

THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

A Survey of West Anatolian Metallurgy Prior to Middle Bronze Age (2000 BC)

H. Levent Keskin

Assistant Professor, Department of Protohistory and Near Eastern Archaeology,
Ankara University, Sıhhiye, Ankara, Turkey

Abstract:

As reflected by the famous treasure finds from Troia, Western Anatolia represents one of the most advanced metalworking schools in a wider Aegean and Anatolian context, especially during the 3rd Millennium B.C. The recent studies throughout the whole region, extending from coastal areas further to inland zones, revealed important data on the metallurgical activities starting in the Late Chalcolithic period and gradually evolves in the Early Bronze Age. Metallurgical finds related to production activities and numerous artefacts discovered at many centres reflect not only the technological advancements but also skilfulness and aesthetic level achieved by West Anatolian metalworkers during these early periods. The inventory of the region displays a unique character in terms of materials, techniques and forms, and also provides important insights on the cultural interactions with adjacent and distant zones. This paper aims to summarize the available data in light of recent discoveries in order to reflect the unique character and dynamics of Western Anatolian metallurgy before the Middle Bronze Age.

Keywords: Western Anatolia, late Chalcolithic period, early bronze age, metalworking, overseas trade

1. Introduction

Considering the entire Near Eastern geography Anatolia is one of the regions where metallurgical activities appeared for the first time as early as 10,000 years ago. The fact that the entire country is extremely abundant in terms of ore sources and mineral deposits depending on the geological formation conditions has a positive impact on development of such activities in the subsequent periods. Furthermore, the fact that majority of such abundant ore sources exist on massive mountain ranges and are easily accessible by prehistoric settlers, played a significant role in such development. Precursor activities observed at the areas where transition to a settled life commenced, escalated in terms of both quality and quantity in line with the advancements experienced in other fields and permeated to the entire country. Although numerous finds from early periods are discovered in reliable contexts at different sites in Anatolia, the pioneering role of Anatolia in this respect has been frequently questioned (Yalçın, 2008:18). Since the first discussions on the emergence of metallurgical activities and their diffusion, such debates are still on going. Relatively scarce nature of the finds until the introduction of extractive metallurgy in Anatolia and early appearance of such stages in the adjacent cultural zones has been the premise for the supporters of this opinion. Although the endeavours for searching the origins which started at early periods of the 20th century has been abandoned for good, such topics continue to surface on some occasions.

2. Theoretical Frame

The discovery of the so-called "Priam's Treasure" by H. Schliemann in 1870s during his excavations at Troia has become a symbol of advanced metallurgy of this region for many years (Schliemann, 1874). Similar finds discovered at Poliochni in 1950s (Bernabo-Brea, 1976:285ff), which can be included in the Western Anatolian cultural *koine*, further endorsed this notion, and was even interpreted to indicate that the Aegean and Southeast European metallurgy originated from here (Yakar, 1984:59). However, later discoveries suggested the contrary. Unlike the Western Anatolian coastline, large number of excavations conducted at Western Aegean and Southeastern Europe demonstrated that extractive metallurgy started at very early dates at such areas (Radivojević *et al.*, 2010; Day and Doonan, 2007), and revealed that precious metals such as gold and silver were used at a gradually increasing manner starting from 5th-4th Millennium BC. Such discoveries formed also a basis for the fact that Western Anatolian metallurgy that remained at the forefront for long years by virtue of sensational materials actually flourished in the 3rd Millennium B.C. and that the origins of such activities should be sought elsewhere. As a matter of fact, discussions on the origin and diffusion of metallurgical activities may provide useful insights, however as Muhly pointed out (1988:3), any quest inclined to solely this aspect of such activities will not provide more than forming a basis for a nationalistic notion. Besides, the emergence and advancement of mining and metalworking activities are not easily explained from a single point of view and cannot be addressed separately. They reflect a complex process (*Chaîne Opératoire*) with multiple components that extends from extraction of the ore to the finishing procedures (Ottoway, 2001; Lehner and Yener,

2014:537). In this respect, advancement of metallurgy appears as one of the elements that have colossal impact on the social structure, leading to divergences and developments on a societal level. In particular, following the assumption that the exploitation of the ore deposits and the necessary conditions for the trading of raw materials and metallic artefacts can only be executed by well-organized political powers, transition from self-sufficient agricultural societies to more complex metal-dependant societies with a central authority might have emerged in this manner (Renfrew, 1972:308-13).

