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THE PRODUCTION AND TRADE OF CYPRIOT COPPER IN THE LATE BRONZE AGE. AN ANALYSIS OF THE EVIDENCE

VASILIKI KASSIANIDOU*

INTRODUCTION

CYPRUS, the third largest island in the Mediterranean, is located in the crossroads between East and West and, although in recent times the island's inhabitants feel a much stronger affiliation with the land rather than with the sea, this was not the case in Antiquity. The mountains of Troodos, which dominate the South-West and cover more than a third of the whole island are heavily wooded and would have been even more so in Antiquity. The forests provided timber for ship building, and throughout Antiquity Cyprus was well known for its ships and shipyards.¹

The forests also provided fuel for the hearths, the pottery kilns and most importantly for the metallurgical furnaces which processed the rich copper ores coming from the foothills of the Troodos. Massive copper sulphide deposits are located in the periphery of the mountain range in the geological formation known as the pillow lavas (FIG. 1). Because of these deposits Cyprus is even today considered to be one of the richest countries in copper per surface area in the world.² It is this mineral wealth which enabled the island to play a leading role in the metals trade of the Late Bronze Age.

COPPER PRODUCTION AND TRADE IN THE LATE CYPRIOTE I

Recent excavations have shown that it is in the Middle Cypriote period that the foundations of the Cypriot copper industry were established.³ However, according to both textual and archaeological evidence, it is in the Late Cypriote (LC) that the production and export of copper truly develop, reaching a peak in the thirteenth century BC. This marked increase in production (and subsequently export), is partly due to significant technological developments in the smelting installations. The furnaces dating to the LC were equipped with a system of bellows and tuyères, the use of which led to a significant increase in the operating temperature and thus to the melting of their contents. The two liquid products, metal and slag, could therefore be easily and efficiently separated without a significant loss of metal in the slag.⁴

The discovery and excavation of a LCI primary smelting workshop at Politiko-*Phorades*, has enabled us to unravel the secrets of the smelting technology of this period.⁵ The smelting furnaces at *Phorades* were cylindrical structures with flat bases that were built entirely of clay. They were used together with cylindrical ceramic tuyères connected to bellows. The tuyères which

* Archaeological Research Unit, Department of History and Archaeology, University of Cyprus, P.O. Box 20537, Nicosia CY 1678, Cyprus, v.kassianidou@ucy.ac.cy.

¹ S. Demesticha, "Harbours, Navigation and Sea Trade" in *Ancient Cyprus Cultures in Dialogue*, D. Pilides, N. Papadimitriou (ed.), Nicosia 2012, p. 80-83.

² G. Constantinou, "Late Bronze Age Copper Production in Cyprus from a Mining Geologist's Perspective" in *Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*, V. Kassianidou, G. Pappasavvas (ed.), Oxford and Oakville 2012, p. 4-13.

³ V. Kassianidou, "The Formative Years of the Cypriot Copper Industry", in *Aegean Metallurgy in the Bronze Age*, I. Tzachilli (ed.), Athens 2008, p. 249-267.

⁴ V. Kassianidou, "Blowing the Wind of Change: the Introduction of Bellows in Late Bronze Age Cyprus", in *Metallurgy: Understanding How, Learning Why. Studies in Honor of James D. Muhly*, P.P. Betancourt, S. C. Ferrence (ed.), Philadelphia 2011 (*Prehistory Monographs* 29), p. 41-47.

⁵ A.B. Knapp, V. Kassianidou, "The Archaeology of Late Bronze Age Copper Production. Politiko *Phorades* on Cyprus", in *Anatolian Metal IV*, Ü. Yalçın (ed.), Bochum 2008 (*Der Anschnitt Beiheft* 21), p. 135-147.

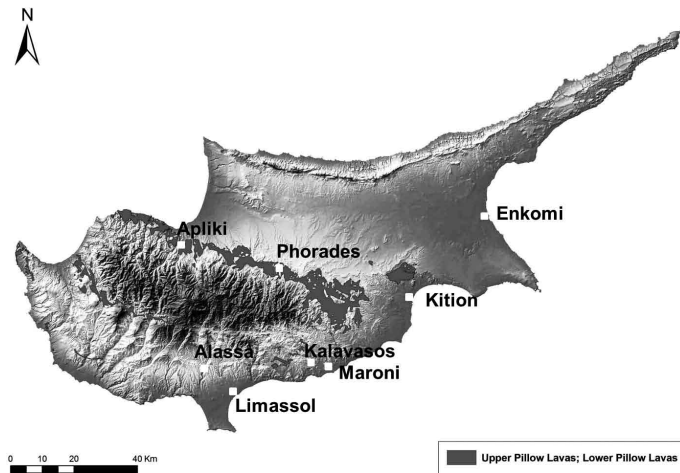


FIG. 1. Map of Cyprus showing the pillow lavas and sites mentioned in the text. Digital geological data provided by the Cyprus Geological Survey.

preserve their nozzle are usually heavily slagged (FIG. 2). The use of bellows at Phorades is indirectly revealed: in the inner surface of some tuyère fragments one can often detect droplets of slag which have been sucked in. The slag is very different from that coming from Middle Cypriote sites. It has a very characteristic plano-concave shape which can only have been produced when the full contents of the furnace, i.e. the slag and the metal were tapped in a pit. The metal being heavier settled in the bottom, and when the two immiscible phases solidified they were easily separated. The slag was discarded while the metal, which

was in fact matte, the intermediate product of the smelting of sulphide ores, had to be processed further in order to be converted into copper. This second stage in the process does not seem to have taken place in the same workshop and this may explain the presence of significant metallurgical remains within the most important urban centre of this earliest phase of the Late Bronze Age, namely Enkomi.

The excavations of Dikaios in Area III of Enkomi brought to light a very large building the earliest occupation of which dates to the beginning of the LCI namely ca 1650-1550 BC.⁶ Its massive architecture, its thick external walls, as well as, the fact that one of the two doors to the building had a complex arrangement with a dog-leg entranceway, led Dikaios to identify this as a Fortress,⁷ something which was later contested by Frontin.⁸ In many of the excavated rooms Dikaios uncovered several almost complete tuyères and crucible fragments as well as installations which he identified as smelting furnaces.⁹ Interestingly one of the most important finds from this phase of occupation of the Fortress is the earliest known tablet in the still undeciphered Cypriote Minoan script.¹⁰

As the Enkomi workshops are contemporary to the smelting workshop of *Phorades* the two can be compared and contrasted. I have argued elsewhere that the installations described by Dikaios as smelting furnaces most probably were hearths in which crucibles, used either for refining or for melting metal, were heated.¹¹ Many such crucible fragments were among the finds from the rooms, which were said to contain a smelting furnace. I have also argued that the tuyères from Enkomi are more likely to have been used to melt metal rather than smelt ores (FIG. 3).¹²

The copper produced would be cast into ingots both for local use and for export. From the 16th century onwards copper begins to be traded in the form of oxhide ingots. Copper oxhide ingots are rectangular slabs with a length averaging sixty centimetres, a width averaging forty

⁶ L. Crewe, *Early Enkomi. Regionalism, Trade and Society at the Beginning of the Late Bronze Age on Cyprus*. Oxford 2007 (BAR, International Series 1706), p.75.

⁷ P. Dikaios, *Enkomi. Excavations 1948-1958, Volume I*, Mainz 1969, p. 16-18.

⁸ M. Frontin, "La Soi-Disant Forteresse d' Enkomi (Chypre) à la Fin du Bronze Moyen et au Début du Bronze Récent", in *Transition. Le Monde Egéen du Bronze Moyen au Bronze Récent*, R. Laffineur (ed.), Liège 1989 (*Aegeum* 3), p.239-249.

⁹ V. Kassianidou, "Metallurgy and Metalwork in Enkomi: the Early Phases", in *Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*, V. Kassianidou, G. Papasavvas (ed.), Oxford and Oakville 2012, p. 94-106.

¹⁰ P. Dikaios, *Enkomi*, cit. (n. 7), p. 23.

¹¹ V. Kassianidou, "Metallurgy", cit. (n. 9), p. 103.

