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Networks and Intermediaries: Ceramic Exchange Systems in the Late Bronze Age Mediterranean

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Networks and Intermediaries:

Ceramic Exchange Systems

in the Late Bronze Age Mediterranean

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Archaeology

by

Christine Leigh Johnston

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ABSTRACT OF THE DISSERTATION

Networks and Intermediaries:

Ceramic Exchange Systems

in the Late Bronze Age Mediterranean

by

Christine Leigh Johnston

Doctor of Philosophy in Archaeology

University of California, Los Angeles, 2016

Professor Sarah P. Morris, Chair

This dissertation explores trade and economic interaction between polities during the Late Bronze Age within the Eastern Mediterranean. This study reconstructs the trade systems extant during this period through a network analysis of Cypriot and Mycenaean pottery distributed throughout Cyprus, Egypt, and the Levant. The network data compiled for this analysis includes over 23,000 sherds and vessels recovered from 269 different sites that date from the terminal Middle Bronze Age to the end of the Late Helladic IIIB period.

There are three primary goals of this dissertation. The first is to assess the structure of Late Bronze Age exchange systems through the distribution and consumption of ceramic imports across the three regions of study. The second is to quantitatively test the hypothesized

intermediary role of Cypriot agents as suppliers of Aegean pottery to neighbouring regions of the Mediterranean. The final analytical goal of is to evaluate the efficacy of network analysis as a method for the quantitative assessment of trade systems, particularly with the aim of exploring broader questions surrounding the structural nature of trade systems and their associated political institutions.

The network analyses of Cypriot and Mycenaean ceramics demonstrate a high degree of variability in consumption and import distribution systems across Cyprus, Egypt, and the Levant. Network centralization and density measures indicate diverging mechanisms for import circulation, suggesting the existence of contrasting political economies. A significant result of this study was the demonstration of competing political institutions in Cyprus, suggesting the absence of a centralized state with a governing core (i.e. a 'Kingdom of Alashiya' centered on Enkomi). The high overall network density, the diffusion of Late Helladic shapes across sites and contexts of differing scale, and the high network centrality measures of multiple competing polities refute the presence of a governing system core. The pervasion of Mycenaean vessels on Cyprus and the correlation between the circulation of Cypriot and Aegean vessels, as evidenced by the high affiliation frequency of vessel groups across ware types, support the hypothesis that Cypriot agents were active in the distribution of Mycenaean imports through a shared primary trade network.

This dissertation of Christine Leigh Johnston is approved.

Leah Michelle Boustan

Charles S. Stanish

John K. Papadopoulos

Sarah P. Morris, Committee Chair

University of California, Los Angeles

2016

To my mom, for reading every page.

To my dad, for supporting every step.

To Yosh, for all of the snacks.

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List of Abbreviations

Chronological periods:

EBA	Early Bronze Age, general (with alphanumeric subdivisions)
MBA	Middle Bronze Age, general (with alphanumeric subdivisions)
LBA	Late Bronze Age, general (with alphanumeric subdivisions)
IA	Iron Age, General (with alphanumeric subdivisions)
EC	Early Cypriot Period, general
MC	Middle Cypriot Period, general
LC I-III	Late Cypriot Period, phases I-III (with alphanumeric subdivisions)
EH	Early Helladic Period, general
MH	Middle Helladic Period, general
LH I-III	Late Helladic Period, phases I-III (with alphanumeric subdivisions)
EM	Early Minoan Period, general
MM	Middle Minoan Period, general
LM I-III	Late Minoan Period, phases I-III (with alphanumeric subdivisions)
NK	New Kingdom Egypt
IP	Intermediate Period, Egypt

Ceramic Wares - Aegean:

MH I-III	Middle Helladic Ware (with alphanumeric subdivisions)
LH I-III	Late Helladic Ware (with alphanumeric subdivisions)
MM I-III	Middle Minoan Ware (with alphanumeric subdivisions)
LM I-III	Late Minoan Ware (with alphanumeric subdivisions)

Ceramic Wares - Cypriot:

BIC	Bichrome Ware
BLWM	Black Lustrous Wheel-made Ware
BRI	Base Ring I Ware
BRII	Base Ring II Ware
BR	Base Ring Ware, general
BS	Black Slip Ware (with alphanumeric subdivisions)
BUC	Bucchero Ware
MONO	Monochrome Ware
PBR	Proto-Base Ring Ware
PWHM	Plain White Handmade Ware
PWS	Proto-White Slip Ware
ROB	Red-on-Black Ware
ROR	Red-on-Red Ware
RLWM	Red Lustrous Wheel-made Ware
RS	Red Slip Ware
WP	White Painted Ware (with alphanumeric subdivisions)
WS	White Slip Ware, general
WSI	White Slip I Ware
WSII	White Slip II Ware
WSh	White Shaved Ware

Publications:

SCE	Swedish Cyprus Expedition

All abbreviations in the bibliography follow the American Journal of Archaeology abbreviation list.

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On reaching the end of the dissertation, the adage ‘it takes a village’ feels inadequate to capture the legions of supporters that it takes to successfully navigate this process. I would first and foremost like to thank my dissertation committee for their generosity of time, support, and knowledge. I would like to thank Leah Platt Boustan and Chip Stanish for grounding this analysis within broader theoretical issues and considerations. From the formulation of nascent research questions to the final written product, this dissertation benefitted immensely from the comments, guidance, and high standards of John Papadopoulos. I owe an immense debt of gratitude to my chair, Sarah Morris, for reading and commenting tirelessly throughout the writing process. My appreciation of your support throughout my time at the Cotsen, as well as your seemingly boundless fount of knowledge, cannot be overstated.

I have been very fortunate as a graduate student to study in two departments with inspiring and encouraging colleagues and mentors. Although I started as an early scholar in Classical Studies, I fortuitously enrolled in a class in Near Eastern archaeology with Lisa Cooper, who inspired me to both become an archaeologist, and to move over to the far side of the Mediterranean. From my earliest days as a graduate student, my career has benefitted immeasurably from the mentorship and incredible generosity of Thomas Schneider. I would also like to thank Kevin Fisher, Hector Williams, Thomas Hikade, Elizabeth Carter, and Aaron Burke for their guidance and encouragement on my research, as well as their support for my pursuit of various projects and fellowships. To my fellow students at UBC and the Cotsen, thank you for providing endless encouragement, laughter, and inspiration.

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In addition to my colleagues and mentors, I must express my deepest gratitude for the generous support of numerous organizations that have provided me with the opportunity to follow this path. I would like to thank the Social Sciences and Humanities Research Council of Canada, The University of British Columbia, the University of California, Los Angeles, and the Cotsen Institute of Archaeology. I would especially like to thank ASOR, the AIA, the Friends of Archaeology, and Charlie Steinmetz for their generous support of myself and other young scholars. I also wish to acknowledge the kind staff at the American School of Classical Studies at Athens and the Cyprus American Archaeological Research Institute for their help during the research stage of this dissertation.

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SECTION I – INTRODUCTION

1. INTRODUCTION

During the Late Bronze Age (roughly 1600-1050 B.C.E.) the greater part of the Eastern Mediterranean was connected through an extensive trade network that enabled the movement of luxury goods and commodities between powerful polities. Connectivity through this region commenced early in prehistory, achieving a well-developed iteration by the mid-second millennium.[1] Lauded as the first truly international period of history, this era saw products of spatially disparate origins accumulated and dispersed through networks of overland, and in particular maritime, trade. Evidence of this prolific exchange system has come from texts, excavations, and the discovery of submerged merchant vessels, including the Uluburun, Cape Gelidonya, and Point Iria shipwrecks. Analyses of circulated products and the cargo from these ships have allowed for the reconstruction of an ancient trade route of vast geographic scope, covering parts of North Africa, the Near East, Cyprus, Greece, and Italy.[2]

Alongside the transportation of material goods, artistic traditions and stylistic and technical innovations were also transferred. Within this atmosphere of intellectual exchange and interconnectivity, finished goods in a new pan-cultural artistic style known as the 'international koine' emerged.[3] The advent of this amalgamated style, in addition to the frequent appearance of import imitations and product substitutes, attests to the importance of commercial exchange as a mechanism for cross-cultural influence during this period. To elucidate the nature of material and intellectual transmission of the Late Bronze Age, it is necessary to adopt a multi-scalar approach

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[1] All dates given from this point on will be B.C.E. unless otherwise specified.

[2] Bass 1973, 1991, 1998; Pulak 2001, 2008.

[3] Feldman 2006.

that first contextualizes interaction through the reconstruction of the exchange system extant during this period, and then examines the cultural conditions and communication networks that governed the proximate interaction of agents of exchange.

This dissertation assesses the structural nature of the exchange system extant in the late second millennium through a network analysis of the distribution of Mycenaean and Cypriot pottery throughout the eastern Mediterranean. The goal of this study is to profile the trade network connecting neighbouring polities around the Mediterranean, elucidating the varying nature of regional integration within the larger system and identifying the active agents of exchange. This dissertation is structured around three central questions: how does import distribution and consumption compare across different Mediterranean cultures; what role did Cyprus play in the circulation of Aegean pottery; and what do the structure of ceramic networks reveal about regional political economies. The network data compiled for this analysis incorporates 23,427 sherds and vessels recovered from 269 sites across Cyprus, Egypt, and the Levant.[4]

Of particular interest is the identification of extra-palatial exchange and communities strategically located throughout the network that subsisted and thrived through the management of exchange and facilitation of the movement of goods. These network nodes display high 'betweenness centrality' values, demonstrating their integral role in connectivity by forming the arcs in scale-free networks between localized regional clusters and the larger supra-regional system. These loci, known frequently as "Ports of Power" or "Gateway Communities", became

[4] This includes 3708 Late Helladic and 9334 Cypriot vessels from 109 sites in the Levant, 1731 Late Helladic and 2006 Cypriot vessels from 64 sites in Egypt, and 6648 Late Helladic vessels from 96 sites in Cyprus. For information on the structure of the database and the data contained in it, see Appendices 1-3.

the venue for the proximate engagement of economic agents, and frequently served as a forum for cultural interaction, intellectual exchange, and the generation of new devices for identity structuration.[5] By identifying the powers at play in the movement of imported goods, the motivating factors underlying the adoption and imitation of artistic traditions may then be explored.

The primary data sets analyzed in this network are traded ceramics produced on Cyprus and on the Greek mainland. The analysis of ceramic vessels, conceptualized as a materialization of past trade systems, benefit from the relative fragility and short-life span of finished pottery, the long-term indestructability of discarded clay sherds, and the relatively low secondary use value of broken pots. Imported Aegean vessels in particular are relatively visible in reporting within Mediterranean archaeology, particularly for earlier excavations, where these materials were privileged relative to local or non-decorated wares and were often documented in a manner of exaggerated importance; this also unfortunately renders proportional or comparative assessment in relation to locally produced wares frequently impossible. Although there is considerable debate as to the value of these ceramics as traded goods, their ubiquity and visibility in the archaeological and documentation records render them an efficacious paper-trail through which the exchange system can be reconstructed—particularly as the primary traded goods of raw materials, metals, and consumables are rarely preserved.[6] The distribution of Mycenaean

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[5] Developments of this type include the conspicuous consumption of Aegyptiaca by competing elites within Minoan Crete, as well as the development of the local Nuzi-imitation Atchana Ware around Alalakh in Anatolia. For a definition of "Port of Power" see Stager 2001; for "Gateway Community" see Hirth 1978.

[6] Bevan 2007; Barrett 2009; Van Wijngaarden 1999, 2002.

vessels is examined independently, as well as in relation to Cypriot wares, which represent the other main traded ceramic class during the Late Bronze Age.

Cypriot ceramics exceeded Mycenaean vessels in exchange frequency throughout much of the Near East, where they appear in significant quantities. In nearly all sites yielding both import groups, the quantity of Cypriot vessels recovered dwarfs that of Mycenaean imports.[7] As with Mycenaean vessels, there is considerable difficulty in acquiring consistent publication details as to the quantities of wares recovered, the proportion of all excavated finds represented by Cypriot vessels, or detailed analyses of ware types and vessel shapes—especially for older excavations of the late nineteenth and early twentieth centuries. It is important to note, therefore, that the data consolidated for this dissertation should not be considered a comprehensive approximation of Cypriot ware circulation during the Late Bronze Age, but rather an imperfect reflection of the consumption of imported Cypriot and Aegean vessels.

The identification of Cyprus as an intermediary in the distribution of Mycenaean ceramics can be related in part to the strong correlation in the presence of both import groups at sites from which Mycenaean vessels have been recovered.[8] The median place of Cyprus within the exchange system is inferred by the central importance attributed to Cypriot copper, and is supported by the cargo excavated from the Uluburun shipwreck, in which the Aegean pottery is

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[7] The sites excluded from this pattern are Tell el-Amarna in Egypt, where 119 Cypriot vessels were found amongst over 1500 Aegean pots and fragments (Merrillees 1968, 78-88), as well as Tell Abu Hawam in Israel, where excavations have generally produced a 3:1 Mycenaean to Cypriot ratio (Balensi 1980). It is important to note however that the new excavations at Tell Abu Hawam by M. Artzy have differed radically, producing a majority of Cypriot wares at an estimated ration of 40:1 (Artzy 2007, 363).

[8] Hankey 1967, 145-146; 1971, 20-21; Hirschfeld 2000, 69; Gilmour 1992, 118.

interpreted as an accompaniment to the Late Cypriot Wares.[9] An attribution of Cypriot origins to some Late Bronze Age Mediterranean trade ships have been proposed by scholars excavating at sites in the Aegean.[10] That the trade system incorporating both Cyprus and the Levant was well-established before the introduction of Aegean imports on any significant scale is also noted as a condition which may have situated Cyprus in an intermediary role in trade between the Aegean and the Near East.[11]

The inferred reconstruction of a Cypriot nexus for Aegean product distribution has been bolstered by the quantity of Mycenaean vessels recovered from the island, which exceeds the quantity recovered from surrounding regions in both number and diversity of shapes.[12] Managing the distribution of Mycenaean vessels would also have facilitated and contributed to the development of the LC IIIC Aegean imitations wares produced in considerable volume during the latter part of the Late Bronze Age.[13] Locally produced Aegeanizing vessels were manufactured on Cyprus on a massive scale, and were traded as substitute wares throughout the Eastern Mediterranean.[14] Understanding the role of Cyprus within the distribution of Aegean imports will serve to contextualize the development of this local imitation tradition. This question is explored through the comparative regional networks of Mycenaean shapes and

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[9] Hankey 1967, 146-147; 1971, 20-21; 1993, 103; Bass et al. 1989; Gilmour 1992, 119; Eriksson 2007a, 58.

[10] For a discussion of the role of Cypriot traders at the site of Kommos during the 15th and 14th centuries, see Rutter 1999.

[11] Hankey 1993, 103.

[12] Gilmour 1992, 115; Hankey 1967, 146.

[13] D'Agata et al. 2005, 378.

[14] Jones 1986, 595; Sherratt and Crouwel 1987; Kling 1987; 1989; 2000; Sherratt 1991.

subtypes, as well as the consolidated network of both wares across all regions, in order to identify associated distribution patterns of regionally produced or consumed vessel groups. The results of the network analysis verify quantitatively the surmised role of Cyprus in the circulation of Aegean ceramics during the Late Bronze Age.

Given the difficulties associated with differentiating Aegean-produced LH IIIC vessels from Cypriot or Levantine imitation wares—or furthermore from wares produced by Aegean migrants within Cyprus or the Levant—the LH IIIC ceramics have been omitted from this study. As more assemblages of LH IIIC vessels continue to be sourced through petrographic or scientific means, it will be advantageous for future research to revisit ceramic distribution networks for the transition from the terminal Late Bronze Age into the Iron Age. This will allow for diachronic comparisons between the Late Bronze Age networks generated in this study with those for the subsequent Iron Age, providing an opportunity to explore the impact of widespread political collapse on supra-regional exchange systems.

The geographic scope of this dissertation has also been limited to the Southeastern Mediterranean, and more specifically to Cyprus, Egypt, and the Levant. Although Mycenaean wares were distributed with some frequency throughout Italy and Anatolia, Cypriot wares were less commonly circulated in the west, rendering comparative circulation analysis ineffectual. Conversely, while Cypriot vessels were widely distributed throughout southern Anatolia in particular, Mycenaean imports are relatively rare. The assessment of the distribution of Mycenaean material in the east Aegean is also complicated by the interpretation of Minoan and Mycenaean interest in the region, including the identification of potential colonies or "anchorages" along the coast.[15] The East Aegean – West Anatolian Interface reflects fluctuating degrees of direct and indirect influence from both neighbouring cultures, evidenced by variation in the material culture between east Aegean islands and mainland sites.[16] This region—and by association the southern Anatolian coast—therefore presents a unique context of cultural integration, within which objects and goods may have been mobilized by different means than other parts of the eastern Mediterranean.

The exchange system through which both Cypriot and Mycenaean ceramics were mobilized was not a singular monolithic centralized entity, thus it would be unproductive to consider the system in its entirety, as variability between regions would blur the data, leading to imprecise and overly general conclusions. Furthermore, the inclusion of all traded vessels of both ceramic groups, in addition to associated examinations of all regions incorporated in this distribution, would be beyond the reasonable scope of this dissertation. While this project concentrates on the trade network centered on Cyprus in the Southeastern Mediterranean, further research would significantly profit from a focused analysis of the connections between Cyprus and the Southern Anatolian coast, especially Cilicia. Ongoing research in this region continues to yield quantities of Cypriot and Mycenaean imports, as well as important data concerning the development of early Cypriot ceramic wares—particularly the lustrous ceramic traditions.

In order to reduce the influence of imperfect data on the comparative analysis results, the

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[15] French 1993, 155. See the discussion in French (1993) for the identification of potential anchorages (such as Beşiktepe), as well as the relative influence of Greece and Anatolia on the eastern Aegean islands.

[16] P. Mountjoy interpreted the material from this region as a reflection of a hybrid culture created through acculturation, with local eastern inhabitants adopting Mycenaean pottery and burial customs (Mountjoy 1998, 37; cf. Niemeier 2005, 199-203).

sample of sites included within the network analysis is limited to those from which Mycenaean imports have been recorded. For the independent analysis of Cypriot distribution networks, the sites from which imports were recovered are drawn exclusively from sites in which Mycenaean vessels have also been uncovered (rather than the entire range of sites from the eastern Mediterranean in which Cypriot vessels have been documented). Assessing the circulation of Cypriot vessels as a complement to the examination of Mycenaean imports is particularly important as a means to examine the purported role that Cypriot traders may have played in the distribution of Mycenaean wares.[17]

This dissertation follows an extensive corpus of research, both on the nature of economic interaction in the Late Bronze Age, as well as on the production and distribution of Cypriot and Mycenaean ceramics during this period. Previous studies have contributed greatly to our understanding of the late second millennium, and provide the platform upon which this analysis is constructed. While ‘networks’ have long been used to conceptualize trade and exchange, the employment of Network Analysis (based on mathematical graph theory and complexity theory) has received less attention. This method allows for patterns, emerging from visual spatial reconstructions and statistical analyses of centrality, clustering, and connectivity, to inform upon how exchange is conducted, rather than simply providing material corroboration for the social and political interaction of the Late Bronze Age as understood from the surviving textual record.

This project employs network analysis to reconstruct a modeled scaffold for the system

[17] This constraint also serves to reduce the magnitude of this dissertation. Limiting the sites examined to those yielding Mycenaean vessels has considerably reduced the number of sites examined; for example, only 26 of the 50 Egyptian sites identified by Hankey as containing Cypriot imports also yielded Mycenaean vessels (1993, 115, note 21). The exhaustive examination of all imported Cypriot ceramics into the Levant alone is a project of considerable scope, and far exceeds the means of this dissertation.

of exchange operational during the Late Bronze Age, through which different material assemblages were mobilized. Variation in the circulation of imported ceramics across Cyprus, Egypt, and the Levant indicate diverging forms of political economy and practices of consumption. In particular, the network centralization and density measures effectively contrast the unified and highly centralized New Kingdom Egyptian state with the competing polities characterizing both the Levant and Cyprus. The absence of a governing core in the case of Cyprus, as demonstrated by the diffusion of shapes across sites and contexts of differing scale and the high centrality of multiple competing polities, is particularly significant as a contribution to the debate over the nature of Late Cypriot political organization. Competition between local elites is further evidenced by the widespread consumption of Mycenaean dining vessels on Cyprus, which were only minimally circulated to other neighbouring regions. While rare ware groups and vessel forms reflect a highly centralized distribution pattern in Egypt, the converse pattern of import diffusion and low degree of network centralization for Mycenaean imports on Cyprus contest the reconstruction of a centralized state (i.e. the Kingdom of Alashiya).

The insights gained in this dissertation extend past the particulars of ceramic circulation in the Mediterranean during the Late Bronze Age. This project also demonstrates the value of network analysis for the effective management, assessment, and visualization of large datasets, as well as for the facilitation of quantitative comparative inquiry. The results of this study reflect the efficacy of this method for the examination of traded goods, particularly with the objective of identifying governing economic structures and political institutions. The inherent flexibility of network construction allows for the accommodation of complex multiscalar spheres of interaction, alleviating many of the concerns associated with traditional and overly-centralized models of political economy. As evidenced by the identification of two alternate and concurrent provisioning networks supplying ceramic imports to Egypt, network analysis can better evaluate and portray the nuances of complex systems. Beyond the specific insights attained in this study, this dissertation contributes to the growing corpus of network studies that demonstrate the value of this methodology for archeological inquiry.

Outline of the Dissertation

This dissertation is organized into five sections: Section I includes an introduction to the research question, as well as a background to the historical period and regions in question; Section II details the theoretical background of the research conducted for this dissertation, including the models employed in data analysis; Section III introduces the classes of data incorporated in this study; Section IV presents the dissertation analysis; Section V concludes the dissertation with final remarks and suggestions for future avenues of research. These five sections are further partitioned into the following chapters.

Chapter Two of this dissertation will provide a historical overview of the regions considered in this research. A general introduction will also be provided for the nature of international relations and diplomacy during the Late Bronze Age, as well as the main categories of materials circulated during this period. The chapter will conclude with a brief synopsis of the chronological issues inherent in the second millennium.

Section II introduces the theory employed in this dissertation, beginning in Chapter Three with an introduction to the study of ancient economies. Different approaches to political economy will be explored, as well as the common models applied to the regional economies of the Late Bronze Age Mediterranean. Chapter Three will also include an introduction to models of trade, including a discussion of both centralized and non-centralized mechanisms for the circulation of goods and materials. This chapter will close with a discussion of the theoretical approaches to studying the reception and consumption of traded goods, particularly ceramics.

Section II will conclude with Chapter Four, which will provide an overview of Network Analysis, the methodology employed in the analysis of this dissertation. This will include a discussion of the development of Network Analysis and Social Network Analysis Theory, as well as the methodologies employed within this field of research. This chapter will also present a survey of previous applications of Network Analysis within the field of archaeology.

Section III will lay out the data analyzed in this project, beginning with Mycenaean Ceramics in Chapter Five. This will include a survey of the shapes and decorative motifs common during each chronological period, as well as an overview of the main regions of production. This chapter will also include a survey of the Mycenaean ceramic imports to each main region studied in this project—Cyprus, Egypt, and the Levant.

Chapter Six will similarly introduce Cypriot Ceramics, including a review of the main ware groups. This will include a discussion of the regions associated with production, as well as the chronological development of different ware subtypes (i.e., Base Ring I and Base Ring II). This chapter will similarly examine the circulation of these ware groups throughout the Eastern Mediterranean, primarily Egypt and the Levant.

Section IV includes the analyses of the dissertation, starting with a network analysis of Mycenaean traded ceramics in Chapter Seven. Networks of Mycenaean imports will be constructed for each region under examination, according to both FS Shape types and chronological ware groups. Affiliation networks will also be constructed for both sites and import types.

Chapter Eight of this dissertation will present the network analysis of Cypriot ceramics distributed throughout both Egypt and the Levant. Networks for each region will be constructed independently. Affiliation networks will also be constructed for each region according to both sites and ceramic ware groups.

Chapter Nine will conclude Section IV of the dissertation by exploring the analysis of a combined Mycenaean and Cypriot Ceramics network. This network will be constructed within each region independently, followed by an examination of the Eastern Mediterranean network as a whole.

Chapter Ten concludes the dissertation by consolidating the results of the analysis from Section IV. Discussion will center on the mechanisms employed in the circulation of goods, as well as a reconsideration of the role of Cyprus within the distribution networks of Mycenaean vessels during the Late Bronze Age. The chapter will close with an assessment of network models as a technique for the elucidating ancient systems of exchange in relation to current models of political economy.

2. THE LATE BRONZE AGE MEDITERRANEAN

The second millennium B.C.E. saw the emergence of an extraordinarily expansive system of long-distance connectivity in the regions surrounding the Mediterranean Sea. Diplomatic engagement accelerated to new levels of complexity, while raw materials and traded goods were circulated on an unprecedented scale. Diplomatic and economic interaction fluctuated within the rapidly shifting political landscape, as competing Late Bronze Age states contended for dominance over vast territories and human and material resources. At the close of the second millennium, once powerful political polities abruptly dissolved in a wave of collapse and destruction that significantly altered the cultural landscape of the Eastern Mediterranean. Associated with this disintegration is the appearance of the group known as the so-called "Sea Peoples", whose arrival mark the end of the vibrant international community cultivated during the Late Bronze Age.

The first chapter subsection will provide a brief background to the cultural history of the Mediterranean in the second millennium B.C.E.. This will include a survey of the cultural groups and polities from the Aegean, Cyprus, Egypt, Anatolia, and the Levant (Figure 2-1). This section will focus in particular on the political and economic structures of each region in order to profile each cultures respective role in the political landscape of the Late Bronze Age Mediterranean. An overview of connectivity during the second millennium will follow, including subsections on international relations and diplomacy, as well as on the traded goods and material commonly circulated during this period. This subsection will also address the implications of using objects such as ceramics for the construction of the exchange network.

The chapter will close with a brief discussion of the chronology of the period, including

Figure 2-1. Map of the Eastern Mediterranean with selected Late Bronze Age sites.

DATES BCE	MAINLAND GREECE	CRETE	CYPRUS	EGYPT	LEVANT	ANATOLIA
	MH LATE					
			MC III	2nd IP		“Dark” Age
1700		LM IA			MB II-III	
	LH I					
			LC I A1, 2	Hyksos		
1600						
	LH IIA	LM IB				Hittite Old
			LC IB		LB I	
1500						Kingdom
	LH IIB	LM II	LC IIA		LB IB	
1400	LH IIIA1	LM IIIA1	LC IIB			
					LB IIA	
	LH IIIA2	LM IIIA2		New		
						Hittite New
1300	LH IIIB1		LC IIC	Kingdom		
		LM IIIB			LB IIB	Kingdom
	LH IIIB2					
1200						
			LC IIIA		IA IA	
	LH IIIC	LM IIIC				
1100			LC IIIB			Neo-Hittites
					IA IB	
	Sub-		Cypro-			
		Subminoan		3rd IP		
1000	Mycenaean		Geometric		IA IIA	

Figure 2-2. Correspondence between Mediterranean regional chronologies

an overview of the relative versus absolute chronology debate, incorporating recent carbon 14 dates and their implications. The chronological scheme adopted in this dissertation will be laid out at this stage, however a general correspondence table between regional chronologies is presented in Figure 2-2.[18] The absolute dates assigned to the different regional chronologies

[18] This chronology is adapted from Bryce 2005; Manning 2006, 2013; Manning et al. 2006; Höflmayer et

follow the high chronology system, however the author notes that the dating accepted here may shift through the publication or more material or the refinement to current calibration systems.

2.1 Cultures: Background to Late Bronze Age Societies

The Aegean

The Bronze Age in the Aegean is characterized by the development of two primary cultural groups, commonly known as the Minoans and the Mycenaeans, which flourished on Crete and the Greek mainland respectively. Neighbouring inhabitants of the Cyclades and Northern and Eastern Aegean Sea were incorporated to fluctuating degrees within the political and economic spheres of influence of the Minoan and subsequent Mycenaean polities, which each in turn exerted considerable cultural influence on these surrounding regions. While the trajectories of cultural development share characteristics between Crete and the Mainland, the culture history of each will be presented in turn.

Minoan Crete

The Minoans, so named for the monumental palace at Knossos and its resemblance to the mythical labyrinth of King Minos, were a cultural group that occupied Crete during the Bronze Age. The political history of this cultural group is traditionally divided into three periods, the Protopalatial, the Neopalatial, and the Final Palatial (or Postpalatial), which represent phases of

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centralized power manifest in the construction of large public structures or palaces. This periodization, based on cyclical socio-economic consolidation and collapse, is punctuated by important external phenomena, including the Theran eruption and the presence of the Mycenaean Greeks (or the impact of Mycenaean interest), which are associated with the close of the Neopalatial and the start of the Final Palatial Periods.

The rise of complex society on Crete begins with the construction of large-scale public architecture in the Protopalatial period (MMIA–MMII), in which the classic monumental structures at Phaistos, Knossos, Mallia, and Petras were erected. The palace buildings are immense public spaces that center on large open central courts, and include extensive storage facilities (assumed to facilitate the collection and redistribution of goods). The construction of the palaces at the start of the Middle Minoan Period coincides with a shift in urbanization, while shared markers such as polychrome pottery, hieroglyphic script, and formal peak sanctuaries emerge.[19] A degree of regionalism is still prevalent in MM II, as evidenced by the differentiation between ceramic styles across urban centers.[20] Although existing large communal tombs continue in use, new cemeteries are established, such as Chrysolakkos near Mallia. Single internments become more common, and there is an overall increase in the wealth of burial equipment. The Protopalatial period is particularly notable for the significant growth in direct foreign contact with Egypt, the Near East, and Anatolia, to whom Minoan products were exported, and from whom finished goods and raw materials were increasingly obtained.[21]

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[19] Rehak and Younger 1998, 100; Shelmerdine 2008.

[20] For example, contrasting styles exist between the sites of Mallia and Knossos, as well as regionally between the east and the Mesara (Knappett 2008, 126-127).

[21] Laffineur 1989, 55. Trade relationships beyond the island are already attested in the EM II period, with contacts established between Cyprus and the Cyclades and the mainland (Watrous 1994, 711-712). This

Following the destruction horizon of the MM II, palatial regeneration begins in the MM III and early LM I, establishing the Neopalatial period which runs to the end of LM IB. Settlement consolidation occurs at the start of this period, with a move towards the establishment of fewer but larger urban centers, observable in both the Mesara and Mallia plains.[22] Although the diversity and scale of architecture from the Neopalatial is well explored, there is a relative dearth of excavated tombs from the period; this absence may be suggestive of diverging mortuary ritual or beliefs from the period, including marine burial or more private ceremonies.[23] While funerary ritual becomes obscured, nearly all other markers of Minoan culture persist, with craft production and artistic style flourishing. A particular artistic evolution associated with the Neopalatial is the development of a miniature tradition in glyptics and frescoes in particular, as observed in the LM I frescoes from Akrotiri and Ayia Irini.[24] The fall-out on Crete in the latter LM I from the eruption on Thera has diverging interpretations, from widespread famine caused by accumulating ash and pumice, to psychological devastation and fragmentation of communication and exchange systems.[25]

Widespread destruction during the late LM IA and LM IB affected the majority of the administrative centers of the island, with the exception of the site of Knossos, which continues to

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also includes the establishment of a Minoan settlement on Kythera, as well as evidence for the importation of metal ores from Lavrion and Siphons (Stos-Gale and MacDonald 1991). Limited imports from the Near East have also been attested, including a Syrian silver cylinder seal from Mochlos (Aruz 1984; Watrous 1994, 712) or Egyptian stone vases (Colburn 2008, 220).

[22] Rehak and Younger 1998, 100, 106-7. The influence of Knossos grows in the Neopalatial period, supplanting Phaistos in influence (MacGillivray 1998, 107).

[23] Rehak and Younger 1998, 110-111.

[24] Immerwahr 1990, 83; Rehak and Younger 1998, 111.

[25] Rehak and Younger 1998, 100; Hood 1973.

operate through this disruption.[26] The destructions associated with the LM I mark the end of the Neopalatial period, and are associated with significant social discontinuity, in which new cultural features were introduced and typically Minoan markers disappear. Many of the newly introduced features are categorized as Mycenaean, including chamber tombs and tholoi, pictorial pottery, mass-produced jewelry, terracotta figurines, and dominantly masculine artistic motifs and themes.[27] As these new styles are adopted, there is a widespread decline in the quality and technique of art, metal working for weapons and jewelry manufacture, ivory carving, and stone vase production. Declining quality of artistic production is accompanied by the loss of typically Minoan cultural features, of which notable examples include architectural elements (such as court-centered buildings, lustral basins, and polythyra), stone relief, lion's, and bull's head rhyta, stone chalices and maces, relief frescoes, three-dimensional figures in faience and ivory, and Linear A texts.[28] Following the LM IB, only Knossos and Ayia Triada have yielded significant evidence of fresco painting.

The destruction of the Neopalatial polities on the island has been alternatively interpreted as evidence for a Mycenaean invasion, environmentally driven collapse, or the result of peer-polity warfare.[29] With or without an assumed Mycenaean hegemonic governance, the site of

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[26] The destruction of sites appears to particularly target administrative centers at which Linear A records were housed—and specifically the records buildings themselves—such as Chania, Nerokourou, Phaistos, Ayia Triada, Gournia, Pseira, Pyrgos, Mochlos, Kommos, Makriyialos, Petras, Palaikastro, Zakros, Archanes Tourkogeitonia, Zominthos, Tylissos, Amnisos, and Mallia (Rehak and Younger 1998, 148).

[27] Rehak and Younger 1998, 149. The shift in artistic themes is also tied to the disappearance of natural subjects including marine motifs and landscapes, as well as images of enthroned women or scenes of women engaged in supposed cultic activity (Rehak 1997, 59*)*.

[28] Rehak and Younger 1998, 149.

[29] Complications may also have arisen form alterations to groundwater supply as a result of the earthquake (Gorokhovich 2005). For an assessment of the relative degree of direct Mycenaean intervention in Crete and potential causes for the wave of LM I destructions, see Popham, Catling, and

Knossos remains the dominant center on the island at the close of the Neopalatial period. The Knossos supremacy appears to finally dissolve by the transition from LM IIIA2 to LM IIIB (ca. 1300 B.C.E), with the site destroyed twice during the subsequent 14th and 13th centuries. This period coincides with a revival of monumental building and forms of elite display at other sites throughout the island, including a resurgence of regionalism in Cretan ceramic styles.[30] Long-distance trade declines relative to the Neopalatial period, however Minoan ceramic exports have been recovered in the Near East, while a considerable amount of Levantine pottery has been found at the site of Kommos (which may have functioned as a Gateway Community at this time).[31] The regeneration, known as the Final Palatial Period (or Postpalatial) was relatively short-lived, with the majority of central sites suffering destruction or abandonment gradually by LM IIIB.

The nature of political organization through the Middle and Late Minoan Periods is highly debated. Early complexity and social hierarchy may begin developing in the preceding pre-palatial Bronze Age as early as EM II, during which time there is an emergence of larger scale architecture, as well as some evidence for wealth inequality in cemetery deposits from Mochlos, Gournia, and Mallia.[32] These features are suggestive of early nascent forms of power, potentially centered on local chiefs, from which the institutionalized social hierarchy of the

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Catling 1974, 252-257; Popham 1976; Niemeier 1983, 217-236; Hood 1985; Catling 1989; Rehak and Younger 1998, 148.

[30] A notable example is the Chania ceramic tradition, which emerges during the LM IIIA, reaching fluorescence during the LM IIIB period.

[31] Rehak and Younger 1998, 151.

[32] The identification of social inequality has been questioned by Watrous, who surveys the archaeological support for such claims (1994, 713-717).

Protopalatial period may have generated.[33] Although the first appearance of these features of social complexity are debated, their achievement by the commencement of the MM IA period is clear. In Protopalatial Crete, central-court buildings functioned as the administrative and economic center of regional agricultural polities, managing the storage and redistribution of foreign and domestic products, housing workshops and craftsmen employed in the manufacture of specialized goods, and organizing the production of wine and oil.[34] The functional role of the palaces reflects the mixed nature of the Minoan economy, which subsisted through a combination of agriculture, sea faring, and trade.[35]

Through the palatial periods of the Bronze Age—particularly the Neopalatial—there is an observable settlement hierarchy, traditionally conceptualized by a tripartite system of palaces, villas, and towns.[36] While these terms are problematic in their romanticized Victorian notion of social stratification, as well as their confounding of multiple dimensions including public versus personal and rural versus urban, they nevertheless reflect a sequence of occupational scale, with peripheral territories governed by monumental urban regional centers. Absent from this categorization are special-function sites peripherally affiliated with large urban centers, including

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[33] Branigan 1988, 48-49, 118-123; Soles 1988, Whitelaw 1992; cf. Watrous 1994; Cherry 1983.

[34] Rehak and Younger 1998, 102; Manning 2008. Institutionalized wine production commences in the Protopalatial period, while the production of oil appears to begin in the Neopalatial period (Hamilakis 1996, 24-25). For an examination of the role of the palaces in redistribution, see Halstead 1988, 1992, 2004; Strasser 1997; Day and Wilson 1998.

[35] Rehak and Younger 1998, 106.

[36] Niemeier 2009, 13-14; Rehak and Younger 1998, 102. The palaces were initially considered by Evans to be an amalgam palace-temple, which served as the seat of a ruling priest-king (1921, 3-4). This model, though now subject to appropriate consideration and critique, has pervaded scholarship and popular opinion through most of the twentieth century (Schoep 2010, 219-220; Preziosi and Hitchcock 2000, 89). The reconstruction of a priest-king at the palaces is challenged by lack of clear indication of the existence of a royal lineage, or definitely iconography of such a ruler (for a discussion of the 'Prince of the Lilies' fresco, see M. Shaw 2004).

peak sanctuaries, defensive watchtowers, and port sites. The reconstruction of a single governing authoritative state has become less assumed, with considerable elite competition and political fragmentation ascribed to more recent peripheral archaeological evidence.[37] Economic activity, including production and exchange, appears also to be partially diffuse, with both centralized and independent merchants in operation.[38]

Shared cultural markers across the island, including artistic motifs, mortuary customs, and architectural style suggest a relatively high degree of integration, while a degree of persistent regionalism is evidenced by variable ceramic traditions through the Protopalatial period. This balance of cultural affinity reflects economic rather than political integration, and has been interpreted as a representation of peer polity competition (rather than a centralized state centered on Knossos).[39] Hierarchical site governance is supported by the advent of the systematic production of wine in the Protopalatial period which, when considered in association with increasing evidence for wealth inequality and conspicuous import consumption in tombs, may be considered an elite strategy of identity formation through competitive feasting.[40]

Crete, although geographically peripheral to the EBA exchange system of the Near East, was integrally situated as a nexus in the expanded Mediterranean exchange system of the MBA.[41] Cretan dominance over the trade system of the late Middle and early Late Bronze Ages

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[37] Hamilakis 2002, 193; Schoep 2002, 106-107; Schoep 2010, 220.

[38] Watrous 1993, 82.

[39] Manning 2008, 111-112; Knappett 2008, 127; Cherry 1986.

[40] Hamilakis 1996, 25.

[41] Knapp 1992, 65. Based on the distribution of pottery, Watrous has identified five predominant trade routes in operation during the Minoan Palatial period: to the Peloponnese via Kythera, to Lavrion via the western Cyclades, to the east via Karpathos and Rhodes, to the Anatolian coast and northward via Rhodes and Kos, and south to Egypt (Watrous 1993, 82).

is frequently conceptualized as a ‘Minoan Thalassaocracy’, through which Crete commanded the maritime circulation of materials throughout the Eastern Mediterranean.[42] The consolidating source of Minoan control is as yet unclear, as the reconstruction of a dominant Minoan military force is problematic.[43] External evidence for Minoan trading activity across the Mediterranean is inferred with the identification of the ‘Keftiu’ as a representation of merchants from Crete.[44] More than 50 attestations of the Keftiu or Kaptaru are documented in texts written in Egyptian, Akkadian, Ugaritic, Hebrew, Greek, and Latin.[45] The description of their geographic source—“the islands in the midst of the Great Green (Sea)”—is cited as an indication of an Aegean point of origin for the Keftiu.[46] The representation of emissaries of the Keftiu in the Theban tombs, who appear bearing offerings, are particularly valuable as they depict the presentation of ephemeral goods such as textiles.[47]

Minoan influence dating to the MM and LM I periods is substantiated for example by the adoption of polythyra and figural wall paintings at Akrotiri, and the influx of MM and LM

[42] Hägg and Marinatos 1984; Wiener 1990; Rehak and Younger 1998; Niemeier 2004, 2009; cf. Merrillees 1974, 7-8; Knapp 1993, 1998. The preserved memory of a Cretan supremacy is inferred based on the description of Minos’ political power in the works of Hesiod, particularly as the political-economic structure described in the texts do not reflect systems extant during the time of Hesiod’s writing (Niemeier 2009, 19). The Minoan Thalassocracy may have been mythologized and celebrated as a mechanism to legitimize the Athenian Aegean hegemony (see discussion in Papadopoulos 2005, 94).

[43] Niemeier 2009, 16; Manning 1986. For an examination of sword production in the Final Palatial period, see Driessen and Macdonald 1984.

[44] For the identification of the Keftiu as individuals from Minoan Crete, see Rehak 1998; Panagiotopoulos 2001; Vandersleyen 2003.

[45] Knapp 1992, 66.

[46] Niemeier 2009, 16. The distinction of the Keftiu from other Aegean inhabitants has been suggested to indicate a unified Cretan leadership, however there is little archaeological or textual support to prove this (see Sakellarakis and Sakellarakis 1984 for this hypothesis).

[47] See the tomb of Menkheperreseneb for the depiction of bolts of cloth (Wachsmann 1987, 75). Depictions of the Keftiu appear in five Theban Tombs: Senenmut (TT71), Intef (TT155), Useramun (TT131), Rekhmire (TT100), and Menkheperreseneb (TT86).

pottery and Linear A at Ayia Irini on Keos. The most commonly traded material type appears to be decorated pottery, commencing with the light-on-dark Kamares Ware in the Middle Minoan Period, followed by various Late Minoan ware groups, most notably the Marine Style (the absence of which at Akrotiri is an important temporal marker for the Theran eruption). Minoan artifacts such as jewelry were also circulated, evidenced by an ornate example recovered from Tell el-Dab'a in Egypt.[48] Alongside the circulation of objects and raw materials, exchange in the Middle Minoan Period also included the transmission of cultural features, technological innovations and ideas, and artistic motifs. The shared appearance of architectural features such as drainage systems and ashlar masonry, as well as the presence of Minoan style frescoes at numerous sites in the Eastern Mediterranean suggests active intellectual exchange between Crete and the Near East.[49]

Minoan influence on the Greek mainland was particularly strong, with a high number of Cretan imports—both luxury goods and more quotidian objects such as pottery—recovered from Mycenaean contexts. Of the materials imported to the mainland, there are also a number that are undocumented at Minoan sites on Crete, but which bear unmistakable Minoan style. Of particular note are niello objects recovered from Mycenaean shaft graves. While the motifs and execution reflect Minoan style, the technique itself is most likely a Syrian import; although a Knossian workshop has been hypothesized for the objects' production, the lack of similar objects

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[48] Walberg 1991; cf. Aruz 1995, 44-46.

[49] Watrous 1987. Further connections to the east are inferred by the presence of common features of monumentality and royal ideology. Chronological questions are raised as to the period of transference, particularly in relation to relative chronology synchronisms in the Eastern Mediterranean, especially given the range of appearance of Minoan style frescoes across Near Eastern sites (Laffineur 1989, 57-58).

on Crete is curious.[50] The early impact of Minoan culture on Mycenaean artistic style and goods production is considerable, however the latter would grow to eclipse their Cretan neighbours in the second half of the Late Bronze Age, usurping the dominance over the Aegean held by the Minoans through the Protopalatial and Neopalatial periods.

Mycenaean Greece

The term 'Mycenaean' is used to denote a Bronze Age culture that formed on the Greek mainland during the second millennium B.C.E.. Mycenaean cultural history is predominantly placed within the Late Helladic Period, although considerable continuity is present with the preceding culture of the Early and particularly Middle Bronze in Greece (known as the Early and Middle Helladic). During the Late Helladic, the mainland is characterized by the development of a number of palatial centers, including Athens, Mycenae, Tiryns, Thebes, Gla, Orchomenos, and Pylos. Following the dissolution of Minoan dominance in the Aegean at the end of LM I (around the transition from LH I to IIA), Mycenaean goods and influence began to spread, first across the Aegean, Crete, and the Cyclades, and finally by the LH III period to other cultures around the Mediterranean.

The socially complex society that developed on the Greek mainland is frequently observed through the lens of Minoan influence, with Mycenaean polities characterized as secondary states.[51] Early scholarship on Mycenaean culture was also dominated by the

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[50] Rehak and Younger 1998, 140-141. Laffineur has proposed a local Mycenaean workshop employing foreign craftsmen for the objects' production (1989, 61-62).

[51] Pullen 2011, 185; Parkinson and Galaty 2007, 113 (in which both the Mycenaean and Minoan economies are characterized as secondary states formed through long-distance trade and interaction with more developed complex states).

representation preserved in the works of Homer, which characterized the Mycenaeans as a warlike group. This depiction appeared to be corroborated by the initial discovery of the Lion Gate by Heinrich Schliemann at the site of Mycenae, which formed the monumental entranceway through the Cyclopean walls of the mound. Further archaeological investigation—including the discovery that not all major sites are fortified—has served to enhance our understanding of Mycenaean culture and broaden our understanding of the complex relationship between the Aegean and the rest of the Mediterranean.[52]

The shift from agricultural village-based communities to complex and organized social systems begins in the Early Helladic Period with the appearance of the 'Corridor House', which represents the first public communal structures.[53] By the subsequent Middle Helladic, many of the regional centers that were important during the following Late Helladic were already established and sustained close contact with the Peloponnese, as well as with the Near East.[54] Evidence for increasing social complexity appears at the transition from the MH to the LH in the form of wealthy graves, most notably the shaft graves from Mycenae. These tombs included a significant increase in the wealth of funerary equipment, including many objects imported from Crete and other foreign contacts.

The Palatial Period of Mycenaean Greece commences in LH III, with numerous palace structures undergoing major rebuilding and extension during the LH IIIA. Some sites including Mycenae and Tiryns were also fortified with monumental Cyclopean walls. Public and religious

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[52] Dickinson 1994, 81.

[53] The most famous example is the House of Tiles at Lerna, however other examples have been excavated at Akovitika, Kolonna, Thebes, and Mitrou (Aprile 2010, 11; J. W. Shaw 1987).

[54] Hope Simpson and Dickinson 1979, 197. For instance the site of Athens has yielded considerable MH material, particularly on the North Slope and on the summit, as well as in wells from the Peripatos and Klepsydra areas (ibid.).

spaces were fixed throughout Mycenaean sites, within which the central focus was the Megaron. In subsequent LH IIIB renovations many sites were refortified, with walls frequently extended to enclose wells or water access points. Interest in securing access to water is visible at the Bronze Age settlement on the Athenian acropolis, at Mycenae, and at Tiryns. In some cases, there were multiple phases of renovation and elaboration, as evidenced by expanding walls of Tiryns and the extension of the citadel walls and construction at Mycenae of a new monumental entranceway—the Lion's Gate. The amplification of defenses reflects the growing instability in the region, which culminated in an extensive horizon of destruction, as nearly all major sites from the Greek mainland indicate evidence of conflagration, destruction, or abandonment.

The monumentality of palatial and fortification construction is paralleled in the immense stone tombs intrinsically associated with the Mycenaean Period. The practice of tumuli construction can be traced to the MH period, during which time limited numbers were built in Messenia, Attica, and the Argolid. By the LH there were a variety of tomb types common, ranging from large stone-built tholoi (predominantly dating to the Second Palace Period and reserved for the wealthiest burials), smaller stone built tombs (perhaps designed in imitation of the larger tholoi), and rock-cut chamber tombs, which were employed by individuals of less elite status.[55] Older burial styles persist, including the use of cist tombs, which continued in use until the early LH III period by individuals of all social status levels.[56] The larger rock-cut and stone-built tombs generally included multiple burials over long periods of reuse, many of which

[55] Dickinson 1994, 223. Tomb construction evinces high level of craft specialization, as demonstrated by the careful stone masonry in the early tholoi, such as Prosymna Tombs 25 and 26 (ibid.).

[56] Wealthy cist burials in the LH period were common only in Athens and Iolkos, and were interspersed among cemeteries with a variety of burial types (Dickinson 1994, 228).

demonstrate evidence for secondary burial;[57] inhumations predominate, with rare evidence for cremation.[58] Mortuary equipment varied widely in wealth, with even the most meager tombs equipped with one or more ceramic vessels. Common items recovered from wealthy tombs include jewelry and forms of ornament, sealstones or signet rings, metal items (including weapons), and figurines (during the LH III phases).[59] Mortuary feasting or drinking is evidence by the high occurrence of drinking vessel (kylikes) fragments and the faunal remains of sheep and goats in association with tombs, particularly along the dromoi.[60]

As early as the LH II period (ca. 1600-1400 B.C.E.), individuals from the Greek mainland were travelling to the east to trade and potentially settle, with Mycenaean influence particularly visible at Rhodes, Kos, and Iasos, as well as on the Anatolian Coast (at sites like Miletus).[61] Throughout the subsequent LH III period, significant quantities of Mycenaean products were distributed throughout these regions, while Mycenaean cultural features including chamber tombs and Linear B texts appear across a large geographic area.[62] The most archaeologically visible exports from Mycenaean Greece are Late Helladic ceramic vessels, which were circulated among nearly all regions of the Mediterranean. The predominance of close

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[57] Evidence for secondary burials is observable in the disarticulation of skeletal remains, while the length of tomb use can be seen in the chronological span of interred goods. Additional evidence for tomb reuse include the recovery of clay braziers in situ that were used for fumigation when tombs were reopened for additional burials (Schofield 2007, 55).

[58] At the cemetery of Elateia-Alonaki for instance, which was operation from the early LH IIIA1 through the Early Protogeometric Period, the cremation rate is less than 2% (representing a ratio of 23 cremation burials to nearly 2000 inhumations; Deger-Jalkotzy 2013, 221)

[59] Dickinson 1994, 228-229.

[60] Schofield 2007, 55; Dickinson 1994, 229.

[61] Jones 1986, 459. Evidence of shifting settlement patterns during the LH IIIA1 period is visible on Rhodes, where settlement density increases from 6 to more than 23 settlements by the start of LH IIIA2 (ibid.).

[62] Jones 1986, 493. Linear B texts outside of the Greek mainland are predominantly found on Crete.

shapes reflects the function of these traded ceramics as containers for the distribution of oil, wine, and unguents.[63] Mycenaean and Minoan craftspersons were also particularly skilled at metalworking and ivory carving, which were both secondary craft production requiring a reliable system of raw material acquisition. Excavations on the mainland have uncovered evidence for large-scale textile production, which is corroborated by the Linear B records. These documents attest to a considerable economy of export manufacture,[64] including the industrialized manufacture of products in wood and leather. Specialization is also apparent in the lists of occupations preserved in the texts, including 'unguent-boiler' and 'cyanos-worker'.[65]

Settlements across the mainland were grouped into territorial states, governed by an administrative center. The polities were subdivided into smaller districts, which were headed by a *Basileus*.[66] Polities were headed by the *Wanax*, who was the political and religious head; although the direct nature of the duties of the wanax are unclear, there are Linear B references that suggest he is active in administration.[67] Sites within and between states were well integrated during the LH III, with evidence for a complex system of transportation routes preserved in the Argolid; sections of roads are also preserved in Phokis, Messenia, and Boeotia.[68] Road systems

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[63] The industrialization of manufacture for export is suggested by Haskell based on the apparent mass-production of storage vessels—particular the medium sized storage jars—which were produced in the Argolid and incised with Cypro-Minoan signs (Haskell 1999, 341).

[64] Many goods in the Linear B texts are designated *xenwia* ('for foreigners'), which may refer to their intended use for export (Shelmderdine and Bennet 2008, 298).

[65] Steele 2009, 34.

[66] Kelder 2010, 9.

[67] Text PY Eo 371 references the interest of the wanax in the pottery production at Pylos. The scenario reflected in this text and the archaeological evidence at Pylos is unusual in that it appears as though the potter referred to in PY Eo 371 may have been individually responsible for the production of half of the fine wares from the palace (Shelmerdine 2013, 449).

[68] Crowley 2008, 268; Hope Simpson and Hagel 2006.

were complemented by advanced systems of dams and canals, reflecting a capacity to execute advanced engineering projects.[69]

The language, format, terminology, and apparent system of taxation found in the Linear B texts recovered from sites throughout Mycenaean Greece reflect a high degree of standardization, implying a uniform system of administration.[70] The content of the Linear B documents has been interpreted to be indicative of a highly centralized economy in relation to both craft production and goods' redistribution, with the palace believed to be governing most industries within their territory.[71] This model, known as a "command economy", relies on centralized infrastructure to organize and mobilize goods and services through taxation, obligatory donations, and gifts.[72] Alternative interpretations question the alleged control wielded by the palace, suggesting that a high degree of variability existed across industries and across states.[73] It is also likely that extra-palatial entrepreneurial actors were engaged in both production and exchange.[74]

The relationship between the various polities of the mainland is similarly unclear. Many scholars argue for a unified state that controlled the other polities of the Greek mainland. This centralized kingdom may have been ruled from Mycenae, and was responsible for the

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[69] The road and canal projects reflect a high level of comprehension about water flow, bridge construction, and terracing techniques (Crowley 2008, 268). Major projects include a dam near Tiryns to prevent flooding of the Manessi River, as well as a drain in the Kopaic basin (Zangger 1994). A similarly complex successfully executed engineering project includes the artificial harbour at Pylos (Zangger et al. 1997, 613-623).

[70] Dickinson 1994, 86; Kelder 2010, 8.

[71] Kelder 2010, 9.

[72] Shelmerdine and Bennet 2008, 292-304; Pullen 2011.

[73] Haskell 1999, 340; Pantou 2010.

[74] Texts from Knossos document transactions undertaken between private individuals, outside of Palace control (see for instance KN Wm 1707 and 8499; Shelmerdine 2013, 450).

development of a relatively homogenous material culture.[75] The reconstruction of a centralized government or a loose confederacy is supported in part by the number of large-scale infrastructure projects undertaken during the Late Helladic, which would have necessitated the mobilization of a large disposable work force. The reconstruction of a unified political system is problematic however, as palace-centered states were not universal in the Late Helladic, with much of Achaea and Laconia maintaining village-centered societies similar to those extant during the Early Helladic Period.[76] Instead, ruling elite from the powerful city-states may have been integrated in a system of peer-polity interaction, contending economically, politically (including militarily), and through conspicuous consumption and competitive emulation.[77]

Mycenaean engagement with other polities of the Mediterranean is likely documented in textual references to the 'Ahhiyawa' and the 'Tanaja' by the Hittites and the Egyptians respectively, which have come to be associated with the Greek mainland.[78] The Ahhiyawa are referenced in a number of Hittite texts from the 14th and 13th centuries B.C.E., and are presented as a threat to Western Anatolia.[79] In a letter of Hattusili III dating to 1250 B.C.E., the king

[75] Kelder suggests that *Ahhiyawa* could in fact reference a kingdom centered on either Thebes or Mycenae, however the wealth of the latter leads to its identification as the capital of the Mycenaean Kingdom (Kelder 2010, 120).

[76] Arena 2015; Shelmerdine and Bennet 2008, 289; Pantou 2010. Located along the periphery of the more centralized states, these polities may in some cases have flourished following the destruction of the Mycenaean Palace states (Arena 2015).

[77] Aprile 2010, 272-274; Shelmerdine and Bennet 2008, 250.

[78] Kelder 2010; Hawkins 1998, 2; Hope Simpson 2003; Niemeier 1998; cf. Steiner 2007. For a linguistic connection between Ahhiyawa and the Greek term 'Axaioi see Finkelberg 1988 (127-134).

[79] The first reference may be in the text known as the "Mischief of Madduwatta" (KUB XIV 1), which was an indictment of Madduwatta (possibly an Arzuwan prince) by King Arnuwanda of the Hittites for raiding the coast of Cyprus. In this text the history of the relationship between the Hittites and Madduwatta is recounted, including the protection provided to the latter by the Hittites when he came into conflict with an individual named 'Attariššija of Ahhija' (Kelder 2010, 23-25; text translation in Beckman 1999).

complains to the Ahhiyawan ruler of his brother's activity on the west coast of Anatolia. In this document, known as the Tawagalawa Letter (KUB XIV 3), the Hittite ruler refers to the Ahhiyawan leader as a "Great King".[80] Other Hittite texts note that Ahhiyawan ships frequent Levantine ports, and that they were guilty of aggressions against Hittite interests in Cyprus, which may have contributed to an eventual Hittite embargo on Ahhiyawan goods and Mycenaean trade with Assyria.[81] The Mycenaeans also appear to be referenced by the Egyptians in multiple texts from the 15th to 13th centuries B.C.E., in which they are referred to as *Tj-nꜣ-jj* (*tnj* or 'Tanaja'), which may reflect a vocalization of the Greek epithet Danaoi.[82] It is unclear whether these designations refer to a specific city-state, and if so which one, with some scholars suggesting that the terms instead refer to a conglomeration of several kingdoms,[83] in a confederacy not too dissimilar to the legendary coalition led by Agamemnon against Troy.

Cyprus

The Bronze Age on Cyprus was a period of increasing complexity in which the island emerged from relative isolation to become an intrinsic component of the Mediterranean exchange system. During the Early and Middle Cypriot Periods (ca. 2500 – 1650 B.C.E.),

[80] This term is understood against the context of the international diplomacy recorded in the Amarna Letters, in which the rulers of powerful expansionist states are referred to as 'Great Kings'. For a discussion of the interpretation of this term as an epithet for a ruler of Mycenaean, see Kelder 2010, 2-3; Liverani 2000, 15-27.

[81] The embargo on Mycenaean trade with Syria is based on the Šaušgamuwa Treaty, in which the Hittite King stipulates that the Amurru are not to let Ahhiyawan ships pass en route to Assyria (Kelder 2010, 32-33, 59; Cline 1991; Beckman 1999, 104; Bryce 2005, 311-312; Singer 1985, 119; cf. Steiner 1989).

[82] Cline 2007, 197. These references are dated to the reigns of Thutmose III, Amenhotep III, and Ramesses II.

[83] Kelder 2010, 44.

elaborate funerary ritual developed with the construction of multi-room rock-cut chamber tombs; these tombs increasingly employed extravagant copper consumption, which may have been instrumental in the perpetuation and amplification of the demand for copper, resulting in heightened copper production and distribution.[84] The development of the infrastructure necessary to exploit copper resources and eventually to mobilize copper materials and products further supported social stratification during this early formative period.[85] Corresponding to the transition from the late Early Cypriot to Middle Cypriot Period, there is an increase in imported goods in tombs.[86] Throughout the Middle Cypriot and into the early Late Cypriot Period, population expands while luxury imports developed a more restricted distribution concentrated on the most elite burials; this suggests an increasing degree of social hierarchy and evidences the rise of a new class of elite, residing predominantly along the southern coast.[87]

The transition marking the beginning of the Late Bronze Age on Cyprus (ca. 1650 B.C.E.) is one of relative social upheaval during which many smaller settlements were abandoned, while many others were destroyed.[88] The settlement pattern exhibits considerable nucleation, with population growth and settlement expansion into new areas, particularly along

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[84] Keswani 2005, 341-2. The earliest exploitation of Cypriot copper resources took place in the northern Troodos foothills in the late Chalcolithic period, before the start of the Bronze Age (Knapp 1994, 279-280). Copper artifacts from this early period were predominantly unalloyed or naturally occurring arsenical copper, with tin-bronzes infrequent before the Late Cypriot Period (Keswani 2005, 341-342). The first examples of tin-bronze in Cyprus appear in the transition from the EBA to MBA, and appear to have been imported (Kassianidou 2003, 109-111). During the MC Period, locally smelted tin bronzes first appear as secondary objects produced from reused imported tin-bronzes (Weinstein Balthazar 1990, 161; Kassianidou 2003, 111)

[85] This included the establishment of sites along the periphery of mineral resource zones (Knapp et al. 1994, 423)

[86] Keswani 2005, 392.

[87] Antoniadou 2005, 68; Keswani 2005, 393. See also Keswani 1989, 1993, 2004.

[88] Merrillees 1971; Steel 2004a.

the coast;[89] new sites founded along the coast include Enkomi, Kition, Hala Sultan Tekke, Maroni, Episkopi, Kouklia in the south and east, and Toumba tou Skourou in the northwest. From the LC I and into the LC II new urban centers were constructed with public and ceremonial architecture and enhanced fortifications,[90] while increasing administrative complexity is suggested by the appearance of the first Cypro-Minoan texts and stamp seals. By the transition to LC IIA (ca. 1450 B.C.E.), regionalism in ceramic traditions began to fade with the abandonment of regional wares (such as the Red-On-Red/Red-On-Black ware tradition in the Karpass Peninsula), while more homogenized assemblages containing Base Ring and White Slip ware groups emerge across the island.[91] Evolution in different media is also attested, including sculpture in terracotta and bronze, lapidary work, ivory-carving, glyptics, and jewelry.[92] New social markers emerged, including a marked increase in elaborate funerary rites and the conspicuous consumption of luxury imports, reflecting considerable social hierarchical differentiation.[93]

By the commencement to LC IIC1 (ca. 1300 B.C.E.) true cities had emerged, including

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[89] Steel 2004a, 149; Cadogan 1993, 92. The centers of Enkomi, Morphou-Toumba tou Skourou, and Maroni were active in the LC I and early LC II, while Kalavasos-Ayios Dhimitrios, Alassa, Hala Sultan Tekke, and Kition became well-established during the LC II (Keswani 2004, 84-85).

[90] Knapp 1992, 60; Keswani 2004, 84.

[91] Horowitz 2007, 275.

[92] Catling 1979, 201.

[93] Keswani 2004, 80, 85; Steel 2010, 107. In the LC II period, this included the frequent deposition of gold, which had a restricted distribution to wealthier tombs, with additional prioritization evident in the distribution of the heaviest and most ornate examples (Keswani 2004, 119). A similarly restricted circulation pattern is evident in the consumption of Egyptian and Near Eastern jewelry in mortuary contexts (Antoniadou 2005, 75). These hierarchical distribution patterns contrast to those of the Early and Middle Cypriot Periods, in which prestige goods were more widely circulated. Although the quantity and quality of grave goods increased in the Late Cypriot Period, there was a decrease in the architecture expenditure in tomb construction in the transition from the MC to the LC, with the mean chamber floor surface area decreasing from 8.2 square meters to 6 square meters (Keswani 2004, 118; the author notes that this may be associated with the space limitations inherent in urban tomb construction).

Enkomi, Kition, and Kalavassos-Ayios Dhimitrios (although the first evidence for major settlement growth is difficult to identify as there is limited settlement excavation data for the 17th–14th centuries B.C.E).[94] Associated changes also include the construction of urban spaces with widespread use of ashlar masonry, and technological improvements in bronze smelting.[95] Hittite documents attest to multiple expeditions against Alashiya in this period, which has been interpreted as a representation of potential hegemony over the island.[96]

At the end of the LC IIC (ca. 1200 B.C.E.) many of the previous large centers were abandoned with signs of widespread destruction, at which point there was also an influx of Aegean LH IIIC material culture into Cyprus.[97] Cyclopean masonry, shaft graves, and central hearths were introduced, while sites such as Maa-Palaeokastro were heavily fortified and potentially occupied by Aegean migrants. Traditional Late Cypriot ceramic ware groups such as Base Ring and White Slip were no longer manufactured on the island, with new mass-produced styles adopted.[98] By the end of the 12th century, most Bronze Age towns were already abandoned, with the exception of Kition, which remained a major Iron Age trading post within the

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[94] Cadogan 1993, 92. Urban centers of the LC IIC vary in size from approximately 10 to 70 ha (Knapp 1997, 53; Negbi 2005, 3.

[95] Cadogan 1993, 93.

[96] Negbi 2005, 18; see also Bryce 2005, 135-136. Consolidation within the Hittite empire has also been suggested to be the source for the introduction of innovations in military architecture and town planning (Fortin 1981, 505-520; Negbi 2005, 7).

[97] The timing of the appearance of Aegeanizing material is also disputed, with Cadogan arguing for a first appearance of LH IIIC before the end of the LC IIC, suggesting that there is a correspondence between the destructions on Cyprus and those on the Aegean mainland at the end of LH IIIB (Cadogan 1993, 95). While there is a tendency to associate destruction on the island with a mass event, it appears as though destructions occurred at different sites at different times (ibid.); the limited sample of excavated sites also should limit the conclusions drawn about events occurring on an island-wide scale (Maier 1986, 317).

[98] Jones 1986, 596; Sherratt 1992, 323; Steel 2010, 113.

Phoenician trade network.[99]

The association of the textually attested "Kingdom of Alashiya" with Bronze Age Cyprus in some capacity has become relatively well established (though by no means uncontested).[100] While some scholars associate the site of Enkomi as the governing polity of the "state" of Alashiya,[101] others have associated the name specifically with the inland center of Alassa (located approximately 12 km inland from Limassol on the southern coast).[102] The foreign references to Alashiya support the interpretation of a regional association with the name, as the designation of URU versus KUR.URU is employed.[103] Furthermore, variation in public architecture across the island, the diffusion of elite funerary assemblages across all regions, and the absence of coherent administrative mechanisms do not support a unified and centralized state

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[99] Cadogan 1993, 95. Other signs of discontinuity include the abandonment of older practices of secondary treatment and collective burials, as well as the appearance of shaft graves for single individuals or limited group burials (Keswani 2004, 85). At this time there was also an associated decrease in mortuary expenditure, including a decline in the investment in tomb construction and a reduction in the internment of high-value grave goods (Pickles and Peltenburg 1998, 90; Keswani 2004, 85; Antoniadou 2005, 75). Keswani associates the decreasing cost of burial ritual with an increase in social heterarchy within the urban community, as well as a shift from competition through mortuary ritual consumption (Keswani 2004, 86).

[100] Muhly 1972; Holmes 1971, 1975; Georgiou 1979; Knapp 1995; Keswani 1993.

[101] Knapp 1992, 60; Muhly 1989, 303. A large centralized state is inferred from the use of titles such as MAŠKIM.GAL in correspondence with Ugarit, suggesting a developed hierarchical government with junior and senior officials (Peltenburg 2012, 346-347). Attestations of this administrative position span the 14^{th} and 13^{th} centuries, suggesting that the political institution it represents held more than a fleeting lifespan (ibid.).

[102] Hadjisavvas 1996; Goren et al. 2004. In order to identify the polity associated with the Alashiya of the Amarna Letters, the clay matrices of the letter tablets were examined (Goren et al. 2004). The tablets selected for study include EA 33, 34, 37 and 38, as well as Alashiya Letters from Ugarit. Additional documents examined as comparanda were taken from Late Cypriote sites in Cyprus, particularly Enkomi. Based on the presence of ophiolite complex and igneous rocks in the fabric matrices, the authors concluded that the only viable source for EA 37 and RS L.1 in particular is Cyprus (Goren et al. 2004, 61). Neutron activation analyses of EA letters referencing Alashiya have been inconclusive in determining the tablets' clay source (Goren et al. 2003, 233-234).

[103] Goren et al. 2004, 71. Alashiya is attested too as early as the Middle Bronze Age in tablets from Mari (Knapp 1992, 58).

governed by a single polity.[104]

The intensification of copper production from the LB I can be associated with the stimulation of urban development and long-distance trade, through which imported valuables were acquired at an increasing rate.[105] Through this network of metals trade—and perhaps generated as a byproduct of it—Cypriot ceramics were exported to the surrounding regions in growing quantities.[106] The association between copper production, trade, and social status is further evinced by the increasing importance of paraphernalia of metal-working and balance weights within tombs of the early Late Cypriot Period.[107] Intensified foreign contact also facilitated the introduction of new technology and ideas, such as the development of local wheelmade ceramic production.[108] Whether Alashiya is representative of the island as a whole, either as an elective coalition or as a centrally governing state, or of a single polity located on it, foreign interest for copper drew the island to some degree into the larger political arena of the Late Bronze Age Eastern Mediterranean.[109]

Although the catalyst for the development of coastal emporia, enhanced social hierarchy, and economic production intensification in LC Cyprus is generally attributed to external stimuli (in the form of demand for copper), the advent of the competitive consumption of luxury goods by the emergent elite already in the Middle Cypriot Period created the conditions from which

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[104] Keswani 1993, 74-75; Webb and Frankel 1994, 5.

[105] J. C. Courtois 1983, 1984a, 1984b; Petruso 1984; Sherratt and Sherratt 1991; Keswani 2004.

[106] Artzy and Marcus 1992, 108; Maguire 2009, 15.

[107] Keswani 2004, 137. The weights represent a number of regional measurement systems, including weights of Syrian, Babylonian, and Anatolian types (Pecorella 1977; J. C. Courtois 1983, 1984, 1986; Petruso 1984)

[108] Crewe 2007d, 225-226.

[109] Steel 1998, 288.

these developments took shape.[110] Just as social complexity intensified in conjunction with the heightened production and distribution of copper in the earlier Cypriot Bronze Age, the socio-political changes associated with the transition from Late Cypriot II to Late Cypriot III can be understood as self-generated phenomena.[111] The continuity exhibited during this evolution suggests that changes need not be the sole result of foreign invasion (by migratory groups from the Aegean) or of direct external intervention.[112]

The development of Late Bronze Age Cypriot culture was not a monolithic trajectory, but one that fluctuated across different regions of the island.[113] During the LC I, the northwest appears to have asserted considerable influence, as inferred through the distribution of Monochrome wares that were produced around the Bay of Morphou.[114] Northern contacts with the southern Anatolian coast were strong from an early period.[115] Tombs from the northern part of the island—particularly the west—reflect the development of social hierarchy through the distribution of elite and imported goods, including bronze, silver, and faience objects, Minoan and Mycenaean pottery, cylinder seals, balance weights, and ornamental weapons.[116] Throughout the LC II and LC III, development trends to the southern and eastern shores, with increasing interaction with Egypt and the Levantine coast. By the Late Cypriot II-III Period, social

[110] Knapp 1996, 60; Keswani 2005, 394.

[111] Cadogan 2005, 313.

[112] Sherratt 1992, 326.

[113] Steel 2004a, 150.

[114] Pilides 1992, 297. The popular Late Cypriot WS and BR wares also appear to have originated in this region (Hennessy 1963, 48; Vaughan 1991, 126; Crewe 2007b; Bushnell 2013, 26, 239).

[115] Steel 2004a, 126-128.

[116] Vermeule 1974; Vermeule and Wolsky 1990; Keswani 2004, 121-124. For the tombs at Kazaphani, see Nicolaou and Nicolaou 1989. Unfortunately, social hierarchy in the early Enkomi tombs cannot be established due to the poor documentation in early reports of contexts from which only local pottery was recovered (Keswani 2004, 125).

inequality is evidenced by wealth disparity among cemeteries throughout the island; the wealthiest tomb from this period may be shaft grave Tomb 23 from Hala Sultan Tekke, in which imports from numerous regions were attested (including Syro-Palestine, Egypt, Babylon, and the Aegean), as well as the possible remains of horses.[117] Although consumption may exhibit social hierarchy, the production and distribution systems for circulating local products such as pottery reflects a degree of political heterarchy associated with regional variation in ware production across the island.[118]

Settlement distribution reflects a hierarchy in scale beginning in the LB I, ranging from large coastal towns to smaller rural settlements, and finally mining settlements in the hinterland.[119] The degree of political complexity for this period is highly debated, with interpretations ranging from a hierarchical state ("Alashiya") governed by Enkomi,[120] to peer-polity competition.[121] Other scholars have envisioned a network of complex chiefdoms,[122] or city-states with core-periphery hinterland structures.[123] Competition between polities is evidenced by the shared distribution of prestige items with a wider circulation than would be

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[117] J. C. Courtois 1986; Keswani 2004, 136.

[118] Steel 2010, 113; Peltenburg 2012, 351.

[119] Catling 1962, 142-143; Keswani 1993, 1996; Knapp 1997, 2008.

[120] Knapp 1988, 151-152; 1992, 60; Muhly 1989, 303; Peltenburg 1996; cf. Keswani 1996, 234. The balance of power between rulers and merchants is reflected in EA 35 (Moran 1992, 107-109), in which the king references the frustrations of timber merchants who have not been paid for cargo provided to the king for trade (Peltenburg 2012, 348).

[121] Keswani 2004, 84-85.

[122] Smith 1994, 33-36. Closely associated with the model of complex chiefdoms is the 'village-state' model, which is based on kinship linearity, a redistributive economy and ceremonial enactment (Maisels 1990).

[123] Steel 2010, 108. The relationship between the core and periphery is one of raw materials dependence, in which the coastal urban polities relied on rural centers for the production of food and the supply of copper and the fuel necessary for bronze production (Catling 1979, 200-201; Keswani 2004, 120). For a discussion of a wealth-staple finance model on Cyprus, see Keswani 1993, 76-79.

supported under a centralized political structure.[124] Furthermore, the lack of cohesive administrative institutions or shared public architectural programs renders it difficult to convincingly reconstruct a centralized system with a political core—as has been hypothesized for Enkomi. The distribution of coastal emporia and the pervasiveness of foreign imports within these sites have led to the identification of 'Gateway Communities' as an integral part of a free enterprise system extant during the Late Cypriot Period.[125] The nature of Cypriot political organization and the role of the island in Mediterranean exchange networks will be explored further through the network analysis of ceramic distribution.

Egypt

The Late Bronze Age corresponds with the New Kingdom in Egypt, in which Egyptian power and influence within the Mediterranean reached its zenith. This period comprises the 18th, 19th, and 20th dynasties,[126] and saw the expansion of the Egyptian empire to its greatest extent, both into the Northern Levant, as well as to the South and West into Nubia and Libya. Diplomatic engagement with the neighbouring powers of the eastern Mediterranean also accelerated, encompassing treaties, trade agreements, and diplomatic marriages. The vast political network of the Late Bronze Age Egypt is most famously attested in the corpus of letters from Tell el-Amarna, which record the complex web of communication and exchange extant

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[124] Keswani 2004, 120.

[125] Stanley Price 1979; Stech 1982, 113; Knapp et al. 1994, 418; Crewe 2007b, 152; see Knapp (1997) for a comparison of the Gateway Community and Wealth-Finance models. For an overview of the problems associated with the application of these models in relation to the socio-economic variability of the Late Cypriot Period, see Horowitz 2007, 19-22.

[126] For the chronology of the New Kingdom and its associated rulers, see I. Shaw 2001, 484-485.

during the time of Amenophis III and his son Amenophis IV (Akhenaten). From the early imperial expansion of the Thutmosids to the Amarna Period and its aftermath, Egypt enjoyed a strong, albeit fluctuating, position of power within the international community of the Late Bronze Age.

Throughout most of the history of Ancient Egypt the Pharaoh stood at the apex of the political and religious hierarchies of the society. Although this power waned in the later periods before the fall to the Roman Empire, during the united dynasties of the Old, Middle and New Kingdoms he (or she) stood at the head of Egypt, as well as, in later periods, their foreign vassal states. Branching out below the Pharaoh was a web of officials and administrators who managed the economic, religious and judicial needs of the kingdom.[127] This structure reflects a tripartite division of the government into three units: internal government, administration of conquests, and the dynasty proper. The internal government was then further divided into four functional areas: the civil government, the royal domain, religious matters, and the military. While the royal domain is considered to be the property of the king, the three remaining branches form the tripartite divisions utilized in numerous discussions of Egyptian administration.[128] The government was dependent in all matters upon its educated civil servants, of whom was required a proficiency in mathematics (primarily geometry), as well as in reading and writing.[129] The primary function of the centralized government was the administration of the economy,

[127] The structural appearance of the Egyptian government was relatively fluid, as it was possible for high officials to hold several positions within different hierarchies (or within one at several levels) simultaneously (Warburton 2001).

[128] See Casson 1965, 94; Trigger et al. 1983, 207-209; Lehner 2001.

[129] Lesko 1994, 17.

specifically the management of the taxation and redistribution of surplus produce,[130] which was the foundation of all other state programs; this process was meticulously documented by scribes at the many recording points of the collection and food production cycles.[131] Through this distribution infrastructure, Egypt's monumental building programs and aggressive foreign policies were sustained.

The economy of Egypt in the New Kingdom relied primarily on the ability to produce an agricultural surplus in order to support the various other military and state programs.[132] This in turn depended entirely on the Nile, which is said by Pliny the Elder to be "performing the duties of the farmer."[133] The role of the farmer was then partially one of management and risk mitigation, utilizing a system of basin irrigation to harness the full benefit of the annual flood.[134] Active intervention in the natural flooding was required to counteract the severe effects created

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[130] The recorded levels of taxation varied temporally and geographically, however leased land appears to have been taxed at a rate of roughly fifty percent during the New Kingdom, while private farms were taxed at about ten percent (Schulz and Seidel 2007, 383; Brewer 2007, 134). For a more detailed discussion of economic activity, including taxes, *bꜣkw* and *inw* see Warburton 2001, 219-290; Bleiberg 1996, 114. For a visual depiction of tax collection, see the reliefs from the tomb of the vizier Rekhmire (TT 100).

[131] For a comprehensive look at the process see Kemp 2006, 171-172.

[132] The site of Deir el-Medina can be examined in order to estimate the values of wages in the New Kingdom. As employees of the king, their food was taken from the 'treasury of Pharaoh,' or from the grain tax in economic downturns. Food rations provided the majority of their wage, and is estimated at a daily wage of 10 loaves and a measure of beer, which fluctuated between one third of a jug up to two jugs. The wages varied across different occupations, however the lowest paid of the Deir el-Medina workmen (the porters and the physician) received a monthly supply of one *khar* of wheat and one quarter *khar* of barley (Kemp 2006, 256). This New Kingdom *khar* is estimated to be 76.48 liters, providing 238, 943 calories (Miller 1991, 265). This would then have been able to support a family of four at 2187 calories a day each for one month. The current Food and Agricultural Association stipulates that, with regard to cereals, approximately 400 grams a day are needed to maintain proper health, while the present protein standard is 37-46 grams per day, with a suggested total calorific intake of 2000-2800 kilocalories per person (Brewer 2007, 144-5). As Egypt had a non-monetary barter system, values were expressed either in terms of weight, or in *hekats* of grain (Kemp 2006, 178).

[133] *'Nilus ibi coloni…'* (Pliny the Elder, *Natural History*, 18.47).

[134] Although this is primarily seen as an attempt to increase the area of cultivatable land, Douglas Brewer argues that this exercise simply increases the water saturation in the floodplains (Brewer 2007, 133).

by small fluctuations in the flood height, as a variance of 50 cm from the ideal level could cause the water to fail to reach much of the land, or conversely cover the fields for too long, restricting the subsequent growing season.[135] The majority of grain production was of either barley or wheat, which were the primary ingredients necessary for two main products—bread and beer. In addition to these two cereals, flax was also produced for use in linens. These products were supplemented through extensive gardening, from which onions, leeks, garlic, lettuce, beans, pumpkins, melons, radishes, and lentils were produced; lentils in particular were an integral part of the Egyptian diet, as they are extremely high in protein and amino acids.[136] Cultivated fruits include grapes, dates and figs, while other plants and herbs were grown for medicinal purposes.[137] Crop cultivation was supplemented by animal husbandry, which provided dietary products such as meat, eggs, milk and fat, as well as skins and pelts, wool, and horns; domesticated animals also provided labour and transportation.[138]

In the New Kingdom—as was the case in most of the other periods—the principal seat of government was in Memphis, which was the traditional site of coronations and important

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[135] Brewer 2007, 132. The verification of these effects is demonstrated by the correlation found between anomalies in the flood levels and periods of political turmoil (Hughes 1992, 14). These levels were measured with 'Nilometers,' which were set up at specific points (such as the First Cataract), and were attended to by designated members of the temple personnel (Hughes 1992, 17).

[136] Brewer 2007, 137.

[137] Schulz and Seidel 2007, 380. Evidence from the New Kingdom suggests that olives may have been cultivated from the 18th or 19th Dynasty on (Kelder 2009, 343-344).

[138] The most valued animal of those domesticated was the cow, for which there are numerous types attested iconographically. Sheep and goats were also commonly kept (each of which appear to have had at least two types in existence), along with pigs and donkeys. In addition to mammals, poultry and fish also constituted part of the diet, and many houses included poultry yards comprised of geese, ducks, cranes, pigeons, ibis and possibly chickens (Schulz and Seidel 2007, 382; Brewer 2007, 141-142). Hunting and fishing were also common industries of food production.

festivals.[139] During this period Egypt experienced the height of its political power, necessitating the development of a professional military and the expansion of its bureaucracy.[140] The institution of a professional, standing army was one of the most significant changes to the state administration. Unlike other civil or religious jobs, military positions were not exclusively dominated by aristocratic families, and provided a means for ambitious men to ascend in the hierarchy; the general Horemheb even ascended to the throne at the end of the 18th dynasty. The development of the military served to extend further the power of the king, providing physical enforcement for royal agendas. This function is often cited in explanation of the apparent ease with which the "heretic" pharaoh Amenophis IV instituted his cultural reforms, assuming a forceful quelling of any resistance (specifically from the Amun priesthood).

Despite early sporadic incursions into the Near East (including Thutmose I's offensive against the Kingdom of Mitanni), Egyptian interest in the Levant was only formalized in the mid to late 18th Dynasty, when campaigns to attain and secure territory approached an annual objective. By the time of Thutmose III (who himself campaigned as far north as Carchemish and the territory of Qatna), Egyptian territories were organized into three administrative units with headquarters at Gaza, Sumur and Kumid el-Loz. In this early period, hegemonic control was maintained largely through the threat of force (often employed during their frequent campaigns), rather than a permanent military presence.[141] Limited military garrisons were established through the 15th and 14th centuries B.C.E. in order to maintain Egypt's connection to trade and

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[139] Kamil 1985, 36-37.

[140] Casson 1965, 58.

[141] Weinstein 1981, 12. An alternative interpretation of the increase in the Egyptian material culture present in the Levant is outlined by C. Higginbotham, who argues instead for the social practice of elite emulation by Egypt adopted by local communities (2000, 6; cf. E. Morris 2005, 9-17; Burke and Lords 2010, 28).

communication networks, with permanent military occupation only established in the 13th century B.C.E.;[142] this increase in militarization culminated in numerous clashes between Egypt and Hatti, such as the Battle of Kadesh. This shift in policy may have been instigated by the loss of access to Syrian port cities, archaeologically indicated by the marked termination of Cypriot ceramics in Egyptian contexts at this time.[143] For the majority of the Late Bronze Age, Egyptian presence thus formed the southern boundary of the politically charged northern Levant, with the borderland fluctuating around the territory of Amki.

The Levant

During the second millennium, the political organization of the Levant was dominated by competing city-states,[144] ruled by powerful elites—including both single rulers and councils of elders.[145] Throughout this period, the region also functioned as the interface between the major Near Eastern powers of Mitanni,[146] Hatti and Egypt. International trade was prolific, with the network of exchange stretching across the Mediterranean to include Cyprus, Crete and the Aegean. The nucleus of the exchange network was focused on the coastal Levantine port sites

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[142] The appearance of Egyptian style architecture and material culture is situated in the 19th Dynasty, at which point Egyptian enclaves appear in the Southern Levant, particularly along the important transportation routes of the Via Maris and the Jordan Valley (E. Morris 2005, 8).

[143] Weinstein 1981, 16. Decreasing Egyptian control during the 14th century B.C.E. is often attributed to shifting political policy during the Amarna period, in which expansionary ambitions were partially abandoned for the pursuit of internal ideological objectives.

[144] For a discussion of the nomenclature and character of "city-states" in the Levant, see Griffeth and Thomas 1981; Yoffee 1997; Savage and Falconer 2003, 32.

[145] Joffe 2002, 42.

[146] The Mitannian state (known as Hanigalbat), centered on the yet unidentified site of Waššukanni, began to emerge following the last Old Babylonian phase before the sack of Babylon by the Hittites (Novak 2007, 389). The material culture of this Hurrian speaking group is best represented by the sites of Nuzi, Brak, and Alalakh (Novak 2007).

(such as Ashkelon, Tyre, Byblos, and Ugarit) and the large inland city-states (such as Hazor, Megiddo, Gezer), which, in addition to strategically directing the movement of goods, boasted valuable resources in timber. These benefits attracted the interest of the larger surrounding states, resulting in numerous struggles and conflicts in the quest for control of this valuable territory.

The preceding Middle Bronze Age period is characterized by waves of urbanization that culminated in powerful palace complexes and fortified sites.[147] By the end of this period, and contemporary to the Egyptian expulsion of the Hyksos from the Nile Delta, the once powerful Middle Bronze city-states dissipated or were destroyed, all of which transpired with an associated trend of general depopulation.[148] Variation is observable in the subsequent reoccupation of different Levantine regions at the start of the Late Bronze Age, with coastal plains and adjacent valleys recovering prosperity more rapidly and to a differing extent than the highland regions of the Galilee or the central Palestinian hill country.[149] Significant continuity is, however, present in the material culture of the region, including the ceramic typology and religious architectural style (as seen at sites such as Megiddo, Hazor, and Shechem).[150] The polities of the Southern Levant in particular were then gradually incorporated into the Egyptian empire, which expanded to consolidate significant portions of Canaanite territory.[151]

Textual references from the Amarna letters and other Egyptian sources have been used to

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[147] Dever 1987; Kempinski 1992; Burke 2004; Akar 2009.

[148] E, Morris 2005, 35. Many of the destroyed sites were reestablished only after a considerable period of inoccupation (Gonen 1992, 216-217).

[149] Groot 2010, 38; Savage and Falconer 2003, 42.

[150] Leonard 1989, 9-11. New ceramic wares introduced during the early Late Bronze Age include Bichrome ware, Gray/Black Lustrous Ware, and Chocolate on White Ware, although finds from Tell el-‘Ajjul and Megiddo may suggest that the former two commenced production during the preceding MB IIC (ibid.).

[151] Burke 2004, 258-259.

reconstruct the political organization of the Near East, particularly the Southern Levant, with a hierarchical system of city-states and the peripheral minor towns affiliated with them.[152] Results have been compared to geographic clustering analysis of settlement patterns, suggesting a relatively high degree of correspondence between both methods.[153] The model of the city-state often applied to the Late Bronze Age Levant designates a socio-political organizational system falling on the complexity spectrum between the chiefdom and the state, in which macro-scale fragmentation is high, and regional political power is centered upon local dynastic rule.[154] Smaller sites are incorporated into city-state territorial holdings in a hierarchical system, including: hamlets, villages, sub-regional centers, secondary regional centers, primary regional centers, and interregional centers.[155] This hierarchical settlement pattern has been variously reconstructed through the use of models such as Thiessen polygons[156] or k-cluster analysis.[157] Results of such analyses indicate that the Levant was highly fragmented, with power distributed between moderately sized polities of diverse sizes and organization.[158]

As the Late Bronze Age drew to a close, the regions surrounding the Mediterranean were witness to a vast wave of destruction that significantly crippled or destroyed altogether the existing powerful empires. There have been numerous hypotheses as to the causes of this

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[152] Bunimovitz 1995; Finkelstein 1996; Na'aman 1997.

[153] Savage and Falconer 2003, 42-43.

[154] Liverani 1987, 66.

[155] Jasmin 2006. Alternatively, hierarchies center settlement tiers around defensive capacities, including the presence of fortification walls or defensible acropoleis (Burke 2004, 259, 272).

[156] Bunimovitz 1995 (see fig. 6 for map of Levantine city-state territories).

[157] Savage and Falconer 2003, fig. 4.

[158] Savage and Falconer 2003, 42-43.

destruction, including natural catastrophes like climate change or an "Earthquake Storm,"[159] as well as an eastward migration of warrior peoples who laid to waste all in their paths. While no definitive consensus has been reached on the catalyst for these events, it is clear that a substantial group of people, becoming dislodged in a period of widespread collapse,[160] travelled to the shores of the eastern Mediterranean, establishing new settlements through varying degrees of force and violence.

This migration, falling in the transition from the Late Bronze Age to the Early Iron Age, is placed into the Biblical Time of the Judges (ca. 1200-1000 B.C.E.), coinciding with the final phase of Egyptian control in Canaan.[161] As the Philistines settled in the Levant, their occupation was focused in five coastal towns known as the Pentapolis. Three of these cities—Gaza, Ashkelon, and Ashdod—were located in the coastal plain (with the first two on the coast), while Tel Miqne/Ekron and Tel el Safi/Gath lie around three kilometers inland in the lower Shephelah. Prior to the Philistine arrival, Gaza, Ashkelon, and Ashdod were all large sites, while the former was the capital and administration and military center of the Egyptian province in Canaan.[162] Although the nature of the preceding occupation at Gath is unclear, it is evident that Ekron was founded as a new city upon arrival.

We know of the so-called 'Sea Peoples' from many sources, predominantly Egyptian.

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[159] This theory suggests that the various fault lines throughout the Mediterranean erupted at the end of the Late Bronze Age into a series of violent earthquakes, causing the cultures of this region (especially their buildings of heavy masonry) to collapse (Nur 2008). Despite diverging historical reconstructions, the joining of various groups of people originating from different parts of the Mediterranean into the phenomenon of the Sea Peoples suggests that they were "both agents and by-products of the eastern Mediterranean political and economic collapse" (Barako 2004, 513).

[160] Knapp 1992, 52.

[161] Mazar 1990, 296.

[162] T. Dothan 1982, 17.

The group is recorded in their histories from military clashes, the first with Merneptah in year 5 of his reign (ca. 1233 B.C.E.), and the second with Ramesses III in year 8 of his reign (ca. 1191 B.C.E.).[163] Our knowledge of these interactions comes from the inscriptions ascribed to these monarchs, as well as from the Papyrus Harris 1, the Onomasticon of Amenope, and the Tale of Wen-Amon. From the well-known inscriptions from the Mortuary Temple of Ramesses III at Medinet Habu we know of seven different groups ascribed to the Sea Peoples, including the "*plst*."[164] This group is only given the specific epithet "of the sea" in one passage from a historical stela of Ramesses III from Deir el Medina.[165] It is the Peleset that are then thought to have settled on the Levantine coast, and are identified as the 'Philistines' of the Bible. Despite the external presentation of the Philistines and Sea Peoples as solely a warrior or mercenary culture, the archaeological evidence supports the interpretation of this group as a migratory community seeking refuge and a new territory to inhabit.[166]

Anatolia

During this Late Bronze Age, a new kingdom emerged in central Anatolia in the territory surrounding the site of Hattuša. Throughout the second half of the second millennium, the Hittite

[163] These dates are taken from the chronology of Donald Redford (Redford 2001). He also notes that there may have been more than two such clashes, however the civil war that raged for two decades between these two events may have caused them to be unrecorded.

[164] In this case this name is given to a single bearded figure—a prince—who is a prisoner of Ramesses III (Sandars 1985, 165).

[165] Sandars 1985, 164. In this inscription they are associated with the Teresh, who are thought to come from the Anatolian coastland.

[166] For further discussion of the origins of the 'Sea Peoples' and their occupation of sites throughout the Levant, see T. Dothan 1982, Sandars 1985, Bunimowitz 1998, Oren 2000, Barako 2004, Yasur-Landau 2010; Killebrew and Lehman 2013.

Kingdom engaged in intensive imperial expansion, settling unoccupied frontiers and subjugating surrounding polities. Traditionally the history of the Hittite Empire is divided into two or three temporal divisions for chronological organization, based primarily on the political history of royal succession.[167] This taxonomy is essentially a derivative of similar systems employed in Egyptian and Mesopotamian history, and is less clearly applicable to the history of the Hittites. A tripartite division into Old, Middle and New Kingdom is likewise utilized by philologists, based on differentiations in the form of the cuneiform script.[168]

During the preceding Early Bronze Age the Anatolian peninsula was geographically and ethnically diverse. The nucleated settlement pattern of this period included prosperous communities centered around sites like Alacahöyük,[169] Hattus (the site of late Hattuša), Alişar (probably ancient Amkuwa), Zalpa and Kaneš.[170] From the latter comes the first reference to a kingdom of Hatti in an Akkadian text of Naram-Sin (ca. 2380-2325), in which it is recorded as a participant in a rebellion that included sixteen other local rulers.[171] The rapid decline in settlement density during the end of the Early Bronze Age has been connected to the appearance of Indo-Europeans within Anatolia–a phenomenon potentially linked to the origins of the

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[167] Genz and Mielke 2011, 14-16; Beckman 2000.

[168] Bryce 2005, 6. An alternative separation into two main phases, Old and New Kingdom, is proposed by Trevor Bryce (ibid.) with the first period commencing with the rule of the first king Labarna in the 17th century B.C.E., and the second comprising the period from the rule of Tudhaliya I/II (late 15th or early 14th century B.C.E.) to the collapse of the empire in the 12th century B.C.E..

[169] The thirteen wealthy shaft tombs from the Early Bronze III period contained numerous valuable grave goods, including metal objects and sculpted pieces (Bachhuber 2011). It has also been suggested that archaeological connections can be drawn between those responsible for the tombs' construction and the early history of the Hittites (Hopkins 2000, 44).

[170] Bryce 2005, 9.

[171] *CTH* 311.

Hittites.[172] There is no consensus on when this migration took place, or where the group originated, with hypotheses including nearly all regions to the east, west or north.[173] At the beginning of the second millennium, Assyrian traders set up a colony at the site of Kaneš (modern Kültepe) in order to procure silver, copper, gold, tin, barley and wool. Documentation of the Middle Assyrian trading colonies in Anatolia records Indo-European names in three dialects: Luwian, Palaian and Nesian.[174] The Indo-European speakers of these dialects settled in the land of Hatti, where Nesite continued to be used, eventually becoming the official language of the Hittite Kingdom. Ethnically, Hittite self-identification is suggested to rely more on the physical geographic context than on shared features of culture, language or history.[175]

The governance of the empire centered on the King as the chief ruler, with direct control of the core territory of the Kingdom of Hatti and its capital (for most of the empire) of Hattuša. The core territories also included a number of smaller regional centers, governed by Councils of Elders, holy cities (such as Nerik, Arinna, Samuha, and Zippalanda), as well frontier settlements and rural estates.[176] By the New Kingdom the geo-political structure was solidified, with peripheral territories—administered by direct governors—surrounding this central homeland, extending eastwards to the Halys, southeast to Mitanni and the country of Išuwa, and southwards

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[172] Collins 2007, 23.

[173] The suggested origins span a region including eastern Anatolia, the south Caucasus, southern Russia, the Black Sea region, to the Balkans and central Europe (for a continued discussion of the origins, see Steiner 1990, 185-214).

[174] Bryce 2005, 10-11. Texts in the Nesite language are referred to as nešili, našili, or nišili.

[175] Bryce 2005, 19. The designation "the land of Hatti" in Akkadian may equally represent "Land of the city of Hattuša" (Gurney 1979, 153), creating a stronger geographic link between the empire and the site of Hattuša.

[176] Bryce 2005, 48. Frontier settlements were particularly important when no divisive buffer territory existed, as was the case in the north and the border with the Kaska.

to the Lower Lands. From provincial archives excavated at both Maşat Höyük and Ortaköy have come extensive letters and edicts, which designate the responsibilities of the governor, including enemy surveillance at the border, the organization of agriculture on state lands, maintenance of royal buildings and temples, and the dispensation of justice.[177] Governors of borderlands were also responsible for the protection of dependent populations—often settled agricultural workers—who were protected overnight in fortified locations.[178]

A primary purpose of provincial territories was the production of agricultural surplus for the imperial core, and thus the 'keepers of the storehouses' (*lumeš agrig*; literally 'keepers of the tablet-houses') were directly appointed and managed by the king. These officials, which numbered up to a hundred, were located throughout the kingdom, and were responsible for facilities for the redistribution of produce and the storing of tribute; the storehouses may have also functioned as armouries for the Hittite military.[179]

The outermost tier of this nuclear structure was the complex of vassal states scattered throughout Anatolia and to the south and east.[180] While the provinces were exploited for various

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[177] Collins 2007, 105. These archives complement the extensive corpus of documents recovered from the capital at Boğazköy, which includes historical documents, treaties, edicts and instructions, as well as laws, medical texts, myths and legends, ritual and festival prescriptions, hymns, prayers, and oracular texts (141-142). A more extensive compilation of duties of the appointment is included in the instruction document known as the Bel Madgalti text (*KUB* XIII 1; *KUB* XIII 2; *CTH* 261).

[178] Beal 1992, 275-6.

[179] Bryce 2002, 18. The military is also an intrinsically important part of any empire, and itself is comprised of a complex administrative hierarchy. In ancient societies, these roles often included additional civic duties. While cross-over between military and civic duties certainly did exist in the Hittite Empire, exposition of the particular details is not crucial for the purposes of this study, and is unfortunately beyond the scope of this paper. Instead it is simply important to note the role that military force (or threat of force) played in the management of provinces and territories. For further discussion of the features of the Hittite military, see Beal 1992.

[180] Bryce 1986-1987, 86-7.

resources, capital was extracted from the vassals through tribute—both economic and military.[181] The organization of conquered territories included partial feudalization, in which large portions of land were incorporated into the crown holdings, while other areas were distributed to high-ranking dignitaries.[182] In addition to vassal states, which were administered by local rulers, Suppiluliuma I installed two viceregal kingdoms in Northern Syria, at the sites of Aleppo and Carchemish (the latter of which oversaw Hittite interests in Syria).

Hittite interest in the northern Levant was attested early on by their integration of Ugarit into the Hittite sphere of influence during the 17th century B.C.E.. During the Old Kingdom, military assaults on the southern region were divorced from any attempt to incorporate or consolidate, as attested by Hattusili I's sack and subsequent retraction from the region of Yamhad. Relations between the Hittites and their southern neighbours was highly variable during the Old and early New Kingdom, particularly involving the Kingdom of Kizzuwadna. While this region may have been incorporated into the Hittite Kingdom during the 16th century B.C.E. (likely as the territory known as Adaniya), it was established as an independent entity through a treaty between Telipinu and the King of Kizzuwadna, Isputahsu.[183] Although the relationship between Kizzuwadna and Hatti fluctuated, forming an allegiance with this territory allowed Hittite forces freedom to move through the region, facilitating expansion into the northern Levant, and creating a buffer between the Land of Hatti and the Kingdom of Mitanni.

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[181] Bryce 2005, 51.

[182] Yakar 2000, 34. Hittite crown land was then cultivated by civilian captives and deportees, as well as by Hittite workers as part of their *luzzi* obligation. This obligation (as stipulated by Article 56 of the Hittite Laws; see Hoffner 1997, 193) included participating in the manning of fortresses while the army was campaigning, the harvesting of crown fields and vineyards, and assisting in the construction of state sponsored structures, roads, and fortifications; it also included paying the *sahhan*, which was a form of taxation requiring the submission of food produce, manufactured goods or livestock (Yakar 2000, 266).

[183] *CTH* 21. This is the earliest known treaty from Hittite history.

With southern Anatolia secured, subsequent forays into the south represented economic interests and imperial ambitions.

2.2 Contacts: International Relations and Diplomacy

Diplomacy was the crux of the political relationships of the Late Bronze Age, and was an integral part of Near Eastern statecraft. The textual record attests to the importance of international relations through the profusion of treaties, vassalage agreements, letters, and business and marriage contracts.[184] Surviving treaties and letters document the alliances forged between the great kings of powerful empires, which stipulated peaceful relationships, often with clauses protecting the succession of the current monarch's heir.[185] A commonly attested diplomatic arrangement was the vassalage agreement, in which stipulated terms and conditions devised by a state leader were imposed upon and accepted under oath by a vassal ruler.[186] These contracts were unilateral, generally requiring the payment of tribute, military assistance, the cessation of independent foreign diplomacy, and guaranteed loyalty.[187] Subversion or neglect of any stipulation could result in immediate military retribution. In addition to formal agreements forged under oath, arrangements were garnered through diplomatic marriages. During the Late Bronze Age, diplomatic marriages were conducted between the rulers of both major and minor

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[184] Warburton 2001, 129. For dissenting opinions on the attribution of public interaction in the modern sense of international relations prior to the Renaissance, see Halliday 1994.

[185] The most famous of these arrangements was the treaty between Ramesses II of Egypt and Hattusili III (Beckman, No. 15), contracted sixteen years after the two empires clashed at the Battle of Qadesh.

[186] These are particularly common in the Hittite archive, in which they represent the most commonly attested form of diplomatic arrangement (Beckman 1999, 2).

[187] Border management, including the transfer of land from disloyal subordinates to loyal ones, often formed a fundamental part of imperial hegemonic policy (Wazana 2001, 696-697).

states, including Egypt, Babylon, Assyria, Hatti, Mitanni, Amurru, and Ugarit.[188] Relationships were further cultivated through the exchanging of lavish gifts with accompanying letters. Our knowledge of the latter is due to the discovery of the ample library preserved at site of El-Amarna in Egypt.

The Amarna Letters are a corpus of 350 letters (382 tablets total) addressed to or written by the 18th Dynasty Egyptian Kings Amenophis III and Amenophis IV.[189] Recovered from an administrative building in the center of Tell el-Amarna in central Egypt, these cuneiform tablets formed the record of international diplomacy between the Egyptian royal court and those of neighbouring states in the Near East. The letters, written in Akkadian,[190] are predominantly incoming, and record the constitution of vassalage agreements, the exchange of gifts, and the provisioning of grain and military resources. The archive is generally divided into two groups, differentiating the correspondence between the Egyptian King and other powerful state leaders who were addressed as "brothers" (including the kings of Hatti, Babylon, the Mitanni, and Assyria), and those to lesser provincial vassals or city-state rulers in Syria and Palestine.[191] In addition to the wealth of socio-cultural information contained within the content of the letters, the Amarna tablets have also proved invaluable in the identification of ancient polities of

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[188] Although this primarily included the offer of a royal princess in marriage to an ally, the Egyptian widow of Tutankhamun famously entreated the Hittite king Suppiluliumas for a royal prince to marry (*The Deeds of Suppiluliumas*, Seventh Tablet, Aiii 5-16; Güterbock 1956a, 94). The subsequent death of this prince en route to Egypt (known as the Zannanza affair) was a primary catalyst for the Hittite-Egyptian conflict that culminated in the Battle of Qadesh.

[189] The Tell el-Amarna letters (designated EA) are published in full in Moran 1987.

[190] There are a few exceptions, including: EA 15 (written in Assyrian), EA 24 (written in Hurrian), and EA 31-32 (written in Hittite). For a discussion of the linguistic background to the language of the letters, see Moran 1987, xviii-xxii.

[191] Podany 2010. The leaders of larger states are also referred to as the "Club of Great Powers" (Van de Mieroop 2007, 129-148). Of the lesser city-states, there are 27 different Canaanite cities attested, with 25 different local rulers identified (Gonen 1992).

unknown location through the elemental analysis and sourcing of the tablet clay.[192]

As an example to explore the diverse facets of Late Bronze Age international relations (including warfare, treaty negotiation, and diplomatic marriages), the interaction between Egypt and Hatti—two of the most powerful imperial states of the period—in the lead up to the famous Battle of Qadesh will be briefly surveyed. The origins of this conflict can be traced to ca. 1370 B.C.E. and the defeat and subjugation of the Mitanni by the neighbouring Hittites, which drastically altered the political landscape of the Ancient Near East. With this conquest, the Hittites emerged as a powerful and hostile threat to the tenuous political balance of the region, as well as to the territorial holdings of Egypt in the Levant.[193] Despite the allegiance between the Kingdom of Mitanni and Egypt, there is no evidence that Egypt engaged in an immediate military reaction to the Hittite conquest.[194] Hostilities did subsequently result from the Hittites expansion into Egyptian held territory in the Levant, including the allegiance between Etakkama, successor of the Egyptian vassal ruler of Qadesh, with the Hittites.[195] Enmities between the two states were exasperated by the Zannanza affair, in which the Hittite prince entreated to marry

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[192] See for instance Goren et al. 2004. Of particular interest is the identification of the state of Alashyia, which is traditionally associated with Cyprus or specifically Enkomi (see discussion above).

[193] The first Egyptian reference to Hatti appears to be in the tomb of Menkheperreseneb (TT86), the High Priest of Amun under Thutmose III, in which the King of Hatti is depicted kneeling and offering tribute to the Egyptian king (Wilson 1969, 248-9; L. Bell 2007, 101).

[194] Murnane 1985, 10. Evidence of an Egyptian military expedition to Syria under Akhenaten may be depicted in a number of fragments of wall decoration from the Amarna period.

[195] The disloyalty of Aitakkama was reported to the Egyptian king by the faithful vassal Akizzi of Qatna (EA 53, 11-12; Moran 1992, 125), Bieri, Ruler of Hashabu, ‘Ildayyi, ruler of Hashi, and ‘Abdi-Risha, ruler of Enishasi (EA 174-6 and 363; Moran 1992, 361).” Aitakkama himself disputes the allegations of the “wicked Biryawaza,” who “has gone on defaming me in your sight” before “[taking] my entire paternal estate along with the land of Qidshu, and sent my cities up in flames (EA 189: 7-12; Moran 1992, 269).” The reports to the king also link Aitakkama to the rebel Amurru leader Aziru in this battle against Biryawaza, as preserved in EA 151 (Moran 1992, 238).

Ankhesenamun (the widow of Tutankhamun) was murdered en route to Egypt.[196] Subsequent clashes between the two states were temporarily halted by independent struggles in the homelands of both states, including plague and contested successions, however Egypt and Hatti eventually met again at the Battle of Qadesh.

The Egyptian and Hittite forces, led by Ramesses II (of the 19th Dynasty) and Muwatalli, engaged in a military conflict that was memorialized throughout Egypt on the monuments erected by the king. Despite the aggrandizement of the battle and the hyperbolized military victory claimed by Ramesses, it appears from the resulting territorial allotment that the battle resulted in a relative stalemate. Although subsequent small-scale conflict arose between the two powers, the emerging military threat of the Assyrians to the east may have acted as a catalyst for the final acquiescence of Egypt to the Hittites' repeated requests for the cessation of hostilities and the acceptance of a peace treaty (known as the 'Silver Treaty').[197] Considered to be the first political peace treaty in the world, copies of this text were transcribed upon the wall just outside the south entrance to the Great Hypostyle Hall at Karnak, as well as in clay tablets in the Hittite capital.[198] The Peace treaty itself was only one component of the correspondence and diplomacy between Egypt and Hatti following the Battle of Qadesh, which also included diplomatic

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[196] This attribution can be traced back to the Deeds of Suppiluliumas by Murshili II, who admitted that the Hittites had broken their oath in attacking Amki, however attributes the motivation for this attack to the death of the Hittite Prince (Seventh Tablet, Aiii 5-25; Güterbock 1956a, 94-95; and Seventh Tablet, Fragments 29-32; Güterbock 1956b, 107-108). This text (Seventh Tablet, Aiv 26-39; Güterbock 1956a, 98) also alludes to the original Kurushtama Treaty, which may have been a previous peace treaty between Suppiluliumas and Egypt (or one of his Hittite Middle Kingdom predecessors) (Murnane 1985, 42). For a more detailed study of this affair, see Schulman 1978 and Bryce 1990.

[197] The Peace Treaty followed the total destruction of Carchemish and Hanigalbit by Assyrian forces, in retribution for the abandonment by Hanigalbit of its loyalty to Assyria. The Assyrians are reported to have destroyed a further nine major cities and no less than 180 settlements, with 14,400 inhabitants of the region reportedly taken prisoner (Kitchen 1982, 74).

[198] Fragments of three archival tablets containing a substantial portion of the text were also recovered in excavations at Hattuša (L. Bell 2007, 109).

correspondence, the mutual exchange of gifts, and the marriage of Ramesses II to two Hittite princesses, occurring in years 33 and ca. 40 in his reign.[199]

The correspondence between the two states following the peace treaty is particularly fascinating, as it includes letters between Puduhepa, Queen of the Hittites, and both Ramesses II and his wife Nefertari. Nefertari initiates a gift exchange between the two royal women by sending to Puduhepa "one very colourful necklace of good gold," and "a grand total of twelve [dyed] linen garments."[200] This type of letter and gift exchange is highly reminiscent of the gifts bestowed upon foreign ambassadors in modern times. Even more illustrative of the central role played by royal women in the diplomacy of the Late Bronze Age are a series of letters written in succession between Ramesses II and Puduhepa herself—these documents suggest that she may even have retained the authority to conduct business on behalf of her husband. In her correspondence, the authority with which Puduhepa speaks, and the assertive almost sarcastic tone she employs, signifies her confidence in the role of diplomat. In one letter, she even chastises Ramesses for his greed and impatience, which she deems to be "worthy neither of renown nor of lordliness."[201]

The diplomatic accord reached between the Egyptians and the Hittites would only temporarily quell discord in the region, as the encroaching Assyrians continued to pressure the territories defined by the Silver Treaty. Furthermore, underneath this textually prominent

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[199] Although little is known about the second marriage, the records associated with the marriage of Ramesses to the first Hittite princess document a dowry 'greater than that of the king of Babylon' (Tyldesley 2000, 137).

[200] *Letter from Queen Naptera of Egypt to Puduhepa of Hatti*, obv. 25-27, rev. 1-4; Beckman 1999, 129.

[201] *Letter from Queen Puduhepa of Hatti to Ramesses II of Egypt*, obv. 16; Beckman 1999, 133. This quip appears to have been ignored by Ramesses, whose response to his "sister" is both cordial and utterly traditional in form.

umbrella of macro-scale geo-political maneuvering, squabbling city-states and minor towns continued to battle independently over the control of territory and resources. While the portrait of Late Bronze Age diplomacy garnered through the textual record only partially encapsulates the complex and nuanced political economy of the time, resources such as the Hittite Royal Archive, the Amarna Letters, and the Silver Treaty provide important insight into the complex nature of international relations during this period.

2.3 Commodities: Traded Goods

Trade in the Late Bronze Age was operational on multiple scales, and incorporated a wide variety of consumables, raw materials, quotidian household products, and exotica of foreign manufacture. Goods were circulated in networks or inter- and intra-regional exchange, drawing together individuals and institutions through commercial trade, gift exchange, and acts of reciprocity. The analysis of trade during the second millennium is informed by archaeological evidence for the consumption of exchanged material and the industrialized production of surplus goods, records of transactions and bills of sale, and administrative documents and letters that explicitly detail aspects of production, exchange, and consumption. The examination of these varied sources of information allows for a holistic interpretation of exchange.

The bulk of commodity trading in the Late Bronze Age was comprised of raw materials and consumables.[202] The predominant raw material type exchanged during the second millennium was metals—specifically copper and tin—which were employed in the smelting of

[202] For a comprehensive overview of traded goods from the Late Bronze Age Mediterranean, see Cline 1993, 1994, 2007.

bronze. The primary source of copper was the island of Cyprus, while tin may have been acquired from different sources including Afghanistan, Anatolia, and potentially England.[203] Other precious metals were also exchanged in raw material form, including silver and gold. While silver was available in Attica at the mines at Lavrion, gold was predominantly sourced from Egypt (which obtained the metal largely from the mines in Nubia). Demand for gold is reflected in the Amarna Letters from the mid-fourteenth century B.C.E., in which numerous foreign kings and rulers pleadingly request shipments of the precious metal.[204] While it is clear from the surviving textual record that these metals were a primary commodity of exchange from the LBA, their high reuse value render them somewhat rare relative to their high level of circulation.

Trade in raw materials also included precious stones, such as lapis lazuli, carnelian, and turquoise, which were used for jewelry, statuary, and the embellishment of any other luxury item. In addition to precious stones, glass, obsidian, ivory, and pigments were also widely circulated as raw materials.[205] Ivory was frequently traded as both a raw material and manufactured products. In the ancient world ivory was primarily obtained from two main sources: elephant tusks and

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[203] Muhly 1985; Yener and Vandiver 1993 (cf. Muhley 1993; response by Yener et al. 1993); Weinstein Balthazar 1990; Kassianidou 2003.

[204] Requests for gold are particularly interesting as Egypt held an essential monopoly of supply, yet foreign rulers considered the material to be abundant and of virtual inconsequence to Egypt; as Aššuruballit of Assyria write, "Gold in your country is dirt; one simply gathers it up" (EA 16; Moran 1992, 39. See also EA 19, 20, 27, 29).

[205] Well-known pigments that were traded as valued raw materials include Tyrian Purple (from the Phoenician coast) and Egyptian Blue, which were produced from crushed murex shells and the heated amalgam of quartz sand, a copper compound, calcium carbonate, and a small amount of ash or natron respectively. Melian obsidian was well-known in Greece, and had been exploited since before the start of the Bronze Age (Broodbank 2008).

hippopotamus teeth.[206] The former could be obtained from Syrian, African, and Asian elephants hunted through areas of Africa and the Near East, while hippopotami teeth were exported from Egypt.[207] The harvesting and trafficking of ivory can be traced back to the mid-fifth millennium in Egypt during the Badarian period,[208] with clear evidence of ivory carving extant in the Near East from at least the fourth millennium.[209] Ivory carving flourished during the Late Bronze Age, with spectacular examples coming from Levantine sites like Megiddo, which yielded types common in both the Near East and the Aegean.[210]

An important yet archaeologically obscured component of exchange in the LBA was consumable goods, such as food, wine, oil, and unguents; textiles, although not a consumable, are highly ephemeral and are therefore similarly manifested by secondary evidence.[211] Although the Linear B documents do not deal with trade directly, there are references to the production and

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[206] While mammoth tusks are slender and curved, the material is too dry and brittle, and generally turns yellow (Barnett 1982, 8). Hippopotami teeth (of which the lower teeth are generally used) are significantly whiter, harder, and denser than elephant tusks, but the teeth themselves are smaller. The hunting of hippos was a dangerous task, and was the recorded cause of death for King Menes (first king of the First Dynasty of Egypt). While hippopotami teeth were utilized often in Egypt (especially for magical wands), elephant tusks were a much more common source of ivory in the Near East.

[207] The Syrian elephant was small, with a hairy and reddish hide and proportionally large tusks. Depictions of this subspecies can be seen in the Tomb of Rekhmire (TT100), as well as on the Black Obelisk of Shalmaneser III, upon which it is shown alongside a Syrian bear. Assyrian records document royal hunts involving the Syrian elephant, the frequency of which may have contributed to their eventual extinction (dated to sometime before the second quarter of the first millennium B.C.E.; Miller 1986, 38; cf. Collon 1977).

[208] Barnett 1982, 16.

[209] At the site of Bit Res-Safadi (near Beersheba in Syria), there are remains of an ivory workshop, including a work-bench, elephant tusk, awls with handles of bone, and potentially a bow-drill. This workshop is dated to 3320 BCE ± 300 years (Barnett 1982, 23).

[210] Evidence for an international trade in ivory from the Late Bronze Age is extant in Assur Tomb 45, which contained an assemblage representing a broad geographic scope, including an ivory pyxis and comb (Feldman 2006, 24).

[211] Smith and Tzachili 2012, 141.

taxation of consumable goods.[212] From the Amarna letters it is possible to ascertain the important economic role of Egyptian grain in the provisioning of numerous Mediterranean states, particularly during periods of famine. Oils scented with rose, sage, cypress, and henna were valued for both cosmetic and medicinal uses, and were exported from the Aegean to both the eastern and western Mediterranean in small stirrup jars.[213] The importance of scented oils is reflected in their place of predominance among dowry items listed for the Hittite and Babylonian princesses given in marriage to the Egyptian King.[214] Consumable goods could also be employed as equity in bartered transactions, as evidenced by records of payments from Mycenaean Greece in which cloth was purchased through the exchange of wheat and figs.[215]

Of the finished products circulated during the Late Bronze Age, the role of pottery—particularly tablewares—as a subsidiary and relatively inconsequential component is a not uncommon assumption.[216] The predominance of closed shapes is understood to reflect the true function of decorated export vessels as containers for liquid commodities. While this was certainly an important role for a large proportion of Aegean and Cypriot traded ceramics, the significant quantity of open shape vessels recovered from foreign domestic and mortuary contexts suggests a considerable independent intrinsic value. Imported pottery may have found a

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[212] Killen 1985, 270; 1984; Beck and Beck 1978; Nosch 2011. A notable exception is the low number of allusions to wine production, particularly in relation to the numerous references to olive oil and unguents (Negbi and Negbi 1993, 319).

[213] Negbi and Negbi 1993, 324-325. It has been suggested that the evolution of the stirrup jar in the second millennium from an ovoid to a more angular shape may have been a conscious shift in consideration for stability during transport (ibid., 321; for the impact of this change on vessel ware and breakage, see Pratt 2016, 50)

[214] EA 14, 22, and 25; Moran 1992, 27-37, 51-61, 72-84; Dabney 2007, 192.

[215] Pylos Un 1322; Shelmerdine 1997, 567

[216] Bergoffen 1991, 60; Donovan 1993, 378; Shelmerdine 1985, 121-141. The ubiquity of Mycenaean pottery in the Eastern Mediterranean has also been argued to reflect the low value of these wares (Antoniadou 2005, 75).

unique role as a primary product substitute or placebo for high-value luxury goods for conspicuous consumption of sub-elite, both in mortuary and cultic settings.[217] The role of open vessels as the accouterment of important social customs such as feasting is argued by M. Dabney to have created a secondary role for these products, as they became both the intended items to be traded, as well as the means through which trade relationships were established.[218] In support of this supposition, a number of Levantine contexts with purported feasting remains are identified, including the palace at Ugarit, residential structures at Tell Abu Hawam, Ashdod, and Megiddo, and temples at Kamid el-Loz, Beth Shean, Hazor, Lachish, and Amman Airport.[219] In addition to pottery, other finished products traded during the second millennium include jewelry, cylinder seals, toiletry items, scarabs, statues and figurines, and weapons.

The information garnered from the material recovered from domestic and mortuary contexts at sites throughout the Mediterranean is supplemented by the recovery of the wrecks of three Late Bronze Age traded vessels: the Uluburun, Cape Gelidonya, and Point Iria shipwrecks. These three vessels were recovered from the south coast of Anatolia and the east coast of Greece, and all date to the LB II period (between roughly 1300 and 1200 B.C.E.). While the former two reflect long-distance trade, likely commencing at Cyprus, the Point Iria ship is a shorter distance

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[217] Sherratt 1998, 295.

[218] Dabney draws a link to the role of feasting as a Mycenaean tradition of social relationship formation and consolidation (2007, 192; citing Palaima 2004; Wright 2004a, 2004b).

[219] The contexts selected to reflect local feasting activities with Mycenaean vessels include: the royal palace at Ugarit; refuse material in the rock-cut chamber of Bey 003 at Beirut; sounding X, II-A/B-8/9, periods III-IV in Area II at Sarepta; Temple 3 at Kamid el-Loz; Area A palace temple and Area H temple, Stratum 1A at Hazor; Buildings 3, 30, 45, 50, and 58 of Stratum V and Buildings 41-43 of Stratum IVa at Tell Abu Hawam; locus 1108 of the Level VIII temple at Beth Shean; Area B public buildings of Strata 1-3 at Ashdod; Fosse Temple III refuse pit (locus 172) at Lachish; Area A of Stratum X at Tell es-Shari’a; and the Amman Airport Temple (Dabney 2007,193-194).

trade vessel, which would have circulated goods on a more meso-scale.[220] The cargo recovered from the excavations of the wreck sites are largely consistent, and include large quantities of copper, tin, and bronze, significant numbers of Mycenaean and Cypriot pottery, stone weights, limited quantities of other raw materials (such as blackwood, ivory, and ostrich eggshells), and a small assortment of personal items of the crew. The locations and hypothesized trajectories for the Uluburun, Gelidonya, and Point Iria wrecks, as well as the comparative distribution patterns for the traded objects constituting the cargo assemblages, suggest that Crete (in the late Middle and early Late Bronze Ages) and Greece (from the 13th to 11th centuries) may have been the primary destination for long-distance maritime trade.[221]

The term "International Style" is used to refer to pictorial elements that in style and iconography are cosmopolitan in nature, lacking a clear origin or association with one distinct location within the broader geographic area in which it is found.[222] This term commonly incorporates the distinct art historical concepts of style and iconography; simply put, the iconography can form the composition of the subject, while style can be defined as "the objective vehicle of the subject matter rather than the units that compose the subject."[223] This distinction is made clear by the separation of features into International Style and International Symbol Set, in which the latter refers to iconographic images and elements specifically. This is particularly important as these two features were often, but not always, spread throughout the Mediterranean

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[220] Bass 1967, 1973, 1991, 1998; Bass el at. 1998; Phelps et al. 1999; Pulak 2001, 2008.

[221] Cline 1994, 10; Graziado 2005, 325.

[222] Smith 2003, 183; Feldman 2006.

[223] Shapiro 1959, 304.

concurrently.[224] The adoption of the International Style and Symbol Set functioned as a form of elite status competition, as it can be argued that "objects, information, and experiences obtained from afar are imbued with latent power, and have the capacity to increase the prestige and status of those who acquire them."[225] Shared styles and symbols also extend to shared valuation of prestige goods, particularly when incorporated in funerary equipment, which in the LBA includes horses, hostages, kingship relations, wives, and the education of sons at foreign courts.[226]

Across the Mediterranean, the international style and shared symbol set of the Late Bronze Age have been referred to as the "international koiné" of art.[227] The cosmopolitan style and motifs were employed in the manufacture of goods in a variety of media, however the luxury ivory items are argued to provide "the clearest expression of the ideology of the international elite as described in the Amarna Letters."[228] Ivory plaques, ornaments, furniture inlays, pyxides, and other goods decorated in the international style have been recovered from all regions of the Mediterranean. The most well-known example is the ivory pyxis lid recovered from Tomb III at the port site of Minet el-Beida. Considered to be a product of Syrian manufacture, it was notably recovered from a context with other exchange goods (including a Mycenaean Type II sword).[229] The pyxis lid depicts a female figure flanked by two caprids to which she offers palm fronds in

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[224] The distinction between the spread of international styles and symbols has similarly been postulated for the development of international motifs and styles in Postclassic Mesoamerica (see Boone and Smith 2003, 192).

[225] Knapp 1998, 195; Feldman 2007, 60.

[226] Philip 1995, 77; Maguire 2009, 20.

[227] This term was coined by Marian Feldman, who discusses the role of art in the diplomacy and interaction of the Late Bronze Age (2006).

[228] Caubet 2008, 407.

[229] Kantor 1947, 91; Poursat 1977, 148.

the traditional Mistress of the Animals motif (a common international symbol in the LBA). The facial features of the female are very Syrian, including the straight line from forehead to nose, the small smile, and the almond eyes, however she is clothed in a Mycenaean style flounced skirt and is seated on an Aegean style altar. In adopting symbols and styles that span multiple cultures, objects like the pyxis from Minet el-Beida can employ a intelligible set of symbols while simultaneously appearing exotic.

2.4 Chronology: Locating the Late Bronze Age in Time

The chronology of the second millennium is one of the most contentiously debated subjects in Mediterranean archaeology. The negotiation of relative cultural trajectories that had dominated research through the late nineteenth and bulk of the twentieth century were revolutionized through the introduction of scientific absolute dating methods, of which radiocarbon and dendrochronology are the most commonly applied. The identification of absolute dates for the transition from both the Early Bronze to the Middle Bronze, and the subsequent commencement of the Late Bronze Age—intrinsically tied to the Theran eruption—continue to elicit ardent discourse. Before presenting the chronological framework adopted for this dissertation, two important points of note must be addressed.

Firstly, although the ceramic data assessed in this analysis is inherently chronological (with periodization integrated into ware taxonomies), the purpose of this analysis is not to address formally questions of absolute chronology.[230] Once distribution networks have been

[230] The employment of chronologically classified objects—such as Mycenaean LH ware groups—for dating purposes creates problems of circularity (for a discussion of circular reasoning within dating methodologies, see Höflmayer 2012: 20–38).

analyzed and assessed, it will be possible to explore chronological implications from the results, however this will necessitate significant further appraisal of the contexts from which wares were recovered. Specifically, this would necessitate a detailed examination of the archaeological reports associated with the imported wares to corroborate the periodization assigned to the contexts of documented ceramics. Space to facilitate such an analysis is accommodated within the dissertation database structure, with the hope that future study may address chronology-related research questions. Rather than an assessment of absolute or relative chronology through circulated ceramics, this project seeks to examine and compare the distribution of contemporary ware groups to explore the mechanics and governance of trade systems during the second millennium.

The second matter that requires acknowledgement is the assumption that the framework adopted here is subject to change. This includes both the absolute dates assigned to different regional periods, as well as the chronological classifications of the Mycenaean and Cypriot ware groups. Numerous alterations are currently under debate, including the identification of the potential White Slip vessel from Thera, or whether the first appearance of Base-Ring vessels in Levant should be pushed back into the MBA,[231] which will undoubtedly cause the dating of the ceramic classification systems to continue to shift.[232] As scholars continue to refine the chronology of the ceramic categorization systems, there will be associated implications for the results and conclusions gained here as to the diachronic shifts in ceramic distribution. By organizing the data according to general ware type, it is hoped that future modifications to the

[231] Merrillees 2001b, 92; Wiener 2007, 39; cf. Manning 2007, 118-119,

[232] Although BR ware is traditionally viewed as a hallmark of the LC period, examples from Tell el-‘Ajjul may indicate an initial appearance in the Levant during the late Middle Bronze (Oren 2001, 127; Bergoffen 2001a, 48; Merrillees 2001a).

system adopted here will not yield significantly large changes to the analysis or conclusions reached.

The synchronization of the chronology of the second millennium has resulted in the emergence of roughly three alternative systems, labeled the High, Middle, and Low Chronology.[233] Within these positions there are numerous alternative variations, with modified and revised versions continually generated in response to the publication of new material or radiocarbon results. In part, the difficulty in synchronizing chronological systems across cultures results from the lack of clearly articulated independent horizons, with precise and chronologically identifiable transitions.[234] As ceramics and other frequently traded goods center prominently in the correlation of relative dating systems, problems associated with the general product life-cycle (from first introduction to widespread distribution and decline) also raise complications. This similarly applies to the adoption of exotic artistic styles or motifs, evidenced by the range of dates associated with the appearance of Minoan style frescoes at the sites of Mari, Alalakh, Qatna, Kabri, and Tell el-Dab'a.[235] To this one may add the complexity arising from the lifespan of an individual object, which can significantly impact the results when assessing chronological questions with any level of precision (as would be required for subjects such as the development of LH IIIC ceramic horizons). The scientific methods employed are similarly prone

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[233] For a comprehensive overview of the development of these divergent systems, see Manning 2007, 2010.

[234] Problematic chronological transitions related to ceramic development include the shift from MC III to LC I (Åström 1987; Bushnell 2013), as well as the commencement of the LB I in the Levant (Dever 1992, 16).

[235] The adoption of Minoan artistic style and fresco technology at these sites without any associated military or political control is referred to as the "Versailles Effect", by which the spread of cultural features is understood as elite emulation (Niemeier 1991; Rehak and Younger 1998, 137; cf. Bietak 2007 for the chronological problems associated with this theory).

to independent issues, with particular calibration inconsistencies centered in the mid-second millennium.[236]

Although the High Chronology was originally proposed by Merrillees based on traditional archaeological approaches,[237] it has become most closely associated with the dating schemes generated through radiocarbon sampling (which have similarly shifted back the dates for the beginning of the Middle Bronze Age and the transition from MB I to MB IIA).[238] Although the dates for the latter part of the Late Bronze Age are in relative accord, they diverge by over a hundred years by the MB/LB transition.[239] Although there are relative merits and disadvantages arguable for each chronological scheme, the approach adopted here follows the high chronology offered by Sturt Manning for Cyprus and the Aegean, as well as the new radiocarbon dates for the Levant published by Höflmayer et al. (see Figure 2-2).[240]

The important chronological marker within this scheme is the Theran eruption, dated to the late 17th century. The range given for the date of this event, between 1663-1599 B.C.E., represents the radiocarbon date-range with the highest confidence interval.[241] Relative chronological systems are adjusted to account for shifting absolute dates, however corresponding

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[236] Problems associated with atmospheric carbon variations—including the effects of the Theran eruption and Mediterranean gas vents—are discussed at length in Wiener 2007. Discrepancies in the dates generated for the Theran eruption across different scientific methods are discussed in Bietak and Höflmayer 2007.

[237] Merrillees 1968; 1977; Kemp and Merrillees 1980.

[238] Höflmayer 2012, 2015; Höflmayer et al. 2016. Traditional dates for the MB strata at Tell el-Dab'a and Ashkelon are presented in Bietak 2007; Bietak et al. 2008.

[239] Rehak and Younger 1998; Bietak and Höflmayer 2007.

[240] Manning 1999, 2001, 2007. A proposal to resolve the problematic LM IB span issue within the High Chronology framework is proposed by Manning (2007, 116-117). New radiocarbon dates for the transition from MB I to MB II have been recently published by Höflmayer et al. (2016), which may further shift the Levantine absolute dates in the future.

[241] Manning 2007, 125; Manning et al. 2014, fig. 1 (Olive-branch radiocarbon sequence); Warren 2006.

associations, such as the introduction of LH IIB during the reign of Thutmose III and the transition from LH IIIA2 to LH IIIB during the Amarna Period, remain consistent.[242] The reign of Thutmose III, dated from 1479 – 1426 B.C.E., also corresponds to the bulk of the BR I and RLWM circulation in Egypt and the Levant, with BR II and WS II appearing at Tell el-Dab'a as early as the latter part of his reign.[243] These markers correlating the relative chronologies of the Aegean, Cyprus, Egypt, and the Near East serve to ground the structure of the absolute chronology, upon which future revisions according to further archaeological or radiocarbon data can be made.

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[242] Warren and Hankey 1989, 145-146; Aston 2003, 145; Manning 2007, 115.

[243] Eriksson 2001b, 51-53, 65; Manning 2007, 122. See Krauss 2007 for absolute dates for the reigns of Thutmose III and other New Kingdom rulers.

SECTION II – THEORY

3. SYSTEMS OF INTERACTION

This first chapter subsection will provide an introduction to economic anthropological theory. This will be primarily a brief historiographic survey of approaches, commencing with a succinct overview of the competing schools of thought associated with formalist and substantivist schools of theory, and the effect that this rift has had on economic studies of prehistory. As this project focuses in particular on trade, the second portion of this theoretical overview will center on theoretical approaches to political economy and economic institutions, as well as issues of exchange—gifting, reciprocity, redistribution, trade, and marketing activities. The methodologies associated with the theoretical models presented below will also be discussed.

3.1 Theory and the Ancient Economy

The application of modern economic theory to the study of the ancient economy has been heavily debated since the 1950s and the growth of the Substantivist school under Karl Polanyi and his students.[244] This school of thought was predicated on the philosophical belief that economic activities are socially embedded behaviours that must be approached and examined as individual phenomena rather than through the application of universal criteria and models.[245] This approach developed in reaction to more formal approaches—termed the Formalist school—that championed the logical and rational economic actions inherent to human behaviour through

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[244] Polanyi 1947, 1963, 1966, 2001 [1944]; Dalton 1969, 1975, 1977; Polanyi et al. 1957; Bohannon and Dalton 1962.

[245] McGeough 2007, 9.

time, and thus the efficacy of general models of production, exchange, and consumption.[246] Although the dichotomy of formalist versus substantivist approaches has become arcane in literature, it reflects a schism that is as yet unresolved, and continues to permeate analyses of the ancient economy through the methodologies adopted.

The division between universal and embedded notions of economy can be traced to the primitivist-modernist debate of the late nineteenth and early twentieth century.[247] Primitivist economic historians conceived of ancient economies as fundamentally different than those of modern capitalist profit-maximizing societies, and relegated exchange to a peripheral and subsidiary place alongside agriculture (upon which ancient societies were assumed to be dependent). The functional unit of the economy was the household or *oikos*, which was self-sustaining and independent from trade for provisioning.[248] Modern concerns of wages, price, and profits were believed to be largely irrelevant to production organization, while economic systems were suggested to have operated in a patriarchal fashion.[249] In reaction to the Primitivist school—and authors such as Bücher and his autarkic conception of the *oikos*—Meyer countered with a modernist approach, arguing that ancient economies as far back as that of third-

[246] LeClair and Schneider 1968.

[247] Oka and Kusimba 2008, 343-345; Parkinson and Galaty 2010, 6. The primitivist-modernist debate can similarly be contextualized against the rise of neo-classical economics during the 1870s, for which price-setting mechanisms and systems of equilibrium were the primary structuring forces of the economy (McGeough 2007, 11-12). This approach culminated in the conceptualization of the perfectly rational *homo economicus* (see Pearson 2000 for a discussion of *homo economicus*, his defining characteristics, and alternative models of economic behaviour). Mill, however, argues that it is not the specific choices that make man rational, it is the rational methods employed in his decision-making process (Persky 1995, 223).

[248] Polanyi 'On the primitivist-modernist debate' [unpublished ms., Concordia University Polanyi Archive]; Pearson 1957, 7; McGeough 2007, 10. The concept of the *oikos* as the basis for economy in antiquity was first proposed by Karl Johann Rodbertus in the 1860s and was subsequently adopted by Karl Bücher (1893).

[249] Dale 2010, 137-138; Whimster 2007, 128-129.

millennium Babylonia were analogous to modern capitalist states.[250] By the Classical Greek culture of the fifth and fourth centuries B.C.E., the presence of monetary systems, the development of systems of accountancy and transportation, the frequency of private transactions of property, and the division of assets after death are all reflective of the presence of a modern capitalist society.[251] According to modernist traditions, ancient economies vary in scale rather than in type.[252]

An early theoretical attempt at compromising these two positions can be seen in the work of Max Weber, who accepted the role of the *oikos* as the primary unit of production, however acknowledged the role of governing institutions that were active in commerce and trade.[253] The latter was viewed as the monopolized prerogative of royal institutions, which exchanged goods through gift-giving and profited through independent ventures including piracy.[254] Weber criticized the application of modern concepts and terminology anachronistically to past systems, stating that "nothing could be more misleading… than to describe the economic institutions of antiquity in modern terms."[255] Despite this proclamation, he granted the value in discussing past cultures as 'capitalist' societies in their employment of wealth as a means to gain profit through

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[250] Pearson 1957, 7.

[251] For the role of early banking systems in the Athenian economy, see Cohen 1997.

[252] Pearson 1957, 9-10.

[253] Weber 1976, 46; McGeough 2007, 13. The development of a system of trade through which exotic goods were acquired is attributed by Schon to the emergence of leadership and political complexity on mainland Greece, which led to the development of city-states (2010, 213). Political complexity is likely the result of the production of surplus (Stanish 2004, 8).

[254] Weber 1976, 46.

[255] Weber 1976, 45. In particular, Weber spurned the use of terms such as 'factory' to describe industries such as textile production in the roman empire (ibid.). A similar critique of the modernist approach was raised by Finley in reaction to the employing of concepts such as banking, investment, or credit to classical Athens (Finley 1973, 26, 116).

commerce.[256] While the economies of antiquity could be conceived of as capitalist in this basic sense, the goals of the participants diverged sharply, as ancient systems were agrarian and served political motives rather than economic ones.[257]

The debate between the relationship between past and present economies and the methodologies used to study them was subsumed in the 1940s and 1950s within the growing substantivist and formalist debate, instigated by Polanyi and the publication of *The Great Transformation*.[258] Polanyi and his students refuted the economic rationalism of the neo-classical and the modernist philosophies, and instead argued that decision-making was guided by socio-political rather than economic profit-seeking concerns.[259] Marxist influence is somewhat visible in the narrow emphasis on top-down elite control of production through the management of labor and resources.[260] Exchange and luxury imports were argued to fall under the exclusive control of emerging elites through a combination of coercion and ideological legitimacy as a form of symbolic prestige structuration.[261] The interpretation of trade and consumption were similarly influenced by the works of Mauss and Malinowski, in which luxury goods were exchanged as part of socially embedded systems of power via mechanisms of reciprocity, redistribution, and

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[256] Weber 1976, 48-52.

[257] Dale 2010, 139.

[258] Polanyi 2001 [1944].

[259] The rejection of neo-classical rationalism and profit seeking has been recently reiterated by Davies, who stresses that the unfettered application of the governing motivations associated with *homo economicus* to ancient societies creates "a gross travesty of reality" (Davies 2005, 130).

[260] Dalton 1969, 1977; Service 1962, 1972; Flannery 1968; Blundell and Layton 1978. Warburton cites the Assyrian traders from Kanesh and their pursuit of profits to refute Polanyi's assertion that trade was conducted simply for the purposes of acquiring goods, with profit considered incidental (Warburton 2003, 173).

[261] Oka and Kusimba 2008, 343; Earle and Ericson 1977; Ericson and Earle 1982.

market-exchange.[262] These circulatory devices, though somewhat divorced from production institutions, nevertheless reflect the recognition of the presence of active systems of exchange, and provide a common framework for the superficial analysis of ancient economies—albeit one that adamantly claims to capture only limited aspects of economic modalities.[263] Although included in this tripartite division, market exchange was conceptualized as a relatively insignificant component of pre-modern systems, and was largely relegated to advanced economies, with markets developing through evolutionary growth.[264]

The impact of Polanyi and the substantivist school in demonstrating the importance of conceptualizing economic activity as a product of social and cultural structures has been profound. Even adherents to neoclassical assumptions of scarcity and competition conceded that ancient economic systems were in part dependent on social and cultural institutions.[265] Two new approaches have been developed that mediate the concerns of the substantivist within new paradigms of acknowledged economic complexity: New Economic Sociology, and New Institutional Economics.

New Economic Sociology (NES) shares substantivist and Weberian concerns of socially embedding economic behaviour, focusing on culturally specific institutions and social

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[262] Polanyi 2001, 250; 1977, 35-36. Similarly, the value of imported objects can also seen as socially constructed and based on subjective 'value judgment', rather than as a formally determined through the summation of labour costs, or the labour purchasable through a traded commodity (Papadopoulos and Urton 2012, 4-5, 7-10).

[263] McGeough 2007, 22-23; Oka and Kusimba 2008, 345. Variation in the importance attributed to exchange still persists between scholars who accept the existence of long-distance exchange in antiquity, with both minimalist and maximalist views attested (Cherry 2010, 133).

[264] Warburton 2003, 146-147. Within his evolutionary structure, Polanyi deemed the appearance of markets as a signifier of the obsolescence of other economic exchange systems (i.e., householding, reciprocity, and redistribution; Warburton 2003, 148).

[265] North 1994, 359.

networks.[266] Like NES, New Institutional Economics (NIE) considers economic activity in terms of social and legal rules or institutions, which structure and regulate production and distribution. NIE adopts neoclassical formalist concerns for cost-benefit maximization and risk minimization, with incentivizing institutions considered the primary determinate of economic performance.[267] Institutional controls include formal constraints such as laws or constitutions, informal constraints such as behavioural norms and conventions, and enforcement strategies. While these institutions constitute the "rules of the game," the players are social and political organizations and independent entrepreneurs.[268] Within NIE systems, competition is seen as the catalyst for growth and learning, while cooperation is a fundamental goal of institutional formation through cost-benefit ratio alteration.[269] NIE therefore strives to balance the attribution of universal economic behaviours to cultural contexts that are defined and structured around individual and inherent cultural institutions.

In moving past this epistemological narrative, interest has increasingly focused on the systemic nature of object movement and the institutions that governed and facilitated distribution. In particular, analyses of ancient economies seek to elucidate the mechanisms that moved goods across the macro-landscapes and to identify the parties underwriting major ventures and the channels through which mobilized goods were dispersed. Among the many criticisms of Polanyi and the substantivist school is the marginalization of markets within ancient economies through

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[266] Manning and Morris 2005.

[267] North 1994, 359-360.

[268] North 1994, 361.

[269] North 1994, 365. While North views price changes as catalysts for institutional change, Dugger argues that price changes are the result and not the cause of institutional evolution (Dugger 1995, 455).

the assertion that commercialized distribution systems did not exist.[270] Since the late twentieth century, discussions of object exchange are increasingly interested in the identification of potential examples of marketing activity and marketplace exchange within the ancient world as a potential tool for the dispersal of subsistence or luxury goods.[271]

3.2 Socioeconomic Organization and Political Economy

The methodologies employed to examine economic organization often intersect with political theory, for which economic control and resource management are often a central part. Models of political economy often center on systems of power and strategies of resource management, naturally intertwining political consolidation policies with economic practices of production and distribution.[272] Scholars assessing Late Bronze Age Mediterranean systems have alternatively employed a variety of post-industrial methodologies including World Systems Theory, Core Periphery Analysis, Territorial-Hegemonic Continuum, Peer-polity Interaction, Gateway Communities and Ports of Power, and Network Theory (the latter will be discussed in Chapter 4). These models will be examined for their efficacy in characterizing the different polities of the Late Bronze Age. The overview will focus in particular on the way in which the economic modalities generated through these models would interact and integrate within larger supra-regional systems of exchange (i.e., how the entrepreneurial underwriting of trading ventures impacts political interactions).

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[270] C. Smith 1976, 314; Smith and Berdan 2003, 7.

[271] Dahlin et al. 2007; Garraty and Stark 2010; Hirth 1998, 2010; Hodges 1988; Minc 2006, 2009; Plattner 1985; M. Smith 2004.

[272] Hall 2000, 4-5; Parkinson and Galaty 2010, 3.

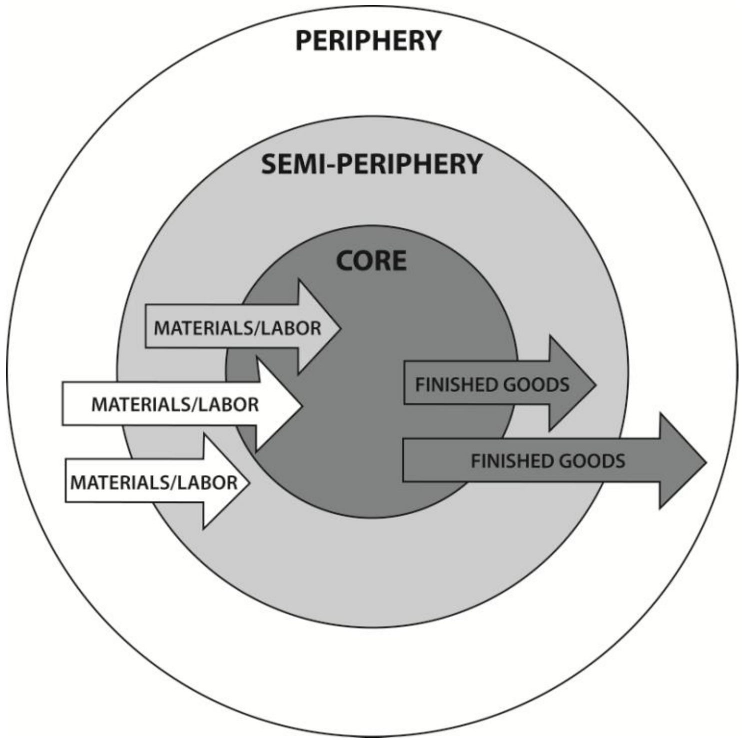

Figure 3-1. Representation of the World Systems Model, in which low-cost materials and labour are transferred from the periphery and semi-periphery into the core, in exchange for which they receive high-profit finished goods (adapted from Wallerstein 1974).

World Systems and Core-Periphery Approaches

Models of political economy frequently feature as an underlying structuring concern the political motivations and policy decisions in the management of resources and the exertion of control over economic activities, both of which have frequently resulted in the generation of uneven power structures. These frameworks help to reconstruct the manner in which societies and polities functioned and differed, and outline provisional guidelines for their analysis. Among the theoretical models of political economy, one of the most influential has been Immanuel Wallerstein's World Systems Theory,[273] and its subsequent derivatives (including the Core-

[273] Wallerstein 1974.

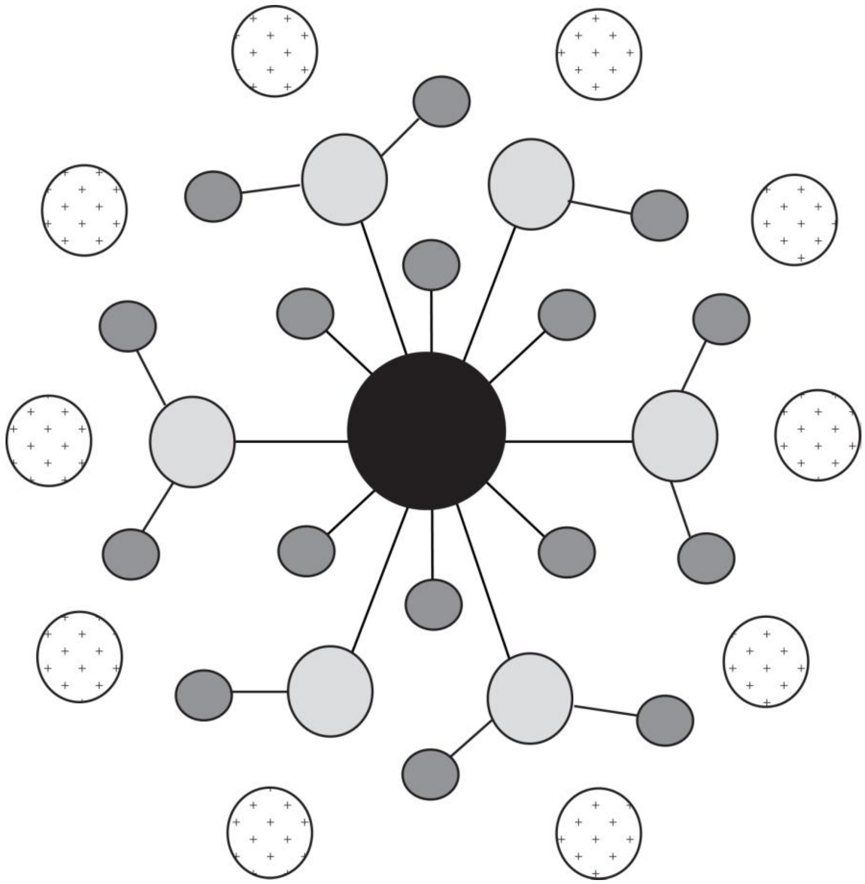

Figure 3-2. Representation of intersocietal relationships and core-periphery structure in a World Systems 'thinking' approach.

Periphery Model, the Metrocentric/Pericentric Model, as well as elements of Marxist theory). The World Systems Model asserts that states (and similarly empires) are primarily political mechanisms through which the core can accumulate capital from production in peripheral areas, emphasizing the motivation of capital accumulation (see Figure 3-1; this notion of resource extraction also underlies the model of the Command Economy).[274] Capital is not exclusively

defined as bulk commodities, but may include luxury products, human capital or labour, and

[274] Sinopoli 1994, 161. The command economy model is characterized by the extraction of resources from the periphery by a centralized governing body under the guise of redistribution, with power consolidated through the public ritual, conspicuous wealth consumption, and the construction of monumental public architecture (Earle 1977, 1982, 1997, 2002; Oka and Kusimba 2008, 349; Stark and Garraty 2010, 34-37).

idiosyncratic culturally defined forms of wealth. The World Systems Model has been particularly appealing to archaeologists for the connections highlighted between politics, economics, and geography into a unified framework, focused on development processes of complex societies on a macro, interregional scale.[275]

Opponents of the World Systems model have criticized its "top down" approach, which perpetuates an understanding of culture change as the transposition of core developments into the periphery.[276] It has thus been the subject of much debate and revision, particularly in its application to pre-capitalist societies, where the structure of exchange between core and peripheries is often dictated by variations in language, religion, and ethnicity.[277] The World System has thus been reconceptualized as a series of intersocietal networks in which "interaction is an important condition of the reproduction of the internal structures of the composite units" (see Figure 3-2).[278] Having moved far past its initial rigid iteration, 'World Systems thinking' can have value for the study of larger scale political entities, where interaction and economic exchange is negotiated under circumstances of fundamental inequality.[279] The incorporation of

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[275] Stein 1999, 27; Parkinson and Galaty 2010, 11.

[276] Wolf 1982, 23; Golitiko and Feinman 2015, 207; Feinman and Garraty 2010. In particular this approach denies agency to the peripheral territories relegated to the status of passive recipients (Dietler 2009, 24). An alternative manner in which colonial and indigenous encounters may be viewed is through a framework of dominance and resistance ideology (Lightfoot and Martinez 1995, 483). Within Anatolian archaeology, this ideology has been implemented in the examination of the consolidation phase of the Hittite Empire in central Anatolia (see Gorny 1995).

[277] Lightfoot and Martinez 1995, 476.

[278] Chase-Dunn and Hall 1991, 7. Parkinson and Galaty promote an approach to interaction and social complexity in which two analytical dimensions are intertwined, within which two complementary terms are employed: 'integration' refers to processes of internal integration and organization, while 'interaction' refers to processes that operate between social units of varying scales (i.e., households, villages, or polities; 2010, 10).

[279] For a more contemporary and nuanced discussion of World Systems Theory, see Parkinson and Galaty 2010 (particularly the contributions of Kardulias and Sherratt).

pre-capitalist societies, namely archaic empires, into the theoretical model has been the focus of numerous historians and sociocultural anthropologists, including Shmuel Eisenstadt (1963), Edward Luttwak (1976),[280] Michael Mann (1986), and Gil Stein (1999).

Theoretical principles of the World Systems Model—such as the focus on large-scale spatial/temporal shifts in geopolitical centers and the implied correlation between expansive peripheral formations and political decentralization—have been subsequently adopted by proponents of the Core-Periphery Model.[281] The core-periphery model considers economic and political activity in relation to geography, with authority assumed to decrease in multiple concentric rings according to distance from the core. It additionally incorporates Hudson's model of agrarian settlement patterns, which traces colonial expansion in connection with occupational changes.[282] In the earliest stages of political expansion, a state will commonly consolidate unoccupied and undeveloped peripheral territory, characterized by low population density and random site spacing.[283] Through time, settlement placement becomes more regular, producing a

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280 This work first forwarded concepts that were subsequently adopted by Terence D'Altroy in his "Territorial-Hegemonic Continuum" (D'Altroy 1992; Parker 2001, 13).

281 Rowlands 1998, 222.

282 Hudson 1969.

283 The initial impetus for imperial expansion is often quite varied, with the catalyst often being simply opportunity—such as the collapse of a preceding or neighbouring political power (as was the case with the Hittite Empire, which developed in the void left by the retraction of the Middle Assyrian trading activities and the collapse of Mitanni). Doyle has identified three loci of expansionist motivation: metrocentric, pericentric, and systemic (Doyle 1986, 123-128). In this model, expansion results from conditions at the center, surrounding regions, or from the balance of power between the two. Motivating factors include security concerns, economic goals, resource acquisition, or ideological factors. Often imperial growth is associated with individual, charismatic rulers, who elicit political and ideological allegiance. Although generally martial in form, expansionary policy often includes diplomatic activity bolstered by the overt threat of force. In less centralized and established empires, a preferred strategy includes the attainment of cooperation from local elites, with connections between the two polities solidified through the creation of kin relationships—namely diplomatic marriages, adoptions, and fosterage (Sinopoli 1994, 164). The consolidation phase incorporates the foundation of a central administrative and military core, as well as the construction of transportation and communication

more nucleated spatial pattern.[284] One significant drawback of this model is the fixation of relationships relative to their spatial arrangement, when in reality core-periphery interactions are far more complex and inconsistent.[285] A more comprehensive approach is instead offered by a "regionalist" perspective, which acknowledges that only a range of models displaying varying validity through time and space can 'account adequately for the complex trends observed in regional development trajectories.'[286] A further weakness of the model is the lack of precision in considering frontier intersocietal interactions.[287] A more flexible iteration of core-periphery notions is advanced by the Distance-Parity model, in which the power of a system's core is assumed to decay within the periphery according to distance, with no dependent relationship presumed between the core and periphery.[288] Core-periphery interaction can instead be conceptualized as a negotiation between independent factions of agency,[289] which is particularly valuable as a mechanisms to measure diachronic shifts power between cores and peripheries (as seen in the transition from Minoan to Mycenaean dominance of the Aegean).[290]

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networks (Parker 2001, 262). The eventual collapse can similarly be the result of various factors, including foreign intrusion, environmental changes, overcentralization, integration failures and factional conflicts, as well as defeat by other states or rivals. The disintegration phase is often facilitated by initial overexpansion, resulting in a failure to incorporate diverse communities and landscapes into an economic, military and bureaucratic system that was developed for the conditions of the core (Lattimore 1962, 503). The generative nature of states is important for the analysis of their developed form and selected strategies of expansion (Cherry 2010, 108).

[284] Hudson 1969, 365.

[285] Sinopoli 1994, 169.

[286] Bintliff 1997, 33.

[287] Lightfoot and Martinez 1995, 477.

[288] Parkinson and Galaty 2010, 13.

[289] Kardulias 2010, 55.

[290] Parkinson and Galaty 2007, 121.

POSITIVE ➔ NEUTRAL ➔ NEGATIVE

Territorial Control	Hegemonic Control	Neutrality	Autonomy	Opposition
Province	Vassal State	Buffer State/Zone	Autonomous State	Enemy State

Figure 3-3. Territorial-Hegemonic Continuum with associated forms of control (adapted from Parker 2001, 253).

The inflexibility of the Core-Periphery Model is addressed by D'Altroy, who promotes the use of a "Territorial-Hegemonic Continuum (Figure 3-3)."[291] This model advocates the use of a a varied approach to peripheral engagement through zones of differing degrees of control, with regional interests classified as Territorial Provinces, Hegemonic Vassal States, Buffer States and Buffer Zones. The territorial-hegemonic continuum is most frequently applied to the study of early expansionist states and empires. The most intensively administered peripheral zones are territorial provinces, which are subjected to direct political control and are administered through a network of appointed officials; territorial provinces are also often subject to heavy economic exploitation. Less directly administered are the hegemonic vassal states, that are formed from conquered centralized polities and that retain a certain level of autonomy. The key to this system is the "economy of force,"[292] principally maintained through the threat of military action. Vassalage agreements bartered degrees of autonomy and military protection by the core for the delivery of tribute, transparency in intelligence and information, and the staunch loyalty of the vassal. On the neutral end of the spectrum are buffer states, which are defined as neutral political entities inhabiting territories abutting neighbouring rival states, which are either maintained or

[291] D'Altroy 1992, 19.

[292] Parker 2001, 259.

established as barrier regions; buffer zones are similar territories, devoid of existing political structures.[293] These regions essentially function as borderlands—zones of cultural contact that have increasingly become the subject of theoretical and methodological discourse.[294]

The original conceptualization of the territorial-hegemonic continuum, which included only the territorial provinces, hegemonic states, and buffer zones, has been criticized for only considering positive degrees of control. The model was therefore expanded by Parker to include autonomous states and hostile states, thereby extending the matrix to include zones of neutrality and hostility. The inclusion of regions of negative control and hostile opposition is argued based on the inorganic genesis of these secondary polities, which frequently arise in reaction to encroaching expansionist ambition.[295] A Late Bronze Age example includes the Kaska as a hostile enemy to the north of the Hittite empire, evidencing the capacity for a "civilization [to]

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[293] Parker 2001, 252.

[294] The study of borderland interaction has traditionally been conducted from colonialist perspectives, with a flawed understanding of inter-polity relationships. Common misconceptions of this approach are the expectation of clear frontier boundaries visible in the material record, the reliance on macro scales of analysis, and the unilateral flow of influence from the core outwards, with the frontier reduced to passive recipient of core innovations (Lightfoot and Martinez 1995, 471). Instead more recent studies investigate frontiers as zones of cross-cultural social networks, and discuss the loci of cultural interaction and evolution (Lightfoot and Martinez 1995, 471; see also the "Middle Ground" conceptualized in White 1991). These spaces become the forum for phenomena such as creolization, acculturation or syncretization of cultural constructs, as well as hybridization, where distinct cultures blend together to form new identities (Lightfoot and Martinez 1995, 473; Glatz and Matthews 2005, 49). Social fluidity may have taken further forms that are elusive in the material record, such as intermarriage and peaceful cohabitation. In addition to cultural mergers, ethnogenesis can also take the form of fragmentation, through which groups disintegrate, and adopt new identities (Rodseth 2005). Conversely, frontiers need not result in hybridization, as cultural interaction often serves to solidify or reinforce ethnic differences between distinct population groups—especially in hostile circumstances. Adherence to traditional values is a common strategy employed by local elites, when no benefit of allegiance exists (Lightfoot and Martinez 1995, 485).

[295] Parker 2001, 253. To demonstrate this Parker utilizes the example of the Assyrian rival Urartu, which is argued to have become a unified force in opposition to Assyrian expansion.

itself create its own barbarian plague."[296] As a model for the variable ways in which states may engage with and exploit surrounding regions, the Territorial-Hegemonic Continuum provides a more comprehensive and nuanced framework.

Peer-Polity Competition, Gateway Communities, and Ports of Power

Beyond large powerful states, smaller polities vary considerably in their degree of centralization, particularly within the realm of economic production and distribution and the manner in which they engage with peripheral states and territories.[297] Although such states may

[296] Lattimore 1962, 504; Zimansky 2007.

[297] Political power and authority can be conceptualized in a variety of fashions, similarly diverging over traditional formalist-substantivist approaches to structuration in the past. Two common approaches to pre-industrial power structures include Weberian philosophies of gerontocracy and patriarchy, which were conceived of as antithetical reaction to formalist concepts of bureaucratic and legal rationalism, and within which social order is viewed as an extension of the ruler's (or divinity's) household (Weber 1978, 1006-1115). Models employed under this theory include Patrimonialism and the Patrimonial Household Model. The Patrimonial Household Model is characterized by the presence of nested structures of hierarchy within social organizations of varying complexities, including tribes, chiefdoms, and states (the only differentiation therefore is the size of the nested network). Without a rational bureaucracy or impersonal state, there is therefore no distinction between public or private sectors, nor should there be any significant structural division between rural and urban—all components are vertically integrated with the sociocultural center formed by the ruling elite (Schloen 2001, 51). This model accommodates the hierarchy of land grants and system of dependent agriculture extant in communities such as Ugarit, not as rational legal contracts between free men, but as agreements forged within nested kinship-based relationships (Schloen 2001, 189). Similarly, all long-distance trade is attributed to royal agents, as the financial investment required for trade (particularly sea travel) would be prohibitive for private merchants. Alternatively, the Patronage model conceptualizes economic ties as personal relationships rather than patrimonial ones. These relationships are most clearly reflected in literary narratives and letters, and are based on the mutual exchange of goods and services, both material and non-material—particularly protection and loyalty (Westbrook 2005, 211). Patronage relationships are further defined by their long duration, as well as their voluntary non-legally binding nature. The duration is particularly important as the exchange is defined as serial rather than reciprocal, giving rise to expectations rather than immediate consideration (ibid.). There are two conditions identified as precursors to the emergence of patronage: societies in which relationships are primarily kin-based and the legal-coercive system is weak, and those with extensive contact with foreign powers which leads to local emulation. The hierarchical organization of patronage has led some scholars to argue for patron relationships for all asymmetrical power relationship in Near Eastern societies (Lemche 1995, 1996). This framework removes the rigid nested organization of the Patrimonial Household Model, but still maintains a unidirectional vertical alignment

be governed by centralized hierarchical structures, there may be no associated expansionist behaviours or consolidation attempts upon neighbouring regions.[298] For the examination of modest states, the Peer-Polity model is particularly appropriate for regions of medium scale and across a short temporal span.[299] Interactive processes leading to the development of a peer-polity system include both militaristic and non-militaristic competition, which incorporate societies of variable organizational complexity and centralization, as well as the production of economic surplus.[300]

Interaction at the medium scale can be dictated by practices of elite emulation,[301] conspicuous consumption,[302] and competitive customs such as feasting.[303] These mechanisms

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with the centralized royal authority at the apex.

[298] The characteristics of incipient states that differentiate them from chiefdoms include: four-tiered settlement hierarchy, three or more levels of decision-making; ideology of stratification that differentiates elites and governors from non-elites; formal official residences or palaces; the use of institutionalized legal force; mechanisms for the enforcement of laws (Parkinson and Galaty 2007, 115-116; also Stanish and Haley 2005, 54).

[299] Parkinson and Galaty 2010, 15.

[300] For the role of surplus production in the evolution of political power (particularly in chiefdoms), see Stanish 2004, 8.

[301] Elite emulation is frequently reflected in the development of local import imitation traditions, such as the Atchana Ware tradition of Nuzi-ware imitation at the site of Alalakh in southeastern Anatolia. Early Aegean examples include the imitation of Egyptian scarab seals and the adoption of ape imagery from Egypt in Early Minoan crafts (Colburn 2008, 220).

[302] The theory of conspicuous consumption, although now frequently associated with the social role of luxury or exotic objects, originally centered on the demonstrative expression of idleness, and the elite and upper classes were exempt from industrial employments (Veblen 1994 [1899], 1; McGeough 2007, 16; Colburn 2008, 206). An apposite example of the conspicuous consumption of exotic imports from the Bronze Age can be found in the considerable assemblage of Aegyptiaca recovered from Minoan tombs on Crete (Bevan 2003; Colburn 2008; Wengrow 2010).

[303] Parkinson and Galaty 2010 17; Hayden 1995; Colburn 2008; Cherry 2010. Interaction leading to peer-polity development can also include a phenomenon termed “symbolic entrainment”, in which objects, energy, and information flow continuously between neighbouring independent polities (Cherry 2010, 110). Feasting as a performative method of surplus consumption can be segmented into ritual feasting marking a major life transition, periodic feasting marking social or economic events, socially integrative feasting, and economic feasts sponsoring communal events such as house building (for visitors; Firth

necessarily require a purposeful association between strategies of wealth financing and the exchange and consumption of luxury goods with conscious strategies of acquiring social and political power and status.[304] Such approaches also acknowledge an active role in import selection and cultural borrowing by indigenous peoples.[305] Leaders may also employ more cooperative or corporate strategies of consolidation and integration, including emphasis on the production of agricultural staples, common ritual activities, public construction projects, and large-scale labour tasks.[306]

Within the network and peripheral to the large expansionist states are smaller polities, often strategically located to form important links within the network. Two models frequently employed for the examination of such sites include Ports of Power and Gateway Communities, which are defined as follows:

> ***Ports of Power***: Communities in an economic system in which import-export merchants reap sizable profits and exercise more economic power than both the local rulers who protected them and the rulers of the interior, who provided goods and raw materials and whose authority and power were largely circumscribed by territorial limits.[307]
>
> ***Gateway Communities***: Large and important settlements that emerged along natural trade

1972, 301-2).

[304] Cherry 2010, 134.

[305] Dietler 1997, 296. For a discussion of the active role of recipient cultures in import consumption, see also Dietler and López-Ruiz 2009, Dietler 2005, 2010.

[306] Parkinson and Galaty 2007, 116.