In addition to the emergence of a technologically advanced metalworking, the answer to the question on how and why such crafts developed more in some centres/regions should be sought at the dynamics of the metalworking itself as well as at the economic conditions, geographical features and social developments. In this respect, beside the abundance of ore deposits and natural resources, the advantages of overseas trade activities with a wide hinterland places Western Anatolia to an extremely favourable position. Although it is one of the least researched regions when compared to the wider Aegean world and other parts of Anatolia, the ever increasing number of studies, initiated at the last quarter of the 20th century, dramatically changed our knowledge on the prehistory of Western Anatolia. These important studies revealed the existence of strong prehistoric cultures from Neolithic period onwards, both in the coastal areas and further at inland zones. The reflections of this cultural development can be easily observed in the field of metallurgy as well.

3. Metallic Occurrences and Mineral Deposits in Western Anatolia

Just like in the other parts of the country, the abundance of metallic ores and mineral deposits (Fidan, 2016; Kaptan, 2000) had a positive impact on such advancement in Western Anatolia. The inventory studies conducted by MTA (General Directorate of Mineral Research and Exploration) today demonstrate such wealth (MTA, 1975; Apaydın and Erseçen, 1981); however, what's actually important is to determine which deposits were known and exploited during the prehistoric periods. Comprehensive surveys and comparative analyses conducted in this respect provide significant information on this matter (De Jesus, 1978 and 1980; Wagner and Öztunalı, 2000; Pernicka *et al.*, 1984). Speaking for today, the majority of Turkey's gold reserves are located at the so-called zone of "Menderes Massive" (MTA, 1970), within the borders of Western Anatolia. Karşıyaka-Arapdağ and Bergama in İzmir, Madendağ-Kartaldağ in Çanakkale and Salihli-Sart reserves in Manisa provinces can be listed as major gold reserves in the region (MTA, 1975:1). It is ascertained that these deposits, not only gold, but also all other metallic occurrences, do not contain economically worth amounts in the modern sense (MTA, 1970:3); however, it wouldn't be completely wrong to postulate that such resources are known and exploited during the prehistoric periods considering the production demands back then. In particular, the alluvial deposits that contain secondary gold reserves - such as Sart Creek (Pactolus River) - where gold is found in native form represented extremely significant reserves during prehistoric periods. Strabo mentions several times (13.1.23; 13.4.5) that the waters of Pactolus River were full of gold and he refers to the wealth of the people in this area. He also notices that the gold mines at the Tmolos Mountain, where the river springs, has been known and exploited for long times. It has been also speculated that Pactolusgold has been exploited and processed in the 3rd MillenniumB.C. and even shipped to distant areas including Southern Mesopotamia (cf. Waldbaum, 1983:4, fn. 25). In ancient times, the abundance of Pactolus gold played the most significant role for the wealth and fame of the Lydian Kingdom. Ancient sources lists significant deposits also further north at Troas. Gold and silver were prominent in this region and were found in the vicinity of Lampsakos and at Astyra or Kremastre southeast of Abydos, while copper was extracted from Central Troas region (Sevin, 2001:71). On the other hand, silver deposits are present at Karşıyaka-Arapdağı and major antimony deposits occur at Ödemiş-Emirli, Kütahya-Simav and Gediz-Muratdağıin İzmir province (MTA, 1975:2-3). The copper, which can be characterized as the most significant metal during the prehistoric periods occurs under three distinct types in Anatolia, with respect to the formation process of mineral deposits. Based on such classification, the resources in Western Anatolia are classified as hydrothermal veins (Erlor, 1995:16ff). Copper resources at Denizli-Babadağ and Manisa-Rahmanlar, and copper + zinc resources at Handeresi, Kurttaş and Arapuçan in Çanakkale Yenice, Bağırkaç and Dursunbey in Balıkesir Edremit, and Bayındır-Sarıyurt in İzmir can be listed as major reserves present in the region (MTA, 1975:4; see also Apaydın and Erseçen, 1981). Archaeological data and results of the analyses indicate that such deposits were quite well-known and skilfully exploited by the prehistoric people.