¹² V. Kassianidou, "Metallurgy", cit. (n. 9), p. 103.

centimetres and a thickness of about four centimetres.¹³ The corners are usually protruded to form four extremities or handles. They weigh from 23 to 39 Kg but many of them weigh around 29 kg, the equivalent of a talent.¹⁴ Excavations in Crete have produced the largest number of complete oxhide ingots found on land,¹⁵ and all those which come from securely dated archaeological deposits can be assigned a Late Minoan IB date.¹⁶ Thus the ingots found in Crete are still today the earliest known examples of this type. This is why Catling proposed in 1964 that the oxhide ingot shape was actually devised

on Crete.¹⁷ He argued that the copper need not have come from a local source (indeed there are no significant copper sources on the island) and that this was a choice based on “administrative convenience for managing its copper supplies”.¹⁸ More recently Stos Gale suggested that perhaps the oxhide ingot shape was a Hurrian invention.¹⁹ The question of the origin of the shape remains unanswered and it is beyond the scope of this paper to discuss it further. Not so with the origin of the metal used to produce some of the oxhide ingots found on Crete, as it has been determined with the help of Lead Isotope Analysis. Initial analytical results showed that the Late Minoan IB oxhide ingots from Aghia Triadha, Tyliossos and Zakros came from an unknown source which could not be in the Mediterranean region or in Anatolia.²⁰ Thus in a paper published in 1989 Gale stated: “At any rate, Cypriot oxhide ingots were not coming to Crete in the period 1550-1450 B.C.; indeed Cypriot copper was almost certainly not being cast into oxhide ingots as early as this. In this period oxhide ingots were made elsewhere, though we know from our work on the Middle Cypriot site Alambra that Cypriot copper was being used on a small scale as early as about 1800 B.C.”²¹ In other words the Lead Isotope Analysis data seemed to confirm Catling’s idea that Cyprus was not the principal source of copper for Crete in the Neopalatial period. Although these results are still partly true, since the source for the copper for the complete ingots from Aghia Triadha and Tyliossos remains unknown, a new set of analytical data has shown that in fact four out of the six complete ingots from Zakros are consistent with a Cypriot provenance.²² The new results are particularly interesting because the six ingots were found together and have the same shape, yet

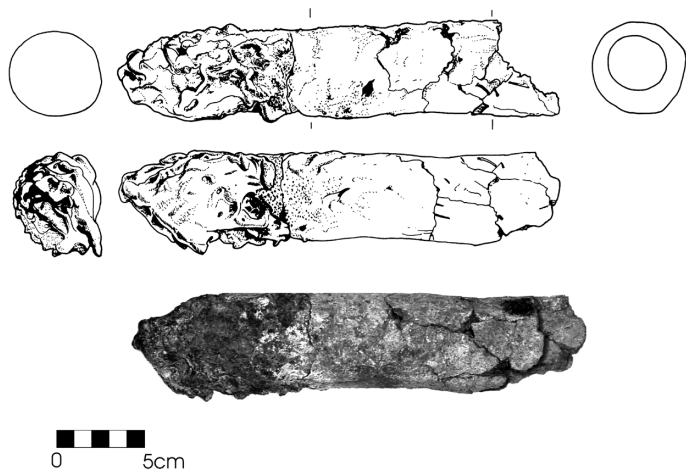


FIG. 2. A cylindrical tuyère from *Phorades* with a melted nozzle (photograph: Christopher Parks; drawing: Glynnis Fawkes).

¹³ G.F. Bass, *Cape Gelidonya: A Bronze Age Shipwreck*, Philadelphia 1967 (*Transactions of the American Philological Society* 57/8), p. 52.

¹⁴ A.B. Knapp, “Cyprus, Copper and Alashiya”, in *Metallurgy: Understanding How, Learning Why. Studies in Honor of James D. Muhly*, P.P. Betancourt, S. C. Ferrence (ed.), Philadelphia 2011 (*Prehistory Monographs* 29), p. 249-254.

¹⁵ L. Hakulin, *Bronzeworking on Late Minoan Crete. A Diachronic Study*. Oxford 2004 (*BAR International Series*, 1245), p.19.

¹⁶ Z.A. Stos Gale, “‘Biscuits with Ears’. A Search for the Origin of the Earliest Oxhide Ingots in *Metallurgy: Understanding How, Learning Why. Studies in Honor of James D. Muhly*, P.P. Betancourt, S. C. Ferrence (ed.), Philadelphia 2011 (*Prehistory Monographs* 29), p. 221-229.

¹⁷ H.W. Catling, *Cypriot Bronzework in the Mycenaean World*, Oxford 1964, p. 271.

¹⁸ H.W. Catling, *Cypriot Bronzework*, cit. (n. 17), p. 271.

¹⁹ Z.A. Stos Gale, “‘Biscuits with Ears’”, cit. (n. 16), p. 228.

²⁰ N.H. Gale, “Copper Oxhide Ingots: their Origin and their Place in the Bronze Age Metals Trade”, in *Bronze Age Trade in the Mediterranean*, N.H. Gale (ed.), Jonsred 1991 (*SIMA X*), p. 197- 239.

²¹ N.H. Gale, “Archaeometallurgical Studies of Late Bronze Age Copper Oxhide Ingots from the Mediterranean Region,” in *Old World Archaeometallurgy*, A. Hauptmann, E. Pernicka, R. Krause (ed.), Bochum 1989 (*Der Anschnitt* 7), p. 247-268.

²² Z.A. Stos Gale, “‘Biscuits with Ears’”, cit. (n. 16), p. 223.

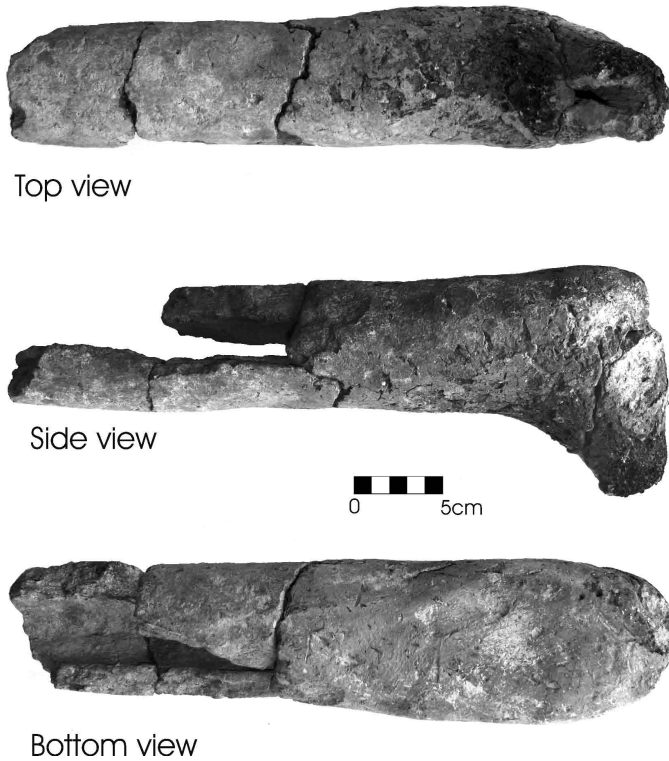


FIG. 3. Elbow tuyère from Enkomi dating to the LCI (photograph: V. Kassianidou).

in Year 38 (ca 1441 BC) and in Year 39 (ca 1440 BC) of his reign.²⁶ The gifts in Year 34 included 108.5 ingots of copper and 2,400 *dbn* of (s)melted copper, in Year 38 an unspecified amount and then in Year 39, forty more ingots of copper.²⁷

The Cypriot oxhide ingots found on Crete and the ones mentioned in the Egyptian texts would have been transported to their destination on ships. Three terracotta model ships dating to the LCI-LCII have been found at Kazaphani and Maroni and because of their shape they are believed to represent merchant ships.²⁸ They indicate that the ingots may very well have been carried on Cypriot merchant ships.