[307] Stager 2001, 625. This corresponds to the Port-of-Trade model of earlier literature, in which port cities between the territorial boundaries of major states provided an independent locale for exchange between agents in long-distance trade (Warburton 2003, 170-171).

routes at key locales for controlling the movement of commodities.[308]

Communities of this type are able to capitalize successfully on strategic locations as links within transportation networks in order to generate real economic power.[309] The theoretical foundations of such models necessarily require an acceptance of a degree of capitalist motives, as accumulation and profit, rather than production, are the primary goals of such societies.[310]

The primary distinction between these two models lies in the agency and control of exchange yielded by the polity in question. While Gateway Communities function as warehousing sites and forums for the proximate interaction of agents of trade, Ports of Power were active administrators in the facilitation of resource acquisition and object distribution. Although no systematic comparison of sites defined as Gateway Communities and Ports of Power has been undertaken, it is plausible that differences exist in the manner in which such polities were integrated into larger supra-regional networks, and in which they were approached by neighbouring expansionist states. Differences in consolidation strategies—particularly between subjugation and integration versus non-interventionist policies—may result from a cost-benefit discrepancy related to the investment costs associated with the assumption of the entrepreneurial activities of a Port of Power; this additional capital requirement may cause expansionist states to favour vassalage methods for Ports of Power while Gateway Communities are subjected to hegemonic control). The testing of this hypothesized distinction will be the focus of subsequent research, with communities of high centrality selected from the resulting network analysis produced here.

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[308] Hirth 1978, 35.

[309] Stager 2001, 629.

[310] Braudel 1984, 3, 65.

Political Economy and Archaeological Manifestations

The following brief survey of material evidence for integration strategies and political economy structures details the archaeological grounding for the theoretical models presented above, and can be utilized in the classification of polities active during the Late Bronze Age. As the second millennium was dominated by expansionist states from Hittite Anatolia in the north to New Kingdom Egypt in the south, the discussion of centralized political institutions is structured around the territorial categories included in the Territorial Hegemonic Continuum for archaic states and empires. The impact realized by increased centralization associated with imperial consolidation is similarly demonstrative of the archaeological correlates associated with other centralized forms of political economy, including World Systems or Core-Periphery structures. Not all imperial strategies will comprise all territorial forms, and they may exhibit further variability in the spatial structuring of different territorial types within their organization. These broad categories for subjugation and consolidation, with their distinctive material correlates, still reflect the primary components of the majority of state forms, and can thus be discussed effectively here regardless of the imperial policy of the subjugating state. Consolidation strategies and their associated material correlates are particularly important for the assessment of economic activity at liminal or smaller polities along the periphery of the expansionist states, as they were bound to evolve through the influence and external pressure of adjacent states and empires. Interpretation of network nodal behaviour is thus dependent on the historical contextualization of the network node-sites within their political climate.

Archaeological manifestations of political and economic control and exploitation vary in accordance with the degree of integration inherent in the policy applied to the territory in question.[311] Some general characteristics, such as the expansion of networks and increased habitation, are archaeologically approachable. General developments plausibly linked to imperial expansion that are detectable archaeologically include the increased flow of luxury goods between local elites and the core, with a corresponding decrease in the intraregional movement of status goods, as elites relinquish personal ties for imperial connections.[312] Certain object groups such as transport vessels and ceramics may begin to be predominantly comprised of subtypes produced in state cores, as exchange networks become dominated by these centers. Multifarious shifts in distribution and consumption therefore necessitate the incorporation of commodities, quotidian objects of exchange, and luxury goods within analyses targeting the archaeological manifestations of political consolidation. Study of imperial-adjacent territories also indicates that propagandistic images are commonly injected into the landscape, including victory monuments and inscriptions, as well as structures and dedications at peripheral cult centers.[313] In addition to these more general indications of imperial involvement, developments associated with particular administrative strategies may further distinguish the nature of control exerted upon a given territory.

In established empires, the various incorporated territories are often subjected to different control policies. The tactic employed is dependent on several factors, including: the potential wealth extant in the territory (both in natural resources and human capital) [314]; the existing degree

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[311] Sinopoli 1994, 169.

[312] Sinopoli 1994, 172.

[313] Postgate 1994, 9. During the LBA, this strategy was commonly employed by the Hittites throughout central Anatolia and the south, but was notably absent from the Paphlagonia border zone in the north (Glatz and Matthews 2005, 62).

[314] Further differentiation occurs between regions exploited predominantly for agricultural production (staple finance), and those engaged in the production of high status or luxury goods (prestige finance)

Figure 3-4. Map of settlement patterns in the Cizre Plain of eastern Anatolia. Map A shows Late Bronze Age occupation, Map B Iron Age occupation (Parker 2001, Fig. 3.10, 69).

of political centralization at the time of subjugation; the expected resources required to extract potential wealth for the core; and the strategic importance of the territory in relation to other polities or commercial networks.[315] At the center of the empire is the core, symbolically manifested in the imperial capital. These sites are generally locations of early foundation and clear cultural continuation, or conversely, new capitals founded as an ideological act.

(D'Altroy and Earle 1985, 187; Brumfiel and Earle 1987). In either case, imperial intrusion commonly involves productive intensification, both around the core, as well as in the periphery (Sinopoli 1994, 166-170).

[315] Parker 2001, 15.

The highest degree of political control used in the incorporation of external territories is exerted over provinces. These regions are completely integrated into the subjugating state or empire, and are administered by a hierarchy of provincial officials. Archaeologically, provinces are characterized by a rapid growth of settlement sites, with a clear settlement hierarchy forming around nucleated administrative centers equipped with new imperial infrastructure. The territory surrounding these centers is dominated by smaller agricultural settlements connected through transportation networks and frequently protected by strategically dispersed fortifications.[316] The alterations to the settlement landscape associated with a new province is appositely illustrated by the Assyrian provincial territory incorporating the Cizre Plain, which saw a marked increase in the number of sites between the Late Bronze and Early Iron Ages (settlements in the region increased from 10 to 38; see in Figure 3-4). In the case of previously occupied territory, administrative capitals are often located at previous regional centers, which are generally highly desirable sites with long occupational continuity. At provincial capitals, the presence of non-local officials is regularly evident in the architectural style utilized in the construction of administrative and elite structures.[317] The systematic agricultural intensification of the provincial territory is further evidenced by the settlement and protection of fertile areas, along with the construction of storage and shipping infrastructures.

In locations where the threat provided by nearby hostile territories is extreme, neutral zones are often deliberately maintained as a buffer. Buffer States are determined by their inhospitable geography, making it difficult to exert more direct political control. These regions

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[316] Parker 2001, 261; Sinopoli 1994, 172.

[317] See for instance the residence of the Assyrian provincial administrator at Tell Tayinat (particularly Buildings IX and X; Harrison 2005, 26-30; 2014, 84-85).

are best identified through the literary record, which may document the preservation of neutral relationships between the Buffer State and the state or empire. Archaeologically, there is often no evidence beyond its spatial relation to adjacent hostile states.[318] Although similar in its associated imperial policy, Buffer Zones lack the viable political structure present in the Buffer States. These regions, previously largely uninhabited, are often settled with a series of military forts in strategic defensive locations. These sites are then connected by transportation networks, and can include small subsidiary sites for limited farming. The defensive motivation of site location is often demonstrated by the accessibility at each location of fresh water and arable land; in accordance many sites also boast fortifications. A Late Bronze Age example of a Buffer Zone is observed in the northern border of the Hittites that abutted the mountainous territory of the Kaska. To maintain this frontier and to distance the Hittite homeland from the ubiquitous Kaskan threat, only limited agricultural settlements were located in this region, and were restricted to areas in close proximity to larger, fortified sites.[319]

Between these two extremes in the spectrum are vassal territories, from which resources are extracted through political control of the local administration. A high level of hegemonic control is often established through military force, which is easily visible in the material record.[320] Administration was often maintained in the hands of the local elite, however a puppet

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[318] An analogous illustration of a buffer state can be found in the first millennium state of Ukka, situated between Assyria and Urartu to the north, which has been identified as a Buffer State due to its rugged mountainous terrain and the apparent lack of Assyrian infiltration. This identification has been subsequently corroborated by surviving literary records, which include letters between the Ukkean King (never identified by name) and the crowned prince Sennacherib, to whom the king passes information on the military situation in Urartu (Parker 2001, 96).

[319] This objective was later reinforced by the relocation of the capital from Hattusas to Tarhuntassa.

[320] Literary records from the Assyrian Empire detail the extensive military campaigns undertaken in the subjugation of the vassal territories of the Levant, which have been corroborated by clear evidence of destruction at sites such as Lachish. Further evidence of these campaigns include the construction of

government could be introduced if they rebelled. The government was then subjugated and monitored through a series of treaties and a network of officials, documented in treaty agreements and correspondence (preserved in the form of cuneiform tablets, for which there are many preserved examples from the Late Bronze Age). Vassalage agreements relied on the channeling of resources from the vassal territories to the center through tribute, often necessitating production intensification in the Vassal State to satisfy these demands. Locally administered production intensification is common, and can be seen in the escalation of mining activity in Nubia through the Middle and New Kingdoms as a result of Egyptian hegemony and demand.[321] While products are directed towards the core, additional sanctions were often instituted to restrict vassal trade with hostile states. This is manifested in a decrease in exotic luxury materials in local elite contexts, as well as a decline in locally exported products found within territories hostile to the subjugating polity. As demonstrated by New Kingdom activity in Nubia, vassal territories are also frequently harvested for their natural resources.[322] Finally, a common tactic of cultural consolidation utilized for Vassal States, and traceable within the archaeological record, includes the appropriation of local cults, frequently involving the movement of cult statues to the subjugating polity in order to ideologically bind diverse regions to the state or empire.[323] Similar to the employment of military threat to maintain political ties,

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defensive features, most notably a water supply system at Jerusalem, located archaeologically and documented in detail in the Hebrew Bible (2 Kings 18; Isaiah 36-37) and in the Siloam Tunnel Inscription.

[321] E. Morris 2005, 195-199, 651-653. A similar strategy of intensification has been frequently argued for the apparent oil production activity at Ekron under Assyrian hegemony (Gitin 1997, 87), however new assessment of the evidence from the Field III industrial quarter suggests that the oil production industry diminished during this period (Faust 2011).

[322] Parker 2001, 94.

[323] Sinopoli 1994, 168. This policy was employed by the Hittite empire in their integration of Kizzuwatna into the Hittite territory following the conquest of Tudhaliya III, as the chief local deity was removed and

this policy provides a psychological deterrent to rebellion.

3.3 Modelling the Movement of Goods

In order to understand the behaviour of individual vertices within a network, a greater understanding of the forms of economic interaction extant within and between polities is necessary. The exchange of goods and services can be examined as the actions of either independent capitalist agents governed by forces of supply and demand, or as a socially embedded activity between parties tied by social relationships and governed by cultural customs. Both approaches will be surveyed briefly. Alternative approaches to production and exchange are best profiled through an examination of both textual and archaeological material, including evidence relating to the production and consumption of both domestic and imported luxury and non-luxury artifacts.

Socially Embedded Material Circulation: Gifting, Reciprocity, Redistribution

The practices of trade and exchange are frequently considered to be byproducts emerging from the cultural tradition of gift exchange.[324] The system of gifting was explored famously by Mauss, who detailed an arrangement that was less reflective of voluntary exchange, and more centered on the creation of interest and obligation.[325] The system of ceremonial gifting was

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relocated to the site of Šamuha.

[324] Firth 1972, 323.

[325] Mauss 1950. The enforcement of obligation created through ceremonial gifting is a foundation of cooperation theory for the emergence of complexity, in which populations are prone to punish—even altruistically—free riders within the system (see Boyd et al. 2003, Shalizi 1999, and Fehr and Gächter 2002 for a discussion of altruistic punishment). The obligations created through gifting can create

founded on a philosophy he termed 'Total Prestation', which dictated not only the obligation to repay gifts received, but also the inherent need to give and receive gifts.[326] Gifting as a mechanism for object mobilization is thus highly socially-embedded.

The creation of obligation to be repaid thus results in a system of reciprocity. The foundation of a reciprocal system was the socially-embedded exchange of luxury goods, first documented and explored in detail by Malinowski in his examination of kula systems in Polynesia.[327] Reciprocity—executed through the symbolic exchange of armshells and necklaces—created life-long relationships between partners (known as *karayta'u*) who were bound to offer protection, hospitality, and assistance.[328] Malinowski considered trade and barter of staple and finished goods to be a subsidiary component of the symbolic circulation system. Ceremonial gifting and the creation of reciprocal obligations have been interpreted as the practice reflected in Linear B tablets and Homeric literature, taking place during the Mycenaean period between both royal and elite individuals.[329]

Redistribution—one of the components of Polanyi's model of economic exchange—is a system by which goods and commodities are transported towards a core (frequently a palace or centralized administrative place), and redistributed as payment for craft specialists and state employees. Redistributive systems are structured as a mechanism by elites in an autarkic society to manage and generate power from the production of staple goods. These goods were then

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significant liabilities and be interpreted as subjugating acts, often outweighing the value of the gift itself (Henrich 2001).

[326] Mauss 1950, 1.

[327] Malinowski 1920, 1921.

[328] Malinowski 1920, 98.

[329] Nakassis et al. 2016; Pullen 2016; S. Morris 2016.

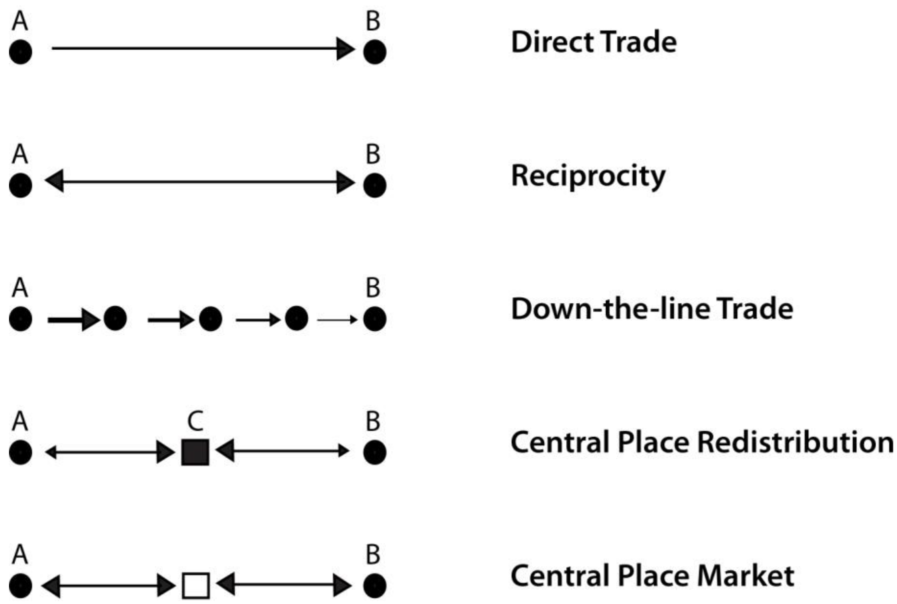

Figure 3-5. Forms of exchange (Renfrew and Bahn 2004, 376).

employed for the generation of social power through public consumption rituals and other displays of wealth.[330] Centralized redistribution as a political-economic institution is generally characteristic of chiefdoms and middle-range societies, while similar structures in states are termed 'command economies'.[331] The merit of redistribution as an analytical tool for the examination of ancient economies has been recently questioned for its overly broad encapsulation of all superficially centralized systems, and for the methodologies inability to capture and outline supplementary mechanisms at differing scales.[332]

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[330] Oka and Kusimba 2008, 349. Redistribution therefore is inherently asymmetrical and exploitative (Gilman 1983, 1991).

[331] Stark and Garraty 2010, 34.

[332] Nakassis et al. 2011, 180-182. For a discussion of redistribution systems in Minoan and Mycenaean Bronze Age societies, see Earle 2011.

Trade and Marketplace Exchange

The nature of exchange can be conceptualized on both the micro and the macro scale. At its most basic level, exchange can take place between two individuals in which goods pass through gifting or reciprocity. Commodities can then travel in this manner through successive person-to-person exchanges in a pattern called Down-the-Line Trade (basic forms of exchange are presented in Figure 3-5).[333] When an additional level is added to the structure, individual or institutionalized intermediaries are incorporated to facilitate this exchange from supplier to consumer. This can take the form of redistribution at a central place (such as the seat of political power) or through either middlemen or emissaries (the latter being sent to negotiate the acquisition of goods by one party).[334] These parties, either individuals or intermediaries, can also congregate at a centralized location, such as a local marketplace or a port of trade. These forms of exchange characterize the type of interaction internal to a society, through which individual actors engage. Interaction also takes place in more complex ways on the inter- and supra-regional scale, through which commodities were exchanged with parties external to a society.

The study of meso- and macro-scale exchange is often based on spatial analysis, plotting artifact distribution and utilizing models such as Fall-Off Analysis. The premise of this approach is that the quantity of traded material decreases with the distance from the source (see Figure 3-6), with the gradient of this decline often indicative of the method of transport (i.e., water transport versus land transport).[335] While Fall-Off analysis can aid in elucidating the types of

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[333] Renfrew and Bahn 2004, 376.

[334] Ibid.

[335] The value of objects is also conversely considered to increase with distance, as objects become more exotic as they stray farther from them source (known as 'distance value'), and as the costs of travel are

Figure 3-6. Graphed presentation of Fall-Off Analysis, which depicts the quantity of traded goods as a function of distance from the goods' source (adapted from Renfrew and Bahn 2004, 377).

transportation used in object distribution, issues of equifinality are associated with the different potential socio-political mechanisms for good circulation (for instance the similar distribution patterns created by central-place redistribution and central-place marketing).[336] Thus theories of exchange necessarily overlap with political theory, as economic institutions frequently structure object circulation in ways reflected in the distribution patterns evident in the archaeological record. Although the nature and goals of the parties engaging in exchange are diverse they are still brought together within a system of interaction—a network of exchange.

In the case of the Late Bronze Age, of particular interest and debate is the potential involvement of extra-palatial agents in privatized production or non-centralized forums of exchange.[337] Central to these issues is the question of whether open marketplaces were operating

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incorporated into the consideration of value (Cline 2005, 45; Colburn 2008, 206)

[336] The use of central place theory is related to the concept of hexagonal lattices used in landscape geography (Christaller 1966), and has been used to study the relationship between retail market centers (Hodder and Orton 1976).

[337] Following the influence of Polanyi there has been a reluctance to accept marketplace exchange as

outside royal jurisdiction, providing independent access to imports and luxury goods. More generally defined, marketing activity or market exchange refers to economic transactions that reflect the powers of supply and demand, for which prices or values are established.[338] These transactions need not transpire within a physical marketplace to qualify as market exchange, however the identification of physical marketplaces still dominates within scholarship.

Traditional archaeological approaches to studying market activity have largely concentrated on the marketplace itself. The first of which, the Configurational Approach, seeks to identify marketing activity by locating the spatial and architectural features associated with market exchange.[339] The value of this approach is clear for cultures with established markets and permanent loci of exchange (such as the Classical Greek agora or Mesoamerican plaza), however the focus on the built environment is less fruitful when applied to smaller scale or less durably constructed periodic marketplaces. A second method to assess marketing activity is the Contextual Approach, which extrapolates the presence of marketplace exchange from the scale of urbanism and the existence of cultural features that would require the provisioning and

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representative of a not insignificant portion of trade in antiquity (C. Smith 1976, 314; Warburton 2003, 146).

[338] Feinman and Garraty 2010, 171. Warburton supports the role of the market as a price-setting mechanism during the Late Bronze Age, as values were expressed in silver, which was relatively unique as a high-value resource in that no Near Eastern power exercised control over it (Warburton 2003, 198). The role of silver as a price-setting commodity is further supported by texts from Egypt, which document the acquisition of silver from Cyprus—on which silver is not mined and therefore most likely reflects the means of payment for Cypriot copper (2003, 272). The development of markets and the conscious exploitation of price differentials for the purpose of generating profit are evident during the second millennium in the behaviour of Assyrian traders in Anatolia, who purchased Babylonian textiles for resale (Warburton 2003, 136).

[339] Hirth 1998, 453. Supplementing the analysis of physical structures and open plazas, a recent and promising avenue of study is the identification of marketplaces through the analysis of chemical signatures, particularly phosphate concentrations, in soil (Anderson et al. 2012; Dahlin 2009; Hutson et al. 2009).

distributive utilities of a market to subsist.[340] There is a perceived threshold at which point communities exceed in size and complexity the redistributive capabilities of a centralized administration. Marketplaces are therefore imbedded institutionally within larger socio-political structures, and are frequently understood as a byproduct of urban growth.[341] Although logical in its theoretical approach, the Contextual method relies exclusively on circumstantial versus material evidence for marketplace identification.

A final traditional method for studying marketplaces is the Spatial Approach. This method deduces the existence of marketing mechanisms for circulating goods based on the distribution pattern of material across the landscape—the assumption being that the efficiency of market systems will increase both the volume and distance that products travel relative to other organizational mechanisms.[342] This approach employed similar methodology to 'fall-off analysis', and has gained extensive use by archaeologists who study trade—particularly long distance exchange. As noted above, the hypothesized effect of market activity on distribution reach does not satisfactorily reduce the problem of equifinality inherent in this approach. While each of these methods can directly or indirectly infer upon the existence of marketplaces within a culture (particularly when used in combination),[343] the role of market exchange as a subsistence strategy on the micro-scale may be more effectively considered through an examination of its provisioning function. A promising methodology with these explicit aims is the Distributional Approach.

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[340] Hirth 1998, 453; Stanish 2010.

[341] Hirth 1998, 453.

[342] Hirth 1998, 454.

[343] Dahlin et al. 2007; Garraty 2009; Minc 2006, 2009.

The Distributional Approach is an archaeologically based framework for the analysis of material distribution and marketplace exchange applied successfully by Hirth at the site of Xochicalco in pre-Hispanic Mexico.[344] This model supplements traditional studies on the location, form, and spatial configuration of the physical marketplace by examining the distribution of objects throughout consumption units.[345] The primary unit of analysis is the household, which is believed to provision itself actively through its own subsistence and through procurement of diversified products. A spatial assumption on which this model is grounded is the "law of monotonic decrement," which supposes that more efficient forms of exchange, such as a marketplace, will result in a wider distribution pattern than linear systems such as reciprocity or redistribution.[346] Elite profit-seeking activity centers on the production of staple goods in large quantities, through which elites are able to capitalize on primitive economies of scale.

The predicted result of this approach is that the independent provisioning of households will lead to a relative homogeneity of material assemblages across households of different social rankings;[347] this differs from redistributive systems in which different social stations have differential access to luxury or import materials. In a market context, individuals have access to materials independent of social status, and are restricted only by purchasing power. When applied to sites within the Mediterranean, a decentralized market-based economic system would be reflected in the permeation of imported goods throughout all contexts of the site, with

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[344] For further successful applications of the Distributional Approach to sites in Mexico and Greece, see Sheets 2000, Garraty 2009, and Aprile 2010.

[345] Hirth 1998, 451.

[346] Hirth 1998, 454. This model is an extension of the Fall-off Analysis.

[347] Hirth 1998, 456.

variations only in quantity as an indication of wealth.[348]

The examination of decentralized systems like that assumed within the Distributional Approach can also be undertaken through network analysis. This method, which by nature omits any assumption of a centralized structuring force, allows for an examination of both the overall structure of the distribution system, as well as the agents active within the system to be profiled. Network analysis and its efficacy for the assessment of material distribution and decentralized political systems will be explored in the next chapter.

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[348] In a distributional analysis of material at Ugarit, the pattern observed in the distribution of ivory objects, imported stone vessels, and weights was in accordance with the pattern hypothesized for the market circulation of goods (Johnston forthcoming).

4. NETWORK ANALYSIS

4.1 Network Theory

Network Analysis is a diagnostic approach that aims to interpret the relationship patterns between entities through visual representation. This methodology has its roots in mathematical Graph Theory, and has been further refined and developed through the incorporation of Social Network Analysis (SNA). The primary goal involves "detecting and interpreting patterns of relationship between subjects of research interest."[349] This perspective is guided by the desire to create a scientific method to 'bridge the gap between the reductionist study of parts to the constructionist study of the related whole,'[350] which provides network analysis with a number of methodological advantages: it forces the focus towards the relationships between entities; it is by nature inherently spatial; it can effectively articulate scales (both spatial and temporal); and it can incorporate both people and objects.[351] Network models are constructed by the spatial arrangement of interacting vertices (often referred to as agents or nodes) and the connecting linkages between them (known as arcs if they are directed or edges when undirected).[352]

Many of the organizational properties inherent to network analysis were developed

[349] Brughmans 2010, 277.

[350] Bentley and Maschner 2003, 1.

[351] Knappett 2011, 10. The focus on the organizing principles of interaction is similar to those associated with New Institutional Economics discussed in section 2.1.

[352] An example of a directed relationship would be the citation of an author by another author, with the relationship governed by the action of one node towards another node (for an example of a network generated from scholarly citations, see Brughmans 2013; 2014). Directedness in archaeology can be challenging to establish, however new scientific provenience analysis (such as elemental fabric analysis) have the possibility of determining at least the origin and terminus locations of an arc—although specific pathways in traversing the arc can remain obscured.

through the examination of social networks within communities.[353] Theory within the field of SNA is predicated on a number of primary social assumptions: that actors within a group are viewed as interdependent rather than independent; that relational ties between actors serve to channel tangible and intangible resources; network models are designed to capture the opportunities and constraints provided for an actor by their environment; and that the network model manifests the social, economic, and political structures generated through actor relationships and interaction.[354] Structure is of central importance in SNA, as it often influences the opportunities and behaviour of a node.[355] Research is therefore generally directed towards variation in structure across groups or contexts in a network. Like the graph in the field of mathematics, the sociogram serves as the visual tool for depicting social group structure as a series of points and links in two-dimensional space.[356] Moreno and his collaborator Jennings developed the sociogram to assess the rate of runaways at Hudson School for Girls in New York, determining that the probability of running away was less dependent on a girl's character than on her integration and position within a social network.[357] This innovation of the sociogram served

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[353] For a description of social network analysis methods and a summary of the theoretical development of field, see Wasserman and Faust 1994; Carrington et al. 2005; Scott and Carrington 2011.

[354] Wasserman and Faust 1994, 4. These assumptions all relate to the three primary components of a complex system (the agents, their rules, and their world; Bentley and Maschner 2003, 48).

[355] Borgatti et al. 2009, 893.

[356] The sociogram was developed in the 1930s by Jacob Moreno (1934, 1946, 1960; Moreno and Jennings 1938).

[357] Moreno and Jennings, 1938. Subsequent research within SNA has further elaborated the understanding of group dynamics, such as the presence of "keystone figures," or individuals who disproportionately affect group dynamics or function (Sih et al. 2009, 978). The role of individual nodes has been further elaborated through the study of embeddedness, particularly as it pertains to site integration in economic networks (Martin 1994; Hess 2004; Borck et al. 2015). Embeddedness may be measured through the E-I index, which measures the propensity of agents to interact with similar agents—a tendency also known as homophily (Krackhardt and Stern 1988; Burt 1991; Laumann 1966; Marsden 1988; McPherson et al. 2001; Everett and Borgatti 2012; Borck et al. 2015). While this metric does not reflect actual interaction,

as the precursor to the development of the field of SNA.[358]

As a complex system, a network is characterized as a formal system of organization that lacks a managing authority in which the rules that govern the connections between nodes are the defining aspects.[359] The coherent functioning of a complex system without a central managing authority is attributed to what is known as 'emergent properties' in Complexity Theory, which is evidenced by overall patterns that are greater than the sum of the parts.[360] Models of complex systems have three primary defining components: the agents, the rules of interaction between agents, and the context in which the agents operate.[361] Network scientists argue therefore that explicit examination of these synergisms in the relationships between entities is necessary in order to understand the behaviour of any individual node.[362] Node roles within the network can then be examined on the meso- and macro-scale through the deconstruction of a network into its components (i.e., cliques, clusters, cores, circles, etc.). The structure of a node's surroundings can also be constructed and examined through the construction of an ego-network. This may be advantageous for the examination of seemingly similar nodes, as ego-networks may still vary

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it captures the likelihood of it (Borck et al. 2015, 39).

[358] Freeman 2004, 30.

[359] McGeough 2007, 31. A complex system can be defined as "a system in which large networks of components with no central control and simple rules of operation give rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution" (Mitchell 2009, 13). Complexity Theory focuses on non-equilibrium systems of unique interacting agents, making it a natural fit for application to social groups (Bentley 2003a, 9).

[360] Bentley 2003a, 14. Precursors to Complexity Theory that provide a theoretical background to the analysis of complex systems include Catastrophe Theory, Chaos Theory, and Kauffman's NK landscapes (Bentley 2003a, 13).

[361] Bentley and Maschner 2003, 48. Network models can be presented in accordance with actual physical space, or may be positioned in relational terms, highlighting either geometric or topological interaction (Knappett 2011, 38).

[362] De Nooy et al. 2005.

greatly among generally homogenous vertices.[363]

Of central importance in conducting network analysis is the selection of a network representation for the communication of archaeological data, which is dependent on the nature of the nodes, ties, overall network, and of the research questions posed.[364] The success of network research depends on the correct definition of the network and its data, the specification of network boundaries, and the critical assessment of the research sample.[365] It is particularly valuable in the examination of dynamic systems, as evolving networks require different explorative measures than more static structures. Within the field of networks, there is a notable distinction between the study of static or dynamic systems. An example of a more static network is a modern transportation network, which may often be predetermined through the optimization of specific characteristics (such as cost or energy requirements), with little node-level participation in the determination of edge placement.[366]

There are two primary strategies employed by network analysts: (1) positional analysis, which focuses on the structure of the network and the position of the actors within them, and (2) relational analysis, which characterizes the ties—their strength, density, and directionality—between individual actors.[367] One of the particular advantages of a network approach is the

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[363] Mol et al.2015, 278. For variation among ego-networks, see Borgatti et al. 2013, 262-283; Hennig et al. 2012, 74, 109-110.

[364] Brughmans 2013, 627.

[365] Brughmans 2013, 627, citing Laumann et al. 1992; Marsden 2005; Frank 2005; and Orton 2000.

[366] Albert and Barabási 2002,78. The relationship between local and global interests in the optimization of pre-determined or static networks such as transportation grids are not yet fully understood (Carlson and Doyle 1999, 2000; Doyle and Carlson 2000).

[367] Knappett 2011, 57. This second characteristic differentiates a network from a graph, as the former supplements the graph with additional relational data (Brughmans 2010, 277). For an extremely helpful and comprehensive glossary of Network Analysis terms and concepts, see Collar et al. 2015, 17-25.

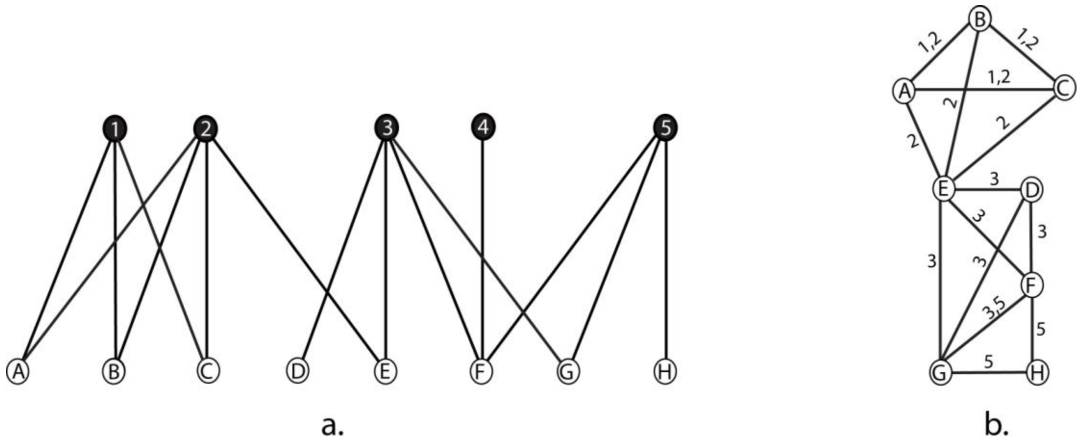

Figure 4-1. Example of a simple two-mode network, in which the white nodes are connected together through their shared relationships with the black nodes (a); (b) presents the same network as a collapsed one-node graph.

flexibility to incorporate both human and non-human agents to capture socio-material interactions—an approach termed Actor-Network Theory.[368] The relationships between different types of entities, both human and non-human, can be created through two-mode or bipartite networks (see Figure 4-1a), in which nodes of one category are connected via a shared link to a node of the second category. To express the relationships between one node type, this can then be collapsed to a one-mode network (Figure 4-1b). Information on the nature of the relationship between any pair of vertices is preserved through the labeling of edges with associative data. Similarly, edges in a network may be weighted rather than binary, reflecting not only the existence but the strength of a connection.

A well-known iteration of this type of network is the 'Hollywood Network'—better known as '6 Degrees of Kevin Bacon'—in which actors are connected through shared performance in a project; in this case the actors and films are the two types of nodes (see

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[368] For a discussion of Actor-Network Theory and its potential application to archaeological questions, see Knappett 2011, particularly pages 7-10; also Callon 1986; Law 1992; Hetherington 1997; Callon and Law 2004; Latour 2005; Brughmans 2014, 274).

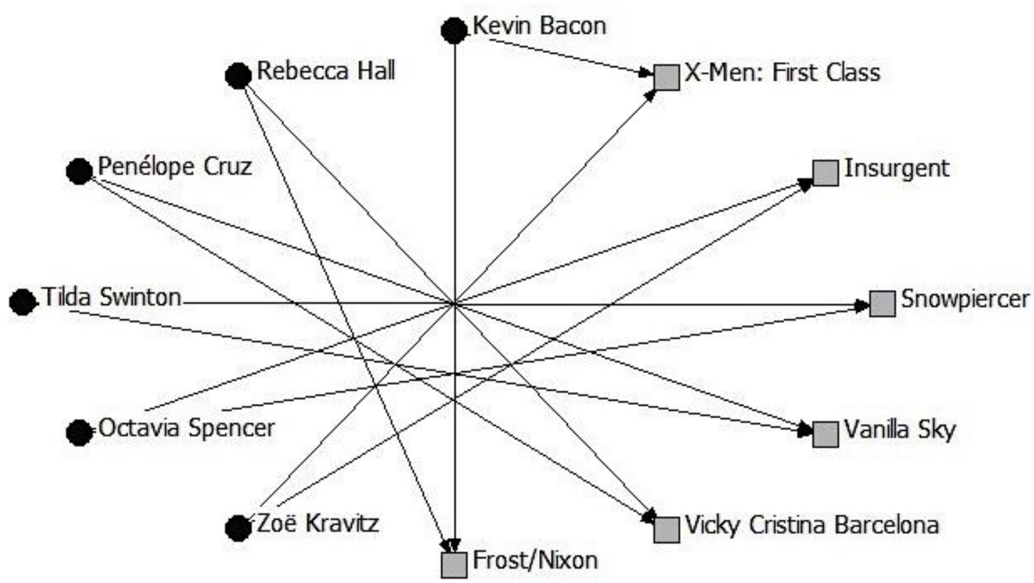

Figure 4-2. Example of the 'Hollywood' bipartite network, where Kevin Bacon is connected to Zoë Kravitz through four other actresses via shared projects. In this case, the graph is also a cycle (a closed subgraph) as Zoë Kravitz is herself connected to Kevin Bacon through the movie "X-Men: First Class".

Table 1. Matrix representing a Hollywood Network connecting Kevin Bacon to Zoë Kravitz.

	Frost/Nixon	Vicky Cristina Barcelona	Vanilla Sky	Snowpiercer	Insurgent	X-Men: First Class
Kevin Bacon	1	0	0	0	0	1
Rebecca Hall	1	1	0	0	0	0
Penélope Cruz	0	1	1	0	0	0
Tilda Swinton	0	0	1	1	0	0
Octavia Spenser	0	0	0	1	1	0
Zoë Kravitz	0	0	0	0	1	1

Figure 4-2).[369] This information may also be presented in a network matrix, with binary values used to represent the presence or the absence of a relationship (presented in

Table 1).

This is a relatively simple example, in which each node is equally connected to the network with a degree of two (each node has two edges). No single node (or actor) has an elevated importance or centrality, suggesting that each are evenly integrated into the network of Hollywood productions—which we know not to be the case. The complexity of two mode networks is quickly revealed if the N nodes of actors are increased to from $N = 6$ to $N = 25$. In this example, the secondary "film" nodes would then increase from $N = 6$ to $N = 28$, and the edges n increase from $n = 12$ to $n = 79$ (see Figure 4-3). Different actors are now connected to varying degrees. With a minimum threshold of two edges, the average number of projects per actor is just over three, while Scarlett Johansson and Amy Adams boast the highest connectivity in this network with five and six edges respectively. In archaeology, the construction of bipartite networks allows for the examination of the relationship between 'people' and 'things' in both positional and relational perspectives, and it is through affiliation networks that the fissure between macro and micro-scales in archaeology can often be broached.[370] There is considerable

[369] For an extensive actor collaboration graph, see Tjaden and Wasson 1996 (https://oracleofbacon.org). The actual network is notable for the significantly high clustering coefficient C in relation to the random network, while the path length L is relatively unchanged (Watts 1999, 515). In the graph constructed above, edges were arbitrarily constrained to include only women, favoring diversity. If personal acquaintances constitute edges, I have a Bacon Number of 3 (as generated on https://oracleofbacon.org).

[370] Objects can play an intermediary role between human scales of interaction, resulting in a so-called 'release from proximity' (Knappett 2011, 10).

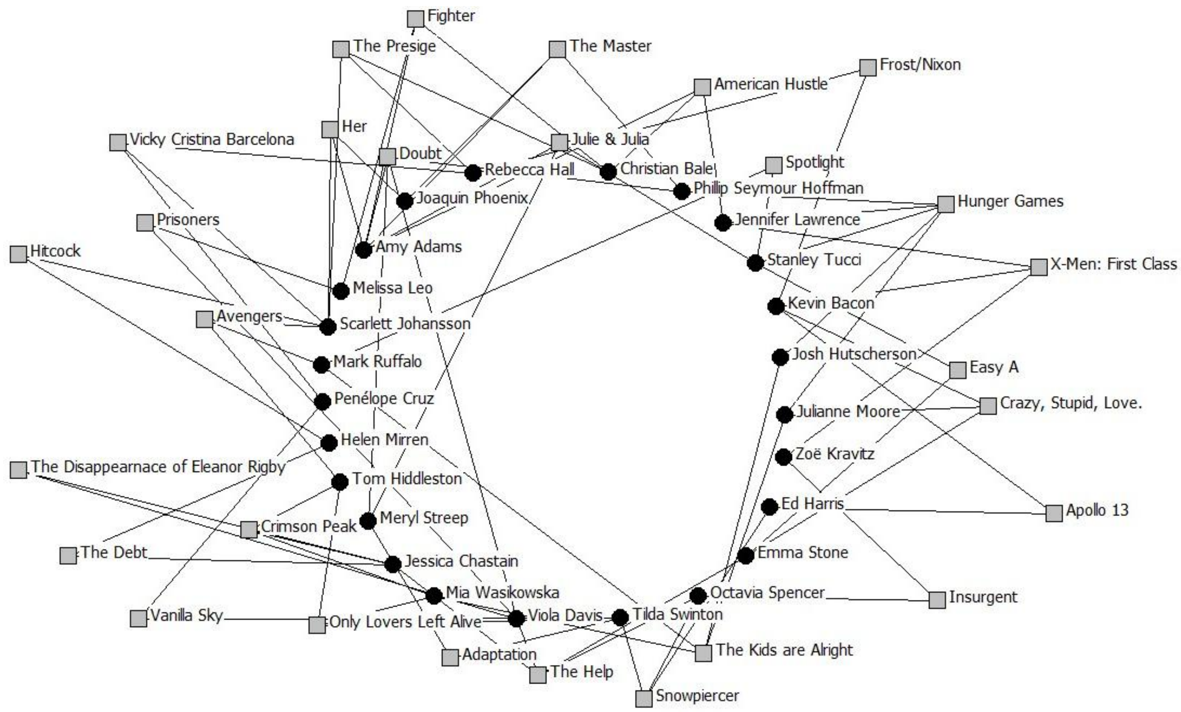

Figure 4-3. Expanded Holly Network example, with *N*= *25* nodes (actors).

difficulty in this endeavor, however the necessity of this approach is appositely championed by Coward, who states that: "we must learn to tack between the large scales of cultural transmission and the small scale of social relations to gain the best possible understanding of cultural transmission past and present."[371]

Network analysis has also been employed for exploring the role of predicted behaviour on network development through the method of Agent Based Modeling (ABM). The modeling of specific social behaviour of agents and their impact on emergent systems has been revolutionary in its capacity to explain observed phenomena through analogy.[372] ABM has been used effectively in historical research, particularly as it pertains to social relationships. Bentley et al.

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[371] Coward 2008, 1495.

[372] Bentley 2003a, 22; Graham and Weingart 2015, 249. Bentley also warns that ABM, while effective in its capacity to explain, is not predictive (ibid.).

successfully constructed an ABM to examine the role of colonizing groups on the economic structure and income inequality of prehistoric indigenous populations, particularly on the way in which changing agent specializations and individual motivations for exchange affected the system.[373] The simulation tested specifically whether specialization and wealth inequality were inherent to economic systems, even at the small-scale.[374]

NETWORK FORMS

Random Graph Theory

The simplest form of a complex network is the random graph, represented by the graph $G = \{P, E\}$ where P is the set of N nodes (P_1, P_2 ...P_N) connected by a set of edges E.[375] The origin of Graph Theory can be found in the work of eighteenth-century Swiss mathematician Leonhard Euler and his famous solution to the Köngsberg Bridge Problem.[376] This exercise identified the inadequacy of geometry and algebra alone in solving this challenge, highlighting the need for a new approach—a *geometria situs*, or 'geometry of position'.[377] From this, graph

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[373] Bentley et al. 2005.

[374] Bentley et al. 2005, 1347. An interesting conclusion of this study was the role that currency and pricing played in altering the structure of the system. This was demonstrated by the two modes of simulation: the 'Margin' mode and the 'bestPrice' mode. In the first, goods were transferred if a sufficient level of quantity discrepancy between two trading parties was reached, while in the latter, trading occurred when the agents both 'liked' the price of a commodity. In the latter mode, wealth inequality was high, with wealth distributed in a highly skewed power law graph (Bentley et al. 2005, 1353).

[375] Albert and Barabási 2002, 54.

[376] Euler 1741 (original publication in latin).

[377] The proposition of a new field of mathematics known as *analysis situs*, or *gemetria situs* was first found in a letter of Gottfried Wilhelm Leibniz to Christiaan Huygens from September 8, 1679. This document, along with the term itself, is cited by Euler in the opening paragraph of his Königsberg Bridge

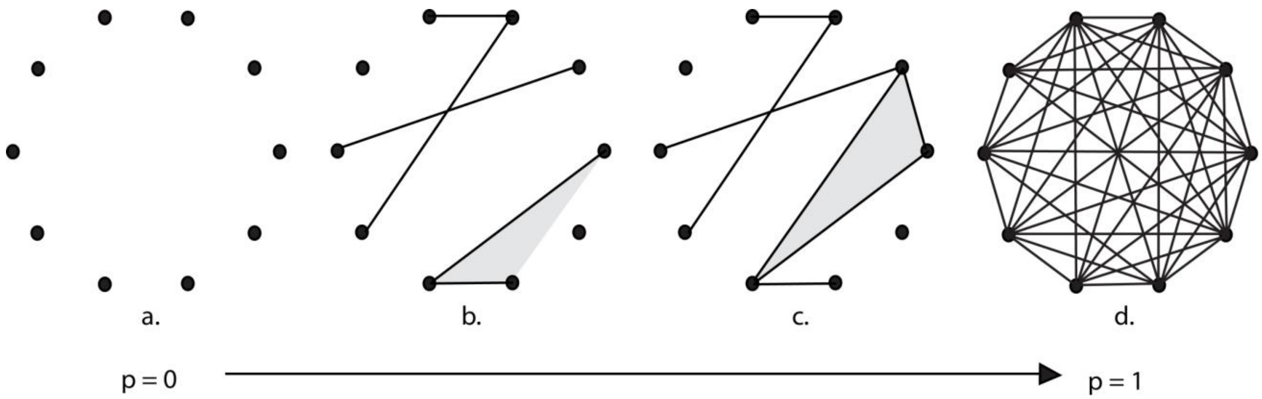

Figure 4-4. Illustration of the graph evolution for the Erdős-Rényi model with *N* = 10 nodes, with probabilities of *p* = 0, *p* = 0.1, *p* = 0.15, and *p* = 1.

theory, a branch of topology, progressed in its statistical and algorithmic complexity throughout the nineteenth and twentieth centuries.[378] Graph theory allows for the conversion of data characterizing regional systems into mathematical matrices "ideal for the flexible, verifiable analysis of system characteristics and for objective comparison with other patterns."[379]

Graph Theory expanded in its application to complex systems through the development of random graphs by Paul Erdős and Alfréd Rényi.[380] The model they developed involved the construction of a graph in which *N* nodes are each connected to other nodes with a probability *p*,

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publication (1741, 128), however there is disagreement as to the similarities of their proposed philosophies (Struik 1986, 183).

[378] For a review of the field of Graph Theory, see Bollobás 1985 and Karoński and Rućinski 1997 (the latter focuses on the development of the Erdős-Rényi model).

[379] Rothman 1987, 74. For an example of a network matrix, see Table 1 above.

[380] Erdős, P. and A. Rényi 1959 and 1960.

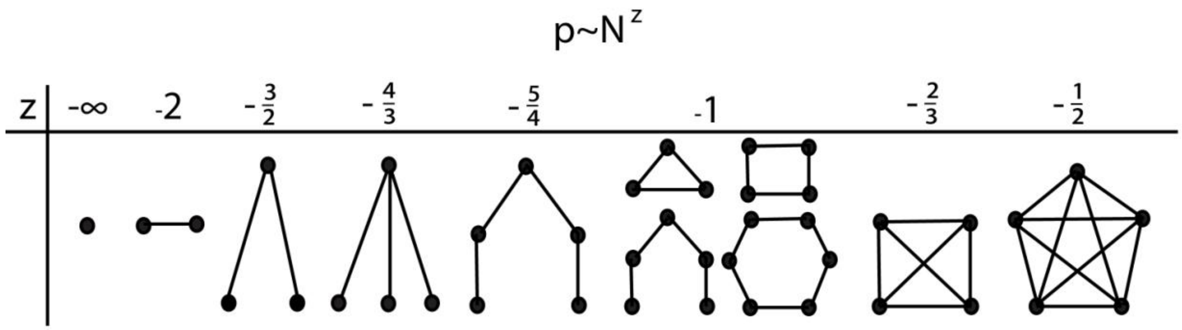

Figure 4-5. This chart presents the probability thresholds of node attachment of a random graph, at which point the associated subgraphs appear (after Albert and Barabási 2002, 56 Fig. 6).

creating a graph in which n edges are selected randomly from the $N(N-1)/2$ possible edges.[381] The n edges connecting N nodes have equiprobable placement, and can be realized through a total of $C^{n}_{[N(N-1)/2]}$ graphs (see Figure 4-4). Typical random graphs are homogeneous, with most nodes connected through equal numbers of edges. In addition to this homogenous node degree, these graphs are characterized by a small diameter (the maximum distance between any pairs of nodes).

The alternative definition of the random graph is the binomial model, in which every pair of N nodes is connected with a probability p, producing an expected value of total edges of $E(n) = p[N(N-1)/2]$. The maximum number of edges achievable in a random graph is given by the equation $n = N(N-1)/2$ for $p \rightarrow 1$. Random graph theory studies the evolutionary properties of the probability space associated with these graphs as $N_{\rightarrow\infty}$. The goal of the theory is to determine the probability p at which point a particular graph will arise.[382] For the binomial model, the probability of correctly graphing a network G_o is $P(G_o) = p^n(1-p)^{N(N-1)/2-n}$.[383]

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[381] Erdős and Rényi 1959.

[382] Albert and Barabási 2002, 55. The construction of a graph is referred to as an ‘evolution’ in mathematical literature (ibid).

[383] Albert and Barabási 2002, 54.

Additional features of random graphs explored by Erdős and Rényi include the development of subgraphs, such as cycles, trees, and complete subgraphs.[384] Cycles are defined as a closed loop of consecutive edges with an average degree of 2 (as each node has two edges); examples of cycles include triangles and rectangles, which have degrees of 3 and 4 respectively (see shaded area in Figure 4-4c). Trees are the opposite of cycles in that they cannot form closed loops, and are defined by an order k if there are k nodes and $k-1$ edges (see shaded area in Figure 4-4b).[385] A Complete Subgraph is entirely connected through all possible $k(k-1)/2$ edges (see Figure 4-5 at $p \sim N^{-½}$). The critical probability of the appearance of various subgraphs is presented in Figure 4-5.[386]

Associated with subgraph evolution is the appearance of clustering. For a random graph, the clustering coefficient—which represents the probability that two neighbouring nodes are connected—is equal to the probability that two randomly selected nodes are connected.[387] For random graphs, this is simply the ratio of edges to nodes, defined by $C_{rand}=p=<k>/N$.[388] Real networks, however, often exhibit clustering such that $C_p \gg C_{rand}$. Therefore, the clustering coefficient of a node C_i may be calculated by the formula $C_i = 2E_i / k_i(k_i - 1)$ where E_i is the number of edges in the real network, and $k_i(k_i-1)/2$ represents the number of edges possible

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[384] Erdős and Rényi 1960; Bollobás 1976; Bollobás and Erdős 1976.

[385] Erdős and Rényi 1960, 22.

[386] Albert and Barabási Fig 6, 56; for a presentation of the theorems and proofs associated with the appearance of each category of subgraph see Erdős and Rényi 1960 (22-50).

[387] Watts and Strogatz 1998, 441; Albert and Barabási 2002, 49; Newman 2010, 262-266.

[388] For k edges and N nodes (Watts and Strogatz 1998, 440). The clustering coefficient is closely related to the sociological concept of the "fraction of transitive triples," and is measured by transitivity T (Wassermann and Faust 1994, 243).

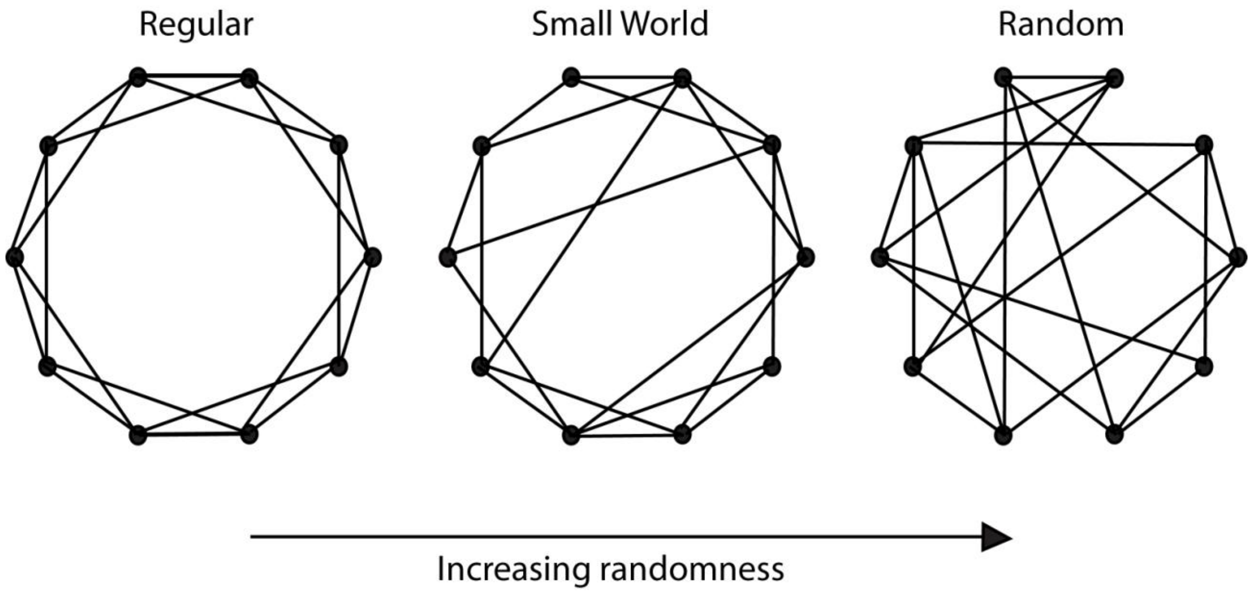

Figure 4-6. Representation of the Watts-Strogatz model, in which a regular ring lattice is gradually rewired through the random reconnection of edges, without altering the original node or edge quantities (after Watts and Strogatz 1998, 441 Fig. 1).

among the total neighbouring nodes (k_i).[389] The average of these node coefficients gives the clustering coefficient of the network as a whole. Continued analysis of clustering in random graph theory has identified a critical probability threshold (p_c) at which point isolated clusters amalgamate to form a giant cluster of the entire network. This phenomenon closely resembles the Percolation Theory discussed in mathematics and statistical mechanics.[390] Clustering is particularly important in the field of Social Network Analysis, as its properties impact dynamic processes; one such process of particular practical note is the spread of disease.[391]

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[389] Albert and Barabási 2002, 49. The clustering coefficient equation for the Watts-Strogatz small-world model can be calculated with a slightly altered equation found in Barrat and Weigt (2000). This approach corresponds to the measure known as the "fraction of transitive triples" (Wasserman and Faust 1994) in sociology.

[390] See Albert and Barabási 2002, 59-63 for a further discussion of percolation theory and its relationship to random graphs.

[391] Solomonoff and Rapoport 1951; Longini 1988; Sattenspiel and Simon 1988; Kareiva 1990; Murray 1991; Hess 1996a, 1996b; Kretzschmar and Morris 1996; Watts 1999. Watts explores the role of clustering in a number of sociological models, including games, cooperation, the Prisoner's Dilemma, cellular automata, and synchronization (Watts 1999).

Real World Networks

While the random graph was the initial and simplest representation of a complex network, it is now understood that networks are guided by organization principles and are not random.[392] Three prominent concepts have subsequently arisen for the representation of complex networks: Small-worlds, Clustering, and Scale-free Networks.[393] The Small-world network model was first developed by Duncan Watts and Steven Strogatz as a one-parameter model that lay between the ordered lattice and random network (see Figure 4-6). The model is conceptually rooted in real world social systems through which individuals link most commonly with their closest neighbours, yet maintain a limited number of longer distance connections (i.e., old friends that move away). This structure was originally identified by Stanley Milgram,[394] who conducted experiments on the hand-to-hand delivery trajectory of letters between two individuals across the planet. The results identified a maximum of six interpersonal steps necessary to connect any two individuals across the globe, a phenomenon famously termed "6 degrees of separation". In this model clusters of individuals are linked together through a select group of vertices, known as bridging nodes, which hold long distance ties.[395]

The algorithm of this model is constructed through the following steps: a ring lattice network of $N=20$ nodes is regularized with each node connecting to the four nearest neighbours; edges are randomly rewired with a probability p, introducing $pNK/2$ longer range edges; as $p \rightarrow 1$

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[392] Albert and Barabási 2002, 48.

[393] Albert and Barabási 2002, 48. These structures are related through the presence in both of well-connected hubs (Bentley 2003a, 20).

[394] 1967, 1992; Korte and Milgram 1970. The term itself (*Small-world Networks*) first appears in the work of Eugene Garfield in 1979.

[395] For the strength of ties and its impact on the connection of small world clusters, see Knappett 2011, 126 ff.; Granovetter 1973.

the graph approaches a random organization.[396] Small-world networks are centered on the notion that, regardless of the size of the network, each individual vertex has a relatively short path to all other vertices.[397] Statistically this is represented by a high clustering coefficient *C(p)* and a small average path length *l(p).* A well-known variant of the Watts-Strogatz (WS) model was proposed by Newman and Watts,[398] which varied from the WS model only in that new long-distance random edges were added to the ring lattice instead of rewiring original edges. The benefit of this alternative model is that it avoids the creation of isolated clusters, which can occur in the original.[399] An important facet of Small World networks, particularly as they apply to prehistory, is the informational imbalance that exists across scales, in that individuals' knowledge is limited to their local cluster, and does not include information on foreign networks or on the functioning of the system as a whole.[400]

In addition to small average path length, the defining characteristic of a small world network is the high clustering coefficient. The development of the Clustering approach seeks to reflect the tendency of networks to foster the development of cliques, capturing this inclination with the quantification of a clustering coefficient. Although this can model the degree of clustering within many real world networks, there is currently no defined predictive equation applicable to scale-free networks. Clusters, or subgroups, can be called 'communities,' and may be identified in a complex graph through a process known as 'cohesive blocking' or 'blockmodelling,' in which nodes within the network are removed to determine the effect on

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[396] Watts and Strogatz 1998.

[397] Albert and Barabási 2002, 48.

[398] 1999. The graph presented in Figure 4-6 presents the form of the original Watt-Strogatz model.

[399] Albert and Barabási 2002, 68.

[400] Brughmans 2013, 643-644. This problem has also been addressed in Kleinberg 2000; Watts et al. 2002.

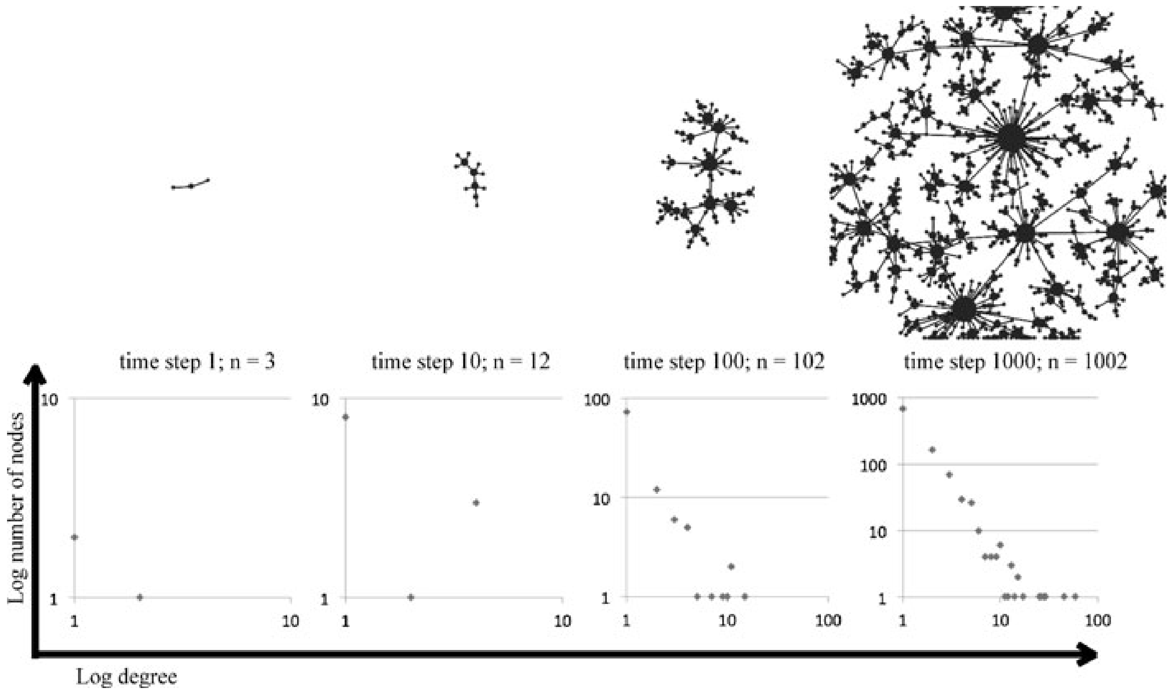

Figure 4-7. Scale-free network growth, beginning with *n = 3* nodes at time-step 1, and adding a node at each subsequent time-step (to 1000). New nodes are attached preferentially, resulting in a power-law node distribution (Brughmans 2013, Fig. 5).

community cohesiveness.[401] The clustering approach has been used to study a variety of phenomena detectable in a number of processes, including games, cooperation, the Prisoner's Dilemma, cellular automata, and synchronization.[402]

One of the most common types of real world network encountered is the Scale-free Network. Scale-free networks differ in that their degree distribution follows a power-law, in which select vertices have more connections than others. Rather than following a poisson distribution curve, the distribution of site connections is given as a power law $P(k) = k^{-y}$ (from the power-law distribution comes the term scale-free; see Figure 4-7).[403] Practically, this means

[401] Knappett 2011, 42.

[402] Albert and Barabási 2002, 91. See Watts 1999.

[403] The power law has a distribution that follows a straight line on a log-log graph of nodes to degree (visible on the bottom right graph of Figure 4-7). Convention in network analysis is to formulate the

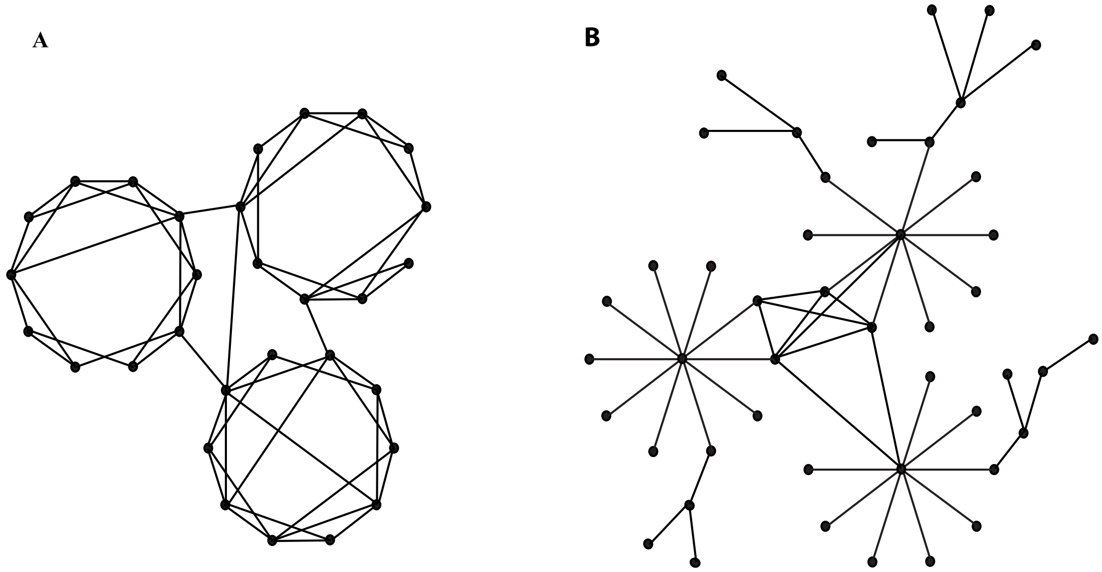

Figure 4-8. Schematic presentation of a Small-world (A) and a Scale-free (B) network. In the small-world network, there is a relatively short path length between any pair of nodes, as most vertices connecting groups in close proximity, while minimal longer-distance connections exist. In the scale-free network, the average node degree is quite low, while a small group of nodes are widely connected with a large number of edges.

that the majority of vertices have a consistently small degree, while a limited few have an extremely large number of edges.[404] Scale-free networks are based on the related phenomenon of small-world networks, and emerge in accordance with two conditions: network growth and preferential attachment (for a comparison of the two network structures, see Figure 4-8).[405] Unlike in random graphs, where new edges connect nodes at random (regardless of a node's degree), in a scale-free network, added nodes attach preferentially to well-connected established

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distributions of connections as $N = C/r^D$ where C is a constant, and the exponent D is placed in the denominator in order to generate a graph with a positive slope (Bentley 2003b, 29).

[404] As an example, imagine that there are 20 nodes and 75 edges in a scale-free network. While 15 of the nodes may have 2 edges each, and 2 others have 5 nodes, the remaining 3 nodes would split the 35 additional edges between them. This type of systemic inequality has a long history of examination in economics, from the 80/20 rule of Vilfredo Pareto, to the modern protest of the 99% against the wealth of the 1% (which led to the famous Occupy Movement of 2011-2012).

[405] Bentley 2003b, 27-29. In relation to the actor-film affiliation network presented above, it is logical to assume that a new actor (a new vertex in the network) will prefer to attach himself or herself to projects in which a well-connected—in this case famous—actor has been cast (Barabási and Albert 1999, 511).

vertices (a process similar to those of gravitational models).[406] New nodes introduced to the network will therefore attach with a probability P to an existing node i depending on the degree k_i of that node such that $P(k_i) = k_i / \Sigma k_i$.[407]

The dynamic properties of this model can be addressed through three different approaches: the Continuum approach, the Master-Equation approach, and the Rate-Equation approach.[408] The first of these approaches studies the time dependence of the degree k of a given node i , given as a function of the growth of new vertices multiplied by the probability of these new nodes attaching to the given node.[409] The Master-Equation approach instead studies the probability that the given node i introduced at time t_i has a degree k_i.[410] Finally, the Rate-Equation approach examines the average number of nodes with a degree k and time t.

As degree inequality expands, considerable barriers to entry for new vertices would theoretically be created, however new entrants persist. This phenomenon may be captured through the attribution of a "fitness value,"[411] which reflects the inherent competitive aspects of individual nodes, for which there is an intrinsic ability to compete for edges.[412] Growing

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406 See Evans et al. 2009. A well known early use of a Gravitational Model in Geography was by Terrell (1976) in his analysis of interaction between populations in Melanesia. In this study, edges reflected the frequency of interaction between groups as a function of population size and distance separating them.

407 Albert and Barabási 2002, 71.

408 For the equations associated with these methods and their proofs, see Albert and Barabási 2002 (71-4). To calculate the distribution of connections at any time, the variable $\lambda(t)$ is introduced to represent the amount of new agents introduced at any time t. For the full formula for this calculation, see Bentley 2003b, Appendix 2A (43-45).

409 The formula of the Continuum Approach for a given node I is: $(\delta k/\delta t = k/2t)$ (Barabási and Albert 1999).

410 This method was created by Dorogovtsev et al. (2000).

411 Bentley 2003b, 31.

412 Albert and Barabási 2002, 81. Bentley also argues that this issue can be addressed by introducing modularity to the network, maintaining both a scale-free structure and clustering by growing in a fashion

inequality may also be undercut by the propensity for 'prestige-bound transmission,' through which vertices frequently mimic or copy advantageous characteristics of powerful nodes.[413] Similarly, real world networks may contain social conditions that limit extreme inequality. The balance between exponential and chaotic inequality is maintained by a mechanism known as 'self-organized criticality,' functioning to balance the power law system and avoiding network stasis.[414] While scale-free networks are generally considered more robust than random networks—being better able to persevere in the event of random node failure—they exhibit high vulnerability through their dependence upon certain central nodes, fragmenting quickly when these nodes are targeted.[415]

NETWORK MEASURES

There are a variety of ways in which to measure the size, connectivity, and cohesion of a network. The overall size of the system can be characterized most simply by the quantity of nodes and edges. The configuration of these features also impacts the overall size of the network. One measurement for the size is the diameter, which is defined as the length of the longest geodesic path between any pair of nodes.[416] The density, also known as network cohesion,

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similar to a fractal tree (Bentley 2003b, 32).

[413] Bentley 2003b, 38.

[414] Bak 1996; Bak et al. 1987; Jensen 1998; Bentley and Maschner 1999, 2000, 2001. For this process, Bentley provides the analogy of a sandpile, which continually grows through a stream of additional grains, and avoids an unstable slope through frequent small sandslides (2003a, 16). These small 'self-organizing' restructuring acts avoid stasis by ensuring network growth at all levels—as an unorganized system would privilege the expansion of the powerful nodes to the extent that all other growth would be cannibalized.

[415] Albert and Barabási 2002, 86. For an examination of the effects of node removal in archaeological networks, see Knappett et al. 2008, 2011.

[416] Newman 2010, 140; Wasserman and Faust 1994, 111-112. A 'geodesic path' in a network is the

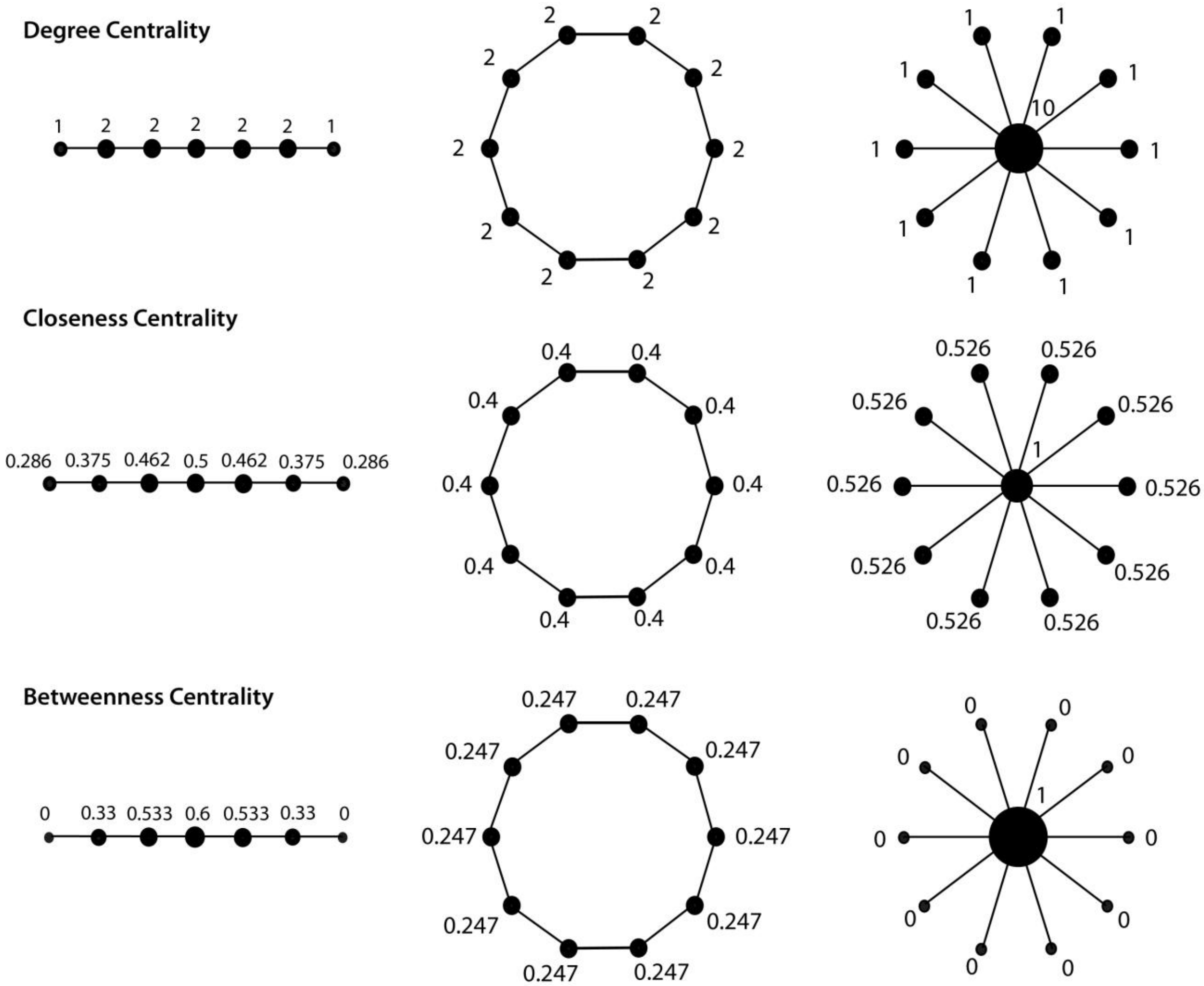

Figure 4-9, Degree, Closeness, and Betweenness centrality measures are demonstrated for three simple network structures.

quantifies the scale of connectivity of the network. It is calculated as the fraction of all potential nodes represented by the existing edges.[417] Structural assessment also includes the identification of independent graph 'components' (or subgraphs), which may be largely unconnected.[418]

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shortest route between pairs of nodes along network edges (Newman 2010, 136-140; de Nooy et al. 2005, 127).

[417] Newman 2010, 134-135; Wasserman and Faust 1994, 101-103.

[418] Newman 2010, 142; de Nooy et al. 2005, 68.

Popular metrics for the examination of individual nodes focus on centrality.

Centrality

Within different network constructions, centrality measures are often employed to analyze the role and importance of specific vertices within the network. Although there is a large range of centrality measures available for use,[419] three measures in particular are frequently employed: Degree Centrality, Closeness Centrality, and Betweenness Centrality (visualized in Figure 4-9). Degree centrality represents the number of relationships of an individual node, only taking into account its immediate neighbours, and is calculated as the sum of all attached edges. Closeness Centrality represents the ease with which a given node in a network can be reached by any other node, and is calculated as the total number of vertices divided by the sum of distances between the given node and all others.[420] In a directed network, it is important to distinguish between input, output, and all closeness centrality.[421] Betweenness Centrality represents the probability that a node will be passed by traffic travelling on the shortest route between any pair of nodes within the network.[422] It is calculated as the proportion of shortest paths between all other vertices that incorporate a given node.

To these primary three centrality measures we may add two less commonly employed but highly

[419] The number of existing network metrics is continuously growing, as new studies refine and rebrand certain techniques (related closeness measures include the Hubbell, Katz, Taylor, Stephenson, and Zelen methods).

[420] De Nooy et al. 2005, 127. This definition is similar to that of the Reach Centrality Measure, which documents the smallest number of edges needed to traverse to reach a certain node (Mizoguchi 2009, 20).

[421] Brughmans 2010, 293. The directedness of networks, when definable, is an important component in accurately measuring a node's degree, as high centrality values are often interpreted as evidence of network power or influence—a conclusion that would be dependent on the nature of network interaction.

[422] De Nooy et al. 2005, 131; Isasken 2008; Brughmans 2010, 280.

promising analytics available to archaeologists in studying networks: Bonacich Power Centrality and Eigenvector Centrality.[423] The Bonacich Power centrality measure accounts for the extent of connectedness of the neighbouring nodes to which the node in question is connected. This measure therefore incorporates the connectedness of the surrounding network and the power-drawn integration of a vertex within it. The Eigenvector Centrality measure captures the 'over-all' network patterns, providing in effect a summation of the other centrality measures.[424] This technique requires calculation through a complex factor analysis. Recent ceramic network analysis of the Late Hispanic US Southwest[425] has demonstrated the efficacy of the Eigenvector centrality measure in capturing accurately the complex flow processes manifested in the affiliation demonstrated in ceramic assemblages.[426]

A number of archaeological studies have found a connection between sites of high regional importance (such as district capitals) and high degree centrality—the proverbial 'all roads lead to Rome' adage.[427] In addition, this high degree centrality also appears to correspond to the greatest range of imported products among the corpus of available traded goods.[428] Although these measures are generally reflective of central authority or power within a network,

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[423] Bonacich 1972. Newly developed centrality measures include metrics capturing group centrality, as well as a measurement for centrality in two-mode networks (Everett and Borgatti 2005).

[424] Mizoguchi 2009, 21. Eigenvector centrality is however particularly sensitive to sampling procedure, as the values can vary widely when the network is incomplete (Gjesfjeld 2015, 191; this is particularly important to note when assessing archaeological networks, which are by nature incomplete). For further information on the stability of the various centrality measures, see Bonacich 1991; Borgatti et al. 2006; Costenbader and Valente 2003; Galaskiewicz 1991; Mills et al. 2013.

[425] Mills et al. 2013.

[426] Borgatti 2005, 62.

[427] Isasken 2008; Sugarman 2000.

[428] Sugarman 2000, 126.

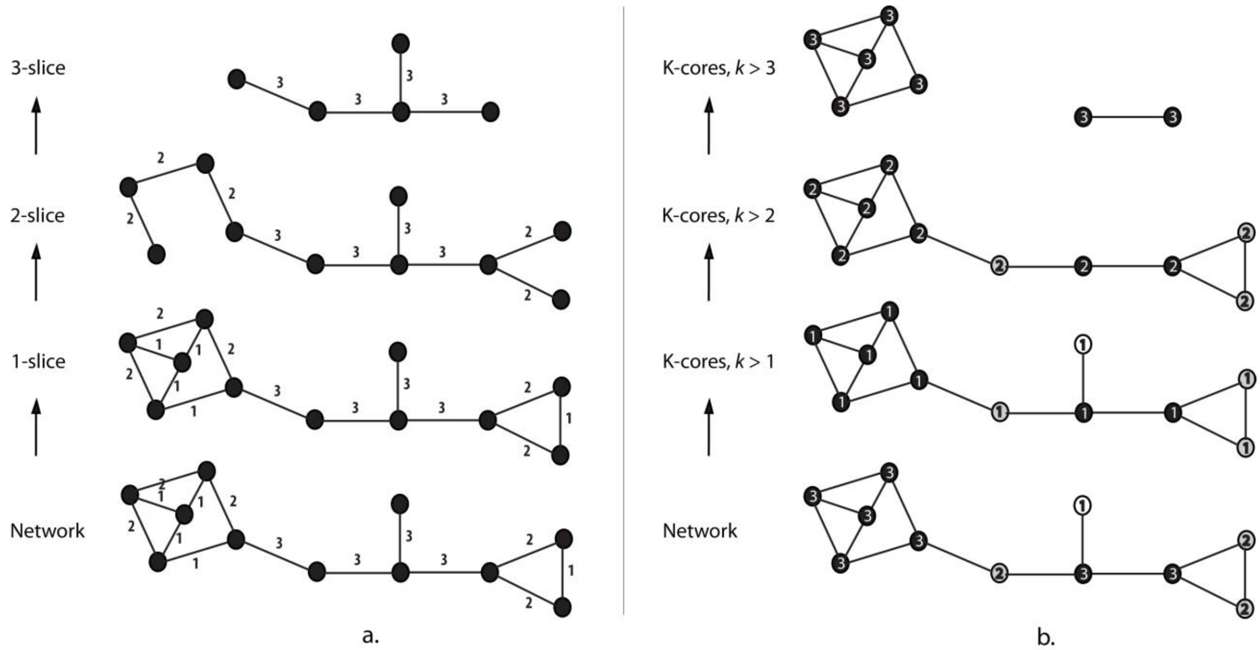

Figure 4-10. Schematic examples that demonstrate the use of M-Slices (a) and K-Cores (b) to segment related network components.

it is not always necessary that a single node rank high on all measures of centrality. For the purposes of identifying communities of exchange (potential Ports of Power or Gateway Communities), Betweenness, Bonacich, and Eigenvector centrality will be the most significant indicators.

Weighted Graphs and Optimization

Network models have the potential for accommodating significant diversity in node and linkage type through the adoption of flexible representations of each (such as varying node size or link thickness). In particular, social scientists emphasize the differentiation of dyadic links on both analytical and theoretical grounds.[429] In the simplest adaptation, weighted networks can be

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[429] Borgatti et al. 2009, 892; Christakis and Fowler 2007.

constructed for analytical purposes with edge weights valuing between 0 and 1.[430] Weighting can also be incorporated visually as a component of graphed relational space. This can be accomplished through the use of 'M-slices,' which graphs affiliation in a collapsed mode bipartite network (Figure 4-10a). Visually, the strength of a tie between vertices, as calculated by the quantity of co-present forms, is reflected in edge width. M-slices then constitute groups of nested vertices, for which the 'm' refers to the edge value of the group.[431] Alternatively, a 'K-cores' graph reflects the degree of a node, with the 'k' standing for the core's number (i.e., its degree) (Figure 4-10b).[432] High K-core values reflect a node that contains material that is also present at a high number of other nodes. K-cores in particular may therefore be reflective of distribution network similarity and reach. The combination of M-slice and K-core networks may be particularly effective in graphing ceramic ware distribution networks.[433]

The second approach to capturing weighted networks is through optimization. Optimization is particularly suited to the analysis of networks in which edges are positioned with the express purpose of minimizing transportation costs.[434] The selection of variables used to weight the edges of the graph are of paramount importance for the success of an optimization model. In an archaeological application, Tim Evans, Carl Knappett, and Ray Rivers employed a Gravitational Hamiltonian model for Imperfect Optimization to examine Middle Bronze Age

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[430] Albert and Barabási 2002, 92.

[431] Brughmans 2010, 289.

[432] This approach creates nested networks of vertices containing a minimum *k* number of connections. As shown in the graph, at a *k* of 1, all nodes are present that have values >1.

[433] Ibid.

[434] Albert and Barabási 2002, 78. The normalization mechanism by which this takes place on a global scale is poorly understood, as local efficiency relies on information that is absent for the network as a whole (Carlson and Doyle 1999; 2000).

Aegean networks before and after the Theran eruption.[435] In this Imperfectly Optimized Network, node size is a function of productive carrying capacity and relative importance, and link strength is calculated as a function of node size and inter-node distance.[436] This is expressed algorithmically as: $H = lE - kI + jP + mT$, where E represents the benefits of exchange; I the benefits from developing local resources, P the cost of sustaining local population, and T the cost of exchanging links.[437]

The Imperfect Optimization formula presented is a complex cost/benefit analysis of the alternative means of subsistence (trade versus production), and provides leeway for the social benefits of each.[438] Constraints and interactions become pressures within an energy landscape through which the entire system moves. By incorporating relative importance into node size calculation the model accommodates for the value of strategic location, and more accurately weighs the "power" of such smaller sites (which frequently include Gateway Communities).

4.2 Networks in Archaeology

The adoption of Social Network Analysis methods in the field of archaeology has a long history, commencing with the work of Cynthia Irwin-Williams in an examination of prehistoric trade.[439] Irwin-Williams describes in detail the variety of archaeological connections possible

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[435] Evans et al. 2009.

[436] Knappett et al. 2008 Fig. 2, 1014.

[437] Evans et al. 2009, 464.

[438] Ibid, 1013-4.

[439] Irwin-Williams 1977.

and the manner in which they may be measured, while exploring a variety of approaches to network construction.[440] The influence of network methods common in geography is visible in the study of Irwin-Williams, as well as the contemporary work of John Terrell in Melanesia, who explored the use of gravitational and equilibrium models in examining human migration, trade, and interaction.[441] Terrell concluded that a geographic approach to the examination of population groups most effectively accounted for the diversity present in the region. As documented by Collar et al., there has been a growing interest in network analysis methods within archaeology in the last half century, particularly in the last decade.[442]

There are two primary network forms employed in the field of archaeology: relational networks of co-presence to study artifact distribution, and geographic networks of distance representing trade or transportation routes.[443] Relational networks have been particularly popular in the analysis of ceramic distribution patterns and the economic exchange systems through which they were mobilized. Shared presence of an artifact, although not indicative of direct contact, reflects the integration of both sites within a shared network.[444] It is important to remember that such models, as minimizing structures, are incapable of rendering the full

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[440] In network construction, Irwin-Williams is influenced strongly by methods common in geography (including Haggett 1965; Haggett and Chorley 1969; Mitchell 1969). The author also employs structures developed by social network analysts, including the "first-order star" first described by Barnes (1972), as well as the delineation of zones of varying density (as adopted from Kapferer 1969).

[441] Terrell 1974, 1976, 1977. The role of social networks in human migration has been expanded to examine the role of networks and mobility in population stability and the avoidance of regional depopulation (Borck et al. 2015).

[442] Collar et al. 2015. For a graphic representation of the number of archaeological publications employing network analysis, see fig. 2, page 3.

[443] Brughmans 2010.

[444] Sindbæk 2007b, 66.

complexity of past social systems,[445] and that network connections in archaeology are significantly more difficult to identify.[446] Yet it is also true that 'wrong models' can still be useful.[447]

The most common application of network models in archaeology is the examination of object distribution. R. Alexander Bentley and Stephen Shennans assessed the distribution of decorated incised bowls in the Merzbach River region during the period of 5300-4850 B.C.E. to plot population spread and network development.[448] The importance of logical and precise chronological periodization was demonstrated by this study, as network growth was not continuous throughout this entire period, requiring the need for the construction of generally consistent horizons of economic and social activity.[449] In a similar fashion, Koji Mizoguchi studied the emergence of centralized hierarchy in Japan during the initial Kofun Period through ceramic distribution patterns, employing six different centrality measures.[450] Through this analysis Mizoguchi concluded that the topological structure of a social network has a significant impact on the emergence of hierarchisation, leading to an asymmetrical interdependence among

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[445] Mitchell 2009, 255. This statement refers in particular to the assumption in many early models that nodes and edges within a network were of equal type and strength, however further developments in methodology have allowed for the incorporation of more entity features and attributes.

[446] Bentley 2003a, 19.

[447] This statement echoes that of the well-known mathematician and statistician George E. P. Box (Box and Draper 1987, 424). It has also been demonstrated through recent social network analytics that simplified and undirected approximations of networks still effectively retain key structural information (Golitiko and Feinman 2015, 213).

[448] Bentley and Shennans 2003.

[449] Bentley and Shennans 2003, 475. The results included a mixture of log-normal distributions (ibid.).

[450] Mizoguchi 2009. The types of centrality incorporated in this analysis were degree centrality, reach centrality, Bonacich power centrality, closeness centrality, Eigenvector centrality, and betweenness centrality (ibid., 19).

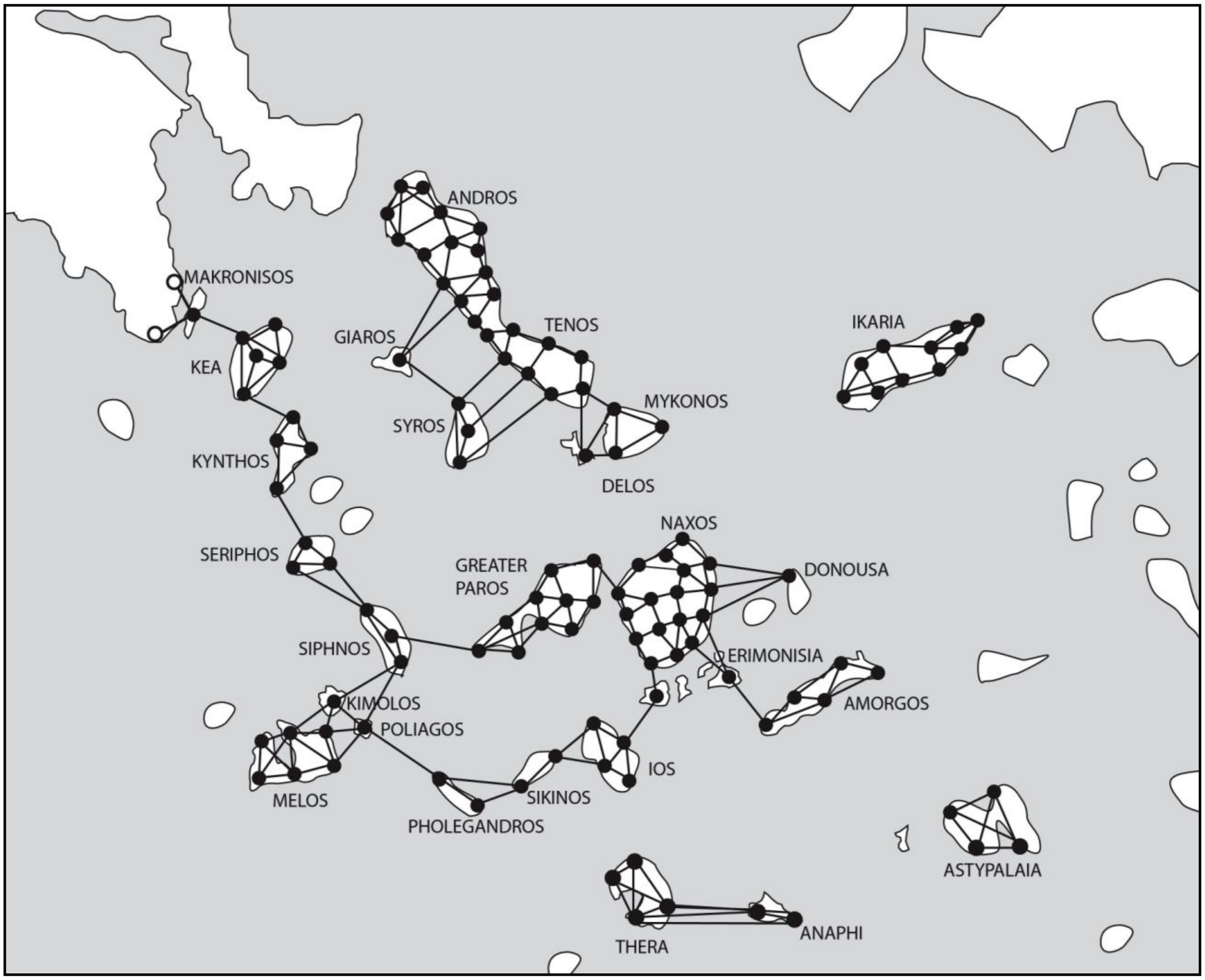

Figure 4-11. Results of Proximal Point Analysis of connections in the Cyclades during the Early Bronze Age (after Broodbank 2000, fig. 114, 339).

polities.[451] The efficacy of co-presence networks as a means of reconstructing distribution systems was also demonstrated by Tom Brughmans in his examination of the spread of Roman tableware in the eastern Roman empire. The co-presence network was then evaluated against a geographical network of inter-site distances as a proxy for assessing hypotheses about lowest-

[451] Mizoguchi then compares these results with the role of agency within power structure development, from the scale of the individual to that of the group (2009, 14-15).

cost trade routes.[452]

Methodologies for transportation network construction were originally based primarily on inter-node distances, with centrality directly corresponding to network importance and power. This is most clearly represented by the Proximal Point Analysis method, in which known sites are mapped and linked to the three closest neighbouring sites; strategically located centers then emerge through this process.[453] This method was employed by Cyprian Broodbank et al. to study prehistoric island interactions in the Aegean (Figure 4-11).[454] Inter-site distances were generally calculated by direct point-to-point routes, which neglect the realities of transportation conditions. This problem persists in the more developed and nuanced network methodologies, necessitating the expansion of the distance equation to include variables such as rates of travel, wind patterns, geographic boundaries, intangible boundaries and risk. The inclusion of these variables can greatly improve the precision of locationally determined network links. This approach, however, is weakened by the overly deterministic and locational approach constructed on the fallacy that sites necessarily link to the closest neighbours.[455] Instead it is important to incorporate more structuralist concerns in the reconstruction of trade routes and relationships. This will be

[452] Brughmans 2010. For a ceramic network analysis of hunter-gatherer groups, see Gjesfjeld 2015.

[453] Broodbank 2000. A similar PPA approach was used by Sindbæk (2007a) to study the emergence of Viking towns. PPA is also linked to “Maximum Distance Networks,” which form geographic radial zones of influence, approximating the region of integration for individual nodes (Mol et al. 2015, 281; Evans et al. 2012)

[454] Broodbank 2000. Proximal point analysis developed from earlier spatial interpretive systems such as Thiessen Polygons or Central Place Theory.

[455] Knappett et al. 2008, 2011. Similar criticisms can be made of the popular ‘Nearest-Neighbour’ analysis (Clark and Evans 1954) commonly used in survey and spatial analysis, which has a history of use in Geography and Ecology. A locational bias can also be argued for dendritic models of object distribution, as object mobilization pathways are conceptualized in geographic terms (for an archaeological example, see Sugarman 2000).

particularly important in areas of expansion, in which settlement chains may be constructed with a predisposition for linked exchange. Further considerations such as kinship and the presence of longstanding animosity or hostility may greatly affect patterns of export, while specifics of local demand impact importation choices.

More advanced modeling capabilities have now facilitated the incorporation of surface distance, horizontal-cost factors, and vertical-cost factors into transportation networks, allowing for more robust least-cost path estimates. These include the hiker function (developed by Tobler in 1993), and the Pathdistance tool in ArcGIS. This type of more comprehensive analysis focusing on 'transportation friction' can be found in the work of Leif Isasken on Roman transportation networks in Baetica.[456] Transportation friction, as defined by Isasken, includes expanded features associated with cost such as the environment, transportation technology (both static and dynamic), cultural systems, and the load to be transported.[457] Social Network Analysis principles can also be adopted into the methodology for analyzing transportation networks, as demonstrated by Shawn Graham. Graham examined Roman Antonine-period itineraries to assess how geographical space was related to perceptions of space as reflected through the network presented to the reader or traveller.[458]

Transportation networks, as argued by David Carballo and Thomas Pluckhahn, have a significant role in political evolution due to their importance in channeling human resources and exchanges.[459] This conclusion was reached through GIS and settlement analysis of transportation

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[456] Isasken 2008.

[457] Static technology includes extant infrastructure, such as roads or jetties, while dynamic technology includes the means of transport, including ships, barges, and beasts of burden.

[458] Graham 2006.

[459] Carballo and Pluckhahn 2007, 609.

corridors in highland central Mexican northern Tlaxcala.[460] The authors were able to identify an administrative restructuring of the region in association with the expansion of Teotihuacan through the reorganization of settlement location and hierarchy.[461] These results corroborated those obtained by David Jenkins in his analysis of settlement locational advantage relative to administrative centers, Inka road networks, and production and storage facilities.[462]

In addition to transportation routes, geographic networks have also been used to explore inter-site visibility, and the prominence such visiblity played in site location selection along transportation networks in Roman Spain.[463] Exponential Random Graph Models (ERGMs) were employed to generate projected site patterns as governed by the hypothesized visibility goals, which were then compared to observed network structures, determining that visibility played a greater role in site locations during the Iberian periods than in the later Roman era.[464]

Although generally representative of macro regional exchange, network models can also be employed to depict localized interaction systems at the site scale. In a localized context, a network can be understood as consisting of "a group of individual agents who share informed norms or values beyond those necessary for ordinary market transactions."[465] This approach

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[460] Travel costs were calculated through the hiker function developed by Tobler (1993) and the Pathdistance tool in ArcInfo, by which the authors were able to construct surfaces that represented time of travel in hours, as well as the highest efficiency pathways (Carballo and Pluckhahn 2007, 612; the methods employed were similar in part to Jennings and Craig 2001). Noted weaknesses in the model include the omission of physiographic features (such as waterways and vegetation), and potential errors in data collection (see Conolly and Lake 2006, 221-224; Wheatley and Gillings 2002, 154-158).

[461] Carballo and Pluckhahn 2007, 621-626.

[462] Jenkins 2001.

[463] Brughmans et al. 2015.

[464] Brughmans et al. 2015, 61.

[465] Fukuyama 1999, 199. In particular, micro-scale network analysis focuses on interaction and communication, borrowing heavily on Bourdieu's notion of 'habitus' and Giddens' 'structuration' (Knappett 2011, 61-63). The interaction between households within a community is deemed the meso-

allows for the reconstruction of modalities of exchange, highlighting the social value of interaction. A micro-scale network model was employed by Kevin McGeough in his assessment of economic structures at Ugarit,[466] in which exchange and interaction at the local scale were presented as larger components of a multivariate system, with interaction examined at nodes of contact.[467] The network model from McGeough's study incorporated the flexibility to reflect the nuances posited by his substantivist approach, without being constrained by a rigid top-down reconstruction. Based on textual and material evidence, McGeough determined that the vast majority of productive activity at Ugarit was decentralized, including the production and surplus exchange of goods. He also demonstrated that numerous agents were active in production and trade, including private capitalists, elite families and royal ambassadors. Combining this type of micro-scale approach with larger network systems has the potential to cross scalar divisions, creating a more representative model of ancient economic activity.[468]

While many archaeological applications privilege the tangible—either material or geographic structures and pathways—select studies have preserved a social network approach. This is particularly true of analyses of competitive feasting and the role it played in the generation of wealth inequality (particularly Michael Dietler and Brian Hayden).[469] Hayden

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scale by Knappett (2011, 98), however site level interaction is considered here as remaining part of the micro-scale.

[466] McGeough 2007.

[467] McGeough 2007, 350-363, especially fig 9.1, 353.

[468] In Johnston (forthcoming) I also demonstrate the efficacy of network models as a method for examining the presence of marketplace exchange, by examining the distribution of multiple import objects across households of varying wealth at the site of Ugarit. The advantages of a network model were most evident in the visualizing of object distributions, coalescing into clear and compelling graphs from the noise created in mapping the presence of large quantities of artifacts.

[469] Dietler 1996, 95; Dietler and Hayden 2001; Hayden 1995, 1998.

further argued that the act of congregating during feasting served to forge connections between neighbouring groups—effectively expanding the size of the economy. R. Alexander Bentley and Herbert Maschner employed a scale-free network structure to examine the relationship between household size and competition in early complex societies of North Pacific hunter-gatherers.[470] The assumption underlying this analysis was that a larger house corresponded to more wealth or power. The results demonstrated that there existed a large number of small and medium-sized houses, and comparatively few large houses, distributed in accordance with a power law.[471]

Similarly, affiliation—or the spread of influence across networks as reflected in stylistic adoption and emulation—can also be analyzed through network methodologies. The importance of information sharing through network exchange was identified early on by Terrell in his study *Geographic Systems and Human Diversity in the North Solomons (1977).* The concept of network affiliation was also adopted by Irad Malkin to assess Greek colonization during the Archaic Period, as well as the development of a unified essence of "Greek Civilization".[472] Through a network of information sharing, regional identities among Hellenic colonists are suggested to have developed within the 'Middle Ground,' which were spaces such as emporia or gateway communities that facilitated the integration of local and settler cultures. Malkin argued that as new regional identities were formed, the migratory spread of Greek culture created the

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[470] Bentley and Maschner 2003.

[471] Bentley and Maschner 2003, 53-58. Their model had an exponent slope of -2.49, or 0.978 on a log-log plot (55).

[472] Malkin 2006, 2011. Although Malkin employs network concepts and structures in his analysis, formal quantitative network analysis is not included (for potential problems associated with the adoption of network terminology and concepts without the use of network analysis or network data, see Brughmans 2014, 273-275).

framework within which a collective Greed identity was crystallized and articulated.[473]

A similar approach, adopting tenets of Social Network Analysis, has been employed by Carl Knappett to examine the dynamic relationship between affiliation and exchange networks in the Middle Bronze Age Aegean.[474] Knappett was interested in the role that internal development played in the sudden rapid increase of adoption and imitation of Minoan styles at Akrotiri and Miletus after over two centuries of contact.[475] The affiliation network constructed by Knappett and various collaborators determined that cultural influence and information sharing was directed, with information flowing outwards from Crete along the network, with little reflux.[476]

Influence is, however, harder to track than material goods. Directionality and direct transmission can be challenging to prove for both ideas and objects, with the latter only fully traceable if a precise origin and direct link between nodes can be identified. When such details are inaccessibly archaeologically, network affiliation becomes the primary goal of quantitative analysis, with sites assessed according to their shared inclusion within an overall system. Network affiliation through shared ceramic material will form the analysis of the following chapters.

[473] Malkin 2011, 205-213.

[474] Knappett and Nikolakopoulou 2005; Knappett et al. 2008; Evans et al. 2009; Knappett 2011; Knappett et al. 2011.

[475] Knappett and Nikolakopoulou 2005, especially 181 ff.

[476] Ibid.

SECTION III – CERAMIC DATA

5. AEGEAN POTTERY

5.1 Wares and Types

The first section of this chapter will briefly introduce the main ware types and forms of Mycenaean pottery produced during the Late Bronze Age. The presentation will be primarily chronological, while within this structure wares will be arranged functionally. The taxonomy employed for organization is the common Furumark Shape system (using the FS numbers).[477] Popular decorative techniques will also be surveyed following Furumark's classification system (with associated Furumark Motif or 'FM' numbers). Following this overview, the frequency of export for each ware will be discussed as a component of both the traded wares, as well as the complete corpus of Aegean pottery. The distribution of Mycenaean ceramics through the Eastern Mediterranean will be addressed with consideration for both function and dispositional context.

For the subsequent analysis Mycenaean LH IIIC wares will not be included. The decision to omit this data is primarily a function of the difficulty associated with accurately dating or identifying the circumstances of manufacture for individual vessels. By the end of the LB IIB in the Levant, and the LC IIC in Cyprus, local Mycenaean imitation wares were being produced in significant quantities at sites off the mainland.[478] Regional styles emerged as the Argolid monopoly eased.[479] Recent petrographic and elemental analysis has confirmed that large

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[477] For a historiographic discussion of this system and its associated problems, see Mountjoy 1986, 7; 1993, 1; Van Wijngaarden 1999; Sherratt 2011.

[478] Jones 1986; Kling 1987, 103, 106; 1989, 130, 170-3; Iacovou, 1988; Sherratt 1991, 191-193; Cadogan 1993, 95; 2005; Killebrew 1998, 162. Earlier evidence of the foreign manufacture of Mycenaean ceramics is present at Miletus, where vessels produced in local fabrics occur as early as LH IIIA, however these are more likely the result of a migrant Mycenaean population in the town, rather than the large scale production of imitation wares (Gödecken 1988, 311; Niemeier 1997, 347; 1998, 30; Van Wijngaarden 2008a, 128).

[479] Jones 1986, 460. Examples include the Close style, the Granary Style, Octopus Style, and the Rude

numbers of Levantine LH IIIC pots were in fact Cypriot products.[480] Although imitation wares were certainly playing an important role in satisfying import demands, the mechanics of their production and distribution may diverge sharply from those posited for the Aegean wares of the preceding periods.[481] Furthermore, this period, following the destruction of the Mycenaean palaces, saw a large eastward migrations of Aegean populations, who both brought wares along, as well as produced Aegean vessels locally in the eastern Mediterranean upon arrival. Unpacking these complexities has filled numerous volumes to date,[482] and continues to form a crucial component of the decipherment of the important Late Bronze to Early Iron Age transition across the Mediterranean.

Clay figurines have also been excluded from this analysis, despite their popularity in the eastern Mediterranean during the LH III period.[483] As a traded good they form a different

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Style, which originated from workshops throughout the Aegean and Mediterranean (i.e., the Rude/Pastoral Style, which was a Cypriot product [Sherratt 1980, 196; Vermeule and Karageorghis 1982, 59-67; Sherratt and Crouwel 1987, 341-342; Cadogan 2005, 320]).

[480] Balensi 1981; Gunneweg and Perlman 1994; Hankey 1993, 104; Leonard et al. 1993, 119; Killebrew 1998, 162; D'Agata et al. 2005. An example of a Cypriot produced LH IIIC vessel from the Levant is the FS 176 stirrup jar from Akko, which was produced in the Paphos region (French 2004, 17). A new study by Yasur Landau and Goren (2004) has suggested that a LH IIIC amphora fragment from Aphek may have been manufactured on the Akko plain, sent to Cyprus where it was filled and inscribed with a Cypro-Minoan symbol, to be returned to the Levant and deposited at Aphek.

[481] This will become particularly important for the examination of the role of Cyprus as a facilitator of Aegean ware distribution in the Levant through the Late Bronze-Early Iron Age transition. Certainly, the proposed role of Cyprus in distributing Late Helladic IIIA-B ceramics is identified as an important contributing factor in the development of the LC IIIC imitation ware production (D'Agata et al. 2005, 378).

[482] See for example French 1969; Rutter 1977; Schachermeyr 1976; S. Sherratt 1981, 1982, 1991; Deger-Jalkottzy 1994; T. Dothan 1982; Killebrew 1998; Crielaard et al. 1999; D'Agata 1999; S. Morris 2003; Mountjoy 2005, 2009, 2010; Deger-Jalkotzy and Bächle 2009; Yasur-Landau 2010; Killebrew and Lehmann eds. 2013.

[483] Furumark's initial classification included three female forms, categorized by their physical resemblance to the Greek letters Phi (Φ), Tau (Τ), and Psi (Ψ; Furumark 1941b, 86-89; refined by French 1971, 1981). Zoomorphic terracotta figurines were equally popular, with Leonard recording 73 zoomorphic and 65 female figurines from the Levant (1994, 137-141). The bovine was the dominant form,

material class, with potentially distinct consumption patterns in relation to their perceived functionality.[484] French argues that, unlike other Mycenaean pottery, the narrow distribution of figurines, along with their lack of intrinsic value to native populations, suggests that "actual Mycenaean merchants, settlers, or consuls must be imagined at the centers which had figurines."[485] This assessment is directed at the larger centers with multiple examples (such as Ras Shamra or Tell Abu Hawam), while acknowledging that solitary finds scattered across smaller sites may be understood as reflecting the "mere curiosities of some local traveller."[486] Even if associated human migration is not assumed for all cases, foreign demand and subsequent consumption patterns of figurines—particularly as objects with ritual association—may result in a different pattern of distribution that could disguise the trade patterns examined in this study.[487] Although beyond the scope of this project, the examination of figurines will certainly add a valuable and informative dimension to the study of Aegean goods distribution within the eastern Mediterranean, as will the incorporation of different material classes of traded goods such as

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with limited equid, oxen, and chariot examples were also recorded, most of which were found at Rash Shamra or Minet el-Beida. One oxen figurine is recorded from Minet el-Beida (Leonard 1994, cat. no. 2287; French 1971, 166), while four equid examples are noted, two each from Ras Shamra and Minet el-Beida (Leonard 1994, cat. nos. 2288-2291; see J.-C. and L. Courtois 1978, 351, and Schaeffer 1949, 146, 230). Chariot figurines were more common, with eleven examples recorded from Ras Shamra, Minet el-Beida, Sarepta, and Byblos (see Leonard 1994, cat. nos. 2292-2302).

[484] Mycenaean figurines are considered more popular in the Levant than in Cyprus (Hankey 1993, 112). Considerable quantities of figurines have been recovered from Ras Shamra (with the greatest volume at 34 examples), Tell Sukas, and Tell Abu Hawam; while scattered finds were also recorded at Minet el-Beida, Tyre, Byblos, Sidon, Sarepta, Kamid el-Loz, Tell Kazel, Hazor, Beth Shemesh, Ashdod, Megiddo, Beth Shean, Lachish, Tell Dan, Tell Ta'annek, and Tell el-Hesi (Gilmour 1992, 118; Leonard 1994, 137-141; Furumark 1944, 121).

[485] French 1971, 175. For an assessment of figurines as diagnostic or emblematic markers of Mycenaean identity in the archaeological record, see Feuer 2011, especially 513-517.

[486] Ibid.

[487] For the religious role of Aegean figurines, particularly in the latter LH IIIC and Early Iron Age periods, see French 1971; also Brug 1985; Mazar 1980.

ivory or glass objects.

LH I

Pottery of the LH I period developed largely from a well-established Middle Helladic ceramic tradition, while incorporating a number of shapes and decorative motifs from Cretan pottery. Other wares popular during this period, including matte painted, polychrome matte painted, Grey Minyan, and Yellow Minyan, are all derivatives of MH wares.[488] Fabrics are generally buff or greenish clay, slipped, and decorated with lustrous black, brown, red, or orange paint. The LH I pottery is the first group of Mycenaean ceramics, and is most commonly found alongside the other wares of this period.[489] As there is considerable continuity in other wares (e.g. Grey Minyan Ware) between the Middle and Late Bronze Age, LH I ceramics are often used as the diagnostic chronological marker for context dating, as they reflect a considerable amount of experimentation by potters in form and decoration.[490] Although Mycenaean ceramics have come from both domestic and funerary contexts, the shaft, cist, and chamber tombs have provided the bulk of examples.[491]

The range of shapes is relatively limited, with a number of common mainland types continuing to be produced in other wares. This is particularly true of larger shapes, including the

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[488] Unpainted pottery from the Middle Helladic period generally belongs to Grey Minyan Ware (grey fabric, grey surface), or Yellow Minyan Ware (yellow to light red fabric, yellow-buff to reddish-yellow surface) (Mountjoy 1993, 35-38).

[489] Dickinson 1974, 118.

[490] Lolos 1985, 221; Mountjoy 1986, 9.

[491] Mountjoy 1993, 32.

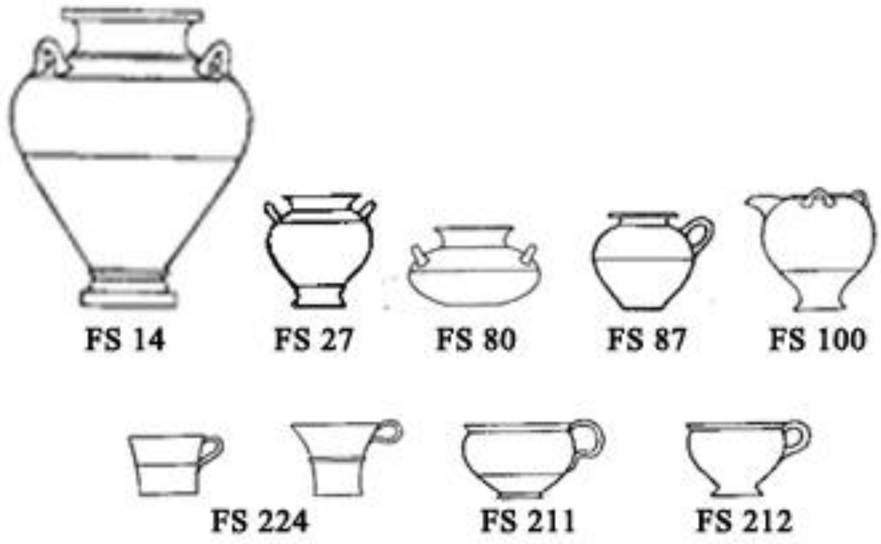

Figure 5-1. Common shapes from the Late Helladic I Period with their Furumark Shapes (adapted from Furumark 1941a).

hydria and amphora, which continued to be ornamented with matte paint.[492] There are six common shapes from the LH I period: piriform jar, hole-mouthed jar, alabastron, squat jug, Vapheio cup, and globular cup (Figure 5-1). These vessels are generally small, and are somewhat irregular despite being wheelmade.[493] The piriform jar (FS 27) and the squat jug (FS 87) are closely related to the MH antecedents, while the hole-mouthed jar (FS 100) was a Cretan shape imported to the mainland repertory during the late Middle Helladic.[494] These shapes are further developed through the adoption of MM and MC features such as neck, handle, or body types.[495] Examples include the more piriform body of the LH I hole-mouthed jar, or the smaller neck diameter of the LH I squat jug. The rounded alabastron (FS 80) is believed to have developed

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[492] Mountjoy 1986, 9.

[493] LH I pottery is described by Dickinson as an "essentially domestic style" due to the small size of the vessels (1974, 113).

[494] Dickinson 1977, 22.

[495] Mountjoy 1993, 33.

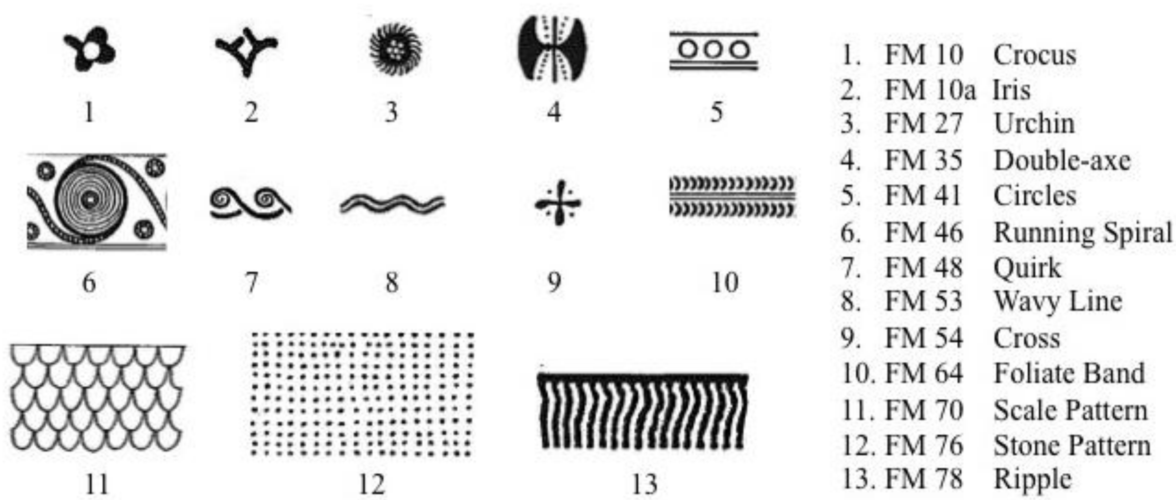

Figure 5-2. Common Late Helladic I ceramic motifs (at various scales). Multiple types are common for the Foliate Band, including naturalistic, stylized, combination, and vertical (adapted from Furumark 1941a).

from the piriform jar, and is also closely related to the squat jug.[496] The alabastron gradually becomes taller and less globular, developing into the straight-sided alabastron (FS 89-90). The semiglobular (FS 211-212) and Vapheio cups (FS 224) are the only common open shapes during the LH I, and are similarly derived from Cretan shapes adopted on the mainland during the Middle Helladic, and are manufactured in both metal and clay.[497] The Vapheio cup has three types; Type I is extremely rare, while Types II and III can be differentiated by the more pronounced midrib and corresponding interior hollow of the former, or the greater flare of the body and smaller, less beveled base of the latter.[498] There are also limited examples of the larger jar FS 14 (including one from Kakovatos)[499], which becomes popular at the end of LH I,

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[496] Furumark 1941a, 40-42; Dickinson 1974, 114.

[497] Lolos 1985, 228; Mountjoy 1993, 34.

[498] Mountjoy 1986, 15. The tripartite classification is based on the stratigraphy of types found at Kythera (Coldstream 1978, 393, 395, fig. 6).

[499] Müller (1909, pl. 23.1); see Mountjoy (1986, 11) for discussion.

extending into LH IIA.

The range of painted motifs common in this period is also limited, with decoration frequently consisting of painted bands. Ornate decoration is more commonly found on the larger vessels, and includes variations of the spiral (FM 46; Tangent, Running, or Linked), the foliate band (FM 64), and bands of horizontal motifs such as the crocus (FM 10), urchin (FM 27), cross (FM 54), wavy line (FM 53), quirk (FM 48), and linked or isolated circles (FM 41) (see Figure 5-2). Other decoration attested on LHI Mycenaean pottery include the double-axe (FM 35), scale pattern (FM 70), stone pattern (FM 76), and ripple pattern (FM 78). Interior slip is not common in this period, creating colour differential between interior and exterior painted decoration.[500] External motifs are placed on the shoulder or belly of vessels, with the exception of the large jar, hole-mouthed jar, Type III Vapheio cup, and straight-sided cup, where it may reach to the lower body.[501] Decoration of LH I vessels commonly incorporates added white paint, particularly for exterior bands, or as dotted or rosette ornamentation in rows or at the center of spirals.[502]

LH IIA

The Mycenaean pottery of the LH IIA period represents a significant expansion in forms and decoration as a result of considerable influence from Minoan ceramics, particularly the Palatial Style of the LM IB.[503] These Minoan-inspired forms, as well as Cretan imports, form the

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[500] Dickinson 1974, 115.

[501] Mountjoy 1986, 9.

[502] Dickinson 1974, 115.

[503] The central role attributed by Furumark to Minoan LM IB vessels in the development of LH IIA pottery (1941a, 484-6) is refuted by Dickinson (1972, 108-109), who argues for a largely mainland trajectory of this ware, as seen in the development of the jar and other common shapes.

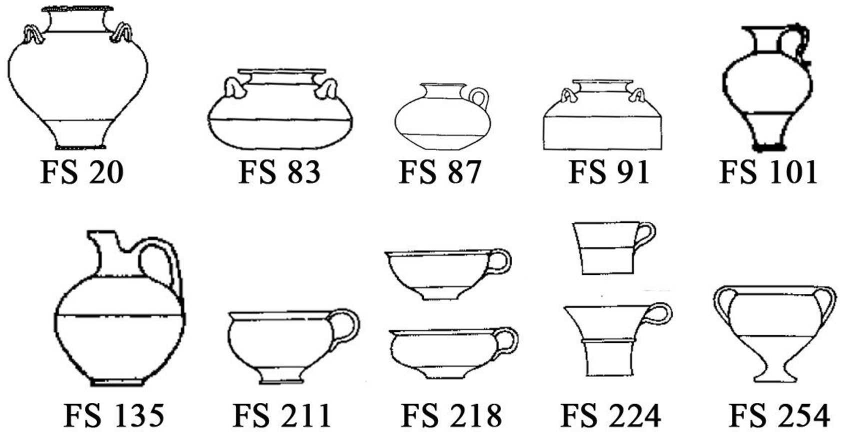

Figure 5-3. The Domestic Group of Late Helladic IIA pottery shapes (adapted from Furumark 1941a).

bulk of the so-called 'palatial shapes,' while 'domestic shapes' are comprised largely of existing LH I types.[504] Metallic vessels are also a source of influence, with features such as the neck ring, base ring, laid-on handle, and central handle groove adopted and reproduced in clay.[505] LH IIA ceramics were produced widely across the Peloponnese and south central Greece, in sites throughout Attica, Boeotia, Euboea, and Phocis.[506] Burial contexts are again dominant in this period, largely as a function of considerable LH IIB rebuilding throughout settlements.[507] Late Helladic ceramics also form a larger component of burial assemblages than in previous periods.

The domestic class includes the shapes common to the LH I period, with some developments (see Figure 5-3). The piriform jar (FS 20, 21) and rounded alabastron (FS 81) are now commonly found with three handles instead of two, while both smaller and taller alabastra

[504] Dickinson 1972, 104; 1974, 26-7.

[505] Mountjoy 1993, 38.

[506] Mountjoy 1993, 10.

[507] Mountjoy 1993, 9.

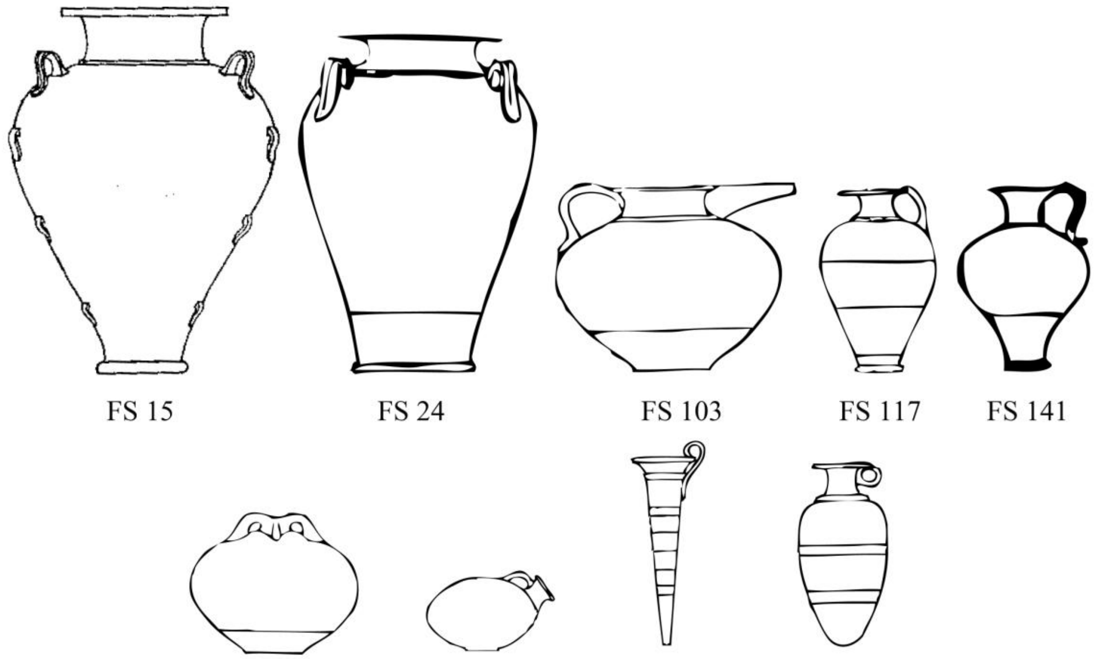

Figure 5-4. The Palatial Group of Late Helladic IIA shapes (adapted from Furumark 1941a).

(FS 83 and FS 81, tall) also appear in limited quantities.[508] The straight-sided alabastron (FS 91), squat jug (FS 87), hole-mouthed jar (FS 101) also continue into the LH IIA. The two open shapes from LH I, the Vapheio and semiglobular cup (FS 224 and FS 211), are also continued. The Vapheio cup Type II remains largely unchanged, while the Type III central rib is shallow, and the handle ends above the rib rather than at it.[509] Examples of the LH IIA semiglobular cup are found with both splayed and raised bases, rather than the flat bases of LH I. The shallower version of the semiglobular cup (FS 218) also develops.[510] Two new shapes are added to this

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[508] Dickinson originally believed the tall alabastron (FS 81) to be imported from Crete (1972, 109), however examples unearthed at Ayia Irini (Kea) and Phylakopi appear to have been made on the mainland (Cummer and Schofield 1984, 101.1143, 125.1547; Mountjoy et al. 1978, 163). For discussion see Mountjoy 1986, 24.

[509] Mountjoy 1986, 33-34.

[510] To these types Mountjoy (1986, 33) would also add the bell cup (FS 221), which is generally seen as a

domestic group: the jug with a cutaway neck (FS 131, 135) and the goblet (FS 254). The jug with the cutaway neck has both tall (FS 131) and short versions (FS 135), with piriform and globular bodies respectively. This shape derives from the Middle Helladic period.[511] Similarly Middle Helladic in origin is the goblet, which continued in production during the LH I in Grey and Yellow Minyan wares, and becomes widespread in the LH IIA, gradually taking over for the semiglobular cup.

The palatial class of LH IIA pottery bears significant influence from Cretan shapes, as this corresponds to the height of the Neopalatial Period (LMIB). Many examples, particularly those discovered on foreign soil are often only identifiable to the level of the chronological period LM IB/LH IIA. This group introduces a number of new shapes, including the stirrup jar (FS 169), which becomes a central and representative shape of Mycenaean ceramics, particularly within the corpus of exported vessels (see Figure 5-4). This shape derives directly from the MM III examples, which may itself have evolved from the piriform jar.[512] The large jar, which emerged near the end of LH I, is common during the LH IIA. There are two variations, one being tall with a conical or piriform shape (FS 15), while the second (FS 24) is a smaller, conical version. This shape is distinguishable from the piriform jar by the greater thickness of the vessel wall.[513] There are metallic influences seen as well, as on the bridge-spouted jug (FS 103), which differs from earlier examples by the neck ring. A similar development is seen in the beaked jug

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Minoan import, however it is included in the mainland repertory based on the fabric and the mainland style decoration. Elemental analysis of bell cups from Kokla and Prosymna demonstrated that some LM IB supposed imports were in fact manufactured in local fabrics (Jones 1993, 79).

[511] Mountjoy 1993, 40. For a MH mainland example, see Goldman 1931, 158, fig. 220.2.

[512] Mountjoy 1993, 42.

[513] Mountjoy 1986, 22.

(FS 141), which, in addition to a taller form, adds a neck-ring to the LM I examples.[514] Metallic influence is also seen in the laid-on handle and the imitation rivets of the ewer (FS 117), however the contemporaneity of the appearance of the metal vessels suggests an earlier stone antecedent from the MM III for this form.[515] An LH IIA or LH IIB date may also be assigned to the appearance of the askos (FS 195), with limited examples coming from Ayia Irini and Phylakopi.[516]

An important component of the palatial group is the addition of two new open vessels: the conical rhyton (FS 199) and the pear rhyton (FS 202). The conical rhyton is the most common of the Aegean rhyta, and is part of the geometric type.[517] This form appears to have developed in Crete during the late Protopalatial period (MM IIB) or the early Neopalatial (MM III), perhaps from earlier EM II animal rhyta.[518] Stone and metallic predecessors of the ceramic form may also have existed during the Middle Minoan period, while an early LH I example made of silver was recovered from Grave Circle A at Mycenae.[519] Metallurgical influence is corroborated by the use of the laid-on handle type, as well as the inclusion of rivets near the top

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[514] Mountjoy 1993, 42. For a LH I beaked jug example, see Pernier and Banti 1951, 176 fig. 106.

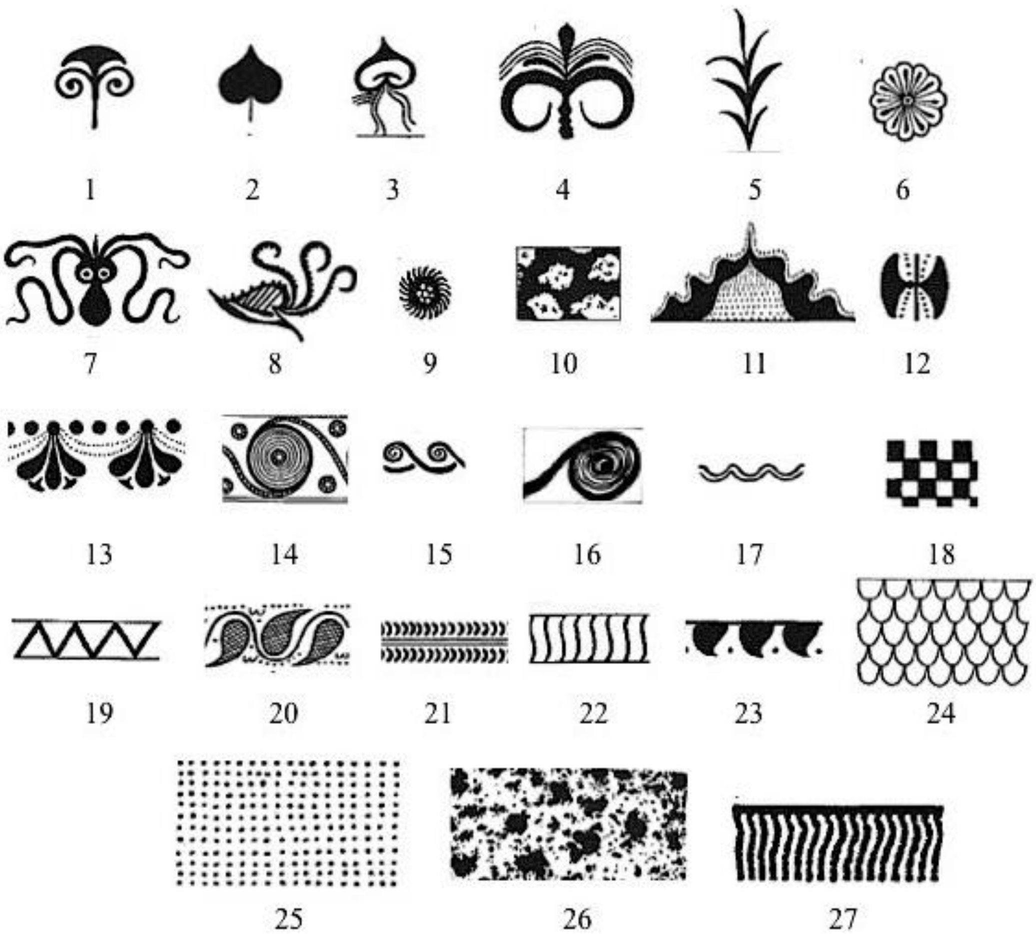
[515] Warren 1969, 172. Early examples of the metal ewer include the silver vessel from shaft grave V of Grave Circle A at Mycenae.

[516] Mountjoy 1986, 31.

[517] This shape is categorized by R. Koehl as Type III (wide-opening, footless) in his classification of Aegean Rhyta, for which he posits a straining or filtering function (2006, 269-274). This form of geometric rhyta, known as 'trichterförmige' or funnel shaped, may have functioned differently than other Aegean rhyta (Karo 1911, 265). Although often prescribed a cultic function associated with liquid libation pouring, the conical rhyta may in fact have been associated with agriculture, and used during ploughing to dispense seeds (Recht 2014, 40; see also Specht 1981).

[518] Koehl 2006.

[519] Vermeule 1972, pl. xiv.



1. FM 11 Papyrus
2. FM 12 Ivy
3. FM 13 Ogival Canopy
4. FM 14 Palm I
5. FM 16 Reed
6. FM 17 Rosette
7. FM 21 Cuttlefish
8. FM 22 Argonaut
9. FM 27 Sea Anemone
10. FM 31 Sponge Pattern
11. FM 32 Rock Pattern I
12. FM 35 Double-axe
13. FM 38 Pendant
14. FM 46 Running Spiral
15. FM 48 Quirk
16. FM 51 Stemmed Spiral
17. FM 53 Wavy Line
18. FM 56 Chequer
19. FM 61 Zigzag
20. FM 63 Hatched Loop
21. FM 65 Wavy Border
22. FM 67 Curved Stripes
23. FM 69 Adder Mark
24. FM 70 Scale Pattern
25. FM 76 Stone Pattern
26. FM 77 Stipple Pattern
27. FM 78 Ripple

Figure 5-5. Common motifs of the Late Helladic IIA (at varying scales). Many motifs have multiple versions, including the Papyrus (simple, elaborate), Ivy (volute, unvoluted), Sea Anemone (solid, disintegrated), Double-axe (wavy, straight stems), Quirk (simple, elaborated), Foliate Band (formal, naturalistic), and Curved Stripes (thin, fat) (adapted from Furumark 1941a).

of the vessels.[520] This shape would go on to be the most commonly and widely imitated Aegean form, manufactured in an unusually broad range of materials.[521] The pear rhyton is a related form, which was adapted from Egyptian ostrich egg flasks, and gradually elongated.[522] This shape also shares the metallic neck ring moulding and imitation rivets common in LH IIA pottery.

Along with an expansion in shapes, decoration of LH IIA pottery includes an increased range of motifs. For the domestic class, the most common motifs include spiral (FM 46), ripple (FM 78), foliate band (FM 64), double-axe (FM 35), and hatched loop (FM 63; Figure 5-5).[523] While the first three were common during the LH I period, the double-axe and the hatched loop are seen as adoptions from Crete. These two motifs, along with the spiral and foliate band, are also commonly used on palatial class LH IIA vessels, along with other pictorial imagery such as plant and marine life. These decorative styles are highly reminiscent of other Minoan palatial art—in particular fresco painting.[524] Abstract ornamentation is also common, including rosettes (FM 17), spirals (FM 46), zigzags (FM 61), and curved stripes (FM 67). Other depicted objects on LH IIA pottery include shields and pendants. Although many of these motifs have ritual associations in Minoan art, these meanings may have been altered or abandoned when adopted into Mycenaean pottery decoration.[525] Stylistic adaptations were also common in the integration of Minoan motifs, characterized generally by a gradual move from naturalism to stylization and symmetry (examples include the double-axe, FM 35 and the octopus/cuttlefish, FM 21).

[520] Mountjoy 1993, 42.
[521] Koehl 2008, 426.
[522] Mountjoy 1993, 42.
[523] Mountjoy 1993, 42.
[524] Mountjoy 1993, 43.
[525] Mountjoy 1993, 43.

Undecorated pottery from this period may be slipped, and occasionally burnished.[526]

Decoration of LH IIA pottery differs from the preceding period in the adoption of a decorative zone including both the shoulder and belly.[527] A second development that characterizes the LH IIA ceramics is the use of interior slip for open shapes and the necks of closed shapes—this practice endures throughout the production of Mycenaean pottery. The use of added white paint diminishes in this period, and is relegated primarily to ornamental dots on spirals.[528] Distinguishing between LH IIA and LM IB pottery can be challenging, however there are syntactical differences noted, particularly for the large 'palace style' jars—namely the division of the decorative zone into vertical panels on Mycenaean vessels while the bottom portion is painted in monochrome.[529] The hallmark of this period, however, is the Marine Style, which was in production in a number of centers across the Argolid, Corinthia, Thebes, and Athens,[530] and has a wide distribution throughout the Aegean.[531] The popularity and wide distribution of this ware, as well as its relatively short lifespan before the destruction of Minoan Neopalatial centers at the close of the LM IB, have contributed to the importance of Marine Style pottery as a diagnostic feature of the LM IB/LH IIA period—and maybe most significantly—of the relative dating of the Theran eruption and destruction that followed.[532]

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[526] Unpainted pottery follows the domestic class in terms of shape.

[527] Mountjoy 1986, 17.

[528] Mountjoy 1986, 17.

[529] Mountjoy 1993, 44. The term 'Palace Style Jar' is a misnomer, as it refers specifically to LM II jars from Knossos, as coined by Sir Arthur Evans (1935), yet is commonly found in use for LM I/LH II vessel description (Mountjoy 1993, 44).

[530] Mountjoy et al. 1978.

[531] Significant quantities of Marine Style pottery have been found on Kea, Phylakopi, Melos, and Aigina.

[532] Manning 2007. See Late Bronze Age chronological discussion in Chapter 1.

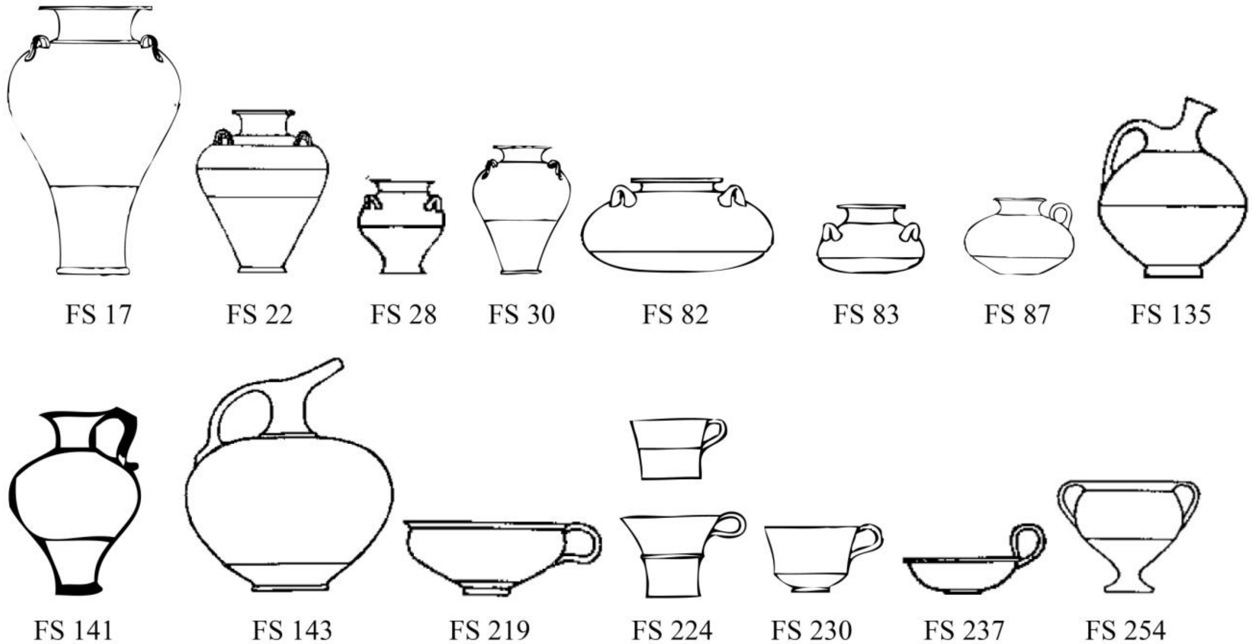

Figure 5-6. Open and closed shapes common in the Late Helladic IIB Period (adapted from Furumark 1941a).

LH IIB

Following the destruction of the Minoan palaces, there is a significant shift in the trajectory of Mycenaean pottery. Cretan influence is largely diminished,[533] while mainland style begins to be exported within the Aegean. There are unfortunately few closed stratified deposits from the LH IIB period,[534] obscuring to a degree the delineation between this and the preceding period. The range of shapes reduces dramatically, as nearly all palatial style forms form the LH IIA disappear.[535] The exception is the beaked jug (FS 141), which continues alongside the LH

[533] Furumark 1941a, 495-496.

[534] Mountjoy 1993, 52.

[535] Rare examples of the large jar (FS 17) were found in LH IIB contexts, some of which may in fact be Cretan imports (Furumark 1941a, 491). Similarly rare is the askos (FS 194), which appears for the first time in the LH IIB, however there is only one published example (Mountjoy 1986, 44). The carinated conical cup (FS 230) is traditionally dated by Furumark to the LH IIIA2 (1941, 624), however Mountjoy

IIA domestic class shapes (Figure 5-6).[536] There are substantial changes to the corpus of unpainted pottery as well, as the remaining Middle Helladic shapes and wares cease in production. The corpus includes the goblet, cup, dipper, basin, deep conical bowl, and various pouring vessels (amphora, hydria, jug, and cut-away neck jug), some of which continue to be slipped and burnished.[537]

The piriform jar continues to be an important and common shape, with an expanding range of subtypes despite the overall simplification of the LH IIB corpus. This group includes small (FS 28), medium (FS 30), and large (FS 22) varieties, all conical-piriform in shape. In addition to differing size, the small jar can also be distinguished by the banded decoration on the lower portion of the body (versus solid monochrome). Medium and large varieties of the rounded alabastron (FS 83 and FS 82) also continue; the two forms may be differentiated by the taller body and smaller mouth diameter of the medium-sized alabastron, as well as its tendency towards plant motifs rather than rock decoration.[538] Similar in shape to the alabastra is the squat jug (FS 87), which largely maintains the body shape of the LH IIA examples, differing mainly in the oblique handle setting.[539] Continuity of form is also observed with the jug with cut-away neck (FS 135), which may be characterized in this period by a large variation in size. As mentioned above the beaked jug (FS 143) also endures into LH IIB, and remains fairly consistent

argues for its inclusion in the repertoire of LH IIB based on its relation to FS 221 examples recovered from the Athenian wells (1986, 46; see Mountjoy 1981, figs. 15.171, 25.333-336).

[536] The conical rhyton (FS 199) continues as a Mycenaean shape, however no secure LH IIB finds have been reported from the mainland (there is one LH IIB example included in Koehl's catalogue, recovered from a tomb on Skopelos [2006, cat. no. 384]).

[537] Mountjoy 1993, 58.

[538] Mountjoy 1986, 42.

[539] Mountjoy 1986, 42.

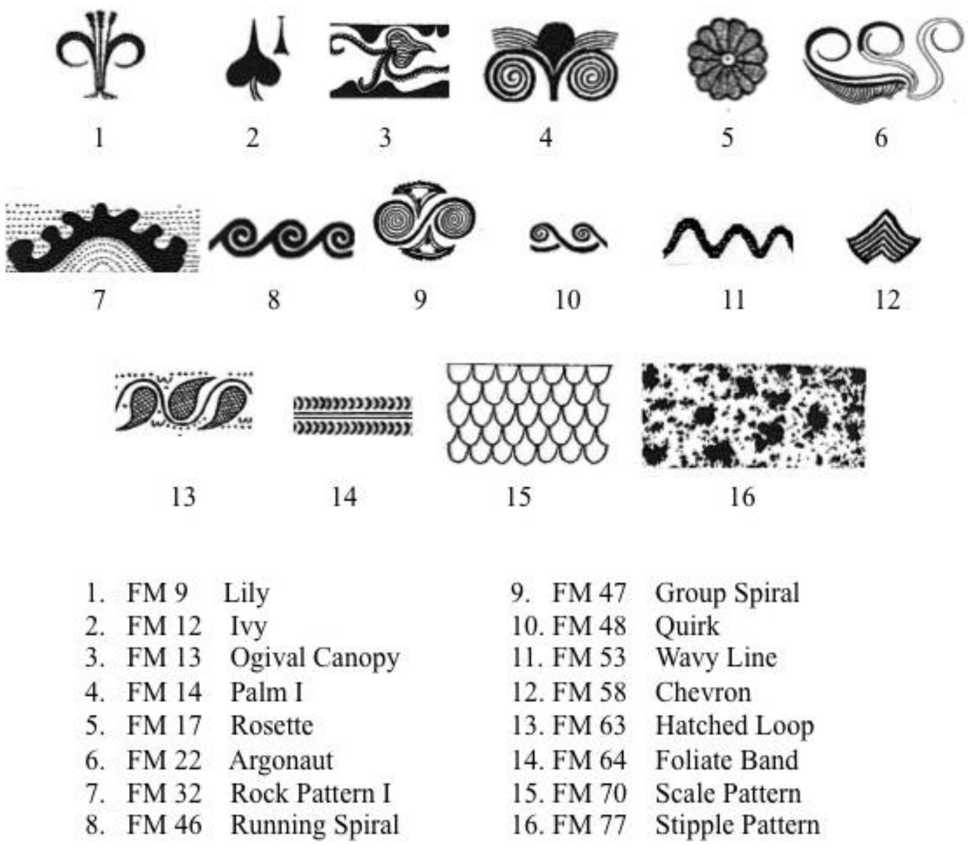

Figure 5-7. Collection of motifs common to the Late Helladic IIB Period. Subtype variations include multiple versions of the Ivy (with and without palm), Rock Pattern (with accompanying Sea Anemone and pendant wave), and Foliate Band (formal and naturalistic) (adapted from Furumark 1941a).

in form into the LH IIIA1 as well.[540]

Open shapes from the LH IIA also persist, including the goblet (FS 254), the Vapheio cup (FS 224) and, rarely, the shallow cup (FS 219). The goblet is the dominant shape of this period, of which the Ephyraean goblet is the most well-known.[541] First discovered by Carl

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[540] Certain motifs may be used to distinguish the LH IIB and LH IIIA1 examples including the presence of the palm on the early versions. The neck decoration is also chronologically diagnostic, as the LH IIB are patterned, while the LH IIIA1 examples are banded (Mountjoy 1986, 44).

[541] Mountjoy 1983, 265-271.

Blegen at the excavations of Korakou,[542] and eponymously named for the Homeric settlement at the site (Ephyra), the Ephyraean goblet varies from small to large, and is characterized by the decoration style, in which a singular motif is presented on the center at each side of the vessel, with an accompanying motif under the handle.[543] The other two decorative goblet types include the 'filled field' variety, and those with painted monochrome interiors and linear or unpainted exteriors. The Vapheio cup—Type III shape—can be characterized by an increased flare in the upper body, and a large, if not total, reduction in the middle rib.[544] The primary innovation from this period is the appearance of the ring-handled cup (FS 237). The shape of this vessel derives from metallic MM III-LM IA examples from Crete, from which the strap handle form is inherited.[545] Falling out of use by the LH IIIA1 period, the short production life of the ring-handled cup designates this shape as a diagnostic feature of the LH IIB.[546]

The range of motifs employed in the LH IIB period is also limited relative to that of the LH IIA period (see Figure 5-7). The examples all continue from the preceding period, while the motifs themselves become more stylized. The marine style so popular during the LH IIA disappears, although the Argonaut (FM 22) continues in a simplified form. Floral motifs continue, the most popular of which is the rosette (FM 17), which is the most common motif on the Ephyraean goblets.[547] The long stemmed ivy (FM 12), palm (FM 14), and lily (FM 9) also become common, as do wavy lines (FM 53), particularly in combination with rock patterns (FM

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[542] Blegen 1921, 54-57.

[543] Mountjoy 1993, 57-58.

[544] Mountjoy 1986, 45.

[545] Mountjoy 1993, 57. For an example, see Seager (1916, fig. 26a).

[546] Mountjoy 1993, 57.

[547] Mountjoy 1986, 37.

32). The rosette's position as the main motif on the goblets also reflects the shifting role of some motifs, as it is no longer employed simply as filling ornamentation.[548] Added white is no longer common by the LH IIB, and the decorative zone is now largely constrained to the shoulder and belly region.

LH IIIA1

The transition between LH IIB and LH IIIA1 is blurred at many sites, however secure distinct contexts from this phase are present at Mycenae[549] and Nichoria.[550] This period saw the foundation of large structures at many of the LBA palace centers on the mainland, including Sparta (the Menelaion), Krisa, Tiryns, Nichoria, Pylos, Volos (Iolkos), and Thebes. Within the context of this social expansion, LH IIIA1 pottery also enjoyed a widespread distribution. This style exhibited a high level of homogeneity with little local variation, suggesting either a limited number of production centers or the presence of a highly dominant stylistically influential center.[551] Mycenaean pottery from this period has been found across the Aegean, with large substantial quantities recovered on Crete; similarly, LM IIIA1 pottery is present on the mainland. Mycenaean influence from this period is also reflected in the presence of Linear B tablets at Knossos, as well as the introduction of chamber tombs to Crete.[552] This period marks the start of Mycenaean expansion, at the end of which, with the final destruction of Knossos, the expanding

[548] Mountjoy 1993, 57.

[549] French 1964.

[550] McDonald et al. 1975, 99-102. Other mainland sites at which LH IIIA1 ceramics have been examined include Asine, Athens, Tiryns, Sparta, and Thebes.

[551] Dickinson 1994, 120.

[552] Mountjoy 1993, 13. The use of chamber tombs begins during the LM II period. Cultural influence of Crete on the mainland is also present, including the introduction of wooden coffins.

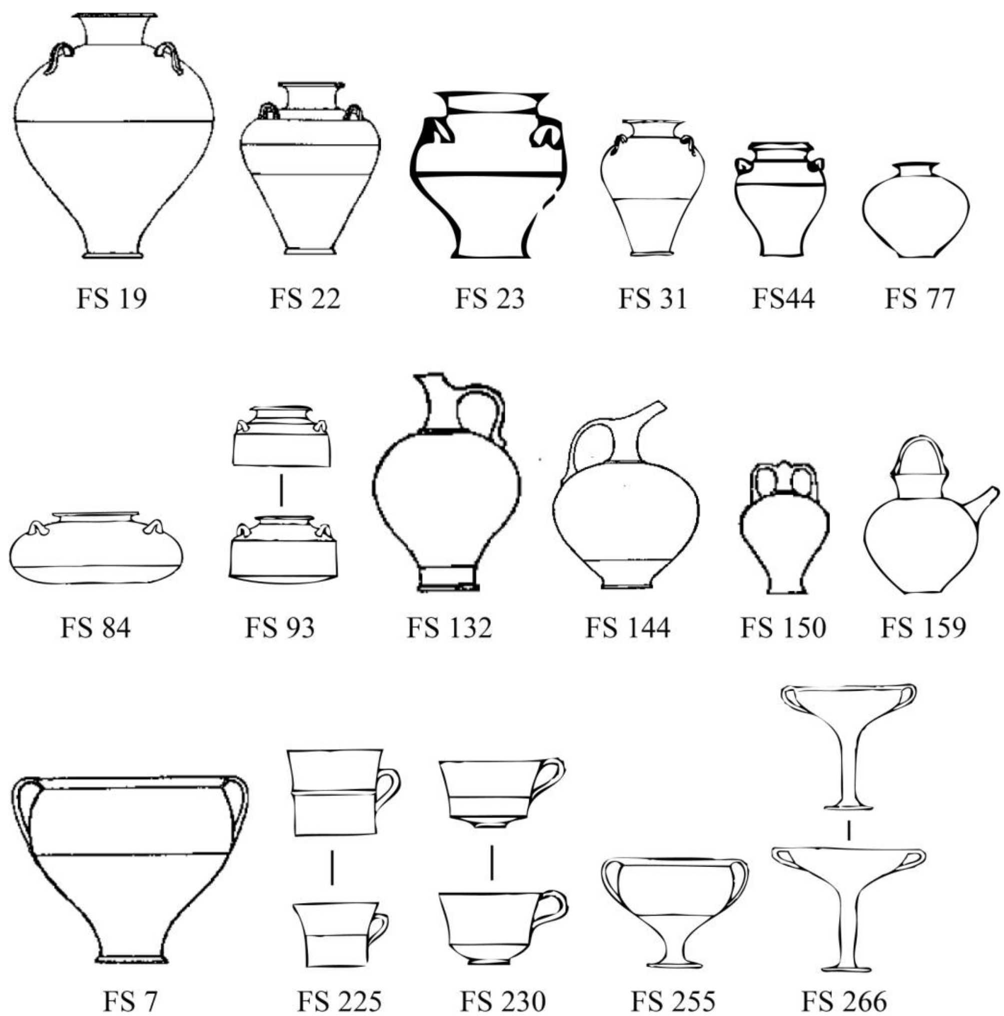

Figure 5-8. Open and closed shapes common in the Late Helladic IIIA1 Period (adapted from Furumark 1941a).

Mycenaean trade network reaches its greatest activity.

The shapes present in the LH IIIA1 corpus change fairly significantly through the abandonment of a large part of the previous range, along with the introduction of a number of new shapes (see Figure 5-8). The squat jug, along with both the Vapheio cup and the ring-handled cup, disappear from use. The forms that do continue, such as the piriform jar, the rounded alabastron, and the goblet, develop a more conical-piriform profile.[553] These shapes also represent the three most popular forms of the LH IIIA1. The piriform jar is again present in a number of varieties related to size, with the largest (FS 19) measuring 50-55cm tall. Other varieties include the wide conical-piriform bodied (FS 22), medium sized (FS 23, 31), and the small (FS 44). Slight differences in profile and rim and handle type can be used along with the vessel height to distinguish the various shapes.[554] The rounded and straight-sided alabastron (FS 84 and 93) continue, with the former exhibiting both baggy and flat varieties. The rounded alabastron can be differentiated from LH II versions by the use of concentric circles on the base, instead of the wavy spoked wheel used exclusively on the earlier forms. The jug with cutaway neck (FS 132) includes examples with a more piriform style body, and is identifiable chronologically due to the new decorative scheme employing only curved stripes (FM 67). The final inherited closed shape is the beaked jug (FS 144), which retains a similar form aside from a more truncated spout.[555]

The small handleless jar (FS 77) is a new introduction during this period, however it most likely descends in form from the ostrich egg rhyton of LH IIA.[556] This vessel has a short production life, and falls out of use by the end of this period—making it a strong diagnostic tool for the LH IIIA1. Similarly Helladic in origin is the feeding bottle (FS 159), which has its roots

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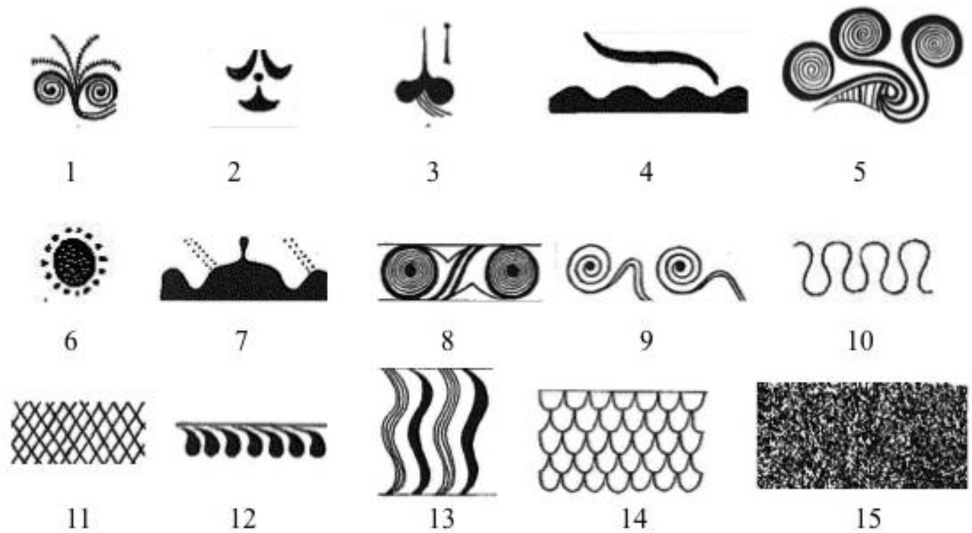
[553] French 1964, 256.

[554] Sherds may often only be distinguished based on their thickness, with the general rule that greater thickness reflects greater height (Mountjoy 1986, 56).

[555] In addition to the development in neck decoration mentioned above (specifically the move from patterned to banded decoration), other motifs may be used to distinguish LH IIIA1 vessels. The most commonly used in this period are the argonaut, the lily, and the spiral, the latter of which is not used on the beaked jug before this period. The remaining motifs are also more elaborate than in the LH IIB (Mountjoy 1986, 61).

[556] Mountjoy 1993, 63.



1.	FM 9	Lily	9.	FM 49	Curve-stemmed Spiral
2.	FM 11	Papyrus	10.	FM 53	Wavy Line
3.	FM 12	Ivy	11.	FM 57	Net
4.	FM 13	Ogival Canopy	12.	FM 64	Foliate Band
5.	FM 22	Argonaut	13.	FM 67	Curved Stripes
6.	FM 27	Sea Anemone	14.	FM 70	Scale Pattern
7.	FM 32	Rock Pattern I	15.	FM 77	Stipple Pattern
8.	FM 46	Running Spiral			

Figure 5-9. Motifs common in the Late Helladic IIIA1 Period. Multiple versions of the Argonaut include the complete and curtailed versions (adapted from Furumark 1941a).

in Middle Helladic forms, first appearing in the LH IIB period (only reaching popularity in LH IIIA1). A rare shape from this period is the stirrup jug (FS 150), which may have a piriform or conical body, with a spout reminiscent of the beaked jug.[557] This period also includes the introduction of Mycenaean style terracotta figurines with the appearance of the proto-phi female figurine.[558]

As in the LH IIB period, the goblet (FS 255) continues as the most popular open shape.

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[557] Mountjoy 1986, 61. Limited examples of askos sherds (FS 194) from Athens may also be dated to the LH IIIA1 period (Mountjoy 1981, nos. 185, 361-362).

[558] French 1971, 112-116.

The majority of examples from this period are large, with taller stems and wider bases than previous forms.[559] The carinated conical cup (FS 230), dated originally by Furumark to the LH IIIA2,[560] and dated by Mountjoy to the LH IIB/IIIA1 is certainly in use by this time. Limited examples of the shallow cup (FS 219) are also present. The primary innovations from this period are the krater (FS 7), the kylix (FS 266), and the mug (FS 225). The Mycenaean krater derives from earlier unpainted versions of the LH I, and is most commonly conical or conical-piriform in shape.[561] The kylix from the LH IIIA1 is in a nascent form, resembling a shallow goblet upon a taller stem. Although generally attributed to a later period, examples from LH IIIA1 domestic and mortuary contexts have been found in both Athens and Sparta.[562] The mug (FS 225) is generally similar to the Vapheio cup, however may have evolved from metallic prototypes.[563] The form has a cylindrical body with central ridge, and a small single strap handle at the middle.[564]

Mycenaean pottery of the LH IIIA1 is the first to exhibit greater standardization of decoration and motifs (see Figure 5-9). The most common motifs of the period are the net (FM 57), scale (FM 70), stipple (FM 77), and spiral (FM 46, and especially FM 49), which appear

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[559] Mountjoy 1986, 64.

[560] 1941a, 624. Furumark accepts a LH IIIA1 date in an addendum, however terms this form FS 229a (ibid., 624).

[561] The FS 7 krater appears to be the most common during the LH IIIA1, although Furumark attributed this form to LH IIIA2, assigning FS 6 to this earlier period (1941a, 586). The earlier assignment of FS 7 is proposed by French (1964, 256), and is supported by a number of examples presented by Mountjoy, who successfully demonstrated its greater frequency during the LH IIIA1 (1986, 61).

[562] Immerwahr 1971, pl. VII.16; Mountjoy 1981, fig. 25.360, pl. 25a; see Mountjoy 1986, 65 for further examples.

[563] Mountjoy 1993, 63.

[564] Mountjoy 1986, 63.

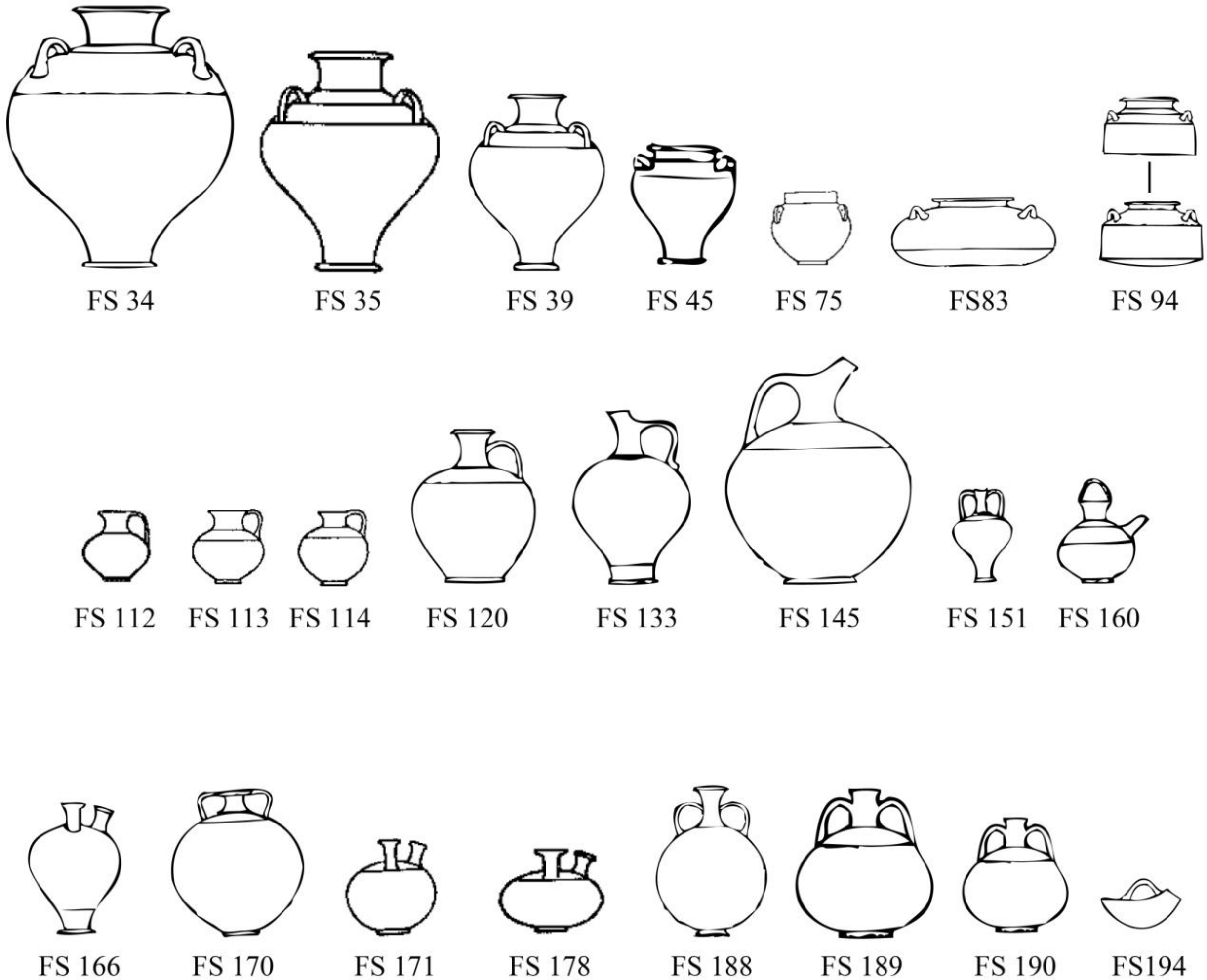

Figure 5-10. Common Late Helladic IIIA2 closed shapes (adapted from Furumark 1941a).

with such notable frequency as to aid in chronological identification.[565] Plant motifs continue to be popular, with the lily (FM 9), papyrus (FM 11), and ivy (FM 12) remaining in use. While the argonaut (FM 22) continues to be popular, the form has become curtailed, with tentacles often reduced to stylized spirals.[566] White paint is again present, but rare. A new decorative technique that emerges during this period is the practice of 'tinning', by which unpainted pots are covered

[565] Mountjoy 1986, 51.

[566] Mountjoy 1986, 52.

with thin sheets of tin in order to resemble metal, in particular silver, vessels.[567] These tinned vases, the most common of which are bowls and kylikes, are generally recovered from tombs, with examples coming from Athens[568] and Dendra.[569] Most shapes from this period also include unpainted versions, which are generally slipped and burnished or polished.

LH IIIA2

Mycenaean expansion reached its zenith in LH IIIA2 and the following LH IIIB periods. Pottery was highly standardized and mass-produced, achieving impressively high levels of technical quality and homogeneity. Ceramics of the "Mycenaean Koine" also began to be distributed in large quantities around the Mediterranean. This period also saw the construction or enhancement of large palatial centers, including Pylos, Tiryns, and Mycenae, as well as fortified towns like Gla. With the widespread destruction and subsequent rebuilding that marks the end of this period, there is relatively little LH IIIA2 pottery from domestic contexts—the majority of

which was instead recovered from tombs.[570] An exception to this is a large collection recovered from various terrace deposits at Mycenae, which span both the early and late LH IIIA2.[571] The pottery from this period is often separated into early and late phases,[572] however

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[567] Mountjoy 1993, 66.

[568] Immerwahr 1971, 170-177.

[569] Persson 1942, 136, fig. 117; also 87-91.

[570] Mountjoy 1993, 71. Although many tholoi have gone out of use on the mainland, the monumental tholoi at Mycenae—including the Treasury of Atreus and the Tomb of Clytemnestra—are constructed during this period.

[571] French 1965, 160. French notes that an early group consisting of mugs found under the Cyclopean Terrace Building includes LH IIIA1 features such as the running spiral and stipple motifs, while the three foundation deposits under the LH IIIB terrace contain largely late LH IIIA2 examples (160-161). Four other small collections of domestic LH IIIA2 wares are presented in Furumark (1941b, 56-57).

have been presented together below.

A general tendency during the LH IIIA2, particularly for closed vessels, is the development of a more conical-piriform body (see Figure 5-10).[573] Many of the basic shapes of the LH IIIA1 period are continued in LH IIIA2, some of which develop a variety of subtypes. This is true of the piriform jar, which includes small (FS 45), medium (FS 39), and large (FS 34, 35) varieties. Slight differences in shape are present, including the more piriform lower bodies of FS 45 and FS 35, the broadness of FS 39, and the shorter wide necks of FS 39 and FS 45. The rounded and straight-sided alabastra (FS 83 and FS 94) also continue, with baggy and globular versions of the former, while the latter may have straight or concave sides.[574] The jug with cutaway neck (FS 133) is present in diminishing quantities with a relatively unchanged form, however may be distinguished by the straighter execution of the wavy line decoration. The beaked jug (FS 145) is also relatively unchanged, however the spout continues to be truncated. The stirrup jug (FS 151) becomes more popular during the LH IIIA2, appearing frequently in tombs. The body has an advanced piriform shape, and, most notably, a third stirrup handle is added.[575] A final closed shape continued from the previous period is the feeding bottle (FS 160), which is similar in style apart from a foreshortening of the spout.[576]

The most common shape of the period is the stirrup jar, which maintains its popularity throughout the Mycenaean period. Appearing briefly in LH IIA, this form was reintroduced from

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[572] Furumark 1941a, 510-522.

[573] Mountjoy 1986, 67.

[574] Furumark assigns FS 94 to the LH IIIB period (1941a, 599), however Mountjoy insists that the bivalve chain motif places it firmly within LH IIIA2 (1986, 74)

[575] Mountjoy 1986, 76. This shape primarily belongs to the LH IIIA2 late period.

[576] To this we can add limited examples of the askos (FS 194), which lacks intrinsic diagnostic features for the period, and must rely on context dating.