4. The Development of West Anatolian Metallurgy

4.1. Late Chalcolithic Period

Last researches show that the metallurgical activities in Western Anatolia emerged and gradually developed during the Late Chalcolithic (henceforward LCh) Period. The finds from earlier excavations collated with the results of recent studies prove that this development was not limited with a particular area, but widespread throughout the whole region from coastal areas to the inland zones. The use of metals prior to this period was encountered at Hacılar, an inland settlement located at the "Lakes District". Traces of copper use are present at Layers VII and VI dated to the Late Neolithic Period. In addition to copper residues within some pots (crucible?), fragments that might reflect artefacts such as beads, needles and awls were also discovered at Layers II-A, II-B and I A-B from the LCh period (Mellaart, 1970:153). These activities should rather be defined as small-scale activities from the preparatory phase of metallurgy.

Mostly small-scale activities are observed during the LCh period. The finds discovered at settlements such as Aphrodisias (Jooukowsky, 1986: 288ff) and Orman Fidanlığı (Ay-Efe, 2002:139) bear traces intended for daily use. In addition to the metal artefacts, metallurgical finds recovered from Kuruçay LCh levels point out to a certain activity for this period (Umurtak, 1996:56-58). Although dating of the spearhead, which reflects an advanced type for this period, is suspicious (ibid:56, fn. 13), crucible and other finds of same nature present important evidence on production activities. The artefacts discovered at Ilıpınar in the vicinity of Bursa,

reflecting slightly a more advanced typology might be the outcomes either of the influence of Balkan metalworking or a result of local advancement (Roodenberg *et al.*, 1990:77). Another group of finds from Beycesultan are dated approximately to the same period as Kuruçay finds. The objects discovered as a single group represents a typical household collection of tools intended for daily use. The analyses showed that all objects except a possible chisel were cold worked (Stronach, 1962:282). A silver ring among them is significantly important in terms of the technological level achieved during this period.

More comprehensive information on this period comes from the coastal settlements. Settlements such as Bakla Tepe, Liman Tepe and Çukuriçi Höyük in İzmir province, located at the centre of Western Anatolian littoral provide significant data on the activities that started in the LCh period and continued progressively. During the LCh period Bakla Tepe reflects an agricultural settlement with a diameter of 400 m. The metal finds discovered from this period, composed of mostly tools and simple weapons also match this character. Beside metal objects many fragments of crucibles, *tuyères*, and a remarkable amount of slags found in different parts of the settlement indicate an intensive metallurgical activity during this period (Keskin, *forthcoming*). In terms of the settlement layout, the large and open areas between independently standing buildings are considered to be communal spaces utilized for production activities (Erkanal and Özkan, 1999:38). The slag fragments and other metallurgical finds discovered intensively in all areas from LCh settlement cannot be associated with any particular architectural feature so as to reflect a complete workshop inventory; however, it is possible to suggest that the open spaces were also used for metallurgical production activities. The preliminary analyses of the slags indicate that metallic copper was obtained through the reduction of copper-oxide ores in open chimneys (Kaptan, 1998b). Among the finds of this period a silver ring with incised decorations on both ends is particularly important. Together with a similar example from LCh levels of Beycesultan (Stronach, 1962:291, Fig. 8:15), Ege Gübre and other items from Korucutepe (van Loon 1973:360, Pl. 4, 1; 5, 1.3-4) in Eastern Anatolia they represent the earliest silver artefacts in Anatolia. The analysis on Beycesultan ring indicates the use of cupellation technique in silver refining process (Gale *et al.*, 1985:164), which points to a distinct level in metallurgical advancement. The silver item from Ege Gübre in İzmir province together with an additional golden find from the same settlement represent a special type known as “ring-idol”. Both objects were discovered at LCh levels of the settlement. The silver example was found in a grave dated to the Chalcolithic period (Mehofer, 2014:471), where the golden example comes from a deposit of the Ege Gübre Level II (Keskin, 2011b:199, Çiz. 1, 7). Calibrated radiocarbon dates for this level give two intervals between 4040-3950 B.C. and 3780-3640 B.C. (*ibid*:199). Both examples deserve special attention in terms of both the early use of precious metals and with respect to the on-going discussions on the appearance and diffusion of ring-idols in chronological matter (cf. Zimmermann, 2007; Keskin, 2011b; Mehofer, 2014).

