ÇAĞDAŞ ÖZDOĞAN THE INITIAL STAGE FOR EARLY BRONZE AGE CYPRUS: A MARITIME CROSS-CULTURAL PERSPECTIVE Bilkent University 2018

THE INITIAL STAGE FOR EARLY BRONZE AGE CYPRUS: METALLURGY OF THE PHILIA CULTURE FROM A MARITIME CROSS-CULTURAL PERSPECTIVE

A Master's Thesis

by

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To My Father, Yavuz Erdal ÖZDOĞAN

THE INITIAL STAGE FOR EARLY BRONZE AGE CYPRUS: METALLURGY OF THE PHILIA CULTURE FROM A MARITIME CROSS-CULTURAL PERSPECTIVE

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Çağdaş Özdoğan

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I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in the Department of Archaeology.

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ABSTRACT

THE INITIAL STAGE FOR EARLY BRONZE AGE CYPRUS: METALLURGY OF THE PHILIA CULTURE FROM A MARITIME CROSS-CULTURAL PERSPECTIVE

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The Philia phase is characterized by whole-scale changes in the economy, technology and society of Cyprus, which mark a profound break with the Chalcolithic period on the island. The products of this new culture were so distinct from the rest, that when Dikaios encountered the ceramic finds from this period for the first time, he named them "Philia", regarding the location of the finds in the cemetery of Philia Vasiliko at the Ovgos valley. However, the nature of this transition is still poorly understood since the discussion mainly revolves around population movement, cultural interaction, or local development. The literature often focuses specifically on the Philia period, disregarding the developments which led to the emergence of the Philia culture. In order to understand the intense changes of the island culture and emergence of the Bronze Age within in the island system, a broader viewpoint must be taken in a long-term temporal perspective. Therefore, this thesis will examine Cyprus as an island culture from the maritime outlook meanwhile analysing the metallurgical aspect of the Philia Phase, which helps one follow the distinct changes that took place in the island in connection with its neighbors.

Keywords: Early Bronze Age Cyprus, Eastern Mediterranean, Metallurgy, Philia Phase, Transmaritime Interactions

ÖZET

KIBRIS’TA ERKEN TUNÇ ÇAĞININ BAŞLANGICI: FİLYA KÜLTÜRÜNÜN METALURJİSİNİN KÜLTÜRLERARASI DENİZCİLİK AÇISINDAN İNCELENMESİ

Özdoğan, Çağdaş

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Filya dönemi, Kıbrıs’ta yaşanan geniş kapsamlı ve Kalkolitik dönemle büyük farklılıklar gösteren ekonomik, teknolojik ve sosyal değişikliklerle karakterize edilmektedir. Bu yeni kültürün ürünleri diğerlerine nazaran o kadar farklıydı ki, Dikaios bu döneme ait seramik buluntularıyla ilk defa karşılaştığında onlara bulundukları yer olan Ovgos Vadisi’ndeki[1] Filya[2] Vasiliko mezarlığına ithafen “Filya” ismini verdi. Ne var ki, tartışma çoğunlukla nüfus hareketi, kültürel etkileşim veya yerel gelişmeler üzerine odaklandığı için bu geçiş sürecinin doğasını anlama çabası yetersiz kalmaktadır. Literatür sıkça Filya dönemine odaklanmakta ve Filya kültürünün ortaya çıkmasına yol açan değişimleri göz ardı etmektedir. Ada kültüründe yaşanan çarpıcı değişimleri ve ada sisteminde Bronz Çağ’ın ortaya çıkışını anlamak için, uzun vadeli ve daha kapsamlı bir bakış açısı kullanılmalıdır. Bu bağlamda bu tez Kıbrıs’ı bir ada kültürü olarak denizcilik perspektifinden ele alırken Filya döneminin metalürjik yönünü analiz etmekte ve adanın komşularıyla bağlantılı olarak yaşadığı değişimleri genel hatlarıyla incelemektedir.

[1] ¨Ovgos Vadisi: Türkçe isimlendirmesi yapılmamıştır. Halk arasında genel olarak bir bölümü İkidere

[2] Serhatköy (Kızılduman, 2004: 199).

Anahtar Kelimeler: Denizaşırı İlişkiler, Doğu Akdeniz, Erken Tunç Dönemi Kıbrıs, Filya Dönemi, Metalurji

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CHAPTER I

INTRODUCTION

1.1 Cypriot Archaeology and the Philia Phase

The transition from the Late Chalcolithic (ca. 3000 BC) to the Early Bronze Age (ca. 2500 BC) in Cyprus is not as well defined as in other regions of the contemporary eastern Mediterranean cultures and represents a unique chronological data-set. In this respect, several periodization schemes were created, adopting different terminologies. Various scholars have categorized the chronological stages of Cyprus for the Prehistoric periods whose periodization schemes from 4000 to 2000 BC are classified as: Early Chalcolithic Period (4000-3500 BC); Middle Chalcolithic Period (3500-3000/2700 BC); Late Chalcolithic Period (3000/2700-2500 BC); Early Bronze Age Period: (2500-2200 BC: Philia Phase and 2200-2000 BC: Early Cypriot I-II-III) (Table 1). The discussion in Cypriot archaeology mainly revolves around the transition from the Chalcolithic period to the Philia phase and its continuity throughout Early Bronze Age Cyprus (Dikaios, 1962; Stewart, 1962; Mellink, 1991; Webb & Frankel, 1999; Knapp, 2008; 2013; Knapp et al. 1990; Steel, 2004; Keswani, 2004; Peltenburg, 1991a; Peltenburg et al. 1998; Manning, 2013).

Since the 1960s, there has been a heated debate between Cypriot archaeologists about the beginning of the Bronze Age in Cyprus and the decisive role of the Philia cultural phase. On the one hand, Stewart (1962: 296) believed that the Philia culture was a diverse regional chronological phase, restricted to the northwest and center of Cyprus and contemporary to the Early Cypriot period. On the other hand, according to Dikaios (1962: 190-91), the Philia phase was an island wide phenomenon and, as an earliest distinct cultural phase, marks the beginning of the conventional Bronze Age in Cyprus. Excavations at three sites have provided important evidence for this debate: Kissonerga-*Mosphilia* (Peltenburg et al. 1998), – which is the only site showing the direct transition from the Late Chalcolithic period to the Philia phase; Sotira *Kaminoudhia* (Swiny et al. 2003), – a major cemetery site from the Philia period to Early Cypriot I-II; and conclusive subsequent findings at Marki-*Alonia* (Frankel & Webb, 1996; 2006) – which is the only settlement showing continuous development from the Philia Phase to the Middle Cypriot period (Table 2, Figure 1). In 1999 Webb and Frankel, who excavated Marki-*Alonia*, identified at least 19 Philia sites restricted to the west, southwest, and center of the island. These Philia sites archaeologically proved that the Philia phase[3] is chronologically earlier and culturally ancestral to Early Cypriot I-II (2200 – 2000 BC), changing the cultural dynamics of Cyprus consequentially (Peltenburg, 1991; Peltenburg et al. 1998; Webb & Frankel, 1999; Steel, 2004: 121; Knapp, 2013: 265; Manning, 2013).

[3]Webb and Frankel (1999) labeled this phenomenon as 'the Philia *facies*'.

The Philia period is now considered an initial phase for the traditional early Bronze Age on Cyprus, and dates to ca. 2500 BC. It is noteworthy that while the beginning of the Bronze Age in Anatolia, Egypt, the Levant and the Aegean dates to around 3000 BC, the transition to the Bronze Age in Cyprus was delayed for almost 500 years compared to its neighbors.

1.2 Cyprus as an Island Culture

It is suggested that communities from Cyprus between 7000 and 2500 BC did encounter genuine difficulties in maintaining external contacts, because of the geographical position of the island – distance, visibility and landfall – along with natural forces – wind and current – which had a great impact on the inaccessibility of Cyprus from the outside world (Manning & Hulin, 2005; Broodbank, 2008). Around the 8th mill. BC, the eastern Mediterranean shoreline took its form at a level close to the current one: for instance, between the 7th and 6th mill. BC, sea level was just 5.5 m below the level from our time (McGrail, 2001: 88-89). This rise in the sea levels possibly caused a certain remoteness for Cypriot culture from the outside world for a long while. Archaeological evidence supports that the rising sea levels together with the naturally occurring visible distance between Cyprus and the mainland, created a relative insularity for the island culture for almost 4000 years (Knapp, 2103: 477-481).

Up to date studies from Cyprus, mostly coming from the well-known prehistoric site of Kissonerga-*Mosphilia* now indicate that the apparent isolation of the island started to break down with the emergence of the Late Chalcolithic communities (Peltenburg, 2007; Bolger, 2013; Knapp, 2013: 260, 477-482, Broodbank, 2013: 342-344). This may be due to the development of maritime social relationships between people and the sea as well as the technology – necessary knowledge and skills for seafaring in the eastern Mediterranean (Wachsmann, 1998; Farr, 2006; Fitzpatrick & Anderson, 2008; Broodbank, 2013; 2016).

1.3 A Maritime Perspective of the Late 4th to 2nd mill. BC Eastern Mediterranean

1.3.1 Nautical Developments

In the eastern Mediterranean, the most important aspect of ancient seafaring was the ability to build seagoing sailboats. Nautical studies indicate that throughout the 3rd mill. BC, sailing vessels were gradually used by the eastern Mediterranean cultures as they developed the knowledge of seas and sea travel (Figure 2) (Wachsmann, 1998; Broodbank, 2013: 282-355; 2016). Especially the sailing technology began to play a significant role in the development of various maritime cultures. Exactly when and where the peoples of the eastern Mediterranean first started building seagoing vessels and invented sailing technology, are still both debated. However existing nautical evidence from the region indicates that coastal sea plains of Egypt and the Levantine mainland have the right to claim to be the cradle of the eastern Mediterranean seafaring actions. The maritime knowledge of these cultures, therefore, played an essential role in the development of seafaring activity, reflecting the nautical capabilities of the various eastern Mediterranean maritime cultures (Broodbank, 2013: 290-292).

It is suggested that the developing sail technology as a profound "game-changer" played a significant role for the earliest maritime connectivity of the eastern Mediterranean cultures (Broodbank, 2016: 26). The earliest sail depiction from the eastern Mediterranean comes from Egypt, which is shown on a Naqada II jar of ca. 3400-3300 BC. It is a red ware pottery jar, depicting a vessel under sail beneath a checkerboard pattern (Figure 3) (Huyge & Darnell, 2010). It suggests that sail technology first appeared on the Nile during the Naqada IIc/d Period. Adaptation of the sail corresponds to various changes including the northern expansion of Naqada culture. The changes which took place in Naqada IIc/d such as the shipping of bulk cargoes, relocation of settlements to the Nile Delta, and increase of Naqada influence in Lower Egypt and Nubia are all associated with the sail (Mark, 2013). It is suggested that rather than "the treacherous waters of the Red Sea", Egyptian sailors first trained in the Nile River and afterwards they learned how to sail on the open seas in the Mediterranean (Mark, 2013: 34).

Archaeological evidence demonstrates that over the following millennia, communities from the Nile Delta, a waterfront land connecting Egypt to the open sea, became the driving forces of maritime changes across the eastern Mediterranean through creating a nautical connection. Around 2700 BC, with their developing maritime knowledge, Egyptian seafarers from the Nile Delta had already established a coastal seaborne commerce with the Levant due to the increasing demand for imported wood to construct monumental buildings (Broodbank, 2013: 286, Fig. 7.15). As an alternative route for overland intervention, the coastal sea-route possibly offered more efficient and fast-moving transportation of bulk northern Levant cedar wood (*Cedrus Libani*) to Egypt, where timber was not only desired for coffins and architecture but was also used for shipbuilding. It is also noteworthy that the cedar tree, which can reach more than 40 m, provides long continuous lengths of a hard wood vital for seafaring vessels, making the boat safer for long distance voyaging (Broodbank, 2013: 286-288). Since no seagoing vessel from the period has yet been found in the eastern Mediterranean, nautical data from Egypt provide valuable insights. The textual evidence, such as an inscription of the pharaoh Sneferu (2613-2589 BC) mentions a fleet of 40 ships transporting wood, while the iconographic evidence of the funerary monuments of Sahure (2487-2475 BC) and Unas (2375-2345 BC) depicts the earliest solid, seagoing ships (Broodbank, 2013: 291-292, Fig. 7.21). While the evidence denotes that the maritime network of sea trade between Egypt and foreign lands existed, a restored full-size ancient riverine craft, the solar boat of Khufu (ca. 2500 BC) from Giza provides solid evidence for the construction of a prehistoric long-vessel. It is a boat with a length of 43m made of 12 tons of cedar wood, brought from Lebanon. Although it was constructed as a riverine boat, the stout length of wood used in the vessel is not only a proof of the proficiency of ancient Egyptian shipbuilders for constructing long riverine craft but conceivably supports their capacity to construct an efficient seagoing vessel similar to the textual and iconographic records (Broodbank, 2013: 288, Fig. 7.17).

The archaeological and textual evidence maintains that the cultural interaction between the Old Kingdom (27^{th} to 22^{nd} centuries BC) of Egypt and the Levantine mainland was further intensified by sea through following the earliest maritime route in the late 4^{th} mill. BC and developed temporally throughout the 2^{nd} mill. BC (Broodbank, 2013: 287-288). Apparently long-range transmaritime interaction was intensifying in the eastern Mediterranean by 2700 BC and rose rapidly after 2500 BC, when it extended from the eastern Mediterranean to the Aegean. Byblos, a significant coastal city in the northern Levant, had established a maritime relationship that reached as far as the Aegean Sea by following the coastal sea route of southern Anatolia. Throughout the 3rd mill. BC the littoral seaways from the Nile Delta to the Aegean Sea – covering most of the eastern Mediterranean seashores, was used for transmaritime communication by skilled seafarers, who created a significant level of material exchanges and advanced the maritime technology in the eastern Mediterranean (Broodbank, 2013: 282-288). As a result, nautical expertise was shared from Egypt and the Levant to the Aegean world. "...The expansion of imagery of early sailing craft plots a westward uptake over almost 2,000 years, from the earlier 3rd mill. BC on the Nile and by inference along the Levantine coast, to around the start of the 2nd mill. BC in the Aegean…" (Broodbank, 2016: 27). Incidentally, the earliest definite image of a sailing ship from the Aegean was depicted around the end of the 3rd mill. BC on a seal stone found in southern Crete with the illustration remarkably presenting a generic similarity with the Byblos Ship iconography (Figure 4).

The maritime evidence summarized here is mostly drawn from Broodbank (2008; 2013, 2016) and is likely to indicate that seaborne sailing technology and mentality emerged during the 3rd mill. BC, and became a shared knowledge for sea voyage, changing the destiny of the eastern Mediterranean cultures through exploration, communication, trade and migration from the 4th to the mid 2nd mill. BC. While the eastern Mediterranean cultures became fully connected with the developing maritime process, the growing connectivity in the region eventually affected the seclusion of Cyprus.

1.3.2 Maritime Connectivity

In his eminent work on the Mediterranean, Braudel proposed that 'the sea was created by the movements of individuals (as agents), the relations they imply, and the routes they follow' (1972: 276). From the earliest time, ancient cultures were intensively engaged in extraction, exploitation and production of a wide range of raw materials. The richness of the raw materials (obsidian, wood, metals and different alloys, etc.) makes the eastern Mediterranean one of the most significant sea basins, where ancient cultures from Egypt, the Levant, Anatolia and the Aegean used the sea for travel, to explore, collect and obtain various natural sources at different times for their necessities. For instance, during the Neolithic period the Cycladic island of Melos became one of the main obsidian resources for the Aegean cultures that were exploited and distributed to different places. Earliest evidence for the exploitations of Melos obsidian and its sea transportation come from the Cave of Franchthi in the Argolid (North-East Peloponnese), ca. 120 km far away from the island of Melos (Broodbank, 2013: 152).

With time, obsidian, as an overriding raw material of the Neolithic and Chalcolithic periods, lost its importance and eventually metal took its place with the Early Bronze Age period. The archaeological evidence indicates that by the 3rd mill. BC., the metallurgical activities which had become widespread in the eastern Mediterranean cultures engaged in intensive extraction, exploitation, and the production of different metals throughout the 2nd mill. BC (Kassianidou & Knapp, 2005; Sherratt, 2007: 252; Yalçın, 2008; Broodbank, 2013: 336-339).

Therefore, at some point, like in the case of Melian obsidian, the quest for fresh raw materials may purposely have directed wandering seafarers of the eastern Mediterranean to Cyprus, which offers one of the richest copper resources in the eastern Mediterranean (Broodbank, 2000: 297-298). Broodbank (2013: 344) suggests that "certainly, sailing ships passing close to the island must have infringed Cyprus's seclusion". Therefore there is always a possibility that as agents, skilled seafarers from the eastern Mediterranean deliberately set their sails to Cyprus for maritime exploration, and finally realized the copper wealth of the island. It suggests that available local copper reserves in Cyprus, which were realized by the other eastern Mediterranean cultures, played a major role for the development of the island culture (Stewart, 1962; Mellink, 1991; Webb et al. 2006; Kouka, 2009; Webb & Frankel, 2011; Webb, 2013; Peltenburg, 2013: 344-346).

On the other hand, in contrast to intentional landing, it is also possible that the isolation of Cyprus was terminated by accidental arrival. It should be considered that sea voyages are always risky and difficult due to the nature of the sea itself and could be extremely perilous for the ancient seafarers. During a journey, ancient seafarers could face bad weather conditions or technical problems, resulting the ship to sink or drive them off course to undetermined places. The oldest known shipwrecks of Dokos, Gelidonya, Uluburun and Point Irion from south Anatolia and the Aegean are good examples of how unexpected circumstances caused the ships to sink in the ancient times. Differently from the archaeological evidence, rare existing textual data also provide an example of ships being blown off course and landed in an unanticipated place. As a sailor's report (historically fictional or not), *The Story/Tale of Wenamun* mentions that after Wenamun sets sail to Egypt from Byblos, he lands on an unexpected place of *Alasiya*, where he had some trouble. Therefore, from my point of view it is also possible that due to the changing weather conditions sailing ships passing close to Cyprus could have made unplanned arrivals to Cyprus, where they became aware of fresh copper sources, temporally breaking the Cypriot isolation.

It is also argued that the relationship between Cyprus and its neighbors was often the result of deliberate choices by Cypriot communities to engage – or refuse to engage – with the extra-insular domain (Peltenburg, 2007; Bolger, 2013). Therefore as opposed to the intentional and unintentional external landing to Cyprus, one should also consider the role of the development of maritime technology as a local process where native seafarers from Cyprus as agents found a way to break the isolation of the island. Since Cypriot communities resided on a piece of land surrounded by water, it is reasonable that they may have felt in control of their insularity. As an island culture, some communities must have had a certain level of interaction with the sea and therefore the island itself became the primary driving force for breaking the isolation. In addition to this, cedar-wood, which is needed for crossing the open sea is not only native to Lebanon but also can be found on the mountains of the eastern Mediterranean basin, including Cyprus, such as *Cedrus brevifolia* (Cyprus cedar) (Eliades et al. 2011). From this assessment it can be proposed that thanks to the availability of the essential materials -especially local cedar wood-, the maritime communities from Cyprus as an island culture always had the potential to build seagoing vessels that would break the isolation and encouraged the islanders to reach out to the mainland regions and interact with them.

1.4 Breaking the Apparent Isolation

It is suggested that communities in the eastern Mediterranean from the late 4th mill. BC to the early 3rd mill. BC faced climatic aridification that instigated severe results for their livelihood. The profound changes in the climatic and environmental conditions may have forced the communities of the eastern Mediterranean to seek new and more liveable places (Clarke et al. 2015, fig. 1). Archaeological evidence suggests that like the other eastern Mediterranean cultures, these prompt changes possibly affected the communities of Cyprus (Clarke et al. 2015: 14-15). For instance, at the end of the Middle Chalcolithic period (ca. 3000 BC), the settlements of Lemba, Erimi and Kissonerga-*Mosphlia* from the southwest of the island were abandoned and left unoccupied for a period of around 200 years, which was interpreted as "a rapid collapse in the west of Cyprus" by Peltenburg (Peltenburg, 1990: 18; Steel, 2004: 106; Knapp, 2103: 245-246). Not only at this time in the west, but also similar dates have been suggested for the abandonment of less well-known Chalcolithic settlements at Kythera, Lapithos, and Ayios Epiktitos-Mezarlık from the north (Frankel et al. 2013: 95).

During the gap period, the only archaeological data comes from Politiko Kokkinorotsos, which is a Chalcolithic hunting station in central Cyprus, occupied around 2880-2670 cal. BC (Frankel et al. 2013). The studies suggest that around the end of the Middle Chalcolithic, there is a rise in hunting activity, for an economy that mainly relied on herded caprines, pigs and most importantly hunted deer (Croft, 1991). From the evidence, scholars consider that "deer-focused subsistence economies have also been seen as a feature of residential instability in early prehistoric Cyprus" (Frankel et al. 2013: 95). The instability of the Cypriot communities might also be the response to a widespread catastrophic episode, which forced them to establish contact with the mainland, or they decided to leave from the island in order to find a more habitable place for their own survival.

The earliest concrete evidence for the outside contacts of Cyprus, for instance, comes from metallurgical findings, which surprisingly dates to the gap period of the island. These are an axe from Pella in Jordan, found in a well-dated EB II hoard of ca. 3000 BC; and two daggers, a fish hook, and an awl from Hagia Photia, Crete at the EB I cemetery of roughly the same date (Philip et al. 2003: 87; Stos-Gale & Gale, 2003, table 5; Webb et al. 2006; Peltenburg, 2011) The lead isotope analyses show that their copper sources derived from Cypriot ores, suggesting communities from Cyprus and the mainland were aware of each other's existence and were capable of interacting during the late 4th to the early 3rd mill. BC (Bolger, 2013: 2). This could mean that during the gap period, either the local metallurgists conveyed the local copper sources to their different destinations or the island was visited by different individual seafarer metallurgists to transport Cypriot copper sources to the Aegean and Levant. Whatever the answer, metallurgical evidence clearly marks the initial stage for breakdown of the island's insularity. From the late 4th to early 3rd mill. BC archaeological evidence, including *metallurgy, ceramics, mortuary practice, figurines,* and *personal ornaments*, from the sites of Kissonerga Mosphilia and

Lemba Lakkous in the Paphos district, supports the view that inhabitants of the island and the Levant had created a certain level of cross-boundary communication/interaction (Bolger, 2013). Their material and cultural integration noticeably displays the island's earliest maritime connectivity with the mainland after 4000 years. It lasted for two centuries, until the emergence of the Late Chalcolithic period on the island.

At the end of the gap period, around 2700 BC, Cypriot communities created a new maritime connection with the Anatolian peninsula, generating various changes characterizing the materiality of the Late Chalcolithic (Broodbank, 2013: 343; Knapp, 2013: 260-262; Bolger, 2013: 15). For instance, the earliest evidence for Anatolian contacts comes from EB II Tarsus, in the form of sherds of Red-on-White pottery, which is the most common type of ware from Cyprus between c. 3900-2800 BC (Mellink, 1991: 170, fig. 3 Bolger, 2013: 4). It is suggested that since this type of pottery (RW) was no longer produced in west of Cyprus, sherds of Cypriot RW pottery at EB II Tarsus were possibly imported from the north/centre of the island, "pointing to the existence of northern precursors for 'sudden' Philia engagement in inter-regional contacts" (Peltenburg, 2011: 7). Regrettably due to the 1974 political incidences, there is very limited evidence from Northern Cyprus explaining what was happening before the pre-Philia period (Peltenburg, 2011: 6; Knapp, 2013: 31-32). After more than 40 years, the excavations in the north were very recent and just restricted to two archaeological sites in Tatlısu/Akanthou (Early Aceramic Neolithic sites) and Kaleburnu-Kral Tepesi/ Galinoporni- King's Hill (Late Bronze Age sites), while there are some survey and heritage projects being conducted under the aegis of the Department of Antiquities and Museums, Turkish Republic of Northern Cyprus.

They present very limited evidence from the northern part of the island for understanding Prehistoric Cyprus as an island wide phenomenon. Other than that, the archaeological occupations situated in Northern Cyprus -similar to archaeological sites worldwide- suffer from erosion and modern cultivation techniques, particularly ploughing that "every year, a bit more is shaved off buried strata and a bit more of the past becomes unreadable" (Wilkinson et al. 2006). In 2004, the survey project[4], which was conducted in the Güzelyurt/Morphou District of Northern Cyprus by Bülent Kızılduman demonstrates that over the last few decades the archaeological sites have been severely disturbed and jeopardized by modern activities, as well as illegal digging and looting. As Webb (2017: 129) emphasizes very recently "ongoing debate on the origin of the Philia (culture) is unlikely to be resolved until excavation and survey on the north coast and in the Morphou Bay/Ovgos Valley area are once again possible". The situation in the Karpass peninsula is more drastic, where traces of Ceramic Neolithic, Chalcolithic and Early Bronze Age have not yet been identified from the region. Since 1974 the only archaeological project in the peninsula started with the discovery of the metal hoards at the end of June 2004 in Kaleburnu-Kral Tepesi/ Galinoporni- King's Hill, which is severely eroding year-by-year due to natural conditions. The rescue excavations there continue to reveal spectacular archaeological evidence from the Late Bronze Age period (Müller & Kızılduman, 2004; Bartelheim et al. 2008; Kızılduman, 2017). It is undeniable that since 1974 all archaeological projects from Cyprus have been concentrated in the southern part of the island. Political incidences have resulted in an archaeological predisposition to interpret Prehistoric Cyprus, including the never-ending debate on the emergence of the Philia culture (Knapp, 2013: 31; Webb, 2017).

[4] G.A.Y.A.P. (Güzelyurt Arkeolojik Yüzey Araştırması Projesi) I. Dönem Ön Çalışmaları (Archaeological Surface Survey Project of Morphou) I. Preliminary Study Report.

In the south, however, Kissonerga-*Mosphilia,* as only site showing a transitional period from Chalcolithic to the Philia phase, is not only contributing to the Philia debate but also documenting most of the earliest Anatolian connections and inspirations in the archaeological record prior to the Philia phase. These mainly involve innovations in textile production (spindle whorls) and dress (annular shell rings/copper spiral rings); ceramic production (Red and Black Stroke Burnished ware and Red Polished Philia ware[5]); and stamp seals (as a possible indication for administration) (Table 3) (Peltenburg, 1991a; 2007; Peltenburg et al. 1998; 256-257). It is suggested that these changes were not brought to the island from outside but were the result of an insular selection by the island culture, which decided where they wanted to establish contacts (Steel, 2004: 117-118; Peltenburg, 2007: 154; Bolger, 2007; 2013). More specifically, the interaction between Cyprus and the mainland was 'a matter of choice' and is likely to have resulted from deliberate decisions of Cypriot communities (Bolger, 2013). "It has become increasingly clear that issues of agency and identity have a fundamental impact on decisions by island communities to engage, or refuse to engage, in wider social networks" (Bolger, 2013: 15). Archaeological evidence from Cyprus shows that the initial reconnection with the Levant was dissolved sometime in the early 3rd mill. BC and by 2700 BC a new relation was created with Anatolia, temporally connecting island communities to external spheres of the eastern Mediterranean (Bolger, 2013: 15-16).

As a result of the increase in seaborne cross-boundary communication/interaction between Cyprus and Anatolia throughout the Late Chalcolithic period (2700-2500

[5]It is significant that Philia Red Polished pottery sherds were found in relatively small numbers at Late Chalcolithic Kissonerga (Period 4b), while the Late Chalcolithic site of Lemba, which was abandoned before the Philia, did not adopt this ceramic tradition (Bolger, 2013: 5).