Crete during the LM IIIA1 period.[577] This shape is found most commonly in tombs, and is distributed widely across the Mediterranean. There are three LH IIIA2 subtypes: the conical-piriform (FS 166), the globular (FS 170, 171), and the squat (FS 178). The squat stirrup jar is characterized by a diameter that exceeds the height. Features that help to distinguish these earlier versions from later examples include the wide discs decorated with concentric circles on the false mouth, wide bands on the lip of the spout, plain bases, and shorter and wider spouts and false necks.[578]

A similarly important addition to the Mycenaean pottery repertoire is the flask, which reaches its zenith of popularity during the LH IIIA2. The majority come from Cypriot and Near Eastern contexts, suggesting a production geared towards exchange. The form may have had a Near Eastern origin, however a similar form is present on Crete as early as the MM II.[579] There are two primary types, the vertical flask (FS 188, 189), decorated with concentric circles on the face, and the horizontal flask (FS 190), ornamented with horizontal banding. Of the vertical flasks, the earlier FS 188 is characterized by a round globular body with flat or round handles joining neck and body and a conical concave base, while the later FS 189 has a wide globular body with a far greater circumference and a small ring base. Both FS 188 and FS 189 are made from joining two independently thrown saucers, while the body of FS 190 is thrown in one complete piece.

There are a number of other new Mycenaean closed shapes introduced during this period. This includes the lug jar (FS 75), of which limited sherds have been recovered. Although

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[577] Mountjoy 1993, 71. The earlier version had three handles, and was of the palatial type.

[578] Mountjoy 1986, 79-81.

[579] Mountjoy 1993, 72. To this form the Minoans are credited with the addition of the base (for an example, see Evans 1928, 215, fig. 121).

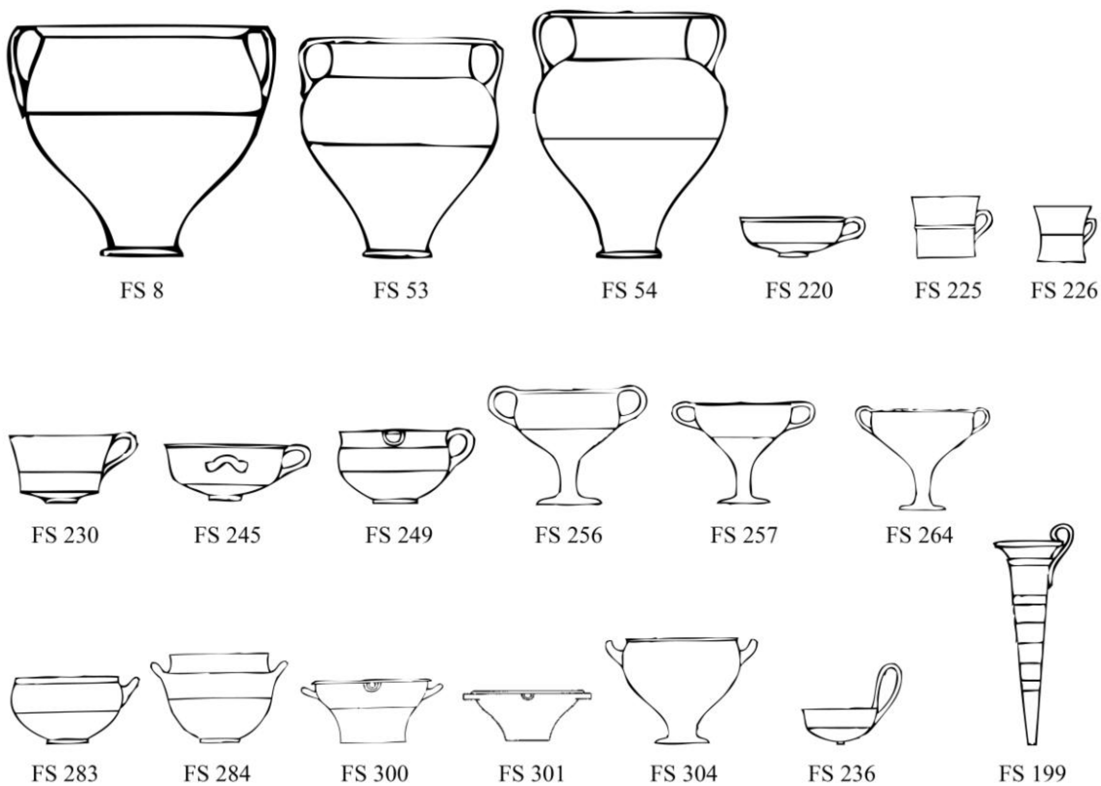

Figure 5-11. Common Late Helladic IIIA2 open shapes (adapted from Furumark 1941a).

generally an LH IIIB shape, there are examples with typically LH IIIA2 decorative motifs (i.e., FM 60, N-Pattern).[580] The small globular jug (FS 112-114) that begins production during this period also has a variety of subtypes that range from ovoid to globular and somewhat baggy. A related new form is the large narrow-necked jug (FS 120) that has its origins in a LM IIIA1 import from Crete.[581] The body of this shape is also extremely similar to the beaked neck vessel, and can be identified only when the neck and rim are preserved. Although rare on the mainland, the amphoroid krater (FS 53, 54) enters production, appearing frequently on Cyprus and in the Eastern Mediterranean.

A number of open shapes also persist from the preceding LH IIIA1 (see Figure 5-11),

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[580] Mountjoy 1986, 72.

[581] Mountjoy 1993, 71.

including the kylix, which takes over from the goblet as the dominant drinking vessel; the absence of the goblet is often considered a diagnostic feature of LH IIIA2.[582] Monochrome versions (FS 264) are quite common, while the kylikes with painted motifs expand from the use of a small decorative zone (FS 256) to the use of ornamentation as far down as the stem (FS 257).[583] In form, the later FS 257 is also less rounded in the body, with a taller and straighter stem. Mugs (FS 225, 226) of small and large variety are also common, and have evolved to include a rib at the rim, and occasionally the base, as well as the waist in the case of FS 226.[584] A variety of shallow cups with a vertical handle (FS 220) are also present, discernable from early examples by the sunken center of the base.[585] A less common shape that appears to have first appeared in the LH IIIA1 period is the carinated conical cup (FS 230), which shares the flaring concave body of the mug, and the single oval handle common to the shallow cup. Large mixing vessels such as the krater (FS 8) continue, with a more advanced conical-piriform shape.[586] The conical rhyton (FS 199) is produced frequently during this period, during which the decoration develops from figural to linear.[587]

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[582] Mountjoy 1986, 67.

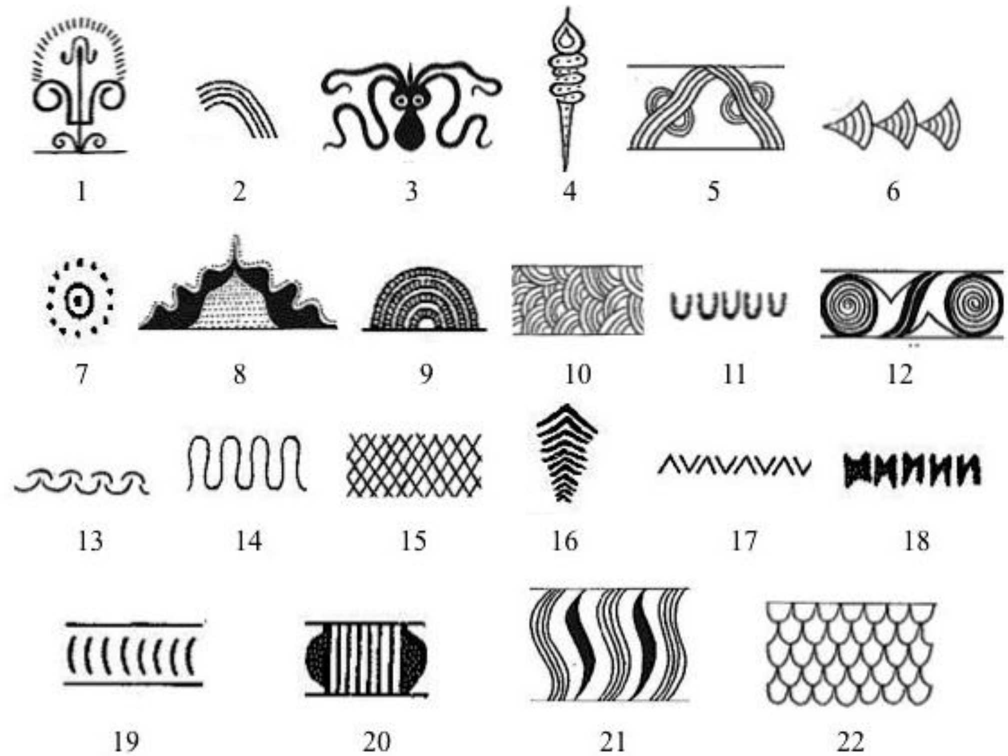
[583] Mountjoy 1986, 67. For an example of the latter, see an example from Mycenae, decorated with the whorl-shell (French 1965, 180 fig. 7:10).

[584] Mountjoy 1986, 86. The size difference employed by Furumark in classifying FS 225 and FS 226 subtypes has been questioned by French, who notes that a number of mugs with a central rib (FS 225) often far exceed the size of the shape as detailed by Furumark (1941a, 623), noting that a later reexamination of this taxonomy will be likely required (1965, 170 footnote 75).

[585] Mountjoy 1986, 84. French notes that many of the LH IIIA2 late examples from Mycenae are also notably shallower in profile than the LH IIIA2 early vessels (1965, 186).

[586] As in the examples from LH IIIA1, Furumark assigns this particular shape to the later LH IIIB period, and FS 7 to the LH IIIA2 (1941a, 586). Given the difficulty in assigning secure divisions between the LH IIIA1 and IIIA2 periods, it may be advantageous to categorize krater sherds as belonging to FS 7-8 (as French selects to do in the analysis of Mycenaean examples [1965, 186]).

[587] Mountjoy 1986, 83.



1.	FM 18	Mycenaean Flower
2.	FM 19	Multiple Stem
3.	FM 21	Cuttlefish
4.	FM 23	Whorl-shell
5.	FM 24	Linked whorl-shell
6.	FM 25	Bivalve Shell
7.	FM 27	Sea Anemone
8.	FM 32	Rock Pattern I
9.	FM 43	Isolated semi-circles
10.	FM 44	Concentric Arcs
11.	FM 45	U-Pattern
12.	FM 46	Running Spiral
13.	FM 48	Quirk
14.	FM 53	Wavy Line
15.	FM 57	Net
16.	FM 58	Chevrons
17.	FM 59	V-Pattern
18.	FM 60	N-Pattern
19.	FM 64	Foliate Band
20.	FM 65	Wavy Border
21.	FM 67	Curved Stripes
22.	FM 70	Scale Pattern

Figure 5-12. Common motifs of the Late Helladic IIIA2 period. Many have multiple versions, in particular the Mycenaean III Flower and the Multiple Stem (adapted from Furumark 1941a).

New additions to the open repertoire include the dipper (FS 236), which developed originally in the Middle Helladic, and continued to be produced in the early LBA in unpainted wares.[588] A common addition is the one-handled bowl (FS 283), which appears in the late LH IIIA2 period, along with the more rare deep bowl (FS 284),[589] both of which are semiglobular in shape. Similar in body shape (but significantly larger) is the new stemmed bowl (FS 304), also a late LH IIIA2 addition, which has tall and short 'truncated' stem varieties.[590] Developing from metal and unpainted prototypes of the earlier LBA,[591] the conical spouted bowl (FS 300, 301) appears at the end of LH IIIA2. The larger and smaller varieties can also be distinguished by the handle type, either round, in the case of FS 300, or strap (FS 301).[592] Other less common innovations include the cup with two horizontal handles (FS 245), which appears late in the LH IIIA2, and the spouted cup (FS 249), which are both deep semiglobular forms, nearly resembling the much larger one-handled bowl.

The standardization present in the preceding period continues into the LH IIIA2. While there are a wide variety of motifs available (see Figure 5-12), specific images are generally employed in a formulaic manner, appearing consistently on designated shapes.[593] As the decorative zone gets narrower through the period, the popularity of running designs and patterns grow (i.e., n-pattern, running spiral, or quirk).[594] LH IIIA2 is characterized by a *horror vacui*,

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[588] For a MH example, see Blegen 1921, fig. 26; and for an early LBA unpainted version, see Mountjoy 1981, fig. 7.45.

[589] The deep bowl is considered to be a development from the Middle Helladic period (Mountjoy 1993, 72; citing Karo 1930, pl. 166.158).

[590] Mountjoy 1986, 92. This form may have developed from the Middle Helladic Minyan ware goblets tradition, with comparable shapes recovered from Grave Circle B at Mycenae (Mylonas 1973, pl. 96a).

[591] An example of the metal prototype is the bronze vessel from Dendra Chamber Tomb 12 (Åström 1977, pl. 26.2).

[592] Mountjoy 1986, 91.

[593] Furumark 1941a, 511; Mountjoy 1993, 72.

[594] Mountjoy 1986, 67.

which is expressed through the liberal use of ornamental fillers and linear designs.[595] White paint is again added to ornament motifs such as the octopus/cuttlefish (FM 21).

The motifs that enjoyed popularity in the LH IIIA1—the net, stipple, scale, and spiral—fell out of vogue in this period, though the running spiral (FM 46) continues in a curtailed form.[596] Floral motifs consist principally of the Mycenaean III Flower (FM 18), a new motif of potential Minoan origin in this period,[597] for which both voluted and unvoluted types are extant. A second similarly unprovenanced addition is the whorl-shell,[598] which appears first as diagonal motifs in a row, and subsequently as rows of vertical images. Many other common LH II-LH III plant motifs disappear, as does the Ephyraean decorative style. The most common motif appears to be the multiple stem (FM 19), which exhibits a number of stylistic variants.[599]

The LH IIIA2 period is particularly well known for the group of 'Pictorial Style' painted vessels. Although originally believed to be a Cypriot or Levantine product[600]—due to the nearly exclusive presence of this ware on Cyprus and the Eastern Mediterranean coast—the presence of over 50 examples including wasters at the site of Berbati has demonstrated that this ware was in production in the Argolid.[601] This decorative style, most commonly seen on kraters, may have

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[595] Furumark 1941a, 515-516; Mountjoy 1986, 67.

[596] Mountjoy 1986, 68. The example given by Mountjoy corresponds most closely to FM 46.16.

[597] Popham 1970, 81.

[598] French 1964, 257.

[599] The most common versions of this motif are FM 19.28/31 (curved), FM 19.50 (hooked), FM 19.19-21 (angular), and FM 19.34 (tongue) (Mountjoy 1986, 69).

[600] Stubbings 1951, 33-38, 42; Furumark 1941a, 431-445; cf. Jones 1986, 602.

[601] Åkerstöm 1986. This assertion is supported by Immerwahr (1993, 218). The predominance of this ware on Cyprus may suggest that Cypriot traders played an active role in the dissemination of pictorial vases (Vermeule and Karageorghis 1982, 168).

developed from the Minoan Palace Style ware, and bears stylistic affinities to fresco painting.[602] Figural decoration is presented in large registers on the shoulder and belly, and commonly includes birds, fish, and chariot scenes.

In addition to painted decoration, large transport stirrup jars were frequently inscribed with Linear B, usually simply a single word (often a personal or place name).[603] These vessels are most common in the LH IIIB, however may have begun to be produced in the LH IIIA2. Unpainted pottery, as well as monochrome vessels, also remain common, and are extremely popular in certain shapes such as the piriform jar and the kylix.[604] In addition to painted decoration, tinning still continues in the LH IIIA2, as demonstrated by a large collection of vessels from a Berbati chamber tomb.[605]

LH IIIB1

The beginning of the LH IIIB is a highly prosperous time on mainland Greece following the rapid growth of Mycenaean centers during the LH IIIA2. Many sites are lavishly embellished, including palace construction at Pylos, the erection of the Lion Gate at Mycenae, and the extension of the fortification walls at Tiryns. The end of this period is marked by destruction

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[602] Mountjoy 1993, 73. Influence from other decorative arts of the period may be visible in the stylization of mammals (such as the bull), as well as the decorative motifs employed around central motifs (commonly stylized flowers, rosettes, or chevrons), which are interpreted by Sherratt to be the imitation on clay of textile patterning (Sherratt 1999, 189). In addition to identifying stylistic origins, some scholars claim to recognize individual painter's hands in the production of certain motifs (see Rystedt 1990, 1992).

[603] Mountjoy 1993, 74. Jars of this type have been recovered from Thebes, Tiryns, Mycenae, Chania, Orchomenos, Eleusis, and Knossos. Vessels from this group were manufactured in both Chania and Mycenae (Catling et al. 1980, 92-93).

[604] Haskell 1981; Mountjoy 1993, 75.

[605] Holmberg 1983, 34-50; Gillis 1994; Mountjoy 1993, 75.

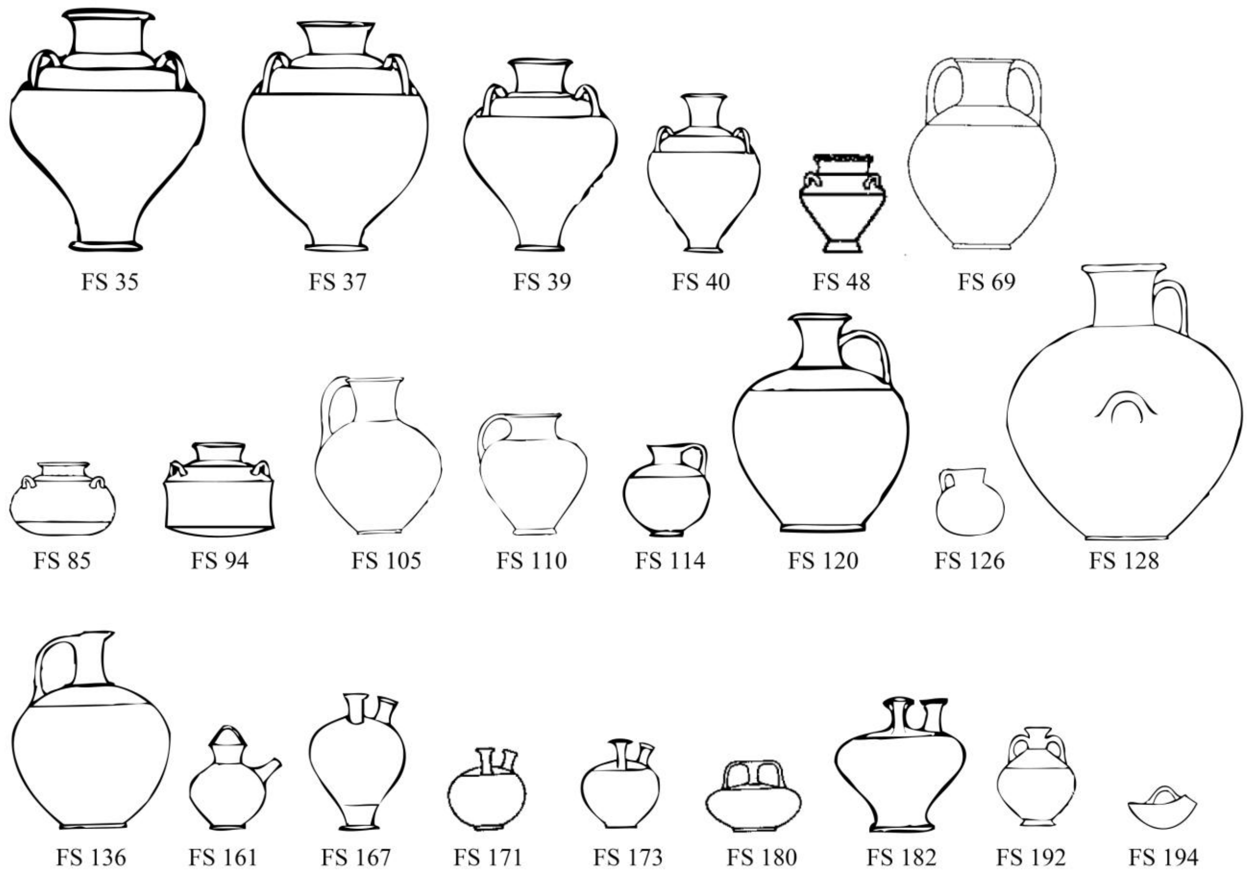

Figure 5-13. Common closed shapes of the Late Helladic IIIB1 (adapted from Furumark 1941a).

resulting from an apparent earthquake, which damaged numerous sites and structures. The LH IIIB period of Furumark has therefore been divided into two groups based on domestic pottery from Mycenae and Tiryns; LH IIIB1 pottery has been recovered from the surrounding wall of the tomb of Clytemnestra, the Citadel House, and destroyed houses outside of the walls at Mycenae,[606] while LH IIIB2 pottery has been found in levels largely within the citadel, as well as in contexts associated with fortification wall repairs at Tiryns.[607] There is difficulty in delineating

[606] French 1966, 216; 1967, 149. See also Wardle 1969. The pottery examined in constructing this period included the whole and restorable vessels from the House of Shields, the House of the Oil Merchant, the West House, the House of Sphinxes, and Phase VII of the Citadel House.

[607] Other LH IIIB2 pottery groups have been recovered at Dendra, Athens, and Thebes, along with isolated contexts outside of the fortification walls at Mycenae (French 1966, 216). This bipartite

the boundary between LH IIIB1 and the earlier LH IIIA2; for this overview, the material is presented in the same manner as Mountjoy, who elects to place the division at the appearance of the deep bowl (rather than the vertical whorl-shell motif).[608]

As in previous periods, the piriform jar is a popular closed shape, with multiple subtypes present (see Figure 5-13). While there are large (FS 25, 27) and medium (FS 39, 40) sized examples, the small subtype (FS 48) is by far the most common. The most frequent shape is, however, the stirrup jar. There are four main subtypes: the tall conical-piriform (FS 167), the globular (FS 171, 173), the squat (FS 180), and the conical (FS 182). While the later is a new introduction, the globular form reaches the apex of its popularity. The stirrup jars of the LH IIIB1 may be identified by the taller and narrower spouts and false necks, smaller and more rounded discs, and decorative tendencies such as the use of concentric circles on bases and spirals on false mouths.[609] Although the stirrup jar diversifies in form, only one flask subtype endures into the LH IIIB1—the horizontal type (FS 192). The amphora (FS 69) also persists in the repertoire, however most examples are only preserved in fragmented sherds.[610] Also enduring are the rounded and straight alabastra (FS 85 and FS 94), both of which are more frequently present in burial contexts.

There are a greater variety of jugs during the LH IIIB1, including the addition of large (FS 105) and miniature (FS 126) varieties to complement the existing small and medium types

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periodization has been further subdivided by Kilian (1988, 118); Mountjoy (1999, 32).

[608] 1986, 93. The division between LH IIIB1 and LH IIIB2 was examined by Schachermeyr (1962, 221-222); Verdelis et al. (1965); French (1969); and Wardle (1973), and has recently been comprehensively reexamined by French et al. 2009.

[609] Mountjoy 1986, 109.

[610] Mountjoy 1986, 98.

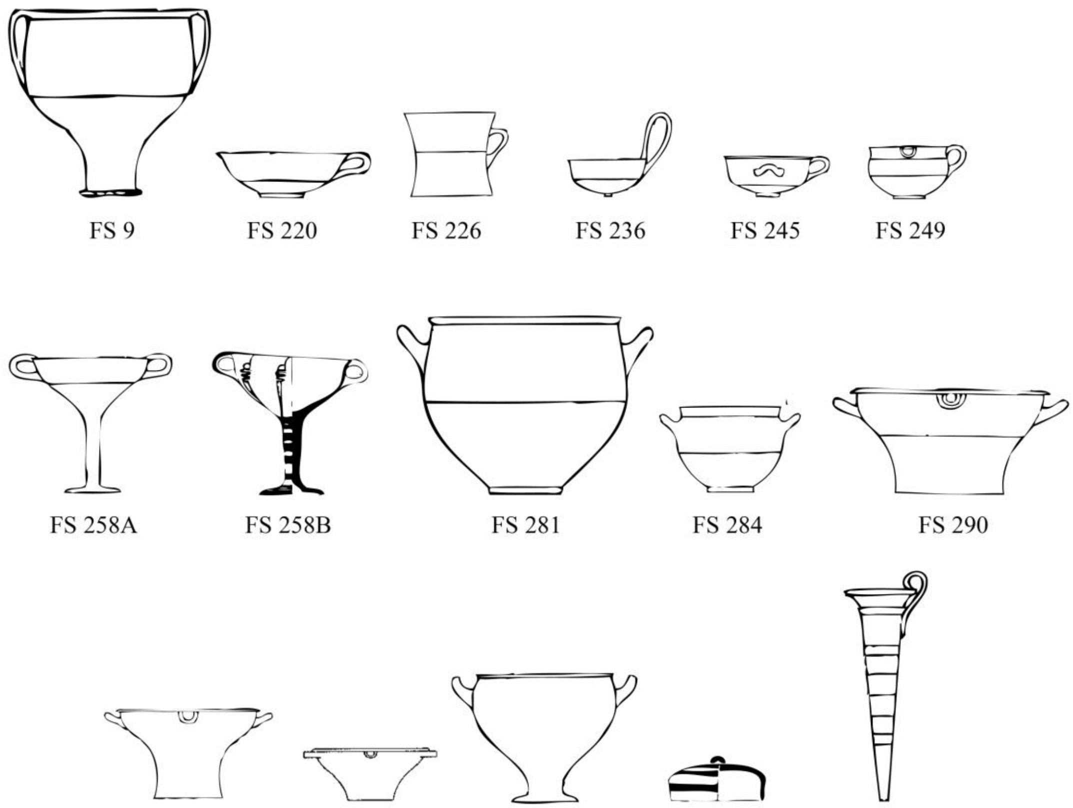


Figure 5-14. Open shapes of the Late Helladic IIIB1 period (adapted from Furumark 1941a).

(FS 114, 110).[611] The narrow-necked and cut-away neck jugs (FS 120 and FS 136) continue and have highly comparable globular forms, differentiated only by the junction of the handle with the neck (the top of the latter shape is joined at the rim rather than the neck).[612] A new form for this period is the hydria (FS 128),[613] which resembles strongly the amphora and the large jug in its globular form; two round handles on the belly provide the diagnostic characteristic for

[611] Mountjoy 1986, 100-102. Other shapes also gain miniature varieties during this period, including the mug, straight-sided alabastron, goblet, cup, and bowl (ibid., 101).

[612] Mountjoy 1986, 101.

[613] Examples of the hydria in unpainted wares are present in the Middle and Late Helladic, however this period marks the introduction of painted forms.

identification.[614] The feeding bottle (FS 161) evolves to a more biconical form than the preceding subtypes, while the spout becomes less tapering. As in previous periods, the askos (FS 194) continues relatively unchanged, and may only be identified by the context.

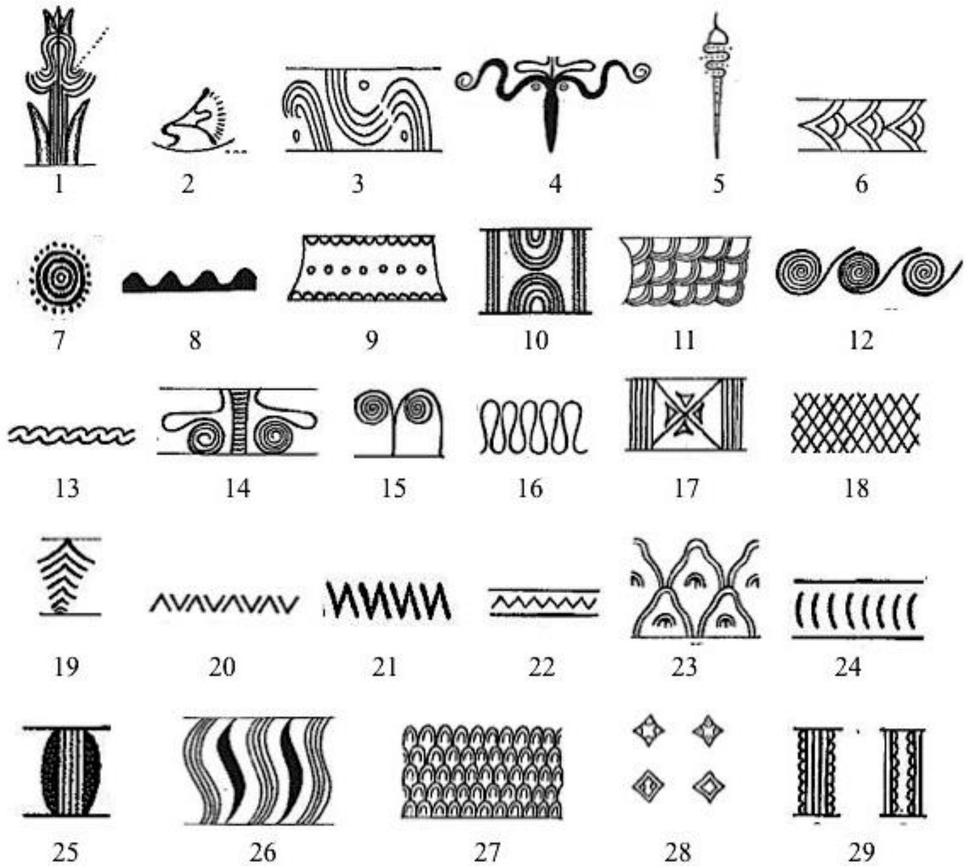
The majority of forms added to the corpus of vessels in the transition from LH IIIA to LH IIIB are open shapes (see Figure 5-14). The bulk of existing LH IIIA open vessels continue with minor changes, including the conical rhyton (FS 199, on which the decorative zone is extended to include the entire body), the krater (FS 9, now exhibiting a more extreme piriform body type). Many of the associated drinking vessels also reflect considerable continuity, including the shallow cup (FS 220), the mug (FS 226), the dipper (FS 236), the cup with two horizontal handles (FS 245), and the spouted cup (FS 249). Small differences exist, including the disappearance of ridges on the smaller mug examples, while the three cup shapes are relatively rare during this period.

The two most common open vessels are the kylix (FS 258) and the deep bowl (FS 284). Kylikes from this period are identifiable in part by their tall stems and by the shallowness of the bowl. The most common type, FS 258B, is often decorated with whorl-shells, which extend from the linear decoration on the rim and the stem. A diagnostic feature of this period is the Zygouries type Kylix (FS 258A). Named for the potter's shop at Zygouries in which the type was discovered,[615] this vessel is highly unusual in its decoration. The body of the kylix is decorated on one side only with a central main motif (primarily the whorl-shell or a flower), which extends from the lip to halfway down the unpainted stem.[616] The remaining bowl is left without

[614]French 1969, 81; Mountjoy 1986, 103.

[615] Blegen 1928 , 143-147.

[616] Mountjoy 1986, 115.



1.	FM 15	Palm II
2.	FM 18	Mycenaean Flower
3.	FM 19	Multiple Stem
4.	FM 21	Cuttlefish
5.	FM 23	Whorl-shell
6.	FM 25	Bivalve Shell
7.	FM 27	Sea Anemone
8.	FM 32	Rock Pattern I
9.	FM 42	Joining Semi-circles
10.	FM 43	Isolated Semi-circles
11.	FM 44	Concentric Arcs
12.	FM 46	Running Spiral
13.	FM 48	Quirk
14.	FM 50	Antithetic Spiral
15.	FM 51	Stemmed Spiral
16.	FM 53	Wavy Line
17.	FM 55	Diagonal Patterns
18.	FM 57	Net
19.	FM 58	Chevrons
20.	FM 59	V-Pattern
21.	FM 60	N-Pattern
22.	FM 61	Zigzag
23.	FM 62	Tricurved Arch
24.	FM 64	Foliate Band
25.	FM 65	Wavy Border
26.	FM 67	Curved Stripes
27.	FM 70	Scale Pattern
28.	FM 73	Lozenge
29.	FM 75	Triglyph

Figure 5-15. Common motifs of the Late Helladic IIIB1 period (at varying scales). Multiple variations are present of the Mycenaean III Flower (volute, hybrid, octopus, raquet, horns, and unvoluted), Multiple Stem (curved, hooked, and tongue), Whorl-shell (filled, dotted, antithetic), and the Triglyph (central, side, and with a rosette or arrow fringe) (adapted from Furumark 1941a).

additional adornment or ornamentation.

The deep bowl, first appearing in LH IIIA2, becomes highly popular during LH IIIB. This vessel is distinguishable from other bowl and krater forms by the straight or slightly flaring upper body and rim, though the stemmed bowl (FS 305) shares many of these characteristics.[617] This shape is important for the delineation of LH IIIB subphases, as Group A is present at the start of the period, while Group B only appears in LH IIIB2.[618] Two other bowl shapes that continue from the preceding period are the deep conical bowl (FS 290), and the closely related spouted conical bowl (FS 300, 301). These forms also show high levels of continuity with the LH IIIA2 vessels.

During the LH IIIB1 the ring-based krater (FS 281) appears, and although it is highly popular in the eastern Mediterranean, it is still relatively rare on the mainland; this distribution pattern, along with the use of pictorial style decoration, is highly suggestive of a production system geared at export for this shape. A final innovation for this period is the lid (FS 334), which was designed to cover the mouth of the collar-necked jars and alabastra.[619] Lid sherds may be identified by their unfinished interior.

Nearly all decorative elements extant in the LH IIIB1 period are derived from earlier LH IIIA2 examples (see Figure 5-15). Some motifs exhibit slight alterations (i.e., the diagonal whorl-shell becomes vertical), while others are grouped together to form new designs.[620] The greatest decorative evolution during this period is the development of paneled style decoration,

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[617] The stemmed bowl may generally be distinguished by the tapering of the deep body, even if the stem and base are not preserved.

[618] French 1969, 74; Mountjoy 1986, 93. The chronological division assigned to these types is confirmed by the material excavated from Mycenae and the West Wall Deposit at Tiryns.

[619] The lid may have first appeared in the LH IIIA2 period (Mountjoy 1986, 120).

[620] Furumark 1941a, 528.

in which symmetry and simplicity are emphasized.[621] The most popular motifs are the whorl-shell (FM 23), the Mycenaean III flower (FM 18), and the triglyph (FM 75) the latter of which is often used in decorative panels. The Pictorial Style also continues to appear on kraters (FS 9, 55, 281), with the bull motif increasing in popularity.[622] Linear decoration is dominant for the storage jars, including the amphora, jugs, and hydria. These linear forms increasingly take the place of unpainted version, which appear less commonly at this time.[623]

LH IIIB2

The transition to the second LH IIIB period occurs following the destruction seen at many sites, which is followed by significant rebuilding. Additional fortification measures are evident at numerous locations, including the fortification of the lower town at Tiryns, as well as the securing of water source access within the fortified cities at Athens and Mycenae. Despite these efforts at renewal, pottery export appears to drop dramatically, as LH IIIB2 pottery is very poorly attested outside of the mainland.[624] By the time of the major destruction that essentially concluded the Mycenaean period on the mainland, pottery was already evolving to show LH IIIC

[621] Mountjoy 1993, 82.

[622] Mountjoy 1986, 95. Additional production centers appear during the LH IIIB1, including Thebes, Tiryns, and Mycenae (Mountjoy 1993, 83).

[623] Unpainted ceramics, particularly smaller vessels, are still abundant, however they are at this time finished with polishing or smoothing rather than burnishing (Mountjoy 1993, 84).

[624] Mountjoy 1993, 80. There is also a marked drop noted in mainland quantities, which French has attributed to changing cultural practices, in which fewer fine ware vessels were deposited in tombs (a problem compounded by the destruction and looting at the close of LH IIIB2) (1969, 71). It is important to note that this paucity may also be due to problems of identification, and may therefore not constitute evidence of absence.

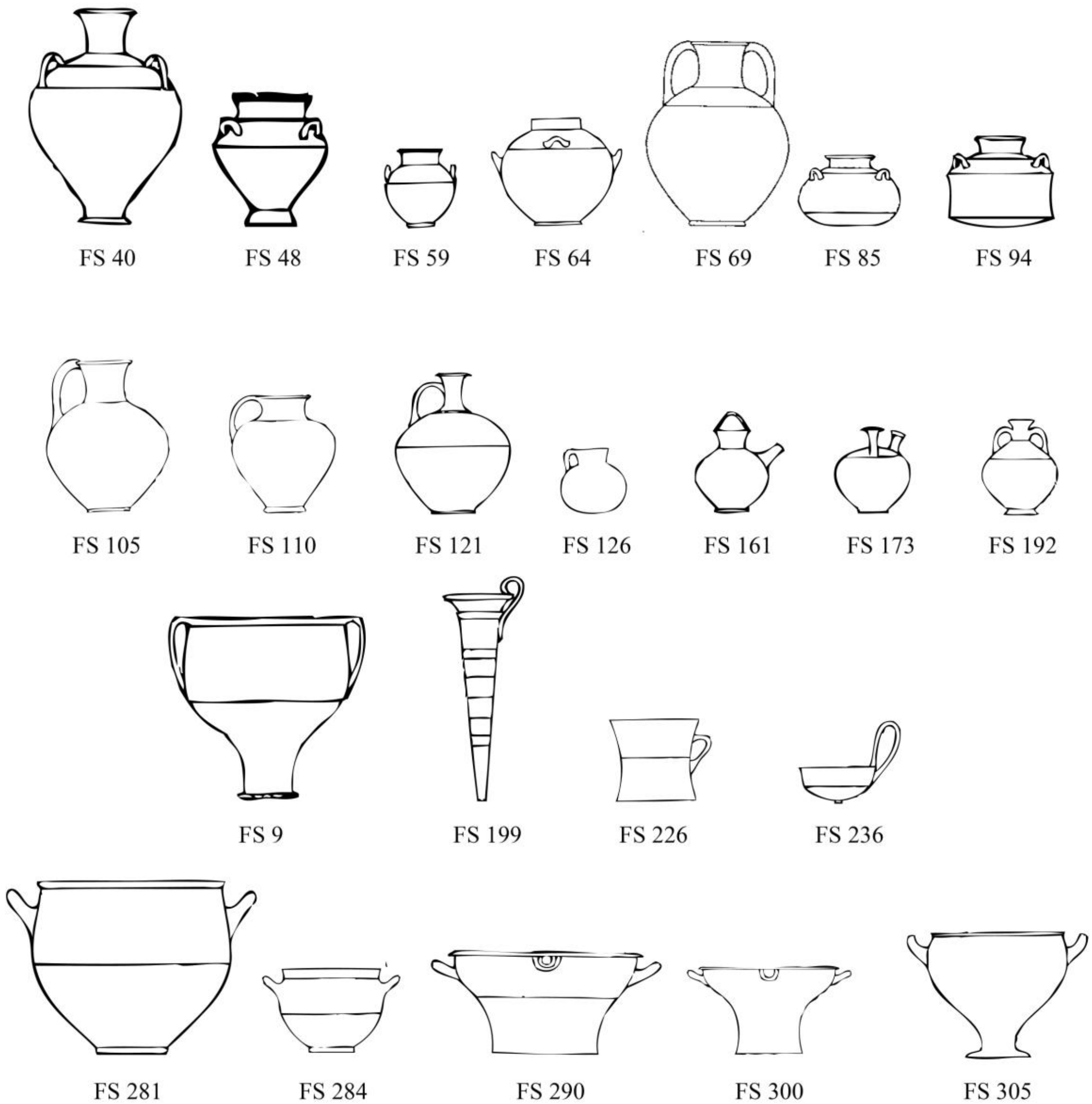

Figure 5-16. Common open and closed shapes of the Late Helladic IIIB2 period (adapted from Furumark 1941a).

features. Pottery of this interim type has been called LH IIIC1,[625] LH IIIC1A,[626] LH IIIB/C transitional,[627] LH IIIC Early,[628] LH IIICe1,[629] as well as LH IIIB2 late.[630] As the LH IIIC

[625] Furumark 1941a, 541-575.

[626] Furumark 1944, 194-220.

[627] Mountjoy 1995; 1997; 1999, 36-38.

[628] S. Sherratt 1981.

pottery and its associated chronological questions are beyond the scope of this project, it will not be included here. In order to examine the potential exchange systems employed in the mobilization of Mycenaean ceramics across the LBA IA transition it will be necessary to be able to reassess the vessels recorded under this inconsistent terminology. Vessels categorized as LH IIIB2 late have been included, as well as those termed LH IIIB/C transitional when they closely follow LH IIIB traditions.

The range of shapes present in the LH IIIB2 period is highly reduced, both in vessel forms and associated subtypes (see Figure 5-16). The piriform jar continues with little form change but reduced variety, with only small (FS 48) and medium (FS 40) examples (of which FS 48 is more common). The narrow-necked jar (FS 121) continues largely unchanged in profile, however adopts a decorative style similar to the Group B deep bowls, including wide, elaborated triglyphs on the shoulder, and large linear bands.[631] The only stirrup jar form conclusively attested during the LH IIIB2 is the globular FS 173, which strongly resembles in shape its LH IIIB1 counterpart.[632] New additions in this period include the amphoriskos (FS 59) and the collar-necked jar (FS 64), which appear at the end of this period, becoming more popular in the subsequent LH IIIC.[633]

There are a number of shapes attested in significant quantities as sherds, however they

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[629] French 2007, 528.

[630] Ibid. For an overview and examination of the current evidence, see Vitale 2006 (particularly 201, Table 3).

[631] Mountjoy 1986, 125.

[632] Fragmentary examples of FS 164 type stirrup jars may also been recovered from Perseia Trench L at Mycenae (French 1969, 74).

[633] Furumark originally situated the amphoriskos exclusively in the LH IIIC (1941a, 594), despite assigning an LH IIIB date to the example from Prosymna (ibid., 657; see Mountjoy 1986, 124).

lack securely stratified LH IIIB2 examples. These include the amphora (FS 69), the rounded and straight-sided alabastra (FS 85 and 94), the feeding bottle (FS 161), the horizontal flask (FS 192) and the FS 105, FS 110, and miniature FS 126 jugs. An open shape that similarly lacks secure LH IIIB2 attestation is the deep conical bowl (FS 290).

Continuity of form is also visible in the corpus of LH IIIB2 open vessels, many of which are distinguishable from earlier types predominantly by the decorative style. This is true of the conical rhyton (FS 199) and the FS 9 and FS 281 (ring-based) kraters (the latter of which gains popularity in this period). The mug (FS 226) does exhibit certain changes, as the ridges at the rim, waist, and base have disappeared, and the decorative motifs extend all the way from the rim to the base.[634] Evolution of form is also demonstrated by the dipper (FS 236), which is given a more flaring profile. New shapes appearing during the late LH IIIB include the small bowl (FS 164) and the basin (FS 294), which is produced in far greater quantities during the LH IIIC period.

The most common open shape of the LH IIIB2 period is the deep bowl (FS 284). While this form continues to be predominantly decorated in the style of Group A (first appearing in LH IIIB1), two new groups develop. The first, the Group B type, is found on larger bowls than those of Group A, and is composed of wide bands covering the rim, belly, and base, while the interior is monochrome (occasionally with a central reserved circle). A single decorative panel on the shoulder is created between the rim and belly bands, and most commonly contains the quirk (FM 48), semi-circle (FM 43), multiple stem (FM 19), tricurved arch (FM 62), or triglyph (FM 75).[635] This type of decoration is also commonly applied to the stemmed bowl (FS 305), which

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[634] Mountjoy 1986, 128.

[635] Mountjoy 1986, 131.

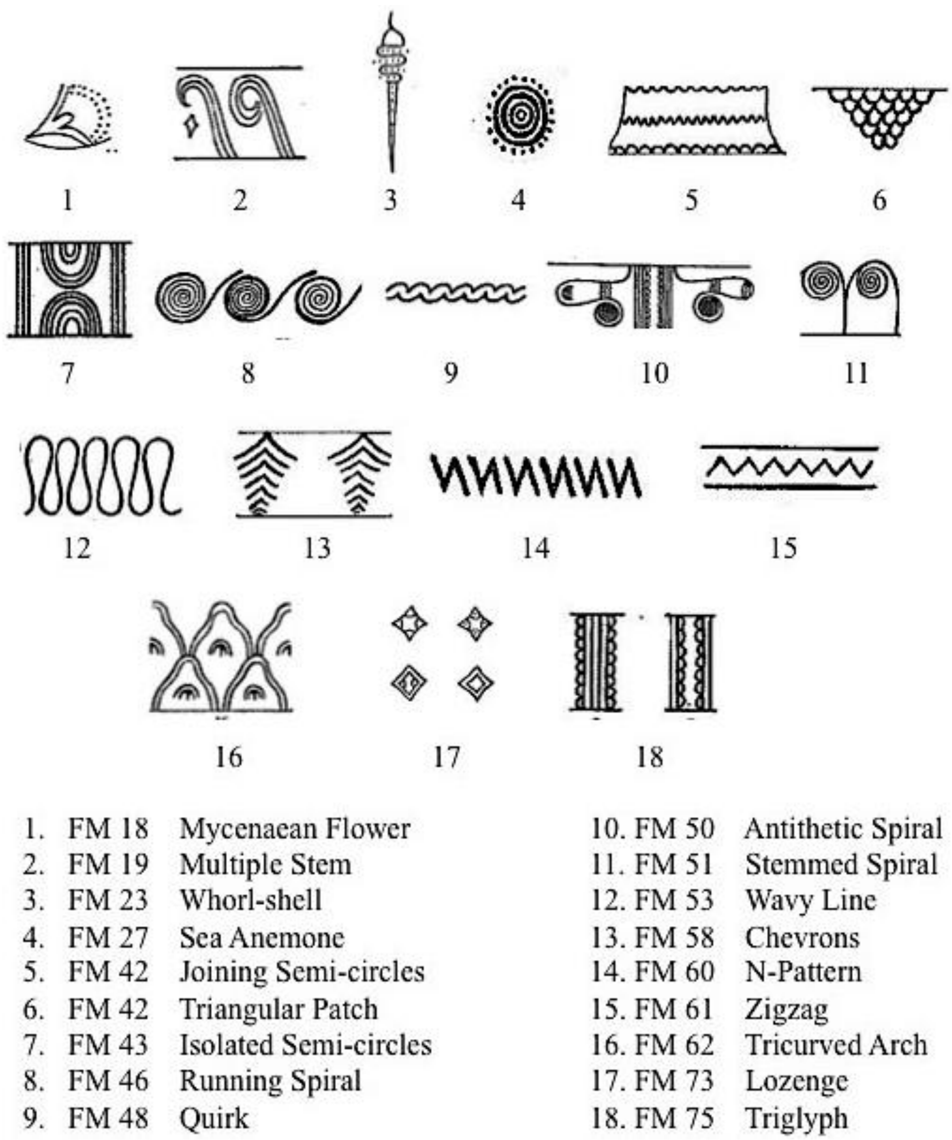

Figure 5-17. Common motifs of the Late Helladic IIIB2 period. Multiple versions are again common for the Mycenaean III Flower (with central quirk or hook), the Lozenge (isolated or in chain), and the Triglyph (chain, central, with side zigzag or chevron, or with half rosette) (adapted from Furumark 1941a).

otherwise exhibits strong continuity with its LH IIIB1 predecessor. The second style of deep bowl that develops at this time is known as the rosette deep bowl, which may be identified by the single large rosette on each side, as well as the dotted rim. The rosette bowls, along with the

Group B style, are the most common diagnostic tools for identifying LH IIIB2 contexts.[636]

The motifs common in LH IIIB2 are inherited from the preceding period, while the execution becomes increasingly dull and heavy (see Figure 5-17).[637] Linear decoration and panels composed of triglyphs (FM 75) become dominant, particularly on open vessels, while the previously popular whorl-shell (FM 23) becomes rare. Evolution is seen in the widening of the decorative zone, as well as the use of half-rosettes or other ornaments used as flanking accent (FM 74).[638] Similarly rare in this period is the Mycenaean III Flower (FM 18), which generally only appears on the shoulder of stirrup jars, and only in the quirk or hook unvoluted varieties. Pictorial Style decoration continues in limited quantities, as the majority of the fine ware vessels from this period are unpainted, finished simply with polishing or smoothing.[639] This is the case for the kylix (FS 267, and FS 274), which only continues in unpainted forms.

5.2 Distribution Patterns

Having surveyed the overall corpus of Late Bronze Age Aegean ceramics, this section will examine their exportation and distribution throughout the Eastern Mediterranean. The discussion will focus on the relationship between different functional classes of vessels (such as

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[636] Mountjoy 1993, 82.

[637] Decoration from the LH IIIB2 reflects a weakening of the standardization that typified the LH IIIA2 – LH IIIB1 horizon (French et al. 2009, 221).

[638] Mountjoy 1986, 121.

[639] Wardle 1973, 304.

closed containers versus open vessels),[640] and their contextual patterning (particularly domestic versus mortuary deposition).[641] The development of this exchange system will be charted, including the significant expansion during the LH IIIA1 and LH IIIA2 periods, and the subsequent reduction throughout the LH IIIB. Distribution will be examined in three primary areas: Cyprus, Egypt, and the Levant. A total of 12, 087 sherds and vessels were documented from the three regions.

The general trajectory of traded Mycenaean ceramics—which consist primarily of decorated wares—reflects an exponential growth pattern, with limited examples and small growth through the LH I and LH II periods, and a sharp increase in LH IIIA. An associated growth is also evident in the quantities of foreign imports to Greece during the Late Helladic III period.[642] A pattern of accelerated expansion is also reflected in the geographic dispersal of traded Mycenaean wares, with the distribution extending in the LH IIIA from the local Cretan and Aegean markets to include the entire Mediterranean basin, broadening to cover fourteen modern nations.[643] Growth is also evinced in the increase in the number of sites from which

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[640] Although a variety of commodities were traded in closed vessels, including olive oil, wine, honey, spices, grains and other foodstuffs, the most common product was scented oils and unguents (Mountjoy 1986; Steel 1998, 286; Leonard 1989, 94-100).

[641] Domestic here refers to any known non-mortuary context. Ritual structures are included for analytical purposes, as they are often integrally linked with domestic or institutional structures, however will be noted in discussion when necessary. No differentiation is made in charts between palatial, wealthy, and more modest domestic structures, although this data is similarly included in the database, and will be incorporated in discussion where appropriate.

[642] Cline 1993, 2007. The quantity of Egyptian and Near Eastern imported objects on the Greek mainland increases from the LH I-II to LH III periods (from 37 in LH I-II to a height of 116 objects in the LH IIIB). The number of objects across the Aegean however remains fairly consistent, as the increase on the Greek mainland is offset by a decrease in material imported from the East on Crete. When combined, there are 131 objects imported during LH I-II, 125 in LH IIIA, 123 in LH IIIB, and 51 in LH IIIC (Cline 2007).

[643] This list includes Spain, Italy, Malta, Cyprus, Albania, Greece, Turkey, Syria, Lebanon, Israel, Palestine, Jordan, Egypt, and the Sudan (Van Wijngaarden 2002, 16).

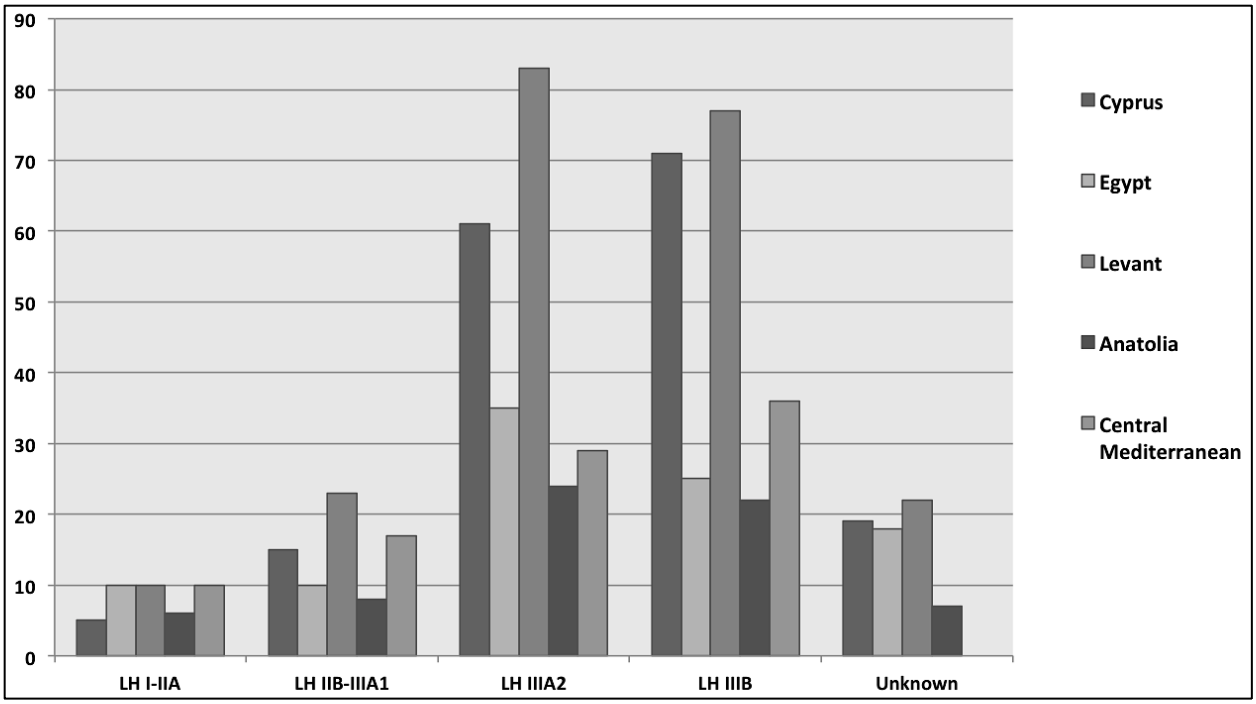

Figure 5-18. This chart displays the number of sites in each period that received Mycenaean imports during the Late Helladic Period. The figures for Anatolia and the Central Mediterranean are taken from Van Wijngaarden (2002).

Mycenaean vessels were recovered (Figure 5-18). The majority of sites held small quantities of Mycenaean imports, with only a few yielding over 100 LH I-LH IIIB vessels.[644]

In the discussion of sites and the relative size of their imported Mycenaean ceramic groups, the classification system employed by Van Wijngaarden has been adopted here.[645] Sites are therefore ranked into five categories, from class 1 (<10 Mycenaean finds) to class 5 (>500 Mycenaean finds). This system does not account for the size of excavations at each site, nor the

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[644] These sites include Deir el-Medina and Tell el-Amarna in Egypt; Enkomi, Hala Sultan Tekke, Kalavasos-Aiyos Dhimitrios, Kition, Maroni, Kouklia Palaeopaphos, Kourion Bamboula, and Maroni Vournes in Cyprus; Amman Airport site, Lachish, Minet el-Beida, Sarepta, Tell Abu Hawam, and Ugarit in the Levant. Sites with over 100 Mycenaean imports in Italy include Scoglio de Tonno, Broglio di Trebisace, Torre del Mordillo and Lipari (Van Wijngaarden 2002, 126 note 17).

[645] Class 1: < 10 finds; Class 2: 10-49 finds; Class 3: 50 – 99 finds; Class 4: 100 – 499 finds; Class 5: > 500 finds (Van Wijngaarden 2002, 17-19).

accuracy or comprehensiveness of the excavations or publications.[646] The varying degree of contextual reliability is especially problematic, for both the comparison of different sites, as well as the internal assessment of intra-site zonal variation for projects with a lengthy excavation history. For the latter the site of Ras Shamra-Ugarit is an apposite example, as excavation techniques and recording practices have varied greatly over the 70-year project history.[647] Limited attempts at accounting for the scale of excavation in cross-site ceramic comparisons have been undertaken by Carol Bell, who selected a number of Near Eastern and Cypriot sites, calculating Mycenaean finds per $100m^2$ of excavation. Comparisons are made across large sites from different Levantine zones (Ugarit, Sarepta, Tell Abu Hawam, and Ashdod), as well as Enkomi on Cyprus. Although beyond the scope of this dissertation, appropriate excavation size information is being slowly collected in the database constructed for this project, with the goal of refining future distribution analysis with appropriate excavation data.

Cyprus

In both volume and pervasion Cyprus was the greatest recipient of Mycenaean ceramics in the Mediterranean, with the corpus of 6,648 imports representing over half of the Late Helladic vessels documented here. Nearly all excavated Late Bronze Age sites yielded at least limited finds, while others such as Enkomi, Kition, Hala Sultan Tekke, and Kalavasos-Ayios

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[646] For the importance of 'confidence ratings' in quantifying the analytical reliability of a context, see Aprile 2010, 118-121.

[647] For instance, there are no published total ceramic counts for most contexts, while many of the early reports limit published finds to *materiel représentatif* (McGeough 2007:283; Yon 2006:145). This material heavily privileged imports, despite the estimation that they probably represented less than 1% of the total ceramic assemblage. Equally problematic, the recorded measurements of small artifacts from early excavation years include a margin of error in elevation of approximately 0.5 m, since levels were measured in relation to the excavation surface without accounting for topographical variation.

Dhimitrios, boasted as much as over a thousand pieces.[648] As with other Mediterranean regions importing Mycenaean vessels, the range of shapes present on Cyprus is much smaller than those available on the mainland (131 distinct shapes are recorded in the database),[649] yet includes certain shapes in large quantities that are not frequent within Greece. The most notable of these are the large amphoroid pictorial kraters (FS 53-55), of which a large portion come from Cypriot contexts.[650] Particularly well-known in this group is a collection of kraters decorated with chariot scenes, which appear, given their lack of popularity on the mainland, to have been produced explicitly for foreign markets.[651]

During the LH IIC period, Aegean-style vessels—including pictorial style kraters—began to be imitated and manufactured on Cyprus en masse.[652] The development of these manufacturing centers could in part be a function of shifting political and economic conditions on the Mainland at this time.[653] Vessels of the imitation group include Cypriot made LH IIIC, as well as the Rude or Pastoral style. Cypriot imitations are also notable for their employment of the

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[648] These figures include LH IIIC pottery, as only approximately 800 sherds and vessels from the LH I – LH IIIB vessels were documented at Kition.

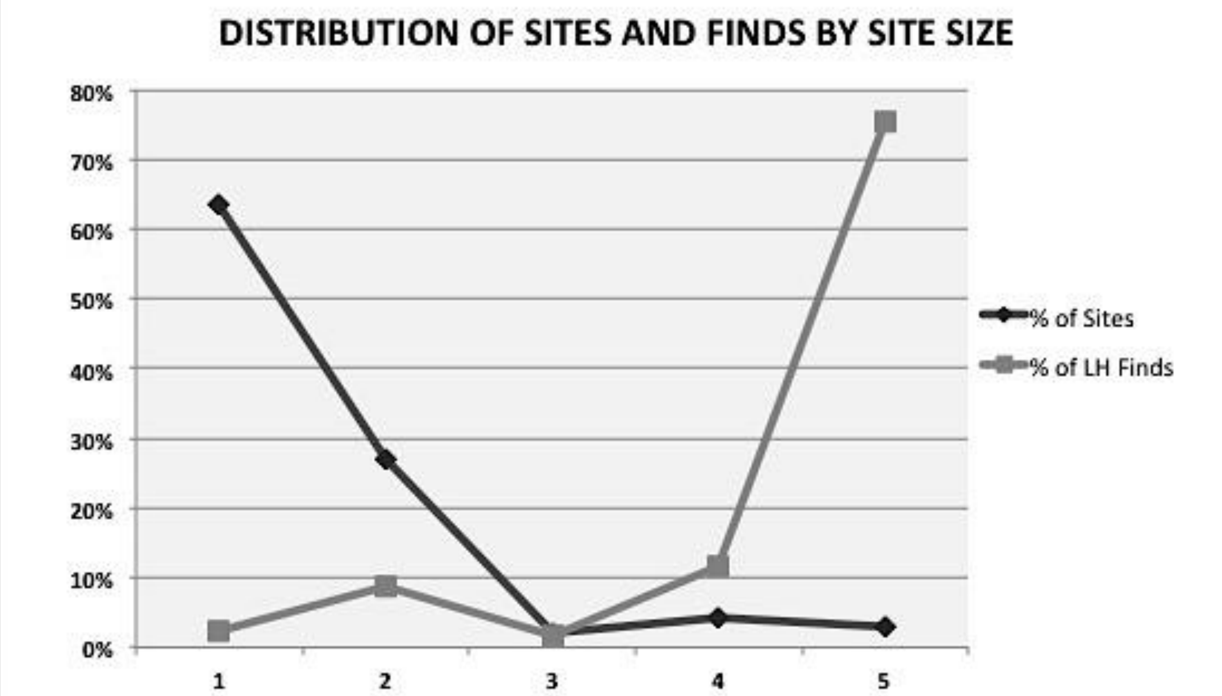
[649] This number represents the number of shapes that were clearly identifiable, while sherds of less distinct form are recorded under 'miscellaneous' groups (i.e., 'miscellaneous stirrup jars, FS 44-48). There is also one date range recorded, for the feeding bottle (FS 159-161). This significantly exceeds the 103 shapes identified by Gilmour (1992, 114-115).

[650] Furumark 1941a, 431; Vermeule and Karageorghis 1982; Crouwel and Morris 1985; Jones 1986, 602; Steel 1998, 292 ff.; Van Wijngaarden 2002.

[651] Mountjoy 1993, 170. This apparent scarcity of chariot kraters may in part be a function of the different consumption patterns across different regions, as Mycenaean examples are rarely found in tombs (the Nauplion Kraters are an exception), resulting in the poorer preservation of extant Late Bronze Age vessels (Immerwahr 1993, 219). Limited examples of pictorial kraters from the mainland come from sites such as Berbati, Corinth, Tiryns, Mycenae, and Nauplion, while, in addition to the Cypriot examples, chariot kraters were found at Amman Airport, Aphek, Ras el Bassit, Sahab, Tell Dan, Tell el 'Ajjul, and Ugarit in the Near East.

[652] The imitation pictorial kraters styles of Cyprus include the 'Rude' or 'Pastoral' styles (Jones 1986, 595; Sherratt and Crouwel 1987; Kling 1987; 1989; 2000; Sherratt 1991).

[653] Jones 1986, 603.



	1	2	3	4	5
No. of Sites	61	26	2	4	3
% of Sites	64%	27%	2%	4%	3%
No. of Finds	157	586	111	774	5020
% of LH Finds	2%	9%	2%	12%	76%

Figure 5-19. Table shows the frequency of sites of each class size, as well as the total Late Helladic I-IIIB ceramics recovered from the sites of that class. The percentage frequencies reflected by these figures are also included in the table, and are graphed in the chart above.

fast wheel, despite the continued prevalence of local handmade wares during this period.[654]

The majority of excavated Late Bronze Age sites on Cyprus have contained at minimum a few sherds of Mycenaean pottery. The material collected for this study includes 96 sites, from which 6648 sherds and vessels of LH I – LH IIIB-C transitional have been recorded and included here (see Appendix Map 1). This number, however, represents only a fraction of the total material that reached Cyprus during the Bronze Age, and new publications are expected to vastly

[654] Sherratt 1991, 191; Kling 1987.

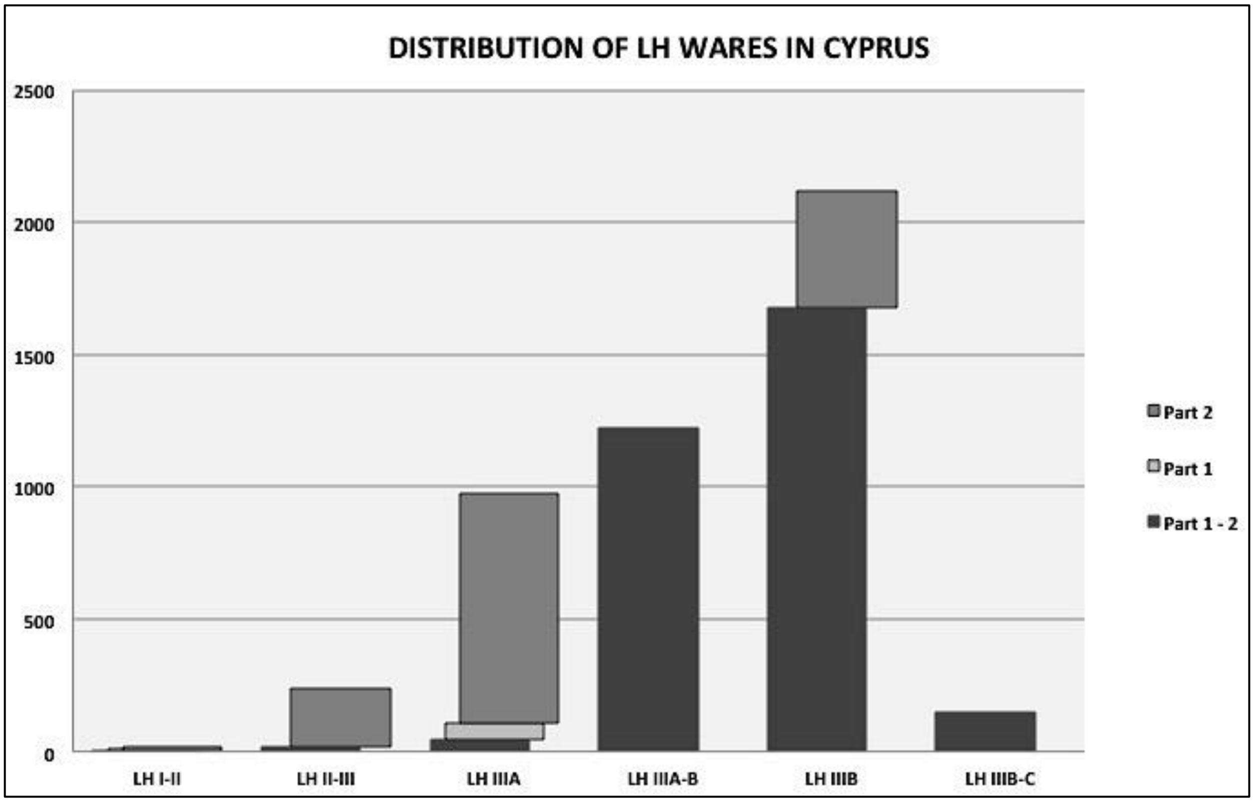


Figure 5-20. Total imported Late Helladic wares per period in Cyprus. Distribution is delineated into sub-periods to include more precise data where available (i.e., LH IIIA2 = LH IIIA2 1-2 + LH IIIA2a + LH IIIA2b). The increase from LH I and LH II to LH III is marked (LH IIIC ceramics and those of unknown date are not included here).

expand this corpus in the future.[655] The majority of contexts previously excavated are either mortuary or cultic in nature, creating an unfortunate imbalance of contextual information;[656] however, many new and ongoing excavations are seeking to rectify this imbalance. The

[655] A particularly large collection awaiting publication in full is that of Hala Sultan Tekke, from which over 4000 sherds are reported to have been recovered, including a substantial group of high quality vessels from tombs excavated in 2016. Additional gaps in the information can be attributed to the loss of material through modern site destruction, as is the case at Toumba tou Skourou (Vermeule and Wolsky 1990, 3-5).

[656] Steel 1998, 286; Cadogan 2005, 313. A large collection of material has also been recovered from a series of wells (including at Hala Sultan Tekke; see Öbrink 1979; Maier 1997, 101; Steel 2004a, 75). This problem is further compounded by the early excavation date of many prominent Cypriot cemeteries, from which important contextual information and documentation of non-luxury finds were poorly recorded (Keswani 2005, 344).

widespread distribution of Mycenaean pottery on Cyprus is reflected in the high proportion ofclass 2 relative to class 1 sites (26:61).[657] There is still, however, a high concentration of total imports vessels in class 4 and 5 sites (i.e., Kouklia-Palaepaphos, Kourion, Maroni-Vournes, Kalavasos-Ayios Dhimitrios, Kition, Hala Sultan Tekke, and Enkomi; see Figure 5-19). Collectively these large sites have contributed 88% of all Mycenaean imports from Cyprus. The distribution of sites with LH I-IIIB imports reveals a small degree of geographic clustering, particularly around the large coastal sites in the south (such as Pyla-Kokkinokremos, Kition and Hala Sultan Tekke, Kalavasos and Maroni, and Kourion).[658]

The earliest imports from Cyprus date to the LH I-II period (see Figure 5-20). Examples come from large sites along the coast, particularly in the south and northwest, including Ayia Irini-Palaeokastro, Maroni, Kition, and Enkomi. Vessels include both open and closed shapes, such as LH I and LH II deep semiglobular cups at Enkomi and Ayia Irini, as well as LH IIA and LH IIB-IIIA1 alabastra at Maroni and Hala Sultan Tekke. Other early finds include a LH IIB-IIIA1 kylix (FS 260) from Milia and a piriform jar (FS 31) from Larnaca tis Lapithou. At other sites like Kouklia-Palaepaphos and Toumba tou Skourou early imported vessels were primarily of Cretan origin.[659] The vast majority of sites with early (LH I-IIB) imports—most of which only yielded single examples—occur along the coast, while limited vessels began to reach important

[657] There is also a high proportion of class 2 to class 1 sites in the Levant (26:69), whereas in Egypt the ration is significantly smaller (6:55). Class 1 sites represent 64% of the sites in Cyprus and the Levant, and 86% of sites in Egypt; Class 2 sites represent 27% in Cyprus, 22% in the Levant, and 9% in Egypt.

[658] Van Wijngaarden notes that the degree of clustering of sites increases when the quantity of finds is taken into account, with additional groupings around Enkomi and Morphou (Van Wijngaarden 2002, 127).

[659] Vermeule and Wolsky 1978; 1990, 381-383. These include an LM IA cup from Kouklia, and LH IIIA1 jug, stirrup jar, and flask from Toumba tou Skourou. For the distribution of Late Minoan vessels in Cyprus, see Appendix Catalogue 4.

mining communities inland by LH IIIA1.[660] Vessels from the interior also range in shape, including a stirrup jar from Idalion, a cup from Dhikomo-Onisia, an alabastron from Katydhata, and a jug from Nicosia-Ayia Paraskevi.[661]

The quantity of imported wares then increases sharply during the LH IIIA2 period, and continues to grow in the LH IIIB. This is similar to the pattern observed in both the Levant and Egypt, however the latter shows an abnormally large spike in the LH IIIA2 period due to the substantial corpus recovered from Tell el-Amarna. As imports begin to diminish at the end of the LH IIIB period, and locally produced imitation manufacturing grows, further discrepancies can be noted between Mainland and export vessel groups. Missing from Cyprus are the LH IIIB deep bowls and skyphoi popular in Greece, while the shallow bowl (FS 295) appears with unusual frequency.[662]

In quantity, imports are clustered around the major sites of the coast, however there is more significant inland distribution, with higher concentrations of vessels in the region surrounding Idalion and Athienou-Bamboula, as well as a large quantity recovered from Sinda (the majority of which dates to the LH IIIB-IIIC1b periods). The growth of hinterland sites supports the hierarchical structure proposed by Keswani and other Cypriot scholars, for which interior mining and resource extraction settlements were connected through complex tributary and exchange relationships to large coastal towns or centers.[663] Similarly, the comparably large and diverse assemblages recovered from Kition, Hala Sultan Tekke, and Enkomi, as well as

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[660] Nicolaou 1973, 51-58.

[661] Van Wijngaarden 2002, 186-187.

[662] Steel 1998, 287; Sherratt 1994, 35. The late appearance of the shallow bowl in LH IIIB is the proposed result of the popularity of existing substitutes in White Slip and Base Ring Wares (Kling 1989, 167-168).

[663] Keswani 1993, 78; 1996, 2010; South 1989, 319; Steel 1998, 289. See also Catling 1962; Knapp 1997.

substantial collections from Maroni, Kourion, and Kouklia, suggest that political and economic control was not completely centralized (headed by a state run by Enkomi). The wide range of shapes available to sites of varying size and political importance further invalidates a highly centralized system dependent on preferential access to goods.[664] The diversity of shapes across different regions of the island also supports the existence of independent import access outside of an organized and highly centralized core.[665]

Although not included in the analysis here, it is noteworthy that the quantity of Mycenaean wares at a number of sites increase significantly in the LH IIIC period, as material begins to be locally produced on Cyprus. For example, at the site of Sinda there are less than 5 LH IIIA finds and roughly 15 LH IIIB examples, however there are more than 50 vessels recovered from the site with a LH IIIC date (with another 15 LH IIIB-C transitional pots).[666] These vessels, found in tombs, settlements, and wells, bear close resemblance to both the material and the find contexts of both Kition and Enkomi.[667] As both local and imported LH IIIC ceramics are present at these sites, there is considerable debate as to the potential presence of Aegean immigrants on the island.[668] Further analysis addressing the impact of both immigration and local manufacturing on the consumption of Aegeanizing wares will form a valuable point of comparison for LH I – LH IIIB distribution patterns examined here.

The most popular shapes for LH I-IIIB imports were stirrup jars and piriform jars (the

[664] Van Wijngaarden 2002, 186-187.

[665] Nicolaou 1973.

[666] Åström 1972.

[667] Van Wijngaarden 2002, 160.

[668] Maier 1973, 75; Asaro and Perlman 1973, 221; Karageorghis 1990, 27; Sherratt 1991; Cadogan 2005, 313.

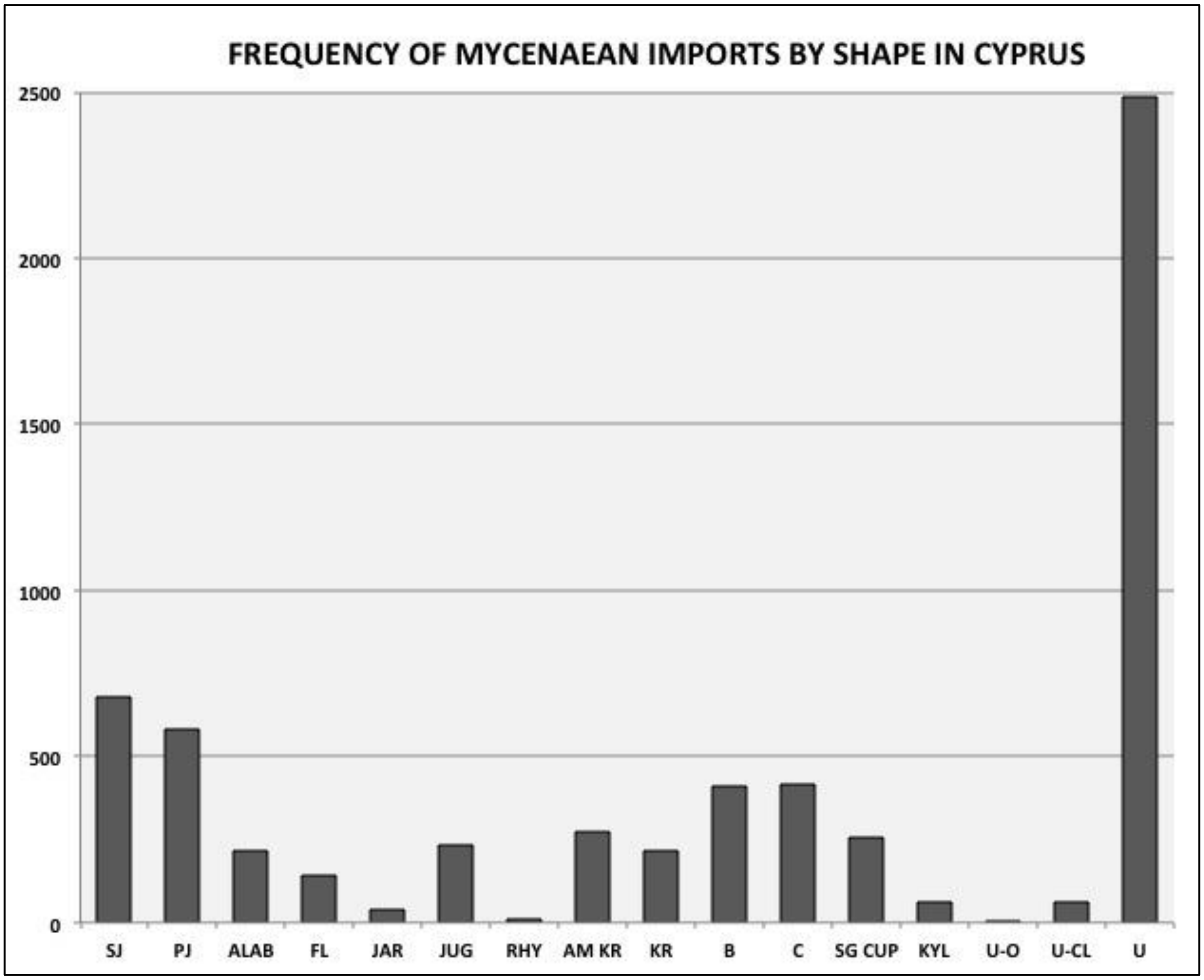

Figure 5-21. This chart shows the number of Mycenaean imports by general shape in Cyprus. The shape codes are as follows: SJ – stirrup jar, PJ – piriform jar, ALAB – alabastron, FL – flask, JUG – jug, JAR – all other jar types, RHY – rhyton, AM KR – amphoroid krater, KR – all other krater types, B – bowl, C – all other cup types, SG CUP – semiglobular cup, KYL – kylix, U-O, unknown open shape, U-CL, unknown closed shape, and U – unknown shape.

most popular of which were FS 45 and FS 171), which account for around 20% of the total imported assemblage (see Figure 5-21). Other popular closed shapes include alabastra (FS 94-95) and globular flasks (FS 187-192). These vessels were exchanged primarily as containers for unguents, and were most frequently deposited in funerary contexts.[669] Imported Late Helladic

[669] Steel 1998, 294; 2004a, 77.

containers were deposited commonly alongside locally produced fine ware containers of White Shaved or Red Lustrous Wheel-made Ware.[670] The extensive distribution of imported Mycenaean containers within tombs of varying social class suggests general access to these goods, as well as the absence of a restrictive value. The wide use of closed vessels may be contrasted with the pictorial kraters, which appear to have been reserved for elite tombs.[671]

Open shapes were much more common in Cyprus relative to other Mediterranean regions, where they represent roughly half of known vessel types. Open forms include a fairly large corpus of drinking and dining vessels, such as cups, goblets, kylikes, and mugs, as well as bowls and kraters. Jugs, particularly the small globular jug (FS 114), (FS 118), small piriform jug (FS 134), and (FS 149), are significantly more popular in Cyprus than in other regions, with the Cypriot examples accounting for over 75% of all jugs from the Eastern Mediterranean (while Cypriot imports together account for only roughly half of the total Mycenaean assemblage in the East).[672] The popularity of open vessels, the frequency of shapes uncommon on the Greek Mainland (such as the chariot pictorial krater), as well as the presence of ostensibly Cypriot-directed morphological peculiarities (such as the addition of a wishbone handle to some bowls)[673] suggest the existence within Greece of demand-driven production of certain vessel groups for export.[674] Although chariot kraters were considered by some scholars to represent

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[670] Steel 1998, 295; Eriksson 1993, 58.

[671] Keswani 1989, 59-60; Steel 1998; 2004, 78. Many examples were recovered from tombs around large coastal centers such as Kition or Enkomi. The mortuary use of these vessels differs from their consumption on the mainland, where they are rarely found in tombs (Jones 1986, 596).

[672] For both Egypt and the Levant, jugs represent only around 1% of the total Mycenaean import corpus, while in Cyprus they account for nearly 4% of this group.

[673] Karageorghis 1976.

[674] Steel 1998, 286-287; Sherratt 1994, 36. A similar export-centered hypothesis for Mycenaean vessels

funerary gifts, the presence of wear marks on many Mycenaean vessels (including piriform jars, stirrup jars, pyxides, flasks, and chariot kraters), as well as the rare evidence of repair work, has demonstrated that most import vessels were likely in use before deposition as grave goods.[675] An analogous consumption pattern is visible for the use and deposition of Middle Cypriot Red Polished wares on the island.[676]

The use of Mycenaean dining vessels is attributed to the popularity of feasting within Cyprus, for which dining sets produced in fine wares appear in the elite tombs of the sixteenth to fourteenth centuries.[677] The elite association of feasting, is demonstrated by the presence of Mycenaean imported dining vessels in wealthy tombs,[678] as well as the large collections of feasting paraphernalia—including large quantities of Mycenaean imports—recovered from the elaborate administrative structure Building X and its adjacent ashlar structures at Kalavasos-Ayios Dhimitrios.[679] Similar import concentrations were also discovered in domestic contexts at other large administrative centers, including Kourion-Bamboula, Kouklia-Palaepaphos, Kition, and Hala Sultan Tekke (where large import groups were recovered from a number of wells).[680] The importance of feasting activities, as well as its elite associations, may be further

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recovered from the Levant, termed 'Proto-Marketing', is considered below (see footnote 764).

[675] Keswani 1989, 562; 2004, 127. The predominance of funerary examples may in part be accounted for by the disproportionate excavation of cemeteries and mortuary contexts.

[676] Steel 2004, 77.

[677] Steel 1998, 292.

[678] There does not appear to be gender restrictions associated with feasting activity, as Mycenaean dining vessels were discovered in the tombs of both males and females (Steel 1998, 290; Goring 1989, 102).

[679] South 1991, 134; 1997, 158; South and Russell 1993, 305. The majority of finds in this structure were recovered from a pit in room A173 along with seeds and animal bones (South and Russell 1993, 304-306). Over 80% of the vessels recovered from this context were bowls or cups.

[680] Kition yielded a particularly large collection of pictorial dining vessels (over 70 examples), including kraters and jugs.

demonstrated by the frequency of Base Ring dinner services in tomb assemblages, which were likely the funerary substitutes of metal vases used in communal feasting.[681] Mycenaean imported dining vessels were then substituted for Cypriot fine ware sets by the elite, resulting in the marked decrease in the demand for, and production of, feasting vessels in White Slip and Base Ring Wares.[682] The popularity of imported dining sets is ascribed by L. Steel to the superior production technology of Mycenaean ceramics, as well as the aristocratic connotations of the pictorial style motifs.[683]

The presence of Mycenaean vessels at sanctuaries and cultic structures, such as Athienou-Bamboulari, Ayios Iakovos-Dhima, Myrtou-Pigadhes, and Kition, demonstrates the role that certain imports could play in both urban and rural ritual activities.[684] These deposits include a group of miniature juglets, which were deposited with other votive vessels at the sanctuary at Athienou.[685] The greatest range of vessels was present at Myrtou, and included kraters, jugs, bowls, and cups.[686] At the open-air site of Ayios Iakovos-Dhima (associated with two nearby cemeteries), only 15 vessels were recovered, of which there were four Mycenaean imports (two piriform jars, a jug, and a conical krater).[687] Ritual vessels, including conical and animal shaped rhyta were also recovered from domestic and mortuary contexts at Maroni, Kition,

[681] Steel 1998, 290. Dining services in White Slip Ware were particularly popular in south-central Cyprus, and are frequent in tombs around Maroni and Kalavasos (ibid.).

[682] Steel 1998, 292; Keswani 1993, 78. These vessels were then replaced by locally made Aegeanizing dining sets in White Painted Wheel-made III Ware (Cadogan 1991, 169-171).

[683] Steel 1998, 293. These include chariots, wildlife, and aristocratic figures or activities (such as boxing, running, horseback riding, and bull-leaping).

[684] Van Wijngaarden 2002, 190. See also Karageorghis 1965; Johnson 1980; du Plat Taylor 1957.

[685] T. Dothan and Ben-Tor 1983, 20, 46; Steel 2004, 76.

[686] Steel 2004, 76.

[687] Webb 1992, 94-96; Steel 2004, 76.

Myrtou-Pigadhes, Sinda, Kourion, and Enkomi, however these shapes appear to have been far more popular in the Levant; despite the Cypriot corpus being nearly double the size, there were over eight times as many rhyta recovered in the Levant.[688] The irregularity of these finds across Cyprus supports an interpretation of regional variation in the adoption of Mycenaean ritual vessels within cultic contexts during the Late Bronze Age.[689]

Egypt

The Late Bronze Age saw the zenith of Egyptian imperial power in the Eastern Mediterranean. Surviving diplomatic correspondence and the prevalence of imported luxury materials and goods attest to the powerful position Egypt played in the trade systems of the late second millennium. In contrast, there is a relative paucity of Mycenaean pottery from elite contexts in Egypt relative to both Cyprus and the Levant.[690] As with Minoan imports of the Middle Bronze Age, Mycenaean ceramics were distributed throughout the delta and Nile valley, from the Mediterranean coast in the north into Nubia in the south. The largest collections of material come from the sites of Tell el-Amarna, Tell el-Dab'a and adjacent Qantir, and Deir el-Medina, three of which served as administrative capitals or palatial sites during their respective

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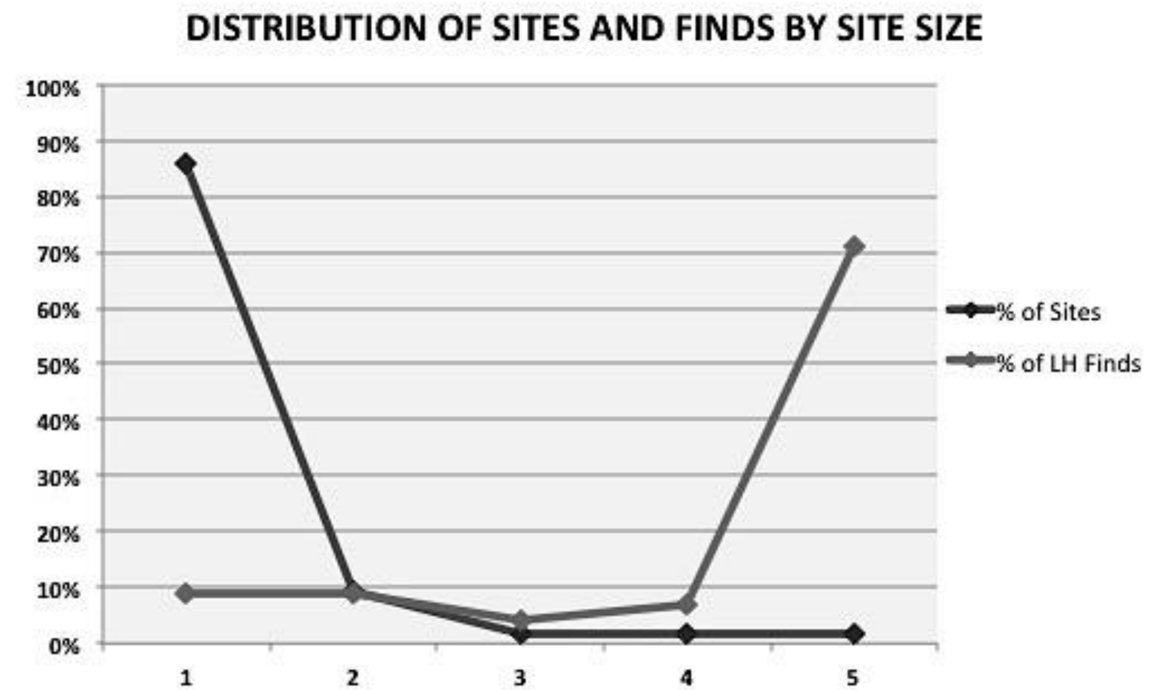
[688] In both regions the conical rhyton (FS 199) was the most common, with 78 examples in the Levant and 7 in Cyprus included in the database. Animal-shaped rhyta were the second most common, with 31 and 4 examples respectively, while ostrich-egg shaped rhyta accounted for 4 and 2 vessels from the Levantine and Cypriot groups (there was an additional group of 11 rhyta of unspecified types recovered from sites throughout the Levant).

[689] Van Wijngaarden 2002, 198; Steel 2004, 74. Webb argues that these vessels were not interned within tombs, as their primary function was for use in religious ceremonies at communal sanctuaries (1992, 89).

[690] Routledge and McGeough 2009, 26. A similar underrepresentation is noted for Hittite elite contexts.



	1	2	3	4	5
No. of Sites	55	6	1	1	1
% of Sites	86%	9%	2%	2%	2%
No. of Finds	153	153	72	121	1232
% of LH Finds	9%	9%	4%	7%	71%

Figure 5-22. Table shows the frequency of sites in Egypt of each class size, as well as the total Late Helladic ceramics recovered from the sites of that class. The percentage frequencies reflected by these figures are also included in the table, and are graphed in the chart above.[691]

periods of occupation.[692] In total 64 sites of the Late Bronze Age have yielded a total of 1,731 Mycenaean finds, though the majority of sites held fewer than 10 pieces each (see Figure 5-22,

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[691] Three of the class 1 sites (Debeira, Aniba, and Soleb) from Nubia have so far only yielded single finds, which appear to be Egyptian imitations of Aegean material. It is unclear from the publications whether additional Mycenaean material was present at the site, and the construction of the Aswan dam has limited the opportunity to explore these sites more fully. They have been included in the list of sites above, however their imitation pieces have not been included in the total ceramic counts of imported material.

[692] Tell el-Amarna, also known as Akhetaten, was the capital during the Amarna period (covering the reign of Amenophis IV). Tell el-Dab'a and Qantir are neighbouring sites, with the former the capital of the Near Eastern Hyksos rulers of the Second Intermediate Period, and the latter the Ramesside capital of the 19th Dynasty.

Appendix Map 3). The exponential relationship between site size and find quantity, in which a small number of large sites contribute a majority portion of total material, resembles the scale-free network described in Chapter 4. Only Deir el-Medina and Amarna currently qualify as class 4 and class 5 sites.[693]

The earliest definitively Late Helladic vessels date to the LH II period (earlier vessels are frequently categorized as LM I/LH I). Two early pieces that date to LH IIA include a ring-handled cup (FS 237) from Saqqara, and a piriform jar (FS 20) from Dra' Abu el-Naga (near Thebes). A similar piriform jar (FS 20) of general LH II date was recovered at Deir el- Medina. Other LH II closed vessels include a rounded alabastron (FS 81) from Saqqara, a squat jar (FS 87) from Kahun, while one LH II semiglobular cup (FS 211) has been found at Abusir.[694] The vast majority of vessels date to the LH IIIA period, in particular to the LH IIIA2, when regular commerce was established (see Figure 5-23).[695] At many of the sites with the largest Mycenaean groups, imported vessels begin appearing in the LH IIIA1 period (as is the case at Marsa Matruh, Amarna, and Tell el-Dab'a).[696] While LH IIIB saw a continued boom in widespread distribution in the Levant and Cyprus, distribution was comparatively more limited in Egypt during this period.[697] The largest group of LH IIIB sherds was found at Qantir, the capital of the Ramesside

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[693] The publication of all excavated Mycenaean finds from Qantir, currently in preparation by Mountjoy, will result in the site being re-categorized as a class 4 site.

[694] An additional LH IIA alabastron was found at Aniba in Nubia, however this appears to be an Egyptian imitation vessel (Kemp and Merrillees 1980, 242-244, 253-254). This high quality piece appears to be the only Egyptian imitation rounded alabastron (Hankey 1993, 114; Weinstein 1983, 83-86).

[695] Hankey 1993, 110.

[696] These include both open and closed shapes, including a cup from Marsa Matruh and two globular flasks (FS 189) from Amarna.

[697] Van Wijngaarden 2002, 22. Hankey has suggested that the supply fall-off in the LH IIIB was simply a precursor to the LH IIIC trade decline in the rest of the Mediterranean, merely occurring in the preceding period (1993, 112).

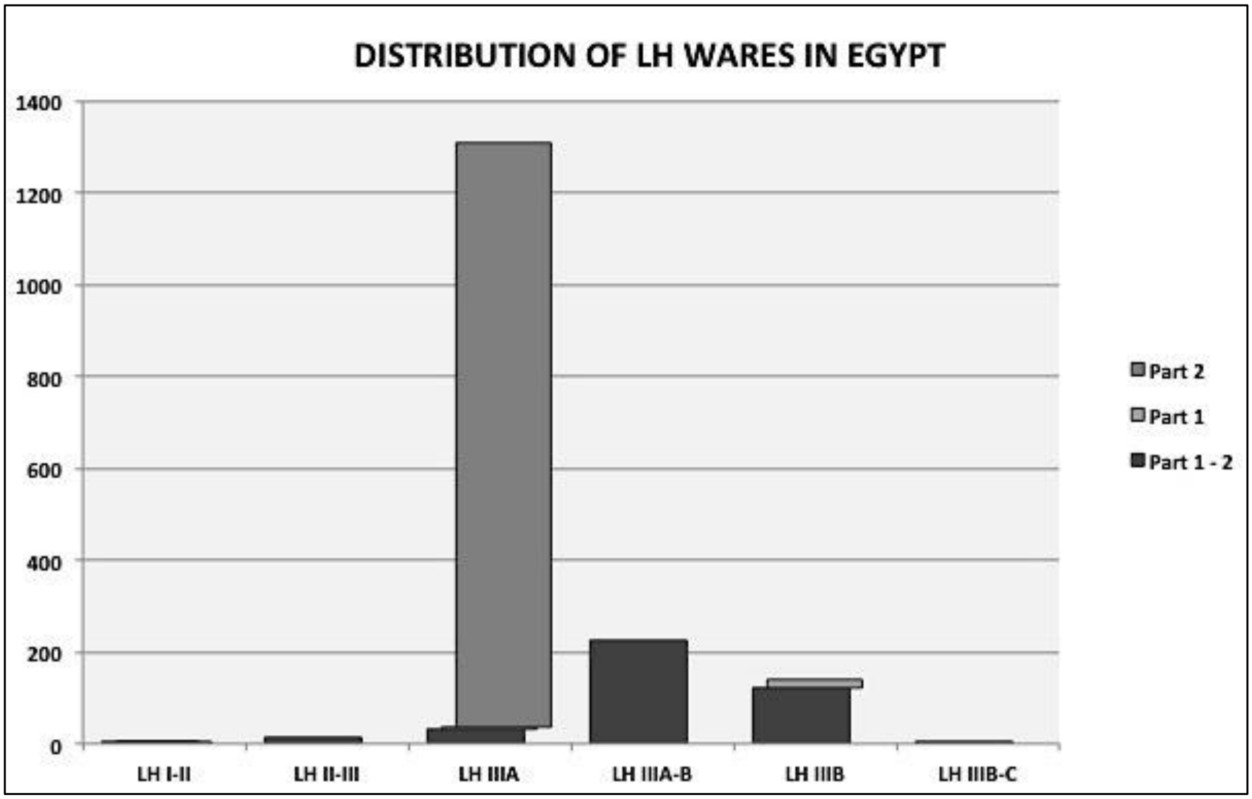

Figure 5-23. Total imported Late Helladic wares per period in Egypt. Distribution is delineated into sub-periods to include more precise data where available (i.e., LH IIIA2 = LH IIIA2 1-2 + LH IIIA2a + LH IIIA2b). The increase from LH I and LH II to LH III is marked (LH IIIC ceramics and those of unknown date are not included here).

rulers of the 19th Dynasty, and includes over 80 published vessels.[698] Of the 1,731 sherds and vessels collected from Egypt, nearly 85% of vessels of known shape are closed forms.

In relation to the Mycenaean pottery distributed throughout the Mediterranean, the material recovered from Egypt reflects a reduced range of forms (with only 54 different shapes identified).[699] The most popular shapes in Egypt are the stirrup jar (FS 164-182) and the globular

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[698] The current count of excavated material exceeds this number by over 200 additional finds which are currently being examined and prepared for publication (Judas 2010, 206; citing personal communication with Astrid Hassler).

[699] Hankey 1993, 112. This number represents only clearly identifiable forms, while sherds of less distinct form are recorded under ‘miscellaneous’ groups (i.e., ‘miscellaneous stirrup jars, FS 44-48). There is also one date range recorded, for the feeding bottle (FS 159-161).

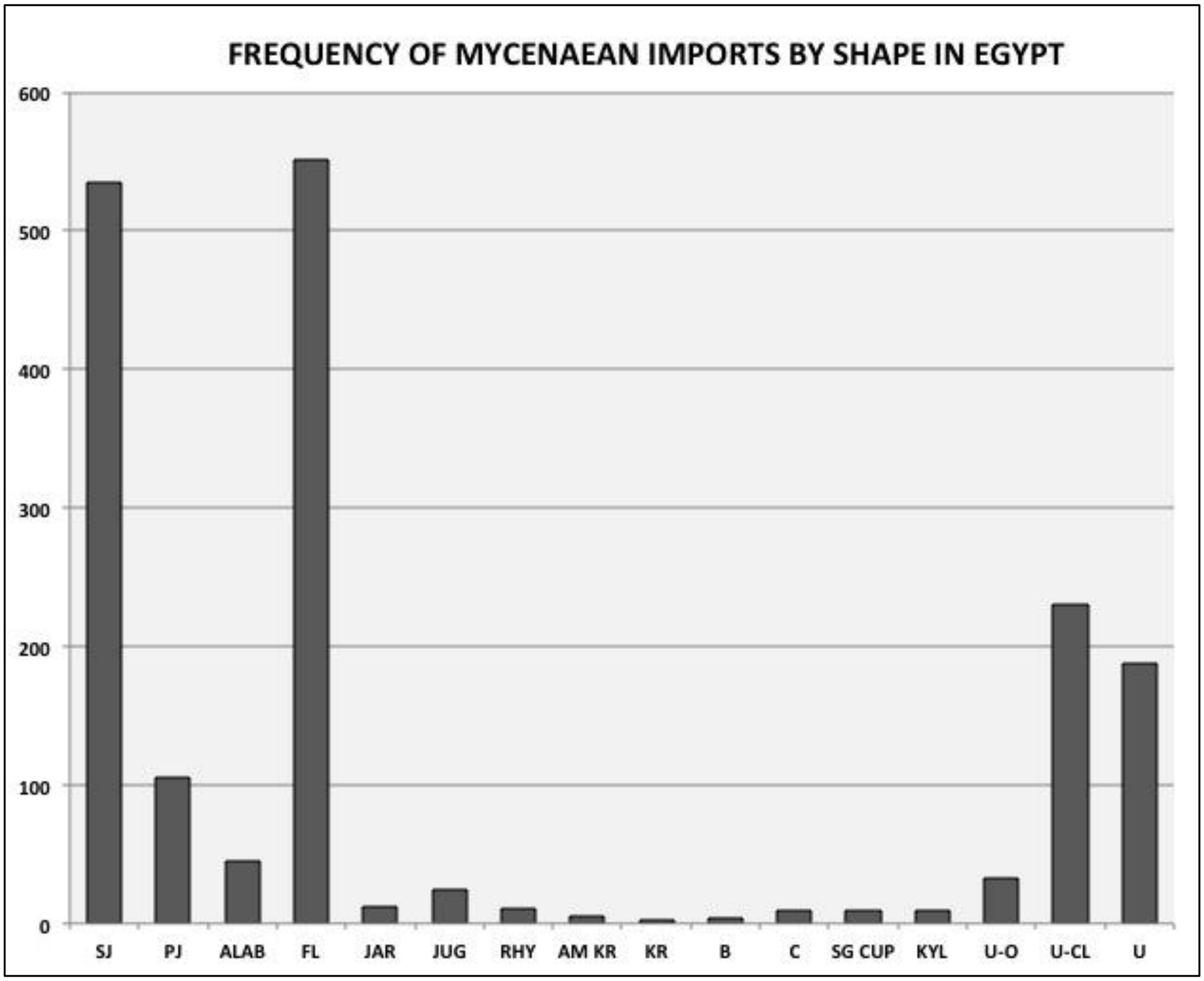

Figure 5-24. This chart shows the number of Mycenaean imports by general shape in Egypt. The shape codes are as follows: SJ – stirrup jar, PJ – piriform jar, ALAB – alabastron, FL – flask, JUG – jug, JAR – all other jar types, RHY – rhyton, AM KR – amphoroid krater, KR – all other krater types, B – bowl, C – all other cup types, SG CUP – semiglobular cup, KYL – kylix, U-O, unknown open shape, U-CL, unknown closed shape, and U – unknown shape.

flask (FS 187-189), which each account for roughly one third of all finds (see Figure 5-24). The high frequency of the globular flask (FS 187-192) is unusual in relation to the distribution of Mycenaean vessels in other regions, as the shape enjoys a less pronounced popularity elsewhere in the Mediterranean.[700] The distribution of the flask is centered heavily on Amarna, where it

[700] Van Wijngaarden 2002, 12. The group of flasks recorded from Egypt represent over 60% of all flasks from the Eastern Mediterranean, with 552 examples documented here (compared to 140 from Cyprus and

outnumbers the stirrup jar nearly 2:1; at nearly all other sites in Egypt the stirrup jar is more common than the flask.[701] This form is particularly popular in the LH IIIA period, and may be replaced in distribution during the LH IIIB by the lentoid flask (FS 186), as only the latter was found in LH IIIB contexts (as seen at Qantir). Other common closed vessels include the straight-sided and rounded alabastra (FS 94 and 85), and the piriform jar (FS 35, 39, 40, 45, 48). Straight-sided alabastra are far more common than the rounded version at Amarna (30:2), while at other sites the remaining examples are fairly evenly distributed. A number of jugs and dinner vessels were also found. These include pouring vessels (FS 114, 118, 120, 121, 130), rhyta (FS 199-202), amphoroid kraters (FS 53-56), bowls (FS 281), and semiglobular and stemmed cups (FS 220, 221, 237, 258, 264). Open shapes are far less common, representing around 15% of the total material; with the exception of the krater (FS 53-56), rhyton (FS 199), and perhaps the semiglobular cup (FS 220), each open shapes is represented by less than five examples throughout Egypt. In contrast with Cyprus and the Levant, pictorial vessels are also very rare in Egypt, with only two examples from Tell Muqdam and Qantir—both in the northeastern delta.[702]

Mycenaean pottery has been recovered from a variety of different contexts. The largest groups of material come from institutional contexts at the administrative or palatial centers of Tell el-Amarna, Tell el-Dab'a, and Qantir.[703] Other institutional structures that have yielded

194 from the Levant). Of the 552 Egyptian flasks, at least 470 can be definitely identified as FS 189, which accounts for 90% of the distribution of this particular shape in the Eastern Mediterranean.

[701] Two exceptions are Tell el-Rataba and Tombos, however the assemblages from these sites are small (Tombos included only four FS 189 globular flasks excavated from two different tombs).

[702] Judas 2010, 610.

[703] A common source of Mycenaean ceramics in Egypt is the rubbish dumps often associated with large palatial structures and royal establishments. At Amarna, the rubbish dumps held the vast majority of vessels from this site. Similar finds within discard piles were also discovered at Lisht, Kahun, Hawara, and Harageh (Hankey 1993, 111).

Mycenaean imports include military establishments and fortifications from the Delta in Lower Egypt (i.e., Bir el-Abd and C86) to Nubia (such as Aniba, Buhen, Sesebi, and Soleb). To this group we may also add specialized settlements such as the workers' villages at Kahun and Deir el-Medina. Domestic settlements of varying wealth were also common sources of Mycenaean imports, including communities at Tell el-Dab'a, Qantir, Memphis, Gurob, and Amarna. While Late Helladic vessels are often included in ritual assemblages in the Levant, there is a notable paucity of Mycenaean vessels from cultic contexts in Egypt.

As is common in Egyptian archaeology, tombs provide a considerable component of excavated contexts. Within tombs, Mycenaean vessels appear to have had a relatively wide distribution, from elite graves such as the Tombs of Horemheb and Maya in Saqqara,[704] to more modest tombs at Saqqara, Gurob, Qubbet el-Hawa, and Thebes. This democratic spread across contexts of varying wealth—also visible in the material from domestic structures—suggests that Mycenaean imports are not restricted to elite social groups. The frequency, however, of these vessels at important institutional sites indicates that their availability may have been concentrated in part within centralized distribution systems.

The great majority of Mycenaean pottery in Egypt can be attributed to the Amarna period. The site of Amarna itself has yielded around 70% of the Late Helladic pottery from Egypt.[705] The vessels from Amarna are almost exclusively LH IIIA2 in style, in predominantly closed

[704] The assemblages from these tombs include LH IIIA2-IIIB1 examples of stirrup jars (FS 166, 171) and globular flasks (FS 189).

[705] There are around 2000 sherds from the site, which may represent upwards of 600 pots (Petrie 1894; Hankey instead suggested that this number was inflated, and should be adjusted to around 200-300 pots, see Kelder 2010, note 20). The Mycenaean ceramics from Amarna documented for this study include 1233 sherds and partial vessels.

shapes (roughly 85% are closed).[706] The most common vessels are stirrup jars (FS 164, 166, 170, 171, and 178), and the globular flask (FS 188, 189). The latter represents 55% of closed vessels, and 40% of all finds from Amarna. Aside from flasks and stirrup jars, there are limited—often singular—examples of piriform jars (FS 349, 39, 45), alabastra (FS 85, 94), and jugs (FS 114, 118, 120, 134, 151) recovered from the site. Open vessels are far less common, and include kraters (FS 53-55), rhyta (FS 199), cups (FS 208, 220), stemmed cups (FS 257, 263), and bowls (FS 283). The majority of this material was recovered from rubbish heaps in the central city, however finds were dispersed across most zones of the site.[707] While the majority of finds are associated with civic and administrative areas, it is notable that no Mycenaean ceramics were recovered from either of the Aten temples.[708] The assemblage from Amarna is also exclusively domestic, as all known tombs were either emptied or heavily looted following the collapse of the Amarna region and the abandonment of the site.[709] The unprecedented size of the group of Helladic vessels at Amarna is interpreted by J. Kelder as a function of a significant increase in the importation of olive oil from Mycenaean Greece during this period.[710] Chemical analysis of the fabric of a group of vessels from Amarna has determined an origin of Mycenae/Berbati in the

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[706] In addition to two recorded LH IIIA1 pieces, there are two vessels purported to be LH IIIB1 (see Warren and Hankey 1989, 149-151). This would pose obvious chronological problems, as Amarna was largely abandoned following the death of Akhenaten (before the beginning of LH IIIB in Greece). The first example held in the University College London collection has since been accepted as LH IIIA2 based on its shape (most likely FS 166 or FS 178), while the second, from the Bonn collection, may be tentatively assigned to the LH IIIA2 based on the confirmation of other, albeit limited, LH IIIA2 examples with comparable lozenge pattern (Wiener 1998, 312; French 1965, 159-202; Kelder 2010, 132).

[707] Petrie 1894; Hankey 1981, 45-46.

[708] Kelder 2010, 130.

[709] Hankey 1993, 111.

[710] Kelder 2010, 131.

Argolid.[711]

The assemblage from Qantir diverges fairly significantly from Amarna in the range of wares present. As noted, the FS 189 globular flask is replaced at the later site by the FS 186 lentoid flask. Further variation includes the addition of a number of stirrup jar subtypes (FS 167, 173, 179, 180, and 182), a feeding bottle (FS 151), a deep bowl (FS 284), a krater stand (FS 336), as well as a potential strainer and dipper (FS 236). While the bowl, stand, and dipper are all unique vessels in Egypt, limited examples of the stirrup jar subtypes do occur at other sites.[712] All comparable stirrup jar examples occur in LH IIIB contexts, suggesting that the divergence between the range of shapes of the Qantir assemblage and the Amarna corpus may reflect the development of the range of Mycenaean wares available in Egypt from the LH IIIA to the LH IIIB period.

Although local imitations of Aegean vessels are rare in Egypt,[713] the influence of Mycenaean style is most clearly seen in Aegean-like examples produced in other materials—namely stone and faience.[714] The most popular locally copied Aegean shapes include stirrup jars, flasks, alabastra, and rhyta. As the corpus of Mycenaean vessels in Egypt is often associated with assumed liquid contents trade, it is unclear whether the locally imitated closed shapes functioned in the same manner. They do, however, occur together contextually at sites such as Buhen.

[711] Mommsen et al. 1992; Mountjoy 2008, 139.

[712] The stirrup jars types present at Qantir but not Amarna are rare—but not unique—shapes in Egypt. These include: FS 167 (also found at Riqqeh and Sedment); FS 173 (also found at Gurob); FS 179 (also found at Gurob and Abydos); FS 180 (also found at Saqqara, Gurob, Abydos, Gurna, and Cairo); and FS 182 (also found at Saqqara, Gurob, and Memphis).

[713] There are at least two confirmed imitation stirrup jars from Deir el-Medina (M. Bell 1982, 150), while Koehl lists two imitation rhyta from Tell el-Dab'a (2006, 343).

[714] Hankey 1995, 117, 123. Examples include an imitation middle Minoan rhyton (BM 22731) and late Helladic stirrup jars in faience from Tuneh el-Gebel (Spur et al. 1999, 32), as well as imitation faience stirrup jars from Debeira (M. Bell 1983, 16), Soleb (Hankey 1993, 114), and Zawyet el Amwat.

Kelder suggests that these vessels were used for the storage and trade of Egyptian olive oil (potentially perfumed).[715] Future residue analysis will hopefully serve to clarify the function of these locally produced imitation wares. Aegean and Cypriot painting styles were also frequently employed in the decoration of locally produced ceramics, examples of which were recovered from Abusir el-Meleq, Aniba, Buhen, Esna, Gurob, Sedment, Tarkhan, and Tell el-Yehudiyeh.

Levant

The presence of Mycenaean pottery in the Levant has received perhaps the most attention by scholars studying traded Aegean wares. In addition to the quantity of wares present, the assemblage of ceramic shapes uncovered in this part of the Mediterranean is notable for the range represented. In particular, there are a number of shapes common in the east that are only minimally present in mainland groups, including the shallow bowl (FS 295-296), chalice (FS 278), angular jugs (FS 139), amphoroid kraters (FS 53-55), and zoomorphic rhyta. The concentration of these types in eastern contexts has suggested a system of production focused primarily on export during the LH IIIA2-LH IIIB periods,[716] and has resulted in the assignment of the name of "Levanto-Helladic" to this group.[717] This term originated from the now disproven

[715] Kelder 2010, 137.

[716] Cadogan 1993, 94; Sherratt 1982, 183. Although Cyprus was suggested as a location of manufacture for these vessels, their presence, although in smaller amounts, in the mainland demonstrates their Greek origin (Sherratt 1980, 195-199; Jones 1986, 599-601).

[717] Gjerstad 1926; Sjöqvist 1940, 3; Furumark 1941a, 9-10; Stubbings 1951, 42-43; Karageorghis 1965, 204-228; Leonard 1994, 6-7. Sjöqvist notes that this assignment is problematic, as it is in part supported by the erroneous assumption that any vessels displaying imperfections are necessarily local imitations (1940, 29).

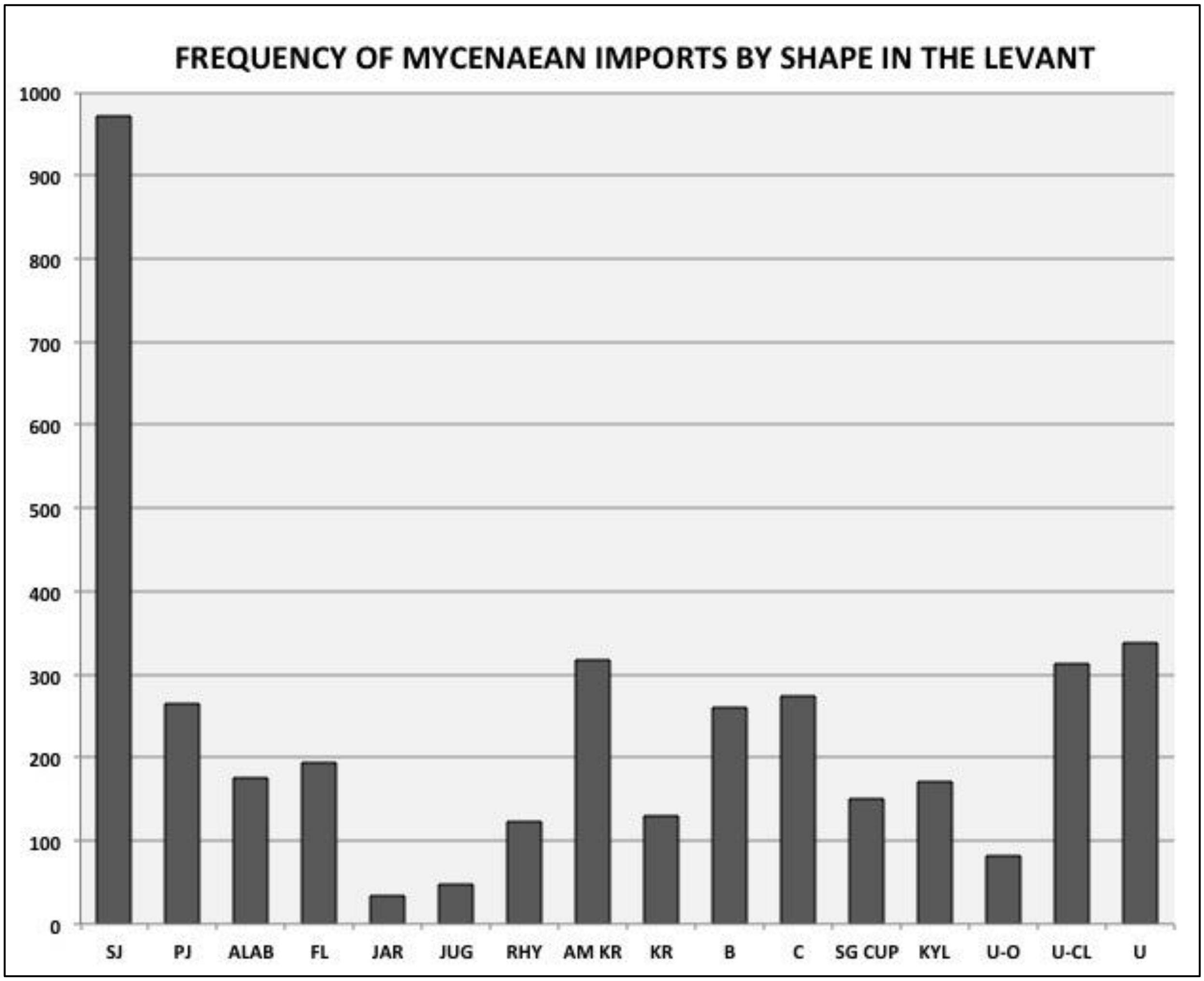

Figure 5-25. This chart shows the number of Mycenaean imports by general shape in the Levant. The shape codes are as follows: SJ – stirrup jar, PJ – piriform jar, ALAB – alabastron, FL – flask, JUG – jug, JAR – all other jar types, RHY – rhyton, AM KR – amphoroid krater, KR – all other krater types, B – bowl, C – all other cup types, SG CUP – semiglobular cup, KYL – kylix, U-O, unknown open shape, U-CL, unknown closed shape, and U – unknown shape.

assumption that the group was manufactured locally within the Levant.[718] The corpus of material collected in this study includes 3708 sherds and partial or whole vessels of 90 different distinct

[718] For studies focusing on the provenance of Levantine Mycenaean pottery, see Asaro and Perlman 1973; Jones 1986; Hoffman and Robinson 1993; Gunneweg et al. 1992; Gunneweg and Michael 1999; Mommsen and Maran 2000-2001; Mommsen et al. 2005; Badre et al. 2005 Zuckerman et al. 2010. In fact, local production in the Levant of Mycenaean-type pottery appears to have been quite modest, with a greater quantity produced in Cyprus (Leonard et al. 1993; Killebrew 1998, 163 ff.; D’Agata et al.2005).

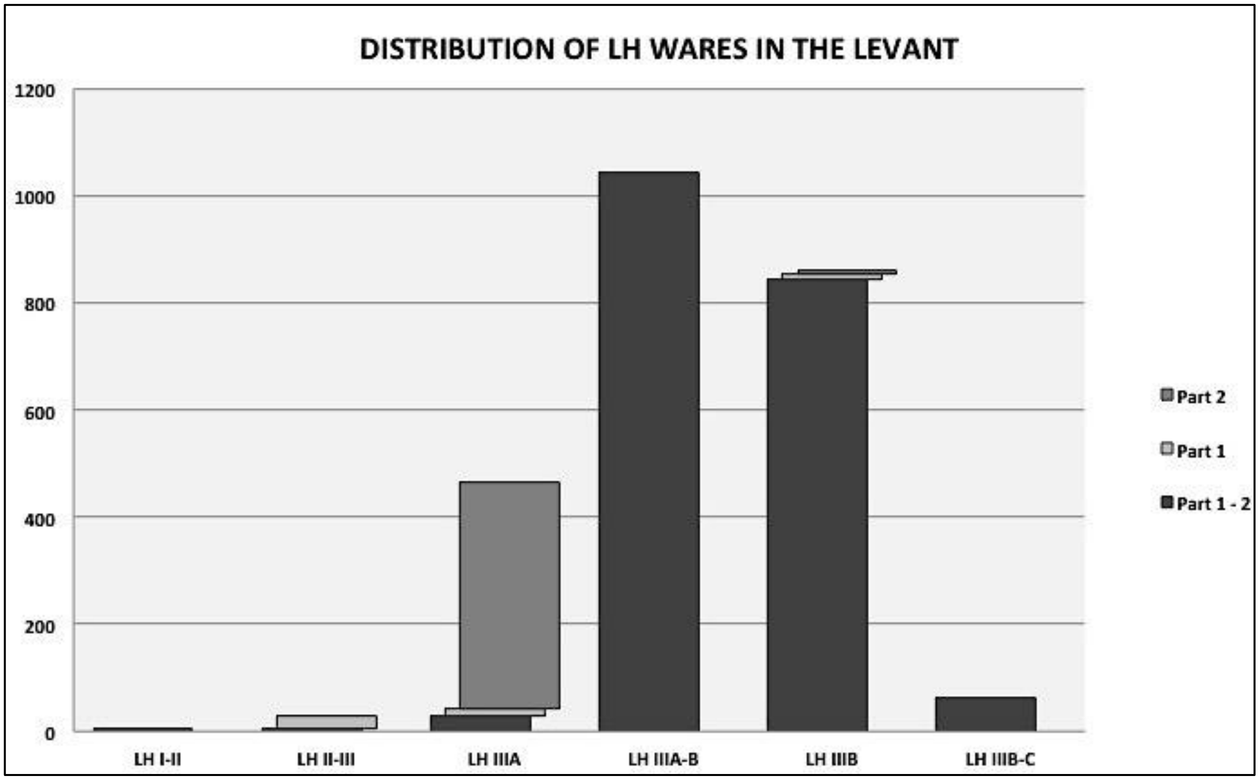

Figure 5-26. Total imported Late Helladic wares per period in the Levant. Distribution is delineated into sub-periods to include more precise data where available (i.e., LH IIIA2 = LH IIIA2 1-2 + LH IIIA2a + LH IIIA2b). The increase from LH I and LH II to LH III is marked (LH IIIC ceramics and those of unknown date are not included here).[719]

forms,[720] of which 1359 are open shapes, 2001 are closed shapes, and 348 are unidentifiable (see

[719] Of the 111 sites Van Wijngaarden includes in his 2002 study, only 11 have LH IIIC vessels, while 11 sites are recorded with LH I-IIA finds, and 19 have LH IIB-IIIA1 vessels (Catalogue 1). This would suggest that the number of imported Mycenaean vessels at the start of the LH IIIC period is not substantially greater than during the earliest periods of Late Helladic trade. The overlapping ranges reflect the chronological imprecision inherent in both the Mycenaean classification system, as well as ambiguities present in many excavation reports. Not included in this graph are the vessels of "unknown" date, which account for roughly a third of the total material (>1200 sherds/vessels).

[720] The last major catalogue of Mycenaean wares in the Near East, compiled by Leonard in 1994, lists 2110 vessels (not including LH IIIC pieces or figurines). While this corpus of just over 3700 sherds and vessels expands greatly on this previous study, a large proportion of the new finds can be attributed to the publication of large groups of material from Ugarit, Minet el-Beida, Tell Abu Hawam, and Lachish. Smaller assemblages of new finds were recovered from Alalakh, Ras Ibn Hani, Tell Kazel, and Tell Dan. The ceramics from these eight sites represent roughly 80% of the new material added to this dataset. The number of shapes represents those forms that were clearly identifiable, and includes two vessel types

Figure 5-25).[721] The proportion of open vessels in the corpus collected for this dissertation exceeds that generally proposed for the Levant, which hovers traditionally around 30% (lower than the roughly 40% suggested here).[722]

Unlike Cyprus, Mycenaean vessels are rare in the Levant from LH I-LH II, and also decline much more sharply in LH IIIC (see Figure 5-26).[723] Relative to Cyprus, Mycenaean pottery distribution on the eastern coast of the Mediterranean is also less comprehensive, as only a portion of sites excavated contained specimens. Of those sites with Mycenaean imports, the quantity of vessels recovered corresponds significantly with site size, suggesting that Mycenaean pottery consumption within the Levant centered on urban cosmopolitan communities.[724] Furthermore, all sites with large quantities are located on the coast or the foothills of major valleys;[725] inland sites with significant quantities of Mycenaean imports are thus characterized as important centers for regional trade systems.[726] The vessel groups from the large key sites are also notable for their large range of shapes, exceeding in variety the range of types present at surrounding smaller sites, suggesting that these larger sites were central in the distribution of

presented as a range including multiple stages of development: the deep conical/piriform krater (FS 8-9) and the feeding bottle (FS 159-161).

[721] Where possible, efforts have been made to omit vessels of disputed provenance, while a conservative approach has been adopted in estimating quantities (opting for the minimum number when ranges of potential vessel counts were given). For sites where no counts are provided, or only passing reference to the presence of Mycenaean ceramics are made, only a value of '1 vessel' is recorded. The counts therefore represent the author's best attempt at the minimum picture currently reflected by the state of published archaeological research to date.

[722] Sherratt in Killebrew 1998, 169; Yasur-Landau and Guzowski 2007, 541-542.

[723] Van Wijngaarden 2008a, 131.

[724] Van Wijngaarden 2008a, 131.

[725] Van Wijngaarden 2008b, 55. The geographic placement of sites containing large quantities of vessels, with their associated corpus size, can be found in Van Wijngaarden 2002, Map 7 (313).

[726] Leonard and Cline 1998, 14; Gilmour 1992, 118-120; Van Wijngaarden 2002, 34.

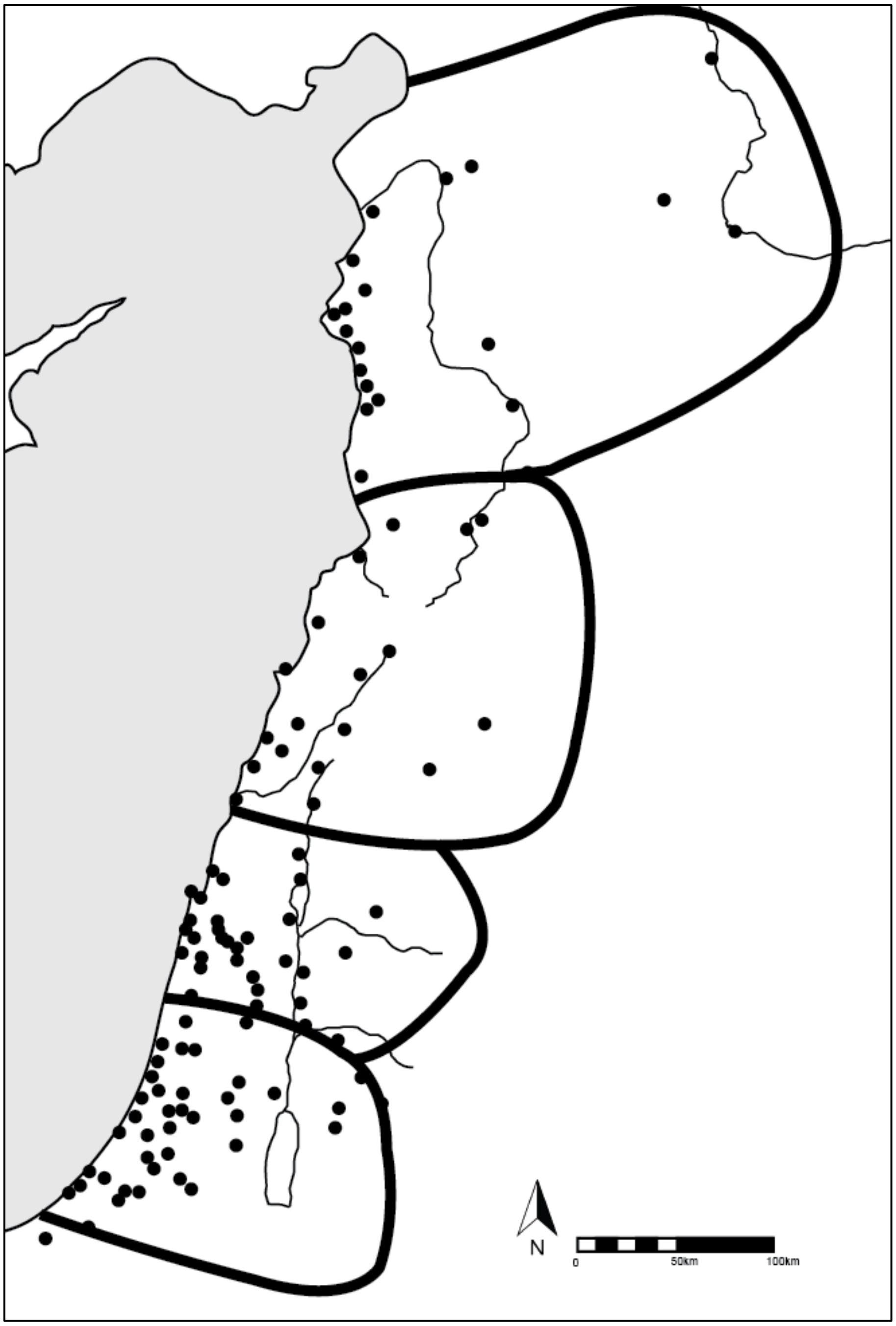

Figure 5-27. Map of the Levant with four delineated regions (after C. Bell 2005, pl. LXXVIII).

goods within regional systems.[727]

[727] Van Wijngaarden 2008b, 55. The systems may have operated at the meso-scale, as the goods reaching remote areas such as the Jordan River Valley were acquired through regional networks that incorporated a

To explore potential regional variation in distribution patterns, the material from the Levant will be presented following Bell's four-part division,[728] in which the Near Eastern coast is divided into the following areas (see Figure 5-27):

- L1 – Northern Levant: Southern Turkey and north-western Syria, extending along the Euphrates to Emar and Carchemish
    - Main Sites: Ugarit, Ras Ibn Hani, Tell Sukas
    - Subject to Hittite Influence to a fluctuating degree
- L2 – Lebanon, south-western Syria, and Upper Israel: area of Iron Age Phoenicia
    - Main Sites: Sarepta, Sidon, Tyre, Kamid el-Loz, Tell Dan
    - Largely part of the Egyptian sphere of influence
- L3 – Carmel Coast area of Israel: entry area for the Jezreel and Jordan Valleys
    - Main Sites: Tell Abu Hawam, Megiddo, Beth Shean
    - Part of Egyptian sphere of influence during the Late Bronze Age
- L4 – Southern Levant: area of Iron Age Philistia
    - Main Sites: Amman Airport, Lachish, Ashkelon, Ashdod
    - Under direct Egyptian Influence

These divisions reflect variations in terrain and landscape, and suggest an integrated system of interior access routes.[729] The zones also signal shifting external political pressures, in particular the influence of the Hittites in the north and Egypt in the south. With this system, Bell sought to examine the role that the political landscape of the Late Bronze Age played in the distribution of imported wares, as well as the subsequent survival or demolition of different sites during the end of the Late Bronze Age and into the Early Iron Age.[730]

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variety of international goods, rather than through direct contact with the Mycenaean world (ibid.).

[728] C. Bell 2006, 1-10; 2009, 30-31.

[729] C. Bell 2006, 35.

[730] C. Bell 2005, 367; 2006, 1-5.

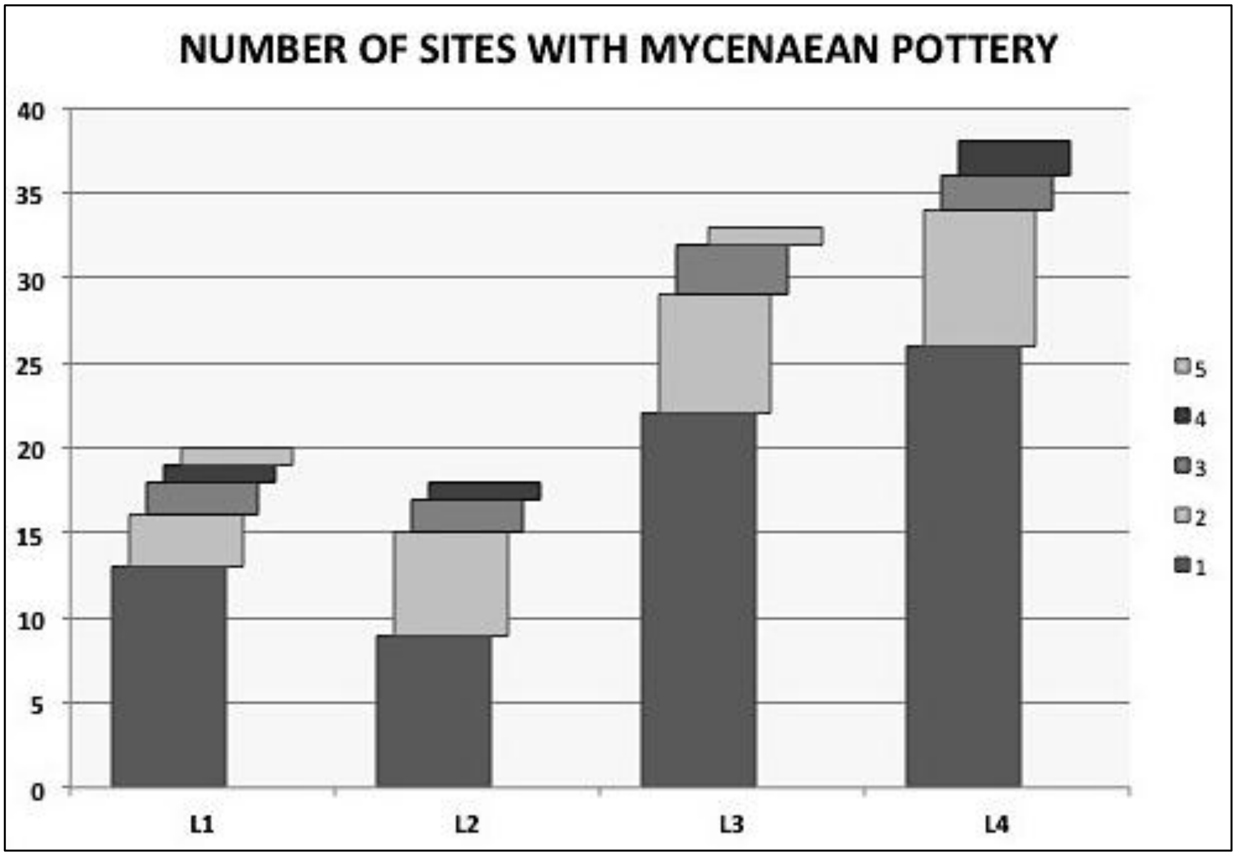


Figure 5-28. Number of sites per area with Late Helladic pottery. Sites are grouped and differentiated by the quantity of Mycenaean vessels recovered (1 = 1-9; 2 = 10-49; 3 = 50-99; 4 = 100-499; 5 = 500+ finds).

One consideration in following this approach is the different degree to which Levantine regions have been explored archaeologically. Greater excavation activity in the southern regions (L3 and L4) have yielded almost twice the number of sites from which Mycenaean pottery was recovered as in the north (L1 and L2; see Figure 5-28).[731] In all cases however, the majority of sites in each zone yielded less than ten vessels, with class 1 sites representing between 50% and 68% of all regional sites (areas L2 and L4 respectively).[732] Overall, class 1 sites represent 70 of

[731] Intense archaeological interest and research in Israel and the Palestinian Authority has its origins in Biblical Archaeology, and was intensified with the formation of Israel in 1948 (Hankey 1993, 101; Van Wijngaarden 2002, 31).

[732] In zone L1, 13 of 20 sites are class 1 (65%); while 22 of 33 sites in L3 are class 1 (67%). The figures

the 109 sites included in this study (roughly 64%). Like the distribution of site sizes, the overall artifact distribution reflects a pattern corresponding to a scale-free network system, with the vast majority of sites with Mycenaean imports yielding few finds, while a large proportion of the total Mycenaean material comes from a small group of larger sites (see Figure 5-29). In the case of the Levant, nearly half (45%) of the total corpus of recovered Mycenaean ceramics come from two sites: Ugarit and Tell Abu Hawam.

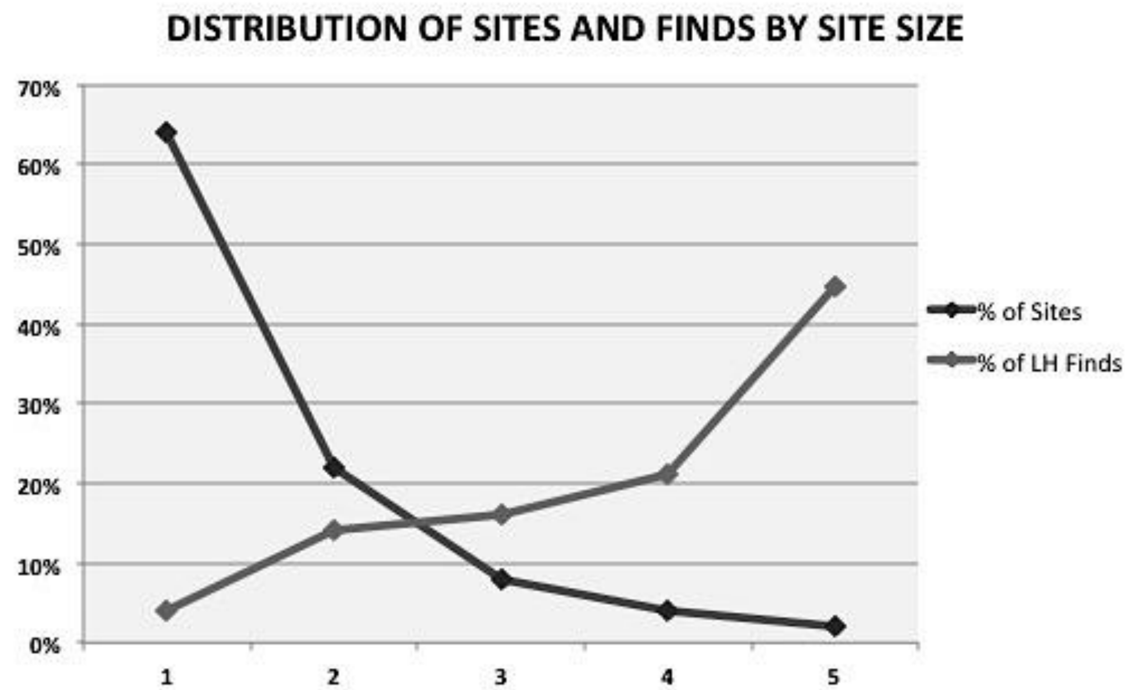
L1 – Northern Levant

The northern zone included southern Anatolia and north-western Syria, from the Amuq to the plain of Akkar and Homs.[733] This region lay at the southern reaches of first the Hurrian and later the Hittite Empire.[734] This zone was dominated by the Kingdom of Ugarit, which was centered on the capital site of Ras Shamra. Ugarit also incorporated the sites of Minet el-Beida (its harbour), Ras Ibn Hani, Ras el-Bassit, Tell Sukas, as well as proximal sites to varying degrees. In addition to the large corpus of Aegean wares at Ras Shamra-Ugarit and Minet el-Beida, the largest imported Mycenaean groups were found at Alalakh (Tell Atchana) and Tell Sukas. Of these, Alalakh is the only inland site in zone L1 with more than 10 Mycenaean finds (it is a class 3 site). This zone extends along the Euphrates to the interior settlements of Emar and Carchemish, which were connected to Ugarit and the coast through economic ties, with the Orontes serving as a primary link to the interior from the Mediterranean (along which important

for L2 are 10 of 19 sites, and 28 of 40 sites in L4. This gives an overall frequency of 65% for class 1 sites included in this study.

[733] There are 20 sites in this region (nos. 97-113 and 116-118 on Appendix Map 2).

[734] Ugarit was subject to Hurrian influence before the Hittite King Suppiluliuma defeated the Mitanni in 1350 B.C.E., at which time the region was subsumed within the Hittite sphere of influence.



	1	2	3	4	5
No. of Sites	70	24	9	4	2
% of Sites	64%	22%	8%	4%	2%
No. of Finds	161	525	582	780	1660
% of LH Finds	4%	14%	16%	21%	45%

Figure 5-29. Table shows the frequency of sites of each class size, as well as the total Late Helladic ceramics recovered from the sites of that class. The percentage frequencies reflected by these figures are also included in the table, and are graphed in the chart above.[735]

commodities such as tin were mobilized).[736]

The earliest Mycenaean finds from this region come from the Late Helladic II period. Single examples of an LH IIA closed vessel of unknown shape and an LH IIA-IIB rounded alabastron (FS 82) were recovered from Minet el-Beida and Alalakh respectively. Ugarit is the

[735] These quantities represent LH I – LH IIIB-C vessels only, and do not include figurines, or LH IIIC imports. The inclusion of these materials causes a number of sites to shift upwards into different categories (notably Megiddo and Beth Shean move from class 3 to class 4, while Tyre shifts from class 2 to class 3).

[736] C. Bell 2009, 30; Macqueen 1996, 44; Lackenbacher 2000; Malbran-Labat 2000.

only site with multiple examples from this early period, including two LH IIA cups (FS 218 and 221), LH IIB goblet (FS 254), and two rounded alabastra (FS 83-85, one dating LH IIA, the other LH IIA-B). An additional early vessel from Ugarit dated to the transitional LH IIB-IIIA1 period is a small handleless jar (FS 77). All of these vessels were recovered from domestic contexts. Distinctly LH IIIA1 imports remain rare, with three recorded examples—one each from Alalakh (unknown open shape), Minet el-Beida (conical rhyton, FS 199), and Ugarit (amphoroid krater, FS 53-55)—and a small group of sherds from Ras el-Bassit. The frequency of Mycenaean imports then explodes through the early LH IIIA2 period through LH IIIB.

Despite only representing 18% of the Levantine sites included here, zone L1 supplied 37% of the Mycenaean ceramics from the Near East. This is due to the size of the assemblage from Ras Shamra-Ugarit, which has yielded almost one thousand published sherds and vessels so far.[737] If the finds from the port site of Minet el-Beida are included, this corpus represents roughly 30% of all Levantine LH I-LH IIIB2 imports. This Kingdom of Ugarit formed an important node of the exchange network of the Late Bronze Age, evidenced by the wide variety of international objects recovered from the area. Imports at the site are plentiful and inclusive of essentially all traded goods from the Mediterranean in this period.[738] Although no comprehensive ceramic counts are available, the excavators note the extensive distribution of Mycenaean and Cypriot ceramics through all contexts of the site, suggesting generalized access to this material

[737] This study includes 923 pieces from the LH I-IIIB2.

[738] The importance of Ugarit archaeologically is augmented by the substantial corpus of documents including economic records, literary and religious texts, and personal and diplomatic letters (Ugarit texts are published in the series Palais Royal d'Ougarit (PRU)). These records provide a highly significant compliment to the excavated material, and have formed the crux of many analyses of the site and its culture (Astour 1973; Heltzer 1978, 1982, 1999; McGeough 2007; Schloen 2001).

throughout Ugarit.[739] Newly published finds from early excavations have also expanded the known distribution of Mycenaean vessels at the site, particularly through the contribution of over 100 sherds and vessels discovered in the *Palais Royal*; this addition is significant as it satisfies the existing confusion over the lack of Late Helladic vessels from the palace, from which other imported goods were abundant.[740] It is also important to note that at Ugarit, as with many near eastern sites, mortuary installations were often dispersed amongst habitation zones, leading to potential contextual contamination or confusion in assigning context types to specific finds.[741] In a few cases, the context has conservatively been deemed here to be 'unknown'.

Although closed vessels are more common in general in the Levant, the ratio of open to closed vessels in zone L1 is roughly 1:1 (613 open to 621 closed; another 120 sherds are indeterminable). The higher proportion of open vessels corresponds in part to the popularity of certain shapes, including mugs and rhyta.[742] Ten of the fourteen recorded mugs (FS 225-226) come from zone L1, while roughly 70% of the rhyta (conical, ostrich egg, and animal shaped) were found in this region.[743] The most common shape in region L1 is the stirrup jar. Nearly all

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[739] Yon et al. 2000, 68; Van Wijngaarden 2002, 43; McGeough 2007, 302.

[740] Routlege and McGeough 2009, 26; Yon et al. 2000, 9.

[741] Yon et al. 2000:6-7, 68.

[742] Gilmour 1992, 115.

[743] Mugs have been recovered from Tell Sukas, Minet el-Beida, and Ugarit (1, 2, and 7 respectively), while examples outside of zone L1 come from Sarepta (L2), Tell 'Ajjul (L4), and 'Ain Shems (also L4). Rhyta are much more common, with 122 examples recorded from the Levant. The most common is the conical rhyton (FS 199), with 89 finds (63 of which come from Minet el-Beida and Ugarit, and one comes from Tell Kazel), to which may be added 4 Ostrich Egg Rhyta (FS 202). The latter are found as single examples at 'Ain Shems and Lachish in the south, and Minet el-Beida and Ugarit in the north. Animal shaped rhyta are also fairly popular with 29 examples—19 of which come from L1. Three of the animal rhyta from Ugarit have been suggested to be locally produced (based on the quality of production), however Van Wijngaarden considers them to be imports due to the Aegean motifs used in the decoration (2002, 40).

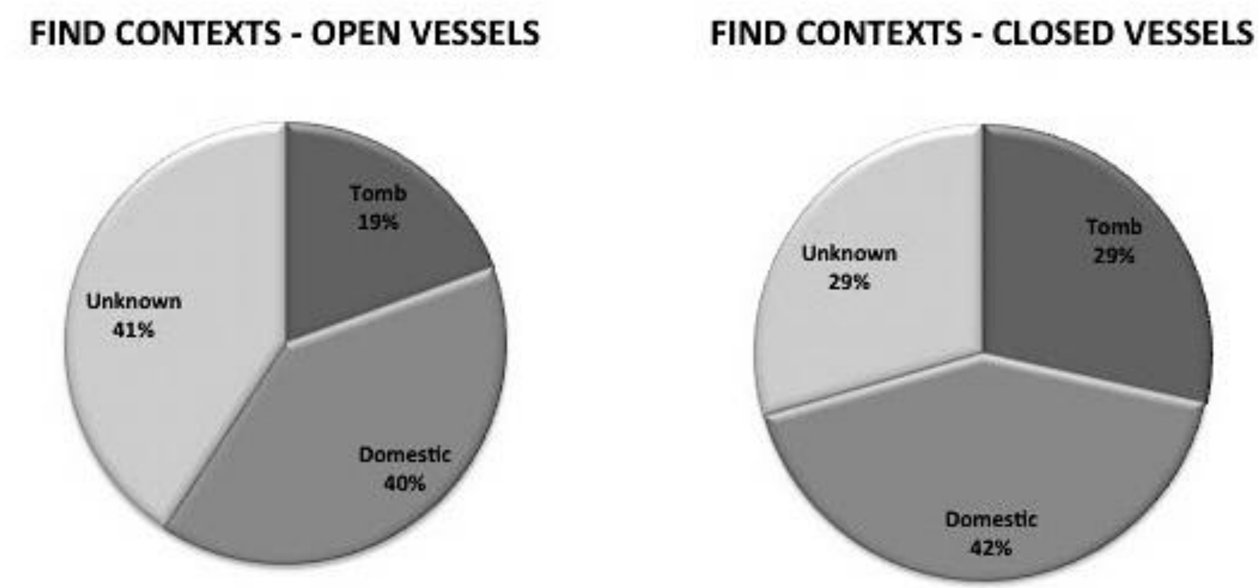

Figure 5-30. The ratio of contexts for open and closed vessels from zone L1.

shapes present in the region are accounted for in the Ugaritic corpus, with the exception of the piriform jar FS 34 and the rounded alabastron FS 82, of which only single examples are present in L1 (found at Qatna and Alalakh respectively).[744] All shapes frequently found in the Levant are also present, with any absences restricted to rare types with few attestations in the Near East.[745] Although there is a larger proportion of vessels in L1 that lack context information (largely due

[744] There are two potential exceptions to this. Only a single example of a Mycenaean lid (FS 334) was found in L1, recovered from Minet el-Beida (although the relationship of this site with Ugarit has been established above). This was also a rare example of undecorated Mycenaean pottery, which was incredibly scarce at all sites in the northern Levant. The other possible exception is the ring kernos (FS 196-197), of which there are extremely limited examples outside of the Mediterranean. In addition to Tell Abu Hawam, at least two examples appear to have been found at Minet el-Beida (however are listed in Van Wijngaarden in the Ugarit finds catalogue; numbers 178 and 468).

[745] Examples include the piriform jars FS 16, 24, 31, and 34 (found at Amman Airport, Beth Shean, Khirbet Judur, and ‘Ain Shems), squat jar FS 87 (found at Sidon), jugs FS 110, 118, and 155 (found at Tell es Saidiyeh, Beth Shean, and Tell Mikne-Ekron respectively), funnel FS 198 (found at Tell Abu Hawam), cups FS 206, 208, and 250 (the first two from Tell Abu Hawam and the latter Sarepta), and spouted bowl FS 304 (from Tell Abu Hawam). It is possible that some of these shapes had counterparts in the Ugarit assemblage, as many sherds are only identifiable to the general group (i.e., LH IIIB cup).

to context contamination and poor recording for early Ugarit excavations), the proportion of closed vessels recovered from tombs is predictably, albeit only slightly, higher than for open vessels (Figure 5-30).

L2 – Phoenicia

The area later known as Phoenicia during the Iron Age extends from roughly the northern border of Lebanon to northern Israel, including south-western Syria.[746] The most northern sites in this zone include Tell Hayat and Qadesh, extending down to Tyre and Tell Dan in the south. Major coastal sites include Tell ‘Arqa, Byblos, Beirut, Sidon, Sarepta, and Tyre, many of which maintained their importance into the subsequent Iron Age. All of these sites yielded more than ten Mycenaean finds, with the largest corpus coming from Sarepta (a class 4 site). Of these however, only Sarepta has been extensively explored, with detailed publication of excavations and finds. Of the hinterland sites, only Kamid el-Loz and Tell Dan contained significant Mycenaean finds (they are categorized as class 3 and class 2 respectively). Tell Dan is particularly notable for the large collection of material recovered from the ‘Mycenaean Tomb’.[747] This zone is the smallest in regards to the size of the Mycenaean assemblage, comprising just over 11% of all Near Eastern Late Helladic imports.

The earliest material in zone L2 comes from the LH II period, with vessels coming from three coastal sites—Byblos, Sarepta, and Sidon. The earliest of these is an unknown closed vessel from Byblos, dating to LH IIA. An LH IIB squat jar (FS 87) was recovered to the south of

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[746] There are 18 sites in this region: nos. 114-151 and 119-134 on Appendix Map 2.

[747] Tomb 387; see Biran 1993, 1994a, 1994b.

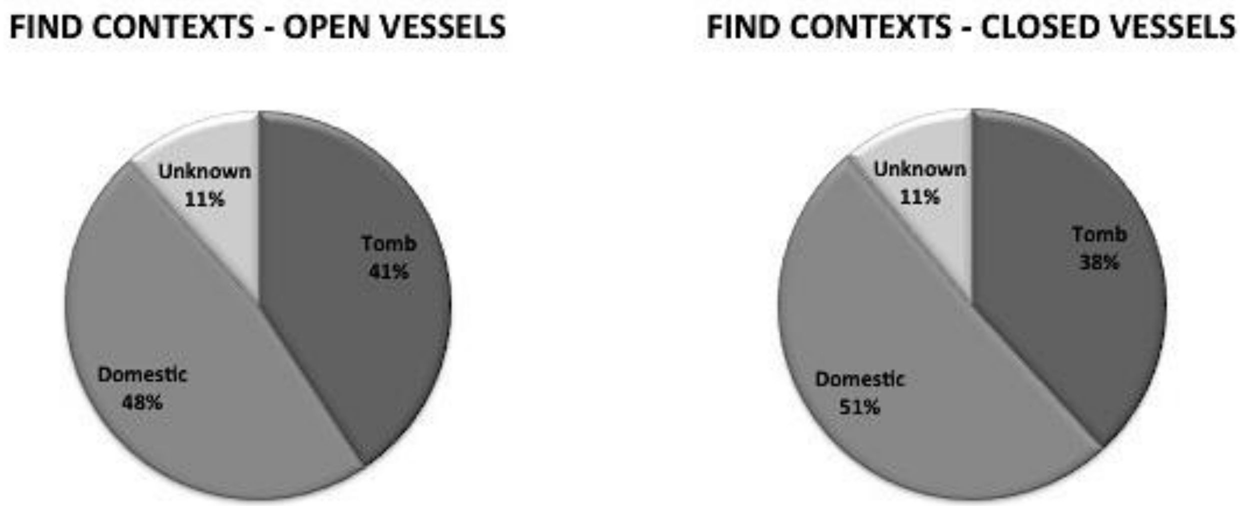

Figure 5-31. The ratio of contexts for open and closed vessels from zone L2.

this from Dakerman Tomb 1.[748] Two LH IIB open vessels were discovered at Sarepta, both early versions of the shallow semiglobular cup (FS 219). Of the 21 vessels that may date as early as the LH IIIA1 period, the vast majority are stirrup jars (15), with only one open vessel (a cup, FS 220), and one of unknown shape. These early vessels all come from Byblos, Sidon, Sarepta. The majority of vessels of known shape from zone L2 are closed—roughly 75%—including flasks, alabastra, and piriform and stirrup jars.[749] The stirrup jar is the most popular shape in this region, accounting for roughly half of the closed vessels.[750] The two-handled lentoid flask (FS 186) is unusually popular at Sarepta, with 11 of the 41 examples documented found at the site. When the

[748] This appears to be the only example of FS 87 discovered in the Levant, however the close correspondence in shape to the rounded alabastron (FS 83) may lead to misidentification (Mountjoy 1986, 25).

[749] Of the vessels and sherds recorded from this region, 86 are open, 262 are closed, and 72 are indefinable.

[750] The percentage of stirrup jars at Sarepta is higher than at any other major site explored by C. Bell in her survey of the Northern Levant, which included Tell Sukas, Ras Ibn Hani, Minet el-Beida, and Ras Shamra-Ugarit (2006, 36).

surrounding region is included, L2 yields half of all Levantine two-handled lentoid flasks, suggesting a local demand for this shape.[751] The dominance of transport and storage vessels contrasts with the assemblage from zone L1, where open dinner vessels were more common. The open and closed vessels of zone L2 have fairly comparable distribution patterns, with tomb and domestic contexts similarly popular (see Figure 5-31).

Like Ugarit in zone L1, Sarepta appears to have been an important trading port, through which material may have been dispersed into the interior.[752] This is especially clear when comparing the assemblages, which correspond sharply. In terms of shape, 90% of all vessels from zone L2 outside of Sarepta are of types also attested at the port site.[753] Sarepta also has the largest variety of shapes in the region, including four types not present elsewhere: the small globular jug (FS 114), the large stirrup jar (FS 164), the squat stirrup jar (FS 178), and the spouted cup (FS 250). The size of the Sarepta collection is further notable for the density of wares discovered during archaeological investigation, as only a relatively small area has been explored—the proportion of finds per excavated area is highest at Sarepta (ranging from 12 to 19 per 100sq m of excavation between the two areas surveyed) when compared with other major

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[751] Of the 41 total examples, 2 are from Byblos, 3 from Beirut, 11 from Sarepta, 2 from Kamid el-Loz, and 2 from Tell Dan. An additional 4 were found at the nearby site of Hazor, in the northern part of zone L3, and quite close to Tell Dan.

[752] Koehl 1985, 144.

[753] Of those shapes appearing outside of Sarepta, there are five vessels that may indeed have counterparts at Sarepta: a piriform jar (FS 46) from Tell Dan, a pyxis (FS 95) from Kamid el-Loz, and three squat stirrup jars (FS 179) from Beirut. All of these shapes have similar vessels from Sarepta, that have yielded small enough fragments to only be roughly identified to a general subtype (i.e., squat stirrup jar FS 178-181). If these examples are removed, the proportion of vessel types accounted for at Sarepta increases to 93%. The vessel types present in L2 but still unattested at Sarepta include: a piriform jar (FS 36) from Beirut, two rounded alabastron (FS 84 and FS 85) and a squat jar (FS 87) from Sidon, a tall jug (FS 105) from Qraye, a small piriform jug (FS 134) from Byblos, four tall stirrup jars (FS 166 or 167) from Beirut, Sidon, Kamid el-Loz, and Qraye, two animal shaped rhyta from Kamid el-Loz and Tell es Saliyeh, and a cup (FS 242-244) and conical bowl (FS 290) from Byblos.

Levantine sites (including Ugarit, Tell Abu Hawam, and Ashdod).[754] The large range of types available at the site, as well as the corresponding assemblages of the hinterland support the assessment of Sarepta as a primary port of importation for LH Mycenaean wares.[755] Bell has further suggested that Sarepta traders were linked directly with their Aegean counterparts, creating relationships that subsequently shielded Sarepta from the wave of destruction at the end of the Late Bronze Age, and allowed the site to survive relatively untouched into the Iron Age.[756]

L3 – Northern Israel

The third zone comprises the northern part of Israel, including thirty-three sites from Hazor in the north to Shechem in the south. The largest site in this region is Tell Abu Hawam on the coast, which is second only to Ugarit in the quantity of Mycenaean vessels recovered. Although there are no class 4 sites in this region, there are a number of class 3 and 2 sites, the largest of which are Hazor, Megiddo, and Beth Shean—all three lying within the interior. Of the 33 sites, there is a large proportion that yielded only minimal sherds that lack secure dating and form classification (7 sites). This zone also has the second largest assemblage of Late Helladic pottery, constituting roughly 31% of all Near Eastern imports—of the 1134 sherds and vessels from this area, Tell Abu Hawam contributes 65%.

The earliest finds from this area date to the LH I-II period, and include a vessel of unknown shape from Tell Bir el-Gharbi, and a bowl and fragments from two unknown vessels

[754] C. Bell 2006, especially 42-43.

[755] Koehl 1985, 144; C. Bell 2006, 52-59.

[756] C. Bell 2005, 367.

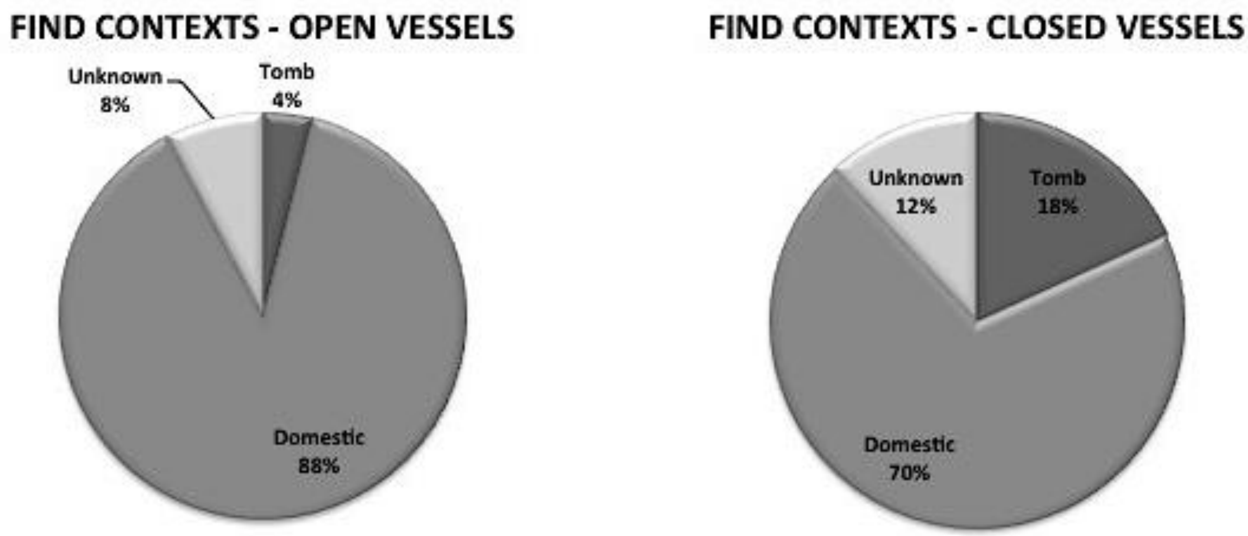

Figure 5-32. The ratio of contexts for open and closed vessels from zone L3.

from Hazor.[757] Additional LH II material from Hazor include fragments of two unknown vessels from LH IIA and LH IIB contexts, a handle from an LH II vessel, an LH IIB rounded alabastron (FS 83), and a closed vessel (potentially a stirrup jar or flask) from LH II-III. Vessels dating to the LH II period have also been discovered at Megiddo (dated to LH IIA) and Tell Abu Hawam, both of unknown shape. There are no vessels dated definitely to the LH IIIA1, however a number of vessels dated generally to LH III may be from an early date in this period. The most common shapes are transport/storage vessels, including piriform and stirrup jars, alabastra, and flasks (FS 186, 189, and 190-192).[758] Certain shapes, such as the amphoroid krater (FS 53-55) are found exclusively at large sites (Hazor, Tell Abu Hawam, Megiddo, Beth Shean). In fact very few open shapes were found outside of these four main sites, with the exception of six cups and two

[757] The material from Hazor was recovered from two pits (L584 and L583) in Area A.

[758] Shapes include: piriform jars (FS 31, 34-36, 44-48); stirrup jars (FS 164, 166-167, 171, 173, 176, 178-180, 182-183); rounded and straight-sided alabastra (FS 83-85; 94-95); and lentoid and globular flasks (FS 186; 189, 190-192).

kraters from Akko and Shechem.[759] Unlike L1 and L2, mortuary contexts are far less common in zone L3, however they are relatively more common for closed shapes (see Figure 5-32).

While Tell Abu Hawam—like Ugarit and Sarepta—appears to have a dominant role in the distribution of Mycenaean import wares, there are some significant discrepancies between the assemblage from the site and the surrounding region. While open vessels are slightly dominant at Tell Abu Hawam (374 sherds and vessels to 335 closed forms),[760] closed shapes are vastly more popular through the rest of zone L3 (representing 82% of remaining vessels). The popularity of open dinner and drinking vessels at the site is uncommon in the Levant in general, with similar proportions found only at a few other large sites (including Ashdod and Minet el-Beida/Ugarit).[761] Balensi has offered a number of hypotheses as to the large collection of dinner vessels at the site, including the distaste for open vessels on Cyprus, a potential direct relationship between Tell Abu Hawam and the Argolid (while Cypriot vessels were instead acquired from Messenia), as well as the potential presence of a large group of Mycenaean traders at the site, whose consumptive preferences account for the large quantities of drinking vessels (particularly FS 220).[762] With subsequent work on Cyprus revealing significant quantities of

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[759] Vessels of unknown open shape from zone L3 have been recorded at Kinneret, Tell Bir-el-Gharbi, and Tell Ta'annach.

[760] The quantities for Tell Abu Hawam are particularly difficult to ascertain, as they are given with wide-ranging estimates for the minimum number of vessels (e.g., between 63-88 FS 220 cups, and between 6-23 FS 295-296 bowls). In all cases, a conservative approach to estimation has been selected (see Table 1, Balensi 2004, 146).

[761] Van Wijngaarden 2002, 109; Balensi 1980, 498; M. Dothan and Porath 1996, 31-36, 48, 58. Van Wijngaarden cautions against the inclusion of Ashdod in this group, as the majority of finds from the site (over one-third) are of unknown shape. To this list, one may add some smaller sites (such as Tell Kazel, Tell Sera', and potentially Ashkelon) which all yielded more open vessels than closed.

[762] Balensi 1980, 568; for the hypothesis of direct trade relations between different sites or regions, see Cline 1994, 86-87. Both Mine el-Beida and Ugarit yielded large groups of FS 220, while limited examples were also recovered from Amman Airport, Beth Shean, Megiddo, Akko, Tell Sukas, Sarepta,

open vessels, and elemental sourcing studies revealing a common Argolid source for most Levantine and Cypriot imports, the first two assertions have been effectively disproven.[763] Further reassessment by Balensi has brought the presence of Mycenaean traders at Tell Abu Hawam into question, positing instead that the irregularly high percentage of dinner vessels may reflect the presence of "proto-marketing" by Greek traders, producing and exporting specific goods tailored to recipient demand.[764]

L4 – Southern Levant

The final region includes the Iron Age area of Philistia, as well as the Negev. This area was heavily influenced by Egypt during the Late Bronze Age, including the presence of a number of Egyptian garrisons. This zone is the largest at forty in terms of number of sites from which Mycenaean pottery was recovered. Unlike L1-L3, there is no single large site dominating this region (there is no class 5 site in L4). The largest groups of Mycenaean imports were found at Lachish and Amman Airport, both class 4, and both of which are located within the interior—Lachish on the Judean foothills and Amman Airport in Jordan. There are also only two class 3 sites—Ashdod and Tell ʻAjjul. Despite the large number of sites in this area, zone L4 only provided 22% of the Mycenaean wares from the Near East. Closed vessels are highly dominant in the assemblage from this region, accounting for roughly 70% of all ceramics of identifiable

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Hazor, Sidon, Byblos, Tell es Shari'a, Tyre, and Beq'a Valley. The collection from Tell Abu Hawam represents roughly 65% of the total examples from the Near East.

[763] Gilmour 1992, 116-117. For sourcing studies, see Catling and Millet 1965; Jones and Catling 1986; French 1991.

[764] Balensi 2004. The practice of export-driven production is supported by the results of petrographic and chemical analysis, which suggest that ceramics were produced at an Argive workshop, most likely in the region of Mycenae, for shipment to the Levantine coast (Badre et al. 2005, 36; Jung 2006, 173-174).

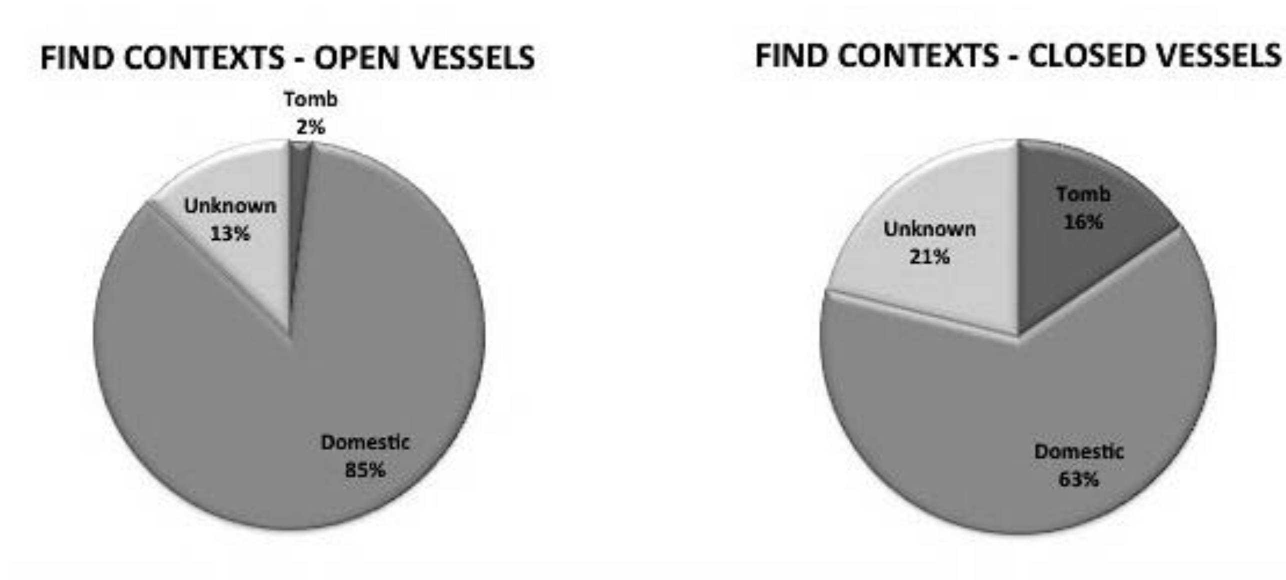

Figure 5-33. The ratio of contexts for open and closed vessels from zone L4.

shape.

