedition; finds and results of the excavations in Cyprus, 1927-1931*. Stockholm: The Swedish Cyprus Expedition.

- Goldstein, Sidney M. 1979. *Pre-Roman and Early Roman Glass in the Corning Museum of Glass*. Corning, New York: Corning Museum of Glass.
- . 1989. Old Glass, New Glass, Gold Glass: Some Thoughts on Ancient Casting Technology. *Kölner Jarhbuch für Vor- und Frühgeschichte* 22: 115-120.
- Goldthwaite, Richard A. 1993. *Wealth and the Demand for Art in Italy, 1300-1600*. Baltimore: Johns Hopkins University Press.
- Goodlett, Virginia C. 1991. Rhodian Sculpture Workshops. *American Journal of Archaeology* 95(4): 669-681.
- Gordon, Jody Michael. 2013. City of Gold: The Archaeology of Polis Chrysochous, Cyprus, edited by William A. P. Childs, Joanna S. Smith, and J. Michael Padgett (review). *Journal of Eastern Mediterranean Archaeology & Heritage Studies* 1(3): 254-258.
- . 2014. Mini-Alexandrias or Local Continuity? Architectural Change, Place-Making, and Identity in Ptolemaic Cyprus. Continuity or Change: The Hellenistic Near East on a Local Scale. *American Schools of Oriental Research Annual Meeting*. San Diego.
- Gorin-Rosen, Yael. 1997. Medieval Glass Vessels (Area TA). *Atiqot* 31: 75-85.
- . 2000. The Ancient Glass Industry in Israel. Summary of the Finds and New Discoveries. *La Route du Verre. Ateliers primaires et secondaires du second millénaire av. J.-C. au Moyen Âge*. M.-D. Nenna ed. Travaux de la Maison de l'Orient Méditerranéen 33. Lyon: Maison de l'Orient. Pp 49-63.
- . 2003. Glass Vessels from Area A. *Jewish Quarter Excavations in the Old City of Jerusalem, Conducted by Nahman Avigad, 1969-1982. Vol. II: The Finds from Areas A, W, and X-2, Final Report*. H. Geva ed. Jerusalem: Israel Exploration Society. Pp 364-400.
- . 2005. The Glass. *Excavations on the Site of the Jerusalem International Convention Center (Binyanei Ha'uma): The pottery and other small finds*. B. Arubas and H. Goldfus eds. Journal of Roman Archaeology Supplementary Series 60. Portsmouth, RI: Journal of Roman Archaeology. Pp 195-210.
- . 2006. Glass Vessels. *Jewish Quarter Excavations in the Old City of Jerusalem Conducted by Nahman Avigad, 1969-1982. Vol. III: Area E and Other Studies*. H. Geva ed. Jerusalem: Israel Exploration Society. Pp 239-265.
- . 2013. Glass Finds from the Crusader-Period Bathhouse in 'Akko (Acre). *Atiqot* 73: 109-116.
- Gosden, Chris. 2013. Technologies of Routine and of Enchantment. *Distributed Objects: Meaning and Mattering after Alfred Gell*. L. Chua and M. Elliott eds. New York: Berghan Books. Pp 39-57.
- Gradel, Coralie. 2012. Les verres d'époques hellénistique et romaine dans le royaume de Méroé. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 114-119.
- Graf, David F. 1992. Hellenisation and the Decapolis. *Aram* 4(1): 1-48.
- Graham, Shawn. 2006. *Ex Figlinis: The network dynamics of the Tiber Valley brick industry in the hinterland of Rome*. BAR International Series 1486. Oxford: Archaeopress.
- Grainger, John D. 1991. *Hellenistic Phoenicia*. Oxford: Clarendon Press.
- . 2010. *The Syrian Wars*. Mnemosyne supplements 320. Leiden: Brill.

- Grandjean, C. 2006. Histoire économique et monétarisation de la Grèce à l'époque hellénistique. *Approches de l'économie Hellénistique*. R. Descat ed. 7. Aix-en-Provence: Musée archéologique de Saint-Bertrand-de-Comminges. Pp 195-214.
- Grandjouan, Claire, Eileen Markson, and Susan I. Rotroff. 1989. *Hellenistic Relief Molds from the Athenian Agora*. Vol. 23. Hesperia Supplements. Princeton: The American School of Classical Studies at Athens.
- Greaves, Alan M. 2012. Divination at Archaic Branchidai-Didyma: A Critical Review. *Hesperia* 81(2): 177-206.
- Green, Peter. 1990. *Alexander to Actium: the historical evolution of the Hellenistic age*. Hellenistic Culture and Society 1. Berkeley: University of California Press.
- Greene, Kevin. 1986. *The Archaeology of the Roman Economy*. London: B.T. Batsford.
- . 2000. Technological Innovation and Economic Progress in the Ancient World: M.I. Finley reconsidered *Economic History Review* 53: 29-59.
- . 2007. Late Hellenistic and Early Roman Invention and Innovation: The Case of Lead-Glazed Pottery. *American Journal of Archaeology* 111(4): 653-671.
- . 2008a. Inventors, Invention, and Attitudes Toward Technology and Innovation. *Oxford handbook of engineering and technology in the Classical world*. J. P. Oleson ed. xviii, 865 p. Oxford: Oxford University Press. Pp 800-818.
- . 2008b. Inventors, Invention, and Attitudes toward Technology and Innovation. *The Oxford Handbook of Engineering and Technology in the Classical World*. J. P. Oleson ed. Oxford: Oxford University Press. Pp 800-818.
- . 2008c. Learning to Consume: Consumption and consumerism in the Roman Empire. *Journal of Roman Archaeology* 21: 64-82.
- Gregory, C. A. 2015. *Gifts and Commodities*. 2nd ed. Chicago: Hau Books.
- Grose, David F. 1973. The Glass from the Roman *Colonia* at Cosa. *Bulletin de l'Association Internationale pour l'Histoire du Verre* 7: 175-182.
- . 1974. Roman Glass of the First Century A.D.: A Dated Deposit of Glassware from Cosa, Italy. *Annales du 6e Congrès de l'Association Internationale pour l'Histoire du Verre (Cologne 1973)*. Liège. Pp 31-52.
- . 1975. Roman Glass of the First Century A.D.: A Dated Deposit of Glassware from Cosa, Italy. *Annales du 6e Congrès de l'Association Internationale pour l'Histoire du Verre (Cologne, July 1973)*. Liège. Pp 31-52.
- . 1977. Early Blown Glass: The Western Evidence. *Journal of Glass Studies* 19: 9-29.
- . 1979. The Syro-Palestinian Glass Industry in the Later Hellenistic Period. *Muse* 13: 54-67.
- . 1981. The Hellenistic Glass Industry Reconsidered. *Annales du 8e Congrès de l'Association Internationale pour l'Histoire du Verre (London 1979)*. Liège. Pp 61-72.
- . 1983. The Formation of the Roman Glass Industry. *Archaeology* 36(4): 38-45.
- . 1984a. Glass Forming Methods in Classical Antiquity: Some Considerations. *Journal of Glass Studies* 26: 25-34.
- . 1984b. The Hellenistic and Early Roman Glass from Morgantina (Serra Orlando), Sicily. *Journal of Glass Studies* 24: 20-29.
- . 1986a. The Glass Vessels from the Sanctuary of Apollo Hylates, Kourion (Cyprus). *Report of the Department of Antiquities, Cyprus*: 187-191.
- . 1986b. Innovation and Change in Ancient Technologies: The Anomalous Case of the Roman Glass Industry. *High Technology Ceramics: past, present, and future: the nature of*

- innovation and change in ceramic technology*. W. D. Kingery ed. Westerville, OH: American Ceramic Society. Pp 65-79.
- . 1989. *Toledo Museum of Art: Early Ancient Glass*. New York: Hudson Hills Press.
- . 2012. The Pre-Hellenistic, Hellenistic, Roman, and Islamic Glass Vessels. *Tel Anafa II,ii*. A. M. Berlin and S. C. Herbert eds. Kelsey Museum Fieldwork Series. Ann Arbor: University of Michigan. Pp 1-98.
- . forthcoming. *Glass from Cosa*. *Memoirs of the American Academy in Rome*. Rome: American Academy.
- Grossmann, R.A. 2013. *Glass. Excavations at Zeugma, Conducted by Oxford University*. W. Aylward ed. Los Altos, California: Packard Humanities Institute. Pp 218-258.
- Grossmark, Tziona. 2010. "And He Decreed that Glassware is Susceptible to Becoming Unclean": The Application of the Laws of Ritual Purity to Glassware Reconsidered. *Jewish Studies Quarterly* 17(3): 191-212.
- Guimier-Sorbets, Anne-Marie, and Marie-Dominique Nenna. 1992. L'emploi du verre, de la faïence et de la peinture dans les mosaïques de Délos. *Bulletin de correspondance hellénique* 116(2): 607-632.
- . 1995. Réflexions sur la couleur dans les mosaïques hellénistiques : Délos et Alexandrie. *Bulletin de correspondance hellénique* 119(2): 529-563.
- Gunter, Ann C., and Margaret Cool Root. 1998. Replicating, Inscribing, Giving: Ernst Herzfeld and Artaxerxes' Silver Phiale in the Freer Gallery of Art. *Ars Orientalis* 28: 2-38.
- Hachlili, Rachel, and Ann E. Killebrew. 1999. *Jericho: The Jewish Cemetery of the Second Temple Period*. IAA Reports 7. Jerusalem: Israel Antiquities Authority.
- Hadas, G. 1994. Nine Tombs of the Second Temple Period at Ein Gedi. *Atiqot* 24: 1*-8*.
- Hadji-Minaglou, Gisèle. 2007. *Tebtynis IV: les habitations à l'est du temple de Soknebtynis*. Fouilles franco-italiennes. Cairo: Institut français d'archéologie orientale.
- Haevernick, Thea Elisabeth. 1960. *Die Glasarmringe und Ringperlen der Mittel- und Spätlatènezeit auf dem europäischen Festland*. Bonn: R. Habelt.
- . 1967. Der Verbreitung der 'Zarten Rippenschalen'. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 14: 153-160.
- . 1981. *Beiträge zur Glasforschung: die wichtigsten Aufsätze von 1938 bis 1981*. Mainz am Rhein: Philip von Zabern.
- Harden, Donald B. 1936. *Roman Glass from Karanis*. Ann Arbor: University of Michigan Press.
- . 1962a. *Glass. Excavations at Nessana*. H. D. Colt ed. London: British School of Archaeology in Jerusalem. Pp 76-91.
- . 1962b. *The Phoenicians*. London.
- . 1967. Some Aspects of Pre-Roman Mosaic Glass. *Annales du 4e Congrès International d'Etude Historique du Verre (Ravenna-Venice 1967)*. Liège: Association Internationale pour l'Histoire du Verre. Pp 29-38.
- . 1968a. Ancient Glass I: Pre-Roman. *Archaeological Journal* 125: 46-72.
- . 1968b. The Canosa Group of Hellenistic Glasses in the British Museum. *Journal of Glass Studies* 10: 21-47.
- . 1969. Ancient Glass II: Roman. *Archaeological Journal* 126: 44-77.
- . 1980. A Hellenistic Footed Glass Bowl of Alexandrine Origin. *Toledo Museum of Art Museum News* 22: 17-25.
- . 1981. *Catalogue of Greek and Roman Glass in the British Museum*. London: Trustees of the British Museum.

- . 1984. Study and Research on Ancient Glass: Past and Future. *Journal of Glass Studies* 26: 9-24.
- Harris, Diane. 1995. *The Treasures of the Parthenon and Erechtheion*. Oxford monographs on classical archaeology. Oxford: Clarendon Press.
- Hayes, John W. 1971. Four Early Roman Groups from Knossos. *Annual of the British School at Athens* 66: 249-275.
- . 1975. *Roman and Pre-Roman Glass in the Royal Ontario Museum: a catalogue*. Toronto: Royal Ontario Museum.
- Hellström, Pontus. 1965. *Pottery of Classical and Later Date, Terracotta Lamps and Glass*. Labraunda: Swedish excavations and researches, Vol. II.1. Lund: Swedish Institute in Athens.
- Henderson, Julian. 1989. The Evidence for Regional Production of Iron Age Glass in Britain. *Le verre préromain en Europe occidentale*. M. Feugère ed. Montagnac: Monique Mergoil. Pp 63-72.
- . 2002. Tradition and Experiment in First Millennium A.D. Glass Production. The Emergence of Early Islamic Glass Technology in Late Antiquity. *Accounts of Chemical Research* 35(8): 594-602.
- . 2013. *Ancient Glass*. Cambridge: Cambridge University Press.
- Henein, Nessim Henry. 1974. *Le verre soufflé en Égypte*. Bibliothèque d'étude 63. Cairo: Institut français d'archéologie orientale du Caire.
- Herbert, Sharon C. 1993. The Greco-Phoenician Settlement at Tel Anafa: A Case Study in the Limits of Hellenization. *Biblical Archaeology Today, 1990. Proceedings of the Second International Congress on Biblical Archaeology, Jerusalem, June-July 1990*. A. Biran and J. Aviram eds. Jerusalem: Israel Exploration Society. Pp 118-125.
- . 1994. *Tel Anafa I,i: Final report on ten years of excavation at a Hellenistic and Roman settlement in northern Israel*. Journal of Roman Archaeology Supplementary Series 10. Ann Arbor: Journal of Roman Archaeology.
- . 2003. Excavating ethnic strata: the search for Hellenistic Phoenicians in the Upper Galilee of Israel. *The Politics of Archaeology and Identity in the Global Context*. S. Kane ed. Boston: Archaeological Institute of America. Pp 101-113.
- Herbert, Sharon C., and Andrea M. Berlin. 2003a. *Excavations at Coptos (Qift) in Upper Egypt, 1987-1992*. Journal of Roman Archaeology Supplementary Series 53. Portsmouth, Rhode Island: Journal of Roman Archaeology.
- . 2003b. A New Administrative Center for Persian and Hellenistic Galilee: Preliminary Report of the University of Michigan/University of Minnesota Excavations at Kedesh. *Bulletin of the American Schools of Oriental Research* 329: 13-59.
- Hess, Catherine, and Karol Wight. 2005. *Looking at Glass: A guide to terms, styles, and techniques*. Los Angeles: The J. Paul Getty Museum.
- Higgins, Reynold Alleyne. 1967. *Greek Terracottas*. Meuthuen's Handbooks of Archaeology. London: Methuen.
- Hitchner, R. Bruce. 2005. "The Advantages of Wealth and Luxury": The Case for Economic Growth in the Roman Empire. *The Ancient Economy: Evidence and Models*. J. G. Manning and I. Morris eds. Stanford: Stanford University Press. Pp 207-222.
- Hodder, Ian. 2011. Human-thing Entanglement: Towards an integrated archaeological perspective. *Journal of the Royal Anthropological Institute* 17(1): 154-177.