Parallel developments for the LCh period are reflected from the discoveries at Liman Tepe (Keskin, *forthcoming*) and Çukuriçi Höyük (Mehofer, 2014:464) in the same region. The finds discovered at both settlements demonstrate the presence of metallurgical activities that started in the LCh period and continued progressively during the Early Bronze Age (henceforward EBA).

4.2. The Early Bronze Age I

It is possible to say that the distinctive characteristics of Western Anatolian metalworking started to shape in the 3rd Millennium B.C., in other words, at the early stages of the EBA. The quantity and quality of the finds discovered at an increased number of settlements compared to the previous era indicate that this activity has now become a particular craft. It is also possible to mention that some distinct types unique to Western Anatolia, such as needles and weapons, started to be formed during this period.

The finds related to production activities during this period provide significant information on the characteristics of this craft. It is a well-known fact that, upon the beginning of the EBA, a transition from rural cultures to a more complex societal structure was experienced in a wide area. This new settlements are characterized by a hierarchical structure reflecting a central authority, the existence of various crafts and well-planned settlements. As a consequence of such developments, settlements reflect a layout plan comprising of various *insulae* surrounded by a fortification wall. The residences of central authority as well as some buildings or open areas intended for production activities were included within such areas.

The first indications pointing out to the metallurgical activities within such an area comes from Troia. A mould discovered at a layer dated to the middle phases of Troia I period gives indication of metallurgical production, although no certain relationship with an architectural feature could be established in the vicinity (Müller-Karpe, 1994:43).

More comprehensive information comes again from the central parts of the coastline. At Liman Tepe, numerous finds related to metallurgical activities are found for this period. Various moulds, blow pipes, ore dressing tools and slags can be listed amongst such finds (Keskin 2004:143). Just like in Bakla Tepe, the preliminary studies show that secondary copper ores were reduced in open chimneys to obtain metallic copper, which was then forwarded to be used in different production processes (Kaptan, 1998a). The fact that the analyses conducted on the slags revealed very scarce amount of copper flux indicates that this process was executed in an extremely successful fashion (*ibid*).

The distribution of metal artefacts as well as these finds that indicate such activities within the settlement point out to a certain area. During the EBA I period long houses sharing mutual walls and leaning against the fortification wall provide plenty of evidence that such spaces were also used as intended for various production activities (Erkanal, 1996). In addition to the metallurgical finds, there are numerous other finds referring to the activities for bone, textile and lithic industry (Keskin, 2004:144).

The finds recovered from the houses point to the industrial character of these buildings. Especially House 2, and partly House 3 were specialized in metalworking activities (Erkanal *et al.*, 2004:167-68). A remarkable number of finds indicating these activities such as moulds, crucibles, *tuyeres*, slags, ore dressing devices and other stone tools were recovered from different floor deposits. Similar arrangements for this period are well documented, especially from the East Aegean islands (Kouka, 2002:297).

It is not certain whether particular spaces were designed for such activities within the houses. However, a mould fragment, ore dressing devices and slags recovered from the southern part of House 2 associated with a partial arrangement (Erkanal, 1998:390) suggest that this part might have been used as a metal workshop. All these finds provide one of the most comprehensive inventories for metalworking activities during the EBA in Western Anatolia.

Similar developments are reflected by the discoveries at Çukuriçi Höyük. Here the production activities started in the LCh period continues progressively during the EBA. Large number of furnaces discovered at earlier phases of the EBA is associated with smelting process (Horejs *et al.*, 2010:22). 26 out of 54 furnaces were unearthed at the hilltop of the mound, where other metallurgical finds were also found (Mehofer, 2016:361). Numerous moulds, blowpipes as well as ingot moulds indicate that metal was not only produced for consumption, but also for storage, and most probably for trading activities (*ibid.*). The analyses on Çukuriçi finds revealed that arsenical copper was used for the majority of the artefacts (Horejs *et al.*, 2010:22). What is interesting here is that both LCh and EBA objects fall within the same group in respect to their compositional data; which might be interpreted as the same deposits were used during both periods (Mehofer, 2016:373). A similar case observed on Bakla Tepe and Liman Tepe artefacts (Keskin, 2009:143ff) might be an indication of the fact that the abundant metal sources of the region were known and exploited for a long time (for a comprehensive list of metallic occurrences in İzmir see Lengeranlı, 2008). Comparative analyses to be conducted on the artefacts and the ore sources would further clarify this fact.