There is only one LH I find from this region, a semiglobular cup (FS 219) recovered from Tell Michal. Early vessels were also discovered at the Amman Airport site, including a LH I-IIA semiglobular cup (FS 219), an LH IIA piriform jar (FS 24), and an unknown open vessel and a piriform jar (FS 16) LH IIB-IIIA1. Lachish also had a group of early vessels, comprising an LH II goblet (FS 254), and a cup (FS 262) and an unknown closed vessel from LH IIA. Scattered LH IIB-IIIA1 fragments were also found at Khirbet Judur, Gezer, 'Ain Shems, Tell 'Ajjul, and Tell Sera'. The most common shape is the stirrup jar, which represents around one-third of all closed vessels.[765] Alabastra are relatively popular in the south, where around one-third of all rounded (FS 84-85) and straight-sided (FS 94-95) examples were recovered. Amphoroid kraters (FS 53-55) are also popular, and are far more widespread than in zone L3 (where they were restricted to the four main large sites). In L4, they have been recovered from nine different sites, ranging

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[765] The common stirrup jars in L4 include FS 166-167, 171-173, 178-180, 182-183

from class 1 to class 4, and distributed throughout the region.[766] The distribution of open and closed vessels by find context is similar to zone L3, as domestic contexts are still dominant, while mortuary find-spots are relatively more common for closed shapes (see Figure 5-33).

General Observations – the Levant

This overview has provided an introduction to the distribution patterns in four large zones of the Near East. As noted by many previous scholars, the vast majority of Mycenaean imports is concentrated at coastal sites, as well as at select interior sites strategically located on transportation routes. Although the distribution is clustered along the coast, Mycenaean pottery has been found as far inland as Tell es-Salihyeh in Syria and Sahab in Jordan (see Appendix Map 2). Across this vast area of distribution the Aegean imports also enjoyed an extensive contextual spread. Vessels have been recovered from elite domestic contexts, as well as more modest houses, such as the houses of the Ville Basse at Ras Shamra and House H at Ashdod.[767] Palatial structures have also yielded Mycenaean vessels, as at Alalakh, Ras Ibn Hani, Megiddo, and Ugarit. In addition to domestic buildings, Mycenaean imports were also found in more industrial structures (i.e., at Tell Abu Hawam, upper Terrace A at Tell Arqa, and Area II, X at Sarepta).[768] Temple complexes as well as ritual or cultic contexts also frequently yielded Mycenaean finds, as at Deir ‘Alla, Tell Sera’, Tell Mevorakh, Hazor, Lachish, Kamid el-Loz, Minet el-Beida, and

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[766] Sites in zone L4 from which amphoroid kraters have been recovered includes ‘Ain Shems, Amman Airport, Ashdod, Gezer, Tell ‘Ajjul, Lachish, Sahab, Ashkelon, and Tell Sera’.

[767] For ceramics from the Ville Basse residential district at Ugarit, see Yon et al. 2000, 29ff. For examples from Ashdod House H, see M. Dothan 1993, 96.

[768] See Balensi 1980 (25 ff.), Charaf 2008 (123), and Andersson 1988 (82) for the finds from Tel Abu Hawam, Tell Arqa, and Sarepta.

Ugarit.[769] Mycenaean ceramics are similarly common in burial contexts, generally present in small groups of a few vessels. Rare and exceptional tombs included large quantities of Aegean wares, often in association with other Mediterranean luxury imports. Examples of such tombs include the 'Mycenaean Tomb' and Tell Dan, and the large cave tomb at Sarepta, which contained other luxury objects such as metal vessels, armor, and jewelry, and ivory, faience, and glass objects.[770]

Variations are also visible among sites situated close together. For example, at Tell Abu Hawam open shapes are more numerous than closed vessels, which contrast with other sites in the same area.[771] Van Wijngaarden detected similar inter-site ceramic variation within the Jordan Valley, at the sites of Hazor and Beth Shean (representing large centers), and Deir 'Alla and Amman Airport (representing smaller cities and specialized sites respectively).[772] The distribution pattern of the Mycenaean ceramics suggests discrepancies in consumption within this small area. At the larger centers of Hazor and Beth Shean the Mycenaean imports were widely distributed throughout the sites, suggesting a common consumption, while at Deir 'Alla the small group of six vessels appears to have been accorded special status.[773] These distribution

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[769]. The Amman Airport site is frequently included among this group (Van Wijngaarden 2008a, 131), however a reexamination of the material and architecture from the site has led to the interpretation of the site as an Egyptian garrison (Mumford 2015, 103-106, 112-116). The wide distribution of Mycenaean ceramics at Ras Shamra-Ugarit appositely reflects the variety of depositional contexts from which these vessels have been recovered, ranging from public buildings, including industrial workshops, religious complexes, and palace compounds, to both elite and modest domestic structures.

[770] Biran 1994a and Baramki 1958. The Sarepta tomb is also notable for the relative paucity of Cypriote ceramics, which generally accompanies Mycenaean vessels in superior quantities (Gilmour 1992, 115).

[771] Van Wijngaarden (2008a, 127-8) citing Balensi 1980, 485; Steel 2002, 32, 44.

[772] The Amman Airport site has been alternatively interpreted as a cultic complex (Van Wijngaarden 2002; 2008b), or an Egyptian garrison (Mumford 2015). A similar site to be added to this group is Tell Mevorakh, which appears to have been a stand-alone cultic or ritual location.

[773] Van Wijngaarden 2008b, 67.

variations suggest that importing communities may have exerted selective demand for preferred vessel types, potentially resulting in specialized systems of distribution.[774]

There are also larger distribution patterns visible at the interregional scale. In particular, there are a number of shapes that cluster in either the northern or southern Levant. As already noted, both mugs (FS 225-226) and rhyta (199-202) cluster generally in the north, as well as the two-handled lentoid flask (FS 186; most common at Sarepta). Additional shapes that are found exclusively in the northern Levant include the small handleless jar (FS 77), the rounded alabastron (FS 82), the squat jar (FS 87), the amphoroid beaked jug (FS 151), side spouted jars (FS 159-161), the spouted cup (FS 250), and the deep conical bowl (FS 290). These shapes are almost entirely restricted to large sites, including Alalakh, Sidon, Sarepta, Byblos, and, most commonly, Ugarit and Minet el-Beida. The most commonly restricted shapes with southern distribution are the LH II-IIIA1 piriform jars (FS 16, 24, and 31), as well as a series of jugs (FS 110, 118, and 155). These vessels are dispersed as single finds across a number of sites, including Amman Airport, Beth Shean, Khirbet Judur, ‘Ain Shems, Tell es Saidiyeh, and Tell Mikne-Ekron. As noted above, the funnel (FS 198) is restricted to Tell Abu Hawam, as are the handleless cups (FS 206, 208) and the deep-stemmed bowl (FS 304). Most of these shapes are also limited to single examples, with the exception of the side-spouted jars from Minet el-Beida and Ugarit, as well as the piriform jars (FS 31) from Beth Shean, Khirbet Judur, and ‘Ain Shems. Although the discrepancies listed above are present in the current corpus of published finds, it is important to remember that differentiation between related shapes during classification can be challenging, particularly when limited sherd material is preserved, and it is therefore difficult to

[774] Van Wijngaarden 2008a, 128.

derive strong conclusions from single finds across varying regions of the Near East. As an illustration, consider the rounded alabastron FS 82, which is represented by a single LH II example from Atchana. In form, this vessel is very close to the LH IIB-IIIA1 examples of FS 83 and FS 84, both of which are attested at different sites.[775]

General Observations – Mycenaean Ceramic Trade

Relative to the Mycenaean imports surveyed from Cyprus and Egypt, there are some notable variations observable (see Appendix Catalogue 2 for a list of all FS forms present in each region). For most shapes, Cyprus yielded the largest corpus of finds (see Figure 5-34). This is particularly true of open vessels, including bowls, cups, kylikes, and kraters. Although the Levant has slightly more amphoroid kraters (FS 53-55) recorded here, the Cypriot corpus included for this study omits the significant amount of locally produced LH IIIB Late, Rude or Pastoral Style vessels in the same form, which attest to the greater popularity of this shape on Cyprus. Some discrepancies in subtype distribution exist, such as the predominance of the shallow semiglobular cups (FS 219 and 220) in the Levant, a large proportion of which were recovered from the site of Tell el-‘Ajjul.[776] In addition, the distribution of the mug (FS 225-226) is centered largely on the Northern Levant, accounting for 11 of 14 examples from the Eastern Mediterranean—it is worth noting that Enkomi, with its close proximity to the northern Levant,

[775] Similarities in shape between FS 77, FS 155 and FS 159-161—all present in single forms—could lead to misidentification if whole vessels are not present.

[776] Of the 269 clearly identified FS 219-220 examples, 110 come from Cyprus (70 of which were found at Enkomi), 10 from Egypt, and 149 from the Levant (of which 81 were found at ‘Ajjul, while only 37 were recovered from Minet el-Beida and Ras Shamra). In addition, numerous other vessels labeled simply ‘semigobular cups’ (FS 211-220) suggest that these quantities were potentially considerably higher.

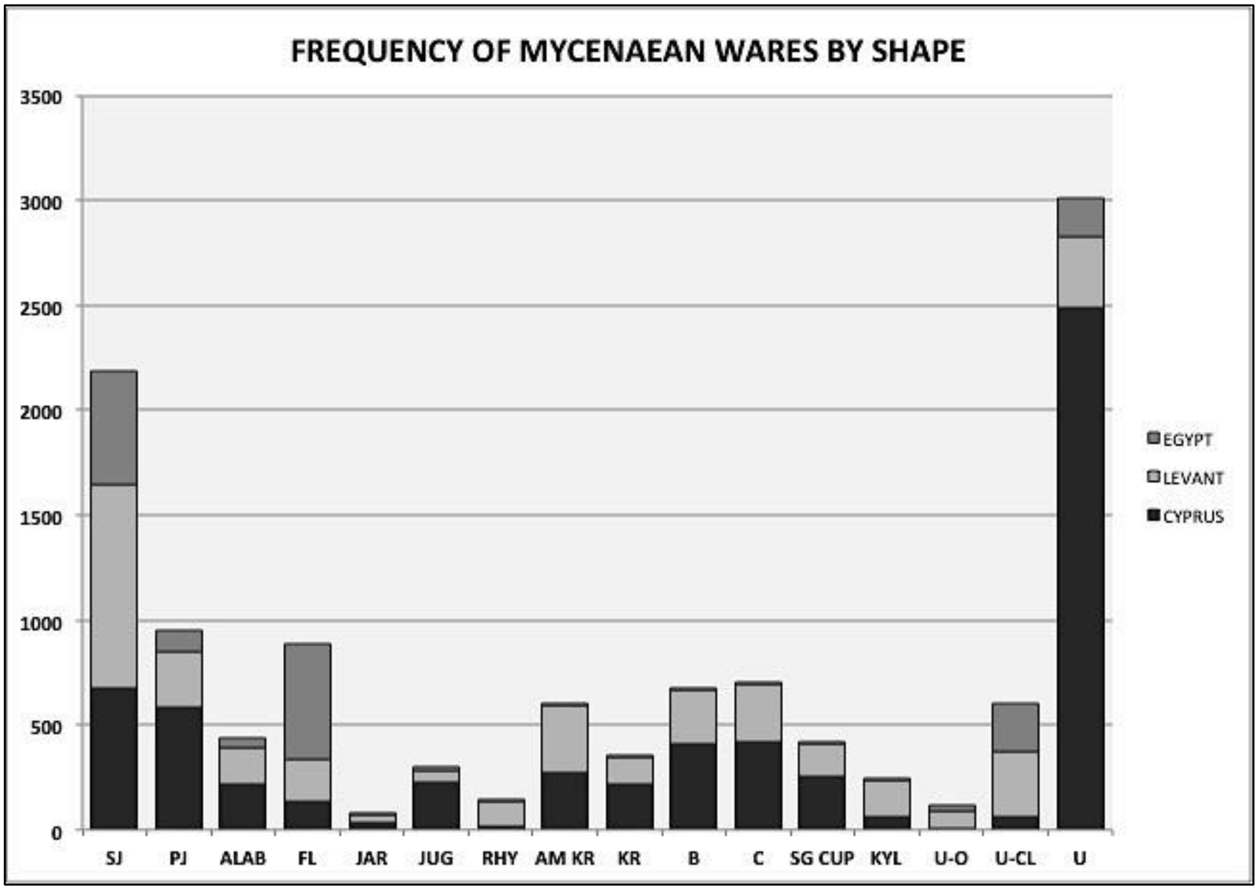

Figure 5-34. This chart shows the distribution of imports by general shape in the three regions under study. The shape codes are as follows: SJ – stirrup jar, PJ – piriform jar, ALAB – alabastron, FL – flask, JUG – jug, JAR – all other jar types, RHY – rhyton, AM KR – amphoroid krater, KR – all other krater types, B – bowl, C – all other cup types, SG CUP – semiglobular cup, KYL – kylix, U-O, unknown open shape, U-CL, unknown closed shape, and U – unknown shape.[777]

is one of the only Cypriot sites that yielded this shape.[778] Supporting the supposition of a northern circulation for this shape is its absence from Egypt while examples have been recorded at a number of sites in Anatolia (including Troy, Miletos, and Mersin).[779] Additional shapes that may be included in this northern Mediterranean focused distribution system are the small

[777] The large quantity of vessels of undetermined shape from Cyprus is due to the great quantity of sherds noted in preliminary reports but with full publication pending, most significantly from Hala Sultan Tekke.

[778] We are including both zones L1 and L2 in the 'northern Levant'. Cypriot examples were recovered from Enkomi and Hala Sultan Tekke.

[779] Mountjoy 2006, 107-121.

handleless jar (FS 77), the amphoroid beaked jug (FS 151),[780] and the semiglobular spouted cup (FS 250), which were recovered from Ras Shamra, Minet el-Beida, and/or Sarepta, as well as Enkomi. As previously discussed, the greatest number of stirrup jars, kylikes, and rhyta were recovered from the Levant, while flasks cluster in distribution in Egypt (as a function of the large Amarna corpus). This is particularly true of globular flasks (FS 187-192), however lentoid flasks (FS 186) remained more popular in the Levant (yielding 70% of the FS 186 examples).[781]

There are very few shapes present in the Levant or Egypt that are not also attested on Cyprus. For Egypt, these include: LH IIA piriform jar (FS 20), squat jug (FS 87), narrow-necked jug (FS 130), bell-shaped cup (FS 221), and stemmed cup (FS 263). Of these, both FS 87 and 221 are attested in the Levant, while FS 20, FS 130, and FS 263 are present in closely related forms (e.g. piriform jars FS 19 and FS 23, and narrow-necked jugs FS 120 and FS 136, and stemmed cups FS 254-256). Shapes FS 19 and FS 23 similarly correspond in form to piriform jar (FS 16) recovered in the Levant, while semiglobular cup (FS 218) and stemmed cup (FS 262) can be compared to Cypriot examples of FS 219 and FS 254 respectively. Variations of the spouted conical bowl (FS 303 and FS 308-310) found on Cyprus may satisfactorily correspond FS 300 and 304, which were found exclusively in the Levant. Two rare Levantine shapes not currently attested on Cyprus are the funnel (FS 198) and the lid (FS 334). The close correspondence of shapes, aside from the variability inherent to the archaeological record and the difficulty in precisely identifying sherd material, intimates that differentiation across regional assemblages may reflect small discrepancies in subtype rather than substantial differences in

[780] Sherds from a single example of the amphoroid beaked jug were uncovered at Tell el-Amarna in Egypt.

[781] This figure represents the proportion of clearly identifiable vessels of this type (48 of 68 examples), however there are a number of sherds and vessels labeled only ‘flask’ that could include further specimens.

consumer demands.

6. CYPRIOT POTTERY

6.1 Wares and Types

The first section of this chapter will briefly introduce the main ware types and forms that were exported throughout the Eastern Mediterranean and Egypt during the LBA. Cypriot wares are categorized by decorative style rather than by a strictly chronological taxonomy like Mycenaean pottery. The presentation of wares here will loosely follow the chronological development of production from Cyprus, in consideration of both the earliest introduction of a particular ware, as well as the height of the production and distribution for each within the Mediterranean (Figure 6-1).[782] There is, however, considerable overlap between groups, and product lifespans across types vary significantly. Cypriot pottery production was also highly regional, with different centers of manufacture and distribution for different wares.[783] Regionality in vessel manufacture may reflect a decentralized small-scale production system alongside specialized workshops, operational at the site or household level.[784]

The earliest groups developed from Middle Cypriot wares, and saw continued distribution from the MC to LC periods. These include White Painted Ware, Black and Red Slip Wares, and the Red-on-Black and Red-on-Red wares. The distributions of these groups were clustered in the early part of the Late Cypriot period, with the majority of examples of White Painted and Red-on-Red and Red-on-Black vessels from the Levant recovered from MB II

[782] The development of different ware groups is best seen at Enkomi, where there is the most complete continuous stratified sequence from the LC I through LC III period, as well as considerable architectural remains (Crewe 2007a, 43).

[783] Merrillees 1971; Manning 2001, 81; Crewe 2007d, 214; Steel 2010, 109-112.

[784] Loney 2000, 651; Crewe 2007d, 216, 227. A specialized pottery workshop has been identified at Toumba tou Skourou (Vermeule and Wolsky 1990).

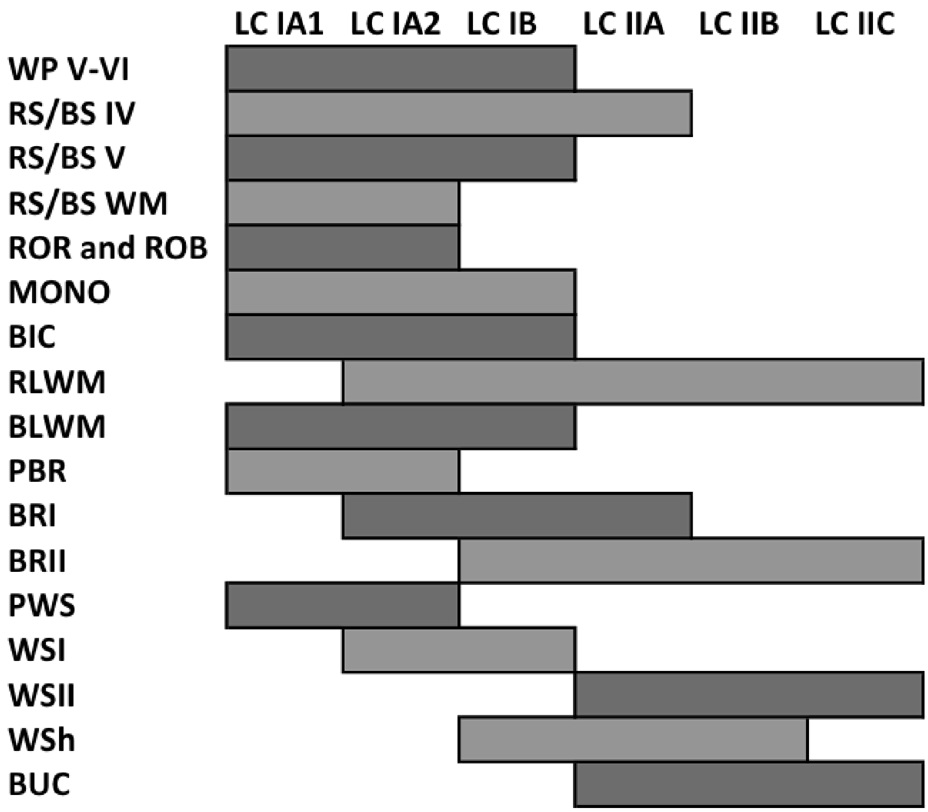

Figure 6-1. General chronological lifespans of the main Cypriot wares traded throughout the Mediterranean.

contexts. The transition to the LBA is signaled in part by the introduction of new wares in Cyprus, which flourished in the LC I period, including: Monochrome Ware, Bichrome Ware, and Red and Black Lustrous Wheel-made Wares. While Monochrome, Bichrome, and Black Lustrous vessels were predominantly distributed during the LC I, Red Lustrous Wheel-made vessels continued to be produced and circulated throughout the LC II period.

The two ceramic traditions on Cyprus with the greatest production and distribution during the Late Bronze Age were White Slip and Base Ring Wares. Together, these wares represent over half of all Cypriot imports from the Levant and Egypt included in this study (see Figure 6-2

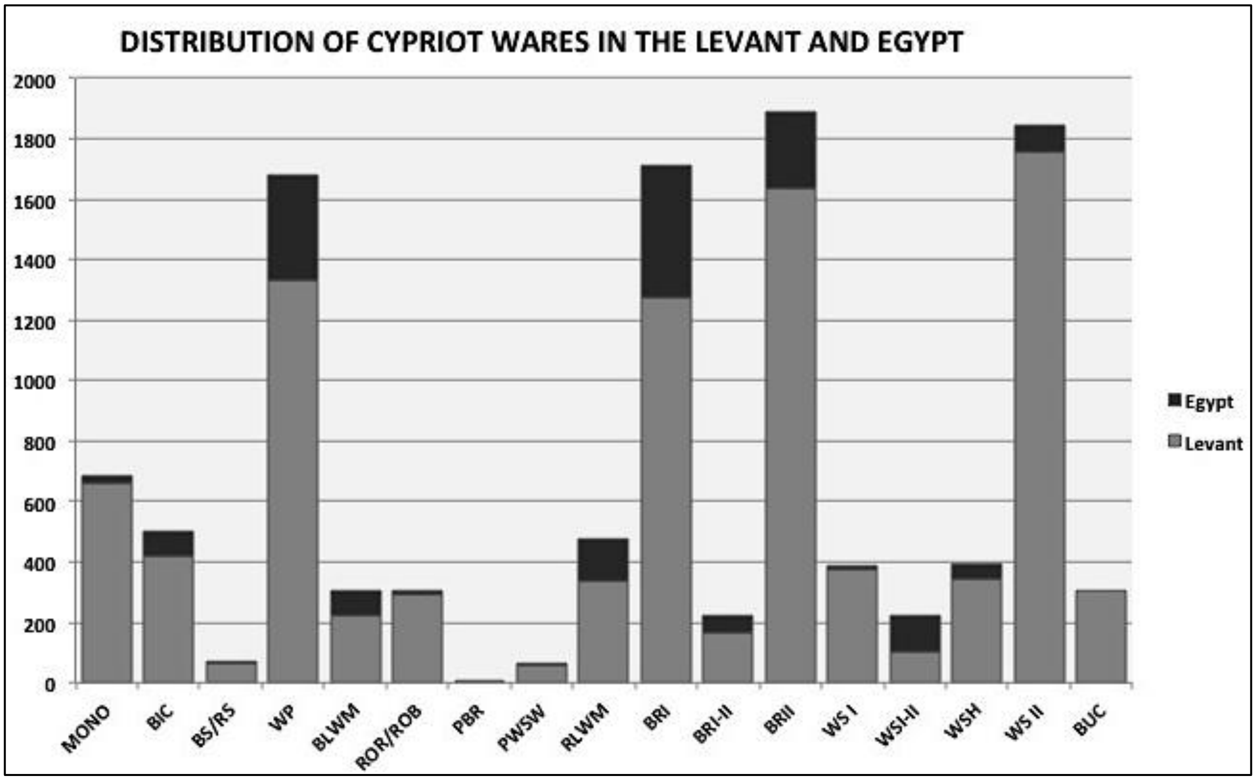

Figure 6-2. The quantities of different imported Cypriot wares groups from the Levant and Egypt.

for the quantities of the different ware types).[785] Both wares commenced production with Proto groups at the advent of LC I, and continued in popularity through the LC II period. Similarly spanning LC I and LC II is the White Shaved Ware, a group that also enjoyed considerable distribution throughout the Eastern Mediterranean. A final ware introduced during the latter part of the Late Bronze Age is the Bucchero style, which developed during the LC II from both Base Ring and Black Slip traditions. Although exported Cypriot ceramics were predominantly painted, a small group of Plain White handmade vessels (PWHM) were discovered in Egypt.[786]

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[785] Proto-Base Ring through Base Ring II represents around 35%, while Proto-White Slip through White Slip II account for just over 22%.

[786] The PWHM group comprises vessels of variable fabric and form, which are characterized primarily through the buff-cream surface (Åström 1972, 126). Many of the vessels tentatively assigned to this group may be undecorated or worn examples of other popular groups (Crewe 2009, 79).

White Painted Ware

White Painted Ware in the Late Cypriot period is a continuation of the Early and Middle Cypriot White Painted group.[787] The numerical designation WPII-VI as constructed by Åström was intended to reflect chronological sequencing, however regional variations across Cyprus have proved this taxonomy to be problematic, resulting in the necessity to modify this system with further categories (generally based on decorative style).[788] The WP group consists of handmade vessels with geometric or linear decoration on buff or pale background (see Figure 6-3).[789] Clay is generally buff (occasionally yellow, green or grey), finely mixed with varying amounts of mica and grit. Wares are fired to a progressively harder state over time.[790] Vessels are occasionally burnished (particularly early examples), however are generally matte in background with matte black or brown painted decoration (red paint is also common). White Painted Handmade ware V and VI (WPV, WPVI) are the two most prominent types in circulation during the Late Bronze Age (transitional WPV-VI examples are also found). WPV and WPVI vessels were liberally distributed across the Levant, however were relatively rare in Egypt—particularly in relation to the distribution of later LC wares.

White Painted VI has a variety of style variations in relation to regional production centers. Many of the decorative features are inherited from the WPV styles that were popular in

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[787] See SCE IV:1B (11-80) and SCE IV:1C (53-60).

[788] Frankel 1974; Maguire 1991; Eriksson 2009. For the original classifications system, see Åström 1972a, 1972b.

[789] Although predominantly handmade, there are wheel-made varieties that develop alongside the continuing handmade tradition, for which the WP designation is continues to be used (as White Painted Wheel-made, Artzy 2007, 12; Artzy et al. 1976).

[790] Horowitz 2007, 193.

a.

b.

c.

d.

Figure 6-3. White painted vessels (at varying scales)
a. WP V Amphora, Enkomi Tomb, BM Inv. no. 1897,0401.1299
b. WP PLS Jug, Phoenikias, BM Inv. no. 1884,1210.7
c. WP VI Jug, Enkomi Tomb 83, BM Inv. no. 1897,0401.1174
d. WP VI Tankard, Klavdia Tomb A1, BM Inv. no. 1899,1229.127

the MC and into LC I.[791] A common group is the WP Cross Line Style (WP CLS), which has a production center at Kalopsidha in eastern Cyprus.[792] This group has been further subdivided, with styles ranging from MC to LC I in date.[793] A variety of other decorative styles are present, including the WP Spouted or Coarse Linear Style (also from Kalopsidha) and the WP VI Soft Triglyphic Style (WP STS; from the southeast).[794]

The White Painted Pendant Line Style (WPIII-IV PLS, often now known simply as WP PLS), is dated mainly to the MC II-III period, however may still have been in production and circulation in the Eastern Mediterranean during the LC IA. This style is believed to have originated in eastern Cyprus, specifically at Kalopsidha. The vessels of the WP PLS are identifiable by the painted pendant straight or wavy lines originating at the encircling bands around the neck or shoulder. Vessels of this type were found at a variety of sites in the Levant and Egypt, including Atlit, Hazor, Tell Kabri, Tell Sukas, Kahun, Tarkhan, and Tell el-Dab'a.

Shapes common in WP wares include the small/medium hemispherical bowls (with or without side-spout), jars, jugs and juglets, tankards, teapots, bottles, flasks, and rattles. In form WP PLS vessels typically have rounded bases and mouths, and handles running from the rim to the shoulder, while WPV-VI vessels generally have flat bases and handles from the neck to the shoulder. Common decorative motifs include straight, wavy, zigzag, and curved lines, circles,

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[791] Åström 1972b, 65. On Cyprus the WPV group is generally Middle Bronze in Date, however Levantine examples occur in both Middle and Late Bronze contexts.

[792] Åström recovered over 21,000 sherds in his excavations at the site (Åström 1966)

[793] An example is the WP Framed Cross Line Style, which is contemporary with the similar Bichrome Ware Cross Line Style, and dated to the LC I (Åström 1972b, 53).

[794] Additional WPV groups that are predominantly produced near the end of the Middle Cypriot period are the Fine Line Style (FLS) from northern Cyprus, as well as the Tangent Line Style (TLS) and the Broad Band Style (BBS) from the southeastern part of the island (Bushnell 2013, 199).

ladders, rows of lozenges, parallel chevrons, tree-pattern, and cross-hatched pattern.[795] Many of these motifs are shared with other Cypriot wares of the period, such as the ladder pattern, which is a hallmark of White Slip Ware.

Black Slip and Red Slip Wares

Black and Red Slip wares are related handmade groups, continuing from earlier MC types.[796] These wares share a similar buff fabric, containing sand, mica, and grits. Differentiation between the two groups is based primarily on the fired colour of the slip, which is believed to largely be a function of firing temperature.[797] The slip itself is matte or smoothed to a light luster, and is often so thin that it is largely worn (often leading to the misidentification of sherds as Plain White Hand-made Ware).[798] Additional decorative techniques of these wares include incision, applied motifs, or patches of 'reserve slip' (see Figure 6-4). BS includes both handmade and later wheelmade examples,[799] and often shows evidence of being shaped and formed by shaving with a knife (for the neck, handle, and body).

There are two main groups from the LC period, BSIV and BSV, which appear to originate from the southeast and northwest respectively. The first group, BSIV, is a continuation of BSII (examples from early excavations were often confused, as Åström originally grouped all

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[795] Åström 1972b, 65.

[796] For Middle Cypriot types, see SCE IV:1B pages 84-105 (Åström 1972a).

[797] Bushnell 2013, 44.

[798] Åström 1972b, 75.

[799] Wheel-made traditions for BS and RS are strongest on the east coast and the southern Karpass peninsula (Horowitz 2007, 197).

a. b.

Figure 6-4. Black Slip/Red Slip Vessels (at varying scales)
a. BS V Juglet, Enkomi Tomb 84, BM Inv. no. 1897,0401.1324
b. BS V Juglet, Enkomi Tomb 19, BM Inv. no. 1884,0401.1309

examples under BSII or ‘late Black Slip’).[800] This group includes new shapes from the earlier MC types, however exhibits an inferior production technique during the LC I-IIA1. Shapes are squatter than the BSV group, with wider necks. BSIV vessels are often quite soft and poorly fired. BSV is instead a LC I continuation of the BSIII tradition, which is characterized by well-mixed, hard-fired clay containing sand, mica, and occasionally crushed pottery. Vessel walls are often very thin, approaching the quality of Proto Base Ring ware.[801] In shape, BSV vessels are usually ovoid, globular, or biconical in form, with generally narrow necks and flat bases.

Common BS IV shapes include shallow and wide spouted bowls, kraters, jugs and juglets,

[800] Åström 1972b, 74. Åström cites earlier publications of his excavations at Kalopsidha as suffering from this classification issue.

[801] Åström 1972b, 80.

tankards, and bottles.[802] The range of BSV vessels includes deeper bowls, pyxides, jugs and juglets, bottles, flasks, and horn-shaped vases.[803] There is a wide variety of decorative motifs, including straight lines, zigzags, parallel chevrons, triglyphs, rows of dots, diamonds, and lozenges, crosses, triangles, oblique lines, lattices, and hatched and cross-hatched bands. These motifs are all highly linear in form, varying only in the specific configuration of the incised lines. Limited examples of applied plastic decoration included encircling ridges or crescent-shaped relief on the neck of jugs, knobs along the sides of flasks, and cross-hatched arches on the body face of jugs.[804]

Red-on-Red/Red-on-Black

Red-on-Black and Red-on-Red (ROB and ROR) handmade wares are less frequently traded Late Bronze age ceramic groups, which develop from Middle Cypriot predecessors. The relationship between these two wares has been noted by many authors, with Robert Merrillees proposing that the two groups instead reflect one single ware, with variation a function of firing technique.[805] They will therefore be presented together here. These two groups originated in and around the Karpass peninsula, and were produced mainly in the MC III and LC I periods. In the Levant, these vessels are generally recovered from MB II contexts.[806]

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[802] Limited examples of amphorae and animal-shaped vessels were also found.

[803] Additional shapes with few examples include animal-shaped vessels, and tripod jars.

[804] Åström 1972b, 85-87.

[805] Merrillees 1979, 118; Bergoffen 1990.

[806] Sites include Tarsus, Gezer, Tell Haror, Sarepta, Tyre, and Tell el-‘Ajjul (Charaf 2008, 143). Charaf notes that these vessels are not true ROR as traditionally defined, but exhibit features of both ROR and ROB bowls--further supporting the supposition of a shared ware between ROR and ROB.

a.

b.

c.

Figure 6-5. Red on Red/Red on Black vessels (at varying scales)
a. ROR/ROB Bowl, Phoenikiais, BM Inv. no. 1884,1210.103
b. ROB Bowl, Ayios Iakovos Tomb 10, Medelhavsmuseet Inv. no. AJ 010A:016
c. ROB Jug, unknown provenance, BM Inv. no. 1927,0317.1

Vessel fabric is light buff in colour with very few inclusions of black, white, or brown (see Figure 6-5). Pots are generally fired to a hard or metallic degree, although rare soft to medium fired examples occur. The majority of ROB and ROR wares are painted, however a small minority are slipped and polished to a deep black colour. The slip can be mottled red, black, or both. Painted decoration consists generally of straight or wavy lines, occasionally produced with a comb-like instrument.[807] Both ROB and ROR employ reserved slip decoration as well. Shapes include mainly bowls and jugs.

Monochrome

Monochrome vessels from the Late Bronze Age demonstrate a high degree of regional variability in form, fabric, and finish: [808] vessels of northern and eastern origin (around Kazaphani or Myrtou) may be differentiated by their thin fine fabric, fired hard with a buff colour and orange to red slip; [809] coarse versions of MONO ware were common for the production of a number of utilitarian vessels in the northwest around Apliki and Katydhata, and is sometimes recorded in early publications as 'Apliki Ware';[810] varieties from the Morphou Bay area, and characterized by the swirls of red and black created through firing are also known as 'Morphou Bay Mottled Ware'.[811] A five-part classification system has been proposed to further differentiate MONO subtypes, termed Monochrome A-E, which reflect regional variation rather than chronological development.[812] This ware first appears in the LC IA, and is considered a

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[807] Bushnell 2013, 49.

[808] Knapp and Cherry 1994, 60; Horowitz 2007, 195. The relationship of MONO to other ware groups, namely Red Polished, BR, RS and BS, is observable in the corpus of ceramics from Toumba tou Skourou (Pilides 1991, 291).

[809] Pilides 1991, 289. These vessels were deemed the antecedents of the fully developed MONO ware by the excavators of Kazaphani (Merrillees 1989, 2).

[810] Vermeule and Wolsky 1990.

[811] Vermeule and Wolsky 1990, 366-367; Horowitz 2007, 196. This ware may be related to the Red Polished V group (Merrillees 1989, 1-2; Pilides 1992, 290).

[812] Pilides 1991, 148.

hallmark of the LC I period.[813]

Monochrome fabric is very hard, almost metallic, and is quite similar in the early vessels to those of Red Polished wares, from which this ware may have derived.[814] Coarse ware is characterized by far more frequent inclusions, however MONO fabric in general may be recognized by the inclusions of sand, mica, grit (grey, white, black, and brown), and chaff. Generally, pots of this ware are fairly evenly fired to a red or brown colour, with limited examples of pink, grey, or buff tones. Coarse ware vessels are darker once fired, generally appearing brick-red, however examples of grey, grey-brown, and variations of these colours do occur. MONO vessels are slipped with a light or dark red, or brownish colour, ranging from matte to slightly lustrous. Burnishing, when present, is done in horizontal or diagonal strokes. Slip for coarse ware ranges from brown and red to black, while the surface may be further decorated through the creation of irregular striations known as “scratch-burnished”.[815] Further decoration includes incised marks on early vessels, as well as the use of relief bands and ridges in later examples. Although counter to the MONO designation, some painted examples do exist, for which motifs are commonly adopted from BR traditions.[816]

The most common vessel shape is the shallow hemispherical bowl, which varies largely in the handle type and the location of its attachment.[817] Main handle types include loop, strap and wishbone. Additional spouted varieties do occur, as do deeper bowls and kraters. Less frequent

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[813] Merrillees 1971; Horowitz 2007, 195.

[814] Åström 1972b, 90. Examples with a softer fired fabric were found at Stephania.

[815] Åström 1972b, 104.

[816] Motifs include rows of dots, parallel lines, and pendent ladder patterns (Åström 1972b, 110-111).

[817] Åström 1972b, 91-93. Wishbone handles of MONO bowls come in a number of varieties, including formed, forked, pointed, extended, square, and bulb types, attached either vertically or horizontally. Vessels may have tail-shaped or lug projections in place of handles (Bergoffen 1991, 108 fig. 12).

shapes include the strainer, cup, jug, and tankard. The jug, along with the shallow hemispherical bowl, are the most common shapes produced in MONO coarse ware, which also includes limited examples of deep bowls, jars, amphorae, and jugs.

Bichrome Handmade and Wheel-made Ware

Bichrome ware includes both handmade and wheel-made examples, although the latter are far more common. Cypriot examples of Bichrome wheel-made vessels (BI ware) were originally believed to be imported examples of contemporary Levantine traditions, however more recent scientific ware analysis has demonstrated that locally produced BI vessels were manufactured during the LC IA period.[818] Lindy Crewe suggests that the similarities between the two wares reflect Levantine influence on the production technology and decorative style of the Cypriot group.[819] In particular, the two colour decorative style is linked to Levantine or Syrian practices.[820] The presence of eastern influence is supported by the initial appearance of Bichrome ware on the eastern coast of Cyprus, in the region of Milia.[821] This ware may also have in turn been produced for intentional exportation to the Levantine coast, as suggested by differences in fabric preparation, as well as the preponderance of kraters and bowls, which were relatively rare in Cyprus.[822]

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[818] Artzy et al. 1973; Artzy 2001, 61; 2007, 12; 2013, 175. A Cypriot origin was originally rejected due to the use of the potter's wheel in manufacturing (Heurtley 1939, 33; Dikaios 1969-71, 226), as well as early, now refuted, petrographic work (L. Courtois 1970, 145-147).

[819] Crewe 2007b, 34. For further discussion of Palestinian Bichrome decoration, see Heurtley 1939; Epstein 1966; Artzy 1972.

[820] Artzy 2001; 2007, 12. Motifs, however, appear to correspond more closely to local WP traditions.

[821] Bushnell 2013, 226. One tomb (Tomb 10), dated to LCI, contained at least 94 BI wheel-made pots.

[822] Artzy 2013, 176, 180.

a. b.

Figure 6-6. Bichrome vessels (at varying scales)
a. Bichrome Jug, unknown provenance, BM Inv. no. 1927,0317.3
b. Bichrome Jug, Maroni Tomb 9, BM Inv. no. 1898,1201.127

BI fabrics come in a variety of colours, including buff (with grey, green, and pink variations), light red, and red-brown. Visible inclusions of mica and white grit are present, rarely in wheel-made vessels, and frequently in hand-made varieties. There is also variation in the colour of the slip, with occasional examples of yellow, white, creamy pink, orange, green, and brown present in addition to the common buff slip. Decoration on BI vessels is generally arranged in horizontal panels, often further subdivided into registers (see Figure 6-6). Motifs correspond to those popular on contemporary WP VI vessels, and include vertical and horizontal linear patterns, triglyphs, crossing lines, zigzags, diagonal crosses, lattice panels, triangles, chevrons, and hatched patterns (see decoration of WP vessels in Figure 6-11 and Figure 6-12). Circles, dotted patterns, running spirals, triangles, and starts are also common. Figural motifs also appear on BI vessels, including men, quadrupeds, animals with six or eight legs, birds, fish, trees, vases, and spoked wheels.[823] The most common BI shapes are dining vessels, including tankards, jugs, kraters, and bowls. Other less frequent shapes include jars, pilgrim flasks, and animal-shaped vessels.[824]

Red Lustrous Wheel-made Ware

Red Lustrous Wheel-made ware (RLWM) is the most common of the lustrous wheel-made group that also includes White Lustrous and Black Lustrous wares.[825] The provenience of RLWM has been energetically disputed, with alternative Anatolian or northern Syrian origins proposed.[826] An extra-Cypriot origin is supported in part by the relative paucity of other Cypriot wares found in connection with RLWM vessels in central and northern Anatolia, as well as the lack of Hittite objects in Cyprus.[827] NAA results, however, have revealed that RLWM fabrics are distinct from local Hittite wares.[828] The lack of examples from the Syrian interior also discredits it as a local production center.[829] The quantitative predominance of finds recovered from

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[823] Åström 1972b, 121-124.

[824] Rare examples of BI handmade cups also exist (cylindrical and stemmed varieties; Åström 1972b, 112).

[825] The WLWM group is not considered separately here, as it is rarely traded across the Mediterranean. Vessels of this type may also be considered variants of the RLWM group (as argued by Lagarce and Lagarce 1985, 148), or may represent an experimental stage of early RLWM development (Eriksson 2007b, 65). The connection between the WLWM and RLWM groups is supported by their shared development in the Kyrenia region (Eriksson 2007b, 66), as well as through NAA analysis, which has revealed similarity in the wares' fabrics (Artzy 2007).

[826] See Eriksson 1993, 2007a; Artzy 2007.

[827] Kozal 2007, 141. An Anatolian origin has seen more recent reconsideration because of the frequency of new RLWM finds in Boğasköy and the Göksu Valley (Artzy 2007, 15).

[828] Kozal 2007, 144. Artzy further argues that NAA results and petrographic analysis should be compared and employed together to deduce more accurately the origin of the ware (2007, 11).

[829] Eriksson 1993, 107; Caubet 2007, 37.

a. b. c. d.

Figure 6-7. Red Lustrous Wheel-made vessels (at varying scales)
a. Red Lustrous Wheel-made Arm-Shaped Vessel, Enkomi Tomb 69, BM Inv. no. 1897,0401.1108
b. Red Lustrous Wheel-made Spindle Bottle, Maroni Tomb 9, BM Inv. no. 1897,0401.1193
c. Red Lustrous Wheel-made Flask, Klavdia Tomb B4, BM Inv. no. 1899,1229.102
d. Red Lustrous Wheel-made Arm-Shaped Vessel, Enkomi Tomb 57, BM Inv. no. 1897,0401.1301

northern Cyprus has suggested a production center in the region of Kazaphani.[830] Recent petrographic analysis of RLWM vessels supports the conclusion that northern Cyprus was the

[830] Eriksson 1993, 149; 2007a, 51. While Eriksson suggests that over half of all RLWM vessels were discovered in northern Cyprus (1993, 149), Artzy has disputed this number, arguing that more recent and substantial finds from the Anatolian heartland since Eriksson's analysis skew this figure significantly (2007, 14). In particular, new finds from Kilisetepe, once published, may significantly change the conclusions reached about the origin and regions of manufacture for this ware (Shubert and Kozal 2007, 169).

main production center.[831] The ware first appears in the LC IA2 period, and is manufactured until the LC IIC-LC IIIA1 transition, reaching maximum production and distribution during LC IB-LC IIA.[832]

The fabric of RLWM ware is finely made and mixed with few white or dark grits and mica,[833] and homogenously fired to a red or reddish colour.[834] Vessels are evenly slipped in a deep, medium, or light red shades, and either burnished (for bottles and arm-shaped vessels) or polished (for flasks) to a high luster (see Figure 6-7). Burnishing appears to have been done with a sharp object—either a stick or a knife—often damaging the slip underneath.[835] Additional decoration includes horizontal ridges at the neck, similar to Base Ring I vessels, as well as incised pot-marks.[836] The range of shapes is fairly limited, with the vast majority of vessels falling under one of three types: spindle bottles, arm-shaped vessels,[837] and lentoid flasks. Limited examples of wide and biconical bowls, jars, jugs, and tankards have also been recovered.[838]

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[831] Knappett et al. 2005. Chemical analysis also shows a significant similarity between RLWM and BR fabrics, however slight variations warrant caution in attributing these two wares to the same production center (Artzy 2007, 14).

[832] Eriksson 2007a; Kozal 2007.

[833] The presence or absence of mica may be reflective of regional production centers (Åström 1972b, 198).

[834] Similarities between the fabrics of RLWM ware and Red-on-Black ware have been noted at the site of Vounari (Horowitz 2007, 205).

[835] Åström 1972b, 198.

[836] Pot-marks were added before firing, and are commonly found on the base of jars and spindle bottles, as well as on the lower handles on pilgrim flasks. For the common pot-marks seen on RLWM vessels, see Åström 1972b, 207 fig. 42.

[837] Arm-shaped vessels are frequently assigned a ritual function, although there is no evidence of incense burning (Eriksson 1993, 27).

[838] Eriksson 1993; Åström 1972b.

Black Lustrous Wheel-made Ware

Although less common than the RLWM group, BLWM ware may have originated on Cyprus as early as the late Middle Bronze period.[839] Most BLWM finds date to the LC I period, and concentrate in the eastern, central, and northwestern part of Cyprus.[840] Unfortunately, the finds from many sites come from unsecure contexts, however a number have been recovered from tombs at Enkomi, where they are found with BS V, BRI and BRII, and WSI and WSII.[841] Many sherds are difficult to distinguish from the Grey and White Lustrous groups, while the latter corresponds in form more closely to RLWM.[842] Petrographic analysis has confirmed a Cypriot origin for this group of vessels.

Similar to the RLWM group, the clay for BL vessels is well mixed and homogenously grey. Inclusions of mica, grit, crushed pottery, and occasionally organic matter are present. Clay is often soft fired, and slipped or washed in black, brownish-black, grey, or mottled red and black. The surface is then polished to a matte lustrous finish, however this is frequently worn. Further decoration includes encircling ridges for jugs and tankards, as well as ridges on the body for the latter. The most common BLWM shapes are jugs, tankards, and spindle bottles, while limited

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[839] Yannai and Goralczany 2007.

[840] Åström 2007, 20; 1972b, 700. The sites with the largest collections of BLWM from non-mortuary contexts are Enkomi and Kalopsidha (Crewe 2007a, 46). The continued use of many tombs reduce the precision possible in assigning production dates, however the presence of multiple vessels in tombs used primarily in the LC IIA-B suggest that it is likely that this ware continued into the early LC II period (ibid., 49).

[841] A BLWM juglet were also recovered from Tomb 8 at Ayios Iakovos (Åström 2007, 19).

[842] Bushnell 2013, 44. Early excavations also occasionally classify BLWM sherds as ‘Black Burnished’. White Lustrous Wheel-made ware is significantly less common, with only a few examples from the Levant or Egypt (sites include Mersin, Boğazköy, Minet el-Beida, Tell el-‘Ajjul, Quban, and ‘Ezbet Helmi (Avaris) in Egypt (Eriksson 2007b, 61). Examples from Cyprus date largely to the LC IB period and are similarly rare, and come exclusively from tomb contexts (ibid.; Crewe 2007a, 43).

examples of bowls and kraters also exist. Juglets are also common, however they appear exclusively in mortuary contexts, and generally do not appear together with BLWM vessels of other shapes.[843] The shape of the tankard is similar to contemporary WP VI and Bichrome wheel-made examples.[844] A chronological development visible in the jugs is the move from a rounded base (Type 1), to a flat base (Type 2).[845]

Base Ring Ware

Base Ring vessels comprise the most commonly traded Cypriot ceramic group from the Late Bronze Age eastern Mediterranean. The first BR vessels, classified as Proto Base-Ring (PBR) appear at the start of the LC IA period. BRI is then generally produced between LC IA2-LC IIA, while BRII is dated to LC IB2-IIC. Although these subtypes are given approximate temporal ranges, the fabric, style, and technological developments meant to signify these divisions occurred at different times across production regions on Cyprus;[846] while a new classification system has been attempted, the traditional SCE taxonomy is still generally employed.[847] The earliest PBR and BR vessels seem to originate around the Morphou Bay area in the northwest part of Cyprus, however the ware may have developed in fabric and shape from

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[843] This is true of the large group from Enkomi, where juglets reflect a very different distribution through the site (Crewe 2007a, 49).

[844] Artzy 2007, 20.

[845] Bushnell 2013, 43. For a more refined categorization system, see Yannai 2007 (page 300).

[846] For the overlap between different Base Ring groups, see Eames 1994, 138; Eriksson 2001b, 51-52. The technology employed in the production of BR vessels share affinities with other Cypriot wheel-made groups, including Red Lustrous and Red Polished; similarities are also visible with Red Lustrous fabric (Vaughan 1987, 283; Artzy 2007, 14).

[847] Vaughan 1991; Bushnell 2013, 38.

a. b.

Figure 6-8. Proto Base Ring vessels (at varying scales)
a. Proto Base Ring Juglet, Ayia Paraskevi, BM Inv. no. 1888,0927.27
b. Proto Base Ring Juglet, Maroni Tomb 9, BM Inv. no. 1898,1201.128

the earlier Middle Cypriot BS tradition.[848] The preponderance of closed shapes, in particular juglets, suggest that BR vessels served primarily as containers of trade.[849]

PBR is similar to the later BR groups, however the fired clay may be pink or brown in addition to the standard BR grey (see Figure 6-8).[850] Like later vessels, the fabric includes mica

[848] Hennessy 1963, 48; Vaughan 1991, 126; Crewe 2007b; Bushnell 2013, 239. Bergoffen characterizes BR vessels as belonging in finish and appearance to the lustrous ware group (Bergoffen 2007, 27).

[849] The shape of the vessel, as well as residue preserved on the interior of recovered vessels, suggest that BR juglets were in part connected to the opium trade (Merrillees 1962; Koschel 1995; Bisset et al. 1996).

[850] Åström 1972b, 126. The core of most BR vessels is blue-grey, which is achieved through high-heat firing within a reducing atmosphere (Horowitz 2007, 191).

a.

b.

c.

d.

Figure 6-9. Base Ring I vessels (at varying scales)
a. Base Ring I Double Juglet, Dhali, BM Inv. no. 1868,0905.18
b. Base Ring I Juglet, Klavdia Tomb B4, BM Inv. no. 1899,1229.105
c. Base Ring I Jug, Enkomi Tomb 34, BM Inv. no. 1897,0401.902
d. Base Ring I Tankard, unknown provenance, BM Inv. no. 1869,0604.16

a.

b.

Figure 6-10. Base Ring II vessels (at varying scales)
a. Base Ring II Jug, Enkomi Tomb 88, BM Inv. no. 1897,0401.1249
b. Base Ring II Bull Rhyton, Enkomi Tomb, BM Inv. no. 1897,0401.1323

and small white, dark, and orange grit. BR fabric is typified by its thin metallic hardness.[851]

Further features seemingly derived from metal vessel traditions include vertical ridges or ribbed moulding on jug handles, broad laid-on handles, imitation rivets on handle attachments, and incised mouldings on vessel necks.[852] By BRII, fabric becomes coarser, while surfaces are pot-marked and may show visible grits. Surfaces of BR vessels are generally thinly slipped and

[851] A metallic precedent for BR vessels has been suggested, however this hypothesis is difficult to verify due to the lack of surviving metal vessels dating to the 15th c. B.C.E. or earlier (Bergoffen 2007; Merrillees 1982). A tradition of metal vessels may also be a source of inspiration for the stone imitations of BR ceramics produced in Egypt (Höflmayer 2011, 353).

[852] Bergoffen 2007, 27. See for example Bergoffen 1990 no. 846, pl. 168.

highly polished, appearing in shades of lustrous brown, black, or mottled brown-black.[853] A small group of red slipped vessels also occur. Decoration of the PBR and BRI vessels is produced through relief, painting, and incision (see Figure 6-9).[854] Relief bands, s-curves, spirals, and curved snakes (for PBR) commonly accent vessel bodies, while additional ridges are raised on vessel necks. The differentiation between BRI and BRII is stylistically fairly simple, as incised and relief patterns are replaced in BRII with analogous painted decoration (Figure 6-10).

Features common to many BR shapes include funnel mouths, trumpet or ring bases, and flat strap handles. Vessels of PBR ware can be primarily classified as jugs and juglets, however limited examples of tankards, amphora, and askoi do occur. Open vessels become more common with BRI, and include hemispherical bowls and kraters. Continuing closed shapes include jugs and juglets and tankards. Additional closed shapes within the BRI corpus consist of pithoid and squat jars, double juglets, spindle bottles, lentoid flasks, and animal-shaped vases. The majority of BRI shapes continue in BRII, such as hemispherical and wide bowls, kraters, pithoid and squat jars, jugs and juglets, tankards, spindle bottles, lentoid flasks, and animal-shaped vases. New shapes introduced in BRII include strainers, baskets, ring vases, rhyta, and stemmed cups. A small group of BRII bowls may also be wheel-made, however they are generally undecorated.[855]

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[853] Vaughan 1991, 123. Although vessels are handmade, finishing and polishing may have been performed with the use of a turntable (ibid., 77).

[854] For a chart of common PBR and BRI motifs, see Åström 1972b (136, fig. 37 and 171, fig. 39).

[855] Åström 1972b, 197-198.

White Slip Ware

White Slip ware is one of the most distinctive and well-studied Late Bronze Age ceramic groups from Cyprus. Similar to BR ware, White Slip ware is divided into three generally chronological groups: Proto White Slip (PWS), White Slip I (WSI), and White Slip II (WSII). A transitional phase between WSI and WSII is often identified, and is employed for the classification of vessels that exhibit features of both phases.[856] Difficulty in categorization is in part a function of the regionality of production styles, as seen with other Cypriot ceramic traditions.[857] The earliest PWS vessels begin to appear at the start of the Late Bronze Age in Cyprus (LC IA1, lasting until the end of LC IA2), while WSI generally runs from LC IA2-B, and WSII from the end of LC IB to the start of LC IIIA.[858] Stylistically, WS ware may have derived from Cypriot WP ware, or from Syro-Palestinian MBA vessels.[859] WS vessels were largely distributed along the Levantine coast, however they were relatively less popular in Egypt than the BR vessels—a discrepancy often associated with the low demand for dining vessels in Egypt. As WS vessels did not function as containers of other goods, the ware has been deemed to be a traded commodity with inherent value.[860]

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[856] Further phasing is proposed within this system, including three phases of PWS, the latter of which is a transitional phase linking PWS to WSI (Eriksson 2001a, 53).

[857] Knapp and Cherry 1994, 57-59. Eriksson relates the earliest PWS phase to Middle Cypriot WP traditions in northwest Cyprus (Eriksson 2001a, 53). The existence of multiple centers of production is supported by elemental ware analysis (Artzy et al. 1981).

[858] Popham 1972, 705-706; Åström 2001, 50. Early PWS vessels have been found in tombs near Paphos (at Anarita and Kedares) along with WPVI, BSV, and Proto MONO vessels (Åström 2001, 49).

[859] Eriksson 2001a, 50-55. Early studies categorizing the developing WS ware as an imitation of leather vessels has been largely refuted (Popham 1972, 431).

[860] Kemp and Merrillees 1980, 1-102; Fitton et al. 1998; Merrillees 2003; Eriksson 2007c; Höflmayer 2011, 343.

a. b. c. d.

Figure 6-11. Proto White Slip and White Slip I vessels (at varying scales)
a. Proto White Slip Bowl, Dhali, BM Inv. no. 1868,0905.45
b. White Slip I Bowl, Enkomi Tomb, BM Inv. no. 1897,0401.1327
c. White Slip I Tankard, Maroni Tomb 28, BM Inv. no. 1898,1201.163
b. White Slip I-II, Klavdia Tomb A33, BM Inv. no. 1899,1229.111

The fabric of WS, masked by the thick white slip, is coarser, with a sandy ferrous composition.[861] Substantial quantities of white and black grits are visible in the fabric. The clay matrix is similar to contemporary cooking wares, affording considerable resistivity to heat; a

[861] Horowitz 2007, 188.

high firing temperature was necessary in order for the thick slip to adhere properly.[862] The technological advances observable in the manufacturing process of WS wares have been associated by Eriksson with the pyrotechnic methods employed in the contemporary copper industry.[863] The unique requirements for the production of WS vessels, including kilns capable of reaching and maintaining the necessary temperatures, may suggest production specializing.[864] Manufacturing seems to have centered originally on northwestern Cyprus, potentially in the Morphou Bay region,[865] while a later manufacturing facility was excavated at Sanidha.[866]

The thickly applied slip shows variation in composition from WSI to WSII, shifting from kaolinite and smectitite clay sources to chloritic or micaceous clay.[867] Although this development may have been necessitated by complications during firing,[868] the different composition of the WSII slip may also have been the result of a move towards mass production for export, requiring simpler manufacturing techniques.[869] Vessels are almost unvaryingly painted, with a variety of motifs that can be fairly precisely charted chronologically.[870] PWS vessels are generally

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[862] Aloupi et al. 2001, 23. Although this fabric is generally reserved for WS vessels, rare examples exist of this clay in MONO and BS/RS wares (Asaro and Perlman 1973, 220).

[863] Eriksson 2001a, 52-53. The temperature required for firing was between 900-1100^{o}C.

[864] Horowitz 2007, 189.

[865] Popham 1972; Vermeule and Wolsky 1990.

[866] Todd and Pilides 2001. A local subtype, known as WSIIA, and contemporary with WSII was produced in the southwest of Cyprus (Popham 1972, 432).

[867] Aloupi et al. 2001, 23-25; Horowitz 2007, 188.

[868] This development may have been necessitated by the tendency of the smectitic slip to blister at the high firing temperatures (Aloupi et al. 2001, 23).

[869] Artzy 2001, 112.

[870] Popham 1972, 432; Manning 1999; Merrillees 2001b; Eriksson 2001a, 57.

a.

b.

c.

d.

Figure 6-12. White Slip II vessels (at varying scales)
a. White Slip II Juglet, Klavdia Tomb A1, BM Inv. no. 1899,1229.110
b. White Slip II Bowl, Enkomi Tomb 22, BM Inv. no. 1897,0401.881
c. White Slip II Bowl, Hala Sultan Tekke Tomb 4, BM Inv. no. 1898,1231.27
d. White Slip II, Enkomi Tomb 45, BM Inv. no. 1897,0401.935

identified by the use of thick painted lines in the production of hatched ladder motifs and wavy rim bands (see Figure 6-11).[871] A common feature of WSI bowls is the presence of straight or wavy lines along the rim, which are supplanted in the WSII by rows of dots or vertical dashes

[871] Popham 1972, 433-436.

(see Figure 6-12). Shared motifs employed across all subgroups include: rope patterns, parallel lines, framed wavy line, cross-hatched lozenges, squares, triangles, and diamonds. An early variant, the festoon pattern (comprising parallel straight and wavy lines), is unique to PWS vessels. By WSI, the patterning of different motifs becomes more consistent and standardized,

and the execution is finer and neater, often incorporating more than one colour of paint. In the latest stages of WSII, slips begin to darken to grey, dark buff, or brown, while painted motifs are produced with less refinement.

Vessels are handmade, and consist primarily of hemispherical bowls known as "milk bowls", to which lips or necks are added to produce kraters, jugs, and tankards. In addition to the painted decoration, milk bowls are also identifiable by the characteristic wishbone handle. Bowls and jugs are both common in PWS, while the bowl becomes the predominant shape in later periods. Rare examples of WSI jars, jugs, and kraters are extant, while the tankard is second to bowls in frequency. The range of vessels expands notably during WSII, with jugs, bottles, and tankards increasing in frequency. Ring bases are also more frequently attached to closed vessels. Aside from the relatively rare WSII bottles, shapes are entirely confined to table-wares, and are functionally all classified as dining vessels.

White Shaved

The White Shaved (WSh) juglet is a commonly traded vessel from the Late Bronze period, and is found in considerable quantities along the Levantine coast. Multiple examples were also recovered from the Uluburun shipwreck.[872] The WSh juglets, unusual in shape for

[872] WSh juglets also made it as far as Thapsos in eastern Sicily (Vagnetti 1986, 203).

Figure 6-13. White Shaved vessels (at varying scales)
a. Palestinian Dipper Juglet, Tell el-'Ajjul, BM Inv. No. 1955,11114.1
b. White Shaved Juglet, Tell Atchana, BM Inv. no. 1977,0704.1
c. White Shaved Juglet, Enkomi Tomb 88, BM Inv. no. 1897,0401.1259

Cypriot ceramics, may have imitated the Palestinian dipper juglet in form (see Figure 6-13:a).[873] Typically Cypriot are the juglet handles, which are pushed through the vessel wall. WSh ware was introduced in either the LC IA2 or LC IB period, with Enkomi as a possible center of manufacture.[874]

The fabric of WSh wares is generally soft to medium hardness, with a sandy buff fabric (colour can vary to yellowish, pinkish, or greenish white). Inclusions of mica and grit (limestone, quartz, and black or brown particles) are common.[875] These handmade vessels are vertically

[873] Amiran 1969, 173; Gittlen 1981, 53-54. The influence of the dipper juglets may have been translated through gypsum vessels, which derive from the Palestinian dipper form, and which bare striking resemblance to the WSh juglets (Bevan 2007, 152; Bushnell 2013, 58).

[874] Bushnell 2013, 226.

[875] Åström 1972b, 221.

trimmed or "shaved" with a knife, and generally include no slip.[876] WSh vessels are almost exclusively juglets, which are oval or spindle-shaped, with a pinched mouth, short neck with handle, and pointed base. A few taller examples from Ayia Iakovos, Ayia Paraskevi, Dheklia, and Sinda are categorized as spindle bottles.

Bucchero

One of the latest LC wares to develop is the Bucchero (BUC) group. The features of this ware reflect its development from both BR—for early examples—and BS/RS traditions—for later vessels.[877] Vessels are generally handmade, however later examples also include wheel-made pots. This group became popular during the height of Cypriot traded wares in the LB IIA.[878] Wasters from Enkomi suggest that this was at least one major center of production for BUC wares.[879] Like the BRI juglets, BUC vessels may have been employed for the trade of opium, chosen for their shared resemblance to the poppy.[880] This ware is generally uncommon as a traded group in the Near East, however a large group was recovered from Tyre.[881]

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[876] Rare slipped examples do exist, which are white or buff in colour. Although typically handmade, wheel-made examples were recovered from Kourion-Bamboula (Åström 1972b, 221). One example from this site also bore an incised pot-mark on the handle.

[877] Åström argues that later vessels are in fact simply variations of the BS and RS Wheel-made traditions (1972b, 425).

[878] Bushnell 2013, 27.

[879] Åström 1972b, 425.

[880] Contents analysis has identified opium alkaloids on select BUC sherds, while others bore the presence solely of olive oil (Merrillees and Evans 1989, 149-154). Similar residue has been discovered on BRI juglets (Koschel 1995, 161). More recent investigations have suggested that the instability of certain opium alkaloids makes them frequently difficult to detect, suggesting that other compounds may be preferential for detecting the presence of opium (Chovanec et al. suggest papaverine and thebaine, 2012; Bergoffen 1991, 139).

[881] Bergoffen 1991. No examples of Bucchero ceramics were recovered from Egypt.

a. b.

Figure 6-14. Bucchero vessels (at varying scales)
a. Bucchero Jug, Enkomi Tomb 73, BM Inv. no. 1897,0401.1121
b. Bucchero Juglet, Enkomi Tomb 83, BM Inv. no. 1897,0401.1323

The fabric of this group is finely mixed and hard baked, with inclusions of mica, quartz, and small amounts of grit. The colour ranges from grey to black, brown, red, and buff, with thick black, red, or grey slightly lustrous slip (see Figure 6-14). The surface is finished through either smoothly or burnishing. Additional features mimic elements of metal vessels, and include ribbed and grooved decoration in vertical, oblique, or s-shaped arrangements. Incised decoration similar to those on BS vessels also occur, including panels of hatched patterns, triangles, chevrons, orhorizontal lines. Nearly all examples also include a ridge at the base of the neck. This ware is exclusively used for the production of jugs and juglets, which in form are derivative of metal precedents.

6.2 Distribution Patterns

Having examined the overall corpus of exported Cypriot Late Bronze Age wares, this section will explore the distributional pattern of these goods throughout the Levant and Egypt. The discussion will focus on the relationship between different functional classes of vessels (such as closed containers versus open vessels), and their contextual patterning. Geographic variation will also be addressed, including the marked decline in Base Ring (BR) closed vessels in Egypt in the transition between BRI and BRII. The relationship between Mycenaean distribution, and its suspected effect on Cypriot exports, will be introduced in the next chapters. This subchapter will also explore regionality in Cypriot ceramic production, and the observed discrepancies in ware distribution patterns (often attributed to disparate exchange networks controlled by different parts of the island).

The frequency of Cypriot wares in the Levant is significantly higher than in Egypt, with nearly five times the number of finds recorded (with approximately 2000 vessels recorded from Egypt, and roughly 9300 from the Levant). There are also marked differences in the distribution of vessels—as was seen with Mycenaean imports; Cypriot vessels in Egypt were predominantly closed shapes, despite the popularity of both open and closed shapes in the Levant.[882] Variation across ware frequency is also visible, including a pronounced paucity of MONO and WSh wares in Egypt, while both wares are frequent in the Levant. Most notably, however, the Egyptian corpus is dominated by BR ceramics, while the distribution of WS vessels is relatively low, despite a comparable popularity for these two wares in the Levant.[883]

[882] Hulin 2009, 40; Merrillees 1968, 7, 78-89; M. Bell 1982; Leonard 1994.

[883] Hulin 2009, 40.

Egypt

Evidence for the importation of Cypriot ceramics begins during the Middle Bronze Age, around the time of the 13th Dynasty in Egypt. This period corresponds to a decrease in the exploitation of mines in the Sinai, suggesting a potential connection between the appearance of Cypriot wares and the development of a trade relationship based on precious metal exchange.[884] The volume of imported vessels from Cyprus increases markedly in the Second Intermediate Period,[885] reaching its height during the New Kingdom (in particular the 18th Dynasty).[886] Throughout the Late Bronze Age, Cypriot imports were distributed along the Nile, extending into Nubian territory during the 18th Dynasty. A total of 2006 Cypriot sherds and vessels have been collected for this study, of which 69 represent finds from sites for which I have been unable to confirm Mycenaean imports,[887] and 180 vessels and sherds reported from survey work in the Sinai (and were thus not included in the network analysis).[888]

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[884] Maguire 2009, 9.

[885] Maguire 2009, 9. The Cypriot imports date to MC II-LC I, and were recovered in significant quantities (upwards of 350 vessels and sherds) from strata F-D/2 at Tell el-Dab'a and 'Ezbet Helmi (Maguire 2009, 17; see also Bietak and Forstner-Muller 2006). Merrillees also notes a correlation during the Second Intermediate Period between the circulation of Cypriot vessels and Tell Yehudiyeh juglets, for which the Hyksos controlled the distribution (Merrillees 1968, 191).

[886] Merrillees has suggested that four distinct periods of importation be differentiated in Egypt, corresponding to the following Pharaonic periods: A - Ahmose I to Thutmose II; B – Hatshepsut and Thutmose III; C – Amenhotep II and Thutmose IV; D – Amenhotep III to Horemheb (Merrillees 1968, 4).

[887] Many of these sites, such as Medinet Habu, are incorporated within settlement regions that yielded evidence for Mycenaean vessels, and were therefore incorporated within the Late Bronze Age trade system. Most of the 19 sites omitted from the network analysis yielded less than five or six vessels, with the exception of Zawyet el-Aryan and Esna. The total group of sites omitted from the later network analysis include Beni Hassan, Deir Tasa, Dendara, Dishasha, El-Maharaqqa, El-Sawama, El-Shallal, Esna, Hu, Mazghun, Medinet Habu, Moalla, Tell Farun, Koptos, Quadras, Saft el-Hinna, Emna, Zawyet el-Aryan, and Zawyet el-Mayitin.

[888] This figure includes the WP and BS/RS vessels that should be dated to the terminal Middle Bronze, however chronological correspondence between the Second Intermediate Period in Egypt and the commencement of the Late Cypriot Period encourages the inclusion of these vessels for a more complete

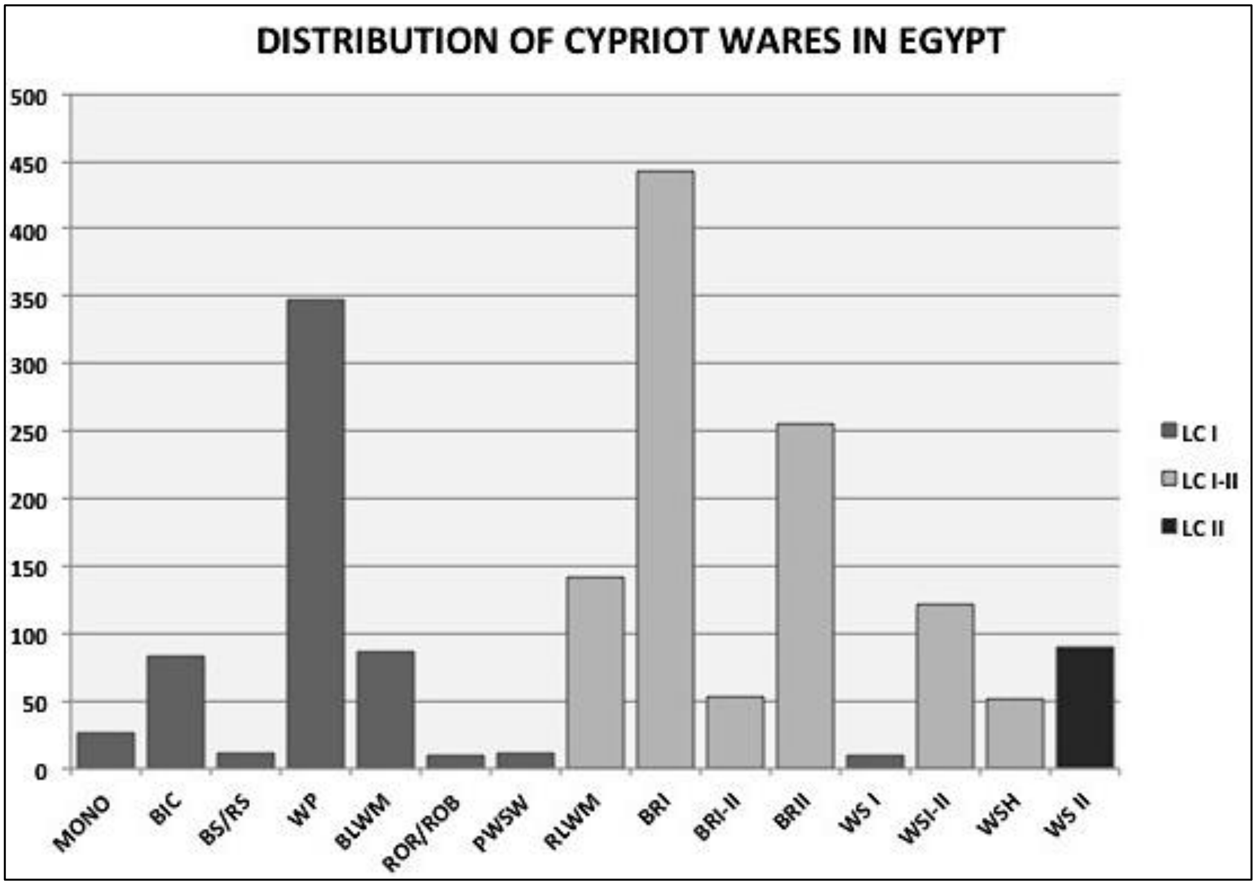

Figure 6-15. This chart shows the frequency of different Cypriot ware types in Egypt.[889]

The consumption of Cypriot pottery in Egypt has been attributed to the sub-elite, or emerging middle class.[890] This social group expanded during the New Kingdom, with greater opportunities for individual economic advancement.[891] The popularity of imported ceramics, particularly juglets and closed vessels of BR and RLWM wares, in middle-class tombs and

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diachronic assessment of extant distribution systems.

[889] The ware frequency data only incorporates vessels and sherds for which a definite ware group is assigned. Vessels and sherds are not included when ware group attribution is uncertain, or where no designation is given (i.e., 'Cypriot juglet'). This graph includes all Cypriot finds document in the database.

[890] Merrillees 1968, 195.

[891] O'Connor 1983, 192-193; Hulin 2009, 41. This is reflected in the shift in tomb biographies from exclusively proclamations of devotion to the political ruler, towards the inclusion of claims of individual successes (Lichtheim 1976, 12-15).

dwellings suggests a non-centralized system of importation rather than imperial resource control or tribute acquisition.[892] In accordance, the popularity of Cypriot vessels in Egypt has also been traced to political activities, with a correlation observed between the frequency of BR juglets in tomb contexts and military activity in the Levant, suggesting that BR vessels and their contained goods may have been brought home by victorious returning soldiers.[893] This supposition is seemingly supported by the subsequent decrease in imported wares during periods of reduced military expansion (e.g. during the reign of Amenhotep IV).

There are a variety of ware types present in Egypt during the Late Bronze Age, including the majority of ware groups distributed throughout the Mediterranean during this period.[894] Many wares are, however, represented by very limited examples, with the corpus of Cypriot ceramics in Egypt largely dominated by the WP, RLWM, BR and WS groups (which together account for around 85% of the nearly 2000 sherds and vessels documented here; see Figure 6-15).[895] Of the remaining Cypriot vessels from Egypt, the BLWM and BIC ware groups are the most common (at around 85 sherds or vessels each). Very few examples of ROB/ROR, BS/RS, MONO, and WSh have been discovered.[896] The majority of vessels were recovered from tomb contexts (roughly two-thirds).[897]

Vessels of the WP group arrive in Egypt during both the Middle and Late Cypriot periods. Although this group represents around 20% of imported Cypriot vessels, the majority of finds of

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[892] Eriksson 2007a, 54.

[893] Bergoffen 1990, 305-314.

[894] An exception is the PBR group, of which limited Levantine examples have been recorded.

[895] The quantity of WP wares may be inflated by the presence of undifferentiated Middle Bronze sherds.

[896] No recorded Bucchero examples from Egypt have been identified in this dissertation.

[897] Bergoffen places the proportion of vessels from mortuary contexts as high as 70% (Bergoffen 1990).

this ware come from Tell el-Dab'a and Qantir. Only 13 additional sites yielded WP vessels, most of which held only one or two examples. Although these sites are not numerous, they do extend through both Lower and Upper Egypt, from Bir el Abd in the Sinai, to Qantir, and Kahun in the Delta and Fayum, to Qau in Middle Egypt, and extending as far as Debeira in the South. There are also seven sites at which local juglets were found painted in imitation of WP decoration. The seven sites with these composite vessels also range geographically through Egypt, and include Abusir el-Meleq, Aniba, Esna, Gurob, Sedment, Tell el-Yehudiyeh, and Tarkhan; of these, only three sites have also yielded imported WP vessels at this time (though that does not necessarily mean that imported vessels did not reach these sites). Outside of Tell el-Dab'a and Qantir, all WP vessels recovered from Egypt were either jugs or juglets. The corpus from Tell el-Dab'a included a great variety of shapes and decoration, including jugs, juglets, bowls, a tankard, and a fish-shaped vessel, produced in a variety of WP V-VI styles (including WP CLS, WP TLS, WP FLS, WP BB, and WP ABBWLS).[898]

RLWM appears either during or just after the reign of Amenhotep I (18^{th} Dynasty/late 16^{th} c. B.C.E.), and reaches its greatest popularity during the reign of Thutmosis III (18^{th} Dynasty/mid 15^{th} c. B.C.E.); very few examples date from his successor Amenophis II on (18^{th} Dynasty/end of 15^{th} c. B.C.E.).[899] The appearance of apparent RLWM vessels in tomb paintings along with Syrian merchants led Merrillees to conclude that these vessels were imported by Levantine traders, however the subsequent identification of a Cypriot origin for this ware group should draw into question this assumption—particularly as Merrillees argues that Cypriot traders

[898] WP ABBWLS is a combination style known as 'Alternating Broad Band Wavy Line Style'.
[899] Eriksson 2007a, 54-55.

are responsible for the influx of other Cypriot ceramics.[900] RLWM vessels in Egypt are almost exclusively spindle bottles, however flasks have also been recovered from at least two tombs in Thebes and Memphis. Large collections of vessels have been found at both Abydos and Aniba, while at least seven other sites along the Nile Valley have yielded more than 5 vessels.[901] In total 35 sites from the Delta down to Nubia have yielded RLWM vessels, creating a much wider distribution than that seen with WP ceramics.[902]

The most commonly imported Cypriot ceramic group during the Late Bronze Age is BR ware, which accounts for over 43% of all Cypriot imports to Egypt. Of these BRI is the most common, both in frequency and distributional reach. From the Egyptian sites that yielded Mycenaean imports, 31 also contained BRI vessels; of these 31 sites, only 21 also held BRII imports, to which three sites with exclusively BRII may be added (Tell el-Amarna, Tell el-Rataba, and Soleb). To the 34 sites with both Mycenaean and BRI-II vessels an additional 33 sites were recorded in the database with documented BR finds (of which 18 held only BRI, 4 held BRII, and 11 held both). These sites contribute an additional 154 sherds and vessels to the over 600 specimens recovered from sites with Mycenaean vessels.

Although both vessel groups are found throughout Egypt, the distribution of BRI is less concentrated, as large groups of 30 or more vessels have been recovered from Abydos, Gurob, Qantir, Saqqara, and Sedment, while at least six other sites also yielded more than 10

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[900] Merrillees 1968, 187.

[901] These include Gurob, Kahun, Qubban, Saqqara (the New Kingdom Acropolis), Sedment, Tell el-Dab'a, and Thebes.

[902] The 35 sites with RLWM vessels include 27 sites incorporated in the network analysis, as well as Dishasha, El-Maharaqqa, El-Shallal, Esna, Hu, Moalla, Semna, and Zawyet el-Aryan in Egypt and Nubia.

examples.[903] With BRII vessels, over half of all finds were recovered from Tell el-Amarna (which produced 108 vessels). Large groups of over 10 vessels were only found at Bir el Abd, Marsa Matruh, Saqqara, and potentially Gurob. Although most BRI vessels were recovered from tombs, the large group of BRII vessels from Tell el-Amarna, in addition to the vessels from Marsa Matruh and the occasional domestic finds from other sites, result in domestic contexts for around 65% of BRII vessels. There is a fair amount of consistency in the shapes imported between BRI and BRII, of which the juglet is the most popular. To this, a number of examples of bottles, jugs, and flasks may be added, while jugs, and especially double juglets, are popular BRI shapes. A unique group of BRI and BRII bowls was also found at Bir el Abd in the northern Sinai, which may reflect the influence of Levantine demand for open dining vessels.

Of the WS vessels found at sites in Egypt, around 80% were recovered from Marsa Matruh. The vessels from this site were predominantly WSII, with at least one krater in addition to the traditional milk bowls. To this krater a WSI-II tankard from Heliopolis may be added, while the remaining vessels from all other sites were bowls. In addition to Marsa Matruh, only three sites (Gurob, Tell el-Dab'a, and Saqqara) have identifiable WSI material, of which only Tell el-Dab'a has yielded more than a single example.[904] Single WSII or transitional WSI-II finds have been recovered from Buhen, Heliopolis, and Tell el-Rataba, while Bir el Abd, Gurob, Marsa Matruh, Tell el-Dab'a, Qantir and Tell el-Amarna yielded multiple vessels.[905] Unlike

[903] These sites include Aniba, Bir el Abd, Kahun, Meydum, Qau, and potentially Tell el-Yehudiyeh. In addition to these sites, large collections of BRI-II vessels were found at survey sites A-343, A-345, and C-69 in the Northern Sinai (see Bergoffen 1990, fig. 1, 11).

[904] WSI bowls have been recovered from 'Ezbet Helmi (adjacent to Tell el-Dab'a) and nearby Qantir, which are being considered together here.

[905] To this group an additional 10 Delta survey sites have revealed WS imports. With the inclusion of sherds recovered from surveys in the Sinai, the proportion of WS material from Marsa Matruh drops to around 70% of all finds from Egypt.

other ware groups, the majority of WS vessels were recovered from domestic contexts.[906]

Although less numerous, BLWM vessels follow a similar distribution pattern to RLWM imports. The largest groups were recovered from Aniba, Gurob, Tell el-Dab'a and Qantir, while an additional 12 sites held less than five examples each. Of the more restricted ware groups, there is also a notable geographic limitation to their distribution. MONO vessels, have been recovered from sites in Lower Egypt, in both the Nile Delta and Sinai, including Bir el Abd, Marsa Matruh, and Tell el-Dab'a and Qantir.[907] These vessels, generally cups and bowls, appear in limited quantities, and do not appear to have been distributed down the Nile valley. While BIC appears in far greater quantity than MONO, vessels have only been found at Marsa Matruh, Tell el-Dab'a and Qantir.

A similarly restricted circulation is also visible with WSh juglets and ROB bowls and jugs, which have also been found at Bir el Abd, Marsa Matruh, Tell el-Dab'a, and Qantir.[908] The BS vessels are an exception to this limited distribution, of which a unique group of BSV juglets was recovered from Aniba, as well as an apparent BSII juglet from nearby Buhen, however the identification of this vessel is uncertain as only the neck survives.[909] The only other recorded BS examples come from Tell el-Dab'a or Qantir. The rare appearance of MONO, BIC, WSh, and ROB vessels in the Delta may be the result of a circulation system that travelled along the

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[906] Limited WS material has been recovered from at least one tomb at Saqqara.

[907] Additional vessels were recorded from North Sinai sites A-343, A-345, and C-69 (see Bergoffen 1990, fig. 1, 11).

[908] The majority of WSh juglets included in the database (41 of 51 examples) are not included in the network analysis as they were recovered from sites with no Mycenaean pottery. These sites are found in the North Sinai, and include A-31, A-286, A-289, and A-345; 37 of the juglets recorded were recovered from A-289 (see Bergoffen 1990, fig. 1, 11).

[909] Steindorf 1937, 171-190. The Buhen vessel is tentatively identified as BSII by Merrillees (1968, 141, pl. I.1).

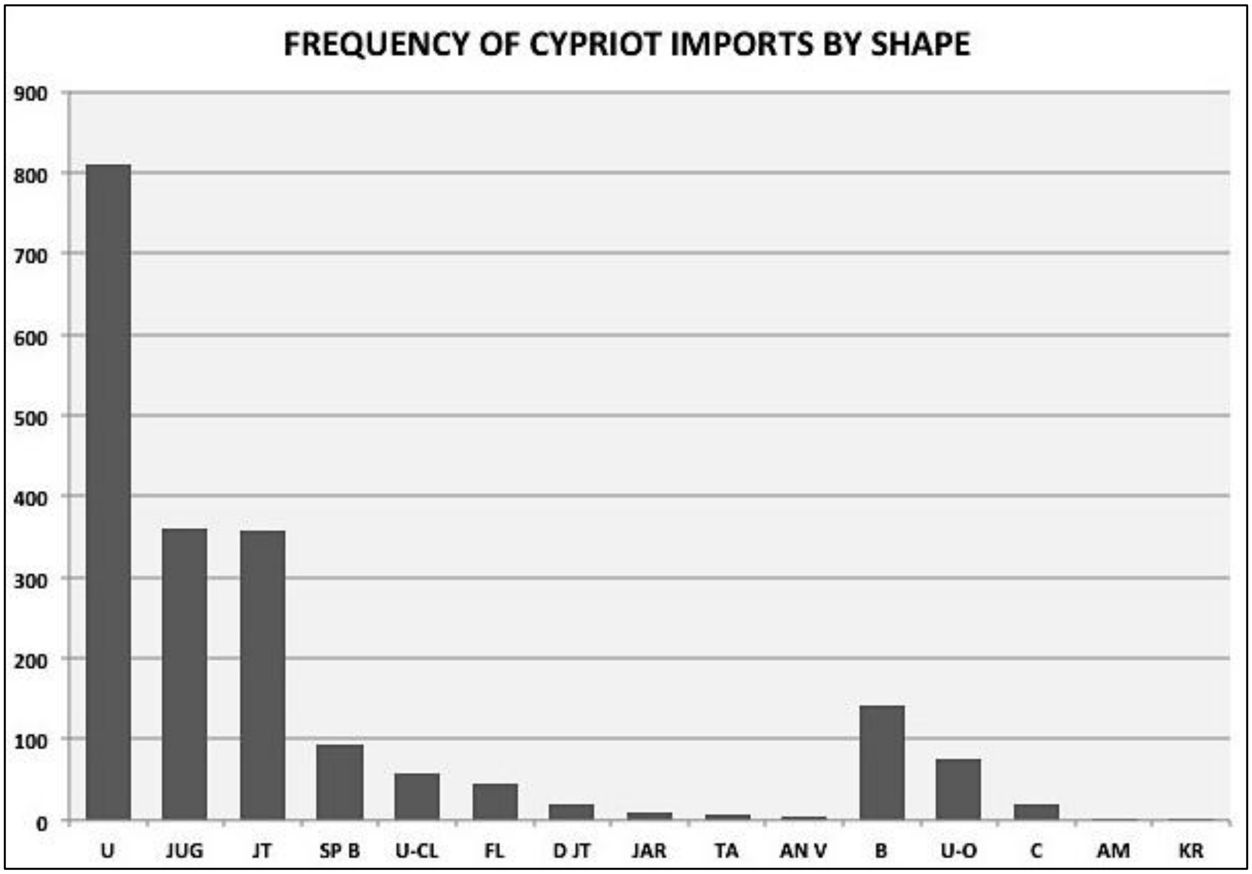

Figure 6-16. This chart shows the frequency of imports by general shape in Egypt. The shape codes are as follows: U – unknown shape, JUG – jug, JT – juglet, SP B – spindle bottle, U-CL – unknown closed shape, FL – flask, D JT – double juglet, JAR – all other jar types, TA – tankard, AN V – animal vessel, U-O – unknown open shape B – bowl, C –cups, AM – amphora, and KR –kraters.[910]

Mediterranean en route to the Southern Levant (potentially via Marsa Matruh), where these ware groups enjoyed greater popularity. Consumption of these vessels may be further attributed to Levantine demand when the role of the Hyksos is considered, as over half of these vessels were recovered from excavations around Tell el-Dab'a and Qantir.

Of the vessels of known form, over 85% are closed shapes (see Figure 6-16). The most popular groups include WP jugs, RLWM spindle bottles and flasks, and BR jugs and juglets. The

[910] For the purposes of demonstrating shape preference, the entire corpus of WP vessels are included here, including those that were most likely imported in the terminal Middle Bronze period (and which are therefore omitted from the later network analysis).

most common open shape is the bowl, generally in MONO and WS wares, with an additional small group of BR bowls from Bir el Abd. Examples of cups and kraters were almost exclusively limited to Marsa Matruh, appearing in BR, WS, and MONO wares. To this group, four partial vessels of BIC ware from Tell el-Dab'a may be added, which have been tentatively identified as kraters.[911]

Levant

The earliest Cypriot sherds attested in the Levant occur at Ugarit, and date to the Early Cypriot-Middle Cypriot Transition.[912] The importation of Cypriot wares intensifies near the end of the Middle Bronze Age, with the appearance of large quantities of WP vessels of late Middle Cypriot date. Also commonly traded to the Levant in the late Middle and early Late Bronze Age are ROR/ROB, MONO, and BIC vessels, as well as limited examples of PWS and PBR vessels (see Figure 6-17). By the Late Bronze II, Cypriot vessels are widely disseminated throughout the Levant, appearing commonly at most excavated sites throughout the region. The corpus collected for this analysis exceeds 9300 sherds and vessels.[913]

Despite its early date, WP vessels are one of the most widely traded groups of Cypriot pottery. Examples of this ware were distributed throughout the Levant, and include a variety of

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[911] Maguire 2009, nos. DAB345, DAB349, DAB351, and DAB 352, p. 163-165.

[912] Merrillees 1968, 190.

[913] This corpus of 9334 entries expands greatly on previous studies (i.e., Gittlen's 1977 study (2085 entries), Bergoffen's corpus from North Sinai and Southern Canaan (1670 entries), or Maguire's examination of MC-LC traded vessels (812 entries from Egypt and the Levant)), however it only represents a fraction of the total vessels undoubtedly traded to the Levant during the terminal Middle and Late Bronze Age (Yon 2001, 117). The total database also includes 119 vessels from 21 different sites that yielded no Mycenaean finds, and which are therefore omitted from the later network analysis.

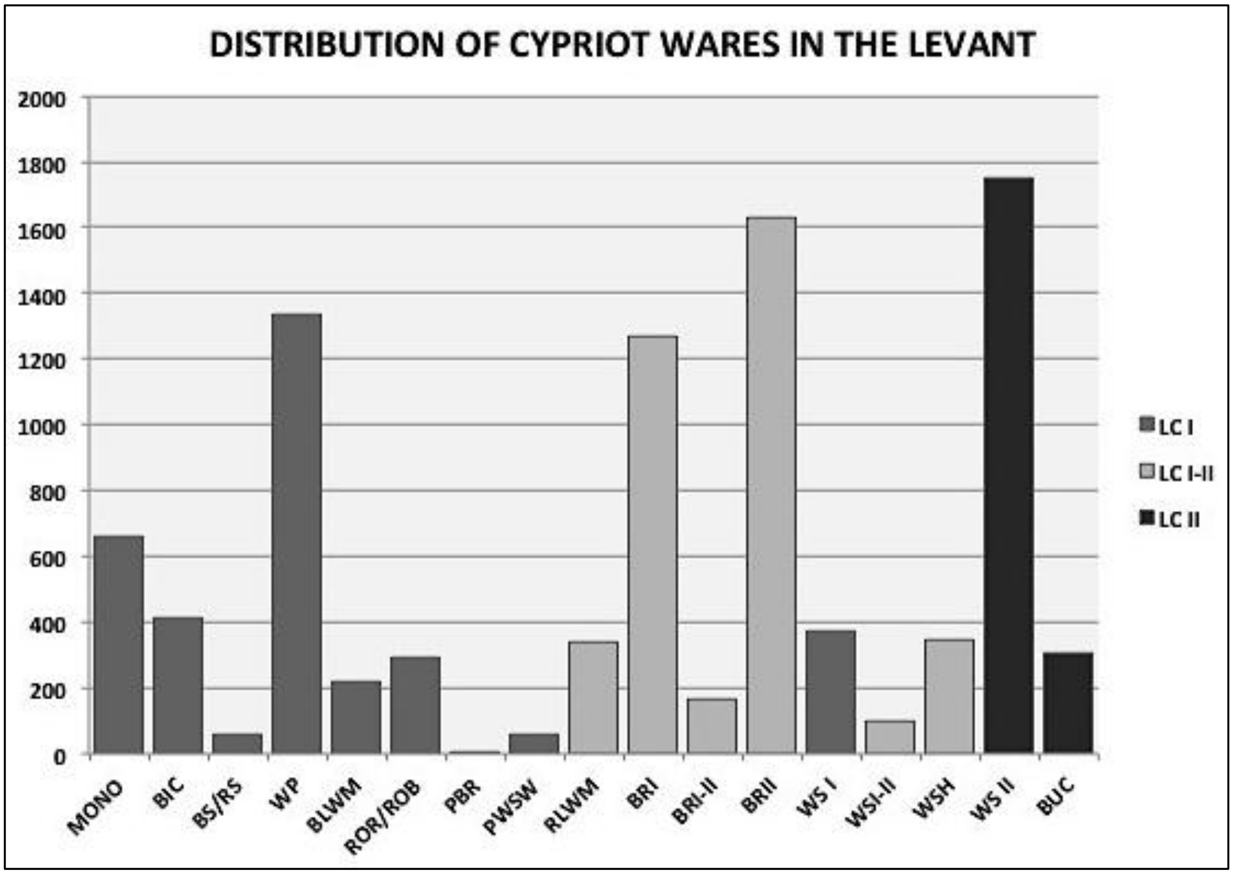

Figure 6-17. This chart shows the frequency of different ware types in the Levant.[914]

shapes and decorative traditions. Forms were primarily closed, namely jugs and juglets, teapots, as well as rare examples of flasks, animal vessels, and a rattle (for general shape popularity in the Levant across all wares, see Figure 6-18).[915] Infrequent examples of WP bowls were recovered from Ugarit, Akko, and Tell el-'Ajjul. There are a large number of sherds of indeterminable shape, however, so the seeming rarity of these vessels may prove to be misleading as more

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[914] This chart omits WP vessels of definitive MB date or those of indistinguishable ware group. Despite such efforts, the quantity of WP wares may be inflated by the presence of undifferentiated Middle Bronze Age sherds.

[915] The lone rattle was excavated at the site of Tell el-Hesi, while at least one flask has been recorded at Megiddo. Animal vessels or protomes have been recovered at Ugarit, Sarepta, Tyre, Tell el-Far'ah (South) and Tell el-'Ajjul.

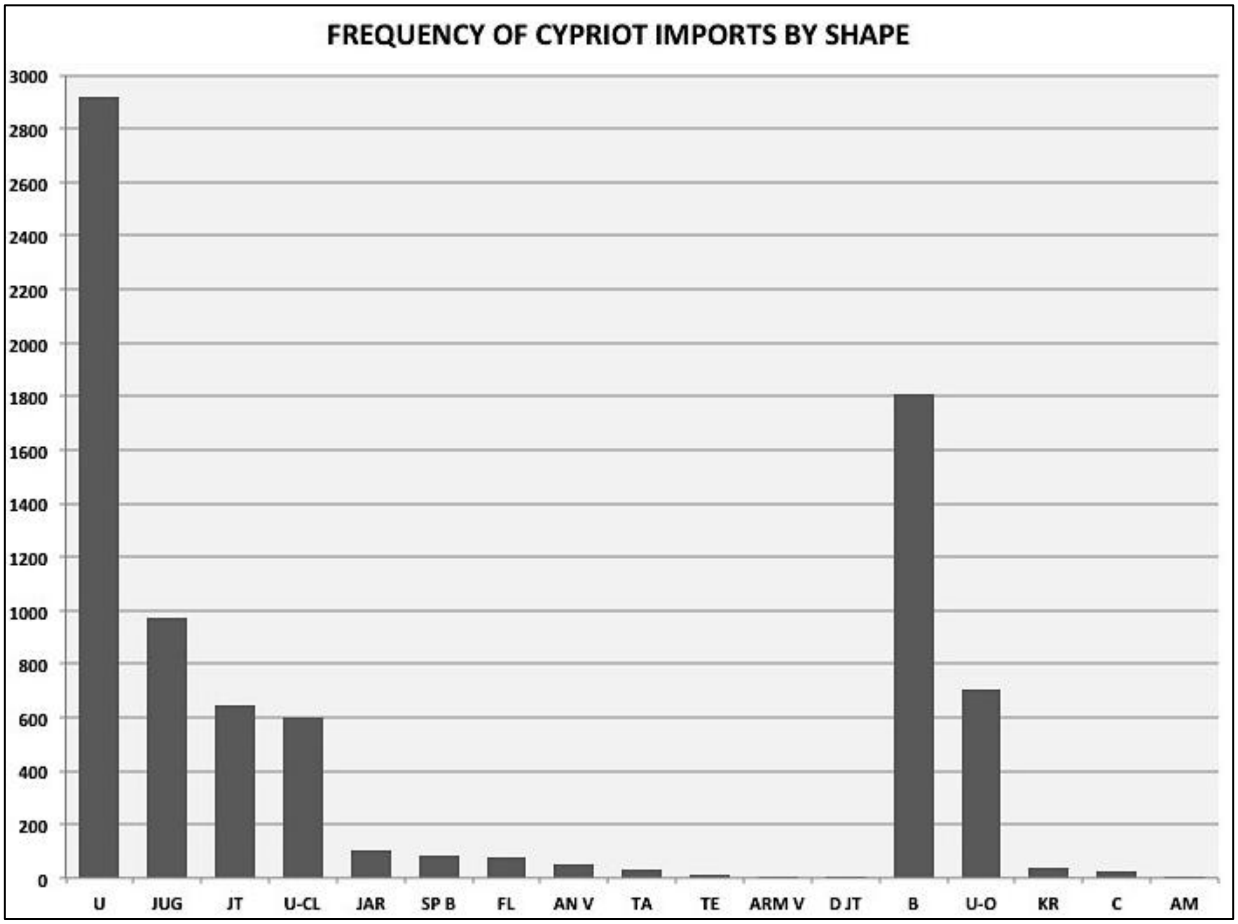

Figure 6-18. This chart shows the frequency of imports by general shape in the Levant. The shape codes are as follows: U – unknown shape, , JUG – jug, JT – juglet, U-CL – unknown closed shape, JAR – all other jar types, SP B – spindle bottle, FL – flask, AN V – animal vessel, TA – tankard, TE – teapot, D JT – double juglet, ARM V – arm-shaped vessel, B – bowl, U-O – unknown open shape, KR –kraters, C –cups, and AM – amphora.[916]

material is uncovered and published. Vessels of many different decorative styles were widely circulated throughout the region, including large collections of WPV-VI, WP PLS, WP TLS, WP CLS, and WP BB decorated wares. These styles appear concurrently at the majority of sites yielding WP wares, and do not appear to cluster, suggesting a shared distribution system.[917]

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[916] The shape frequency data only incorporates vessels and sherds for which a shape is recorded (including the designation 'unknown'). Shapes are not designated for ceramics only recorded according to ware with no shape documented.

[917] A notable exception is the rarity of the WP Zigzag Style, which appears so far only in limited

Of the other early wares to be circulated during the late Middle and early Late Bronze Age, the MONO group is the largest after WP ware, enjoying a wide distribution throughout the region. The most common shape was the bowl, while rare examples of kraters (from Tell esh Shari'a), jugs (Lachish, Tell Qasis, and Tell el-'Ajjul), and juglets (Tell el Hesi) have also been recovered.[918] The largest collections were recovered from major coastal centers, including Tyre and Tell el-'Ajjul. Although fewer in number, the distribution of BIC is similar to that of MONO vessels. Large groups of vessels were also discovered at a number of sites, particularly coastal and inland distribution centers,[919] from Alalakh in the north to Tell el-'Ajjul in the south (from which over 120 sherds and vessels of this group were recovered). Shapes include both open and closed forms such as bowls, kraters (from Hazor and Alalakh), a cup (from Hazor),[920] jars, and jugs.[921] An unusual form not attested on Cyprus is the pot stand, however an interesting example comes from Alalakh Level V (to which a fragmentary example from Tell el-'Ajjul may be compared).[922] The Alalakh stand was decorated with a male caprid, a motif which corresponds to Mitannian rather than Cypriot ceramic decoration.[923] Attributed to local producers, it is not yet definitively clear where this vessel was manufactured, however the amalgam of a Syrian vessel form executed in a Cypriot ware with Mitannian decorative motif is a testament to the active

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quantities at Tell el-'Ajjul (Bergoffen 1990, nos. 281 and 282, p. 390).

918 An unusual collection of unslipped MONO bowls was discovered at Alalakh, which were erroneously classified by Woolley as undecorated WS vessels (Woolley 1955, 360; Bergoffen 2003, 39-40).

919 Artzy 2001, 167.

920 This vessel is tentatively classified as a goblet, dating to the LB II period (Hesse 2008, no. A 236/5, 233; see also Ben-Tor et al. 1997, fig. II.32, 15).

921 A number of sherds of this ware are recorded as 'unknown form'.

922 Epstein 1966, 43-44, fig. 3; Bergoffen 2003, 38.

923 Epstein 1966, 150-152.

flow of goods and cultural influence during this period.

The distribution of ROR/ROB vessels is similar to that of MONO and BIC. Geographically, vessels have been recovered from sites throughout the Levant, including Alalakh, Ugarit, and Tell Sukas in the North, to Tyre and Sarepta in the central region, to Tell el-‘Ajjul, Gezer, and Ashkelon in the South. The primary shape is also the bowl, with rare examples of cups (at Ugarit), and jugs (at Jericho and Tell Arqa) also recovered. Far less widely circulated is the RS/BS ware group. Vessels were recovered from a limited number of sites, generally in small quantities—the exception being a large group of over 30 pots from Tell el-‘Ajjul. The most popular shape is the jug or juglet, while at least one bottle has also been recovered (from ‘Ajjul). Bowls have also been documented at Sarepta and Tell Kabri, while a few further bowls of indeterminable type from Megiddo and Tell Nami have been tentatively catalogued as either WP/RS or WP/BS.

Of the Lustrous Wares, RLWM is the most common, both in quantity and distribution. Although less numerous than MONO or WP, BLWM and RLWM vessels nevertheless were similarly distributed from the northern to southern extents of the Levant. While most sherds were recovered from large coastal sites, vessels reached as far inland as Pella and Amman (recovered in the Amman Airport excavations). Vessels of BLWM ware are restricted to juglets, while a variety of shapes occur in RLWM fabrics, including flasks, arm-shaped vessels, and spindle bottles (which are the most frequent).[924] RLWM vessels were also imitated and manufactured on the Levantine coast, potentially at a workshop in the vicinity of Beirut,[925] with examples

[924] One of the arm-shaped RLWM from Alalakh is notable for its size (84.5 cm), making it the largest recorded example of this vessel type in the Mediterranean (Bergoffen 2003, 47).

[925] Yannai et al. 2003, 101-107.

recovered from Alalakh, Jaffa, Gezer, and Lachish.[926] The presence of a number of potter's marks on RLWM vessels, primarily spindle bottles, supports the assignment of a Cypriot origin, as marks from pots recovered in Alalakh, Ugarit, Minet el-Beida, and Tell el-'Ajjul correspond to marks found on vessels at a number of Cypriot sites (including Enkomi and Ayia Irini).[927] The largest RLWM groups were recovered from Ugarit and Alalakh in the Northern Levant, while the largest collections of BLWM were discovered at Ashkelon and Tell el-'Ajjul. Of the sites that yielded examples of both wares, it is interesting to note that RLWM is proportionately more common in the North (as seen at Ugarit, Alalakh, and Tell Tweini), while BLWM is more common in the South (attested at Tell el-'Ajjul, Ashkelon, Lachish and Megiddo).

The largest import groups are the BR and WS wares, which represent 33% and 25% respectively of all Cypriot ceramics imported into the Levant. Both of these wares first appear in the LC IA1 period (or roughly MB IIC-LB I in the Near East), and are found in limited quantities.[928] PBR is extremely rare in the Levant, with only single vessels, all jugs, recorded at Megiddo, Tell el-'Ajjul, Shechem, and Tell Abu al-Kharaz. Only slightly more common are PWS vessels, all bowls, which appear at Ugarit, Tell Dan, Megiddo, Hazor, Lachish, Ashkelon, Hanita, Tell er Ridan, and Tell el-'Ajjul. Aside from the PWS at Tell el-'Ajjul, which exceeds 20 sherds and vessels, all of these early proto-wares appear alone or in pairs. With the exception of the single PWS bowl at Ugarit, these vessels also notably cluster around the southern Levant. The bowls from Tell el-'Ajjul also reflect early trade relations with different regional production

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[926] Hein 2007, 82.

[927] Eriksson 1993, 145-147; Bergoffen 2003, 48.

[928] The original assertion that BR vessels did not appear in the Levant before LB I (Oren 2001, 127) has since been challenged by Bergoffen and Merrillees, who cite early examples from Tell el-'Ajjul (Bergoffen 2001a, 48; Merrillees 2001a).

centers on Cyprus, as both the Lattice Rope style (liked to the northwest of the island) and the Ladder Framed Lozenge style (linked to the south coast) are represented at the site.[929]

Vessels of WSI remain quite rare relative to the quantity of WSII imported. In addition to bowls, which form the vase majority of WS vessels, rare examples of the WSI-II bottle, and WSII tankards and kraters have been recovered.[930] In terms of geographic reach, WS wares appear at the greatest number of Levantine sites, a number of which have yielded extremely large collections (the highest quantity was recovered from Tell el-‘Ajjul). A number of decorative styles are popular in the Levant, generally appearing in groups with a variety of different styles present. Of note, the motif of the framed lozenge bordered by ladders is common at Tell-el-‘Ajjul, despite the relative scarcity of this decorative style on Cyprus and within the Levant, while the popular Wavy Line Style is proportionately quite rare at the site.[931] Imported WS vessels have been recovered from a variety of contexts, including mortuary, ritual, and domestic excavations. In a number of wealthy tombs (including those at Ugarit and Sidon), high quality WSI and early WSII bowls are frequently deposited with other imported or luxury goods, attesting to their value.[932] The elite association of early WS vessels is supported by the discovery of the majority of PWS and WSI bowls in the palace at Tell el-‘Ajjul.[933] During the later 13th and 12th c. B.C.E., as the quantity of imported milk bowls soars, vessels are more frequently

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[929] Eriksson 2001b, 61.

[930] The WSI-II bottle recovered from Alalakh is a unique find outside of Cyprus (Bergoffen 2003, 51). WSII tankards have been found at Alalakh, Tel Abu al-Kharaz, and Gezer. WSII kraters have been recovered from Alalakh, Hama, Qatna, Tell esh Shari’a, Tell Abu Hawam, Hazor, Shechem, Tell Mevorakh, Ain Shems, Ashdod, Gezer, and Tell el-‘Ajjul.

[931] Bergoffen 2001b, 154.

[932] Yon 2001, 122.

[933] Oren 2001, 140.

uncovered in domestic contexts, suggesting that they are increasingly circulated among broader socio-economic groups.[934]

The most common Cypriot imports to the Levant are the BR wares. Both BRI and BRII were widely circulated, with BRII exceeded BRI in both quantity and distributive reach.[935] Although the jug, juglet, and bowl are the most popular shapes, a variety of forms reached the eastern Mediterranean, including dining vessels (such as kraters and tankards), closed shapes (such as flasks, bottles, and animal vessels), and a rare example of a double juglet.[936] Vessel assemblages inclusive of all shape types generally cluster around larger centers, including Alalakh, Ugarit, Lachish, Megiddo, and Tell el-'Ajjul. Less common vessel types are also limited to distribution centers, such as the group of kraters (all BRI) which appear at Alalakh, Lachish, and Tell el-'Ajjul. This restricted distribution is also extended to rare vessel subtypes, such as the Type IBb BRI bowl, which occurs only at Alalakh and Megiddo.[937] While the bowl, jug, and juglet remain popular throughout both BRI and BRII, chronological variations occur with other shapes. The krater and tankard are predominantly circulated during the BRI, while the flask is generally a BRII shape. The majority of BR vessels, particularly the closed shapes, were recovered from mortuary contexts (around 70%).[938]

Also ubiquitous during the later Late Bronze Age in the Levant are WSh juglets. These vessels are widely distributed throughout the region, with the largest concentrations found at

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[934] Yon 2001, 122.

[935] One notable exception to the general increase in quantity from BRI to BRII is Alalakh, which yielded nearly three times as many BRI vessels (despite a concurrent increase in WSI to WSII vessels).

[936] Despite the popularity of the BR double juglet in Egypt, Gittlen recorded only a single example from Jerusalem (Gittlen 1977, no. XII.A.a.1, 193).

[937] Yon 2001, 40.

[938] Gittlen 1977, 77; Bergoffen 1990.

Ugarit and Tell el-‘Ajjul. This ware was commonly found in both funerary and cultic contexts (such as Necropolis K and the Temple of the Obelisks at Byblos)[939]. Imitation WSh juglets were also manufactured in the Levant, including at least one juglet at Tell ‘Arqa.[940] Bucchero vessels , however, are not particularly common, and only appear at around a dozen sites. Most vessels of this group were discovered at Tyre, and include mainly jugs and plates. Limited examples have been recovered from other major sites, including Alalakh, Minet el-Beida, Megiddo, Lachish, and Tell el-‘Ajjul. To date no BUC examples have been recovered from Egypt.

Tell el-‘Ajjul in southern Palestine may have functioned as an important center of importation—possibly of copper—early in the Middle and Late Cypriot periods, as the site yielded some of the earliest PWS and PBR vessels.[941] The corpus of Cypriot vessels from this site is also the largest included in this database, and comprises all ware groups imported into the Levant. Although the majority of vessels from the site were WS and BR wares (roughly 58%), the Cypriot collection from ‘Ajjul is most notable for the large groups of ROR/ROB and MONO vessels, of which the site accounts for 58% and 40% respectively of all vessels from these groups in the Levant.[942] Additional rare imports include BR kraters,[943] and large group of PWS bowls. As early excavations recovered the majority of the site’s Cypriot vessels from tombs, the continued excavations in domestic areas have highlighted that RWLM and BLWM vessels in particular appear to have been almost exclusively associated with mortuary contexts, as the new

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[939] Salles 1980, 25; Dunand 1973, pl. CXLI:13436.

[940] Charaf 2008, 145.

[941] Stewart 1974, 120; Eriksson 2001b, 61; Bushnell 2013, 221.

[942] In total the group from Tell el-‘Ajjul comprises roundly 21% of the total group of Cypriot ceramics imported to the Levant (as included in this dissertation database).

[943] Bergoffen 2007, 30. These vessels were rare outside of Cyprus, and concentrate at Alalakh and Tell el-‘Ajjul.

excavations continue to yield very low quantities of these wares.[944] Tell el-‘Ajjul may also have played an important role in the distribution of Cypriot ceramics throughout the surrounding regions, and may have further formed an important trade connection with Egypt. The relationship between this site and the Egyptian delta is evidenced by the presence of imported and locally produced Egyptian stone vessels and scarabs.[945]

Both Ugarit in the Northern Levant and Tyre on the central coast appear to share similarly important roles in the circulation of Cypriot vessels. Each of these sites yielded very large collections of Cypriot finds, encompassing nearly all traded types. Tyre is particularly notable for the large collection of Bucchero vessels, which are absent from Ugarit (likely due to the site’s destruction prior to the wide circulation of this ware). Ugarit and its surrounding region—including the sites of Ras Ibn Hani and Ras el-Bassit—are also notable for a collection of WSII, BRII, and ROR/ROB cups. These vessels appear in some quantity, and are so far entirely absent from other sites in the Eastern Mediterranean, save for examples from Marsa Matruh.[946] This is particularly interesting when considering the route taken by such vessels, as examples are entirely lacking between the southwestern and northeastern edges of this region.

Discussion:

The earliest large scale trade in Cypriot wares begins in the late Middle Bronze period with the distribution of WP and ROR/ROB vessels. The largest collections of early Cypriot

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[944] Fischer 2007, 77. Lustrous wares have represented less than 2% of Cypriot imported material from new excavations (ibid.).

[945] Ben-Tor 2007, 190-193; Bevan 2007, 105-106.

[946] One example of a BIC cup has been recovered from Hazor (Hesse 2008, no. A 236/5, 233).

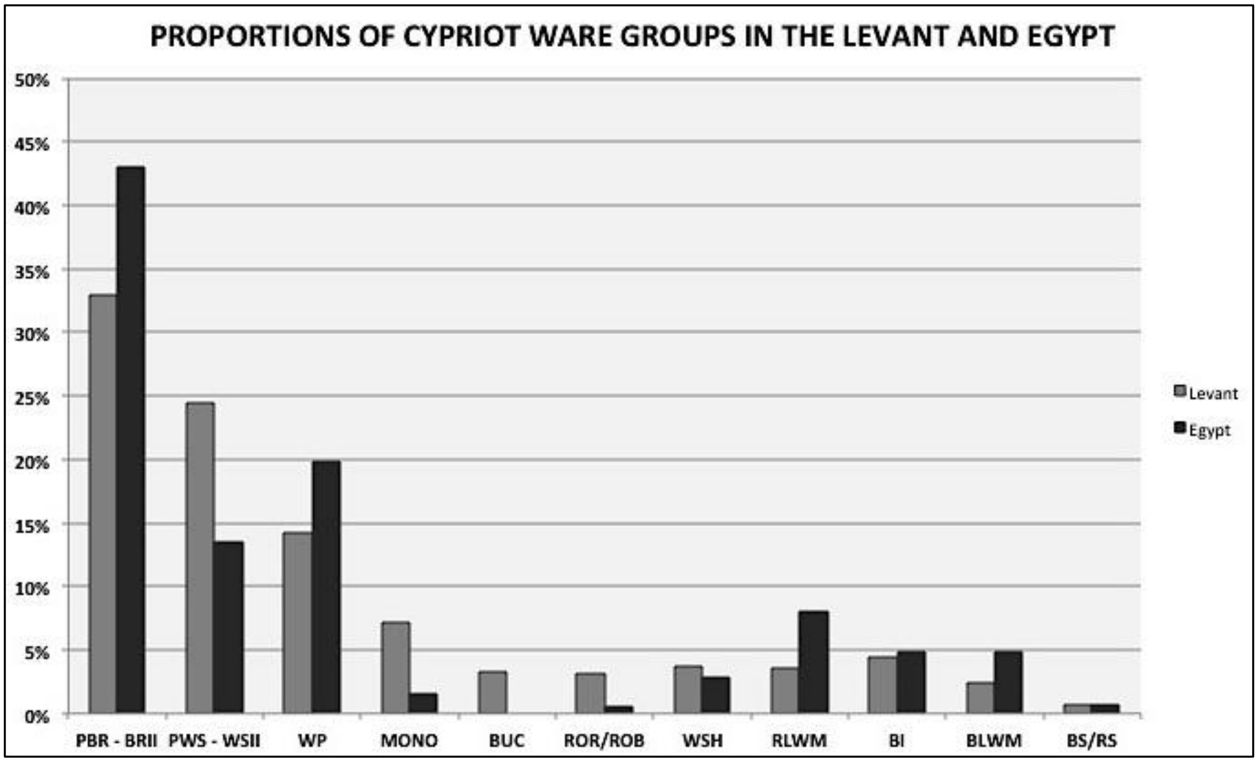

Figure 6-19. The relative proportions of different ware groups imported to the Levant and Egypt.

imports come from Tell el'Ajjul, Akko, Alalakh, Ugarit, and Tyre in the Levant, and Tell el-Dab'a in Egypt (which has the largest corpus with over 500 sherds).[947] These wares continue into the Late Bronze, at which point additional groups appear. Of the early LB I wares, MONO shows the largest discrepancy in distribution, as the popularity of this group in the Levant is stark against the paucity of this group in Egypt (see Figure 6-19). The restriction of these vessels to the Northern Sinai, Marsa Matruh, and Qantir suggest that the consumption of this group in Egypt may be an auxilliary effect of Levantine demand.

Conversely, though there are slightly more recovered lustrous vessels in the Levant, the proportional distributions of both RLWM and BLWM vessels among all Cypriot ceramics are greater in Egypt, appearing at more sites and in greater assemblage proportions. Lustrous vessels

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[947] Maguire 2009; Bergoffen 2002.

in Egypt account for 13% of Cypriot imports, whereas they comprise only 6% of the Cypriot ceramics in the Levant. As a curious comparison, the distribution pattern of RLWM vessels relative to other imported Mycenaean and Cypriot vessels in Anatolia differs from both Cyprus and Egypt. As Ekin Kozal notes, Mycenaean and RLWM wares have disparate distribution patterns in Anatolia as the former cluster on the Western coast while RLWM vessels are generally found in central and northern regions.[948] This includes a group of arm-shaped vessels discovered at Boğazköy, suggesting a potentially cultic function and specialized demand.[949] The popularity of these vessels is distinguishable from the Levant and Egypt, where spindle bottles and flasks are more popular.[950] Variation is also present in the distributions of RLWM and other Cypriot wares, as only the former type appears to have reached central Anatolia in significant quantities, while multiple ware groups are present in the southern Amuq Valley.[951] As RLWM vessels disappear from Egypt and decline sharply in the Levant during the LC IIB, importation remains strong in Anatolia.[952]

The distribution of later Cypriot wares shows more marked variation between the Levant and Egypt, particularly in the LB II period. The frequency of BRI juglets in Egypt is demonstrative of the high demand for these wares and their contents, yet there is a pronounced decrease in BRII quantities. This contrast with the frequency of BRI and BRII wares in the Levant, where quantities increase approximately 30% between BRI and BRII. Similarly, despite

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948 Kozal 2007, 142.

949 Artzy 2007, 14.

950 Eriksson 2007a, 52. A cultic function for arm-shaped RLWM vessels has been tentatively proposed for the 2-4 vessels from Alalakh, which were found exclusively in House 37, which was a monumental structure with purportedly cultic associations (Bergoffen 2003, 47).

951 Both BR and WS wares are present at Alalakh as early as Level V (Kozal 2007, 145).

952 Eriksson 2007a, 52.

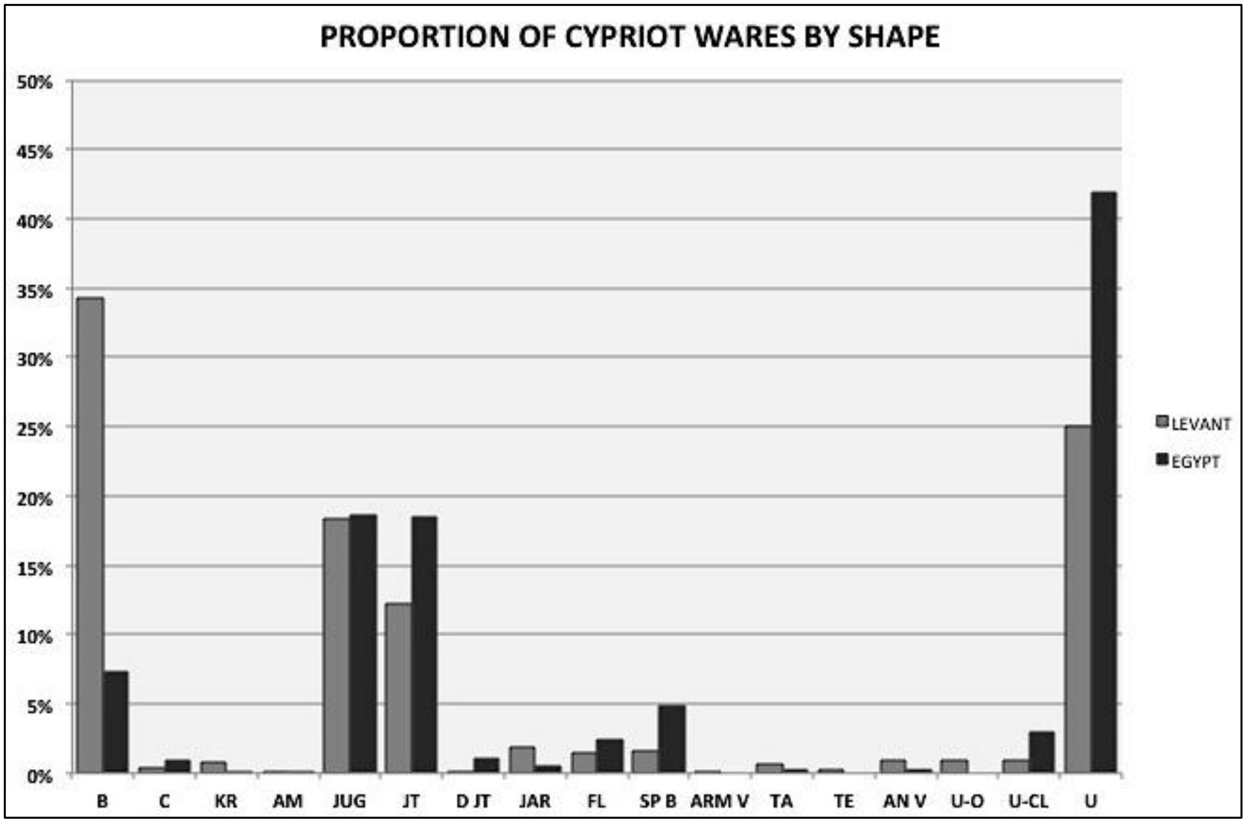

Figure 6-20. The proportion of different vessel shapes in the Levant and Egypt. The shape codes are as follows: U – unknown shape, JUG – jug, JT – juglet, U-CL – unknown closed shape, SP B – spindle bottle, FL – flask, JAR – all other jar types, AN V – animal vessel, TA – tankard, D JT – double juglet, TE – teapot, ARM V – arm-shaped vessel, B – bowl, U-O – unknown open shape, KR –kraters, C –cups, and AM – amphora.

the introduction of BUC ware during LB II, for which there are over 300 sherds and vessels in the Levant, it is as of yet unaccounted for in Egypt. The absence of this ware, and the pronounced infrequency of WSh juglets in Egypt, further attest to a reduction in Cypriot vessel circulation in Egypt during the LB II period. The continued popularity of Mycenaean imports throughout this period suggests that trade continued to be active, and that shifting demand or changes in the supply chain may be responsible for the decrease in imported Cypriot material.

As noted above, the greatest distinction between the distribution of Cypriot imports in Egypt and the Levant is the relative rarity of WS vessels in Egypt. There is a corresponding relative rarity of open shapes in Egypt, as dining vessels (including bowls, cups, and kraters) account for around 14% of all vessels, versus nearly 49% of all shapes in the Levant (see Figure 6-20). The lack of demand for open vessels extends beyond WS vessls to other ware groups; while BRI and BRII bowls are frequent in the Levant, they are extremely rare in Egypt, occuring only at sites in the Delta or North Sinai (specifically Tell el-Dab'a, Bir el Abd, and Sinai survey sites A-249 and A-345).[953] A preference for closed vessels is also observable with early Cypriot imports, as closed WP forms were imported in large quantities, while ROB/ROR bowls were highly rare (despite the popularity of both groups at Tell el-'Ajjul).[954] These variations may reflect differing consumption patterns or demand, as juglets appear most frequently in Egypt and are primarily recovered from mortuary contexts,[955] while open vessels—of which the WS milk bowl is the most common—are deposited predominantly in Levantine domestic contexts.[956] This would suggest fundamentally disparate demand and consumption patterns between the two regions.[957]

The relationship between the distribution systems supplying Cypriot wares to Egypt and the Levant is still under debate. While Merrillees first attributed an intermediary role to Syria—and specifically Ugarit—based on the quantity and range of the Ugaritic corpus, the large collections of Cypriot vessels discovered since this assertion at Tel el-'Ajjul and Marsa Matruh draw into question the central role of Ugarit as a direct intermediary in supplying Cypriot vessels

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[953] Bergoffen 1990, fig. 1, 11.

[954] Bergoffen 1991, 69; Oren 2001, 140.

[955] Closed vessels account for approximately 88% of known vessel forms, while mortuary contexts have yielded roughly 87% of the closed vessels from known findspots.

[956] Approximately 75% of open vessels of known findspot within the Levant were recovered from domestic contexts.

[957] Bergoffen 1990, 9.

to Egypt.[958] In order to address questions of supply systems, including the potential role of Cyprus in the circulation of Aegean vessels, the distribution of both Cypriot and Mycenaean vessels will be examined.

[958] Merrillees 1968, 187.

SECTION IV – NETWORK ANALYSIS

7. MYCENAEAN CERAMIC NETWORKS

The construction of a ceramic distribution network will examine the distribution of Mycenaean and Cypriot ceramics separately before examining the relative circulation systems of both ceramic groups. The distribution of imports will be assessed with respect to both chronological and morphological groups. In the case of Mycenaean ceramics, this will incorporate network analysis with respect to different FS shapes. The different regions under consideration here will also be presented separately first, before exploring the correspondence between areas. This analysis will seek to determine the central importance of the Late Bronze Age ceramic trade, with respect to both geographic and material features.

The distribution of Mycenaean ceramics will be discussed for all three regions considered above—Cyprus, the Levant, and Egypt. Material has been categorized chronologically (with LH classifications) and morphologically (in accordance to the Furumark Shape system and functional use groups). For the FS taxonomy, additional—and more general—groups have been included where sherd identification was limited to the general class (i.e., 'stirrup jar of unknown type'). Although this system is in part inherently chronological (as the assignment of sequential shape numbers was undertaken with consideration for typological development), a separate LH network was necessary to accommodate the significant proportion of recovered material that is recorded in overly general terms—much of which is, however, ascribed a rough chronological period with respect to the fabric and decoration. Therefore different classifications systems—and thus multiple ceramic networks—have been constructed for each region under examination.

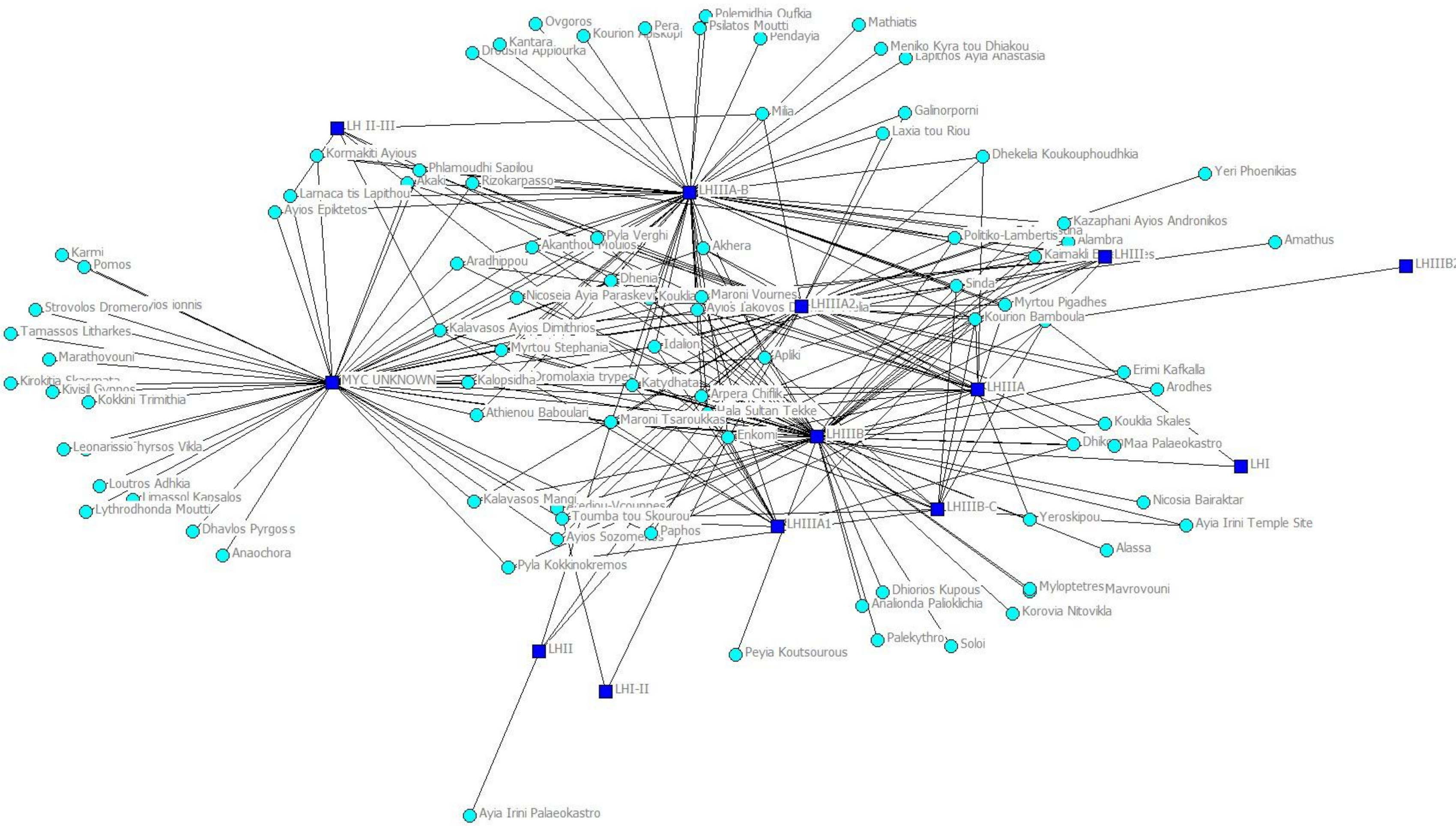

Figure 7-1. Two-mode network of Mycenaean imports in Cyprus by chronological period.

7.1 Cyprus

Chronological Network

The distribution of Late Helladic imports in Cyprus is presented in Figure 7-1.[959] This graph depicts a two-mode network, with sites and ceramic groups denoted by two different node types (aqua dots and blue squares respectively). Nodes are arranged within the space through the spring-embedded graphing tool, which employs similarity and dissimilarity to determine node placement.[960] Proximal nodes therefore have short geodesic distances between them.[961] The spring-embedded configuration effectively conveys node similarity, while maintaining visual clarity through the minimization of line crossing and the avoidance of node overlapping.[962] It is important to note that the configuration is therefore not reflective of accurately scaled coordinates, as visual simplicity supersedes metric scaling in this approach.

In order to graph node similarity, the data underwent correspondence analysis, which calculates spatial coordinates for each node;[963] these coordinates reflect three primary properties: sites are placed near other sites that share pottery groups; sites are placed near pottery groups that

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[959] All network analysis was conducted using Ucinet 6 (Borgatti, Everett, and Freeman 2002) and all visualizations were produced by NetDraw (Borgatti 2002) unless otherwise stated.

[960] This method is known as distance scaling, in which edges act as springs, drawing similar nodes together while repelling dissimilar vertices (Borgatti 2008; the most well known algorithms for distance scaling were developed by Kamada and Kawai 1989, and Fruchterman and Reingold 1991). This approach derives from the desire to situate objects in a conceptual space, in which like objects are drawn together while dissimilar objects are pushed apart (Orton 1980, 45; Brughmans 2014, 37).

[961] The geodesic distance is the shortest pathway through a network joining two nodes together (Borgatti and Everett 2006, 3). Nodes that are closely connected (share connections to the same nodes of the second mode) are shown close together.

[962] Borgatti 2008, section 6.1.

[963] Borgatti and Everett 1997, 246.

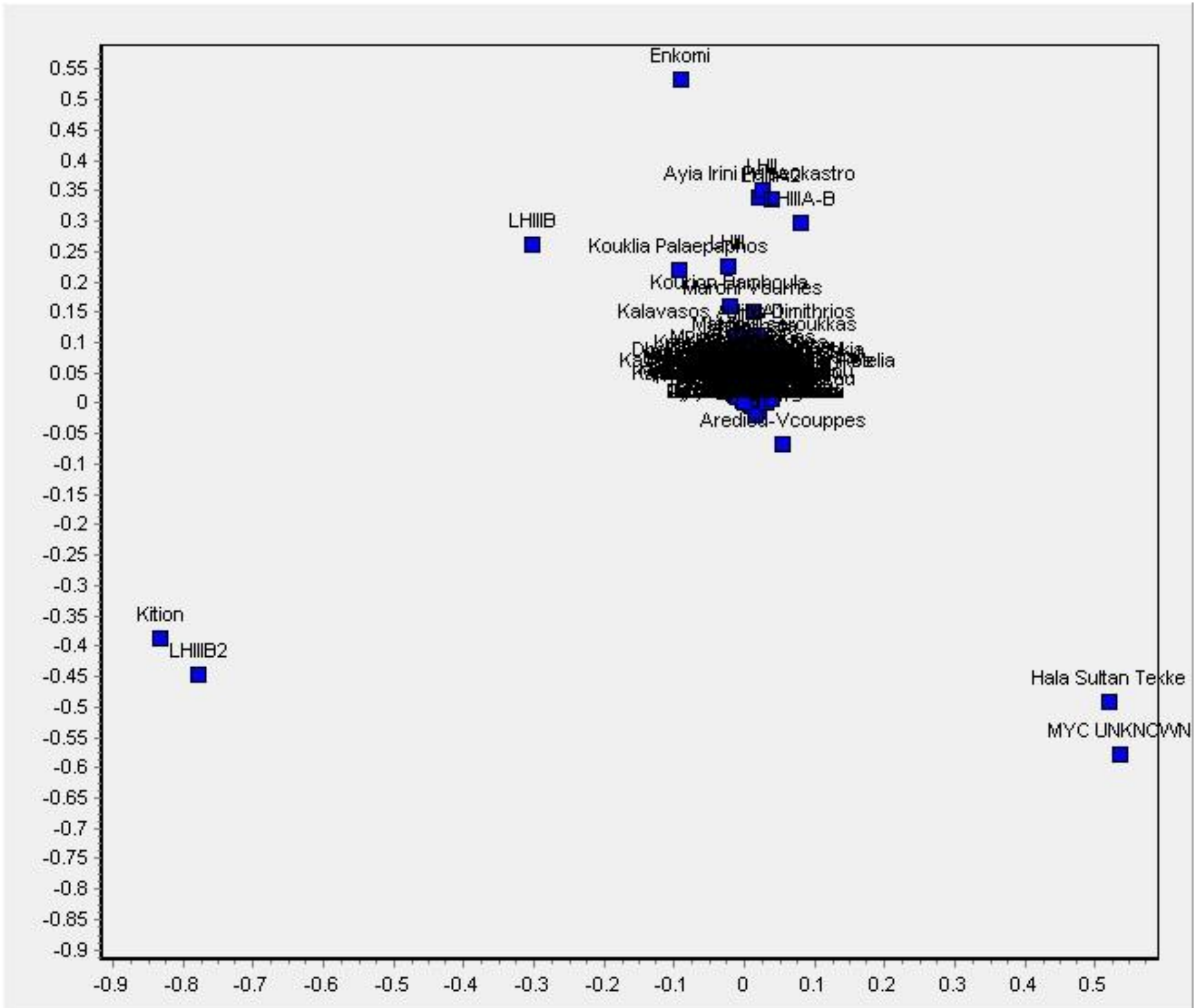

Figure 7-2. Scatterplot of correspondence scaling scores of the two-mode network of Mycenaean imports in Cyprus by chronological period.[964]

they contain; pottery groups are placed near other groups that appear at the same sites. The graph produced through this method more accurately reflects spatial arrangement with respect to node similarity, emphasizing outlying nodes that exhibit irregular attributes—in this case, sites with unusual assemblages or ware groups with unusual distribution patterns. The coordinates generated through correspondence scaling can then be displayed in a scatterplot. The scatterplot

[964] The scatterplot axes represent relational space between the graph nodes, however it is important to note that distances between nodes are not Euclidean (Borgatti and Everett 1997, 247).

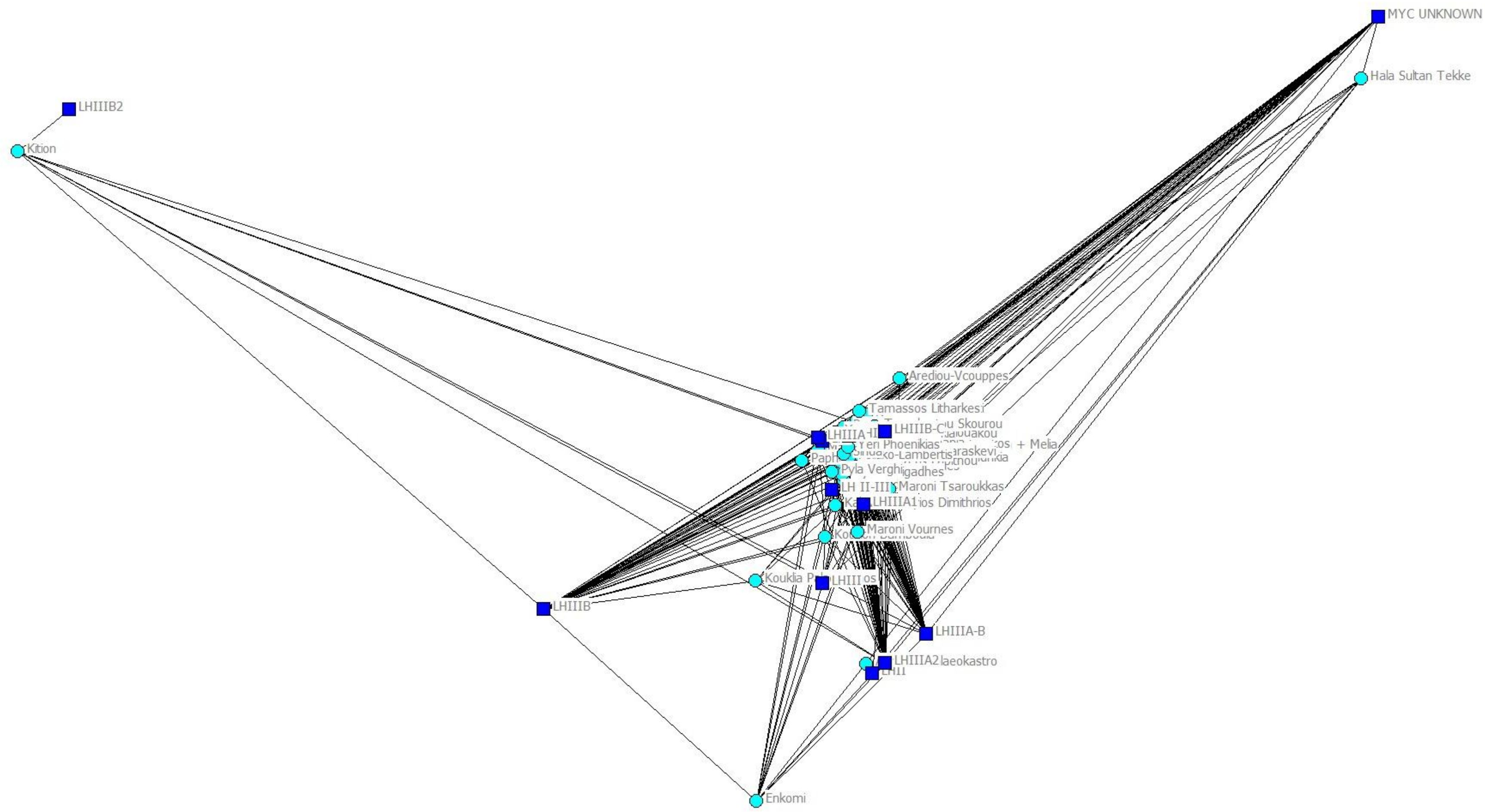

Figure 7-3. Two-mode network of Mycenaean imports in Cyprus by chronological period, with nodes located according to coordinates derived from correspondence analysis.

renders the relational space of the network into two dimensions (although the software accommodates the rendering of additional dimensions if desired). As outliers are emphasized, nodes with higher levels of correspondence are drawn together, causing significant nodal overlap, and often obscuring less pronounced attribute dissimilarities. The algorithm employed for correspondence scaling includes the option to allow for the eigenvector scaling of coordinates, however an alternative scaling method that employs geodesic distances was instead employed during analysis.

The placement of many of the sites and ware groups in the scatterplot of correspondence coordinates for the network of LH ware groups in Cyprus is difficult to ascertain due to the overlapping of nodes (Figure 7-2).[965] Certain nodes placed along the periphery of the central cluster are discernable, and reflect sites with assemblages that vary slightly from the general group. This may include the predominance of an outlying ware group, as seen here with the placement of Arediou-Vouppes along the lower edge of the main cluster, as this node is being drawn towards the 'unknown' chronological group; the attraction towards this ware node is due to the predominance of the ware group in the assemblage of the site (16 of 18 sherds are of undetermined date). Since this graph represents valued data, the Hala Sultan Tekke node—which also includes material of predominantly unknown date—is situated far closer to the ware group, as it contains nearly 2000 sherds and vessels of this type.

Correspondence scaling for this dataset, when visualized in a two-mode graph (Figure 7-3), emphasizes the unusually large quantities of LH IIIB2 vessels at Kition, as well as the high volume of "unknown" sherds from Hala Sultan Tekke. The large number of sherds and vessels of

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[965] A similar issue arose using the Gower Metric Scaling method in NetDraw, as the size of this network and the overlapping of nodes made the network difficult to examine.

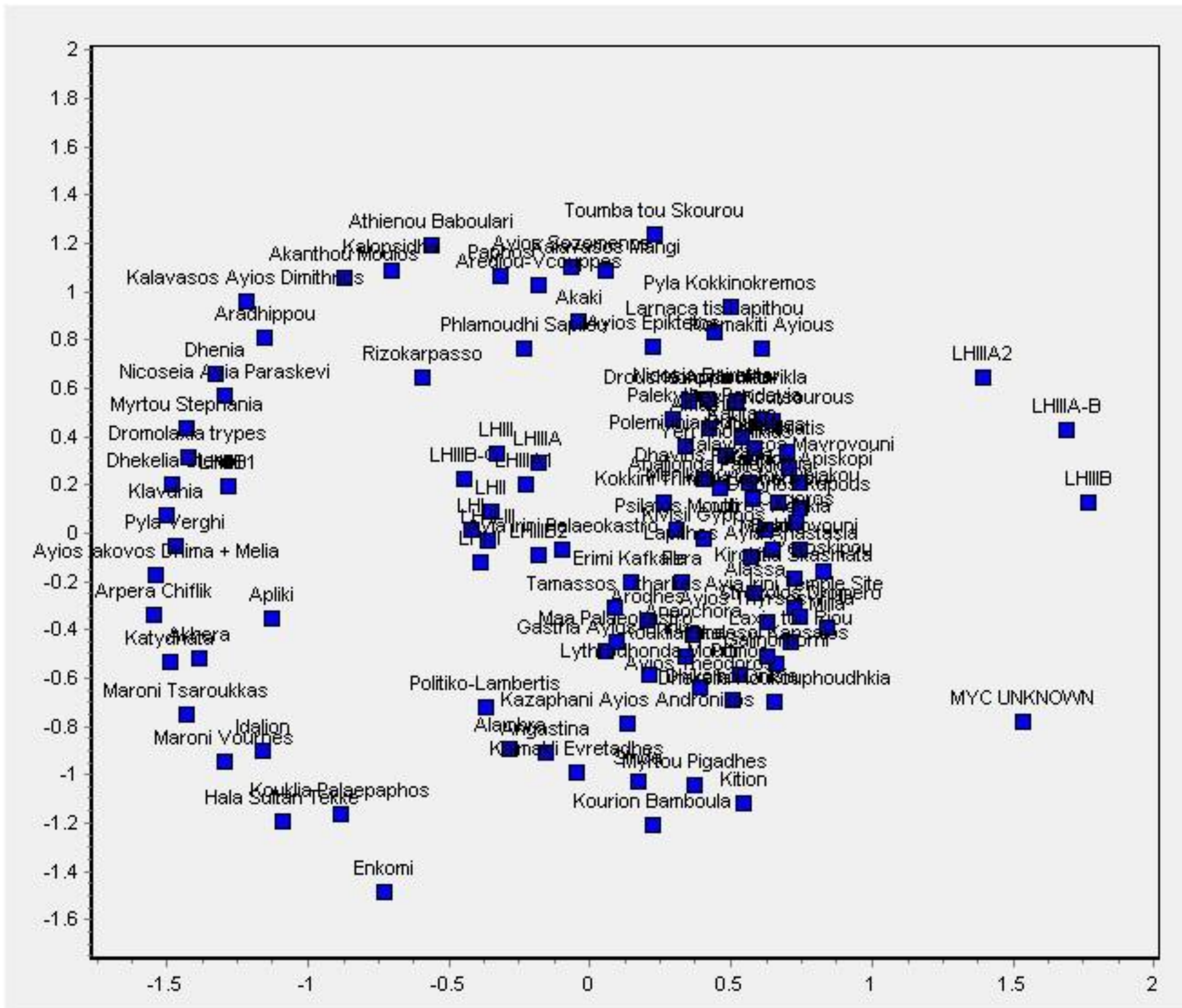

Figure 7-4. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Mycenaean imports in Cyprus by chronological period.

unknown date from the latter site comprise numerous sherds mentioned in recent preliminary reports, for which full classification data is awaiting further publication. Both the scatterplot and the graph also differentiate the Enkomi assemblage, which is dissimilar to the material recovered from other sites in both its size and breadth of ware groups.

An alternative method used is non-metric multidimensional scaling of geodesic distances, which calculates coordinates for each of the nodes based on the analysis of a network's

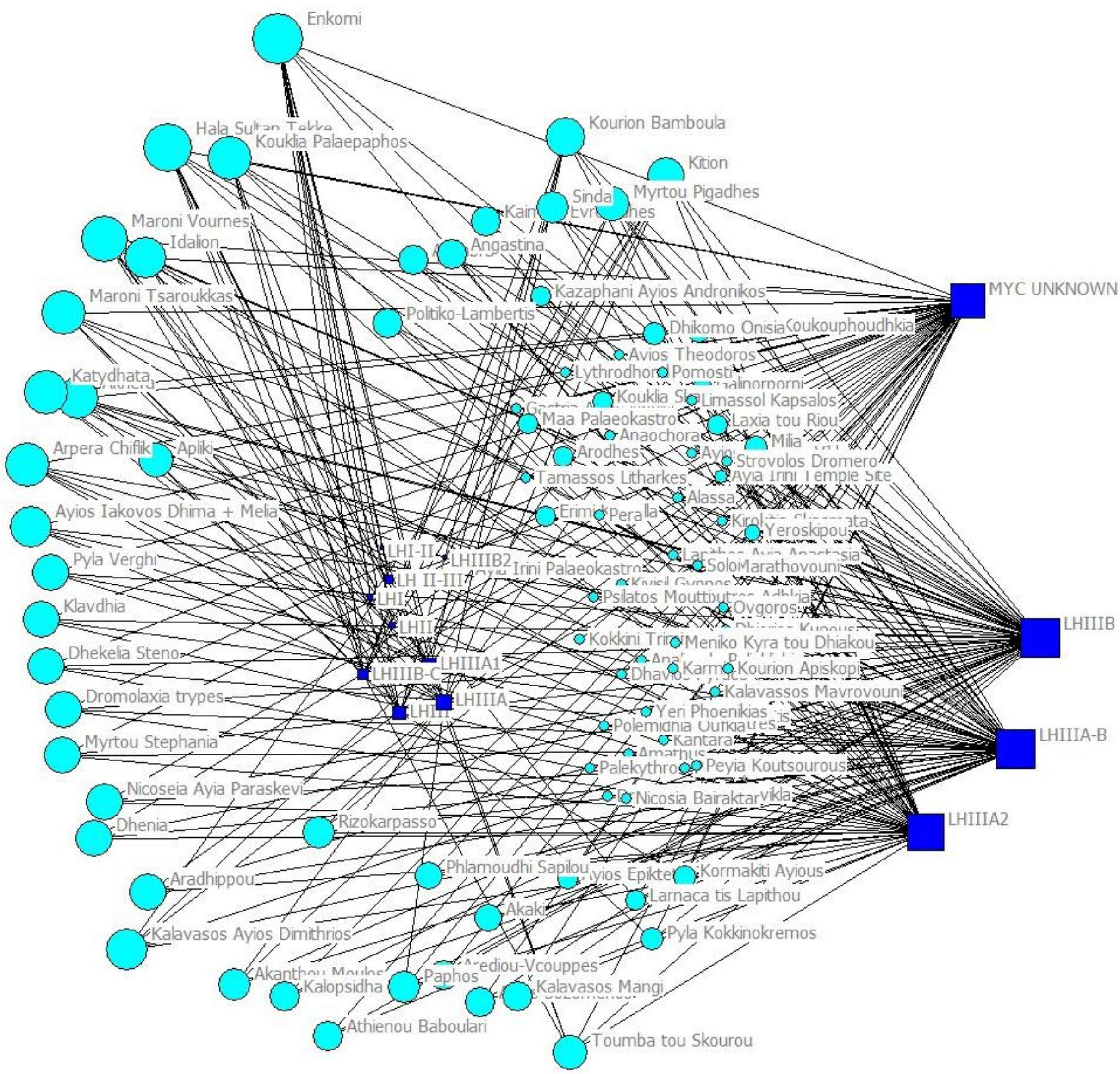

Figure 7-5. Two-mode network of Mycenaean imports in Cyprus by chronological period, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures.

configuration and structure.[966] The first step in this process is to construct a bimodal matrix from the two-mode network. A bimodal matrix is a symmetrical adjacency matrix that incorporates both nodes types in the matrix columns and rows (both sites and ware groups are included on

[966] Borgatti 1997, http://www.analytictech.com/networks/mds.htm; Wasserman and Faust, 1994.

both axes).[967] Geodesic distances, or the steps needed along the network to reach each node pairs, are calculated, and then submitted to non-metric multidimensional scaling (according to similarity).[968] The resulting scatterplot (Figure 7-4) and graph (Figure 7-5) more clearly reflect distinct blocks of both sites and ware groups, the latter of which shows logical chronological grouping, particularly for LH IIIA2, LH IIIA-B, and LH IIIB wares. The first group of sites (the aqua dots) immediately to the left of these three ware groups includes sites that primarily yielded ceramics of these three types, as well as vessels of unknown period. The top, bottom, and left-most groups of sites include vessels of the remaining chronological period groups in addition to these most popular ware types. These nodes are sized in accordance with eigenvector centrality, which incorporates both the degree of the node themselves (or the number of ware types present at these sites) as well as the degree of the nodes to which they are connected.[969]

When reconsidering the initial graph two-mode network graph (Figure 7-6; here enhanced through the sizing of nodes relative to eigenvector centrality measures), the relationship between ware groups and sites is in some ways more clear. This configuration (created with the spring-embedded function) highlights the large number of sites (roughly 40%) that contain only one ware type—these sites appear as pendant nodes, connected by a single edge to a single ware group. A large number of these pendant sites (16) are only included in the network through their association with vessels of 'unknown LH' type. This group also demonstrates the potentially misleading nature of the spring-embedded configuration—relative

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[967] Borgatti 2008, 9. With sites and chronological ware groups in both the table columns and rows, the adjacency data is contained in two of the four matrix quadrants.

[968] Following the approach of Borgatti and Everett (Borgatti and Everett 1997, 249; Borgatti 2008; Everett and Borgatti 2012).

[969] Bonacich 1972; Borgatti and Everett 1997, 257.

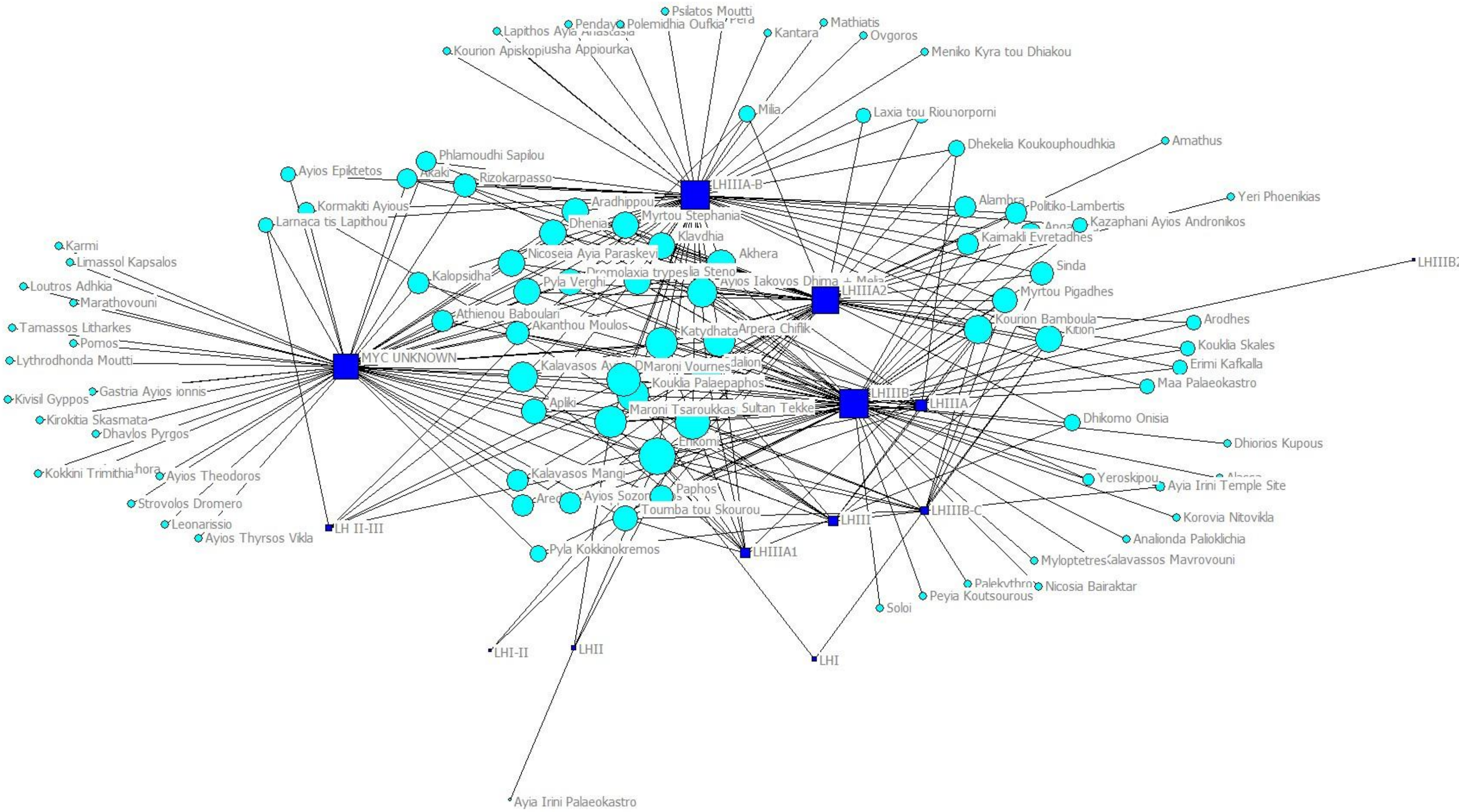

Figure 7-6. Two-mode network of Mycenaean imports in Cyprus by chronological period. Node symbols are sized according to eigenvector centrality measures.

to the other scaled approaches—as the desire for node and label visibility supersedes accuracy in node placement and path length. For instance, although the lowest three nodes (Ayios Thursos Vikla, Leonarissio, and Strovolos Dromero) appear staggered with different tie lengths, they share equivalent connection strength of one vessel with the 'unknown LH' ware group. The visual arrangement of the most connected nodes towards the middle of the graph effectively communicates the centrality of these vertices within the network, however certain features (such as the uniquely large collection of LH IIIB2 vessels at Kition) are much less clear. This graph of Late Helladic vessels shows no visible regional clustering, as vessels of all periods penetrated all regions of the island.

A common approach for the presentation of two-mode data is to convert the matrix to a one-mode affiliation matrix, in which nodes of one type are linked together by their shared association with nodes of the second type—in this case sites are linked together through their shared presence of a ware type. The data graphed here represent binary relationships rather than valued ones. The edges connecting sites therefore reflect the number of different chronological ware groups present at each site, irrespective of the number of examples present from each period. This means that the connection between Enkomi and Toumba tou Skourou is given a weighting of 6 (6 shared ware groups), as is the edge between Enkomi and Kalavasos-Ayios Dhimitrios, despite the greater quantity and range of vessels—and the greater similarity in overall corpus—present in the assemblages from Kalavasos-Ayios Dhimitrios and Enkomi. The use of binary relationships to reflect the presence or absence—rather than the intensity—of a connection between sites can be particularly useful when examining archaeological material, as there is significant variation in the extent of excavation and publication across the sites under consideration. Additional discrepancy in recording practices, particularly in the case of pottery

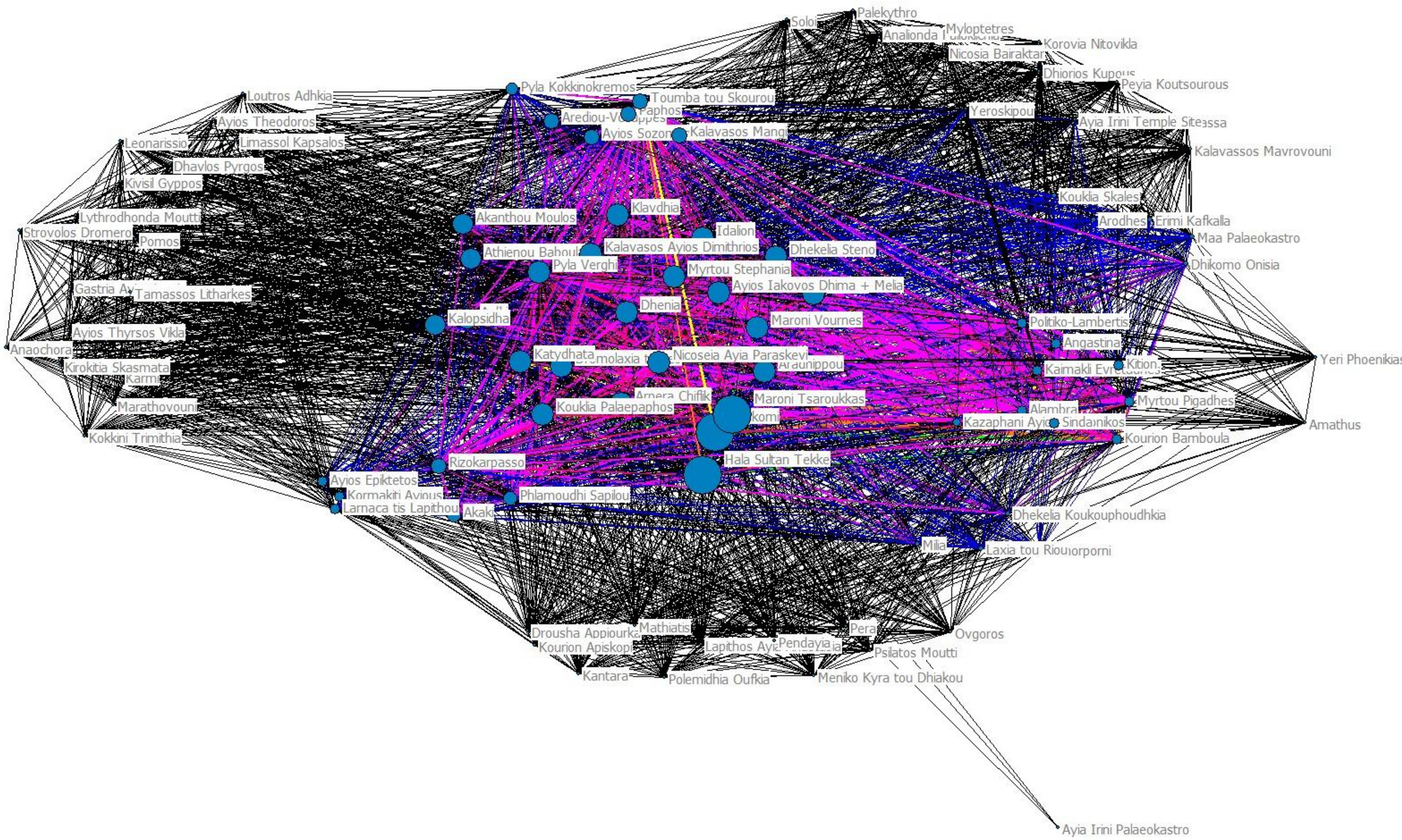

Figure 7-7. One-mode network of Mycenaean imports from Cyprus. The site relationships reflect the presence of shared ware types, which are characterized by chronological period. This graph demonstrates the connections between site assemblages presented in graph Figure 7-1. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie strength is scaled between 1 and 2. Nodes are sized according to betweenness centrality measures.

sherds, can artificially inflate the volume of material from different sites (whether finds are reported as 'sherds', weighed material, minimum vessels, or individual sherds before restoration work).

In the one-mode graph (Figure 7-7), sites are again arranged through the spring-embedded algorithm, while ties are colour coded to reflect the number of shared ware types.[970] Node sizes are scaled by eigenvector centrality, which accounts for the network centrality of a given site, as well as the centrality of the other sites with which the node shares edges (for centrality values see Appendix Table 5). The eigenvector centrality measure therefore incorporates the network importance of a given site as well as its connections, which bears interesting results. As mentioned above, despite the equivalent degrees of Kalavasos-Ayios Dhimitrios and Toumba tou Skourou, the differences between the assemblages of the latter two sites yield different eigenvector centrality measures (as visible by the node size and placement). Furthermore, although Kition has a degree of 8, it has a lower eigenvector centrality value than both Kalavasos-Ayios Dhimitrios and Toumba tou Skourou, which have degrees of 6. This is due to the unusual composition of the Kition assemblage, which includes a large component of vessels that date to the later LH IIIB2 and LH IIIB-C periods. The small eigenvector measure for Kition is, however, an apposite example of the need to exercise caution in employing such measures without critically interpreting the data, as the Kition eigenvector value is significantly impacted by the lack of designated "unknown LH" sherds recorded from the site. This group is present at many of the sites included here—particularly those excavated early on or only published in preliminary reports—creating numerous potentially misleading connections

[970] The colour key for node ties is as follows: 1-Black; 2-Blue; 3-Magenta; 4-Pink; 5-Orange; 6-Yellow; 7-Green; 8-Aqua; 9-Red.

between sites with vessels attributed to this general group. In this case the thorough stratigraphic publication of the Kition material has affected its network centrality when analyzing this data set according to the taxonomy selected here (despite the fact that sherds of unknown chronological date have almost certainly been recovered at the site). This example clearly demonstrates the impact of data organization and analytical tool selection on the results obtained with this analysis.

As is clear from this graph, the sites situated within the center of the network contain the largest ranges of chronological ware groups, and includes many of the large coastal sites with large assemblages (such as Enkomi, Kition, Maroni, and Hala Sultan Tekke). Conversely, the nodes along the perimeter (and connected with exclusively black edges) contain vessels from only a single ware group. A number of blocks are again visible, including the group of nodes on the left side, which represent those sites from which limited quantities of vessels of 'unknown LH' type were found. The block of sites on the top right of the graph includes those sites from which only LH IIIB vessels were recovered, while the cluster towards the bottom include sites with transitional LH IIIA-B vessels. Ayia Irini Palaeokastro is spatially differentiated due to the unusual corpus of vessels from the site, which date predominantly to the LH II period.