- . 2012. *Entangled: An archaeology of the relationships between humans and things*. Chichester: Wiley-Blackwell.
- Hodge, Christina J. 2014. *Consumerism and the Emergence of the Middle Class in Colonial America: The genteel revolution*. New York: Cambridge University Press.
- Hodos, Tamar. 2008. Striking a Local-Global Balance in Eastern Iberia: A Comment on Vives-Ferrándiz. *Journal of Mediterranean Archaeology* 21(2): 273-276.
- . 2010a. Globalization and Colonization: A View from Iron Age Sicily. *Journal of Mediterranean Archaeology* 23(1): 81-106.
- . 2010b. Local and Global Perspectives in the Study of Social and Cultural Identities. *Material Culture and Social Identities in the Ancient World*. S. Hales and T. Hodos eds. Cambridge: Cambridge University Press. Pp 3-31.
- . 2014. Stage Settings for a Connected Scene. Globalization and material-culture studies in the early first-millennium B.C.E. Mediterranean. *Archaeological Dialogues* 21(1): 24-30.
- Hoepfner, Wolfram, and Ernst-Ludwig Schwandner. 1986. *Haus und Stadt im klassischen Griechenland*. Wohnen in der klassischen Polis 1. München: Deutscher Kunstverlag.
- Honigman, Sylvie. 2014. *Tales of High Priests and Taxes: the Books of the Maccabees and the Judean Rebellion against Antiochos IV*. Berkeley: University of California Press.
- Hopkins, Keith. 1980. Taxes and Trade in the Roman Empire (200 B.C.-A.D. 400). *The Journal of Roman Studies* 70: 101-125.
- . 2002. Rome, Taxes, Rents and Trade. *The Ancient Economy*. W. Scheidel and S. von Reden eds. Edinburgh: Edinburgh University Press. Pp 190-230.
- Hornblower, Simon. 2012. Hellenism, Hellenization. *The Oxford Classical Dictionary*, edited by S. Hornblower, A. Spawforth and e. Eidinow. Oxford: Oxford University Press. Pp
- Horsley, Richard A. 1995. *Galilee: History, Politics, People*. Valley Forge, PA: Trinity Press International.
- Howland, Richard Hubbard. 1958. *The Athenian Agora Vol. IV: Greek Lamps and Their Survivals*. Princeton: American School of Classical Studies at Athens.
- Hughes, Thomas P. . 1983. *Networks of Power: Electrification in Western Societies, 1880-1930*. Baltimore: Johns Hopkins University Press.
- Humphrey, John William, John Peter Oleson, and Andrew N. Sherwood, eds. 1998. *Greek and Roman Technology: A sourcebook*. London: Routledge.
- I Tesori dei kurgani del Caucaso settentrionale: nuove scoperte degli archeologi sovietici nell'Adygeja e nell'Ossezia settentrionale*. 1990. Rome: Leonardo-De Luca.
- Ibrahim, Leila, Robert H. Brill, and Robert Lorentz Scranton. 1976. *Kenchreai: Eastern Port of Corinth Vol. II. The panels of opus sectile glass*. Leiden: Brill.
- Ignatiadou, Despina. 1999. A Hellenistic Board-game with Glass Counters (in Greek). *Ancient Macedonia* 1: 508-522.
- . 2002a. Colorless Glass in Late Classical and Early Hellenistic Macedonia. *Journal of Glass Studies* 44: 11-24.
- . 2002b. Macedonian Glass-working in the 4th Cent. B.C. *Hyalos = Vitrum = Glass : history, technology and conservation of glass and vitreous materials in the Hellenic world*. G. Kordas ed. Athens: Glasnet Publications. Pp 63-69.
- . 2003. Glass and Gold on Macedonian Funerary Couches. *Annales du 15e Congrès de l'Association Internationale pour l'Histoire du Verre (Corning 2001)*. Nottingham. Pp 4-7.

- . 2005. Colourless Glass Vessels from the Maussolleion at Halikarnassos. *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. M.-D. Nenna ed. Bristol. Pp 37-38.
- . 2009. Almonds, Lobes, and Ribs. *Annales du 17e Congrès de l'Association Internationale pour l'Histoire du Verre (Antwerp 2006)*. Brussels. Pp 19-24.
- . 2010. Achaemenid and Greek Colourless Glass. *The World of Achaemenid Persia*. J. Curtis and J. Simpson eds. London: British Museum. Pp 419-426.
- . 2012. A Haematinon Bowl from Pydna. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 69-74.
- Ignatiadou, Despina, and Anastassios Antonaras. 2010. Burial Customs and Uses of Glass in the Cemeteries of Northern Greece. *Γυάλινος Κόσμος / Glass Cosmos*. P. Adam-Veleni and D. Ignatiadou eds. Thessaloniki: Archaeological Museum of Thessaloniki. Pp 121-124.
- , eds. 2012. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. Thessaloniki: Association Internationale pour l'Histoire du Verre.
- Ignatiadou, Despina, Elissavet Dotsika, Athanassios Kouras, and Yannis Maniatis. 2005. Nitrum Chalestricum: The Natron of Macedonia. *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. M.-D. Nenna ed. Bristol. Pp 64-67.
- Ingemark, Dominic. 2014. *Glass, Alcohol and Power in Roman Iron Age Scotland*. Edinburgh: NMS Enterprises.
- Ingraham, Christopher. 2014. *1.6 million Americans don't have indoor plumbing. Here's where they live*. Washington Post. April 23, 2014 [accessed February 2, 2015]. <http://www.washingtonpost.com/blogs/wonkblog/wp/2014/04/23/1-6-million-americans-dont-have-indoor-plumbing-heres-where-they-live/>.
- Isings, Clasina. 1957. *Roman Glass from Dated Finds*. Groningen: Wolters.
- Israeli, Yael. 1991. The Invention of Blowing. *Roman Glass. Two Centuries of Art and Invention*. M. Newby and K. Painter eds. Occasional Papers of the Society of Antiquaries of London 13. London. Pp 46-55.
- . 2005. What Did Jerusalem's First-Century BCE Glass Workshop Produce? *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. M.-D. Nenna ed. Nottingham. Pp 54-57.
- . 2008. The Glass Vessels. *Archaeological Excavations at Caesarea Maritima: Areas CC, KK and NN. Final Reports*. J. Patrich ed. Jerusalem: Israel Exploration Society. Pp 367-418.
- . 2014. Glass Vessels from Stratum 3, Area J. *Jewish Quarter Excavations in the Old City of Jerusalem conducted by N. Avigad, vol. VI : Areas J, N, Z and other studies*. H. Geva ed. Jerusalem: Israeli Exploration Society. Pp 288-301.
- Israeli, Yael, and Natalya Katsnelson. 2006. Refuse of a Glass Workshop of the Second Temple Period from Area J. *Jewish Quarter Excavations in the Old City of Jerusalem III: Area E and Other Studies*. H. Geva ed. Jerusalem: Israel Exploration Society. Pp 411-460.
- Jackson-Tal, R.E. 2004. The Late Hellenistic Glass Industry in Syro-Palestine: A Reappraisal. *Journal of Glass Studies* 46: 11-32.

- Jackson-Tal, Ruth E. 2000. The Hellenistic Glass Finds in the Land of Israel in Light of Excavations at Marisa and Dor (in Hebrew). MA Thesis, Hebrew University of Jerusalem.
- . 2005. A Preliminary Survey of the Late Hellenistic Glass from Maresha (Marisa), Israel. *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. M.-D. Nenna ed. Nottingham. Pp 49-53.
- . 2008. Glass Trade in the Persian Period: The evidence from Palestine. *Transeuphratène* 36: 79-90.
- . 2009. Early Roman Glass in Context: Gamla (Gamala) Destruction of 67 AD. *Annales du 17e Congrès de l'Association Internationale pour l'Histoire du Verre (Antwerp 2006)*. Brussels. Pp 157-162.
- . 2013a. The Glass Finds from the Hasmonean and Herodian Palaces at Jericho. *Hasmonean and Herodian Palaces at Jericho. Final Reports of the 1973-1987 Excavations. Volume V: The Finds from Jericho and Cypros*. R. Bar-Nathan and J. Gärtner eds. Jerusalem: Israel Exploration Society. Pp 100-129.
- . 2013b. The Glass Finds from the Palatial Fortress at Cypros. *Hasmonean and Herodian Palaces at Jericho. Final Reports of the 1973-1987 Excavations. Volume V: The Finds from Jericho and Cypros*. R. Bar-Nathan and J. Gärtner eds. Jerusalem: Israel Exploration Society. Pp 165-173.
- . 2015. The Glass Finds from the Area of Herod's Tomb. *Herodium: Final Reports of the 1972-2010 Excavations Directed by Ehud Netzer*. R. Porat, R. Chachy and Y. Kalman eds. Jerusalem: Israel Exploration Society. Pp 396-408.
- Jackson, Caroline M. 2012. On the Provenance of Roman Glasses. *Obsidian and Ancient Manufactured Glasses*. I. Liritzis and C. M. Stevenson eds. Albuquerque: University of New Mexico Press. Pp 157-165.
- Jackson, Heather. 2014. *Jebel Khalid on the Euphrates Volume 4: The Housing Insula*. Mediterranean Archaeology Supplement 9. Sydney: University of Sydney.
- Jackson, Monica M. 2012. The Amisos Treasure: A Hellenistic Tomb From the Age of Mithradates Eupator. *The Black Sea, Paphlagonia, Pontus and Phrygia in Antiquity*. G. R. Tsetsikhilade ed. BAR International Series 2432. Oxford: Archaeopress. Pp 109-116.
- Jacobson, David, and Nikos Kokkinos. 2008. *Herod and Augustus: Papers Presented at the IJS Conference, 21st-23rd June 2005*. Brill.
- Jaffe, M. 1978. *Glass at the Fitzwilliam Museum*. Cambridge: Cambridge University Press.
- James, Sarah A. 2010. The Hellenistic Pottery from the Panayia Field: Studies in Chronology and Context. PhD Dissertation, University of Texas Austin, Austin, TX.
- . 2014. Bridging the Gap: Local Pottery Production in Corinth 146-44 BC. *Pottery, Peoples and Places: Study and interpretation of Late Hellenistic Pottery*. P. G. Bilde and M. L. Lawall eds. Black Sea Studies 16. Aarhus: Aarhus University Press. Pp 47-64.
- Jeammet, Violaine, ed. 2010. *Tanagra: Figurines for life and eternity. The Musée du Louvre's Collection of Greek Figurines*. Valencia: Fundación Bancaja.
- Jennings, Justin. 2011. *Globalizations and the Ancient World*. Cambridge: Cambridge University Press.
- Jennings, Sarah. 2000. Late Hellenistic and Early Roman Cast Glass from the Souks Excavation (BEY 006), Beirut, Lebanon. *Journal of Glass Studies* 42: 41-59.
- . 2002. Late Hellenistic and Early Roman Glass from the Souks Excavations in Beirut, Lebanon. *Hyalos = Vitrum = Glass : history, technology and conservation of glass and*

- vitreous materials in the Hellenic world*. G. Kordas ed. Athens: Glasnet Publications. Pp 127-132.
- . 2004-2005. *Vessel Glass from Beirut, BEY 006, 007, and 045*. Berytus 48-49. Beirut: American University of Beirut.
- Jidejian, Nina. 1969. *Tyre Through the Ages*. Beirut: Dar el-Mashreq Publishers.
- Jockey, Philippe. 1998. Neither School nor *Koine*: The Local Workshops of Delos and their Unfinished Sculpture. *Regional Schools in Hellenistic Sculpture: Proceedings of an international conference held at the American School of Classical Studies at Athens, March 15-17, 1996*. O. Palagia and W. D. E. Coulson eds. Oxbow Monograph 90. Oxford: Oxbow Books. Pp 177-184.
- Johns, C. N. 1950. The Citadel, Jerusalem. A Summary of Work since 1934. *Quarterly of the Department of Antiquities in Palestine* 14: 121-190.
- Jones, A. H. M. 1971. *The Cities of the Eastern Roman Provinces*. Second ed. Oxford: Clarendon Press.
- Jones, Donald W. 2014. *Economic Theory and the Ancient Mediterranean*. Wiley Blackwell.
- Jones, Janet Duncan. 1995. Classical and Hellenistic Core-formed Vessels from Gordion. *Journal of Glass Studies* 37: 21-33.
- . 2005. Glass Vessels from Gordion: Trade and Influence along the Royal Road. *The Archaeology of Midas and the Phrygians: Recent Work at Gordion*. L. Kealhofer ed. Philadelphia. Pp 101-116.
- . 2013. Glass. *Humayma Excavation Project, 2. Nabataean Campground and Necropolis, Byzantine Churches, and Early Islamic Domestic Structures*. J. P. Oleson and R. Schick eds. Boston: American Schools of Oriental Research. Pp 515-546.
- . forthcoming. *The Glass Vessels*. Gordion Special Studies. Philadelphia: University of Pennsylvania Press.
- Kahn, Lisa C. 2014. Herodian Innovation: The Glass Industry. *Near Eastern Archaeology* 77(2): 129-139.
- Kaltsas, Nikolaos, Elena Vlachogianni, and Polyxeni Bouyia, eds. 2012. *The Antikythera Shipwreck: the ship, the treasures, the mechanism*. Athens: Hellenic Ministry of Culture and Tourism.
- Kantor, Helene J. 1947. *The Aegean and the Orient in the Second Millennium B.C.* Monographs on Archaeology and Fine Arts 4. Bloomington, IN: Principia Press.
- Kantzia, Charis. 1988. Corner Streets Mpoumpoulinas and Herodotou (O.T. 13, Ch. Kourounis Property) (in Greek). *Archaiologikon Deltion* 43(B2): 635-637.
- Karageorghis, Vassos, Joan R. Mertens, and Marice E. Rose. 2000. *Ancient Art from Cyprus: the Cesnola Collection in the Metropolitan Museum of Art*. New York: Metropolitan Museum of Art.
- Karageorghis, Vassos, Eleni Vassilika, and Penelope Wilson. 1999. *The Art of Ancient Cyprus in the Fitzwilliam Museum, Cambridge*. Nicosia: The A.G. Leventis Foundation.
- Keller, Daniel. 1997. Swiss-Liechtenstein Excavations at Az-Zantur in Petra 1996, The Seventh Season: Mosaic Glass from az-Zantur. *Annual of the Department of Antiquities Jordan* 41: 242-246.
- . 2006. Die Gläser aus Petra. *Petra, Ez Zantur III: Ergebnisse der Schweizerisch-Liechtensteinischen Ausgrabungen*. Mainz: Philipp von Zabern
- Kennedy, David. 2013. *Gerasa and the Decapolis*. Duckworth Debates in Archaeology. London: Bloomsbury Publishing.