At Bakla Tepe, the settlement of this period is concentrated at the centre of the mound surrounded with a fortification wall (Erkanal and Özkan, 1999:20). Likewise the preceding phase moulds, crucibles and slags from all over the settlement indicate the existence of intensive metallurgical activities (Keskin, *forthcoming*). But the majority of the metal artefacts of this period come from the extramural cemetery located to the east of the settlement (Keskin, 2004:146). Apart from copper artefacts, silver is widely used during this period especially for jewellery.

In particular, the silver artefacts indicate an intensive relation with the Cyclades (Keskin, 2011a:147). A similar pattern is also observed at Iasos cemetery (Pecorella, 1984), although scarce amount of metal artefacts are discovered. Such relations that start during the Chalcolithic period and escalate in the EBA I period are well attested in other material groups at many centres both at the coastline and inland zones. The reason underlying the intensity of overseas trade during this period should be the rich mineral deposits of the region. In accordance with this, the analyses of the metallic artefacts discovered at Cyclades demonstrated that almost 1/3 of the lead and silver used throughout the entire Early Cycladic period originated from Anatolia (Gale and Stos-Gale, 2008:387, Fig. 37.2 a-b).

In addition to the intense appearance of silver items at Bakla Tepe, the golden artefacts discovered at Liman Tepe (Keskin, 2004:44, Res. 8 a-b) and Gavurtepe (Meriç, 1993:Res. 4) represent the earliest finds of the 3rd Millennium B.C. for Eastern Aegean and document the refining and utilization of the precious metals during the early periods, as attested previously at Ege Gübre in the same region. An artefact discovered at Çukuriçi Höyük and produced with almost equal proportions of copper and silver also illustrates the alloying skills of Western Anatolian metalworkers in these early periods (Horejs *et al.* 2010:19ff). A mace head made of meteorite iron from Troia (Branigan, 1974:56) indicates that iron metallurgy was also present and started as early as in the 3rd Millennium B.C. in this region, parallel to other numerous finds from different parts of Anatolia (Yalçın, 1998). Another technologically significant advancement of this period is the first appearance of tin bronzes. An early example of tin bronzes is known in the Aegean from Sitagroi Layer IV (Muhly, 1991:366), dated to the second half of the 4th Millennium B.C. (yet not certain) and several examples in Anatolia from the end of the 4th and the beginning of the 3rd Millennia are also attested at İkiztepe in Black Sea coast, Alişar in Central Anatolia and Tell el-Judaidah on Amuq Plain in the south (Yalçın, 2008:23). Although the extensive use of tin bronzes throughout the Aegean and the Near East starts after the EBA II period, the artefacts from Liman Tepe (Keskin, 2009:146) and Beşiktepe (Begemann *et al.*, 2003:189-90) dated to earlier phases of the EBA renders Western Anatolia as one of the important regions of this significant advancement.

Large quantities of slags were collected from the surface during the surveys carried out at Lember Tepe (Bostancı, 2002), another centre in the vicinity of Bakla Tepe. On the other hand, the finds from Altın Tepe, another settlement visited during the surveys in the region, present significant value especially in terms of metallurgical activities. The analyses on large amount of bulky slags collected especially from the eastern slopes of the mound concluded that an extremely deliberate and high-capacity copper metallurgy was undertaken at this centre (Kaptan, 1999). As it is quite likely that copper sulphide ores were used for such process, smelting furnaces capable of achieving high temperatures should also be used. While some of the pottery sherds collected during surface surveys date back to the LCh, the majority of the later sherds represent characteristics of the earlier phases of the EBA (Bostancı, 2002). In the light of these finds, it is possible to postulate that a large scale production activity was undertaken at Altın Tepe that starts in the LCh and continues in the EBA. Moreover, keeping the potential of the region in terms of metallic deposits in mind, Altın Tepe could also be considered as a primary production centre that supply ready-to-process metal to other settlements in the region. Large number of artefacts, some made of precious metals, discovered at many centres as well as the comprehensive inventory of other finds clearly point out to the production activities that reflect the technological level of this region achieved during this period.