FS Shape Network

When assessing the distribution of different FS shape groups, the two-mode network highlights the unique assemblage from Enkomi (see Figure 7-8). A number of shapes (those surrounding and especially to the left of the site on the diagram) are attested either solely at this center, or at an extremely limited number of other sites. Enkomi is visually isolated from the other site nodes within the graph by a number of FS shape nodes, again highlighting the unusual range of vessels present at this site. A number of other rare shapes, found at only a few sites,

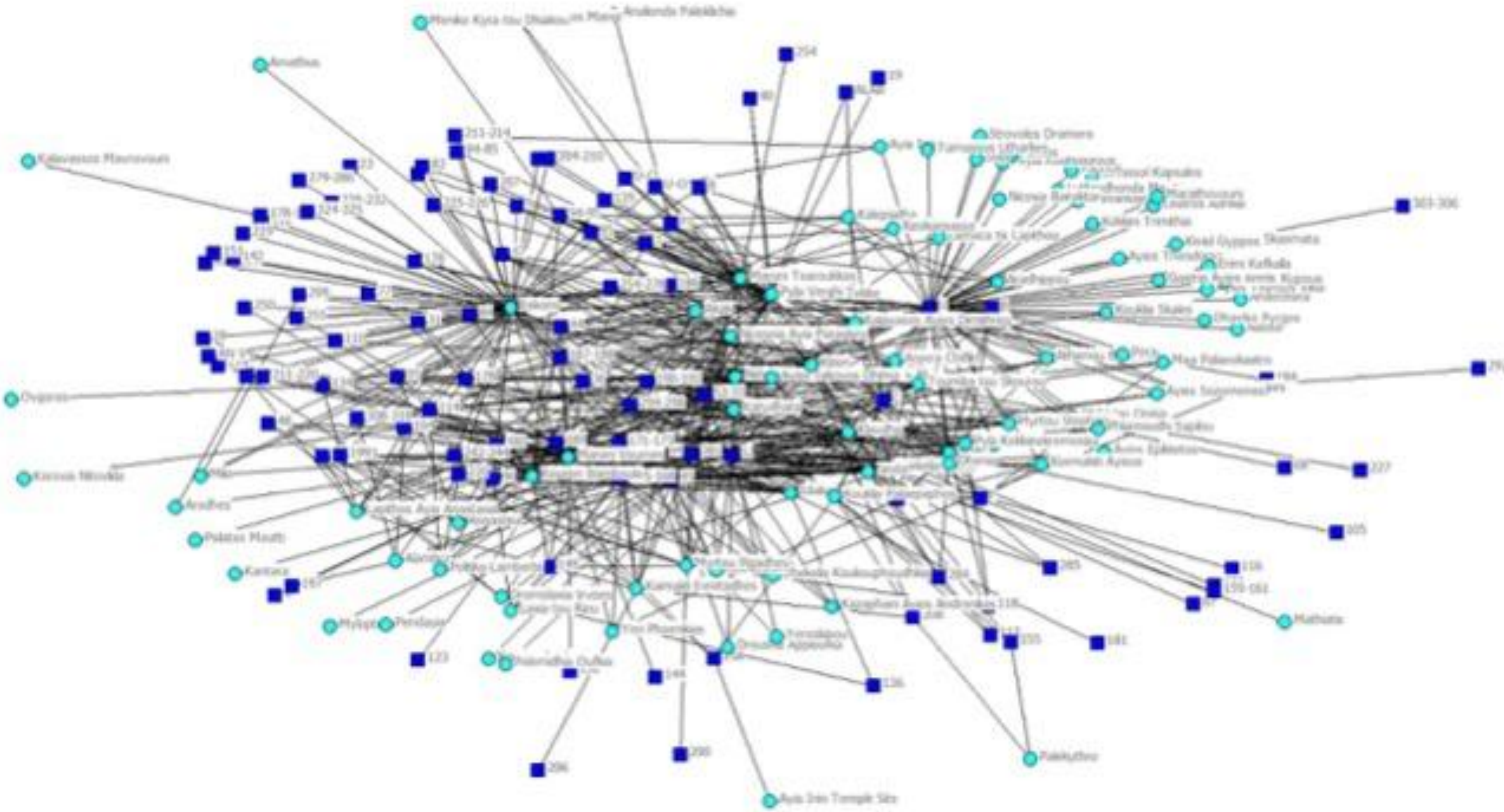

Figure 7-8. Two-mode network of Mycenaean imports in Cyprus by FS Shape.

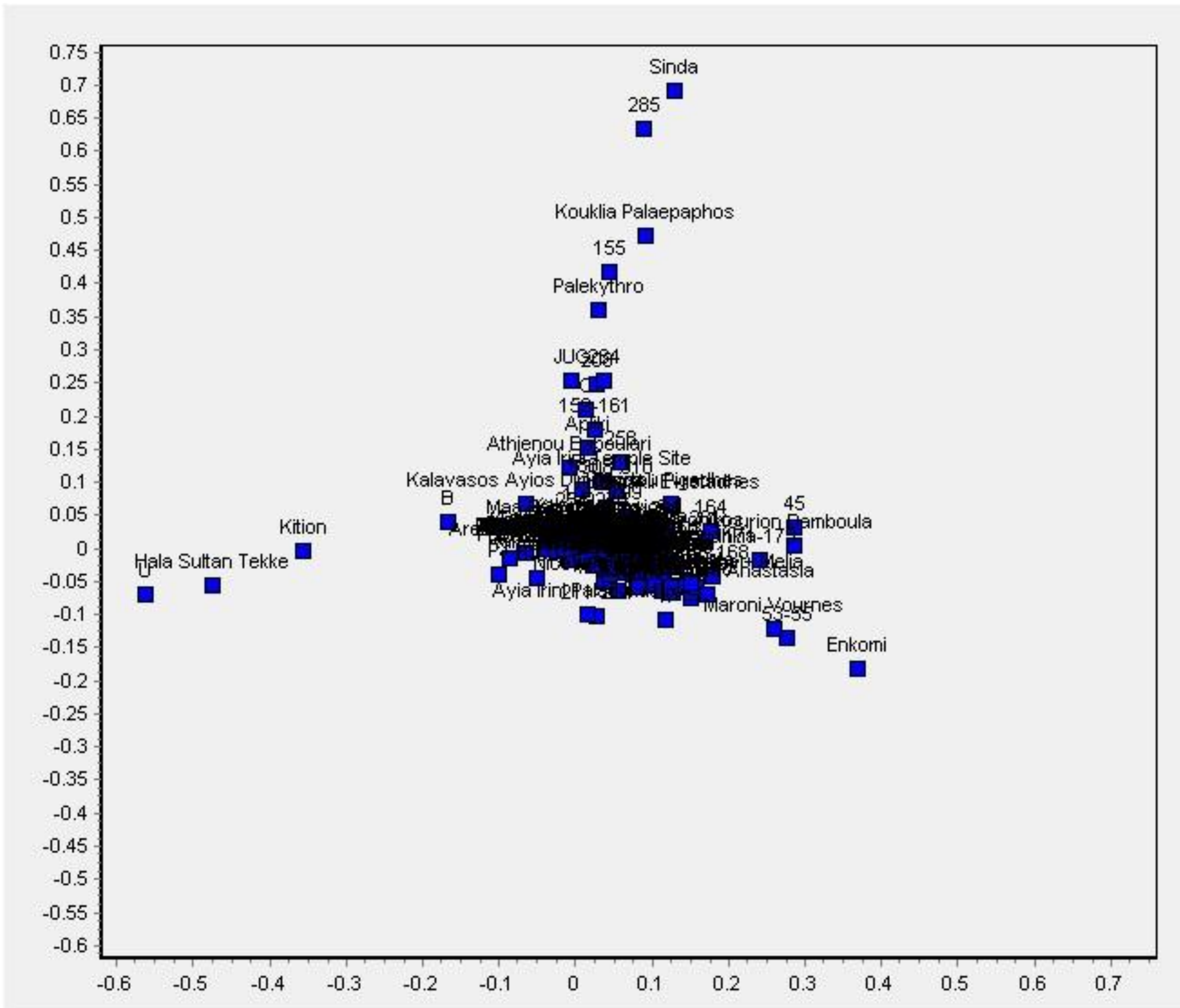

Figure 7-9 Scatterplot of correspondence scaling scores of the two-mode network of Mycenaean imports in Cyprus by FS shape.

appear as pendant nodes around the network periphery. All isolate nodes have been deleted from the graph.[971] Again the organization of the data bears impact on the organization of the graph, as can be noted by the pendant nodes of Kalavasos Mavrovouni and Ovgoros on the left side. These two sites appear to be relatively isolated by their connection to Enkomi through two rarer shape

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[971] Shapes that do not connect to the main network are known as isolates (meaning that although they appear elsewhere in the Mediterranean—and are thus included in the type list—they are not yet definitively attested at any Cypriot sites). These include FS 16, 24, 39, 56, 80, 82, 87, 93, 96, 120-12s1, 126, 130, 176, 200-202, 236, 237, 248-253, 256, 257, 262, 272, 278, 282, 283, 304, 334, 336.

groups. In fact, Kalavasos Mavrovouni connects to Enkomi through the shared presence of squat stirrup jar (FS 178-180), while Ovgoros specifically contains the squat stirrup jar of LH IIIA2 type (FS 178). These groups obviously overlap, and data can be combined when desired (or alternatively the more vaguely defined FS 178-180 group can be amalgamated into the general 'SJ' category). They have been left separate here to preserve the greatest amount of data available, however it is important to note the overlap between this, and a few additional groups in the data, when considering the network graphs.[972]

There are also a number of pendant nodes surrounding the "unknown" shape node in the upper right part of the graph, which represent sites from which only sherds of unknown type have been recovered (many of which correspond to the sites from the previous graph that were incorporated solely by the presence of "unknown LH" sherds). Centrality measures for the two-mode graph can be found in Appendix Table 6.

The FS shape data was subjected to the same scaling methods of the previous graph. The correspondence analysis yielded the scatterplot seen in Figure 7-9. As before, the overlay of nodes creates difficulties in assessing this scatterplot, as well as the resulting two-mode network graph (Figure 7-10). As this is a valued graph, the high quantity of sherds and vessels of unknown shape ('U' on the graph) from both Kition and Hala Sultan Tekke account for the

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[972] The grouping of FS types is accessible in the Appendix under the centrality values (which contains all node groupings). The general shape groups include: PJ (piriform jar), SJ (stirrup jar), ALAB (alabastron, rounded and straight-sided), Jug, F (flask), C (cup), B (bowl), U (unknown), U-CL (unknown, closed shape), and U-O (unknown, open shape). In addition to FS 178-180, there are other FS shape groupings that create overlap with individual shape listings, including: FS 84-85, FS 94-95, FS 204-210, FS 211-214, FS 211-220, FS 248-253, FS 254-278, FS 279-286, and FS 303-306. These general categories were created to classify material published with partial descriptions (i.e. semiglobular cup), or partial pictures to which I could assign a general group (but for which diagnostic analysis has not been published).

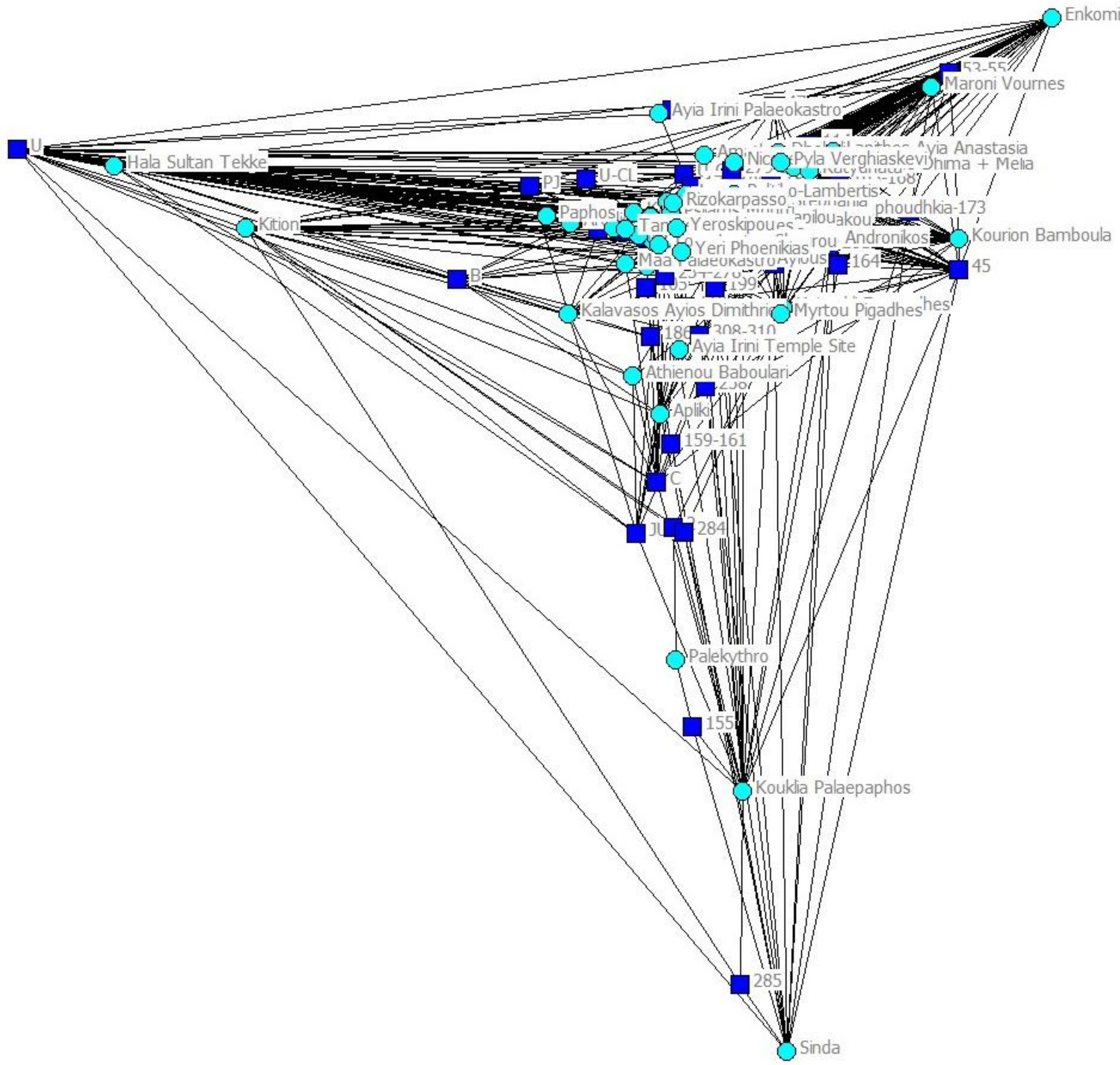

Figure 7-10. Two-mode network of Mycenaean imports in Cyprus by FS shape, with nodes located according to coordinates derived from correspondence analysis.

clustering of these three nodes to the left of the graph.[973] The graph and the scatterplot also identify additional relationships, particularly between the chronologically later shapes (FS 155, 284, and 285). The sites from which these shapes appear do not reflect any geographic clustering

[973] Sherds of unknown shape represent 80% and 77% of the finds from Kition and Hala Sultan Tekke respectively.

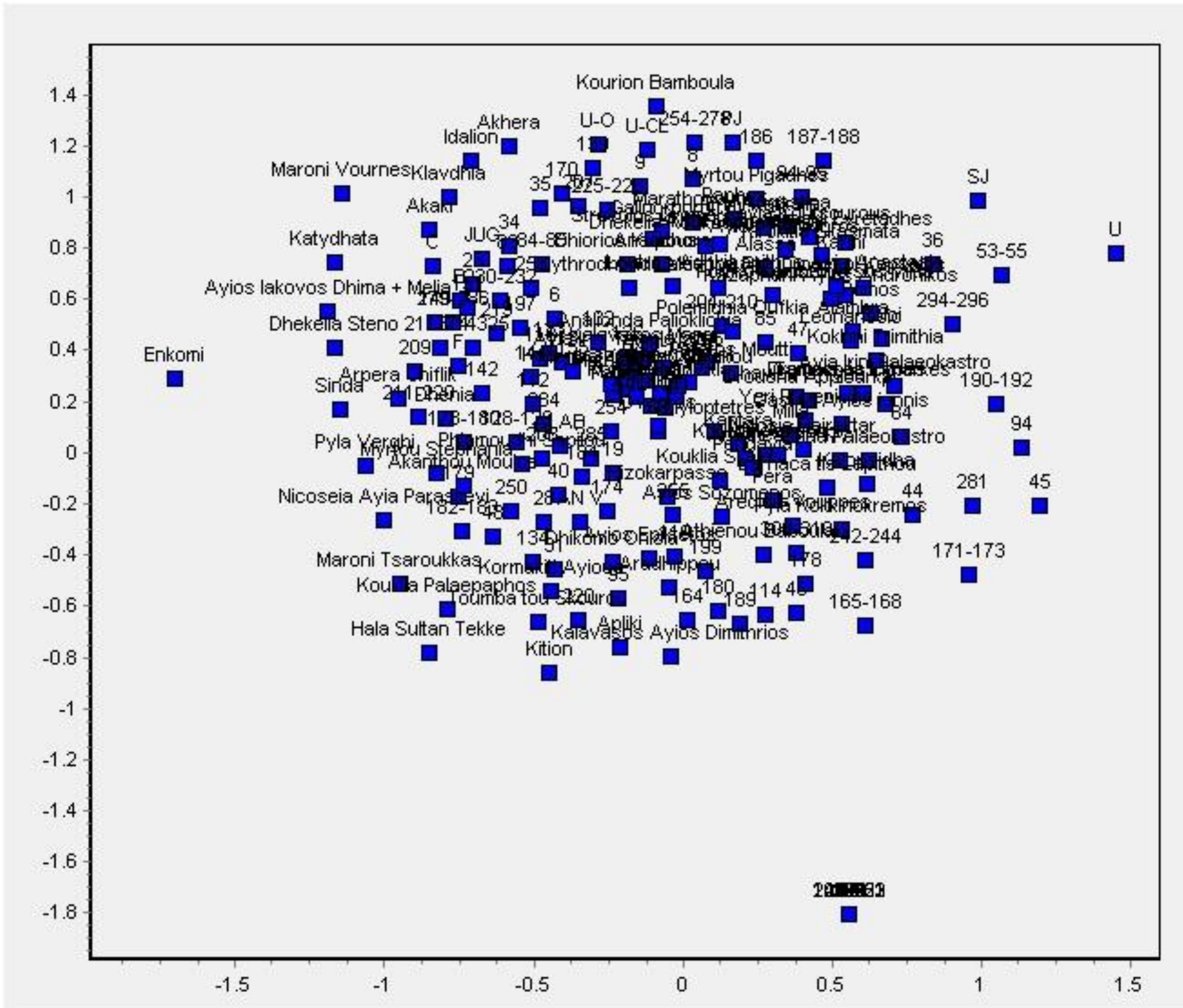

Figure 7-11. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Mycenaean imports in Cyprus by FS shapes.

on Cyprus, ranging from Sinda in the northeast, to Kition and Kouklia Palaepaphos in the south and southwest.

When the coordinates are calculated through the non-metric multidimensional scaling of geodesic distances, the resulting scatterplot (Figure 7-11) contains less visible clustering than that of the graph constructed according to chronological periods. A few observations may be made from the graph constructed according to these coordinates (Figure 7-12). Node sizes are

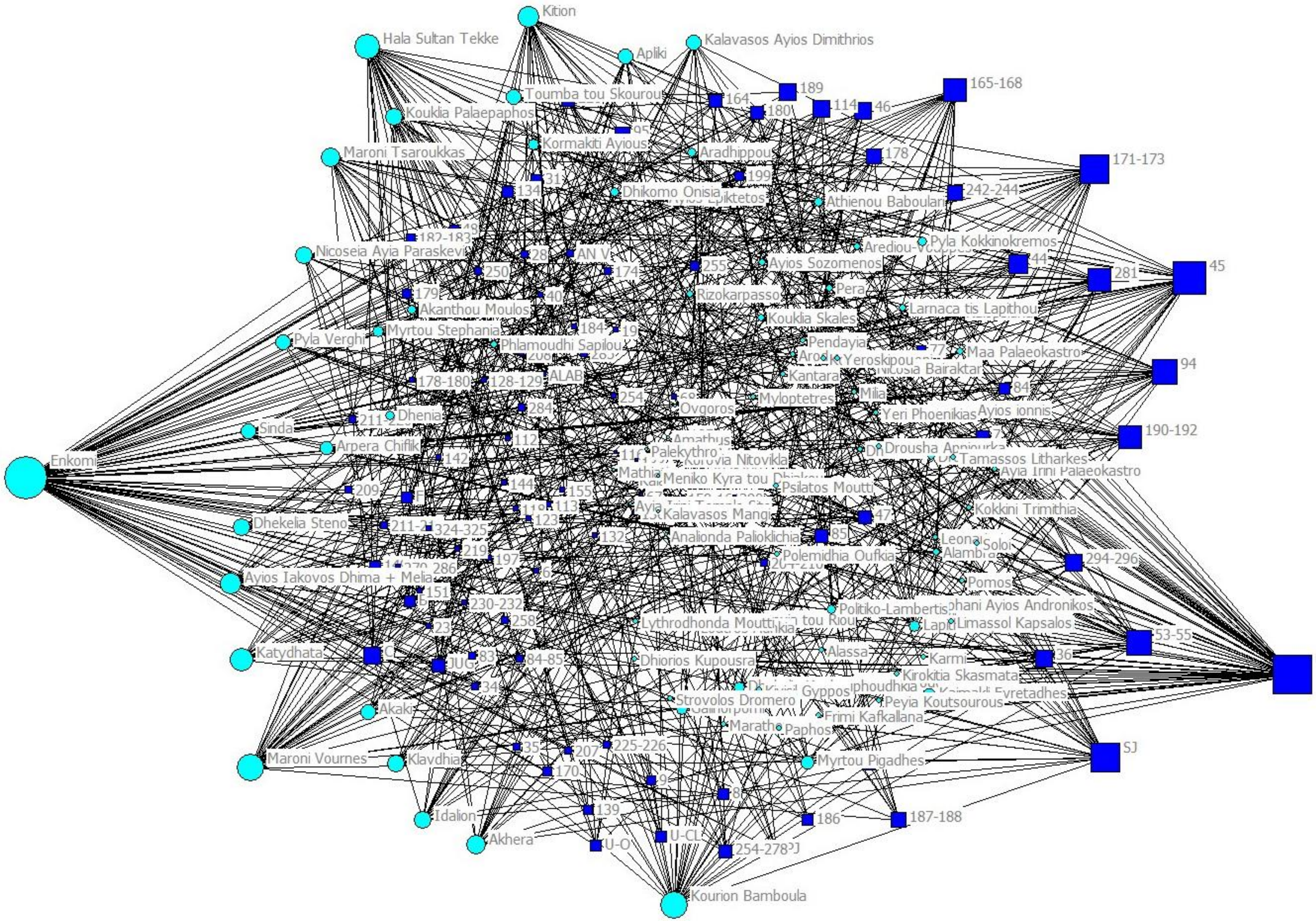

Figure 7-12. Two-mode network of Mycenaean imports in Cyprus by FS shape, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures.

scaled by eigenvector centrality, with the most central sites located around the perimeter of the graph on the left side. The sites with the largest centrality values are, unsurprisingly, generally large coastal centers. Since sites are positioned in relation to corpus similarities, the proximity of geographically grouped sites, including Enkomi, Ayios Iakovos Dhima, Dheklia Steno, Sinda, Apera Chiflik, and Pyla Verghi from the eastern and southeastern region (located to the left of the graph), as well as Maroni-Tsaroukkas, Kouklia Palaepaphos, Kalavasos-Ayios Dhimistrios, Apliki, Kormakti Ayious, and Toumba tou Skourou from the southwest and northwest of the island (found at the top of the graph), reflect potential geographic clustering of Late Helladic Imports. While there may be a correspondence between the assemblages of these larger sites, the sites with lower centrality measures—grouped in the center of the graph—display less geographic clustering. A second potential group of sites from the northwest and southwest of the island are visible to the right of the graph. Despite the apparent presence of small regional groupings, regression analysis (using Ucinet's 'Profit' algorithm) on graph coordinates with respect to geographic region yielded no correlation between these variables.[974] The adjacent placement of Hala Sultan Tekke and Kition at the top of the graph is also unsurprising given the sites' geographic proximity.

The FS shape nodes also show some grouping. In particular, the shapes with the highest eigenvector centrality measures are located on the right-hand side of the graph. These also represent the nodes with the highest degree centrality (here representative of the number of sites from which each shape was recovered). These include the piriform jar (FS 45), the amphoroid

[974] Regions were grouped as follows: Northwest, Southwest, Central, South-central, and Northeast. The R^2 regression values with respect to the coordinates from both correspondence and multidimensional scaling analysis were all low, ranging between 0.003 and 0.041. Similarly low regression values were obtained when scaling these coordinates against GPS coordinates.

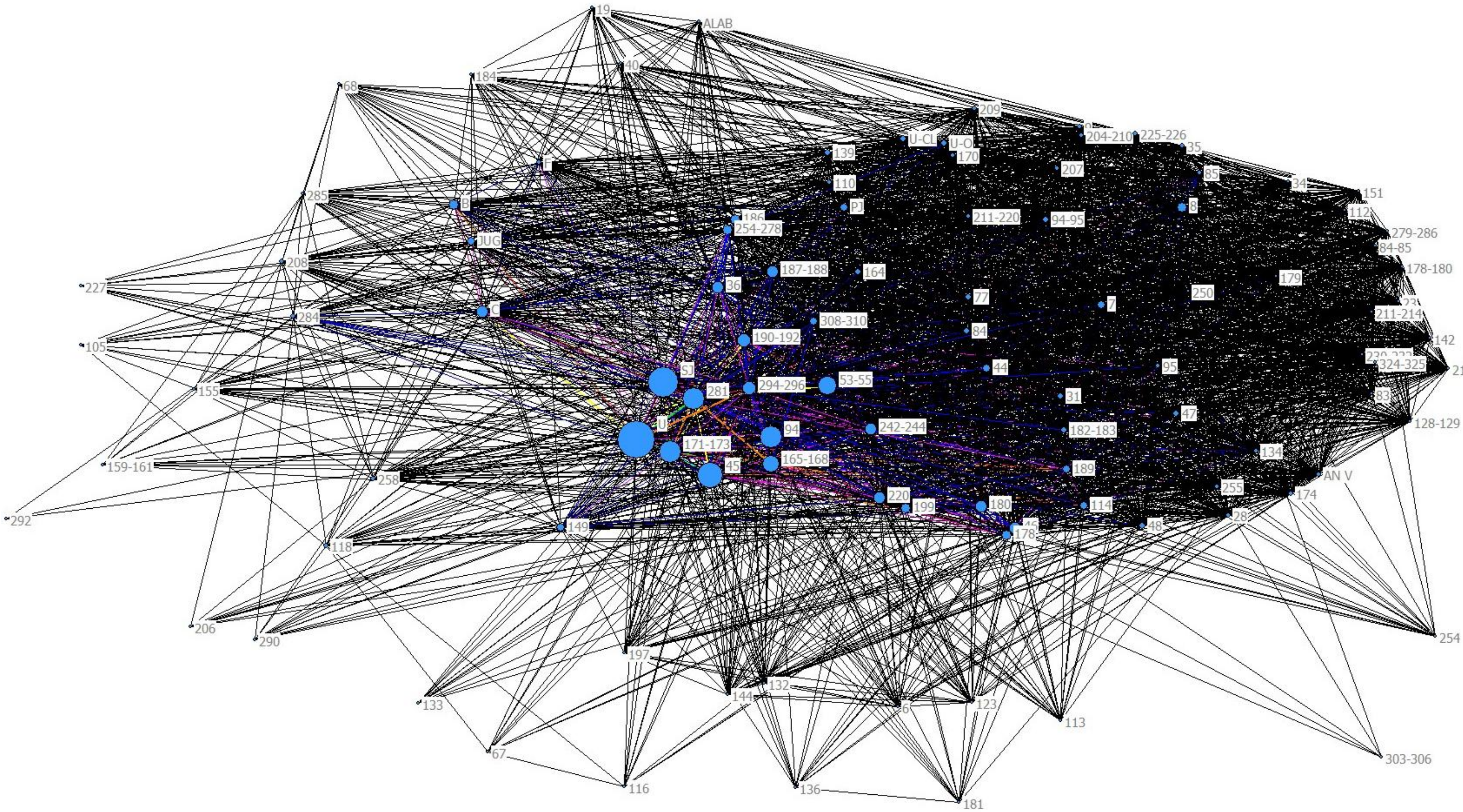

Figure 7-13. One-mode network of FS shapes imported to Cyprus. The relationships reflect the number of sites at which each pair of shapes was present. This graph demonstrates the connections between the site assemblages presented in graph Figure 7-8. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie size is scaled between 1 and 2. Nodes are sized according to betweenness centrality measures.

krater (FS 53-55), the square-sided alabastron (FS 94), the conical-piriform stirrup jar (FS 165-168), the globular stirrup jar (FS 171-173), the globular flask (FS 190-192; horizontal type), and the deep rounded bowl (FS 281; also known as the ring-based krater). Sherds of either unknown shape (U) or general stirrup jar (SJ) are also common. FS shape nodes are interspersed throughout the graph, with a number clustered just inside the sites on the left-hand perimeter of the network, representing the shapes that had more restrictive distributions, concentrating at the larger coastal centers.

When graphed as a single one-mode network (Figure 7-13), the centrality of these same shape groups becomes apparent. Node sizes are scaled in accordance with betweenness centrality values, with the nodes with the largest centrality values clustered in the center of the graph.[975] To the shapes listed above, we may add the piriform jar (FS 36), the lentoid and globular flasks (FS 186, 187-188), the conical rhyton (FS 199), the semiglobular cup (FS 220), the one-handled conical bowl (FS 242-244), the shallow angular bowl (FS 294-295), and the shallow stemmed bowl (FS 308-310). A number of the general groups (including 'bowls', 'cups', 'flasks', and 'jugs') predictably cluster together, as these more general designations are commonly employed together in site publications with less thoroughly studied or presented material. The remaining block of shapes with densely connected edges (on the right) represent the less popular shapes of Late Helladic imports on Cyprus that were recovered from sites with larger assemblages (generally from the major coastal sites) while the peripheral nodes located to the left of these are the more rare types included in smaller assemblages; the lower density of edges reflects the smaller number of other vessel groups with which a particular type was recovered.

[975] The colour key for node ties is as follows: 1-3: Black; 4-5: Blue; 6-7: Magenta; 8-9: Pink; 10-11: Orange; 12-13: Yellow; 14-15: Green; 16-17: Aqua; 18-20: Red.

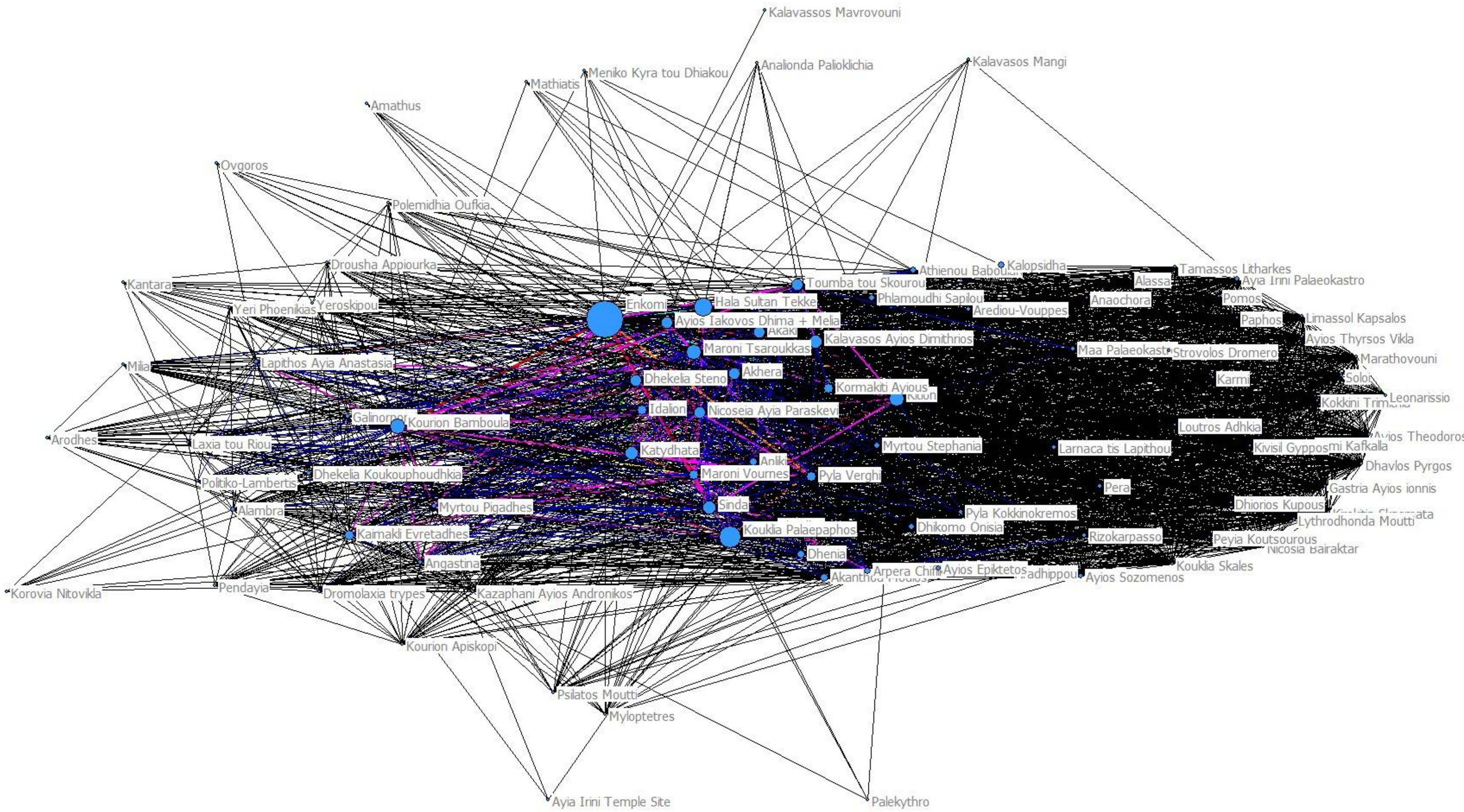

Figure 7-14. One-mode network of Cypriot sites with Late Helladic imports. The relationships reflect the number of shared FS shapes between each pair of sites. This graph demonstrates the connections between site assemblages presented in graph Figure 7-8. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie strength is scaled between 1

and 2. Nodes are sized according to betweenness centrality measures.

The one-mode graph of Cypriot sites containing Mycenaean imports (Figure 7-14) is structurally similar to that of FS shapes. The centrally located sites are also those with the highest betweenness centrality measures, as evidenced by their node sizes.[976] The nodes include the large coastal centers of Enkomi, Kition, Hala Sultan Tekke, Kalavasos-Ayios Dhimitrios, Toumba tou Skourou, Kouklia Palaepaphos, and Maroni. Nearly all of these large sites share their strongest connection with Enkomi, with the exception of Kalavasos-Ayios Dhimitrios which shares eleven shapes with Hala Sultan Tekke (one more than with Enkomi). The diversity of the Enkomi assemblage is demonstrated by the correspondence analysis, as no other site contains more than around 30% of the vessel range from Enkomi. Of the 70 possible shape groups accounted for at Enkomi (of which five are general categories), the strongest relationships are with Maroni Vournes, Kourion Bamboula, and Hala Sultan Tekke, which share 27, 25, and 24 of these shapes respectively. Enkomi also shares strong connections with smaller sites from its surrounding region, including: Ayios Iakovos Dhima and Milia (17 shared of 19 shapes present); Akhera (15 shared of 16 shapes present); Pyla Verghi (13 shared of 14 shapes present); Sinda (10 shared of 14 shapes present); and Kalopsidha (4 shared of 6 shapes present). The presence of many rare groups at Enkomi inflates its betweenness centrality measure in this graph, although less so than would be the case in a two-mode network (as rare vessel types only play a factor if they are also present at another site, creating a tie between that site and Enkomi).

Similar to the FS shape graph, the sites located in the dense group to the right of the graph include highly interconnected sites, characterized by few, but common, shared vessels. For the most part, this group includes sites with limited vessels of unknown type. The connections

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[976] The colour key for node ties is as follows: 1-3: Black; 4-6: Blue; 7-9: Magenta; 10-12: Pink; 13-14: Orange; 15-16: Yellow; 17-18: Green; 19-24: Aqua; 25-27: Red.

between these sites is therefore misleading, as it does not reflect shared FS shapes, but merely the presence of uncategorized Mycenaean imports. Limited stronger connections within this group, visible as blue lines, reflect additional shared wares, of which the amphoroid krater (FS 53-55) and deep bowl (FS 281) are common. The sites to the left of the graph, as well as those placed to the periphery of the central core, have more diverse assemblages. The farther the site is into the graph periphery, the smaller the assemblage.

Functional Group Network

The distribution of Mycenaean imports in Cyprus can also be examined in accordance with functional use, indicating the nature of import consumption in the region. FS shapes are therefore grouped into four general categories: storage, dining, ritual, and unknown.[977] Within storage, differentiation is made for the storage of liquid or dry goods, with a general 'storage' group maintained for vessels such as the piriform jar (FS 14-42) on the squat jug (FS 87) that could have held either dry or liquid contents. Similarly the 'dining' group is also further delineated to specify those shapes used for serving (namely the vessels required for the preparation and pouring of mixed beverages), drinking, and eating. The 'ritual' category includes rhyta, askoi, and composite vessels, while the 'unknown' group is differentiated into 'unknown-closed' and 'unknown-open' shapes (shapes with no indication as to form are not included as no assumptions about function can be made).

A two-mode network of Mycenaean imports by functional group in Cyprus is presented in Figure 7-15. Nodes of both modes are sized according to eigenvector centrality. As vessels of

[977] The classification system follows Van Wijngaarden 2002, 283-284.

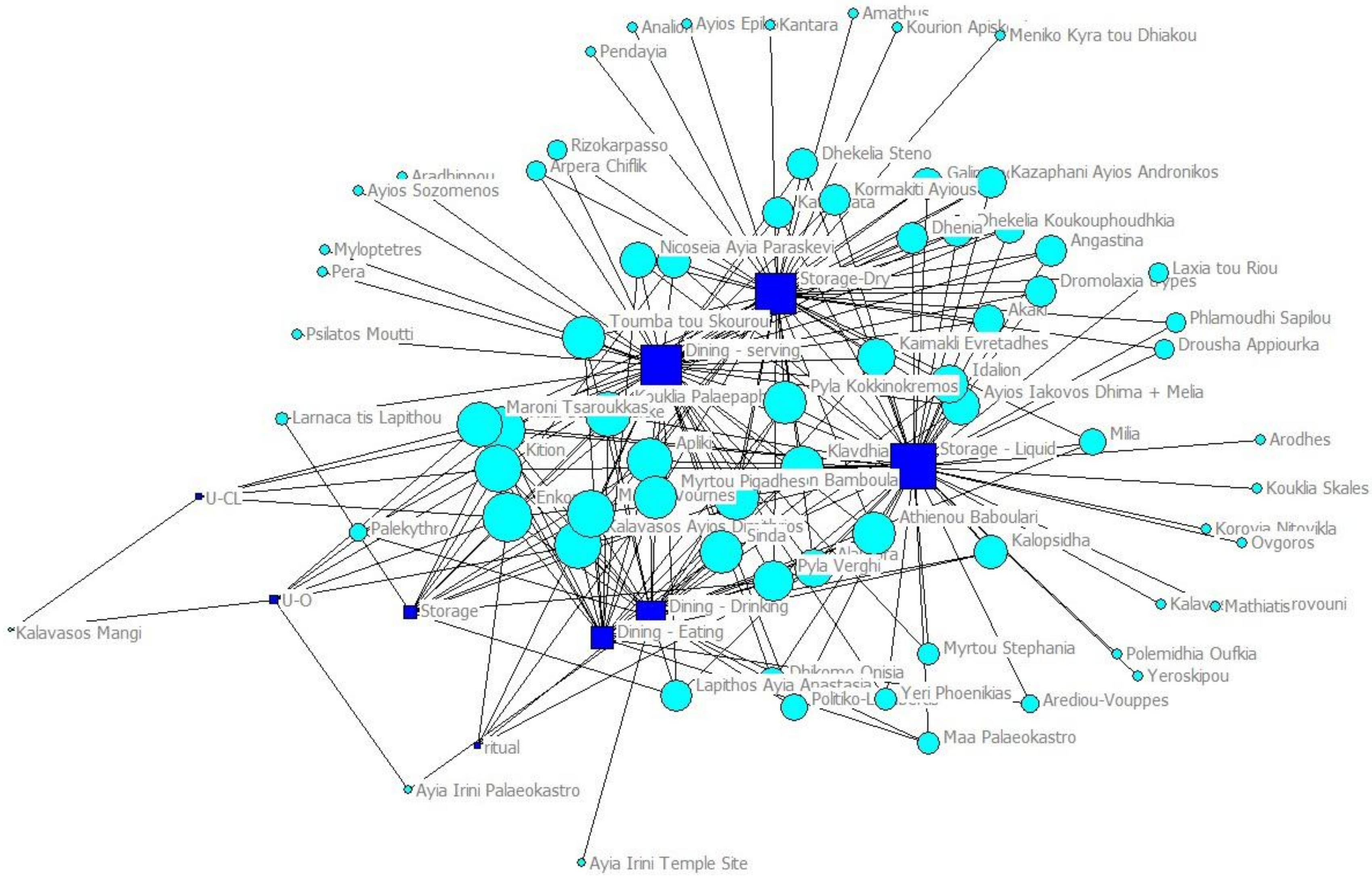

Figure 7-15. Two-mode network of Mycenaean imports in Cyprus by functional use group. Nodes are scaled according to eigenvector centrality values.

completely unknown shapes are excluded from the network, the number of sites included drops from 96 to 72. Of the 72 sites included in the network, 21 sites are incorporated as pendant nodes, with imported examples of only one functional group. Only Enkomi includes vessels of all functional group types, as most Cypriot sites with large Late Helladic assemblages have yet to yield ritual vessels.

The most popular vessel types are clearly storage vessels—both for liquid and dry goods—as well as serving vessels used in communal dining.[978] Along the top and sides of the graph are a number of pendant site nodes connected to the three most popular functional node groups, indicating that both serving and storage vessels could be imported based on either their own intrinsic value or for their contents (rather than the former being included strictly as a bundled component of consumable goods trade. The centrality of the serving vessels, particularly at sites from which no other Mycenaean imports were recovered, indicates the conspicuous consumption of Mycenaean imports in public settings, as well as the demand for the paraphernalia associated with Aegean-style wine consumption.

Significantly less popular are personal drinking or eating vessels, such as cups, kylikes, and bowls. Ritual vessels are also rare in Cyprus, appearing only at Alambra, Enkomi, Maroni-Vournes, Myrtou Pigadhes, and Sinda.[979] Both of these vessel groups occur in conjunction with other import types, appearing almost exclusively in contexts from which storage or serving vessels were also recovered; the exception is the presence of a single drinking vessel (FS 258) at

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[978] The 'storage-liquid' node has the highest degree centrality of the network at 0.552, followed by 'storage-dry' and 'dining-serving' with degree centrality values of 0.490. Although the latter two nodes share the same number of edges, the node representing serving vessels has a slightly higher eigenvector centrality measure of 0.494 versus 0.489 (see Appendix Table 7).

[979] Single examples were recovered from Alambra and Sinda, while Maroni-Vournes, Myrtou-Pigadhes, and Enkomi yielded three, two, and seven vessels respectively.

the Ayia Irini Temple site. Imports of the less common functional groups—represented by the dining-eating, dining-drinking, and ritual nodes—are predominantly found at sites with large assemblages, represented by the collection of larger nodes in the lower-left are of the central graph cluster. These include many of the large coastal centers, such as Toumba tou Skourou, Myrtou Pigadhes, Kition, Maroni, Enkomi, and Kalavasos-Ayios Dhimitrios.

7.2 Egypt

The impact of Egypt's geography is an important distinction to consider when undertaking a network analysis of Mycenaean imports to Egypt, particularly in relation to the questions posed in examining Late Helladic imports to either Cyprus or the Levant. In Egypt, all material discovered in Middle Egypt, Upper Egypt, or in the Egyptian/Nubian borderland will have reached the region after passing first through the Nile Delta. Imports to Cyprus or the Levant, on the other hand, may have had a number of points of entry through which material may have been funneled, leading to greater possible regional discrepancies in ware distribution. The examination of Late Helladic material in Egypt will instead consider the route taken by imports—either from Marsa Matruh on the western edge of the Delta, or through the Sinai Peninsula en route from the Levant—by examining assemblage similarities across these regions. Chronological variations in circulation will also be explored.

Chronological Network

The two-mode spring-embedded network of Mycenaean vessels in Egypt (Figure 7-16)

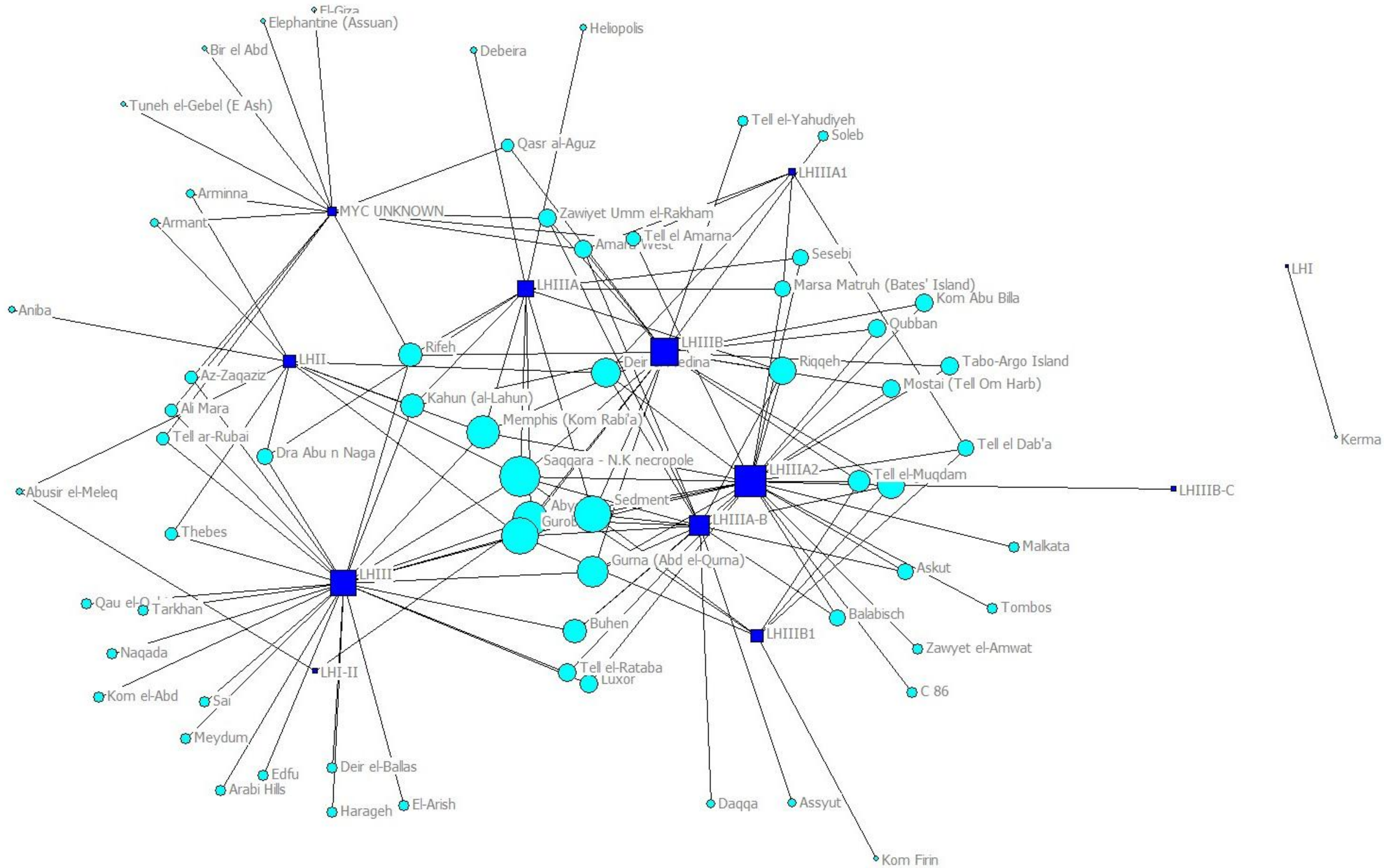

Figure 7-16. Two-mode network of Mycenaean imports in Egypt by chronological period. Node symbols are sized according to eigenvector centrality measures.

graphs the distribution of Late Helladic imports according to chronological ware group. Nodes are scaled according to eigenvector centrality values, with the nodes of highest centrality values placed in the center of the graph (see Appendix Table 8 for centrality values). The highest eigenvector centrality for the ware mode belongs to the LH IIIA2 group, closely followed by the general LH III group (both groups were recorded at 27 different sites, giving the two nodes equivalent degree centrality measures). Relative to the LH groups in Cyprus, there are fewer sites with vessels of unknown chronological date (MYC UNKOWN), reflected by both the fewer number of edges and the smaller node size. Of the 64 sites with recorded Mycenaean vessels, only 14 have wares of unknown date.[980] Much of the material from Egypt that cannot be precisely dated is instead ascribed to the LH III group; of the sites with generally LH III material, 11 have exclusively yielded sherds or vessels that cannot be identified as belonging to a specific ware group. Of the 64 sites within this network, 28 are pendant nodes, connecting to only one ware group, while Kerma, as the only site with distinctly LH I finds (and no other ware groups present), is isolated as a separate subgraph. The lower number of connections between node groups yields a lower network density (0.149) than the equivalent chronological network of Mycenaean vessels in Cyprus as seen above (0.186).[981]

It is also notable that the sites with the largest Mycenaean import assemblages are not included within the group of sites with the highest eigenvector centrality values (i.e. Tell el-Amarna, Deir el-Medina, Qantir, or Tell el-Dab'a). The lower values are the result of the circumscribed chronological range of the sites' assemblages, as a function of the shorter-lived

[980] This may be compared to the data from Cyprus, from which 52 of the 96 network sites held vessels of unclassified date (the proportion from the Levant is slightly lower at 46 of 110 sites).

[981] The network density is calculated as the number of ties present divided by the number of possible ties in the two-mode network.

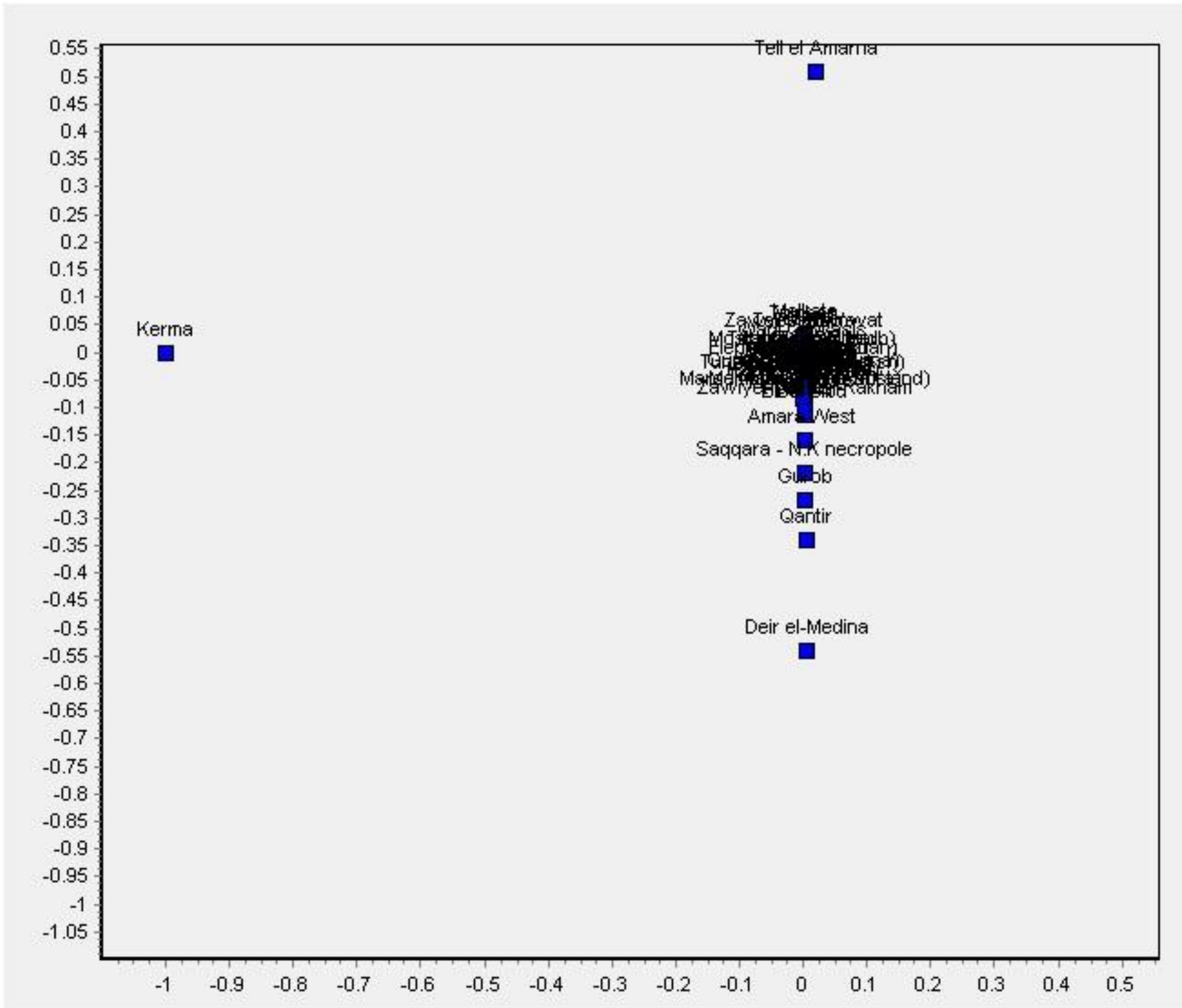

Figure 7-17. Scatterplot of correspondence scaling scores of the two-mode network of Mycenaean imports in Egypt by chronological period.

occupations of these political centers. Therefore, despite the high quantity of material from Tell el-Amarna, which accounts for around 70% of all Mycenaean material from Egypt, vessels are almost exclusively dated to the LH IIIA2 period (with a few limited LH IIIA1 examples). The presence of chronological variations inherent in the dataset is more effectively captured through the practice of data scaling.

This two-mode network is first scaled through correspondence analysis, in which site connections are profiled and compared across nodes of the same mode. The node coordinates

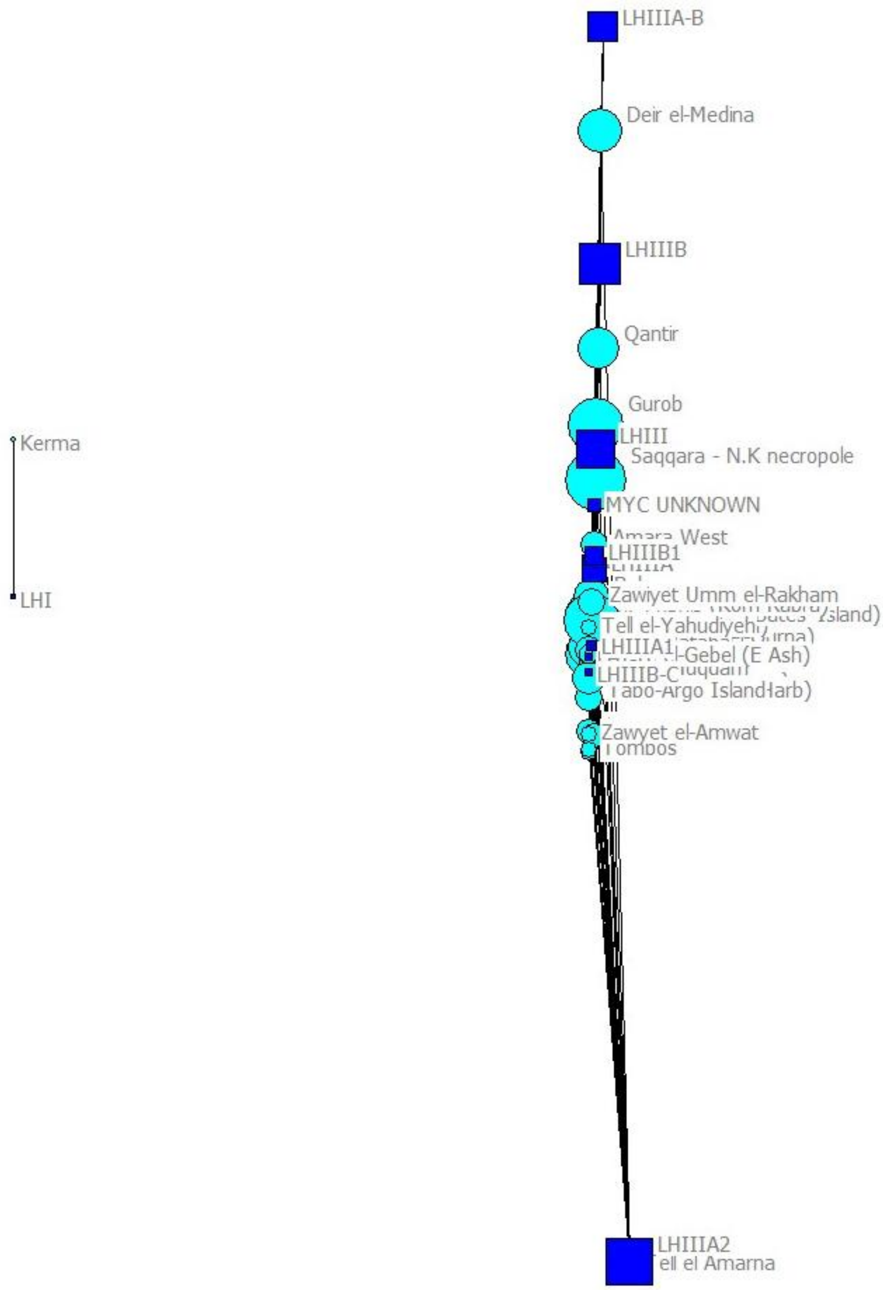

Figure 7-18. Two-mode network of Mycenaean imports in Egypt by chronological period, with nodes located according to coordinates derived from correspondence analysis.

obtained through this scaling approach are presented as a scatterplot (Figure 7-17). The majority of sites cluster together as assemblages correspond fairly closely, with the exception of Kerma, Tell el-Amarna, and Deir el-Medina. While the material from Kerma is notable for its early LH I date, Tell el-Amarna and Deir el-Medina are characterized by the predominance of LH IIIA2 and

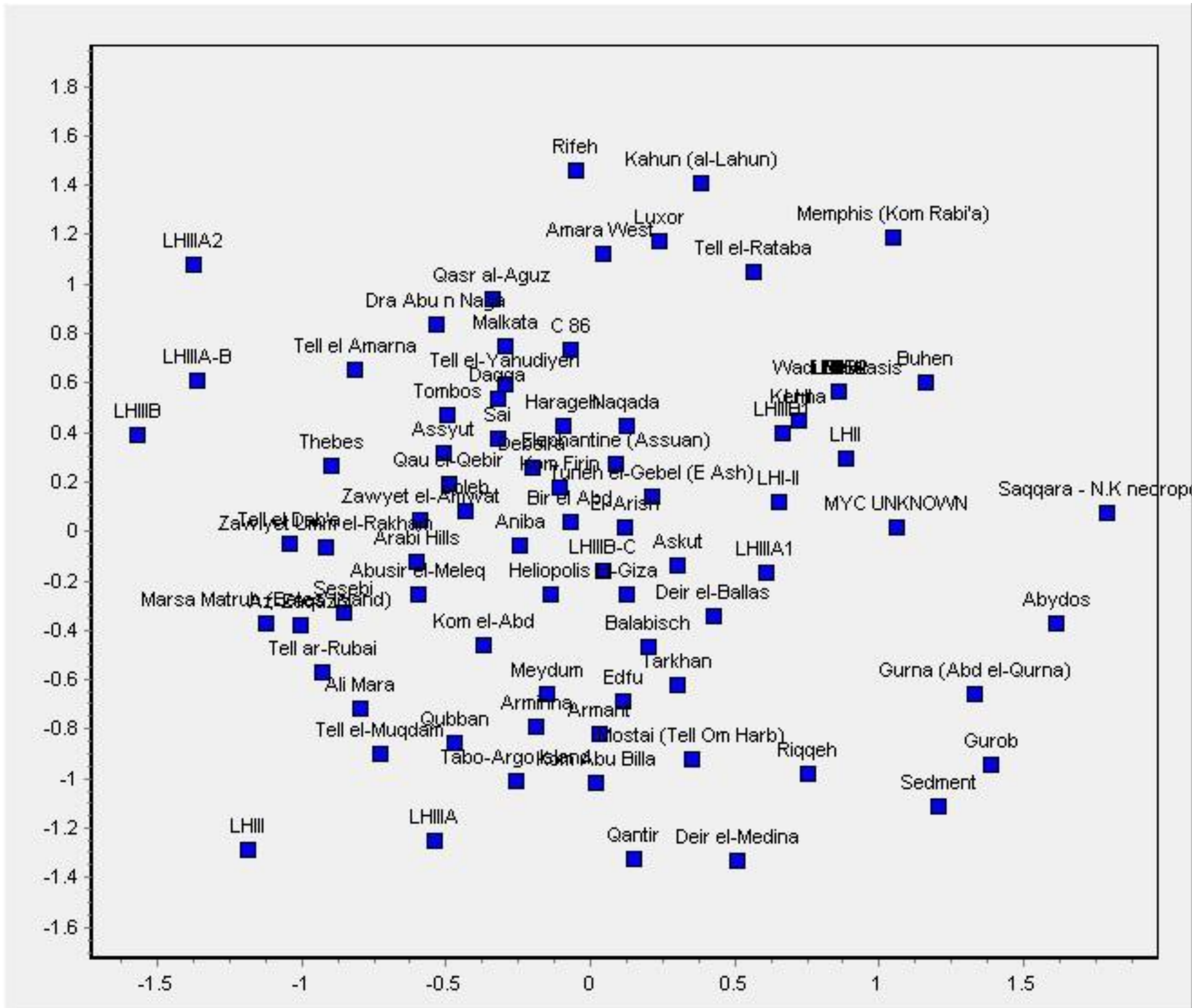

Figure 7-19. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Mycenaean imports in Egypt by chronological period.

LH IIIA-B material respectively. The predominance of later LH IIIB or LH IIIB-C material from Qantir, Gurob, Saqqara, and Amara West differentiate these sites slightly from the large cluster of sites above them.

These coordinates are then applied to the two-mode network (Figure 7-18). Again Kerma appears as an isolate, as the site and associated LH I node are disconnected from the main network. The high correlation of assemblages is reflected by the overlapping of nodes, with Deir el-Medina and Tell el-Amarna (and their associated primary ware groups) placed at the

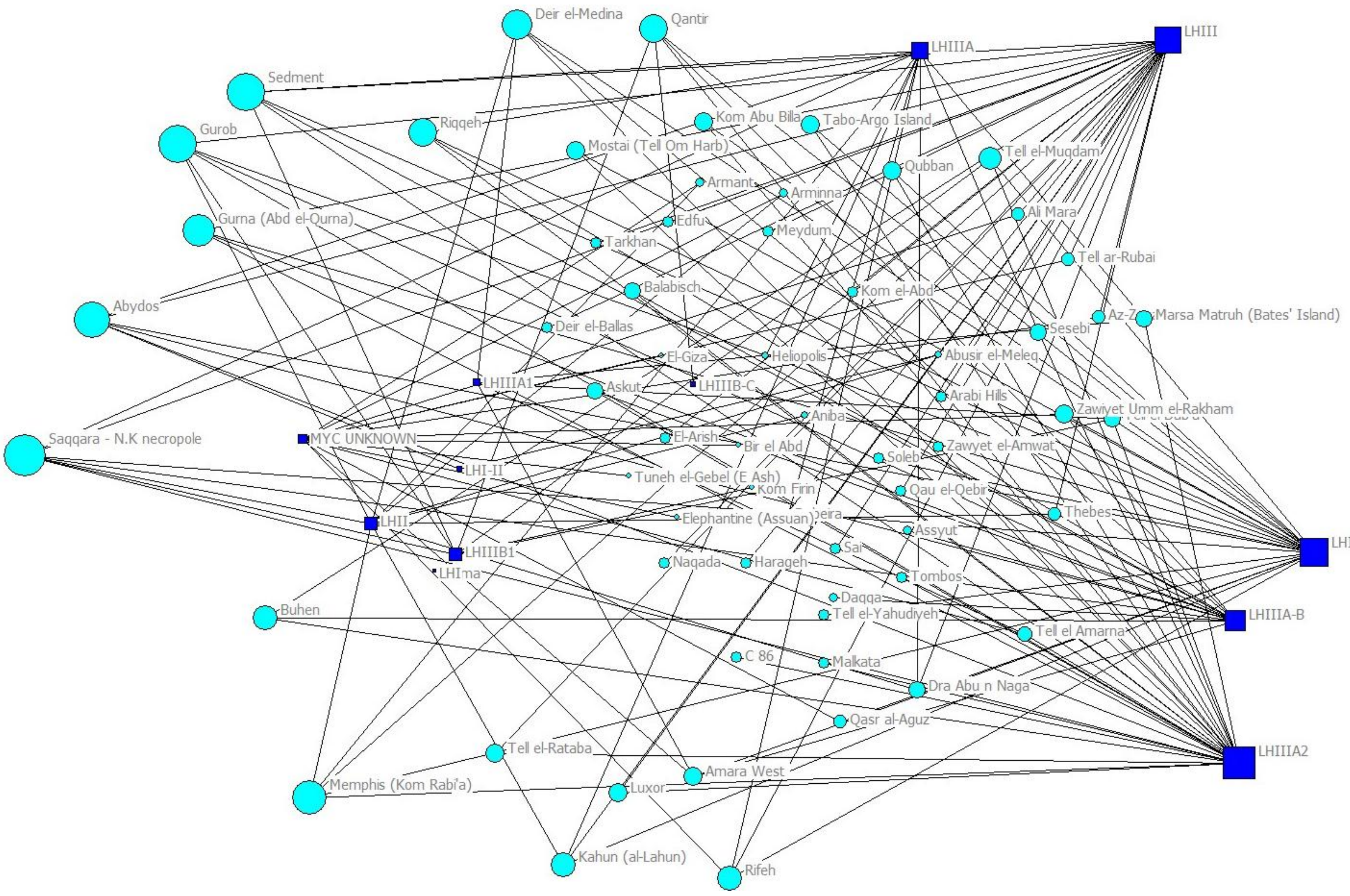

Figure 7-20. Two-mode network of Mycenaean imports in Egypt by chronological period, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures.

extremities of the network, connected to—yet comparatively dissimilar to—the network core. Although the assemblage composition of most sites is more difficult to ascertain from this graph than the spring-embedded two-mode network, the correspondence-scaled network clearly reflects the unusual composition of material from certain sites (particularly those with bounded lifespans).

The second method for assessing network structure is the non-metric multidimensional scaling of geodesic distances, which generates a scatterplot of node coordinates (Figure 7-19). Sites are more visibly articulated in this scatterplot, and the relationships between the two-modes are observable. The coordinates translate from the scatterplot to the network graph (Figure 7-20), in which again the relationship between the two modes is highlighted. Nodes are scaled according to eigenvector centrality, with the sites with the highest measures located along the left-hand periphery of the graph, while the ware groups with the highest centrality values lie along the right-hand periphery. Logical correspondence between related ware groups, such as the LH IIIA2, LH IIIA-B, and LH IIIB wares, is visible by the clustering of the nodes. There are also some small groups of geographically proximate sites, including Sedment, Gurob, and Riqqeh near the top left of the network, however sites of all regions are largely interspersed through the graph. The lack of pronounced geographic clustering within this network demonstrates that wares of different periods were well circulated throughout Egypt. Early LH I to LH II examples ranged throughout, from northern sites such as Gurob, Memphis, and Saqqara in Lower Egypt, to as far south as Kerma, Aniba, and Arminna on the border with Nubia.

The high centrality values of the large mortuary sites are emphasized in the one-mode network of Egyptian sites yielding Mycenaean imports (Figure 7-21). [982] These sites,

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[982] The colour key for node ties is as follows: 1-Black; 2-Blue; 3-Magenta; 4-Orange; 5-Yellow; 6-Green.

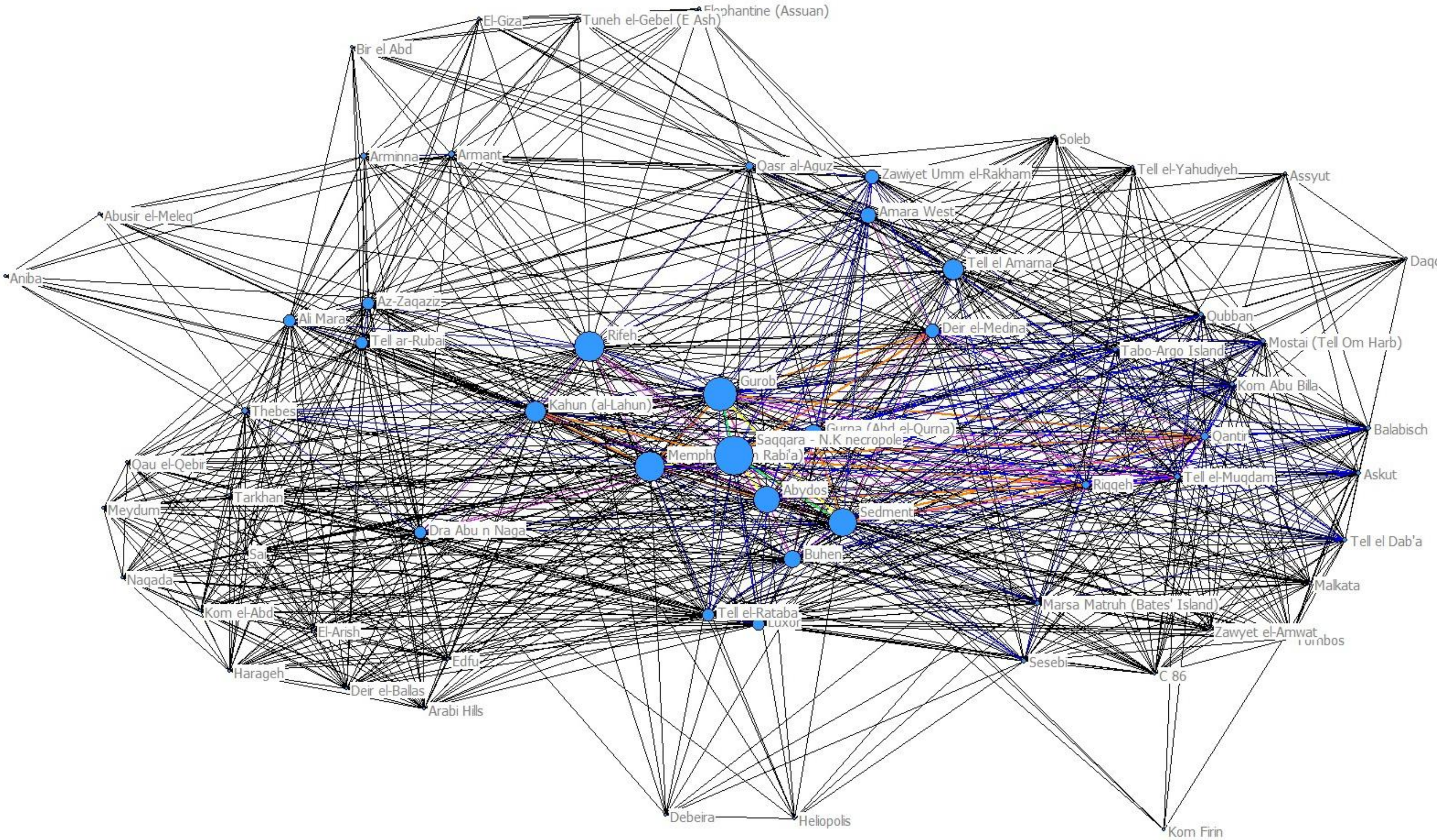

Figure 7-21. One-mode network of Mycenaean imports from Egypt. The site relationships reflect the presence of shared ware types, which are characterized by chronological period. This graph demonstrates the connections between site assemblages presented in graph Figure 7-16. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie strength is scaled between 1 and 2. Nodes are sized according to betweenness centrality measures.

characterized by multi-generational use, are clustered in the center of the graph. Although many of the sites with high centrality are located in the between Giza and the Fayum, there are highly connected sites ranging throughout Egypt (from Zawiyet Umm el-Rakham in the northwest to Buhen and Amara West in the south). Kerma is omitted from this graph as it is disconnected from the main network.

The eigenvector centrality measure emphasizes sites with lengthy occupation histories, from which imports of numerous chronological periods were recovered. In particular, many of the most centrally important sites (according to these metrics) include the major necropoleis located between Cairo and Sedment. Despite the large size of the Amarna corpus, it is marginalized within this network graph. The use of the wide chronological grouping, while demonstrating the broad diachronic circulation of imports, fails to reflect the important role that shorter-lived sites like Tell el-Amarna, Deir el-Medina, and Qantir played in the distribution of Mycenaean imports.

FS Shape Network

In order to examine more closely regional variation in distribution, as well as the role of important political centers that were more short-lived, a network of Mycenaean imports according to FS shape has been constructed (Figure 7-22). Relative to the graph of FS shapes in Cyprus, a vast number of shapes are not included in the material collected from Egypt, despite their presence as imports elsewhere in the Mediterranean. Unlike the graph of Mycenaean imports in Egypt according to LH groups, the graph of FS shapes more clearly emphasizes the centrality of important political centers such as Tell el-Amarna, Tell el-Dab’a, and Qantir, from which large assemblages with a wide range of forms were recovered (see Appendix Table 9 for

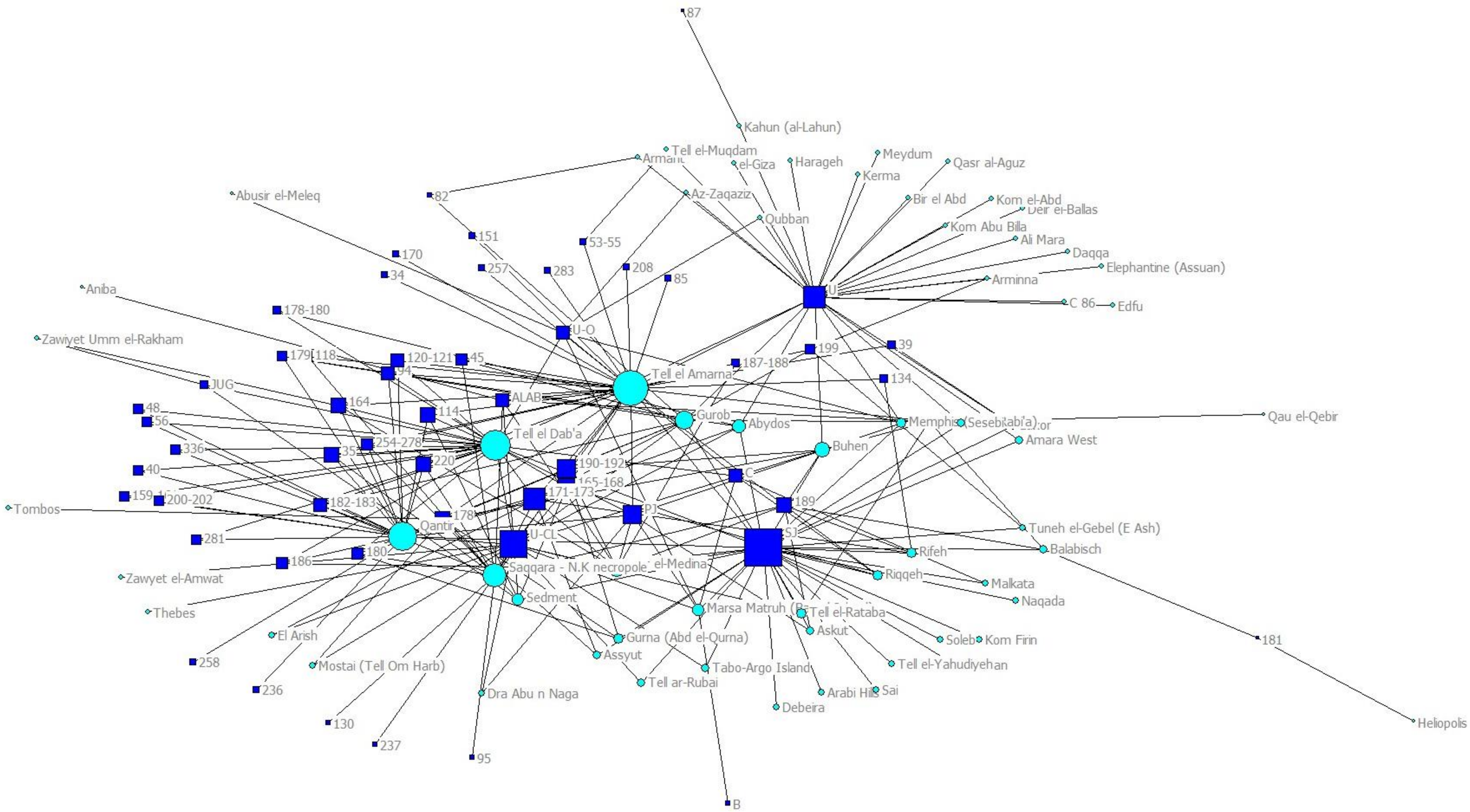

Figure 7-22. Two-mode network of Mycenaean imports in Egypt by FS shape. Node symbols are sized according to eigenvector centrality measures.

centrality measures). Of the site nodes with large eigenvector centrality measures in the graph of chronological LH groups, only Saqqara retains a high centrality measure in this graph.

There are a number of shapes present only at Amarna—appearing as pendant nodes to the upper left of the site—while a number of other rare shapes are connected exclusively to Qantir and Tell el-Dab'a. Nearly half of the sites included (31 of 64) form pendant nodes on the graph, as they connect only to one shape group; in this network, the majority of the pendant site nodes connect to the group of unknown wares (U), the unknown closed forms (U-CL), and to the general stirrup jar group (SJ)—the latter of which is the largest ware group within this network (represented by the largest node according to eigenvector centrality scaling). Other shapes with high centrality values in this graph include the large piriform jar (FS 35), the tall stirrup jar (FS 165-168), the globular stirrup jar (FS 171-173), the squat stirrup jar (FS 178), the vertical and horizontal globular flasks (FS 189; FS 190-192),and the shallow semi-globular cup (FS 220).

In order to assess the similarity of site assemblages, coordinates for network sites were calculated through correspondence analysis, yielding a scatterplot of axial coordinates (Figure 7-23). There is significant overlap in node layout, which obscures many of the more moderate assemblage variations between Egyptian sites. Clearly visible is the differentiation of the assemblages from both Saqqara and Tell el-Amarna, as they fall to the periphery of the central node cluster. The assemblage from Tell el-Amarna is characterized by the high quantity of vertical globular flasks (FS 189), for which the ware node is located in close proximity to the Amarna site node in the scatterplot. In addition, this graph emphasizes the rarity of the squat stirrup jar (FS 181), which falls outside of the main cluster due to its presence at only two sites; of the two sites from which this shape was recovered, one of which (Heliopolis) contains only this shape. Although there are a number of other shapes that appear at a limited number of sites,

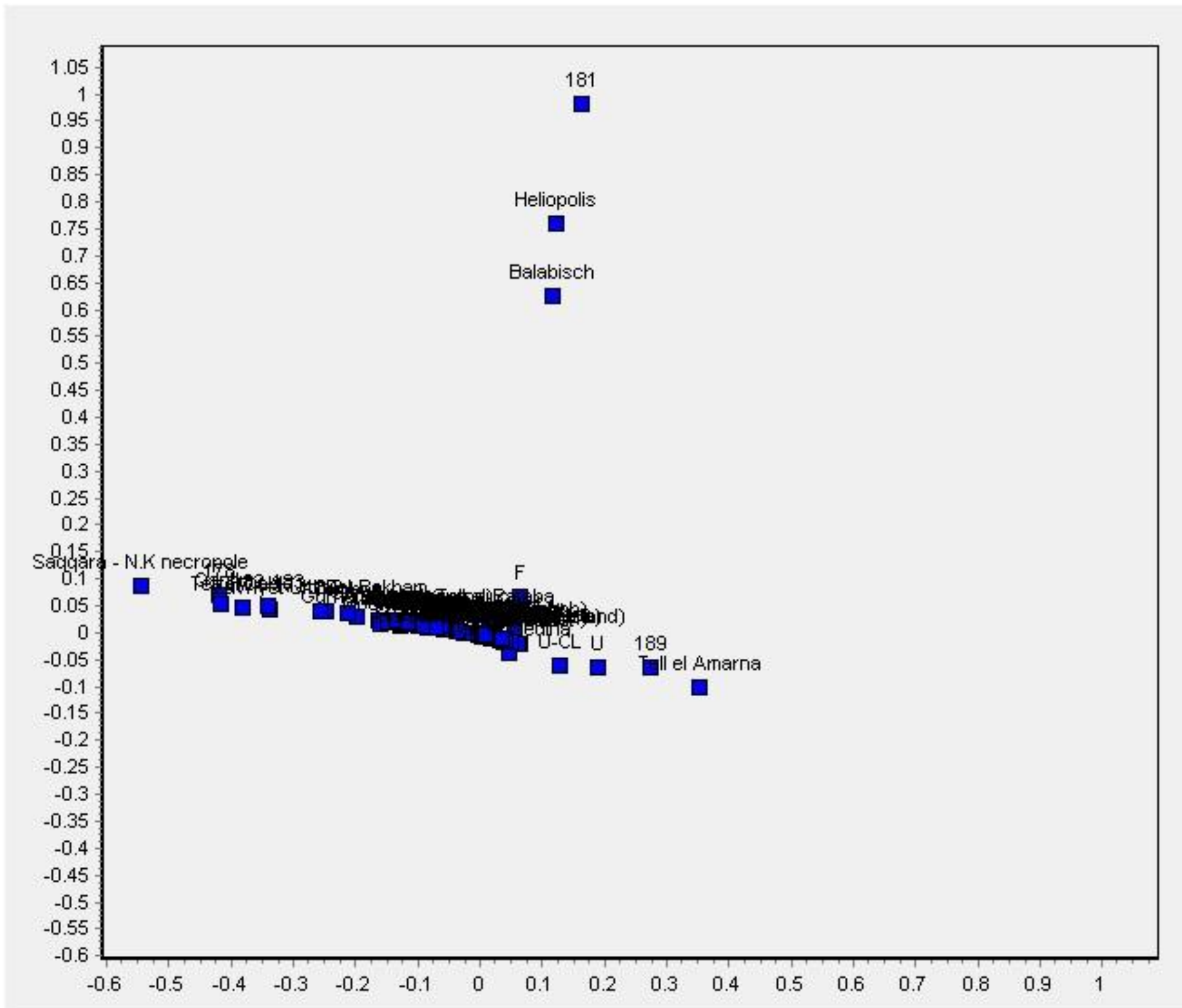

Figure 7-23. Scatterplot of correspondence scaling scores of the two-mode network of Mycenaean imports in Egypt by FS shape.

it is uncommon for a relatively rare shape to be recovered as the sole Mycenaean import at any given site.

The coordinates obtained through correspondence scaling may then be applied to the two-mode graph of Mycenaean imports (Figure 7-24). As with the scatterplot, there is significant overlap of nodes and edges, however more nodes and node labels are discernable. The network features emphasized by this graph are the high eigenvector centrality values of Tell el-Amarna, Saqqara, Tell el-Dab'a, and Qantir (portrayed through scaled node size), as well as the

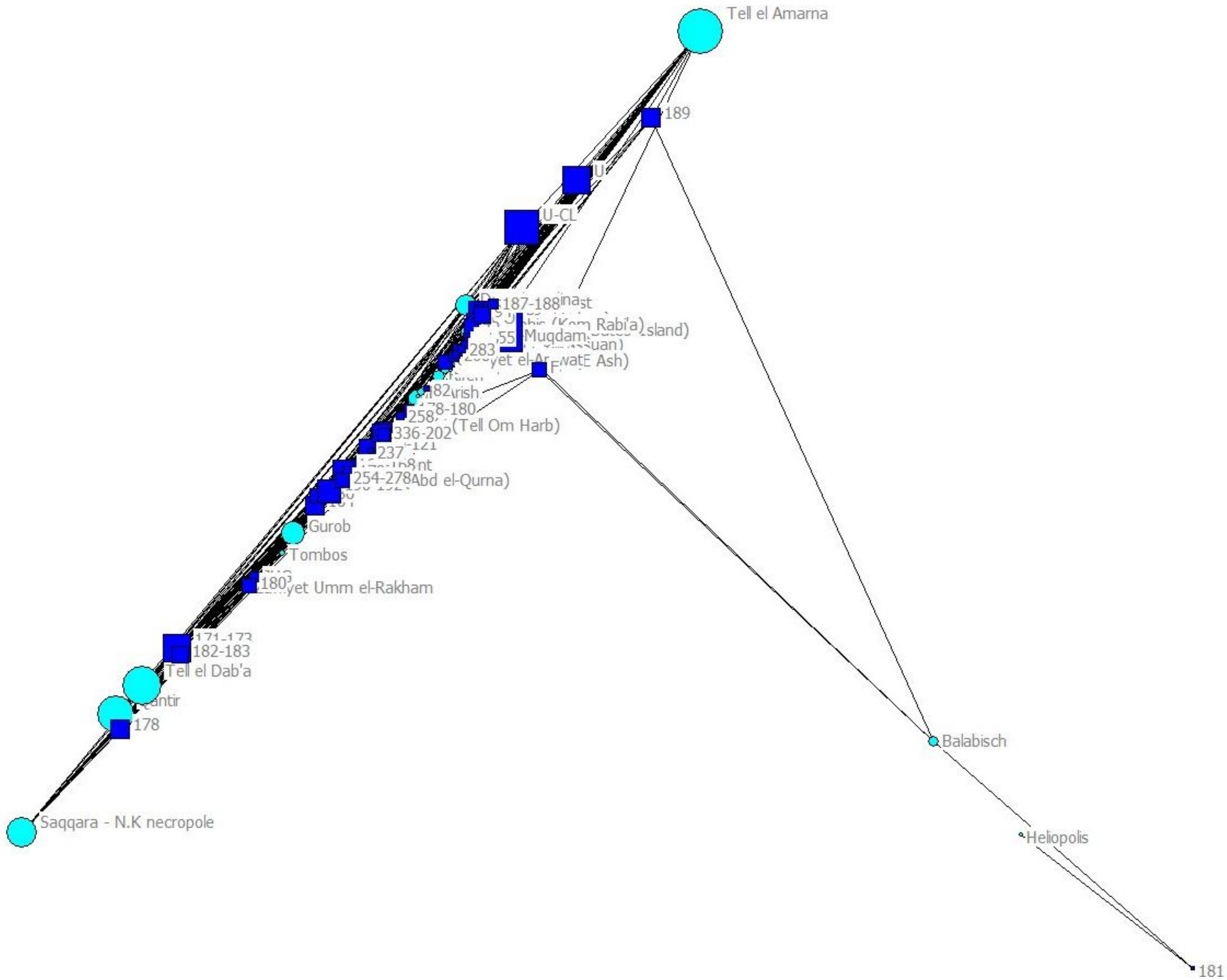

Figure 7-24. Two-mode network of Mycenaean imports in Egypt by FS shape, with nodes located according to coordinates derived from correspondence analysis.

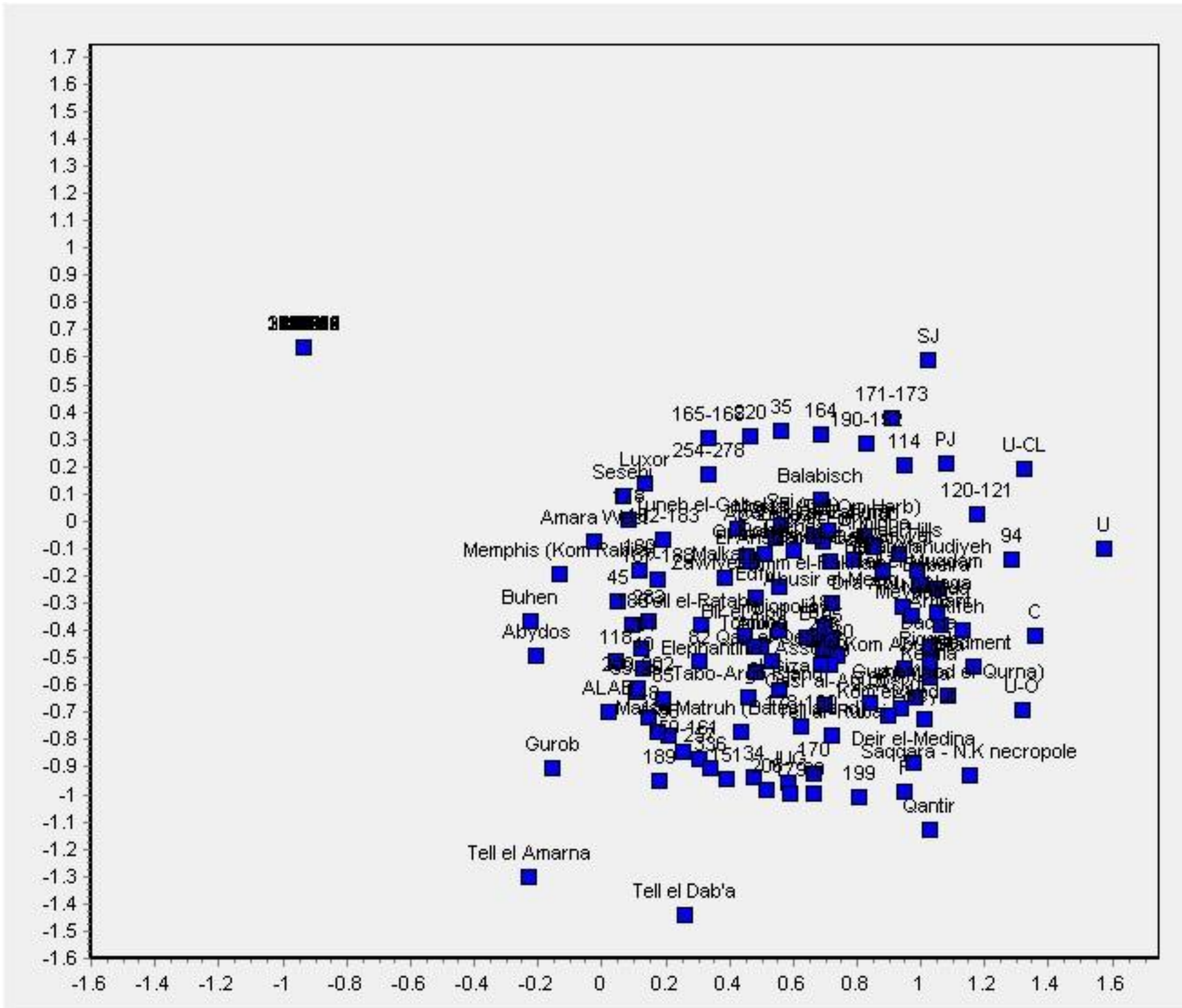

Figure 7-25. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Mycenaean imports in Egypt by FS shapes.

distinction of the assemblages from these sites according to the variety of FS shape groups present (with Saqqara and Amarna falling at either end of the main graph cluster). As visible in the scatterplot, the presentation of a weighted graph results in the close association of shape groups with sites from which numerous examples were recovered (such as the concentration of vertical globular flasks, FS 189, at Tell el-Amarna). As with the scatterplot, the FS 181 node is situated within the network periphery, due to the rarity of the type, as well as the low quantity of other ware groups found in conjunction with this shape.

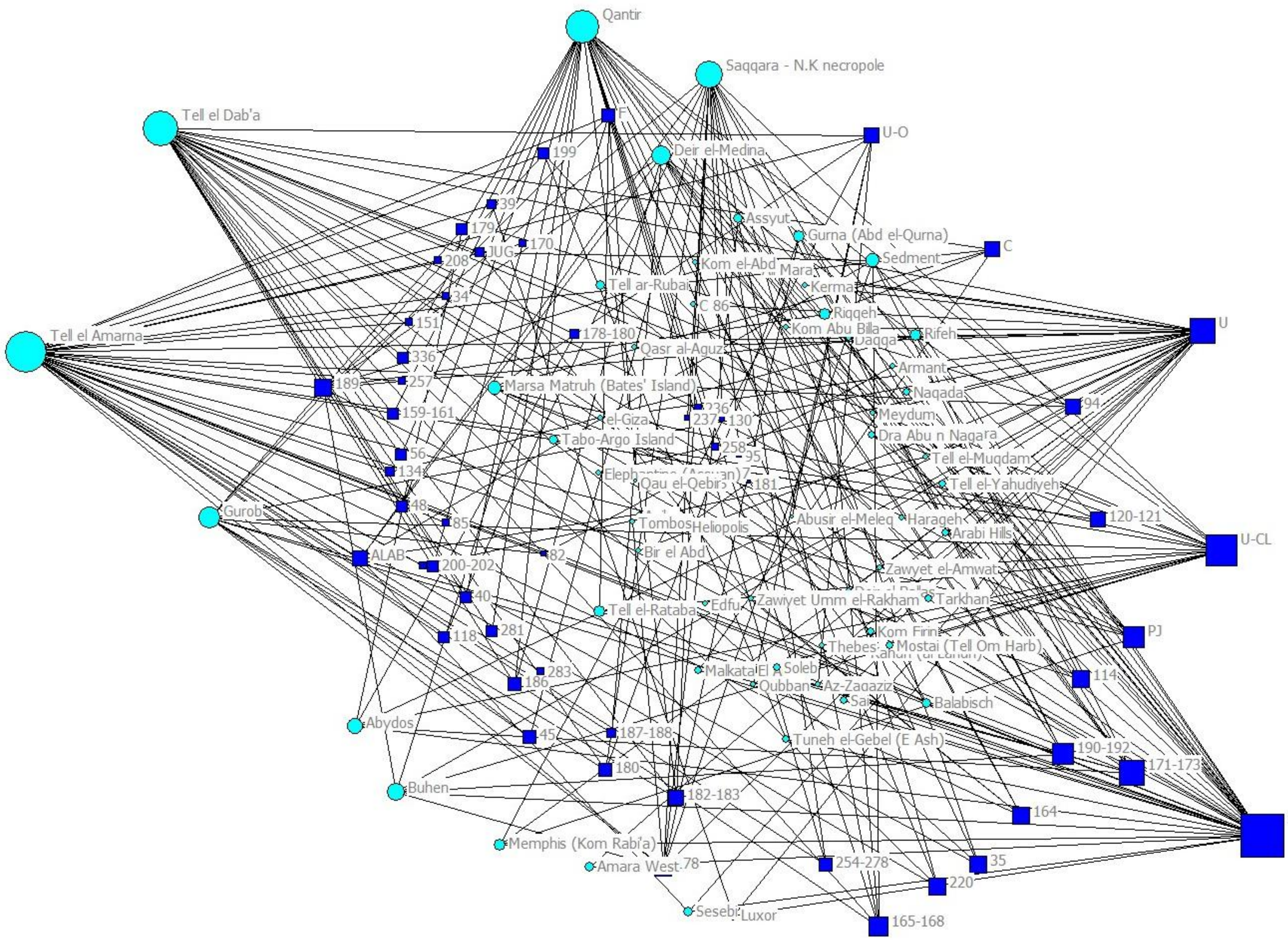

Figure 7-26. Two-mode network of Mycenaean imports in Egypt by FS shape, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures.

Having assessed the correspondence between different nodes, the network structure itself may be explored through the examination of geodesic distances, with coordinates generated through non-metric multidimensional scaling. The scatterplot of node coordinates (Figure 7-25) again highlights the unusual assemblages from Tell el-Amarna and Tell el-Dab'a, located at the bottom of the graph. The node arrangements also reflect two general groups: a dense core site and FS shape nodes, and an external ring of nodes situated in the periphery (including a number of outliers further removed from the center). Although the information is less obscured by overlapping than with the correspondence scaling, node labels are still difficult to read.

The two-mode network graphed according to the scaled coordinates is presented in Figure 7-26. Node sizes are again scaled according to eigenvector centrality measures, with the nodes of largest centrality values placed along the edges of the network (sites are located on the left and FS shapes on the right). The sites of high centrality values correspond to those with high measures in the correspondence scaled graph, and include the main political centers (Tell el-Amarna, Tell el-Dab'a, and Qantir), as well as large mortuary sites (Saqqara and Gurob). Aligned with these sites along the interior of the periphery are the FS shapes that occur predominantly at the larger sites, and which are minimally distributed among smaller assemblages. The most commonly traded vessel groups are located along the right-hand side of the graph, and include the general unknown (U), unknown closed shape (U-CL), and stirrup jar (SJ) categories, of which the stirrup jar group has the highest centrality (this group also has the highest degree, as vessels of this group are attested at 33 sites, while unknown and unknown-closed vessels appear at 29 and 17 sites). To these general groups of high eigenvector centrality we may add the tall stirrup jar (FS 165-168), the globular and squat stirrup jars (FS 171-173 and FS 178), and the vertical and horizontal globular flasks (FS 189 and FS 190-192). Additional

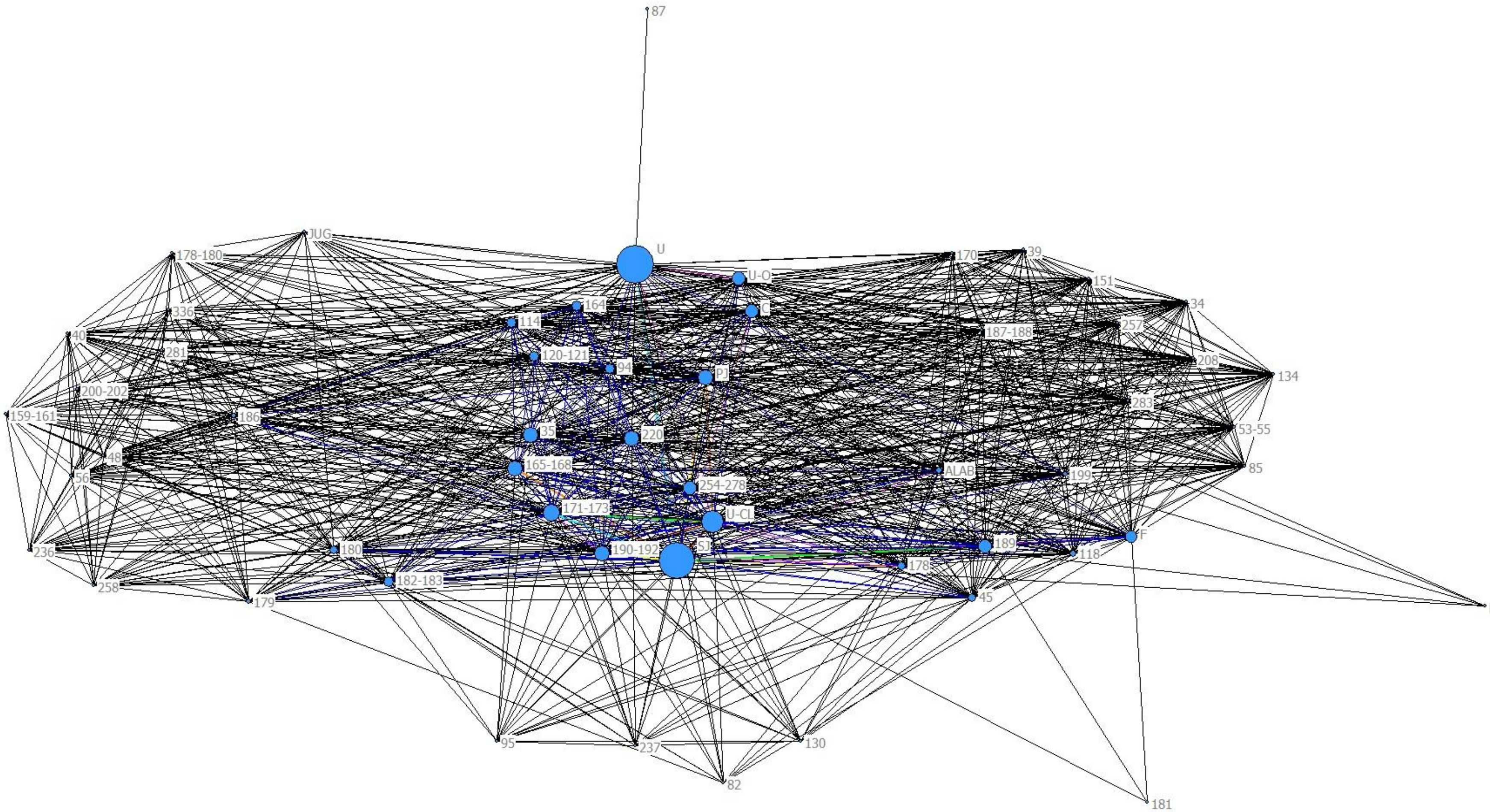

Figure 7-27. One-mode network of FS shapes imported to Egypt. The relationships reflect the number of sites at which each pair of shapes was present, demonstrating the connections between site assemblages presented in graph Figure 7-22. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie strength is scaled between 1 and 2. Nodes are sized according to betweenness centrality measures.

groups of high centrality include the piriform jar (FS 35), the straight-sided alabastron (FS 94), and the small globular jug (FS 114), which are rarely distributed, yet generate high eigenvector centrality measures due to their concentration at the important sites of Tell el-Amarna, Tell el-Dab'a, and Qantir.[983]

The relationship between FS shapes may be graphed as a one-mode network with nodes scaled according to betweenness centrality measures (Figure 7-27);[984] as relationships between nodes reflect the number of sites in which the two shapes appear together, high betweenness centrality measures capture the breadth of distribution, including the diversity of assemblages and associated shapes with which a group appears. This measure is particularly sensitive to the association of shapes with other less common wares, found at limited sites. The high betweenness centrality value of the unknown shape node (U) is significantly inflated through its association with FS 87 (squat jar), which was found exclusively at Kahun (al-Lahun), along with a number of unidentifiable sherds. If this pendant node is removed, the betweenness centrality measure of the unknown shape group drops from the highest value among shapes to a value comparable to that of FS 164 or FS 114.[985] The association of the general stirrup jar group (SJ) with a number of less common shapes situated along the lower periphery of the graph similarly increases the betweenness centrality measure of this shape group.

The strength of ties between different paired shape nodes represents the number of sites

[983] An example of FS 35 was also recovered from Saqqara, while an example of FS 114 was found at Sedment.

[984] The colour key for node ties is as follows: 1-2: Black; 3-4: Blue; 5: Magenta; 6: Orange; 7: Yellow; 8: Green; 9: Aqua; 12: Red.

[985] The removal of node FS 87 causes the betweenness centrality of the unknown shape group to drop from 69.938 to 15.938, while the eignenvector centrality is unaffected (as a pendant node of little central importance within the network, the removal of FS 87 has no impact on this measure).

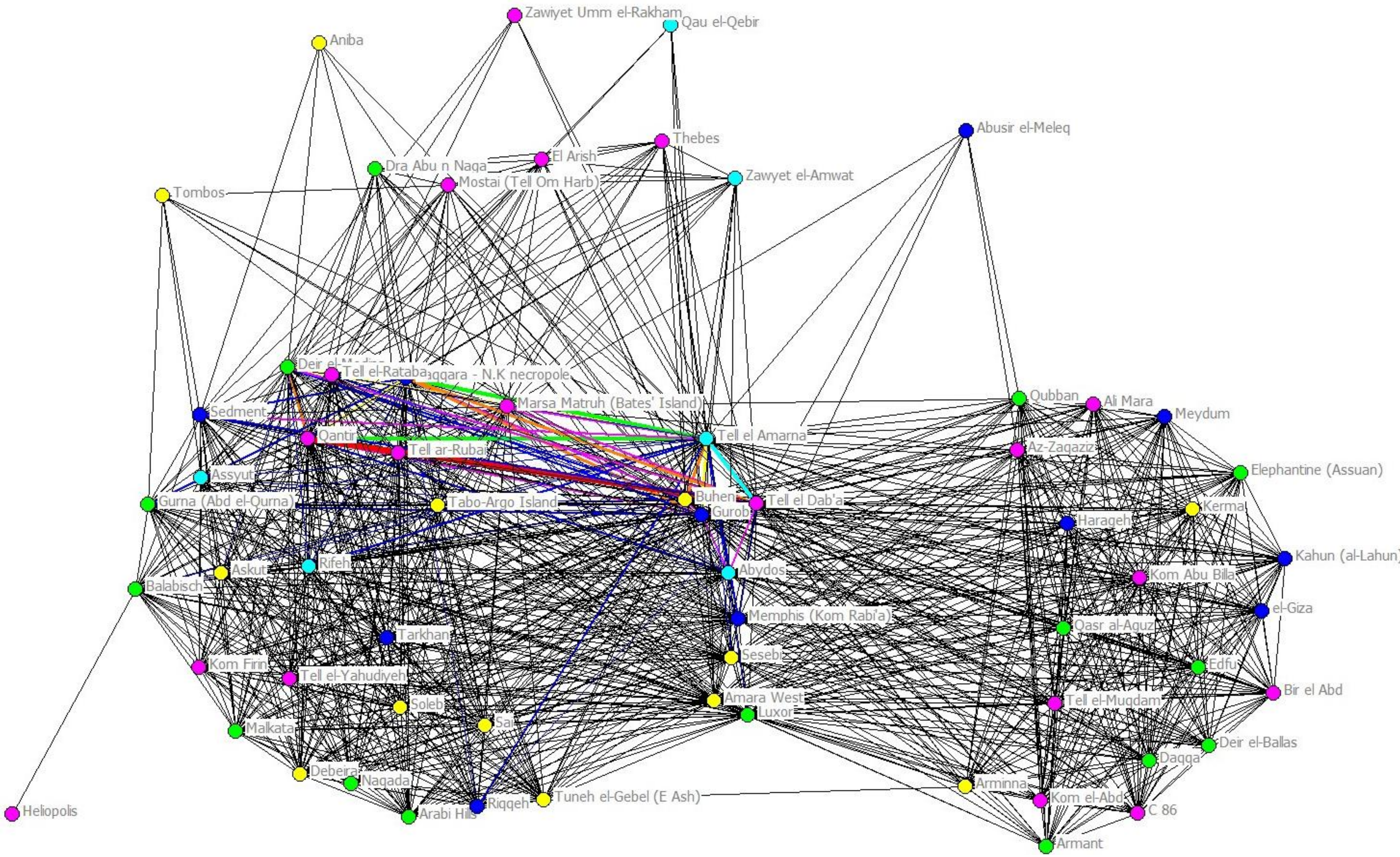

Figure 7-28. One-mode network of Egyptian sites with Late Helladic imports. The relationships reflect the number of shared FS shapes between each pair of sites, demonstrating the connections between site assemblages presented in graph Figure 7-22. Edges in this network are coloured to demonstrate the strength of ties (the number of shared ware groups), while tie strength is scaled between 1 and 2. Nodes are coloured according to site region.

in which the shapes are found together, and are reflected in the graph by both line thickness and colour. As the graph reflects binary relationships, the number of vessels of each shape attested from a shared site is not considered. The periphery of the network is characterized by nodes of low centrality, which are connected by numerous edges of low degree (either 1 or 2 sites, reflected by black edges). Although these vessels appear at only a few sites, they are generally found among assemblages with a high number of diverse shapes. As the graph nears the core, nodes with stronger connections and higher betweenness centrality figures occur, including the piriform jar (FS 45), the squat, squat globular, and conical stirrup jars (FS 178, FS 180 and FS 182-183), and the lentoid and globular flasks (FS 186 and FS 189).[986] The majority of these shapes, as well as those located within the core of the network, share the strongest connections with the general stirrup jar (SJ) and unknown closed vessel (U-CL) nodes. These centrally located nodes represent the most widely distributed vessel shapes in Egypt.

In order to understand the relationship between distribution according to sites, a one-mode network of sites was constructed (Figure 7-28) in which edges represent the number of shared shape groups between sites. Tie strength is reflected in both the size and colour of the edge,[987] while nodes are coloured according to geographic region of the site's location (grouped into Delta/Sinai, Memphis/Fayum, Middle Egypt, Upper Egypt, and Egypt/Nubia frontier).[988] When nodes are scaled according to betweenness centrality values, the central core consisting of Tell el-Amarna, Gurob, Tell el-Dab'a, Buhen, Abydos, Memphis, Sesebi, Amara West, and

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[986] The general flask group (F) also appears in close proximity to the FS 189 node.

[987] The colour key for node ties is as follows: 1-2: Black; 3-4: Blue; 5-6: Magenta; 7-8: Orange; 9: Yellow; 13: Green; 14: Aqua; 20: Red.

[988] The colour key for node region is as follows: Delta/Sinai: Magenta; Memphis/Fayum: Blue; Middle Egypt: Aqua; Upper Egypt: Green; Egypt/Nubia: Yellow.

Luxor have the largest node sizes, while the only peripheral node with a high value is Balabisch (this high figure is the product of the shared presence of FS 181 at this site and Heliopolis). Unfortunately scaling by centrality values renders the peripheral nodes too small to display their colour, so the nodes have been uniformly sized in order to reflect more clearly potential regional variation in shape distribution.

There are two main clusters of sites, with the central nodes acting as bridging connectors between these two regions. Within each region the sites are highly interconnected, however the number of shared vessels remains small (represented by the black edges). There are also a number of nodes located in the periphery above the main network group. These sites have limited connections, generally reflecting the presence of smaller assemblages with less common shapes. The sites of this poorly connected group are geographically spread through all regions of Egypt, and form connections with sites from different regions—therefore we may conclude that the rare shapes reflected by these limited connections were spread to sites of disparate location. Of the sites generally connected to these outlying nodes, it is interesting to note that they include mostly Delta or Lower Egyptian sites, with the exception of Deir el-Medina (a site which is certainly unusual in its character and assemblage). The relationship between rare shapes and delta sites is logical as imports were funneled through the Delta en route to disparate locations. The dispersal of sites from different regions throughout the network demonstrates the wide circulation of vessels within Egypt, for which geographic clustering appears non-existent. This conclusion is supported by correspondence analysis, in which GPS locations were regressed against both the correspondence and multidimensional scaled coordinates, yielding insignificant results.[989]

The strongest network connections are between Tell el-Dab'a, Qantir, Tell el-Amarna, Deir el-Medina, and Saqqara, of which the highest correspondence is between Tell el-Dab'a and Qantir (which is not unexpected given their geographic proximity). Other high value edges (representing five or more shared FS shapes) through the network all connect to one of these important nodes, with the exception of the edge between Abydos and Gurob. The generally low number of shared vessels between most sites, as well as the significant variation in site assemblages, suggest that there was no predominant bundle (or "set") of Mycenaean shapes circulated throughout Egypt, as a vast variety of import options were available.

Functional Group Network

The distribution of Mycenaean imports in Egypt by functional group diverges sharply from the functional group network in Cyprus (see Figure 7-29). The dominant group of import vessels includes those used for the storage of liquid goods, and is represented in the graph by the largest node in the network. The eigenvector centrality of the 'storage-liquid' node is significantly higher than the other functional group nodes at 0.729, followed by the 'unknown-closed' group at 0.406 and the 'storage-dry' node at 0.349 (see Appendix Table 10). Of the shapes associated with dining, the serving group has the highest degree, followed by drinking and then eating vessels. Ritual vessels are also relatively uncommon in Egypt, with single examples recovered from Arminna, Gurob, Qas'r al-Aguz, Tell el-Dab'a, and Tuneh el-Gebel,

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[989] Regression analysis was run according to the discrete regional groupings, as well as against GPS coordinates. The R^2 regression values with respect to the coordinates from both correspondence and multidimensional scaling analysis were all low, ranging between 0.001 and 0.089.

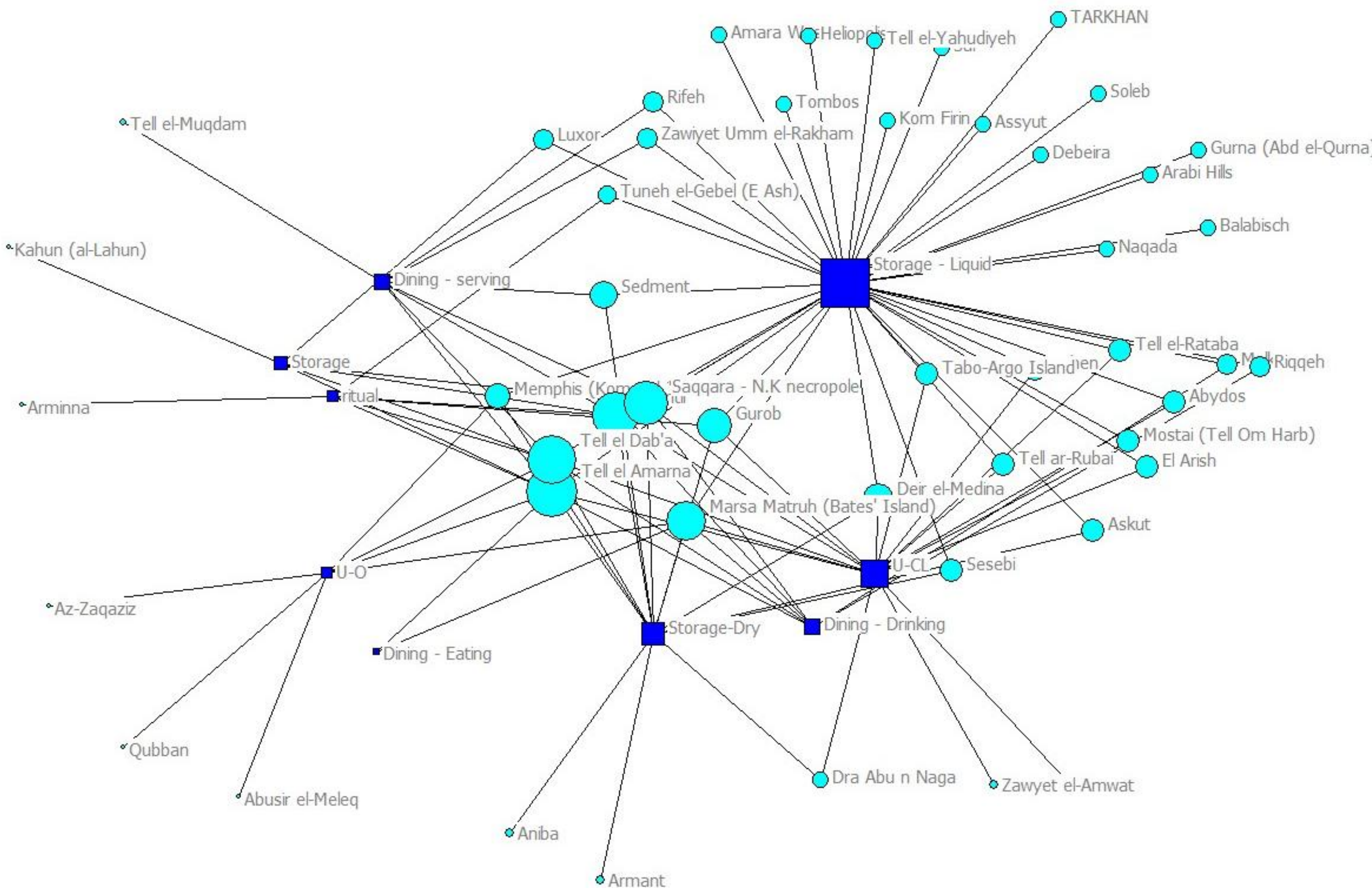

Figure 7-29. Two-mode network of Mycenaean imports in Egypt by functional use group. Nodes are scaled according to eigenvector centrality values.

and a collection of four conical rhyta (FS 199) from Tell el-Amarna.

With the removal of basic unknown shapes, 15 of the 64 original network sites are removed from the graph. Of the sites remaining, 24 are incorporated as pendant nodes, representing sites from which only a single functional class was recovered. Although the majority of such sites yielded storage containers for liquid goods, nearly all function nodes areconnected to at least one pendent node. Fewer sites yielded vessels of multiple functional classes than in the network of functional groups in Cyprus; these sites are clustered near the center of the graph, and include Tell el-Amarna, Tell el-Dab'a, Qantir, Saqqara, Gurob, and Marsa Matruh. In particular, this cluster of sites represents the locations from which storage, dining, and ritual vessels were recovered, demonstrating access to a variety of vessel types. Of the sites with large and varied assemblages, only Tell el-Amarna has a degree centrality of 1.000, reflecting the presence of all different functional groups at the site. Relative to the corresponding network of imports in Cyprus, there appears to be far less demand for Aegean style dining vessels in Egypt, including the serving vessels that were popular on Cyprus. This pattern of limited dining vessels is echoed in the distribution of Cypriot vessels in Egypt, in which open shapes were far more rare.

7.3 The Levant

Chronological Network

The construction of a two-mode chronological network of Mycenaean ceramics in the Levant is presented in Figure 7-30. Nodes are sized according to eigenvector centrality measures,

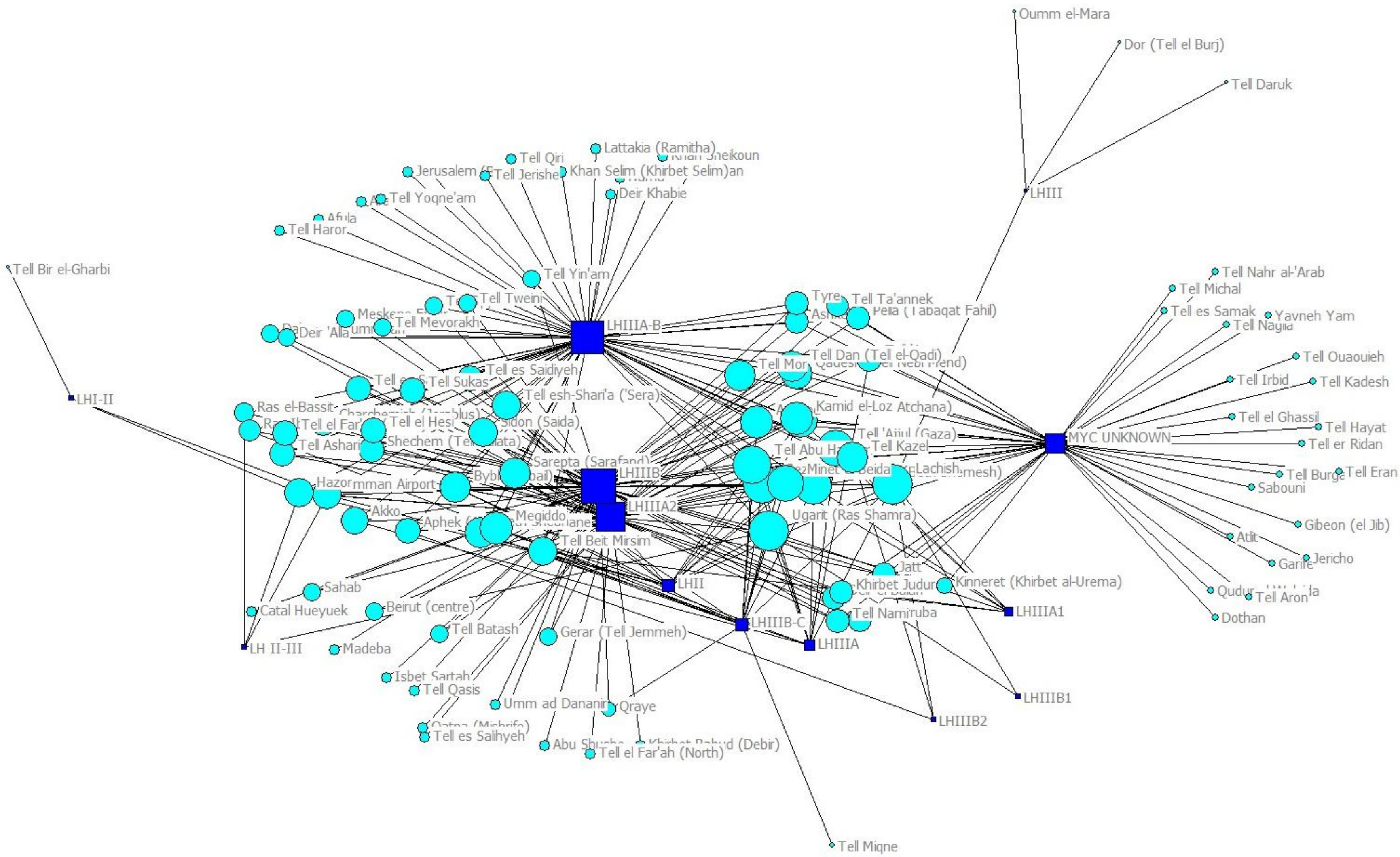

Figure 7-30. Two-mode network of Mycenaean imports in the Levant by chronological period. Node symbols are sized according to eigenvector centrality measures.

demonstrating the exponential growth in quantity distributed during the LH IIIA2 and LH IIIB periods. No sites in this network include distinctly LH I material (as vessels of undetermined LH/LM origin are omitted), while the LH I-II transitional node includes only one edge (to Tell Bir el-Gharbi). The node degree of LH II increases sharply, with 14 edges, growing to a degree of 50 by LH IIIA2 and 61 by LH IIIB. Of the 109 site nodes, 22 are included exclusively through their association with vessels of unknown chronological period, forming pendant nodes to the right of the graph. The spring-embedded orientation also reflects the logical chronological grouping of the LH IIIA2, LH IIIA-B, and LH IIIB ware groups. The sites with the largest eigenvector centrality measures are clustered in the center of the graph, and include Gezer, Ain Shems, Tell ‘Ajjul, Lachish, Tell Abu Hawam, Ugarit, Minet el-Beida, and Alalakh. These central sites are notable for their inclusion of imports from numerous chronological ware groups.

The structure of the chronological network is examined first through correspondence scaling, generating node coordinates (presented in scatterplot Figure 7-31). The main outlying node of this graph is the LH III ware group, for which three pendant site nodes are attached (Dor, Tell Dark, and Oumm el-Mara). Of these three, Dor is situated closest to the ware group node due to the higher number of vessels from this site (11 of the 15 examples from this group were recovered at Dor). These 4 nodes are integrated into the larger network through the presence of LH III type vessels at Lachish. In interpreting these results, however, it is important to note that these sites would have been well integrated within the distribution network, as the more general LH III vessel group is clearly distributed within the same trade system as the more precisely dated vessels from the chronological subdivisions this period encompasses.

When the network is reconfigured according to correspondence scaling coordinates (Figure 7-32), the LH III vessels group is clearly peripheral. While many site assemblages show

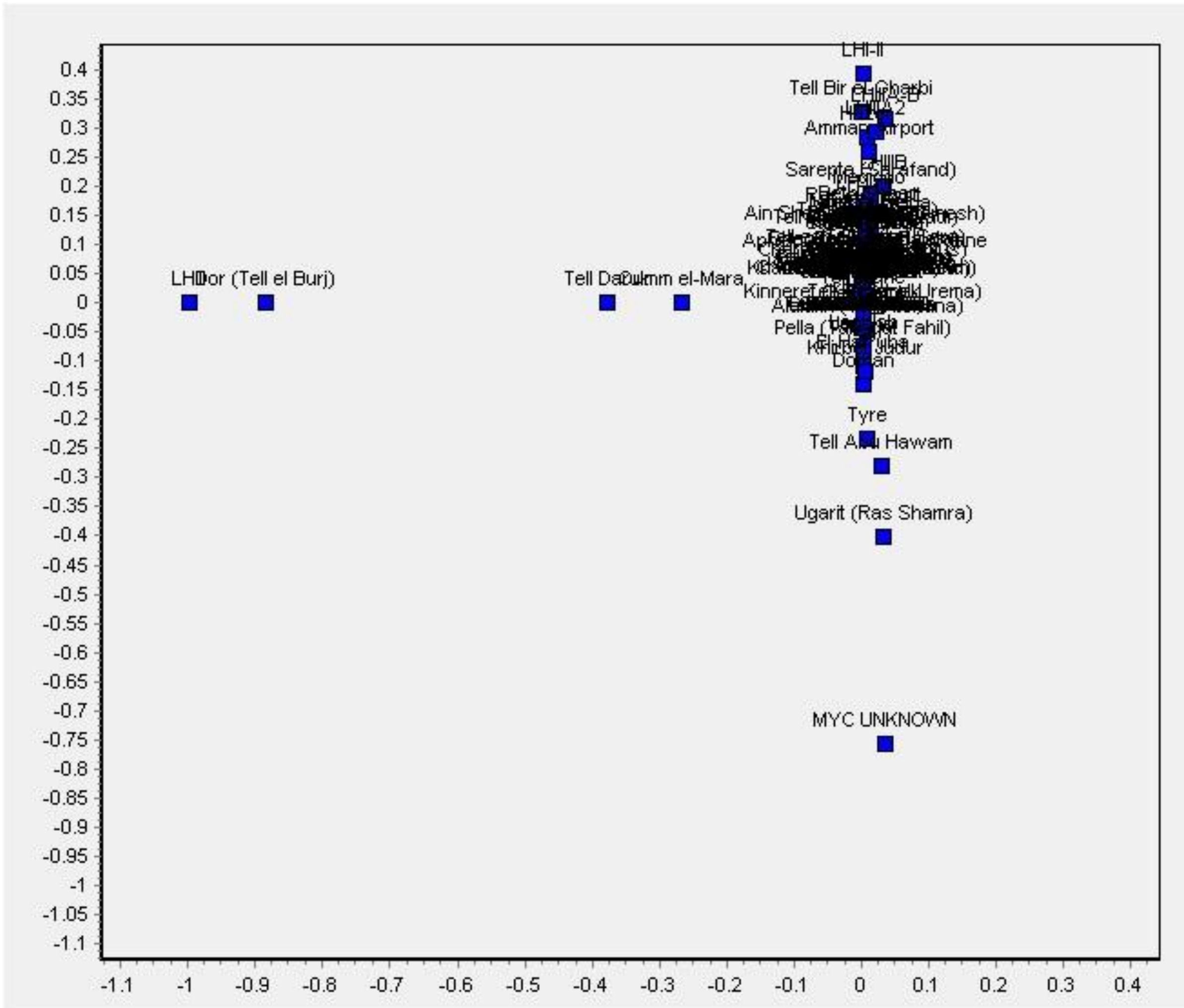

Figure 7-31. Scatterplot of correspondence scaling scores of the two-mode network of Mycenaean imports in the Levant by chronological period.

significant correspondence, the graph also highlights the assemblages of larger sites, which may be differentiated from other nodes through the presence of a number of sherds of unknown date (specifically Ugarit, Tell Abu Hawam, and Tyre). While the quantity of undated examples from Tyre is significantly lower than the other two sites (and lower than other sites which are situated further away from the 'unknown' node), this shape group forms a proportionately larger component of Tyre's recorded assemblage.

Having examined the general correspondence between site assemblages, the network

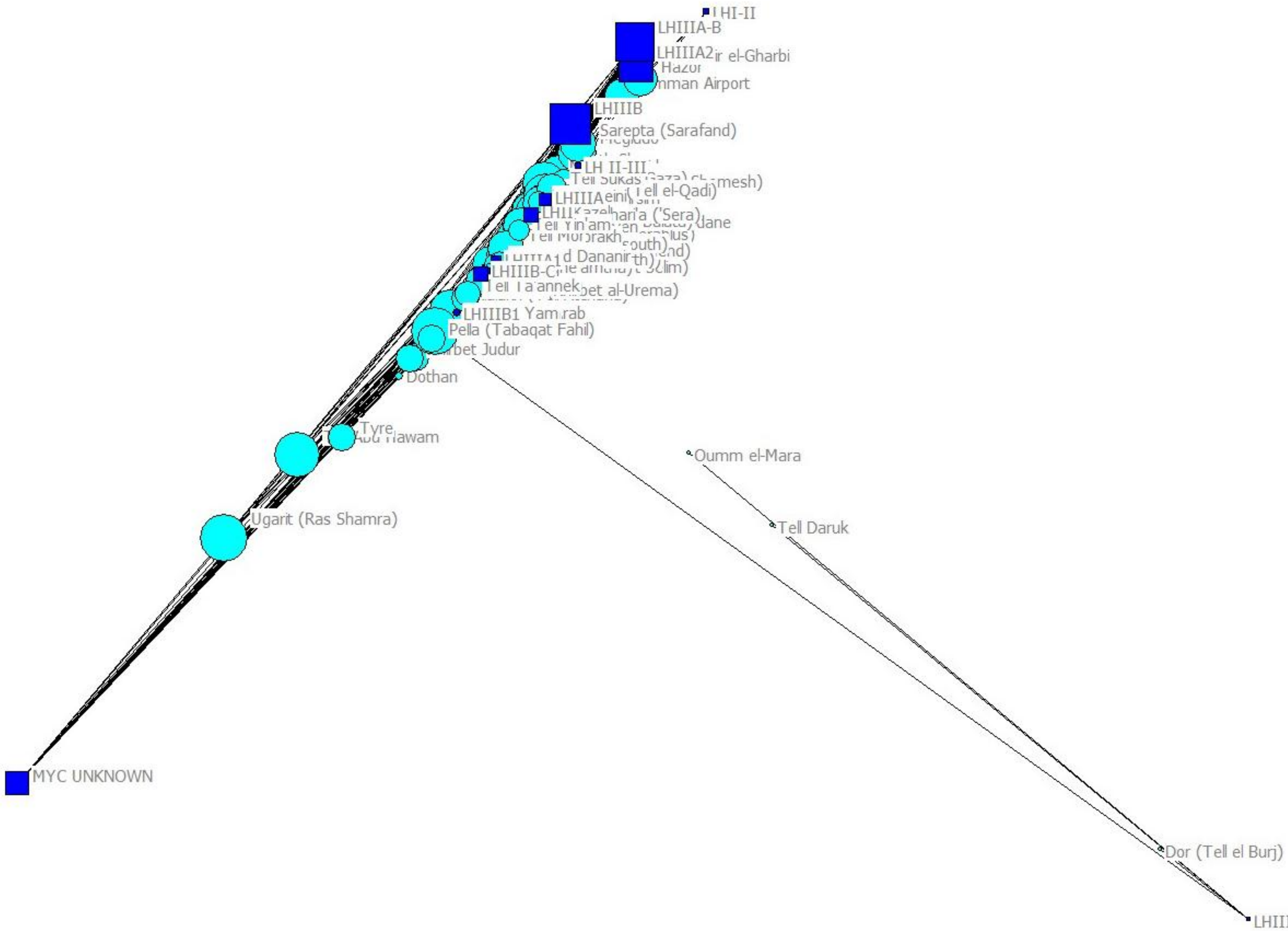

Figure 7-32. Two-mode network of Mycenaean imports in the Levant by chronological period, with nodes located according to coordinates derived from correspondence analysis.

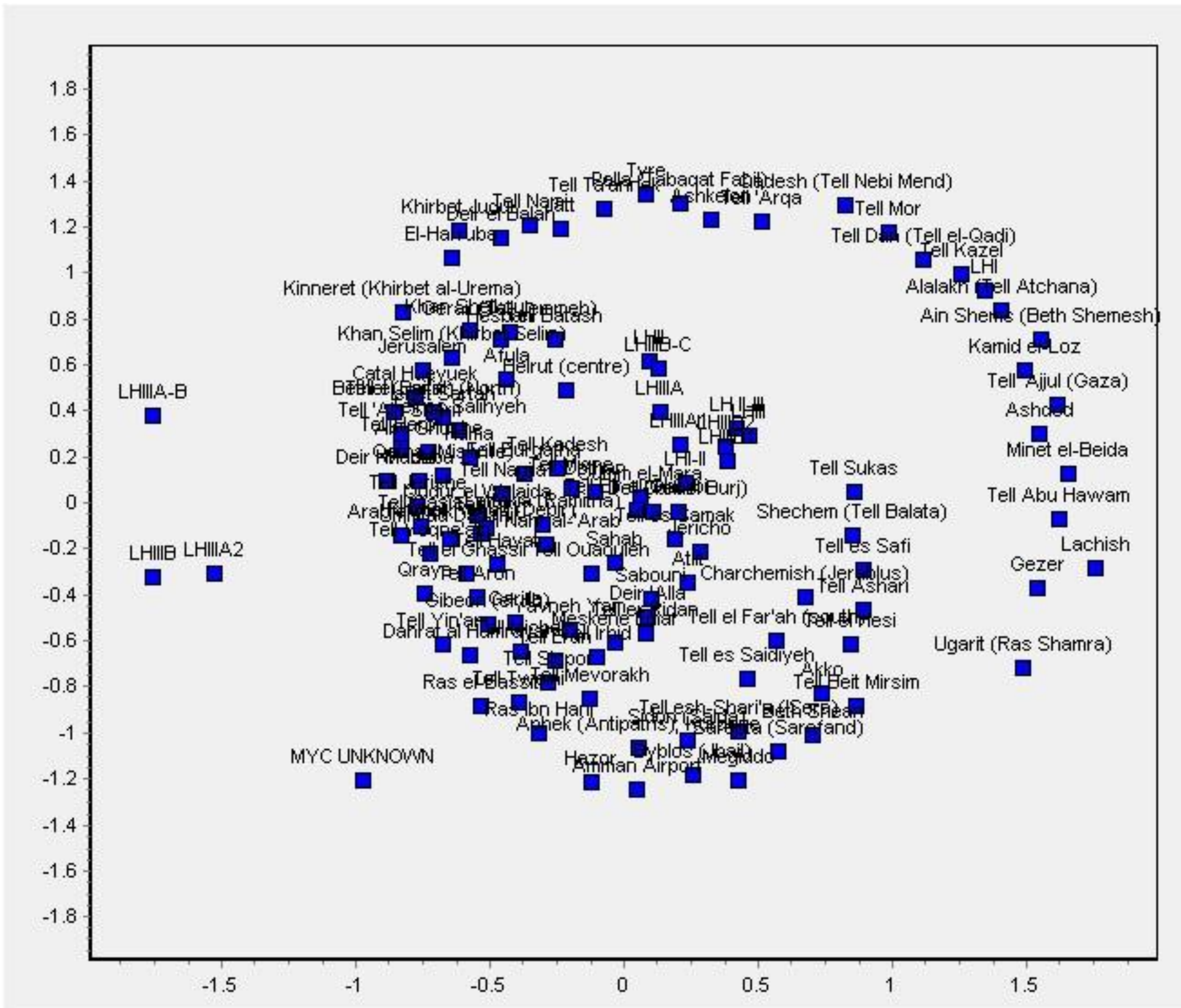

Figure 7-33. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Mycenaean imports in the Levant by chronological period.

structure can also be examined with respect to the relationship between nodes of the two modes through the computation of geodesic distances between sites of each mode, scaled through non-metric multidimensional analysis according to similarity. The generated scatterplot and graph (Figure 7-33 and Figure 7-34) again differentiate and cluster the LH IIIA2, LH IIIA-B, and LH IIIB nodes with respect to network structure, as well as the position of the “Myc Unknown” group (as these nodes form the largest chronological ware groups). The sites with high eigenvector centrality values are located along the right side of the graph, and contain edges

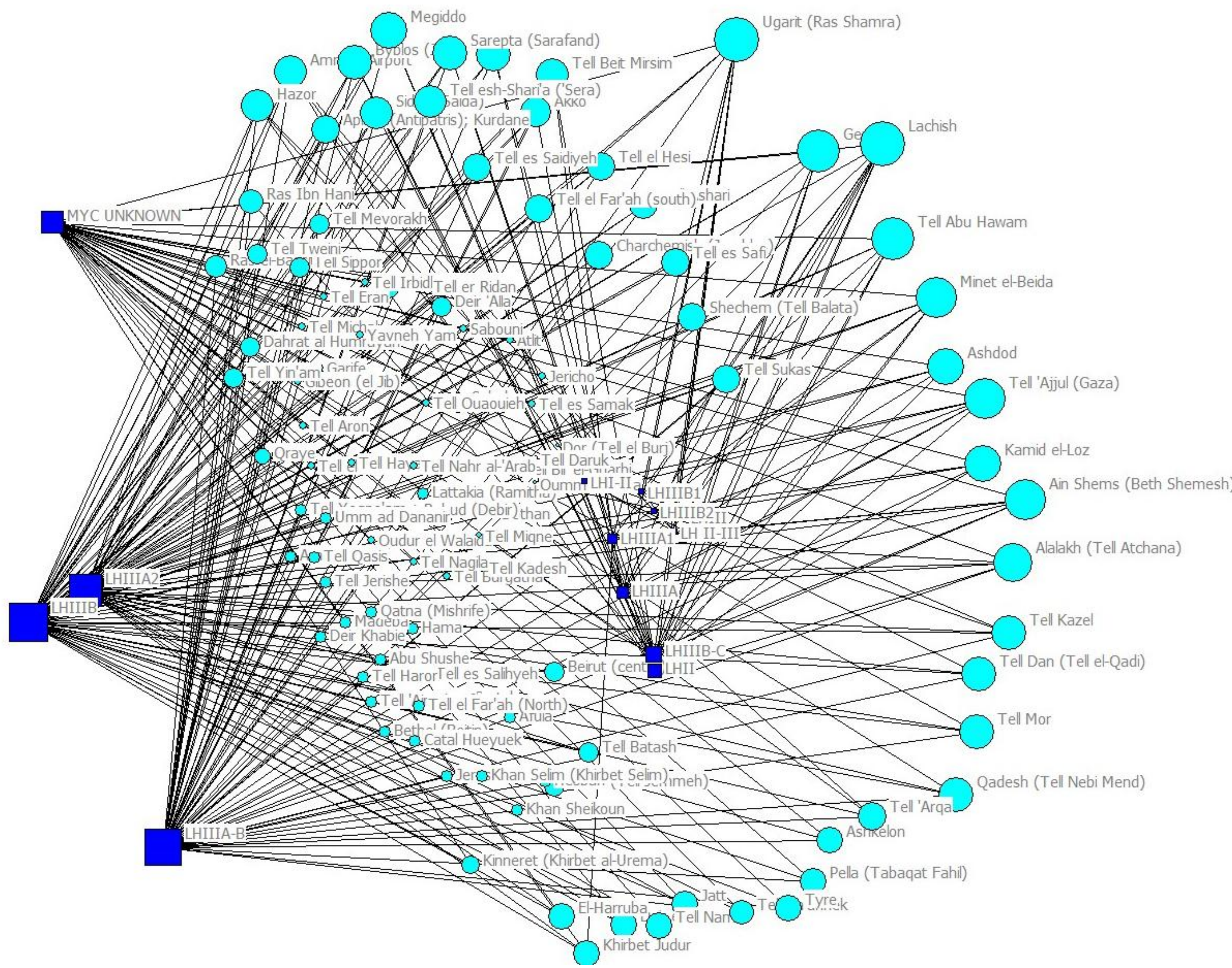

Figure 7-34. Two-mode network of Mycenaean imports in the Levant by chronological period, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures.

connecting to both the common ware node groups (located on the left of the graph), as well as the more rare chronological ware nodes clustered in the center of the graph. These sites include many of the large coastal centers from all regions of the Levant. The highest eigenvector centrality value for this network is held by Lachish (0.197), followed closely by Ugarit (0.196; see Appendix Table 11 for all network centrality values). These values reflect the lengthy occupations of both sites, as manifested in the presence of Mycenaean imports documented from nearly all periods of attested trade (examples are present from 11 and 10 of the possible 14 LH ware groups at Lachish and Ugarit respectively). The betweenness centrality value for Lachish is considerably higher than other network nodes due to the presence of general LH III material within the dataset, however as addressed above this artificially bolsters the importance of this node within the network (as this group does not represent an unusual type with limited distribution). Although Lachish was certainly a large and politically powerful site that was well integrated into the exchange network of the Late Bronze Age, the overall corpus of Mycenaean imports recovered from excavations is significantly smaller than many of the other important polities included here. The high centrality value is in part a function of the extensive archaeological work at the site, as well as the thorough assessment and publication of the imported material. The role of this site within the exchange network will be further examined with respect to FS shape distribution.

The connections between sites of this network are explored through a one-mode graph of Levantine sites, with edges reflecting shared chronological ware groups (Figure 7-35). Site nodes are coloured to reflect geographic region and are uniform in size, as scaling according to

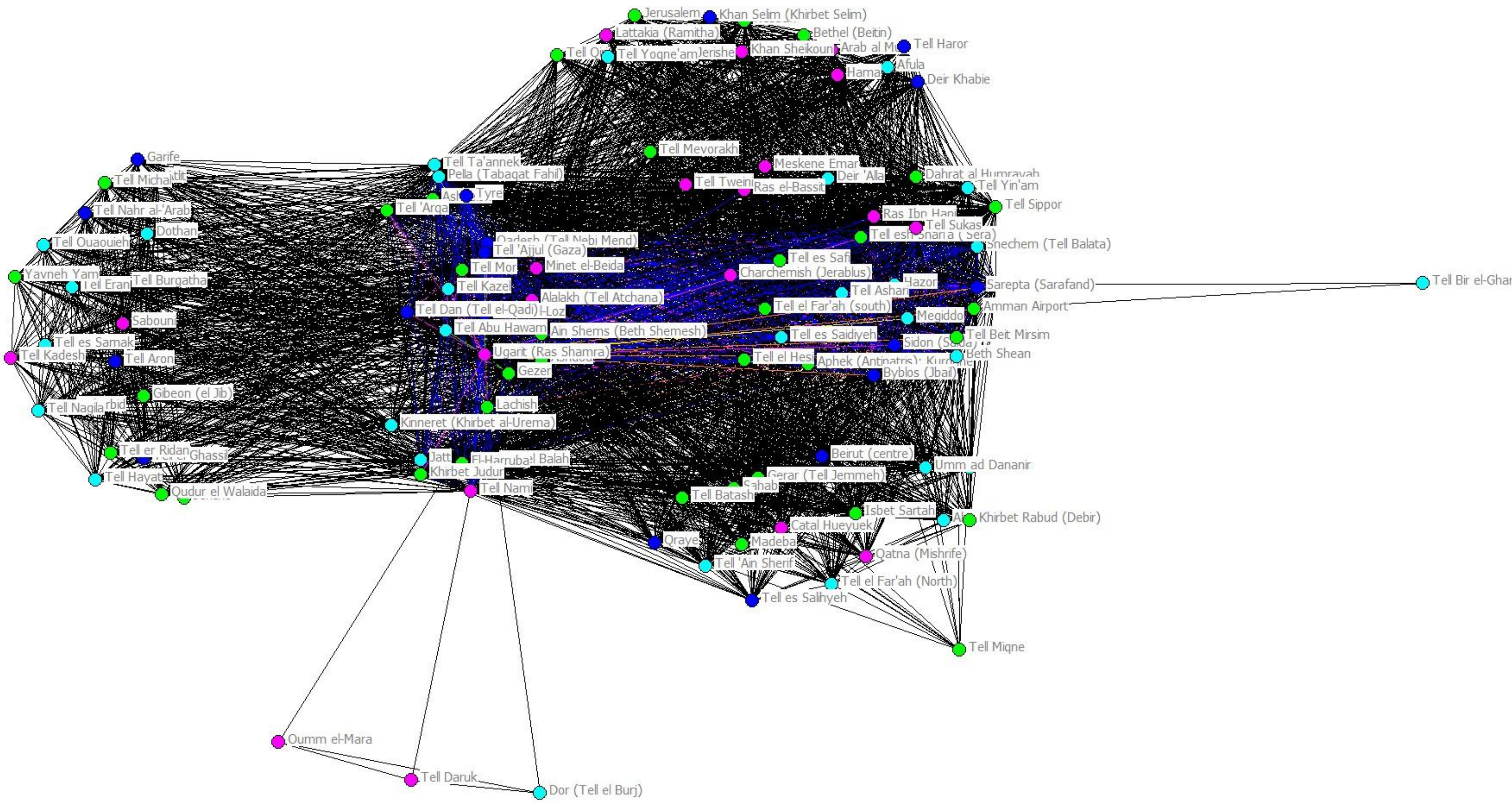

Figure 7-35. One-mode network of Mycenaean imports from the Levant. The site relationships reflect the presence of shared ware types, which are characterized by chronological period. This graph demonstrates the connections between site assemblages presented in graph Figure 7-30. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie strength is scaled between 1 and 2. Nodes are coloured according to site region.

betweenness centrality values obscured the node colour for the peripheral sites.[990] Furthermore, the betweenness centrality values of this graph are misleadingly skewed by the LH III chronological group and its limited associations with Dor, Tell Daruk, Oumm el-Mara, and Lachish, which inflates the centrality metrics for these sites (the spring-embedded algorithm situates the former three sites as a closed subgroup below the main network graph). The strongest edges connect to important centers including Ugarit and Minet el-Beida, Gezer, Lachish, Tell el-'Ajjul, and Tell Abu Hawam, as these sites contained the widest range of wares.[991] In addition to the central core, there are four blocks visible. The block to the right of the center forms the strongest connection to the core (evinced through the blue and magenta coloured edges), and includes many of the first and second tier polities not included in the network core, such as Megiddo, Sarepta, Tell Sukas, and Byblos. The blocks above and below this cluster on the right side of the graph correspond to sites with finds ascribed exclusively to the LH IIIA-B groups (for the upper block) and sites with both LH IIIA2 and LH IIIB finds (the lower block). The nodes clustered to the left of the graph represent those sites from which only material of undetermined chronological date was recovered (i.e., the pendant node sites from the two-mode network Figure 7-30).

Visual observation of the one-mode network indicates little geographic clustering, as nodes from all regions are spread throughout the different graph sections. In order to ascertain the role of location in ware distribution, the correspondence and scaled geodesic coordinates were regressed against both discrete regional values, as well as GPS coordinates. The resulting

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[990] Site nodes are coloured according to the following regions: L1-Magenta; L2-Blue; L3-Aqua; L4-Green.

[991] The colour key for node ties is as follows: 1-2: Black; 3-Blue; 4-Magenta; 5-Orange; 6-Yellow; 7-Green; 9 - Red.

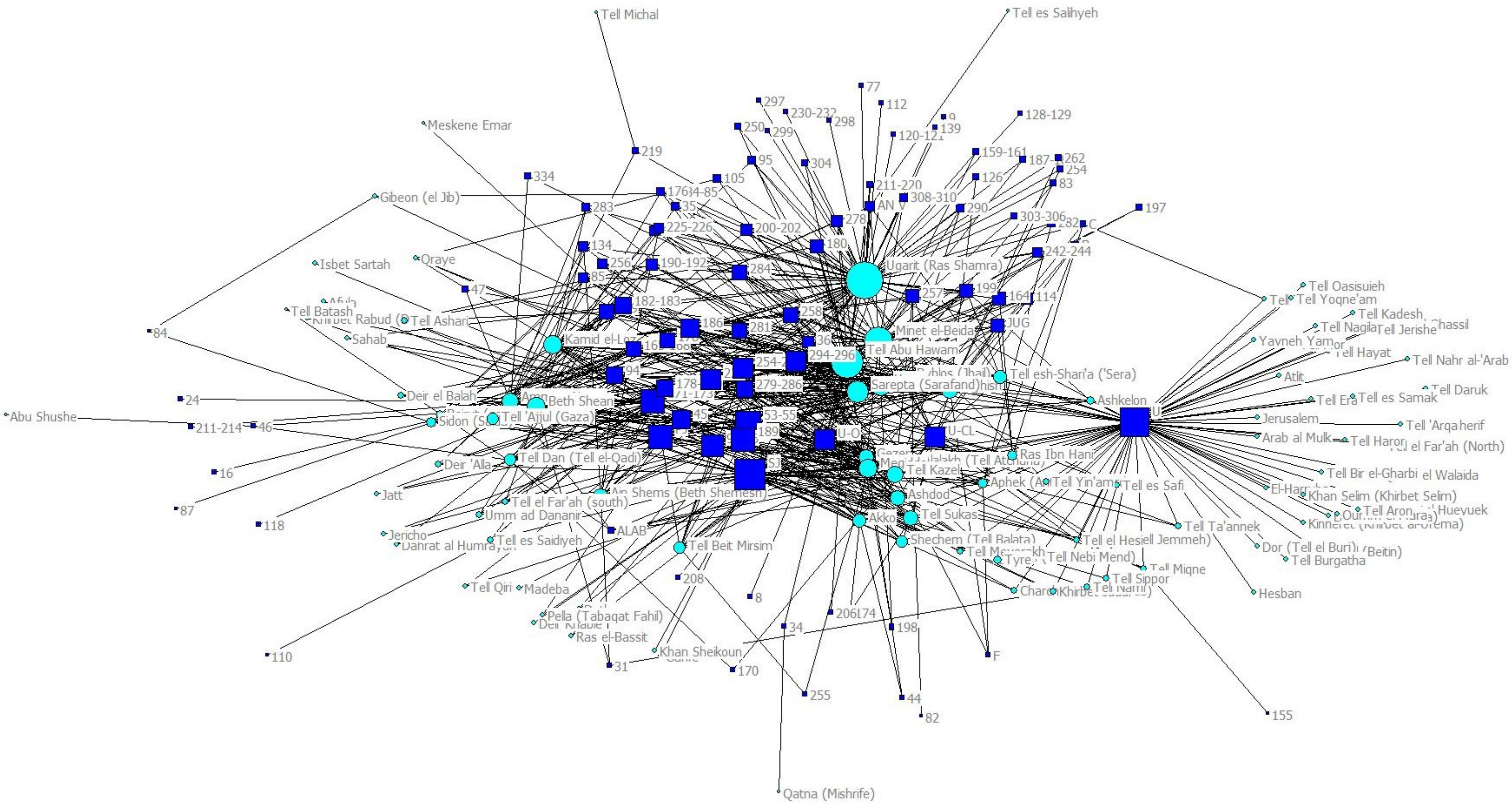

Figure 7-36. Two-mode network of Mycenaean imports in the Levant by FS shape. Node symbols are sized according to eigenvector centrality measures.

R^2 values were very low (ranging from 0.003-0.004), confirming the absence of geographic clustering with respect the LH chronological ware groups in the network graph. The network analysis results suggest that the chronological ware categories are overly general and too broad to elucidate effectively any idiosyncrasies within the broad circulation system of Mycenaean wares in the Levant.

FS Shape Network

In order to address the presence of regional distribution variations, a network of Mycenaean material in the Levant with respect to FS shape groups was constructed (Figure 7-36). Immediately observable is the large number of pendant nodes, representing sites from which only a single FS shape was recovered. Of the 109 site nodes, 50 form pendant nodes within this graph (or 45%), which is only marginally lower than the network of FS shapes in Egypt (in which 48% were pendant nodes).[992] In addition, the Levantine network includes the largest number of sites from which only material of 'unknown shape' is recorded. This group, displayed as pendant nodes on the right side of the graph, account for 38 nodes (or 34% of network sites), substantially higher than either Cyprus or Egypt (at 25% and 26% respectively).[993]

The spring-embedded graph structure also highlights the range of vessels present in the assemblages of Ugarit, Minet el-Beida, and Tell Abu Hawam, as these three nodes are largest in size (according to eigenvector centrality values), and they are visually surrounded by a number

[992] The lowest proportion of pendant nodes was found in the network of FS shapes in Cyprus, in which 38 of the 96 nodes were connected to the network through a single FS shape node (representing 39% of all network site nodes).

[993] The high proportion of sites with only material of unknown shape is likely a function of the procedures for data recording in older excavations that were more common in the Levant.

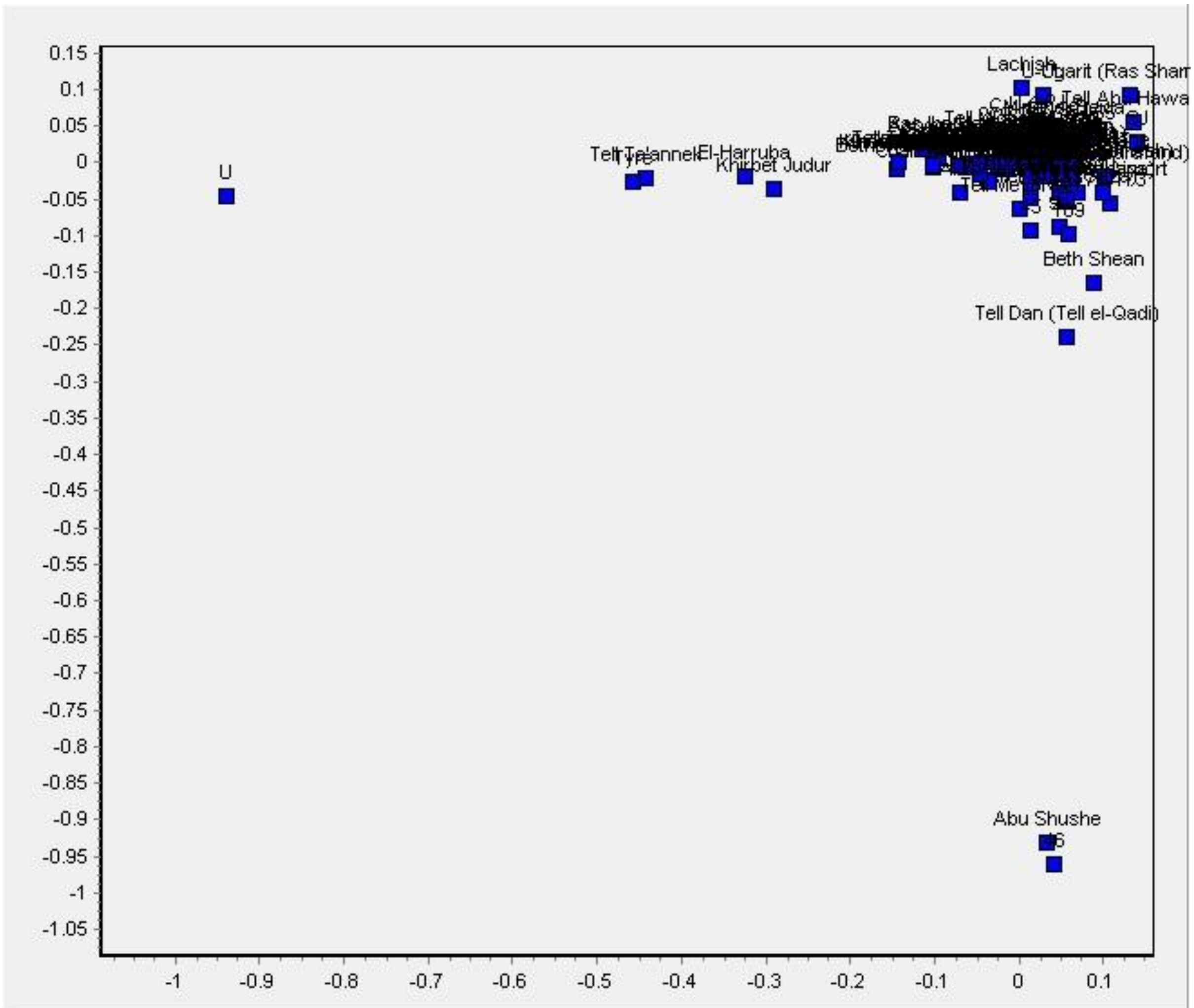

Figure 7-37. Scatterplot of correspondence scaling scores of the two-mode network of Mycenaean imports in the Levant by FS shape.

of ware nodes that connect predominantly to these three sites; there are a large number of pendant nodes connected exclusively to Ugarit (located above this site in the graph). There are also a number of rare FS shapes located on the lower periphery of the network, which denote those less common shapes that were recovered from less centrally integrated sites with smaller assemblages.

The FS shape nodes with high centrality values include a number of the general shape groups, which run horizontally in the center of the network. These include the piriform jars,

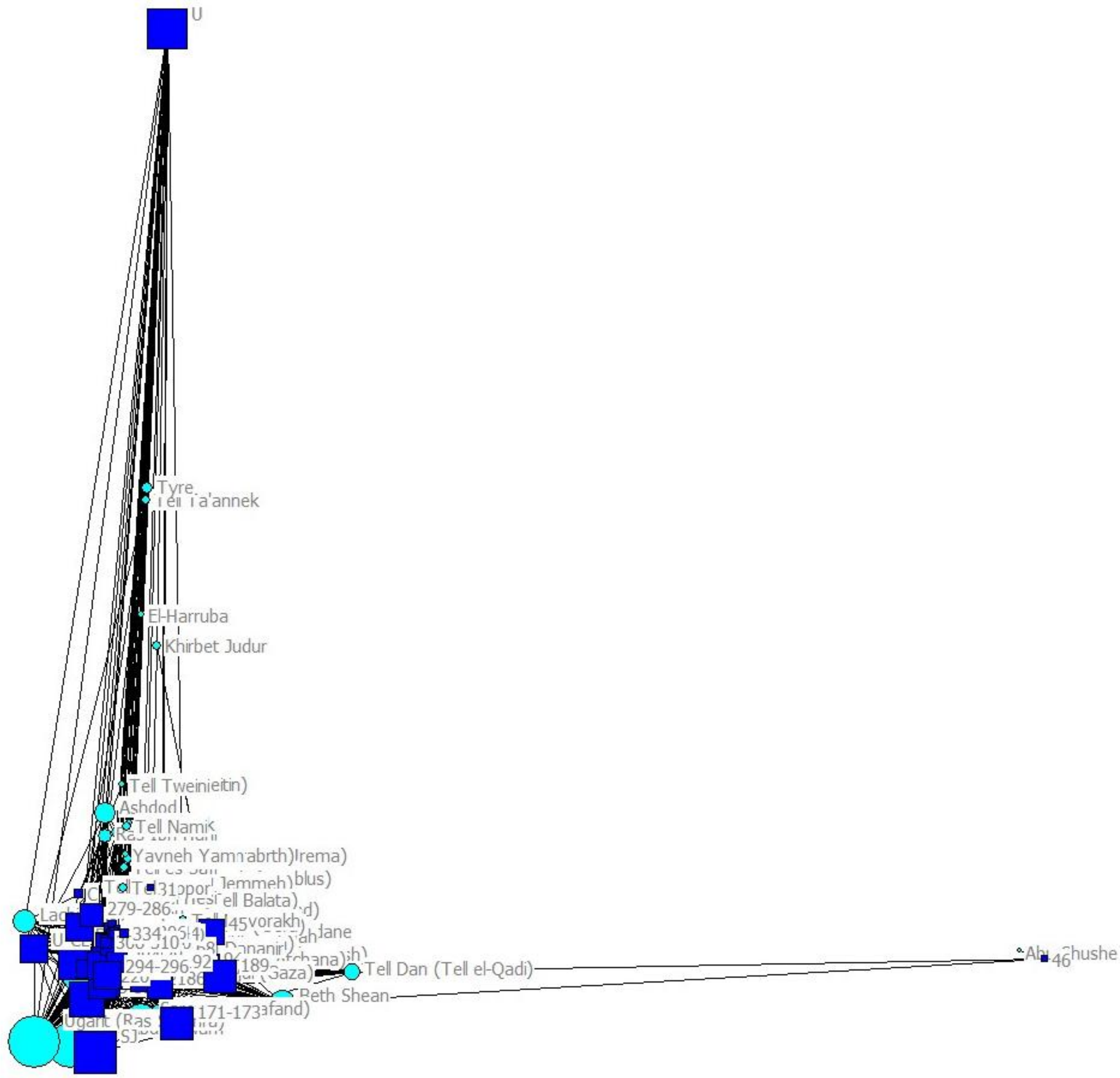

Figure 7-38. Two-mode network of Mycenaean imports in the Levant by FS shape, with nodes located according to coordinates derived from correspondence analysis.

stirrup jars, unknown open shapes, unknown closed shapes, and completely unknown vessel sherds. Other vessel types with high 2-mode centrality values include: FS 45 (piriform jar), FS 53-55 (amphoroid krater), FS 94-95 (straight-sided alabastron), FS 171-173 (globular stirrup jar), FS 178-180 (squat stirrup jar), FS 186 (lentoid flask), FS 189 (vertical globular flask), FS 220 (shallow semiglobular cup), FS 254-278 (stemmed cups), FS 279-286 (deep bowl), and FS 294-

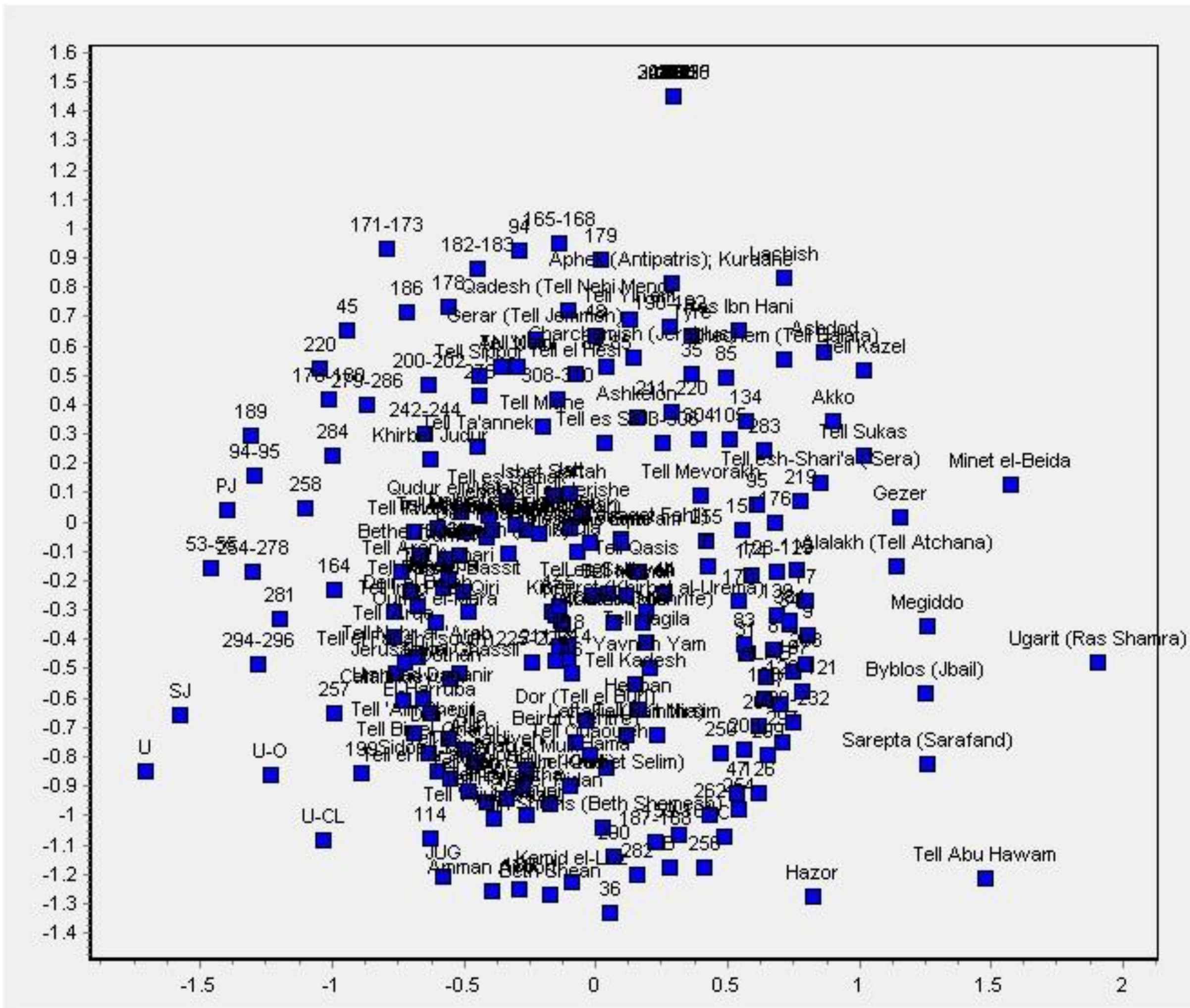

Figure 7-39. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Mycenaean imports in the Levant by FS shapes.