- Kertesz, Trude. 1989a. Beads and Pendants. *Excavations at Tel Michal, Israel*. Z. Herzog, G. R. Rapp and O. Negbi eds. Minneapolis: University of Minnesota Press. Pp 370-374.
- . 1989b. Glass Artifacts. *Excavations at Tel Michal, Israel*. Z. Herzog, G. R. Rapp and O. Negbi eds. Minneapolis: University of Minnesota Press. Pp 365-369.
- Keyser, Paul T., and Georgia Irby-Massie. 2006. Science, Medicine, and Technology. *The Cambridge Companion to the Hellenistic World*. G. R. Bugh ed. Cambridge: Cambridge University Press. Pp 241-264.
- Knappett, Carl. 1999. Tradition and Innovation in Pottery Forming Technology: Wheel-Throwing at Middle Minoan Knossos. *The Annual of the British School at Athens* 94: 101-129.
- , ed. 2013. *Network Analysis in Archaeology: New Approaches to Regional Interaction*. Oxford: Oxford University Press.
- Kolonas, L. 2002. Τα γυάλινα αγγεία της Πάτρας. *To Γυαλί από την αρχαιότητα έως σήμερα (Glass from Antiquity to the Present)*. P. G. Themeles ed. Athens: Hetaireia Messēniakōn Archaialogikōn Spoudōn. Pp 109-134.
- Kopytoff, Igor. 1986. The Cultural Biography of Things: Commoditization as process. *The Social Life of Things: Commodities in Cultural Perspective*. A. Appadurai ed. Cambridge: Cambridge University Press. Pp 64-91.
- Kouremenos, Anna, Sujatha Chandrasekaran, and Roberto Rossi, eds. 2011. *From Pella to Gandhara: Hybridisation and Identity in the Art and Architecture of the Hellenistic East*. BAR International Series 2221. Oxford: Archaeopress.
- Kowatli, Ibrahim, Hans H. Curvers, Barbara Stuart, Yvette Sablerolles, Julian Henderson, and Paul Reynolds. 2006. A Pottery and Glass Production Site in Beirut (BEY 015). *Baal: Bulletin d'archeologie et d'architecture libanaises* 10: 103-129.
- Kozloff, Arielle P. 1996. Is There an Alexandrian Style - What is Egyptian about It? *Alexandria and Alexandrianism: Papers Delivered at a Symposium Organized by the J. Paul Getty Museum and the Getty Center of the History of Art and the Humanities and Held at the Museum April 22-25, 1993*. Malibu: J. Paul Getty Museum. Pp 247-260.
- Kucharczyk, Renata. 2007. Late Roman/Early Byzantine Glass from the Auditoria on Kom el-Dikka in Alexandria. *Polish Archaeology in the Mediterranean* 17: 45-53.
- Kuhn, Steven. 2004. Evolutionary Perspectives on Technology and Technological Change. *World Archaeology* 36(4): 561-570.
- Kuhrt, Amelie, and Susan M. Sherwin-White, eds. 1987. *Hellenism in the East: Interaction of Greek and non-Greek civilizations from Syria to Central Asia after Alexander*. London: Duckworth.
- Kunina, Nina. 1997. *Ancient Glass in the Hermitage Collection*. Art Treasures of Russia. St. Petersburg: State Hermitage.
- Kurinsky, Samuel. 1991. *The Glassmakers: An Odyssey of the Jews, the First Three Thousand Years*. New York: Hippocrene Books.
- Landau, Y. H. 1966. A Greek Inscription Found Near Hefzibah. *Israel Exploration Journal* 16: 54-70.
- Landvatter, Thomas P. 2013. Identity, Burial Practice, and Social Change in Ptolemaic Egypt. Ph.D. Dissertation, Classical Art and Archaeology, University of Michigan, Ann Arbor.
- Langdon, Susan Helen. 2008. *Art and Identity in Dark Age Greece, 1100-700 B.C.E.* Cambridge: Cambridge University Press.

- Langin-Hooper, Stephanie M. 2007. Social Networks and Cross-Cultural Interaction: A New Interpretation of the Female Terracotta Figurines of Hellenistic Babylon. *Oxford Journal of Archaeology* 26(2): 145-165.
- . 2013. Problematizing Typology and Discarding the Colonialist Legacy: Approaches to hybridity in the terracotta figurines of Hellenistic Babylonia. *Archaeology and Cultural Mixture*. W. P. van Pelt ed. Archaeological Review from Cambridge 28.1. Pp 950-114.
- Lapp, Nancy L. 1980. The Excavations at Araq el-Emir. Volume I. *The Annual of the American Schools of Oriental Research* 47: iii-158.
- Larson, Katherine A. 2013. A Network Approach to Hellenistic Sculptural Production. *Journal of Mediterranean Archaeology* 26(2): 233-259.
- . forthcoming-a. Beads and Pendants. *Tel Anafa II,iii*. A. M. Berlin and S. C. Herbert eds. Ann Arbor: Kelsey Museum of Archaeology
- . forthcoming-b. Glass Counters. *Tel Anafa II,iii*. A. M. Berlin and S. C. Herbert eds. Ann Arbor: Kelsey Museum of Archaeology
- Larson, Katherine A., Andrea Berlin, and Sharon Herbert. in preparation. Glass Vessels from the Persian and Hellenistic Administrative Building at Tel Kedesh, Israel. *Annales of the 20th Congress of the Association International pour l'Histoire du Verre*. Romont: Association International pour l'Histoire du Verre
- Larson, Katherine A., and Katherine M. Erdman. forthcoming. Tools for Textile Manufacture. *Tel Anafa II,iii*. A. M. Berlin and S. C. Herbert eds. Ann Arbor: Kelsey Museum of Archaeology
- Lateiner, Donald. 1976. Tissaphernes and the Phoenician Fleet (Thucydides 8.87). *Transactions of the American Philological Association* 106: 267-290.
- Lauwers, Veerle, Patrick Degryse, and Marc Waelkens. 2007a. A Ceramic Tool for the Glass-Blower. *Oxford Journal of Archaeology* 26(2): 193-200.
- . 2007b. Evidence for Anatolian Glassworking in Antiquity: The Case of Sagalassos (Southwestern Turkey). *Journal of Glass Studies* 49: 39-50.
- Lawler, Andrew. 2012. Diving Into the Indian Ocean's Past. *Science* 337(6092): 288-289.
- Leibner, Uzi. 2009. *Settlement and History in Hellenistic, Roman, and Byzantine Galilee: An Archaeological Survey of the Eastern Galilee*. Tübingen: Mohr Siebeck.
- Leonard, Albert, Jr. 2001. Miscellaneous Material Culture. *Ancient Naukratis: Excavations at a Greek Emporium in Egypt, Part II: The excavations at Kom Hadid*. A. Leonard, Jr. ed. Annual of the American Schools of Oriental Research 55. Pp 164-220.
- Leskov, Aleksandr Mikhailovich, V. L. Lapushnian, and V.A. Nabatchikov. 1987. *Shedevry drevnego iskusstva Kubani : katalog vystavki = Art treasures of ancient Kuban : catalog of exhibition*. Moscow: Ministerstvo kul'tury SSSR.
- Lesure, Richard. 1999. On the Genesis of Value in Early Hierarchical Societies. *Material Symbols: Culture and economy in prehistory*. J. E. Robb ed. Occasional Paper 26. Carbondale: Center for Archaeological Investigations, Southern Illinois University. Pp 23-55.
- Levine, Tikva. 2003a. Pottery and Small Finds from Subterranean Complex 44. *Maresha Excavations Final Report I. Subterranean Complexes 21, 44, 70*. A. Kloner ed. IAA Reports 17. Jerusalem: Israel Antiquities Authority. Pp 131-135.
- . 2003b. Pottery and Small Finds from Subterranean Complexes 21 and 70. *Maresha Excavations Final Report I. Subterranean Complexes 21, 44, 70*. A. Kloner ed. IAA Reports 17. Jerusalem: Israel Antiquities Authority. Pp 73-130.

- Levy, Abraham. 1990. Small Inventions? They Changed How People Lived in the Hellenistic Age. *Biblical Archaeology Review* 16(4): 32-41.
- Liardet, Frances. 2009. Learning by Hand: Artefact Consistency and Craft Tradition. *Annales du 17e Congrès de l'Association Internationale pour l'Histoire du Verre (Antwerp 2006)*. Brussels. Pp 184-188.
- Lierke, Rosemarie. 1993. 'Aliud Torno Teritur' Rippenschalen und die Spuren einer unbekanntenen Glasstechnologie Heisses Glas auf der Töpferscheibe. *Antike Welt* 24(3): 218-234.
- . 1999. *Antike Glastöpferei: ein vergessenes Kapitel der Glasgeschichte*. Sonderbände der Antiken Welt. Mainz am Rhein: Philipp von Zabern.
- . 2009. *Die nicht-geblasenen antiken Glasgefäße: ihre Herstellung von den Anfängen bis zu den Luxusglasern der Römer = The non-blown ancient glass vessels: their manufacturing from the beginning to the luxury glasses of the Romans*. Offenbach/Main: Deutsche glastechnische Gesellschaft.
- Lightfoot, Christopher S. 1990. Three Cast Vessels from Anatolia. *Annales du 11e Congrès de l'Association Internationale pour l'Histoire du Verre (Basel 1988)*. Amsterdam. Pp 85-94.
- . 1993a. Recent Finds of Roman Glass from the Tigris in South-east Turkey. *Annales du 12e Congrès de l'Association Internationale pour l'Histoire du Verre (Vienna 1991)*. Amsterdam: Association Internationale pour l'Histoire du Verre. Pp 89-98.
- . 1993b. Some Examples of Ancient Cast and Ribbed Bowls in Turkey. *Journal of Glass Studies* 35: 22-38.
- . 2003. From East to West: The Early Roman Glass Industry. *Échanges et commerce du verre dans le monde antique*. D. Foy and M.-D. Nenna eds. Monographies instrumentum 24. Montagnac: Editions Monique Mergoïl. Pp 341-347.
- . 2014. *Ennion: Master of Roman Glass*. New York: Metropolitan Museum of Art.
- Lillios, Katina T. 1999. Objects of Memory: The Ethnography and Archaeology of Heirlooms. *Journal of Archaeological Method and Theory* 6(3): 235-262.
- Lipschits, Oded, Sylvie Honigman, Thomas Römer, and Christoph Nihan, eds. forthcoming. *Judaea in the Long Third Century BCE: The Transition between the Persian and Hellenistic Periods*. Eisenbrauns.
- Liritzis, Ioannis, and Christopher M. Stevenson, eds. 2012. *Obsidian and Ancient Manufactured Glasses*. Albuquerque: University of New Mexico Press.
- Lund, John. 1999. Rhodian Amphorae in Rhodes and Alexandria as Evidence of Trade. *Hellenistic Rhodes: Politics, Culture, and Society*. V. Gabrielsen, P. Bilde, T. Engberg-Pedersen, L. Hannestad and J. Zahle eds. Studies in Hellenistic Civilization IX. Aarhus, Netherlands: Aarhus University Press. Pp 187-204.
- . 2005. An Economy of Consumption: The Eastern Sigillata A Industry in the Late Hellenistic Period. *Making, Moving and Managing: The New World of Ancient Economies 323-31 B.C.* Z. Archibald, J. K. Davies and V. Gabrielsen eds. Oxford: Oxbow. Pp 233-252.
- Lyubomirova, Valentina, Žiga Šmit, Helena Fajfar, and Ivelin Kuleff. 2014. Chemical Composition of Glass Beads from the Necropolis of Apollonia Pontifica (5th–3rd Century BC). *Archaeologia Bulgarica* 18(2): 1-17.
- Ma, John. 2002. *Antiochus III and the Cities of Western Asia Minor*. Revised ed. Oxford: Oxford University Press.

- . 2013. Re-Examining Hanukkah. *Marginalia Review of Books*, <http://marginalia.lareviewofbooks.org/re-examining-hanukkah/>.
- Macalister, Robert Alexander Stewart. 1912. *The Excavation of Gezer, 1902-1905 and 1907-1909, Vol 2*. London: Palestine Exploration Fund.
- Mace, Ruth, Clare J. Holden, and Stephen Shennan. 2005. *The Evolution of Cultural Diversity: A Phylogenetic Approach*. London: UCL Press.
- Magen, Izchak. 2002. *The Stone Vessel Industry in the Second Temple Period: Excavations at Hizma and the Jerusalem Temple Mount*. Judea and Samaria Publications 1. Jerusalem: Israel Exploration Society.
- Magness, Jodi. 2011. *Stone and Dung, Oil and Spit: Jewish Daily Life in the Time of Jesus*. Grand Rapids, MI: Eerdmans.
- Mahnke, Charis. 2008. *Alexandrinische Mosaikglaseinlagen: die Typologie, Systematik und Herstellung von Gesichterdarstellungen in der ptolemäischen Glaskunst*. *Philippika* 22. Wiesbaden: Harrassowitz.
- Mairs, Rachel. 2014. Models, Moulds and Mass Production: The Mechanics of Stylistic Influence from the Mediterranean to Bactria. *Ancient West & East* 13: 175-195.
- Makharadze, George, and Mariam Saginashvili. 1999. An Achaemenian Glass Bowl from Sairke, Georgia. *Journal of Glass Studies* 41: 11-17.
- Mallowan, M. E. L. 1966. *Nimrud and its remains*. 3 v. (677 p.). New York: Dodd, Mead.
- Mandeville, Bernard. 1729. *The Fable of the Bees*. London: J. Tonson.
- Manning, J. G. 2010. *The Last Pharaohs: Egypt under the Ptolemies, 305-30 B.C.* Princeton: Princeton University Press.
- Marcus, Michelle I. 1991. The Mosaic Glass Vessels from Hasanlu, Iran: A study in large-scale stylistic trait distribution. *The Art Bulletin* 73(4): 536-560.
- Margaritis, Evi, and Martin Jones. 2008. Olive Oil Production in Hellenistic Greece: the interpretation of charred olive remains from the site of Tria Platania, Macedonia, Greece (fourth-second century B.C.). *Vegetation History and Archaeobotany* 17(4): 393-401.
- Marine Archaeologists Excavate Greek Antikythera Shipwreck*. 2015. Woods Hole Oceanographic Institution, September 24, 2015 [accessed October 3 2015]. <http://www.whoi.edu/news-release/antikythera-shipwreck-excavation>.
- Markoe, Glenn. 2000. *Phoenicians*. London: British Museum Press.
- Martin, Ann Smart. 1994. Fashionable Sugar Dishes, Latest Fashion Ware: The Creamware Revolution in the Eighteenth-Century Chesapeake. *Historical Archaeology of the Chesapeake*. P. A. Shackel and B. J. Little eds. Washington DC: Smithsonian Institution Press. Pp 169-188.
- . 1996. Frontier Boys and Country Cousins: The Context for Choice in Eighteenth-Century Consumerism. *Historical Archaeology and the Study of American Culture*. L. A. De Cunzo and B. L. Herman eds. Knoxville: University of Tennessee Press. Pp 71-102.
- Martins, Christopher Barry. 2005. *Becoming Consumers: Looking Beyond Wealth as an Explanation for Villa Variability: Perspectives from the East of England*. British Archaeological Reports British Series 403. Oxford: Archaeopress.
- Matteis, Lorella Maria de, and Giandomenico de Tommaso. 2001. Vetri. *Gortina Vol. V.3: Lo scavo del Pretorio (1989-1995). I Materiali*. A. d. Vita ed. Padua: Bottega d'Erasmus. Pp 190-259.

- Mattingly, David. 2010. Cultural Crossovers: Global and Local Identities in the Classical World. *Material Culture and Social Identities in the Ancient World*. S. Hales and T. Hodos eds. Cambridge: Cambridge University Press. Pp 283-295.
- Mauss, Marcel. 1925. *The Gift: Forms and Functions of Exchange in Archaic Societies*.
- McCall, Bernadette, Amanda Dusting, and Iona McRae. 2015. Glass Fragments from Qaleh Kali, an Achaemenid Site in South-western Iran. Paper given at *20e Congrès de l'Association Internationale pour l'Histoire du Verre*. Fribourg, Switzerland.
- McCann, Anna Marguerite. 2002. *The Roman Port and Fishery of Cosa: A short guide = Il porto romano e la peschiera di Cosa: guida breve*. Rome: American Academy in Rome.
- McCann, Anna Marguerite, and Joanne Bourgeois. 1987. *The Roman Port and Fishery of Cosa: A center of ancient trade*. Princeton, NJ: Princeton University.
- McClellan, Murray C. 1984. Core-formed Glass from Dated Contexts. PhD Dissertation, University of Pennsylvania, Philadelphia.
- McCray, Patrick. 1998. *The Prehistory & History of Glassmaking Technology*. Westerville, Ohio: The American Ceramic Society.
- McCray, Patrick, and W. David Kingery. 1998. Introduction: Toward a Broader View of Glass History and Technology. *The Prehistory & History of Glassmaking Technology*. P. McCray ed. Westerville, OH: The American Ceramic Society. Pp 1-16.
- McCray, W. Patrick. 1999. *Glassmaking in Renaissance Venice: The fragile craft*. Aldershot: Ashgate.
- McGing, Brian. 2003. Subjection and Resistance: To the Death of Mithradates. *A Companion to the Hellenistic World*. A. Erskine ed. Oxford: Blackwell Publishing. Pp 71-89.
- McKendrick, Neil, John Brewer, and J. H. Plumb. 1982. *The Birth of a Consumer Society: the Commercialization of Eighteenth-century England*. Bloomington, IN: Indiana University Press.
- McParland, Laura, Zoë Hazell, Gill Campbell, Margaret Collinson, and Andrew Scott. 2009. How the Romans Got Themselves into Hot Water: temperatures and fuel types used in firing a hypocaust. *Environmental Archaeology* 14: 176-183.
- Meadows, Andrew. 2014. The Spread of Coins in the Hellenistic World. *Explaining Monetary and Financial Innovation*. P. Bernholz and R. Vaubel eds. Financial and Monetary Policy Studies 39. Springer International Publishing. Pp 169-195.
- Melikian-Chirvani, Assadollah-Souran. 1993. The International Achaemenid Style. *Bulletin of the Asia Institute* 7: 111-130.
- Merker, Gloria S. 2012. The Objects of Metal. *Tel Anafa II,ii*. S. Herbert and A. Berlin eds. Kelsey Museum Fieldwork Series. Ann Arbor: University of Michigan. Pp 215-280.
- Messika, N. 1997. Excavation of the Courthouse Site at 'Akko: The Hellenistic Terracotta Figurines from Areas TB and TC (Supplement: A Glass Figurine). *Atiqot* 31: 127.
- Meyer, Carol. 1992. *Glass from Quseir al-Qadim and the Indian Ocean trade*. Studies in Ancient Oriental Civilization. Chicago: Oriental Institute of the University of Chicago.
- Meyers, Eric M., A. Thomas Kraabel, and James F. Strange. 1976. Ancient Synagogue Excavations at Khirbet Shema', Upper Galilee, Israel 1970-1972. *Annual of the American Schools of Oriental Research* 42.
- Meyers, Eric M., James F. Strange, and Dennis E. Groh. 1978. The Meiron Excavation Project: Archaeological Survey in Galilee and Golan, 1976. *Bulletin of the American Schools of Oriental Research* 230: 1-24.