BC), people began to immigrate to Cyprus with the Philia phase (ca. 2500), changing Cypriot cultural dynamics dramatically (Knapp, 2013: 260-262). The Philia phase marks a clean break with Chalcolithic Cyprus that the profound changes in the cultural system are presented by multiple lines of evidence recorded in the material culture, as well as the economic and social system of the island culture (Knapp, 2013: 346). These changes include new architectural planning (oval to rectilinear), settlement patterns (agglutinative), spatial organization (organized extra-mural cemeteries) and burial custom (new type of chamber tombs commonly used for multiple burials). Also pottery production ("adopted" innovative forms and techniques) and culinary traditions (new cooking and drinking practices; direct fire-boiling) show different traditions and novel technologies. As for subsistence strategies, agriculture (from Hoe-based to Plough-based; backed sickles for forest clearance) and animal husbandry, including a reintroduction of cattle (after almost 5000 years) along with new species (donkeys, screw-horned goats) show that the landscape of the island was transformed and the economy was altered by the new cultural system. These new species also brought secondary animal products such as milk, wool or hair to the island communities, who treated them in new ways. For instance, new types of spindle-whorls and loom weights illustrate the introduction of novel textile technology of the Philia phase. Most importantly, metallurgical production and exchange were developed and intensified by the Philia culture within local and extra-insular communications. These whole scale changes record a certain level of spatial organization and diverse specialized expertise. It is obvious that the Philia phase, as a new cultural and social system marks an important cultural stage in the external development of Cypriot community; nevertheless their ethnic derivation(s) or association(s) in the transformation have not been mapped or documented precisely[6] (Table 4).

1.5 Origins of the Philia Culture

Cultural transformation during the Philia phase represents a rapid "whole scale change in the island's material culture", however the dynamic of the transformation "still elicits lively debate" (Knapp, 2013: 261, 263). It has been broadly argued that the Philia culture emerged from an ethnic migration or colonization from Anatolia to Cyprus where Anatolian immigrants were responsible for the technological developments and social changes, as well as everyday practices (Frankel et al. 1996; Frankel & Webb, 1998; 2004; Peltenburg et al. 1998: 256-258; Steel 2004: 117-118; Peltenburg, 2007; Bolger, 2007: 164-70; Webb & Frankel, 1999; 2004; 2007; 2008; 2011, Frankel, 2000; 2005). It is suggested that awareness of the rich Cypriot copper sources played an important role in Anatolian immigration to the island, where most of the changes were directly introduced from Anatolia. These also resulted in Cypriot involvement in the "Anatolian Trade Network" (Kouka, 2009; Webb, 2013; Şahoğlu, 2005; see also Efe, 2007).

The discussion is enriched by drawing attention to the "cross-cultural links" between the eastern Aegean/western Anatolia and Cyprus from the early 3rd mill. to the early 2nd mill. BC (Kouka, 2009). Accordingly, the immigration process was generated by

[6] For detailed information and discussions on the transition to the Philia phase see Webb & Frankel 1999; Steel, 2004: 119-148; Knapp, 2013: 260-347; Peltenburg, 2013).

Aegean/Anatolian elites, “who wished to establish themselves in their homeland” (Kouka, 2009: 38). It is argued that the eastern Aegean/western Anatolia region and Cyprus were culturally interconnected since the beginning of the 3rd mill. BC, when “elite identities” from both sides of the Aegean as metalworkers-merchants in the “Anatolian Trade Network” learned about the islands’ rich copper sources. They eventually would have established a new and socially distinctive cultural phase in Cyprus around 2400 BC. The perspective suggests that the Philia phase and the *Anatolian Trade Network* system are just overlapping periods, and their interconnections created an extra-insular network system for Cyprus, where population movement as elite replacements from Aegean/Anatolia to the island created a new cultural system.

Archaeologically, the “Anatolian Trade Network” system (henceforth ATN) is recognized by the distribution patterns of new vessel forms (*depas* and tankard) together with wheel-made plates, two-handled cups, cutaway-spouted jugs and Syrian bottles. These appear in Anatolia and the Aegean towards the end of the Early Bronze Age II and at the beginning of the Early Bronze Age III period and are materially characterizing the ATN system (Table 5). Besides the material culture, the system also corresponds to changes in *organized settlement structures indicating the presence of a central authority; monumental fortification systems; large settlements with citadels and lower towns; first introduction of mass produced ceramics and the first examples of tin alloy* (Şahoğlu, 2005). However in Cyprus, apart from cutaway-spouted jugs and tin copper objects, there is no evidence for other critical elements of the ATN period. Although Kouka (2009) believes that most of the innovations and cultural traits were introduced to the island by the east Aegean/western Anatolian immigrant elite-identities, it seems likely that these "distinct" immigrant groups were not transmitting the major ceramic technology and its products (prestigious wheel-made vessels of *depas* and *tankard*) and most of the cultural traits of the ATN to Cyprus, which challenges the argument for the emergence of elite identities on Cyprus. There, architectural planning presents multi-roomed rectilinear houses in an agglutinative organization without *monumental fortification systems, citadel or lower towns* and there is no visible presence of *central authority* (for Anatolia see Şahoğlu, 2005; Efe, 2007; Bachhuber, 2014; for Cyprus see Papaconstantinou, 2013; 129-160).

Due to the fact that these significant features of the ATN cannot be attested in Cyprus, it has also been suggested that the immigration process happened just before the occurrence of the ATN system and before the ceramic innovations of EB III since wheel-made technology and its products of *depas* and tankard are not part of the "Philia repertoire" (Webb, 2013: 61).

Chronologically, the potter's wheel in the eastern Mediterranean was employed in the southern Levant since the late 5th mill. BC. In Anatolia the earliest adaptation of this technology dates to c. 2400 BC, but not throughout the whole area (Massa, 2016: 147-156). For instance, while wheel-made pottery first appears in Anatolia as imported products in the site of Kültepe around 2600-2500 BC, the technology was introduced to the site after one or two centuries (Efe, 2007; see also Massa, 2016: 148-152). It demonstrates that the introduction of wheel-made technology was not an independent innovation for Anatolia, but it occurred from 2400 to 1900 BC in a context of technological transmission from Syro-Cilicia to central Anatolia which spread directly from there to western Anatolia.

As popular wheel-made products, the circulation of drinking cups, such as *depas* (Figure 5) and tankard in Anatolia indicates that their production was assured by specialized workshops in relation with elite activities (Şahoğlu, 2014; Massa, 2016: 155). For Cyprus, it took the earliest wheel made pottery a longer time to appear, which occurred ca. 1650 BC (Crewe & Knappett, 2012: 179). The elongated delay in the introduction of wheel-made products and its technology to Cyprus may not only refer to the absence of specialized workshops but is likely also to indicate a social system without elites. As an interesting comparison, the earliest wheel-made pottery in the island of Crete appeared 250 years before Cyprus around 1900 BC (Crewe & Knappett, 2012: 177). As in Cyprus, *depas* did not appear during the Early Bronze Age (Şahoğlu, 2014: 266-277).

Metallurgical evidence demonstrates that during the Philia phase, Cyprus interacted with Anatolian and Aegean cultures. While Cyprus's role in the metal trade network remains unclear, communities from the island had access to the circulated metals of the ATN system, including imported metals: copper (from the Aegean and Anatolia) and tin (unknown origin) as well as precious metals (electrum: possibly originating from Anatolia) (Webb et. al 2006; Webb, 2013). Since both regions interacted with each other throughout the Philia period (ca. 2500-2200) the seafaring communities from Cyprus used imported metals but meanwhile did not adopt the wheel-made technology and its products, which were popular and widely used in Anatolia.

The Philia culture's ceramic traditions indicate that rather than directly importing Anatolian vessels, Cypriot communities preferred to make their own ceramics by replicating pottery-producing practices of Anatolia. Extra-insular relationships between the island and the Anatolian peninsula from the beginning of the Late Chalcolithic to the end of the Philia period show that pottery was never imported, but instead borrowed "Anatolianising" traits (Mellink, 1991: 172-173; Knapp, 2013: 272). The first known imported pottery vessels on the island date no earlier than the EC period, in the last centuries of the 3rd mill. BC (Bolger, 2013: 4). The individual interests of the island culture in their own ceramic manufacturing may explain why *depas* and tankard did not materialize in Cyprus. Additionally, in Anatolia, the various pits found in Küllüoba, Troy, Kanlıgeçit and Limantepe indicate that such wheel-made products of depata, tankards, plates, jugs were buried nearby public building areas with animal bones, suggesting "ritual feasting connected with elite activities" (Massa, 2016: 155). Since wheel-made products are associated with elite activities in Anatolia, it is evident that their absence in Cyprus also signals the absence of elite activity.

Whether the population movement of the Philia culture from Anatolia to Cyprus occurred before the ATN, or was contemporary to the trade system, it is clear that the Philia occupants of the island were not "interested" in wheel-technology and its products but were interested in conducting a metal trade with Anatolia and the Aegean. It seems that the absence of wheel made products, as well as most of ATN traits in the Philia phase remain one of the striking disconnections between Cyprus and Anatolia (Mellink, 1991: 173; Bachhuber, 2014: 144). In contrast, metallurgical studies do contribute positive evidence for our understanding of the social and interactive process of the Philia culture.

The distinctive features of Philia metallurgy, including technology and production and their significant association with the eastern Mediterranean cultures therefore have the potential to present a significant insight for understanding the emergence of the Philia culture. Webb and her colleagues (2006: 281-283) state that whereas "the role of Cyprus in this interaction is still poorly understood", the Philia culture "may itself have been a participant in the long-distance trade networks stretching from the Aegean to Cilicia and perhaps as far as north Syria" (see also Şahoğlu, 2005; Efe, 2007). They suggest that "these networks appear to have been mobilized primarily by Vasilia during the Philia EC…" and "…the north coast port of Vasilia can be seen to have participated directly…" as "…recipients of a systematic long-distance exchange in metals during the Philia period" (Webb et al. 2006: 283; Webb, 2013: 68). She highlights the role of Anatolia as the source of most innovations and assumes that Vasilia played a key role due to not only its coastal position to Anatolia but also its location to key communication routes in the Kyrenia range (Figure 6). It is obvious that the Panagra pass and the Ovgos Valley, where most of the Philia sites are present, would also provide easy access to the central plain of Cyprus, specifically to the substantial Philia settlement at Marki-*Alonia* close to the copper sources in Mathiatis (Figure 7). "There can be no doubt that prominent individuals at Vasilia played a key role in promoting these networks and ensuring a flow of metal to the north coast" (Webb, 2013: 63). Webb adopts Stewart's views (1962) on the centrality of the copper trade in prehistoric Bronze Age and argues that this thesis has been strengthened by recent metallurgical studies (Webb, 2013: 61, Fig. 2).

The centrality of the copper trade within the Philia cultural system has long been debated and still "continues to play a defining role in discussions of prehistoric Bronze Age Cyprus, albeit within a different chronological and historical frame work" (Webb, 2013: 61). Although Stewart and Webb emphasize the importance of the Ovgos valley and the central plain, they were not particularly interested in the whole island system, especially southwest of Cyprus, where habitation was considered to be more isolated (Webb, 2013: 60). It is notable that the Ovgos valley and central plain played a formative role in the establishment of an island-wide "Philia" cultural system. Bolger (2007: 163) suggests that however "in order to more fully understand the profound changes associated with the emergence of Bronze Age culture in Cyprus, it is necessary to examine socio-economic developments on the island prior to c. 2500 BC when traditional modes of existence began to be transformed by the influx of artifacts, cultural practices, belief systems and social groups from the surrounding mainland"[7]. In this respect metallurgical studies can provide significant insights into the pre-transitional period of the Philia phase and this can be contextualized within the *longue durée* process, where increasing maritime interaction and migration created social complexity and cultural progress for the island culture from ca. 3000 to 2200 BC. It seems that the Philia phase is the conclusion of a process that began in the Late Chalcolithic Cyprus. *Longue durée*

[7] In her study, Bolger only focuses on the ceramic evidence, which accordingly "can shed valuable light on the dynamics of culture change in Cyprus during the 3rd millennium by highlighting innovations in technology, production and distribution of material culture, and by furnishing evidence for investigating modes of cultural interaction between indigenous and foreign populations" (Bolger, 2007: 163).

perspective of the Philia period underlines the timing involved in this rapid cultural transformation. It suggests that the Philia cultural phase is not “a short-lived series of *events* but of long-term cultural *processes* spanning more than half a millennium” (Bolger, 2007: 165). This cultural process can be best perceived by the metallurgical advances of the island culture, which started from the Middle Chalcolithic (ca. 3500 BC) and accelerated from Late Chalcolithic period to the end of the Philia phase. Therefore the investigation of the systematic development of metal technology in Cyprus can shed valuable light on the nature of the Philia phase.

CHAPTER 2

THE DEVELOPMENT OF METALLURGY BY THE NEIGHBORS OF CYPRUS FROM THE EARLIEST STAGE TO THE END OF THE BRONZE AGE

2.1 Metals and Metalworking in the Eastern Mediterranean

Peltenburg (1990) suggests that “the beginning of the Cypriot Bronze Age needs to be viewed in the much broader context of the strife and upheavals that profoundly affected much of the East Mediterranean”. Therefore before moving to Cyprus, a general assessment of the metallurgy of the Eastern Mediterranean should be made in order to contextualize the changes in the island in a broader aspect. An interregional perspective in metallurgy demonstrates that metal production and consumption emerged in the eastern Mediterranean where mineral and native metal resources were relatively abundant (Yalçın, 2008). Whereas the beginning of metallurgy starts as an endogenous development in several places at different times, for its transformational stages, however, it is necessary to consider the role of interregional communication/interaction, as well as migration between different communities. Exogenous factors like these produced complex metallurgical technologies in the eastern Mediterranean regions.

It seems that the first metallurgical activities from the eastern Mediterranean started more than 10.000 years ago in Anatolia at the sites of Çayönü Tepesi (8200-7500 BCE) and Aşıklı Höyük (7800-7600 BCE), but they cannot be regarded as an isolated phenomenon. While in several places the emergence of metallurgy started at different times, archaeological evidence indicates that from the end of the 8th mill. to the 7th mill. BC, the earliest metallurgic activities occurred simultaneously in North Syria, upper Mesopotamia and Iran. The use of metal began a little later in the Levant, such as Jordan and South Syria towards the end of the 5th mill. BC (Yalçın, 2008: 18-19). This chapter aims to provide a brief introduction for eastern Mediterranean metallurgical development with a specific focus on the regions of Anatolia, the Aegean, Mesopotamia and the coastal Levant to evaluate Cypriot metallurgy from a general perspective.

2.1.1 Anatolia

The Anatolian peninsula, as a bridge connecting East and West, has a very large number of potential copper sources due to its geographical formation (de Jesus, 1980; Gale et al. 1985). "…Anatolia has extensive polymetallic deposits of copper, iron, lead, silver (often in the form of argentiferous lead), and zinc in addition to rarer deposits of antimony, arsenic, nickel, gold and tin" (Lehner & Yener, 2014: 531). Accordingly there are 415 copper-rich zones, more than 136 lead-zinc – copper ore deposits, and almost 200 silver-lead deposits (Yener, Geçkinli & Özbal, 1996: 375; Muhly, 2011: 859). In the Anatolian plateau, the largest sulfide ore deposits are located in the metallogenic districts of Ergani Maden in the eastern

Taurus, and Küre and Murgul/Göktaş in the Black Sea region (Lehner & Yener, 2014: 531). The richness of the metal resources made the Anatolian peninsula one of the most important regions in the eastern Mediterranean, itself recognized as "the cradle of the metal bearing cultures in the old world" (Yalçın, 2008: 25). While the history of Anatolian metallurgy can be studied for its earliest internal development, its long-term expansion in the Bronze Age should be considered from a broader context of the eastern Mediterranean (Gale, 1991: 41). When the Anatolian Trade Network, which was largely based on metallurgy and the trade in precious metals like silver and tin, gradually became active over a wider area in Early Bronze II-III, Anatolian cultures not only interacted with neighboring regions, but also started to play a leading role in the development of eastern Mediterranean metallurgy. It is suggested that "the merchants who systematically traded these Anatolian metals to distant areas must have acquired, in return, archaeologically invisible materials like textiles, perfumes, scented oils and wine" (Şahoğlu, 2005: 354). Therefore, the relationship between Anatolian communities and their neighbors is important for understanding the metallurgical developments of the eastern Mediterranean cultures. Archaeological evidence demonstrates that since Western Anatolia provides a bridge between the land trade routes of Anatolia and the sea trade routes of the Aegean, most of the western Anatolian and Aegean settlements also contributed to this trade network (ATN) (Şahoğlu, 2005: 354).

2.1.2 The Aegean

It has been argued that there were possible Anatolian influences on Aegean metallurgy in the 3rd mill. BC (Muhly, 1985a: 121-129). Material evidence indicates that the earliest metallurgical activities in the Aegean started during the Late/Final Neolithic in the 5th mill. and earlier 4th mill. BC. With the 4th mill. BC exploitation and working of gold and silver were also initiated in the region. As archaeological evidence reveals, the period between ca. 3200 and ca. 2700 BC still represents the earliest stage for Aegean metallurgy, and even then “there was a limited interest in metals in the Aegean in general” (Sherratt, 2007: 245). In the Aegean these activities peaked only with the Early Bronze II period in the middle of the 3rd mill. BC, when communities from the region participated in intensive exchange networks for metals with the eastern Mediterranean cultures, using not only inland roads but also seaways from Anatolia to the Levantine region, as far as Egypt. It has been suggested that “metallurgy came to the Aegean from the east. Whether its origin were in Mesopotamia or southern Anatolia, metalworking was practiced in both areas well before its relatively sudden arrival in the Aegean” (Renfrew, 1967: 14). On the other hand “Muhly maintains that Aegean metallurgy has its roots and closest parallels in the Balkans, where a strong metalworking tradition had developed much earlier – around the Late Neolithic of the Aegean (ca. 5500–4500 B.C) ” (quoted in Kassianidou & Knapp, 2005: 216). Latest researches from the neighboring region also suggest that metallurgical activities emerged in Western Anatolia from either the influence of Balkan metalworking or a result of local advancement in the Late Chalcolithic period (Keskin, 2016: 189). The important point is that the studies from both sides of the Aegean demonstrate that in the 3rd mill. BC, metallurgy truly began to flourish in the region and its related technology was developed progressively throughout the Early Bronze Age along with developments in seafaring, the intensification of trade, and the emergence of the maritime culture (Gale, 1991: 37-41; Kassianidou & Knapp, 2005: 217; Sherratt, 2007; Zimmermann, 2007; Keskin, 2016; for general discussion see Day & Doonan, 2007). Therefore while the origin of Aegean metallurgy can be considered an indefinite exogenous expansion or a local process, archaeological evidence demonstrates that its rapid development during the Bronze Age closely links to the integration of the ATN system, connecting the Aegean via Anatolia to the south, towards Cilicia, Syria and Mesopotamia (Şahoğlu, 2005; Keskin, 2016).

2.1.3 Mesopotamia

"That no site in Mesopotamia has produced as much native copper as Çayönü is not surprising, but there was certainly interest in obtaining the material" (Stech, 1999: 61).

The earliest copper object from northern Mesopotamia is an awl from Tell Maghzaliyeh, which dates around the 7^{th} mill. BC. Analysis indicates that the awl was made of native copper and its source could have come from Anatolia at the Ergani mine along with Anatolian obsidian (Muhly, 1989: 2-5). The 5^{th} and early 4^{th} mill. BC are considered a development stage in metallurgy since smelting technology was being used in Mesopotamia (Stech, 1999: 62). At the end of the 4^{th} and beginning of the 3^{rd} mill. BC, copper arsenic alloys were introduced, followed by tin and its alloy which became widespread over the entire Mesopotamian region during the middle of the 3rd millennium BC (ED III, 2600–2300 BC) (De Ryck et al., 2005: 266). Broodbank (2013: 336-337) emphasizes that "tin and its alloy appeared in Mesopotamia, Anatolia and rarely Egypt early in the 3^{rd} mill. BC, but quantities rose rapidly after 2500 BC, and spread to the northern Levant and Aegean, much probably in pre-alloyed form". This widespread appearance of tin demonstrates the intensity of exchange networks and interregional contacts between the eastern Mediterranean communities.

2.1.4 The Levantine Coast

The Levantine mainland, a connecting littoral corridor between Egypt and southeastern Anatolia, should be considered as two distinct regions: The northern Levant within the southeastern Anatolia interaction sphere; and the southern Levant directly related with the Nile Valley and Egypt from the late 4th mill. to the early 3rd mill. BC. (Suriano, 2014)

2.1.4.1 The Northern Levant

The northern part of the region is mainly associated with the Lebanese-Syrian coast, where copper objects first appeared in the Chalcolithic period as fishhooks, which were replacing bone predecessors (Artin, 2014: 249). The earliest copper fishhooks from the region were found in Byblos and Ras Shamra. Both are well-known regional coastal sites from the Chalcolithic period onwards; their location and fishbone remains indicate that fish was the important diet for these maritime communities, who used copper for making metal fishhooks.

Metallurgical evidence from the region also demonstrates that in addition to utilitarian copper objects, communities from the region used silver and gold as ornaments. It may indicate that while copper objects were preferred for hunting purposes (fishhook, arrowheads, daggers), silver and gold materials were mainly utilized for adornment. However an interesting fact for northern Levantine metallurgy is that although different metal objects were recovered from the region, evidence for local metal production is not yet attested there. Therefore it is suggested that such metal objects reached the region because of commercial activity connecting it with neighboring sites in Palestine, Egypt, and Anatolia. They were possible suppliers of metal objects, appearing while commercial activities extended throughout the Bronze Age, when the region became more connected with the eastern Mediterranean world (Artin, 2014: 218-220).

2.1.4.2 The Southern Levant

The situation in the southern Levant was different (Gale, 1991: 41-43). The emergence of metallurgy dates earlier than the northern part, around the late 6th mill. BC. Fenan, Timna and Sinai are the main mining sites in the southern Levant, and "produced the richest evidence for Early Bronze Age mining and smelting so far" (Genz, 2001). These main mining sites indicate that while copper production was conducted on a small scale in Early Bronze I, copper production intensified in the region during Early Bronze II-III. However, there is a clear separation between smelting activities and metalworking, specifically melting metal and producing tools. Smelting is only attested near the copper mines, whereas the metallurgical remains from Early Bronze II-III settlement sites point to the production of tools, weapons and other items in the settlement (Genz, 2001: 56). The axes from Early Bronze II Pella indicate that they were made from copper consistent with production from ore deposits in Cyprus and Anatolia, as well as the southern Levant (Philip et al. 2003).

These discoveries may indicate that the interregional metal trade actually had already started in the eastern Mediterranean during the early 3^{rd} mill. BC (Kassianidou & Knapp, 2005: 217).

CHAPTER 3

THE DEVELOPMENT OF METALLURGY ON CYPRUS FROM THE ORIGINS TO THE PHILIA PHASE

3.1 Dawn of the Cypriot Copper Age

3.1.1 Chalcolithic Finds

Metal production in Cyprus is one of the most fascinating and surprising technological aspects of the Cypriot culture. Although the Troodos Mountains from Cyprus contain one of the richest copper sources in the eastern Mediterranean, the first evidence for metalwork in Cyprus is distinctively dated no earlier than the Middle Chalcolithic period (ca. 3500-3000), while the beginning of metallurgy outside Cyprus dates to a much earlier time of the Neolithic in Anatolia, the Aegean and the Levant (Muhly, 1989; Gale, 1991; Peltenburg, 2001; Kassianidou & Knapp, 2005; Kassianidou, 2013a; Knapp, 2013: 230-232). It is generally accepted that while Middle and Late Chalcolithic metallurgical activities from Cyprus correspond to the earliest stage of Cypriot metallurgy, the transition from Chalcolithic to the Early Bronze Age Cyprus witnessed the radical and rapid changes in the metallurgical technology, as well as in the metalworking techniques employed. It is supposed that Cyprus did encounter genuine difficulties in maintaining external contacts from the end of the Late Aceramic Neolithic period (ca. 7000 BC) until the emergence of the Bronze Age culture, which is also known as the Philia culture (ca. 2500) (Manning & Hulin, 2005; Broodbank, 2008; Knapp, 2013: 260, 477-482). Within this distinct cultural phase, it is also suggested that some people and families from Anatolia began to immigrate to Cyprus, changing Cypriot cultural dynamic considerably and also affecting the development of the Cypriot metallurgy (Mellink, 1991; Frankel et al., 1996; Frankel & Webb, 1998; 2004; Peltenburg, 1990; 1991; 2007; 2013; Peltenburg et al. 1998: 256-258; Steel 2004: 117-118; Bolger, 2007; 2013; Webb, 2013; Webb & Frankel, 1999; 2004; 2007; 2008; 2011; Frankel, 2000; 2005 Kouka, 2009; Knapp, 2013: 261-263; Bachhuber, 2014). Although the Philia culture played a formative role in the establishment of advanced local metallurgy on the island of Cyprus, it must be emphasized that the Chalcolithic sites in southwest Cyprus also provide significant insights into the pre-transitional period, prompting the earliest metallurgical expertise of the island culture (Peltenburg, 1990; 1991; 2001; Peltenburg et al. 1998).

In Peltenburg's listing of metal finds from Chalcolithic Age Cyprus, they were distributed in the copper-poor southwest of the island, at the sites of Erimi, Souskiou-*Laona*, Souskiou-*Vathrykakas*, Kissonerga-*Mosphilia* and Lemba-*Lakkous*. Among the earliest metal finds are a spiral ornament and a corroded piece of copper from the Tombs 23 and 78 at Souskiou *Vathyrkakas*; a spiral ornament ("bead") and pendant (?) from tomb 158 and a blade, a pendant and "amorphous" fragments from Building 34 at Souskiou-*Laona*; and an object which may be a hook from Kissonerga-*Mylouthkia*, ca. 3500 BC (Table 6) (Figure 8) (Kassianidou & Knapp, 2005; Knapp, 2013: 229). From Erimi-*Pamboulla* comes the tip of a chisel, which is the first object as metal evidence ever found in Cyprus, dating to ca. 3200 BC. The excavation at Lemba-*Lakkous* recovered two copper based objects: a chisel and a corroded trapezoidal piece of metal. Gale (1991: 43-45) and Kassianidou (2013a: 231) recognize that even so, only eight copper objects are attested from the Middle Chalcolithic period, distributed over five sites. Knapp (2013: 232) considers that according to recent evidence “no more than 20 metal artefacts (ornaments, tools) can be dated to the Chalcolithic period”.

Despite the island’s rich copper resources, they started to be exploited long after metallurgy began in the eastern Mediterranean. This circumstance led Gale to suppose that early metallurgy (from the mid-4th mill. BC to the early 3rd mill. BC) on Cyprus was “primitive and provincial” – especially “when viewed from the standpoint of metallurgy in the surrounding mainland regions” (Gale, 1991: 54). The key to Gale’s argument is that Chalcolithic people on Cyprus, whether Cypriot or foreigners used non-Cypriot copper metal sources to make their metal objects through cold-working and annealing of copper, which were known and frequently practiced in Chalcolithic Cyprus. It is also worth mentioning, in this context, that because of the imported copper-based objects, Gale (1991) also discards Peltenburg’s hypothesis (1982) about the possible link between the exploitation of picrolite and copper.

3.1.2 Picrolite and Copper Relationship

3.1.2.1 Picrolite Sources in the Context of the Discovery of Copper

Peltenburg (1982: 53-56) suggested that the earliest Cypriot metallurgical activity resulted from a close connection with picrolite production. Picrolite is a blue and green soft rock used in prehistoric Cyprus to produce mainly ornaments and figurines that increased significantly during the fourth mill. BC, specifically in the “copper-poor” south and west of the island (Peltenburg, 1991b: 109-111; Xenophontos, 1991: 127; Knapp, 2013: 230-232). For instance, from the Chalcolithic periods there are almost 450 picrolite objects, mainly ornaments and figurines, while there are no more than 26 copper based ornaments and tools (Knapp, 2013: 232, Mina, 2014: 234). The higher number of the picrolite objects emphasizes that the raw material can be easily obtained from the available sources. Therefore, Peltenburg proposes that the great interest of the Cypriot Chalcolithic communities in picrolite production and its color likeness to copper triggered the first appearance of metallurgy on Chalcolithic Cyprus (Peltenburg, 1982).