No copper oxhide ingots dating to the LCI have yet been found on Cyprus.²⁹ However, an oxhide ingot is depicted on a cylinder seal found in a tomb in Enkomi dating to the end of the LCI.³⁰

²³ Z.A. Stos Gale, “Biscuits with Ears”, cit. (n. 16), p. 226.

²⁴ Z.A. Stos Gale, “Biscuits with Ears”, cit. (n. 16), p. 223; N.H. Gale, “Lead Isotope Characterization of the Ore Deposits of Cyprus and Sardinia and its Application to the Discovery of the Sources of Copper for Late Bronze Age Oxhide Ingots”, in *Metals in Antiquity*, S.M.M. Young, A.M. Pollard, P. Budd, R.A. Ixer (ed.), Oxford 1999 (*BAR International Series* 792), p. 110-121.

²⁵ A.B. Knapp, “Cyprus, Copper”, cit. (n. 14), p. 251.
²⁶ K.A. Kitchen, “Alas(h)i(y)a (Irs) and Asiya (Isy) in Ancient Egyptian Sources”, in *Egypt and Cyprus in Antiquity*, D. Michaelides, V. Kassianidou, R. S. Merrillees (ed.), Oxford 2009, p.1-8. For a recent discussion of the identification of Alashiya with Cyprus see A.B. Knapp, *Prehistoric & Protohistoric Cyprus*, Oxford 2008, p. 300-303.

²⁷ B.G. Ockinga, “Hieroglyphic Texts from Egypt”, in *Sources for the History of Cyprus. Volume II Near Eastern and Aegean Texts from the Third to the First Millennia BC*, A.B. Knapp (ed.), Altamont, New York 1996, p. 42-50.

²⁸ S. Wachsmann, *Seagoing Ships & Seamanship in the Bronze Age Levant*, College Station and London 1998, p. 64.

²⁹ V. Kassianidou, “Oxhide Ingots in Cyprus”, in *Oxhide Ingots in the Central Mediterranean*, F. Lo Schiavo, J. D. Muhly, R. Maddin, A. Giumlia Mair (ed.), Rome 2009, p. 41-81.

³⁰ Oxhide ingots appear in a number of seals found on Cyprus. The evidence has recently been compiled by G. Graziadio, “I Lingotti Oxhide nella Glittica Cipriota”, *Studi Micenei ed Egeo-Anatolici* XLV/1 (2003), p. 27-69 and G. Papasavvas, “The Iconography of the Oxhide Ingots”, in *Oxhide Ingots in the Central Mediterranean* F. Lo Schiavo, J.D. Muhly, R. Maddin, A. Giumlia Mair (ed.), Rome 2009, p. 83-132.

they are made of copper coming from two different sources.²³ Furthermore, other Lead Isotope Analyses show that fragments of ingots found at Mochlos, Syme and Gournia dating to the same period are also consistent with a Cypriot provenance.²⁴ Therefore, the current evidence indicates that Cyprus was exporting significant amounts of copper to Crete in the shape of oxhide ingots already since the 16th century, the period during which the *Phorades* workshop and the workshops of Enkomi were in full swing.

Textual evidence for the export of copper in this early phase of the Late Bronze Age is found in Egyptian hieroglyphic texts dating to the 15th century BC.²⁵ According to the texts the ruler of Isy, which is believed to be another form name for Alashiya, in its turn identified as Cyprus, sends diplomatic gifts to the pharaoh Tuthmosis III on three different occasions in Year 34 (ca 1445 BC),

It is in this period that cylinder seals begin to appear on the island and this is believed to be the result of the increasing involvement of Cyprus in the trading networks of the Near East.³¹ The fact that this motif appears already from the beginning of seal use on the island should be noted. Also significant is the fact that more than half of the cylinder seals with a secure provenance come from Enkomi.³²

In a paper published in 1996 Peltenburg asserted that “*the raison d’être of Enkomi was at least in part the exploitation of Cypriot copper resources on a large, perhaps unprecedented scale*”.³³ I would like to support a slightly modified version of this idea. I believe that the *raison d’être* of Enkomi was the export of Cypriot copper on a large, and certainly unprecedented scale, as well as the control of the import of other metals such as gold, silver and tin which were needed but not produced on the island.³⁴ The choice of this particular location to build a city can only be based on the favourable conditions for establishing a harbour: throughout the island’s history Famagusta Bay, where Enkomi is situated, has always been the location of one of the island’s main ports. Catling argued in the past that the mouth of the Pedieos river, now silted up, would probably have been navigable up to Enkomi.³⁵ This was recently confirmed by Devillers who undertook a geomorphological study of the Gialias river basin.³⁶ He identified the presence of a large lagoon which in the Late Bronze Age would have expanded as far as Enkomi.³⁷ The results of his research, therefore, support the idea that Enkomi would have been a port town during her lifetime.

COPPER PRODUCTION AND TRADE IN THE LATE CYPRIOTE IIA-IIB

In the fourteenth century the scale of production and export intensified significantly. Support for this argument, in the form of both textual and archaeological data, comes from overseas. Invaluable textual evidence is provided in the well-known letters from Alashiya which were found in the archive of Tell el Amarna.³⁸ In five of the eight letters sent from Alashiya to Egypt shipments of copper are recorded.³⁹ The fact that among those who correspond with the pharaoh, the king of Alashiya is the only one who sends copper, has often been used as an argument to support the identification of Alashiya with Cyprus.⁴⁰ The Amarna letters are important for a number of reasons. First of all, as vividly explained by Kitchen: “*One other item of importance in these few letters is the political status of the King of Alashia vis-à-vis the pharaoh of Egypt. He actually greets the pharaoh – wealthiest and most prestigious monarch of the time – as “Brother”, just as did the kings of Hatti, Babylon, and Mitanni (if not Arzawa). Not for him, the snivelling, grovelling in the dust: “my lord, I am the mere dirt under your feet, I flatten myself in obeisance 7 times each on my back and my belly” kind of talk! Not here!*”⁴¹ Undoubtedly this political importance stems from the ability of the king of Alashiya to provide the pharaoh of Egypt with copper. Both the king and the governor of Alashiya mention in their letters ships that belong to the king and Cypriot merchants who are stationed in Egypt.

³¹ J. M. Webb and J. Weingarten, “Seals and Seal Use: Markers of Social, Political and Economic Transformations on Two Islands”, in *Parallel Lives Ancient Island Societies in Crete and Cyprus*, G. Cadogan, M. Iacovou, K. Kopaka, J. Whitley (ed.), London 2012 (*British School at Athens Studies* 20), p. 85-104.

³² J. M. Webb and J. Weingarten, “Seals”, cit. (n. 31), p. 87.

³³ E. Peltenburg, “From Isolation to State Formation in Cyprus c. 3500-1500 BC”, in *The Development of the Cypriot Economy. From the Prehistoric Period to the Present Day*, V. Karageorghis, D. Michaelides (ed.), Nicosia 1996, p. 45-60.

³⁴ V. Kassianidou, “*“May He Send Me Silver in Very Great Quantities” EA 35*”, in *Egypt and Cyprus in Antiquity*, D. Michaelides, V. Kassianidou, R. Merrillees (ed.), Oxford 2009, 48-57; V. Kassianidou, “The Trade of Tin and the Island of Copper”, in *Le Problème de l’Étain à l’Origine de la Métallurgie*, A. Giunilia-Mair, F. Lo Schiavo (ed.), Oxford 2003 (*BAR International Series* S1199), p. 109-119.

³⁵ H. W. Catling, “Patterns of Settlement in Bronze Age Cyprus”, *OAth* IV (1962), p. 129-169.

³⁶ B. Devillers, *Morphogenèse et Anthropisation Holocènes d’un Bassin Versant Semi-Aride : le Gialias, Chypre*. Thèse de Doctorat de Géographie Physique. Université Aix-Marseille I, Aix 2005.

³⁷ B. Devillers, *Morphogenèse*, c. (n. 36) p. 323-325.

³⁸ W. L. Moran, *The Amarna Letters*, Baltimore and London 1992.

³⁹ A. B. Knapp, “Cyprus, Copper”, cit. (n. 14), p. 250.