- Meyers, Eric M., James F. Strange, and Carol L. Meyers. 1981. *Excavations at Ancient Meiron, Upper Galilee, Israel, 1971-72, 1974-75, 1977*. Meiron Excavation Project 3. Cambridge, MA: American Schools of Oriental Research.
- Michelaki, Kostalena, Gregory V. Braun, and Ronald G. V. Hancock. 2014. Local Clay Sources as Histories of Human-Landscape Interactions: A Ceramic Taskscape Perspective. *Journal of Archaeological Method and Theory* 22(3): 783-827.
- Mikesell, Marvin W. 1969. The Deforestation of Mount Lebanon. *Geographical Review* 59(1): 1-28.
- Miles, Margaret M. 2008. *Art as Plunder: The ancient origins of debate about cultural property*. Cambridge: Cambridge University Press.
- Millar, Fergus. 2006 (1983). The Phoenician Cities: A Case-Study of Hellenisation. *Rome, the Greek World, and the East. Vol. 3: The Greek World, the Jews, and the East*. Chapel Hill: University of North Carolina Press. Pp 32-50.
- Miller, Daniel. 1987. *Material Culture and Mass Consumption*. Social Archaeology. Oxford: Blackwell.
- . 2001. *Consumption: Critical concepts in the social sciences*. 4 v. London: Routledge.
- Miller, Stella G. 1979. The So-Called Palaiokastro Treasure. *American Journal of Archaeology* 83(2): 175-191.
- Millett, Martin. 1992. *The Romanization of Britain: An essay in archaeological interpretation*. Cambridge: Cambridge University Press.
- Mirtsou, E., M. Kessissoglou, and Marie-Dominique Nenna. 1999. Analyses de verres découverts à Délos. *Les Verres. Exploration Archéologique de Délos Fascicule 37*. Athens: École Française d'Athènes. Pp 205-212.
- Mladenova, J. 1963. Objets en verre et en albâtre de la nécropole d'Apollonia. *Apoloniia: razkopkite v nekropol na Apoloniia prez 1947-1949*. I. Venedikov ed. Sofia: Izd-vo Bulgarska akademiia na naukite. Pp 305-312; French summary 385-386.
- Mlynarczyz, Jolanta. 2009. Sigillatae (ESA, CS) and "Pseudo-Sigillata" (PPW) at Geronisos: An overview of forms and comparison of repertoire. *Report of the Department of Antiquities, Cyprus* 118(2): 349-364.
- Mollo, Rosanna, and Patrizia Framarin. 2003. Glass and Areas of Production in the Ancient World. *Glass throughout time: history and technique of glassmaking from the ancient world to the present*. R. Barovier Mentasti, R. Mollo, P. Framarin, M. Sciacaluga and A. Geotti eds. Milan: Skira. Pp 15-23.
- Moorey, P. R. S. 1999. *Ancient Mesopotamian Materials and Industries: The archaeological evidence*. Winona Lake: Eisenbrauns.
- Morel, Jean-Paul. 1969. Kerkouane, ville punique du cap Bon: Remarques archéologiques et historiques. *Mélanges d'archéologie et d'histoire*: 473-518.
- Morris, Ian. 1999. Forward. *The Ancient Economy by M. I. Finley*. University of California Press: Berkeley. Pp ix-xxxvi.
- . 2005. Archaeology, Standards of Living, and Greek Economic History. *The Ancient Economy: Evidence and Models*. J. G. Manning and I. Morris eds. Stanford: Stanford University Press. Pp 91-126.
- Moyer, Ian S. 2011. *Egypt and the Limits of Hellenism*. Cambridge: Cambridge University Press.
- Muhs, Brian. 2001. Membership in Private Associations in Ptolemaic Tebtunis. *Journal of the Economic and Social History of the Orient* 44: 1-21.

- Mukerji, Chandra. 1983. *From Graven Images: Patterns of modern materialism*. New York: Columbia University Press.
- Muller, Arthur. 2000. Artisans, techniques de production et diffusion: le cas de la coroplastie. *L'artisanat en Grèce ancienne: les productions, les diffusions: actes du colloque de Lyon (10-11 décembre 1998)*. F. Blonde and A. Muller eds. Villeneuve d'Ascq: Université Charles de Gaulle - Lille. Pp 91-106.
- Müller, Christel. 2013. Mobility and Belonging in Antiquity: Greeks and Barbarians on the Move in the Northern Black Sea Region. *Migration and Membership Regimes in Global and Historical Perspective*. U. Bosma, G. Kessler and L. Lucassen eds. Leiden: Brill. Pp 23-50.
- Mullins, Paul R. 2004. Ideology, Power, and Capitalism: The Historical Archaeology of Consumption. *A Companion to Social Archaeology*. L. Meskell and R. W. Preucel eds.: Blackwell Publishing. Pp 195-211.
- . 2011a. *The Archaeology of Consumer Culture*. American Experience in Archaeological Perspective. Gainesville: University Press of Florida.
- . 2011b. The Archaeology of Consumption. *Annual Review of Anthropology* 40: 133-144.
- Muthucumarana, R., A. S. Gaur, W. M. Chandraratne, M. Manders, B. Ramlingeswara Rao, Ravi Bhushan, V. D. Khedekar, and A. M. A. Dayananda. 2014. An Early Historic Assemblage Offshore of Godawaya, Sri Lanka: Evidence for Early Regional Seafaring in South Asia. *Journal of Maritime Archaeology* 9(1): 41-58.
- Mutz, Alfred. 1972. *Die Kunst des Metaldrehens bei den Römern: Interpretationen antiker Arbeitsverfahren auf Grund von Werkspuren*. Basel: Birkhäuser.
- Myers, E. A. 2010. *The Ituraeans and the Roman Near East: Reassessing the sources*. Society for New Testament Studies Monograph Series 147. Cambridge: Cambridge University Press.
- Najbjerg, Tina. 2012. The City of Arsinoe in the Hellenistic and Roman Periods. *City of Gold: The Archaeology of Polis Chrysochous, Cyprus*. W. A. P. Childs, J. S. Smith and J. M. Padgett eds. New Haven: Yale University Press. Pp 230-248.
- Neff, Hector. 1992. Ceramics and Evolution. *Archaeological Method and Theory* 4: 141-193.
- Nenna, Marie-Dominique. 1993a. Eléments d'incrustation en verre des nécropoles alexandrines. *Annales du 12e Congrès de l'Association Internationale pour l'Histoire du Verre (Vienna 1991)*. Amsterdam: Association Internationale pour l'Histoire du Verre. Pp 45-52.
- . 1993b. La Verrerie d'Époque Hellenistique à Delos. *Journal of Glass Studies* 35: 11-21.
- . 1995. Les éléments d'incrustation: une industrie égyptienne du verre. *Alessandria e il mondo Ellenistico-Romano*. Rome: L'Erma di Bretschneider. Pp 377-384.
- . 1998. Les ateliers de verriers dans le monde grec aux époques classique et hellénistique. *Topoi* 8(2): 693-701.
- . 1999. *Les Verres. Exploration Archéologique de Délos, Fascicule 37*. Exploration Archéologique de Délos Fascicule 37. Athens: École Française d'Athènes.
- . 2000a. Ateliers de production et sites de consommation en Égypte. Ve siècle av.J.-C. - VIIe siècle ap.J.-C. Premier bilan. *Annales du 14e Congrès de l'Association internationale pour l'Histoire du Verre (Venice-Milan 1998)*. Lochem: International Association for the History of Glass. Pp 20-24.

- . 2000b. *La route du verre: ateliers primaires et secondaires du second millénaire av. J.-C. au Moyen Âge*. Travaux de la Maison de l'Orient Méditerranéen 33. Lyon: Maison de l'Orient Méditerranéen.
- . 2001. Le mobilier en verre. *Nécropolis I*. Études alexandrines 5. Cairo: Institut français d'archéologie orientale. Pp 505-512.
- . 2007a. Compte rendu: Vessel Glass from Beirut, BEY 006, 007 and 045. *Topoi* 15(2): 767-774.
- . 2007b. La production et la circulation du verre au Proche-Orient: état de la question. *Topoi* Suppl. 8: 123-150.
- . 2013. Compte rendu: Tel Anafa II, ii. Glass Vessels, Lamps, Objects of Metal and Groundstone and Other Stone Tools and Vessels. *Topoi* 18(2): 639-650.
- . 2015. Primary Glass Workshops in Graeco-Roman Egypt. *Glass of the Roman World*. J. Bayley, I. Freestone and C. Jackson eds. Oxford: Oxbow Books. Pp 1-22.
- Nenna, Marie-Dominique, and Bernard Gratuze. 2009. Étude diachronique des compositions de verres employés dans les vases mosaïqués antiques: Résultats préliminaires. *Annales du 17e Congrès de l'Association Internationale pour l'Histoire du Verre (Antwerp 2006)*. Brussels. Pp 59-63.
- Nenna, Marie-Dominique, Maurice Picon, Valérie Thirion-Merle, and Michèle Vichy. 2005. Ateliers primaires du Wadi Natrun: Nouvelles Découvertes. *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. M.-D. Nenna ed. Nottingham. Pp 59-63.
- Nenna, Marie-Dominique, Maurice Picon, and Michèle Vichy. 2000. Ateliers primaires et secondaires en Égypte à l'époque Gréco-Romaine. *La Route du Verre. Ateliers primaires et secondaires du second millénaire av. J.-C. au Moyen Âge*. M.-D. Nenna ed. Travaux de la Maison de l'Orient Méditerranéen 33. Lyon: Maison de l'Orient. Pp 97-112.
- Nenner-Soriano, Ravit. 2006. Miscellaneous Finds. *Jewish Quarter Excavations in the Old City of Jerusalem Conducted by Nahman Avigad, 1969-1982. Voi. III: Area E and Other Studies*. H. Geva ed. Jerusalem: Israel Exploration Society. Pp 310-314.
- Netzer, Ehud. 2001. *The Palaces of the Hasmoneans and Herod the Great*. Jerusalem: Yad Ben-Zvi Press.
- . 2008. *Architecture of Herod, the Great Builder*. Grand Rapids, MI: Baker Academic.
- Nevett, Lisa C. 1999. *House and Society in the Ancient Greek World*. New Studies in Archaeology. Cambridge: Cambridge University Press.
- . 2007. Housing and Households: The Greek World. *Classical Archaeology*. S. E. Alcock and R. Osborne eds. Blackwell Studies in Global Archaeology. Oxford: Blackwell. Pp 205-223.
- Nicholson, Paul T. 2003. New Excavations at a Ptolemaic-Roman Faience Factory at Memphis, Egypt. *Annales du 15e Congrès de l'Association Internationale pour l'Histoire du Verre (Corning 2001)*. Nottingham: International Association for the History of Glass. Pp 49-52.
- . 2013. *Working in Memphis: The production of faience at Roman Period Kom Helul*. Excavation Memoir 105. London: Egypt Exploration Society.
- Nicholson, Paul T., Rainer Gerish, Elina Brook, and Caroline Jackson. 2007. *Brilliant Things for Akhenaten: The production of glass, vitreous materials and pottery at Amarna Site O45.I*. Excavation Memoir 80. London: Egypt Exploration Society.

- Nicolaou, Ino. 1984. A Hellenistic and Roman Tomb at Eurychou-Phoenikas. *Report of the Department of Antiquities, Cyprus* 1984: 234-256.
- Nightingale, Georg. 1998. Glass and the Mycenaean Palaces of the Aegean. *The Prehistory & History of Glassmaking Technology*. P. McCray ed. Westerville, OH: The American Ceramic Society. Pp 205-226.
- Novičenkova, Natalia G. 2008. Mountainous Crimea: A Frontier Zone of Ancient Civilization. *Meetings of Cultures in the Black Sea Region: Between conflict and coexistence*. P. G. Bilde and J. H. Petersen eds. Aarhus: Aarhus University Press. Pp 287-301.
- O'Hea, Margaret. 1992. The Glass Industry of Pella and the Decapolis. *Aram* 4(1&2): 253-265.
- . 2002. The Glass and Personal Adornment. *Jebel Khalid on the Euphrates: Report on Excavations 1986-1996 Vol I*. G. Clarke ed. Mediterranean Archaeology 5. Sydney: University of Sydney. Pp 245-272.
- . 2005. Late Hellenistic Glass from Some Military and Civilian Sites in the Levant: Jebel Khalid, Pella and Jerusalem. *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. M.-D. Nenna ed. Nottingham. Pp 44-48.
- . 2006/2007. Greeks and Glass: the Role of Hellenistic Greek Settlements in the Eastern Mediterranean in Glass Production and Consumption. *Mediterranean Archaeology* 19/20: 141-150.
- . 2011a. Another Look at the Origins of Iron Age II Cast Glass Vessels in the Levant. *Levant* 43(2): 153-172.
- . 2011b. Jebel Khalid Fieldwork Report 2009-2010: The Glass. *Mediterranean Archaeology* 24: 152-163.
- Ogden, Jack. 1982. *Jewellery of the Ancient World*. New York: Rizzoli.
- Oikonomou, Artemios, Marijke Gnade, Julian Henderson, Simon Chenery, and Nikos Zacharias. 2015. The Provenance of Hellenistic Core Formed Vessels from Satricum, Italy. Poster. *20e Congrès de l'Association Internationale pour l'Histoire du Verre*. Fribourg, Switzerland.
- Oliver, Andrew. 1968a. Millefiori Glass in Classical Antiquity. *Journal of Glass Studies* 10: 48-70.
- . 1968b. The Reconstruction of Two Apulian Tomb Groups. *Antike Kunst* 5: 3-25.
- . 1969. A Gold-glass Fragment in the Metropolitan Museum of Art. *Journal of Glass Studies* 11: 9-16.
- . 1983. Tomb 12 at Episkopi. *Report of the Department of Antiquities, Cyprus*: 245-256.
- . 1990. Glass. *The Extramural Sanctuary of Demeter and Persephone at Cyrene, Lybia: Final Reports Volume 4. Part I: The Small Finds. Part II: Glass. Part III: Faunal and Human Skeletal Remains*. D. White ed. Philadelphia: The University Museum, University of Pennsylvania. Pp 89-109.
- . 1992. The Glass. *La nécropole d'Amathonte tombes 113-367. Vol. VI, Bijoux, armes, verre, astragales et coquillages, squelettes*. V. Karageorghis, O. Picard and C. Tytgat eds. Études chypriotes XIV. Nicosia: Nicolaou. Pp 101-121.
- Oliver, Andrew Jr. 1970. Persian Export Glass. *Journal of Glass Studies* 12: 9-16.
- Oliver, G.J. 2011. Mobility, Society, and Economy in the Hellenistic Period. *The Economies of Hellenistic societies, third to first centuries BC*. Z. Archibald, J. K. Davies and V. Gabrielsen eds. xvi, 460 p. Oxford: Oxford University Press. Pp 345-367.
- Oppenheim, A. Leo. 1988 (1970). The Cuneiform Texts. *Glass and glassmaking in ancient Mesopotamia: an edition of the cuneiform texts which contain instructions for*