4.3. The Second Half of the 3rd Millennium BC (EBA II & III)

The changes observed in many fields after the second half of the 3rd Millennium B.C. appear as advancements that mark this era in a broad geography. Existence of a more powerful central authority during this period is well endorsed by archaeological finds. In particular, the trade networks based on the circulation of raw materials and luxurious items including metal artefacts might only be established and maintained through a significant political and economical organization. Therefore, it would not be wrong to postulate that metalworking craft was controlled by the central authority. On the other hand, advancements in metallurgy triggered the

developments at the societal level, which, in turn, enabled the development of mining and metalworking activities as a result of several factors such as the increased trading capacity, competitions in order to seize new markets etc.

In addition to the technological breakthroughs, overseas trade that involves the coastal centres should have played the major role in such developments. As defined by Renfrews "The International Spirit of the Aegean Early Bronze Age II Period" (1967:15ff), the increased trading capacity based on the advancements on the ship construction and seafaring capabilities brought along many different aspects. The indications of such trade activities and mutual interactions can be easily observed on, but not limited to, metal artefacts.

From a general point of view it is possible to draw a distinct line, which separates the metallurgical practices during Western Anatolian EBA I and II periods. This difference manifests itself not only at the technical and aesthetic level, but also at the diversity of forms and materials. The reason behind this variation and diversity might also be sought in these trading activities. In addition to the vessels made of precious metals and bronze weapons, great variety of jewellery items and their overall circulation consolidated the wealth and power of the central authority on one hand and brought along specialization in distinct crafts on the other hand.

At Liman Tepe during the earlier phases of this period the long houses were re-used with slight changes (Şahoğlu, 2002:25). Finds from the houses such as moulds, stone tools and slags also show that the industrial character of these buildings was continued from the preceding period.

Limited amount of finds unearthed at coastal settlements such as Çeşme-Bağlararası (Keskin, *forthcoming*) and Miletus (Niemeier, 2000:128) indicates that activities within the settlements were rather intended for finishing processes during this period, similar to those at Liman Tepe.

At Bakla Tepe more information comes from the cemetery of this period. The preliminary results show that the cemetery was started to be used in the late EB II and continued during the earlier phases of EB III period. The widely investigated cemetery provides a rich inventory of metal artefacts of this period. The achievement on the variety of forms, materials and techniques is well documented throughout the whole Anatolia and the Aegean during this era (Keskin, *forthcoming*).

The majority of the rich finds of this period throughout the Western Anatolia are represented by cemetery and hoard finds. Therefore, the assessments in this respect predicated mostly on typological grounds. However, the developments experienced notably at certain artefact groups clearly reveal some unique West Anatolian types and their line of progress, a fact that might be interpreted as an evidence of local production despite the insufficient data on production activities. In addition to Bakla Tepe (Keskin, *forthcoming*) on the coastline and the finds from inland Yortan region (Kamil, 1982; Bittel, 1955; Buchholz and Drescher, 1989), the cemeteries of Demircihöyük-Sarıket, Küçükhöyük and Harmanören-Göndürle and Karataş-Semayük (for the finds from inland zones see Efe and Fidan, 2006) to the south in further inland zones, present a rich and diversified inventory of this period.

Beside the treasure finds that provide important insights both on the production techniques and cultural interactions, Troia has also yielded some data that might indicate the production activities within the residential areas. Several finds from Troia Level III give us some clues on this subject. The so-called House 300 excavated during Blegen's campaigns (Blegen *et al.*, 1951:64) was re-examined and interpreted as a possible metal workshop by Müller-Karpe based on the inventory of the house and finds recovered from adjacent areas (1994:45ff). Beside many types of pottery, idols, grinding stones and a hearth the inventory of the house further consist of a mould fragment, *tuyères*, bronze nails and clay rivets, possibly used to combine two-piece moulds. Although Blegen didn't mention such an assessment, it seems quite possible that this building was associated with metalworking activities as suggested by Müller-Karpe. A number of crucible fragments found at the adjacent street also support this argument (*ibid*:46).