According to Gale, however, this is not the case. After conducting chemical analyses on Chalcolithic objects, Gale (1991: 49-57) decided that associating the inauguration of metallurgy with the increasing exploitation of picrolite is not a valid assumption, since, according to him, the earliest copper artifacts were made from non-Cypriot (imported) copper metal and presumably imported as finished artifacts to the island. More specifically, lead isotope analysis from the only adequate available samples shows that an axe butt (KM 457) found from the tumble of building 86 at Kissonerga-*Mosphilia* was made from non-Cypriot copper metal and may represent an Anatolian origin as an exported object (Gale, 1991: 46-47, 56-57, Fig. 9; Fig. 11; Fig. 12; Fig. 20; Fig. 21). However, Peltenburg (2011: 3-4) emphasized that the axe analysed by Gale was recovered in disturbed deposits along with other material dating to the Philia period and should date to this later period. Contrary to Gale, Knapp (2013: 231) also stresses that "the lead isotope field used to exclude axe/adze KM 457 was inadequately defined. It could well lie within a Cypriot field…" However the important point is that due to the stratigraphic context (Period 5/Philia Phase at Kissonerga-*Mosphilia*) whether imported or not we should exclude the Philia axe (KM 457) from the Chalcolithic metal assemblages. Another important indication for the axe (KM 457) is that the earliest metal items from Cyprus were mainly tools, rather than weaponry equipment, which first appeared with the Philia culture. Although the axe is one of the essential tools for Cypriot communities, the metal ones (as an earliest example: an axe with polygonal butt) were introduced with the Philia phase and any example from the Chalcolithic period has not been found yet (Kassianidou, 2013a) (Table 7). In addition, as the chemical analyses indicated, the axe might have come from outside of Cyprus. Nonetheless, it possibly dates to the Philia period, while the Chalcolithic copper ore (KM 633) from the same site like the other analyzed object points to local knowledge of oxidized Cypriot copper ores.

The oxidized ores (KM 633) from Kissonerga-*Mosphilia* have an isotopic composition falling within a Cypriot copper deposit (Gale, 1991: 53; Peltenburg, 2011: 5). It is noteworthy that chemical analyses from the sample of the oxidized ores (KM 633) present high percentages of copper, while there are no traces of tin or arsenic alloys (Gale, 1991: 47). Aside from the isotopic composition of the oxidized ores, the analyses of the Cypriot mines suggest that such copper ores are also obtainable from Cyprus (Gale et al. 1997). For instance, Crewe (2015: 138) underlines that “the west has its own access to the copper sources of the Troodos”. More specifically the nearest small copper-bearing pillow lava outcrops from the Kissonerga area are only 3km far away, while the main pillow lava outcrops can be reached at a distance of about 20km. However within 10 km – from Kissonerga district to the Troodos Mountains, there are several smaller copper deposits, which can also be used. Although Gale (1991: 47) was deeply sceptical about the extraction of local metallic copper ores during the Chalcolithic period, he also admitted that Chalcolithic people from Kissonerga area had knowledge about rich Cypriot copper ores, which “were certainly known at that site” (Gale, 1991: 53). Therefore, as a more convincing explanation, the availability of the copper sources around the Kissonerga area and the oxidized ores from the site at *Mosphilia* may give evidence for the extraction of Cypriot copper ores during the Late Chalcolithic period. Therefore it again turns Peltenburg’s assumption into a hypothesis worthy of further study that when Chalcolithic people may have become interested in collecting picrolite raw material, they also might have realized and started to collect copper minerals from available sources.

Furthermore, for instance Knapp (2013: 232) neither denies nor accepts the Chalcolithic connection between “extracting copper and collecting picrolite” but emphasizes “the social and ideological significance of picrolite” objects instead of copper items during the Late Chalcolithic, which was however altered in the mid-3rd mill. BC by “the emergence of an entirely new social and economic system involving the production and exchange of metallic (not native) copper” (see also Peltenburg, 1991b; Mina, 2014: 234, 237). While the south and west of Cyprus are considered as a copper-poor region, Chalcolithic communities from the same region had their own access to the picrolite sources. Geological study shows that picrolite veins can be found from Cyprus in two particular places: they can be quarried directly from the Troodos outcrops, or collected from the riverbanks, where water transported the picrolite from the main resource, as workable rounded pebbles. This indicates that in general both sources can abundantly provide picrolite raw material to the Chalcolithic inhabitants of the Southwestern Island. However, the same study also supports that "suitable material for picrolite artifact manufacture is present only on Mt. Olympus, the highest point in the Troodos Mountains (1951 m), a source that could not have been easily accessible" (Xenophontos, 1991:127). Therefore the Chalcolithic populace from Cyprus mainly used the sources available in the area between Paphos and Erimi. Xenophontos (1991: 131-137) believes that picrolite objects may have been a chance find rather than quarried since the geometry of the "nuggets" suggests the Chalcolithic people had not been extracting from the outcrop itself, but from downstream, after pieces had been transported by water. "The Rivers made the raw material more readily available to the Chalcolithic inhabitants of the island" (Xenophontos, 1991: 132,136). According to Xenophontos, the Kouris river, which flows from the south part of the Troodos Mountains and drains away to the sea near Erimi and the Kayritos river, which flows in the opposite direction in the north part of the Troodos, are two main sources that carried picrolite pebble sources to the Chalcolithic populations (Xenophontos, 1991: 132-137). This indicates that the Chalcolithic Erimi culture and other communities from the southwest Cyprus possibly used the picrolite pebbles available in the Kouris river (Xenophontos, 1991: 131, Fig. 3). However the occupation at Yialia on the northwest of the island, which has been also dated to the Chalcolithic period, presents a different scenario.

3.1.2.2 The Yialia Example

Yialia is a site in the Paphos District of Cyprus, where early archaeological study uncovered a famous and "most sophisticated" cruciform (cross-shaped) picrolite figure, 16 cm tall (Figure 9) (Webb & Frankel, 1999: 13). Although Xenophontos argues that picrolite supplies were collected from the riverbank, the substantial size of the Yialia picrolite figure (16 cm) may indicate its source was not a riverbed but extracted from the Troodos outcrops. Xenophontos (1991: 136) underlines that the Kouris provides "a bagful of excellent-quality pebbles up to 14 cm in diameter and up to 3.5 cm thick"; pebbles from the Karyotis river are "slightly smaller". Therefore, as suggested by Xenophontos, if the raw material of the picrolite object was a fortuitous find, it seems that the Karyotis river, as a nearest main source, can be an option for the Chalcolithic Yialia population to acquire picrolite pebbles. The pebble sizes from the Karyotis river are not suitable to create a 16 cm tall picrolite figure, however according to the study, the Kouris river could have supplied picrolite raw material for the Yialia picrolite figure. As the location of Yialia indicates, in order to reach the Kouris river there are two options: to cross the Troodos Mountains or follow the more coastal way passing through the Paphos district, which is still today used by Cypriot communities. The walking distance is ca. 90 – 100 km between Yialia and Kouris and requires three days' walk (30km/day) to reach that site. If true, it also indicates an existence of the Late Chalcolithic inter-site dynamic between the different Cypriot communities.

On the other hand, the map of picrolite sources prepared by Xenophontos (1991: 131, Fig. 3.) also points out a source for serpentinite, as an alternate picrolite raw material, located in the Akamas peninsula, just 30 km far away from Yialia. However, to recall what Xenophontos suggests "suitable material for artifact manufacture, is present only on Mt. Olympus, the highest point in the Troodos Mountains (1951 m) or just from the two rivers." Although Xenophontos believes that the main sources in Mt. Olympus "could not have been easily accessible", the Yialia example may reverse that assumption (Xenophontos, 1991: 127).

It should be stressed that the Chalcolithic economy mainly relied on herded caprines, pigs and most importantly hunted deer (Croft, 1991). Deer inhabits the forested regions, which are available in the Troodos Mountains, therefore could have been visited by the Chalcolithic communities during hunts. Their hunting interest may lead or direct them to visit the highest point of the Troodos Mountains, specifically Mt. Olympus, where the main picrolite sources are also existed, differently from two rivers. It seems that Xenophontos underestimates the role of individual human agency within an archaeological context. An example from Anatolia, the Kağızman district from the Kars province -also referred to as Çamışlı and Yazılıkaya- at an altitude of 3134 m, demonstrates "early' hunter-gatherers societies" hunting interest at such a high altitude. The area revealed large, smooth faced panels from the early Holocene period engraved with many images of animals depicted with precision, especially stags with massive antlers along with several other rock arts from the same region, mainly depicting hunting scenes (Sagona & Zimansky, 2010: 33). Although the evidence is far away from Cyprus and dated to very earlier times, it demonstrates earliest prehistoric communities' hunting activities at altitudes over

3000 m. As another example, the most famous individual from “the Copper Age” is Ötzi (5,300-years-old), who was discovered in September 1991 as a glacier mummy in the Ötztal Valley, Alps, specifically positioned between the peaks Fineilspitze (3,514 m) and Similaun (3,603 m)[8]. It is significant for Copper Age agency that Ötzi carried an axe of almost pure copper whose source came from hundreds of miles away, in Tuscany, Italy. Although the source of the axe associated with copper sources of Tuscany, most significantly “traces of arsenic were found in his hair, leading to the conclusion that Ötzi was sometimes present where metal ores were being smelted”[9] (Brothwell & Grime, 2002; Both, 2012). It is argued that as an agent Ötzi participated in long-term metalworking, accompanied by high arsenic exposure (Bolt, 2012: 825). Therefore, Ötzi, who died[10] between 3359 and 3105 BC, proves that as an individual he visited the highest peaks of the Alps Mountains and he not only carried a copper axe, which originated from central Italy but also personally may have engaged in metal extraction from accessible ore by a process involving heating and melting (Brothwell & Grime, 2002; Oeggl, 2009; Bolt, 2012: 825). From these two different examples, it seems reasonable to assume that individual human agency from Chalcolithic communities of Cyprus also visited the highest point of the Troodos Mountains, Mt. Olympus (1951 m), where they may not only have exploited the main picrolite sources, but also collected and extracted Cypriot rich copper sources existing in the Troodos Mountains.

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[8] For the find spot images: http://www.age-of-the-sage.org/archaeology/otzi_the_iceman_map.html
[9] See more at: http://www.iceman.it/en/the-mummy/
[10] For more informtaion: https://www.livescience.com/37311-otzi-iceman-death-clues.html

All of which goes to indicate that there are only two possibilities to get the raw material for creating the Yialia picrolite figure; one is climbing Mt. Olympus and the other is collecting the sources available around the Kouris river. On this basis, it is still difficult to determine from the available evidence whether they preferred just one of them or both sources together. However, the important point here is that in both cases, the road directly passes from one of the significant copper sources of Cyprus, such as the Limni mine, which may open further discussion about a possible connection between picrolite and copper exploitation (Figure 1 & 7).

Evidence indicates that the Yialia area was occupied during the Chalcolithic period. Since the site is close to copper ores in and around the Limni mines, circumstances may indicate a link between the exploitation of picrolite and metal sources. However, as a promising hypothesis, the Chalcolithic occupation at Yialia still requires more extensive investigation of it to evaluate the connection between the picrolite and the copper exploitation (Gale, 1991: 43, Peltenburg, 1991b: 112, Fig. 5; Fig. 2; Xenophontos, 1991: 131, Fig. 3; Webb & Frankel, 1999: 13; Steel, 2004: 120, Fig. 5.1; Knapp, 2013: 239, Fig. 63)

3.1.2.3 The Colour Aspect

Another way to look at this association is, as Gale (1991: 49) underlines, from the perspective of colour: “native copper is rarely blue but ranges mostly from copper-red through brown to black”. This colour aspect also challenges the hypothesis about a possible link between the exploitation of picrolite and the earliest copper utilizations. The distinctive finds of a piece of malachite (one of the earliest identified example from Cyprus) in a bivalve shell (KM 2109) from Grave 554 at

Kissonerga-*Mosphilia* may point out such an “earliest” reconnection. It has been suggested that malachite may have been used as a cosmetic article in Prehistoric Cyprus rather than for a metallurgical purpose (Peltenburg, 1991a: 21). From another viewpoint, Peltenburg (1991a: 21) states that the malachite from Kissonerga-*Mosphilia* is one of early instances of copper use on Cyprus.

Chronologically, Peltenburg (2011: 4) and Bolger (2013: 12) dated the malachite mineral to the Middle Chalcolithic period (Table 6) (Figure 8. A). However according to Knapp (2013: 203) it belongs to the Early Chalcolithic. If it really dates to the Early Chalcolithic period as Knapp suggests, this is the time when there is a near-complete lack of evidence for metallurgy in Cyprus. The only exception is a hook from Early Chalcolithic *Mylouthkia*. However, Peltenburg (2011: 5) emphasizes that “its poor stratigraphic security and the absence of other evidence for metalwork at that time mean that we should treat it as unreliable evidence for metalwork on Cyprus during the Early Chalcolithic”. It seems that Knapp may misdate the Kissonerga evidence since he cited Peltenburg’s earliest publication about Kissonerga-*Mosphilia*, which attributed Grave 554 to the Early Chalcolithic period (Period 2 at Kissonerga-*Mosphilia*) (Peltenburg, 1991a: 21). However apart from the chronological dispute, the important point is that malachite and azurite, which are bright green and blue minerals, are available in Cyprus; and contrary to native copper, their vivid color resembles the tint of picrolite closely. Malachite copper ore can be obtained along the west coast of Cyprus, such as at Chlorakas and Akoursas. Therefore, it was easily accessible to those who lived at *Mosphilia* (Peltenburg, 1991a: 33; Gale, 1991: 58; Gale et al. 1997: 238, Table 1; Knapp, 2013: 231). However, it is difficult to reach such a conclusion from this single example even if the mineral is accessible in the southwest of Cyprus. Another possible scenario is that the malachite ore and its bivalve shell reached the island from either Egypt or Mesopotamia, where comparable samples of such coloured minerals in shells were deposited in burials (Gale, 1991: 45). However the maritime perspectives already demonstrated that the island was isolated and not connected with the mainland cultures until the end of the Middle Chalcolithic. Considering the isolation and the availability of malachite mineral in the island can suggest that some communities were beginning to exploit not only picrolite resources but also used coloured metal mineral ore, such as malachite to produce pigment as early as the mid- 4th mill. BC (Bolger, 2013: 12).

Recent finds at Souskiou-*Laona* give further information for the connection of picrolite with copper (Table 6) (Figure 10) (Peltenburg, 2001). Excavations of the Chalcolithic settlement show that it was very active in the production of picrolite figurines and a source of copper artifacts, which may support the connection between picrolite and metal exploitation. For instance, it is shown that some of the picrolite objects at the site were collected from the ophiolite source at the Troodos Mountains, where copper ores are also present (Kassianidou, 2013b: 37, Knapp, 2013: 245). It is significant that the location of Souskiou-*Laona,* in the southwest of the island of Cyprus gave easier access to picrolite pebble sources scattered around the Kouris river than the Yialia settlement in the northwest. Although as the easiest option the Koruis river could provide picrolite pebbles for the Chalcolithic communities in Souskiou-*Laona*, they also preferred to acquire the picrolite sources of the Troodos Mountains (Xenophontos, 1991: 131, Fig. 3). It also demonstrates that contrary to Gale's perception, whereas Souskiou-*Laona* revealed several metal objects, Cypriot Chalcolithic communities from the site visited the Troodos Mountains to obtain their picrolite raw materials, as well as they may collect local oxide ores to produce small objects, such as beads, pendants and tools.

A comprehensive list of picrolite occurrences for the Chalcolithic from the several sites of Cyprus demonstrates that Cypriot picrolite consumption of the Chalcolithic communities achieved wide circulation in the 4th mill. BC (Peltenburg, 1991b: 124-126, Table 3, 4, 5, 6). Muhly (1989:1) underlines that “there is little use of picrolite prior to ca. 3500 BC, nor are there any recorded objects of copper. The relationship between the two may turn out to be something more than a simple one of cause and effect…”. Even though it can be assumed that picrolite usage is associated with the inauguration of copper to the island, it is still an open debate.

From the evidence and examples presented, it is however not easy to make an explicit conclusion. As Gale also proposed, associating the inauguration of metallurgy with exploitation of picrolite is still a “hypothesis worthy of further study” (Gale, 1991: 49). It is clear that the amount of the picrolite assemblages was higher than the number of the metal objects from Cyprus during the Chalcolithic period. Therefore, it can be suggested that while the great number of picrolite objects may refer to specialized groups – possibly in a household level, whereas the small-scale metal production during the Chalcolithic period can be attributed to specialized individuals existing in the Cypriot Chalcolithic communities.

It would be appropriate to conclude this section of the discussion with closer clarification of the earliest exploitation of Cypriot copper sources, which dates to the end of the Middle Chalcolithic period. As mentioned above as a part of the maritime perspective, more reliable evidence for the earliest extraction of copper ores from Cyprus surprisingly appeared from outside the island: the axe from Pella in Jordan – found from a well-dated EB II hoard of ca. 3000 BC and two daggers, a fish hook, and an awl from Hagia Photia, Crete - found from the Cretan EB I cemetery of roughly the same date. They reveal that according to lead isotope analysis their copper sources derived from Cypriot ores. However, they oddly date around the time of the transition between the Middle and Late Chalcolithic (early 3rd mill. ca. 3000/2900 – 2800/2700 BC) (Peltenburg, 1990: 18; Steel, 2004: 106; Knapp, 2013: 245-246).

Knapp (2013: 230) indicates that although we have evidence for the earliest attested use of copper on Cyprus during the mid-4th mill. BC, at the end of the Middle Chalcolithic period, there is no clear evidence apart from the finds of Pella and Crete to indicate that Cypriot copper ores were produced or exported around 3000 BC. Since the archaeological sequence presents a clear *lacuna* between the Middle and Late Chalcolithic periods of Cyprus this also raises the question whether small-scale raw material exchanges were occurring between the local modest groups of Cyprus and the other different cultures; or whether foreign agents were responsible and took an active role in the transportation of metal resources (Webb et al. 2006: 277; Peltenburg, 2011: 6; Knapp, 2013: 230). Another controversy is the blue faience beads found in Souskiou-*Vathyrkakas* at Tombs 29,55, and 78, and Souskiou-*Laona* at Tombs 135, 158, and 221, which required further investigations since one of these faience objects contain high amount of tin. (Peltenburg, 2011: 6). The analysis shows that the cylindrical bead from Tomb 29 at Souskiou-*Vathyrkaka* contains important amount of tin and the glaze was colored by copper while tin does not occur in Cyprus. Therefore the object itself or its tin content must have been imported from the mainland, specifically the Levant or eastern Anatolia, where the same type of beads were also found (Shortland & Tite, 2006). However chronologically, it is suggested that since the presence of tin alloy anywhere in the Mediterranean before the 3rd mill. BC is infrequent, the earliest example of the faience bead from Souskiou-*Vathyrkakas* possibly dates around the late 4th mill. BC, when the island culture also created a maritime connectivity with the Mainland cultures after 4000 years (Peltenburg, 2011: 6; Bolger, 2013: 4-13, fig 12).

Differently from the tin copper bead, it is argued that metalwork from Chalcolithic Cyprus was mainly unalloyed and likely to have been made from Cypriot copper sources through using annealing and cold-hammering techniques (Muhly, 1993: 243; Kassianidou, 2013a: 232). However chemical analyses revealed that whereas a tin object reached the island as an imported product at the end of the Middle Chalcolithic, the chisel from Erimi and the later chisel from Lemba are made from arsenical copper (Gale, 1991: 47). Especially the chisel from Erimi as the first secure evidence for metalwork from the Middle Chalcolithic Cyprus would suggest that it was made of local arsenical copper ores occurring in Cyprus, such as the polymetallic ores of the Limasol Forest area, which in close proximity to the site of Erimi, could have beeen a source for the chisel (Kassianidou, 2013: 233; Webb, 2013: 62). Whereas the evidence from the transitional period is elusive, at least for Middle Chalcolithic Cyprus the evidence for picrolite object production and 14 copper and metal-related materials are attested in Cyprus (Peltenburg, 1991b; 2011: 4-7).

3.2 Local Metal Working in Transition from Chalcolithic to the Philia Phase

Even though the emergence of metallurgy in Cyprus is not precisely concluded to be indigenous or exogenous for the Middle Chalcolithic, evidence from Late Chalcolithic period is definitely pointing to small-scale local metallurgical activities occurring in the island. The discovery of fragments of oxidized copper, two possible crucibles and copper rich ore lumps from Kissonerga-*Mosphilia* show that extractive metallurgy and metalworking from local ores had begun two/three centuries before the mid-3rd mill. BC (Table 6, Figure 8) (Knapp, 2013: 230-231). It has been discussed that the location of the Chalcolithic settlement at Kissonerga-*Mosphilia* would provide access to a small copper-bearing pillow lava outcrop around Kissonerga (Crewe, 2015: 138). Therefore, the site at *Mosphilia*, where the majority of the Late Chalcolithic metalwork from Cyprus was found, reveals that local copper working took place in a Late Chalcolithic settlement (Webb & Frankel, 1999: 9; Steel, 2004: 114-115; Knapp, 2013: 229-232, 298; Kassianidou, 2013a: 232). Although the entire phase Chalcolithic Cyprus is considered a primitive metallurgical stage, Late Chalcolithic evidence from the different metal assemblages, all together suggest that the exploitations of local copper ores had started around 3000 BC (Knapp, 2013: 230).

A recent analysis of early copper production data shows a striking increase in metal objects for the Philia phase. Meanwhile, during the 1000-year Chalcolithic phase, not more than 26 objects were found, the Philia phase of 250 years present more than 100 examples (Mina, 2014: 231-234). It is significant that the frequency of Chalcolithic objects from Cyprus was much lower than expected when we consider its 1000 years' time span. However, this could mean that, as Peltenburg points out, "much of our information on the extraction and/or production of copper during the Chalcolithic period comes from the copper-poor south and west of Cyprus, not the copper-rich north" (quoted in Knapp, 2013: 230). Therefore the evidence we have can be enriched with further excavations and studies from Northern Cyprus. In the same way we should also consider the possible lack of experienced individuals in the Chalcolithic communities, who had expertise in metallurgy. Although evidence from the earliest Cypriot metallurgy comes from copper-poor regions, one must consider that individuals from Late Chalcolithic Cyprus, who had a certain expertise in metallurgy, were integrating small-scale local metal exploitation and production, probably using scanty copper resources of the southwestern part of the island. It shows that although Cyprus contains a large number of copper sources, Cypriot Chalcolithic metallurgy in this respect was at an early stage.

3.3 Advanced Metallurgy of the Philia Culture in Early Bronze Age Cyprus

3.3.1 Copper and the Philia Phase

> "It seems unlikely that we are going to find any use of copper on the island much before ca. 3500 BC. What we do find in Cyprus is a continuous development in the use of copper, with amount and variety of usage greatly increasing in the following Philia transitional period and then on into the Early Cypriot period" (Muhly, 1989: 2)

With the introduction of advanced metallurgy, the evidence coming from Cyprus regarding metal production is abundant after the Late Chalcolithic. The sites from the Philia period of which at least 19 have been identified by Webb and Frankel (1999) were mainly located around the Ovgos valley in west-central Cyprus (Figure 1, Figure 7). Distinctly from the Chalcolithic Cypriot sites, which were situated in the copper-poor southwest of the island, the new occupational zone at the beginning of the Bronze Age presents a close proximity to the island's copper sources, highlighting the significant role of the Philia sites in working local copper sources and the development of indigenous copper manufacturing (Steel, 2004: 121; Webb, 2013).

The major lead isotope compositions data for the Cypriot ores published by Gale and his colleagues (1997) determined that metal ores from Cyprus are "predominantly copper and iron sulphides, also oxidized ores of iron, manganese and copper", while "there are no ore deposits of tin or lead on this island" (Stos-Gale & Gale, 2010: 388). The lead isotope data reveals that Limni, Solea, Larnaca, Kalavasos and the Limassol Forest area are the main regions in Cyprus, representing the copper richness of the island (Gale et al. 1997: 241-246, Table 2,3,4,5,6). Geographically, the richest copper deposits from Cyprus are situated in the north-western foothills of the Troodos Mountains. More specifically Apliki, Skouriotissa and Mavrovouni mines in the region present the largest copper deposits from the entire Mediterranean, "and in modern times this region was the source of 85% of all copper produced on the island" (Kassianidou, 2013a: 237). Site catchment analysis shows that from the same region newly established Philia inland settlements, specifically around the Ovgos valley had their own access to such rich copper sources. Metallurgical evidence also indicates that these mines were possibly mined in the Philia phase. Therefore, it can be assumed that the awareness of the richest copper deposits of Cyprus could be a possible motivation that may have led the Philia culture populace to settle near rich copper resources, which eventually created a new socially distinctive cultural phase in Cypriot prehistory.

3.3.2 Developments in the Metalwork of the Philia Phase

Mina (2014: 235) calculates that 82% of the Philia metalwork has been found in burial contexts. This indicates that apart from the settlement at Marki-*Alonia*, most of the Philia metalwork was recovered from cemeteries, which are well-documented sites for the Philia phase, and the majority are situated in the west-central Cyprus. The *ARCANE Cyprus* (Peltenburg, 2013) database of Philia metalwork, for instance, includes only four metal objects from the settlement context at Marki-*Alonia*, whereas sixteen objects came from burials at Sotira-*Kaminoudhia*, Marki-*Davari*, Kyra-*Kaminia*, Nicosia-*Ayia Paraskevi* and Philia-*Vasiliko.*

The copper-rich Philia sites at Marki-Alonia along with the burials at Sotira-Kaminoudhia provide close proximity to the island's copper sources and illustrate the metal richness of the Philia period, which were considerably different from the Late Chalcolithic (Period 4 at Kissonerga-*Mosphilia*). Metallographic evidence from the Chalcolithic examples attests that local smiths created their metalwork through hammering, cold-working and annealing (Gale, 1991: 57; Kassianidou, 2013a: 234; Mina, 2014: 231). The Philia burials at Sotira-Kaminoudhia revealed "a small "billet" casting of a dagger blade" (M12, from Tomb 6) and "a 99% pure copper dagger, forged from locally smelted copper ores" (M18, from Tomb 15), presenting evidence for local casting activity (Knapp, 2013: 300; Mina, 2014: 234). The location of Sotira-*Kaminoudhia* shows close proximity to the local copper ores existing in the Limassol Forest area, which were being mined in the Philia period (Webb, 2013: 62).

The Philia village at Marki-*Alonia*, as a settlement site provides further detail on the exploitation of Cypriot copper ores and local casting activity. The location of Marki-*Alonia* settlement was about 10km away from the nearest mine, and it is assumed that it had a "communication and transportation role" (Webb, 2013: 63, 68, Fig. 4). More specifically, the site at Marki-*Alonia* is near to the ore sources at Mathiatis, Kampia (Kambia) and Sia*,* with reliable verification for the smelting and casting of local ores specifically for the Philia period (Gale et al. 1997: 243-244, Table 4.; Frankel & Webb, 2006: 217; Kassianidou, 2013a: 231-232; Knapp, 2013: 271, 299-300; Mina, 2014: 234). Webb (2013: 63) confirms that similar to the Limassol area, copper ore sources in Mathiatis area - nearby Marki-*Alonia* were being mined during the Philia period.