- glassmakers: with a catalogue of surviving objects*. Reprinted. Corning: Corning Museum of Glass Press. Pp 2-101.
- Oppenheim, A. Leo, Robert H. Brill, Dan Barag, and Axel von Saldern. 1988 (1970). *Glass and Glassmaking in Ancient Mesopotamia: An edition of the cuneiform texts which contain instructions for glassmakers: with a catalogue of surviving objects*. Reprinted 1988 ed. Corning Museum of Glass Monographs. Corning.
- Özet, Aynur. 2000. *Sparkles from the Deep: Glass Vessels of the Bodrum Museum of Underwater Archaeology*. Istanbul: Bericap Kapak Sanayi.
- Page, Jutta-Annette. 2004. Introduction. *Beyond Venice: Glass in Venetian style, 1500-1750*. Corning: Corning Museum of Glass. Pp 3-19.
- Panagopoulou, Katerina. 2007. Between Necessity and Extravagance: Silver as a Commodity in the Hellenistic Period. *The Annual of the British School at Athens* 102: 315-343.
- Papantoniou, Giorgos. 2012. *Religion and Social Transformations in Cyprus: From the Cypriot Basileis to the Hellenistic Strategos*. Mnemosyne Supplements, History and Archaeology of Classical Antiquity. Leiden: Brill.
- Papathanasopoulos, G. 1966. Ελληνιστικά υθάλινα αγγεία τοῦ Μοθσειῦ Πύλου. *Archaiologikon Deltion* 21(A): 184-197.
- Papathanasopoulos, G., Thanos G. Papathanasopoulos, and D. A. Hardy. 2000. *Pylos-Pylia : A journey through space and time : Nestor's Pylos, Navarino, Methone, Corone*. Athens: Archaeological Receipts Fund.
- Parker, S. Thomas. 1975. The Decapolis Reviewed. *Journal of Biblical Literature* 94(3): 437-441.
- Parlama, Liana. 1973. Καλύβια Ἡλίδος. *Archaiologikon Deltion* 28(B1): 204-206.
- Paynter, Sarah. 2004-2005. Glass Analysis. *Vessel Glass from Beirut, BEY 006, 007, and 045*. Berytus. Beirut: American University of Beirut. Pp 299-304.
- Pemberton, Elizabeth G. 1985. Ten Hellenistic Graves in Ancient Corinth. *Hesperia* 54(3): 271-307.
- Perring, Dominic, Paul Reynolds, and Reuben Thorpe. 2003. The Archaeology of Beirut: a report on work in the insula of the House of the Fountains. *The Antiquaries Journal* 83: 195-229.
- Perring, Dominic, Reuben Thorpe, and Tim Williams. 2004-2005. The Beirut Souks Excavations. *Vessel Glass from Beirut, BEY 006, 007, and 045*. Berytus 48-49. Beirut: American University of Beirut. Pp 8-26.
- Petrie, W. M. Flinders. 1911. The Pottery Kilns at Memphis. *Historical Studies II*. E. B. Knobel, W. W. Midgeley, J. G. Milne, M. A. Murray and W. M. F. Petrie eds. London: British School of Archaeology in Egypt. Pp 34-37.
- . 1914. Glass-Blowing. *Ancient Egypt* 1: 33.
- Petrie, W. M. Flinders, F. Ll Griffith, and Alexander S. Murray. 1888. *Nebesheh (Am) and Defenneh (Tahpanhes)*. Egypt Exploration Fund 5 pt. 2. London: Trübner & Co.
- Pfrommer, Michael. 1996. Roots and Contacts: Aspects of Alexandrian Craftsmanship. *Alexandria and Alexandrianism: Papers Delivered at a Symposium Organized by the J. Paul Getty Museum and the Getty Center of the History of Art and the Humanities and Held at the Museum April 22-25, 1993*. Malibu: J. Paul Getty Museum. Pp 171-189.
- Picard, C. 1946. Sur une coupe de verre a dorures d'un Kourgane du Caucase Septentrional. *Revue Archéologique* 25: 173-182.

- Pirling, Renate. 1978. Die Römischen und Byzantinischen Glassfunde von Apamea in Syrien. *Annales du 7e Congrès de l'Association Internationale pour l'Histoire du Verre* (Berlin 1977). Liège: International Association for the History of Glass. Pp 137-147.
- Pitts, Martin, and M. J. Versluys, eds. 2015. *Globalisation and the Roman world: World history, connectivity and material culture*. New York: Cambridge University Press.
- Platz-Horster, Gertrud. 1976. *Antike Gläser: Ausstellung, November 1976-Februar 1977, Antikenmuseum Berlin, Staatliche Museen Preussischer Kulturbesitz*. Berlin: Antikenmuseum.
- . 1995. Die Berliner Glasamphora aus Olbia. *Journal of Glass Studies* 37: 35-49.
- . 2002. Die Berliner Glasamphora aus Olbia - Herstellung und Handel von Glas im Hellenismus. *To Γυαλί από την αρχαιότητα έως σήμερα* (*Glass from Antiquity to the Present*). P. G. Themeles ed. Athens: Hetaireia Messēniakōn Archaialogikōn Spoudōn. Pp 73-80.
- Ploug, Gunhild. 1985. *Hama: fouilles et recherches, 1931-1938, III.i The Graeco-Roman Town*. Copenhagen: Carlsberg Foundation.
- Ployer, René. 2012. Glass from the Excavations in the So-called 'Hellenistic' Town of Palmyra. A preliminary report. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre* (Thessaloniki 2009). D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 104-108.
- Poblome, Jeroen. 2004. Comparing Ordinary Craft Production: Textile and Pottery Production in Roman Asia Minor. *Journal of the Economic and Social History of the Orient* 47(4): 491-506.
- Pollitt, J. J. 1986. *Art in the Hellenistic Age*. 329 p. Cambridge: Cambridge University Press.
- Pollock, Susan. 1983. Style and Information: An Analysis of Susiana Ceramics. *Journal of Anthropological Archaeology* 2: 354-390.
- Porten, Bezalel, and Ada Yardeni. 1993. *Textbook of Aramaic Documents from Ancient Egypt III: Literature, Accounts, Lists*. Jerusalem: Hebrew University.
- Poulaki, Effie. 2003. Farmhouses in the Area of Phila-Herakleio and Leivithra of the Macedonian Olympus. *Ancient Country Houses on Modern Roads: Central Macedonia*. P. Adam-Veleni, E. Poulaki and K. Tzanavari eds. Athens: Archaeological Receipts Fund. Pp 63-70.
- Prag, Jonathan R. W., and Josephine Crawley Quinn. 2013a. Introduction. *The Hellenistic West: Rethinking the Ancient Mediterranean*. J. R. W. Prag and J. C. Quinn eds. Cambridge: Cambridge University Press. Pp 1-13.
- , eds. 2013b. *The Hellenistic West: Rethinking the Ancient Mediterranean*. Cambridge: Cambridge University Press.
- Price, Jennifer. 1985. Late Hellenistic and Early Imperial Vessel Glass at Berenice: A Survey of Imported Tableware Found during Exvavations at Sidi Khrebish, Benghazi. *Cyrenaica in Antiquity*. G. Barker, J. Lloyd and J. Reynolds eds. BAR International Series 236. Oxford: Archaeopress. Pp 287-296.
- . 1987. Late Hellenistic and Early Imperial Cast Vessel Glass in Spain. *Annales du 10e Congrès de l'Association Internationale pour l'Histoire du Verre* (Madrid 1985). Amsterdam. Pp 61-80.
- . 1990. A Survey of the Hellenistic and Early Roman Vessel Glass Found on the Unexplored Mansion Site at Knossos in Crete. *Annales du 11e Congrès de l'Association Internationale pour l'Histoire du Verre* (Basel 1988). Amsterdam. Pp 27-36.

- . 1991. Decorated Mould-Blown Glass Tablewares in the First Century AD. *Roman Glass: Two Centuries of Art and Invention*. M. Newby and K. Painter eds. Occasional Papers from the Society of Antiquaries of London XIII. London: Society of Antiquaries. Pp 56-75.
- . 1992. Hellenistic and Roman Glass. *Knossos: From Greek City to Roman Colony: Excavations at the Unexplored Mansion*. Supplementary Volume 21. Athens: British School of Archaeology at Athens. Pp 415-462.
- . 1993. Vessel glass from the Neronian Legionary Fortress at Usk in South Wales. *Annales du 12e Congrès de l'Association Internationale pour l'Histoire du Verre (Vienna 1991)*. Amsterdam: Association Internationale pour l'Histoire du Verre. Pp 67-77.
- Price, Jennifer, and Sally Cottam. 2000. Glass Tablewares in Use at Mytilene in Lesbos in the Early-mid 1st century AD. *Annales du 14e Congrès de l'Association internationale pour l'Histoire du Verre (Venice-Milan 1998)*. Lochem: International Association for the History of Glass. Pp 58-62.
- Prior, Jonathan David. 2015. The Impact of Glassblowing on the Early-Roman Glass Industry (circa 50 B.C. - A.D. 79). Ph.D. Dissertation, Durham University.
- Pritchard, James B. 1978. *Recovering Sarepta, a Phoenician City: Excavations at Sarafand, Lebanon, 1969-1974, by the University Museum of the University of Pennsylvania*. Princeton, N.J.: Princeton University Press.
- . 1988. *Sarepta IV: the objects from area II, X: the University Museum of the University of Pennsylvania excavations at Sarafand, Lebanon*. Sarepta 4. Beyrouth: Lebanese University, Section des Études Archéologiques.
- Purowski, T., P. Dzierzanowski, E. Bulska, B. Wagner, and A. Nowak. 2012. A Study of Glass Beads from the Hallstatt C-D from Southwestern Poland: Implications for Glass Technology and Provenance. *Archaeometry* 54(1): 144-166.
- Raeder, Joachim. 1984. *Priene: Funde aus einer griechischen Stadt im Berliner Antikenmuseum*. Bilderheft der Staatlichen Museen Preussischer Kulturbesitz 45/46. Berlin: Mann.
- Rahmani, L. Y. 1967. Jason's Tomb. *Israel Exploration Journal* 17(2): 61-100.
- . 1976. A Phoenician Scarab from Ashkelon. *Atiqot* 11: 110-111.
- Ratté, Christopher. 2008. Reflections on the Urban Development of Hellenistic Sardis. *Love for Lydia: a Sardis anniversary volume presented to Crawford H. Greenewalt, Jr.* C. H. Greenewalt and N. Cahill eds. Archaeological Exploration of Sardis 4. Cambridge, MA: Harvard University Press. Pp 125-133.
- Rauh, Nicholas K. 1999. Rhodes, Rome, and the Eastern Mediterranean Wine Trade, 166-88 BC. *Hellenistic Rhodes: Politics, Culture, and Society*. V. Gabrielsen, P. Bilde, T. Engberg-Pedersen, L. Hannestad and J. Zahle eds. Studies in Hellenistic Civilization IX. Aarhus: Aarhus University Press. Pp 162-186.
- Ravitchandirane, P. 2007. Stratigraphy and Structural Context of Arikamedu. *East and West* 57(1/4): 205-233.
- Ray, Nick. 2006. Consumption and Roman Archaeology: Beyond Pompeii. *TRAC 2005: Proceedings of the Fifteenth Annual Theoretical Roman Archaeology Conference, Birmingham 2005*. B. Croxford, H. Goodchild, J. Lucas and N. Ray eds. Oxford: Oxbow. Pp 25-41.
- Reade, Wendy, Ian C. Freestone, and St J Simpson. 2005. Innovation or Continuity? Early first millennium BCE glass in the Near East: the cobalt blue glasses from Assyrian Nimrud.

- Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. London: Association Internationale pour l'Histoire du Verre. Pp 23-27.
- Reade, Wendy J., Janet Duncan Jones, and Karen Privat. 2012. Iron Age and Hellenistic monochrome glasses from Gordion. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 81-86.
- Redding, Richard W. 1994. The Vertebrate Fauna. *Tel Anafa I, i: Final report on ten years of excavation at a Hellenistic and Roman settlement in northern Israel*. S. C. Herbert ed. Journal of Roman Archaeology Supplementary Series 10. Ann Arbor: Journal of Roman Archaeology. Pp 279-322.
- Reger, Gary. 1994. *Regionalism and Change in the Economy of Independent Delos, 314-167 BC*. Hellenistic Culture and Society 14. Berkeley: University of California Press.
- . 2002 (1997). The Price Histories of Some Imported Goods on Independent Delos. *The Ancient Economy*. W. Scheidel and S. Von Reden eds. Edinburgh: Edinburgh University Press. Pp 133-154.
- . 2003. The Economy. *A Companion to the Hellenistic World*. A. Erskine ed. Oxford: Blackwell Publishing. Pp 331-353.
- Regev, Eyal. 2013. *The Hasmoneans: Ideology, Archaeology, Identity*. Göttingen: Vandenhoeck & Ruprecht.
- Rehren, T., Philip Connolly, N. Schibille, and H. Schwarzer. 2015. Changes in Glass Consumption in Pergamon (Turkey) from the Hellenistic to Late Byzantine and Islamic Times. *Journal of Archaeological Science* 55: 266-279.
- Rehren, Thilo. 2000. Rationales in Old World Base Glass Compositions. *Journal of Archaeological Science* 27(12): 1225-1234.
- Rehren, Thilo, and Ian C. Freestone. 2015. Ancient Glass: From kaleidoscope to crystal ball. *Journal of Archaeological Science* 56: 233-241.
- Rehren, Thilo, Lindsay Spencer, and Pavlos Triantafyllidis. 2005. The Primary Production of Glass at Hellenistic Rhodes. *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre (London 2003)*. M.-D. Nenna ed. Nottingham: Association Internationale pour l'Histoire du Verre. Pp 39-43.
- Reich, Ronny. 1981. Archaeological Evidence of the Jewish Population at Hasmonean Gezer. *Israel Exploration Journal* 31(1/2): 48-52.
- . 2013. *Miqwa'ot (Jewish baths) in the Second Temple, Mishnaic and Talmudic Periods (in Hebrew)*. Jerusalem.
- Reisner, George Andrew, Clarence Stanley Fisher, and David Gordon Lyon. 1924. *Harvard excavations at Samaria, 1908-1910*. Harvard Semitic series 2 v. Cambridge: Harvard University Press.
- Renfrew, Colin. 1986. Varna and the Emergence of Wealth in Prehistoric Europe. *The Social Life of Things: Commodities in cultural perspective*. A. Appadurai ed. Cambridge: Cambridge University Press. Pp 141-168.
- Rice, Prudence M. 1999. On the Origins of Pottery. *Journal of Archaeological Method and Theory* 6(1): 1-54.
- Richardson, Peter. 1999. *Herod: King of the Jews and Friend of the Romans*. Fortress Press.
- Ridley, R.T. 1986. To be Taken with a Pinch of Salt: The Destruction of Carthage. *Classical Philology*: 140-146.