⁴⁰ A. B. Knapp, “Introduction”, in *Sources for the History of Cyprus. Volume II Near Eastern and Aegean Texts from the Third to the First Millennia BC*, A. B. Knapp (ed.), Altamont, New York 1996, p. 1-13.

⁴¹ K. A. Kitchen, “Alas(h)(y)a (Irs)” cit. (n. 26) p. 4.

Most importantly, in letter EA35 the king of Alashiya apologises for sending only 500 unspecified units of copper explaining that this is because the god Nergal has “*slain all the men in my country, and there is not a (single) copper-worker*”.⁴² This shows that the copper was locally produced and sent directly from Alashiya to Egypt. In 1986 Zaccagnini argued that the amount of copper in this letter was 500 shekels⁴³ but a number of scholars now believe that the amount is actually 500 talents or ingots of copper.⁴⁴ If we accept that the Amarna letters refer to numbers of ingots or talents of copper then in the five letters a total of 113 talents and 934 ingots of copper, were exported from Cyprus to Egypt.⁴⁵ If an average weight of 28 Kg is used for the ingots and the talents then the amount corresponds to 29,000 kilos of metal.⁴⁶ Considering that the chronological span of this correspondence is 30 years at most, and 15 is more likely,⁴⁷ and that most probably only a section of the correspondence has survived, the amount of copper sent is striking.

The discovery and excavation of the Uluburun shipwreck showed that such a cargo was indeed realistic. The ship carried almost 10 tonnes of copper in a variety of ingot shapes. The cargo included 354 oxhide ingots, 317 of which are of the normal shape and weigh on average 24 Kg, 31 have only two rather than four handles and the other six are smaller than normal oxhide ingots. The cargo also included 121 plano convex ingots each weighing on average 6,2 Kg and 7 ovoid bun ingots.⁴⁸ According to LIA analysis the most likely source for the metal of both the oxhide and the bun ingots is Cyprus.⁴⁹ Even if the ship is not Cypriot as the excavator claims,⁵⁰ the size of the cargo indicates that Cypriot workshops could produce a load of ten tons of copper for a single shipment. Considering the probability that this was not the only ship loaded with Cypriot copper that sailed that year, then the importance of Cyprus as a source of copper for the Eastern Mediterranean in this period is clear. The ship was also carrying at least a ton of tin in oxhide shaped ingots but also in ingots of other shapes.⁵¹ Together the two metals would produce 11 tons of a bronze with a copper to tin ratio of 10 to 1. Pappasavvas converted this amount of bronze into finished objects based on published weights of contemporary weapons and tools and he reached the conclusion that the Uluburun cargo could have produced 30,000 swords of a Late Helladic/Late Minoan type or 25,000 swords of the later in date Naue II type, or 36,000 daggers or 85,000 chisels.⁵² As he points out this would have been more than enough to outfit an army such as the one led by Ramses II against the Hittites at Kadesh. No wonder the Egyptian pharaoh was keen to receive the shipments of copper from Alashiya: the copper would have been used among other things to produce weapons necessary for the Egyptian army.

What is known about copper production in Cyprus in this period? The metallurgical workshops in Area III of Enkomi were as active as ever. According to Dikaios:⁵³ “*In many of these (rooms) we found remnants on successive floors of furnaces littered with masses of tuyères and broken crucibles, together with much copper oxidation and other debris from copper smelting establishments*”.

⁴² Translation by W. L. Moran *The Amarna*, cit. (n. 38), p. 107.

⁴³ C. Zaccagnini, “Aspects of Copper Trade in the Eastern Mediterranean during the Late Bronze Age”, in *Traffici Mercanti nel Mediterraneo: Problemi Storici e Documentazione Archeologica*, M. Marazzi, S. Tusa, L. Vagnetti, (ed.), Taranto 1986 (*Magna Graecia* 3), p. 413-424.

⁴⁴ Moran in his translation of the letter adds the word “talents” in brackets after the number 500. W. L. Moran, *The Amarna*, cit. (n. 38), p. 150.

⁴⁵ A.B. Knapp, “Cyprus, Copper”, cit. (n. 14), p. 251.

⁴⁶ A.B. Knapp, V. Kassianidou, “The Archaeology”, cit. (n. 5), p. 135.

⁴⁷ W. L. Moran *The Amarna*, cit. (n. 38), p. xxxiv.

⁴⁸ C. Pulak “The Uluburun Shipwreck and Late Bronze Age Trade”, in *Beyond Babylon. Art, Trade and Diplomacy in the Second Millennium B.C.*, J. Aruz, K. Benzel, J.M. Evans (ed.), New York, New Haven and London 2008, p. 289-385; C. Pulak, “Das Schiffswrack von Uluburun” in *Das Schiff von Uluburun. Welthandel vor 3000 Jahren*, Ü. Yalçın, C. Pulak, T. Slotta (ed.), Bochum 2005, p.55-102.

⁴⁹ Z.A. Stos “Across the Wine Dark Seas... Sailor Tinkers and Royal Cargoes in the Late Bronze Age Eastern Mediterranean”, in *From Mine to Microscope. Advances in the Study of Ancient Technology*, A.J. Shortland, I.C. Freestone, Th. Rehren (ed.), Oxford 2009, p. 163-180.

⁵⁰ C. Pulak, “The Uluburun Shipwreck”, c. (n. 48), p. 299.

⁵¹ C. Pulak, “The Uluburun Shipwreck”, c. (n. 48), p.292.

⁵² G. Pappasavvas, “Profusion of Cypriot Copper Abroad, Dearth of Bronzes at Home: a Paradox in Late Bronze Age Cyprus”, in *Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*, V. Kassianidou, G. Pappasavvas (ed.), Oxford and Oakville 2012, p. 117-138.

⁵³ Inv. 4543 and Inv. 4544, P. Dikaios, *Enkomi. Excavations 1948-1958. Volume II*. Mainz 1971, p. 505.

Among the finds from this stratum was a pair of limestone pot bellows⁵⁴ (FIG. 4). The fact that they were found as a pair and their low height led Davey to suggest that they were foot rather than hand operated.⁵⁵ The tuyères that were used together with these bellows are exactly the same as those of the previous period, in other words they are elbow tuyères. A limited amount of metallurgical debris was also recovered from the LCIIA-B at the site of Maroni-Vournes. This included some slag, scrap metal and furnace material all of which indicate some kind of metallurgical activity taking place at this site in the 14th century BC.⁵⁶

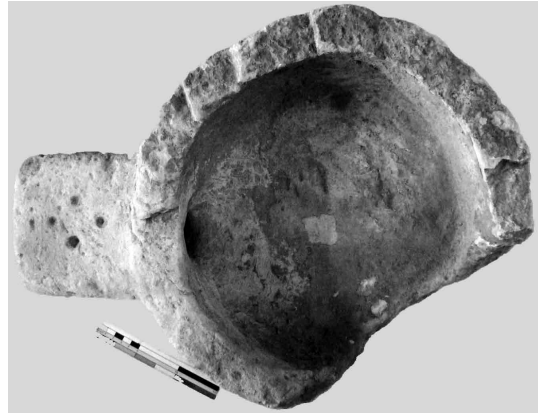


FIG. 4. Stone bellows from Enkomi dating to the LCIIA-LCIIB (photograph: Demetris Tsouris).

The 14th century is also the time when the first oxhide ingot fragments are found on the island.⁵⁷ One fragment was found in a 14th century stratum of Quartier 5W of Enkomi,⁵⁸ and such a date is also assigned to the oxhide ingot fragments from Maroni-Vournes which were found below the floor of the Ashlar Building, together with an assemblage of finds that indicate the presence of a metallurgical workshop.⁵⁹ More recently during the analytical study of some metallic artefacts which came from tombs in Limassol dating to the Late Cypriote IIA-B,⁶⁰ what were thought to be small pieces of slag, were actually found to be amorphous lumps of copper.⁶¹ Unfortunately they are too small to be conclusively identified as fragments of an oxhide ingot. Nevertheless, they are extremely important, as they add another previously unknown LCIIA-IIB site, Limassol, on the list of places where some metallurgical activity, including the production and/or use of raw copper was taking place in the 14th century.