296 (shallow angular bowl). These shape nodes with high centrality values notably include both open and closed vessels.

The relationship between site assemblages is assessed according to correspondence analysis, which yields node coordinates (presented in scatterplot Figure 7-37). The majority of sites and wares appear in the highly overlapping cluster at the top of the scatterplot, from which the large assemblages of Ugarit, Tell Abu Hawam, and Lachish have been slightly differentiated due to the size and range of shapes in their assemblages, and are situated along the periphery.

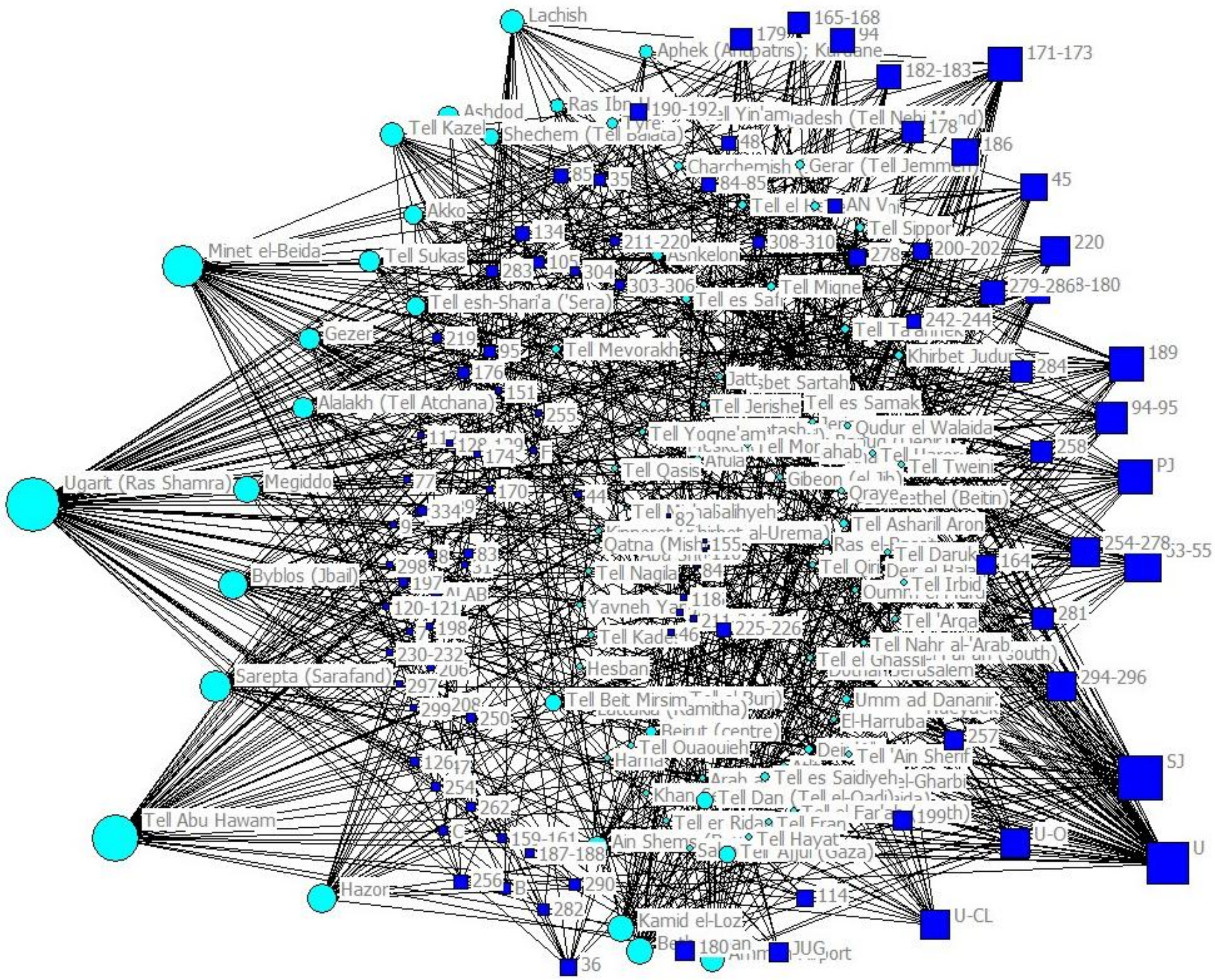

Figure 7-40. Two-mode network of Mycenaean imports in the Levant by FS shape, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures.

Sarepta and Minet el-Beida are also placed in the periphery in close proximity to the former three sites, as well as the general 'stirrup jar' node, as these sites yielded the highest quantities of this shape.

Two groups are clearly discernable as dissimilar to the core cluster in both the scatterplot and associated graph (Figure 7-38). The first group is represented by piriform jar FS 46, which has been recovered at only three sites—Abu Shushe, Tell Dan, and Beth Shean. The close proximity of the Abu Shushe site node is due to the exclusive presence of this shape at the site. The dissimilarity of the unknown shape group is reflected in the betweenness centrality measures for this node, which is significantly higher than any other FS type (due to the number of sites that yielded exclusively vessels and sherds of indeterminate shape (for centrality measures, see Appendix Table 12).

To assess the overall network structure, coordinates for both node types were calculated through the non-metric multidimensional scaling of geodesic distances (according to similarity). The scatterplot of coordinates (Figure 7-39) exhibits the same clustering of general shape groups evidence in the original two-mode network graph; this cluster includes the SJ, U, U-O, and U-CL nodes, which appear near the bottom left corner of the graph. Nodes show three general groups, resembling circular rings. This structure is also observable in the two-mode graph of imports according to FS shape (Figure 7-40). The sites with the smallest assemblages and the wares with the most restricted distribution lie near the center of the network, and are surrounded by a secondary ring of nodes of tertiary size. Peripheral to these groups are the nodes of highest eigenvector centrality values, of which Ugarit, Minet el-Beida, and Tell Abu Hawam are the largest. To this peripheral group we may add Hazor, Sarepta, Byblos, Megiddo, Alalakh, and Gezer, which exhibit strong similarities in assemblage composition. A group of sites with

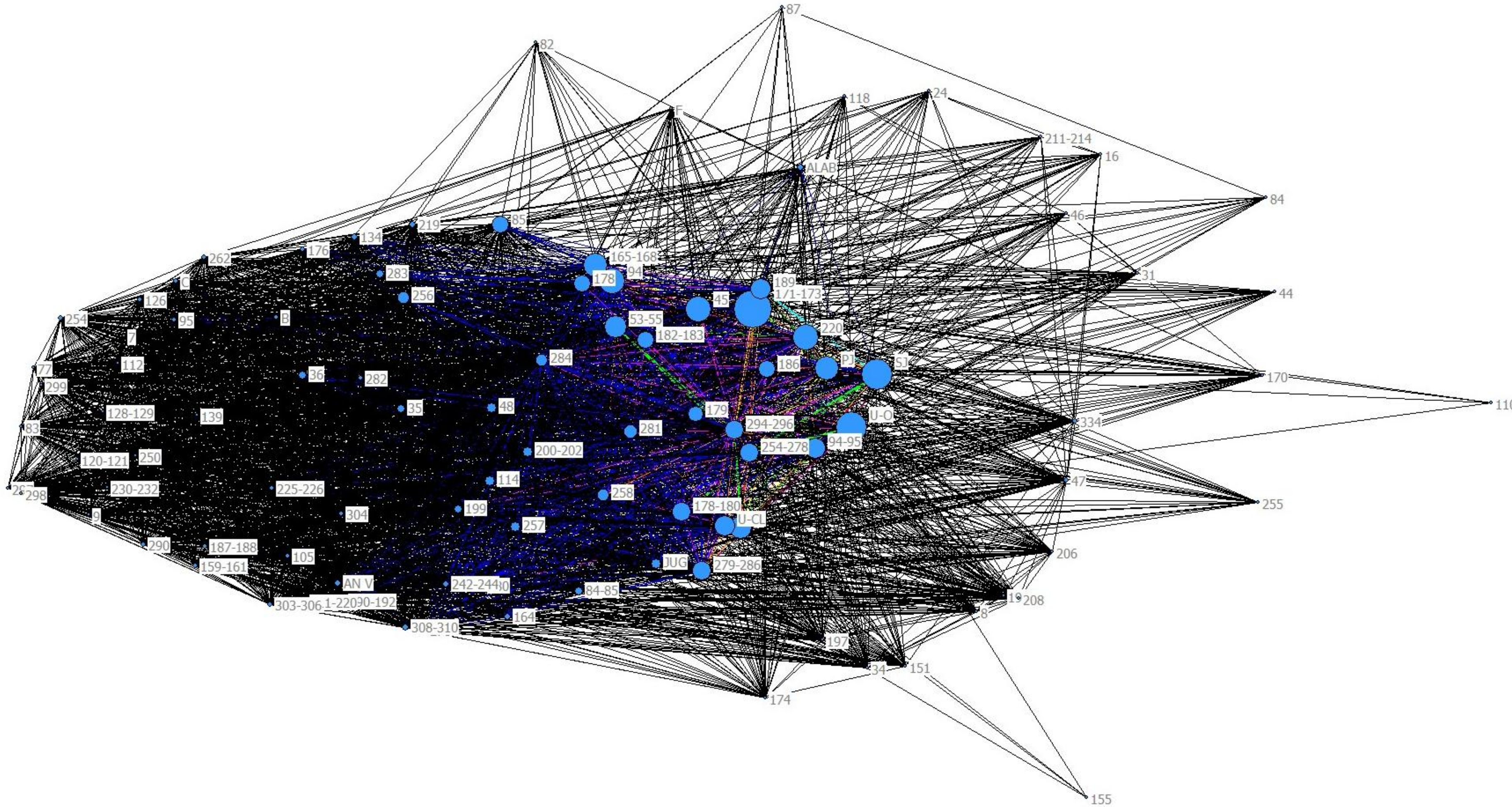

Figure 7-41. One-mode network of FS shapes imported to the Levant. The relationships reflect the number of sites at which each pair of shapes was present. This graph demonstrates the connections between site assemblages presented in graph Figure 7-36. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie strength is scaled between 1 and 2. Nodes are sized according to betweenness centrality measures.

moderately high centrality values cluster near Lachish.

The distribution of FS shape nodes also suggests the presence of distinct groups, of which the cluster of general shape nodes has already been observed (of the shape groups this is the most clear in the scatterplot and graph). Aside from the cluster of rare shapes and sites in the center of the graph is a peripheral ring of shapes, adjacent to the sites of high centrality, which represent ware groups generally restricted to these larger centers. To the right side of the network are the most commonly circulated FS shapes, of which the general groups cluster together at the lower right corner. It is interesting to note that many of the most popular stirrup jar shapes, including FS 165-168, 171-173, FS 178, FS 179, FS 178-180, and FS 182-183 are all located in close proximity at the top right corner of the graph. This would suggest similarities in distribution, as these vessels are situated within close geodesic distance within the two-mode network (low network path-lengths in a two-mode network suggest the shared presence of these forms atindividual sites). Between these two groups are a number of other highly popular shapes, including FS 94-95, FS 189, FS 254-278, FS 53-55, and the general piriform jar group.

The relationship between the various FS shape groups can also be examined through a one-mode network, in which edges reflect the shared presence of a pair of shapes within at least one site (Figure 7-41).[994] The large cluster of FS groups on the left of the graph represent relatively uncommon shapes that occur within larger assemblages. These nodes therefore connect to a number of other shape nodes, however the edge values are three or less (depicted by the black coloured ties), meaning that they do not appear with any other shape at more than three sites. On the other edge of the graph are a number of peripheral shape nodes that are similarly

[994] The colour key for node ties is as follows: 1-3: Black; 4-6: Blue; 7-8: Magenta; 9-10: Orange; 11-12: Yellow; 13-14: Green; 15-16: Pink; 17-18: Aqua; 19-24: Red.

uncommon, yet generally appear at smaller sites with smaller shape ranges. Although the range of vessel types is small at the sites within which these peripheral rare forms occur, the imports found in conjunction generally include popular shapes. These peripheral FS shape nodes therefore represent the anomalous rare vessel types from a given—usually smaller—site. An example is the side-spouted Jug (FS 155), of which a single Levantine example was recovered from Tell Miqne. In association with this find were sherds and vessels of unknown shape, including examples tentatively interpreted as unknown open and closed forms. This node therefore connects to these three general and highly central nodes, yet includes no other network edges.[995]

The central core of highly connected shape types is reflected in both the size of the nodes (scaled through betweenness centrality values), as well as edge colours (assigned according to tie strength). The data reflects binary relationships, meaning that tie strength is dependent on the number of sites of shape co-presence, irrespective of the quantity of vessels. The edges of highest value connect the general stirrup jar and unknown shape nodes, and connect from these nodes to the amphoroid krater (FS 53-55), the straight-sided alabastron (FS 94-95), and the vertical globular flask (FS 189). Strong ties are also present between these shapes and the piriform jar (FS 45), the globular stirrup jar (FS 171-173), the conical stirrup jar (FS 182-183), the shallow semiglobular cup (FS 220), the general stemmed cup group (FS 254-278), and the shallow bowl (FS 294-296). Most of these popular shape groups correspond closely with the shapes popular in both Cyprus and Egypt—the exception being the paucity of open vessel shapes (including FS 53-55 and FS 220) in Egypt.

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[995] A similar network position is observable for the globular wide-necked jug (FS 110), which has a single attested example from Tell es Saidiyeh. Other recorded shape types from this site include the general SJ, FS 84, FS 171-173, and FS 178-180, all of which are popular vessel types found at numerous other sites.

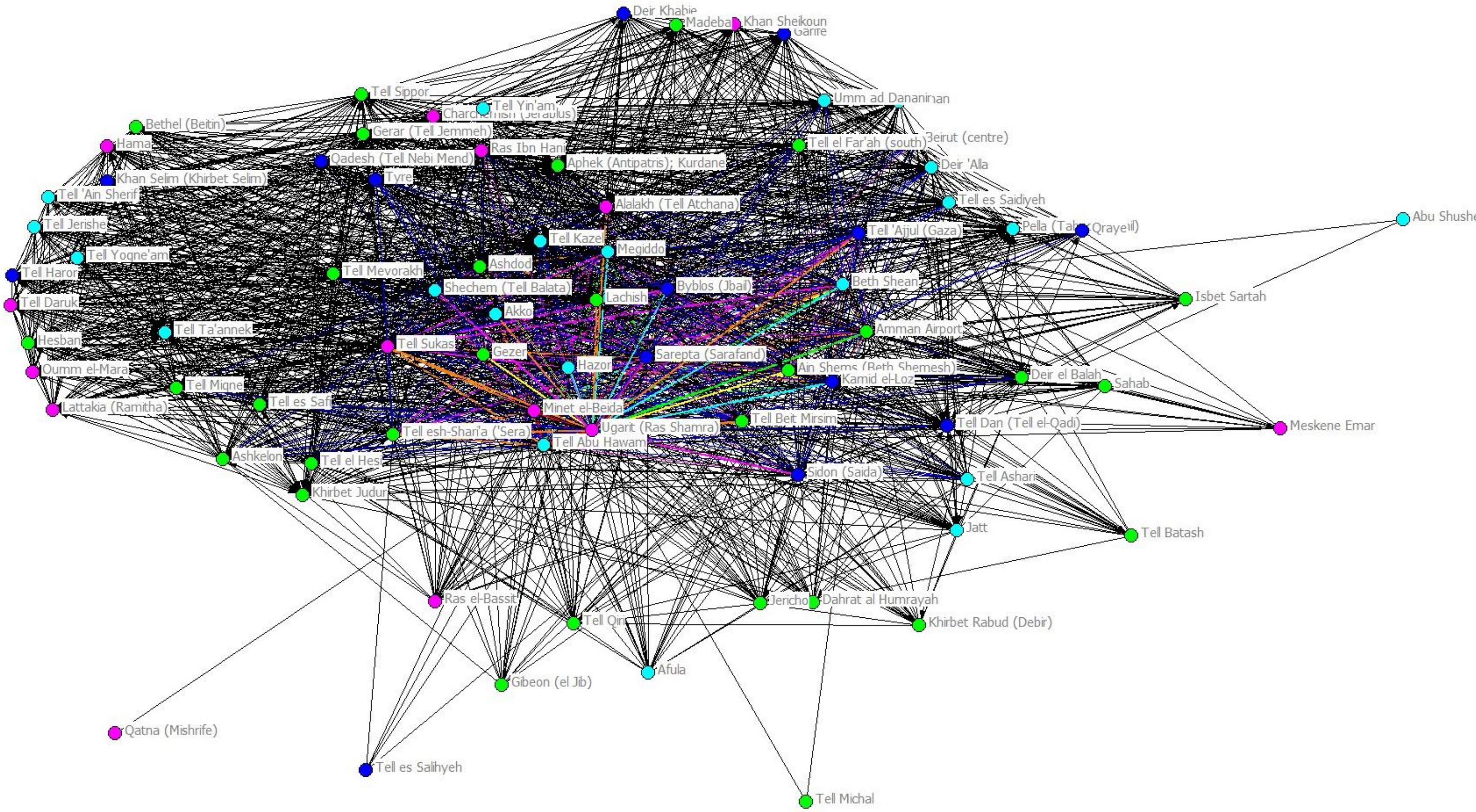

Figure 7-42. One-mode network of Levantine sites with Late Helladic imports. The relationships reflect the number of shared FS shapes between each pair of sites. This graph demonstrates the connections between site assemblages presented in graph Figure 7-36. Edges in this network are coloured to demonstrate the strength of ties (as in the number of shared ware groups), while tie strength is scaled between 1 and 2. Nodes are coloured according to site region.

The one-mode consolidated network of sites Mycenaean imports in the Levant according to FS shape is presented in Figure 7-42. This spring-embedded network is constructed with Ugarit at the center, and strong ties (represented by the thick coloured edges) radiating out.[996] Nodes in this graph are not scaled according to betweenness centrality values, however the spring-embedded function incorporates centrality measures in node arrangement. As both Ugarit and Tell Abu Hawam include a number of highly rare shapes in their assemblages (many of which appear only at these two sites), the betweenness centrality measures for these two sites are extremely high relative to other site nodes. Many of the remaining sites situated in the central cluster represent large political centers, either located on the coast or on inland trade routes; these include Tell Kazel, Byblos, Hazor, Sarepta, Tell Sukas, Alalakh, Lachish, Megiddo, Ashdod, and Gezer.

Within this network, blocks of similar nodes are less visibly partitioned than in the two-mode network. The main cluster on the left side of the graph represents the sites with smaller assemblages, which are densely connected through the shared presence of popular shapes. With limited FS groups present, the edges connecting node pairs from this group are all of a low degree (represented here with black ties). The nodes along the lower periphery of the graph conversely represent sites from which uncommon shapes are present, which connect predominantly to larger centers (within which the associated rare shape is also present). The general dissimilarity of the overall assemblages of these sites repel them from the main network structure by means of the spring-embedded orientation algorithm.

Upon visual inspection, there appears to be some minimal geographically derived

[996] The colour key for node ties is as follows: 1-3: Black; 4-6: Blue; 7-9: Magenta; 10-12: Orange; 13-15: Yellow; 16-18: Green; 19-22: Aqua; 24-26: Pink; 31-38: Red.

clustering, particularly of southern Levantine sites (represented by green nodes) in the peripheral ring of nodes in the bottom and right side of the network (of which they account for over half).[997] These nodes, however, show very little interconnection between them. This would suggest then that rare shapes, when circulated outside of large regional centers, were frequently deposited at sites of the southern Levant. Where other groups of related sites appear they rarely include more than three nodes, with site nodes of all four regions instead widely distributed within this network. From this network structure it would appear as though Mycenaean ceramic distribution was not contingent on geographic location, with vessels of all types circulated throughout all four areas. This inference is corroborated by the regression of site location (both in terms of region and GPS coordinates) against coordinate values attained through correspondence and multidimensional scaling, which determined that the correlation between these variables was insignificant.[998]

Functional Group Network

The distribution of Mycenaean imports in the Levant according to functional group is presented in Figure 7-43. As noted in the FS shape network above, the Late Helladic material from the Levant includes the largest group of sherds and vessels classified as ‘unknown’ in shape, rendering the largest number of sites as isolates in this network, as unknown vessels are excluded from this graph. There are also a large number of pendant nodes attached to both liquid and dry goods storage vessels (13 and 6 respectively); although the quantity of pendant nodes is comparable to the functional graph of Mycenaean imports in Egypt, it represents a smaller

[997] The colour key for node region is as follows: L1-Magenta; L2-Blue; L3-Aqua; L4-Green.

[998] R^2 values generated through this regression analysis ranged between 0.003 and 0.010.

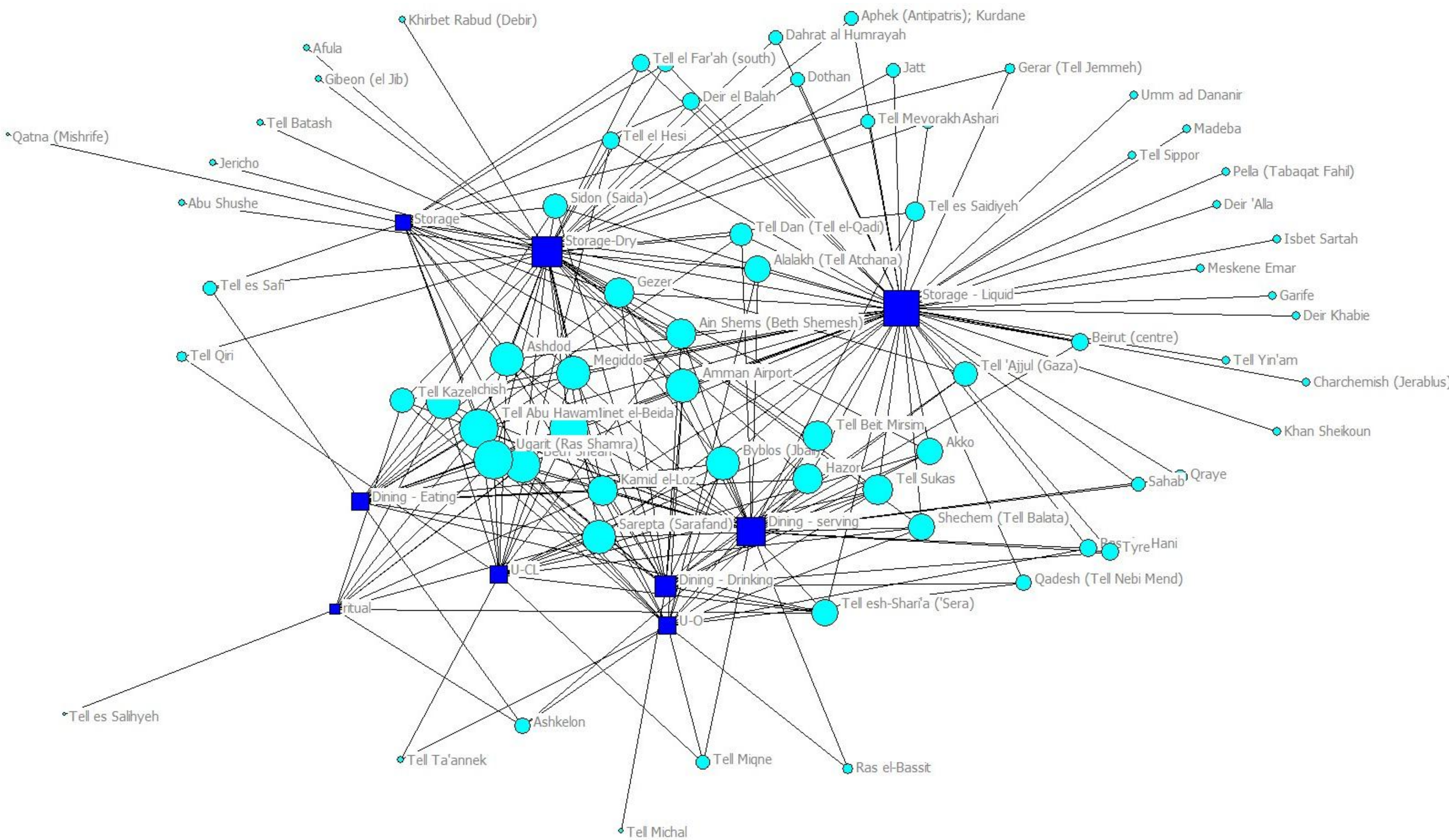

Figure 7-43. Two-mode network of Mycenaean imports in the Levant by functional use group. Nodes are scaled according to eigenvector centrality values.

proportion of the Levantine network. Of the less common functional types, most appear in conjunction with more popular vessel groups. Exceptions include Tell es Salihyeh, which yielded a single animal shaped vessel, and Tell Michal, which held a single semiglobular cup (FS219).

The large cluster of nodes with high eigenvector centrality measures in the center of the graph represent the sites from which multiple (four or more) different functional sub-groups are present. This includes the major coastal and inland centers with large and varied assemblages. Of these sites, Minet el-Beida, Tell Abu Hawam, and Ugarit contain vessels of all functional groups presented here, while Beth Shean contained eight and Amman Airport, Ashdod, Byblos, Lachish, Megiddo, and Sarepta contain seven of the possible nine edges. This group of sites that include between seven and nine functional groups is proportionally far higher than in either the Cypriot or Egyptian networks.[999] Import distribution in the Levant is therefore more widely diffused across a greater number of sites that enjoyed access to a large and diverse assortment of vessel types and shapes.

As with the functional group network of Mycenaean imports in Cyprus, the most common groups are the liquid and dry goods storage vessels, as well as dining vessels used for serving. The group node with the highest degree centrality is the ‘storage-liquid’ group—stirrup and piriform jars, alabastra, and flasks—which has a degree centrality of 0.495 (centrality measures are presented in Appendix Table 13). Following the popular ‘storage-liquid’ node are the ‘storage-dry’ and the ‘dining-serving’ nodes with degree centralities of 0.385 and 0.294 respectively. The eigenvector centrality measures are closer in value than the degree centrality metrics due to the high number of pendent sites nodes with small assemblages that connect to

[999] The group of Levantine nodes with seven or more edges includes 10 sites, representing approximately 15% of the total network. This exceeds the number of sites in Cyprus (a total of six comprising 8% of the total network) and Egypt (two sites which represents 5% of the network site nodes).

both storage vessel type nodes.[1000] The popularity of drinking vessels in the Levant is higher than Egypt but lower than Cyprus, while ritual vessels appear at more sites and in far greater numbers (due largely to the substantial collections of rhyta from Ugarit, Minet el-Beida, and Tell Abu Hawam).

7.4 Discussion

When assessing the circulation of different FS shapes, characteristics of the network structure as a whole must be examined. The average degree for the network Cypriot sites according to FS imports is 56.7, meaning that the sites with Mycenaean imports are connected by shared vessel shape with, on average, approximately 56 of the 96 other sites with Late Helladic ceramics (or 58%; see Appendix Table 17). The site with the highest degree value is Enkomi with 92 of 95 possible edges present, followed by Hala Sultan Tekke, Katydhata, and Maroni Tsaroukkas, with 88, 87, and 86 respectively (see Appendix Table 14). The degree centralization of the graph, which measures the distribution of degree values among nodes, is 0.379. This analytic—often referred to as Freeman's Graph Centralization or Freeman's Measure—effectively calculates the global centrality of the network, by examining the extent to which edges are concentrated amongst limited nodes.[1001] This metric is based off the star network (seen in Figure 4.9 on the right), in which the central node is connected to every other node in the network—giving it a degree of *n-1*—while all other nodes share only one edge with the central vertex. The Freeman Measure for graph centralization measure, given as a value between zero

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[1000] Although the spread between the degree centrality values of these three most common vessel types equals 0.201, the spread between the corresponding eigenvector centrality values is only 0.122.

[1001] Freeman 1977, 1979.

and one, calculates the extent to which a given network inclines towards this extreme scale of centralization.

Cohesion measures were then calculated with FS shape groups consolidated in order to eliminate any group overlap. For closely related subtypes FS numbers were grouped together (i.e., FS 84 and FS 85 were combined into FS 84-85), while broader ranging groups were added to the general shape categories; specifically, the general FS 254-278 and FS 279-286 groups were amalgamated into the general 'cup' and 'bowl' groups. Following this consolidation there was marginal effect on the overall graph centralization, which has a normalized degree value of 0.3731 (down from 0.3794). Consolidating ware groups also impacted individual sites' degrees, as Enkomi increased its degree measure from 92 to 93; the degree values for Hala Sultan Tekke and Katydhata also increase by one, while the degree values of many other sites remain unchanged (as is the case for Maroni Tsaroukkas).

The degree centralization for Egypt is higher than on Cyprus, with a normalized graph degree of 0.500. This suggests that the Egyptian network for Cypriot imports tends towards a scale-free network, in which edges are concentrated among a highly connected core of sites. This value is also inflated by the high number of relatively uncommon shapes and wares that are particularly concentrated at large political centers. The average degree of the network is 31.50, meaning that Egyptian sites thus share on average at least one FS shape type with approximately half of the other sites from which Mycenaean vessels were recovered. The highest site degree is 62 (of a possible 63 connections), which is held by Tell el-Amarna, followed by Buhen, Gurob, and Tell el-Dab'a, with degrees of 59 (see Appendix Table 15). Saqqara and Qantir—which generally have high eigenvector network centrality values—have degrees of only 39 and 38 respectively (meaning that they share ware types with only approximately 60% of other Egyptian sites). Following ware group consolidation, the graph centralization, as reflected by the average degree, decreases slightly to 0.4982.

The network centralization of the Levant is comparable to that of Cyprus, with an average degree of 65.211. This gives a density of roughly 60%—comparable to the measure for the network of FS shapes in Cyprus, but greater than for that of Egypt. The nodes with the greatest number of connections are Ugarit and Tell Abu Hawam (with 106 of 108 possible connections), followed by Minet el-Beida at 104, and Sarepta, Hazor, and Byblos at 103 each (see Appendix Table 16). Other sites with degree values of 100 or more include Ashdod, Gezer, Lachish, and Megiddo. The degree centralization of the graph is 0.385, which is slightly higher than Cyprus. With the increase in density there is a corresponding decrease in centrality, as medium and smaller scale sites become more integrated into the network through an increasing quantity of edges. After FS shape groups are consolidated, there is a slight decrease in the group centralization degree of the Levantine network (the degree value drops from 0.3847 to 0.3810). While Ugarit maintains its degree value of 106, Tell Abu Hawam increases to 107 (meaning that the Tell Abu Hawam assemblage contains at least one FS shape in common with 107 of 108 other possible Levantine sites).

In all the networks, the sites with the highest degree values—Enkomi in Cyprus, Tell el-Amarna in Egypt, and Ugarit and Tell Abu Hawam in the Levant—are almost entirely integrated within the network, sharing ware types with nearly all other regional sites. The minimal effects on network integration following the consolidation of ware groups is not unexpected, as the number of examples recorded in each of the distinct FS shape groups is relatively small, and the presence of closely related subtypes at specific sites often correspond. This measure is also normalized, and reflects a proportional value of network realization, therefore changes to the number of columns in the data matrix will result in at least minimal alterations.

In order to assess the network impact of the 'unknown' shape groups (including unknown, unknown-closed, and unknown-open categories), the degree values were calculated for the regional networks with these groups omitted. The graph degree centralization for the Levantine network fell slightly to a value of 0.375 (compared to 0.385 for the origin data matrix). The density of the network also decreases substantially, suggesting that the presence of unknown shape groups within the data matrix artificially inflated a number of edge values.[1002] The number of sites included in this network also drops from 109 to 70, while Ugarit and Tell Abu Hawam continue to have the largest degrees at 67 and 68 of 69 possible edges respectively.

The removal of unknown shape groups from the Cypriot network data created some unexpected effects. The graph centralization degree average increases for Cyprus from an original value of 0.379 to 0.411, however the density of the network decreases significantly.[1003] This means that the remaining sites are connected to, on average, more network nodes, however the edge values decrease—specifically that joined nodes now share fewer FS shapes in common. The structure of the network is far reduced, as there are a number of sites that also become isolated from the network through the removal of these general ware groups, thus the number of site nodes drops from 96 to 70. Enkomi remains the most well-connected network node, with a degree of 67, however the site with the second largest number of connections is now Kourion

[1002] In the comparison of network densities between valued graphs, the value decreases from 48.1633 to 40.6313 following the consolidation of related subtypes and the removal of unknown shape groups, while the density of the binary graphs decreases from 1.1549 to 0.7188. Measures were calculated through a bootstrap paired sample t-test. A decrease in network density is logical given the commonness 'unknown shape' node groups.

[1003] In the comparison of network densities between valued graphs, the value decreases from 271.6228 to 15.9904 following the consolidation of related subtypes and the removal of unknown shape groups, while the density of the binary graphs decreases from 1.1511 to 0.7711. Measures were calculated through a bootstrap paired sample t-test.

Bamboula with a degree of 66; since Kourion Bamboula had no recorded vessels of unknown shape in the dataset, the degree of 66 remains constant, however the site is now connected to all but two sites in this new network iteration.

The greater network connectivity of sites in Cyprus following the removal of unknown shape groups demonstrates the extent of material circulation masked by the poor recording and reporting of finds. The real density of the Late Bronze Age distribution network would likely fall between the two measures calculated here (with and without unknown shapes), as numerous edges between sites are artificially present through the shared 'unknown sherd' group, however the single value tie representing this group would multiply in many cases in accommodation of the numerous shapes currently grouped under this heading. The most evocative example of the impact of partial data on network measures may be made with the material from Hala Sultan Tekke. Of the nearly 2200 sherds and vessels included here roughly 80% are recorded as being of 'unknown shape' (including those of unknown closed or open forms). In addition to these general groups, 29 other FS shape types are attested at the site (compared to 67 at Enkomi). Within the original network, Hala Sultan Tekke has a degree of 88, meaning that the assemblage shares at least one FS group in common with 88 other sites (or 92% of the network). Once the unknown shape groups are removed, the degree drops to 62, which represents again roughly 90% of the network (which had decreased in size to 70 nodes). It is likely, given the size of the assemblage and range of vessels attested, that Hala Sultan Tekke would remain highly integrated—perhaps with a degree approaching Enkomi's—within the network should future publication provide more precise data on vessel forms. In that case, however, the density of the network would likely increase dramatically, as existing edges would increase in value as paired sites would share an increasing number of FS shapes.

Following the removal of unknown shapes from the network of FS groups in Egypt, the graph centralization degree decreases substantially from 0.500 to 0.372, while the number of nodes decreases from 64 to 44. This demonstrates the high proportion of site edges formed by unknown shapes. It is interesting to note that many of the sites with high numbers of unknown vessels are also the sites with slightly unusual assemblages—both in shapes types and ware groups (such as Tell el-Amarna, Tell el-Dab'a, and Amara West). Although the presence of unknown shapes thus connected these sites to other nodes with smaller assemblages, the removal of the unknown shape groups thus reduced the dominance of these sites in the overall network. Accordingly, the network density decreases following the removal of the unknown groups, although less dramatically than observed with either the Levantine or Cypriot networks.[1004] Tell el-Amarna remains the most well-connected node, with 41 of 43 possible edges present.

Network structures were also assessed for the presence of subgroups or 'k-cores'. Through this analysis, the Cypriot network was partitioned into a structure with 18 different components in relation to site degree (as a function of the number of other sites with which the node shares an FS shape). The primary block within the Cypriot network is composed of sites above a threshold of $k = 62$ (where k represents the degree, or number of site edges). This value delineates the critical threshold at which the interconnectivity falls off sharply, with the successive highest k-core group valued at 38 (which includes Kourion Bamboula). This primary k-core incorporates 63 sites or approximately 66% of the network (see Appendix Table 14 for partition metrics). The network was then assessed according to the consolidated data matrix, with

[1004] In the comparison of network densities between valued graphs, the value decreases from 38.6300 to 19.1558 following the consolidation of related subtypes and the removal of unknown shape groups, while the density of the binary graphs decreases from 0.6875 to 0.4236. Measures were calculated through a bootstrap paired sample t-test.

the primary subgroup maintaining a minimum degree of 62. The alterations made to the input data—specifically the consolidation of certain shape groups—increased the degree of the least connected nodes, as the *k* value for the least integrated subgroup increasing from *k* = 3 to *k* = 6.

When the network of Mycenaean material imported to Egypt is similarly assessed for k-cores, the data is fractured into 7 components (see Appendix Table 15). The first subgroup groups sites with a degree of *k* = 32 or greater, while the seventh subgroup is represented exclusively by Heliopolis (*k* = 1), which is minimally connected to the network through the presence of one FS 181 stirrup jar example (which again only appears within Egypt at Heliopolis and Balabisch). The primary subgroup at *k* = 32 incorporates 33 sites, representing 52% of the total network (a smaller group than the primary k-core of the Cypriot network). The second k-core group is significantly closer in degree to the primary network at *k* = 28 (and includes 20 sites). As observed with the Cypriot network, the degree threshold of the primary subgroup following consolidation remains constant at *k* = 32 edges. The majority of k-core values are unchanged, except for the fourth subgroup, which assumes an increase from *k* = 8 to *k* = 11.

The network of Mycenaean imports from the Levant shows similar fragmentation to the network of Cypriot sites, with up to 17 clusters detected. The first partition occurs at a degree of *k* = 70 (see Appendix Table 16 for partition metrics). This primary k-core includes 71 sites, representing 65% of the total network. The second partition falls substantially lower at *k* = 40, and includes 17 sites. Similar to Egypt, there is a single outlier site, Qatna, which constitutes its own subgroup defined at *k* = 1 (reflecting the shared presence of piriform jar FS 34 at Qatna and Tell Abu Hawam). This shape has a highly limited distribution within the eastern Mediterranean, appearing elsewhere only at Enkomi and Tell el-Amarna.[1005] Again, the degree of the largest subgroup is unchanged following consolidation (*k* = 70). There is still also a large gap between the coreness values for the primary and secondary subgroups (*k* = 70 and *k* = 40), however the following cluster coreness values are relatively close.

Of the three regional one-mode site networks constructed to assess the distribution of Mycenaean imports with respect to general LH Ware group, the Cypriot network has the highest density measure (0.720; for all cohesion metrics, see Appendix Table 18). This metric reflects the proportion of possible total edges realized within the network. This is considerably higher than the density of the one-mode site network according to FS shapes (0.597). The Levantine network of LH wares also yields a higher density (0.635 versus 0.604), while the Egyptian network density measure drops slightly below the FS shape network level (0.460 versus 0.500). Given the ability demonstrated above for general ware groups to inflate the density of the network through the creation of artificial links between sites with shared general shape (i.e., "jar"), the LH Ware network provides a better indication of the sites actively engaged in the distribution network at any given time. The high-density values also suggest a relative degree of diachronic consistency, as sites with of different occupation period are relatively well connected to those from other periods through shared ware groups. The significantly lower density value for Egypt may reflect diachronic shifts in the distribution of Mycenaean vessels in Egypt, which may echo shifts in consumption visible in the importation of Cypriot vessels (including the relative popularity of BRI vessels versus BRII).

The high density of the one-mode networks for Mycenaean imports in Cyprus is echoed

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[1005] The high number of vessels and sherds recorded as 'piriform jar of unknown type' from numerous other sites may render this perceived rarity invalid.

in the cohesion observed of the two-mode network by FS Shape, which is the least fragmented of the three regional networks (which has a fragmentation value of 0.230; see Appendix Table 19).[1006] All three networks are partially fragmented, as they are two-mode networks, for which no one region yielded all FS shapes attested throughout the Mediterranean. Of the other two regional systems, the Levantine network corresponds fairly closely to that of Cyprus, with density and fragmentation measures of 0.048 and 0.273 respectively. Despite the similarity of these two regional networks, the data from Egypt diverges sharply. The network of Mycenaean imports in Egypt is significantly more fragmented, with a fragmentation measure of 0.619. The density is accordingly low at 0.030. These cohesion measures for the three regional networks thus vary in accordance with the breadth of shape range present, with the greatest number of distinct types present in Cyprus, and the lower number attested in Egypt.

Cohesion measures were reassessed following the consolidation of associated shape subtypes, as well as the omission of unknown general groups. With these alterations, the Cypriot network becomes significantly more fragmented, with the fragmentation score increases from 0.230 to 0.437. This high measure reflects the artificial inflation generated through the removal of certain ware groups, while maintaining the original sample of site nodes (many of which now have no imports included in the new network). The density and average geodesic path distances, however, remain fairly consistent—suggesting a similar degree of overall connectivity between the included nodes. Comparable results were observed with the equivalent alterations to the network of Mycenaean imports in Egypt, with the graph becoming highly fragmented (the

[1006] The fragmentation measure reflects the proportion of node pairs that cannot be linked through the network. Fragmentation values greater than zero reflect a disconnected graph. See Appendix Table 16.

fragmentation measure increased from 0.619 to 0.754).[1007] In addition, the density of the network decreased, from a value of 0.030 to 0.024. Similarly, the consolidated network of Late Helladic vessels in the Levant exhibited reduced density (0.044, down from 0.048) as well as a marked increase in network fragmentation (0.5333, up from 0.273). In all three networks, the removal of 'unknown' vessel groups has a considerable impact on the networks structure, as a number of sites became isolates. These results emphasize the large proportion of documented vessels from each region that are recorded in only the most vague terms.

[1007] As the graph becomes more fragmented the average geodesic value begins to decrease, as the measure is calculated within graph components. A similarly shorter average geodesic distance was observed for the consolidated Levantine network.

8. CYPRIOT CERAMIC NETWORKS

The distribution of Cypriot ceramics will be briefly examined independently, before considering the potential correlation between this circulation system and that of Mycenaean wares. The examination will focus on ware groups, as this taxonomy includes both chronological as well as functional use data (as most ware types appear in standard shape groups).[1008] The focus will be on the role of these vessels as imports, therefore networks will be constructed exclusively for material recovered from Egypt and the Levant. Regionality in the production of wares within Cyprus was addressed in Chapter 6, and will be incorporated in the assessment of the overall ceramics trade network.

8.1 Egypt

The Cypriot imports to Egypt are examined here according to ware group. Differentiation is not made within this network for vessel shape, however the shapes associated with each different ware group often include a specific assortment of types. The vast majority of vessels recovered from Egypt are closed shapes, and are predominantly containers in function (including jugs, juglets, flasks, and spindle bottles). Accordingly, ware groups with vessels of predominantly closed shapes are dominant within the network of Cypriot vessels distribution in Egypt. Of the nearly 2000 sherds and vessels of imported Cypriot ceramics, there are fewer than 20 cups and approximately 140 bowls documented. The bowls and cups from Egypt are

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[1008] There is also a geographic component to the Cypriot ware group taxonomy, as certain wares are associated with particular regions of manufacture.

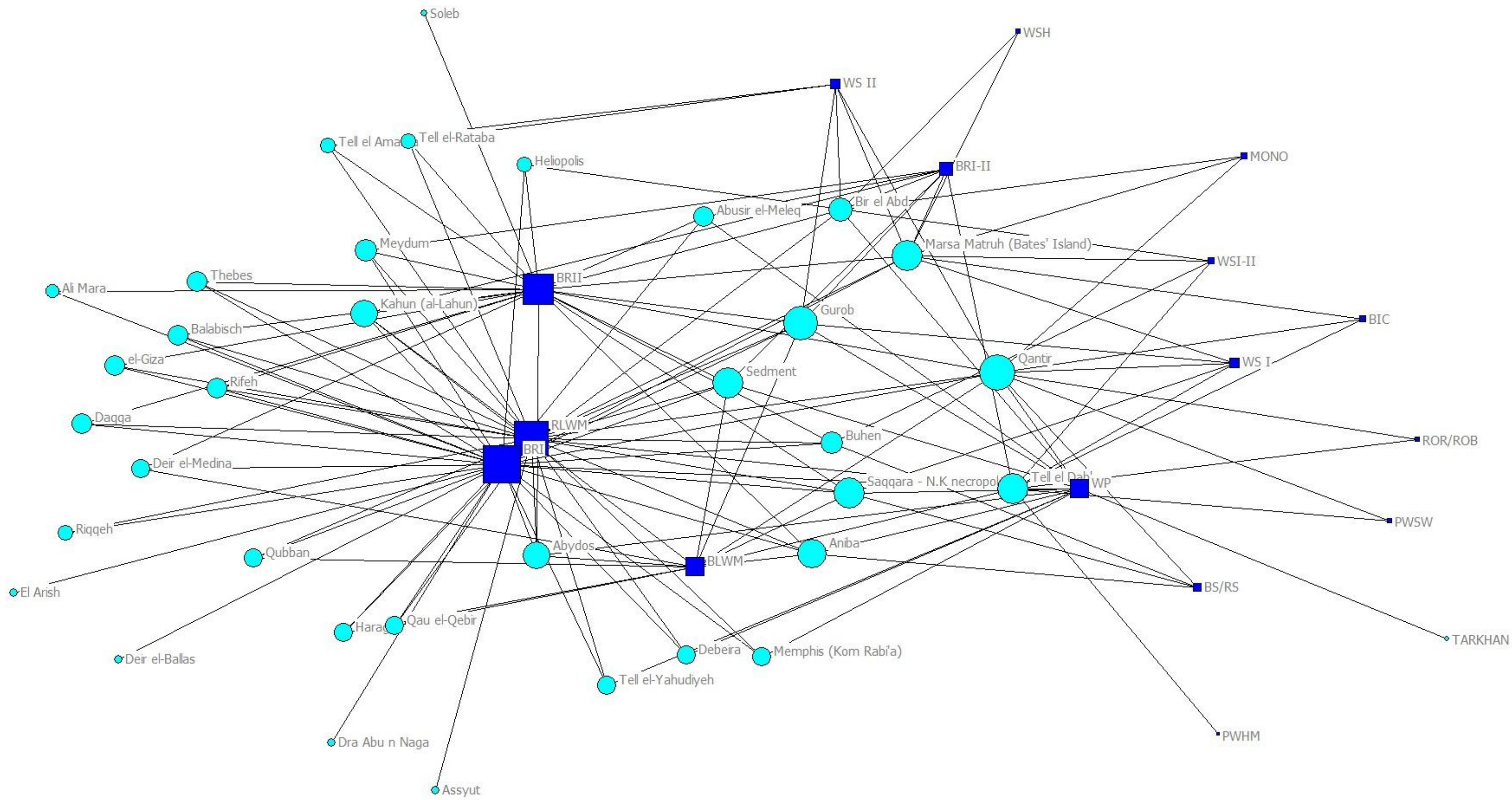

Figure 8-1. Two-mode network of Cypriot imports in Egypt.

predominantly manufactured in WS and MONO wares,[1009] which are ware groups that include almost exclusively open shapes. To these vessels we may add around 10 open vessels of unknown form, as well as a handful of kraters, including examples in both WS and BI.[1010]

The two-mode network of Cypriot vessels in Egypt (Figure 8-1) includes a number of site node isolates, which represent sites that yielded Mycenaean imports but no Cypriot vessels.[1011] Isolates of the ware mode include ceramic groups present in the Levant but not accounted for in Egypt (namely PBR and BUC wares). As anticipated, the most centrally located ware groups are BRI, BRII, and RLWM. These nodes are also the largest when scaled according to eigenvector centrality measures (see Appendix Table 20 for network measures). The least common ware groups are located on the right periphery of the graph, including BS/RS, PWSW, PWHM, ROR/ROB, BIC, MONO, and WSH. The WSI, WSI-II, and WSII nodes are also located near the periphery, and share a limited number of edges (5, 4, and 6 respectively). These wares are connected primarily to the largest sites, situated in a cluster in the center of the graph.

The sites with the highest centrality measures are grouped between the collection of ware nodes along the right perimeter, and the group of larger ware groups near the center left (BLWM, BRI, BRII, and RLWM). The sites with high centrality measures include Marsa Matruh, Qantir, Tell el-Dab'a, Saqqara, Gurob, Aniba, and Sedment—many of the same sites with high centrality

[1009] An exception to this is a small collection of BR bowls from Bir el Abd.

[1010] An example of a WS krater was recovered at Marsa Matruh, while a small collection of BI kraters (between 2 and 4) were recovered from Tell el-Dab'a (MacGuire 2009, nos. DAB345, DAB349, DAB351, and DAB 352, p. 163-165). There are roughly an additional 50 Cypriot sherds of unknown open form, however many of these vessels have indistinguishable or undocumented ware groups associated (and are therefore not included in the network).

[1011] It should be noted that there are similarly a number of sites in Egypt from which Cypriot imports were recovered with no associated Mycenaean vessels, however they have not been included here as the goal here is rather to examine the role of Cyprus in Mycenaean vessel distribution. The number of site nodes in this network drops to 36 which only sites that also yielded Mycenaean imports are included.

values from the networks of Mycenaean imports. These include both political centers with primarily domestic contexts, as well as large mortuary complexes. Despite the large size of the Cypriot ceramic corpus from Tell el-Amarna, the site node in Figure 8-1 is relatively small, and is located near the edge of the network. This reflects the limited range of ware types present—BRII, WSII, RLWM—of which only WSII is a relatively uncommon. Far more central in this graph is the site of Marsa Matruh (Bates' Island), which yielded eight different Cypriot ware groups. The greater number of types present, as well as the close network proximity of other Delta sites such as Bir el Abd and Abusir el-Meleq, would support the hypothesis that Marsa Matruh was an important stopping point on the trade route from Cyprus.[1012] Examination of this central group of nodes also reveals possible geographic clustering, as many nodes represent sites located within the Delta and the Memphis/Fayum region, with the exceptions of Aniba and Buhen in Nubia.

It is interesting to note that, relative to the graphs of Mycenaean imports, there are very few pendant nodes on this diagram. Of the sites included in this network, there are only 6 with a degree of 1, including: Tarkhan, Soleb, Assyut, El Arish, Deir el-Ballas, and Dra' Abu el-Naga'. This represents only 16% of the network, rather than the 48% of pendant nodes present in the network of Mycenaean imports. This indicates that nearly all sites from which Cypriot imports have been recovered yielded assemblages comprised of vessels from more than one ware group, suggesting the ceramics were mobilized in bundles. Of the ware groups, only PWHM is integrated through a single edge, reflecting the small collection of vessels from Tell el-Dab'a.

The network data was submitted to correspondence analysis, which generated the

[1012] For this hypothesis, see Merrillees 1968.

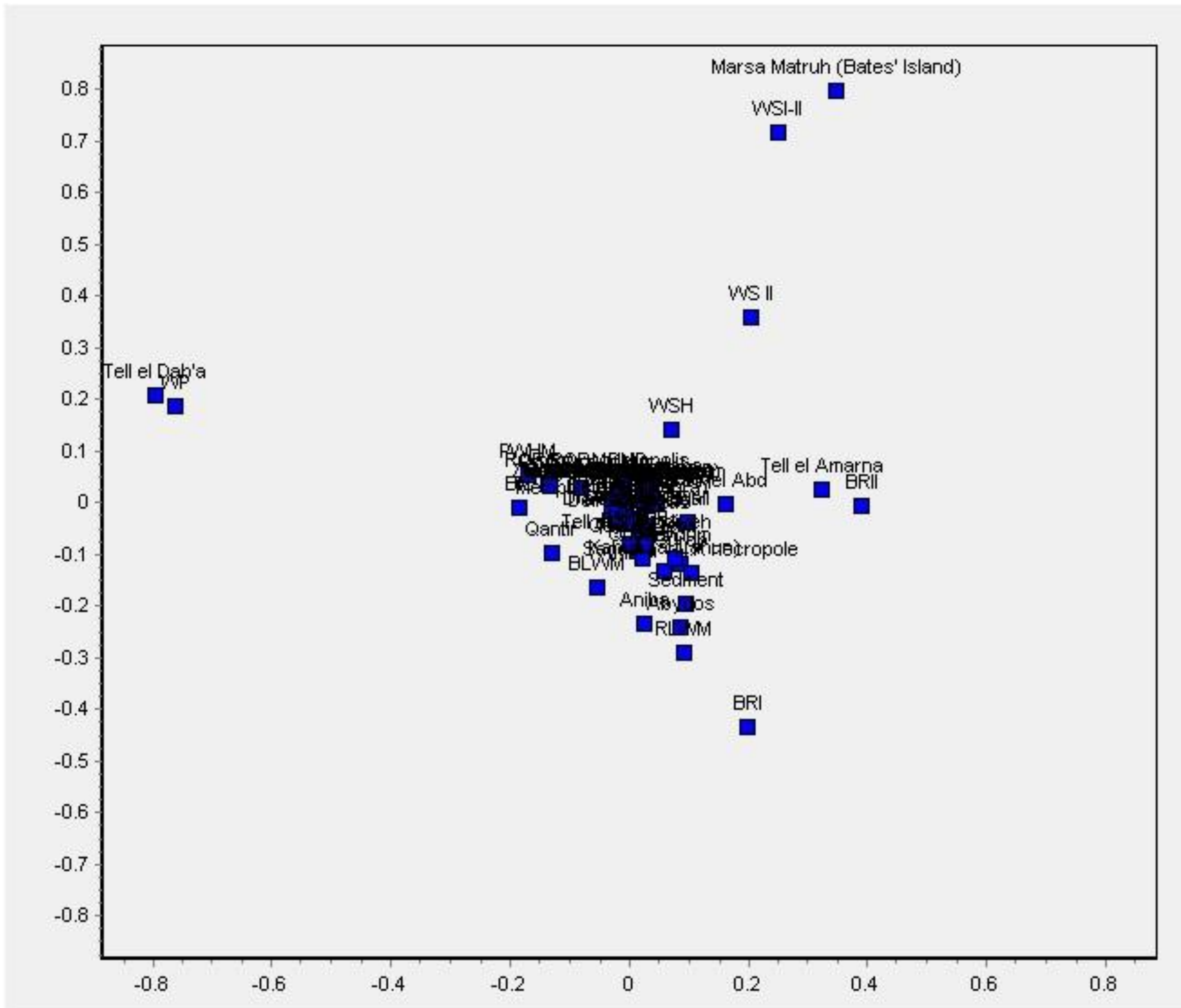

Figure 8-2. Scatterplot of correspondence scaling scores of the two-mode network of Cypriot imports in Egypt.

coordinates graphed in the scatterplot below (Figure 8-2). The graph, which spatially reflects node similarity, shows considerable overlap in which the majority of sites are clustered in the center of the graph.[1013] The scatterplot does however effectively isolate a number of ware groups, including those with limited quantities imported to Egypt or which have geographically restricted circulations (such as WSh, WSI-II, or WSII). Similarly the BRI node is in the lower periphery of

[1013] For the description of the methods and goals of correspondence analysis, see the discussion of Figure 7.2 above.

the graph, as the quantity and geographic reach of the ware's distribution is unique and therefore necessitates differentiation. BRI, along with RLWM, are the most widely distributed among Cypriot ceramic types in Egypt, appearing at 26 and 31 sites respectively; there is also significant overlap in the sites within which these two ware groups were circulated, which is reflected in their graph proximity. The position of the WP ware group to the periphery on the left is a function of both its limited distribution, as well as the concentration of the majority finds at Tell el-Dab'a. Like WP ware, WSI-II and BRII are also shown along the periphery of the main graph cluster, in close association with the sites at which they are predominantly found (specifically Tell el-Dab'a and Marsa Matruh). There is also an visual association between the lustrous wares and the sites of Abydos and Aniba at the bottom of the central graph cluster, as these sites yielded two of the largest collections of lustrous vessels[1014]; RLWM and BLWM also formed unusually large proportions of the total Cypriot assemblages recovered from Abydos and Aniba.

The sites of Marsa Matruh and Tell el-Dab'a are significantly separated from the graph's core cluster. Although the graph is calculated to capture the presence of rare ware groups at these sites, it is worth noting that both Tell el-Dab'a and Marsa Matruh are also unique in the inclusion within their Cypriot import assemblages of vessel shapes within popular ware groups that are rare in Egypt—namely open dining vessels such as cups, bowls, and kraters. In this way, the correspondence metrics appositely reflect the dissimilarity of these two sites and their Cypriot import wares from other sites in Egypt.

The positions of the different ware group nodes are more visible in the network constructed according to the correspondence scaling coordinates (Figure 8-3). The outliers (WSI-

[1014] Abydos has a recorded 17 RLWM and 4 BLWM, while Aniba has 29 RLWM and 27 BLWM. Tell el-Dab'a also has a large corpus of BLWM with 16.

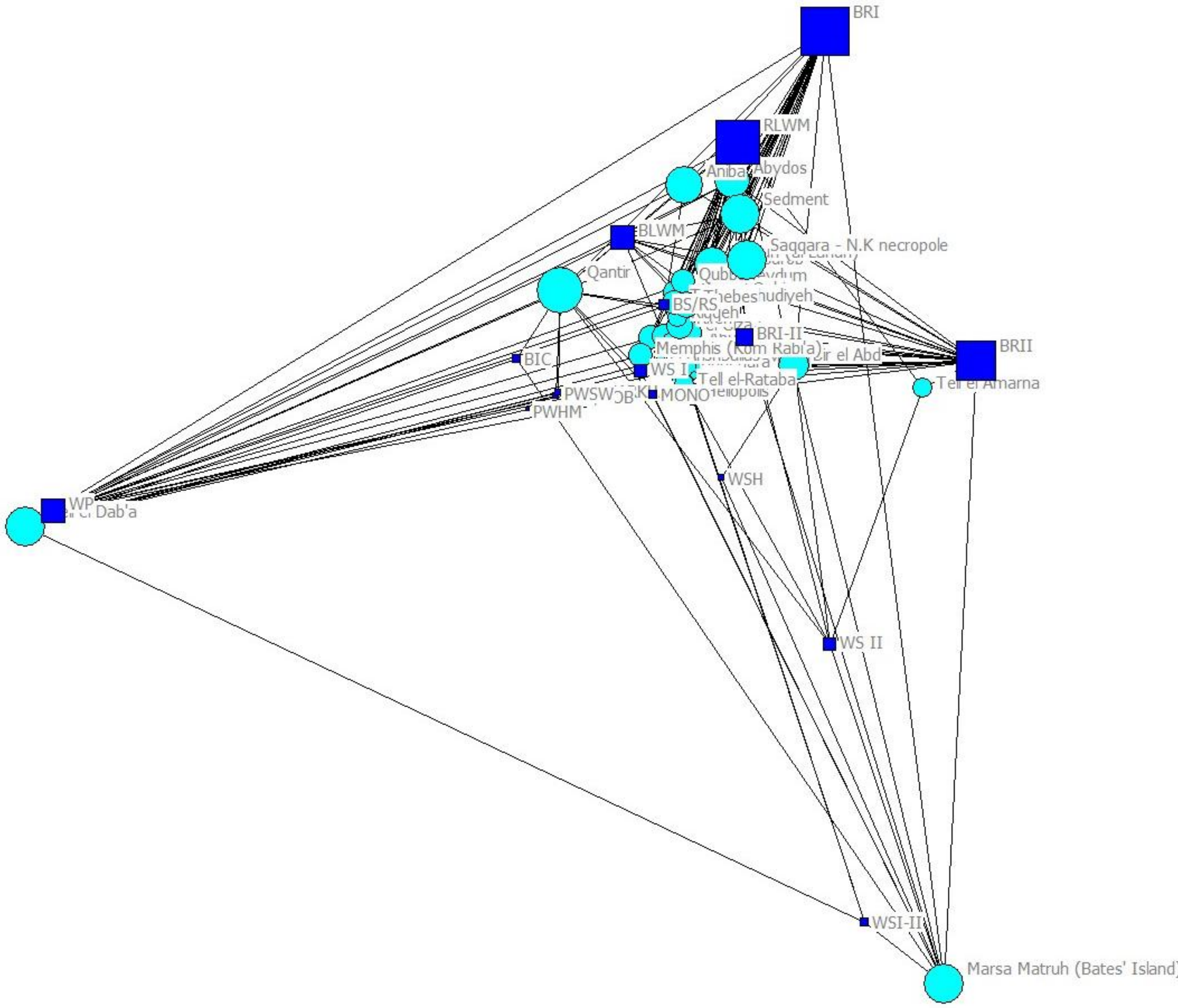

Figure 8-3. Two-mode network of Cypriot imports in Egypt, with nodes located according to coordinates derived from correspondence analysis. Nodes sizes are scaled according to eigenvector centrality measures.

II, WSII, WP, and BRI) apparent in the scatterplot are clearly differentiated, while the more centrally located ware groups are now more visible. Some additional sites with large eigenvector centrality measures from the core cluster of the network are also more visible in this graph (such as Sedment, Saqqara, Bir el Abd, Meydum, and Kahun). It is important to remember that node sizes are indicative of eigenvector centrality measures rather than assemblage size, as the WP node is considerably smaller than the BRI, BRII, and RLWM nodes, despite the greater

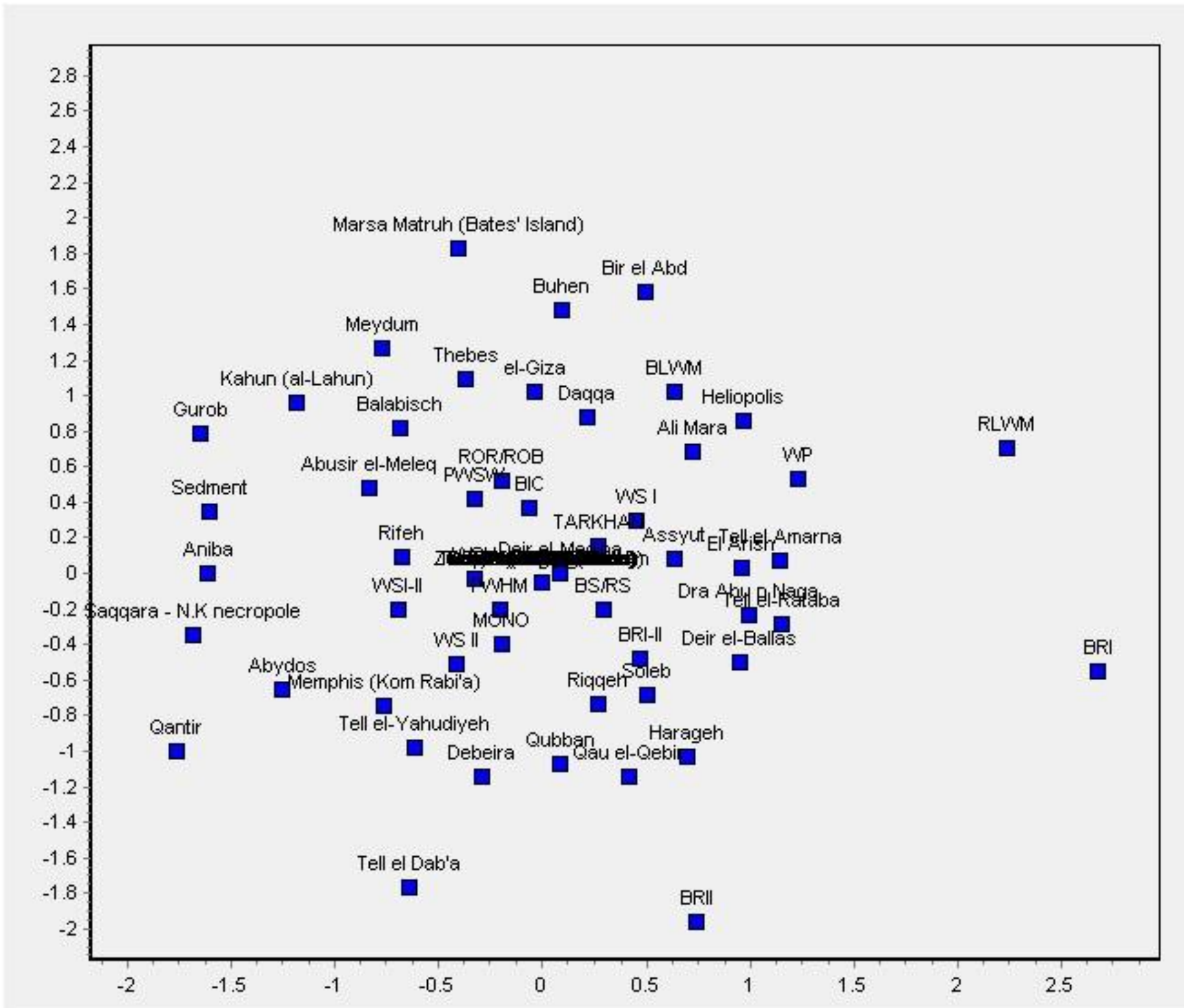

Figure 8-4. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Cypriot imports in Egypt.

quantities of the former recovered from Egypt.[1015] The site of Qantir in particular is more notable in the network graph, where it is differentiated in part due to the unusually high proportions of BLWM and WP wares in its assemblage, as well as the diversity of wares present at the site—eleven of twelve ware groups currently accounted for in Egypt have been uncovered in excavations at the site (the exception being WSh). The diversity of Qantir's assemblage is

[1015] The WP assemblage is almost identical in size to that of BRI (around 350 examples), and significantly larger than either BRII or RLWM (roughly 150 and 220 examples each).

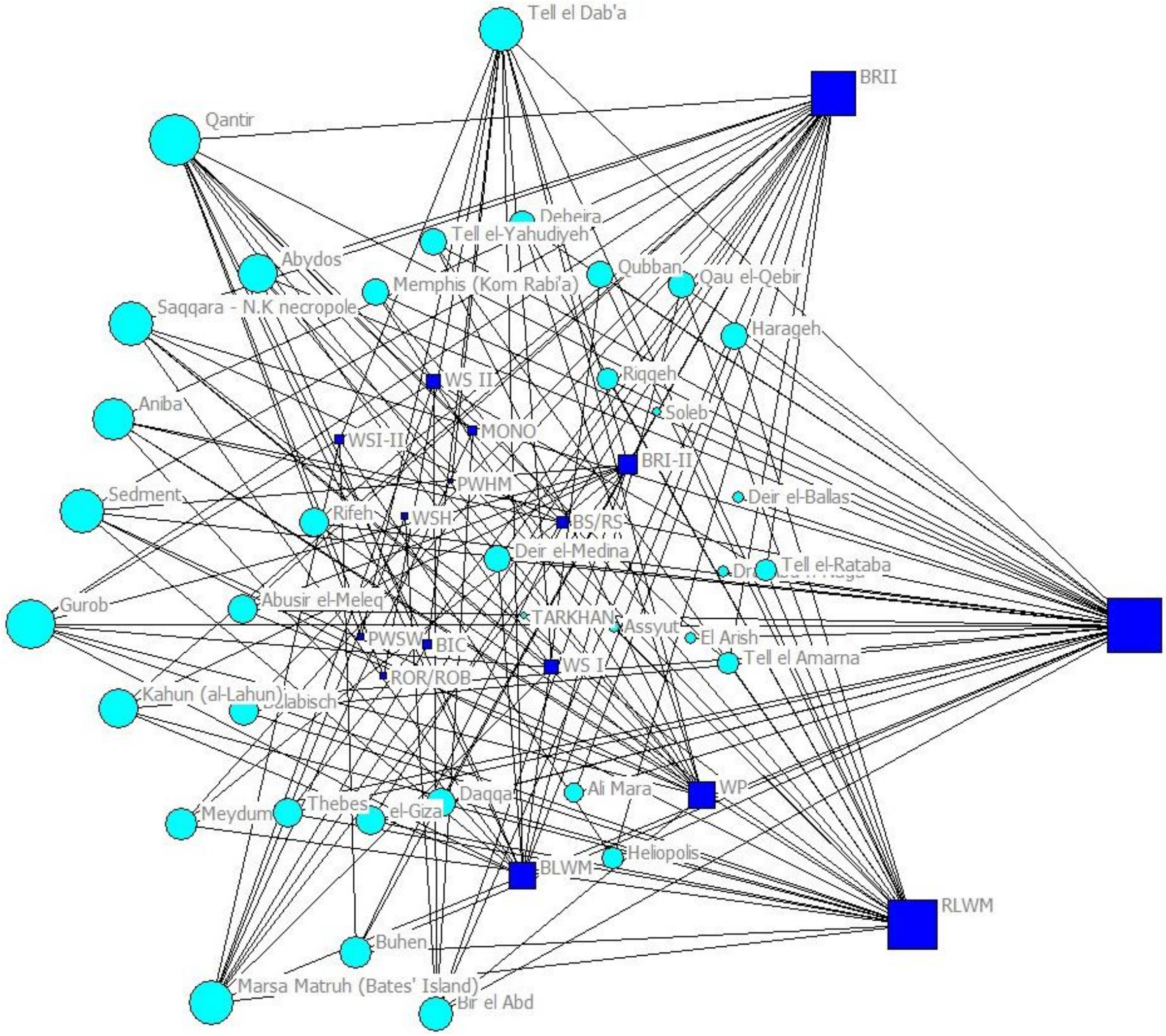

Figure 8-5. Two-mode network of Cypriot imports in Egypt, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures.

reflected in the large size of the site’s node as well as the high number of edges connecting this node to the rest of the graph. Within the two-mode network, Qantir has the highest eigenvector centrality measure, followed by Marsa Matruh, Tell el-Dab’a, and Aniba.

The relational structure of this network is graphed in the scatterplot Figure 8-4, with site coordinates calculated through the non-metric multidimensional scaling of geodesic distances.[1016] As with the correspondence scaling, the four most commonly distributed ware groups (WP, RLWM, BRI and BRII) are located along the periphery of the main network core. Within the center of the network structure is a cluster of less common ware groups, including WSI, WSI-II, WSII, and MONO, which all represent ware groups associated with open shapes (and are generally recovered from domestic contexts from a smaller number of sites).

There is little visible association between ware groups of similar chronological period within the scatterplot,[1017] however the network graphed from these coordinates (Figure 8-5) shows some chronological influence. There is a very rough general orientation, in which LBI import nodes are located within the lower half of the network, while those distributed during the LBII (BRI-II, BRII, WSII, and WSI-II) are located in the top of the graph. This rule is not absolute, particularly when considering wares distributed through both periods, such as RLWM. Rather than an indication of a diachronic shift in the distribution network of Cypriot imports in Egypt, this broad trend may instead reflect the influence on the network structure of chronologically discrete sites with proportionally large assemblages. The lack of significant chronological clustering in the graph suggests that the distribution network remained relatively consistent, with no significant diachronic shifts in regional access to Cypriot imports.

The network graph also highlights the dominant position of the most popular three wares within the distribution network. Similarly emphasized are the sites of Tell el-Dab’a and Qantir, and Marsa Matruh. In addition to large eigenvector centrality values, these three sites also contain the largest number of edges within the site node class. The majority of sites with high

[1016] For the description of the methods and goals of non-metric multidimensional scaling, see the discussion of Figure 7.4 above.

[1017] There is a small group including ROR/ROB, PWSW, and BIC in the center, however the contemporaneous wares of WP, BWLM, BS/RS, MONO, and RLWM are dispersed around the graph.

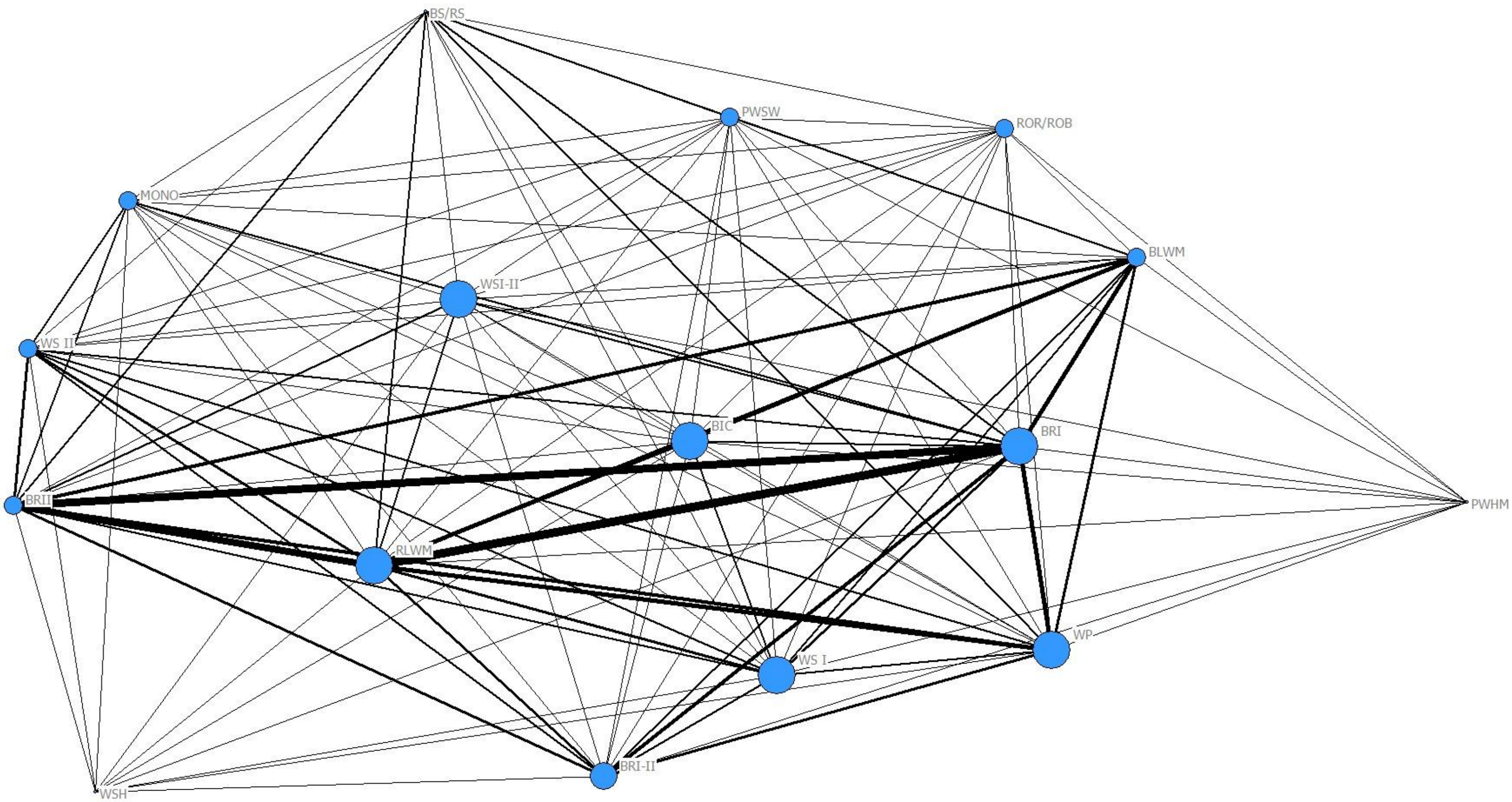

Figure 8-6. One-mode network of Cypriot wares imported to Egypt. The edges reflect the number of sites at which each pair of shapes was present. Edges in this network are sized on a scale of 1 to 5 to demonstrate the strength of ties (as in the number of shared ware groups). Nodes are sized according to betweenness centrality measures.

centrality values, located along the left edge of the graph, are located within Lower Egypt, with the exception of Abydos—a long lasting large mortuary site—and Aniba.

The relative distribution of ware groups is displayed through the one-mode network presented in Figure 8-6. Nodes are located according to the spring-embedded algorithm. The correlation of contemporary wares groups is more marked, particularly amongst the less circulated wares, including the association of BS/RS, PWSW, and ROR/ROB near the top of the graph. The latest wares, BRII and WSII, are also grouped together on the left side. The remaining ware groups are interspersed throughout, irrespective of temporal association.

Nodes are scaled according to eigenvector centrality, with the largest nodes reflecting the associated wide circulation of both the individual ware in question, as well as the ceramic groups with which it is associated. The correspondence in distribution between different ware groups is reflected through the weighting of edges, by which wares of similar distribution are connected by increasingly strong edges. The strongest connections are, not unexpectedly, among the three most widely traded groups (RLWM, BRI, and BRII). These three ware groups appear in conjunction at the greatest number of sites throughout Egypt. Strong ties also connect BLWM and WP to the other ware nodes.

The position and size of the BIC ware node is particularly interesting, for although this ware is only frequently at three sites—Marsa Matruh, Qantir, and Tell el-Dab'a—it shares edges with all other ware groups. Significantly smaller and peripheral in the network is the WSh node, which is only found at two sites: Bir el Abd, Marsa Matruh. As both of these sites have unusual assemblages, the WSh node is the smallest with the slimmest edges. The presence of strong ties between ware groups of different chronological periods (such as BRII and BS/RS) suggests a degree of stability in import distribution, through which sites in Egypt enjoying continuous

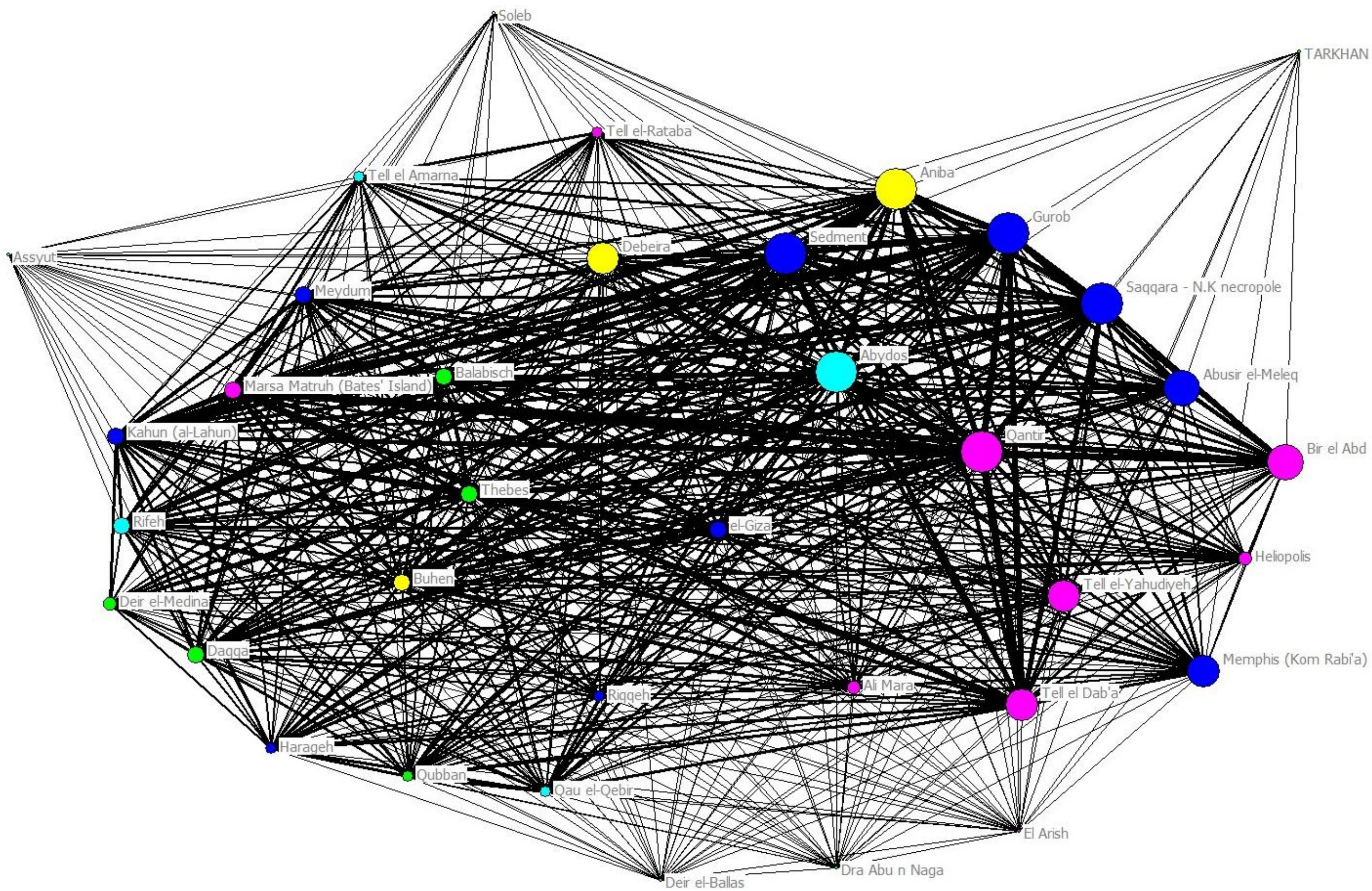

Figure 8-7. One-mode network of Egyptian sites with Cypriot imports. The edges reflect the number of shared ware types between each pair of sites. This graph demonstrates the connections between site assemblages presented in graph Figure 7-1. Edges in this network are sized to demonstrate the strength of ties on a scale of 1 to 2. Nodes are coloured according to geographic region.[1018]

[1018] The node region colour key: Delta/Sinai: Magenta; Memphis/Fayum: Blue; Middle Egypt: Aqua; Upper Egypt: Green; Egypt/Nubia: Yellow.

access to Cypriot wares.

Relationships between site assemblages are illustrated through the construction of a one-mode network of sites, visualized with a spring-embedded structure (Figure 8-7).[1019] Tie strength is scaled to depict the number of shared ware groups between sites. The strongest connections run between the large political and mortuary centers of the Nile Delta and the Memphis/Fayum region to its immediate south; sites include Tell el-Dab'a, Qantir, Saqqara, Gurob, and Sedment. High value edges also connect these nodes to other sites from Lower Egypt, including Bir el Abd and Marsa Matruh.

Around the periphery of the network core are sites from which limited ware groups were recovered, with the six most distant nodes—Assyut, Soleb, Tarkhan, Deir el-Ballas, Dra' Abu el-Naga', El Arish—representing the pendant nodes from the original two-mode network (each of which contained only a single ware type). These sites include smaller settlements from disparate regions throughout Egypt, many of which are located in close proximity to sites with large and varied assemblages (e.g. Tarkhan, which is located in the Memphite area to the south of Saqqara). Relatively peripheral to the network core—despite the size of the Cypriot assemblage—is Tell el-Amarna, from which only three of the ware groups were recovered (RLWM, BRII, WSII).

Nodes are sized according to betweenness centrality measures, which reflects, in part, the wide range of ceramic groups at a site, particularly the less frequently attested types. There appears to be a clear geographic clustering, both with respect to network placement and high betweenness measures, between sites of the Delta and Memphis/Fayum regions (represented by the magenta and blue nodes). Very few nodes from other regions appear on the right side of the

[1019] The location of the Tarkhan site node was manipulated, moving the site from the far right to the top right corner at roughly an equivalent distance from the main network core. This was done in order to fit a larger scaled image on the page.

graph, of which Aniba and Abydos are noteworthy. Aniba in particular, despite its location at the southern edge of Egypt, was highly integrated within both the Cypriot and Mycenaean ceramic circulation systems. The correlation between site location and network coordinates was assessed through a regression analysis of GPS coordinates and scaled geodesic coordinates, yielding R^2 values between 0.170 and 0.274. Although this measurement is far higher than those generated for the Mycenaean networks, the R^2 values do not indicate a significantly strong correlation between these two variables, despite the apparent visual clustering. The role of location in ceramic circulation will be explored further in the comparison of both Mycenaean and Cypriot import distributions.

8.2 The Levant

The distribution of Cypriot ceramics in the Levant was far more extensive than in Egypt. The higher quantity of site nodes thus renders the two-mode network of Cypriot pottery in the Levant (Figure 8-8) somewhat less immediately articulate than the corresponding graph of imports in Egypt, in which sites with corresponding assemblages are more visibly clustered. There is a rough horizontal division, with the highly central nodes of both modes appearing in the center of the graph. On the right are the highly circulated ware groups, with the smaller sites from which only these dominant ceramics were recovered falling to the periphery of these ware nodes along the far right. In the center left are the majority of sites with large and diverse import assemblages, with the nodes representing the less circulated ware groups to the site nodes' periphery along the left. Further peripheral to these ware nodes are the rare small sites from

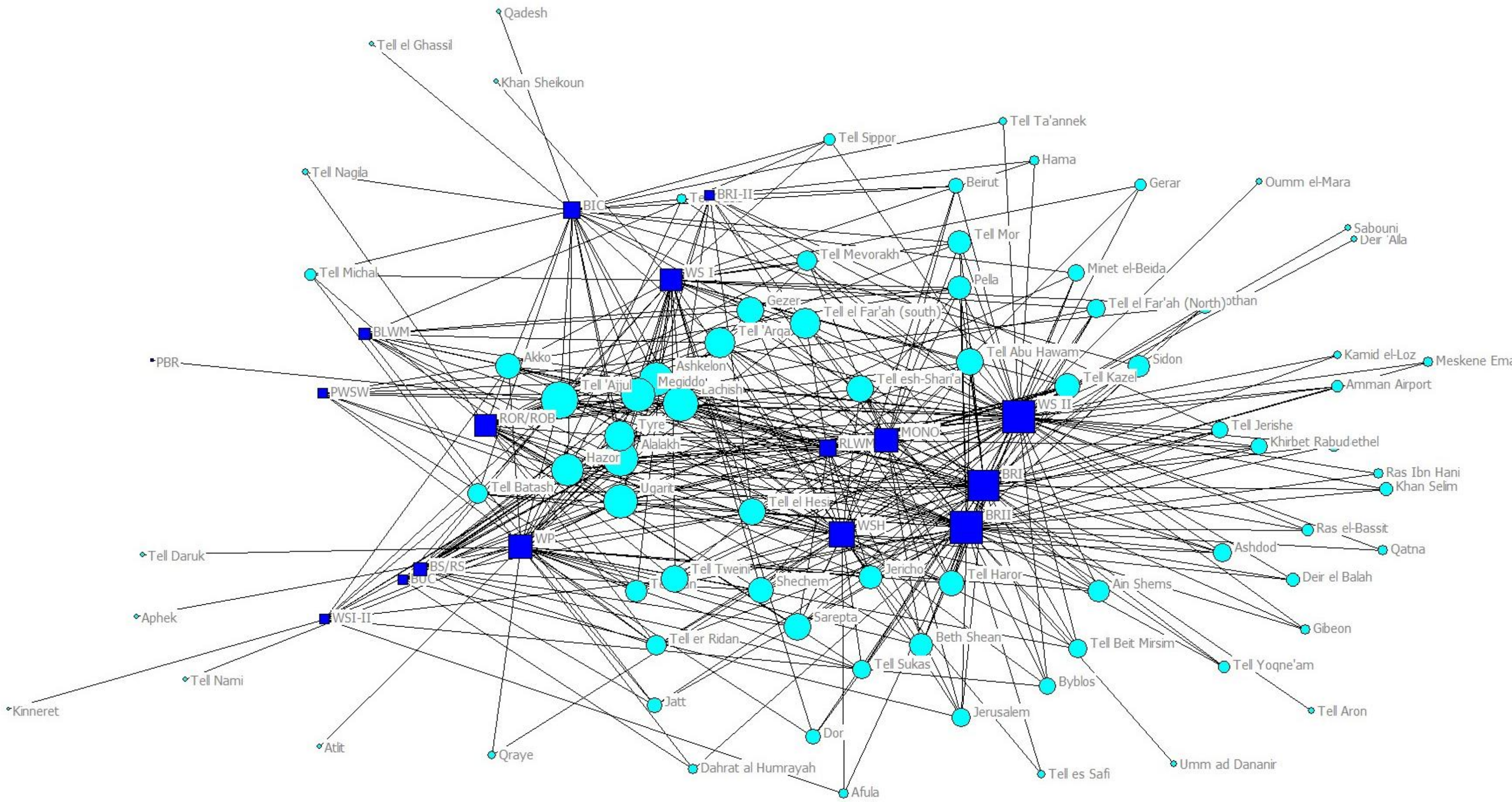

Figure 8-8. Two-mode network of Cypriot imports in the Levant.

which only examples of these less circulated wares were recovered.

Graph Figure 8-8 also omits a number of isolate site nodes, which represent sites from which Mycenaean imports were recovered, yet for which I was unable to document Cypriot ceramics. The removal of isolates reduced the number of site nodes from 109 to 78.[1020] As Cypriot vessels have a wide circulation in the Near East, absences of Cypriot imports from sites included in this analysis should not be readily attributed to significant gaps in trade, as they are quite likely reflective of the variability of data from early excavations. The only isolated ware node that does not appear in the network graph is the PWHM group, which was more rarely circulated, and appears in Egypt only at Tell el-Dab'a.[1021] Furthermore, the identification of this ware group is problematic in that it can frequently include misidentified undecorated vessels of other contemporary wares; [1022] true PWHM vessels themselves can conversely be underrepresented in ceramic analysis, as they are often missed in archaeological investigations.

In addition to the site and ware node isolates, the two-mode network of Cypriot imports in the Levant also includes a number of pendant nodes. While the majority of pendant network nodes represent sites, there is a single ware group, PBR, which appears exclusively at Tell el-'Ajjul. The largest and most centrally located ware nodes are BRI, BRII, WSII, MONO, and WSh. These import groups are the most widely distributed, with finds recovered from numerous sites that yielded both small and large assemblages. Closely associated with these is the RLWM node, with the remaining ware group nodes located along the left side of the graph. The least

[1020] Site isolates in the two-mode network of Cypriot imports in the Levant include: Abu Shushe, Arab al Mulk, Çatal Hüyük, Carchemish, Deir Khabie, El-Harruba, Garife, Hesban, Isbet Sartah, Khirbet Judur, Lattakie, Madeba, Qudur el Walaida, Sahab, Tell 'Ain Sherif, Tell Ashari, Tell Bir el-Gharbi, and Tell Burgatha.

[1021] Bushnell 2013, 226.

[1022] Crewe 2009, 86.

commonly circulated wares (WLSM, PWSW, BS/RS, and WSI-II) are represented by small peripheral nodes, which reflect their lower network eigenvector centrality values. These wares are present at predominantly large central sites with diverse assemblages, with occasional edges to smaller sites from which only a single ware group was recovered.

Despite the relatively comparable quantities of WSh and BUCC wares imported into the Levant, BUCC vessels are predominantly concentrated at Tyre, and were distributed across a far more limited geographic area.[1023] The more limited distribution of BUCC renders its network node small and peripheral, while the WSh node is central and relatively large. Similarly, although WP has the third largest number of imports in the Levant, this ware group is relatively less central in the two-mode network. The low eigenvector centrality measure is a factor of the high number of pendant nodes attached to this ware group, as WP wares were recovered from the greatest number of sites from which no other Cypriot ware groups were found (see Appendix Table 21).[1024]

The sites with the largest and most centrally located nodes include Tell el-‘Ajjul, Hazor, Ugarit, Alalakh, Tyre, Megiddo, Lachish, Ashkelon, Tell ‘Arqa, Gezer, and Tell el Far’ah (South). These sites are located down the length of the Levant, with most situated either along the coast or directly accessible by major trade routes. Other nodes of high eigenvector values include Sidon, Tell Kazel, Tell el Hesi, Tell Haror, and Tell Tweini, however the assemblages

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[1023] The assemblage of BUCC wares from Tyre represents approximately 89% of the wares total number of Levantine imports.

[1024] Four of the 13 pendant nodes in the graph (i.e., sites from which only one ware group was recovered) connect to the WP group. The WSII node has the second highest number of pendant nodes at three, followed by BIC at two. The four pendant node sites from the WP group are Aphek, Atlit, Tell Nami, and Tell Daruk, which—aside from the neighbouring Atlit and Tell Nami—are quite geographically dispersed, and do not appear to reflect a small regional network in which WP ware was exclusively circulated in the late Middle or early Late Bronze Age.

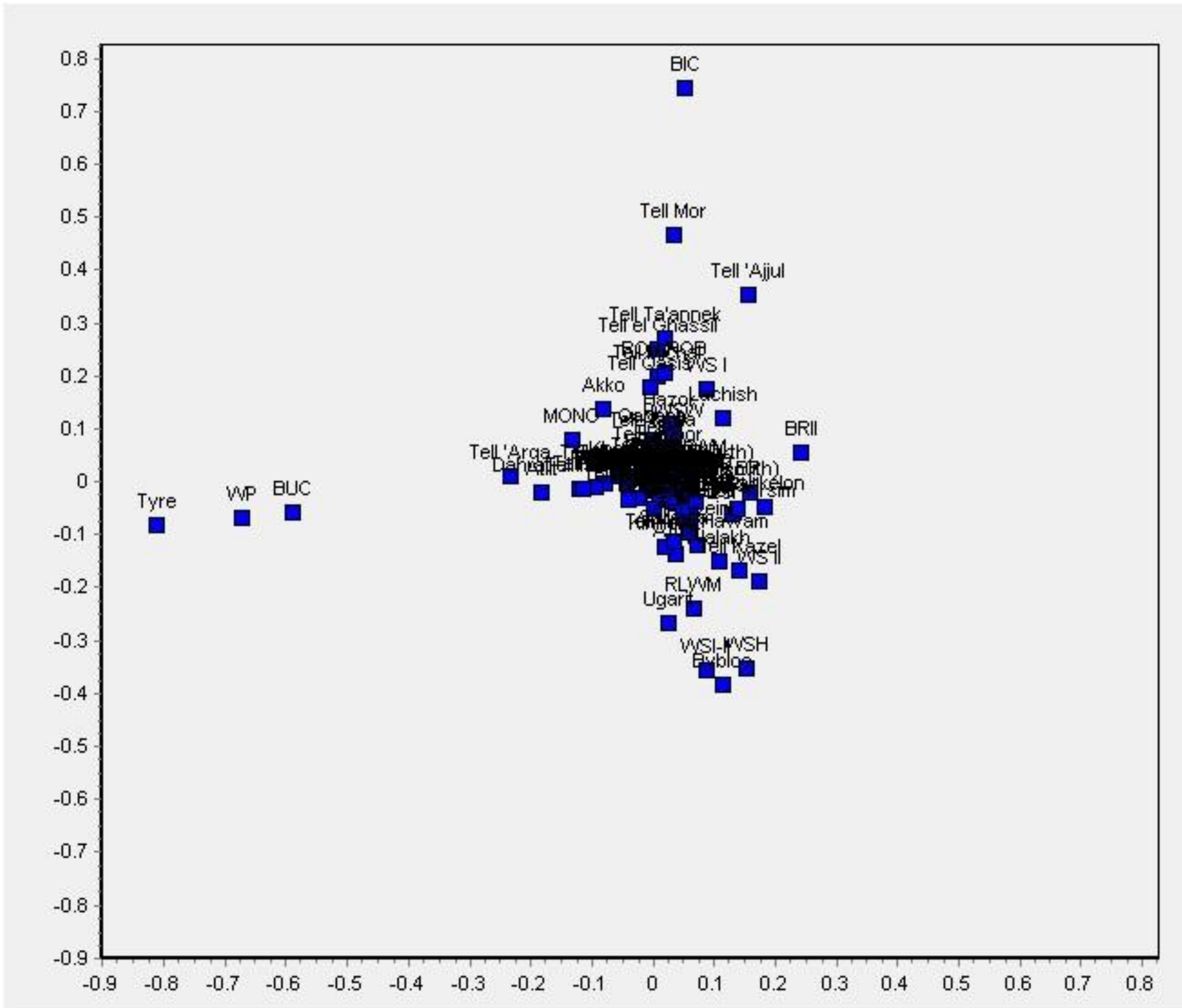

Figure 8-9. Scatterplot of correspondence scaling scores of the two-mode network of Cypriot imports in the Levant.

from these sites are comprised predominantly of highly circulated wares. The betweenness centrality measures for these sites are therefore lower. The highest betweenness centrality value belongs to Tell el-‘Ajjul, followed by Alalakh, Tyre, and Ugarit; the higher values of the latter sites are in part a function of the inclusion within their assemblages of ware groups with more limited distribution. Notably smaller and less central than in the network of LH Ware groups in the Levant are the sites of Minet el-Beida and Tell Abu Hawam, which yielded sherds from only five and nine of the thirteen possible ware groups respectively.

The network data was submitted to correspondence scaling, which generated the coordinates graphed in the scatterplot Figure 8-9. As with the Cypriot imports in Egypt, the scatterplot graph shows considerable nodal overlap, in which the majority of sites are obscured in the central graph cluster. The distribution patterns of a number of ware groups are also differentiated, including BIC in the top of the graph, WP and BUCC on the left, and WSI-II and WSh at the bottom. RLWM and WS II also tend towards the small cluster at the bottom, while BRII is distinguishable in a peripheral position along the right side of the central cluster. A number of sites also group around these peripheral nodes, reflecting the concentration of the corpus of each peripheral ware group at specific sites (i.e., WP and BUCC wares at Tyre, or WSI-II and WSh wares at Byblos). The association between Tyre and WP and BUCC is quite clear, as the site yielded approximately 43% and 89% respectively of all imports of each ware group in the Levant. Similarly, Byblos at the bottom of the graph is closely associated with WSI-II, of which it yielded 30% of the total quantity recorded here. While only approximately 10% of all WSh ware in the Levant came from Byblos, this represents the third largest collection of wares from this group (next to Tell Kazel and Ugarit).[1025] Furthermore, the WSh group represents an abnormally large proportion of the total ware assemblage from the site at 39%. The proximity of the WSh node to both the Byblos site and WSI-II ware nodes is in part also a function of the shared distribution pattern between the two ware groups, for although WSh is far more widely distributed (appearing at 35 sites), WSI-II appears most commonly at sites from which WSh was also recovered (nine of the eleven sites from which it was recovered).

The site of Ugarit is also distinct from the central network core, located along the bottom

[1025] In this analysis there are 36 distinct WSh finds recorded from Byblos, 39 from Tell Kazel, and 59 from Ugarit.

periphery. Ugarit is most closely associated with the RLWM node, as the site yielded 46% of all examples recovered of this ware from the Levant. As addressed above, Ugarit also contained a large corpus of WSh vessels, as well as a significant collection of WP wares (comprising 17% of the site's total assemblage). This proportion is only exceeded at a few sites in the Levant, including Tyre and Tell ‘Arqa, which is visible on the left edge of the central graph cluster as it tends towards the WP node. Similar ware-site associations are visible between the BIC node at the top of the graph and the proximate site nodes of Tell Mor, Tell el-‘Ajjul, Tell Ta'annek, Tell el Ghassil, and Akko, for which the ware comprises 74%, 6%, 72%, 100%, and 33% of the total assemblages respectively. Proximity between sites and the BIC node is not solely a function of the proportion of a site's assemblage constituted by the ware, as the correspondence scaling also incorporates the distributional similarity of BIC and other wares. This is particularly evident in consideration of the relatively large distance between BIC and Tell el-Ghassil despite the exclusive recovery of this ware group from the site; instead the site node tends towards other site nodes in the graph from which only a single ware of a similarly distributed group was recovered. The site of Tell el-‘Ajjul has yielded a Cypriot ceramic import assemblage of such a large scale that it is rendered in part dissimilar from other site assemblages, rendering it peripheral to the graph's core cluster.

When the coordinates from the correspondence analysis scatterplot are applied to the graph of the two-mode network of Cypriot ceramics in the Levant (seen in Figure 8-10), the site and ware nodes of the central graph cluster are slightly less obscured. The positions of the smaller ware groups are now visible, however their associations with nearby sites nodes are still too difficult to articulate. The association between Tell el-‘Ajjul and a number of the medium to smaller ware groups is more visible in the network graph, particularly MONO, BLWM, BS/RS,

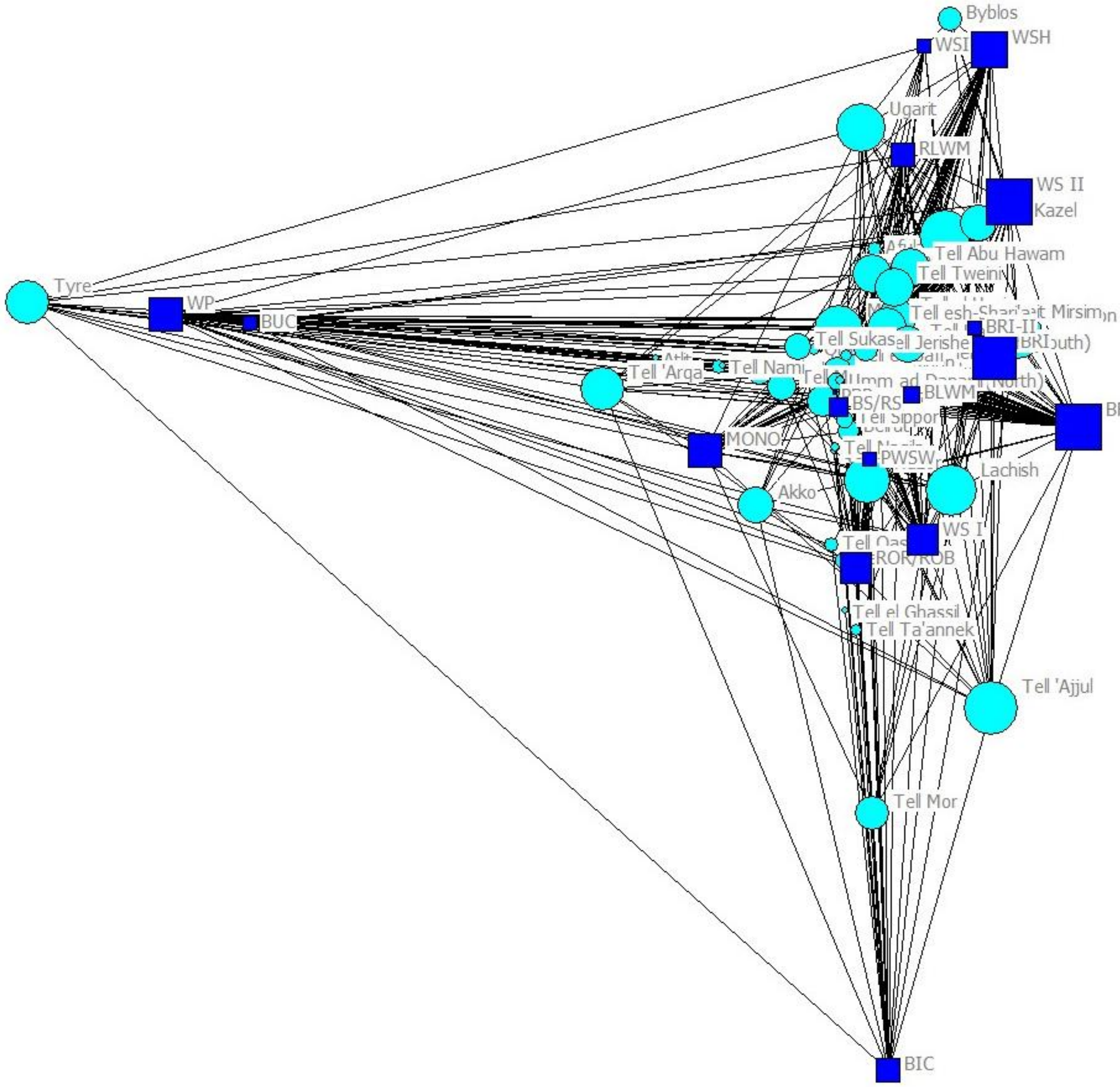

Figure 8-10. Two-mode network of Cypriot imports in the Levant, with nodes located according to coordinates derived from correspondence analysis.

ROR/ROB, PWSW, and WSI; of the total number of imports from each of these groups in the Levant, the Tell el-‘Ajjul assemblage accounts for approximately 40%, 30%, 53%, 60%, 77%, and 61% respectively. The concentration of the less widely circulated wares at Tell el-‘Ajjul contributes to the site’s differentiation within the network graph, as the Cypriot import assemblage from Tell el-‘Ajjul is unique in both its breadth and size.

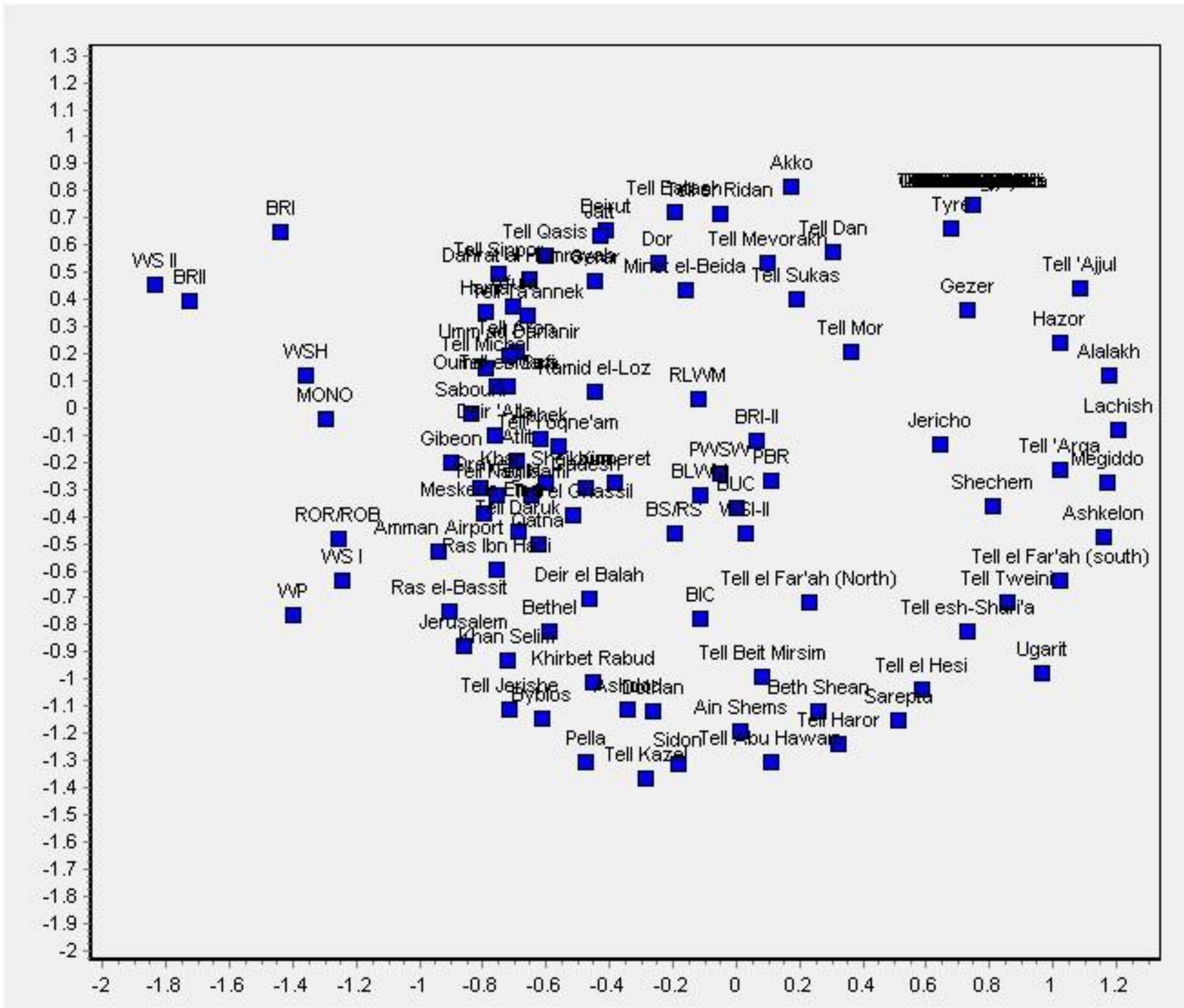

Figure 8-11. Scatterplot of the multidimensional scaling analysis of geometric distances for the two-mode network of Cypriot imports in the Levant.

Like the scatterplot above, the unusual assemblage from Tyre is also emphasized, as both the site node and the corresponding WP and BUCC ware nodes are far removed from the central graph core. The network graph of node correspondence also highlights the significant distribution of the largest ware groups from the period (WSh, WSII, BRI, and BRII). Unlike the spring-embedded two-mode network graph (Figure 8-8) in which node edges are difficult to distinguish and attribute to a specific ware group, the correspondence graph more clearly emphasizes the relative quantity of edges. This is particularly visible for BRII on the right side of the graph, as the edges originating from this node are unobstructed by other network ties. Edges in this graph are not weighted, however, so the relative strength of the edges is not articulated. The network graph also elucidates more clearly the concentration of ware groups such as WP at further sites, including the exclusive presence of WP wares at Atlit and Tell Nami, as well as the large corpus of WP ceramics from Tell ʻArqa.

The non-metric multidimensional scaling of geometric distances (Figure 8-11) yields a somewhat different scatterplot than that seen for Cypriot vessels in Egypt above (see Figure 8-4). In particular, there are a greater number of shape groups that fall together at the edge of the scatterplot than in the previous graph on vessels in Egypt. While the BRI and BRII groups remain along the periphery, the RLWM ware node is now located in the center of the scatterplot, in close proximity to the ware groups with more limited distribution (BLWM, PWSW, PBR, BS/RS, BRI-II, WSI-II, and BUCC). The group of popular wares along the left side of the scatterplot and the collection of ware nodes in the center form two main clusters of ware nodes, which contrasts with the scatterplot for Egypt in which ware groups were diffused throughout. The central ware types in the Levantine scatterplot primarily include shapes from the LBI, suggesting a potential chronological component to clustering (although it should be noted that not all LBI specific ware groups are included in this central core).

In the corresponding two-mode network graphed from the multidimensional scaling coordinates (Figure 8-12), the five most popular ware groups—BRI, BRII, WSII, MONO, and WP—appear along the right side of the scatterplot, with four of the five clustered together near the top right portion of the graph. In close proximity to this cluster of popular Levantine imports is the WSh group; although the quantity of WSh vessels imported to the Levant is only roughly one-half of the number of MONO vessels and one-third of the WP group, WSh juglets have a

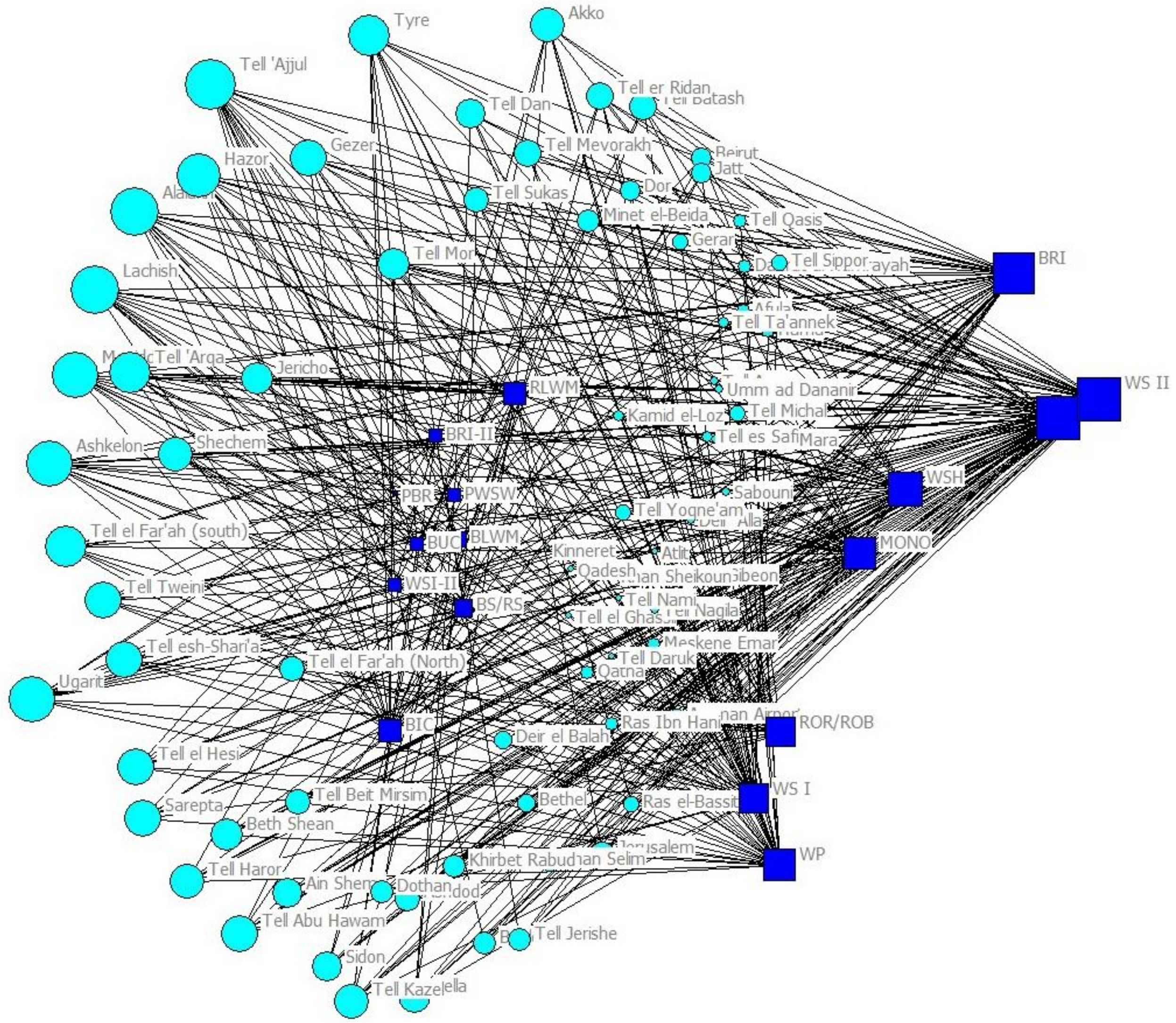

Figure 8-12. Two-mode network of Cypriot imports in the Levant, with nodes located according to coordinates derived from the non-metric multidimensional scaling of geodesic distances. Node symbols are sized according to eigenvector centrality measures

wider distribution, appearing predominantly at sites in conjunction with BRI, BRII, and WSII. In the center of the graph are the ware groups with limited distribution, many of which appear predominantly at large sites with diverse assemblages (which are themselves located along the left edge of the network). The RLWM node has a notably lower centrality value in the network for the Levant, despite appearing as a dominant ware group in the network of Cypriot imports in Egypt (see Figure 8-5). There does not appear to be any significant geographic clustering in the

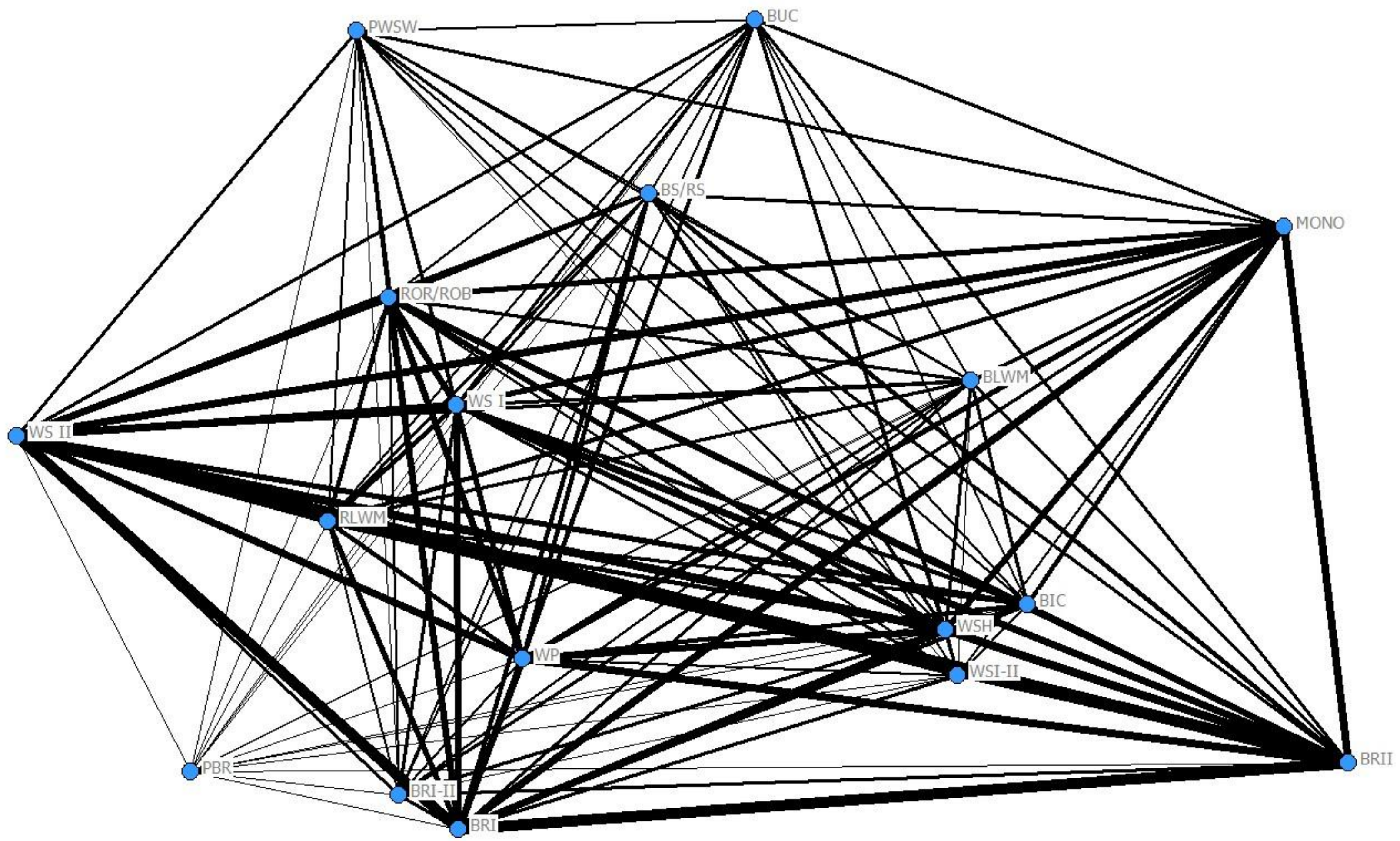

Figure 8-13. One-mode network of Cypriot wares imported to the Levant. The edges reflect the number of sites at which each pair of shapes was present. This graph demonstrates the connections between site assemblages presented in graph Figure 8-8. Edges in this network are sized on a 1 to 5 scale to demonstrate the strength of ties (as in the number of shared ware groups). Nodes are sized according to betweenness centrality measures.

arrangement of site nodes, as sites from all regions are interspersed in both the collection of high centrality sites along the left side of the graph, as well as the less central sites depicted with small nodes in the center of the network.

The relative distribution of ware groups is also explored in a one-mode network (Figure 8-13). Both the overall strength of ties in this network and the density of edges demonstrate the interconnectivity of the distribution systems used in mobilizing Cypriot traded ware groups. This suggests that, as with Egypt, wares were most likely distributed in bundles, as the majority of sites yielded multiple ware groups. The density of the graph also demonstrates the accessibility of each ware group, at least in the case of highly central trade emporia. Furthermore, the strength of ties between ware groups from the early LBA and the later LBA (such as ROR/ROB and WSII; MONO and BRII; BIC and WSh) suggests that there was a significant level of diachronic consistency in the circulation of wares, through which communities throughout the Levant enjoyed access to Cypriot imports. The strongest ties are unsurprisingly between the most commonly distributed ware types, namely BRI, BRII, WSII, and WP. Although the ware nodes are technically scaled by betweenness centrality measures, they are all the same size. This is due to the number of sites (including Lachish, Tell el-‘Ajjul, and Alalakh) from which all Cypriot wares in the Levant were recovered, rendering this metric ineffective.

The relationship between site assemblages can also be graphed in a one-mode network according to Cypriot imports. Site nodes are colour coded according to geographic region in order to explore potential regional clustering.[1026] The network is extremely dense, with a highly connected core and a well-integrated periphery. The nodes with the highest betweenness

[1026] The colour key for node is as follows: L1-Magenta; L2-Blue; L3-Aqua; L4-Green.

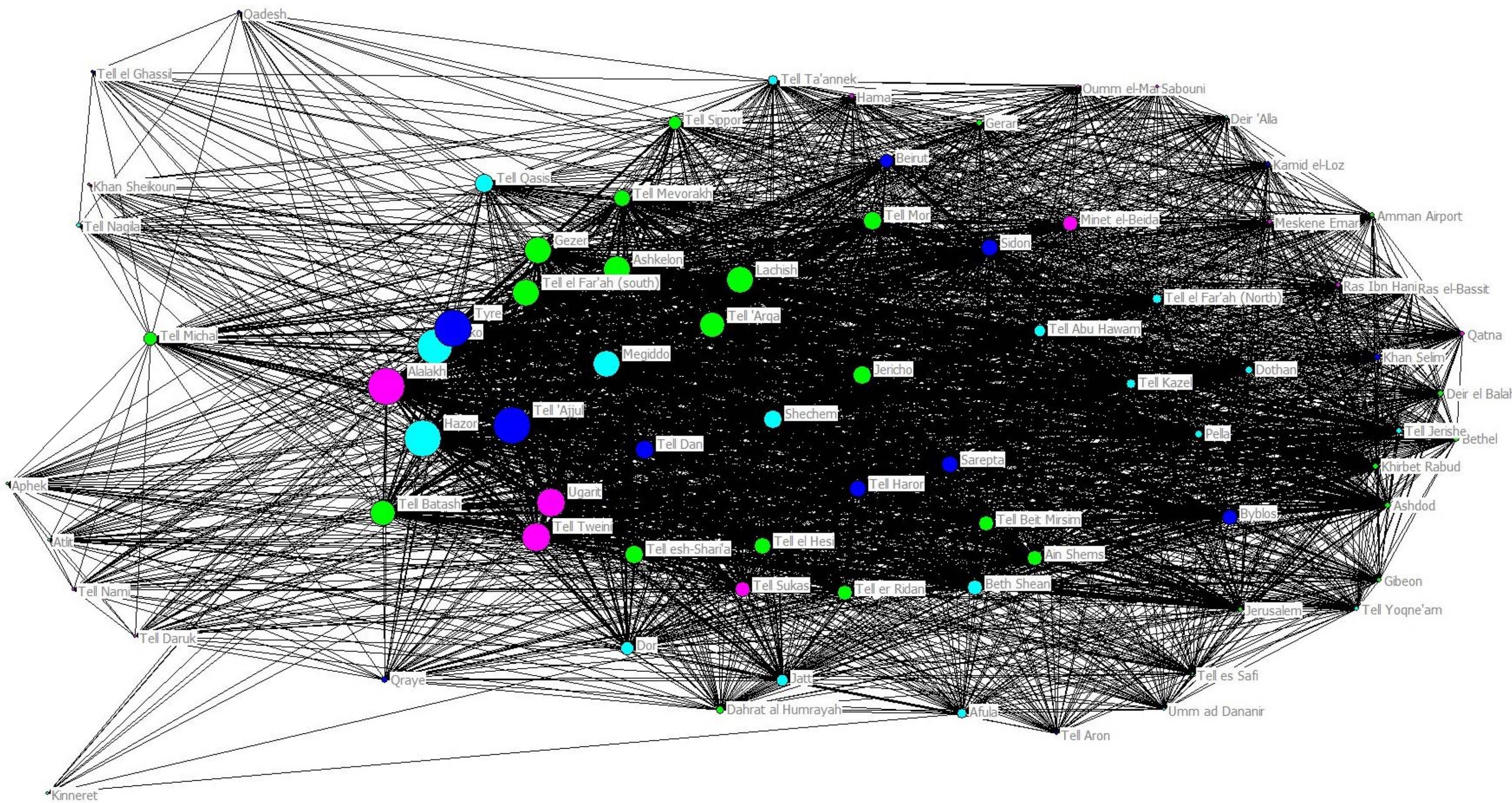

Figure 8-14. One-mode network of Levantine sites with Cypriot imports. The edges reflect the number of shared ware types between each pair of sites. This graph demonstrates the connections between site assemblages presented in graph Figure 8-8. Edge thickness is scaled between 1 and 2 to represent the strength of ties (as in the number of shared ware groups). Nodes are sized according to betweenness centrality measures, and are coloured according to geographic region.

centrality values cluster along the left side of the central core, with the least integrated sites along the periphery to their left. The furthest nodes along the left side represent sites from which either one or a small number of ware groups were recovered, many of which appeared as pendant nodes in the original two-mode network of Cypriot wares in the Levant (Figure 8-8). Interestingly, the ceramic groups that appear on their own at these sites all date to the LBI, and include primarily WP, BIC, and ROR/ROB. The exceptions are Khan Sheikoun and Kinneret, from which single examples of WSI and WSI-II were found. Tell Michal is also an exception, in that small quantities of multiple LBI ware groups were recovered from the site (including WP, ROR/ROB, WSI, and BIC). The site of Qraye is also semi-peripheral, however both WP and WSh were recovered from the site, creating multiple edges for the node. For the peripheral sites with limited network integration, there seems to be a chronological concentration in the LBI, perhaps suggesting that the distribution system from this earlier period was less broad, and was conducted in a less systematic fashion.

The sites of highest centrality are Tyre, Akko, Alalakh, Hazor, and Tell el-‘Ajjul, followed by a second tier group that includes Ugarit, Tell Tweini, Megiddo, Ashkelon, Gezer, Tell el-Far’ah (South), Lachish, and Tell ‘Arqa. In addition to these highly central sites, there also appears to be a greater number of intermediary sites within this network, with a number of graduated node sizes reflecting relative degrees of network integration (see for instance the range of node sizes represented by Alalakh, Ugarit, Tell Batash, Tell Sukas, Jatt, Dahrat al Humrayah, and Tell Aron). The majority of sites are small, with increasingly fewer sites per node size as the betweenness centrality values increase. This would support the interpretation of the network as reflective of a scale-free system, in which the node edges increase at an exponential rate, concentrating the majority of network edges around a few highly connected nodes.

Of the largest group, all but Hazor are coastal sites often interpreted as trade emporia, while many of the second tier sites also fall under this category. Within the group of second tier sites, there also appears to be a small cluster from the Southern Levant, while the largest and most central sites are drawn from all regions of the Eastern Mediterranean coast. The correlation between site location and network coordinates was assessed through a regression analysis of GPS coordinates and scaled geodesic coordinates, yielding an R^2 value of 0.03, suggesting no statistical correlation between these two variables.

8.3 Discussion

In comparing the 1-mode site network structures of Cypriot imports in the Levant and Egypt it is clear even from a visual inspection that the Levantine network is far more densely connected. The density measure for the Levantine network is 41.5%, while the density for the Egyptian network is 28.8% (see Appendix Table 22). Of the sites in the Levant, the average degree is 44.789, meaning that sites within that network connect to on average 44 of the 77 other available sites. The highest degree within the network is 77—the maximum number of edges possibly—and is jointly held by Alalakh, Hazor, Tell el-‘Ajjul, and Tyre, while Akko, Ashkelon, Gezer, Lachish, Megiddo, and Tell el-Far’ah (South) follow just behind at 76. Ugarit is included in the third tier of highly connected sites with a degree of 75. Aside from isolate nodes (a function of the inclusion of sites from which Mycenaean vessels were found yet no Cypriot ceramics are confirmed), the lowest degree within the Levantine network was held by Kinneret, which was connected to only ten other sites in the network through shared presence of transitional WSI-II vessels. The degree centralization of the network of Cypriot vessels in the Levant, also known as Freeman's Measure, was 0.304.

The average degree for the network of Cypriot vessels in Egypt is 18.156, meaning that Egyptian sites connect by shared ware group to on average 18 of the possible 35 other sites remaining in the network. The largest degree value for sites in Egypt is 35 (again the highest possible number of edges), held by Abydos, Ali Mara, Aniba, Gurob, Qantir, Sedment, and Saqqara. Despite a lower network density in Egypt (at 28% versus 41% for the Levant), the lowest degree for a site within the Egyptian network is actually higher than that of the Levant—the site of Tarkhan has the lowest value with a degree of 12. This site is integrated through the sole presence of WP vessels in the import assemblage. It should be noted that, although the absolute degree value for Tarkhan is only marginally higher than Kinneret, the least connected site in the Egyptian network (Tarkhan) is linked to 34% of potential network nodes, while the least connected Levantine site (Kinneret) only holds 13% of possible network edges. The degree centralization for Egypt is also slightly lower than the Levant, with a measure of 0.276. The lower centralization value suggests a lower standard deviation in degree values.

Network structures were also assessed for the presence of subgroups or 'k-cores'. Through this analysis, the network of Cypriot vessels in the Levant was partitioned into a structure with 10 different components in relation to site degree (as a function of the number of other sites with which the node shares a Cypriot ware group). The primary block within the network is composed of sites above a threshold of $k = 55$ (where k represents the degree, or number of site edges).[1027] The two successive clusters are also relatively high in degree, at 53

[1027] Network K-coreness values for Levantine sites with Cypriot wares are included in Appendix Table 23.

and 51 for clusters two and three respectively. This primary k-core incorporates approximately 51% of the sites from the Levant, the nodes of which are similarly connected to at least half of the remaining network nodes. The least connected nodes in the network—aside from network isolates—have a *k* value of $k = 10$ (of a possible 77 edges).

The network of Cypriot vessels in Egypt shows considerably less degree variation, with only five clusters detected. The first partition occurs at a degree of $k = 30$, followed by $k = 29$.[1028] The main cluster incorporates 31 sites, which are themselves connected to at least half of the other network nodes. The smallest cluster, represented by the site of Tarkhan, has a degree of $k = 12$ (out of a possible 35 edges). Relative to the k-core analyses of the Mycenaean ceramic imports, both the Levantine and Egyptian Cypriot ceramic distribution networks show significantly less fragmentation, with far fewer clusters.

Of the two-mode regional networks of Cypriot import distribution according to ware groups, the Levantine network has the highest density measure at 0.216 (for all structural metrics, see Appendix Table 25). This metric reflects the proportion of possible total edges realized within the network. This value is higher than the density of the Egyptian network (at 0.126), and significantly larger than those of the Mycenaean ceramics according to FS shape (results for which can be found in Appendix Table 16), which fall between 0.024 and 0.050. Given the chronological associations of the Cypriot ceramic classification system, the high network density values also suggest a relative degree of diachronic consistency in the mechanics and associated patterns of import circulation.

In considering the cohesion of the overall two-mode Cypriot import networks, it is

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[1028] Network K-coreness values for Egyptian sites are included in Appendix Table 24.

important to note the large number of graph isolates—sites with a degree of zero—as the sample of sites for the network is derived from the Mycenaean distribution system. There are therefore a high number of sites included which yielded no Cypriot import vessels, creating extremely large network fragmentation values (0.601 and 0.439 for the Levant and Egypt respectively). Metrics such as the network density are also impacted by the inclusion of site isolates. In order to examine the impact of these network vertices, the isolate sites from the Cypriot regional networks were removed.

Once isolates were removed from the one-mode site networks of Cypriot ware groups, the average degree for sites in Egypt increases to 32, while the degree for Levantine sites rises to 62 (from 18 and 44 in the original network; see Appendix Table 26). The densities of the new networks rise considerably, to 0.922 and 0.813 for Egypt and the Levant respectively. These values are incredibly high, indicating that the vast majority of sites within a region shared at least one ware group in common with the rest of the network nodes. As the network is more interconnected, the degree centralization values for both systems also decrease substantially (with new calculations providing centralization values of 0.082 for Egypt and 0.192 for the Levant). As predicted, the removal of the network sample sites from which only Mycenaean wares were recovered increases both the density and interconnectivity of the one-mode network graphs.

Similar results were obtained in the cohesion calculations for the two-mode regional Cypriot import networks with isolate nodes removed (see Appendix Table 27). In omitting the sites from which only Mycenaean imports were recovered with no associated Cypriot vessels, the cohesion of the networks increased; the Egyptian network increased from a two-mode density of 0.126 to a value of 0.224, while the Levantine network increased from 0.216 to 0.303. For the

Levantine network, this measure signifies that 30% of all possible network ties were realized, indicating that even the more rare ware groups of Cypriot imports were widely circulated. The greatest reflection of the impact of the removal of isolate nodes on network cohesion is the fragmentation measure, which was significantly reduced for both networks. In the new network permutation, the fragmentation of the Egyptian network decreased from 0.601 to 0.073, while the fragmentation of the Levantine network decreased from 0.439 to 0.021. While the new measures tend toward zero, the networks continue to appear fragmented as neither region yielded all available import ware types—PWHM was not recorded from the Levant (due to the noted assignment issues), while no BUCC vessels have been recovered from Egypt. The large impact on network measures created by the removal of network nodes from Mycenaean network that lacked Cypriot imports demonstrates the importance of data selection and organization in the use of network analysis.

The presence of a hierarchy of sites (a quasi-middle class) is indicated by moderate network degree centralization and high degree values for the middle k-core clusters for both networks of Cypriot imports. When considered against the distribution of assemblage quantities, these metrics would support the interpretation of scale-free networks, particularly for the Levant, with large coastal and inland trade emporia at the top of the system. This contrasts against the centralized trade system, dominated by palace-organized exchange, often hypothesized for Late Bronze Age trade. This interpretation for the distribution of Cypriot ceramics in the Levant corresponds to the interpretation of imports to Egypt, which were themselves believed to be distributed largely to the middle class (particularly the BRI and BRII juglets). In both regions, Cypriot finds were distributed throughout the geographic expanse of the area in question, clustering around transportation routes rather than royal institutions.

9. COMBINED CERAMIC NETWORKS

Having explored the regional circulation of Mycenaean and Cypriot imports independently, the combined distribution of each will be examined. The complete network of Mycenaean vessels across Cyprus, the Levant, and Egypt will be considered first, before examining the shared distribution of Cypriot and Mycenaean ceramics in both the Levant and Egypt. The macro-scale consolidated Mycenaean import network across all three regions will be constructed according to FS Shape, while the combined regional networks will incorporate both Cypriot ware groups and Mycenaean imports categorized according to functional vessel groups. The goal of this examination will be to explore potential variability in distribution patterns across regions, as well as the correspondence between site assemblages throughout the Mediterranean.

9.1 Mycenaean Vessels in Cyprus, Egypt, and the Levant

In constructing a network of the Mycenaean imports to all three regions, the limitation of visualization becomes clear. The two-mode graph created from the imports (Figure 9-1) is exceedingly crowded and difficult to read or interpret. This is due to the high number of nodes included in the network, with 270 sites and 134 different FS shapes. The overlapping of nodes renders most graph nodes largely obscured, with only a small proportion clearly visible. The main value of the complete graph is the overall network structure information presented in it. As with the other networks, the most common ware groups and the sites with the largest assemblages are located in the center of the graph. The sites with smaller assemblages or the wares with limited distribution are located along the network's edge. In this case, the complete

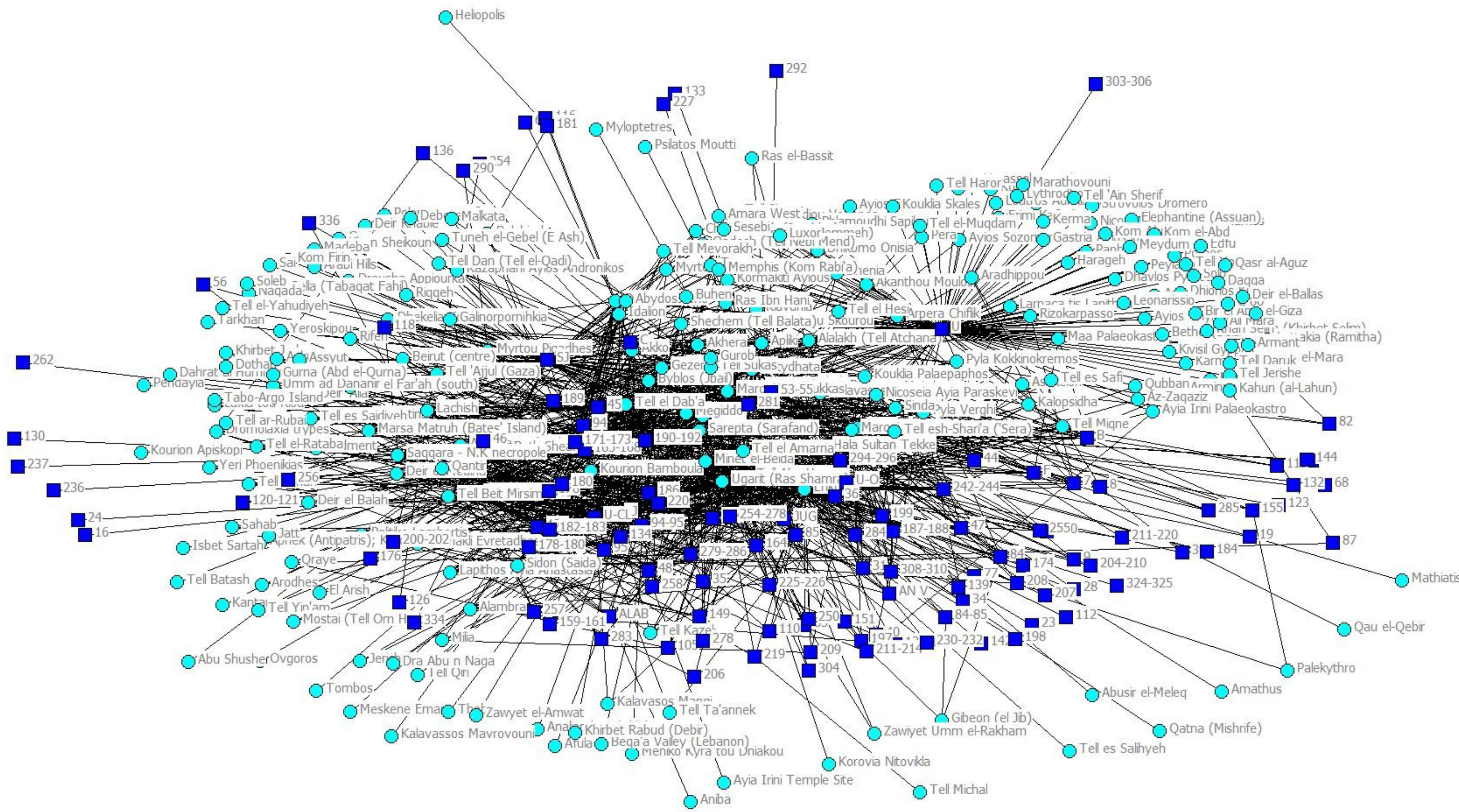

Figure 9-1. Two-mode network of Mycenaean imports by FS Shape in Cyprus, Egypt, and the Levant.

network demonstrates the high number of pendant nodes and those incorporated with only a few edges. Of the 134 FS shape nodes, 23 form pendant nodes on the graph, while 27 more are attached through only two or three edges, representing 17% and 20% respectively of the network. The number of minimally integrated site nodes is higher, with 93 (or 34%) of sites forming pendant nodes in the graph, while another 18% are integrated by only two or three edges. In the case of sites, over half of the network includes sites that yielded three or less different FS shapes. The vast majority of the poorly integrated nodes cluster around the unknown shape node in the upper right portion of the graph.

As demonstrated by Figure 9-1, the majority of the network represents sites that are only minimally connected within the overall trade system. In order to assess the organization of the highly connected sites, the pendant nodes have been removed, and a new graph has been constructed with a focus on the central network core (Figure 9-2). The sites with the largest eigenvector centrality measures are located in the center of the graph, and include Ugarit, Minet-el-Beida, Tell Abu Hawam, and Enkomi.[1029] Other sites located in close proximity include large centers from all three regions of analysis, such as Amman Airport, Beth Shean, Megiddo, Sarepta, Hazor, Tell el-Amarna, Kourion, Hala Sultan Tekke, Maroni, and Kition. As expected, all of these sites formed prominent nodes within their respective regional networks, forming central gateways through which imports were likely mobilized. Since sites in the network were weighted according to eigenvector centrality measures, the sizes of the main site nodes reflect their integral systemic role, as well as the centrality of the shapes constituting their import assemblages.

[1029] For centrality measures, see Appendix Table 28.

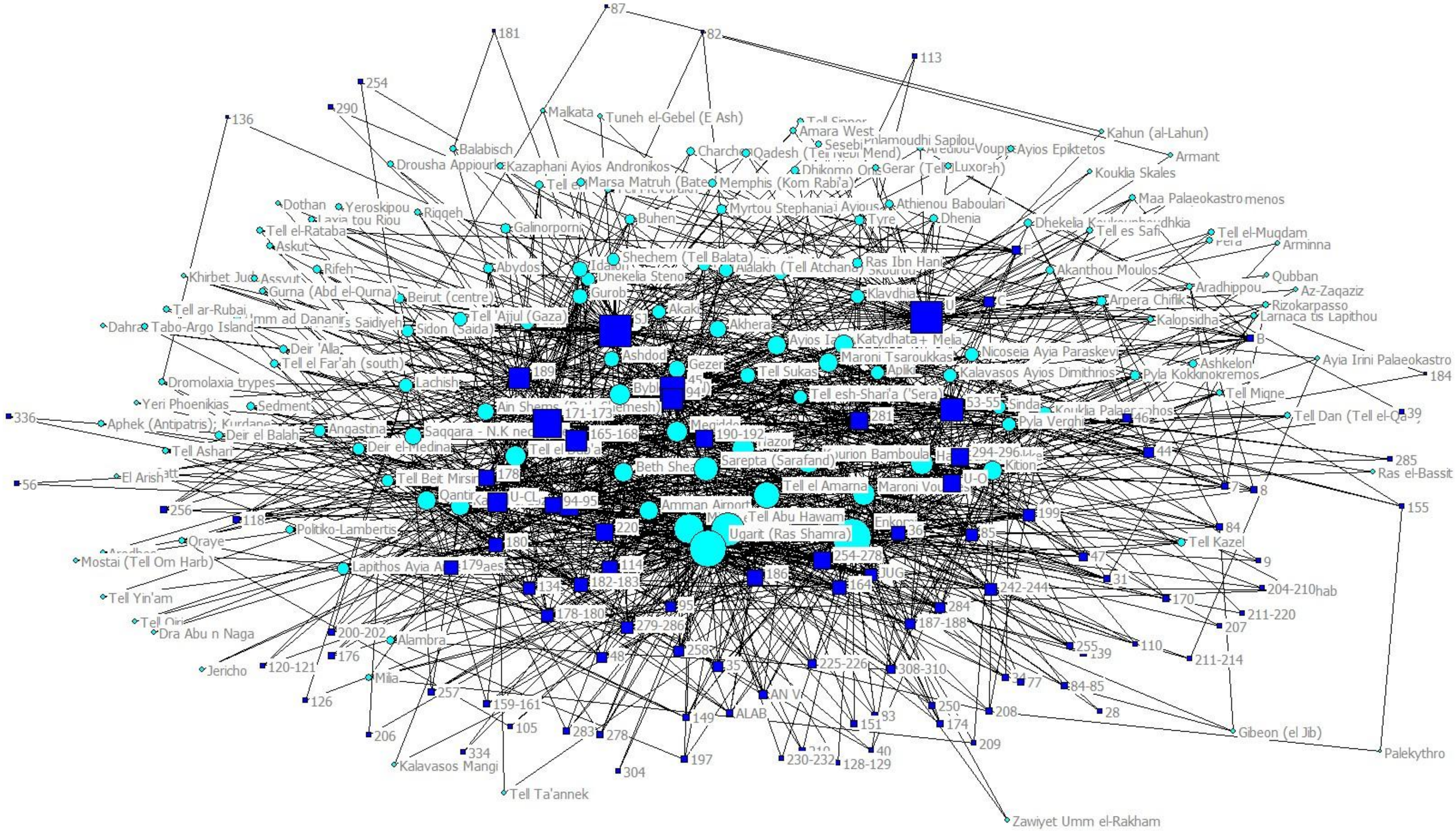

Figure 9-2. Two-mode network of Mycenaean imports by FS Shape in Cyprus, Egypt, and the Levant. Pendant nodes have been removed, and the remaining nodes have been sized according to eigenvector centrality values.

The FS shape nodes that enjoyed the widest distribution during the Late Bronze Age are also situated within the central portion of the graph. These include a number of general ware categories—such as the 'unknown' and 'stirrup jar' nodes—as well as a variety of FS groups. The vessel forms with high centrality values consist of both open and closed shapes, and represent the commonly traded Mycenaean types of the Late Bronze Age. The shapes with high centrality values include the piriform jar (FS 45), the amphoroid krater (FS 53-55), the straight-sided alabastron (FS 94, 95), the stirrup jar, both tall (FS 165-168) and globular (FS 171-173) forms, the globular flask (FS 189, 190-192), the shallow semiglobular cup (FS 220), and the ring-based krater (FS 281). These FS shapes represent the most popular subtypes of common vessel forms, for which numerous alternatives appear in the graph (particularly within the stirrup jar category). Of these popular shapes, both the amphoroid and ring-based kraters are shapes that are relatively rare on the mainland, and appear to have been manufactured in part for distribution across the Mediterranean.

In addition to the amphoroid and the ring-based kraters, other shapes that appear in the Eastern Mediterranean that were relatively rare on the mainland include the angular jug (FS 139), the chalice (FS 278), the shallow bowl (FS 295-296), and zoomorphic rhyta. The distributions of these vessels have been graphed together to determine whether there is any geographic patterning evident in the distribution of vessels typically considered the products of export-driven manufacture (also known as proto-marketing). The resulting graph, Figure 9-3, presents the distribution of these FS shapes across all three regions. In the center of the graph is a cluster of sites from which most of the vessel types were recovered. The only site that yielded all FS shapes was Ugarit, while Enkomi, Minet el-Beida, and Tell Abu Hawam held all but the angular

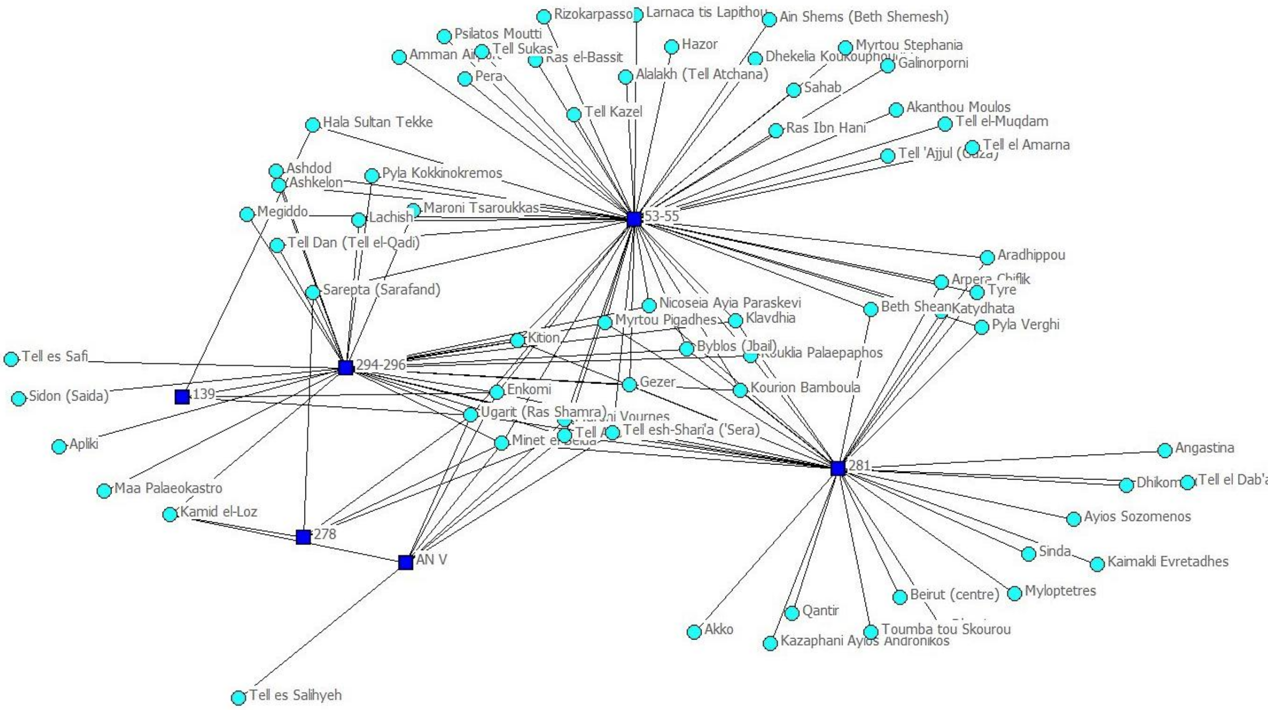

Figure 9-3. Two-mode network of FS Shapes imported into Cyprus, Egypt, and the Levant that appear only rarely on the Greek Mainland.

jug (FS 139). The more common vessels, the amphoroid and ring-based kraters, were more widely distributed, appearing at sites throughout Cyprus, Egypt, and the Levant.

The shapes with limited distribution (that were similarly rare on the mainland) reflect the only geographic clustering, and include the chalice (FS 278) and the animal-shaped vessels. While the former has a distribution limited to the upper Levantine coast (appearing at Ugarit, Minet el-Beida, Kamid el-Loz, Sarepta, and Tell Abu Hawam), the latter appears at Enkomi and Maroni, as well as the aforementioned Levantine coastal sites (to which we may also add Tell es Salihyeh and Tell ‘Sera). Other shapes that share a similar distribution pattern are the large piriform jar (FS 34) and the mug (FS 225-226), which appear almost exclusively at limited Cypriot and large Levantine coastal sites (as well as three examples of FS 34 at Tell el-

Amarna).[1030]

Of the shapes that may have been manufactured for export, most appear predominantly in the Levant and Cyprus, with only a few appearing in Egypt (rare examples of FS 34, FS 53-55, and FS 281 have been documented), nearly all of which were recovered from the political centers of Tell el-Amarna, Tell el-Dab'a, and Qantir.[1031] This centralized distribution reflects the patterning exhibited by other vessel groups, with open shapes and dining wares of both Cypriot and Mycenaean manufacture limited in Egypt to the Delta and palatial sites. This demonstrates the variability in the consumption of imported ceramics between elite and non-elite contexts, suggesting that certain material types were mobilized through a politically centralized network to the large palatial centers, while the more common closed shapes may have been circulated through a secondary system. The conspicuous nature of dining vessels may reflect a degree of emulation in the consumption of Mycenaean imports at palatial centers, particularly given the cultural phenomenon of social feasting associated with many of the drinking and serving shapes—the adoption of which in Cyprus has been interpreted as elite emulation for the purposes of raising social status.[1032]

[1030] The piriform jar (FS 34) appears at Tell el-Amarna, Tell Abu Hawam, Qatna, Pyla Verghi, and Enkomi, while the mug (FS 225-226) has been recorded at Hala Sultan Tekke, Enkomi, Ugarit, Minet el-Beida, Tell Sukas, Sarepta, Tell el-'Ajjul, and 'Ain Shems.

[1031] A single example of an amphoroid krater was reported from Tell el-Muqdam, located in the Nile Delta.

[1032] For the role of Mycenaean dining vessel consumption in Cyprus within the context of social feasting, see Dabney 2007 (192).

9.2 Combined Cypriot and Mycenaean Network - Egypt

The combined network of Cypriot and Mycenaean vessels will focus on the two regions in which both wares were imports—Egypt and the Levant. Although the independent examination of Late Helladic imports included networks constructed according to LH groups, FS Shapes, and functional ware type, the network here will focus on the latter classification. As demonstrated in Chapter 7, the networks constructed with the LH classification system were overly broad, and did not reflect nuanced features of trade. While the FS network was particularly useful for the assessment of regional variation in consumption, the high number of nodes included in this system renders the graphs exceedingly crowded and difficult to read. The FS shape graphs are also less immediately indicative of shape similarities to all those for whom the Furumark System is not intimately familiar. The functional group classification effectually matches part of the taxonomy of the Cypriot ware designation system, as the latter is intrinsically morphological, with each ware group largely limited to a small range of functional ware types.

The combined two-mode network for imports in Egypt is presented in Figure 9-4. The four largest vessel nodes include the Mycenaean 'storage-liquid' node and the BRI, BRII, and RLWM Cypriot import nodes. The dominance of containers for liquid materials is immediately evident, as all four of these ware types functioned primarily as containers for the transportation of liquid goods (namely BR juglets, and RLWM spindle bottles and flasks). Conversely, nearly all of the wares commonly used for the production of open vessels, which were in turn associated with dining, appear along the bottom periphery.[1033] These Cypriot ware groups—namely WS, MONO, and ROR/ROB—appear in close proximity with the Mycenaean 'dining' ware nodes, of

[1033] The PBR and BUC nodes were isolates in the graph, as neither ware appears in Egypt.

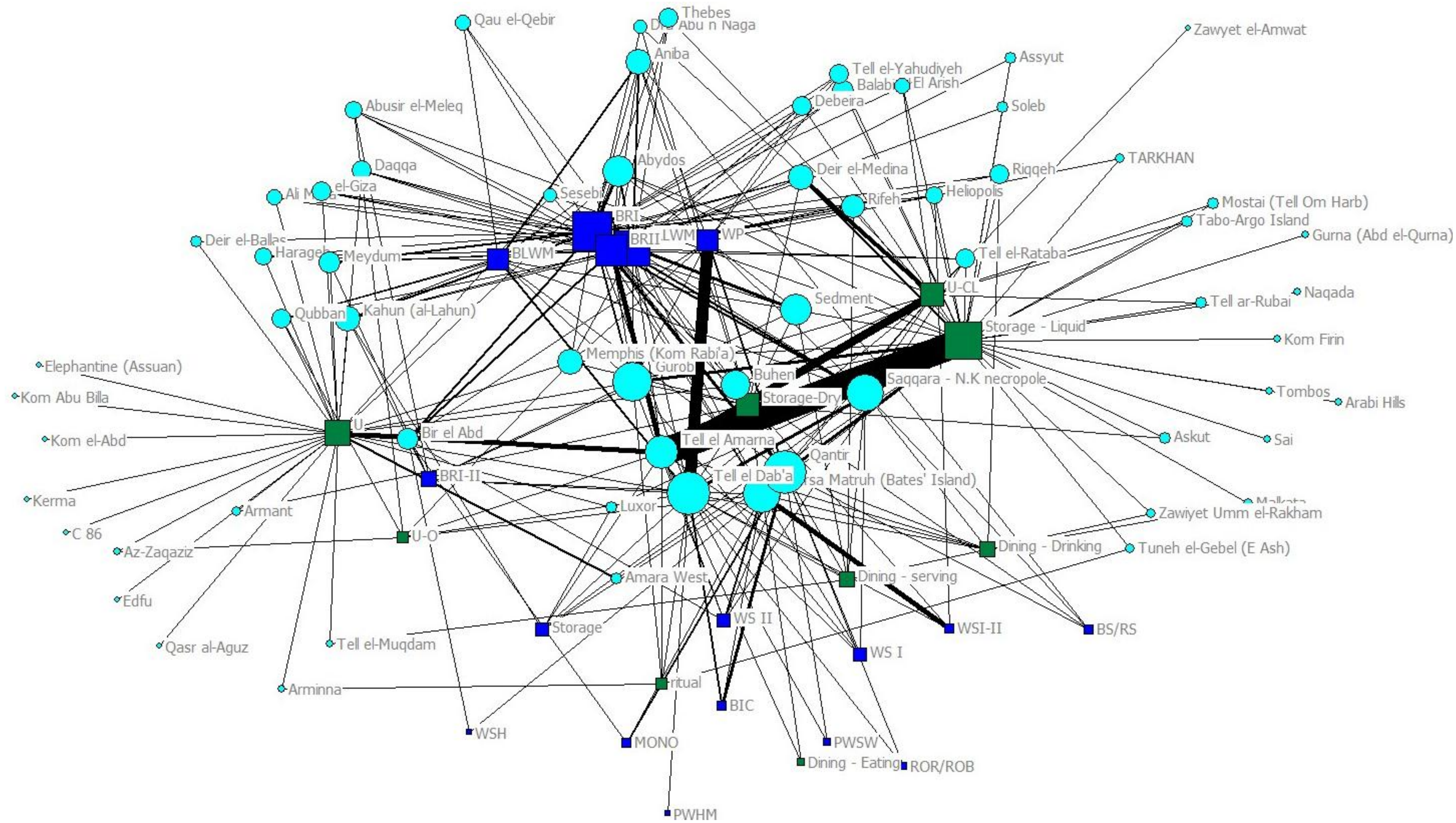

Figure 9-4. Two-mode network of Mycenaean and Cypriot import vessels in Egypt according to functional group and ware type. Mycenaean functional group nodes are coloured green, while Cypriot ware groups are royal blue. Nodes have been sized according to eigenvector centrality values, while edges are weighted between 1 and 2 according to tie strength.

which the 'dining-serving' node is the most integrated and has the highest eigenvector centrality value.[1034] Although the BLWM vessels in Egypt include both bowls and cups, the similar distribution pattern between this ware and the RLWM group creates the close correspondence between these two nodes in the graph.

The weighting of ties also demonstrates an unusual feature of the distribution of imported ceramics in Egypt, and that is the frequent concentration of ware types at a single site. Examples include the strong tie between Tell el-Dab'a and WP vessels, or Tell el-Amarna and Mycenaean liquid containers (stirrup jars and flasks). The concentration of certain imports at political centers is not unexpected, particularly given the tradition of diplomatic exchange extant during the period, and the centralized nature of the Egyptian Late Bronze Age political economy. The most intriguing relationship, already identified in the discussion of Cypriot import distribution in Egypt, is the large collection of Cypriot—particularly lustrous—imports at Aniba on the Nubian frontier. The varied assemblage from the site indicate that Aniba may have functioned as a gateway community for the region, through which imported goods were funneled to surrounding sites and traders. The relatively low number of pendant nodes (eight), suggests that ceramic import was a developed industry with considerable and consistent circulation.

The distributional correspondence between the different ceramic groups is presented in a square matrix (Table 2), with matrix figures reflective of the number of sites in which each pair of vessel type was present. The 'unknown' Mycenaean vessel group has been omitted from this matrix, although the 'unknown-closed' and 'unknown-open' shape categories have been

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[1034] See Appendix Table 29 for centrality measures. The eigenvector centrality for serving vessels is only marginally higher than the drinking vessel group, at 0.134 and 0,132 respectively.

Table 2. Affiliation matrix of Cypriot wares and Mycenaean import vessels according to functional group in Egypt.

	RLWM	BLWM	WP	ROR/ROB	BRI	BRII	BRI-II	PWSW	WSI	WSII	WSI-II	WSH	MONO	PWHM	BIC	BS/RS	Storage	S-Dry	S-Liquid	D-Serve	D-Drink	D-Eat	Ritual	U-CL	U-O
RLWM	26	11	10	2	23	17	6	2	5	5	3	1	2	1	3	4	5	9	17	6	6	2	4	10	5
BLWM	11	12	7	2	12	8	4	2	4	2	1	0	1	1	2	3	4	7	7	4	3	0	3	6	2
WP	10	7	13	2	12	8	5	2	4	3	1	1	2	1	2	3	3	7	10	4	3	0	3	5	3
ROR/RO	2	2	2	2	2	1	1	2	2	1	1	0	1	1	2	1	2	2	2	2	2	0	2	2	1
BRI	23	12	12	2	31	20	8	2	5	4	4	2	3	1	3	4	4	10	17	5	5	1	3	11	5
BRII	17	8	8	1	20	23	7	1	4	6	3	2	3	0	2	4	4	8	14	5	4	2	3	10	3
BRI-II	6	4	5	1	8	7	8	1	3	3	2	2	2	1	2	0	2	4	4	2	2	1	2	3	3
PWSW	2	2	2	2	2	1	1	2	2	1	1	0	1	1	2	1	2	2	2	2	2	0	2	2	1
WSI	5	4	4	2	5	4	3	2	5	3	2	1	2	1	3	2	3	5	5	3	4	1	3	5	2
WSII	5	2	3	1	4	6	3	1	3	6	1	2	3	0	2	1	2	4	5	2	3	2	3	5	2
WSI-II	3	1	1	1	4	3	2	1	2	1	4	1	1	1	2	1	1	2	4	1	2	1	1	3	2
WSH	1	0	1	0	2	2	2	0	1	2	1	2	2	0	1	0	0	1	1	0	1	1	0	1	1
MONO	2	1	2	1	3	3	2	1	2	3	1	2	3	0	2	1	1	2	2	1	2	1	1	2	1
PWHM	1	1	1	1	1	0	1	1	1	0	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1
BIC	3	2	2	2	3	2	2	2	3	2	2	1	2	1	3	1	2	3	3	2	3	1	2	3	2
BS/RS	4	3	3	1	4	4	0	1	2	1	1	0	1	0	1	4	2	3	3	2	2	0	1	3	0
Storage	5	4	3	2	4	4	2	2	3	2	1	0	1	1	2	2	6	4	5	4	4	1	3	4	2
S-Dry	9	7	7	2	10	8	4	2	5	4	2	1	2	1	3	3	4	14	11	5	5	2	4	8	4
S-Liquid	17	7	10	2	17	14	4	2	5	5	4	1	2	1	3	3	5	11	38	7	7	2	5	14	4
D-Serve	6	4	4	2	5	5	2	2	3	2	1	0	1	1	2	2	4	5	7	8	4	1	3	4	2
D-Drink	6	3	3	2	5	4	2	2	4	3	2	1	2	1	3	2	4	5	7	4	7	2	3	5	3
D-Eat	2	0	0	0	1	2	1	0	1	2	1	1	1	0	1	0	1	2	2	1	2	2	1	2	2
Ritual	4	3	3	2	3	3	2	2	3	3	1	0	1	1	2	1	3	4	5	3	3	1	6	4	2
U-CL	10	6	5	2	11	10	3	2	5	5	3	1	2	1	3	3	4	8	14	4	5	2	4	17	3
U-O	5	2	3	1	5	3	3	1	2	2	2	1	1	1	2	0	2	4	4	2	3	2	2	3	7

included. The entries across the matrix diagonal show the total number of sites at which each ware type appears. The vessel group with the widest distribution is the Late Helladic 'storage-liquid' type, which appears at 38 different sites (representing approximately 60% of all sites in the network). As demonstrated in Figure 9-4, the other main ware groups with wide circulation are BRI, BRII, and RLWM, which appear at 31, 23, and 26 sites respectively.

The most commonly paired ware groups are all drawn from these widely circulated wares. The highest affiliation scores occur between the following paired nodes: BRI-RLWM (23), BRI-BRII (20), BRII-RLWM (17), S-Liquid-BRI (17), and S-Liquid-RLWM (17).[1035] The high degree of correlation in distribution between Mycenaean and Cypriot ware groups, as demonstrated by both the two-mode network and the square affiliation matrix, suggests that the two import groups were circulated along a corresponding—or perhaps even shared—distribution system. Given the strong affiliation between different ware groups, such as the recovery of BLWM vessels from sites which all additionally contained examples of WP ware (and with one exception all contained RLWM vessels), it is difficult to interpret the distribution of most Cypriot imports as the product of an irregular system of booty accumulation by military personnel overseas.[1036] While some BRI and BRII vessels may certainly have been acquired in this manner,[1037] the organized system demonstrated by the high degree of ware affiliation instead suggests a systematized network of trade and import distribution active in Egypt during the Late Bronze Age.