Most importantly, as an indication for the Early Bronze Age local casting activity, the site at Marki-*Alonia* produced one of the earliest chalk-casting molds from Cyprus, which dates securely to the Philia phase. (Figure 11) It displays a substantial advancement in the metallurgical technology of Cypriot culture. It also points out that metal production of the Philia culture was likely to increase in Cyprus with the introduction of the casting-mold (Frankel & Webb, 2006: 216-217, Fig. 6.19; Webb et al., 2006: 264; Knapp, 2013: 299-300; Webb, 2013: 62, Fig. 3; Mina, 2014: 234).

It is evident that most of the metal objects from Marki-*Alonia* (46% by weight of the 56 metal artifacts) belong to the Philia culture (Webb, 2013: 63).

A dagger (M18) from tomb 15 at Sotira-*Kaminoudhia* and the mold from Marki-*Alonia* are chronologically contemporary to the Philia phase and both are signaling the presence of indigenous metalworking activity (Knapp, 2013: 300). Other possible indication for using a casting mold during the Philia phase are the awls from Sotira-*Kaminoudhia* (Balthazar, 1990: 373). These suggest that Cypriot rich copper sources around the regions of Sotira and Marki were exploited in the beginning of the Bronze Age. It would appear that while metallurgical activities were performed in the settlement context during the Philia Period, local metallurgical technology had been transformed and proliferated throughout the Philia culture contrary to the Chalcolithic metallurgy (Knapp, 2013: 271; Mina, 2014: 234, 237).

3.3.2 Metal Typology of the Philia Phase

Metal types associated with the Philia period consist primarily of weapons, tools, ornaments and objects of personal use. According to their functional category, "44% of the extant assemblages are items of jewelry, 40% weapons, 12% attire-related objects (attached to dress) and 4% grooming utensils. They are distributed among all the various Philia sites (Kassianidou, 2013a: 234; Mina, 2014: 235, fig. 2). Among these Philia sites, excavations at one disturbed pit tomb (Tomb 6) from the site at Marki-*Davari* revealed a copper spiral earring (Webb & Frankel, 1999: 10; Mina, 2014: 232, Table 1.). In addition to jewelry, various other categories of metal objects were attested in different Philia sites.

A cemetery at Kyra-*Kaminia*, located 200m south of the Kyra-*Alonia* settlement, produced earrings along with metal knives from one shallow oval pit tomb with two distinct burials (Webb & Frankel, 1999: 10; Table 1. in Mina, 2014: 232). The Nicosia-*Ayia Paraskevi* cemetery revealed much Philia metalwork, including knives/daggers, an axe, a spearhead and spiral earrings along with a significant amount of Philia material: pottery vessels, a biconical spindle whorl, and shell and stone ornaments (Webb & Frankel, 1999: 10). For the Ovgos valley, Deneia-*Kafkalla*, and in the Philia area, Philia-*Laxia tou Kasinou*, Vasilia-*Alonia*, Vasilia-*Kafkallia*, Vasilia-*Killistra* and Vasilia are the other sites where Philia metalwork was discovered. They include weapons (axe, dagger, spearhead, hook-tang weapon) and personal objects (ear-ring, annular pendant, razor/scraper, pin and toggle pin) (Mina, 2014: 232, Table 1) (Figure 12).

It is suggested that the metal objects from the Philia sites have distinct typological features, representing the characteristic of the Philia cultural phase (Balthazar, 1990: 97). For instance, spiral earrings are considered to be one of the significant chronological markers for the Philia periods (Webb & Frankel, 1999: 31; Kassianidou, 2013a: 239, 244-245). Webb and Frankel (1999: 31) show that typical spiral earrings were found in the various Philia sites at Philia-*Laksia tou Kasinou*, Kyra-*Kaminia,* Dhenia-*Kafkalla*, Nicosia-*Ayia Paraskevi,* Kissonerga-*Mosphilia*, Marki-*Alonia,* Marki-*Davari* and Sotira-*Kaminoudhia.* They were mainly produced from arsenical copper, bronze and electrum (Table 8). Giardino and his colleagues (2003: 389) describe bronze spiral earrings from Sotira-*Kaminoudhia*, which have “a narrow circular loop broadening to an expanded end, consisting of a strip of metal with one end pointed and the other flattened, a type of artifact peculiar to the Philia Phase".

Awls with a square section and pointed tangs from Sotira-*Kaminoudhia* were also interpreted by Balthazar as specific to the Philia phase and continuing to a later date. According to her the two Philia awls from Sotira-*Kaminoudhia* have similar features from the Philia phase to the ECII period. Therefore, while they were similar during the Philia Phase and the Early Cypriot II, the type changed in EC III and then lasted until the end of the Middle Cypriot III period (Balthazar, 1990: 373). Unlike spiral earrings, using awls as typological markers for the Philia period can be problematic, although the two awls from the site were found in contexts with secure dating (Kassianidou, 2013a: 237, 239). The excavations at Kissonerga-*Mosphilia* also uncovered an awl and some chisels in the settlement context and an earring from a grave, representing authentic Philia affiliations. Furthermore, the site at Marki-*Alonia* produced six complete or almost complete needle examples, of which one is catalogued in the ARCANE Cyprus database. It securely dates to the Philia period (the first from a Philia context), and radically revises Balthazar's statement (1990: 380) that "needles first appeared in EC I" (Webb & Frankel, 1999: 32; Kassianidou, 2013a: 239). Webb and Frankel (1999: 32) imply that chisels, awls and needles have an almost unchanged feature from the Philia period to the Early Cypriot period; whereas the needle from Marki-*Alonia* is smaller than Early Cypriot and Middle Cypriot forms. Typologically, toggle pins from the Philia phase have "solid heads and round apertures instead of hammered heads and cleft eyelets" (Balthazar, 1990:

97). Therefore, like Philia weaponry, toggle pins may also be distinguished from the Early Cypriot examples (Webb & Frankel: 1999: 32).

For the Philia weaponry assemblage, Balthazar (1990: 97) emphasizes that they often have “raised midsections instead of midribs”. According to Stewart the Philia knives have no rivet holes for the handle attachment, making them fundamentally different from their successors (quoted in Kassianidou, 2013a: 238-239). Two bronze spearheads from a collection of Philia metal artifacts[11], which included flat axes bought from a Nicosian dealer by Stewart in 1959, were also considered unique to the Philia culture and characteristically different from Early Cypriot/Middle Cypriot types (Webb & Frankel, 1999: 31-32). In general, this shows that the Philia metalwork, including weaponry and personal ornaments bears a close relationship with social changes, which visibly characterized the transitional phase of the Philia culture differently from the Chalcolithic and the Early/Middle Cypriot periods (Webb & Frankel, 1999: 31 -34; Mina, 2014: 229, 236-239).

3.3.3 Introduction of the Technology of Alloying

While Middle and Late Chalcolithic metal objects correspond to the earliest stage of Cypriot metallurgy, the transition from the Chalcolithic to the Early Bronze Age witnessed the radical and rapid changes in metallurgical technology, as well as in the metalworking techniques employed (Kassianidou, 2013a: 232). It is noticeable that differently from their Chalcolithic predecessors the metalworking techniques and

[11] Now, exhibited in the the Museum of Antiquities of the University of New England in Armidale, Australia (UNEMA).

technologies during the Philia period were significantly improved, including acquiring the knowledge of metal alloying and local copper casting. Since the number of copper artifacts significantly increased in the earliest phase of Bronze Age, it appears that the time of this transition between the Chalcolithic and the Bronze Age periods brought about the radical transformation for Cypriot metallurgy.

As metallurgical practices indicate not only the characteristic metal consumption of the Philia culture but also the production of the metal, this reveals a separation between the Chalcolithic period and the Philia phase. The metalwork from the Philia sites represents several radical modifications of the metallurgical technology within the presence of local metallurgical activities since the metal alloying knowledge of local smiths form the transitional phase represented by the Philia culture (Knapp, 2013: 300). It is suggested that while in the Chalcolithic period objects were made of unalloyed metal, in the Philia phase both copper and copper alloys were used (Kassianidou, 2013a: 232).

Archaeological and archaeometallurgical (EDXRF) evidence for local metalworking from the Philia phase offers valuable insights about indigenous metal expertise (Table 8). Metalwork from burials at Sotira-*Kaminoudhia* not only provides with evidence for local metal production, but also demonstrates the smith's expertise in using copper-arsenic alloy during the Philia period (Knapp, 2013: 300). The Philia cemetery of Sotira-*Kaminoudhia* is located closest to the arsenical copper sources of the Limassol area, and were being quarried in the Philia period (Webb, 2013: 62).

The studies show that the majority of the Philia metalwork from Sotira-*Kaminoudhia* contain arsenic alloy, which ranges between 0.3% and 7% (Giardino et al. 2013). Giardino and his colleagues prepared a categorization chart from the analysis to classify the metal finds from Sotita-*Kaminoudhia* by their content of arsenic (Figure 14). According to the data there are three different groups of the metal objects from Sotira-*Kaminoudhia*. In the first group, eight metal objects (M5, 8, 11, 18, 27A, 27B, 29), have concentration of AS less than 1%. Therefore, the first group is considered as pure copper-based objects, “with only small amount of other elements” (Giardino et al. 2003: 387). Contrary to the common expectations the metal items from the first group were not produced from Cypriot native copper, which is extremely pure, but “were more likely to have been forged from smelted copper ore”. It is significant that although there is no clear evidence for a local metallurgical activity in Sotira-*Kaminoudhia*, in 1997 the Sotira archaeological Project Survey found a crucible fragment on the surface at the Early Cypriot/Middle Cypriot settlement of Paramali *Pharkonia*. The X-ray fluorescence analysis shows that “the crucible had apparently been used to produce artifacts of almost pure copper with a small unintentional amount of arsenic” (Table 8) (Giardino et al. 2003: 391). The second group presents arsenical values between 1.7% and 4%, which are considered as a deliberate addition of arsenic, which would increase the hardness of the metal (Kassianidou, 2013a: 232-233). The third category includes only one metal piece with the highest content of arsenic (7%), which is an ornamental earring (M16).

The analyses show that there are at least eight metal objects from Sotira-*Kaminoudhia*, including tools: axes (M19/M16), awls (M10/M25), a needle (M30), chisels (M9/M17); and ornamental objects: earrings (M16/M20). All demonstrated the presence of arsenic alloy ranges between 2.5% – 7%. According to Giardino *et* al. (Figure 13) objects with less than l% arsenic represent an unintentional alloy.

The hardness achieved by alloying copper with arsenic is similar to the tin copper alloys. Kassianidou (2013a: 232-233) emphasizes that a relatively low amount of arsenic, which ranges between 0.1 and 2.8% would have been enough to increase in quality the mechanical properties and hardness of the metal. The high rate of arsenic alloy in the copper tools (M19, M16, M10, M25, M30, M9, M17) implies that they were mainly used for cutting, carving or sewing purposes. This may indicate that Cypriot metal smiths intentionally used arsenic alloy to increase the strength of copper due to their usage purposes (Giardino et al. 2003: 388; Webb et al. 2006: 275). However differently from cutting, carving or sewing purposes, metal smiths may have also used arsenic alloy to generate a shiny effect for the ornament. According to the same study the shiny effect of the arsenic "was clearly sought after by the ancient metallurgist" which could be the reason for the metallurgist to prefer to add the highest content of arsenic 7% for the earring (M16) of Sotira-*Kaminoudhia,* that is in order to produce a shiny appearance (Swiny et al. 2003: 288). However while Giardino and his colleagues (2003: 388) support that the arsenic alloy was a deliberate attempt done by the prehistoric metal smith for different functional types, it is not clear whether this represents a deliberate technical choice of the metal smith or not.

A dagger blade (M12) gives further evidence for the usage of the arsenical copper from Sotira-*Kaminoudhia* (Giardino et al. 2003: 387). Accordingly, three different samples taken from the dagger blade (M12), from the lower side (A), near the tip of the blade (B) and the tang (C), revealed almost identical arsenides fractions (as 3.2%, as 3.5% and as 3.8%). This demonstrates the metal smiths' expertise in controlling the composition of the arsenical alloy (Giardino et al. 2003: 387). The researchers consider that the dagger blade was produced by pouring arsenical copper into a one-piece mold (Giardino et al., 2003: 391). This dagger is exceptionally thicker (7-12 mm), than other findings of the Philia phase which are usually between 2 and 2.5 mm thick. Ingots with tapered shapes and sizes similar to the dagger M12 were also found in the Aegean in the mid-third mill. BC. (Giardino et al. 2003: 391). Therefore the Sotira example is also believed to be an ingot, which was common in Aegean prehistory in this early period.

Giardino and his colleagues (2003: 391) emphasize that although no evidence for metallurgical activity has been found at Sotira-*Kaminoudhia*, the presence of crucibles at Paramali-*Pharkonia* and Episkopi-*Phaneromeni* indicate that at least some metal work was being carried out in the area. While Cyprus has several arsenical copper sources: Mathiati, near Marki-*Alonia* in the central Cyprus, or Peristerka in "the Larnaca axis", where samples present approximately 5.0% arsenic, Cypriot copper sulfide ores available at Laxia tou Mavrou near Dhierona or around Pevkos in the Limassol Forest area present an arsenic rate more than 7.6%. Therefore, it can be also supposed that one of these ores can be the source for the arsenical copper objects of Sotira-*Kaminoudhia* (Gale, 1991: 50, Table 7.; Gale et al., 1997: 243-245, Table 4.; Table 5.; Kassianidou, 2013a: 233). It is possible that the complex polymetallic ores of Limassol Forest area were indeed being mined during the Philia period (Webb, 2013: 62-63), since close proximity to the Sotira-*Kaminoudhia* communities coincides well with the higher arsenic values of the analysed metals from that site (ranges between 2.5% – 7%).

Webb suggests that "an understanding of the technical advantages provided by even quite low concentrations of arsenic and the absence of local tin may have led prospectors in Cyprus to seek out (arsenical) ores from the beginning" (Webb, 2013: 63). She suggests that mixing copper with arsenic alloy was a deliberate choice done by the Cypriot metal smith or it can be supposed that since the local smiths had realized the technical advantage of arsenic alloy, Cypriot metallurgists preferred to mine the Limassol area where the nearest source presents high arsenic ores (Webb, 2013: 62-63). Muhly (1985b) suggests that since there is not any confirmation for arsenic being used as a separate mineral in the Bronze Age, arsenical objects were produced as natural alloys by smelting arsenical copper ore. Additionally, he emphasizes that while Bronze Age textual evidence refers to tin as separate metal, there is no specific indication for arsenic, suggesting it was not used as separate metal like tin. The negative consequences of using arsenic alloy might have led the islanders to use another alloying metal, namely tin (Mina, 2014: 235). Harper examines the Bronze Age bronze working in detail in order to assess the potential hazard in producing arsenical copper alloys that can cause skin cancer and the development of a peripheral neuritis, which leads to weakness in the legs and feet as a long-term effect (Harper, 1987: 656). Therefore, differently from the technical advantages, the arsenide is a hazardous chemical for the human health due to the effect of chronic toxicity. Harper suggests that "in the case of arsenic a definite picture emerges of the effect of toxicity as a useful material is abandoned for health reasons on discovery of an acceptable alternative". Contrary to the Sotira-Kaminoudhia metal, none of the analyzed "local" Philia metalwork from the UNEMA collection present any arsenical residues. The only arsenical alloy objects from the UNEMA examples belonged to the later (Early Cypriot III and Middle Cypriot I) local assemblages (Table 9).

Analyses on Philia metalwork also show that some of its examples alloyed Cypriot ores with tin. Two axes attributed to a looted Philia tomb at Vasilia (?) on the north coast of Cyprus are consistent with the local copper source of Petromoutti/Yeresa in the Limassol Forest area. Lead isotope analyses show that while one of the flat axes (no. 1) presents almost pure copper (98.21% of Cu), the other flat axe (no. 2) contains a high amount of tin alloy (Sn 12.24%) (Table 9). According to Webb and her colleagues (2006: 274), since Cypriot native copper is extremely pure therefore the flat axe no. 1 is not likely to have been produced from the pure copper of Cyprus, but was probably cast from smelted copper ore, which was acquired from Petromoutti/ Yerasa, while the flat axe (no. 2) was produced from the same local copper ore and alloyed with imported tin. Although Cyprus presents one of the richest copper sources in the eastern Mediterranean, "tin was not available in Cyprus and was not present in Cypriot copper ores" (Muhly, 1985b; Giardino et al. 2003: 389; Webb et al. 2006: 274; Webb, 2013: 62-63; Knapp 2013: 309). Therefore, the analyses indicate that local smiths from Cyprus were sometimes alloying Cypriot (local) copper ores with (imported) tin to make bronze artifacts, as clearly evident in the UNEMA example (No. 2) (Table 9, Table 10) (Webb et al. 2006: 262; Webb, 2013: 62).

Although arsenical copper artifacts have a long history in Cyprus -since the Middle Chalcolithic period- it was believed until recently that true bronze (copper and tin alloy) did not appear until the Middle Cypriot period (Balthazar, 1990: 73). However, the UNEMA axe demonstrates that bronze (copper and tin alloy), either as imported finished objects or as local work, does occur during the Philia phase (Webb et al. 2006: 268; Webb, 2013: 62; Kassianidou, 2013a: 233). Therefore, evidence from the Philia metalwork listed by Webb and her colleagues (2006: 273, Table 5) may also support that during the Philia period local metal smiths in the Kyrenia Range for health reasons were moving to an acceptable alternative for arsenic, imported tin alloy. Meanwhile the abovementioned flat axe no. 2 is not the only example of tin alloy, there are two more objects (nos. 4,8) dating to the Philia period, which arrived to Cyprus from Anatolia either as imported objects or as imported stanniferous mineral. Therefore, it is possible that tin arrived to the island as a separate raw material or as finished copper tin products such as ingots or artefacts. The UNEMA examples demonstrate that the tin which was imported to the island was deliberately used by indigenous metal smiths of Cyprus to make durable bronze artefacts to substitute alloying copper with arsenic (Webb et al., 2006: 268, 274; Kassianidou, 2013a: 233).

Although the vast majority of the analyzed metal objects from Sotira-*Kaminoudhia* contain arsenic alloy, some do supplement evidence for bronze in the Philia culture.

At least four spiral rings (M13, M14, M21 and M22), from Sotira tomb 6 combine copper ores with imported tin. The spiral earrings (M13, M14, M21 and M22) were the first evidence for tin-copper alloys from Cyprus and they date to the Philia phase, which attests to the earliest appearance of the technological developments and innovations in the alloying practices (Giardino et al. 2003: 388).

It should be noted that, severe corrosion makes it difficult to conduct reliable analyses on these artifacts. However Quantative Energy Dispersive X-Ray Fluorescence analyses indicate that the spiral earrings contain tin. Samples M13, M14 and M22 present a small amount of arsenic and tin alloy; earring M21 shows a high presence of tin (Sn 10.2%), together with a significant amount of arsenical residues (As 1.7%); and sample M22 contains the highest rate of tin alloy (Sn 13.1%) (Giardino et al. 2003: 395, 388-390, Fig. 8.1.3; Webb et al., 2006: 274-275; Knapp, 2013: 312). Giardino and his colleagues (2003: 388) emphasize that the four bronze spiral earrings demonstrate a deliberate alloying process due to the high amount of tin (Sn between 5% and 13%). Therefore they (2003: 390) suggest that "the tin may have come from melting bronze with arsenical copper scrap metal". They were most likely to be imported artefacts or raw materials from Anatolia to Cyprus, since they resemble the examples from Early Bronze II Tarsus in Cilicia (Mellink, 1991: 173; Knapp, 2013: 309).

Overall, at least seven identified metal items from the Philia period contain tin alloy, which equals approximately 8% of the extant Philia metal objects, whereas the average of EB II metal objects from central and southern Anatolia, and Tarsus (EB II metal objects) is around 28% (Mina, 2014: 235). It is thought provoking that at the end of the Philia period (c. 2200 BC) tin-copper alloy (bronze) vanished from Cyprus until its recurrence after 2000 BC (Balthazar, 1990: 72-4; Webb et al., 2006: 274).

If the sources for Cypriot EB copper are well attested, those for tin are less evident. For some years, the Taurus Mountains in Anatolia have been proposed as the main source for tin during the 3rd mill. BC (Yener & Vandiver, 1993), but this still is a controversial assumption (Muhly, 1993; Weisgerber & Chierny, 2002: 180-181; see also *Journal of Mediterranean Archaeology* (5): 1995). While tin copper objects emerged in the Aegean, including Crete and the Cyclades in the Early Bronze Age II period (Early Minoan II and Early Cycladic II), the appearance of the bronze in Anatolia is dated toward the end of the fourth mill. BC, in the southeast at Tell Judeideh in the Amuq. Evidence from Troy in Anatolia and Thermi in Greece as two opposite coastlines in the Aegean Sea indicates that the earliest appearance of bronze alloy is dated to the late fourth mill. BC (Giardino et al. 2003: 389). According to Giardino and his colleagues, "chronological data seem to emphasize the importance of Cyprus in transmitting this new technology by sea from the Anatolian coast across to the Aegean". However, chronologically tin copper objects first appeared in Cyprus during the Philia period, when the island culture engaged in the *Anatolian Trade Network* system. Since tin copper objects became widespread in Mesopotamia and Central Anatolia as far as Troy by 2600 BC, the technology possibly reached Cyprus across the Anatolian Trade network zone (Şahoğlu, 2005; Broodbank, 2013: 336-337; Manning, 2013: 18).

In addition to arsenic-copper and tin-copper production, precious metals, - such as electrum, are attested by a few objects in Cyprus. Sotira-*Kaminoudhia* produced two spiral earrings (M6 and M7), which are the earliest electrum (the natural alloy of silver and gold) ever to be excavated in Cyprus, displaying the use of these precious metals at this time (Figure 15). For instance, as Kassianidou (2013a: 234) underlines, “although 4.6 tons of gold and 26.3 tons of silver were exported from Cyprus in the 20th century, it is highly unlikely that precious metals were ever extracted in antiquity on the island”. Whereas traces of gold and silver occur in Cyprus, concentrations in the massive sulphide deposits of the Troodos Mountains are very low, and extraction of these metals is a complicated process even today. However, metallurgical analyses indicate that the local smiths made their artifacts from “an alloy of gold, silver (15-20%) and copper (1-3%)”. (Giardino et al. 2003: 391; Webb et al., 2006: 265; Kassianidou, 2013a: 233-234, Mina, 2014: 234-235). The lead isotope composition from one of the spiral earrings suggests that the source of the electrum may be compatible with “an Anatolian source: the Pactolus river, which runs through Sardis” (Kassianidou, 2013a: 234; Mina, 2014: 235). The appearance of Anatolian electrum -as in the case of tin alloy- may have reached the island in relation with “the Anatolian Trade Network” of the Cypriot agency, whether as an indigenous or Anatolian migrant of Cyprus (Şahoğlu, 2005; Kouka, 2009).

It is suggested that the metal smith who produced the spiral earrings (M13, M14, M21 and M22), chose a copper-tin alloy to imitate the color of gold (Webb *et* al., 2006: 274). The artisan’s aim was to make jewellery with a particular chromatic effect, in this case a brilliant tone of yellow similar to gold. Since a pair of gold earrings (M6 and M7) was found on the site, this indicates that the metal was well known and appreciated by the *Kaminoudhia* community (Giardino et al. 2003: 389). However, it may not have been a deliberate technical choice (Mina, 2014: 235). Taking everything into account, differently from the usage of alloy, various metallurgical evidence conclusively demonstrates that there was a seaborne cultural exchange of metals, including copper, tin and precious metal (electrum) between Cyprus and other parts of the Eastern Mediterranean (Knapp, 2013: 307-311).

The other result from the analysed metal objects indicates that some of the Philia finished metalworks or their ores, were also imported from the mines in either Anatolia (Bolkardağ, Ergani Maden and Doğancılar) or the Cyclades (Kythnos (Milyes ores) and Seriphos). The axe butt (KM 457) from Philia period 5 at Kissonerga-*Mosphilia* may have come from north-western Anatolia, since its lead isotope composition is compatible with the Doğancılar copper ore deposit in the Troad (Gale, 1991: 54). The analytical results from the UNEMA collection, also significantly verified the use of non-Cypriot copper metal. Lead Isotope Analysis shows that two bronze spearheads and a sword, in any case typologically non-Cypriot, can probably be traced to a copper source in the central Taurus Mountains (Bolkardağ), with the amount of tin between 9.87% and 12.57% (Table 9, Table 10) (Webb *et al.*, 2006: 264-265, 268, 271; Webb, 2013: 62; Mina, 2014: 234). The typology and the sophisticated manufacture of the spearheads, made in two-piece molds, connect them to examples from EB II Tarsus (Webb et al. 2006: 265; Mina, 2014: 235). Therefore, it is suggested that they were imported as finished objects from Anatolia to Cyprus (Kassianidou, 2013a: 232-233; Webb, 2013: 62-63).

In addition to Anatolian sources, Cycladic copper ores were also used in the metal manufacturing during the Philia phase. It is evident from the armband or ring-ingot (no. 3), and perforated axe (no. 5) in the UNEMA collection, which "are marginally consistent with an origin from copper/iron ores occurring at Milyes on Kythnos in the Cyclades" (Table 9) (Webb et al. 2006: 271). Another Lead Isotope Analysis on a Philia metalwork knife (no. 14) also reveals that its copper source is coming from either Kythnos or Seriphos in the Cyclades (Webb et al. 2006: 271; Kassianidou, 2013a: 232-233). As Webb (2013: 62) underlines "these analyses suggest that Cyprus was receiving raw material from foreign sources and adopting "international" ingot forms from the earliest phase of local production". However it should not be forgotten that although local smiths of Cyprus obtained some of their metal from the foreign sources, except for pre-Philia examples from Pella (the Levant) and Crete (the Aegean) (ca. 3000 -2800 BC), Cypriot ores have not yet been found outside of Cyprus contemporary with the Philia period (ca. 2500/2450 – 2350/2200 BC). It is possible that since Anatolian communities had their own access to local copper sources, they were not interested in foreign sources. The other option is that a metal smith in Cyprus as a skilled Anatolian immigrant may have produced copper ingots to distribute them in an island-scale, like the other Philia homogeneous material culture, such as the ceramic uniformity and the enclosed character of Early Cypriot Cyprus (almost no outside contact from 2200 to 2000 BC). These features were supplemented by "metals and the metals trade, both of which are associated with major changes and considered to have played an important role in the island's internal economy during the Philia period" (Dikomitou-Eliadou, 2013: 30). Adopting new metallurgical technologies and the consumption of metal as a product established a "distinct cultural" phase in Prehistoric Cyprus, which may have been promoted by the neighborhoods of Cyprus, including the Aegean (Crete: Early Minoan IIB and Cyclades: The Lefkandi I-*Kastri* Phase), Anatolia (Early Bronze II/Southeast Anatolia: Early Bronze III Tarsus), the Levant (Early Bronze III/IVA) and Mesopotamia (Early Dynastic III) (Mina, 2014: 234, 237; see also Goldman, 1956, Fig. 434.2; Stewart, 1962: 275; Swiny, 1985: 21-22; Swiny, 1986: 37; Gale, 1991: 54; Mellink, 1991; Webb et al. 2006: 265; Kouka, 2009: 45,36, Fig 1.; Knapp, 2013: 309; Bachhuber, 2014: 144-148). The novel metallurgical practices of the Philia culture can provide insights about transformations, technical skill, cultural knowledge and meaning, as well as social organization and cultural relations (gender roles and identities) (Mina, 2014: 236). In this respect there can be no doubt that metallurgical practices of the Philia culture reflected a social transformation in which the patterns of cultural interaction presented a largely unified social environment in Cyprus.