COPPER PRODUCTION AND TRADE IN THE LATE CYPRIOTE IIC

The LCIIC which roughly corresponds to the thirteenth century BC has produced the majority of the evidence for copper production. It is in this period that the only known mining settlement, Apliki *Karamallos*, is dated. The site was excavated in 1938 when modern mining operations uncovered the remains of buildings and was subsequently destroyed.⁶² It is clear from the finds which include tap slag, tuyères, which are massive and numerous stone tools, that the ore extracted from the nearby mine was processed and smelted to produce copper metal at this settlement.⁶³ The Apliki mine lies within Cyprus' richest mining district, defined in the publications of Gale

⁵⁴ P. Dikaios, *Enkomi*, c. (n. 53), p. 637, Plate 8.3 and Plate 127.48, 48a.

⁵⁵ C.J. Davey, "Some Ancient Near Eastern Pot Bellows", *Levant* 11 (1979), p. 101-111.

⁵⁶ R.C.P. Doonan, G. Cadogan, D. Sewell, "Standing on Ceremony: The Metallurgical Finds from Maroni Vournes, Cyprus, in *Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*, V. Kassianidou, G. Papasavvas (ed.), Oxford and Oakville 2012, p. 48-57.

⁵⁷ V. Kassianidou, "Oxhide Ingots", c. (n.29), p. 58.

⁵⁸ J. Lagarce, E. Lagarce, "La métallurgie" in *Enkomi et le Bronze Récent à Chypre*, J.C. Courtois, J. Lagarce and E. Lagarce, Nicosia 1986, p. 60-99.

⁵⁹ R.C.P. Doonan, G. Cadogan, D. Sewell, "Standing on Ceremony", cit. (n. 56), p. 52; V. Kassianidou, "Oxhide Ingots", c. (n.29), p. 46-47.

⁶⁰ V. Karageorghis, Y. Violaris, *Tombs of the Late Bronze Age in the Limassol Area (17th-13th Centuries BC)*, Nicosia 2013.

⁶¹ A. Charalambous, V. Kassianidou, "Chemical Analyses of Metal Artefacts from Late Cypriot Tombs Excavated in the Limassol Area with the Employment of pXRF", in *Tombs of the Late Bronze Age in the Limassol Area (17th-13th Centuries BC)*, V. Karageorghis, Y. Violaris, Nicosia 2013, p. 300-308.

⁶² J. Du Plat Taylor, "A Late Bronze Age Settlement at Apliki, Cyprus", *The Antiquaries Journal* XXXII (1952), p. 133-67; B. Kling, J.D. Muhly, *Joan du Plat Taylor's Excavations at the Late Bronze Age Mining Settlement at Apliki Karamallos, Cyprus*, Sävedalen 2007 (SIMA 94:1).

⁶³ J.D. Muhly, "The Organisation of the Copper Industry in Late Bronze Age Cyprus", in *Early Society in Cyprus*, E. Peltenburg (ed.), Edinburgh 1989, p. 298-314.



FIG. 5. The modern open cast mine of Skouriotissa in relation to the mine of Mavrovouni and the ancient site of Soloi (photograph: V. Kassianidou).

(FIG. 5). This is where the Iron Age kingdom of Soloi was established, one of the richest and most important on the island throughout the first millennium BC.⁶⁶

In Area III of Enkomi, in the LCIIC a new building with a completely new form and consisting of different sectors was erected⁶⁷ (FIG. 6). The West sector constitutes a vast group of copper workshops, organized around a central court. According to Dikaios: “Nearly every room in this sector yielded important evidence of copper smelting and other associated work which testifies to an unprecedented intensification of the copper industry during the present Level”.⁶⁸ In one of the rooms one of the best known metallurgical artefacts from Enkomi was found.⁶⁹ This is the cylindrical crucible which is similar in shape to the Phorades smelting furnaces, but it is much smaller. Although Tylecote suggested that this was a smelting furnace,⁷⁰ it is much more likely that it was an installation that was related to secondary processing of the metal rather than primary smelting.⁷¹ The tuyères dating to the LCIIC continue to be of the elbow type with a narrow nozzle, and they are completely different from the contemporary tuyères from Apliki. This suggests once more that they were used in different processes. The tuyères were connected to ceramic bellows, examples of which were recovered from this level. The extensive metallurgical activities, which led to the formation of a significant slag dump,⁷² led Peltenburg and Pickles to suggest that this building was nothing less than a copper factory.⁷³ Among the products of the Enkomi workshops were

and Stos Gale as the Solea axis deposits,⁶⁴ which include the mines of Mavrovouni and Skouriotissa. In modern times the three mines produced more than 85% of the total copper ore concentrate that was exported from Cyprus.⁶⁵ Skouriotissa is the only copper mine still operating today and a modern plant is now producing very pure metallic copper on the island for the first time since Antiquity. The coast is less than ten kilometres away and when standing on the top of Phoukasa hill at Skouriotissa on a clear day, one can see the pier of the Cyprus Mines Corporation where, prior to the Turkish invasion of 1974, the copper concentrates from these three mines were exported

⁶⁴ Z.A. Stos-Gale, G. Maliotis, N. Gale, N. Annetts, “Lead Isotope Characteristics of the Cyprus Copper Deposits Applied to Provenance Studies of Copper Oxide Ingots”, *Archaeometry* 39 (1997), p. 83-124.

⁶⁵ G. Constantinou, “Geological Features and Ancient Exploitation of the Cupriferous Sulphide Orebodies of Cyprus”, in *Early Metallurgy in Cyprus 4000 - 500 BC*, ed. J.D. Muhly, R. Maddin, V. Karageorghis (ed.), Nicosia 1982, p. 13-23.

⁶⁶ A. Stylianou, “The Age of the Kingdoms. A Political History of Cyprus in the Archaic and Classical Periods”, in *Travaux et Mémoires II*, T. Papadopoulos (ed.), Nicosia 1992, p. 375-530.

⁶⁷ P. Dikaios, *Enkomi*, c. (n. 7), p.46.

⁶⁸ P. Dikaios, *Enkomi*, c. (n.7), p. 58; P. Dikaios, *Enkomi*, c. (n. 53), p. 644.

⁶⁹ R.F. Tylecote, “The Late Bronze Age: Copper and Bronze Metallurgy at Enkomi and Kition”, in *Early Metallurgy in Cyprus, 4000 - 500 BC*, J. D. Muhly, R. Maddin, V. Karageorghis (ed.), Nicosia 1982, p.81-103.

⁷⁰ A. Hauptmann, “Slags from the Late Bronze Age Metal Workshops at Kition and Enkomi, Cyprus”, in *Metallurgy: Understanding How, Learning Why: Studies in Honor of James D. Muhly*, P.P. Betancourt, S. C. Ferrence (ed.), Philadelphia 2011 (*Prehistory Monographs* 29), p. 189-202.

⁷¹ S. Pickles, E. Peltenburg, *Metallurgy, Society and the Bronze / Iron Transition in the East Mediterranean and the Near East*, Report of the Department of Antiquities Cyprus, 1998, p.67-100.

⁷² P. Dikaios, *Enkomi*, c. (n. 7), p.56.

⁷³ P. Dikaios, *Enkomi*, c. (n.7), p. 61.