- Riefstahl, Elizabeth. 1968. *Ancient Egyptian Glass and Glazes in the Brooklyn Museum*. Brooklyn: Brooklyn Museum.
- Roberts, Paul, William Gudenrath, Veronica Tatton-Brown, and David Whitehouse. 2010. *Roman Cameo Glass in the British Museum*. London: British Museum Press.
- Robertson, Roland. 1995. Glocalization: Time-Space and Homogeneity-Heterogeneity. *Global modernities*. M. Featherstone, S. Lash and R. Robertson eds. Theory, culture & society. London: Sage Publications. Pp 25-44.
- Roche, Daniel. 2000. *A History of Everyday Things. The birth of consumption in France, 1600-1800*. Cambridge: Cambridge University Press.
- Rodziewicz, Elzbieta. 1991. Remains of a Chryselephantine Statue in Alexandria. *Bulletin de la Société archéologique d'Alexandrie* 44: 119-130.
- Rodziewicz, Mieczysław. 1984. *Alexandrie III: Les habitations romaines tardives d'Alexandrie: à la lumière des fouilles polonaises à Kôm el-Dikka*. Warsaw: Editions scientifiques de Pologne.
- Rogers, Everett M. 2003. *Diffusion of Innovations*. 5th ed. New York: Free Press.
- Rogl, Christine. 2001. Eine Vorschau zu den reliefverzierten Trinkbechern der ephesischen Monogramm-Werkstätte. *Studien zur Hellenistischen Keramik in Ephesos*. F. Krinzinger ed. Ergänzungshefte zu den Jahresheften des Österreichischen Archäologischen Institutes in Wien 2. Vienna: Österreichischen Archäologischen Institute. Pp 99-112.
- Romano, Irene Bald. 1994. A Hellenistic Deposit from Corinth: Evidence for Interim Period Activity (146-44 B.C.). *Hesperia* 63(1): 57-104.
- Rondot, V. 2004. *Tebtynis II: Le temple de Soknebtynis et son dromos*. Cairo: Institut français d'archéologie orientale.
- Rosenfeld, Ben-Zion. 1988. The 'Boundary of Gezer' Inscriptions and the History of Gezer at the End of the Second Temple Period. *Israel Exploration Journal* 38(4): 235-245.
- Rostovtzeff, Michael Ivanovitch. 1951. *The Social and Economic History of the Hellenistic World*. 2nd ed. Oxford: Clarendon Press.
- Rotroff, Susan I. 1982. Silver, Glass, and Clay Evidence for the Dating of Hellenistic Luxury Tableware. *Hesperia* 51(3): 329-337.
- . 1997. *Agora XXIX. Hellenistic Pottery: Athenian and Imported Wheelmade Table Ware and Related Material*. The Athenian Agora. The American School of Classical Studies at Athens.
- . 2006. The Introduction of the Moldmade Bowl Revisited: Tracking a Hellenistic Innovation. *Hesperia* 75(3): 357-378.
- Rotroff, Susan I., and Andrew Oliver. 2003. *The Hellenistic Pottery from Sardis: The finds through 1994*. Archaeological Exploration of Sardis 12. Cambridge: Harvard University Press.
- Rottloff, Andrea. 2000. Hellenistic, Roman and Islamic glass from Bethsaida (Iulias, Israel). *Annales du 14e Congrès de l'Association internationale pour l'Histoire du Verre (Venice-Milan 1998)*. Lochem: International Association for the History of Glass. Pp 142-146.
- . 2009. Pre-Roman, Roman, and Islamic Glass from Bethsaida. *Bethsaida: A City by the North Shore of the Sea of Galilee Vol 4*. R. Arav and R. A. Freund eds. Bethsaida Excavations Project, Reports & Contextual Studies. Kirksville, Missouri: Truman State University Press. Pp 204-251.

- Roux, Valentine. 2003. A Dynamic Systems Framework for Studying Technological Change: Application to the Emergence of the Potter's Wheel in the Southern Levant. *Journal of Archaeological Method and Theory* 10(1): 1-30.
- . 2013. Spreading of Innovative Technical Traits and Cumulative Technical Evolution: Continuity or Discontinuity? *Journal of Archaeological Method and Theory* 20: 312-330.
- Roymans, Nico, Hans Huisman, Joas Van der Laan, and Bertil Van Os. 2014. La Tène Glass Armrings in Europe: Interregional Connectivity and Local Identity Construction. *Archäologisches Korrespondenzblatt* 44(2): 215-228.
- Roymans, Nico, and Linda Verniers. 2013. Glass La Tène Bracelets in the Lower Rhine Region: typology, chronology, and social interpretation. *Germania* 88(1): 195-219.
- Rozenberg, Silvia. 2008. Wall Paintings of the Hellenistic and Herodian Period in the Land of Israel. *Herod and Augustus: Papers Presented at the IJS Conference, 21st-23rd June 2005*. D. Jacobson and N. Kokkinos eds. Boston: Brill. Pp 249-265.
- Sackett, L.H. 1992. Summary and Conclusions. *Knossos: From Greek City to Roman Colony: Excavations at the Unexplored Mansion*. Supplementary Volume 21. Athens: British School of Archaeology at Athens. Pp 463-467.
- Saguí, Lucia. 2008. Glass in Late Antiquity: The Continuity of Technology and Sources of Supply. *Technology in Transition A.D. 300-650*. L. Lavan, E. Zanini and A. Sarantis eds. Leiden: Brill. Pp 211-232.
- Saliby, Nassib. 1981. Verres provenant de la côte phénicienne. *Annales du 8e Congrès de l'Association Internationale pour l'Histoire du Verre (London 1979)*. Liege. Pp 133-144.
- Saller, Richard. 2005. Framing the Debate over Growth in the Ancient Economy. *The Ancient Economy: Evidence and Models*. J. G. Manning and I. Morris eds. Stanford: Stanford University Press. Pp 223-238.
- Sanders, I. F. 1982. *Roman Crete: An archaeological survey and gazetteer of late Hellenistic, Roman and early Byzantine Crete*. Classical studies. Warminster: Aris & Phillips.
- Sartre, Maurice. 2005. *The Middle East under Rome*. Cambridge: Harvard University Press.
- Scatozza Höricht, Lucia Amalia. 1986. *I vetri Romani di Ercolano*. Roma: "L'Erma" di Bretschneider.
- Schätzschock, Martina. 2010. 1st Century-Glass from Terrace House 2 in Ephesos. *Städtisches Wohnen im östlichen Mittelmeerraum 4. Jh. v. Chr.-1. Jh. n. Chr.: Akten des internationalen Kolloquiums vom 24.-27. Oktober 2007 an der Österreichischen Akademie der Wissenschaften*. S. Ladstätter and V. Scheibelreiter eds. Archäologische Forschungen 18. Vienna: Verlag der Österreichischen Akademie der Wissenschaften. Pp 231-236.
- Scheidel, Walter. 1995. The Most Silent Women of Greece and Rome: Rural labour and women's life in the ancient world (I). *Greece and Rome* 42(2): 202-217.
- Scheidel, Walter, and Steven J. Friesen. 2009. The Size of the Economy and the Distribution of Income in the Roman Empire. *Journal of Roman Studies* 99: 61-91.
- Scheidel, Walter, Ian Morris, and Richard P. Saller, eds. 2007. *The Cambridge Economic History of the Greco-Roman World*. Cambridge: Cambridge University Press.
- Schiering, Wolfgang. 1999. Glas für eine Göttin: Zum Gewand einer klassischen Kolossalstatue (Nike?) in Olympia - Ein Beitrag zu experimenteller Archäologie. *Antike Welt* 30: 39-48.
- Schiering, Wolfgang, Juergen Letsch, and Walter Noll. 1991. *Die Werkstatt des Pheidias in Olympia: Werkstattfunde*. Olympische Forschungen 2. Berlin: de Gruyter.

- Schiffer, Michael B. 1992. *Technological Perspectives on Behavioral Change*. Culture and Technology. Tucson: University of Arizona Press.
- . 2005. The Electric Lighthouse in the Nineteenth Century: Aid to Navigation and Political Technology. *Technology and Culture* 45: 275-305.
- . 2008. Expanding Ethnoarchaeology: Historical Evidence and Model-Building in the Study of Technological Change. *Oxford Handbook of Engineering and Technology in the Classical World*. J. P. Oleson ed. Oxford: Oxford University Press. Pp 821-835.
- Schilling, Heinze. 1983. Innovation Through Migration: The Settlement of the Calvinistic Netherlanders in Sixteenth- and Seventeenth-Century Central and Western Europe. *Histoire sociale* 16: 7-33.
- Schmidt, Erich Friedrich. 1953. *Persepolis I. Structures, Reliefs, Inscriptions*. University of Chicago Oriental Institute Publications 68. Chicago: University of Chicago Press.
- . 1957. *Persepolis II. Contents of the Treasury and Other Discoveries*. University of Chicago Oriental Institute Publications 69. Chicago: University of Chicago Press.
- Schürer, Emil. 1973. *The History of the Jewish People in the Age of Jesus Christ (175 B.C.-A.D. 135)*. Revised ed. Edinburgh: T&T Clark Ltd.
- Schwarzer, H., and T. Rehren. In press. Antikes Glas aus Pergamon. Erste Ergebnisse archäologischer und naturwissenschaftlicher Untersuchungen. *Pergamon als Zentrum der hellenistischen Kunst*. U. Kästner and A. Scholl eds. Petersberg: Michael Imhof
- Seaford, Richard. 2004. *Money and the Early Greek Mind: Homer, Philosophy, Tragedy*. Cambridge: Cambridge University Press.
- Seefried, Monique. 1982. *Les pendentifs en verre sur noyau des pays de la méditerranée antique*. Collection de l'École française de Rome 57. Rome: École française de Rome, Palais Farnèse.
- . 1986. Glass in Cyprus from the Late Bronze Age to Roman Times. *Report of the Department of Antiquities, Cyprus*: 145-149.
- Segal, Arthur, Jolanta Mlynarczyk, Mariusz Burdajewicz, Guy Bar-Oz, Hefah Universitat, and Iearekheologya Makhon. 2009. *Excavations of the Hellenistic Site in Kibbutz Sha'ar-Ha'Amakim (Gaba), 1984-1998: final report*. Haifa: Zinman Institute of Archaeology, University of Haifa.
- Shennan, Stephen. 1997. *Quantifying Archaeology*. Edinburgh: Edinburgh University Press.
- Sherwin-White, Susan M., and Amelie Kuhrt. 1993. *From Samarkhand to Sardis: A new approach to the Seleucid Empire*. London: Duckworth.
- Shortland, A. J., and H. Schroeder. 2009. Analysis of First Millennium BC Glass Vessels and Beads from the Pichvnari Necropolis, Georgia. *Archaeometry* 51(6): 947-965.
- Shortland, A.J., Patrick Degryse, Marc Walton, M. Geer, Veerle Lauwers, and L. Salou. 2011. The evaporitic deposits of Lake Fazda (Wadi Natrun, Egypt) and their use in Roman glass production. *Archaeometry* 53(5): 916-929.
- Shortland, A.J., and M.S. Tite. 2005. Technological Study of Ptolemaic-Early Roman Faience from Memphis, Egypt. *Archaeometry* 47(1): 31-46.
- Shortland, Andrew. 2004. Hopeful Monsters? Invention and Innovation in the Archaeological Record. *Invention and Innovation: The Social Context of Technological Change 2: Egypt, the Aegean and the Near East, 1650-1150 BC*. J. Bourriau and J. Phillips eds. Oxford: Oxbow Books. Pp 1-11.
- Silliman, Stephen W. 2015. A Requiem for Hybridity? The problem with Frankensteins, purées, and mules. *Journal of Social Archaeology* 15(3): 277-298.

- Sinopoli, Carla M. 2003. *The Political Economy of Craft Production: Crafting Empire in South India, c. 1350-1650*. Cambridge: Cambridge University Press.
- Slane, Kathleen Warner, J. Michael Elam, Michael D. Glascock, and Hector Neff. 1994. Compositional Analysis of Eastern Sigillata A and Related Wares from Tel Anafa (Israel). *Journal of Archaeological Science* 21(1): 51-64.
- Slane, Kathleen Warner, and Jodi Magness. 2005. Jalame Restudied and Reinterpreted. *Rei Creatariae Romanae Fautorum Acta* 39: 257-261.
- Small, David B. 1995. Monuments, Laws, and Analysis: Combining Archaeology and Text in Ancient Athens. *Methods in the Mediterranean: Historical and Archaeological Views on Texts and Archaeology*. D. B. Small ed. Mnemosyne 135. Leiden: Brill. Pp 143-174.
- Smedley, J.W., C.M. Jackson, and C.A. Booth. 1998. Back to the Roots: The Raw Materials, Glass Recipes and Glassmaking Practices of Theophilus. *The prehistory & history of glassmaking technology*. P. McCray ed. Westerville, Ohio: The American Ceramic Society. Pp 145-165.
- Smith, Monica L. 2015. The Concept of Copies: An Archaeological View of the Terracotta Ornaments from Sisupalgarh, India. *West 86th* 22(1): 23-43.
- Smith, Ray Winfield. 1957. *Glass from the Ancient World: The Ray Winfield Smith Collection*. Corning: Corning Museum of Glass.
- Smith, Robert Houston. 1990. The Southern Levant in the Hellenistic Period. *Levant* 22(1): 123-130.
- Sombart, Werner. 1922. *Luxus und Kapitalismus*. Munich: Duncker & Humblot.
- Sommer, Michael. 2009. Networks of Commerce and Knowledge in the Iron Age: The Case of the Phoenicians. *Greek and Roman Networks in the Mediterranean*. I. Malkin, C. Constantakopoulou and K. Panagopoulou eds. xii, 321 p. London: Routledge. Pp 94-108.
- Spaer, Maud. 1987a. Some Egg-Shaped Glass Vessels and Reflections on Early Glass Blowing. *Israel Museum Journal* 6: 51-58.
- . 1987b. Some Observations on the Stratified Mediterranean Eye-Beads of the First Millennium BC. *Annales du 10e Congrès de l'Association Internationale pour l'Histoire du Verre (Madrid 1985)*. Amsterdam: International Association for the History of Glass. Pp 1-12.
- . 1993. Gold-Glass Beads: A Review of the Evidence. *Beads* 5: 9-25.
- . 2001. *Ancient Glass in the Israel Museum, Beads and Other Small Objects*. Jerusalem: Israel Museum.
- . 2014. Appendix B: Beads and Pendants from Gezer. *Gezer VI: the objects from Phases I and II (1964-1974)*. G. H. Gilmour ed. Winona Lake, IN: Eisenbrauns. Pp 208-241.
- Spanò Giammellaro, Antonella. 2008. *I vetri della Sicilia punica*. Rome: Bonsignori.
- Spencer, A. J. 1996. *Excavations at Tell el-Balamun 1991-1994*. London: British Museum Press.
- . 2009. Excavations at Tell el-Balamun, 2003-2008. London: British Museum.
http://www.britishmuseum.org/research/research_projects/excavation_in_egypt/reports_in_detail.aspx.
- Spivey, Nigel. 1991. Greek Vases in Etruria. *Looking at Greek Vases*. T. Rasmussen and N. Spivey eds. Cambridge: Cambridge University Press. Pp 131-150.
- Spratt, D.A. 1982. The Analysis of Innovation Processes. *Journal of Archaeological Science* 9: 79-84.