At the same time, it also represents homogeneity in material culture: pottery, spurred annular pendants, distinctive metal artifacts, and biconical spindle whorls (Webb & Frankel, 1999; 2008; Knapp, 2013: 280). For instance, in the Chalcolithic period, picrolite, faience, dentalium shell and bone (pendants and beads) were used for embellishing the body. However, it seems that the introduction of advanced metal technology affected “the concept of embodiment”. It can be also seen that differently from the Chalcolithic bone pins, the Philia toggle-pins were used as a novel dress fastener, presenting close relations with the innovations in textile production (introduction of new types of spindle whorls and loom weights) (Crewe, 1998). Therefore, it should be recognized that the metal objects from the Philia period, which were used as dress attachments, present a close relation with the innovative textile products, which are also associated with major changes (Mina, 2014).

It has been shown that the metallurgical developments in prehistoric Cyprus are closely related with its cultural changes. In spite of its rich copper sources compared to its neighbors, the exploitation of copper occurred later than these regions, which can be explained with its relative isolation. The Middle Chalcolithic is considered as the initial stage for the metallurgical activities in Cyprus, while Late Chalcolithic is the experimentation and organisation phase. Next, the transition from Chalcolithic to the Early Bronze Age Cyprus witnessed profound changes in the metallurgical technology, as well as in the metalworking techniques employed. This transition corresponds to the development stage.

The general assessment suggests that the introduction of copper (ca. 3500 BC) to Cyprus is often associated with the usage of picrolite as a drive for the exploitation of copper sources. However, it is an ongoing debate as to what extent picrolite and copper were associated. The evidence coming from Yialia and Souskiou-Laona suggests that awareness of the presence of copper ores was possibly linked to the usage of picrolite.

It still cannot be concluded whether the emergence of metallurgy during Middle Chalcolithic (ca. 3500 BC) Cyprus was internal or external, but by Late Chalcolithic (ca. 3000 BC) it was present with small-scale local activities. However, the rapid development in metallurgical activities occurs throughout the Philia culture (ca. 2500 BC). This transformation was especially accelerated by the introduction of local casting through molds and resulted in significant changes in the typology and technology of production. This period is characterized especially by spiral earrings, which emerged during this phase and disappeared with it. Concerning the technology of metallurgy, one can point out to the usage of arsenical copper which produces more durable products, while a healthier alternative may also have been imported as raw material or an end product, which was tin.

The adaptation of these new metallurgical technologies as well as different typologies of metal objects point to a distinct cultural phase lasting between ca. 2500-2200 BC. As also shown with the maritime perspective, when the isolation of Cyprus ended, the interaction with neighboring regions, the Aegean, Anatolia, the Levant and Mesopotamia may have been the facilitators of such developments, especially accelerating with the migration from Anatolia. Therefore the changes in metallurgical activities are closely linked with interaction with the outsiders, and these metallurgical activities culturally characterize the Philia phase.

CHAPTER 4

DISCUSSION AND CONCLUSION

4.1 A General Overview of the Eastern Mediterranean Metallurgy

In the following chapter, after a general overview of the developments in the eastern Mediterranean metallurgy, the Philia phase will be contextualised within this assessment. In the light of Yalçın's work (Table 11) on the periodization of the development of metallurgy in Anatolia, a similar periodization will be adapted to the eastern Mediterranean and Cyprus in order to compare the course of the macro (eastern Mediterranean) with the micro (Cyprus).

4.1.2 4000 BC Development Phase

In the early 4th mill. BC, widespread metallurgical activities appeared for the first time in/throughout the eastern Mediterranean (Yalçın, 2008: 22-23). Among their products are standardized types of tools and jewellery and they include the earliest alloys. Late Chalcolithic and Early Bronze metalsmiths may have realized the advantages of arsenical copper to produce high-quality artefacts. Workshops were found in the settlement as well as raw materials and therefore metal trade.

4.1.3 3000 BC Building Phase

In the 3rd mill. BC wide-spread metallurgical practices such as underground mining and smelting in furnaces were introduced. Tin copper objects appeared and by 2600 BC, became widespread in Mesopotamia and Central Anatolia as far as Troy (related with the ATN system). "The discovery of bronze gave rise to the golden age of the metal trade" (Yalçın, 2008: 24). However, this cannot be observed throughout all Anatolian regions; certain localities in the Near East and Anatolia kept using arsenic copper (for instance, İkiztepe), where local availability of ores may have played an important role. The objects found such as ingots, weapons, tools, and jewellery were also commonly made of lead, silver and gold. Hierarchical structures developed within the society due to well-organised mining, metallurgy and metal trade (Yalçın, 2008: 24).

4.2 An Assessment of Cypriot Metallurgy in Relation with the Eastern Mediterranean

4.2.1 3500 BC: Beginning/Initial Stage[12]

Even though metallurgical activities became widespread in the eastern Mediterranean around 4000 BC, the earliest metallurgical evidence in Cyprus occurred almost 500 years later (Table 12). Oxide ores were collected then for the first time and were used as pigments or to produce small items such as tools and ornaments (chisels, beads and pendants). In Anatolia, while the beginning of collecting copper oxide ores is closely associated with the earliest interest in obsidian

[12] For references, see pp. 32-46.

manufacturing, in Cyprus it can be related with the local picrolite industry. Therefore, both obsidian and picrolite are associated with the emergence of copper exploitation.

Obsidian, picrolite and metal are the basic extractive raw materials from which utilitarian products such as tools are made for various purposes in the prehistoric periods. It seems that these different elements as natural resources were attracting ancient cultures' attention at different times. It is obvious that as an earliest precious raw material, obsidian -which is a glasslike volcanic rock formed by the rapid solidification of lava without crystallization -played a substantial role in the cultural development of mankind from the Paleolithic period until the Bronze Age. As a very solid material, obsidian allowed ancient cultures to make more durable sharp-edged tools and weapons for different purposes, such as knives, saws and arrow points. Obsidian resources are very limited in the world and only occur in areas where volcanic activities created this special type of rock. For the eastern Mediterranean; Anatolia and the Aegean, where the highest quality obsidian deposits in the world can be found, became the two main obsidian suppliers for ancient cultures. The main obsidian deposits from Anatolia are located in eastern Anatolia (around Lake Van) and in south central Anatolia (near Cappadocia), whereas the Cycladic island of Melos became the main sources of obsidian for the Aegean and Western Anatolian cultures. Both resources were exploited and distributed throughout the regions from the Final Palaeolithic period until the Bronze Age (Chataigner et al. 1998; Perlès et al. 2011; Düring & Gratuze, 2013).

Differently from Anatolia and the Aegean; in Cyprus, where local resources are absent, obsidian was imported as finished objects or in the form of raw materials that were worked on the island. It was mainly Cappadocian in origin – from Göllü Dağ (Knapp, 2013: 91). However, with the beginning of the Chalcolithic period the common trends in obsidian exchange in Cyprus shifted temporally to the local product of picrolite, possibly due to difficulties in maintaining external contacts from the end of the Late Aceramic Neolithic period (ca. 7000 BC) until the emergence of the metallurgical activities on Cyprus. During the Neolithic period, Cypriot communities like other eastern Mediterranean peoples participated in obsidian exchange with the mainland, documenting maritime connectivity with the eastern Mediterranean. Even if the interest in obsidian did not completely disappear in Cyprus, it is possible that due to the inaccessibility of the island, it became a rare commodity. While obsidian can be used to create durable strong tools, the soft material of picrolite is not suitable for creating such artifacts. Therefore, throughout its occurrence picrolite was associated with a different purpose as a religious and/or identity maker that can be compared with the anthropomorphic marble figurines of the Cycladic civilization. When native picrolite products replaced the role of imported obsidian, picrolite started to be circulated widely on an island scale in the 4^{th} mill. BC.

As discussed earlier, the relationship between obsidian and metal with the growing interest in picrolite exploitation simultaneously played a significant role for the emergence of local metallurgy in Cyprus. Chalcolithic cultures from Cyprus brought picrolite into their sites and created valuable products. Then ca. 3500, in their exploration for picrolite, the Chalcolithic communities from southeastern Cyprus discovered a new local raw material, namely copper, to use as pigments or to produce ornaments and basic tools. This may suggest that while there was a changing ideology from obsidian to metal in the eastern Mediterranean, in Cyprus it occurred from local picrolite to metal. Gale interpreted the Chalcolithic copper industry as primitive and provincial, suggesting that it was possibly “influenced by diffusion, Cypriot intervention, local innovation within Cyprus, transmaritime contacts and imports” (1991: 37). However as discussed previously, concerning maritime connectivity, until the start of the Late Chalcolithic Cyprus was in isolation. Therefore, it can be concluded that the initiation of metallurgy in Cyprus was not a result of foreign intervention, as suggested by Gale, but was a native development, possibly in relation with picrolite. Although the nature of distance between Cyprus and the mainland highlights the relative insularity for the island culture for a long time period, material and maritime evidence shows that its isolation started to break down with the Late Chalcolithic period.

4.2.2 3000 BC: Organization/Experimentation Stage[13]

While the transition from the Middle to Late Chalcolithic period presents a clear gap so far as settlement is concerned, copper objects found in the Aegean and the Levant that were exported from Cyprus date to ca. 3000 BC. They are the earliest examples of copper exploitation in Cyprus. The eastern Mediterranean peoples’ quest for metal, like Melian obsidian, possibly led them to Cyprus, where copper sources are abundant. This period until 2500 BC can be considered an experimental phase due to the indications of mining close to the surface, represented by a total 12 objects varying from tools to ornaments such as chisels, awls and pendants. The evidence

[13] For references, see pp. 47-49.

coming from a copper object, metal waste and possible crucible(s) (ca. 2700 BC) indicates a small scale working of copper in the Late Chalcolithic (Bolger, 2013: 4). This is shown by the 26 objects from the entire Chalcolithic period that were dominantly made of Cypriot copper with only 2 objects from arsenical copper; meanwhile they were produced by hammering and annealing. A very recent study which examines the evidence coming from the Late Chalcolithic site Chlorakas-*Palloures* supports that during the Late Chalcolithic period, before the Philia Phase, Cyprus was involved in exchange networks which can also be related with the organization/experimentation stage of metallurgy (During et al. 2018).

4.2.3 2500 BC: Developmental Stage[14]

A drastic increase can be observed in the number of objects found after 2500 BC, with more than 100 objects ranging from ornaments and tools to weapons (dagger, knife, axe, chisel, awl, needle, earring, pin, razor). There is definite evidence for the continuing use of crucibles and the introduction of the casting-mold. This technique often indicates mass production, however not in the case of Cyprus where only small-scale production can be observed. Metallurgical studies indicate that copper ore extractions from the various local ores started during this period. The most important region to offer evidence for the exploitation of local arsenical copper resources is the Limassol forest area, which is in close relation with the site of Sotira-Kaminoudhia. There are also significant traces of copper imported from the Aegean and Anatolia as raw material or finished objects. In addition to these copper objects, 7 others containing imported tin alloy were found in Cyprus. These are mainly from the Kyrenia Range, with 4 objects made of tin-copper alloy from Sotira-

[14] For references, see pp. 49-70.

Kaminoudhia. This site is also distinctive for two electrum ornaments of possible Anatolian origin.

4.3 The Organization of Metallurgical Production and its Indications for the Philia Phase

Although there is no evidence to how the metal trade was organized by the Philia culture, one can make assumptions about the organization of metallurgical production deriving from the conclusions about Anatolia. For Anatolia it is suggested that metal production and circulation present a multi-tiered organization of two distinct areas; high-lands which are associated with mines as primary smelting and extracting sites and low-lands which are associated with large settlements as secondary production and consumption sites (Yener et al. 2015: 597). However in Cyprus it seems that the production is limited to small scale local copper workshops, managed by a group (an extended family) which was possibly integrated to the *Anatolian Trade Network* system. This is firstly due to the population estimation from the settlement of Marki Alonia, which reveals a group of settlers no more than fifty people and secondly to the presence and findspot of a casting mold (Webb & Frankel, 2004). Although Sotira as a cemetery site in the Philia period did not reveal any casting molds, its close proximity to the arsenical copper resources in the Limassol area proves the importance of the site in relation with metallurgical activity.

The evidence shows that the production of metal is closely related to the social dynamics of the ancient cultures. Therefore, metallurgical evidence should be considered as an index for the relationship among social complexity, technology, and long-distance trade. If one moves back to the origin of the Philia phase after the assessment of the metallurgical evidence, it is clear that the emergence of the Philia culture should be assessed from a wider perspective, just as metallurgy did not develop overnight but was a result of a multi-layered interaction starting from the Late Chalcolithic. The social and cultural developments which shaped Philia were also not the result of a rapid shift generated by migration, but an island-wide phenomenon of slow development affected by different variables.

Recently Bernard Knapp (2013: 264-277) re-evaluated the notion of an ethnic migration or colonization from a postcolonial perspective of hybridization by dividing the Philia communities into two distinctive groups: Anatolian migrants and the indigenous Cypriotes. Regarding the hybridization practices, he has opposed Webb and Frankel's proposition on ethnic migration from Anatolia which is supported by material evidence and lists their seven innovations and 'everyday practices' to demonstrate the origins of diverse material, sociocultural innovations of the Philia phase. In the whole discussion, Knapp suggests that there is sometimes nothing to connect some of the innovations solely to Anatolia, but they can also be considered as indigenous developments, if they were not in relation with the Levantine mainland. This perspective emphasizes the presence of local island communities in the southwest of the island, such as Kissonerga-Mosphilia, where the island communities created a hybrid culture with the Anatolian immigrants throughout the Philia phase (Peltenburg, 1991a, 2007; Bolger, 2006; 2013, Knapp, 2008: 114-130; 2013: 260-262).

This also leads one to consider the indigenous population from the Levantine perspective, which underlines straightforwardly the presence of Chalcolithic local populations in the island, who previous to the Anatolian interaction process - communication (ca. 2700 BC) and immigration (ca. 2500 BC)- had developed interactions with the Levantine mainland from the late 4th to early 3rd mill. BC (Bolger, 2013). It is significant that ¨Philia material culture in Cyprus and the Early Transcaucasian influences in the Levant are parallel developments in the 3rd mill. BC and mark the beginning of the Bronze Age in both regions¨ (Bachhuber, 2014: 139). All archaeological evidence from Cyprus in relation with the Levant draws a connection between the ETC culture and Cyprus. Even though the ETC culture movement is out of the scope of this thesis, detailed examinations of the ETC movement in the Levant and Cyprus can provide supplementary data for exploring and understanding the nature of the local island culture and the emergence of the distinct phase of the Philia (Rothman, 2004; Batiuk, 2005; 2013; Batiuk & Rothman, 2007; Greenberg & Palumbi, 2014). Overall, since ETC-related cultural traits seem to have coexisted in Cyprus, postcolonial assessment also demonstrates that people belonging to the Philia culture were neither wholly Cypriot nor Anatolian, and also involved hybridization' practices from the Levantine mainland especially in the late 4th and early 3rd mill. BC (Bolger, 2013).

It can also be argued that individual decision-making may trigger such various levels of migration from the mainland regions - "including the movement of men, women, children, potters, weavers, herdsmen and metallurgists, along with cattle, donkeys, goats and sheep and of some copper and tin" that formed a mixing of complex sociocultural groups (Kouka, 2009: 36; see also Webb & Frankel, 2007: 206).

Agent-Based Modeling in archaeology (Wurzer et. al. 2015) should also be applied here, since 'as an experimental test-bed it allows examining how individual decisions and actions could influence the emergence of complex social and socio-environmental systems', representing the important role of individual decision-making process. A significant case study, Horuichi's (2015) constructed agent-based simulation (ABMs) can be mentioned here. It confirms that neighboring multiple groups/cultures can be connected as a circular stepping-stone formation without boundaries and thus determines that cross-boundary communication and movements of individuals between societies affects the accumulation of cultures. The transformation from the Chalcolithic period to the Philia phase and the Early Bronze Age may have been generated from such interaction, springing between Cyprus and east Aegean/southwestern Anatolia, Cilicia and the Levant (Steel, 2004; Kouka, 2009; Bolger, 2013; Knapp, 2013; Bachhuber, 2014). In the initial stage, from late 4^{th} to early 3^{rd} mill. BC, Cyprus shows transmaritime connectivity with the Levantine cultures, as well as the ETC culture, while climatic stress was generating various difficulties for the eastern Mediterranean cultures (Bolger, 2013; Clarke et al. 2015). This connectivity then coupled with the Anatolian integration and immigration to Cyprus, and resulted in a hybridized culture emerging in the island, which was also associated with the metallurgical activities as shown before.

4.4 Conclusion

The cross-boundary communication and movements of individuals between the distinct societies formed a complex system that created a 'ratchet effect' for Cypriot cultural organization (Tomasello, 1999; Tennie et al. 2009). The ratchet effect is a concept in cultural psychology, which states that imitative learning is continuous, modified and improved, ¨…in which modifications and improvements stay in the population fairly readily (with relatively little loss or backward slippage) until further changes ratchet things up again¨ (Tennie et al. 2009: 2405). The Philia period is one of the most dynamic periods in all of Cypriot prehistory but lasted not more than 150-300 years (Manning, 2013). If we assume a generation of 30 years, it equals to 10 generations for 300 years. It can be supposed that the process of change towards a different social order from Late Chalcolithic to the Philia phase generated a ratchet effect as a sea change in the whole cultural organization of Bronze Age Cyprus.

The Philia phase profoundly changed the overall cultural system of Cyprus. Since the Late Chalcolithic period, the internal and external dynamics of the cultural changes rooted in maritime connectivity led to a noticeable transition in both material and cultural structures of the Cypriot societies, as well as the way in which native islanders came to deal with the changing conditions of their society. This happened through the common trend of maritime communication, interaction and expansion. During the Philia phase, Cyprus became the island of the eastern Mediterranean, as an integrated part of the region.

REFERENCES

Artin, G. (2014). The Northern Levant During the Chalcolithic Period. In M. L. Steiner, A. E. Killebrew (Eds.), *The Oxford Handbook of the Archaeology of the Levant* (pp. 212-223). Oxford: Oxford University Press.

Bachhuber, C. (2014). The Anatolian Contexts of Philia Material Culture in Cyprus. In B. A. Knapp, P. Van Dommelen (Eds.), *The Cambridge Prehistory of the Bronze and Iron Age Mediterranean*, (pp. 139-156). Cambridge: Cambridge University Press.

Balthazar, J. W. (1990). *Copper and Bronze Working in Early through Middle Bronze Age Cyprus*. Jönsered: P. Åströms Förlag.

Bartelheim, M., Kızılduman, B., Müller, U., Pernicka, E., & Tekel, H. (2008). The Late Bronze Age Hoard of Kaleburnu/Galinoporni on Cyprus, *Památky Archeologické*, 99, 161-188.

Batiuk, S. (2005). *Migration Theory and the Distribution of the Early Transcaucasian Culture.* (Ph.D. Dissertation). Toronto: University of Toronto.

Batiuk, S. (2013). The Fruits of Migration: Understanding the 'Longue durée' and the Socio-economic Relations of the Early Transcaucasian Culture, *Journal of Anthropological Archaeology,* 32, 449-477.

Batiuk, S. & Rothman, M. (2007). Early Transcaucasian Cultures and their Neighbors: Unraveling Migration, Trade, and Assimilation. *Expedition*, 49(1), 7-17.

Bolger, D. (2007). Cultural Interaction in 3rd Millennium BC Cyprus: Evidence of Ceramics. In S. Antoniadou, A. Pace (Eds.), *Mediterranean Crossroads,* (pp. 163-88). Athens: Pierides Foundation.

Bolger, D. (2013). A Matter of Choice: Cypriot Interactions with the Levantine Mainland during the Late 4th–3rd Millennium BC, *Levant*, 45, 1-18.

Bolt, H. M. (2012). Arsenic: An Ancient Toxicant of Continuous Public Health Impact, from Iceman Ötzi until now, *Archives of Toxicology*, 86 (6), 825-830.

Braudel, F. (1972). *The Mediterranean and the Mediterranean World in the Age of Philip II.* S. Reynolds, trans. NY: Harper and Row.

Broodbank, C. (2000). *An Island Archaeology of the Early Cyclades*. Cambridge University Press.

Broodbank, C. (2008). Not Waving but Drowning, *Journal of Island and Coastal Archaeology* 3(1), 72-76.

Broodbank, C. (2013). *The Making of the Middle Sea: A History of the Mediterranean from the Beginning to the Emergence of the Classical World*. London: Thames & Hudson.

Broodbank, C. (2016). The Transmitting Sea: A Mediterranean Perspective. In E. Kiriatzi, C. Knappett (Eds.), *Human Mobility and Technological Transfer in the Prehistoric Mediterranean,* (pp. 18-30). The British School at Athens: Cambridge University Press.

Brothwell, D. & Grime, G. (2002) The Analysis of the Hair of the Neolithic Iceman. In N. Lynnerup, C. Andreasen & J. Berglund (Eds.), *Mummies in a New Millennium*. Proceedings of the 4th World Congress on Mummy Studies, Sept. 4–10, 2001, (pp 66–69). Nuuk, Greenland: Greenland National Museum and Archives and Danish Polar Center.

Chataigner, C., Poidevin, J. L., & Arnaud, N. O. (1998). Turkish Occurrences of Obsidian and Use by Prehistoric Peoples in the Near East from 14,000 to 6000 BP, *Journal of Volcanology and Geothermal Research*, 85(1-4), 517-537.

Clarke, J., Brooks, N., Banning, E. B., Bar-Matthews, M., Campbell, S., Clare, L., ... & Manning, S. (2016). Climatic Changes and Social Transformations in the Near East and North Africa during the 'Long' 4th millennium BC: A comparative Study of Environmental and Archaeological Evidence, *Quaternary Science Reviews*, *136*, 96-121.

Crewe, L. (1998). *Spindle Whorls: A Study of Form, Function and Decoration in Prehistoric Bronze Age Cyprus* (SIMA Vol. 149). Göteborg: P. Åströms Förlag.

Crewe, L. (2015). Expanding and Shrinking Networks of Interaction: Cyprus c. 2200 BC. In H. H. Meller et. al. (Eds.), *2200 BC – A Climatic Breakdown as a Cause for Collapse of the Old World?,* (pp. 131-148). Berlin: Tagungen des Landesmuseum für Vorgeschichte Halle – Band 12/I.

Crewe, L., & Knappett, C. (2012). Technological Innovation and Island Societies: Wheelmade Pottery on Bronze Age and Iron Age Crete and Cyprus, *British School at Athens Studies*, 175-185.

Croft, P. (1991). Man and Beast in Chalcolithic Cyprus, *Bulletin of the American Schools of Oriental Research* (282/283), 63-79.

Day, P. M., & Doonan, R. C. (Eds.). (2007). *Metallurgy in the Early Bronze Age Aegean*. Oxford: Oxbow Books.

Dikaios, P. (1962). The Stone Age. In P. Dikaios & J. R. Stewart (Eds.), *The Swedish Cyprus Expedition, Volume IV, Part 1A, The Stone Age and Early Bronze Age in Cyprus,* (pp. 1-204). Lund: The Swedish Cyprus Expedition.

Dikomitou-Eliadou, M. (2013). Interactive Communities at the Dawn of the Cypriot Bronze Age: An Interdisciplinary Approach to Philia Phase Ceramic Variability. In A. B. Knapp, J. M. Webb, A. McCarthy (Eds.), *An Archaeological Legacy* (*SIMA* Vol 139), (pp. 23-31). Uppsala: Åströms Förlag.

De Jesus, P. S. (1980). *The Development of Prehistoric Mining and Metallurgy in Anatolia* (B.A.R. Vol. 74). Oxford: Arcaeopress.

De Ryck, I., Adriaens, A., & Adams, F. (2005). An Overview of Mesopotamian Bronze Metallurgy during the 3rd millennium BC, *Journal of Cultural Heritage*, 6(3), 261-268.

Düring, B. S., & Gratuze, B. (2013). Obsidian Exchange Networks in Prehistoric Anatolia: New Data from the Black Sea Region, *Paléorient*, 173-182.

Düring, B. S., Klinkenberg, V., Paraskeva, C., Kassianidou, V., Souter, E., Croft, P., & Charalambous, A. (2018). Metal Artefacts in Chalcolithic Cyprus: New Data from Western Cyprus. *Mediterranean Archaeology and Archaeometry*, 18(1), 11-25.

Efe, T. (2007). The Theories of the 'Great Caravan Route' between Cilicia and Troy: the Early Bronze Age III Period in Inland Western Anatolia, *Anatolian Studies*, 57, 47-64.

Eliades, N. G. H., Gailing, O., Leinemann, L., Fady, B., & Finkeldey, R. (2011). High Genetic Diversity and Significant Population Structure in Cedrus Brevifolia Henry, a Narrow Endemic Mediterranean Tree from Cyprus, *Plant Systematics and Evolution*, 294(3-4), 185-198.

Farr, H. (2006). Seafaring as Social Action, *Journal of Maritime Archaeology*, 1, 85-99.

Fitzpatrick, S., & Anderson, A. (2008). Island Worlds Apart: Interaction and Remoteness on Seas and Oceans, *Journal of Island & Coastal Archaeology*, 3(1), 1-3.

Frankel, D. (2000). Migration and Ethnicity in Prehistoric Cyprus: Technology as Habitus, *European Journal of Archaeology,* 3, 167-87.

Frankel, D. (2005). Becoming Bronze Age: Acculturation and Enculturation in the Third Millennium BCE Cyprus. In J. Clark (Eds.), *Archaeological Perspectives on the Transmission and Transformation of Culture in the Eastern Mediterranean*, (pp. 18-24). Oxford: Oxford University Press.

Frankel, D. & Webb, J. M. (1996). *Marki-Alonia: An Early and Middle Bronze Age Town in Cyprus. Excavations 1990-1994*. (SIMA 123.1) Jönsered: P. Åströms Förlag.

Frankel, D. & Webb, J. M. (1998). Three Faces of Identity. Ethnicity, Community and Status in the Cypriot Bronze Age, *Mediterranean Archaeology,* 11, 1-12.

Frankel, D. & Webb, J. M. (2004). An Early Bronze Age Shell Pendant from Cyprus, *Bulletin of the American Schools of Oriental Research,* 336, 1-9.

Frankel, D. & Webb, J. M. (2006). *Marki-Alonia: An Early and Middle Bronze Age Settlement in Cyprus. Excavations 1995-2000*. (SIMA 123.2) Sävedalen: P. Åströms Förlag.

Frankel, D., Webb, J. M. & Pike-Tay, A. (2013). Seasonality and Site Function in Chalcolithic Cyprus, *European Journal of Archaeology*, 16(1), 94-115.

Gale, N. H. (1991). Metals and Metallurgy in the Chalcolithic Period, *Bulletin of the American Schools of Oriental Research*, 282/283, 37-61.

Gale, N. H., Papastamataki, A., & Stos-Gale, Z. (1985). Copper Sources and Copper Metallurgy in the Aegean Bronze Age (Retroactive Coverage), *British Museum Publications Ltd., Furnaces and Smelting Technology in Antiquity,* 81-101.

Gale, N. H., Stos-Gale, Z. A., Maliotis, G., & Annetts, N. (1997). Lead Isotope Data from the Isotrace Laboratory, Oxford: Archaeometry Data Base 4, Ores from Cyprus, *Archaeometry*, 39(1), 237-246.

Genz, H. (2000). The Organization of Early Bronze Age Metalworking in the Southern Levant, *Paléorient*, 55-65.

Giardino, C., E. Gigante, G. E. & Ridolfi, S. (2003). Archaeometallurgical Studies. In S. Swiny, G. Rapp, E. Herscher (Eds.), *Sotira Kaminoudhia: An Early Bronze Age Site in Cyprus.* American Schools of Oriental Research Archaeological Reports Volume 8, Cyprus American Archaeological Reseacrh Institute Monograph 4, (pp. 369-396). Boston: American Schools of Oriental Research.

Goldman, H. (Ed.). (1956). *Excavations at Gözlü Kule, Tarsus. 2, From the Neolithic through the Bronze Age:[2]. Plates*. Princeton University Press.