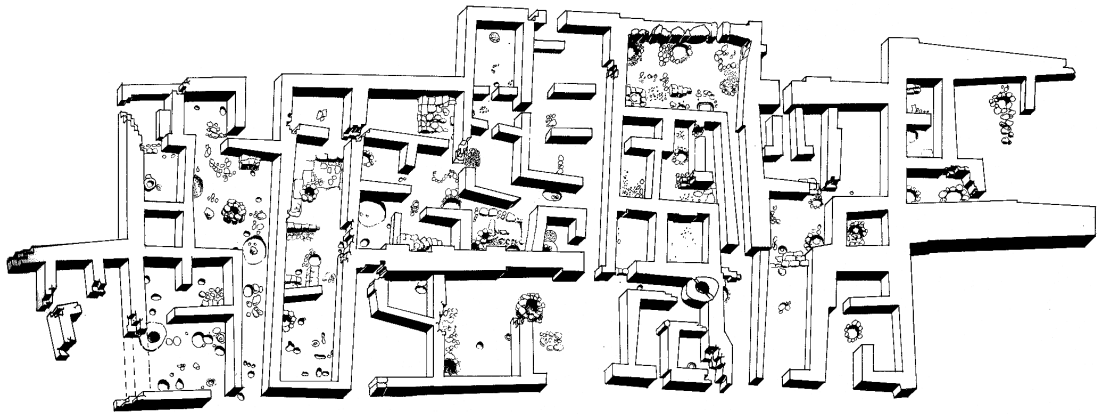


FIG. 6. Isometric plan of the building in Area III of Enkomi in the West Sector of which there are copper workshops (P. ΔΙΚΑΙΟΣ, *Enkomi. Excavations 1948-1958, Volume IIIb*, Mainz 1971).

the two well-known statuettes from Enkomi, namely the Horned God and the Ingot God.⁷⁴ Dating to the LCIIIC there is a plethora of archaeometallurgical finds also from other sites such as Kalavassos *Ayios Dhimitrios*⁷⁵ and Alassa *Pano Mandilaris*.⁷⁶ However, it must be stressed that none of these sites has produced metallurgical remains in the scale and variety of Enkomi. Enkomi continues to stand apart.

The LCIIIC is also the period in which most of the excavated oxhide ingot fragments found on the island can be attributed.⁷⁷ Unlike Crete where complete ingots have been discovered in what are believed to have been storerooms,⁷⁸ in Cyprus oxhide ingots are found in fragments either in areas or buildings, where there is clear evidence of metallurgical activity or as part of hoards that have been classified as founder's hoards.⁷⁹ The sole possible exception may be the so-called Enkomi Ingot Hoard, the existence of which is presumed because two of the only three complete ingots known from Cyprus appeared at the same time in the antiquities market in the 1930s and were said to come from Enkomi. Therefore, it has been argued that they may have been found together as part of a hoard⁸⁰ (FIG. 7). The fact that, in Cyprus oxhide ingots are found in pieces, usually as part of founder's hoards or with other metallurgical debris, is, I believe, clear evidence that copper oxhide ingots were being used in Cyprus and were not only meant for export as has been argued in the past⁸¹ (FIG. 8). Further support for this argument is offered by the plethora of ingot representations in a variety of Late Cypriote artifacts. According to Papasavvas: "It is evident that no other place in the Mediterranean or elsewhere, has such an extensive and consistent "ingot iconography" to show as Cyprus, although many possessed an inconceivably richer pictorial tradition than this island".⁸²

⁷⁴ G. Papasavvas, "From Smiting to Smithing, the Transformation of a Cypriot God", in *Metallurgy Understanding How Learning Why. Studies in Honor of James D. Muhly*, P. Betancourt, S. Ferrence (ed.), Philadelphia 2011, p. 59-66.

⁷⁵ A. South, "Tinker, Tailor, Farmer, Miner: Metals in the Late Bronze Age Economy at Kalavassos", in *Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*, V. Kassianidou, G. Papasavvas (ed.), Oxford and Oakville 2012, p. 35-47.

⁷⁶ S. Hadjisavvas, "Broken Symbols: Aspects of Metallurgy at Alassa", in *Metallurgy: Understanding How, Learning Why: Studies in Honor of James D. Muhly*, P.P. Betancourt, S. C. Ferrence (ed.), Philadelphia 2011 (*Prehistory Monographs* 29), p. 21-27.

⁷⁷ V. Kassianidou, "Oxhide Ingots", c. (n.29), p. 58.

⁷⁸ For example at Aghia Triadha (H. G. Buchholz, "Keftiubarren und Erzhandel in zweiten vorchristlichen Jahrtausend", *Præhistorische Zeitschrift*, XXXVII/1 (1959), p. 1-40) and Zakros (N. Platon, *Ζάκρος. Το Νέον Μινωϊκόν Ανάκτορον*. (Zakros. The New Minoan Palace). Athens 1974).

⁷⁹ V. Kassianidou, "Oxhide Ingots", c. (n.29), p. 60-61.

⁸⁰ J. C. Courtois, "L'Activité Métallurgique et les Bronzes d'Enkomi au Bronze Récent (1650-1100 avant J.C)", in *Early Metallurgy in Cyprus 4000-500 BC*, J. D. Muhly, R. Maddin, V. Karageorghis (ed.), Nicosia 1982, p. 155-174; H.W. Catling, *Cypriot Bronzework*, cit. (n.17), p. 282.

⁸¹ The idea that copper oxhide ingots were only made for export was supported by Gale (N.H. Gale, "Lead Isotope", c. (n. 24), p. 117.

⁸² G. Papasavvas, "The Iconography", c. (n. 30), p. 84.

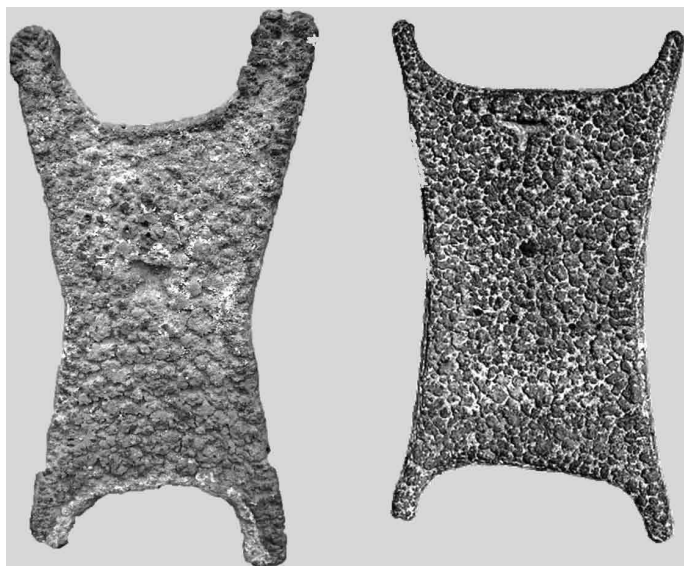


FIG. 7. Two of the only three complete ingots ever found on Cyprus. The one on the left is now in Claremont, California and the other in the Cyprus Museum in Nicosia. (Photo Nicholas Muhly and Department of Antiquities, Cyprus).

per in the form of 34 complete oxhide ingots, 20 plano-convex ingots, numerous ingot fragments and scrap metal⁹⁰ (Bass 1967, 52). According to Lead Isotope Analyses, all the ingots and ingot fragments that have been analysed and date from the 14th century onwards, including those from Cape Gelidonya, have a fingerprint consistent with copper ore deposits in the Troodos Mountains and specifically with that of Apliki.⁹¹

Although not as extensive or as detailed as those of the 14th century, there are a number of references in the ancient sources of the 13th century which mention Cypriot copper. In a Hittite text which described the magical rite sanctifying a new palace and defining the place of origin of the

From the thirteenth century onwards Cypriot copper was exported far and wide. Oxhide ingots are known from as far east as the Kassite palace of Dur-Kurigalzu located near Baghdad,⁸³ as far west as Marseille,⁸⁴ as far north as Oberwilfingen in Germany⁸⁵ and as far south as Qantir in Egypt.⁸⁶ Lo Schiavo⁸⁷ discovered an example on the island of Corsica while a couple of ingots were lately dredged from the river Göksu, a tributary of the Euphrates river in the province of Adiyaman, in Turkey.⁸⁸ Finally, several examples are now known from Bulgaria.⁸⁹ The largest concentration of complete oxhide ingots dating to this period comes again from a shipwreck. The ship that sank off Cape Gelidonya, dating to the end of the 13th century, was carrying a ton of copper

⁸³ J. A. Brinkman, "Twenty Minas of Copper", in *Language, Literature, and History: Philological and Historical Studies Presented to Erica Reiner*, F. Rochberg-Halton (ed.), New Haven, CT 1987 (*American Oriental Series* 67), p. 33-36; J.D. Muhly, "Oxhide Ingots in the Aegean and Egypt", in *Oxhide Ingots in the Central Mediterranean*, F. Lo Schiavo, J.D. Muhly, R. Maddin, A. Giumlia Mair (ed.), Rome 2009, p.17-39.