Some of the stone tools discovered here might have been also used in relation to metallurgical activities. Numerous bone and antler fragments discovered in the house are interpreted as indications that illustrate presence of another craft, but such type of artefacts might also be served as accessories such as hilts or ornaments ready to be used for various metal artefacts (*ibid*:47). The whole inventory indicates that this building was not only used as a workshop, but also for domestic purposes. The location of the house at the central area of the settlement might be presented as evidence in this period for the existence of such a workshop affiliated to the central authority, attested at Liman Tepe in the preceding period. Leaving the inadequate number of excavations aside, the scarcity of metallurgical finds within the settlements from this period might be commented as a consequence of positioning the production sites in the vicinity of ore sources in accordance with the increasing production demands (Yener, 2000:71ff). Yet it is an extremely laborious process to transport both the ores and the wood to be used for charcoal to the settlements, which requires tremendous labour and costs. Accordingly, the smelting areas should be sought either in the vicinity of the ore sources or in more isolated, remote areas within the settlement borders, a well-known pattern from Kestel in Central Anatolia (*ibid*:71).

The treasure finds from Troia display a wide range of artefacts that vary from metal vessels, predominantly from precious metals, to the weaponry, and a great variety of jewellery (Sazcı, 2007). In addition to the objects that demonstrate ingenious employment of all kinds of production and decoration techniques, several ingots with distinct shapes and lenses from rock crystals provide significant information especially on the production methods of the gold- and silversmiths that require elaborate workmanship (Sazcı, 2002:70). Very distinct techniques and aesthetic levels observed on jewellery, particularly on the earrings and diadems, reflect the advancement achieved in metalworking during this period (Kuckenburg, 1992). Moreover, it is argued that the craftsmen involved in the production of such type of artefacts –such as diadem bands formed by joining lots of beads, chains and pendants to each other –are specialized solely in this profession, and different craftsmen took part in production of simpler types that resemble a more or less mass production. The fact that identical artefacts of the treasure finds or their distinct variations especially in the form of earrings, needles and beads are discovered at Bakla Tepe (Keskin, *forthcoming*) and far southern regions (in Bodrum Museum; not published), reflect a common tradition and/or insight that disseminates in the entire region throughout the coastline.

5. Conclusion

The decline observed at all Western Anatolian settlements by the end of EBA manifests itself also in the field of metallurgy. Most probably the negative impact caused by the breakdown of trade networks weakened the central authorities, whose wealth and power solely depends on these activities. Together with some unfortunate climatic events these adverse incidents brought a long era to an end.

The present data propound the existence of metallurgical activities that starts in the LChperiod and continues progressively during the EBA throughout the entire Western Anatolia. This fact supported by virtue of the abundant ore sources in the region and the advantages of the geographical position reached to its climax during the second half of the 3rd Millennium B.C. In addition to the finds that reflect production activities, the artefacts that display a wide variety of forms, techniques and materials not only represent the advanced level achieved in technological aspect, but also shed light on the unique characteristics of Western Anatolian metalworking school and on the relations and interactions with other cultural zones. Comprehensive analyses to be carried out on the artefacts and ore sources, and future excavations shall enable us to reveal and clarify the advancements in this field in a more detailed manner.