[1035] For the frequency of affiliation, see Appendix Table 31.

[1036] Bergoffen 1990, 305-314.

[1037] The average affiliation frequency—as a function of the number of times that a given ware appears in association with a different ware group—for the BRI and BRII are the lowest of all Cypriot ware groups at 22% and 25% respectively (the latter is equaled by RLWM at 25%).

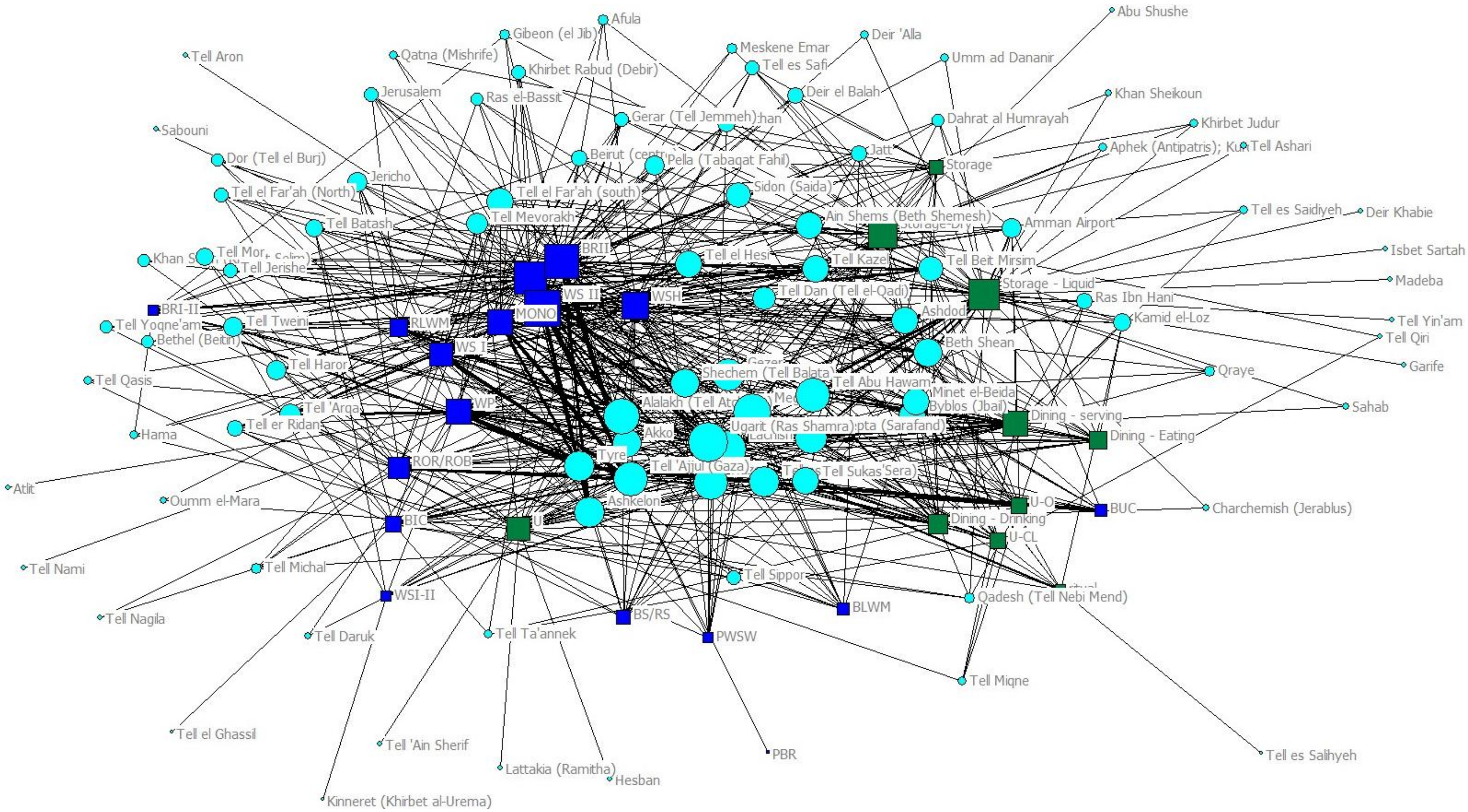

Figure 9-5. Two-mode network of Mycenaean and Cypriot import vessels in the Levant according to functional group and ware type. Mycenaean functional group nodes are coloured green, while Cypriot ware groups are royal blue. Nodes have been sized according to eigenvector centrality values, while edges are weighted between 1 and 2 according to tie strength.

9.3 Combined Cypriot and Mycenaean Network – The Levant

The distribution of Cypriot and Mycenaean imports in the Levant is presented in the two-mode network Figure 9-5. Like the corresponding graph for ceramic distribution in Egypt, there are relatively few pendant nodes attached to the network, suggesting that distribution was widespread and systematic, with a variety of ware groups available through established trade systems. Unlike the graph for imports in Egypt, many of the most prominently located and largest scaled nodes represent wares that include predominantly open shaped dining vessels.[1038] These include the Mycenaean dining groups, which are clustered together on the right side of the graph, as well as the MONO, WSI, and WSII nodes in the center-left. Aside from the less common ware groups located along the lower periphery of the graph, there appears to be a clustering of Cypriot ware groups on the left side of the graph, while the majority of the Mycenaean function groups appear on the right.

The majority of the site nodes on the right edge of the graph, with import assemblages comprised of predominantly Late Helladic vessels, are smaller sites from the lower Levant (regions L3 and L4).[1039] These sites include the majority of poorly connected nodes, with minimal edges and eigenvector centrality measures. The predominance of small sites with limited—and exclusively Mycenaean—import vessels is a function of the data selection process for this project, in which the sites sampled were limited to those from which Mycenaean vessels had been recovered, thus eliminating the undoubtedly large number of Levantine sites from which Cypriot vessels have been recovered without any accompanying Late Helladic imports.

[1038] For network centrality figures, see Appendix Table 30.

[1039] Exceptions include Deir Khabie, Garife, and Tell es-Salihyeh from L2.

With the pendant nodes removed, the network structure is not drastically altered, suggesting that the clustering noted amongst Cypriot and Mycenaean nodes persists.

The collection of large and centrally situated site nodes remain relatively consistent in composition to previously constructed networks. With the inclusion of both Cypriot and Mycenaean wares, the notable additions to this group include Tell ‘Sera, Shechem, and Tell Dan, all of which contained varied Late Helladic and Cypriot assemblages. The remaining site nodes with high eigenvector centrality values are comprised of the important trading sites along the Levantine coast, and in the case of Hazor, Lachish, Shechem, and Megiddo, upon inland trade routes. As with the earlier graphs, there are also close associations between certain ware groups and particular sites, as indicated by the strength of the ties between them; examples include Tyre and BUC and MONO wares, or Tell el-‘Ajjul and BRII.

Although the sites of the central cluster yielded large assemblages with vessel types from the majority of the included ware groups, the peripheral sites reflect a greater degree of variability. In particular, the most restricted distribution patterns are associated with the Mycenaean vessel groups in the lower right part of the graph, including the dining, unknown, and ritual vessels, as well as the more uncommon BS/RS, BLWM, and BUC Cypriot wares. These vessel groups are associated most commonly with the larger central sites with broad assemblages. This pattern may be indicative of the distributional system employed in the circulation of material—particularly Mycenaean dining vessels—in which goods were first transported to trading hubs before being disseminated within the surrounding regions. The concentration of certain vessel types as funerary equipment in local elite tombs around central hubs and their immediate periphery (i.e., the Mycenaean Tomb at Tell Dan), suggests some degree of preferential access.

Table 3. Affiliation matrix of Cypriot wares and Mycenaean import vessels according to functional group in the Levant.

	RLWM	BLWM	WP	ROR/ROB	PBR	BRI	BRII	BRI-II	PWSW	WSI	WSII	WSI-II	WSH	MONO	BUC	BIC	BS/RS	Storage	S-Dry	S-Liquid	D-Serve	D-Drink	D-Eat	Ritual	U-CL	U-O
RLWM	19	8	12	13	1	17	18	5	6	13	18	6	14	14	7	9	9	6	12	13	13	10	8	6	6	7
BLWM	8	12	10	8	1	11	11	4	6	9	11	3	9	9	4	8	7	5	8	10	8	6	6	4	3	4
WP	12	10	36	23	1	25	27	7	8	20	27	7	22	19	8	13	12	7	22	24	19	15	10	6	11	8
ROR/R	13	8	23	27	1	22	23	6	8	21	25	7	18	18	6	14	12	6	16	17	16	13	10	6	9	7
PBR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0
BRI	17	11	25	22	1	46	41	10	8	24	39	8	27	28	10	14	12	12	29	29	22	18	15	9	14	14
BRII	18	11	27	23	1	41	53	10	10	25	42	10	31	28	11	15	12	14	32	31	24	18	16	9	14	14
BRI-II	5	4	7	6	1	10	10	12	3	8	11	3	10	9	5	5	4	4	8	8	6	3	2	3	3	3
PWSW	6	6	8	8	1	8	10	3	10	9	10	3	7	8	4	5	5	2	7	8	7	5	6	3	3	3
WSI	13	9	20	21	1	24	25	8	9	31	27	8	16	20	8	14	8	7	18	22	15	11	9	6	8	7
WSII	18	11	27	25	1	39	42	11	10	27	56	8	30	28	9	18	12	16	30	37	28	20	17	10	16	17
WSI-II	6	3	7	7	1	8	10	3	3	8	8	11	9	6	4	6	4	2	8	7	7	6	3	1	3	4
WSH	14	9	22	18	1	27	31	10	7	16	30	9	35	22	8	13	10	13	25	25	22	17	15	9	13	11
MONO	14	9	19	18	1	28	28	9	8	20	28	6	22	31	9	13	10	11	20	23	18	12	12	8	10	9
BUC	7	4	8	6	1	10	11	5	4	8	9	4	8	9	11	7	4	3	9	10	8	6	4	3	4	4
BIC	9	8	13	14	1	14	15	5	5	14	18	6	13	13	7	23	6	7	11	14	11	11	7	3	5	6
BS/RS	9	7	12	12	1	12	12	4	5	8	12	4	10	10	4	6	13	3	9	10	10	7	5	5	6	6
Storag	6	5	7	6	0	12	14	4	2	7	16	2	13	11	3	7	3	18	15	16	11	9	10	4	6	7
S-Dry	12	8	22	16	1	29	32	8	7	18	30	8	25	20	9	11	9	15	42	34	23	18	16	8	15	13
S-	13	10	24	17	1	29	31	8	8	22	37	7	25	23	10	14	10	16	34	54	29	21	16	9	15	15
D-	13	8	19	16	1	22	24	6	7	15	28	7	22	18	8	11	10	11	23	29	32	19	16	10	15	17
D-rink	10	6	15	13	1	18	18	3	5	11	20	6	17	12	6	11	7	9	18	21	19	23	14	8	12	10
D-Eat	8	6	10	10	0	15	16	2	6	9	17	3	15	12	4	7	5	10	16	16	16	14	18	9	9	9
Ritual	6	4	6	6	0	9	9	3	3	6	10	1	9	8	3	3	5	4	8	9	10	8	9	11	6	6
U-CL	6	3	11	9	0	14	14	3	3	8	16	3	13	10	4	5	6	6	15	15	15	12	9	6	18	10
U-O	7	4	8	7	0	14	14	3	3	7	17	4	11	9	4	6	6	7	13	15	17	10	9	6	10	19

The affiliation between different ware groups within the network of Cypriot and Mycenaean imports in the Levant is presented in Table 3. The most popular ware groups are WSII, BRII, and the Mycenaean containers for liquid goods, which were recovered from 56, 53, and 54 Levantine sites respectively. There is a high correspondence between BR and WS distribution, with the majority of sites from which either ware were recovered including both wares in their assemblages. This is also largely true of subtype evolution, in which the majority of sites with BRI and WSI also included BRII and WSII. There is also a strong correlation evident between the consumption of Mycenaean ritual vessels and dining vessels, including those used for serving, drinking, and eating. Conversely, ritual vessels in Egypt most commonly appear with containers for dry and liquid goods.

From the network analysis of the previous chapters, it was clear that the networks of imported vessels in Egypt had lower densities than their Levantine counterparts. Similarly, the affiliation frequency levels for import ware groups in the Levant are higher than that of Egypt (see Appendix Tables 31 and 32). These matrices reflect the percentage frequency of affiliation for each paired ware nodes; simply put, these figures reflect the number of times that each ware appears with the paired vessel node as a percentage of the total sites at which the ware was found (i.e., BLWM appears at 12 sites in Egypt, of which RLWM also appears 11 times, giving an affiliation frequency of 0.92). Although the overall means of the Egyptian and Levantine matrices were fairly similar, the standard deviation for the affiliation frequencies in Egypt is considerably higher. When comparing the two tables, it is evident that the inflated standard deviation for import ware affiliation in Egypt is a function of the centralization of ware distribution. Specifically, there are a higher number of wares with limited distribution, which appear almost exclusively at central sites with large assemblages (giving affiliation frequencies closer to 1). At the other end of the spectrum, there are also the widely circulated BR and RLWM vessel groups, which appear frequently at smaller sites with few other associated ware groups. The broader distribution of ware groups in the Levant yields more consistent affiliation frequency values, generating a lower standard deviation. Within the Levantine distribution system, a greater proportion of sites had access to a wider variety of shapes.

9.4 Combined Cypriot and Mycenaean Network – The Levant and Egypt

The final analysis of the network of Mycenaean and Cypriot imports in the Eastern Mediterranean comprises a consolidation of a number of previous network iterations. This network incorporates sites from both Egypt and the Levant, arranged into a one-mode affiliation network through shared vessel types (see Figure 9-6). The vessel groups included for this analysis are Cypriot ware groups and Mycenaean vessels categorized according to function. This network therefore represents the correspondence between import consumption at sites in the southern and eastern regions of the Mediterranean.

Sites in the network are arranged according to coordinates generated through non-metric multidimensional scaling, generating a fixed euclidean space within which graphed node proximity corresponds to network similarity. From the arrangement of sites within the network, there is no conclusive evidence for pronounced regional variation in import circulation. Sites of disparate geographic regions are dispersed throughout the network, suggesting that ware groups and vessel types were—in general terms—similarly broad in their accessibility. The structure of the network attends more to the dissimilarity of distinct peripheral nodes than to any substantial differentiation of central network sites or regional clusters.

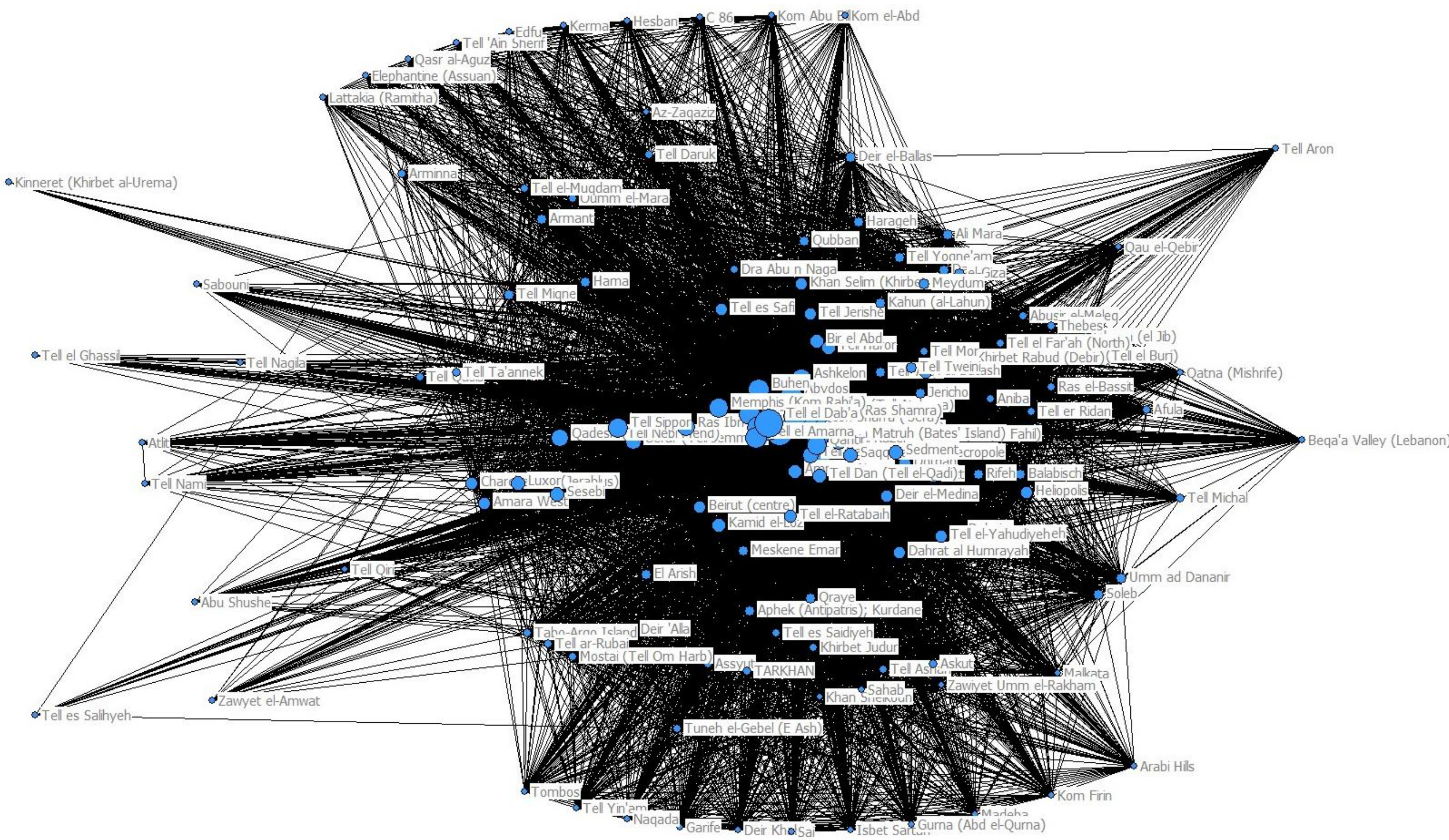

Figure 9-6. One-mode affiliation network of Levantine and Egyptian sites according to shared Mycenaean and Cypriot import vessels. Nodes are situated according to coordinates generated through non-metric multidimensional scaling, and have been sized according to betweenness centrality values.

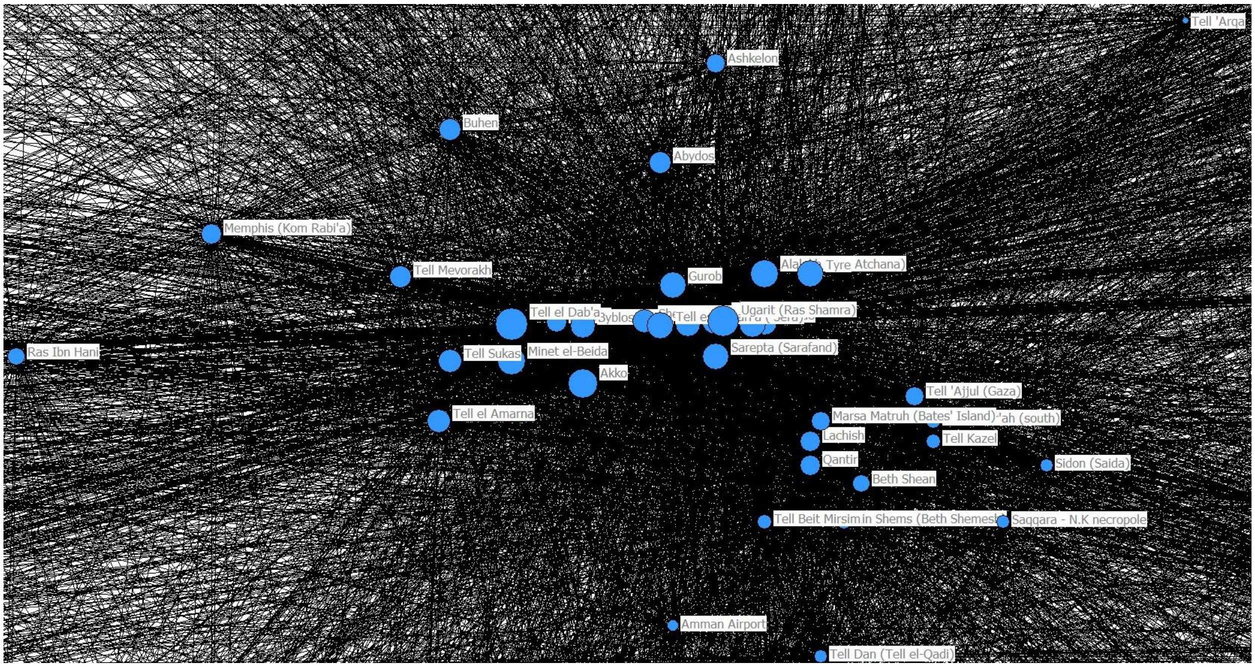

Figure 9-7. Close image of the central cluster of sites in the one-mode affiliation network of Levantine and Egyptian sites according to shared Mycenaean and Cypriot import vessels. Nodes are situated according to coordinates generated through non-metric multidimensional scaling, and have been sized according to betweenness centrality values.

The central cluster of sites from graph Figure 9-6 is presented in Figure 9-7. The close proximity of many of the site nodes reflects the close correspondence between numerous import assemblages. The overlapping group in the center of the graph includes (from left to right) Tell Sukas, Minet el-Beida, Tell el-Dab'a, Ashdod, Byblos, Tell Abu Hawam, Tell 'Sera, Sarepta, Megiddo, Gezer, Shechem, Hazor, Ugarit, and Tell el Hesi. This group includes sites with both large and moderate assemblages, however all sites correspond in their wide array of import vessel types (such as the presence of rare Mycenaean ritual vessels at Tell 'Sera and the closely associated Tell Mevorakh). Surrounding this central cluster are many of the sites commonly identified in previous networks as central locales for the distribution of different import groups, incorporating sites from all regions of Egypt and the Levant.

Although there is regional variation evident in the overall network, the small cluster of sites in the bottom right portion of Figure 9-7 is of particular interest. Aside from Sidon and Saqqara, this group incorporates the major sites associated with the hypothesized trade route along the northern coast of Egypt towards the Levant, from Marsa Matruh to Tell el Far'ah (South) and Tell el-'Ajjul. The remaining Delta and southern Levantine sites in this group would have been incorporated in a Late Bronze Age distribution system that directly supplied both Egypt and their regional interests in the southern Levant. Further research into additional material correspondence will be necessary into order to elucidate fully the connection between these two areas, as well as the specific route taken in supplying these adjacent regions during periods of Egyptian incursion and subjugation of southern Levantine polities. The close affinity between this cluster of nodes and a number of other regionally disparate sites in the central core of the consolidated network indicates that large sites from across both regions were connected through shared access to the bulk of Mycenaean and Cypriot imports available during the Second Millennium.

SECTION V – CONCLUSIONS

10. CONCLUSIONS

The primary goals of this dissertation were threefold: to explore the nature of Late Bronze Age ceramic trade networks through the distribution of both Mycenaean and Cypriot traded wares; to assess the role of Cyprus in the transmission of Aegean pottery to surrounding regions; and finally to use the ceramic network structures to profile the economic institutions of each region and evaluate current models of political economy employed in the analysis of second millennium Mediterranean polities. The results associated with each of these research questions will be considered in turn.

In addition to these principal research questions, this project further served to explore the efficacy of network analysis methodology as an analytical tool for the quantitative assessment of traded goods, particularly with the expressed aim of exploring broader questions surrounding the structural nature of trade systems and their associated political institutions. The successful application of network techniques here complements an emerging corpus of network studies—most notably on Roman history—that demonstrate the value of this approach for archaeological inquiry. In the analyses of the preceding chapters, network centrality and density measures proved effective in capturing structural features of the overall trade systems, which facilitated the comparison of measures across study regions of varying political organization. As demonstrated in Chapters Seven through Nine, network analysis is particularly effective in evaluating and visualizing complex relationships. The ability to code various factors by colouring and scaling nodes and edges allows for the incorporation of numerous measures and correspondence dimensions within a single network graph. The use of affiliation networks and the inclusion of both Cypriot and Mycenaean ware groups allowed for the comprehensive analysis of ceramic exchange in an unparalleled fashion.

The application of any model in archaeological research, particularly for the analysis of incomplete or fragmentary data, should be undertaken with conscious effort to recognize limitations and caveats. This was particularly evident in the assessment of Late Helladic wares, for which a considerable quantity was recorded in publications as simply 'unknown' in form and date. Accordingly, the high network centrality of the 'unknown' group node in preliminary network models demonstrates the high proportion of data that lacks definitive characteristics necessary for quantitative examination. In the case of network analysis, as with most analytical methods, the categorization of data bears considerable impact on the outcome. This was demonstrated through the varying quality of results generated through the analysis of Late Helladic imports according to the three selected taxonomic systems—chronological periods, FS shapes, and functional groups. The LH ware system proved overly broad, and frequently lacked the precision necessary to capture the nuances of regional variation or diachronic shifts. Conversely, the degree of detail incorporated in the FS shape networks obscured the patterning inherent in the associated distribution of related shapes (the recognition of which would require a comprehensive familiarity with the Furumark system). The delineation of study-region boundaries also impacts the results, as it necessarily requires the assignment of discrete borders to what may be relatively fluid frontiers (as is likely the case with the frontier between L1 and Anatolia in the northern Levant), and causes peripheral regions to have inevitably lower centrality scores, as large components of those regions' networks are omitted from the study.[1040]

In practical use, network graphs can prove difficult to interpret. An inherent difficulty with network visualization, particularly in the publication of network graphs, is the obscuring of

[1040] Sindbæk 2015, 111.

similar vertices through nodal overlap. This was particularly evident in the graphs constructed according to correspondence and non-metric multidimensional scaling, in which vertices of comparable network placement became overly crowded. Fortunately this problem is inherently one of visualization presentation, as network software programs allow the user to examine obscured graph sections, while network matrices can be used as an alternative to network graphs for data presentation. Despite these limitations, network analysis has proved particularly effective for the management, consolidation, and study of the large dataset of 23,427 sherds and vessels included in this study.

10.1 Ceramic Networks of the Second Millennium

The network analyses of Cypriot and Mycenaean traded ceramics demonstrate a high degree of variability across the three regions examined. Differentiation in import consumption across Cyprus, Egypt, and the Levant is indicated by the diverse popularity of open form dining vessels versus closed containers, diffusion of vessel circulation, concentration of large assemblages and rare forms at higher order sites, and centralization of distributional systems around political centers. These contrasting network attributes signify regional differences in demand and consumption, as well as trade infrastructure.

Ceramic networks of the eastern Mediterranean were well established by the commencement of the Late Bronze Age, connecting Cyprus, the Aegean, and neighbouring cultures through a regularly structured trade system. The early incorporation of the Aegean within this exchange network is evidenced by the presence of a number of imports of the LH I-IIB period in the south and northwestern parts of Cyprus, the Levantine coast, and select sites from both Upper and Lower Egypt. Late Minoan imports from Crete also appear from the early Late Bronze Age, with a similar distribution area as the Middle Minoan Kamares ware before it. There is a high degree of correspondence between the sites from which large assemblages of Mycenaean imports were found and those that yielded LM imports (see Appendix Catalogue 4). The shared distribution patterns of the Minoan and subsequently Mycenaean wares demonstrate the similarity in trade routes employed in the circulation of both groups. While both imports continue to be exchanged during the LM and LH III periods, Mycenaean vessels exceed exponentially the quantity of Minoan vessels circulated.

The largest and most typologically diverse collection of Late Helladic imports was recovered from Cyprus. Contrary to both the Levant and Egypt, Mycenaean imports were ubiquitous across the island, with examples recovered from most Late Bronze sites. Broad distribution continued throughout the Late Cypriot period, as evidenced by the high density of the one-mode network of Late Helladic wares on Cyprus, with groups of different periods highly connected. The high density value of the one-mode network also reflects the large number of sites from different regions that maintained access to imported vessels across a considerable time span. During the LH IIIB and LH IIIC periods, the substantial assemblage of imported Mycenaean vessels was supplemented with a large and growing industry for the domestic manufacture of Mycenaean imitation wares, which were circulated throughout both Cyprus and the neighbouring Levant. The concentration of wares on the island and the emergence of a local imitation trade are indicative of the large demand for such vessels on the island, as well as the central role of Cyprus in the ceramics trade of the Late Bronze Age.

The consumption of dining vessels on Cyprus is particularly notable for the large collections of bowls, cups, kylikes, and kraters recovered. Although both open and closed vessels were widely distributed, there appears to be more general access to closed shapes, as open vessels—particularly amphoroid kraters (FS 53-55)—were concentrated in elite tombs.[1041] The broad range of dining vessels on the island exceeds that of either the Levant or Egypt, suggesting that Cypriot consumers exhibited a higher demand for such products. The popularity of dining vessels corresponds to a well-established practice of communal feasting within Late Cypriot society, with Mycenaean import dining sets acting as an exotic substitute for local wares, likely as a form of conspicuous elite consumption.

The distribution of Late Helladic vessels in the Levant parallels in many ways the consumption of Mycenaean imports on Cyprus. Although closed shapes predominate the assemblage, the proportion of open vessels is higher than traditionally ascribed to the region, representing approximately 40% of all Mycenaean imports (rather than the traditional estimate of 30%). Similar to the distribution pattern observed for the highly popular Cypriot WS bowls, Mycenaean dining vessels were commonly deposited in domestic areas, which represent a far higher proportion of import deposition contexts than in either Cyprus or Egypt (however, as noted above, both Egyptian and Cypriot archaeology suffer from an overall comparative dearth of published domestic contexts from the Late Bronze Age). The consumption of open versus closed vessels evinces regional variation, with open shapes far more common in the north than the south; the highest proportion occurs in L1, in which open vessels appear in equivalent frequency to closed shapes. The distributions of certain uncommon open shapes also cluster in the northern Levant, including rhyta (FS 199-202) and mugs (FS 225-226). Regional differentiation in circulation patterns also exist for a number of shape subtypes, such as the

[1041] Steel 2004a, 77.

concentration of lentoid flasks (FS 186) in L2. Consumption differences such as the popularity of alabastra in L4 may reflect the influence of Egypt in the southern Levant, as this peripheral region was subsumed into the Egyptian authority through parts of the second millennium. The impact of Egyptian domination in the southern Levant may also be indicated by the diffuse pattern of Mycenaean imports in the area, for which there is a corresponding lack of Class 5 sites.

Regional variation is similarly exhibited by Cypriot ware distribution across the Levant, including discrepancies in the relative popularity of different lustrous wares. While BLWM is comparatively more popular in the southern regions, RLWM dominates in the north. The concentration of RLWM in the northern Levant is particularly intriguing when considered within the context of the current dispute over the origin of manufacture for the ware group. Early trade contacts between Cyprus and the Levant are demonstrated by the wide distribution of WP vessels in the terminal Middle Bronze, as well as early Late Cypriot wares (such as MONO and BIC) during LB I. Regional variation is again evident from the earliest periods of trade, with PWS and PBR imports concentrating in the southern Levant (PWS vessels have been found at Ashkelon, Dothan, Hazor, Lachish, Megiddo, Pella, Tell Dan, Tell er Ridan, Ugarit, and in significant quantity at Tell el-‘Ajjul; a single PBR vessel has been recovered from Tell el-‘Ajjul). Tell el-‘Ajjul also yielded an unusual collection of WP vessels, in which a number of uncommon decorative styles were attested. Geographic differentiation visible in the networks of both Mycenaean and Cypriot imports in the Levant demonstrates the existence of multiple ports of entry or ‘gateways’ to this market during the Late Bronze Age, through which different vessel types could be funneled with varying frequency according to local demand.

Of the three regions examined, Egypt has the highest proportion of closed vessels of both Cypriot and Mycenaean manufacture, with most imports categorized as storage vessels for the containment of liquid goods. Ceramic imports also reflect the greatest predominance of mortuary contexts for the recovered finds (although, as noted, this is not unexpected for excavations in Egypt). The network of Mycenaean and Cypriot imports in Egypt also reflects the highest degree of diachronic variation associated with political changes during the Late Bronze Age. This is particularly evident in network shifts related to the relocation of state administrative and palatial sites from the Second Intermediate Period through the 18th and 19th Dynasties. The movement of political centers resulted in the accumulation of large but highly chronological circumscribed assemblages at shorter-lived sites. Chronological variation in Egyptian ceramic import consumption is also visible in the circulation of Cypriot imports, with significant changes occurring in the transition from the LB I to LB II. This transition is associated with the marked decrease in import quantities around the development from BRI and BRII. The prominent decrease in the number of BRII imports has been attributed to the reduction in military excursions to the Levant, as the distribution of BRI juglets in Egypt has been associated with the spoils of war accumulated by soldiers during campaigns in the Levant.[1042] This hypothesis is supported by the wide distribution of BRI juglets in non-elite tombs from periods of high imperial expansion. While returning soldiers may have been responsible for the importation of closed BR vessels (primarily for their contents),[1043] other ware groups would have been mobilized through alternative and more institutional channels. The use of established trade networks for the transportation of more rare ware groups and shapes in Egypt is supported by the concentration of these vessel types in royal capitals, as well as the correspondence between the

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[1042] Bergoffen 1990, 305-314.

[1043] Cypriot juglets, both BR and BUC, were receptacles employed for the distribution of either opium or oils (see Merrillees 1962; Merrillees and Evans 1989; Koschel 1995; Bisset et al. 1996; cf. Chovanec et al. 2012).

assemblages of such sites with state and regional centers in Cyprus and the Levant.

Aside from import concentration in capital sites (specifically Tell el-Amarna, Tell el-Dab'a, and Qantir), a number of ware groups and shape types are highly clustered in the Delta/Fayyum and Sinai, highlighting the transportation system through which ceramic imports were mobilized. Wares found primarily in the north include MONO, BIC, ROR/ROB, WS, and WSh. As these ware groups were widely circulated in both Cyprus and the Levant, their presence in the north may reflect foreign influence in Lower Egypt, or simply the specific trade route taken (entering Egypt either through Marsa Matruh in the western Delta or from a large site like Tell el-'Ajjul via the Sinai). Similar patterning is evident in the distribution of shapes rare in Egypt but common in Cyprus and the Levant, including bowls, kraters and cups. These open import vessels correspondingly cluster along the northern trade route through the Delta and Sinai, of which the collection of BR bowls at Bir el Abd is an example. There are also somewhat unusual concentrations of Cypriot vessel groups in the liminal region in southern Egypt along the frontier with Nubia. In particular, this includes the large collections of BS and lustrous vessels at Aniba, as well as a broad collection of Mycenaean stirrup jars and flasks at Buhen.

Variation across the Mycenaean import networks constructed for the three regions of study reveal marked differences in both the density and centrality of the systems in each area. The most marked difference is the considerable disparity in density between the Cypriot and Levantine networks and those for Egypt. Cyprus has the highest site interconnectivity, with the greatest proportion of sites connected in the one-mode networks constructed according to LH Wares and FS shapes (see Appendix Tables 13, 14, and 15). The overall density of distribution in Cyprus is further reflected by the low proportion of sites of Class 1, and the higher proportion of Class 2 sites (see Table 4). Rather than a pervasion of isolated import examples, the trade

Table 4. Frequency of sites and Mycenaean imports according to site size.

	1	2	3	4	5
No. Sites – Cyprus	61	26	2	4	3
% Sites – Cyprus	64%	27%	2%	4%	3%
% LH Finds - Cyprus	2%	9%	2%	12%	75%
No. Sites – Egypt	55	6	1	1	1
% Sites – Egypt	86%	9%	1.5%	1.5%	1.5%
% LH Finds - Egypt	9%	9%	4%	7%	71%
No. Sites – Levant	70	24	9	4	2
% Sites – Levant	64%	22%	8%	4%	2%
% LH Finds - Levant	4%	14%	16%	21%	45%

network supplying Late Helladic vessels to Cyprus enjoyed broad coverage with regular circulation. Although marginally lower than Cyprus, the density values for both Cypriot and Mycenaean imports in the Levant were considerably higher than those for Egypt (see Appendix Table 21). While the Cypriot and Levantine networks are comparatively denser than the corresponding graphs in Egypt, the networks of ceramic imports in Egypt are the most centralized, with traded goods concentrating at important political centers.

The network centralization values for imports in Cyprus, Egypt, and the Levant similarly indicate that the distribution of material within Egypt was significantly more centralized. In the case of Mycenaean imports, the largest assemblage—recovered from the site of Tell el-Amarna—represents 69% of the total collection of Late Helladic ceramics from the region. Egypt, and to a lesser degree Cyprus, have high concentrations of total imported vessels within Class 4 and 5 sites (however large sites are notably more common in Cyprus). Conversely, the wider and more diffuse distribution of imported ceramics in the Levant is indicated by the dissemination of a larger proportion of total Late Helladic imports across smaller scale sites (Classes 1-3); of the three regions examined, the Levant had the lowest concentration of imports in higher order sites.

Although the overall trade network in Egypt is the most centralized, all three regional networks reflect at minimum a moderate degree of internal centralization, as each was dominated by a small collection of sites. The regional networks all approach scale-free systems, in which strategically located network hubs boast assemblages of exceedingly great quantity and variety. This is particularly true of Enkomi on Cyprus. Although the site's assemblage contained a high number of rare vessel types that were only marginally attested on the island, the smaller sites located in its immediate periphery share nearly all of their import FS shapes with Enkomi. This therefore suggests that the distribution of material to the region surrounding Enkomi was conducted via the site itself. Although it may have acted as a redistributive center for the circulation of Mycenaean imports for the surrounding area, the distribution of material throughout contexts of varying economic status throughout the site suggests that the systems through which material was mobilized were not politically centralized or exclusively open to elite patrons.

Comparable distribution hubs in the Levant include Ugarit in L1, Sarepta in L2, and Tell Abu Hawam in L3. Each of these sites contained the broadest range of shapes and wares within their respective regions. Nearly all shapes attested within their neighbouring areas were accounted for within each site's assemblage, alongside of which a variety of less popular shapes and ware groups were present. Although Ugarit, Sarepta, and Tell Abu Hawam may represent the most important distribution hubs in the Levant, the prevalence of additional high-ranking sites in both the Levant and Cyprus indicate the lack of a central governing network administrative or political center. The short average path lengths and apparent clustering of the Levant network indicate features consistent with the Small-World model, from which the trade system of the Levant developed. This structural diffusion is stark in contrast to Egypt, for which distribution was far more restricted to important political centers.

The popularity of open Mycenaean imports, particularly in the Levant and Cyprus, indicate the inherent value of these vessels as traded goods, rather than as simply subsidiary products circulated for their contents. The use wear on many of these ceramics demonstrates that imported open shapes were not exclusively used for mortuary consumption.[1044] Instead, the importation of open shapes for use in dining contexts may have been a factor driving demand. Open dining vessels, recovered from both domestic and mortuary contexts, may have been employed during communal feasting events, in which the conspicuous display of imported goods would infer elite status upon the owners.[1045] The concentration of particular dining vessel groups in elite contexts—such as decorated amphoroid kraters (FS 53-55) in elite tombs on Cyprus or BR and WS kraters and bowls in Levantine palaces[1046]—further corroborates the inherent high value attached to imported Late Helladic and Cypriot open vessels. While consumable contents remain an integral component of Late Bronze Age ceramic distribution, it is clear from the wide circulation and elite deposition contexts of Late Helladic and Cypriot open vessels that the circulation of these goods was driven by both high demand and material worth.

10.2 Cyprus and the Circulation of Aegean Pottery

The role of Cyprus as an intermediary in the circulation of Mycenaean ceramics

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[1044] Keswani 1989, 562; 2004, 127.

[1045] See Steel (1998, 2004b) and Keswani (1993) for discussions of the use of imported Mycenaean dining vessels for the establishment of elite status on Cyprus.

[1046] For example, BRI kraters were found in the Level IV palace at Alalakh and the palace at Tell el-‘Ajjul, while the latter also yielded a number of early WS bowls and kraters.

throughout the eastern Mediterranean has been indirectly surmised from the assumed agency of Cyprus in the trade of copper, the large corpus of Late Helladic imports recovered from the island, the frequent co-presence of both ware groups in neighbouring regions, and the emergence of a local industry for the production of Late Helladic wares in the latter part of the Late Bronze Age.[1047] To substantiate the hypothesized role of Cypriot agents in the dissemination of Mycenaean ceramics, the nature of regional import circulation on Cyprus was contrasted with the distribution networks of Egypt and the Levant, while the macro-scale Mediterranean network for Late Helladic ceramics was assessed to determine the relative centrality of Cypriot sites. The correspondence between the distribution of Cypriot and Mycenaean ceramics was further demonstrated by the results of the analysis of the combined ceramic network in Egypt and the Levant.

Of the total range of Mycenaean FS shapes present as imports in the three regions examined, very few are not documented on Cyprus. The majority of FS shapes not yet accounted for include shape subtypes for which analogous forms have been recovered. Examples of such subtype absence include piriform jars (FS 16, 24, 39), the LH II rounded alabastron (FS 82), and the LH IIB/C globular stirrup jar (FS 176). For each of these shapes, closely related vessel types are attested in large quantities on the island.[1048] Late Helladic import shapes not present in any

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[1047] Hankey 1967, 1971; Hirschfeld 200; Gilmour 1992; Eriksson 2007a.

[1048] The total group of shapes not accounted for in Cyprus—but present elsewhere in the Mediterranean—include (with the sites where they are found, along with comparable shapes attested on Cyprus, presented in brackets): FS 16 (Amman Airport; comparable to FS 19, and 23), FS 24 (Amman Airport; comparable to FS 31), FS 39 (Luxor; comparable to FS 35), FS 56 (Qantir, Tell el-Dab’a; comparable to FS 53-55), FS 82 (Gurob, Alalakh, Armant; comparable to FS 83-85); FS 87 (Kahun, Sidon; comparable to other globular conical jars), FS 120-121 (Tell el-Dab’a, Qantir, Amarna; comparable to FS 128-129), FS 126 (Lachish, Ugarit), FS 130 (Saqqara; comparable to FS 128-129), FS 176 (Ugarit, Beth Shean, Byblos, Ashdod; comparable to FS 169-177), FS 198 (Tell Abu Hawam), FS 236 (Qantir), FS 237 (Saqqara), FS 256, 257, 262, and 278 (Akko, Gezer, Lachish, Kamid el-Loz, Minet el-Beida, Qadesh, Sidon, Sarepta, comparable form are the funnel (FS 198) and the lid (FS 334). Given that much of the Mycenaean material is published in vague detail (i.e., "stirrup jar"), or is comprised of sherds small enough to make definitive attribution difficult, it is clear that differences in regional assemblages are more indicative of small subtype variation and the limiting quality of the archaeological record rather than significant discrepancies in demand or consumption.

The concentration of Late Helladic imports on Cyprus is particularly evident when considering the range of shapes present at the site level. The average number of different FS shapes per site is higher in Cyprus (6.75) than either the Levant or Egypt (5.76 and 3.83 respectively).[1049] Within Egypt, the sites with the highest range of shapes include Tell el-Amarna, Tell el-Dab'a, and Qantir, with 34, 26, and 25 FS shapes attested each. The largest Levantine site assemblages are considerably more diverse, with the greatest range of vessel shapes attested at Ugarit, Tell Abu Hawam, and Minet el-Beida (56, 46, and 40). There are also a number of second-tier centers with 20 or more FS shapes present, including Amman Airport, Beth Shean, Byblos, Hazor, Kamid el-Loz, Megiddo, and Sarepta. Conversely, though Mycenaean imports were widely distributed, there are fewer sites in Cyprus with assemblages comprising more than 20 different FS shapes; sites exceeding this threshold include Enkomi, Hala Sultan Tekke, Kition, Kourion Bamboula, and Maroni Vournes. Although there are fewer Cypriot sites within this class, the largest assemblage, recovered from Enkomi, has the greatest number of shapes present of any site in the Mediterranean at 70. It is also likely that Hala Sultan Tekke (which currently

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Tell Abu Hawam, Ugarit; comparable to other stemmed cups/kylikes/goblets FS 254-278), FS 283 (Amman Airport, Kamid el-Loz, Ugarit, Tell el-Amarna; comparable to other deep bowls FS 281-286), FS 304 (Ugarit, Tell el-Amarna; comparable to deep stemmed and spouted bowls FS 303-306, 308-310), FS 334 (Amman Airport, Minet el-Beida), and FS 336 (Tell el-Dab'a and Qantir).

[1049] These values are all artificially low due to the high proportion of material published as 'unknown shape'.

attests 32 different FS Shapes and general form groups) will yield an assemblage of considerable diversity once all Late Helladic imports are studied and published in detail.[1050]

By examining the distribution of Mycenaean and Cypriot imports together, it was possible to assess trade in the Late Bronze Age through new and innovative methods. The similarity in the circulation of both ware groups is evidenced by the correspondence between sites with high centrality in both Cypriot and Mycenaean regional networks. Furthermore, on a macro-scale, both ware groups were consumed fairly consistently within each region of study. For example, containers for liquid goods were by far the most popular vessel types in Egypt for both Cypriot and Aegean wares, including Mycenaean flasks and stirrup jars, BR juglets, and RLWM flasks and spindle bottles. In the Levant, both storage and dining vessels were popular, with open and closed shapes of both ware groups imported to varying degrees throughout all Levantine regions. The affiliation frequency matrices for Cypriot and Mycenaean vessel groups presented in Chapter Nine quantitatively verified the distributional correspondence of these two import groups, which regularly appear together in site assemblages across Egypt and the Levant.

The attestation of nearly all Late Helladic shapes in Cyprus, as well as the diverse assemblage and high network centrality of Enkomi in particular, support the supposition that Cyprus was active in the distribution of Mycenaean imports throughout the eastern and southern Mediterranean. In both Egypt and the Levant, Cypriot imports were far more common than Aegean vessels (with the exception of Tell Abu Hawam and Tell el-Amarna, from which larger quantities of Mycenaean vessels were reported).[1051] Given the high affiliation frequency of

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[1050] In addition to the large collection of preliminarily reported material recovered from a number of wells at the site are new high quality imports discovered in an elite tomb excavated during the 2016 season (Surugue 2016).

[1051] The higher quantity of Cypriot vessels in the Southern Levant has been interpreted by Bergoffen as an vessel groups across ware types, it is likely that Mycenaean vessels were circulated along corresponding or shared distribution networks to those employed for the exchange of Cypriot ceramics. Whether these distribution systems were administered by Cypriot agents, or whether Cyprus simply formed an interceding stop along the main trade route employed by Mycenaean or independent merchants, the correlation between the circulation of Cypriot and Aegean vessels supports the reconstruction of a single primary trade network for ceramic exchange in the Late Bronze Age.

10.3 Trade and Political Economy in the Late Bronze Age Mediterranean

Network analysis also proved highly effective in the assessment of state-level economic institutions in Cyprus, Egypt, and the Levant, that governed and administrated to varying degrees the mobilization of exchanged goods. The traditional analytical approaches used for the study of political economy in the Late Bronze Age were surveyed in Chapter Three, while the models commonly applied to the different regions studied here were discussed in Chapter Two. The structuring philosophy of many such models is the relative degree of political and economic centralization associated with alternative styles of governance within an individual state and its associated periphery. From World Systems to Peer-Polity Competition, different models intimate varying methods of interaction and exchange at both intra- and inter-regional scales, with the perceived 'core' dominating economic activity to differing degrees within each approach. Integral to these models is the perceived role of independent and entrepreneurial ventures

indication of the higher value of Mycenaean imports, which she has afforded a luxury status relative to the more quotidian Cypriot vessels (1990, 288).

conducted outside of official institutional channels. Centralization within any economic system should thus be defined at both the micro- and macro-scales, in consideration of the incorporation of extra-palatial agents in production and exchange, as well as the dominance of a central core over the system as a whole.

While many of the traditional models used in the study of pre-capitalist economies suffer from excessive rigidity through a perceived absolute centralization of production and exchange, the network model employed here accommodates a more fluid and substantivist assessment of the numerous interaction spheres extant in the complex system of Late Bronze Age exchange. Within the most politically centralized region incorporated in this study—the imperial state of Egypt headed by a hereditary monarch—two quasi-independent circulation systems have been identified. Administrative and palatial centers in Egypt appear to have been supplied through institutional state-sponsored networks of exchange, in the forms of tribute, reciprocal gifting, and commercial trade, through which both storage and dining vessels were circulated. This is demonstrated by the correspondence of assemblage composition between the palatial and administrative centers of Egypt and those recovered from state centers in the Levant and Cyprus. This correlation in import consumption between political centers across regions differs markedly from the disparity between import assemblages from high and low order sites within Egypt (particularly in regards to the higher proportion of open vessels). The majority of sites throughout Egypt appear instead to have provisioned through a more independent exchange network, dealing predominantly in the more common—and perhaps more affordable—imported wares, namely BR, RLWM, and Late Helladic storage vessels. Although Egypt had a high degree of political centralization, the broad distribution of import vessels throughout contexts of varying social status suggest that the internal circulation mechanisms for imported goods were not overly centralized. The distinct distribution pattern of less common ware and shape groups within the Delta further supports the reconstruction of a ceramic trade network operating outside of state-level institutions, which traversed this region en route to and from the southern Levant.

While Egypt represents a singular state governed by a central administration, both the Levant and Cyprus reflect more decentralized systems of political economy. The distribution of ceramic imports in the latter two areas illustrates the absence of a single administrative core, as competing states in both regions enjoyed relatively unrestricted access to ceramic imports. Large strategically located sites along the coast and interior trade routes formed important ‘gateway’ nodes within both the Cypriot and Levantine trade networks, through which traded goods were distributed. While the largest and most diverse assemblages concentrate on such sites, the wide circulation of ceramic imports across ware groups and vessel forms signifies a wide degree of accessibility to consumers of varying social status. Although the distribution of certain vessel subtypes such as the Mycenaean amphoroid krater (FS 53-55) suggests preferential access and elite-emulation in consumption,[1052] the circulation of these and related forms far exceed in breadth the distribution associated with centralized political economies (e.g. central-place redistribution), demonstrating the lack of a governing central authority in the exchange system.

Although the Levant is ordinarily characterized by the presence of smaller competing kingdoms during the second millennium, consensus over the interpretation of the political organization of Cyprus is less established. While Enkomi forms the largest node within the Cypriot trade network—at least according to Late Helladic imports—the overall network structure lacks an influential governing core. Thus, while Enkomi was afforded a central place

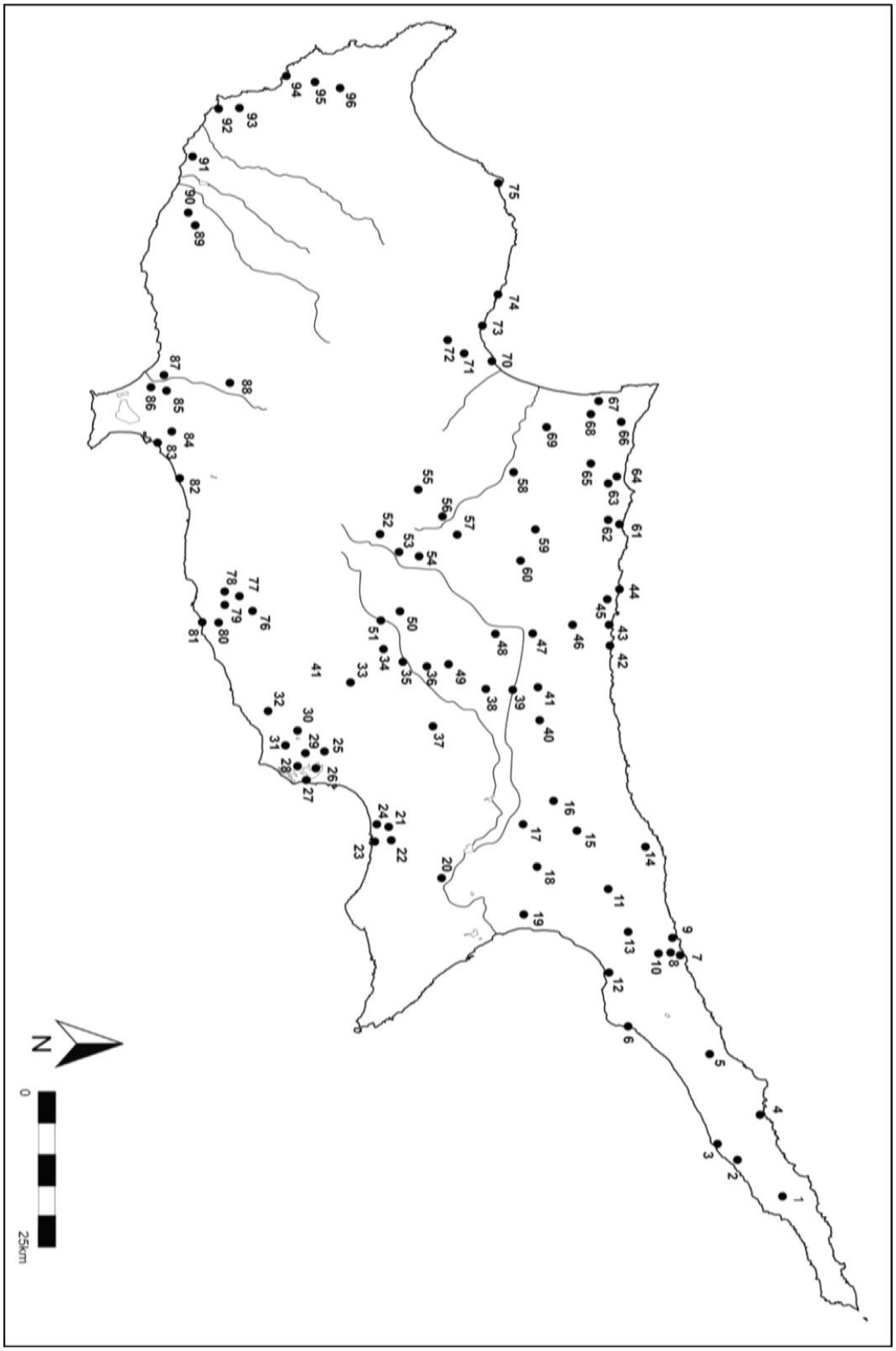
[1052] For the role of Mycenaean dining vessel consumption in Cyprus within the context of social feasting, see Dabney 2007 (192).

within the trade network of the Late Cypriot period, the high density and low centralization of the overall network structure, as well as the comparable network centrality of sites such as Hala Sultan Tekke and Kition, support the reconstruction of competing peer-polity states or even complex-chiefdoms rather than a hierarchical 'Alashiyan' kingdom with Enkomi as the capital. In accordance with the noted lack of cohesive administrative institutions and shared public architectural programs, the absence of a central core and the diffusion of elite shapes amongst competing centers within the network of Mycenaean imports in Cyprus refute the reconstruction of a centralized kingdom with a political core. Further articulation of the political economy of Cyprus will necessitate a more in-depth contextual analysis of import consumption, as well as a broader assessment of material culture across the island, however the results of this network analysis explicitly contest the proposal of a unified state of Cyprus during the Late Bronze Age.

The network analysis of this dissertation forms a basis for the further assessment of trade systems in the Late Bronze Age Mediterranean. The robustness of the results and conclusions obtained here will be greatly enhanced by the inclusion of additional luxury and quotidian import material within the data, as well as the comparison of results to detailed examinations of textual records associated with production and circulation of goods at different sites. Areas of particular interest for future research include a more detailed assessment of the diachronic changes in distribution networks in the southern Levant in association with fluctuating pressure from Egypt, as well as exchange relations between northern Cyprus and the southern Anatolia through the terminal Middle and Late Bronze Ages. As additional material groups and expanded research areas are incorporated within the network, future research on Mediterranean trade systems and political institutions will be able to capture more effectively the complex nature of exchange in the Late Bronze Age.

APPENDICES

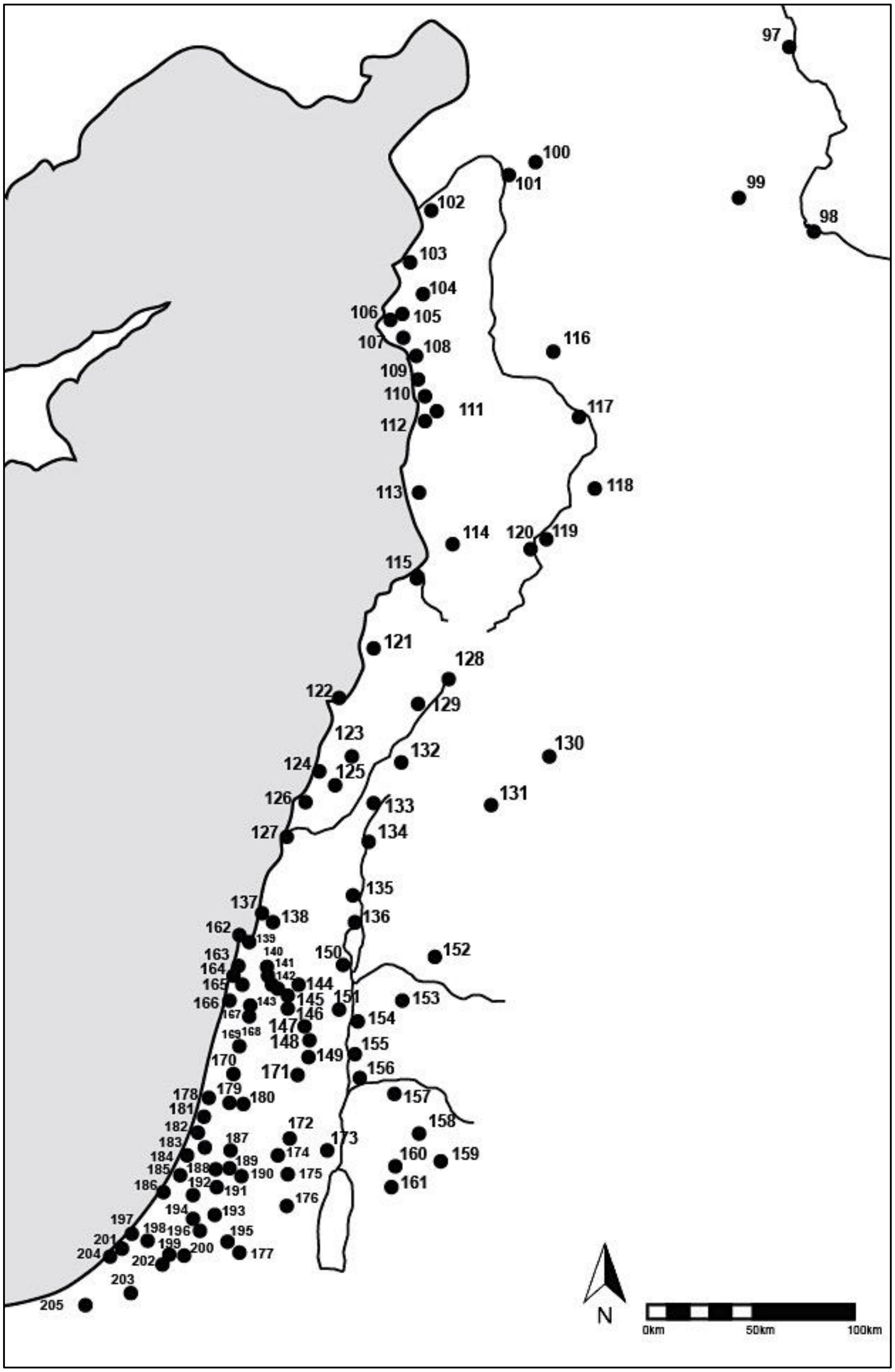
MAP 1 – SITES IN CYPRUS WITH MYCENEAN IMPORTS



Map 1 – Sites

1 Rizokarpasso
2 Galinorporni
3 Korovia Nitovikla
4 Ayios Thyrsos Vikla
5 Leonarissio
6 Ayios Theodoros
7 Dhavlos Pyrgos
8 Anaochora
9 Phlamoudhi Sapilou
10 Kantara
11 Ayios Iakovos Melia & Dhime
12 Gastria Ayios ionnis
13 Ovgoros
14 Akanthou Moulos
15 Psilatos Moutti
16 Marathovouni
17 Sinda
18 Milia
19 Enkomi
20 Kalopsidha
21 Pyla Kokkinokremos
22 Dhekelia Steno
23 Dhekelia Koukouphoudhkia
24 Pyla Verghi
25 Aradhippou
26 Kition
27 La1ia tou Riou
28 Hala Sultan Tekke
29 Dromola1ia trypes
30 Klavdhia
31 Arpera Chiflik
32 Kivisil Gyppos
33 Lythrodhonda Moutti
34 Alambra
35 Idalion
36 Ayios Sozomenos
37 Athienou Baboulari
38 Nicoseia Ayia Paraskevi
39 Kaimakli Evretadhes
40 Angastina
41 Palekythro
42 Ayios Epiktetos
43 Kazaphani Ayios Andronikos
44 Myloptetres
45 Karmi
46 Dhikomo Onisia
47 Nicosia Bairaktar
48 Strovolos Dromero
49 Yeri Phoenikias
50 Analionda Palioklichia
51 Mathiatis
52 Politiko-Lambertis
53 Pera
54 Tamassos Litharkes
55 Akhera
56 Meniko Kyra tou Dhiakou
57 Arediou-Vouppes
58 Akaki
59 Dhenia
60 Kokkini Trimithia
61 Lapithos Ayia Anastasia
62 Larnaca tis Lapithou
63 Myrtou Pigadhes
64 Myrtou Stephania
65 Dhiorios Kupous
66 Kormakiti Ayious
67 Ayia Irini Palaeokastro
68 Ayia Irini Temple Site
69 Toumba tou Skourou
70 Pendayia
71 Katydhata
72 Apliki
73 Soloi
74 Loutros Adhkia
75 Pomos
76 Kirokitia Skasmata
77 Kalavassos Mavrovouni
78 Kalavasos Ayios Dhimitrios
79 Kalavasos Mangi
80 Maroni Vournes
81 Maroni Tsaroukkas
82 Amathous
83 Limassol Kapsalos
84 Polemidhia Oufkia
85 Erimi Kafkalla
86 Kourion Apiskopi
87 Kourion Bamboula
88 Alassa
89 Kouklia Skales
90 Kouklia Palaepaphos
91 Yeroskipou
92 Paphos
93 Peyia Koutsourous
94 Maa Palaeokastro
95 Arodhes
96 Drousha Appiourka

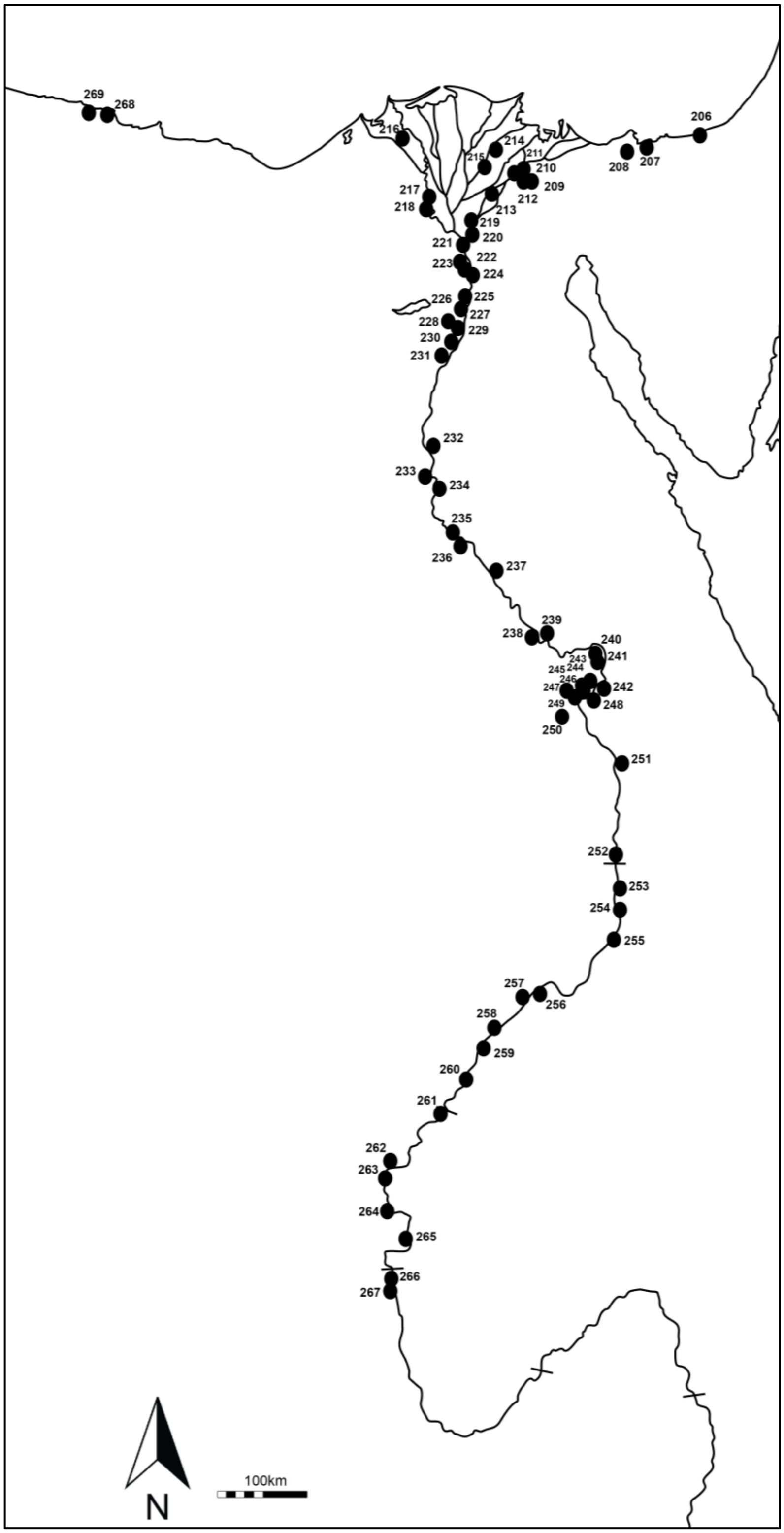
MAP 2 – SITES IN THE LEVANT WITH MYCENEAN IMPORTS



Map 2 – Sites

97 Charchemish (Jerablus)
98 Meskene Emar
99 Oumm el-Mara
100 Çatal Hüyük
101 Alalakh (Tell Atchana)
102 Sbouni
103 Ras el-Bassit
104 Tell Narh al-‘Arab
105 Ugarit (Ras Shamra)
106 Minet el-Beida
107 Ras Ibn Hani
108 Lattakia (Ramitha)
109 Tell Tweini
110 Tell Sukas
111 Arab al Mulk
112 Tell Daruk
113 Tell Kazel
114 Tell Hayat
115 Tell ‘Arqa
116 Khan Sheikoun
117 Hama
118 Qatna (Mishrife)
119 Tell Ouaouieh
120 Qadesh (Tell Nebi Mend)
121 Byblos (Jbail)
122 Beirut (centre)
123 Garife
124 Sidon (Saida)
125 Qraye
126 Sarepta (Sarafand)
127 Tyre
128 Tell el Ghassil
129 Tell ‘Ain Sherif
130 Tell es Salihyeh
131 Deir Khabie
132 Kamid el-Loz
133 Khan Selim
134 Tell Dan (Tell el-Qadi)
135 Hazor
136 Kinneret (Khirbet al-Urema)
137 Akko
138 Tell Bir el-Gharbi
139 Tell Abu Hawam
140 Tell Qasis
141 Tell Qiri
142 Tell Yoqne’am
143 Abu Shushe
144 Afula
145 Megiddo (Tell el-Mutesselim)
146 Tell Kadesh
147 Tell Ta’annek
148 Dothan
149 Tell el Far’ah (North)
150 Tell Yin’am
151 Beth Shean
152 Tell Ashari
153 Tell Irbid
154 Pella (Tabaqat Fahil)
155 Tell es Saidiyeh
156 Deir Ala
157 Umm ad Dananir
158 Amman Airport
159 Sahab
160 Hesban
161 Madeba
162 Tell es Samak
163 Atlit
164 Tell Nami
165 Tell Eran
166 Dor (Tell el Burj)
167 Tell Mevorakh
168 Tell Aron
169 Jatt
170 Tell Burtgatha
171 Shechem (Tell Balata)
172 Bethel (Beitin)
173 Jericho
174 Gibeon (el Jib)
175 Jerusalem
176 Khirbet Judur
177 Khirbet Rabud (Debir)
178 Tell Michael
179 Aphek (Antipatris)
180 Isbet Sartah
181 Tell Jerishe
182 Yavneh Yam
183 Dahrat al Humrayah
184 Tell Mor
185 Ashdod
186 Ashkelon
187 Gezer
188 Tell Miqne
189 Tell Batash
190 Ain Shems (Beth Shemesh)
191 Tell es Safiyeh
192 Tell Sippor
193 Lachish (Tell ed Duweir)
194 Tell el Hesi
195 Tell Beit Mirsim
196 Tell Nagila
197 Tell ‘Ajjul (Gaza)
198 Qudur el Walaida
199 Tell Haror
200 Tell Sera’
201 Deir el Balah
202 Gerar (Tell Jemmeh)
203 Tell el Far’ah (south)
204 Tell er Ridan
205 El-Harruba

MAP 3 – SITES IN EGYPT WITH MYCENEAN IMPORTS



Map 3 – Sites

206 El-Arish
207 Bir el Abd
208 C 86
209 Ali Mara
210 Tell el-Dab'a
211 Qantir
212 Tell el-Rataba
213 Az-Zaqaziz
214 Tell ar-Rubai
215 Tell el-Muqdam
216 Kom Firin
217 Mostai (Tell Om Harb)
218 Kom Abu Billo
219 Tell el-Yahudiyeh
220 Heliopolis
221 el-Giza
222 Abusir el-Meleq
223 Saqqara - N.K necropole
224 Memphis (Kom Rabi'a)
225 Tarkhan
226 Riqqeh
227 Meydum
228 Kahun (al-Lahun)
229 Harageh
230 Gurob
231 Sedment
232 Zawyet el-Amwat
233 Tuneh el-Gebel (E Ash)
234 Tell el-Amarna
235 Assyut
236 Rifeh
237 Qau
238 Abydos
239 Balabisch
240 Deir el-Ballas
241 Naqada
242 Thebes
243 Kom el-Abd
244 Deir el-Medina
245 Qasr al-Aguz
246 Malkata
247 Dira Abu n Naga
248 Karnak
249 Armant
250 Gurna (Abd el-Qurna)
251 Edfu
252 Elephantine (Assuan)
253 Arabi Hilla
254 Daqqa
255 Qubban
256 Aniba
257 Arminna
258 Debeira
259 Buhen
260 Askut
261 Sai
262 Amara West
263 Soleb
264 Sesebi
265 Tombos
266 Kerma
267 Tabo-Argo Island
268 Marsa Matruh (Bates' Island)
269 Zawiyet Umm el-Rakham

CATALOGUE 1 – SITES WITH MYCENAEAN IMPORTS

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
CYPRUS					
Akaki	X		X	X	2
Akanthou Moulos	X		X	X	2
Akhera	X		X	X	2
Alambra			X	X	2
Alassa				X	1
Amathous			X		1
Analionda Palioklichia				X	1
Anaochora	X				1
Angastina			X	X	2
Apliki	X		X	X	3
Aradhippou	X		X	X	2
Arediou-Vouppes	X		X	X	2
Arodhes			X	X	1
Arpera Chiflik	X		X	X	2
Athienou Baboulari	X		X	X	2
Ayia Irini Palaeokastro		X			1
Ayia Irini Temple Site			X	X	1
Ayios Epiktetos	X		X	X	1
Ayios Iakovos Dhima + Melia	X		X	X	2
Ayios Sozomenos	X		X	X	1
Ayios Theodoros	X				1
Ayios Thyrsos Vikla	X				1
Dhavlos Pyrgos	X				1
Dhekelia Koukouphoudhkia			X	X	2
Dhekelia Steno	X		X	X	2
Dhenia	X		X	X	1
Dhikomo Onisia			X	X	1
Dhiorios Kupous				X	1
Dromolaxia trypes	X		X	X	2
Drousha Appiourka			X	X	1
Enkomi	X	X	X	X	5
Erimi Kafkalla			X	X	1
Galinorporni			X	X	1
Gastria Ayios ionnis	X				1
Hala Sultan Tekke	X	X	X	X	5
Idalion	X		X	X	2
Kaimakli Evretadhes			X	X	2

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
Kalavasos Ayios Dhimitrios	X		X	X	4
Kalavasos Mangi	X		X	X	1
Kalavassos Mavrovouni				X	1
Kalopsidha	X		X	X	1
Kantara			X	X	1
Karmi	X				1
Katydhata	X		X	X	2
Kazaphani Ayios Andronikos			X	X	1
Kirokitia Skasmata	X				1
Kition		X	X	X	5
Kivisil Gyppos	X				1
Klavdhia	X		X	X	2
Kokkini Trimithia	X				1
Kormakiti Ayious	X		X		1
Korovia Nitovikla				X	1
Kouklia Palaepaphos	X		X	X	4
Kouklia Skales			X	X	**1**
Kourion Apiskopi			X	X	1
Kourion Bamboula			X	X	4
Lapithos Ayia Anastasia			X	X	2
Larnaca tis Lapithou	X		X	X	2
Laxia tou Riou			X	X	1
Leonarissio	X				1
Limassol Kapsalos	X				1
Loutros Adhkia	X				1
Lythrodhonda Moutti	X				1
Maa Palaeokastro			X	X	2
Marathovouni	X				1
Maroni Tsaroukkas	X	X	X	X	3
Maroni Vournes	X	X	X	X	4
Mathiatis			X	X	1
Meniko Kyra tou Dhiakou			X	X	1
Milia			X	X	1
Myloptetres				X	1
Myrtou Pigadhes			X	X	2
Myrtou Stephania	X		X	X	2
Nicoseia Ayia Paraskevi	X		X	X	2
Nicosia Bairaktar				X	1
Ovgoros			X	X	1
Palekythro				X	1

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
Paphos	X		X	X	2
Pendayia			X	X	1
Pera			X	X	1
Peyia Koutsourous				X	1
Phlamoudhi Sapilou	X		X	X	1
Polemidhia Oufkia			X	X	1
Politiko-Lambertis			X	X	1
Pomos	X				1
Psilatos Moutti			X	X	1
Pyla Kokkinokremos	X			X	2
Pyla Verghi	X		X	X	2
Rizokarpasso	X		X	X	1
Sinda			X	X	2
Soloi				X	1
Strovolos Dromero	X				1
Tamassos Litharkes	X				1
Toumba tou Skourou	X	X	X	X	2
Yeri Phoenikias			X		1
Yeroskipou			X	X	1

LEVANT

Abu Shushe			X		1
Afula			X	X	1
Ain Shems (Beth Shemesh)	X		X	X	2
Akko			X	X	2
Alalakh (Tell Atchana)	X	X	X	X	3
Amman Airport		X	X	X	4
Aphek (Antipatris)			X	X	2
Arab al Mulk			X	X	1
Ashdod	X		X	X	3
Ashkelon	X		X	X	2
Atlit	X				1
Beirut			X	X	2
Beth Shean			X	X	3
Bethel (Beitin)			X	X	1
Byblos (Jbail)		X	X	X	3
Çatal Hüyük				X	1
Charchemish (Jerablus)			X	X	1
Dahrat al Humrayah			X	X	1
Deir ‘Alla			X	X	1

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
Deir el Balah	X		X	X	1
Deir Khabie			X	X	1
Dor (Tell el Burj)			X		2
Dothan	X				2
El-Harruba	X		X	X	2
Garife	X				1
Gerar (Tell Jemmeh)			X	X	1
Gezer	X	X	X	X	2
Gibeon (el Jib)	X				1
Hama			X	X	1
Hazor		X	X	X	3
Hesban			X	X	1
Isbet Sartah				X	1
Jatt	X		X	X	1
Jericho	X				1
Jerusalem			X	X	1
Kamid el-Loz	X		X	X	3
Khan Selim (Khirbet Selim)			X	X	1
Khan Sheikoun			X	X	1
Khirbet Judur	X		X	X	2
Khirbet Rabud (Debir)			X		1
Kinneret (Khirbet al-Urema)	X			X	1
Lachish	X	X	X	X	4
Lattakia (Ramitha)			X	X	1
Madeba				X	1
Megiddo		X	X	X	3
Meskene Emar			X	X	1
Minet el-Beida	X	X	X	X	4
Oumm el-Mara			X		1
Pella	X		X	X	2
Qadesh (Tell Nebi Mend)	X		X	X	2
Qatna (Mishrife)			X		1
Qraye				X	1
Qudur el Walaida	X				1
Ras el-Bassit			X	X	1
Ras Ibn Hani			X	X	2
Sahab			X	X	1
Sarepta (Sarafand)		X	X	X	4
Sabouni	X				1
Shechem (Tell Balata)			X	X	2
Sidon (Saida)		X	X	X	2

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
Tell ‘Ain Sherif				X	1
Tell el-‘Ajjul (Gaza)	X	X	X	X	3
Tell ‘Arqa	X		X	X	2
Tell Abu Hawam	X	X	X	X	5
Tell Aron	X				1
Tell Ashari			X	X	1
Tell Batash			X	X	1
Tell Beit Mirsim			X	X	2
Tell Bir el-Gharbi		X			1
Tell Burgatha	X				1
Tell Dan (Tell el-Qadi)	X		X	X	2
Tell Daruk			X		1
Tell el Far’ah (North)			X		1
Tell el Far’ah (south)			X	X	1
Tell el Ghassil	X				**1**
Tell el Hesi			X	X	1
Tell er Ridan	X				1
Tell Eran	X				1
Tell es Safi			X	X	1
Tell es Saidiyeh			X	X	2
Tell es Salihyeh			X		1
Tell es Samak	X				1
Tell esh-Shari’a (‘Sera)		X	X	X	2
Tell Haror			X	X	1
Tell Hayat	X				1
Tell Irbid	X				1
Tell Jerishe			X	X	1
Tell Kadesh	X				1
Tell Kazel	X		X	X	2
Tell Mevorakh			X	X	2
Tell Michal	X				1
Tell Miqne				X	1
Tell Mor	X		X	X	1
Tell Nagila	X				1
Tell Nami	X		X	X	1
Tell Nahr al-‘Arab	X				1
Tell Ouaouieh	X				1
Tell Qasis				X	1
Tell Qiri			X	X	1
Tell Sippor			X	X	**1**
Tell Sukas			X	X	3

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
Tell Ta'annek	X		X	X	1
Tell Tweini			X	X	2
Tell Yin'am			X	X	1
Tell Yoqne'am			X	X	1
Tyre	X		X	X	2
Ugarit (Ras Shamra)	X	X	X	X	5
Umm ad Dananir				X	1
Yavneh Yam	X				1

EGYPT

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
Abusir el-Meleq		X			1
Abydos		X	X	X	1
Ali Mara	X		X		1
Amara West	X		X	X	2
Aniba		X			1
Arabi Hills			X		1
Armant	X	X			1
Arminna	X	X			1
Askut	X		X	X	1
Assyut				X	1
Az-Zaqaziz	X		X		1
Balabisch			X	X	1
Bir el Abd	X				2
Buhen			X	X	2
C 86			X		1
Daqqa				X	1
Debeira			X		1
Deir el-Ballas	X		X		1
Deir el-Medina		X	X	X	4
Dra' Abu el-Naga'		X	X		1
Edfu			X		1
El-Arish			X		1
El-Giza	X				1
Elephantine (Asswan)	X				1
Gurna (Abd el-Qurna)			X	X	1
Gurob		X		X	3
Harageh			X		1
Heliopolis			X		1
Kahun (al-Lahun)		X	X	X	1
Kerma		X			1

	MYC UN	LHI-II	LHIIIA	LHIIIB	SIZE
Kom Abu Billa			X	X	1
Kom el-Abd			X		1
Kom Firin				X	1
Luxor			X	X	1
Malkata			X		1
Marsa Matruh (Bates' Island)			X		2
Memphis (Kom Rabi'a)		X	X	X	1
Meydum					1
Mostai (Tell Om Harb)			X	X	1
Naqada			X		1
Qantir			X	X	3
Qasr al-Aguz	X			X	1
Qau el-Qebir			X		1
Qubban			X	X	1
Rifeh	X		X	X	1
Riqqeh			X	X	1
Sai			X		1
Saqqara - N.K necropole		X	X	X	3
Sedment			X	X	1
Sesebi			X		1
Soleb				X	1
Tabo-Argo Island			X	X	1
Tarkhan			X		1
Tell ar-Rubai	X				1
Tell el-Amarna	X		X		5
Tell el-Dab'a			X	X	2
Tell el-Muqdam			X	X	1
Tell el-Rataba			X		1
Tell el-Yahudiyeh				X	1
Thebes		X			1
Tombos			X		1
Tuneh el-Gebel (E Ash)	X				1
Zawiyet Umm el-Rakham	X		X	X	1
Zawyet el-Amwat			X		1

CATALOGUE 2 – MYCENAEAN IMPORT DISTRIBUTION

Shape (FS)	Cyprus	Levant	Egypt
6	1		
7	2		
8	1		
9	1		
8-9		1	
16		1	
19	1		
20			1
23	1		
24	1	1	
28	1		
31	2	1	
34	1	1	1
35	1	1	1
36	2	2	
35-37			1
38	1		
39	1		1
40	1		1
44	2	1	
45	4	3	2
46	2	1	
47	2	1	
48	1	1	1
53	2		
54	2		
55	1		
53-55	4	4	1
59	1		
61	1		
63	1		
67	1		
68	1		
77	1	1	
80	1		
81			1
82		1	1
83	1	1	
84	2	1	

Shape (FS)	Cyprus	Levant	Egypt
85	2	2	1
82-85	1	2	
87		1	1
93	1		
94	3	2	2
95	2	1	1
94-95	2	3	
96	1		
102	1		
105	1	1	
106	1		
110	1	1	
112	1		
113	1		
114	2	2	1
116	1		
118	2	1	1
120	1	1	1
121	1		1
123	1		
126		1	
128-129	1	1	
130			1
132	1		
133	1		
134	2	1	1
136	1	1	
139	2		1
142	1		
144	1		
149	2		
151	1	1	1
155	1	1	
159-161	1	1	1
164	2	2	1
166	3	2	1
167	2	1	2
166-167		2	
170	2	1	1
171	4	2	2
172	1		

Shape (FS)	Cyprus	Levant	Egypt
173	2	2	2
171-173	1	3	1
174	1	1	
176	1	1	
177	1		
178	2	2	2
179	2	2	2
180	2	2	2
178-180	1	3	1
181	1		1
182	2	2	2
183	1	1	
182-183		2	
184	1		
186	2	2	2
187	1		
188	2		
187-188	1	2	2
189	2	2	4
190	2		
191	2		
190-192	2	3	2
197	1	1	
198		1	
199	1	3	1
200-202	1	1	1
an rhyton		2	
203	1		
206	1	1	
207	1		
208	1	1	1
209	1		
210	1		
204-210	1		
211-214	2	1	
218		1	
219	2	1	
220	3	4	2
221		1	1
223	1		
225-226	1	2	

Shape (FS)	Cyprus	Levant	Egypt
227	1		
228	1		
230	1	1	
231	1	1	
236			1
237			1
242	1		
243	1		
244	1		
249	1		
250	1		
254	1	1	
255	1	1	
256	1	1	
257	1	2	1
258	1	2	1
256-258A		2	
259	1	1	
260	1	1	
261		1	
262		1	
263			1
264	1	1	1
267	1	1	
272	1		
274-275	1		
278	1	2	
254-278	2	2	
281	4	2	1
282	1		
281-282		2	
283		2	1
284	2	2	1
285	2	1	
284-5	2	2	
290	1	4	
294	1		
296	2		
294-296	4	4	
297		1	
298		1	

Shape (FS)	Cyprus	Levant	Egypt
299		1	
300		1	
303	1		
304		1	
309	1		
310	1	2	
308-310	1		
334		1	
336			1
337	1		1
MISC PJ	4	4	2
MISC JAR	2	2	1
MISC ALAB	2	1	1
MISC JUG	3	2	1
MISC SJ	4	5	4
MISC CUP	4	3	1
MISC KYL	2	2	1
MISC KR	3	3	
MISC BOWL	3	2	1
UNKNOWN	5	5	5

CATALOGUE 3 – CYPRIOT IMPORTS AT SITES WITH MYCENAEAN POTTERY

	RLWM	BLWM	WP	ROR/B	BRI	BRII	WSI	WSII	WSH	MONO	BUC	BIC	BS/RS
LEVANT													
Abu Shushe													
Afula						X		X	X				
Ain Shems (Beth Shemesh)			X		X	X		X	X	X			
Akko	X		X	X		X	X	X	X			X	
Alalakh (Tell Atchana)	X	X	X	X	X	X	X	X	X	X	X	X	X
Amman Airport	X				X	X	X	X					
Aphek (Antipatris)			X										
Arab al Mulk													
Ashdod					X	X		X	X	X			
Ashkelon	X	X	X	X	X	X	X	X	X	X		X	X
Atlit			X										
Beirut					X		X	X	X	X		X	
Beth Shean		X	X		X	X		X	X	X			
Bethel (Beitin)					X	X		X					
Byblos (Jbail)					X	X		X		X			
Çatal Hüyük													
Charchemish (Jerablus)													
Dahrat al Humrayah			X			X					X		
Deir ‘Alla								X					
Deir el Balah						X		X	X				
Deir Khabie													
Dor (Tell el Burj)			X		X	X	X						
Dothan					X	X	X	X					
El-Harruba													
Garife													
Gerar (Tell Jemmeh)							X	X		X			
Gezer		X	X	X	X	X	X	X	X			X	
Gibeon (el Jib)					X	X							

	RLWM	BLWM	WP	ROR/B	BRI	BRII	WSI	WSII	WSH	MONO	BUC	BIC	BS/RS
Hama						X	X	X					
Hazor			X	X	X	X	X	X	X	X	X	X	
Hesban													
Isbet Sartah													
Jatt		X	X		X	X							X
Jericho	X		X	X	X	X	X	X					
Jerusalem					X	X			X	X	X		
Kamid el-Loz								X	X				
Khan Selim					X	X		X					
Khan Sheikoun							X						
Khirbet Judur													
Khirbet Rabud (Debir)					X	X		X		X			
Kinneret (Khirbet al-Urema)								X					
Lachish	X	X	X	X	X	X	X	X	X	X	X	X	X
Lattakia (Ramitha)													
Madeba													
Megiddo	X	X	X	X	X	X	X	X	X	X	X	X	
Meskene Emar					X			X					
Minet el-Beida					X	X		X			X	X	
Oumm el-Mara								X					
Pella (Tabaqat Fahil)	X	X			X	X	X	X		X			
Qadesh (Tell Nebi Mend)												X	
Qatna (Mishrife)						X		X					
Qraye			X						X				
Qudur el Walaida						X		X					
Ras el-Bassit	X					X		X					
Ras Ibn Hani						X		X					
Sahab													
Sarepta (Sarafand)	X		X	X	X	X		X	X	X			X
Sabouni								X					
Shechem (Tell Balata)			X	X	X	X	X	X		X			X
Sidon (Saida)	X				X	X		X	X	X		X	
Tell ‘Ain Sherif													

	RLWM	BLWM	WP	ROR/B	BRI	BRII	WSI	WSII	WSH	MONO	BUC	BIC	BS/RS
Tell el-‘Ajjul (Gaza)	X	X	X	X	X	X	X	X	X	X	X	X	X
Tell ‘Arqa	X	X	X		X	X		X	X	X		X	
Tell Abu Hawam	X			X	X	X	X	X	X	X			X
Tell Aron					X								
Tell Ashari													
Tell Batash					X	X	X	X	X	X	X		
Tell Beit Mirsim			X		X	X		X	X				
Tell Bir el-Gharbi													
Tell Burgatha													
Tell Dan (Tell el-Qadi)			X	X		X	X	X		X			
Tell Daruk			X		X		X						
Tell el Far’ah (North)				X	X	X	X	X					
Tell el Far’ah (south)			X	X	X	X	X	X	X	X		X	
Tell el Ghassil												X	
Tell el Hesi			X		X	X	X	X	X	X	X		
Tell er Ridan			X	X		X		X	X				X
Tell Eran													
Tell es Safi						X			X				
Tell es Saidiyeh													
Tell es Salihyeh								X					
Tell es Samak													
Tell esh-Shari’a (‘Sera)			X	X	X	X	X	X	X	X			
Tell Haror			X	X	X	X		X	X	X			
Tell Hayat													
Tell Irbid													
Tell Jerishe					X	X		X	X				
Tell Kabri		X	X										X
Tell Kadesh													
Tell Kazel	X				X	X	X	X		X	X		
Tell Mevorakh			X	X	X		X	X		X			
Tell Michal			X	X			X					X	
Tell Miqne													
Tell Mor				X	X	X	X	X		X		X	

	RLWM	**BLWM**	**WP**	**ROR/B**	**BRI**	**BRII**	**WSI**	**WSII**	**WSH**	**MONO**	**BUC**	**BIC**	**BS/RS**
Tell Nagila				X								X	
Tell Nami			X										
Tell Nahr al-‘Arab													
Tell Ouaouieh													
Tell Qasis			X		X		X	X	X	X		X	
Tell Qiri													
Tell Sippor		X					X	X				X	
Tell Sukas			X	X	X	X	X	X	X				X
Tell Ta’annek								X				X	
Tell Tweini	X		X	X	X	X	X	X	X				
Tell Yin’am													
Tell Yoqne’am					X	X		X	X	X			
Tyre	X		X	X	X	X	X	X		X	X	X	X
Ugarit (Ras Shamra)	X	X	X	X	X	X	X	X	X	X			X
Umm ad Dananir						X							
Yavneh Yam													
EGYPT													
Abusir el-Meleq			X		X	X							
Abydos	X	X	X		X	X							
Ali Mara	X				X	X							
Amara West													
Aniba	X	X	X		X	X							X
Arabi Hills													
Armant													
Arminna													
Askut													
Assyut	X												
Az-Zaqaziz													
Balabisch	X				X	X							
Bir el Abd			X		X	X		X	X	X			
Buhen	X				X	X		X					X
C 86													
Daqqa	X				X	X							
Debeira	X		X		X								

	RLWM	BLWM	WP	ROR/B	BRI	BRII	WSI	WSII	WSH	MONO	BUC	BIC	BS/RS
Deir el-Ballas					X								
Deir el-Medina		X			X	X							
Dra’ Abu el-Naga’					X								
Edfu													
El-Arish					X								
El-Giza	X				X	X							
Elephantine (Asswan)													
Gurna (Abd el-Qurna)													
Gurob	X	X	X		X	X	X	X					
Harageh													
Heliopolis					X	X		X					
Kahun (al-Lahun)	X	X			X	X							
Kerma													
Kom Abu Billa													
Kom el-Abd													
Kom Firin													
Luxor													
Malkata													
Marsa Matruh (Bates’ Island)	X				X	X	X	X	X	X		X	
Memphis (Kom Rabi’a)	X		X		X								
Meydum	X				X	X							
Mostai (Tell Om Harb)													
Naqada													
Qantir	X	X	X	X	X	X	X	X		X		X	X
Qasr al-Aguz													
Qau el-Qebir	X	X			X								
Qubban	X	X			X								
Rifeh	X				X	X							
Riqqeh	X				X								
Sai													
Saqqara - N.K necropole	X	X	X		X	X	X						X
Sedment	X	X	X		X	X							

	RLWM	BLWM	WP	ROR/B	BRI	BRII	WSI	WSII	WSH	MONO	BUC	BIC	BS/RS
Sesebi													
Soleb						X							
Tabo-Argo Island													
Tarkhan			X										
Tell ar-Rubai													
Tell el-Amarna	X					X		X					
Tell el-Dab'a	X	X	X	X	X	X	X	X				X	
Tell el-Muqdam													
Tell el-Rataba	X					X		X					
Tell el-Yahudiyeh	X		X		X								
Thebes	X				X	X							
Tombos													
Tuneh el-Gebel (E Ash)													
Zawiyet Umm el-Rakham													
Zawyet el-Amwat													

CATALOGUE 4 – MINOAN IMPORTS AT SITES WITH MYCENAEAN POTTERY

	KAM	LMI	LMII	LMIII
CYPRUS				
Akaki				
Akanthou Moulos				X
Akhera				
Alambra				
Alassa				
Amathous				
Analionda Palioklichia				
Anaochora				
Angastina				
Apliki				
Aradhippou				X
Arediou-Vouppes				X
Arodhes				
Arpera Chiflik				
Athienou Baboulari				X
Ayia Irini Palaeokastro				
Ayia Irini Temple Site				
Ayios Epiktetos				
Ayios Iakovos Dhima + Melia				
Ayios Sozomenos				
Ayios Theodoros				
Ayios Thyrsos Vikla				
Dhavlos Pyrgos				
Dhekelia Koukouphoudhkia				
Dhekelia Steno				
Dhenia				
Dhikomo Onisia				
Dhiorios Kupous				
Dromolaxia trypes				
Drousha Appiourka				
Enkomi				X
Erimi Kafkalla				
Galinorporni				
Gastria Ayios ionnis				
Hala Sultan Tekke			X	X

	KAM	LMI	LMII	LMIII
Idalion				
Kaimakli Evretadhes				
Kalavasos Ayios Dhimitrios				
Kalavasos Mangi				
Kalavassos Mavrovouni				
Kalopsidha				
Kantara				
Karmi				
Katydhata				
Kazaphani Ayios Andronikos				
Kirokitia Skasmata				
Kition				X
Kivisil Gyppos				
Klavdhia				
Kokkini Trimithia				
Kormakiti Ayious				
Korovia Nitovikla				
Kouklia Palaepaphos		X		
Kouklia Skales				
Kourion Apiskopi				
Kourion Bamboula				
Lapithos Ayia Anastasia				X
Larnaca tis Lapithou				
Laxia tou Riou				
Leonarissio				
Limassol Kapsalos		X		
Loutros Adhkia				
Lythrodhonda Moutti				
Maa Palaeokastro				X
Marathovouni				
Maroni Tsaroukkas				X
Maroni Vournes				X
Mathiatis				
Meniko Kyra tou Dhiakou				
Milia				
Myloptetres				
Myrtou Pigadhes				
Myrtou Stephania				
Nicoseia Ayia Paraskevi				

	KAM	LMI	LMII	LMIII
Nicosia Bairaktar				
Ovgoros				
Palekythro				
Paphos				
Pendayia				
Pera				
Peyia Koutsourous				
Phlamoudhi Sapilou				
Polemidhia Oufkia				
Politiko-Lambertis				
Pomos				
Psilatos Moutti				
Pyla Kokkinokremos				X
Pyla Verghi				X
Rizokarpasso				
Sinda				X
Soloi				
Strovolos Dromero				
Tamassos Litharkes				
Toumba tou Skourou		X	X	X
Yeri Phoenikias				
Yeroskipou				

LEVANT

	KAM	LMI	LMII	LMIII
Abu Shushe				
Afula				
Ain Shems (Beth Shemesh)	X			X
Akko				X
Alalakh (Tell Atchana)		X	X	
Amman Airport		X		X
Aphek (Antipatris)				
Arab al Mulk				
Ashdod		X		
Ashkelon	X			
Atlit				
Beirut (centre)	X			X
Beth Shean				
Bethel (Beitin)				

	KAM	LMI	LMII	LMIII
Byblos (Jbail)	X	X	X	
Çatal Hüyük				
Charchemish (Jerablus)				
Dahrat al Humrayah				
Deir ‘Alla				
Deir el Balah				
Deir Khabie				
Dor (Tell el Burj) – 2				
Dothan				
El-Harruba – 2				
Garife				
Gerar (Tell Jemmeh)				
Gezer		X	X	X
Gibeon (el Jib)				
Hama				
Hazor	X	X		
Hesban				
Isbet Sartah				
Jatt				
Jericho				
Jerusalem				X
Kamid el-Loz		X		
Khan Selim (Khirbet Selim?)				
Khan Sheikoun				
Khirbet Judur				X
Khirbet Rabud (Debir)				
Kinneret (Khirbet al-Urema)				
Lachish (Tell ed Duweir)		X	X	X
Lattakia (Ramitha)				
Madeba				
Megiddo (Tell el-Mutesselim)				
Meskene Emar				
Minet el-Beida				X
Oumm el-Mara				
Pella (Tabaqat Fahil)		X		
Qadesh (Tell Nebi Mend)				
Qatna (Mishrife)	X			
Qraye				
Qudur el Walaida				

	KAM	LMI	LMII	LMIII
Ras el-Bassit				
Ras Ibn Hani				X
Sahab				
Sarepta (Sarafand)				
Sabouni				
Shechem (Tell Balata)				
Sidon (Saida)	X			
Tell ‘Ain Sherif				
Tell ‘Ajjul (Gaza)			X	
Tell ‘Arqa				
Tell Abu Hawam				X
Tell Aron				
Tell Ashari				
Tell Batash				
Tell Beit Mirsim				
Tell Bir el-Gharbi				
Tell Burgatha				
Tell Dan (Tell el-Qadi)				
Tell Daruk				
Tell el Far’ah (North)				X
Tell el Far’ah (south)				
Tell el Ghassil				
Tell el Hesi				
Tell er Ridan				
Tell Eran				
Tell es Safi				
Tell es Saidiyeh				
Tell es Salihyeh				
Tell es Samak				
Tell esh-Shari’a (‘Sera)				
Tell Haror				
Tell Hayat				
Tell Irbid				
Tell Jerishe				
Tell Kadesh				
Tell Kazel				
Tell Mevorakh				
Tell Michal		X		
Tell Miqne				

	KAM	LMI	LMII	LMIII
Tell Mor				
Tell Nagila				
Tell Nami				
Tell Nahr al-‘Arab				
Tell Ouaouieh				
Tell Qasis				
Tell Qiri				
Tell Sippor				
Tell Sukas		X		
Tell Ta’annek		X		
Tell Tweini				
Tell Yin’am				
Tell Yoqne’am				
Tyre				
Ugarit (Ras Shamra)	X	X		X
Umm ad Dananir				
Yavneh Yam				

EGYPT

	KAM	LMI	LMII	LMIII
Abusir el-Meleq				
Abydos	X	X		
Ali Mara				
Amara West				
Aniba		X		
Arabi Hills				
Armant				
Arminna				
Askut				
Assyut				
Az-Zaqaziz				
Balabisch				
Bir el Abd				
Buhen				
C 86				
Daqqa				
Debeira				
Deir el-Ballas				
Deir el-Medina		X		

	KAM	LMI	LMII	LMIII
Dra’ Abu el-Naga’				
Edfu				
El-Arish				
El-Giza				
Elephantine (Asswan)	X			
Gurna (Abd el-Qurna)				
Gurob				X
Harageh				
Heliopolis				
Kahun (al-Lahun)	X	X		
Kerma		X		
Kom Abu Billa				
Kom el-Abd				
Kom Firin				
Luxor				
Malkata				
Marsa Matruh (Bates’ Island)				X
Memphis (Kom Rabi’a)		X		
Meydum				
Mostai (Tell Om Harb)				
Naqada				
Qantir				
Qasr al-Aguz				
Qau el-Qebir				
Qubban				
Rifeh				
Riqqeh				
Sai				
Saqqara - N.K necropole				
Sedment		X		
Sesebi				
Soleb				
Tabo-Argo Island				
Tarkhan				
Tell ar-Rubai				
Tell el-Amarna				X
Tell el-Dab’a	X	X		
Tell el-Muqdam				
Tell el-Rataba				

	KAM	**LMI**	**LMII**	**LMIII**
Tell el-Yahudiyeh				
Thebes				
Tombos				
Tuneh el-Gebel (E Ash)				
Zawiyet Umm el-Rakham				
Zawyet el-Amwat				

Table 5 – CENTRALITY MEASURES FOR LH WARES IN CYPRUS

		1 Degree	2 2-Local	3 Eigenvector	4 Closeness	5 Betweenness
1	Akaki	0.200	0.105	0.110	0.823	0.004
2	Akanthou Moulos	0.267	0.122	0.127	0.903	0.007
3	Akhera	0.333	0.153	0.165	0.928	0.009
4	Alambra	0.200	0.107	0.116	0.792	0.002
5	Alassa	0.067	0.038	0.040	0.663	0.000
6	Amathus	0.067	0.032	0.037	0.627	0.000
7	Analionda Palioklichia	0.067	0.038	0.040	0.663	0.000
8	Anaochora	0.067	0.036	0.035	0.647	0.000
9	Angastina	0.200	0.107	0.116	0.792	0.002
10	Apliki	0.333	0.126	0.133	0.911	0.009
11	Aradhippou	0.267	0.143	0.150	0.919	0.008
12	Arediou-Vcouppes	0.200	0.106	0.112	0.830	0.004
13	Arodhes	0.133	0.070	0.077	0.709	0.000
14	Arpera Chiflik	0.400	0.161	0.177	0.936	0.011
15	Athienou Baboulari	0.200	0.111	0.113	0.895	0.006
16	Ayia Irini Palaeokastro	0.067	0.003	0.004	0.496	0.000
17	Ayia Irini Temple Site	0.133	0.046	0.050	0.668	0.000
18	Ayios Epiktetos	0.133	0.073	0.073	0.774	0.002
19	Ayios Iakovos Dhima + Melia	0.333	0.153	0.165	0.928	0.009
20	Ayios Sozomenos	0.200	0.106	0.112	0.830	0.004
21	Ayios Theodoros	0.067	0.036	0.035	0.647	0.000
22	Ayios Thyrsos Vikla	0.067	0.036	0.035	0.647	0.000
23	Dhavlos Pyrgos	0.067	0.036	0.035	0.647	0.000
24	Dhekelia Koukouphoudhkia	0.200	0.079	0.090	0.724	0.001
25	Dhekelia Steno	0.267	0.143	0.150	0.919	0.008
26	Dhenia	0.267	0.143	0.150	0.919	0.008
27	Dhikomo Onisia	0.200	0.078	0.089	0.714	0.001
28	Dhiorios Kupous	0.067	0.038	0.040	0.663	0.000
29	Dromolaxia trypes	0.267	0.143	0.150	0.919	0.008
30	Drousha Appiourka	0.067	0.037	0.038	0.655	0.000
31	Enkomi	0.800	0.185	0.210	1.000	0.057
32	Erimi Kafkalla	0.133	0.070	0.077	0.709	0.000
33	Galinorporni	0.133	0.069	0.076	0.714	0.001
34	Gastria Ayios ionnis	0.067	0.036	0.035	0.647	0.000
35	Hala Sultan Tekke	0.600	0.178	0.200	0.972	0.028
36	Idalion	0.400	0.158	0.172	0.936	0.012
37	Kaimakli Evretadhes	0.200	0.107	0.116	0.792	0.002
38	Kalavasos Ayios Dhimitrios	0.400	0.155	0.168	0.936	0.013
39	Kalavasos Mangi	0.200	0.106	0.112	0.830	0.004
40	Kalavassos Mavrovouni	0.067	0.038	0.040	0.663	0.000
41	Kalopsidha	0.200	0.111	0.113	0.895	0.006
42	Kantara	0.067	0.037	0.038	0.655	0.000
43	Karmi	0.067	0.036	0.035	0.647	0.000
44	Katydhata	0.400	0.161	0.177	0.936	0.011
45	Kazaphani Ayios Andronikos	0.133	0.075	0.078	0.774	0.001
46	Kirokitia Skasmata	0.067	0.036	0.035	0.647	0.000

47	Kition	0.533	0.134	0.153	0.823	0.032
48	Kivisil Gyppos	0.067	0.036	0.035	0.647	0.000
49	Klavdhia	0.267	0.143	0.150	0.919	0.008
50	Kokkini Trimithia	0.067	0.036	0.035	0.647	0.000
51	Kormakiti Ayious	0.200	0.080	0.083	0.779	0.003
52	Korovia Nitovikla	0.067	0.038	0.040	0.663	0.000
53	Kouklia Palaepaphos	0.467	0.162	0.176	0.945	0.016
54	Kouklia Skales	0.133	0.070	0.077	0.709	0.000
55	Kourion Apiskopi	0.067	0.037	0.038	0.655	0.000
56	Kourion Bamboula	0.467	0.140	0.162	0.817	0.008
57	Lapithos Ayia Anastasia	0.067	0.037	0.038	0.655	0.000
58	Larnaca tis Lapithou	0.200	0.077	0.079	0.779	0.004
59	Laxia tou Riou	0.133	0.069	0.076	0.714	0.001
60	Leonarissio	0.067	0.036	0.035	0.647	0.000
61	Limassol Kapsalos	0.067	0.036	0.035	0.647	0.000
62	Loutros Adhkia	0.067	0.036	0.035	0.647	0.000
63	Lythrodhonda Moutti	0.067	0.036	0.035	0.647	0.000
64	Maa Palaeokastro	0.133	0.070	0.077	0.709	0.000
65	Marathovouni	0.067	0.036	0.035	0.647	0.000
66	Maroni Vournes	0.533	0.172	0.192	0.953	0.017
67	Maroni Tsaroukkas	0.467	0.164	0.180	0.953	0.022
68	Mathiatis	0.067	0.037	0.038	0.655	0.000
69	Meniko Kyra tou Dhiakou	0.067	0.037	0.038	0.655	0.000
70	Milia	0.200	0.073	0.081	0.719	0.002
71	Myloptetres	0.067	0.038	0.040	0.663	0.000
72	Myrtou Pigadhes	0.333	0.122	0.136	0.804	0.005
73	Myrtou Stephania	0.267	0.143	0.150	0.919	0.008
74	Nicoseia Ayia Paraskevi	0.267	0.143	0.150	0.919	0.008
75	Nicosia Bairaktar	0.067	0.038	0.040	0.663	0.000
76	Ovgoros	0.067	0.037	0.038	0.655	0.000
77	Palekythro	0.067	0.038	0.040	0.663	0.000
78	Paphos	0.267	0.117	0.126	0.837	0.005
79	Pendayia	0.067	0.037	0.038	0.655	0.000
80	Pera	0.067	0.037	0.038	0.655	0.000
81	Peyia Koutsourous	0.067	0.038	0.040	0.663	0.000
82	Phlamoudhi Sapilou	0.200	0.105	0.110	0.823	0.004
83	Polemidhia Oufkia	0.067	0.037	0.038	0.655	0.000
84	Politiko-Lambertis	0.200	0.107	0.116	0.792	0.002
85	Pomos	0.067	0.036	0.035	0.647	0.000
86	Psilatos Moutti	0.067	0.037	0.038	0.655	0.000
87	Pyla Kokkinokremos	0.200	0.082	0.084	0.792	0.004
88	Pyla Verghi	0.267	0.143	0.150	0.919	0.008
89	Rizokarpasso	0.267	0.115	0.125	0.837	0.005
90	Sinda	0.267	0.115	0.126	0.798	0.004
91	Soloi	0.067	0.038	0.040	0.663	0.000
92	Strovolos Dromero	0.067	0.036	0.035	0.647	0.000
93	Tamassos Litharkes	0.067	0.036	0.035	0.647	0.000
94	Toumba tou Skourou	0.400	0.123	0.136	0.851	0.014
95	Yeri Phoenikias	0.067	0.032	0.037	0.627	0.000
96	Yeroskipou	0.133	0.049	0.054	0.677	0.000

		1 Degree	2 2-Local	3 Eigenvector	4 Closeness	5 Betweenness
1	MYC UNKNOWN	0.542	0.293	0.437	0.590	0.340
2	MH	0.000	0.000	0.000	0.000	0.000
3	LHI	0.021	0.000	0.029	0.403	0.000
4	LHI-II	0.021	0.000	0.027	0.400	0.000
5	LHII	0.042	0.002	0.047	0.405	0.018
6	LH II-III	0.063	0.004	0.072	0.411	0.002
7	LHIII	0.104	0.011	0.128	0.425	0.005
8	LHIIIA	0.156	0.024	0.183	0.440	0.013
9	LHIIIA1	0.115	0.013	0.148	0.425	0.005
10	LHIIIA2	0.479	0.230	0.472	0.564	0.157
11	LHIIIA-B	0.552	0.305	0.484	0.602	0.292
12	LHIIIB	0.573	0.328	0.505	0.614	0.304
13	LHIIIB1	0.000	0.000	0.000	0.000	0.000
14	LHIIIB2	0.010	0.000	0.012	0.348	0.000
15	LHIIIB-C	0.115	0.013	0.124	0.428	0.008

Table 6 – CENTRALITY MEASURES FOR FS SHAPES IN CYPRUS

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenness
1	PJ	0.083	0.015	0.104	0.690	0.010
2	SJ	0.260	0.031	0.249	0.793	0.043
3	ALAB	0.021	0.004	0.025	0.559	0.000
4	JUG	0.104	0.012	0.093	0.643	0.004
5	F	0.083	0.009	0.074	0.614	0.009
6	C	0.146	0.017	0.132	0.674	0.008
7	B	0.115	0.011	0.086	0.634	0.004
8	U	0.656	0.039	0.358	0.963	0.252
9	U-CL	0.052	0.012	0.073	0.677	0.004
10	U-O	0.073	0.013	0.084	0.682	0.007
11	6	0.010	0.003	0.018	0.547	0.000
12	7	0.083	0.013	0.096	0.677	0.003
13	8	0.052	0.011	0.073	0.669	0.002
14	9	0.031	0.009	0.057	0.659	0.000
15	16	0.000	0.000	0.000	0.000	0.000
16	19	0.010	0.003	0.016	0.550	0.000
17	23	0.010	0.005	0.030	0.632	0.000
18	24	0.000	0.000	0.000	0.000	0.000
19	28	0.021	0.008	0.048	0.647	0.000
20	31	0.052	0.012	0.078	0.674	0.002

21	34	0.021	0.007	0.040	0.636	0.000
22	35	0.021	0.008	0.046	0.655	0.000
23	36	0.104	0.021	0.144	0.717	0.006
24	39	0.000	0.000	0.000	0.000	0.000
25	40	0.021	0.004	0.026	0.570	0.000
26	44	0.115	0.020	0.152	0.703	0.005
27	45	0.333	0.035	0.290	0.818	0.059
28	46	0.104	0.017	0.134	0.700	0.005
29	47	0.083	0.013	0.098	0.667	0.009
30	48	0.052	0.010	0.064	0.662	0.002
31	53-55	0.240	0.028	0.222	0.769	0.031
32	56	0.000	0.000	0.000	0.000	0.000
33	67	0.010	0.001	0.010	0.517	0.000
34	68	0.010	0.002	0.013	0.531	0.000
35	77	0.031	0.011	0.065	0.672	0.001
36	80	0.000	0.000	0.000	0.000	0.000
37	82	0.000	0.000	0.000	0.000	0.000
38	83	0.021	0.007	0.042	0.638	0.000
39	84	0.052	0.013	0.087	0.679	0.001
40	85	0.083	0.013	0.102	0.667	0.002
41	84-85	0.021	0.007	0.042	0.638	0.000
42	87	0.000	0.000	0.000	0.000	0.000
43	93	0.000	0.000	0.000	0.000	0.000
44	94	0.219	0.027	0.216	0.773	0.029
45	95	0.094	0.015	0.118	0.672	0.003
46	94-95	0.083	0.014	0.095	0.679	0.010
47	96	0.000	0.000	0.000	0.000	0.000
48	105	0.010	0.001	0.008	0.511	0.000
49	110	0.031	0.010	0.061	0.667	0.000
50	112	0.010	0.005	0.030	0.632	0.000
51	113	0.021	0.003	0.029	0.541	0.000
52	114	0.104	0.018	0.139	0.690	0.004
53	116	0.010	0.001	0.010	0.517	0.000
54	118	0.042	0.004	0.031	0.552	0.001
55	120-121	0.000	0.000	0.000	0.000	0.000
56	123	0.010	0.003	0.018	0.547	0.000
57	126	0.000	0.000	0.000	0.000	0.000
58	128-129	0.010	0.005	0.030	0.632	0.000
59	130	0.000	0.000	0.000	0.000	0.000
60	132	0.010	0.003	0.018	0.547	0.000
61	133	0.010	0.001	0.010	0.511	0.000
62	134	0.063	0.012	0.090	0.664	0.001
63	136	0.021	0.002	0.014	0.523	0.000
64	139	0.031	0.010	0.060	0.669	0.001
65	142	0.010	0.005	0.030	0.632	0.000
66	144	0.010	0.003	0.018	0.547	0.000
67	149	0.083	0.010	0.081	0.627	0.003
68	151	0.010	0.005	0.030	0.632	0.000
69	155	0.031	0.003	0.020	0.544	0.003
70	159-161	0.010	0.001	0.009	0.516	0.000
71	164	0.104	0.013	0.098	0.690	0.012
72	165-168	0.208	0.025	0.198	0.753	0.021
73	170	0.031	0.009	0.053	0.657	0.000
74	171-173	0.260	0.031	0.254	0.786	0.034

75	174	0.021	0.008	0.048	0.647	0.000
76	176	0.000	0.000	0.000	0.000	0.000
77	178	0.104	0.015	0.117	0.687	0.011
78	179	0.052	0.009	0.057	0.647	0.002
79	180	0.094	0.014	0.108	0.692	0.004
80	178-180	0.021	0.006	0.030	0.634	0.008
81	181	0.010	0.001	0.011	0.519	0.000
82	182-183	0.063	0.011	0.070	0.669	0.002
83	184	0.021	0.003	0.022	0.556	0.000
84	186	0.052	0.012	0.077	0.687	0.002
85	187-188	0.083	0.017	0.111	0.709	0.004
86	189	0.135	0.017	0.138	0.692	0.007
87	190-192	0.167	0.024	0.190	0.738	0.012
88	197	0.021	0.003	0.022	0.552	0.000
89	198	0.000	0.000	0.000	0.000	0.000
90	199	0.042	0.010	0.065	0.672	0.001
91	200-202	0.000	0.000	0.000	0.000	0.000
92	AN V	0.021	0.008	0.048	0.647	0.000
93	204-210	0.021	0.008	0.046	0.655	0.000
94	206	0.010	0.001	0.007	0.468	0.000
95	207	0.021	0.008	0.046	0.655	0.000
96	208	0.042	0.004	0.031	0.570	0.005
97	209	0.031	0.008	0.045	0.655	0.001
98	211-214	0.021	0.006	0.032	0.634	0.001
99	211-220	0.021	0.007	0.041	0.655	0.000
100	219	0.010	0.005	0.030	0.632	0.000
101	220	0.104	0.015	0.108	0.703	0.006
102	225-226	0.021	0.008	0.046	0.655	0.000
103	227	0.010	0.001	0.009	0.510	0.000
104	230-232	0.010	0.005	0.030	0.632	0.000
105	236	0.000	0.000	0.000	0.000	0.000
106	237	0.000	0.000	0.000	0.000	0.000
107	242-244	0.073	0.016	0.112	0.700	0.003
108	248-253	0.000	0.000	0.000	0.000	0.000
109	250	0.021	0.008	0.048	0.647	0.000
110	254	0.010	0.001	0.012	0.526	0.000
111	255	0.031	0.010	0.061	0.655	0.001
112	256	0.000	0.000	0.000	0.000	0.000
113	257	0.000	0.000	0.000	0.000	0.000
114	258	0.042	0.005	0.036	0.575	0.008
115	262	0.000	0.000	0.000	0.000	0.000
116	272	0.000	0.000	0.000	0.000	0.000
117	278	0.000	0.000	0.000	0.000	0.000
118	254-278	0.083	0.014	0.094	0.692	0.004
119	279-286	0.010	0.005	0.030	0.632	0.000
120	281	0.219	0.026	0.203	0.759	0.029
121	282	0.000	0.000	0.000	0.000	0.000
122	283	0.000	0.000	0.000	0.000	0.000
123	284	0.052	0.007	0.049	0.579	0.001
124	285	0.031	0.005	0.033	0.564	0.000
125	290	0.010	0.001	0.008	0.474	0.000
126	292	0.010	0.000	0.003	0.480	0.000
127	294-296	0.125	0.021	0.148	0.720	0.008
128	303-306	0.010	0.000	0.004	0.486	0.000

129	304	0.000	0.000	0.000	0.000	0.000
130	308-310	0.052	0.012	0.074	0.679	0.002
131	324-325	0.010	0.005	0.030	0.632	0.000
132	334	0.000	0.000	0.000	0.000	0.000
133	336	0.000	0.000	0.000	0.000	0.000

		1	2	3	4	5
		Degree	2-Local	Eigenvect	Closeness	Betweenness
1	Akaki	0.090	0.008	0.134	0.637	0.006
2	Akanthou Moulos	0.038	0.001	0.078	0.611	0.002
3	Akhera	0.120	0.014	0.178	0.653	0.011
4	Alambra	0.045	0.002	0.053	0.534	0.002
5	Alassa	0.008	0.000	0.024	0.564	0.000
6	Amathus	0.008	0.000	0.007	0.437	0.000
7	Analionda Palioklichia	0.008	0.000	0.007	0.448	0.000
8	Anaochora	0.008	0.000	0.024	0.564	0.000
9	Angastina	0.075	0.006	0.109	0.558	0.002
10	Apliki	0.105	0.011	0.124	0.640	0.016
11	Aradhippou	0.045	0.002	0.065	0.597	0.009
12	Arediou-Vouppes	0.030	0.001	0.047	0.586	0.008
13	Arodhes	0.015	0.000	0.021	0.493	0.000
14	Arpera Chiflik	0.060	0.004	0.110	0.618	0.003
15	Athienou Baboulari	0.045	0.002	0.068	0.595	0.002
16	Ayia Irini Palaeokastro	0.023	0.001	0.032	0.570	0.001
17	Ayia Irini Temple Site	0.008	0.000	0.002	0.392	0.000
18	Ayios Epiktetos	0.015	0.000	0.044	0.595	0.000
19	Ayios Iakovos Dhima + Melia	0.143	0.020	0.205	0.663	0.016
20	Ayios Sozomenos	0.015	0.000	0.038	0.582	0.000
21	Ayios Theodoros	0.008	0.000	0.024	0.564	0.000
22	Ayios Thyrsos Vikla	0.008	0.000	0.024	0.564	0.000
23	Dhavlos Pyrgos	0.008	0.000	0.024	0.564	0.000
24	Dhekelia Koukouphoudhkia	0.053	0.003	0.083	0.550	0.002
25	Dhekelia Steno	0.105	0.011	0.153	0.650	0.024
26	Dhenia	0.038	0.001	0.073	0.613	0.002
27	Dhikomo Onisia	0.030	0.001	0.064	0.599	0.001
28	Dhiorios Kupous	0.008	0.000	0.024	0.564	0.000
29	Dromolaxia trypes	0.038	0.001	0.047	0.527	0.002
30	Drousha Appiourka	0.015	0.000	0.031	0.512	0.000
31	Enkomi	0.526	0.277	0.443	0.871	0.229
32	Erimi Kafkalla	0.008	0.000	0.024	0.564	0.000
33	Galinorporni	0.045	0.002	0.092	0.564	0.001
34	Gastria Ayios ionnis	0.008	0.000	0.024	0.564	0.000
35	Hala Sultan Tekke	0.241	0.058	0.244	0.710	0.058
36	Idalion	0.120	0.014	0.167	0.653	0.022
37	Kaimakli Evretadhes	0.083	0.007	0.103	0.566	0.014
38	Kalavasos Ayios Dhimitrios	0.113	0.013	0.133	0.647	0.012
39	Kalavasos Mangi	0.015	0.000	0.011	0.446	0.000
40	Kalavassos Mavrovouni	0.008	0.000	0.002	0.421	0.000
41	Kalopsidha	0.045	0.002	0.059	0.588	0.002
42	Kantara	0.008	0.000	0.015	0.486	0.000
43	Karmi	0.008	0.000	0.024	0.564	0.000

44	Katydhata	0.143	0.020	0.218	0.669	0.016
45	Kazaphani Ayios Andronikos	0.023	0.001	0.050	0.539	0.000
46	Kirokitia Skasmata	0.008	0.000	0.024	0.564	0.000
47	Kition	0.195	0.038	0.195	0.674	0.037
48	Kivisil Gyppos	0.008	0.000	0.024	0.564	0.000
49	Klavdhia	0.098	0.010	0.152	0.640	0.013
50	Kokkini Trimithia	0.008	0.000	0.024	0.564	0.000
51	Kormakiti Ayious	0.045	0.002	0.086	0.618	0.003
52	Korovia Nitovikla	0.008	0.000	0.007	0.448	0.000
53	Kouklia Palaepaphos	0.135	0.018	0.160	0.661	0.028
54	Kouklia Skales	0.015	0.000	0.037	0.572	0.000
55	Kourion Apiskopi	0.008	0.000	0.020	0.505	0.000
56	Kourion Bamboula	0.218	0.048	0.269	0.637	0.031
57	Lapithos Ayia Anastasia	0.090	0.008	0.099	0.545	0.003
58	Larnaca tis Lapithou	0.023	0.001	0.044	0.580	0.001
59	Laxia tou Riou	0.030	0.001	0.057	0.527	0.000
60	Leonarissio	0.008	0.000	0.024	0.564	0.000
61	Limassol Kapsalos	0.008	0.000	0.024	0.564	0.000
62	Loutros Adhkia	0.008	0.000	0.024	0.564	0.000
63	Lythrodhonda Moutti	0.008	0.000	0.024	0.564	0.000
64	Maa Palaeokastro	0.038	0.001	0.054	0.580	0.001
65	Marathovouni	0.008	0.000	0.024	0.564	0.000
66	Maroni Vournes	0.248	0.062	0.273	0.704	0.066
67	Maroni Tsaroukkas	0.143	0.020	0.182	0.666	0.024
68	Mathiatis	0.008	0.000	0.005	0.411	0.000
69	Meniko Kyra tou Dhiakou	0.008	0.000	0.006	0.443	0.000
70	Milia	0.030	0.001	0.034	0.504	0.000
71	Myloptetres	0.008	0.000	0.014	0.480	0.000
72	Myrtou Pigadhes	0.098	0.010	0.112	0.576	0.013
73	Myrtou Stephania	0.038	0.001	0.086	0.611	0.001
74	Nicoseia Ayia Paraskevi	0.105	0.011	0.154	0.647	0.010
75	Nicosia Bairaktar	0.008	0.000	0.024	0.564	0.000
76	Ovgoros	0.008	0.000	0.008	0.447	0.000
77	Palekythro	0.015	0.000	0.003	0.392	0.000
78	Paphos	0.008	0.000	0.024	0.564	0.000
79	Pendayia	0.008	0.000	0.020	0.505	0.000
80	Pera	0.015	0.000	0.039	0.578	0.000
81	Peyia Koutsourous	0.008	0.000	0.024	0.564	0.000
82	Phlamoudhi Sapilou	0.023	0.001	0.052	0.595	0.001
83	Polemidhia Oufkia	0.008	0.000	0.017	0.495	0.000
84	Politiko-Lambertis	0.053	0.003	0.069	0.527	0.001
85	Pomos	0.008	0.000	0.024	0.564	0.000
86	Psilatos Moutti	0.008	0.000	0.015	0.484	0.000
87	Pyla Kokkinokremos	0.060	0.004	0.073	0.606	0.004
88	Pyla Verghi	0.105	0.011	0.144	0.640	0.010
89	Rizokarpasso	0.030	0.001	0.056	0.582	0.001
90	Sinda	0.105	0.011	0.131	0.647	0.021
91	Soloi	0.008	0.000	0.024	0.564	0.000
92	Strovolos Dromero	0.008	0.000	0.024	0.564	0.000
93	Tamassos Litharkes	0.008	0.000	0.024	0.564	0.000
94	Toumba tou Skourou	0.098	0.010	0.127	0.637	0.015
95	Yeri Phoenikias	0.023	0.001	0.029	0.510	0.000
96	Yeroskipou	0.015	0.000	0.030	0.520	0.000

Table 7 – CENTRALITY MEASURES FOR FUNCTIONAL USE GROUPS IN CYPRUS

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Akaki	0.333	0.170	0.122	1.178	0.002
2	Akanthou Moulos	0.333	0.170	0.122	1.178	0.002
3	Akhera	0.444	0.184	0.135	1.192	0.003
4	Alambra	0.556	0.209	0.156	1.236	0.006
5	Alassa	0.000	0.000	0.000	0.000	0.000
6	Amathus	0.111	0.054	0.039	0.917	0.000
7	Analionda Palioklichia	0.111	0.054	0.039	0.917	0.000
8	Anaochora	0.000	0.000	0.000	0.000	0.000
9	Angastina	0.333	0.170	0.122	1.178	0.002
10	Apliki	0.667	0.240	0.184	1.252	0.005
11	Aradhippou	0.111	0.054	0.040	0.917	0.000
12	Arediou-Vouppes	0.222	0.083	0.064	0.980	0.000
13	Arodhes	0.111	0.061	0.043	0.971	0.000
14	Arpera Chiflik	0.222	0.109	0.079	1.042	0.001
15	Athienou Baboulari	0.556	0.226	0.171	1.236	0.004
16	Ayia Irini Palaeokastro	0.222	0.042	0.035	0.799	0.000
17	Ayia Irini Temple Site	0.111	0.034	0.028	0.787	0.00
18	Ayios Epiktetos	0.111	0.054	0.039	0.917	0.000
19	Ayios Iakovos Dhima + Melia	0.444	0.204	0.151	1.221	0.003
20	Ayios Sozomenos	0.111	0.054	0.040	0.917	0.000
21	Ayios Theodoros	0.000	0.000	0.000	0.000	0.000
22	Ayios Thyrsos Vikla	0.000	0.000	0.000	0.000	0.000
23	Dhavlos Pyrgos	0.000	0.000	0.000	0.000	0.000
24	Dhekelia Koukouphoudhkia	0.333	0.170	0.122	1.178	0.002
25	Dhekelia Steno	0.333	0.170	0.122	1.178	0.002
26	Dhenia	0.333	0.170	0.122	1.178	0.002
27	Dhikomo Onisia	0.333	0.149	0.111	1.112	0.001
28	Dhiorios Kupous	0.000	0.000	0.000	0.000	0.000
29	Dromolaxia trypes	0.333	0.170	0.122	1.178	0.002
30	Drousha Appiourka	0.222	0.116	0.083	1.076	0.001
31	Enkomi	1.000	0.259	0.202	1.318	0.020
32	Erimi Kafkalla	0.000	0.000	0.000	0.000	0.000
33	Galinorporni	0.333	0.170	0.122	1.178	0.002
34	Gastria Ayios ionnis	0.000	0.000	0.000	0.000	0.000
35	Hala Sultan Tekke	0.889	0.253	0.196	1.301	0.016
36	Idalion	0.444	0.204	0.151	1.221	0.003
37	Kaimakli Evretadhes	0.444	0.204	0.151	1.221	0.003
38	Kalavasos Ayios Dimithrios	0.778	0.248	0.191	1.284	0.010
39	Kalavasos Mangi	0.222	0.014	0.012	0.675	0.000
40	Kalavassos Mavrovouni	0.111	0.061	0.043	0.971	0.000
41	Kalopsidha	0.444	0.171	0.131	1.137	0.002
42	Kantara	0.111	0.054	0.039	0.917	0.000
43	Karmi	0.000	0.000	0.000	0.000	0.000
44	Katydhata	0.333	0.170	0.122	1.178	0.002
45	Kazaphani Ayios Andronikos	0.333	0.170	0.122	1.178	0.002

46	Kirokitia Skasmata	0.000	0.000	0.000	0.000	0.000
47	Kition	0.889	0.253	0.196	1.301	0.016
48	Kivisil Gyppos	0.000	0.000	0.000	0.000	0.000
49	Klavdhia	0.556	0.226	0.171	1.236	0.004
50	Kokkini Trimithia	0.000	0.000	0.000	0.000	0.000
51	Kormakiti Ayious	0.333	0.170	0.122	1.178	0.002
52	Korovia Nitovikla	0.111	0.061	0.043	0.971	0.000
53	Kouklia Palaepaphos	0.667	0.240	0.184	1.252	0.005
54	Kouklia Skales	0.111	0.061	0.043	0.971	0.000
55	Kourion Apiskopi	0.111	0.054	0.039	0.917	0.000
56	Kourion Bamboula	0.667	0.240	0.184	1.252	0.005
57	Lapithos Ayia Anastasia	0.444	0.163	0.124	1.124	0.002
58	Larnaca tis Lapithou	0.222	0.068	0.053	0.926	0.000
59	Laxia tou Riou	0.222	0.116	0.083	1.076	0.001
60	Leonarissio	0.000	0.000	0.000	0.000	0.000
61	Limassol Kapsalos	0.000	0.000	0.000	0.000	0.000
62	Loutros Adhkia	0.000	0.000	0.000	0.000	0.000
63	Lythrodhonda Moutti	0.000	0.000	0.000	0.000	0.000
64	Maa Palaeokastro	0.333	0.117	0.092	1.021	0.001
65	Marathovouni	0.000	0.000	0.000	0.000	0.000
66	Maroni Vournes	0.778	0.245	0.190	1.268	0.008
67	Maroni Tsaroukkas	0.778	0.240	0.183	1.284	0.014
68	Mathiatis	0.111	0.061	0.043	0.971	0.000
69	Meniko Kyra tou Dhiakou	0.111	0.054	0.039	0.917	0.000
70	Milia	0.333	0.149	0.111	1.124	0.002
71	Myloptetres	0.111	0.054	0.040	0.917	0.000
72	Myrtou Pigadhes	0.667	0.231	0.177	1.252	0.007
73	Myrtou Stephania	0.222	0.116	0.083	1.076	0.001
74	Nicoseia Ayia Paraskevi	0.444	0.192	0.143	1.192	0.002
75	Nicosia Bairaktar	0.000	0.000	0.000	0.000	0.000
76	Ovgoros	0.111	0.061	0.043	0.971	0.000
77	Palekythro	0.222	0.088	0.068	0.971	0.000
78	Paphos	0.000	0.000	0.000	0.000	0.000
79	Pendayia	0.111	0.054	0.039	0.917	0.000
80	Pera	0.111	0.054	0.040	0.917	0.000
81	Peyia Koutsourous	0.000	0.000	0.000	0.000	0.000
82	Phlamoudhi Sapilou	0.222	0.116	0.083	1.076	0.001
83	Polemidhia Oufkia	0.111	0.061	0.043	0.971	0.000
84	Politiko-Lambertis	0.333	0.149	0.111	1.112	0.001
85	Pomos	0.000	0.000	0.000	0.000	0.000
86	Psilatos Moutti	0.111	0.054	0.040	0.917	0.000
87	Pyla Kokkinokremos	0.556	0.226	0.171	1.236	0.004
88	Pyla Verghi	0.556	0.218	0.164	1.236	0.004
89	Rizokarpasso	0.222	0.109	0.079	1.042	0.001
90	Sinda	0.667	0.231	0.177	1.252	0.007
91	Soloi	0.000	0.000	0.000	0.000	0.000
92	Strovolos Dromero	0.000	0.000	0.000	0.000	0.000
93	Tamassos Litharkes	0.000	0.000	0.000	0.000	0.000
94	Toumba tou Skourou	0.556	0.226	0.171	1.236	0.004
95	Yeri Phoenikias	0.222	0.116	0.083	1.076	0.001
96	Yeroskipou	0.111	0.061	0.043	0.971	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Storage	0.125	0.016	0.161	0.538	0.006
2	Storage-Dry	0.490	0.240	0.489	0.812	0.170
3	Storage - Liquid	0.552	0.305	0.536	0.889	0.214
4	Dining - Serving	0.490	0.240	0.494	0.812	0.161
5	Dining - Drinking	0.302	0.091	0.349	0.644	0.055
6	Dining - Eating	0.198	0.039	0.256	0.577	0.013
7	Ritual	0.052	0.003	0.073	0.505	0.000
8	U-CL	0.052	0.003	0.063	0.505	0.006
9	U-O	0.073	0.005	0.082	0.514	0.011

Table 8 – CENTRALITY MEASURES FOR LH WARES IN EGYPT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenness
1	Abusir el-Meleq	0.133	0.014	0.030	0.549	0.002
2	Abydos	0.400	0.108	0.270	0.876	0.057
3	Ali Mara	0.133	0.043	0.071	0.681	0.011
4	Amara West	0.267	0.057	0.132	0.709	0.023
5	Aniba	0.067	0.011	0.025	0.540	0.000
6	Arabi Hills	0.067	0.028	0.056	0.610	0.000
7	Armant	0.133	0.026	0.041	0.600	0.005
8	Arminna	0.133	0.026	0.041	0.600	0.005
9	Askut	0.133	0.044	0.115	0.650	0.001
10	Assyut	0.067	0.016	0.045	0.562	0.000
11	Az-Zaqaziz	0.133	0.043	0.071	0.681	0.011
12	Balabisch	0.133	0.044	0.115	0.650	0.001
13	Bir el Abd	0.067	0.015	0.016	0.540	0.000
14	Buhen	0.200	0.072	0.170	0.788	0.014
15	C 86	0.067	0.028	0.070	0.621	0.000
16	Daqqa	0.067	0.016	0.045	0.562	0.000
17	Debeira	0.067	0.013	0.034	0.544	0.000
18	Deir el-Ballas	0.067	0.028	0.056	0.610	0.000
19	Deir el-Medina	0.333	0.082	0.212	0.746	0.024
20	Dra’ Abu el-Naga’	0.200	0.052	0.115	0.688	0.010
21	Edfu	0.067	0.028	0.056	0.610	0.000
22	El-Arish	0.067	0.028	0.056	0.610	0.000
23	El-Giza	0.067	0.015	0.016	0.540	0.000
24	Elephantine (Assuan)	0.067	0.015	0.016	0.540	0.000
25	Gurna (Abd el-Qurna)	0.267	0.094	0.231	0.825	0.022
26	Gurob	0.400	0.112	0.279	0.898	0.051
27	Harageh	0.067	0.028	0.056	0.610	0.000

28	Heliopolis	0.067	0.013	0.034	0.544	0.000
29	Kahun (al-Lahun)	0.267	0.074	0.176	0.788	0.020
30	Kerma	0.067	0.001	0.000	141.000	0.000
31	Kom Abu Billa	0.133	0.050	0.130	0.668	0.001
32	Kom el-Abd	0.067	0.028	0.056	0.610	0.000
33	Kom Firin	0.067	0.007	0.022	0.505	0.000
34	Luxor	0.133	0.056	0.126	0.746	0.008
35	Malkata	0.067	0.028	0.070	0.621	0.000
36	Marsa Matruh (Bates' Island)	0.200	0.046	0.114	0.668	0.007
37	Memphis (Kom Rabi'a)	0.333	0.102	0.246	0.876	0.037
38	Meydum	0.067	0.028	0.056	0.610	0.000
39	Mostai (Tell Om Harb)	0.133	0.050	0.130	0.668	0.001
40	Naqada	0.067	0.028	0.056	0.610	0.000
41	Qantir	0.333	0.074	0.201	0.709	0.034
42	Qasr al-Aguz	0.133	0.036	0.076	0.650	0.007
43	Qau el-Qebir	0.067	0.028	0.056	0.610	0.000
44	Qubban	0.133	0.050	0.130	0.668	0.001
45	Rifeh	0.267	0.077	0.166	0.815	0.038
46	Riqqeh	0.267	0.078	0.209	0.716	0.009
47	Sai	0.067	0.028	0.056	0.610	0.000
48	Saqqara - N.K necropole	0.467	0.125	0.313	0.934	0.064
49	Sedment	0.400	0.114	0.287	0.876	0.044
50	Sesebi	0.133	0.041	0.104	0.656	0.002
51	Soleb	0.067	0.022	0.061	0.590	0.000
52	Tabo-Argo Island	0.133	0.050	0.130	0.668	0.001
53	Tarkhan	0.067	0.028	0.056	0.610	0.000
54	Tell ar-Rubai	0.133	0.043	0.071	0.681	0.011
55	Tell el-Amarna	0.200	0.048	0.096	0.716	0.026
56	Tell el-Dab'a	0.200	0.041	0.103	0.644	0.005
57	Tell el-Muqdam	0.200	0.057	0.153	0.681	0.005
58	Tell el-Rataba	0.133	0.056	0.126	0.746	0.008
59	Tell el-Yahudiyeh	0.067	0.022	0.061	0.590	0.000
60	Thebes	0.133	0.040	0.081	0.650	0.004
61	Tombos	0.067	0.028	0.070	0.621	0.000
62	Tuneh el-Gebel (E Ash)	0.067	0.015	0.016	0.540	0.000
63	Zawiyet Umm el-Rakham	0.200	0.052	0.121	0.688	0.015
64	Zawyet el-Amwat	0.067	0.028	0.070	0.621	0.000

		1	2	3	4	5
		Degree	2-Local	Eigenvect	Closeness	Betweenness
1	MYC UNKNOWN	0.219	0.048	0.121	0.487	0.134
2	MH	0.000	0.000	0.000	0.000	0.000
3	LHI	0.016	0.000	0.000	92.000	0.000
4	LHI-II	0.031	0.001	0.038	0.413	0.003
5	LHII	0.172	0.030	0.199	0.487	0.087
6	LH II-III	0.000	0.000	0.000	0.000	0.000
7	LHIII	0.422	0.178	0.436	0.579	0.337
8	LHIIIA	0.188	0.035	0.264	0.492	0.075
9	LHIIIA1	0.078	0.006	0.084	0.405	0.007
10	LHIIIA2	0.422	0.178	0.546	0.594	0.255

11	LHIIIA-B	0.234	0.055	0.351	0.514	0.096
12	LHIIIB	0.328	0.108	0.475	0.551	0.165
13	LHIIIB1	0.109	0.012	0.173	0.444	0.033
14	LHIIIB2	0.000	0.000	0.000	0.000	0.000
15	LHIIIB-C	0.016	0.000	0.026	0.339	0.000

Table 9 – CENTRALITY MEASURES FOR FS SHAPES IN EGYPT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenness
1	PJ	0.125	0.013	0.198	1.093	0.007
2	SJ	0.516	0.024	0.452	1.378	0.112
3	ALAB	0.094	0.008	0.130	1.019	0.008
4	JUG	0.047	0.004	0.059	0.921	0.002
5	F	0.094	0.007	0.115	1.012	0.010
6	C	0.078	0.008	0.125	1.051	0.003
7	B	0.016	0.001	0.014	0.732	0.000
8	U	0.453	0.015	0.253	1.262	0.119
9	U-CL	0.266	0.019	0.316	1.197	0.038
10	U-O	0.109	0.009	0.130	1.065	0.012
11	6	0.000	0.000	0.000	0.000	0.000
12	7	0.000	0.000	0.000	0.000	0.000
13	8	0.000	0.000	0.000	0.000	0.000
14	9	0.000	0.000	0.000	0.000	0.000
15	16	0.000	0.000	0.000	0.000	0.000
16	19	0.000	0.000	0.000	0.000	0.000
17	23	0.000	0.000	0.000	0.000	0.000
18	24	0.000	0.000	0.000	0.000	0.000
19	28	0.000	0.000	0.000	0.000	0.000
20	31	0.000	0.000	0.000	0.000	0.000
21	34	0.016	0.004	0.051	0.948	0.000
22	35	0.063	0.012	0.167	1.079	0.002
23	36	0.000	0.000	0.000	0.000	0.000
24	39	0.031	0.004	0.060	0.953	0.000
25	40	0.031	0.006	0.084	0.921	0.000
26	44	0.000	0.000	0.000	0.000	0.000
27	45	0.047	0.008	0.109	1.000	0.001
28	46	0.000	0.000	0.000	0.000	0.000
29	47	0.000	0.000	0.000	0.000	0.000
30	48	0.031	0.006	0.084	0.921	0.000
31	53-55	0.031	0.004	0.055	0.953	0.001
32	56	0.031	0.006	0.084	0.921	0.000
33	67	0.000	0.000	0.000	0.000	0.000
34	68	0.000	0.000	0.000	0.000	0.000
35	77	0.000	0.000	0.000	0.000	0.000
36	80	0.000	0.000	0.000	0.000	0.000
37	82	0.031	0.002	0.029	0.837	0.000
38	83	0.000	0.000	0.000	0.000	0.000

39	84	0.000	0.000	0.000	0.000	0.000
40	85	0.016	0.004	0.051	0.948	0.000
41	84-85	0.000	0.000	0.000	0.000	0.000
42	87	0.016	0.000	0.003	0.664	0.000
43	93	0.000	0.000	0.000	0.000	0.000
44	94	0.047	0.010	0.135	1.051	0.001
45	95	0.016	0.002	0.032	0.770	0.000
46	94-95	0.000	0.000	0.000	0.000	0.000
47	96	0.000	0.000	0.000	0.000	0.000
48	105	0.000	0.000	0.000	0.000	0.000
49	110	0.000	0.000	0.000	0.000	0.000
50	112	0.000	0.000	0.000	0.000	0.000
51	113	0.000	0.000	0.000	0.000	0.000
52	114	0.063	0.011	0.148	1.058	0.002
53	116	0.000	0.000	0.000	0.000	0.000
54	118	0.031	0.006	0.083	0.982	0.000
55	120-121	0.047	0.010	0.135	1.051	0.001
56	123	0.000	0.000	0.000	0.000	0.000
57	126	0.000	0.000	0.000	0.000	0.000
58	128-129	0.000	0.000	0.000	0.000	0.000
59	130	0.016	0.002	0.032	0.770	0.000
60	132	0.000	0.000	0.000	0.000	0.000
61	133	0.000	0.000	0.000	0.000	0.000
62	134	0.031	0.004	0.062	0.953	0.000
63	136	0.000	0.000	0.000	0.000	0.000
64	139	0.000	0.000	0.000	0.000	0.000
65	142	0.000	0.000	0.000	0.000	0.000
66	144	0.000	0.000	0.000	0.000	0.000
67	149	0.000	0.000	0.000	0.000	0.000
68	151	0.016	0.004	0.051	0.948	0.000
69	155	0.000	0.000	0.000	0.000	0.000
70	159-161	0.031	0.006	0.084	0.921	0.000
71	164	0.078	0.011	0.161	1.065	0.006
72	165-168	0.094	0.013	0.191	1.093	0.004
73	170	0.016	0.004	0.051	0.948	0.000
74	171-173	0.156	0.017	0.259	1.131	0.011
75	174	0.000	0.000	0.000	0.000	0.000
76	176	0.000	0.000	0.000	0.000	0.000
77	178	0.141	0.010	0.168	1.045	0.012
78	179	0.047	0.005	0.082	0.943	0.001
79	180	0.063	0.007	0.112	1.000	0.001
80	178-180	0.031	0.004	0.059	0.901	0.000
81	181	0.031	0.001	0.008	0.710	0.006
82	182-183	0.063	0.010	0.142	1.012	0.002
83	184	0.000	0.000	0.000	0.000	0.000
84	186	0.047	0.007	0.107	0.948	0.000
85	187-188	0.031	0.005	0.074	0.959	0.000
86	189	0.125	0.010	0.163	1.038	0.007
87	190-192	0.109	0.013	0.202	1.093	0.004
88	197	0.000	0.000	0.000	0.000	0.000
89	198	0.000	0.000	0.000	0.000	0.000
90	199	0.063	0.006	0.087	0.988	0.003
91	200-202	0.031	0.006	0.084	0.921	0.000
92	AN V	0.000	0.000	0.000	0.000	0.000

93	204-210	0.000	0.000	0.000	0.000	0.000
94	206	0.000	0.000	0.000	0.000	0.000
95	207	0.000	0.000	0.000	0.000	0.000
96	208	0.016	0.004	0.051	0.948	0.000
97	209	0.000	0.000	0.000	0.000	0.000
98	211-214	0.000	0.000	0.000	0.000	0.000
99	211-220	0.000	0.000	0.000	0.000	0.000
100	219	0.000	0.000	0.000	0.000	0.000
101	220	0.063	0.012	0.167	1.079	0.002
102	225-226	0.000	0.000	0.000	0.000	0.000
103	227	0.000	0.000	0.000	0.000	0.000
104	230-232	0.000	0.000	0.000	0.000	0.000
105	236	0.016	0.003	0.041	0.792	0.000
106	237	0.016	0.002	0.032	0.770	0.000
107	242-244	0.000	0.000	0.000	0.000	0.000
108	248-253	0.000	0.000	0.000	0.000	0.000
109	250	0.000	0.000	0.000	0.000	0.000
110	254	0.000	0.000	0.000	0.000	0.000
111	255	0.000	0.000	0.000	0.000	0.000
112	256	0.000	0.000	0.000	0.000	0.000
113	257	0.016	0.004	0.051	0.948	0.000
114	258	0.016	0.003	0.041	0.792	0.000
115	262	0.000	0.000	0.000	0.000	0.000
116	272	0.000	0.000	0.000	0.000	0.000
117	278	0.000	0.000	0.000	0.000	0.000
118	254-278	0.047	0.009	0.124	1.058	0.001
119	279-286	0.000	0.000	0.000	0.000	0.000
120	281	0.031	0.006	0.084	0.921	0.000
121	282	0.000	0.000	0.000	0.000	0.000
122	283	0.016	0.004	0.051	0.948	0.000
123	284	0.000	0.000	0.000	0.000	0.000
124	285	0.000	0.000	0.000	0.000	0.000
125	290	0.000	0.000	0.000	0.000	0.000
126	292	0.000	0.000	0.000	0.000	0.000
127	294-296	0.000	0.000	0.000	0.000	0.000
128	303-306	0.000	0.000	0.000	0.000	0.000
129	304	0.000	0.000	0.000	0.000	0.000
130	308-310	0.000	0.000	0.000	0.000	0.000
131	324-325	0.000	0.000	0.000	0.000	0.000
132	334	0.000	0.000	0.000	0.000	0.000
133	336	0.031	0.006	0.084	0.921	0.000

	1	2	3	4	5
		Degree	2-Local	Eigenvect	Closeness	Betweenness

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenness
1	Abusir el-Meleq	0.008	0.000	0.014	0.608	0.000
2	Abydos	0.045	0.002	0.150	0.881	0.009
3	Ali Mara	0.008	0.000	0.027	0.685	0.000
4	Amara West	0.015	0.000	0.074	0.830	0.002
5	Aniba	0.008	0.000	0.014	0.589	0.000
6	Arabi Hills	0.008	0.000	0.048	0.728	0.000
7	Armant	0.015	0.000	0.030	0.689	0.001

8	Arminna	0.015	0.000	0.036	0.693	0.000
9	Askut	0.023	0.001	0.086	0.740	0.000
10	Assyut	0.023	0.001	0.093	0.749	0.001
11	Az-Zaqaziz	0.015	0.000	0.040	0.700	0.001
12	Balabisch	0.030	0.001	0.078	0.749	0.013
13	Bir el Abd	0.008	0.000	0.027	0.685	0.000
14	Buhen	0.053	0.003	0.176	0.899	0.011
15	C 86	0.008	0.000	0.027	0.685	0.000
16	Daqqa	0.008	0.000	0.027	0.685	0.000
17	Debeira	0.008	0.000	0.048	0.728	0.000
18	Deir el-Ballas	0.008	0.000	0.027	0.685	0.000
19	Deir el-Medina	0.075	0.006	0.217	0.799	0.007
20	Dra’ Abu el-Naga’	0.015	0.000	0.054	0.671	0.000
21	Edfu	0.008	0.000	0.027	0.685	0.000
22	El Arish	0.015	0.000	0.061	0.671	0.000
23	el-Giza	0.008	0.000	0.027	0.685	0.000
24	Elephantine (Assuan)	0.008	0.000	0.027	0.685	0.000
25	Gurna (Abd el-Qurna)	0.030	0.001	0.098	0.749	0.001
26	Gurob	0.098	0.010	0.245	0.938	0.026
27	Harageh	0.008	0.000	0.027	0.685	0.000
28	Heliopolis	0.008	0.000	0.001	0.447	0.000
29	Kahun (al-Lahun)	0.015	0.000	0.027	0.689	0.006
30	Kerma	0.008	0.000	0.027	0.685	0.000
31	Kom Abu Billa	0.008	0.000	0.027	0.685	0.000
32	Kom el-Abd	0.008	0.000	0.027	0.685	0.000
33	Kom Firin	0.008	0.000	0.048	0.728	0.000
34	Luxor	0.023	0.001	0.081	0.835	0.004
35	Malkata	0.015	0.000	0.061	0.732	0.000
36	Marsa Matruh (Bates’ Island)	0.045	0.002	0.130	0.785	0.009
37	Memphis (Kom Rabi’a)	0.030	0.001	0.109	0.852	0.005
38	Meydum	0.008	0.000	0.027	0.685	0.000
39	Mostai (Tell Om Harb)	0.015	0.000	0.051	0.678	0.000
40	Naqada	0.008	0.000	0.048	0.728	0.000
41	Qantir	0.188	0.035	0.385	0.875	0.039
42	Qasr al-Aguz	0.008	0.000	0.027	0.685	0.000
43	Qau el-Qebir	0.008	0.000	0.012	0.586	0.000
44	Qubban	0.015	0.000	0.040	0.700	0.001
45	Rifeh	0.030	0.001	0.099	0.744	0.001
46	Riqqeh	0.030	0.001	0.098	0.740	0.001
47	Sai	0.008	0.000	0.048	0.728	0.000
48	Saqqara - N.K necropole	0.135	0.018	0.304	0.841	0.030
49	Sedment	0.045	0.002	0.121	0.766	0.004
50	Sesebi	0.023	0.001	0.088	0.841	0.004
51	Soleb	0.008	0.000	0.048	0.728	0.000
52	Tabo-Argo Island	0.015	0.000	0.081	0.753	0.000
53	Tarkhan	0.008	0.000	0.048	0.728	0.000
54	Tell ar-Rubai	0.015	0.000	0.081	0.753	0.000
55	Tell el-Amarna	0.256	0.065	0.488	1.136	0.114
56	Tell el-Dab’a	0.195	0.038	0.412	1.036	0.064
57	Tell el-Muqdam	0.015	0.000	0.032	0.689	0.001
58	Tell el-Rataba	0.023	0.001	0.093	0.762	0.001
59	Tell el-Yahudiyeh	0.008	0.000	0.048	0.728	0.000
60	Thebes	0.008	0.000	0.033	0.661	0.000
61	Tombos	0.008	0.000	0.018	0.600	0.000

62	Tuneh el-Gebel (E Ash)	0.015	0.000	0.057	0.736	0.000
63	Zawiyet Umm el-Rakham	0.015	0.000	0.023	0.614	0.000
64	Zawyet el-Amwat	0.008	0.000	0.033	0.661	0.000

Table 10 – CENTRALITY MEASURES FOR FUNCTIONAL USE GROUPS IN EGYPT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Abusir el-Meleq	0.111	0.012	0.019	0.659	0.000
2	Abydos	0.222	0.095	0.148	1.000	0.002
3	Ali Mara	0.000	0.000	0.000	0.000	0.000
4	Amara West	0.111	0.066	0.095	0.944	0.000
5	Aniba	0.111	0.024	0.046	0.707	0.000
6	Arabi Hills	0.111	0.066	0.095	0.944	0.000
7	Armant	0.111	0.024	0.046	0.707	0.000
8	Arminna	0.111	0.010	0.022	0.652	0.000
9	Askut	0.222	0.090	0.141	1.000	0.003
10	Assyut	0.111	0.066	0.095	0.944	0.000
11	Az-Zaqaziz	0.111	0.012	0.019	0.659	0.000
12	Balabisch	0.111	0.066	0.095	0.944	0.000
13	Bir el Abd	0.000	0.000	0.000	0.000	0.000
14	Buhen	0.222	0.095	0.148	1.000	0.002
15	C 86	0.000	0.000	0.000	0.000	0.000
16	Daqqa	0.000	0.000	0.000	0.000	0.000
17	Debeira	0.111	0.066	0.095	0.944	0.000
18	Deir el-Ballas	0.000	0.000	0.000	0.000	0.000
19	Deir el-Medina	0.333	0.120	0.194	1.047	0.007
20	Dra’ Abu el-Naga’	0.222	0.054	0.099	0.789	0.001
21	Edfu	0.000	0.000	0.000	0.000	0.000
22	El Arish	0.222	0.095	0.148	1.000	0.002
23	el-Giza	0.000	0.000	0.000	0.000	0.000
24	Elephantine (Assuan)	0.000	0.000	0.000	0.000	0.000
25	Gurna (Abd el-Qurna)	0.111	0.066	0.095	0.944	0.000
26	Gurob	0.444	0.130	0.216	1.080	0.014
27	Harageh	0.000	0.000	0.000	0.000	0.000
28	Heliopolis	0.111	0.066	0.095	0.944	0.000
29	Kahun (al-Lahun)	0.111	0.010	0.023	0.652	0.000
30	Kerma	0.000	0.000	0.000	0.000	0.000
31	Kom Abu Billa	0.000	0.000	0.000	0.000	0.000
32	Kom el-Abd	0.000	0.000	0.000	0.000	0.000
33	Kom Firin	0.111	0.066	0.095	0.944	0.000
34	Luxor	0.222	0.076	0.118	0.971	0.004
35	Malkata	0.222	0.078	0.124	0.957	0.002
36	Marsa Matruh (Bates’ Island)	0.667	0.148	0.252	1.154	0.039
37	Memphis (Kom Rabi’a)	0.333	0.102	0.160	1.063	0.017

38	Meydum	0.000	0.000	0.000	0.000	0.000
39	Mostai (Tell Om Harb)	0.222	0.095	0.148	1.000	0.002
40	Naqada	0.111	0.066	0.095	0.944	0.000
41	Qantir	0.778	0.167	0.296	1.174	0.035
42	Qasr al-Aguz	0.000	0.000	0.000	0.000	0.000
43	Qau el-Qebir	0.000	0.000	0.000	0.000	0.000
44	Qubban	0.111	0.012	0.019	0.659	0.000
45	Rifeh	0.222	0.080	0.123	0.971	0.003
46	Riqqeh	0.222	0.078	0.124	0.957	0.002
47	Sai	0.111	0.066	0.095	0.944	0.000
48	Saqqara - N.K necropole	0.667	0.156	0.274	1.134	0.025
49	Sedment	0.333	0.104	0.169	1.031	0.007
50	Sesebi	0.222	0.090	0.141	1.000	0.003
51	Soleb	0.111	0.066	0.095	0.944	0.000
52	Tabo-Argo Island	0.222	0.095	0.148	1.000	0.002
53	Tarkhan	0.111	0.066	0.095	0.944	0.000
54	Tell ar-Rubai	0.222	0.095	0.148	1.000	0.002
55	Tell el Amarna	1.000	0.182	0.325	1.286	0.075
56	Tell el Dab’a	0.889	0.179	0.315	1.262	0.061
57	Tell el-Muqdam	0.111	0.014	0.028	0.665	0.000
58	Tell el-Rataba	0.222	0.095	0.148	1.000	0.002
59	Tell el-Yahudiyeh	0.111	0.066	0.095	0.944	0.000
60	Thebes	0.111	0.030	0.053	0.730	0.000
61	Tombos	0.111	0.066	0.095	0.944	0.000
62	Tuneh el-Gebel (E Ash)	0.222	0.076	0.117	0.971	0.004
63	Zawiyet Umm el-Rakham	0.222	0.080	0.123	0.971	0.003
64	Zawyet el-Amwat	0.111	0.030	0.053	0.730	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Storage	0.094	0.009	0.176	0.530	0.026
2	Storage-Dry	0.219	0.048	0.349	0.593	0.074
3	Storage - Liquid	0.594	0.353	0.729	0.920	0.414
4	Dining - Serving	0.125	0.016	0.216	0.544	0.031
5	Dining - Drinking	0.109	0.012	0.223	0.537	0.009
6	Dining - Eating	0.031	0.001	0.075	0.503	0.000
7	Ritual	0.094	0.009	0.169	0.530	0.026
8	U-CL	0.266	0.071	0.406	0.620	0.091
9	U-O	0.109	0.012	0.145	0.537	0.066

Table 11 – CENTRALITY MEASURES FOR LH WARES IN THE LEVANT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenness
1	Abu Shushe	0.071	0.032	0.037	0.619	0.000

2	Afula	0.071	0.040	0.041	0.661	0.000
3	Ain Shems (Beth Shemesh)	0.500	0.164	0.177	0.924	0.018
4	Akko	0.286	0.119	0.130	0.771	0.003
5	Alalakh (Tell Atchana)	0.429	0.156	0.166	0.910	0.015
6	Amman Airport	0.429	0.126	0.139	0.786	0.023
7	Aphek (Antipatris); Kurdane	0.286	0.114	0.123	0.771	0.005
8	Arab al Mulk	0.071	0.040	0.041	0.661	0.000
9	Ashdod	0.357	0.153	0.159	0.910	0.014
10	Ashkelon	0.214	0.110	0.107	0.856	0.008
11	Atlit	0.071	0.030	0.024	0.599	0.000
12	Beirut (centre)	0.143	0.072	0.080	0.693	0.000
13	Beth Shean	0.357	0.129	0.144	0.781	0.004
14	Bethel (Beitin)	0.071	0.040	0.041	0.661	0.000
15	Byblos (Jbail)	0.357	0.132	0.148	0.781	0.004
16	Çatal Hüyük	0.071	0.040	0.043	0.657	0.000
17	Charchemish (Jerablus)	0.214	0.112	0.120	0.766	0.002
18	Dahrat al Humrayah	0.143	0.073	0.078	0.723	0.001
19	Deir ‘Alla	0.143	0.080	0.084	0.737	0.001
20	Deir el Balah	0.214	0.102	0.104	0.797	0.005
21	Deir Khabie	0.071	0.040	0.041	0.661	0.000
22	Dor (Tell el Burj)	0.071	0.003	0.001	0.490	0.000
23	Dothan	0.071	0.030	0.024	0.599	0.000
24	El-Harruba	0.214	0.102	0.104	0.797	0.005
25	Garife	0.071	0.030	0.024	0.599	0.000
26	Gerar (Tell Jemmeh)	0.143	0.072	0.080	0.693	0.000
27	Gezer	0.500	0.168	0.182	0.924	0.018
28	Gibeon (el Jib)	0.071	0.030	0.024	0.599	0.000
29	Hama	0.071	0.040	0.041	0.661	0.000
30	Hazor	0.429	0.126	0.139	0.786	0.023
31	Hesban	0.071	0.040	0.041	0.661	0.000
32	Isbet Sartah	0.071	0.040	0.043	0.657	0.000
33	Jatt	0.214	0.102	0.104	0.797	0.005
34	Jericho	0.071	0.030	0.024	0.599	0.000
35	Jerusalem	0.071	0.040	0.041	0.661	0.000
36	Kamid el-Loz	0.357	0.153	0.159	0.910	0.014
37	Khan Selim (Khirbet Selim)	0.071	0.040	0.041	0.661	0.000
38	Khan Sheikoun	0.071	0.040	0.041	0.661	0.000
39	Khirbet Judur	0.286	0.107	0.112	0.803	0.007
40	Khirbet Rabud (Debir)	0.071	0.032	0.037	0.619	0.000
41	Kinneret (Khirbet al-Urema)	0.143	0.069	0.067	0.756	0.003
42	Lachish	0.786	0.179	0.197	0.979	0.102
43	Lattakia (Ramitha)	0.071	0.040	0.041	0.661	0.000
44	Madeba	0.071	0.040	0.043	0.657	0.000
45	Megiddo	0.429	0.138	0.158	0.786	0.005
46	Meskene Emar	0.143	0.080	0.084	0.737	0.001
47	Minet el-Beida	0.500	0.167	0.180	0.924	0.018
48	Oumm el-Mara	0.071	0.003	0.001	0.490	0.000
49	Pella (Tabaqat Fahil)	0.214	0.110	0.107	0.856	0.008
50	Qadesh (Tell Nebi Mend)	0.286	0.142	0.144	0.896	0.011
51	Qatna (Mishrife)	0.071	0.032	0.037	0.619	0.000
52	Qraye	0.143	0.050	0.057	0.665	0.000
53	Qudur el Walaida	0.071	0.030	0.024	0.599	0.000
54	Ras el-Bassit	0.214	0.082	0.087	0.741	0.003
55	Ras Ibn Hani	0.214	0.090	0.098	0.746	0.002

56	Sahab	0.143	0.072	0.080	0.693	0.000
57	Sarepta (Sarafand)	0.357	0.132	0.148	0.781	0.004
58	Sabouni	0.071	0.030	0.024	0.599	0.000
59	Shechem (Tell Balata)	0.214	0.112	0.120	0.766	0.002
60	Sidon (Saida)	0.286	0.121	0.134	0.771	0.002
61	Tell ‘Ain Sherif	0.071	0.040	0.043	0.657	0.000
62	Tell ‘Ajjul (Gaza)	0.500	0.163	0.176	0.917	0.017
63	Tell ‘Arqa	0.286	0.116	0.117	0.862	0.009
64	Tell Abu Hawam	0.500	0.168	0.182	0.924	0.018
65	Tell Aron	0.071	0.030	0.024	0.599	0.000
66	Tell Ashari	0.214	0.112	0.120	0.766	0.002
67	Tell Batash	0.143	0.072	0.080	0.693	0.000
68	Tell Beit Mirsim	0.357	0.128	0.143	0.781	0.005
69	Tell Bir el-Gharbi	0.071	0.002	0.002	0.435	0.000
70	Tell Burgatha	0.071	0.030	0.024	0.599	0.000
71	Tell Dan (Tell el-Qadi)	0.286	0.142	0.144	0.896	0.011
72	Tell Daruk	0.071	0.003	0.001	0.490	0.000
73	Tell el Far’ah (North)	0.071	0.032	0.037	0.619	0.000
74	Tell el Far’ah (south)	0.214	0.112	0.120	0.766	0.002
75	Tell el Ghassil	0.071	0.030	0.024	0.599	0.000
76	Tell el Hesi	0.214	0.112	0.120	0.766	0.002
77	Tell er Ridan	0.071	0.030	0.024	0.599	0.000
78	Tell Eran	0.071	0.030	0.024	0.599	0.000
79	Tell es Safi	0.214	0.112	0.120	0.766	0.002
80	Tell es Saidiyeh	0.214	0.112	0.120	0.766	0.002
81	Tell es Salihyeh	0.071	0.032	0.037	0.619	0.000
82	Tell es Samak	0.071	0.030	0.024	0.599	0.000
83	Tell esh-Shari’a (‘Sera)	0.286	0.121	0.134	0.771	0.002
84	Tell Haror	0.071	0.040	0.041	0.661	0.000
85	Tell Hayat	0.071	0.030	0.024	0.599	0.000
86	Tell Irbid	0.071	0.030	0.024	0.599	0.000
87	Tell Jerishe	0.071	0.040	0.041	0.661	0.000
88	Tell Kadesh	0.071	0.030	0.024	0.599	0.000
89	Tell Kazel	0.357	0.144	0.147	0.903	0.017
90	Tell Mevorakh	0.143	0.080	0.084	0.737	0.001
91	Tell Michal	0.071	0.030	0.024	0.599	0.000
92	Tell Miqne	0.071	0.010	0.014	0.519	0.000
93	Tell Mor	0.286	0.142	0.144	0.896	0.011
94	Tell Nagila	0.071	0.030	0.024	0.599	0.000
95	Tell Nami	0.214	0.102	0.104	0.797	0.005
96	Tell Nahr al-‘Arab	0.071	0.030	0.024	0.599	0.000
97	Tell Ouaouieh	0.071	0.030	0.024	0.599	0.000
98	Tell Qasis	0.071	0.040	0.043	0.657	0.000
99	Tell Qiri	0.071	0.040	0.041	0.661	0.000
100	Tell Sippor	0.143	0.080	0.084	0.737	0.001
101	Tell Sukas	0.214	0.112	0.120	0.766	0.002
102	Tell Ta’annek	0.214	0.103	0.102	0.844	0.008
103	Tell Tweini	0.143	0.080	0.084	0.737	0.001
104	Tell Yin’am	0.143	0.073	0.078	0.723	0.001
105	Tell Yoqne’am	0.071	0.040	0.041	0.661	0.000
106	Tyre	0.214	0.110	0.107	0.856	0.008
107	Ugarit (Ras Shamra)	0.714	0.177	0.196	0.947	0.036
108	Umm ad Dananir	0.071	0.040	0.043	0.657	0.000
109	Yavneh Yam	0.071	0.030	0.024	0.599	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenness
1	MYC UNKNOWN	0.418	0.175	0.310	0.511	0.336
2	LHI	0.000	0.000	0.000	0.000	0.000
3	LHI-II	0.027	0.001	0.022	0.330	0.016
4	LHII	0.127	0.016	0.177	0.417	0.009
5	LH II-III	0.036	0.001	0.044	0.382	0.001
6	LHIII	0.036	0.001	0.016	0.386	0.048
7	LHIIIA	0.091	0.008	0.129	0.402	0.004
8	LHIIIA1	0.073	0.005	0.104	0.398	0.002
9	LHIIIA2	0.455	0.207	0.477	0.535	0.189
10	LHIIIA-B	0.564	0.318	0.525	0.591	0.346
11	LHIIIB	0.555	0.308	0.553	0.586	0.279
12	LHIIIB1	0.018	0.000	0.030	0.384	0.000
13	LHIIIB2	0.027	0.001	0.036	0.384	0.000
14	LHIIIB-C	0.145	0.021	0.181	0.417	0.026