- . 1989. Innovation Theory Made Plain. *What's New? A closer look at the process of innovation*. S. E. Van der Leeuw and R. Torrence eds. London: Unwin Hyman. Pp 245-257.
- Stager, Lawrence E., J. David Schloen, and Daniel M. Master. 2008. *Ashkelon I: Introduction and Overview (1985-2006)*. Final Reports of the Leon Levy Expedition to Ashkelon. Winona Lake, IN: Eisenbrauns.
- Steel, Louise. 2013. *Materiality and Consumption in the Bronze Age Mediterranean*. Routledge studies in archaeology 7. New York: Routledge.
- Stek, Tessa D. 2014. Roman Imperialism, Globalization and Romanization in Early Roman Italy. *Archaeological Dialogues* 21(1): 30-40.
- Stern, E. Marianne. 1981. Hellenistic Glass from Kush (Modern Sudan). *Annales du 8e Congrès de l'Association Internationale pour l'Histoire du Verre (London 1979)*. Liège. Pp 35-59.
- . 1985a. Ancient and Medieval Glass from the Necropolis Church at Anemurium. *Annales du 9e Congrès de l'Association Internationale pour l'Histoire du Verre (Nancy 1983)*. Liège. Pp 35-64.
- . 1985b. Die Kapitelle der Nordhalle des Erechtheion. *Mitteilungen des Deutschen Archäologischen Instituts* 100: 405-426.
- . 1987. On the Glass Industry of Arikamedu (Ancient Podouke). *Archaeometry of Glass. Proceedings of the Archaeometry Session of the XIV International Congress on Glass 1986*. H. C. Bhardwaj ed. New Delhi, India: Indian Ceramic Society Pp 26-36.
- . 1989. Colored Glass Inlays in Architectural Ornament: Athens and Rhamous. *American Journal of Archaeology* 93: 254.
- . 1993. The Glass from Heis. *Sur les routes antiques de l'Azanie et de l'Inde: le fonds Révoil du Musée de l'homme (Heïis et Damo, en Somalie)*. J. Desanges, E. M. Stern and P. Ballet eds. Mémoires de l'Académie des inscriptions et belles-lettres n. s. 13. Paris: F. Paillart. Pp 21-61.
- . 1995. *Roman Mold-blown Glass: The first through sixth centuries*. Toledo: Toledo Museum of Art.
- . 1996. Clockwise and counterclockwise in ancient core-glass. *Annales du 13e Congrès de l'Association Internationale pour l'Histoire du Verre (Pays Bas 1995)*. Amsterdam. Pp 21-32.
- . 1998. Interaction between Glassworkers and Ceramists. *The Prehistory & History of Glassmaking Technology*. P. McCray ed. Westerville, OH: The American Ceramic Society. Pp 183-104.
- . 1999a. Ancient Glass in Athenian Temple Treasuries. *Journal of Glass Studies* 41: 19-50.
- . 1999b. Roman Glassblowing in a Cultural Context. *American Journal of Archaeology* 103(3): 441-484.
- . 2000. Three Notes on Early Mold-Blown Glass. *Journal of Glass Studies* 42: 165-167.
- . 2001. *Roman, Byzantine, and Early Medieval Glass, 10 BCE-700 CE: Ernesto Wolf Collection*. Ostfildern-Ruit, Germany: Hatje Cantz.
- . 2002. Review: Glass Is Hot. *American Journal of Archaeology* 106(3): 463-471.
- . 2004. The Glass Banausoi of Sidon and Rome. *When Glass Matters: Studies in the history of science and art from Graeco-Roman antiquity to early modern era*. M. Beretta ed. Biblioteca di Nuncius. Studi e testi 53. Firenze: Leo S. Olschki. Pp 77-120.
- . 2007. Ancient Glass in a Philological Context. *Mnemosyne* 60(3): 341-406.

- . 2008a. Glass Production. *The Oxford Handbook of Engineering and Technology in the Classical World*. J. P. Oleson ed. Oxford: Oxford University Press. Pp 520-547.
- . 2008b. Glass Vessels and Terracotta Lamps from Petra. Review of Petra Ez Zantur III: Ergebnisse der Schweizerisch-Liechtensteinischen Ausgrabungen. *Journal of Roman Archaeology* 21: 687-695.
- . 2011. A New Window on Ancient Glass Technology, including cameo glass and cage cups. *Journal of Roman Archaeology* 24: 619-626.
- . 2012a. Ancient Greek Technical Terms Related to Glass Production. *Annales du 18e Congrès de l'Association Internationale pour l'Histoire du Verre (Thessaloniki 2009)*. D. Ignatiadou and A. Antonaras eds. Thessaloniki: Association Internationale pour l'Histoire du Verre. Pp 1-6.
- . 2012b. Blowing Glass from Chunks Instead of Molten Glass: Archaeological and Literary Evidence. *Journal of Glass Studies* 54: 33-45.
- Stern, E. Marianne, and Birgit Schlick-Nolte. 1994. *Early Glass of the Ancient Worldm 1600 B.C.-A.D. 50: Ernesto Wolf Collection*. Ernesto Wolf Collection. Ostfildern: G. Hatje.
- Stern, Ephraim. 1990. The Dor Province in the Persian Period in the Light of the Recent Excavations at Dor. *Transeuphratène* 2: 147-155.
- Stewart, Andrew. 2013. Sculptors' Sketches, Trial Pieces, Figure Studies, and Models in Poros Limestone from the Athenian Agora. *Hesperia* 82(4): 615-650.
- Stewart, Andrew F. 1990. *Greek Sculpture: an Exploration*. New Haven: Yale University Press.
- . 2006. Hellenistic Art: Two Dozen Innovations. *The Cambridge Companion to the Hellenistic World*. G. R. Bugh ed. Cambridge: Cambridge University Press. Pp 158-185.
- . 2014. *Art in the Hellenistic World: An Introduction*. New York: Cambridge University Press.
- Stewart, Andrew, and S. Rebecca Martin. 2003. Hellenistic Discoveries at Tel Dor, Israel. *Hesperia: The Journal of the American School of Classical Studies at Athens* 72(2): 121-145.
- Stone, Peter. 2012. 'Provincial' Perspectives: The Persian, Ptolemaic, and Seleucid Administrative Center at Tel Kedesh, Israel, in a Regional Context. PhD Dissertation, Department of Classics, University of Cincinnati.
- Stone, Shelley C. 2015. *Morgantina Studies, Volume VI: The Hellenistic and Roman Fine Pottery*. Princeton: Princeton University Press.
- Strootman, Rolf. 2014. *Courts and Elites in the Hellenistic Empires: The Near East After the Achaemenids, c. 330 to 30 BCE*. Edinburgh: Edinburgh University Press.
- Swan, Carolyn. 2013. The Glass. *Excavations at Tel Zahara (2006-2009): the Hellenistic and Roman strata*. S. L. Cohen ed. BAR international series 2554. Oxford: Archaeopress. Pp 103-119.
- Sweetman, Rebecca J. 2013. *The Mosaics of Roman Crete: Art, Archaeology and Social Change*. Cambridge: Cambridge University Press.
- Swift, Ellen. 2003. Late-Roman Bead Necklaces and Bracelets. *Journal of Roman Archaeology* 16: 336-349.
- Syon, Danny. 2015. *Small Change in Hellenistic-Roman Galilee: The Evidence from Numismatic Site Finds as a Tool for Historical Reconstruction*. Numismatic Studies and Researches XI. Jerusalem: Israel Numismatic Society.
- Tait, Hugh. 2012. *Five Thousand Years of Glass*. Revised ed. London: British Museum Press.

- Tal, Oren. 2003. Some Cultural Trends in Plain Black Attic Imports Found in the Coastal Plain of Palestine. *Griechische Keramik im kulturellen Kontext : Akten des Internationalen Vasen-Symposiums in Kiel vom 24.-28.9.2001*. B. Schmaltz and M. Söldner eds. Münster: Archäologisches Institut der Christian-Abrechts-Universität zu Kiel. Pp 271-273.
- Tatton-Brown, Veronica. 1981. Rod-Formed Glass Pendants and Beads of the First Millennium BC. *Catalogue of Greek and Roman Glass in the British Museum*. London: Trustees of the British Museum. Pp 143-155.
- . 1990. Notes on Some Glass Pendants and Bangles from Cyprus. *Kypriake Archaologia* 2: 113-114.
- . 1994. The Glass. *Excavations at Carthage: The British Mission Vol. II,1. The Circular Harbour, North Side. The Site and Finds Other than Pottery*. H. R. Hurst ed. Oxford. Pp 282-290.
- Taylor, Mark, and David Hill. 2008. Experiments in the Reconstruction of Roman Wood-Fired Glassworking Furnaces. *Journal of Glass Studies* 50: 249-270.
- Tek, Ahmet Tolga. 2013. Arykanda Kazilarinda (1993-2007 Sezonlari) Bulunan Mozaik Cam Kase ve Tabaklar (Mosaic Glass Bowl and Plates from Arykanda Excavations (The seasons of 1993-2007)). *Kaunos/Kbid Toplantilari 2. Anadolu Antik Cam Arařtırmalari Sempozyumu*. Ç. G. Güray ed. Ankara. Pp 213-236.
- Temin, Peter. 2013. *The Roman Market Economy*. Princeton: Princeton University Press.
- Tëmkin, Ilya, and Niles Eldredge. 2007. Phylogenics and Material Cultural Evolution. *Current Anthropology* 48(1): 146-152.
- Thalmann, John-Paul. 1978. Tell Arqa' (Liban Nord), campagnes I-III (1972-1974). *Syria* 45: 1-152.
- Themelis, Petros G. 2000. *Iroes kai Iroa sti Messini (Heroes and Hero Shrines in Messene)*. Athens: Archaologiki Etaireia.
- Thirgood, J.V. 1981. *Man and the Mediterranean Forest: A History of Resource Depletion*. London: Academic Press.
- Thirion-Merle, V. 2005. Les verres de Beyrouth et les verres du Haut Empire dans le monde occidental: étude archéométrique. *Journal of Glass Studies* 47: 37-53.
- Thompson, Dorothy J. 1988. *Memphis under the Ptolemies*. Princeton: Princeton University Press.
- Thomson, George Derwent. 1960. *The Greek Language*. Cambridge: W. Heffer and Sons.
- Thorn, James Copland. 2005. *The Necropolis of Cyrene: two hundred years of exploration*. Monografie di archeologia libica 26. Roma: L'Erma di Bretschneider.
- Thür, Hilke. 2010. Die Wohnbebauung des Hanghauses 2 im späten Hellenismus und in der frühen Kaiserzeit. *Städtisches Wohnen im östlichen Mittelmeerraum 4. Jh. v. Chr.-1. Jh. n. Chr.: Akten des internationalen Kolloquiums vom 24.-27. Oktober 2007 an der Österreichischen Akademie der Wissenschaften*. S. Ladstätter and V. Scheibelreiter eds. Archäologische Forschungen 18. Vienna: Verlag der Österreichischen Akademie der Wissenschaften. Pp 193-212.
- Triantafyllidis, Pavlos. 1998. Τα Γυαλινα Αντικειμενα απο την Μινωα Αμοργου: συμβολη στην μελετη της υαλουργιας στις κυκλαδες κατα την ελληνιστικη και Ρωμαϊκη περιοδο (The Glass Objects from Minoia in Amorgos: contribution to the study of the glassware in the Cyclades in the Hellenistic and Roman Period). Ph.D. Dissertation, University of Ioannina, Ioannina.

- . 2000a. New Evidence of the Glass Manufacture in Classical and Hellenistic Rhodes. *Annales du 14e Congrès de l'Association internationale pour l'Histoire du Verre (Venice-Milan 1998)*. Lochem: International Association for the History of Glass. Pp 30-34.
- . 2000b. New Evidence of the Glass Manufacture in Classical and Hellenistic Rhodes. *Annales du 14e Congrès de l'Association internationale pour l'Histoire du Verre (Venice-Milan 1998)*. Lochem: International Association for the History of Glass. Pp 30-34.
- . 2000c. *Ροδιακή Υαλουργία I: τα εν θερμώ διαμορφωμένα διαφαν αγγεία πολυτελείας (Rhodian Glassware I. The luxury hot-formed transparent vessels of the classical and early Hellenistic periods)*. Athens: Ephoria of Prehistoric and Classical Antiquities.
- . 2002. Ενδειξεις και εργαστήρια υαλοτεχνικής παραγωγής στη Ρόδο από τοθς προϊστορικούς έως και τοθς παλαιοχριστιανικούς χρόνους. *Το Γυαλί από την αρχαιότητα εως σήμερα (Glass from Antiquity to the Present)*. P. G. Themeles ed. Athens: Hetaireia Messēniakōn Archaiologikōn Spoudōn. Pp 41-56.
- . 2003a. Achaemenian Glass Production. *Annales du 15e Congrès de l'Association Internationale pour l'Histoire du Verre (Corning 2001)*. Nottingham. Pp 13-17.
- . 2003b. Classical and Hellenistic Glass Workshops from Rhodes. *Échanges et commerce du verre dans le monde antique*. D. Foy and M.-D. Nenna eds. Monographies instrumentum 24. Montagnac: Editions Monique Mergoïl. Pp 131-137.
- . 2006a. Late Hellenistic Glass from Kos, Dodecanese, Greece. *Journal of Glass Studies* 48: 145-161.
- . 2006b. A Unique Late Hellenistic Glass Bowl from Kalymnos (Dodecanese, Greece). *Journal of Glass Studies* 48: 325-327.
- . 2009. Early Core-Formed Glass from a Tomb at Ialysos, Rhodes. *Journal of Glass Studies* 51: 26-39.
- . 2014. Γυάλινος σκύφος πολυτελείας των ελληνιστικών χρόνων από το ακριτικό Αγαθονήσι. *Σοφία Άδολος Τιμητικός Τομος για τον Ιωαννη χρ. Παπαχριστοδουλου*. Rhodes: Archaeological Institute of Aegean Studies. Pp 573-580.
- Trigg, Andrew B. 2001. Veblen, Bourdieu, and Conspicuous Consumption. *Journal of Economic Issues* 35(1): 99-115.
- Trofimova, Anna A., ed. 2007. *Greeks on the Black Sea: ancient art from the Hermitage*. Los Angeles: J. Paul Getty Museum.
- Trowbridge, Mary Luella. 1930. *Philological Studies in Ancient Glass*. Urbana: The University of Illinois.
- Turner, W.E.S. 1956. Studies of Ancient Glass and Glassmaking Processes. Part V: Raw materials and melting processes. *Journal of the Society of Glass Technology* 40: 276-299.
- Valente, Thomas W. 1995. *Network Models of the Diffusion of Innovations*. Quantitative Methods in Communication. Cresskill, NJ: Hampton Press.
- . 2005. Network Models and Methods for Studying the Diffusion of Innovations. *Models and Methods in Social Network Analysis*. P. J. Carrington, J. Scott and S. Wasserman eds. Cambridge: Cambridge University Press. Pp 98-116.
- Van der Spek, Robartus J. 2011. The 'Silverization' of the Economy of the Achaemenid and Seleukid Empires and Early Modern China. *The Economies of Hellenistic Societies, Third to First Centuries BC*. Z. Archibald, J. K. Davies and V. Gabrielsen eds. Oxford: Oxford University Press. Pp 402-420.