Greenberg, R., & Palumbi, G. (2012). Corridors and Colonies: Comparing Fourth–Third Millennia BC Interactions in Southeast Anatolia and the Levant. In B. A. Knapp, P. Van Dommelen (Eds.), *The Cambridge Prehistory of the Bronze and Iron Age Mediterranean*, (pp. 111-138). Cambridge: Cambridge University Press.

Harper, M. (1987). Possible Toxic Metal Exposure of Prehistoric Bronze Workers, *Occupational and Environmental Medicine*, 44(10), 652-656.

Horiuchi, S. (2015). Globalization May Cause Cultural Accumulation in the Whole Population. In. Nakai Y., Koyama Y., Terano T. (Eds.), *Agent-Based Approaches in Economic and Social Complex Systems VIII. Agent-Based Social Systems*, Vol 13. (pp. 27-37). Tokyo: Springer.

Huyge, D., & Darnell, J. C. (2010). Once More British Museum EA35324, *Göttinger Miszellen*, 225, 71-74.

Kassianidou, V. (2013a). Metals. In E. Peltenburg (Ed.), *ARCANE. Associated Regional Chronologies for the Ancient Near East and the Eastern Mediterranean*. *Volume II. Cyprus*, (pp. 231-249). Turnhout: BREPOLS.

Kassianidou, V. (2013b). Mining Landscapes of Prehistoric Cyprus, *Metalla*, 20(2), 5-57.

Kassianidou, V., & Knapp, A. B. (2005). Archaeometallurgy in the Mediterranean: The Social Context of Mining, Technology and Trade. In E. Blake & A. B. Knapp (Eds.), *The Archaeology of Mediterranean Prehistory*. (pp. 215-251). Oxford: Blackwell Publishing.

Keskin, L. H. (2016). A Survey of West Anatolian Metallurgy Prior to Middle Bronze Age (2000 BC), *The International Journal of Humanities & Social Studies.* Vol. 4(6), 187-195.

Keswani, P. (2004). *Mortuary Ritual and Society in Bronze Age Cyprus*. London: Equinox Publishing Ltd.

Kızılduman, B. (2004). Güzelyurt Arkeolojik Yüzey Araştırma Projesi I. Dönem Çalışması, *Journal of Cyprus Studies,* 10(26/27), 189-199.

Kızılduman, B. (2017). Kıbrıs'ta Kaleburnu-Kral Tepesi/Galinoporni-Vasili'de Dikkate Değer bir Geç Tunç Çağı Yapısı, *Olba*, 25, 113-159.

Knapp, B. A. (2008). *Prehistoric and Protohistoric Cyprus: Identity, Insularity and Connectivity.* Oxford: Oxford University Press.

Knapp, B. A. (2013). *The Archaeology of Cyprus: From Earliest Prehistory through the Bronze Age*. New York: Cambridge University Press.

Knapp, B. A., Bouzek, J., Frankel, D., Held, S. O., Peltenburg, E., & Simmons, A. H. (1990). Production, Location, and Integration in Bronze Age Cyprus [and Comments and Reply], *Current Anthropology*, 31(2), 147-176.

Kouka, I. (2009). Cross-cultural Links and Elite-Identities: The Eastern Aegean/Western Anatolia and Cyprus from Early Third Millennium through the Early Second Millennium BC. In V. Karageorghis, O. Kouka (Eds.), *Cyprus and the East Aegean: Intercultural Contacts from 3000 to 500 BC*, (pp. 31-47). Nicosia: A. G. Leventis Foundation.

Lehner, J. W., & Yener, K. A. (2014). Organization and Specialization of Early Mining and Metal Technologies in Anatolia. In B. W. Roberts, C. P. Thornton (Eds.), *Archaeometallurgy in Global Perspective,* (pp. 529-557). New York: Springer.

Manning, S. (2013). Cyprus at 2200 BC: Rethinking the Chronology of the Cypriot Early Bronze Age. In A.B. Knapp et al. (Eds.), *J.R.B. Stewart: An Archaeological Legacy, (*SIMA 139*)*, (pp. 1-21). Uppsala: P. Åströms Förlag.

Manning, S. W. & Hulin, L. (2005). Maritime Commerce and Geographies of Mobility in the Late Bronze Age of the Eastern Mediterranean: Problematizations. In E. Blake, A.B. Knapp (Eds.), *The Archaeology of Mediterranean Prehistory,* (pp. 270-302). Malden, MA: Blackwell Publication.

Mark, S. (2013). The Earliest Sailboats in Egypt and their Influence on the Development of Trade, Seafaring in the Red Sea, and State Development, *Journal of Ancient Egyptian Interconnections*, *5*(1), 28-37.

Massa, M. (2016). *Networks Before Empires: Cultural Transfers in West and Central Anatolia during the Early Bronze Age* (Doctoral dissertation, University College London).

McGrail, S. (2001). *Boats of the World: From the Stone Age to Medieval Times.* Oxford: Oxford University Press.

Mellink, M. J. (1991). Anatolian Contacts with Chalcolithic Cyprus, *Bulletin of the American Schools of Oriental Research,* (282/283),167-175.

Mina, M. (2014). Forging Identities: Metallurgical Technology and Embodied Experiences in the Philia Period. In J. M. Webb (Ed.), *Structure, Measurement and Meaning: Studies on Prehistoric Cyprus in Honour of David Frankel (*SIMA 143*)*, (pp. 229-243). Uppsala: P. Åströms Förlag.

Muhly, J. D. (1985a). Beyond Typology: Aegean Metallurgy in its Historical Context. In N. C. Wilkie, W. D. E. Coulson (Eds.), *Contributions to Aegean Archaeology. Studies in Honor of William A. McDonald, Center of Ancient Studies, University of Minnesota, Minneapolis*, (pp. 109-141). Minneapolis: Kendall/Hunt Pub. Co.

Muhly, J. D. (1985b). Sources of Tin and the Beginnings of Bronze Metallurgy, *American Journal of Archaeology*, 89(2), 275-291.

Muhly, J. D. (1989). Çayönü Tepesi and the Beginnings of Metallurgy in the Ancient World. In A. Hauptman, E. Pernicka, G. A. Wagner (Eds.), *Old World Archaeometallurgy: Proceedings of the International Symposium "Old World Archaeometallurgy*", (pp. 1-11). Heidelberg: Bochum.

Muhly, J. D. (1993). Early Bronze Age Tin and the Taurus, *American Journal of Archaeology*, 97(2), 239-253.

Muhly, J. D. (2011). Metals and Metallurgy. In S. R. Steadman, G. McMahon (Eds.), *The Oxford Handbook of Ancient Anatolia:(10,000-323 BCE),* (pp. 858-876). New York: Oxford University Press.

Müller, U. & Kızılduman, B. (2004). A Newly Discovered Bronze Age Site in Cyprus, *Journal of Cyprus Studies,* 10(26/27), 200-205.

Oeggl, K. (2009) The Significance of the Tyrolean Iceman for the Archeobotany of Central Europe, *Vegetation History and Archaeobotany*, 18:1–11.

Papaconstantinou, D. (2013). Settlement Planning and Architecture. In E. Peltenburg (Ed.), *ARCANE. Associated Regional Chronologies for the Ancient Near East and the Eastern Mediterranean. Volume II. Cyprus*, (pp. 129-160). Turnhout: BREPOLS.

Peltenburg, E. (1982). Early Copperwork in Cyprus and the Exploitation of Picrolite: Evidence from the Lemba Archaeological Project. In J. Muhly, R. Maddin, V. Karageorghis (Eds.), *Early Metallurgy in Cyprus, 4000-500 BC,* (pp. 41-65). Larnaca: Pierides Foundation.

Peltenburg, E. (1990). Chalcolithic Cyprus. In J. Harris (Ed.), *Cyprus before the Bronze Age: Art of the Chalcolithic Period,* (pp. 5-24). Malibu, California: The J. Paul Getty Museum.

Peltenburg, E. (1991a). Kissonerga-Mosphilia: A Major Chalcolithic Site in Cyprus, *Bulletin of the American Schools of Oriental Research* (282/283), 17-35.

Peltenburg, E. (1991b). Local Exchange in Prehistoric Cyprus: An Initial Assessment of Picrolite, *Bulletin of the American Schools of Oriental Research* (282/283), 107-126.

Peltenburg, E. (2007). East Mediterranean Interaction in the 3rd Millennium BC. In S. Antoniadou, A. Pace (Eds.), *Mediterranean Crossroads,* (pp. 141-161). Athens, Oxford: Pierides Foundation; Oxbow.

Peltenburg, E. (2011). Cypriot Chalcolithic Metalwork. In P.B. Betancourt, S.C. Ferrence (Eds.), *Metallurgy: Understanding How, Learning Why. Studies in Honor of James D. Muhly,* (pp. 3-10). Philadelphia: INSTAP Academic Press.

Peltenburg, E. (2013). (Ed.). *ARCANE. Associated Regional Chronologies for the Ancient Near East and the Eastern Mediterranean. Volume II. Cyprus*. Turnhout: BREPOLS.

Peltenburg, E. & Project Members (1998). *Lemba Archaeological Project II.1A. Excavation at Kissonerga-Mosphilia 1979-1992*. (SIMA 70. 2.) Jönsered: P. Åströms Förlag.

Perlès, C., Takaoğlu, T., & Gratuze, B. (2011). Melian Obsidian in NW Turkey: Evidence for Early Neolithic Trade, *Journal of Field Archaeology*, 36(1), 42-49.

Philip, G., Clogg, P. W., Dungworth, D., & Stos, S. (2003). Copper Metallurgy in the Jordan Valley from the Third to the First Millennia BC: Chemical, Metallographic and Lead Isotope Analyses of Artefacts from Pella, *Levant*, 35(1), 71-100.

Renfrew, C. (1967). Cycladic Metallurgy and the Aegean Early Bronze Age, *American Journal of Archaeology*, 71(1), 1-20.

Rothman, M. (2004). Ripples in the Stream: Transcaucasia–Anatolian Interaction in the Murat/Euphrates Basin at the Beginning of the Third millennium BC. In A. Smith, K. Rubinson (Eds.), *Archaeology in the Borderlands: Investigation in Caucasia and Beyond,* (94-114). UCLA: Cotsen Institute of Archaeology.

Sagona, A. & Zimansky P. (2010). *Ancient Turkey*. New York: Routledge.

Sherratt, S. (2007). The Archaeology of Metal Use in the Early Bronze Age Aegean: A Review. In P. M. Day, R. C. P. Doonan (Eds.), *Metallurgy in the Early Bronze Age Aegean*, (pp. 245-263). UK: Oxbow Books.

Shortland, A. & Tite, M. (2006). Report on the Analysis of Cylindrical Bead SVP 29/32. In E. Peltenburg (Ed.) *The Chalcolithic Cemetery of Souskiou-Vathyrkakas, Cyprus: Results of the Investigations of Four Missions, from 1950 to 1997*, (pp. 95-96). Nicosia: Department of Antiquities, Cyprus.

Stech, T. (1999). Aspects of Early Metallurgy in Mesopotamia and Anatolia. In V. C. Pigott (Ed.) *The Archaeometallurgy of the Asian Old World* (University Museum Symposium Series), (pp. 59-72). Philadelphia: Museum University of Pennsylvania.

Steel, L. (2004). *Cyprus Before History: From the Earliest Settlers to the End of the Bronze Age.* London: Duckworth.

Stewart, J. R. (1962). The Early Cypriote Bronze Age, In P. Dikaios & J. R. Stewart (Eds.),*The Swedish Cyprus Expedition, Volume IV, Part 1A, The Stone Age and Early Bronze Age in Cyprus,* (pp. 205-401). Lund: The Swedish Cyprus Expedition.

Stos-Gale, Z. A., & Gale, N. H. (2003). Lead Isotopic and Other Isotopic Research in the Aegean. In K. P. Foster, R. Laffineur (Eds.), *Metron: Measuring the Aegean Bronze Age, Aegaeum*, *24*, (pp. 83-101). Peeters Pub & Booksellers.

Stos-Gale, Z. A., & Gale, N. H. (2010). Bronze Age Metal Artefacts Found on Cyprus - Metal from Anatolia and the Western Mediterranean, *Trabajos de Prehistoria* 67: 389-403.

Stos - Gale, Z. A., Maliotis, G., Gale, N. H., & Annetts, N. (1997). Lead Isotope Characteristics of the Cyprus Copper Ore Deposits Applied to Provenance Studies of Copper Oxhide Ingots*, Archaeometry,* 39(1), 83-123.

Suriano, M. (2013). Historical Geography of the Ancient Levant. In M. L. Steiner & A. E. Killebrew (Eds.), *The Oxford Handbook of the Archaeology of the Levant*, (pp. 9-23). Oxford: Oxford University Press.

Swiny, S. (1985). Sotira-*Kaminoudhia* and the Chalcolithic/Early Bronze Age Transition in Cyprus. In V. Karageorghis (Ed.), *Archaeology in Cyprus* 1960-1985, (pp. 115-124). Nicosia: Department of Antiquities.

Swiny, S. (1986). The Philia Culture and its Foreign Relations. In V. Karageorghis (Ed.), *Acts of the International Archaeological Symposium ¨Cyprus Between the Orient and Occident¨,* (pp. 29-40). Nicosia: Department of Antiquities.

Swiny, S., G. Rapp & E. Herscher (Eds.) (2003). *Sotira Kaminoudhia: An Early Bronze Age Site in Cyprus*. American Schools of Oriental Research, Archaeological Reports 8. Cyprus American Archaeological Research Institute Monograph 4. Boston: American Schools of Oriental Research.

Şahoğlu, V. (2005). The Anatolian Trade Network and the İzmir Region during the Early Bronze Age, *Oxford Journal of Archaeology*, 24, 339-360.

Şahoğlu, V. (2014). The Depas and Tankard Vessels. In M. Lebeau (Ed.) *ARCANE Interregional Vol. 1*: *Ceramics*, (pp. 289-311). Turnhout: BREPOLS.

Tennie, C., Call, J., & Tomasello, M. (2009). Ratcheting up the Ratchet: On the Evolution of Cumulative Culture, *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1528), 2405-2415.

Tomasello M. (1999). The Human Adaptation for Culture*, Annual Review of Anthropology,* 28, 509–529.

Wachsmann, S. (1998). *Seagoing Ships & Seamanship in the Bronze Age Levant*. London: Chatham Publication.

Webb, J. M. (2013). ¨The Mantle of Vasilia¨: Have Stewart's Views on the Centrality of the Copper Trade in Prehistoric Bronze Age Cyprus Stood the Test of Time. In A.B. Knapp et al. (Eds.), *J.R.B. Stewart: An Archaeological Legacy, (*SIMA 139*)*, (pp. 1-21). Uppsala: P. Åströms Förlag.

Webb, J. M. (2017). *Vounoi* (Vounous) and Lapithos in the Early and Middle Bronze Age: A Reappraisal of the Central North Coast of Cyprus in the Light of Fieldwork and Research Undertaken since 1974. In D. Pilides, M. Mina (Eds.), *Four Decades of Hiatus in Archaeological Research in Cyprus: Towards Restoring the Balance*, (pp. 128-139). Vienna: Verlag Holzhausen GmbH & Department of Antiquities, Cyprus.

Webb, J. M., & Frankel, D. (1999). Characterizing the Philia Facies: Material Culture, Chronology and the Origin of the Bronze Age in Cyprus, *American Journal of Archaeology,* 103, 3-43.

Webb, J. M., & Frankel, D. (2004). Intensive Site Survey. Implication for Estimating Settlement Size, Population and Duration in Prehistoric Bronze Age Cyprus. In M. Iacovou (Eds.), *Archaeological Field Survey in Cyprus. Past History, Future Potentials (British School at Athens, Studies 11*) (pp. 125-137). London: British School at Athens.

Webb, J. M., & Frankel, D. (2007). Identifying Population Movement by Everyday Practice: The Case of 3rd millennium Cyprus. In S. Antoniadou, A. Pace (Eds.), *Mediterranean Crossroads,* (pp. 163-88). Athens: Pierides Foundation.

Webb, J. M., & Frankel, D. (2008). Fine Ware Ceramics, Consumption and Commensality: Mechanism of Horizontal and Vertical Integration. In L. A. Hitchcock, R. Laffineur, J. Crowley (Eds.), *Early Bronze Age Cyprus*. Dais: The Aegean Feast. Aegaeum, 29, (pp. 287-295). Liege: Universite de Liege.

Webb, J. M., & Frankel, D. (2011). Heart and Home as Identifiers of Community in Mid-third Millennium Cyprus. In V. Karageorghis, O. Kouka (Eds.), *On Cooking Pots, Drinking Cups, Loomweights and Ethnicity in Bronze Age Cyprus and Neighbouring Regions,* (pp. 29-42). Nicosia: Leventis Foundation.

Webb, J. M., Frankel, D., Stos, Z. A., & Gale, N. (2006). Early Bronze Age Metal Trade in the Eastern Mediterranean. New Compositional and Lead Isotope Evidence from Cyprus, *Oxford Journal of Archaeology*, 25(3), 261-288.

Weisgerber, G., & Cierny, J. (2002). Tin for Ancient Anatolia. In Ü. Yalçın *Anatolian Metal II. Der Anschnitt 15,* (pp. 179-186). Bochum: Deutsches Bergbau Museum.

Wilkinson, K., Tyler, A., Davidson, D., & Grieve, I. (2006). Quantifying the Threat to Archaeological Sites from the Erosion of Cultivated Soil, *Antiquity*, 80(309), 658-670.

Wurzer, G., Kowarik, K. & Reschreiter, H. (2015). (Eds.) *Agent-based Modeling and Simulation in Archaeology.* Vienna*:* Springer.

Xenophontos, C. (1991). Picrolite, Its Nature, Provenance, and Possible Distribution Patterns in the Chalcolithic Period of Cyprus. *Bulletin of the American Schools of Oriental Research*, 282/283, 127-138.

Yalçın, Ü. (2008). Ancient Metallurgy in Anatolia. In Ü. Yalçın, H. Özbal, AG Paşamehmetoğlu (Eds.*), Ancient Mining in Turkey and the Eastern Mediterranean,* (pp. 15-42). Ankara: Atılım University.

Yener, K. A., & Vandiver, P. B. (1993). Tin Processing at Göltepe, an Early Bronze Age Site in Anatolia, *American Journal of Archaeology*, 97(2), 207-238.

Yener, K. A., Geçkinli, E., & Özbal, H. (1996). A Brief Survey of Anatolian Metallurgy Prior to 500 BC. In Ş. Demirci, A. M. Özer, & G. D. Summers (Eds.), *Archaeometry*, 94: *The Proceedings of the 29th International Symposium on Archaeometry*, (pp. 375-391). Ankara: Türkiye Bilimsel ve Teknik Araştırma Kurumu.

Yener, K. A., Kulakoğlu, F., Yazgan, E., Kontani, R., Hayakawa, Y. S., Lehner, J. W., ... & Hacar, A. (2015). New Tin Mines and Production Sites near Kültepe in Turkey: A Third-Millennium BC Highland Production Model, *Antiquity*, 89(345), 596-612.

Zimmermann, T. (2007). Anatolia and the Balkans, Once Again–Ring-Shaped Idols from Western Asia and a Critical Reassessment of Some 'Early Bronze Age' Items from İkiztepe, Turkey, *Oxford Journal of Archaeology*, 26(1), 25-33.

TABLES

Table 1: Different chronological approaches to Cyprus between 3000-2000 BC (Peltenburg, 2013: 2, Table 1.1)

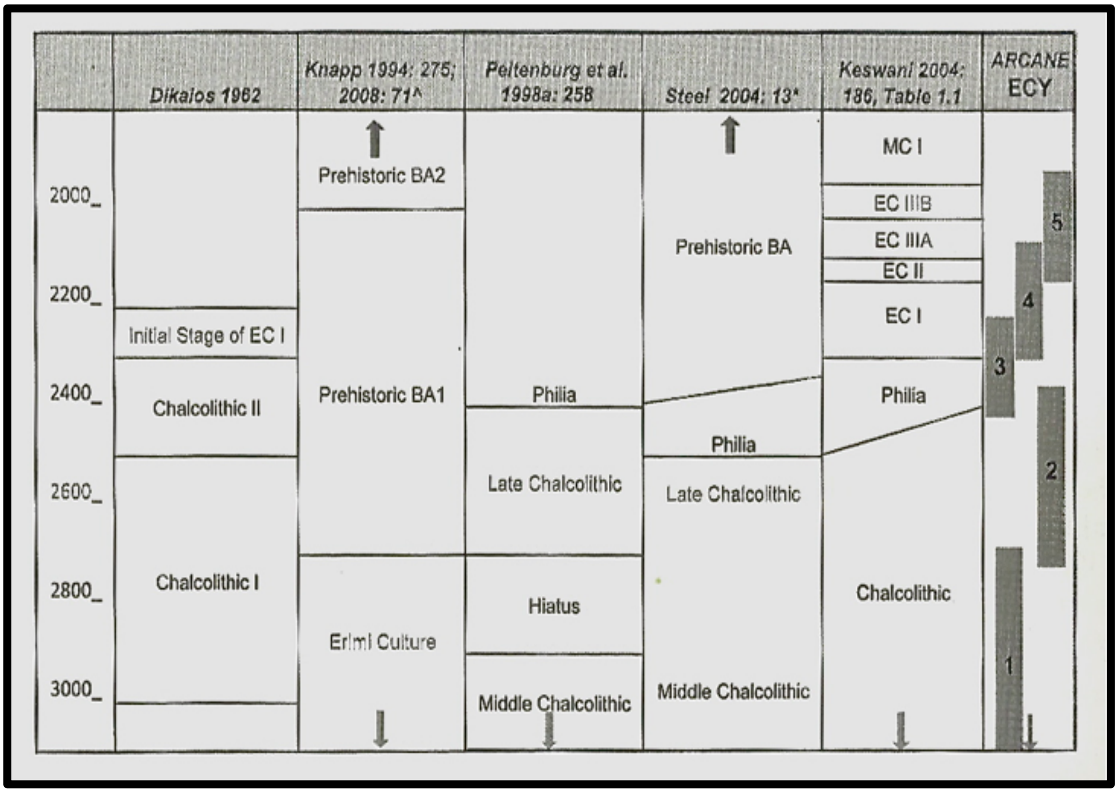


Table 2: Different Schematic representation of the chronological and cultural position of the Philia culture (Webb, 2013: 60, Fig. 1)

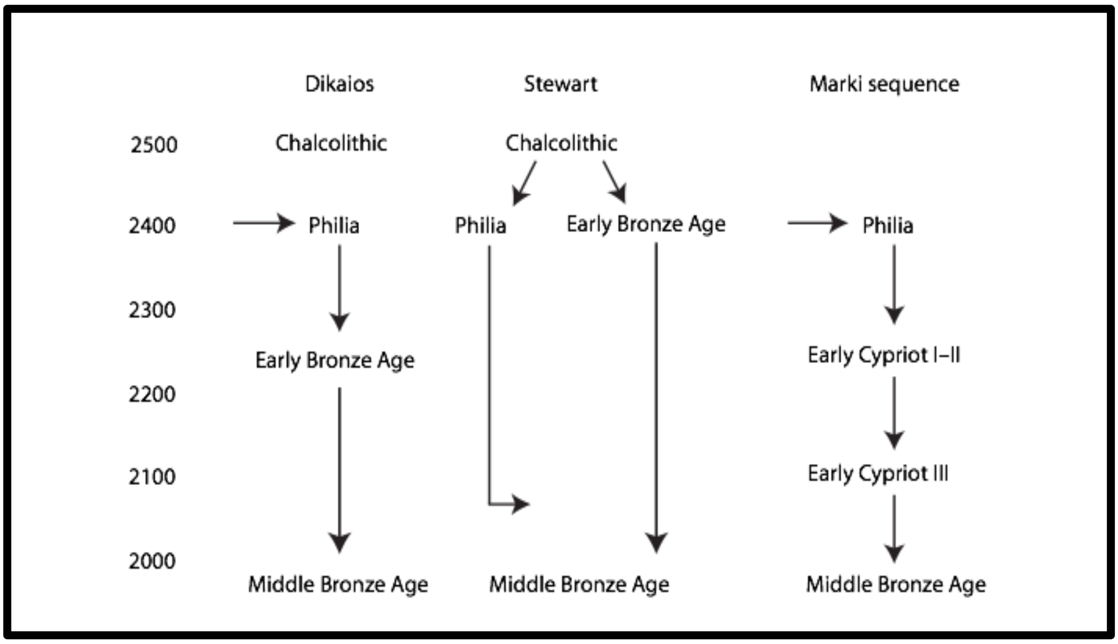


Table 3: Innovation of the contact and intensive contact phases in Kissonerga-*Mosphilia*, Anatolian influences shaded. (Peltenburg et. al. 1998: 256, Table 14.7)