Table 12 – CENTRALITY MEASURES FOR FS SHAPES IN THE LEVANT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	PJ	0.220	0.030	0.216	0.775	0.030
2	SJ	0.376	0.038	0.286	0.844	0.078
3	ALAB	0.055	0.006	0.045	0.610	0.002
4	JUG	0.073	0.017	0.108	0.708	0.002
5	F	0.028	0.003	0.025	0.570	0.000
6	C	0.037	0.007	0.041	0.666	0.001
7	B	0.037	0.008	0.048	0.668	0.000
8	U	0.651	0.034	0.275	0.945	0.279
9	U-CL	0.174	0.025	0.183	0.748	0.012
10	U-O	0.183	0.026	0.186	0.769	0.017
11	6	0.000	0.000	0.000	0.000	0.000
12	7	0.009	0.005	0.025	0.655	0.000
13	8	0.009	0.003	0.021	0.604	0.000
14	9	0.009	0.005	0.025	0.655	0.000
15	16	0.009	0.002	0.010	0.495	0.000
16	19	0.000	0.000	0.000	0.000	0.000
17	23	0.000	0.000	0.000	0.000	0.000
18	24	0.009	0.002	0.010	0.495	0.000
19	28	0.000	0.000	0.000	0.000	0.000
20	31	0.028	0.003	0.022	0.570	0.000
21	34	0.018	0.003	0.021	0.606	0.007
22	35	0.028	0.010	0.056	0.688	0.000
23	36	0.101	0.014	0.096	0.698	0.004

24	39	0.000	0.000	0.000	0.000	0.000
25	40	0.000	0.000	0.000	0.000	0.000
26	44	0.018	0.002	0.016	0.548	0.000
27	45	0.156	0.025	0.169	0.760	0.012
28	46	0.028	0.002	0.017	0.506	0.007
29	47	0.018	0.005	0.031	0.624	0.000
30	48	0.037	0.013	0.074	0.698	0.001
31	53-55	0.220	0.032	0.235	0.781	0.019
32	56	0.000	0.000	0.000	0.000	0.000
33	67	0.000	0.000	0.000	0.000	0.000
34	68	0.000	0.000	0.000	0.000	0.000
35	77	0.009	0.005	0.025	0.655	0.000
36	80	0.000	0.000	0.000	0.000	0.000
37	82	0.009	0.001	0.009	0.538	0.000
38	83	0.018	0.006	0.037	0.657	0.000
39	84	0.018	0.001	0.006	0.466	0.000
40	85	0.064	0.012	0.073	0.693	0.002
41	84-85	0.037	0.011	0.065	0.690	0.002
42	87	0.009	0.001	0.005	0.463	0.000
43	93	0.000	0.000	0.000	0.000	0.000
44	94	0.138	0.021	0.144	0.742	0.015
45	95	0.037	0.009	0.058	0.666	0.000
46	94-95	0.202	0.028	0.195	0.766	0.025
47	96	0.000	0.000	0.000	0.000	0.000
48	105	0.028	0.009	0.047	0.678	0.001
49	110	0.009	0.000	0.003	0.457	0.000
50	112	0.009	0.005	0.025	0.655	0.000
51	113	0.000	0.000	0.000	0.000	0.000
52	114	0.055	0.015	0.096	0.701	0.001
53	116	0.000	0.000	0.000	0.000	0.000
54	118	0.009	0.002	0.011	0.493	0.000
55	120-121	0.009	0.005	0.025	0.655	0.000
56	123	0.000	0.000	0.000	0.000	0.000
57	126	0.018	0.006	0.035	0.661	0.000
58	128-129	0.009	0.005	0.025	0.655	0.000
59	130	0.000	0.000	0.000	0.000	0.000
60	132	0.000	0.000	0.000	0.000	0.000
61	133	0.000	0.000	0.000	0.000	0.000
62	134	0.055	0.011	0.071	0.678	0.001
63	136	0.000	0.000	0.000	0.000	0.000
64	139	0.009	0.005	0.025	0.655	0.000
65	142	0.000	0.000	0.000	0.000	0.000
66	144	0.000	0.000	0.000	0.000	0.000
67	149	0.000	0.000	0.000	0.000	0.000
68	151	0.009	0.003	0.018	0.588	0.000
69	155	0.009	0.000	0.003	0.487	0.000
70	159-161	0.018	0.008	0.043	0.666	0.000
71	164	0.064	0.016	0.101	0.698	0.001
72	165-168	0.138	0.020	0.135	0.745	0.010
73	170	0.018	0.002	0.016	0.563	0.000
74	171-173	0.239	0.032	0.224	0.795	0.032
75	174	0.018	0.004	0.027	0.591	0.000
76	176	0.037	0.009	0.056	0.671	0.000
77	178	0.101	0.018	0.122	0.733	0.005

78	179	0.110	0.020	0.132	0.733	0.006
79	180	0.073	0.016	0.107	0.701	0.002
80	178-180	0.138	0.022	0.153	0.733	0.010
81	181	0.000	0.000	0.000	0.000	0.000
82	182-183	0.119	0.022	0.144	0.739	0.013
83	184	0.000	0.000	0.000	0.000	0.000
84	186	0.119	0.023	0.157	0.739	0.005
85	187-188	0.018	0.008	0.043	0.666	0.000
86	189	0.220	0.030	0.217	0.778	0.021
87	190-192	0.073	0.014	0.090	0.698	0.002
88	197	0.018	0.006	0.039	0.626	0.000
89	198	0.009	0.003	0.021	0.604	0.000
90	199	0.073	0.017	0.110	0.706	0.002
91	200-202	0.046	0.014	0.085	0.706	0.001
92	AN V	0.055	0.014	0.082	0.693	0.008
93	204-210	0.000	0.000	0.000	0.000	0.000
94	206	0.009	0.003	0.021	0.604	0.000
95	207	0.000	0.000	0.000	0.000	0.000
96	208	0.009	0.003	0.021	0.604	0.000
97	209	0.000	0.000	0.000	0.000	0.000
98	211-214	0.009	0.002	0.010	0.495	0.000
99	211-220	0.018	0.008	0.045	0.676	0.000
100	219	0.028	0.007	0.035	0.673	0.007
101	220	0.138	0.025	0.173	0.753	0.008
102	225-226	0.055	0.012	0.080	0.678	0.001
103	227	0.000	0.000	0.000	0.000	0.000
104	230-232	0.009	0.005	0.025	0.655	0.000
105	236	0.000	0.000	0.000	0.000	0.000
106	237	0.000	0.000	0.000	0.000	0.000
107	242-244	0.037	0.013	0.076	0.688	0.000
108	248-253	0.000	0.000	0.000	0.000	0.000
109	250	0.018	0.007	0.039	0.657	0.000
110	254	0.018	0.006	0.035	0.661	0.000
111	255	0.018	0.002	0.018	0.552	0.000
112	256	0.064	0.012	0.078	0.685	0.002
113	257	0.064	0.017	0.104	0.706	0.001
114	258	0.092	0.020	0.131	0.722	0.002
115	262	0.018	0.006	0.035	0.661	0.000
116	272	0.000	0.000	0.000	0.000	0.000
117	278	0.046	0.015	0.089	0.690	0.001
118	254-278	0.156	0.025	0.179	0.750	0.011
119	279-286	0.128	0.020	0.140	0.725	0.007
120	281	0.101	0.019	0.127	0.727	0.004
121	282	0.028	0.008	0.048	0.673	0.000
122	283	0.037	0.009	0.055	0.678	0.001
123	284	0.073	0.019	0.123	0.716	0.002
124	285	0.000	0.000	0.000	0.000	0.000
125	290	0.028	0.009	0.055	0.668	0.000
126	292	0.000	0.000	0.000	0.000	0.000
127	294-296	0.147	0.025	0.176	0.745	0.008
128	297	0.009	0.005	0.025	0.655	0.000
129	298	0.009	0.005	0.025	0.655	0.000
130	299	0.009	0.005	0.025	0.655	0.000
131	303-306	0.018	0.008	0.045	0.676	0.000

132	304	0.018	0.008	0.045	0.676	0.000
133	308-310	0.028	0.011	0.064	0.685	0.000
134	324-325	0.000	0.000	0.000	0.000	0.000
135	334	0.018	0.005	0.029	0.616	0.000
136	336	0.000	0.000	0.000	0.000	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Abu Shushe	0.007	0.000	0.001	0.368	0.000
2	Afula	0.007	0.000	0.012	0.501	0.000
3	Ain Shems (Beth Shemesh)	0.110	0.012	0.149	0.613	0.006
4	Akko	0.088	0.008	0.119	0.690	0.009
5	Alalakh (Tell Atchana)	0.132	0.018	0.153	0.707	0.019
6	Amman Airport	0.176	0.031	0.173	0.631	0.033
7	Aphek (Antipatris); Kurdane	0.066	0.004	0.075	0.674	0.007
8	Arab al Mulk	0.007	0.000	0.016	0.579	0.000
9	Ashdod	0.096	0.009	0.142	0.696	0.006
10	Ashkelon	0.044	0.002	0.069	0.629	0.001
11	Atlit	0.007	0.000	0.016	0.579	0.000
12	Beirut (centre)	0.051	0.003	0.064	0.566	0.001
13	Beth Shean	0.169	0.029	0.183	0.626	0.025
14	Bethel (Beitin)	0.007	0.000	0.016	0.579	0.000
15	Byblos (Jbail)	0.154	0.024	0.202	0.727	0.014
16	Çatal Hüyük	0.007	0.000	0.016	0.579	0.000
17	Charchemish (Jerablus)	0.022	0.000	0.046	0.640	0.001
18	Dahrat al Humrayah	0.015	0.000	0.021	0.518	0.000
19	Deir ‘Alla	0.037	0.001	0.052	0.564	0.000
20	Deir el Balah	0.037	0.001	0.048	0.552	0.000
21	Deir Khabie	0.007	0.000	0.017	0.537	0.000
22	Dor (Tell el Burj)	0.007	0.000	0.016	0.579	0.000
23	Dothan	0.015	0.000	0.029	0.552	0.000
24	El-Harruba	0.007	0.000	0.016	0.579	0.000
25	Garife	0.007	0.000	0.017	0.537	0.000
26	Gerar (Tell Jemmeh)	0.022	0.000	0.039	0.635	0.001
27	Gezer	0.125	0.016	0.151	0.707	0.013
28	Gibeon (el Jib)	0.022	0.000	0.015	0.500	0.001
29	Hama	0.007	0.000	0.016	0.579	0.000
30	Hazor	0.162	0.026	0.206	0.730	0.016
31	Hesban	0.007	0.000	0.016	0.579	0.000
32	Isbet Sartah	0.007	0.000	0.013	0.515	0.000
33	Jatt	0.022	0.000	0.032	0.530	0.000
34	Jericho	0.015	0.000	0.024	0.524	0.000
35	Jerusalem	0.007	0.000	0.016	0.579	0.000
36	Kamid el-Loz	0.162	0.026	0.190	0.629	0.008
37	Khan Selim (Khirbet Selim)	0.007	0.000	0.016	0.579	0.000
38	Khan Sheikoun	0.007	0.000	0.017	0.537	0.000
39	Khirbet Judur	0.029	0.001	0.040	0.624	0.003
40	Khirbet Rabud (Debir)	0.007	0.000	0.013	0.506	0.000
41	Kinneret (Khirbet al-Urema)	0.007	0.000	0.016	0.579	0.000
42	Lachish	0.162	0.026	0.173	0.724	0.022
43	Lattakia (Ramitha)	0.007	0.000	0.016	0.579	0.000

44	Madeba	0.007	0.000	0.017	0.537	0.000
45	Megiddo	0.147	0.022	0.198	0.718	0.016
46	Meskene Emar	0.007	0.000	0.009	0.489	0.000
47	Minet el-Beida	0.316	0.100	0.311	0.804	0.059
48	Oumm el-Mara	0.007	0.000	0.016	0.579	0.000
49	Pella (Tabaqat Fahil)	0.015	0.000	0.030	0.552	0.000
50	Qadesh (Tell Nebi Mend)	0.029	0.001	0.049	0.645	0.001
51	Qatna (Mishrife)	0.007	0.000	0.001	0.423	0.000
52	Qraye	0.029	0.001	0.032	0.537	0.000
53	Qudur el Walaida	0.007	0.000	0.016	0.579	0.000
54	Ras el-Bassit	0.015	0.000	0.025	0.519	0.000
55	Ras Ibn Hani	0.066	0.004	0.089	0.667	0.004
56	Sahab	0.022	0.000	0.031	0.524	0.000
57	Sarepta (Sarafand)	0.191	0.037	0.240	0.743	0.019
58	Sabouni	0.007	0.000	0.016	0.579	0.000
59	Shechem (Tell Balata)	0.059	0.003	0.100	0.680	0.003
60	Sidon (Saida)	0.081	0.007	0.086	0.575	0.014
61	Tell ‘Ain Sherif	0.007	0.000	0.016	0.579	0.000
62	Tell ‘Ajjul (Gaza)	0.074	0.005	0.098	0.585	0.002
63	Tell ‘Arqa	0.007	0.000	0.016	0.579	0.000
64	Tell Abu Hawam	0.368	0.135	0.349	0.838	0.097
65	Tell Aron	0.007	0.000	0.016	0.579	0.000
66	Tell Ashari	0.037	0.001	0.044	0.538	0.000
67	Tell Batash	0.015	0.000	0.011	0.497	0.000
68	Tell Beit Mirsim	0.081	0.007	0.108	0.599	0.004
69	Tell Bir el-Gharbi	0.007	0.000	0.016	0.579	0.000
70	Tell Burgatha	0.007	0.000	0.016	0.579	0.000
71	Tell Dan (Tell el-Qadi)	0.096	0.009	0.111	0.573	0.008
72	Tell Daruk	0.007	0.000	0.016	0.579	0.000
73	Tell el Far’ah (North)	0.007	0.000	0.016	0.579	0.000
74	Tell el Far’ah (south)	0.037	0.001	0.049	0.564	0.000
75	Tell el Ghassil	0.007	0.000	0.016	0.579	0.000
76	Tell el Hesi	0.029	0.001	0.052	0.631	0.001
77	Tell er Ridan	0.007	0.000	0.016	0.579	0.000
78	Tell Eran	0.007	0.000	0.016	0.579	0.000
79	Tell es Safi	0.029	0.001	0.044	0.622	0.001
80	Tell es Saidiyeh	0.037	0.001	0.048	0.566	0.007
81	Tell es Salihyeh	0.007	0.000	0.005	0.467	0.000
82	Tell es Samak	0.007	0.000	0.016	0.579	0.000
83	Tell esh-Shari’a (‘Sera)	0.088	0.008	0.120	0.669	0.005
84	Tell Haror	0.007	0.000	0.016	0.579	0.000
85	Tell Hayat	0.007	0.000	0.016	0.579	0.000
86	Tell Irbid	0.007	0.000	0.016	0.579	0.000
87	Tell Jerishe	0.007	0.000	0.016	0.579	0.000
88	Tell Kadesh	0.007	0.000	0.016	0.579	0.000
89	Tell Kazel	0.140	0.020	0.167	0.710	0.017
90	Tell Mevorakh	0.029	0.001	0.052	0.642	0.001
91	Tell Michal	0.007	0.000	0.002	0.457	0.000
92	Tell Miqne	0.037	0.001	0.047	0.615	0.008
93	Tell Mor	0.007	0.000	0.016	0.579	0.000
94	Tell Nagila	0.007	0.000	0.016	0.579	0.000
95	Tell Nami	0.015	0.000	0.033	0.631	0.001
96	Tell Nahr al-‘Arab	0.007	0.000	0.016	0.579	0.000
97	Tell Ouaouieh	0.007	0.000	0.016	0.579	0.000

98	Tell Qasis	0.007	0.000	0.016	0.579	0.000
99	Tell Qiri	0.015	0.000	0.024	0.516	0.000
100	Tell Sippor	0.015	0.000	0.033	0.631	0.001
101	Tell Sukas	0.096	0.009	0.140	0.690	0.007
102	Tell Ta'annek	0.022	0.000	0.038	0.607	0.000
103	Tell Tweini	0.015	0.000	0.019	0.581	0.000
104	Tell Yin'am	0.029	0.001	0.048	0.649	0.001
105	Tell Yoqne'am	0.007	0.000	0.016	0.579	0.000
106	Tyre	0.037	0.001	0.065	0.652	0.002
107	Ugarit (Ras Shamra)	0.544	0.296	0.418	0.946	0.193
108	Umm ad Dananir	0.029	0.001	0.045	0.559	0.000
109	Yavneh Yam	0.007	0.000	0.016	0.579	0.000

Table 13 – CENTRALITY MEASURES FOR FUNCTIONAL USE GROUPS IN THE LEVANT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Abu Shushe	0.111	0.043	0.037	1.047	0.000
2	Afula	0.111	0.043	0.037	1.047	0.000
3	Ain Shems (Beth Shemesh)	0.667	0.190	0.177	1.471	0.005
4	Akko	0.556	0.171	0.159	1.433	0.003
5	Alalakh (Tell Atchana)	0.556	0.168	0.151	1.433	0.004
6	Amman Airport	0.778	0.209	0.198	1.490	0.006
7	Aphek (Antipatris); Kurdane	0.222	0.098	0.080	1.301	0.001
8	Arab al Mulk	0.000	0.000	0.000	0.000	0.000
9	Ashdod	0.778	0.205	0.193	1.471	0.006
10	Ashkelon	0.444	0.082	0.087	1.027	0.001
11	Atlit	0.000	0.000	0.000	0.000	0.000
12	Beirut (centre)	0.333	0.106	0.095	1.271	0.001
13	Beth Shean	0.889	0.220	0.211	1.531	0.008
14	Bethel (Beitin)	0.000	0.000	0.000	0.000	0.000
15	Byblos (Jbail)	0.778	0.209	0.200	1.471	0.005
16	Çatal Hüyük	0.000	0.000	0.000	0.000	0.000
17	Charchemish (Jerablus)	0.111	0.055	0.043	1.178	0.000
18	Dahrat al Humrayah	0.222	0.098	0.080	1.301	0.001
19	Deir 'Alla	0.111	0.055	0.043	1.178	0.000
20	Deir el Balah	0.333	0.116	0.098	1.331	0.002
21	Deir Khabie	0.111	0.055	0.043	1.178	0.000
22	Dor (Tell el Burj)	0.000	0.000	0.000	0.000	0.000
23	Dothan	0.222	0.098	0.080	1.301	0.001
24	El-Harruba	0.000	0.000	0.000	0.000	0.000
25	Garife	0.111	0.055	0.043	1.178	0.000
26	Gerar (Tell Jemmeh)	0.222	0.073	0.061	1.216	0.001
27	Gezer	0.667	0.190	0.179	1.452	0.004
28	Gibeon (el Jib)	0.111	0.043	0.037	1.047	0.000

29	Hama	0.000	0.000	0.000	0.000	0.000
30	Hazor	0.667	0.191	0.180	1.452	0.004
31	Hesban	0.000	0.000	0.000	0.000	0.000
32	Isbet Sartah	0.111	0.055	0.043	1.178	0.000
33	Jatt	0.222	0.098	0.080	1.301	0.001
34	Jericho	0.111	0.043	0.037	1.047	0.000
35	Jerusalem	0.000	0.000	0.000	0.000	0.000
36	Kamid el-Loz	0.667	0.182	0.173	1.452	0.005
37	Khan Selim (Khirbet Selim)	0.000	0.000	0.000	0.000	0.000
38	Khan Sheikoun	0.111	0.055	0.043	1.178	0.000
39	Khirbet Judur	0.333	0.116	0.098	1.331	0.002
40	Khirbet Rabud (Debir)	0.111	0.043	0.037	1.047	0.000
41	Kinneret (Khirbet al-Urema)	0.000	0.000	0.000	0.000	0.000
42	Lachish	0.778	0.201	0.193	1.490	0.006
43	Lattakia (Ramitha)	0.000	0.000	0.000	0.000	0.000
44	Madeba	0.111	0.055	0.043	1.178	0.000
45	Megiddo	0.778	0.208	0.198	1.490	0.005
46	Meskene Emar	0.111	0.055	0.043	1.178	0.000
47	Minet el-Beida	1.000	0.239	0.231	1.552	0.010
48	Oumm el-Mara	0.000	0.000	0.000	0.000	0.000
49	Pella (Tabaqat Fahil)	0.111	0.055	0.043	1.178	0.000
50	Qadesh (Tell Nebi Mend)	0.333	0.097	0.088	1.271	0.001
51	Qatna (Mishrife)	0.111	0.018	0.018	0.856	0.000
52	Qraye	0.222	0.088	0.077	1.230	0.000
53	Qudur el Walaida	0.000	0.000	0.000	0.000	0.000
54	Ras el-Bassit	0.222	0.052	0.053	0.983	0.000
55	Ras Ibn Hani	0.333	0.107	0.096	1.257	0.001
56	Sahab	0.222	0.088	0.077	1.230	0.000
57	Sarepta (Sarafand)	0.778	0.201	0.193	1.490	0.006
58	Sabouni	0.000	0.000	0.000	0.000	0.000
59	Shechem (Tell Balata)	0.556	0.168	0.153	1.415	0.003
60	Sidon (Saida)	0.556	0.157	0.145	1.398	0.003
61	Tell ‘Ain Sherif	0.000	0.000	0.000	0.000	0.000
62	Tell ‘Ajjul (Gaza)	0.444	0.153	0.139	1.398	0.002
63	Tell ‘Arqa	0.000	0.000	0.000	0.000	0.000
64	Tell Abu Hawam	1.000	0.239	0.231	1.552	0.010
65	Tell Aron	0.000	0.000	0.000	0.000	0.000
66	Tell Ashari	0.222	0.098	0.080	1.301	0.001
67	Tell Batash	0.111	0.043	0.037	1.047	0.000
68	Tell Beit Mirsim	0.667	0.191	0.178	1.452	0.004
69	Tell Bir el-Gharbi	0.000	0.000	0.000	0.000	0.000
70	Tell Burgatha	0.000	0.000	0.000	0.000	0.000
71	Tell Dan (Tell el-Qadi)	0.444	0.149	0.135	1.380	0.002
72	Tell Daruk	0.000	0.000	0.000	0.000	0.000
73	Tell el Far’ah (North)	0.000	0.000	0.000	0.000	0.000
74	Tell el Far’ah (south)	0.333	0.116	0.098	1.331	0.002
75	Tell el Ghassil	0.000	0.000	0.000	0.000	0.000
76	Tell el Hesi	0.333	0.116	0.100	1.347	0.001
77	Tell er Ridan	0.000	0.000	0.000	0.000	0.000
78	Tell Eran	0.000	0.000	0.000	0.000	0.000
79	Tell es Safi	0.333	0.080	0.077	1.119	0.001
80	Tell es Saidiyeh	0.333	0.130	0.114	1.364	0.001
81	Tell es Salihyeh	0.111	0.011	0.013	0.812	0.000
82	Tell es Samak	0.000	0.000	0.000	0.000	0.000

83	Tell esh-Shari'a ('Sera)	0.667	0.158	0.156	1.364	0.004
84	Tell Haror	0.000	0.000	0.000	0.000	0.000
85	Tell Hayat	0.000	0.000	0.000	0.000	0.000
86	Tell Irbid	0.000	0.000	0.000	0.000	0.000
87	Tell Jerishe	0.000	0.000	0.000	0.000	0.000
88	Tell Kadesh	0.000	0.000	0.000	0.000	0.000
89	Tell Kazel	0.556	0.161	0.146	1.433	0.004
90	Tell Mevorakh	0.222	0.098	0.080	1.301	0.001
91	Tell Michal	0.111	0.022	0.025	0.882	0.000
92	Tell Miqne	0.333	0.070	0.073	1.009	0.000
93	Tell Mor	0.000	0.000	0.000	0.000	0.000
94	Tell Nagila	0.000	0.000	0.000	0.000	0.000
95	Tell Nami	0.000	0.000	0.000	0.000	0.000
96	Tell Nahr al-'Arab	0.000	0.000	0.000	0.000	0.000
97	Tell Ouaouieh	0.000	0.000	0.000	0.000	0.000
98	Tell Qasis	0.000	0.000	0.000	0.000	0.000
99	Tell Qiri	0.222	0.061	0.057	1.087	0.000
100	Tell Sippor	0.111	0.055	0.043	1.178	0.000
101	Tell Sukas	0.667	0.191	0.178	1.452	0.004
102	Tell Ta'annek	0.222	0.038	0.039	0.926	0.000
103	Tell Tweini	0.000	0.000	0.000	0.000	0.000
104	Tell Yin'am	0.111	0.055	0.043	1.178	0.000
105	Tell Yoqne'am	0.000	0.000	0.000	0.000	0.000
106	Tyre	0.333	0.110	0.102	1.257	0.001
107	Ugarit (Ras Shamra)	1.000	0.239	0.231	1.552	0.010
108	Umm ad Dananir	0.111	0.055	0.043	1.178	0.000
109	Yavneh Yam	0.000	0.000	0.000	0.000	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Storage	0.165	0.027	0.221	0.668	0.021
2	Storage-Dry	0.385	0.148	0.453	0.899	0.119
3	Storage - Liquid	0.495	0.245	0.528	1.087	0.205
4	Dining - Serving	0.294	0.086	0.406	0.786	0.044
5	Dining - Drinking	0.202	0.041	0.309	0.698	0.022
6	Dining - Eating	0.165	0.027	0.263	0.668	0.009
7	Ritual	0.101	0.010	0.153	0.622	0.014
8	U-CL	0.165	0.027	0.241	0.668	0.015
9	U-O	0.174	0.030	0.239	0.676	0.019

Table 14 – K-CORE VALUES FOR THE NETWORK OF FS SHAPES IN CYPRUS

	Original Network	Consolidated Network	Unknown' Shapes Removed
	Coreness	Coreness	

		Value	Degree	Value	Degree	Degree
1	Akaki	62	82	62	85	52
2	Akanthou Moulos	62	78	62	78	46
3	Akhera	62	84	62	87	56
4	Alambra	34	42	35	42	42
5	Alassa	62	62	62	62	0
6	Amathus	7	7	7	7	7
7	Analionda Palioklichia	7	7	7	7	7
8	Anaochora	62	62	62	62	0
9	Angastina	36	49	37	56	56
10	Apliki	62	81	62	81	49
11	Aradhippou	62	71	62	71	33
12	Arediou-Vouppes	62	69	62	69	28
13	Arodhes	24	24	25	27	27
14	Arpera Chiflik	62	78	62	80	52
15	Athienou Baboulari	62	71	62	77	43
16	Ayia Irini Palaeokastro	62	63	62	63	0
17	Ayia Irini Temple Site	3	3	3	3	3
18	Ayios Epiktetos	62	74	62	74	31
19	Ayios Iakovos Dhima + Melia	62	85	62	88	59
20	Ayios Sozomenos	62	68	62	68	20
21	Ayios Theodoros	62	62	62	62	0
22	Ayios Thyrsos Vikla	62	62	62	62	0
23	Dhavlos Pyrgos	62	62	62	62	0
24	Dhekelia Koukouphoudhkia	36	48	37	52	52
25	Dhekelia Steno	62	85	62	87	56
26	Dhenia	62	79	62	79	44
27	Dhikomo Onisia	62	74	62	74	39
28	Dhiorios Kupous	62	62	62	62	0
29	Dromolaxia trypes	34	40	35	40	40
30	Drousha Appiourka	30	32	34	38	38
31	Enkomi	62	92	62	93	67
32	Erimi Kafkalla	62	62	62	62	0
33	Galinorporni	36	55	37	57	57
34	Gastria Ayios ionnis	62	62	62	62	0
35	Hala Sultan Tekke	62	88	62	89	62
36	Idalion	62	84	62	86	55
37	Kaimakli Evretadhes	36	52	37	57	57
38	Kalavasos Ayios Dhimitrios	62	83	62	83	53
39	Kalavasos Mangi	6	6	6	6	0
40	Kalavassos Mavrovouni	1	1	15	15	15
41	Kalopsidha	62	68	62	76	43

42	Kantara	20	20	28	28	28
43	Karmi	62	62	62	62	0
44	Katydhata	62	87	62	88	62
45	Kazaphani Ayios Andronikos	36	45	36	45	45
46	Kirokitia Skasmata	62	62	62	62	0
47	Kition	62	82	62	82	54
48	Kivisil Gyppos	62	62	62	62	0
49	Klavdhia	62	82	62	85	58
50	Kokkini Trimithia	62	62	62	62	0
51	Kormakiti Ayious	62	80	62	82	48
52	Korovia Nitovikla	9	9	9	9	9
53	Kouklia Palaepaphos	62	85	62	86	59
54	Kouklia Skales	62	65	62	65	15
55	Kourion Apiskopi	31	31	31	31	31
56	Kourion Bamboula	38	65	38	66	66
57	Lapithos Ayia Anastasia	34	41	35	42	42
58	Larnaca tis Lapithou	62	67	62	67	23
59	Laxia tou Riou	34	40	35	44	44
60	Leonarissio	62	62	62	62	0
61	Limassol Kapsalos	62	62	62	62	0
62	Loutros Adhkia	62	62	62	62	0
63	Lythrodhonda Moutti	62	62	62	62	0
64	Maa Palaeokastro	62	65	62	66	25
65	Marathovouni	62	62	62	62	0
66	Maroni Vournes	62	85	62	86	61
67	Maroni Tsaroukkas	62	86	62	86	58
68	Mathiatis	7	7	7	7	7
69	Meniko Kyra tou Dhiakou	7	7	28	28	28
70	Milia	26	27	35	42	42
71	Myloptetres	20	20	20	20	20
72	Myrtou Pigadhes	37	54	37	55	55
73	Myrtou Stephania	62	78	62	78	47
74	Nicoseia Ayia Paraskevi	62	84	62	86	60
75	Nicosia Bairaktar	62	62	62	62	0
76	Ovgoros	9	9	15	15	15
77	Palekythro	4	4	7	7	7
78	Paphos	62	62	62	62	0
79	Pendayia	31	31	31	31	31
80	Pera	62	67	62	67	22
81	Peyia Koutsourous	62	62	62	62	0
82	Phlamoudhi Sapilou	62	74	62	76	33
83	Polemidhia Oufkia	24	24	24	24	24

84	Politiko-Lambertis	33	36	34	36	36
85	Pomos	62	62	62	62	0
86	Psilatos Moutti	22	22	22	22	22
87	Pyla Kokkinokremos	62	73	62	73	38
88	Pyla Verghi	62	81	62	83	55
89	Rizokarpasso	62	67	62	67	25
90	Sinda	62	84	62	85	54
91	Soloi	62	62	62	62	0
92	Strovolos Dromero	62	62	62	62	0
93	Tamassos Litharkes	62	62	62	62	0
94	Toumba tou Skourou	62	81	62	85	54
95	Yeri Phoenikias	32	32	32	32	32
96	Yeroskipou	33	36	34	36	36

Table 15 – K-CORE VALUES FOR THE NETWORK OF FS SHAPES IN EGYPT

		Original Network		Consolidated Network		Unknown' Shapes Removed
		Coreness Value	Degree	Coreness Value	Degree	Degree
1	Abusir el-Meleq	6	6	6	6	0
2	Abydos	32	57	32	58	35
3	Ali Mara	28	28	28	28	0
4	Amara West	32	52	32	52	32
5	Aniba	5	5	5	5	5
6	Arabi Hills	32	32	32	32	32
7	Armant	28	28	28	28	1
8	Arminna	28	29	28	29	3
9	Askut	32	33	32	33	33
10	Assyut	32	35	32	35	35
11	Az-Zaqaziz	28	30	28	30	0
12	Balabisch	32	34	32	34	34
13	Bir el Abd	28	28	28	28	0
14	Buhen	32	59	32	59	35
15	C 86	28	28	28	28	0
16	Daqqa	28	28	28	28	0
17	Debeira	32	32	32	32	32

18	Deir el-Ballas	28	28	28	28	0
19	Deir el-Medina	32	39	32	39	36
20	Dra’ Abu el-Naga’	16	18	16	18	7
21	Edfu	28	28	28	28	0
22	El Arish	16	18	16	18	9
23	el-Giza	28	28	28	28	0
24	Elephantine (Assuan)	28	28	28	28	0
25	Gurna (Abd el-Qurna)	32	34	32	34	34
26	Gurob	32	59	32	59	38
27	Harageh	28	28	28	28	0
28	Heliopolis	1	1	1	1	1
29	Kahun (al-Lahun)	28	28	28	28	0
30	Kerma	28	28	28	28	0
31	Kom Abu Billo	28	28	28	28	0
32	Kom el-Abd	28	28	28	28	0
33	Kom Firin	32	32	32	32	32
34	Luxor	32	52	32	52	32
35	Malkata	32	32	32	32	32
36	Marsa Matruh (Bates’ Island)	32	40	32	40	33
37	Memphis (Kom Rabi’a)	32	54	32	54	33
38	Meydum	28	28	28	28	0
39	Mostai (Tell Om Harb)	16	20	16	20	11
40	Naqada	32	32	32	32	32
41	Qantir	32	38	32	39	37
42	Qasr al-Aguz	28	28	28	28	0
43	Qau el-Qebir	5	5	5	5	5
44	Qubban	28	30	28	30	0
45	Rifeh	32	33	32	33	33
46	Riqqeh	32	32	32	32	32
47	Sai	32	32	32	32	32
48	Saqqara - N.K necropole	32	39	32	39	36
49	Sedment	32	36	32	36	36
50	Sesebi	32	53	32	53	33
51	Soleb	32	32	32	32	32
52	Tabo-Argo Island	32	37	32	37	32
53	Tarkhan	32	32	32	32	32
54	Tell ar-Rubai	32	37	32	37	32
55	Tell el Amarna	32	62	32	62	41
56	Tell el Dab’a	32	59	32	60	37
57	Tell el-Muqdam	28	28	28	28	1
58	Tell el-Rataba	32	38	32	38	33
59	Tell el-Yahudiyeh	32	32	32	32	32

60	Thebes	16	16	16	16	0
61	Tombos	8	8	11	11	11
62	Tuneh el-Gebel (E Ash)	32	33	32	33	33
63	Zawiyet Umm el-Rakham	5	5	5	5	5
64	Zawyet el-Amwat	16	16	16	16	0

Table 16 – K-CORE VALUES FOR THE NETWORK OF FS SHAPES IN THE LEVANT

		Original Network		Consolidated Network		Unknown' Shapes Removed
		Coreness Value	Degree	Coreness Value	Degree	Degree
1	Abu Shushe	2	2	2	2	2
2	Afula	21	21	29	29	29
3	Ain Shems (Beth Shemesh)	40	64	40	65	64
4	Akko	70	99	70	100	59
5	Alalakh (Tell Atchana)	70	99	70	101	62
6	Amman Airport	40	63	40	66	64
7	Aphek (Antipatris)	70	96	70	99	57
8	Arab al Mulk	70	70	70	70	0
9	Ashdod	70	100	70	100	61
10	Ashkelon	70	81	70	81	30
11	Atlit	70	70	70	70	0
12	Beirut (centre)	40	49	40	50	50
13	Beth Shean	40	62	40	66	65
14	Bethel (Beitin)	70	70	70	70	0
15	Byblos (Jbail)	70	103	70	105	65
16	Çatal Hüyük	70	70	70	70	0
17	Charchemish (Jerablus)	70	90	70	90	46
18	Dahrat al Humrayah	27	28	32	35	35
19	Deir ‘Alla	40	50	40	50	50
20	Deir el Balah	35	43	38	48	48
21	Deir Khabie	40	40	40	40	40
22	Dor (Tell el Burj)	70	70	70	70	0
23	Dothan	40	46	40	50	50
24	El-Harruba	70	70	70	70	0
25	Garife	40	40	40	40	40
26	Gerar (Tell Jemmeh)	70	88	70	88	42
27	Gezer	70	100	70	102	61

28	Gibeon (el Jib)	17	17	23	23	23
29	Hama	70	70	70	70	0
30	Hazor	70	103	70	104	64
31	Hesban	70	70	70	70	0
32	Isbet Sartah	25	25	25	25	25
33	Jatt	29	33	36	40	40
34	Jericho	28	31	32	36	36
35	Jerusalem	70	70	70	70	0
36	Kamid el-Loz	40	64	40	65	65
37	Khan Selim (Khirbet Selim)	70	70	70	70	0
38	Khan Sheikoun	40	40	40	40	40
39	Khirbet Judur	70	81	70	81	28
40	Khirbet Rabud (Debir)	23	23	23	23	23
41	Kinneret (Khirbet al-Urema)	70	70	70	70	0
42	Lachish	70	101	70	103	64
43	Lattakia (Ramitha)	70	70	70	70	0
44	Madeba	40	40	40	40	40
45	Megiddo	70	101	70	103	63
46	Meskene Emar	12	12	12	12	12
47	Minet el-Beida	70	104	70	106	66
48	Oumm el-Mara	70	70	70	70	0
49	Pella (Tabaqat Fahil)	40	46	40	46	46
50	Qadesh (Tell Nebi Mend)	70	89	70	89	41
51	Qatna (Mishrife)	1	1	1	1	1
52	Qraye	33	34	33	34	34
53	Qudur el Walaida	70	70	70	70	0
54	Ras el-Bassit	28	28	28	28	23
55	Ras Ibn Hani	70	93	70	94	51
56	Sahab	28	30	32	34	34
57	Sarepta (Sarafand)	70	103	70	104	64
58	Sabouni	70	70	70	70	0
59	Shechem (Tell Balata)	70	99	70	99	58
60	Sidon (Saida)	39	50	39	53	53
61	Tell ‘Ain Sherif	70	70	70	70	0
62	Tell ‘Ajjul (Gaza)	40	56	40	56	56
63	Tell ‘Arqa	70	70	70	70	0
64	Tell Abu Hawam	70	106	70	107	68
65	Tell Aron	70	70	70	70	0
66	Tell Ashari	33	36	38	44	44
67	Tell Batash	17	17	29	30	30
68	Tell Beit Mirsim	40	61	40	63	61
69	Tell Bir el-Gharbi	70	70	70	70	0

70	Tell Burgatha	70	70	70	70	0
71	Tell Dan (Tell el-Qadi)	37	47	39	52	52
72	Tell Daruk	70	70	70	70	0
73	Tell el Far’ah (North)	70	70	70	70	0
74	Tell el Far’ah (south)	40	50	40	52	52
75	Tell el Ghassil	70	70	70	70	0
76	Tell el Hesi	70	84	70	87	35
77	Tell er Ridan	70	70	70	70	0
78	Tell Eran	70	70	70	70	0
79	Tell es Safi	70	83	70	87	36
80	Tell es Saidiyeh	40	51	40	56	56
81	Tell es Salihyeh	5	5	5	5	5
82	Tell es Samak	70	70	70	70	0
83	Tell esh-Shari’a (‘Sera)	70	91	70	94	46
84	Tell Haror	70	70	70	70	0
85	Tell Hayat	70	70	70	70	0
86	Tell Irbid	70	70	70	70	0
87	Tell Jerishe	70	70	70	70	0
88	Tell Kadesh	70	70	70	70	0
89	Tell Kazel	70	99	70	100	57
90	Tell Mevorakh	70	88	70	88	37
91	Tell Michal	2	2	15	15	15
92	Tell Miqne	70	78	70	78	16
93	Tell Mor	70	70	70	70	0
94	Tell Nagila	70	70	70	70	0
95	Tell Nami	70	87	70	87	40
96	Tell Nahr al-‘Arab	70	70	70	70	0
97	Tell Ouaouieh	70	70	70	70	0
98	Tell Qasis	70	70	70	70	0
99	Tell Qiri	27	28	27	28	23
100	Tell Sippor	70	87	70	87	40
101	Tell Sukas	70	98	70	101	60
102	Tell Ta’annek	70	76	70	76	0
103	Tell Tweini	70	70	70	75	19
104	Tell Yin’am	70	91	70	94	48
105	Tell Yoqne’am	70	70	70	70	0
106	Tyre	70	91	70	92	47
107	Ugarit (Ras Shamra)	70	106	70	106	67
108	Umm ad Dananir	40	48	40	50	50
109	Yavneh Yam	70	70	70	70	0

Table 17 – NETWORK COHESION SCORES, FS SHAPE NETWORKS

		FS SHAPE IN CYPRUS	FS SHAPE IN EGYPT	FS SHAPE IN LEVANT
		---------	---------	---------
1	Avg Degree	56.708	31.5	65.211
2	Indeg H-Index	62	32	70
3	Deg Centralization	0.379	0.5	0.385
4	Out-Central	0.375	0.492	0.381
5	In-Central	0.375	0.492	0.381
6	Density	0.597	0.5	0.604
7	Components	1	1	1
8	Component Ratio	0	0	0
9	Connectedness	1	1	1
10	Fragmentation	0	0	0
11	Closure	0.842	0.796	0.836
12	Avg Distance	1.405	1.514	1.404
13	SD Distance	0.496	0.528	0.506
14	Diameter	3	3	3
15	Wiener Index	12818	6106	16526
16	Dependency Sum	3698	2074	4754
17	Breadth	0.202	0.252	0.199
18	Compactness	0.798	0.748	0.801
19	Mutuals	0.597	0.5	0.604
20	Asymmetrics	0	0	0
21	Nulls	0.403	0.5	0.396
22	Arc Reciprocity	1	1	1
23	Dyad Reciprocity	1	1	1

Table 18 – NETWORK COHESION SCORES, LH WARE NETWORKS

		LH WARE IN CYPRUS	LH WARE IN EGYPT	LH WARE IN LEVANT
		---------	---------	---------
1	Avg Degree	68.396	29.415	68.532
2	Indeg H-Index	54	30	60
3	Deg Centralization	0.286	0.461	0.363
4	Out-Central	0.283	0.454	0.359
5	In-Central	0.283	0.454	0.359

6	Density	0.72	0.46	0.635
7	Components	1	3	1
8	Component Ratio	0	0.031	0
9	Connectedness	1	0.939	1
10	Fragmentation	0	0.061	0
11	Closure	0.831	0.73	0.83
12	Avg Distance	1.28	1.513	1.37
13	SD Distance	0.449	0.504	0.491
14	Diameter	2	3	3
15	Wiener Index	11674	5908	16124
16	Dependency Sum	2554	2002	4352
17	Breadth	0.14	0.301	0.183
18	Compactness	0.86	0.699	0.817
19	Mutuals	0.72	0.46	0.635
20	Asymmetrics	0	0	0
21	Nulls	0.28	0.54	0.365
22	Arc Reciprocity	1	1	1
23	Dyad Reciprocity	1	1	1

Table 19 – NETWORK STRUCTURE METRICS, FS SHAPE NETWORKS

	1 Density	2 Avg Dist	3 Radius	4 Diameter	5 Fragmenta	6 Transitiv	7 Norm Dist
Cyprus	0.051	2.882	4.000	6.000	0.230	0.360	0.681
Cyprus (consol)	0.050	2.890	4.000	6.000	0.437	0.393	0.922
Egypt	0.030	2.950	4.000	7.000	0.619	0.431	1.376
Egypt (consol)	0.024	2.855	1.000	6.000	0.754	0.462	2.197
Levant	0.048	2.842	4.000	6.000	0.273	0.399	0.728
Levant (consol)	0.044	2.773	4.000	6.000	0.533	0.435	1.156

Table 20 – CENTRALITY MEASURES FOR CYPRIOT WARES IN EGYPT

		Degree	2-Local	Eigenvect	Closeness	Betweenne
1	Abusir el-Meleq	0.222	0.065	0.156	1.286	0.003
2	Abydos	0.278	0.091	0.218	1.333	0.003
3	Ali Mara	0.111	0.047	0.107	1.220	0.000

4	Amara West	0.000	0.000	0.000	0.000	0.000
5	Aniba	0.333	0.095	0.229	1.358	0.007
6	Arabi Hills	0.000	0.000	0.000	0.000	0.000
7	Armant	0.000	0.000	0.000	0.000	0.000
8	Arminna	0.000	0.000	0.000	0.000	0.000
9	Askut	0.000	0.000	0.000	0.000	0.000
10	Assyut	0.056	0.023	0.053	1.059	0.000
11	Az-Zaqaziz	0.000	0.000	0.000	0.000	0.000
12	Balabisch	0.167	0.069	0.160	1.263	0.001
13	Bir el Abd	0.389	0.075	0.183	1.358	0.015
14	Buhen	0.278	0.076	0.180	1.309	0.00
15	C 86	0.000	0.000	0.000	0.000	0.000
16	Daqqa	0.167	0.069	0.160	1.263	0.001
17	Debeira	0.167	0.061	0.142	1.263	0.001
18	Deir el-Ballas	0.056	0.027	0.060	1.143	0.000
19	Deir el-Medina	0.167	0.057	0.136	1.241	0.001
20	Dra’ Abu el-Naga’	0.056	0.027	0.060	1.143	0.000
21	Edfu	0.000	0.000	0.000	0.000	0.000
22	El Arish	0.056	0.027	0.060	1.143	0.000
23	el-Giza	0.167	0.069	0.160	1.263	0.001
24	Elephantine (Assuan)	0.000	0.000	0.000	0.000	0.000
25	Gurna (Abd el-Qurna)	0.000	0.000	0.000	0.000	0.000
26	Gurob	0.444	0.108	0.267	1.412	0.011
27	Harageh	0.167	0.060	0.142	1.241	0.001
28	Heliopolis	0.167	0.050	0.116	1.241	0.002
29	Kahun (al-Lahun)	0.278	0.087	0.209	1.309	0.003
30	Kerma	0.000	0.000	0.000	0.000	0.000
31	Kom Abu Billa	0.000	0.000	0.000	0.000	0.000
32	Kom el-Abd	0.000	0.000	0.000	0.000	0.000
33	Kom Firin	0.000	0.000	0.000	0.000	0.000
34	Luxor	0.000	0.000	0.000	0.000	0.000
35	Malkata	0.000	0.000	0.000	0.000	0.000
36	Marsa Matruh (Bates’ Island)	0.556	0.096	0.240	1.440	0.029
37	Memphis (Kom Rabi’a)	0.167	0.061	0.142	1.263	0.001
38	Meydum	0.222	0.076	0.180	1.286	0.002
39	Mostai (Tell Om Harb)	0.000	0.000	0.000	0.000	0.000
40	Naqada	0.000	0.000	0.000	0.000	0.000
41	Qantir	0.667	0.113	0.287	1.532	0.042
42	Qasr al-Aguz	0.000	0.000	0.000	0.000	0.000
43	Qau el-Qebir	0.167	0.060	0.142	1.241	0.001
44	Qubban	0.167	0.060	0.142	1.241	0.001
45	Rifeh	0.167	0.069	0.160	1.263	0.001
46	Riqqeh	0.111	0.049	0.113	1.220	0.000
47	Sai	0.000	0.000	0.000	0.000	0.000
48	Saqqara - N.K necropole	0.389	0.099	0.244	1.385	0.010
49	Sedment	0.333	0.098	0.238	1.358	0.005
50	Sesebi	0.000	0.000	0.000	0.000	0.000
51	Soleb	0.056	0.020	0.047	1.000	0.000
52	Tabo-Argo Island	0.000	0.000	0.000	0.000	0.000
53	TARKHAN	0.056	0.011	0.029	0.889	0.000
54	Tell ar-Rubai	0.000	0.000	0.000	0.000	0.000
55	Tell el-Amarna	0.167	0.048	0.114	1.200	0.001
56	Tell el-Dab’a	0.611	0.093	0.239	1.469	0.044
57	Tell el-Muqdam	0.000	0.000	0.000	0.000	0.000

58	Tell el-Rataba	0.167	0.048	0.114	1.200	0.001
59	Tell el-Yahudiyeh	0.167	0.061	0.142	1.263	0.001
60	Thebes	0.167	0.069	0.160	1.263	0.001
61	Tombos	0.000	0.000	0.000	0.000	0.000
62	Tuneh el-Gebel (E Ash)	0.000	0.000	0.000	0.000	0.000
63	Zawiyet Umm el-Rakham	0.000	0.000	0.000	0.000	0.000
64	Zawyet el-Amwat	0.000	0.000	0.000	0.000	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	RLWM	0.406	0.165	0.493	1.140	0.086
2	BLWM	0.188	0.035	0.268	0.845	0.013
3	WP	0.203	0.041	0.271	0.875	0.029
4	ROR/ROB	0.031	0.001	0.057	0.721	0.000
5	PBR	0.000	0.000	0.000	0.000	0.000
6	BRI	0.484	0.235	0.557	1.289	0.137
7	BRII	0.359	0.129	0.438	1.043	0.066
8	BRI-II	0.125	0.016	0.184	0.790	0.006
9	PWSW	0.031	0.001	0.057	0.721	0.000
10	WSI	0.078	0.006	0.137	0.766	0.002
11	WSII	0.094	0.009	0.130	0.766	0.004
12	WSI-II	0.063	0.004	0.083	0.754	0.002
13	WSH	0.031	0.001	0.046	0.681	0.000
14	MONO	0.047	0.002	0.076	0.731	0.001
15	BUC	0.000	0.000	0.000	0.000	0.000
16	PWHM	0.016	0.000	0.026	0.662	0.000
17	BIC	0.047	0.002	0.082	0.742	0.001
18	BS/RS	0.063	0.004	0.101	0.721	0.001

Table 21 – CENTRALITY MEASURES FOR CYPRIOT WARES IN THE LEVANT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Abu Shushe	0.000	0.000	0.000	0.000	0.000
2	Afula	0.167	0.050	0.049	0.971	0.001
3	Ain Shems	0.333	0.130	0.126	1.153	0.002
4	Akko	0.500	0.148	0.147	1.238	0.006
5	Alalakh	0.833	0.212	0.218	1.337	0.014
6	Amman Airport	0.167	0.062	0.060	1.022	0.000
7	Aphek	0.056	0.018	0.018	0.815	0.000
8	Arab al Mulk	0.000	0.000	0.000	0.000	0.000
9	Ashdod	0.278	0.112	0.109	1.088	0.001
10	Ashkelon	0.722	0.199	0.205	1.293	0.009

11	Atlit	0.056	0.018	0.018	0.815	0.000
12	Beirut	0.278	0.080	0.079	1.078	0.002
13	Beth Shean	0.389	0.137	0.134	1.164	0.003
14	Bethel	0.167	0.078	0.073	1.059	0.000
15	Byblos	0.278	0.102	0.097	1.099	0.002
16	Çatal Hüyük	0.000	0.000	0.000	0.000	0.000
17	Charchemish	0.000	0.000	0.000	0.000	0.000
18	Dahrat al Humrayah	0.167	0.050	0.049	1.004	0.001
19	Deir ʻAlla	0.056	0.029	0.025	0.947	0.000
20	Deir el Balah	0.167	0.073	0.068	1.059	0.000
21	Deir Khabie	0.000	0.000	0.000	0.000	0.000
22	Dor	0.222	0.084	0.082	1.078	0.001
23	Dothan	0.278	0.099	0.096	1.099	0.001
24	El-Harruba	0.000	0.000	0.000	0.000	0.000
25	Garife	0.000	0.000	0.000	0.000	0.000
26	Gerar	0.167	0.060	0.059	1.013	0.000
27	Gezer	0.500	0.162	0.160	1.238	0.006
28	Gibeon	0.167	0.056	0.054	0.987	0.000
29	Hama	0.167	0.050	0.049	1.004	0.000
30	Hazor	0.667	0.188	0.190	1.293	0.010
31	Hesban	0.000	0.000	0.000	0.000	0.000
32	Isbet Sartah	0.000	0.000	0.000	0.000	0.000
33	Jatt	0.278	0.081	0.082	1.059	0.001
34	Jericho	0.389	0.136	0.135	1.188	0.003
35	Jerusalem	0.333	0.099	0.102	1.031	0.001
36	Kamid el-Loz	0.111	0.046	0.043	0.996	0.000
37	Khan Selim	0.167	0.078	0.073	1.059	0.000
38	Khan Sheikoun	0.056	0.016	0.017	0.788	0.000
39	Khirbet Judur	0.000	0.000	0.000	0.000	0.000
40	Khirbet Rabud	0.222	0.094	0.090	1.068	0.000
41	Kinneret	0.056	0.006	0.006	0.694	0.000
42	Lachish	0.833	0.211	0.218	1.322	0.013
43	Lattakia	0.000	0.000	0.000	0.000	0.000
44	Madeba	0.000	0.000	0.000	0.000	0.000
45	Megiddo	0.722	0.198	0.203	1.293	0.010
46	Meskene Emar	0.111	0.052	0.048	1.013	0.000
47	Minet el-Beida	0.278	0.096	0.091	1.120	0.002
48	Oumm el-Mara	0.056	0.029	0.025	0.947	0.000
49	Pella	0.444	0.131	0.133	1.130	0.003
50	Qadesh	0.056	0.012	0.011	0.748	0.000
51	Qatna	0.111	0.055	0.050	1.040	0.000
52	Qraye	0.111	0.036	0.036	0.903	0.000
53	Qudur el Walaida	0.000	0.000	0.000	0.000	0.000
54	Ras el-Bassit	0.167	0.065	0.061	1.049	0.000
55	Ras Ibn Hani	0.111	0.055	0.050	1.040	0.000
56	Sahab	0.000	0.000	0.000	0.000	0.000
57	Sarepta	0.500	0.161	0.162	1.200	0.004
58	Sabouni	0.056	0.029	0.025	0.947	0.000
59	Shechem	0.444	0.149	0.149	1.200	0.003
60	Sidon	0.389	0.134	0.131	1.153	0.003
61	Tell ʻAin Sherif	0.000	0.000	0.000	0.000	0.000
62	Tell ʻAjjul	0.944	0.217	0.225	1.368	0.028
63	Tell ʻArqa	0.611	0.178	0.181	1.251	0.007
64	Tell Abu Hawam	0.500	0.158	0.161	1.164	0.003

65	Tell Aron	0.056	0.023	0.023	0.876	0.000
66	Tell Ashari	0.000	0.000	0.000	0.000	0.000
67	Tell Batash	0.389	0.117	0.117	1.141	0.003
68	Tell Beit Mirsim	0.278	0.115	0.109	1.141	0.002
69	Tell Bir el-Gharbi	0.000	0.000	0.000	0.000	0.000
70	Tell Burgatha	0.000	0.000	0.000	0.000	0.000
71	Tell Dan	0.389	0.124	0.124	1.176	0.003
72	Tell Daruk	0.056	0.018	0.018	0.815	0.000
73	Tell el Far'ah (North)	0.278	0.108	0.105	1.109	0.001
74	Tell el Far'ah (south)	0.556	0.178	0.177	1.251	0.006
75	Tell el Ghassil	0.056	0.012	0.011	0.748	0.000
76	Tell el Hesi	0.500	0.158	0.157	1.200	0.005
77	Tell er Ridan	0.389	0.117	0.117	1.164	0.003
78	Tell Eran	0.000	0.000	0.000	0.000	0.000
79	Tell es Safi	0.111	0.044	0.043	0.955	0.000
80	Tell es Saidiyeh	0.000	0.000	0.000	0.000	0.000
81	Tell es Salihyeh	0.000	0.000	0.000	0.000	0.000
82	Tell es Samak	0.000	0.000	0.000	0.000	0.000
83	Tell esh-Shari'a	0.444	0.160	0.159	1.200	0.003
84	Tell Haror	0.444	0.150	0.149	1.188	0.003
85	Tell Hayat	0.000	0.000	0.000	0.000	0.000
86	Tell Irbid	0.000	0.000	0.000	0.000	0.000
87	Tell Jerishe	0.278	0.102	0.098	1.088	0.001
88	Tell Kadesh	0.000	0.000	0.000	0.000	0.000
89	Tell Kazel	0.500	0.149	0.150	1.153	0.004
90	Tell Mevorakh	0.333	0.116	0.116	1.141	0.002
91	Tell Michal	0.222	0.060	0.062	0.955	0.001
92	Tell Miqne	0.000	0.000	0.000	0.000	0.000
93	Tell Mor	0.389	0.136	0.134	1.153	0.003
94	Tell Nagila	0.111	0.025	0.027	0.821	0.000
95	Tell Nami	0.056	0.018	0.018	0.815	0.000
96	Tell Nahr al-'Arab	0.000	0.000	0.000	0.000	0.000
97	Tell Ouaouieh	0.000	0.000	0.000	0.000	0.000
98	Tell Qasis	0.167	0.059	0.054	1.078	0.001
99	Tell Qiri	0.000	0.000	0.000	0.000	0.000
100	Tell Sippor	0.222	0.062	0.061	1.040	0.001
101	Tell Sukas	0.333	0.109	0.109	1.153	0.002
102	Tell Ta'annek	0.111	0.040	0.036	0.996	0.000
103	Tell Tweini	0.500	0.160	0.159	1.225	0.006
104	Tell Yin'am	0.000	0.000	0.000	0.000	0.000
105	Tell Yoqne'am	0.167	0.066	0.065	0.987	0.000
106	Tyre	0.667	0.181	0.185	1.293	0.010
107	Ugarit	0.778	0.199	0.206	1.293	0.011
108	Umm ad Dananir	0.056	0.027	0.025	0.918	0.000
109	Yavneh Yam	0.000	0.000	0.000	0.000	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	RLWM	0.174	0.030	0.188	0.627	0.008
2	BLWM	0.110	0.012	0.125	0.591	0.003

3	WP	0.330	0.109	0.288	0.737	0.075
4	ROR/ROB	0.248	0.061	0.259	0.675	0.019
5	PBR	0.009	0.000	0.014	0.542	0.000
6	BRI	0.422	0.178	0.371	0.822	0.068
7	BRII	0.477	0.228	0.398	0.883	0.099
8	BRI-II	0.110	0.012	0.110	0.591	0.004
9	PWSW	0.092	0.008	0.106	0.581	0.002
10	WSI	0.284	0.081	0.269	0.701	0.035
11	WSII	0.514	0.264	0.405	0.929	0.137
12	WSI-II	0.101	0.010	0.099	0.586	0.014
13	WSH	0.321	0.103	0.296	0.730	0.038
14	MONO	0.284	0.081	0.285	0.701	0.021
15	BUC	0.101	0.010	0.111	0.586	0.003
16	PWHM	0.000	0.000	0.000	0.000	0.000
17	BIC	0.211	0.045	0.181	0.650	0.040
18	BS/RS	0.119	0.014	0.137	0.596	0.003

Table 22 – NETWORK COHESION SCORES, CYPRIOT NETWORK

		CYPRIOT IN EGYPT	CYPRIOT IN LEVANT
		--------	--------
1	Avg Degree	18.156	44.789
2	Indeg H-Index	30	58
3	Deg Centralization	0.276	0.304
4	Out-Central	0.272	0.301
5	In-Central	0.272	0.301
6	Density	0.288	0.415
7	Components	29	32
8	Component Ratio	0.444	0.287
9	Connectedness	0.313	0.51
10	Fragmentation	0.688	0.49
11	Closure	0.952	0.896
12	Avg Distance	1.078	1.187
13	SD Distance	0.268	0.39
14	Diameter	2	2
15	Wiener Index	1358	7130
16	Dependency Sum	98	1124
17	Breadth	0.7	0.538
18	Compactness	0.3	0.462
19	Mutuals	0.288	0.415
20	Asymmetrics	0	0
21	Nulls	0.712	0.585

22	Arc Reciprocity	1	1
23	Dyad Reciprocity	1	1

Table 23 – K-CORE VALUES FOR THE NETWORK OF CYPRIOT VESSELS IN THE LEVANT

		Coreness Value	Degree
1	Abu Shushe	0	0
2	Afula	53	56
3	Ain Shems (Beth Shemesh)	55	72
4	Akko	55	76
5	Alalakh (Tell Atchana)	55	77
6	Amman Airport	55	62
7	Aphek (Antipatris)	35	35
8	Arab al Mulk	0	0
9	Ashdod	55	67
10	Ashkelon	55	76
11	Atlit	35	35
12	Beirut (centre)	55	66
13	Beth Shean	55	72
14	Bethel (Beitin)	55	66
15	Byblos (Jbail)	55	68
16	Çatal Hüyük	0	0
17	Charchemish (Jerablus)	0	0
18	Dahrat al Humrayah	53	60
19	Deir ‘Alla	55	55
20	Deir el Balah	55	66
21	Deir Khabie	0	0
22	Dor (Tell el Burj)	53	67
23	Dothan	55	68
24	El-Harruba	0	0
25	Garife	0	0
26	Gerar (Tell Jemmeh)	55	61
27	Gezer	55	76
28	Gibeon (el Jib)	53	58
29	Hama	55	60
30	Hazor	55	77
31	Hesban	0	0

32	Isbet Sartah	0	0
33	Jatt	53	64
34	Jericho	55	74
35	Jerusalem	53	60
36	Kamid el-Loz	55	60
37	Khan Selim (Khirbet Selim)	55	66
38	Khan Sheikoun	30	30
39	Khirbet Judur	0	0
40	Khirbet Rabud (Debir)	55	66
41	Kinneret (Khirbet al-Urema)	10	10
42	Lachish	55	76
43	Lattakia (Ramitha)	0	0
44	Madeba	0	0
45	Megiddo	55	76
46	Meskene Emar	55	62
47	Minet el-Beida	55	70
48	Oumm el-Mara	55	55
49	Pella (Tabaqat Fahil)	55	68
50	Qadesh (Tell Nebi Mend)	22	22
51	Qatna (Mishrife)	55	65
52	Qraye	44	48
53	Qudur el Walaida	0	0
54	Ras el-Bassit	55	65
55	Ras Ibn Hani	55	65
56	Sahab	0	0
57	Sarepta (Sarafand)	55	73
58	Sabouni	55	55
59	Shechem (Tell Balata)	55	74
60	Sidon (Saida)	55	71
61	Tell ‘Ain Sherif	0	0
62	Tell ‘Ajjul (Gaza)	55	77
63	Tell ‘Arqa	55	75
64	Tell Abu Hawam	55	70
65	Tell Aron	45	45
66	Tell Ashari	0	0
67	Tell Batash	53	70
68	Tell Beit Mirsim	55	72
69	Tell Bir el-Gharbi	0	0
70	Tell Burgatha	0	0
71	Tell Dan (Tell el-Qadi)	55	73
72	Tell Daruk	35	35
73	Tell el Far’ah (North)	55	69

74	Tell el Far’ah (south)	55	76
75	Tell el Ghassil	22	22
76	Tell el Hesi	55	73
77	Tell er Ridan	55	72
78	Tell Eran	0	0
79	Tell es Safi	53	55
80	Tell es Saidiyeh	0	0
81	Tell es Salihyeh	0	0
82	Tell es Samak	0	0
83	Tell esh-Shari’a (‘Sera)	55	74
84	Tell Haror	55	73
85	Tell Hayat	0	0
86	Tell Irbid	0	0
87	Tell Jerishe	55	67
88	Tell Kadesh	0	0
89	Tell Kazel	55	69
90	Tell Mevorakh	55	71
91	Tell Michal	44	53
92	Tell Miqne	0	0
93	Tell Mor	55	71
94	Tell Nagila	33	35
95	Tell Nami	35	35
96	Tell Nahr al-‘Arab	0	0
97	Tell Ouaouieh	0	0
98	Tell Qasis	55	68
99	Tell Qiri	0	0
100	Tell Sippor	55	63
101	Tell Sukas	55	72
102	Tell Ta’annek	55	60
103	Tell Tweini	55	75
104	Tell Yin’am	0	0
105	Tell Yoqne’am	53	58
106	Tyre	55	77
107	Ugarit (Ras Shamra)	55	75
108	Umm ad Dananir	51	51
109	Yavneh Yam	0	0

Table 24 – K-CORE VALUES FOR THE NETWORK OF CYPRIOT VESSELS IN EGYPT

		Coreness Value	Degree
1	Abusir el-Meleq	30	34
2	Abydos	30	35
3	Ali Mara	30	33
4	Amara West	0	0
5	Aniba	30	35
6	Arabi Hills	0	0
7	Armant	0	0
8	Arminna	0	0
9	Askut	0	0
10	Assyut	25	25
11	Az-Zaqaziz	0	0
12	Balabisch	30	34
13	Bir el Abd	30	34
14	Buhen	30	34
15	C 86	0	0
16	Daqqa	30	34
17	Debeira	30	34
18	Deir el-Ballas	30	30
19	Deir el-Medina	30	33
20	Dra’ Abu el-Naga’	30	30
21	Edfu	0	0
22	El Arish	30	30
23	el-Giza	30	34
24	Elephantine (Assuan)	0	0
25	Gurna (Abd el-Qurna)	0	0
26	Gurob	30	35
27	Harageh	30	33
28	Heliopolis	30	33
29	Kahun (al-Lahun)	30	34
30	Kerma	0	0
31	Kom Abu Billo	0	0
32	Kom el-Abd	0	0
33	Kom Firin	0	0
34	Luxor	0	0
35	Malkata	0	0
36	Marsa Matruh (Bates’ Island)	30	34
37	Memphis (Kom Rabi’a)	30	34

38	Meydum	30	34
39	Mostai (Tell Om Harb)	0	0
40	Naqada	0	0
41	Qantir	30	35
42	Qasr al-Aguz	0	0
43	Qau el-Qebir	30	33
44	Qubban	30	33
45	Rifeh	30	34
46	Riqqeh	30	33
47	Sai	0	0
48	Saqqara - N.K necropole	30	35
49	Sedment	30	35
50	Sesebi	0	0
51	Soleb	22	22
52	Tabo-Argo Island	0	0
53	Tarkhan	12	12
54	Tell ar-Rubai	0	0
55	Tell el Amarna	29	31
56	Tell el Dab'a	30	34
57	Tell el-Muqdam	0	0
58	Tell el-Rataba	29	31
59	Tell el-Yahudiyeh	30	34
60	Thebes	30	34
61	Tombos	0	0
62	Tuneh el-Gebel (E Ash)	0	0
63	Zawiyet Umm el-Rakham	0	0
64	Zawyet el-Amwat	0	0

Table 25 – NETWORK STRUCTURE METRICS, CYPRIOT NETWORKS

	1 Density	2 Avg Dist	3 Radius	4 Diameter	5 Fragmenta	6 Transitiv	7 Norm Dist
Egypt	0.126	2.306	3.000	5.000	0.601	0.599	1.795
Levant	0.216	2.365	2.000	4.000	0.439	0.615	1.324

Table 26 – NETWORK COHESION SCORES, CYPRIOT NETWORK—NO ISOLATES

		CYPRIOT IN EGYPT	CYPRIOT IN LEVANT
		--------	--------
1	Avg Degree	32.278	62.59
2	Indeg H-Index	30	58
3	Deg Centralization	0.082	0.192
4	Out-Central	0.08	0.19
5	In-Central	0.08	0.19
6	Density	0.922	0.813
7	Components	1	1
8	Component Ratio	0	0
9	Connectedness	1	1
10	Fragmentation	0	0
11	Closure	0.952	0.896
12	Avg Distance	1.078	1.187
13	SD Distance	0.268	0.39
14	Diameter	2	2
15	Wiener Index	1358	7130
16	Dependency Sum	98	1124
17	Breadth	0.039	0.094
18	Compactness	0.961	0.906
19	Mutuals	0.922	0.813
20	Asymmetrics	0	0
21	Nulls	0.078	0.187
22	Arc Reciprocity	1	1
23	Dyad Reciprocity	1	1

Table 27 – NETWORK STRUCTURE METRICS, CYPRIOT NETWORKS—NO ISOLATES

	1 Density	2 Avg Dist	3 Radius	4 Diameter	5 Fragmenta	6 Transitiv	7 Norm Dist
	---------	---------	---------	---------	---------	---------	---------
Egypt	0.224	2.306	3.000	5.000	0.073	0.599	0.724
Levant	0.303	2.358	2.000	4.000	0.021	0.616	0.733

Table 28 – CENTRALITY MEASURES FOR FS SHAPES IN CYPRUS, EGYPT, AND THE LEVANT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Akaki	0.090	0.012	0.085	0.708	0.003
2	Akanthou Moulos	0.037	0.008	0.047	0.669	0.001
3	Akhera	0.119	0.017	0.111	0.751	0.006
4	Alambra	0.045	0.004	0.036	0.573	0.000
5	Alassa	0.007	0.004	0.014	0.613	0.000
6	Amathus	0.007	0.000	0.003	0.482	0.000
7	Analionda Palioklichia	0.007	0.001	0.008	0.517	0.000
8	Anaochora	0.007	0.004	0.014	0.613	0.000
9	Angastina	0.075	0.009	0.071	0.606	0.001
10	Apliki	0.104	0.012	0.080	0.731	0.005
11	Aradhippou	0.045	0.006	0.034	0.647	0.005
12	Arediou-Vouppes	0.030	0.006	0.030	0.685	0.005
13	Arodhes	0.015	0.002	0.017	0.549	0.000
14	Arpera Chiflik	0.060	0.009	0.056	0.674	0.002
15	Athienou Baboulari	0.045	0.008	0.044	0.699	0.001
16	Ayia Irini Palaeokastro	0.022	0.005	0.022	0.627	0.001
17	Ayia Irini Temple Site	0.007	0.000	0.004	0.479	0.000
18	Ayios Epiktetos	0.015	0.005	0.024	0.643	0.000
19	Ayios Iakovos Dhima + Melia	0.142	0.019	0.130	0.765	0.009
20	Ayios Sozomenos	0.015	0.004	0.021	0.625	0.000
21	Ayios Theodoros	0.007	0.004	0.014	0.613	0.000
22	Ayios Thyrsos Vikla	0.007	0.004	0.014	0.613	0.000
23	Dhavlos Pyrgos	0.007	0.004	0.014	0.613	0.000
24	Dhekelia Koukouphoudhkia	0.052	0.006	0.043	0.589	0.001
25	Dhekelia Steno	0.104	0.015	0.093	0.749	0.014
26	Dhenia	0.037	0.008	0.046	0.671	0.001
27	Dhikomo Onisia	0.030	0.007	0.037	0.669	0.001
28	Dhiorios Kupous	0.007	0.004	0.014	0.613	0.000
29	Dromolaxia trypes	0.037	0.004	0.032	0.572	0.001
30	Drousha Appiourka	0.015	0.004	0.023	0.593	0.000
31	Enkomi	0.522	0.035	0.288	0.917	0.094
32	Erimi Kafkalla	0.007	0.004	0.014	0.613	0.000
33	Galinorporni	0.045	0.009	0.064	0.647	0.001
34	Gastria Ayios ionnis	0.007	0.004	0.014	0.613	0.000
35	Hala Sultan Tekke	0.239	0.022	0.153	0.811	0.030
36	Idalion	0.119	0.016	0.107	0.754	0.016
37	Kaimakli Evretadhes	0.082	0.008	0.066	0.603	0.002
38	Kalavasos Ayios Dimithrios	0.112	0.013	0.084	0.747	0.006
39	Kalavasos Mangi	0.015	0.002	0.014	0.533	0.000
40	Kalavassos Mavrovouni	0.007	0.001	0.005	0.487	0.000
41	Kalopsidha	0.045	0.006	0.035	0.653	0.001
42	Kantara	0.007	0.001	0.008	0.525	0.000
43	Karmi	0.007	0.004	0.014	0.613	0.000
44	Katydhata	0.142	0.018	0.125	0.766	0.009
45	Kazaphani Ayios Andronikos	0.022	0.005	0.032	0.614	0.000
46	Kirokitia Skasmata	0.007	0.004	0.014	0.613	0.000

47	Kition	0.194	0.018	0.131	0.772	0.018
48	Kivisil Gyppos	0.007	0.004	0.014	0.613	0.000
49	Klavdhia	0.097	0.013	0.089	0.710	0.008
50	Kokkini Trimithia	0.007	0.004	0.014	0.613	0.000
51	Kormakiti Ayious	0.045	0.009	0.053	0.716	0.002
52	Korovia Nitovikla	0.007	0.001	0.005	0.499	0.000
53	Kouklia Palaepaphos	0.134	0.015	0.099	0.744	0.010
54	Kouklia Skales	0.015	0.004	0.021	0.630	0.000
55	Kourion Apiskopi	0.007	0.001	0.010	0.536	0.000
56	Kourion Bamboula	0.216	0.021	0.163	0.705	0.012
57	Lapithos Ayia Anastasia	0.090	0.008	0.072	0.597	0.001
58	Larnaca tis Lapithou	0.022	0.005	0.026	0.636	0.000
59	Laxia tou Riou	0.030	0.004	0.030	0.567	0.000
60	Leonarissio	0.007	0.004	0.014	0.613	0.000
61	Limassol Kapsalos	0.007	0.004	0.014	0.613	0.000
62	Loutros Adhkia	0.007	0.004	0.014	0.613	0.000
63	Lythrodhonda Moutti	0.007	0.004	0.014	0.613	0.000
64	Maa Palaeokastro	0.037	0.006	0.028	0.633	0.001
65	Marathovouni	0.007	0.004	0.014	0.613	0.000
66	Maroni Vournes	0.246	0.021	0.157	0.790	0.033
67	Maroni Tsaroukkas	0.142	0.018	0.124	0.777	0.012
68	Mathiatis	0.007	0.000	0.002	0.467	0.000
69	Meniko Kyra tou Dhiakou	0.007	0.001	0.006	0.503	0.000
70	Milia	0.030	0.003	0.023	0.560	0.000
71	Myloptetres	0.007	0.001	0.007	0.512	0.000
72	Myrtou Pigadhes	0.097	0.010	0.076	0.648	0.003
73	Myrtou Stephania	0.037	0.010	0.057	0.716	0.001
74	Nicoseia Ayia Paraskevi	0.104	0.013	0.088	0.713	0.005
75	Nicosia Bairaktar	0.007	0.004	0.014	0.613	0.000
76	Ovgoros	0.007	0.001	0.006	0.507	0.000
77	Palekythro	0.015	0.000	0.002	0.465	0.000
78	Paphos	0.007	0.004	0.014	0.613	0.000
79	Pendayia	0.007	0.001	0.010	0.536	0.000
80	Pera	0.015	0.005	0.024	0.633	0.000
81	Peyia Koutsourous	0.007	0.004	0.014	0.613	0.000
82	Phlamoudhi Sapilou	0.022	0.006	0.031	0.656	0.000
83	Polemidhia Oufkia	0.007	0.003	0.014	0.580	0.000
84	Politiko-Lambertis	0.052	0.006	0.047	0.585	0.000
85	Pomos	0.007	0.004	0.014	0.613	0.000
86	Psilatos Moutti	0.007	0.001	0.010	0.530	0.000
87	Pyla Kokkinokremos	0.060	0.008	0.051	0.662	0.002
88	Pyla Verghi	0.104	0.013	0.087	0.705	0.004
89	Rizokarpasso	0.030	0.005	0.029	0.636	0.000
90	Sinda	0.104	0.012	0.086	0.710	0.006
91	Soloi	0.007	0.004	0.014	0.613	0.000
92	Strovolos Dromero	0.007	0.004	0.014	0.613	0.000
93	Tamassos Litharkes	0.007	0.004	0.014	0.613	0.000
94	Toumba tou Skourou	0.097	0.013	0.083	0.743	0.009
95	Yeri Phoenikias	0.022	0.003	0.021	0.562	0.000
96	Yeroskipou	0.015	0.004	0.023	0.601	0.000
97	Abu Shushe	0.007	0.000	0.003	0.482	0.000
98	Afula	0.007	0.001	0.006	0.503	0.000
99	Ain Shems (Beth Shemesh)	0.112	0.015	0.110	0.681	0.003
100	Akko	0.090	0.014	0.092	0.753	0.005

101	Alalakh (Tell Atchana)	0.082	0.013	0.090	0.714	0.004
102	Amman Airport	0.179	0.017	0.134	0.701	0.019
103	Aphek (Antipatris); Kurdane	0.022	0.003	0.025	0.568	0.000
104	Arab al Mulk	0.000	0.000	0.000	0.000	0.000
105	Ashdod	0.097	0.015	0.098	0.747	0.005
106	Ashkelon	0.045	0.008	0.048	0.657	0.001
107	Atlit	0.000	0.000	0.000	0.000	0.000
108	Beirut (centre)	0.052	0.007	0.051	0.624	0.000
109	Beqa’a Valley	0.007	0.001	0.007	0.513	0.000
110	Beth Shean	0.172	0.017	0.135	0.691	0.007
111	Bethel (Beitin)	0.007	0.004	0.014	0.613	0.000
112	Byblos (Jbail)	0.157	0.021	0.149	0.782	0.011
113	Çatal Hüyük	0.000	0.000	0.000	0.000	0.000
114	Charchemish (Jerablus)	0.022	0.007	0.037	0.692	0.001
115	Dahrat al Humrayah	0.015	0.002	0.017	0.552	0.000
116	Deir ‘Alla	0.037	0.006	0.043	0.618	0.000
117	Deir el Balah	0.037	0.005	0.042	0.590	0.000
118	Deir Khabie	0.007	0.003	0.014	0.580	0.000
119	Dor (Tell el Burj)	0.000	0.000	0.000	0.000	0.000
120	Dothan	0.015	0.003	0.021	0.592	0.000
121	El-Harruba	0.000	0.000	0.000	0.000	0.000
122	Garife	0.007	0.003	0.014	0.580	0.000
123	Gerar (Tell Jemmeh)	0.022	0.007	0.033	0.686	0.001
124	Gezer	0.127	0.017	0.118	0.758	0.006
125	Gibeon (el Jib)	0.022	0.001	0.010	0.517	0.000
126	Hama	0.007	0.004	0.014	0.613	0.000
127	Hazor	0.164	0.022	0.156	0.788	0.009
128	Hesban	0.007	0.004	0.014	0.613	0.000
129	Isbet Sartah	0.007	0.002	0.012	0.547	0.000
130	Jatt	0.022	0.003	0.023	0.568	0.000
131	Jericho	0.015	0.002	0.015	0.530	0.000
132	Jerusalem	0.000	0.000	0.000	0.000	0.000
133	Kamid el-Loz	0.164	0.016	0.126	0.675	0.006
134	Khan Selim (Khirbet Selim)	0.007	0.004	0.014	0.613	0.000
135	Khan Sheikoun	0.007	0.003	0.014	0.580	0.000
136	Khirbet Judur	0.022	0.003	0.021	0.559	0.000
137	Khirbet Rabud (Debir)	0.007	0.001	0.008	0.517	0.000
138	Kinneret (Khirbet al-Urema)	0.000	0.000	0.000	0.000	0.000
139	Lachish	0.104	0.011	0.082	0.669	0.009
140	Lattakia (Ramitha)	0.007	0.004	0.014	0.613	0.000
141	Madeba	0.007	0.003	0.014	0.580	0.000
142	Megiddo	0.149	0.020	0.143	0.782	0.008
143	Meskene Emar	0.007	0.001	0.006	0.501	0.000
144	Minet el-Beida	0.299	0.027	0.213	0.833	0.027
145	Oumm el-Mara	0.007	0.004	0.014	0.613	0.000
146	Pella (Tabaqat Fahil)	0.007	0.003	0.014	0.580	0.000
147	Qadesh (Tell Nebi Mend)	0.030	0.007	0.036	0.693	0.001
148	Qatna (Mishrife)	0.007	0.000	0.002	0.477	0.000
149	Qraye	0.030	0.003	0.026	0.566	0.000
150	Qudur el Walaida	0.000	0.000	0.000	0.000	0.000
151	Ras el-Bassit	0.015	0.002	0.017	0.544	0.000
152	Ras Ibn Hani	0.052	0.011	0.063	0.720	0.002
153	Sahab	0.022	0.002	0.020	0.549	0.000
154	Sarepta (Sarafand)	0.194	0.024	0.179	0.803	0.012

155	Sabouni	0.000	0.000	0.000	0.000	0.000
156	Shechem (Tell Balata)	0.060	0.012	0.070	0.730	0.002
157	Sidon (Saida)	0.082	0.008	0.066	0.618	0.004
158	Tell ‘Ain Sherif	0.007	0.004	0.014	0.613	0.000
159	Tell ‘Ajjul (Gaza)	0.075	0.011	0.083	0.653	0.001
160	Tell ‘Arqa	0.000	0.000	0.000	0.000	0.000
161	Tell Abu Hawam	0.343	0.031	0.247	0.860	0.043
162	Tell Aron	0.000	0.000	0.000	0.000	0.000
163	Tell Ashari	0.037	0.004	0.033	0.570	0.000
164	Tell Batash	0.007	0.001	0.008	0.525	0.000
165	Tell Beit Mirsim	0.082	0.010	0.074	0.649	0.002
166	Tell Bir el-Gharbi	0.000	0.000	0.000	0.000	0.000
167	Tell Burgatha	0.000	0.000	0.000	0.000	0.000
168	Tell Dan (Tell el-Qadi)	0.037	0.004	0.032	0.566	0.000
169	Tell Daruk	0.007	0.004	0.014	0.613	0.000
170	Tell el Far’ah (North)	0.000	0.000	0.000	0.000	0.000
171	Tell el Far’ah (south)	0.037	0.006	0.040	0.616	0.000
172	Tell el Ghassil	0.000	0.000	0.000	0.000	0.000
173	Tell el Hesi	0.030	0.007	0.037	0.673	0.001
174	Tell er Ridan	0.000	0.000	0.000	0.000	0.000
175	Tell Eran	0.000	0.000	0.000	0.000	0.000
176	Tell es Safi	0.030	0.006	0.032	0.639	0.000
177	Tell es Saidiyeh	0.037	0.006	0.040	0.622	0.001
178	Tell es Salihyeh	0.007	0.000	0.003	0.480	0.000
179	Tell es Samak	0.000	0.000	0.000	0.000	0.000
180	Tell esh-Shari’a (‘Sera)	0.090	0.013	0.089	0.716	0.003
181	Tell Haror	0.007	0.004	0.014	0.613	0.000
182	Tell Hayat	0.000	0.000	0.000	0.000	0.000
183	Tell Irbid	0.000	0.000	0.000	0.000	0.000
184	Tell Jerishe	0.007	0.004	0.014	0.613	0.000
185	Tell Kadesh	0.000	0.000	0.000	0.000	0.000
186	Tell Kazel	0.045	0.005	0.041	0.579	0.000
187	Tell Mevorakh	0.030	0.008	0.045	0.681	0.001
188	Tell Michal	0.007	0.000	0.001	0.472	0.000
189	Tell Miqne	0.037	0.006	0.033	0.656	0.002
190	Tell Mor	0.000	0.000	0.000	0.000	0.000
191	Tell Nagila	0.000	0.000	0.000	0.000	0.000
192	Tell Nami	0.000	0.000	0.000	0.000	0.000
193	Tell Nahr al-‘Arab	0.000	0.000	0.000	0.000	0.000
194	Tell Ouaouieh	0.000	0.000	0.000	0.000	0.000
195	Tell Qasis	0.000	0.000	0.000	0.000	0.000
196	Tell Qiri	0.015	0.002	0.016	0.536	0.000
197	Tell Sippor	0.015	0.006	0.028	0.682	0.001
198	Tell Sukas	0.097	0.015	0.103	0.756	0.005
199	Tell Ta’annek	0.015	0.002	0.014	0.533	0.000
200	Tell Tweini	0.000	0.000	0.000	0.000	0.000
201	Tell Yin’am	0.015	0.002	0.014	0.535	0.000
202	Tell Yoqne’am	0.007	0.004	0.014	0.613	0.000
203	Tyre	0.037	0.009	0.053	0.707	0.001
204	Ugarit (Ras Shamra)	0.418	0.034	0.277	0.878	0.050
205	Umm ad Dananir	0.030	0.006	0.037	0.613	0.000
206	Yavneh Yam	0.000	0.000	0.000	0.000	0.000
207	Abusir el-Meleq	0.007	0.001	0.007	0.511	0.000
208	Abydos	0.045	0.010	0.057	0.725	0.002

209	Ali Mara	0.007	0.004	0.014	0.613	0.000
210	Amara West	0.015	0.006	0.028	0.682	0.001
211	Aniba	0.007	0.000	0.002	0.461	0.000
212	Arabi Hills	0.007	0.003	0.014	0.580	0.000
213	Armant	0.015	0.004	0.014	0.614	0.000
214	Arminna	0.015	0.004	0.018	0.618	0.000
215	Askut	0.022	0.005	0.031	0.606	0.000
216	Assyut	0.022	0.005	0.032	0.610	0.000
217	Az-Zaqaziz	0.015	0.004	0.021	0.626	0.000
218	Balabisch	0.030	0.004	0.026	0.601	0.002
219	Bir el Abd	0.007	0.004	0.014	0.613	0.000
220	Buhen	0.052	0.011	0.060	0.720	0.003
221	C 86	0.007	0.004	0.014	0.613	0.000
222	Daqqa	0.007	0.004	0.014	0.613	0.000
223	Debeira	0.007	0.003	0.014	0.580	0.000
224	Deir el-Ballas	0.007	0.004	0.014	0.613	0.000
225	Deir el-Medina	0.075	0.010	0.075	0.647	0.002
226	Dra Abu n Naga	0.015	0.002	0.016	0.536	0.000
227	Edfu	0.007	0.004	0.014	0.613	0.000
228	El Arish	0.015	0.003	0.020	0.567	0.000
229	el-Giza	0.007	0.004	0.014	0.613	0.000
230	Elephantine (Assuan)	0.007	0.004	0.014	0.613	0.000
231	Gurna (Abd el-Qurna)	0.030	0.005	0.033	0.601	0.000
232	Gurob	0.097	0.015	0.094	0.756	0.007
233	Harageh	0.007	0.004	0.014	0.613	0.000
234	Heliopolis	0.007	0.000	0.000	0.417	0.000
235	Kahun (al-Lahun)	0.015	0.004	0.014	0.615	0.001
236	Kerma	0.007	0.004	0.014	0.613	0.000
237	Kom Abu Billa	0.007	0.004	0.014	0.613	0.000
238	Kom el-Abd	0.007	0.004	0.014	0.613	0.000
239	Kom Firin	0.007	0.003	0.014	0.580	0.000
240	Luxor	0.022	0.006	0.029	0.684	0.001
241	Malkata	0.015	0.003	0.018	0.584	0.000
242	Marsa Matruh (Bates’ Island)	0.045	0.007	0.042	0.618	0.001
243	Memphis (Kom Rabi’a)	0.030	0.008	0.043	0.704	0.001
244	Meydum	0.007	0.004	0.014	0.613	0.000
245	Mostai (Tell Om Harb)	0.015	0.002	0.014	0.541	0.000
246	Naqada	0.007	0.003	0.014	0.580	0.000
247	Qantir	0.187	0.016	0.133	0.688	0.014
248	Qasr al-Aguz	0.007	0.004	0.014	0.613	0.000
249	Qau el-Qebir	0.007	0.000	0.002	0.467	0.000
250	Qubban	0.015	0.004	0.021	0.626	0.000
251	Rifeh	0.030	0.006	0.039	0.615	0.000
252	Riqqeh	0.030	0.005	0.035	0.615	0.000
253	Sai	0.007	0.003	0.014	0.580	0.000
254	Saqqara - N.K necropole	0.134	0.015	0.111	0.670	0.013
255	Sedment	0.045	0.006	0.041	0.615	0.001
256	Sesebi	0.022	0.006	0.030	0.685	0.001
257	Soleb	0.007	0.003	0.014	0.580	0.000
258	Tabo-Argo Island	0.015	0.004	0.022	0.592	0.000
259	Tarkhan	0.007	0.003	0.014	0.580	0.000
260	Tell ar-Rubai	0.015	0.004	0.022	0.592	0.000
261	Tell el Amarna	0.254	0.025	0.186	0.825	0.029
262	Tell el Dab’a	0.194	0.020	0.149	0.792	0.018

263	Tell el-Muqdam	0.015	0.005	0.024	0.633	0.000
264	Tell el-Rataba	0.022	0.004	0.024	0.596	0.000
265	Tell el-Yahudiyeh	0.007	0.003	0.014	0.580	0.000
266	Thebes	0.007	0.001	0.008	0.518	0.000
267	Tombos	0.007	0.001	0.006	0.507	0.000
268	Tuneh el-Gebel (E Ash)	0.015	0.003	0.019	0.586	0.000
269	Zawiyet Umm el-Rakham	0.015	0.001	0.010	0.511	0.000
270	Zawyet el-Amwat	0.007	0.001	0.008	0.518	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	PJ	0.141	0.020	0.184	0.573	0.027
2	SJ	0.348	0.121	0.315	0.676	0.147
3	ALAB	0.033	0.001	0.037	0.491	0.005
4	JUG	0.067	0.004	0.092	0.535	0.005
5	F	0.052	0.003	0.048	0.500	0.011
6	C	0.070	0.005	0.076	0.523	0.004
7	B	0.044	0.002	0.038	0.488	0.001
8	U	0.474	0.225	0.309	0.733	0.289
9	U-CL	0.148	0.022	0.170	0.576	0.034
10	U-O	0.122	0.015	0.148	0.565	0.021
11	6	0.004	0.000	0.007	0.440	0.000
12	7	0.030	0.001	0.039	0.507	0.001
13	8	0.019	0.000	0.031	0.504	0.000
14	9	0.011	0.000	0.024	0.500	0.000
15	16	0.004	0.000	0.006	0.405	0.000
16	19	0.004	0.000	0.007	0.449	0.000
17	23	0.004	0.000	0.013	0.488	0.000
18	24	0.004	0.000	0.006	0.405	0.000
19	28	0.007	0.000	0.020	0.494	0.000
20	31	0.030	0.001	0.044	0.513	0.001
21	34	0.019	0.000	0.037	0.514	0.005
22	35	0.033	0.001	0.076	0.530	0.001
23	36	0.078	0.006	0.112	0.545	0.005
24	39	0.007	0.000	0.010	0.455	0.000
25	40	0.015	0.000	0.024	0.476	0.000
26	44	0.048	0.002	0.072	0.520	0.002
27	45	0.189	0.036	0.225	0.604	0.039
28	46	0.048	0.002	0.062	0.522	0.006
29	47	0.037	0.001	0.058	0.521	0.005
30	48	0.041	0.002	0.079	0.534	0.002
31	53-55	0.181	0.033	0.222	0.594	0.033
32	56	0.007	0.000	0.013	0.447	0.000
33	67	0.004	0.000	0.004	0.424	0.000
34	68	0.004	0.000	0.006	0.433	0.000
35	77	0.015	0.000	0.040	0.517	0.000
36	80	0.000	0.000	0.000	0.000	0.000
37	82	0.011	0.000	0.009	0.438	0.000
38	83	0.015	0.000	0.038	0.503	0.000
39	84	0.026	0.001	0.039	0.512	0.001

40	85	0.056	0.003	0.087	0.532	0.002
41	84-85	0.015	0.000	0.030	0.504	0.001
42	87	0.007	0.000	0.004	0.411	0.000
43	93	0.000	0.000	0.000	0.000	0.000
44	94	0.141	0.020	0.185	0.586	0.026
45	95	0.052	0.003	0.083	0.527	0.002
46	94-95	0.111	0.012	0.144	0.552	0.019
47	96	0.000	0.000	0.000	0.000	0.000
48	105	0.015	0.000	0.028	0.489	0.000
49	110	0.015	0.000	0.028	0.503	0.000
50	112	0.004	0.000	0.013	0.488	0.000
51	113	0.007	0.000	0.012	0.440	0.000
52	114	0.074	0.005	0.132	0.550	0.004
53	116	0.004	0.000	0.004	0.424	0.000
54	118	0.026	0.001	0.033	0.485	0.000
55	120-121	0.011	0.000	0.021	0.471	0.000
56	123	0.004	0.000	0.007	0.440	0.000
57	126	0.007	0.000	0.016	0.477	0.000
58	128-129	0.007	0.000	0.025	0.500	0.000
59	130	0.004	0.000	0.005	0.392	0.000
60	132	0.004	0.000	0.007	0.440	0.000
61	133	0.004	0.000	0.004	0.408	0.000
62	134	0.052	0.003	0.087	0.530	0.002
63	136	0.007	0.000	0.006	0.430	0.000
64	139	0.015	0.000	0.038	0.515	0.000
65	142	0.004	0.000	0.013	0.488	0.000
66	144	0.004	0.000	0.007	0.440	0.000
67	149	0.030	0.001	0.034	0.479	0.000
68	151	0.011	0.000	0.031	0.511	0.000
69	155	0.015	0.000	0.010	0.446	0.001
70	159-161	0.019	0.000	0.039	0.490	0.000
71	164	0.081	0.007	0.120	0.546	0.011
72	165-168	0.152	0.023	0.185	0.586	0.023
73	170	0.015	0.000	0.031	0.508	0.000
74	171-173	0.222	0.049	0.264	0.621	0.048
75	174	0.015	0.000	0.034	0.505	0.000
76	176	0.015	0.000	0.030	0.481	0.000
77	178	0.107	0.012	0.138	0.559	0.019
78	179	0.074	0.005	0.110	0.541	0.005
79	180	0.078	0.006	0.120	0.550	0.006
80	178-180	0.070	0.005	0.102	0.529	0.008
81	181	0.011	0.000	0.006	0.430	0.005
82	182-183	0.081	0.007	0.126	0.550	0.010
83	184	0.007	0.000	0.009	0.452	0.000
84	186	0.078	0.006	0.131	0.552	0.004
85	187-188	0.044	0.002	0.081	0.538	0.002
86	189	0.163	0.027	0.199	0.578	0.023
87	190-192	0.115	0.013	0.157	0.567	0.012
88	197	0.015	0.000	0.029	0.489	0.000
89	198	0.004	0.000	0.011	0.467	0.000
90	199	0.059	0.004	0.097	0.540	0.004
91	200-202	0.022	0.000	0.045	0.494	0.000
92	AN V	0.030	0.001	0.063	0.518	0.005
93	204-210	0.007	0.000	0.020	0.499	0.000

94	206	0.007	0.000	0.014	0.469	0.000
95	207	0.007	0.000	0.020	0.499	0.000
96	208	0.022	0.000	0.033	0.493	0.004
97	209	0.011	0.000	0.020	0.497	0.000
98	211-214	0.011	0.000	0.020	0.495	0.000
99	211-220	0.007	0.000	0.017	0.497	0.000
100	219	0.015	0.000	0.032	0.506	0.005
101	220	0.107	0.012	0.165	0.567	0.013
102	225-226	0.030	0.001	0.063	0.519	0.000
103	227	0.004	0.000	0.004	0.422	0.000
104	230-232	0.007	0.000	0.025	0.500	0.000
105	236	0.004	0.000	0.006	0.399	0.000
106	237	0.004	0.000	0.005	0.392	0.000
107	242-244	0.041	0.002	0.087	0.534	0.001
108	248-253	0.000	0.000	0.000	0.000	0.000
109	250	0.015	0.000	0.041	0.506	0.000
110	254	0.007	0.000	0.009	0.440	0.000
111	255	0.019	0.000	0.035	0.501	0.000
112	256	0.022	0.000	0.029	0.474	0.000
113	257	0.019	0.000	0.039	0.493	0.000
114	258	0.048	0.002	0.083	0.517	0.005
115	262	0.004	0.000	0.004	0.391	0.000
116	272	0.000	0.000	0.000	0.000	0.000
117	278	0.019	0.000	0.047	0.490	0.000
118	254-278	0.100	0.010	0.148	0.557	0.009
119	279-286	0.056	0.003	0.089	0.521	0.002
120	281	0.122	0.015	0.160	0.566	0.016
121	282	0.000	0.000	0.000	0.000	0.000
122	283	0.015	0.000	0.033	0.497	0.000
123	284	0.044	0.002	0.082	0.511	0.001
124	285	0.011	0.000	0.014	0.453	0.000
125	290	0.007	0.000	0.010	0.443	0.000
126	292	0.004	0.000	0.001	0.398	0.000
127	294-296	0.100	0.010	0.148	0.553	0.008
128	303-306	0.004	0.000	0.002	0.381	0.000
129	304	0.007	0.000	0.024	0.484	0.000
130	308-310	0.030	0.001	0.065	0.523	0.001
131	324-325	0.004	0.000	0.013	0.488	0.000
132	334	0.007	0.000	0.016	0.473	0.000
133	336	0.007	0.000	0.013	0.447	0.000

Table 29 – CENTRALITY MEASURES FOR FS FUNCTIONAL GROUPS AND CYPRIOT WARES IN EGYPT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Abusir el-Meleq	0.179	0.046	0.106	0.616	0.003
2	Abydos	0.286	0.105	0.214	0.819	0.021

3	Ali Mara	0.107	0.046	0.088	0.670	0.002
4	Amara West	0.071	0.037	0.057	0.726	0.005
5	Aniba	0.250	0.069	0.163	0.642	0.005
6	Arabi Hills	0.036	0.021	0.034	0.606	0.000
7	Armant	0.071	0.024	0.042	0.606	0.001
8	Arminna	0.071	0.020	0.031	0.579	0.001
9	Askut	0.071	0.029	0.054	0.626	0.001
10	Assyut	0.071	0.036	0.068	0.658	0.001
11	Az-Zaqaziz	0.071	0.020	0.032	0.579	0.001
12	Balabisch	0.143	0.066	0.133	0.700	0.003
13	Bir el Abd	0.286	0.064	0.137	0.706	0.021
14	Buhen	0.286	0.096	0.191	0.819	0.027
15	C 86	0.036	0.016	0.022	0.566	0.000
16	Daqqa	0.143	0.061	0.122	0.681	0.004
17	Debeira	0.143	0.060	0.123	0.700	0.003
18	Deir el-Ballas	0.071	0.033	0.059	0.653	0.001
19	Deir el-Medina	0.214	0.075	0.159	0.726	0.007
20	Dra Abu n Naga	0.107	0.035	0.078	0.626	0.001
21	Edfu	0.036	0.016	0.022	0.566	0.000
22	El Arish	0.107	0.048	0.092	0.700	0.002
23	el-Giza	0.143	0.061	0.122	0.681	0.004
24	Elephantine (Assuan)	0.036	0.016	0.022	0.566	0.000
25	Gurna (Abd el-Qurna)	0.036	0.021	0.034	0.606	0.000
26	Gurob	0.464	0.127	0.275	0.865	0.043
27	Harageh	0.143	0.055	0.111	0.675	0.004
28	Heliopolis	0.143	0.054	0.106	0.700	0.004
29	Kahun (al-Lahun)	0.250	0.075	0.162	0.700	0.009
30	Kerma	0.036	0.016	0.022	0.566	0.000
31	Kom Abu Billa	0.036	0.016	0.022	0.566	0.000
32	Kom el-Abd	0.036	0.016	0.022	0.566	0.000
33	Kom Firin	0.036	0.021	0.034	0.606	0.000
34	Luxor	0.107	0.041	0.067	0.733	0.007
35	Malkata	0.071	0.025	0.046	0.611	0.001
36	Marsa Matruh (Bates’ Island)	0.571	0.109	0.253	0.811	0.063
37	Memphis (Kom Rabi’a)	0.250	0.088	0.174	0.802	0.018
38	Meydum	0.179	0.065	0.134	0.688	0.005
39	Mostai (Tell Om Harb)	0.071	0.031	0.055	0.626	0.001
40	Naqada	0.036	0.021	0.034	0.606	0.000
41	Qantir	0.679	0.126	0.302	0.846	0.072
42	Qasr al-Aguz	0.036	0.016	0.022	0.566	0.000
43	Qau el-Qebir	0.107	0.039	0.088	0.597	0.000
44	Qubban	0.179	0.059	0.120	0.681	0.006
45	Rifeh	0.179	0.070	0.145	0.713	0.005
46	Riqqeh	0.143	0.057	0.116	0.700	0.003
47	Sai	0.036	0.021	0.034	0.606	0.000
48	Saqqara - N.K necropole	0.464	0.114	0.262	0.786	0.028
49	Sedment	0.321	0.097	0.214	0.748	0.013
50	Sesebi	0.107	0.045	0.076	0.748	0.007
51	Soleb	0.071	0.034	0.063	0.658	0.001
52	Tabo-Argo Island	0.071	0.031	0.055	0.626	0.001
53	TARKHAN	0.071	0.028	0.053	0.626	0.001
54	Tell ar-Rubai	0.071	0.031	0.055	0.626	0.001
55	Tell el Amarna	0.464	0.105	0.225	0.865	0.052
56	Tell el Dab’a	0.714	0.133	0.303	0.939	0.118

57	Tell el-Muqdam	0.071	0.021	0.034	0.592	0.001
58	Tell el-Rataba	0.179	0.061	0.128	0.706	0.005
59	Tell el-Yahudiyeh	0.143	0.060	0.123	0.700	0.003
60	Thebes	0.143	0.054	0.121	0.626	0.001
61	Tombos	0.036	0.021	0.034	0.606	0.000
62	Tuneh el-Gebel (E Ash)	0.071	0.025	0.043	0.616	0.001
63	Zawiyet Umm el-Rakham	0.071	0.026	0.046	0.616	0.001
64	Zawyet el-Amwat	0.036	0.009	0.021	0.520	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	RLWM	0.406	0.165	0.383	0.621	0.078
2	BLWM	0.188	0.035	0.207	0.532	0.014
3	WP	0.203	0.041	0.214	0.541	0.020
4	ROR/ROB	0.031	0.001	0.053	0.488	0.000
5	PBR	0.000	0.000	0.000	0.000	0.000
6	BRI	0.484	0.235	0.419	0.656	0.122
7	BRII	0.359	0.129	0.334	0.596	0.060
8	BRI-II	0.125	0.016	0.138	0.518	0.007
9	PWSW	0.031	0.001	0.053	0.488	0.000
10	WSI	0.078	0.006	0.122	0.509	0.001
11	WSII	0.094	0.009	0.115	0.509	0.003
12	WSI-II	0.063	0.004	0.075	0.504	0.002
13	WSH	0.031	0.001	0.034	0.465	0.000
14	MONO	0.047	0.002	0.060	0.496	0.001
15	BUC	0.000	0.000	0.000	0.000	0.000
16	PWHM	0.016	0.000	0.026	0.468	0.000
17	BIC	0.047	0.002	0.075	0.500	0.001
18	BS/RS	0.063	0.004	0.080	0.484	0.001
19	Storage	0.094	0.009	0.115	0.509	0.004
20	Storage-Dry	0.219	0.048	0.225	0.551	0.032
21	Storage - Liquid	0.594	0.353	0.392	0.711	0.307
22	Dining - Serving	0.125	0.016	0.134	0.518	0.014
23	Dining - Drinking	0.109	0.012	0.132	0.518	0.007
24	Dining - Eating	0.031	0.001	0.042	0.472	0.000
25	Ritual	0.094	0.009	0.103	0.509	0.011
26	U	0.453	0.205	0.256	0.641	0.236
27	U-CL	0.266	0.071	0.244	0.567	0.060
28	U-O	0.109	0.012	0.106	0.513	0.010

Table 30 – CENTRALITY MEASURES FOR FS FUNCTIONAL GROUPS AND CYPRIOT WARES IN THE LEVANT

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	Abu Shushe	0.036	0.014	0.013	0.653	0.000
2	Afula	0.143	0.046	0.046	0.762	0.001

3	Ain Shems (Beth Shemesh)	0.429	0.144	0.146	0.943	0.005
4	Akko	0.536	0.161	0.163	1.004	0.012
5	Alalakh (Tell Atchana)	0.750	0.200	0.206	1.065	0.021
6	Amman Airport	0.357	0.106	0.109	0.908	0.003
7	Aphek (Antipatris)	0.107	0.043	0.040	0.791	0.001
8	Arab al Mulk	0.000	0.000	0.000	0.000	0.000
9	Ashdod	0.464	0.149	0.150	0.950	0.007
10	Ashkelon	0.643	0.165	0.175	0.965	0.013
11	Atlit	0.036	0.012	0.012	0.632	0.000
12	Beirut (centre)	0.286	0.085	0.085	0.875	0.003
13	Beth Shean	0.536	0.158	0.163	0.972	0.009
14	Bethel (Beitin)	0.143	0.062	0.059	0.807	0.001
15	Byblos (Jbail)	0.464	0.144	0.145	0.965	0.008
16	Çatal Hüyük	0.000	0.000	0.000	0.000	0.000
17	Charchemish (Jerablus)	0.071	0.029	0.025	0.762	0.000
18	Dahrat al Humrayah	0.179	0.064	0.061	0.857	0.001
19	Deir ‘Alla	0.071	0.036	0.032	0.786	0.000
20	Deir el Balah	0.214	0.084	0.080	0.863	0.001
21	Deir Khabie	0.036	0.018	0.015	0.697	0.000
22	Dor (Tell el Burj)	0.143	0.054	0.054	0.776	0.000
23	Dothan	0.250	0.095	0.091	0.882	0.002
24	El-Harruba	0.000	0.000	0.000	0.000	0.000
25	Garife	0.036	0.018	0.015	0.697	0.000
26	Gerar (Tell Jemmeh)	0.214	0.073	0.071	0.869	0.002
27	Gezer	0.571	0.176	0.178	1.012	0.011
28	Gibeon (el Jib)	0.143	0.050	0.049	0.766	0.001
29	Hama	0.143	0.044	0.042	0.781	0.001
30	Hazor	0.679	0.193	0.198	1.047	0.017
31	Hesban	0.036	0.012	0.010	0.629	0.000
32	Isbet Sartah	0.036	0.018	0.015	0.697	0.000
33	Jatt	0.250	0.083	0.082	0.875	0.002
34	Jericho	0.286	0.101	0.102	0.863	0.002
35	Jerusalem	0.214	0.063	0.068	0.752	0.001
36	Kamid el-Loz	0.286	0.088	0.090	0.882	0.003
37	Khan Selim (Khirbet Selim)	0.143	0.062	0.059	0.807	0.001
38	Khan Sheikoun	0.071	0.028	0.026	0.739	0.000
39	Khirbet Judur	0.107	0.037	0.034	0.743	0.000
40	Khirbet Rabud (Debir)	0.179	0.074	0.073	0.807	0.001
41	Kinneret (Khirbet al-Urema)	0.036	0.004	0.004	0.560	0.000
42	Lachish	0.786	0.199	0.211	1.047	0.019
43	Lattakia (Ramitha)	0.036	0.012	0.010	0.629	0.000
44	Madeba	0.036	0.018	0.015	0.697	0.000
45	Megiddo	0.750	0.205	0.213	1.056	0.018
46	Meskene Emar	0.107	0.051	0.047	0.823	0.000
47	Minet el-Beida	0.536	0.149	0.151	0.996	0.012
48	Oumm el-Mara	0.071	0.030	0.027	0.748	0.000
49	Pella (Tabaqat Fahil)	0.321	0.101	0.102	0.882	0.003
50	Qadesh (Tell Nebi Mend)	0.179	0.050	0.048	0.828	0.002
51	Qatna (Mishrife)	0.107	0.041	0.039	0.766	0.000
52	Qraye	0.143	0.051	0.051	0.796	0.001
53	Qudur el Walaida	0.000	0.000	0.000	0.000	0.000
54	Ras el-Bassit	0.179	0.058	0.059	0.796	0.001
55	Ras Ibn Hani	0.214	0.081	0.077	0.882	0.002
56	Sahab	0.071	0.028	0.027	0.713	0.000

57	Sarepta (Sarafand)	0.607	0.179	0.185	1.021	0.013
58	Sabouni	0.036	0.018	0.017	0.705	0.000
59	Shechem (Tell Balata)	0.500	0.160	0.162	0.988	0.009
60	Sidon (Saida)	0.429	0.136	0.138	0.928	0.005
61	Tell ‘Ain Sherif	0.036	0.012	0.010	0.629	0.000
62	Tell ‘Ajjul (Gaza)	0.750	0.188	0.197	1.038	0.030
63	Tell ‘Arqa	0.393	0.114	0.120	0.857	0.004
64	Tell Abu Hawam	0.679	0.189	0.197	1.021	0.014
65	Tell Aron	0.036	0.015	0.015	0.667	0.000
66	Tell Ashari	0.071	0.031	0.028	0.734	0.000
67	Tell Batash	0.286	0.088	0.091	0.845	0.003
68	Tell Beit Mirsim	0.393	0.134	0.135	0.935	0.005
69	Tell Bir el-Gharbi	0.000	0.000	0.000	0.000	0.000
70	Tell Burgatha	0.000	0.000	0.000	0.000	0.000
71	Tell Dan (Tell el-Qadi)	0.393	0.127	0.129	0.935	0.005
72	Tell Daruk	0.071	0.023	0.022	0.709	0.000
73	Tell el Far’ah (North)	0.179	0.069	0.069	0.791	0.001
74	Tell el Far’ah (south)	0.464	0.151	0.151	0.957	0.007
75	Tell el Ghassil	0.036	0.007	0.007	0.593	0.000
76	Tell el Hesi	0.464	0.150	0.149	0.972	0.008
77	Tell er Ridan	0.250	0.075	0.077	0.817	0.002
78	Tell Eran	0.000	0.000	0.000	0.000	0.000
79	Tell es Safi	0.214	0.066	0.066	0.823	0.001
80	Tell es Saidiyeh	0.107	0.042	0.040	0.752	0.000
81	Tell es Salihyeh	0.036	0.004	0.004	0.558	0.000
82	Tell es Samak	0.000	0.000	0.000	0.000	0.000
83	Tell esh-Shari’a (‘Sera)	0.536	0.165	0.170	0.996	0.010
84	Tell Haror	0.321	0.108	0.109	0.869	0.003
85	Tell Hayat	0.000	0.000	0.000	0.000	0.000
86	Tell Irbid	0.000	0.000	0.000	0.000	0.000
87	Tell Jerishe	0.214	0.077	0.075	0.823	0.001
88	Tell Kadesh	0.000	0.000	0.000	0.000	0.000
89	Tell Kazel	0.500	0.147	0.150	0.943	0.008
90	Tell Mevorakh	0.321	0.117	0.115	0.943	0.004
91	Tell Michal	0.179	0.045	0.049	0.730	0.001
92	Tell Miqne	0.143	0.034	0.035	0.701	0.000
93	Tell Mor	0.250	0.087	0.088	0.812	0.001
94	Tell Nagila	0.071	0.016	0.017	0.636	0.000
95	Tell Nami	0.036	0.012	0.012	0.632	0.000
96	Tell Nahr al-‘Arab	0.000	0.000	0.000	0.000	0.000
97	Tell Ouaouieh	0.000	0.000	0.000	0.000	0.000
98	Tell Qasis	0.107	0.037	0.036	0.771	0.000
99	Tell Qiri	0.071	0.019	0.020	0.667	0.000
100	Tell Sippor	0.214	0.069	0.065	0.875	0.002
101	Tell Sukas	0.464	0.142	0.145	0.980	0.007
102	Tell Ta’annek	0.143	0.038	0.038	0.748	0.001
103	Tell Tweini	0.321	0.102	0.105	0.845	0.003
104	Tell Yin’am	0.036	0.018	0.015	0.697	0.000
105	Tell Yoqne’am	0.143	0.054	0.053	0.781	0.001
106	Tyre	0.571	0.163	0.167	1.004	0.013
107	Ugarit (Ras Shamra)	0.857	0.215	0.226	1.093	0.026
108	Umm ad Dananir	0.071	0.035	0.031	0.801	0.000
109	Yavneh Yam	0.000	0.000	0.000	0.000	0.000

		1 Degree	2 2-Local	3 Eigenvect	4 Closeness	5 Betweenne
1	RLWM	0.173	0.030	0.147	0.543	0.006
2	BLWM	0.109	0.012	0.099	0.519	0.002
3	WP	0.327	0.107	0.230	0.612	0.058
4	ROR/ROB	0.245	0.060	0.200	0.573	0.019
5	PBR	0.009	0.000	0.010	0.458	0.000
6	BRI	0.418	0.175	0.297	0.661	0.058
7	BRII	0.482	0.232	0.319	0.701	0.083
8	BRI-II	0.109	0.012	0.084	0.519	0.003
9	PWSW	0.091	0.008	0.082	0.512	0.001
10	WSI	0.282	0.079	0.209	0.590	0.024
11	WSII	0.509	0.259	0.334	0.719	0.103
12	WSI-II	0.100	0.010	0.079	0.516	0.015
13	WSH	0.318	0.101	0.247	0.607	0.025
14	MONO	0.282	0.079	0.227	0.590	0.017
15	BUC	0.100	0.010	0.090	0.516	0.002
16	PWHM	0.000	0.000	0.000	0.000	0.000
17	BIC	0.209	0.044	0.142	0.558	0.030
18	BS/RS	0.118	0.014	0.109	0.522	0.002
19	Storage	0.164	0.027	0.122	0.536	0.007
20	Storage-Dry	0.382	0.146	0.260	0.641	0.065
21	Storage - Liquid	0.491	0.241	0.293	0.707	0.149
22	Dining - Serving	0.291	0.085	0.231	0.594	0.025
23	Dining - Drinking	0.209	0.044	0.176	0.558	0.012
24	Dining - Eating	0.164	0.027	0.147	0.536	0.004
25	Ritual	0.100	0.010	0.088	0.512	0.014
26	U	0.327	0.107	0.201	0.607	0.076
27	U-CL	0.164	0.027	0.134	0.536	0.009
28	U-O	0.173	0.030	0.131	0.539	0.008

Table 31 – FREQUENCY OF AFFILIATION BETWEEN FS FUNCTIONAL GROUPS AND CYPRIOT WARES IN EGYPT

	RLWM	BLWM	WP	ROR/ROB	BRI	BRII	BRI-II	PWSW	WSI	WSII	WSI-II	WSH	MONO	PWHM	BIC	BS/RS	Storage	S-Dry	S-Liquid	D-Serving	D-Drinking	D-Eating	Ritual	U-CL	U-O	AVG
RLWM	1.00	0.42	0.38	0.08	0.88	0.65	0.23	0.08	0.19	0.19	0.12	0.04	0.08	0.04	0.12	0.15	0.19	0.35	0.65	0.23	0.23	0.08	0.15	0.38	0.19	**0.25**
BLWM	0.92	1.00	0.58	0.17	1.00	0.67	0.33	0.17	0.33	0.17	0.08	0.00	0.08	0.08	0.17	0.25	0.33	0.58	0.58	0.33	0.25	0.00	0.25	0.50	0.17	**0.33**
WP	0.77	0.54	1.00	0.15	0.92	0.62	0.38	0.15	0.31	0.23	0.08	0.08	0.15	0.08	0.15	0.23	0.23	0.54	0.77	0.31	0.23	0.00	0.23	0.38	0.23	**0.32**
ROR/B	1.00	1.00	1.00	1.00	1.00	0.50	0.50	1.00	1.00	0.50	0.50	0.00	0.50	0.50	1.00	0.50	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.50	**0.75**
BRI	0.74	0.39	0.39	0.06	1.00	0.65	0.26	0.06	0.16	0.13	0.13	0.06	0.10	0.03	0.10	0.13	0.13	0.32	0.55	0.16	0.16	0.03	0.10	0.35	0.16	**0.22**
BRII	0.74	0.35	0.35	0.04	0.87	1.00	0.30	0.04	0.17	0.26	0.13	0.09	0.13	0.00	0.09	0.17	0.17	0.35	0.61	0.22	0.17	0.09	0.13	0.43	0.13	**0.25**
BRI-II	0.75	0.50	0.63	0.13	1.00	0.88	1.00	0.13	0.38	0.38	0.25	0.25	0.25	0.13	0.25	0.00	0.25	0.50	0.50	0.25	0.25	0.13	0.25	0.38	0.38	**0.36**
PWSW	1.00	1.00	1.00	1.00	1.00	0.50	0.50	1.00	1.00	0.50	0.50	0.00	0.50	0.50	1.00	0.50	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.50	**0.75**
WSI	1.00	0.80	0.80	0.40	1.00	0.80	0.60	0.40	1.00	0.60	0.40	0.20	0.40	0.20	0.60	0.40	0.60	1.00	1.00	0.60	0.80	0.20	0.60	1.00	0.40	**0.62**
WSII	0.83	0.33	0.50	0.17	0.67	1.00	0.50	0.17	0.50	1.00	0.17	0.33	0.50	0.00	0.33	0.17	0.33	0.67	0.83	0.33	0.50	0.33	0.50	0.83	0.33	**0.45**
WSI-II	0.75	0.25	0.25	0.25	1.00	0.75	0.50	0.25	0.50	0.25	1.00	0.25	0.25	0.25	0.50	0.25	0.25	0.50	1.00	0.25	0.50	0.25	0.25	0.75	0.50	**0.44**
WSH	0.50	0.00	0.50	0.00	1.00	1.00	1.00	0.00	0.50	1.00	0.50	1.00	1.00	0.00	0.50	0.00	0.00	0.50	0.50	0.00	0.50	0.50	0.00	0.50	0.50	**0.44**
MONO	0.67	0.33	0.67	0.33	1.00	1.00	0.67	0.33	0.67	1.00	0.33	0.67	1.00	0.00	0.67	0.33	0.33	0.67	0.67	0.33	0.67	0.33	0.33	0.67	0.33	**0.54**
PWHM	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	**0.75**
BIC	1.00	0.67	0.67	0.67	1.00	0.67	0.67	0.67	1.00	0.67	0.67	0.33	0.67	0.33	1.00	0.33	0.67	1.00	1.00	0.67	1.00	0.33	0.67	1.00	0.67	**0.71**
BS/RS	1.00	0.75	0.75	0.25	1.00	1.00	0.00	0.25	0.50	0.25	0.25	0.00	0.25	0.00	0.25	1.00	0.50	0.75	0.75	0.50	0.50	0.00	0.25	0.75	0.00	**0.44**
Stor	0.83	0.67	0.50	0.33	0.67	0.67	0.33	0.33	0.50	0.33	0.17	0.00	0.17	0.17	0.33	0.33	1.00	0.67	0.83	0.67	0.67	0.17	0.50	0.67	0.33	**0.45**
S-D	0.64	0.50	0.50	0.14	0.71	0.57	0.29	0.14	0.36	0.29	0.14	0.07	0.14	0.07	0.21	0.21	0.29	1.00	0.79	0.36	0.36	0.14	0.29	0.57	0.29	**0.34**
S-L	0.45	0.18	0.26	0.05	0.45	0.37	0.11	0.05	0.13	0.13	0.11	0.03	0.05	0.03	0.08	0.08	0.13	0.29	1.00	0.18	0.18	0.05	0.13	0.37	0.11	**0.17**
D-S	0.75	0.50	0.50	0.25	0.63	0.63	0.25	0.25	0.38	0.25	0.13	0.00	0.13	0.13	0.25	0.25	0.50	0.63	0.88	1.00	0.50	0.13	0.38	0.50	0.25	**0.38**
D-D	0.86	0.43	0.43	0.29	0.71	0.57	0.29	0.29	0.57	0.43	0.29	0.14	0.29	0.14	0.43	0.29	0.57	0.71	1.00	0.57	1.00	0.29	0.43	0.71	0.43	**0.46**
D-E	1.00	0.00	0.00	0.00	0.50	1.00	0.50	0.00	0.50	1.00	0.50	0.50	0.50	0.00	0.50	0.00	0.50	1.00	1.00	0.50	1.00	1.00	0.50	1.00	1.00	**0.54**
Rit	0.67	0.50	0.50	0.33	0.50	0.50	0.33	0.33	0.50	0.50	0.17	0.00	0.17	0.17	0.33	0.17	0.50	0.67	0.83	0.50	0.50	0.17	1.00	0.67	0.33	**0.41**
U-CL	0.59	0.35	0.29	0.12	0.65	0.59	0.18	0.12	0.29	0.29	0.18	0.06	0.12	0.06	0.18	0.18	0.24	0.47	0.82	0.24	0.29	0.12	0.24	1.00	0.18	**0.28**
U-O	0.71	0.29	0.43	0.14	0.71	0.43	0.43	0.14	0.29	0.29	0.29	0.14	0.14	0.14	0.29	0.00	0.29	0.57	0.57	0.29	0.43	0.29	0.29	0.43	1.00	**0.33**

Table 32 – FREQUENCY OF AFFILIATION BETWEEN FS FUNCTIONAL GROUPS AND CYPRIOT WARES IN THE LEVANT

	RLWM	BLWM	WP	ROR/B	PBR	BRI	BRII	BRI-II	PWSW	WSI	WSII	WSI-II	WSH	MONO	BUC	BIC	BS/RS	Stor	S-Dry	S-Liq	D-Serv	D-Drink	D-Eat	Ritual	U-CL	U-O	AVG
RLWM	1.00	0.42	0.63	0.68	0.05	0.89	0.95	0.26	0.32	0.68	0.95	0.32	0.74	0.74	0.37	0.47	0.47	0.32	0.63	0.68	0.68	0.53	0.42	0.32	0.32	0.37	**0.51**
BLWM	0.67	1.00	0.83	0.67	0.08	0.92	0.92	0.33	0.50	0.75	0.92	0.25	0.75	0.75	0.33	0.67	0.58	0.42	0.67	0.83	0.67	0.50	0.50	0.33	0.25	0.33	**0.55**
WP	0.33	0.28	1.00	0.64	0.03	0.69	0.75	0.19	0.22	0.56	0.75	0.19	0.61	0.53	0.22	0.36	0.33	0.19	0.61	0.67	0.53	0.42	0.28	0.17	0.31	0.22	**0.39**
ROR/B	0.48	0.30	0.85	1.00	0.04	0.81	0.85	0.22	0.30	0.78	0.93	0.26	0.67	0.67	0.22	0.52	0.44	0.22	0.59	0.63	0.59	0.48	0.37	0.22	0.33	0.26	**0.46**
PBR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	**0.77**
BRI	0.37	0.24	0.54	0.48	0.02	1.00	0.89	0.22	0.17	0.52	0.85	0.17	0.59	0.61	0.22	0.30	0.26	0.26	0.63	0.63	0.48	0.39	0.33	0.20	0.30	0.30	**0.38**
BRII	0.34	0.21	0.51	0.43	0.02	0.77	1.00	0.19	0.19	0.47	0.79	0.19	0.58	0.53	0.21	0.28	0.23	0.26	0.60	0.58	0.45	0.34	0.30	0.17	0.26	0.26	**0.35**
BRI-II	0.42	0.33	0.58	0.50	0.08	0.83	0.83	1.00	0.25	0.67	0.92	0.25	0.83	0.75	0.42	0.42	0.33	0.33	0.67	0.67	0.50	0.25	0.17	0.25	0.25	0.25	**0.45**
PWSW	0.60	0.60	0.80	0.80	0.10	0.80	1.00	0.30	1.00	0.90	1.00	0.30	0.70	0.80	0.40	0.50	0.50	0.20	0.70	0.80	0.70	0.50	0.60	0.30	0.30	0.30	**0.56**
WSI	0.42	0.29	0.65	0.68	0.03	0.77	0.81	0.26	0.29	1.00	0.87	0.26	0.52	0.65	0.26	0.45	0.26	0.23	0.58	0.71	0.48	0.35	0.29	0.19	0.26	0.23	**0.41**
WSII	0.32	0.20	0.48	0.45	0.02	0.70	0.75	0.20	0.18	0.48	1.00	0.14	0.54	0.50	0.16	0.32	0.21	0.29	0.54	0.66	0.50	0.36	0.30	0.18	0.29	0.30	**0.35**
WSI-II	0.55	0.27	0.64	0.64	0.09	0.73	0.91	0.27	0.27	0.73	0.73	1.00	0.82	0.55	0.36	0.55	0.36	0.18	0.73	0.64	0.64	0.55	0.27	0.09	0.27	0.36	**0.47**
WSH	0.40	0.26	0.63	0.51	0.03	0.77	0.89	0.29	0.20	0.46	0.86	0.26	1.00	0.63	0.23	0.37	0.29	0.37	0.71	0.71	0.63	0.49	0.43	0.26	0.37	0.31	**0.44**
MONO	0.45	0.29	0.61	0.58	0.03	0.90	0.90	0.29	0.26	0.65	0.90	0.19	0.71	1.00	0.29	0.42	0.32	0.35	0.65	0.74	0.58	0.39	0.39	0.26	0.32	0.29	**0.45**
BUC	0.64	0.36	0.73	0.55	0.09	0.91	1.00	0.45	0.36	0.73	0.82	0.36	0.73	0.82	1.00	0.64	0.36	0.27	0.82	0.91	0.73	0.55	0.36	0.27	0.36	0.36	**0.55**
BIC	0.39	0.35	0.57	0.61	0.04	0.61	0.65	0.22	0.22	0.61	0.78	0.26	0.57	0.57	0.30	1.00	0.26	0.30	0.48	0.61	0.48	0.48	0.30	0.13	0.22	0.26	**0.39**
BS/RS	0.69	0.54	0.92	0.92	0.08	0.92	0.92	0.31	0.38	0.62	0.92	0.31	0.77	0.77	0.31	0.46	1.00	0.23	0.69	0.77	0.77	0.54	0.38	0.38	0.46	0.46	**0.56**
Stor	0.33	0.28	0.39	0.33	0.00	0.67	0.78	0.22	0.11	0.39	0.89	0.11	0.72	0.61	0.17	0.39	0.17	1.00	0.83	0.89	0.61	0.50	0.56	0.22	0.33	0.39	**0.42**
S-D	0.29	0.19	0.52	0.38	0.02	0.69	0.76	0.19	0.17	0.43	0.71	0.19	0.60	0.48	0.21	0.26	0.21	0.36	1.00	0.81	0.55	0.43	0.38	0.19	0.36	0.31	**0.37**
S-L	0.24	0.19	0.44	0.31	0.02	0.54	0.57	0.15	0.15	0.41	0.69	0.13	0.46	0.43	0.19	0.26	0.19	0.30	0.63	1.00	0.54	0.39	0.30	0.17	0.28	0.28	**0.32**
D-S	0.41	0.25	0.59	0.50	0.03	0.69	0.75	0.19	0.22	0.47	0.88	0.22	0.69	0.56	0.25	0.34	0.31	0.34	0.72	0.91	1.00	0.59	0.50	0.31	0.47	0.53	**0.45**
D-D	0.43	0.26	0.65	0.57	0.04	0.78	0.78	0.13	0.22	0.48	0.87	0.26	0.74	0.52	0.26	0.48	0.30	0.39	0.78	0.91	0.83	1.00	0.61	0.35	0.52	0.43	**0.48**
D-E	0.44	0.33	0.56	0.56	0.00	0.83	0.89	0.11	0.33	0.50	0.94	0.17	0.83	0.67	0.22	0.39	0.28	0.56	0.89	0.89	0.89	0.78	1.00	0.50	0.50	0.50	**0.52**
Rit	0.55	0.36	0.55	0.55	0.00	0.82	0.82	0.27	0.27	0.55	0.91	0.09	0.82	0.73	0.27	0.27	0.45	0.36	0.73	0.82	0.91	0.73	0.82	1.00	0.55	0.55	**0.53**
U-CL	0.33	0.17	0.61	0.50	0.00	0.78	0.78	0.17	0.17	0.44	0.89	0.17	0.72	0.56	0.22	0.28	0.33	0.33	0.83	0.83	0.83	0.67	0.50	0.33	1.00	0.56	**0.46**
U-O	0.37	0.21	0.42	0.37	0.00	0.74	0.74	0.16	0.16	0.37	0.89	0.21	0.58	0.47	0.21	0.32	0.32	0.37	0.68	0.79	0.89	0.53	0.47	0.32	0.53	1.00	**0.43**

APPENDIX 1 – DATA MANAGEMENT AND ANALYSIS

A1.1 Database Structure and Metadata

Project Database Structure

To consolidate, store, and analyze the data for this project a relational database was constructed in Microsoft Access. The database was structured in order to allow for ease of entry, aid in maintaining data consistency, and allow for effective use in later projects with different research goals and questions. Another consideration factoring into the specific design of the database is the desire to make the database open to the public following the completion of the project, similar to projects such as the OCHRE project of the University of Chicago. This goal is founded in the desire to preserve historical and cultural information, as well as to foster academic collegiality and cooperation. In part the sharing of the database from this project is also stimulated by the desire to reduce research redundancy, allowing for stimulated analytical research versus data slogging consolidation projects. The desire to share the database following the completion of the project also added to the desire to a clear, user-friendly, and effective platform for data acquisition, analysis, archiving, and curation.

The software chosen for this project is Microsoft Office Access. Access is a relational database management program that provides a powerful database system (Microsoft Jet Database Engine) with a user-friendly graphical interface. This simple interface allows non-expert users, such as many archaeologists, to easily and effectively create a database system without having to learn relational database programming code such as SQL (Structured Query Language)[1053]. For

[1053] SQL is the more commonly used database programming languages, comprised of a data definition more advanced users however, it can function as the 'front-end,' for more powerful 'back-end' tables (i.e. Microsoft SQL, Oracle, and Sybase). Given the desire to publish results on the internet following the completion of the project, the ability to convert to a web format through Microsoft SharePoint is of further benefit.

The database is constructed for a single artifact class—ceramics. The choice to limit the artifact class allowed for the inclusion of a greater amount of diagnostic details without making the system over cumbersome and bloated. This was particularly important for the future repurposing of the database into a public system, as it was necessary to avoid over complex and convoluted input forms. This certainly does not negate the possibility of creating similarly designed input forms for other artifact classes in the future, however it alleviates the burden of an overly complex format for this stage. The benefit of a single artifact type is that it allows for a number of category specific fields for data entry, creating a more robust data set, which is facilitates future and more focused analysis on a variety of dimensions that were not necessarily the focus of this study. It allows improves the precision of analytical conclusions, as it will be possible to sort the data under a number of provenience, sourcing or context quality dimensions.

As a relational database, the information for each artifact was recorded and arranged in sixteen associated tables. The primary table is the ID TABLE, which includes all of the basic identification information associated with each piece (for a detailed description of each of the table fields see the database dictionary in Appendix X). The primary key for the table is an autogenerated number that is unique to each entry. This main table includes all of the central information pertaining to the piece, in particular physical characteristics and diagnostic features

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language and a data manipulation language. Although useable for different database programs, codes transferred between software systems may be incompatible. Created by Edgar F. Codd in 1970, SQL was adopted by the American National Standards Institute (ANSI) in 1986.

(such as size, fabric, and form). Each aspect of these features is entered in a separate field in order to maintain data normalization and facilitates easier querying in the analysis phase (for example fabric inclusions are catalogued in three separate entries: Inclusion Frequency, Inclusion Size, and Inclusion Type). The majority of these features, when they are not simply metrics (like height or length), are entered through lookup tables, which maintains consistency in entering details. For these many of these tables multiple entries are allowed; a partial vessel can have an entry of ‘rim,’ ‘body,’ and ‘handle’ in the ‘Shred Type’ field instead of being limited to only one. For fields that may include a larger variety of potential options, the option to add new entries to the lookup table during the data entry phase has been enabled. This allows for the database to become operational without necessitating the entry of every single possible option into the lookup tables (such as all potential fabric inclusion materials that may be encountered). By still utilizing a lookup table however, the entry will be controlled and consistent, which lessens potential query problems during the analytical phase.

Characteristics of the vessel that are not easily quantifiable (such as the details of the site phase or locus in which the sherd was found), are also referenced in this table, but are detailed in related tables (see Appendix 4 for the table relationship structure). For these features, numeric Foreign keys are included in the ID Table that link to supporting related tables. For instance, when entering a Cypriot sherd found at Ugarit, the ID Table will contain a number in the Site field (in this case 8). This number will link to the Site Table, within which all of the basic site and excavation details are included (modern location, site occupation dates, GIS coordinates, and excavation and publication dates). By including these details in a related table, they only need to be entered once (and then are referenced simply with the Primary Key number), and do not clutter the main ID table and entry form. This approach was also taken for other contextual fields (including the phases and contexts associated with each site), chronological periods, and ware, form, and decoration types. The significant advantage of entering this type of information into related tables, is that if any changes are required—such as a shifting in absolute dates associated with new C14 Theran eruption dates—need only be altered in the single phase entry rather than in every entry which is classified to this period.

The issue of data normalization was addressed through the use of a confidence coefficient assigned by the author to both the context of the ceramic. This takes into account the excavation and publication record of the site, as well as the specific context in question. This system is adopted from G. Van Wijngaarden's dissertation on Mycenaean pottery consumption throughout the Mediterranean,[1054] and provides six qualitative rankings as follows:[1055]

1. The only thing that is known is that Mycenaean pottery has been found at the site
2. It is impossible to assign contexts to the Mycenaean pottery, either because it all comes from levelling strata, or because it is insufficiently published
3. For part of the Mycenaean pottery it is possible to assign a context. However, for a significant part this is not the case
4. For a significant part of the pottery it is possible to assign a context. However, associated objects are not (fully) known
5. For a significant part of the pottery it I possible to assign a context and associated objects are known to a large extent.
6. The excavation is fully published and contexts and associated objects can be assigned to

[1054] Van Wijngaarden 1999, 485-7.

[1055] A similar approach was taken by Jaimie Aprile, who created a four-tiered confidence rating to assign to archaeological strata (see Aprile 2010, 118-121).

all objects. Moreover, the Mycenaean pottery has been quantitatively analysed.

By attributing a context rating such as this, it will be possible during the analysis phase to increase result precision by running network simulations on only the highest rated ceramic finds, which can then be compared to the general network to test the simulation confidence. In this way finds can also be documented for which there is only a minimum of information—simply that a Aegean or Cypriot sherd was recovered—with no further data available. This site can therefore be recorded without any further sherd details, and can be included if desired in geographic network constructions to determine distribution reach. This process is currently ongoing, alongside the accumulation of excavation data related to the size and scope of projects at different sites (to facilitate more precise comparisons of import frequency of proportionality).

Database Entry Interface

The database entry interface is structured through a primary navigation form that includes 5 subordinate forms: ID, SITE, CONTEXT, FORM, and ANALYSIS. These forms are arranged categorically, and in some cases draw on more than one table. The goal in designing this entry system was to create a clear and logical interface for data entry, as well as to expedite the process by streamlining entry into a variety of shorter, subject organized forms. This was valuable in particular for the entry of ceramics discovered and published in early excavations, which generally include a significantly smaller amount of associated details or images. The navigation form structure allows the user to focus on the forms that contain fields for which there is associated data, and skip those with more detailed dimensions that are not always present in more cursory publication sources (versus requiring the user to scroll down through a large single form, which may include embedded subforms). This was certainly the case for the ANALYSIS

Table, which documented any archaeometric analysis done on any item (such as sourcing or dating analysis). The amount of ceramics included in the study that had associated scientific analysis results were certainly the minority, and therefore the entry form and all of the related data fields could be skipped when navigating through the data entry form.

The navigation form layout also allowed for greater efficiency when supplementary details were added to existing artifacts. Situations such as this commonly occurred when entering ceramics from sites that were published in pottery-centric publications, for which there were basic find spot details (such as the trench or locus). Additional contextual information (such as locus type, dates of excavation, and quantity of ceramics found) could then be retrieved from other site publication reports and added into the system. This was also particularly valuable when certain more obscure reports were accessed in the field, allowing for maximum efficiency in recording the specific data that was only available in these contexts. This also proved beneficial in quickly accessing data—particularly contextual—associated with ceramics found early on at long-running archaeological sites. Many of the sites examined for this study, as is not surprising in archaeology, were subject to a number of later revisions as to issues of stratigraphy and chronology, and these details could be quickly and easily updated through the use of the navigation form.

Metadata

An important concern when constructing the database was the production of metadata. Structural metadata for the project was prepared in the planning and construction phase, and can be found in the data dictionary (Appendix X). This dictionary was updated throughout when new entries were added into lookup tables for different fields, with the corresponding date of inclusion. Descriptive metadata was integrated into the design of a number of the tables themselves, along with easy-use features provided by Access. Autogenerated metadata about the content include the date of entry (recorded when the entry is created), and will include a user name log once the database is open to additional users (currently, as the only data entrant, this was unnecessary). This concern permeated other data recording practices, including fields that document the excavator of the artifact, the archaeological responsible for the classification and description, and the technician conducting laboratory analysis when such details were available. Fields were also created in which reclassifications could be proposed by the author or other specialists, creating an analytical history of the ceramic. This is particularly important in avoiding confusion between original publications and updated data for artifacts that are reclassified as typologies and sequences are refined over time.

A1.2 Database Construction Theory

The purpose of a database is to provide a structured receptacle to record, consolidate, and access any type of information. The simplest and most efficient method by which to construct a database is through the use of a Data-base Management System (or DBMS). The DBMS is the software that functions as the mechanism by which data is consolidated, organized, and analyzed within a database. In form, the DMBS is a set of programs that is designed according to the structure of a data model[1056] to store and retrieve database information in an efficient and

[1056] The 'data model,' as defined by Codd (1980), consists of three components: a collection of data structure types; a collection of operators or inferencing rules; a collection of general integrity rules (Martin and Gutierrez 2006, 4).

convenient manner.[1057] The benefits associated with using a DBMS are the independence between the program interface and the data, and the ability to represent the complex relationships existing between the data.[1058] The use of DBMSs expanded rapidly among non-expert consumers through the introduction of the user-friendly Rapid Application Design products (RADs), such as Microsoft Office, FoxPro, DBASE, and FilmakerPro, for personal computers.[1059] Although the functionality and structure of these DBMS vary, the underlying rules associated with data structuring and information organization remain the same.

A database is formed through the ordering of data into one or more tables. Each entity (i.e. artifact) entered into a database is known as a 'record,' and represents one row within the table. The characteristics recorded for each entity are termed 'attributes,' and are entered into the columns of the table—each of which is known as a 'field.' Within a table, the 'primary key' refers to the entity attribute that acts for the index of the table. The primary key in a single table database acts as the name of the record, to which all other attributes are linked. The information contained in the primary key field must be unique, and is generally best represented in large databases by an autogenerated integer. For complex data that requires the recording of a high number of attributes, a number of tables can be created in a hierarchical structure of nested relationships—this structure is termed a 'Relational Database.' Information is related through the use of 'foreign keys.' This attribute will be the primary key in one table (i.e. the Late Minoan 1A period in a chronological table), and will be entered as a foreign key in a related table (i.e. a table containing information on sites in Crete, for which one of the attributes is the date of occupation).

[1057] Silberschatz et al., 2001.

[1058] Martin and Gutierrez 2006, 5-6.

[1059] Ossa and Simon 2010, 4.

Data from two related tables are then connected through a series of 'joins.' These joins can be designed to reflect a variety of relationships.

The simplest type of connection is termed a 'one-to-one relationship,' and links a single field in one table to a single field in another. In this case, neither table may have multiple entries about the object in question. An example of this type of relationship would be that between two parents of a child, as only two individuals can be linked through the discrete event of reproducing a single offspring. Frequently however, relationships are not constrained to a single discrete connection, and can be represented by 'one-to-many' or 'many-to-one' relationships. These joins differ on the nature of the hierarchy between the two tables, appositely termed the 'parent' and 'child' tables. The 'one-to-many' join can be expressed as the relationship between a mother and her children (as a single female is capable of producing a number of offspring). A 'many-to-one' connection reflects the converse association, with the information on children stored in the 'parent table,' and connected to data on their mother in the 'child table' (many entities in the 'parent table' can connect to any single entity contained in the 'child table,' however no single member of the 'parent table'—in this case a child—can be connected to more than one mother). The most complex form of join is the 'many-to-many relationships' in which any number of entries in each table may be linked to any number within a second table. These relationships can be computationally problematic, and the prescribed solution is frequently to construct an intermediary table that captures each distinct relationship event between records.[1060]

When constructing and using a database, there are a number of problems that can be encountered, including data integrity issues, problematic entry forms, confusing menus and

[1060] Eiteljorg 2008, 79

dialog boxes, and tedious task sequences.[1061] There are a number of strategies to employ in order to avoid some of these issues. Before collecting data, it is important to address the following questions: what attributes are needed to answer the project research questions; how do these attributes related to one another; and what are the main organizing principles of the data.[1062] Tables should be designed and schematics of table relationships should be drawn and assessed before any steps are taken to construct the database. Important in this design phase is the table hierarchy, as well as the nature of the joins between the fields within them.

One of the central tasks in designing a database is to protect data integrity. There are three central principles that must be employed for this end. The first of which is to 'atomize' data into its smallest constituents. This ensures that multiple attributes are not recorded in a binding form in one field, for example, no single cell describing a Cypriot vessel should contain the information "White Shaved Juglet." This entry contains data on both the ware type and vessel shape, which should be separated into two different attribute categories. Secondly, data must also be 'normalized,' meaning that tables must be organized in order to avoid duplication of information. This will avoid incorrect query responses, as well as a bloated and redundant mass of information. Finally, data entry procedures must ensure 'referential integrity' between tables. This refers to the event in which an entry from the primary key in one table is removed, isolating any data that referred to this entry in a child table. For example, if a ceramic ware type is determined after further evidence to in fact be a variant of another ware type, and this entry is removed from a 'ware' table, all pots which list this original type in their table under a related foreign key will encounter a referential error. One strategy to avoid referential errors is to use

[1061] Hernandez 2003, 3.

[1062] Ossa and Simon 2010, 5.

'lookup tables' which provide a limited selection of options for any given field.

The final consideration advocated by database design experts is the importance of metadata, or information about the database itself. All elements, from the scope of the data set, to the database structure and attribute meanings, must be explicitly defined through the use of a database dictionary.[1063] Metadata can be divided into two functional groups—Structural Metadata and Descriptive Metadata. The first refers to the design of data structures (data about data containers), while the later refers to the data content. For content, it is necessary to address the nature of null columns (a field for which no data was entered). It must be clear whether this absence refers to a lack of knowledge, a zero value, or a lack of attribute applicability. It is also crucially important to track the data itself, from initial entry through any alterations. This can be done through a variety of methods, including time and technician ID stamping, ghost tables, or manual comment entry. Any necessary changes to the structure of the database required by the nature of the data for this project were tracked throughout the data acquisition process.

[1063] Eiteljorg 2008, 88.

APPENDIX 2 – DATABASE DICTIONARY

ID TABLE

ID Number	IDNumPk	Autogenerated number; the primary key of the table	Integer
Entry Date	EntryCreated	Time stamp on initial record entry	Date
Site Number	SiteNumFk	Foreign key linking to the Site Table	Integer
Context Number	ContextNumFk	Foreign key linking to the Context Table	Integer
Catalogue	Catalogue	Number given to the record in its original excavation/publication	Short text
Publication Source	PublicationSourceFk	Foreign key linking to Source Table	Integer
Period Number	PeriodNumFk	Foreign key linking to the Period Table	Integer
Ware Number	WareNumFk	Foreign key linking to the Ware Table	Integer
Sherd Type	SherdType	Lookup table; multiple entries allowed; new entries allowed	Rim Body Base Handle Multiple Whole
Sherd Size	SherdSize	Lookup table; multiple entries allowed; new entries allowed	Bits (0-1cm) Small (1-3cm) Medium (3-5cm) Large (5-10cm) VeryLarge (>10cm)
Percent Vessel	PercentVessel	Estimation of amount represented	Integer
Comments	IDComments		Long Text
Form/Shape	FormShapeNumFk	Foreign key linking to the FormShape Table	Integer
Form/Shape Subgroup	FormShapeSubgroupNumFk	Foreign key linking to the	Integer

		FormShapeSubgroup Table	
Form Comments	FormComments	Lookup table; multiple entries allowed; new entries allowed; assigned by Me	Unknown Open Closed Plate Bowl Chalice Lamp Lid Krater Cookpot Cup Goblet Stand Jar Jug Juglet Pitcher Amphora Pithos Bottle Flask Askos Kernos Teapot Strainer Miniature
Is it an open shape	IsOpen	Yes/No	Yes = Open No = Closed
Height	Height	Number in cm	Integer
Maximum Diameter	MaxDiameter	Number in cm	Integer
Body Type	BodyTypeNumFk	Foreign key linking to the BodyType Table	Integer
Body Comments	BodyComments		Long text
Rim Type	RimTypeNumFk	Foreign key linking to the RimType Table	Integer
Rim Diameter	RimDiameter	Number in cm	Integer
Rim Comments	RimComments		Long text
Base Type	BaseTypeNumFk	Foreign key linking to the BaseType Table	Integer
Base/Foot Diameter	BaseFootDiameter	Number in cm	Integer
Base Comments	BaseComments		Long text
Number of Handles	NumOfHandles	Number	Integer
Handle Type	HandleTypeNumFk	Foreign key linking to	Integer

		the HandleType Table	
Handle Location	HandleLocation	Lookup table; multiple entries allowed; new entries allowed	Rim Neck Shoulder Body Unknown Multiple
Handle Length	HandleLength	Number in cm	Integer
Handle Width	HandleWidth	Number in cm	Integer
Handle Comments	HandleComments		Long text
Examiner	Examiner	Last name, First name	Short text
Material Type	MaterialType	Lookup table; multiple entries allowed; new entries allowed	Clay Metal Stone Multiple
Hardness	Hardness	The degree to which it is fired; Lookup table; multiple entries allowed	Low fired Soft Medium Hard Over fired Vitrified
Levigation	Levigation	Lookup table	Low Medium High
Porosity	Porosity	Judged by frequency of voids (refer to chart); Lookup table	Few Common Many
Inclusion Frequency	Inclusions	Frequency of inclusions (refer to chart); Lookup table	Few Common Many
Inclusion Size	InclusionSize	Size (refer to chart); Lookup table; multiple entries allowed; new entries allowed	Tiny Small Medium Large Very large
Inclusion Type	InclusionType	Identification of Inclusions; Lookup table; multiple entries allowed; new entries allowed	Shell Organics Charcoal Sand/quartz Lime/calcium Red grits, stone/jasper Black/dark brown mineral grits

			Mixed mineral grits Crushed calcite Mica Clay matrix nodules Grog Unknown
Surface Colour	SurfaceColour	Dominant colour of surface fabric; Lookup table; multiple entries allowed; new entries allowed	Red Tan Brown Black Yellow Pink Salmon Orange White Cream Blue Gray Green Peach
Surface Colour Comments	SColourComments	Munsell if available	Short Text
Fracture Colour	FractureColour	Dominant colour of interior fabric; Lookup table; multiple entries allowed; new entries allowed	Black Yellow Pink Salmon Orange White Cream Blue Gray Green Peach
Fracture Colour Comments	FColourComments	Munsell if available	Short text
Fabric Description	FabricDescription		Long text
Wear Evidence	WearEvidence	Yes/No	
Wear Type	WearType	Indications of use, pre-depositional; Sherd wear, post-depositional; Lookup table; multiple entries allowed; new entries allowed	Worn Burnt Lime-encrusted Cut/shaped Inscribed Pick-marks

			Residue Discolouration (from contents) Vitrified Drilled hole Other
Wear Comments	WearComments		Long text
Painted	Painted	Yes/No	
Patterned	Patterned	Yes/No	
Burnished	Burnished	Yes/No	
Light on Dark	LightonDark	Yes/No	Yes = Light on Dark No = Dark on Light; other
Decoration Type	DecorationType	Lookup table; multiple entries allowed; new entries allowed	Painted Applied Incision Raised Stamped Multiple None
Decoration Location	DecorationLocation	Lookup table; multiple entries allowed; new entries allowed	Rim Neck Body Handle Base Inside Multiple
Decoration Comments	DecorationComments		Long text

SITE TABLE

Site Number	SiteNumPk	Autogenerated Number; primary key of the table	Integer
Site Name	SiteName		Short text
Modern Location	ModernLocation	Country in which the site is currently a part	Short text
Political Affiliation	PoliticalAffiliation	The community to	Short text

in the LBA		which it belonged (its own; larger kingdom; empire)	
Site Start Date	SiteStartDate	Date when the site was founded; date BCE (positive number)	Date/Time
Site Start Date	SiteStartDate	Date when the site was founded; date BCE (negative number)	Date/Time
Site End Date	SiteEndDate	Date when the site was finally abandoned; date BCE (negative number)	Date/Time
Excavation Start Date	ExcavationStartDate	Date when excavations first began at the site	Date/Time
Excavation End Date	ExcavationEndDate	Date when excavations ended at the site; for ongoing excavations enter 2013	Date/Time
Years Excavated	YearsExcavated	Total amount of excavations years between start and end dates; including breaks	Integer
Published up to	PublishedUpTo	Most recent excavation year published	Date/Time
Rough Site Size	SiteSize	Estimate; size in hectares	Integer
GIS – Latitude of Site	SLatCoord		Number
GIS—Longitude of Site	SLongCoord		Number
Site Description	SiteDescription	Comment	Long text

PHASE TABLE

Phase Number	PhaseNumPk	Autogenerated Number; primary key of the table	Integer
Phase Name	PhaseName	Name given to the phase by the excavators	Short text
Site Number	SiteNumFk	Foreign key linking the Site Table	Integer
Phase Start Date	PhaseStartDate	Start date for the phase	Date/Time
Phase End Date	PhaseEndDate	End date for the phase	Date/Time
Square Feet Excavated	PSqFtExcavated	From this Phase	Number
Ceramic Quantity—MNI	PCeramicQuantMNI	Total amount of ceramics excavated in this Phase in MNI	Number
Ceramic Quantity—Weight	PCeramicQuantWeight	Total amount of ceramics excavated in this Phase in weight (kg)	Number
Import Quantity—MNI	PImportQuantMNI	Total amount of imported ceramics excavated in this Phase in MNI	Number
Import Quantity—Weight	PImportQuantWeight	Total amount of imported ceramics excavated in this Phase in weight (kg)	Number

CONTEXT TABLE

Context Number	ContextNumPk	Autogenerated number; primary key for the table	
Context Type	ContextType	Lookup table; multiple entries allowed; new entries allowed	Cut Pit Garbage/trash Well Room floor Street surface

			Outdoor space Fill-room Fill-street Wall Oven/hearth Kiln Multiple Unknown
Context Condition	ContextCondition	Conditions that effect the context; Lookup table; multiple entries allowed; new entries allowed	In-situ Indoor debris Cleaned surface Interior fill/detritus Grab from feature Dump deposit-discrete Dump-accumulated Traffic worn Intrusive cut
Site Number	SiteNumFk	Foreign key linking to the Site Table	Integer
Phase Number	PhaseNumFk	Foreign key linking to the Phase Table	Integer
Period Number	PeriodNumFk	Foreign key linking to the Period Table	Integer
Trench Number	TrenchNum	Trench number as assigned in the excavation	Short text
Locus Number	LocusNum	Locus number as assigned in the excavation	Short text
Lot Number	LotNum	Lot number as assigned in the excavation	Short text
Square Feet Excavated	CSqFtExcavated	From this context	Number
Ceramic Quantity—MNI	CCeramicQuantMNI	Total amount of ceramics excavated in this Context in MNI	Number
Ceramic Quantity—Weight	CCeramicQuantWeight	Total amount of ceramics excavated in this Context in weight (kg)	Number
Import Quantity—MNI	CImportQuantMNI	Total amount of imported ceramics excavated in this	Number

		Context in MNI	
Import Quantity—Weight	CImportQuantWeight	Total amount of imported ceramics excavated in this Context in weight (kg)	Number
Analysis of Pottery Rating	AnalysisRating	Based on VanWijngaarden's system	1) The only thing that is known is that Mycenaean pottery has been found at the site 2) It is impossible to assign contexts to the Mycenaean pottery, either because it all comes from levelling strata, or because it is insufficiently published 3) For part of the Mycenaean pottery it is possible to assign a context. However, for a significant part this is not the case 4) For a significant part of the pottery it is possible to assign a context. However, associated objects are not (fully) known 5) For a significant part of the pottery it I possible to assign a context and associated objects are known to a large extent. 6) The excavation is fully published and contexts and associated objects can be assigned to all objects. Moreover, the Mycenaean pottery has been

			quantitatively analysed.
GIS – Latitude of Context	CLatCoord		Number
GIS—Longitude of Context	CLongCoord		Number
Excavation Date	ExcavationDate	Year in which this context was excavated (or first begun); note in comments if it extends beyond one season	Date/Time
Excavator	Excavator	Name of the Excavator/Supervisor for the area if known	Short Text; Last name, First name
Context Description	ContextDescription		Long text

PERIOD TABLE

Period Number	PeriodNumPk	Autogenerated number; the primary key in this table	Integer
Period Name	PeriodName	As assigned by the excavators	Short text
Period Start Date	PerStartDate		Date/Time
Period End Date	PerEndDate		Date/Time
Dating Comments	DatingComments		Long text

WARE TABLE

Ware Number	WareNumPk	Autogenerated number; the primary key in this table	Integer
Ware Name	WareName	Name given to the ware type	Includes specificity (i.e. PBR, BRI, BRII, BRU)

Period Number	PeriodNumFk	Foreign Key that links to the Period Table	Integer
Origin	Origin	Country of Origin	For the ware type; not necessarily the specific piece
Ware Comments	WareComments		Long text

FORMSHAPE TABLE

Form/Shape Number	FormShapeNumPk	Autogenerated number; the primary key in this table	Integer
Form/Shape Name	FormShapeName	Name given to the form/shape type	Short text
Furumark/Astrom Number	FurumAstromNum	The combination letter/number code given in the typology	Short text

FORMSHAPE SUBGROUP TABLE

Form/Shape Number	FormShapeNumFk	Foreign key that links to the FormShape Table	Integer
Form/Shape Subgroup Number	FormShapeSGNumPk	Autogenerated number; the primary key in this table	Integer
Form/Shape Subgroup Name	FormShapeSGName	Name given to the form/shape subgroup type	Short text
Subgroup Comment	SubgroupComment		Long text

MOTIF TABLE

Motif Number	MotifNumPk	Autogenerated	Integer

		number; the primary key in this table	
ID Number	IDNumFK		
Decoration Type	DecorationType	Lookup table; multiple entries allowed; new entries allowed	Painted Applied Incision Raised Stamped Multiple None
Furum/Astrom Number	FurumAstromNum		Short text
Motif Location	MotifLocation	Lookup table; multiple entries allowed; new entries allowed	Rim Neck Shoulder Body Handle Base Inside Multiple
Motif Colour	MotifColour	Lookup table; multiple entries allowed; new entries allowed	Black Yellow Pink Salmon Orange White Cream Blue Gray Green Peach
Motif Comments	MotifComments		Long text

RIMTYPE TABLE

Rim Type Number	RimTypeNumPk	Autogenerated number; the primary key in this table	Integer
Rim Name	RimName	Based on Horowitz's terms Lookup table; multiple entries	Straight Hook Thickened Flared

		allowed; new entries allowed	Funnel Inturning Everted Flanged Hole mouthed straight Trefoil, straight edge Trefoil, folded edge Tapered Folded Rolled out Rolled in Lid ridge Rail rim Mushroom bottle Folded funnel Hammer Pinched Open spout/cutaway Beak-spout Platter Double Flattened Flowerpot Unknown Spout Unknown
Rim Description	RimDescription		Short text
Furum/Astrom Number	FurumAstromNum		Short text

BODYTYPE TABLE

Body Type Number	BodyTypeNumPk	Autogenerated number; the primary key in this table	Integer
Body Name	BodyName	Based on Horowitz's terms Lookup table; multiple entries allowed; new entries allowed	Body wall Neck wall Carinated body Open spout Closed spout Strainer holes Stopper

			Shoulder wall Goblet stem
Body Description	BodyDescription		Short text
Furum/Astrom Number	FurumAstromNum		Short text

HANDLETYPE TABLE

Handle Type Number	HandleTypeNumPk	Autogenerated number; the primary key in this table	Integer
Handle Name	HandleName	Based on Horowitz's terms Lookup table; multiple entries allowed; new entries allowed	Strap Round-sectioned Lug Knob or tab High loop Ribbon Spiral Twisted Double-rounded Pierced knob Basket handle Vertical lug Unknown
Handle Description	HandleDescription		Short text
Furum/Astrom Number	FurumAstromNum		Short text

BASETYPE TABLE

Base Type Number	BaseTypeFumPk	Autogenerated number; the primary key in this table	Integer
Base Name	BaseName	Based on Horowitz's terms Lookup table; multiple entries	Flat Ring Concave Convex

		allowed; new entries allowed	Rounded Disc Button Pointed Tripod or Quad Foot Unknown Faceted Flat with hole cut pre-firing Disc with hole cut pre-firing High-angle flat Knob/lid top Ring base with hole Rounded base with hole
Base Description	BaseDescription		Short text
Furum/Astrom Number	FurumAstromNum		Short text

FURUM/ASTROMNUM TABLE

Furum/Astrom Number	FurumAstromNum	Autogenerated number; the primary key in this table	Short text
Furum/Astrom Description	FADescription	Furumark/Astrom number; description	Short text

ANALYSIS TABLE

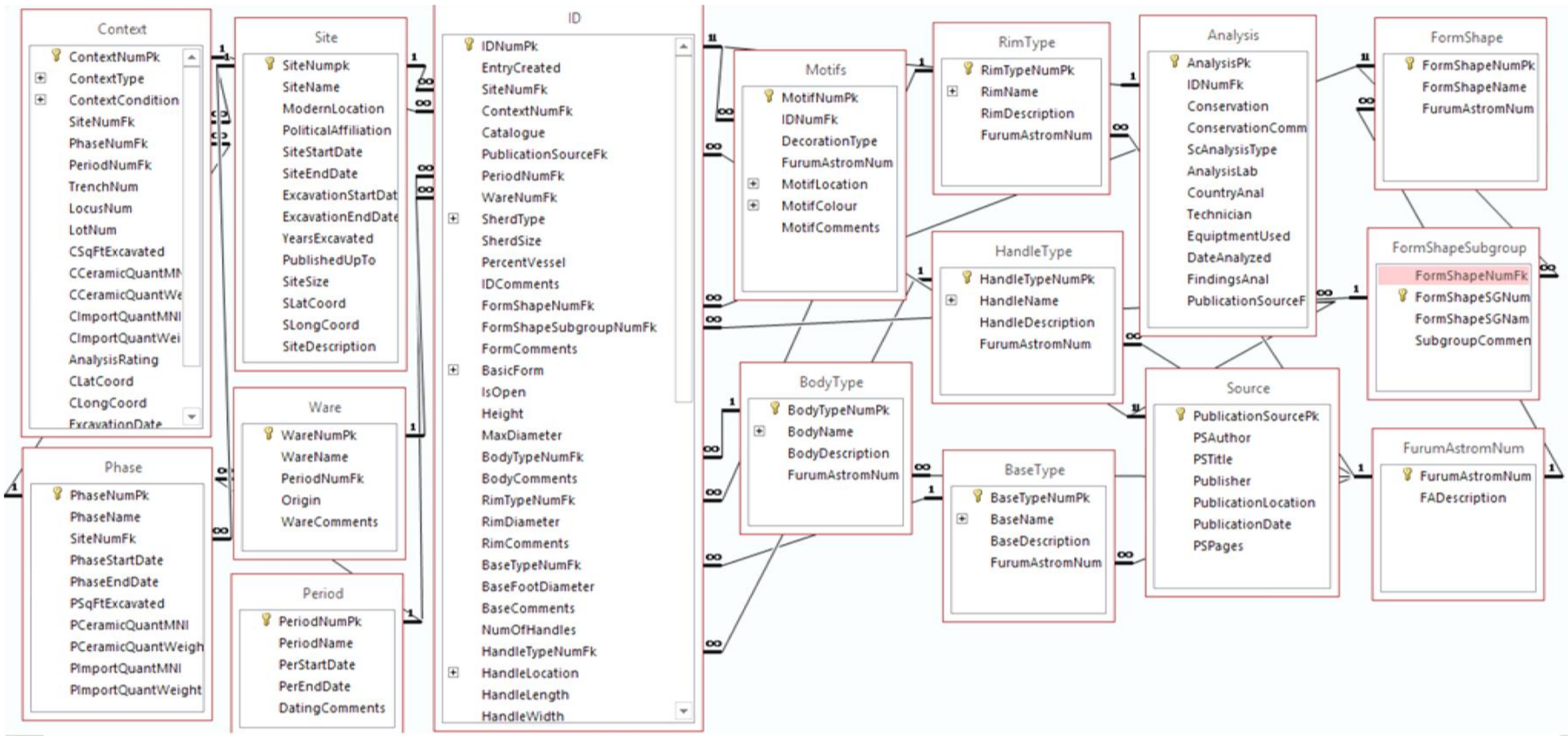
Analysis	AnalysisPk	Autogenerated number; the primary key in this table	Integer
ID Number	IDNumFk	Foreign key linking to ID Table	Integer
Conservation Done	Conservation	Yes/No	
Conservation Comments	ConservationComments		Long text

Analysis Type	ScAnalysisType		Short text
Analysis Lab	AnalysisLab	Lab where the analysis took place	Short text
Country of Analysis	CountryAnal	Country of the Lab	Short text
Technician	Technician	Last name, First Name	Short text
Equipment Used	EquipmentUsed		Short text
Date Analyzed	DateAnalyzed		Date/Time
Findings of Analysis	FindingsAnal		Long text
PublicationSourceFk	PublicationSourceFk	Foreign key that link to Source Table	Integer

SOURCE TABLE

Publication Source Number	PublicationSourcePk	Autogenerated number; the primary key in this table	Integer
Author	PSAuthor	Last name, First name	Short text
Title	PSTitle		Long text
Publisher	Publisher		Short text
Publication Location	PublicationLocation		Short text
Publication Date	PublicationDate		Date/Time
Pages	PSPages		Short text

APPENDIX 3 – DATABASE TABLES AND KEY RELATIONSHIPS



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