⁸⁴ C. Domergue, C. Rico, "À Propos de Deux Lingots de Cuivre Antiques Trouvés en Mer sur la Côte Languedocienne", in *Vivre, Produire et Échanger: Reflets Méditerranéens. Mélanges Offerts à Bernard Liou*, L. Rivet, M. Sciallano (ed.), Montagnac 2002 (*Arch. et Hist. Rom.*, 8), p. 141-152.

⁸⁵ M. Primas, E. Pernicka, "Der Depotfund von Oberwilfingen", *Germania* 76 (1998), p. 25-65.

⁸⁶ Th. Rehren, E. B. Pusch, "Alloying and Resource Management in New Kingdom Egypt: the Bronze Industry at Qantir – Pi-Ramesse and its Relationship to Egyptian Copper Sources", in *Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*, V. Kassianidou, G. Papasavvas (ed.), Oxford and Oakville 2012, p. 215-221.

⁸⁷ F. Lo Schiavo, "Metallhandel im Zentralen Mittelmeer", in *Das Schiff von Uluburun. Welthandel vor 3000 Jahren*, Ü. Yalçın, C. Pulak, T. Slotta (ed.), Bochum 2005, p. 399-414.

⁸⁸ C. Pulak, "Three Copper Oxhide Ingots in the Sanliurfa Archaeology Museum, Turkey", in *Metallurgy: Understanding How, Learning Why: Studies in Honor of James D. Muhly*, P.P. Betancourt, S. C. Ferrence (ed.), Philadelphia 2011 (*Prehistory Monographs* 29), p.293-304.

⁸⁹ K. Leshtakov, "The Eastern Balkans in the Aegean Economic System during the Late Bronze Age. Oxhide and Bun Ingots in Bulgarian Lands", in *Between the Aegean and Baltic Seas: Prehistory Across Borders*, I. Galanaki, H. Tomas, Y. Galanakis, R. Laffineur (ed.), Liege and Austin 2007 (*Aegaeum* 27), p. 447-457.

⁹⁰ G.F. Bass, *Cape Gelidonya: A Bronze Age Shipwreck*, Philadelphia 1967 (*Transactions of the American Philological Society* 57/8).

⁹¹ N. H. Gale, "Copper Oxhide Ingots and Lead Isotope Provenancing", in *Metallurgy Understanding How Learning Why: Studies in Honor of James D. Muhly*, P. Betancourt S. Ferrence (ed.), Philadelphia 2011. 213-220.

materials to be used, it is stated that the copper and bronze were brought from Mount Taggata of Alashiya.⁹² From Egypt, there is a hieroglyphic inscription dating to the time of Ramses II in the Temple of Amun in Luxor, which lists several mineral regions. Among them “the Mount of Asiya” and the “Mount of Alasia”, are said to offer the Pharaoh silver and copper.⁹³ Perhaps the most important text, however, comes from Ugarit. Excavations at the house of Urtenu, a high ranking civilian, brought to light a letter written by the king of Alashiya to the king of Ugarit.⁹⁴ This text is extraordinary as it gives us the name of a Late Bronze Age Cy-

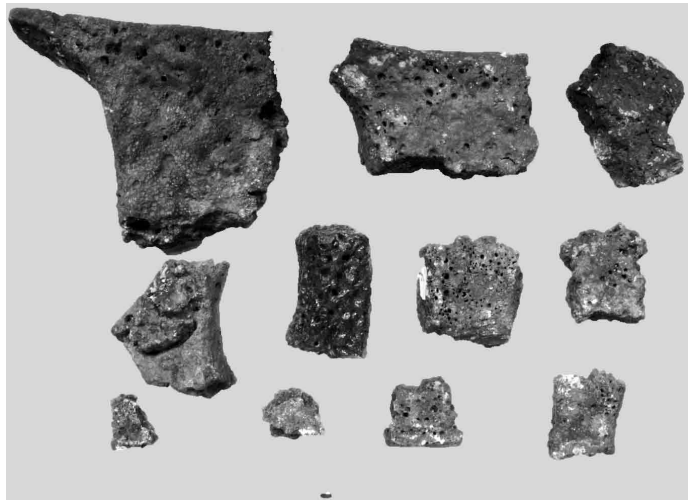


Fig. 8. Oxhide ingot fragments from the Mathiatis Hoard now in the Cyprus Museum in Nicosia (Photo V. Kassianidou).

priot king for the first time. King Kusmesusa of Alashiya informs king Nigmaddu of Ugarit, whom he addresses as his son that he intends to send him 33 ingots of copper which weigh 30 talents. If we use the rounded number of 30kg for a talent then the king of Alashiya was intending to send almost a ton of copper to the king of Ugarit. The fact that the king of Alasia addresses the king of Ugarit as his son indicates that the former was politically superior to the latter.⁹⁵

Where was the seat of power of king Kusmesusa? More importantly, where was the one ton of copper he ships to Ugarit cast into ingots, and where were the ingots loaded on the ship that carried them to Ugarit? Unfortunately, the fact is that still very little is known about the socio-political structure of 13th century Cyprus and consequently even less regarding the organization of the copper industry in this period.⁹⁶ It is, I believe, very likely that one of the main products of the extensive metallurgical workshops of Enkomi were copper oxhide ingots, as well as metallic artefacts, and that the ingots would have been exported from the port of this city. But it is impossible to know whether or not they were also produced in other workshops and exported from other ports. The difficulty rises from the fact that it is not known, whether in this period the island was still a single political entity governed by a single king or whether it had already started to break up into smaller regional polities which will eventually develop to the Iron Age kingdoms. The fact that the Lead Isotope Analysis identifies a single mine, Apliki, as the source of the metal for all ingots that have been found outside the island but also in the island, does make one wonder how everything worked, and how would it have been possible for Enkomi to have been the sole port of export for the copper which comes from Apliki, on the opposite side of the island.

Perhaps, to shed some light to this problem, one should have a brief look at what is happening in the Iron Age. In the Iron Age the kingdom of Soloi which controlled the mines of Apliki, Skouriotissa and Mavrovouni, was the chief rival of Salamis. The kings of Soloi and Salamis were the wealthiest and most powerful amongst the Cypriot kings. This leads me to believe that there must have been a Late Bronze Age predecessor, in this area which may have been the place where

⁹² This is the text KBo IV 1. G. Beckman, “Hittite Documents from Hattusa”, in *Sources for the History of Cyprus. Volume II Near Eastern and Aegean Texts from the Third to the First Millennia BC*, A.B. Knapp (ed.), Altamont, New York 1996, p. 31-35.

⁹³ K.A. Kitchen, “Alas(h)i(y)a (Irs)” cit. (n. 26), p. 6.

⁹⁴ F. Malbran-Labat, “Nouvelles Données Epigraphiques sur Chypre et Ugarit”, *RDAC* 1999, p. 121-123.

⁹⁵ K.A. Kitchen, “Alas(h)i(y)a (Irs)” cit. (n. 26), p. 4.

⁹⁶ For a recent review of the evidence see A. B. Knapp, *Prehistoric and Protohistoric*, c. (n. 26).

the copper from Apliki was cast into ingots and shipped abroad or even to Enkomi. Unfortunately this area is under Turkish occupation and thus cannot be investigated at the moment.