- Van Ess, Margarete, and Friedhelm Pedde. 1992. *Glas. Uruk: Kleinfunde II*. Mainz am Rhein: Philipp von Zabern. Pp 159-175.
- van Lith, Sophia Maria Elisabeth, and Klaus Randsborg. 1985. Roman Glass in the West: A Social Study. *Berichten van de Rijksdienst voor het Ouidkundig Bodemonderzoek* 35: 413-532.
- van Nijf, Onno. 1997. *The Civic World of Professional Associations in the Roman East*. Dutch monographs on ancient history and archaeology 17. Amsterdam: J.C. Gieben.
- Vanek, Joann. 1978. Household Technology and Social Status: Rising Living Standards and Status and Residence Differences in Housework. *Technology and Culture* 19(3): 361-375.
- Veblen, Thorstein. 1899 (2000). *The Theory of the Leisure Class*. Reprint ed. New Brunswick: Transaction Publishers.
- Venticinque, Philip F. 2009. Common Causes: Guilds, craftsmen and merchants in the economy and society of Roman and late Roman Egypt. Ph.D. Dissertation, University of Chicago, Chicago.
- Verdan, Samuel. 2013. *Eretria XXII. Le sanctuaire d'Apollon Daphnéphoros à l'époque géométrique*. Lausanne: Gollion.
- Vermeule, Emily T. 1967. A Mycenaean Jeweler's Mold. *Boston Museum Bulletin* 65(339): 19-31.
- Versluys, Miguel John. 2008. Exploring Identities in the Phoenician, Hellenistic and Roman East. *Bibliotheca Orientalis* 65(3-4): 342-356.
- Vessberg, Olof. 1952. Roman Glass in Cyprus. *Opuscula Archaeologica* 7: 109-165.
- . 1956. Glass. *The Swedish Cyprus Expedition. Vol. IV, Part 3, The Hellenistic and Roman Periods in Cyprus*. O. Vessberg and A. Westholm eds. Stockholm. Pp 128-175, 193-219.
- Vickers, M., and A. Kakhidze. 2001. The British-Georgian Excavation at Pichvnari 1998: The 'Greek' and 'Colchian' Cemeteries. *Anatolian Studies* 51: 65-90.
- Vickers, Michael. 1987. Value and Simplicity: Eighteenth-Century Taste and the Study of Greek Vases. *Past & Present* (116): 98-137.
- Villing, Alexandra, Marianne Bergeron, Alan Johnston, Aurélie Masson, and Ross Thomas. 2015. *The Material Culture of Naukratis - An Overview* 2015 [accessed May 21 2015]. http://www.britishmuseum.org/research/online_research_catalogues/ng/naukratis_greeks_in_egypt/material_culture_of_naukratis.aspx.
- Vita-Finzi, Claudio. 1969. *The Mediterranean Valleys: Geological changes in historical times*. Cambridge: Cambridge University Press.
- Vitto, Fanny. 2005. Hellenistic and Crusader Remains at Montmusard, Acre ('Akko). *Atiqot* 50: 153-179.
- Vives-Ferrándiz, Jaime. 2008. Negotiating Colonial Encounters: Hybrid Practices and Consumption in Eastern Ibera (8th-6th centuries BC). *Journal of Mediterranean Archaeology* 21(2): 241-272.
- Vives y Escudero, Antonio. 1917. *Estudio de arqueología cartaginesa: La necropoli de Ibiza*. Madrid.
- Vogeikoff-Brogan, Natalia, Jeffrey S. Soles, and Kostas Davaras. 2014. *Mochlos III : the Late Hellenistic settlement, the beam-press complex*. Prehistory monographs 48. Philadelphia: INSTAP Academic Press.
- von Saldern, Axel. 1959. Glass Finds at Gordion. *Journal of Glass Studies* 1: 23-51.

- . 1962. Glass from Sardis. *American Journal of Archaeology* 66(1): 5-12.
- . 1966a. Glass. *Nimrud and its Remains*. M. E. L. Mallowan ed. New York: Dodd, Mead & Company. Pp 623-634.
- . 1966b. The Glass, Appendix III. *Nimrud and its Remains II*. M. E. L. Mallowan ed. New York: Dodd, Mead & Company. Pp 623-634.
- . 1966c. Mosaic Glass from Hasanlu, Marlik, and Tell al-Rimah. *Journal of Glass Studies* 8: 9-25.
- . 1975. Two Achaemenid Glass Bowls and a Hoard of Hellenistic Glass Vessels. *Journal of Glass Studies* 17: 37-46.
- . 1980. *Ancient and Byzantine glass from Sardis*. Archaeological Exploration of Sardis 6. Cambridge, Mass.: Harvard University Press.
- . 1988 (1970). Other Mesopotamian Glass Vessels (1500-600 B.C.). *Glass and glassmaking in ancient Mesopotamia: an edition of the cuneiform texts which contain instructions for glassmakers: with a catalogue of surviving objects*. Corning: Corning Museum of Glass Press. Pp 203-228.
- Walsh, Justin St. P. 2011-2012. Urbanism and Identity at Classical Morgantina. *Memoirs of the American Academy in Rome* 56-57: 115-136.
- . 2013. Consumption and Choice in Ancient Sicily. *Regionalism and Globalism in Antiquity, Proceedings of the International Conference in Vancouver*. F. de Angelis ed. *Colloquia Antiqua* 7. Leuven: Peeters. Pp 229-245.
- . 2014. *Consumerism in the Ancient World: Imports and Identity Construction*. Routledge Monographs in Classical Studies. New York: Routledge.
- Walter-Karydi, Elena. 1998. *The Greek house: the rise of noble houses in late classical times*. Athens: The Archaeological Society at Athens.
- Walton, M. S., A. Shortland, S. Kirk, and P. Degryse. 2009. Evidence for the trade of Mesopotamian and Egyptian glass to Mycenaean Greece. *Journal of Archaeological Science* 36(7): 1496-1503.
- Watson-Treumann, Brigitte. 2000. Beyond the Cedars of Lebanon: Phoenician Timber Merchants and Trees from the "Black Mountain". *Die Welt des Orients* 31: 75-83.
- Weinberg, Gladys Davidson. 1959. Glass Manufacture in Ancient Crete. *Journal of Glass Studies* 1: 10-21.
- . 1960. Excavations at Tarrha, 1959. *Hesperia* 29(1): 90-108.
- . 1961. Hellenistic Glass Vessels from the Athenian Agora. *Hesperia* 30(4): 380-392.
- . 1962a. Evidence for Glass Manufacture in Ancient Thessaly. *American Journal of Archaeology* 66(2): 129-133.
- . 1962b. Glass Vessels in the Museums of Greece. *Annales du 2d Congrès International d'Etude Historique du Verre (Leiden 1962)*. Liège. Pp 45-53.
- . 1965. The Glass Vessels from the Antikythera Wreck. *Transactions of the American Philosophical Society* 55(3): 30-39.
- . 1969. Glass Manufacture in Hellenistic Rhodes. *Archaiologikon Deltion* 24: 143-151.
- . 1970. Hellenistic Glass from Tel Anafa in Upper Galilee. *Journal of Glass Studies* 12: 17-27.
- . 1973. Notes on Glass from Upper Galilee. *Journal of Glass Studies* 15: 35-51.
- . 1983. A Hellenistic Glass Factory on Rhodes: Progress report. *Journal of Glass Studies* 15: 37.

- . 1988. *Excavations at Jalame: site of a glass factory in late Roman Palestine*. Columbia: University of Missouri Press.
- . 1992. *Glass Vessels in Ancient Greece: Their History Illustrated from the Collection of the National Archaeological Museum, Athens*. Athens: Ministry of Culture.
- Weinberg, Gladys Davidson, Virginia R. Grace, G. Roger Edwards, Henry S. Robinson, Peter Throckmorton, and Elizabeth K. Ralph. 1965. The Antikythera Shipwreck Reconsidered. *Transactions of the American Philosophical Society* 55(3): 3-48.
- Weinberg, Gladys Davidson, and E. Marianne Stern. 2009. *Vessel Glass*. Athenian Agora 34. Princeton: American School of Classical Studies at Athens.
- Weinberg, Saul S. 1971. Tel Anafa: The Hellenistic Town. *Israel Exploration Journal* 21(2/3): 86-109.
- . 1973. Tel Anafa - 1972: The Fourth Season. *Muse* 6: 8-18.
- . 1988. A Syro-Palestinian Bowl. *Muse* 22: 64-74.
- Weiner, Annette. 1985. Inalienable Wealth. *American Ethnologist* 12: 210-227.
- Wells, Martin, Erin Haapala, Keith Cogshall, and Jessie Weaver. 2012. Groundstone and Other Stone Tools, Vessels, and Miscellaneous Objects. *Tel Anafa II,ii*. S. Herbert and A. Berlin eds. Kelsey Museum Fieldwork Series. Ann Arbor: University of Michigan. Pp 299-338.
- Wente, Leila I. 1983. A Catalog of Glass in the Graeco-Roman Museum of Alexandria. *American Research Center in Egypt Newsletter* 121: 19-22.
- Westgate, R. C. 2000. Space and Decoration in Hellenistic Houses. *The Annual of the British School at Athens* 95: 391-426.
- Westgate, Ruth. 2011. Party Animals: The Imagery of Status, Power and Masculinity in Greek Mosaics. *Sociable Man: Essays on Ancient Greek Social Behavior in Honour of Nick Fisher*. S. D. Lambert ed. Swansea: Classical Press of Wales. Pp 291-322.
- White, Donald. 1984. *The Extramural Sanctuary of Demeter and Persephone at Cyrene, Libya I: Background and Introduction to the Excavations*. University Museum Monograph 52. Philadelphia: University Museum, University of Pennsylvania.
- . 1990. *The Extramural Sanctuary of Demeter and Persephone at Cyrene, Lybia: Final Reports Volume 4. Part I: The Small Finds. Part II: Glass. Part III: Faunal and Human Skeletal Remains*. Philadelphia: The University Museum, University of Pennsylvania.
- White, Lynn. 1962. *Medieval Technology and Social Change*. Oxford: Oxford University Press.
- Whitehouse, David. 1997. *Roman Glass in the Corning Museum of Glass*. Corning: Corning Museum of Glass.
- . 1998. *The Glass Vessels*. Vol. 1. Excavations at ed-Dur (Umm al-Qaiwain, United Arab Emirates) 1. Leuven: Peeters.
- . 2000. Ancient Glass: Some recent developments. *Annales du 14e Congrès de l'Association internationale pour l'Histoire du Verre (Venice-Milan 1998)*. Lochem: International Association for the History of Glass. Pp 1-5.
- . 2004. Glass in the Price Edict of Diocletian. *Journal of Glass Studies* 46: 189-191.
- . 2012. *Glass: a short history*. London: British Museum.
- Wiegand, T., and H. Schrader. 1904. *Priene: Ergebnisse der Ausgrabungen und Untersuchungen in den Jahren 1895-1898*. G. Reimer.
- Williams, Charles K. 1978. Corinth 1977, Forum Southwest. *Hesperia* 47(1): 1-39.

- Willmott, Hugh. 2004. Venetian and *Façon de Venise* Glass in England. *Beyond Venice: glass in Venetian style, 1500-1750*. J.-A. Page ed. Corning: Corning Museum of Glass. Pp 271-307.
- Wilson, R.J.A. 2013. Hellenistic Sicily, c. 270-100 BC. *The Hellenistic West: Rethinking the Ancient Mediterranean*. J. R. W. Prag and J. C. Quinn eds. Cambridge: Cambridge University Press. Pp 70-119.
- Winger, Justin Thomas. 2012. The Cultural and Economic Composition of Late Hellenistic Upper Galilee: A Case Study of the Squatters at Tel Kedesh. Ph.D. Dissertation, Near Eastern Studies, University of Michigan, Ann Arbor.
- Winter, Irene. 2005. Establishing Group Boundaries: Toward Methodological Refinement in the Determination of Sites as a Prior Condition to the Analysis of Cultural Contact and/or Innovation in First Millennium BCE Ivory Carving. *Crafts and Images in Contact: Studies on Eastern Mediterranean art of the first millennium BCE*. C. E. Suter and C. Uehlinger eds. Fribourg: Academic Press. Pp 23-42.
- Winter, Irene J. 1976. Phoenician and North Syrian ivory carving in historical context: Questions of style and distribution. *Iraq* 38(1): 1-22.
- Winter, Tamar. 2010. The Byzantine-Period Glass Vessels from Ḥorbat Rozez. *Atiqot* 62: 145-155.
- Wiseman, James. 1969. Excavations in Corinth: The Gymnasium Area, 1967-1968. *Hesperia* 38(1): 64-106.
- Wittman, Otto. 1966. *Toledo Glass National* The Toledo Museum of Art 1966. http://www.toledomuseum.org/pdf/Toledo_Glass_National.pdf.
- Wolff, Samuel R., and Gerald Finkielsztejn. 2009. Two New Hellenistic Lead Weights of the Tanit Series. *Exploring the Longue Durée: essays in honor of Lawrence E. Stager*. J. D. Schloen ed. Winona Lake, Ind.: Eisenbrauns. Pp 497-506.
- Woolf, Greg. 1998. *Becoming Roman: The Origins of Provincial Civilization in Gaul*. Cambridge: Cambridge University Press.
- Wootton, Will. 2012. Making and Meaning: The Hellenistic Mosaic from Tel Dor. *American Journal of Archaeology* 116(2): 209-234.
- Wright, Kathleen Slane. 1980. A Tiberian Pottery Deposit from Corinth. *Hesperia* 49(2): 135-177.
- Wuilleumier, Pierre. 1930. *Le trésor de Tarente (Collection Edmond de Rothschild)*. Paris: E. Leroux.
- Wurmser, Hélène. 2010. Hellenistic Living in the Aegean. *Städtisches Wohnen im östlichen Mittelmeerraum 4. Jh. v. Chr.-1. Jh. n. Chr.: Akten des internationalen Kolloquiums vom 24.-27. Oktober 2007 an der Österreichischen Akademie der Wissenschaften*. S. Ladstätter and V. Scheibelreiter eds. Archäologische Forschungen 18. Vienna: Verlag der Österreichischen Akademie der Wissenschaften. Pp 13-25.
- Xia, Nai. 2014. *Ancient Egyptian Beads*. Berlin: Springer.
- Yacoub, Mohamed. 2000. *L'histoire du verre en Tunisie, ou, eclipse et renaissance d'un métier d'art*. Tunisia: Noir sur Blanc.
- Yannai, Eli. 2010. A Salvage Excavation at Horbat Rozez. *Atiqot* 62: 107-137.
- Young, S. H. 2007. Glass. *Kourion: Excavations in the Episcopal Precinct*. A. H. S. Megaw ed. *Dumbarton Oaks Studies* 38. Washington, D.C.: Dumbarton Oaks. Pp 485-526.
- Zaccagnini, Carlo. 1983. Patterns of Mobility among Ancient Near Eastern Craftsmen. *Journal of Near Eastern Studies* 42(4): 245-264.

- Zarmakoupi, Mantha. 2014. Die Hafenstadt Delos. *Häfen und Hafenstädte im östlichen Mittelmeerraum von der Antike bis in byzantinische Zeit. Neue Entdeckungen und aktuelle Forschungsansätze vol. 2.* S. Ladstätter, F. Pirson and T. Schmidts eds. Byzas 2. Istanbul: Ege Yayinlari. Pp 553-570.
- Zaven, T. 2011. The Early Roman Glass Vessels from the Sidon 2009 Season of Excavation. *Archaeology and History in Lebanon* 34-35: 406-414.
- Zimmer, Gerhard. 1996. Prunkgeschirr hellenistischer Herrscher. *Basileia, die Paläste der hellenistischen Könige: internationales Symposium in Berlin vom 16.12.1992 bis 20.12.1992.* W. Hoepfner and G. Brands eds. Mainz am Rhein: Philip von Zabern. Pp 130-135.
- Zissu, Boaz, and Samuel Rokach. 1999. A Hellenistic Columbarium at Ziqim. *Atiqot* 38: 65-73.
- Zouhdi, Bachir. 1964. Les verres mosaïqués et millefiori du Musée National de Damas. *Annales du 3e Congrès Internatioanl d'Etude Historique du Verre (Damascus 1964).* Liege. Pp 68-78.