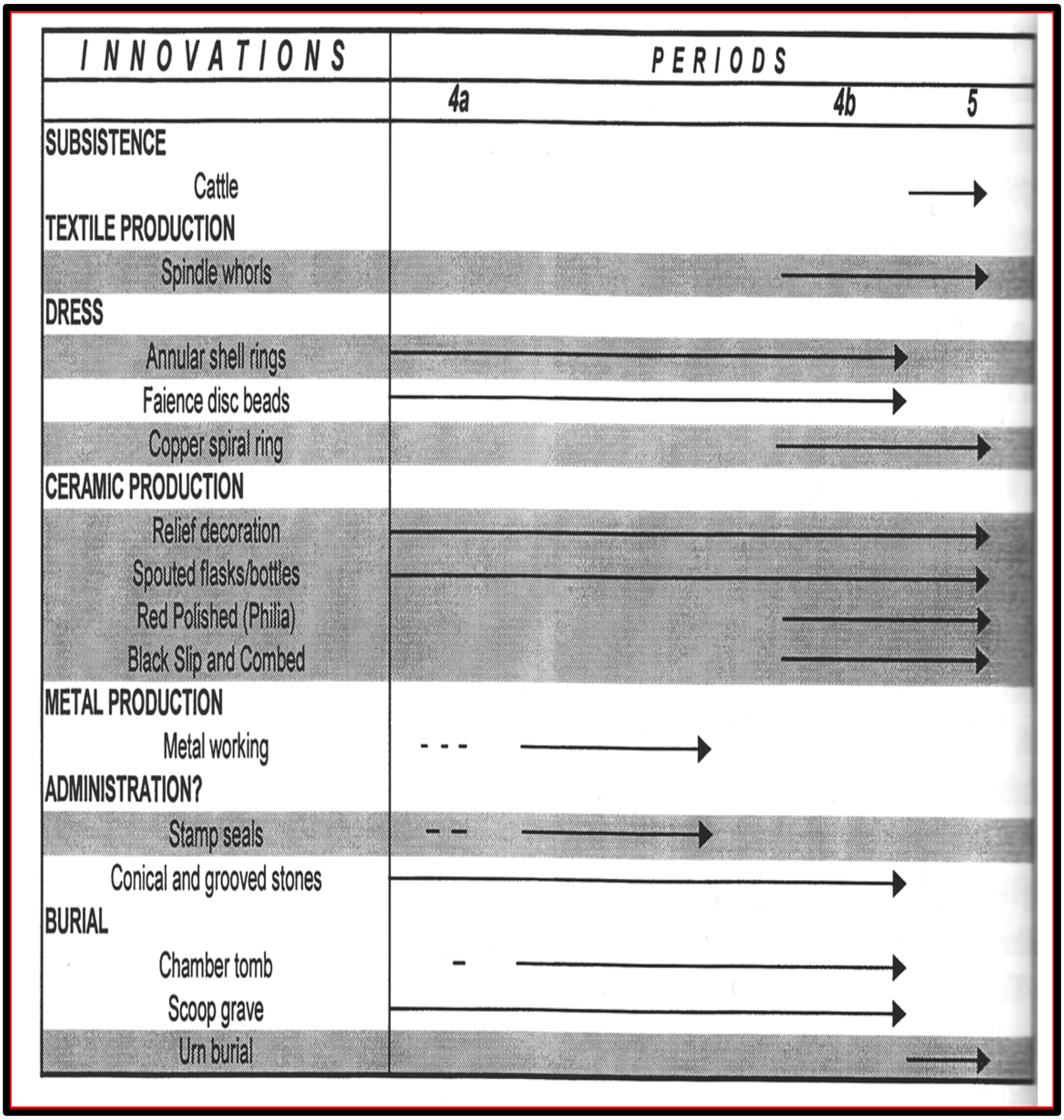
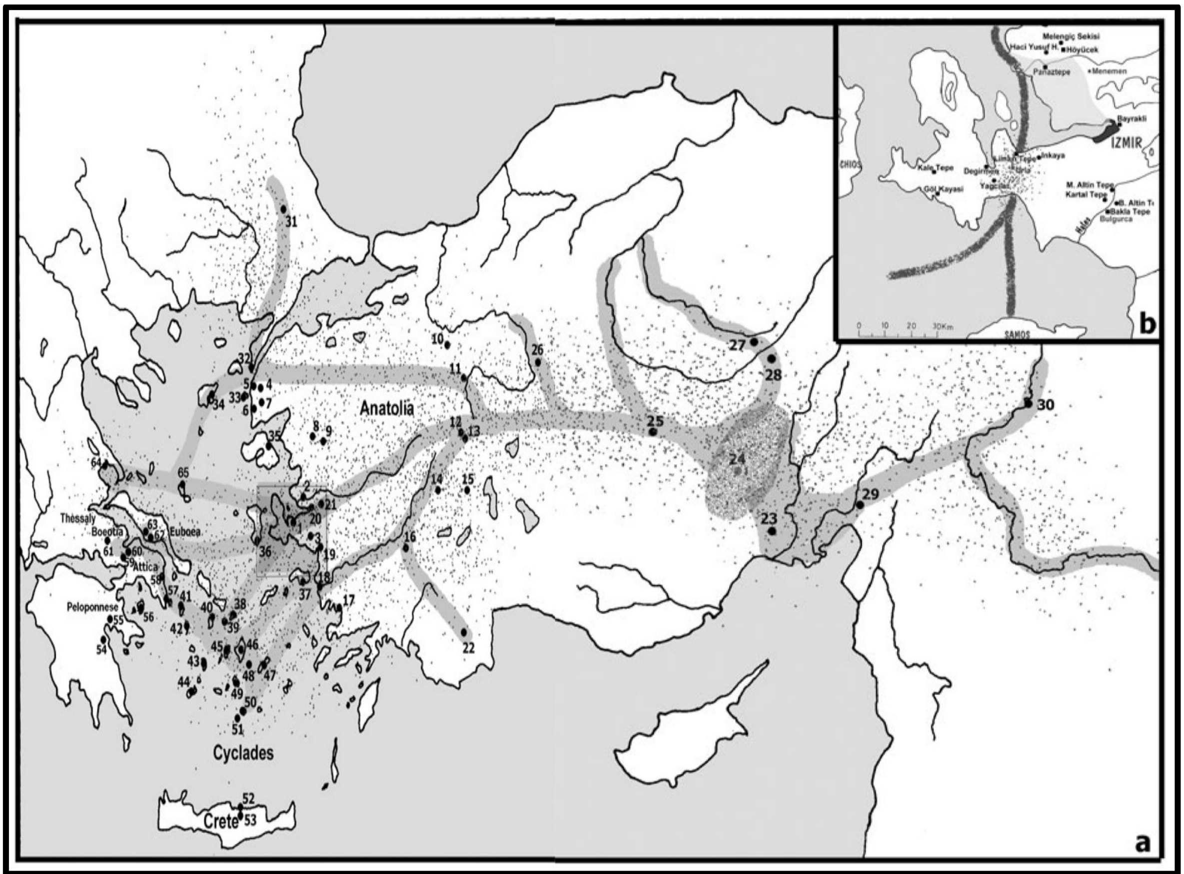


Table 4: The changes that took place with the Philia Phase (by author)

Prehistoric Cyprus	**The Middle and Late Chalcolithic Periods (ca. 3500-2500 BC: 1000 years period)** 100-200 years gap (?) between the Middle and Late Chalcolithic Period Transmaritime interaction and sea change in the materiality of Late Chalcolithic Cyprus during the late 4th and early 3rd mill. BC.	**The Philia Phase (ca. 2500-2200 BC: No more than 300 years)** Initial Stage for Bronze Age Cyprus Direct Transition from the Late Chalcolithic Period Transmaritime Connectivity of the Philia culture and immigration from the mainland
Sites	Erimi, Souskiou-*Laona*, Souskiou-*Vathrykakas*, Lemba-*Lakkous*. Kissonerga-*Mosphilia* Changes in material culture: Spindle Whorl, Copper Spiral Earring, some ceramic forms already attested in the LChlal Kissonerga-*Mopshilia* (Period 4)	Kissonerga-*Mosphilia* (The Chalcolithic to the Philia Period) Marki-*Alonia* (The Philia Period to the Middle Cypriot Period) Sotira-*Kaminoudhia* (Philia and EC I-II cemeteries; Not presenting a stratified settlement data before Early Cypriot III)
Spatial Organization Settlement Planning/ Architecture	The greatest density in southwest Cyprus Single-roomed circular houses mud-wall construction LChacl Communal (Administrative) Building: Pithos House in Kissonerga-*Mosphilia* Abandonment of some LChal sites in the west of Cyprus (Paphos Region)	New Settlement Location (New Inland Settlements and most strongly represented in the center (Ovgos Valley) and north (Kyrenia Range) of Cyprus): Unified Island Culture Multi-roomed rectilinear houses Mould-made mud-brick construction Agglutinative Plan: Courtyard Close proximity to the Cypriot Copper resources
Cemetery Sites Mortuary Practices	Intra-mural Cemeteries: Pit Grave, with or without a capstone Introduction of Single or two Chamber(s) Tomb (also used for multiple burials) in LChal Kissonerga-Mosphilia (13 total) associated with new types of pottery (Red and Black Stroke-burnished ware)	Organized Extra-mural Cemeteries Rock-cut Chamber Tomb became a common burial type Bellapais Vounous, Vasilia *Kafkallia*, Lapithos *Vrysi tou Barba*, Karmi *Palealona*, Philia *Laxia tou Kasniou*, Nicosia *Ayia Paraskevi* Pithos/Urn Burial for infant in the Settlement Area (Marki-*Alonia*)
Agriculture and Animal Husbandry	Hoe-Based Sheep, goat, pig, deer (Primary Products) Rise in hunting activities.	Plough-Based – Backed Sickles (Clearance of the forest area for agricultural activity) Pig, Deer, Cattle (Re-introduction after c. 4000 years), Donkey and screw-horned goats (New Species) (Secondary Products: Wool and Milk)
Ceramics	Vessels without handles and Painted decoration Main Types Red-on-White Ware (c. 3400-2800 BC) Red and Black Stroke-burnished ware (c. 2800-2500 BC)	New Ceramic technology: Innovative Forms, Fabrics and Decoration Vessels with handles Incised decoration Main Type: Red Polished Philia ware (c. 2500-2200 BC) Relief Decoration, Spouted flasks/bottle
Culinary Tradition	Central hearth in the oval shaped building No direct-fire boiling vessels	Horseshoe-shaped hearth surrounds ('hobs' or pot stands), baking pans, tripod braziers; ovens Direct-fire boiling vessels New Types of Food (Meat, Cereals) and Drinking habits
Textile Production	No evidence	Introduction of new types of spindle whorls (Low-whorl spinning) and loom-weights (Vertical wrap-weighted looms)
Metals and Metalworking	No evidence before Middle Chalcolithic (c. 3500-3000 BC): Initial Stage c. 3000 BC: Exported Cypriot Copper in the Aegean (2 Objects) and the Levant (1 Object) Small Scale Production in the Late Chalcolithic (c. 3000-2500 BC): Experimentation and organization stage 26 Objects: Tools and Ornaments Predominantly made of Cypriot Copper 2 objects Arsenical copper Hammering, Cold Working, Annealing	Cypriot Copper extraction More than 100 Objects: Ornaments, Tools and Weapon Arsenical Copper (Mainly in Sotira-*Kaminoudhia*) 7 objects contains tin alloy 2 objects made of Electrum (probably from Anatolia) Imported Copper from the Aegean and Anatolia as raw material or finished object

Table 5: Anatolian Trade Network Map and Chronological Table (Şahoğlu 2005, Figs. 1-2)



DATE	ANATOLIA Kültepe	Tarsus	Beyce Sultan	CRETE	GREEK MAINLAND	CYCLADES	EASTERN AEGEAN ISLANDS	TROIA	LİMAN TEPE AREA - A	LİMAN TEPE AREA - B	PERIOD
2000 BC.			VIa VIII		Early Helladic III Aegina V	Middle Cycladic Early Cycladic III (Phylakopi I)	Heraion V Poliochni Brown Heraion IV	V IV (?)	?	LMT B IV-1	EBA IIIb
	11b			Early Minoan IIB	Lerna IV Aegina IV	Early Cycladic IIb (Kastri Group) Ayia Irini III Palamari III Syros-Kastri Zas IV Mt. Kynthos	Heraion III Poliochni Yellow Emborio I	III		LMT B IV-2	EBA IIIa
	12	EBA III	XII c		Early Helladic II Late Lerna IIID Aegina III			Late	LMT A V-1	LMT B V-1a	End of EBA II
	13				Lefkandi I / Manika Pevkakia VII			II		LMT B V-1b	EBA II Late
					Aegina II		Heraion II Emborio II		LMT A V-2a	LMT B V-2	
2500 BC.	14	EBA	XIII a		Lerna IIIC Pevkakia VI						

Table 6: Middle and Late Chalcolithic metal objects from Cyprus (Peltenburg, 2011: 4, Table1.1)

SITE CODE	SITE AND CONTEXT	CLASS	DESCRIPTION	PUBLICATION	FIGURE
			Middle Chalcolithic		
—	Erimi depth 0.4–0.6 m	Narrow band (bead?)	Bent strip, L. 2.9 cm	Gale 1991, 44–45	1.1:B
—	Erimi	Blade(?)	L. 2.3, w. 1.4, th. 0.2–0.25 cm	Gale 1991, 44–45	1.1:C
388	Erimi Layer IX	Chisel	Tip of cutting edge	Dikaios 1938, 50, 80	1.1:D
—	Erimi depth 0.0–0.20 m	"Needle"	One of two "bronze needles"	Bolger 1985, 182 (from Dikaios's daybook)	—
—	Erimi depth 0.60 m	"Needle"	One of two "bronze needles"	Bolger 1985, 182 (from Dikaios's daybook)	—
KM 2109	Kissonerga-*Mosphilia* Gr. 554	Mineral	Malachite in bivalve	Peltenburg 1998a, fig. 97:5; 1998b, 231–233	1.1:A
SL 428	Souskiou-*Laona* T. 158	Spiral bead	Flat strip coiled nine times in spiral for cylindrical bead. Traces mineralized thread, L. 2.7, dia. 0.6 cm	Crewe et al. 2005, 65, fig. 16:2	1.1:G
SL 429	Souskiou-*Laona* T. 158	Pendant(?)	six curved fragments, five with circular sections, one of these with tightly looped terminal, L. 2.5, dia. 0.2 cm	Crewe et al. 2005, 65, fig. 16:3	1.1:H
SL 554	Souskiou-*Laona* Bld. 34	Pendant(?)	Flat spiraliform band of metal, L. 2.5, w. 1.4, th. 0.4 cm	Peltenburg et al. 2006, 98, fig. 21	1.1:E
SL 569	Souskiou-*Laona* Bld. 34	Fragment	Amorphous, mineralized fragment, 0.5 x 0.3 cm	Unpublished	—
SL 570	Souskiou-*Laona* Bld. 34	Blade	Flat fragment, 1.6 x 1.8 x 0.8 cm	Unpublished	1.1:I
SL 867	Souskiou-*Laona* Bld. 34	Fragment	Amorphous lump, 0.9 x 0.8 x 0.7 cm	Unpublished	—
SV 23/34	Souskiou-*Vathrykakas* T. 23	Spiral bead	Flat strip coiled nine times in spiral for cylindrical bead. Traces mineralized thread (?), L. 3.2, dia. 0.4 cm	Peltenburg, ed., 2006, pl. 10:5	1.1:F
SV 78/19	Souskiou-*Vathrykakas* T. 78	Corrosion product	Adheres to stone pendant	Peltenburg, ed., 2006, 99	—
			Late Chalcolithic		
C 384	Kissonerga-*Mosphilia* Bld. 834	Fragments	Flakes of oxidized copper, from object?	Peltenburg 1998b, 231–232	—
KM 416	Kissonerga-*Mosphilia* above Pit 411	Awl	Square-sectioned, tapered to point, bone handle, 3.9 x 0.45 x 0.45 cm	Peltenburg 1998a, fig. 97:4; 1998b, 231	1.2:A
KM 633	Kissonerga-*Mosphilia* Unit 150	Ore	Rust-colored nugget in green envelope, 7.5 x 6 x 3.2 cm	Zwicker 1988; Gale 1991; Peltenburg 1998b, 231	1.2:F
KM 693	Kissonerga-*Mosphilia* Bld. 706	Crucible(?)	Subrectangular stone dish, L. 10.8 x h. 4.3 cm	Peltenburg 1998a, fig. 95:14; 1998b, 231–233	1.2:J
KM 694	Kissonerga-*Mosphilia* Bld. 706	Chisel	Square-sectioned, tapered above cutting edge, broken above bend, 9.8 x 1.1 x 1.1 cm	Peltenburg 1998a, fig. 97:2; 1998b, 231	1.2:B
KM 701	Kissonerga-*Mosphilia* Bld. 706	Ore	Lumps with bright green corrosion	Gale 1991; Peltenburg 1998b, 231	1.2:I
KM 986	Kissonerga-*Mosphilia* Quarry 654	Chisel	Square-sectioned, convex working edge, tapered to flat butt, 11.2 x 0.8 x 0.75 cm	Peltenburg 1998a, fig. 97:3; 1998b, 231	1.2:C
KM 1007	Kissonerga-*Mosphilia* Bld. 3	Crucible(?)	Shallow bowl, L. 17.6 x h. 6.7 cm	Peltenburg 1998a, fig. 97:15	—
KM 1182	Kissonerga-*Mosphilia* Gr. 529	Ear/hair ring	Spiral with expanded and pointed terminals	Peltenburg 1998a, fig. 97:5; 1998b, 231	1.2:H
KM 2174	Kissonerga-*Mosphilia* Bld. 834	Chisel	Tip, oval-section, beveled cutting edge, 2.5 x 0.5 cm	Peltenburg 1998a, pl. 36:2; 1998b, 231	1.2:G
LL 134	Lemba-*Lakkous* Bld. 3	Chisel	Square-sectioned, non-splayed cutting edge, L. 9.4 x w. 0.06 cm	Slater 1985, 199–200, fig. 86:5, pl. 48:11; Gale 1991	1.2:D
LL 209	Lemba-*Lakkous* Bld. 3	Blade(?)	Thin trapezoidal fragment, L. 3.5 x w. 1.5 cm	Slater 1985, 199, fig. 86:6, pls. 18:3, 48:10; Gale 1991	1.2:E

Table 7: Metal objects from 3000 to 2000 BC in Cyprus (ECY 3: The Philia Phase) (Kassianidou, 2013a: 241, Table 6.2)

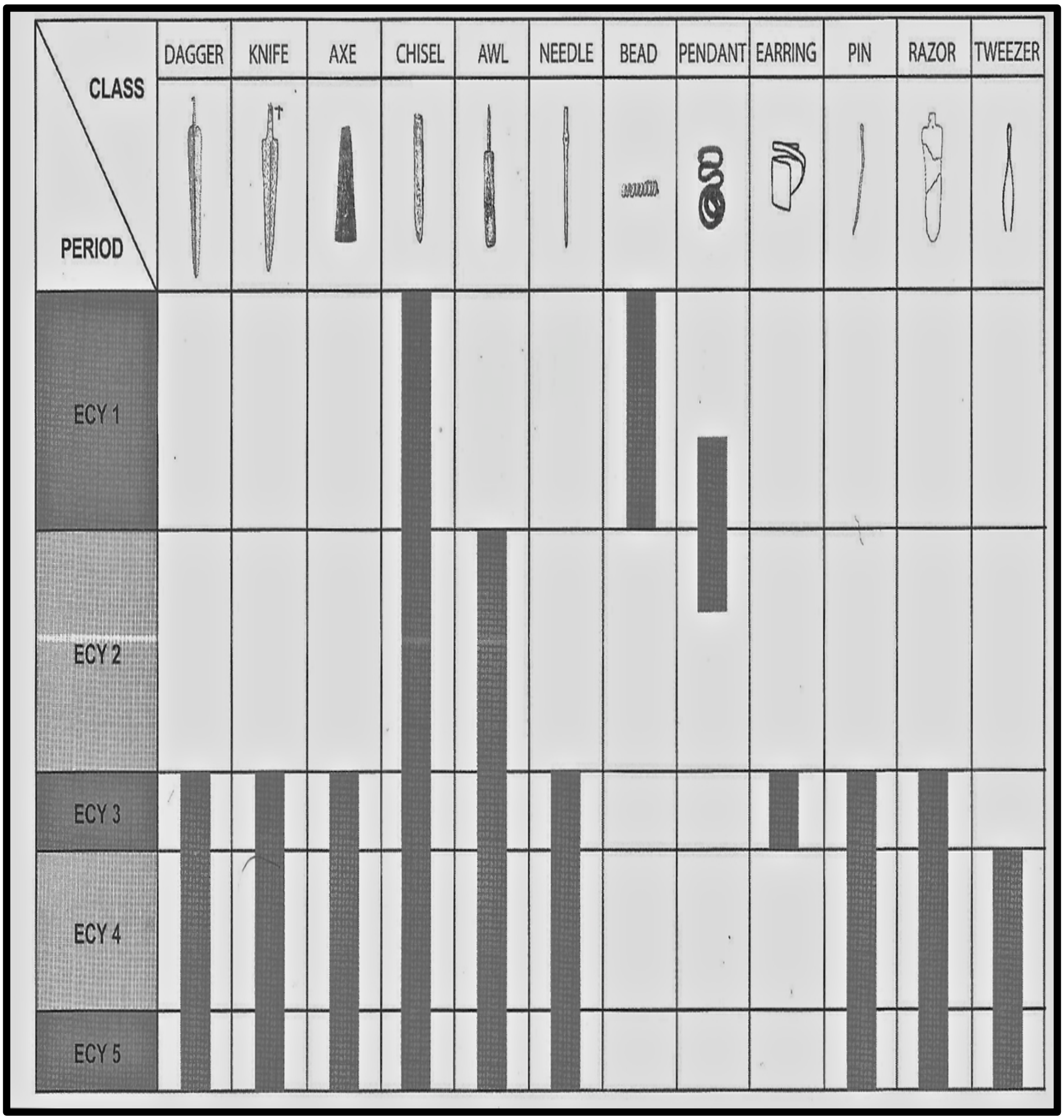


Table 8: Quantative Energy Dispersive X Ray Fluorescence analyses of metal objects from Sotira Kaminoudhia and a crucible from Paramali Pharkonia (Giardino et al., 2003: 393, Table 8.1.1)

		%								weight
		as	pb	sn	fe	sb	ni	cu		grams
sample name										
m5 (A)		-	-	-	tr	-	-	100.0		3
m8 (A)		-	-	-	tr	-	-	100.0		2
m9 (A)		4.0	-	-	tr	-	-	96.0		8
m10 (A)		2.7	-	-	tr	-	-	97.3		4
m11 (A)		-	-	-	tr	-	-	100.0		6
m12 (A)		3.2	-	-	0.3	-	-	96.5		114
m12 (B)		3.8	-	-	0.6	-	-	95.6		
m12 (C)		3.5	-	-	tr	-	-	96.5		
m13 (A)		0.9	0.3	4.8	0.3	-	-	93.7		1
m14 (A)		0.5	-	5.8	-	-	-	93.7		1
m15 (A)		0.6	-	-	0.2	-	-	99.2		1
m16 (A)		7.0	-	-	2.1	-	-	90.9		<1
m17 (A)		2.0	0.1	-	tr	0.9	2.1	94.9		10
m18 (A)		0.3	-	-	0.5	-	-	99.2		35
m18 (B)		0.3	-	-	0.5	-	-	99.2		
m19 + m26 (A)		1.7	-	-	0.4	-	-	97.9		20
m19 + m26 (B)		1.6	-	-	tr	-	-	98.4		
m20 (A)		2.8	-	-	tr	-	-	97.2		<1
m21 (A)		1.7	0.3	10.2	0.7	-	-	87.1		<1
m22 (A)		0.5	-	13.1	-	-	-	86.4		<1
m25 (A)		2.9	-	-	0.7	-	-	96.4		<1
m27 (A)		0.6	-	-	0.7	-	-	98.7		4
m27 (B) rivet		1.0	-	-	tr	-	-	99.0		
m28 (A)		0.4	-	-	0.6	-	-	99.0		1
m29 (A)		-	-	-	-	-	-	100.0		4
m30 (A)		2.9	-	-	1.4	-	-	95.7		<1
		cu	ag	au						
m6		1 - 3	15 - 20	77 - 84						
m7		1 - 3	15 - 20	77 - 84						
		as	pb	sn	fe	sb	ni	cu		
crucible (A)		0.3	-	-	2.8	-	-	96.9		

Table 9: Lead isotope analysis of the UNEMA objects (Webb et al. 2006: 273, Table 5)

Sample	Artefact	Pb208/Pb206	Pb207/Pb206	Pb206/Pb204	Origin of the copper	Date
1	axe	2.06836	0.83288	18.716	Cyprus: Limassol (Petromoutti)	Philia EC
2	axe	2.07070	0.83407	18.756	Cyprus: Limassol (Petromoutti)	Philia EC
3	ring-ingot	2.06893	0.83014	18.886	Cyclades: Kythnos (Milyes ores)	Philia EC
4	spearhead	2.06313	0.82830	18.949	Anatolia: Bolkardağ or Ergani Maden	Philia EC
5	perforated axe	2.06796	0.83097	18.915	Cyclades: Kythnos (Milyes ores)	Philia EC
6	perforated axe	2.07284	0.83545	18.706	Cyprus: Mathiati or Laxia tou Mavrou	EC III/MC I–II
7	axe	2.07287	0.83544	18.705	Cyprus: Mathiati or Laxia tou Mavrou	EC I
8	sword	2.05537	0.82626	18.974	Southern Anatolia: Taurus, Bolkardağ	Philia EC
9	knife	2.06358	0.82959	18.865	Anatolia: Ergani Maden	Philia EC
10	knife	2.07302	0.83545	18.709	Cyprus: Mathiati or Laxia tou Mavrou	EC III
11	knife	2.07301	0.83549	18.709	Cyprus: Mathiati or Laxia tou Mavrou	EC III/MC I–II
12	knife	2.07243	0.83524	18.769	Cyclades: Kythnos or Seriphos	EC III/MC I
13	knife	2.07294	0.83550	18.707	Cyprus: Mathiati or Laxia tou Mavrou	EC III/MC I
14	knife	2.07145	0.83457	18.773	Cyclades: Kythnos or Seriphos	Philia EC
15	razor	2.07317	0.83555	18.705	Cyprus: Mathiati or Laxia tou Mavrou	EC I
16	razor	2.07331	0.83559	18.707	Cyprus: Mathiati or Laxia tou Mavrou	EC III

Table 10: Compositional analysis using Energy Dispersive X Ray Spectroscopy (Webb et al. 2006: 268, Table)

Sample	Artefact	Cu	Fe	S	As	Sn	Pb	Total
1	axe	98.21		0.16				98.37
2	axe	87.07				12.24		98.11
3	ring-ingot	95.72					1.47	97.19
4	spearhead	85.77		0.65		12.52		98.35
5	perforated axe	95.31		0.54				95.85
6	perforated axe	94.53	1.19	0.2	3.16			99.09
7	axe	96.94	0.65	0.71				98.3
8	sword	88.46				9.87		98.32
9	knife	97.19		0.76				97.95
10	knife	86.22	1.09	0.3	2.56			90.18
11	knife	94.07	0.68		2.7			97.45
12	knife	93.55	1.94	0.38	4.78			100.66
13	knife	92.04	0.6	0.18	3.29			96.11
14	knife	97.35	0.13	0.59	0.94			99.01
15	razor	92.87	1.68	1.17	2.73			98.45
16	razor	95.15			4.86			100.01
17	pin	97.53		0.54				98.07

Table 11: Development stages of metallurgy in Anatolia (Yalçın, 2008: 20, Table 1)

development stage	chronology	technologies: mining, smelting, processing	material/production	sociocultural consequences
Period I Pre-phase	Paleolithic-Neolithic > 8200 BC	collecting malachite and hematite; forming and handling of stone and obsidian	coloured ore: using as pigment and jewel (bead)	organised collecting and mining of obsidian and coloured ore
Period II Beginnings Phase	PPNB since 8200 BC PN since 7300 BC	collecting malachite and native copper; annealing: beginning of pyrotechnology	malachite and native copper: beads and other small objects	raw material trade; workshops in the settlements
	Chalcolithic since 5000 BC	native copper: hot forging; manufacture of ceramic	native copper, galena: beads and other small objects	raw material trade; workshops in the settlements
Period III Development Phase	Late Chalcolithic since 4000 BC	near-surface mining; extractive metallurgy smelting in crucible, casting	oxide ore, smelting relics copper: standardised types, tools and jewels	"Haushaltsmetallurgy" raw material and metal trade; workshops in the settlements
Period IV Building Phase	EBA II-Iron Age since 2800 BC	underground mining; smelting in furnace	complex and polymetallic ores; copper, arsenic copper, lead, silver, gold; standardised types	extensive metallurgy in the workshops inside of settlements; raw material and metal trade
Period V Industrial Phase		centrally managed mining and metallurgy; smelting goes to the deposits processing/manufacture in the settlements	copper, lead, silver, gold, tin, bronze and other alloys; steel; since 1st mil.: brass serial producing: ingots, weapons, tools, jewels	centrally organised community with distinctive metal-culture supra-regional metal trade! building of regional state

Table 12: Development stages of metallurgy in Cyprus (by author)

Development Stage of Metallurgy in Cyprus	**Chronology**	**Technologies: mining, smelting, processing**	**Material/Production**	**Sociocultural Consequences**
Period I Beginning/Initial Stage	Middle Chalcolithic ca. 3500- 3000 BC	Collecting picrolite, malachite and copper (?) Forming stone and picrolite Copper: annealing and cold-hammering techniques	Colored ore: using as pigment, jewel (bead) and other small objects 14 Metal related objects	Organized collecting and mining of picrolite Great interest in picrolite industry Collecting colored ore (?)
Period II Organization/Experimentation Stage	Late Chalcolithic ca. 3000-2500 BC	Near-surface mining; extractive metallurgy smelting in crucible Pyro-technology	Oxide ore: Tools and Ornaments 12 metal-related materials	Temporally disappearance of picrolite and small-scale metal production Preliminary Long-distance trade Networks (?), including the Levant and the Aegean (Metal from Cyprus) and Anatolia (Ceramic from Cyprus)
Period III Development Stage	Philia Phase ca. 2500-2200 BC	Near-surface mining; extractive metallurgy smelting in crucible, casting	Complex and polymetallic ores; local copper ores and arsenical copper ores Imported copper and its alloys (tin and electrum) Standardized types More than 100 Objects: Ornaments, Tools and Weapon	'Extensive metallurgy' Materially organized community with distinctive metal-culture; Raw materials and interregional trade