What can be definitely refuted are earlier suggestions that the Cypriot copper industry was controlled by foreigners. In the past, Catling had suggested that the production and systematic export of the copper only started after the arrival of the Mycenaeans,⁹⁷ while Bass maintained that it was the Syrians who were the driving force behind the trade of Cypriot copper.⁹⁸ However, in a review of Cyprus in the thirteenth century, Cadogan wrote that: “*Nothing suggests that foreigners were in charge in Cyprus or living in resident enclaves, let alone governors’ houses*”.⁹⁹ In other words, there is absolutely no evidence that would support the idea that the copper industry was in foreign hands. Furthermore, the discoveries at Middle Cypriote sites such as Pyrgos-Mavrorachi¹⁰⁰ and Politiko-Phorades, as well as the evidence from Enkomi clearly show that, by the thirteenth century, the Cypriot copper industry had already a long history. Indeed, as I have argued elsewhere, Cypriots were not only in charge of their own copper industry, but were also major players, rather than passive spectators as some scholars present them, in the metals trade within the Mediterranean.¹⁰¹

I strongly believe, although I cannot prove it, that the copper oxhide ingots which are sometimes marked with symbols of the Cypro-Minoan script, were exported on Cypriot ships travelling to the East and the West and taking with them also small quantities of Cypriot pottery. The latter are much more visible in the archaeological record, as most of the oxhide ingots would have been alloyed with tin and cast into a variety of objects by the local smiths who received them.

Peltenburg has recently tried to combine the 13th textual evidence, especially the one from Ugarit which still mentions a king of Alashiya, to the archaeological evidence. In an effort to propose a model of how the trade of copper would be organized, noting the absence of structures on the island which can be clearly identified as palaces, and the presence of several large administrative buildings throughout the island, he suggests: “*The incentive for accepting the institution of a primus inter pares, referred to in the texts as a “king”, was to ensure and expand the successful export of high value copper and other insular resources by joining the existing framework of the international gift exchange system. That system required a “king”, and, as far as Alašiya was concerned, it enabled merchants to operate effectively under the aegis of the Alašiyian leader. No doubt merchants worked independently too, but the trade in metals was especially the concern of elites of the highest rank*”.¹⁰²

Enkomi, which stands apart from all other sites both in terms of the amount and quality of foreign imports, luxury goods, number of inscriptions, cylinder seals, and, above all, metallurgical workshops, is still, I believe, the best candidate for the seat of this king also in the LCIIIC.

COPPER PRODUCTION AND TRADE IN THE LATE CYPRIOTE III

According to the archaeological evidence, copper was still being produced in Cyprus after the thirteenth century BC. Although the workshops in Area III of Enkomi are abandoned at this time there are many others which are active in this period and a number of sectors of the town were dedicated to copper production.¹⁰³ Extensive workshops dating to this period have also been excavated in the sacred precinct of Kition.¹⁰⁴ The metal produced was still being cast into oxhide

⁹⁷ H.W. Catling, *Cypriot Bronzework*, cit. (n. 17), p. 271.

⁹⁸ G.F. Bass, “Evidence of Trade from Bronze Age Shipwrecks, in *Science and Archaeology: Bronze Age Trade in the Mediterranean*, N. H. Gale (ed.), Göteborg 1991 (*SIMA* 90), p. 69-82.

⁹⁹ G. Cadogan, “The Thirteenth Century Changes in their East Mediterranean Context”, in *Mediterranean Peoples in Transition. Thirteenth to Early Tenth Centuries BC*, S. Gitin, A. Mazar, E. Stern (ed.), Jerusalem 1998, p. 6-16.

¹⁰⁰ M.R. Belgiorno, D. Ferro and D.R. Loepf, “Pyrgos-Mavrorachi in Cypriot Metallurgy” in *Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*, V. Kassianidou, G. Pappasavvas (ed.), Oxford and Oakville 2012, p. 26-34.

¹⁰¹ V. Kassianidou, “The Trade of Tin”, c. (n. 34).

¹⁰² E. Peltenburg, “Text Meets Material in Late Bronze Age Cyprus”, in *Cyprus an Island Culture*, A. Georgiou (ed.), Oxford 2012, p. 1-23.

¹⁰³ J. C. Courtois, “L’Activité Métallurgique”, c. (n. 80), p. 160-162.

¹⁰⁴ V. Karageorghis, V. Kassianidou, “Metalworking and Recycling in Late Bronze Age Cyprus - the Evidence from Kition”, *OJA* 18.2 (1999), p. 171-188.

ingots and used in this form within the island. Catling¹⁰⁵ argued in the past that two of the three complete ingots known from Cyprus,¹⁰⁶ should be dated to the 12th century BC, but the fact is that their archaeological context and consequently their date is unknown. Nevertheless, the excavations at Enkomi have produced some oxhide ingots fragments in a stratum dating to the end of the twelfth century.¹⁰⁷ More importantly oxhide ingots were still being exported: indeed, at this time, Cypriot copper was exported even further as shown by the frequency of oxhide ingot fragments in Sicily¹⁰⁸ and Sardinia dating mostly to the twelfth and eleventh centuries.¹⁰⁹ Chronologically the examples from Sardinia are the most recent examples of oxhide ingots that are known to date. All oxhide ingots found in Sardinia are consistent with a Cypriot provenance.¹¹⁰ In the 11th century the Late Bronze Age comes to an end but not the production and trade of Cypriot copper which continues to thrive in the Iron Age.¹¹¹

CONCLUSIONS

To conclude, I would like to summarize the evidence presented above as follows. The archaeological and textual evidence clearly shows that from the very beginning of the Late Bronze Age Cyprus produces large quantities of copper, which was cast in the shape of oxhide ingots. Some of the copper was used locally but much was already exported to the East and the West. By the 13th century Cyprus takes over the role of the main copper producer and exporter in the Mediterranean. This should not come as a surprise: Cyprus has some of the richest copper ore deposits in the Eastern Mediterranean, extensive forests which provided timber for ships and also a geographical position which was advantageous for sea borne trade between the East and the West. Cyprus was able to successfully maintain this important role until the end of the Late Bronze Age and I would argue throughout the Iron Age.

ABSTRACT

Within the Troodos foothills in the geological formation known as the Pillow Lavas there are rich copper ore deposits because of which Cyprus is even today considered to be one of the richest countries in copper per surface area in the world. It is this mineral wealth which enabled the island to play a leading role in the metals trade of the Late Bronze Age. Recent excavations have shown that it is in the Middle Cypriote period that the foundations of the Cypriot copper industry were established. However, according to both textual and archaeological evidence, it is in the Late Cypriote (LC) that the production and export of copper truly develop, reaching a peak in the thirteenth century BC. The aim of this paper is to present the latest evidence regarding the production and trade of Cypriot copper throughout the Late Bronze Age and to show that Cyprus was the main source of copper for all the Eastern Mediterranean but also was intensively involved in the sea borne trade of the metal.

¹⁰⁵ H.W. Catling, *Cypriot Bronzework*, cit. (n. 17), p. 282.

¹⁰⁶ One is now in the Cyprus Museum and the other in the Cypriot collection of antiquities of the Harvey Mudd College in Claremont, CA, USA. V. Kassianidou, "Oxhide Ingots", c. (n. 29), p. 43.

¹⁰⁷ V. Kassianidou, "Oxhide Ingots", c. (n. 29), p. 59.

¹⁰⁸ F. Lo Schiavo, R.M. Albanese Procelli, A. Giumlia Mair, "Oxhide Ingots from Sicily", in *Oxhide Ingots in the Central Mediterranean*, F. Lo Schiavo, J.D. Muhly, R. Maddin, A. Giumlia Mair (ed.), Rome 2009, p.135-221.

¹⁰⁹ F. Lo Schiavo, "Oxhide Ingots in Nuragic Sardinia", in *Oxhide Ingots in the Central Mediterranean*, F. Lo Schiavo, J.D. Muhly, R. Maddin, A. Giumlia Mair (ed.), Rome 2009, p.225-390.

¹¹⁰ A. Hauptmann, "Lead Isotope Analysis and the Origin of Sardinian Metal Objects", in *Oxhide Ingots in the Central Mediterranean*, F. Lo Schiavo, J.D. Muhly, R. Maddin, A. Giumlia Mair (ed.), Rome 2009, p.499-514.

¹¹¹ V. Kassianidou, "The Origin and Use of Metals in Iron Age Cyprus", in *Cyprus and the Aegean in the Early Iron Age. The Legacy of Nicolas Coldstream*, M. Iacovou (ed.), Nicosia 2012, p. 229-259.