FIGURES

Figure 1: Map of Cyprus, Chalcolithic and Philia Sites with main copper resources (Map by author created by NatGeo Mapmaker Interactive)

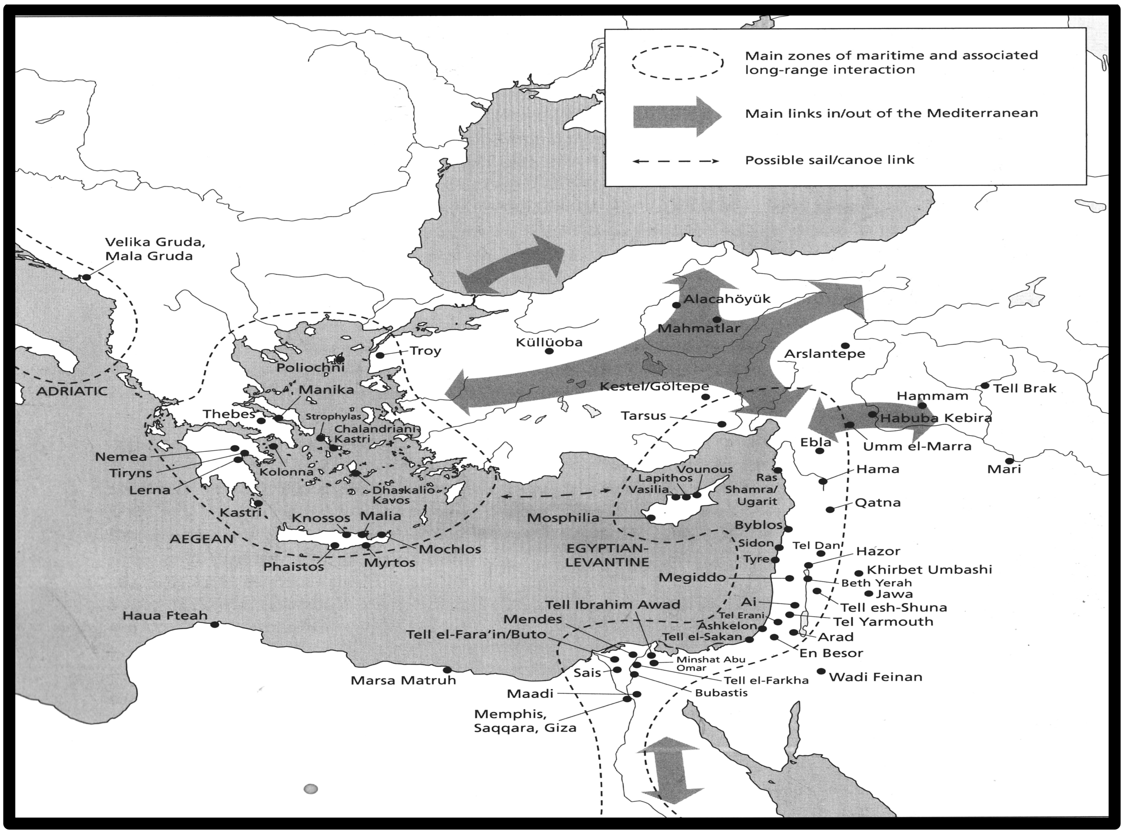


Figure 2: Map of the Eastern Mediterranean in the 3rd Mill. BC from the maritime perspective (Broodbank, 2013: 259, Fig. 7.1)

Figure 3: Naqada II Jar (The British Museum, EA35324)

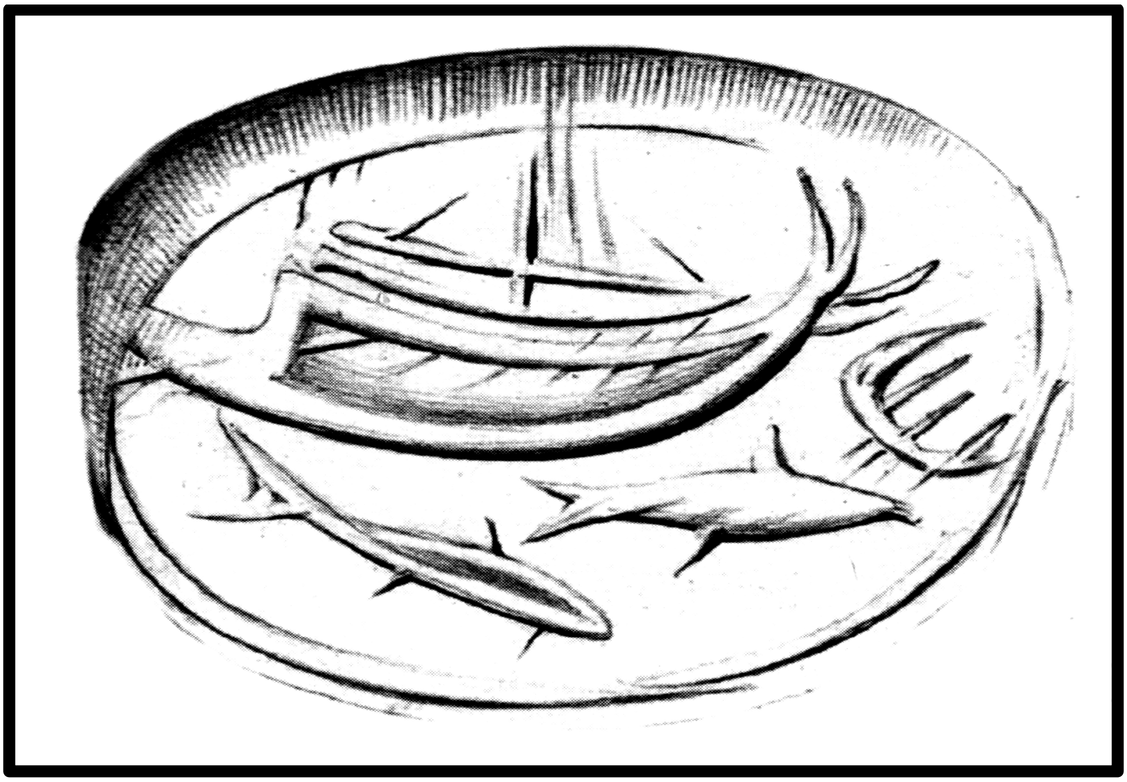


Figure 4: Seal stone from a tomb at Platanos, Crete, 2000 BC (Broodbank, 2013: 353, Fig. 8.5)

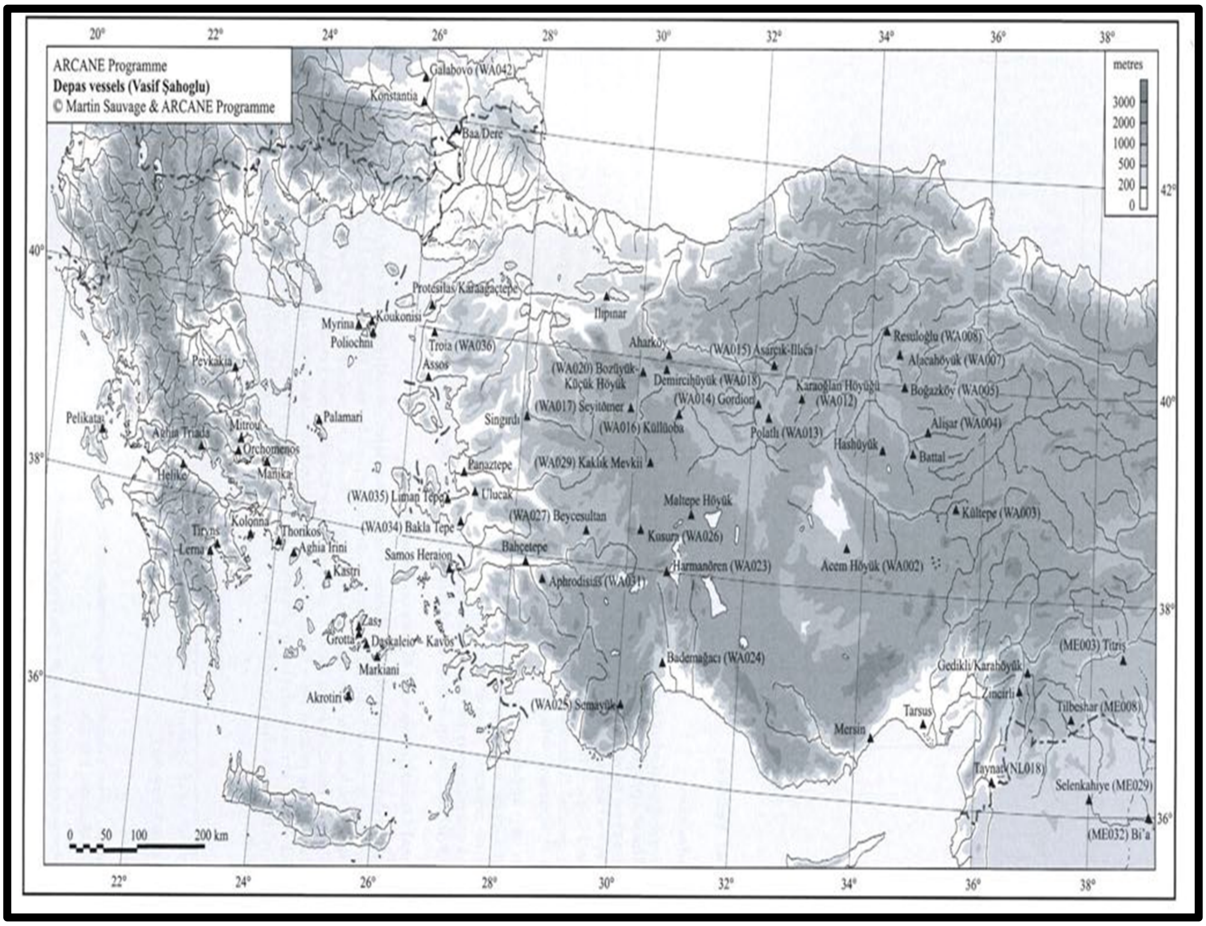


Figure 5: Distribution map of depas vessels (Şahoğlu, 2014: 266, Fig. 1)

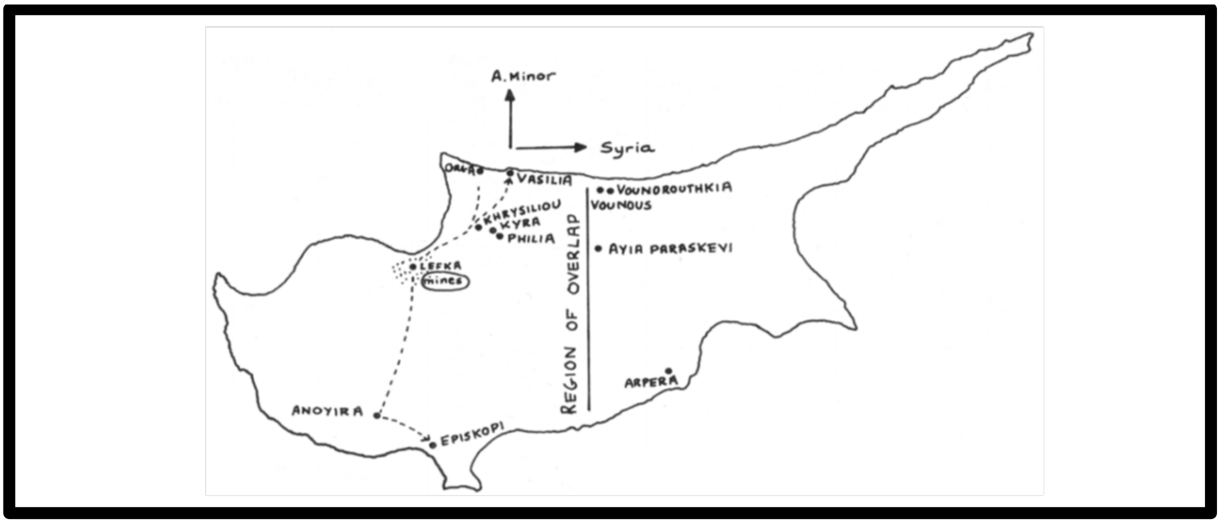


Figure 6: Stewart's 1955 sketch map of Philia sites and possible copper routes (Webb, 2013: 61, Fig. 2)

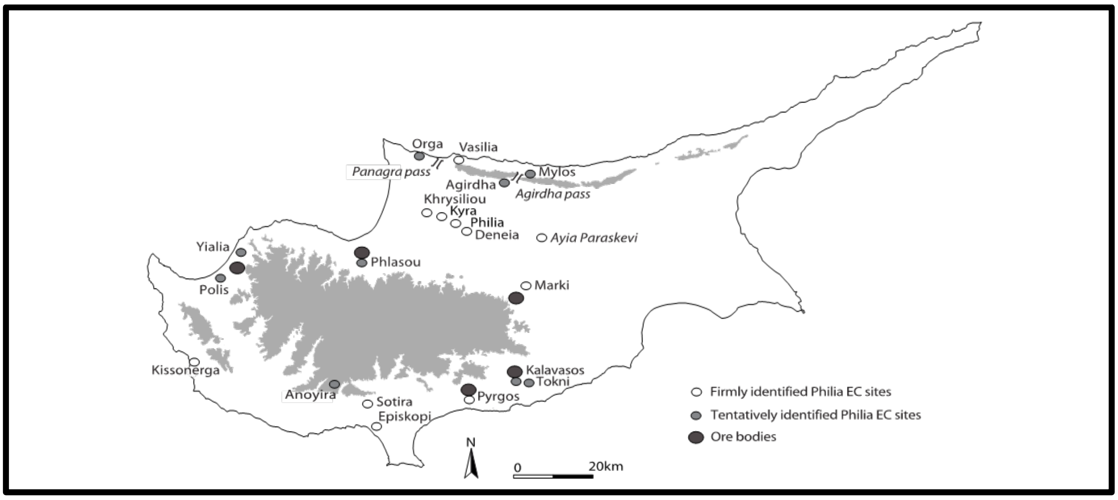


Figure 7: Philia sites and copper ores (Webb, 2013: 63, Fig. 4)

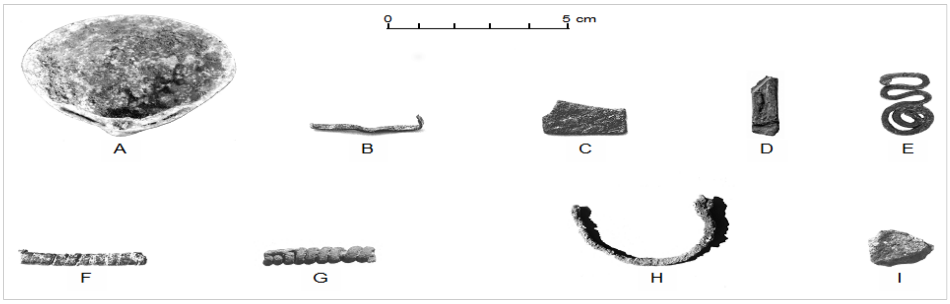


Figure 1.1. Middle Chalcolithic metal objects from Cyprus. For object descriptions, see Table 1.1. A: KM 2109; B: Erimi narrow band; C: Erimi blade; D: Erimi chisel 388; E: SL 554; F: SV 23/34; G: SL 428; H: SL 429; I: SL 570.

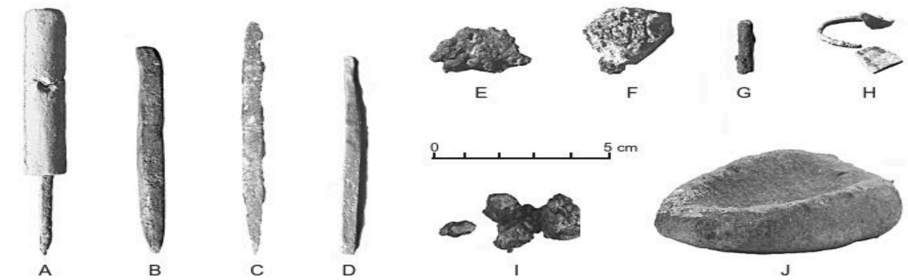


Figure 1.2. Late Chalcolithic metal objects from Cyprus. For object descriptions see Table 1.1. A: KM 416; B: KM 694; C: KM 986; D: LL 134; E: LL 209; F: KM 633; G: KM 2174; H: KM 1182; I: KM 701; J: KM 693.

Figure 8: Middle and Late Chalcolithic metal objects from Cyprus (Peltenburg, 2011: 5, Fig. 1.1). For object descriptions see Table 6

Figure 9: Cruciform (Cross-shaped) picrolite figure from Yialia (16 cm tall)
(Cyprus Museum)

Figure 10: Map of Cyprus indicating the site of Souskiou-Laona
(*http://www.shca.ed.ac.uk/projects/lemba/PDFs/Souskiou_RDAC_figs.pdf*) (Fig. 1)

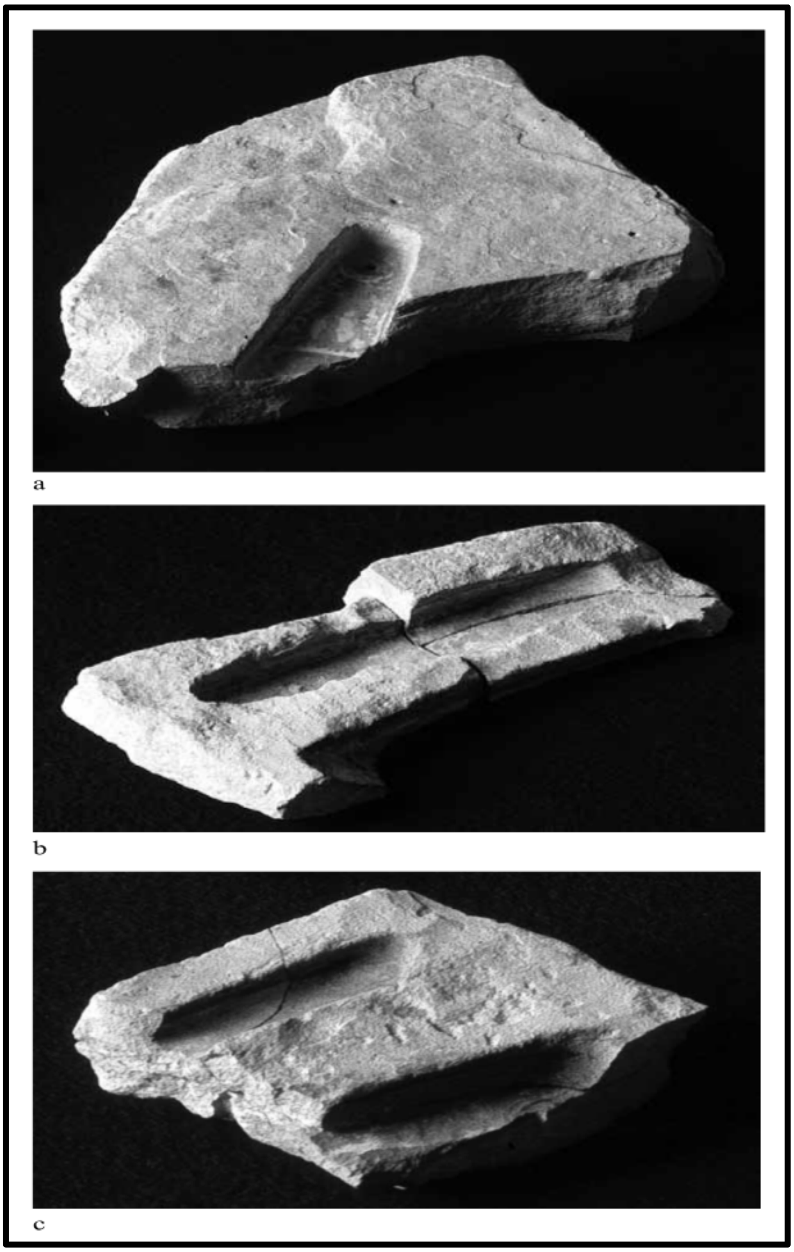


Figure 11: Chalk casting molds from Marki: (a) S850, (b) S744, (c) S745 (Webb, 2013: 62, Fig. 3)

Figure 12: Copper objects of the Philia Period (Knapp, 2008: 85, Fig. 13)

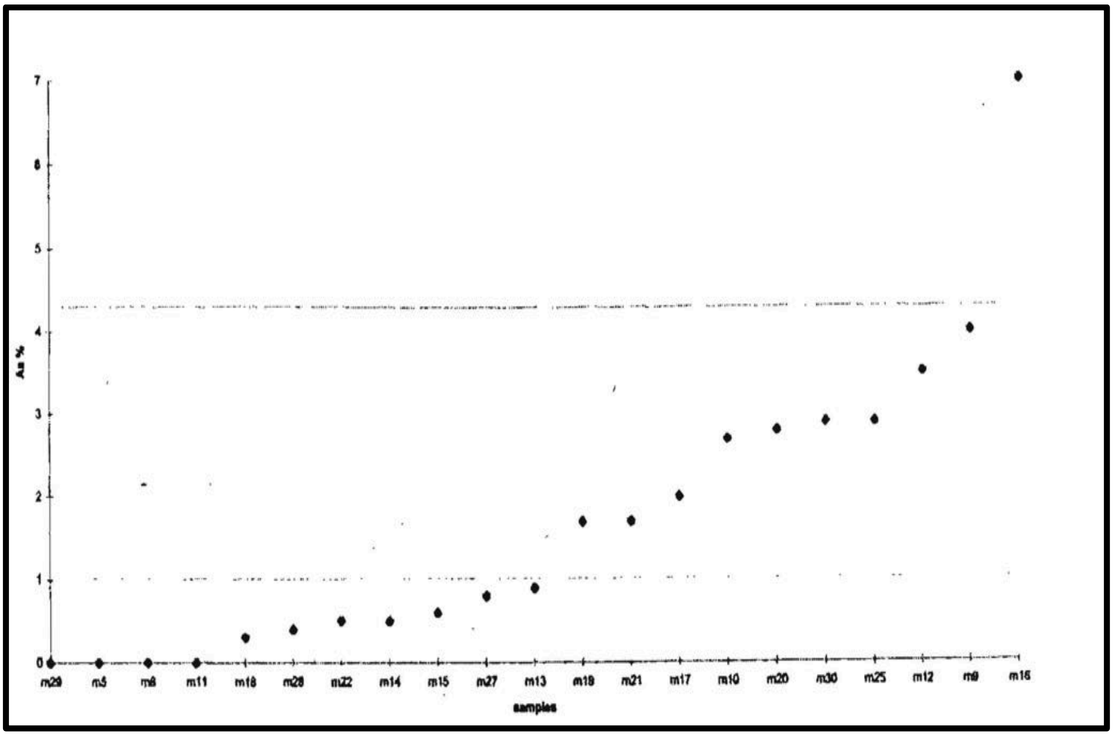


Figure 13: Arsenic content of the objects from Sotira-Kaminoudhia (Giardino et al. 2003: 395, Fig. 8.1.3.)

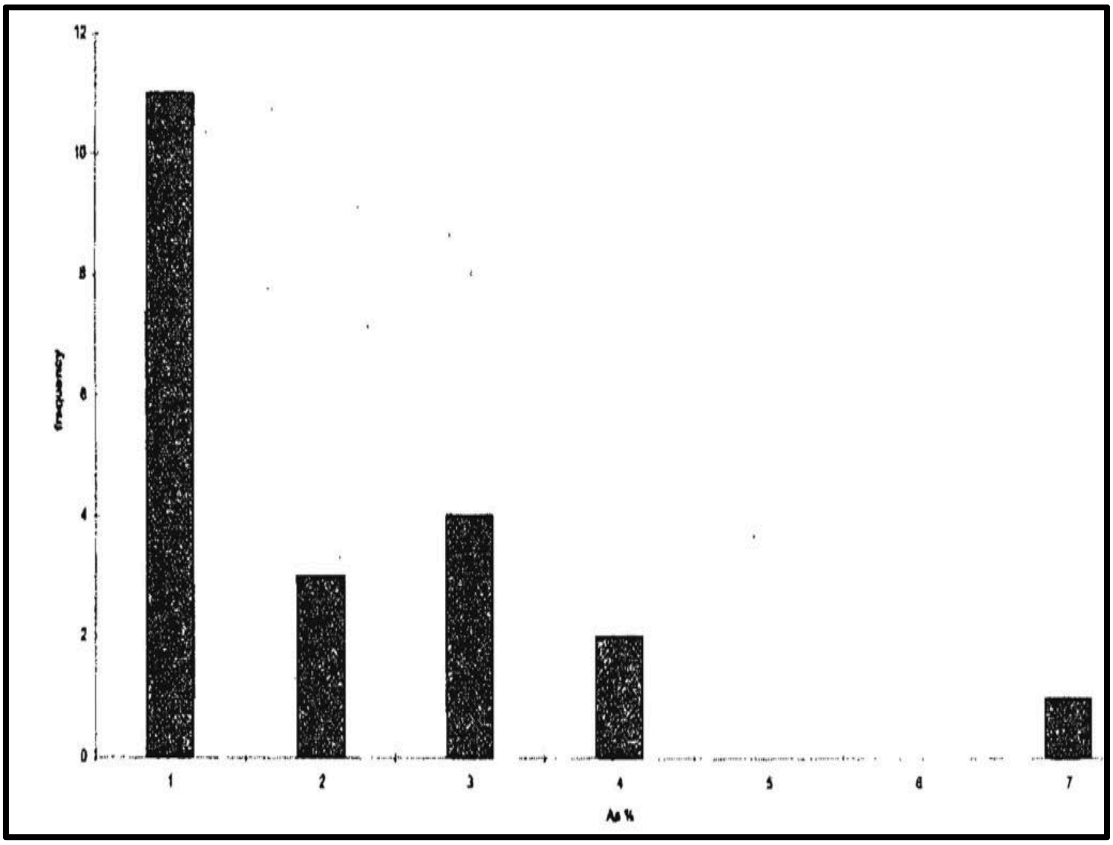
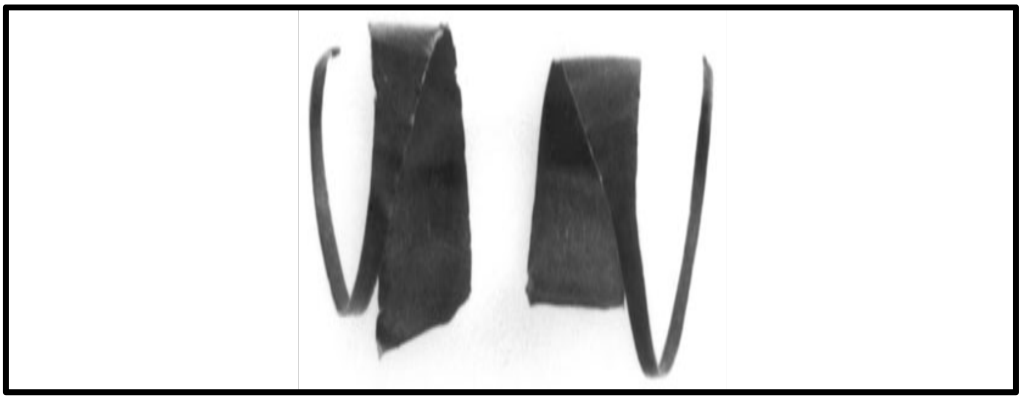


Figure 14: Relative percentage of arsenic found in the metal objects from Sotira-Kaminoudhia (Giardino et al. 2003: 395, Fig. 8.1.4.)



		cu	ag	au
m6		1 - 3	15 - 20	77 - 84
m7		1 - 3	15 - 20	77 - 84

Figure 15: Electrum earrings from Sotira Kaminoudhia and its quantitative energy dispersive fluorescence X-Ray analysis (Knapp, 2008: 77, Fig. 12; Giardiona et al., 2003: 393, Table 8.1.1)