6. References

- i. Apaydın, N. and Erseçen, N. (1981). Türkiye'nin Bilinen Maden ve Mineral Kaynakları / Known Ore and Mineral Resources of Turkey. Ankara: MTA Enstitüsü Plan ve Koordinasyon Dairesi Türkiye Maden Envanterleri Servisi.
- ii. Ay-Efe, D. Ş. M. (2002). The Small Finds of Orman Fidanlığı. In T. Efe (Ed.), The Salvage Excavations at Orman Fidanlığı. A Chalcolithic Site in Inland Northwestern Anatolia. İstanbul: Ege Yayınları.
- iii. Begemann, F., Schmitt-Strecker S. and Pernicka, E. (2003). On the Composition and Provenance of Metal Finds from Beşiktepe (Troia). In G. A. Wagner, E. Pernicka & H. P. Uerpman (Eds.), Troia and the Troad. Scientific Approaches. Berlin: Springer (173-202).
- iv. Bernabo-Brea, L. (1976). Poliochni, Città Preistorica nell'isola di Lemnos 2/1: Testo. Rome: L'Erma.
- v. Bittel, K. (1955). Einige Kleinfunde aus Mysien und aus Kilikien. Istanbul Mitteilungen, 6, 113-18.
- vi. Blegen, C. W., Caskey, J. L. and Rawson, M. (1951). Troy. Vol. 2, Part 1. The Third, Fourth, & Fifth Settlements. Princeton: Princeton University Press.
- vii. Bostancı, O. (2002). Bakla Tepe ve Çevresindeki Prehistorik Merkezler. Unpublished Master's Thesis, Hacettepe University.
- viii. Branigan, K. (1974). Aegean Metalwork in the Early and Middle Bronze Ages. Oxford: Clarendon.
- ix. Buchholz, H. G. and Drescher, H. (1989). Einige frühe Metallgeräte aus Anatolien. Acta Praehistorica et Archaeologica, 19, 37-70.
- x. Day, P. M. and Doonan, R. C. P. (2007). Metallurgy in the Early Bronze Age Aegean. Oxford: Oxbow Books.
- xi. de Jesus, P. S. (1978). Metal Resources in Ancient Anatolia. Anatolian Studies, 28, 97-102.
- xii. (1980). The Development of Prehistoric Mining and Metallurgy in Anatolia. Part I-II. Oxford: British Archaeological Reports.
- xiii. Efe, T. and Fidan, E. (2006). Pre-Middle Bronze Age Metal Objects From Inland Western Anatolia: A Typological and Chronological Evaluation. Anatolia Antiqua, XIV, 15-43.
- xiv. Erkanal, H. (1996). Erken Tunç Çağında Batı Anadolu Sahil Kesiminde Kentleşme / Early Bronze Age Urbanization in the Coastal Region of Western Anatolia. In Y. Sey (Ed.) Tarihten Günümüze Anadolu'da Konut ve Yerleşme / Housing and Settlement in Anatolia: A Historical Perspective. İstanbul: Türkiye Ekonomik ve Toplumsal Tarih Vakfı (pp. 70-82).
- xv. (1998). 1996 Liman Tepe Kazıları. Kazı Sonuçları Toplantısı, 19:1, 379-98.
- xvi. Erkanal, H. and Özkan, T. (1999). Bakla Tepe Kazıları. In T. Özkan & H. Erkanal (Eds.), Tahtalı Barajı Kurtarma Kazısı Projesi / Tahtalı Dam Area Salvage Project. İzmir: İzmir Arkeoloji Müzesi Müdürlüğü (pp. 12-41, 108-37).
- xvii. Erler, A. (1995). Türkiye Bakır Potansiyeli. Metalurji, 89, 16-20.
- xviii. Fidan, E. (2016). Tarih Öncesi Dönemlerde Anadolu'da Kullanılmış Olan Maden Yatakları. Yer Altı Kaynakları Dergisi, 5:9, 49-60.
- xix. Gale N. H., Z. A. Stos-Gale and Gilmore, G. R. (1985). Alloy Types and Copper Sources of Anatolian Copper Alloy Artifacts. Anatolian Studies, 35, 143-73.
- xx. Gale, N. H. and Stos-Gale, S. Z. (2008). Changing Patterns in Prehistoric Cycladic Metallurgy. In N. J. Brodie, J. Doole, G. Gavalas & C. Renfrew (Eds.), Horizon – Όρίζων: A Colloquium on the prehistory of the Cyclades, Cambridge, 25th-28th March 2004 McDonald Institute Monograph Series. Cambridge: McDonald Institute for Archaeological Research (pp. 387-408).
- xxi. Horejs, B., Mehofer, M. & Pernicka, E. (2010). Metallhandwerker im frühen 3. Jt. V. Chr. – Neue Ergebnisse vom Çukuriçi Höyük. Istanbul Mitteilungen, 60, 7-37.
- xxii. Joukowsky, M. S. (1986). Prehistoric Aphrodisias. An Account of the Excavations and Artefact Studies. Vol. I: Excavations and Studies, Vol. II: Bibliography, Catalogue, Appendix, Index. Louvain-la-Neuve: Université Catholique de Louvain.
- xxiii. Kamil, T. (1982). Yortan Cemetery in the Early Bronze Age of Western Anatolia. Oxford: British Archaeological Reports.
- xxiv. Kaptan, E. (1998a). Liman Tepe'de Eski Metalurjiye Ait Buluntular. Arkeometri Sonuçları Toplantısı, XIII, 83-101.
- xxv. (1998b). Bakla Tepe'de Eski Metalurjiye Ait Buluntular. Arkeometri Sonuçları Toplantısı, XIII, 103-14.
- xxvi. (1999). Altın Tepe'de Kalkolitik ve Eski Tunç Çağına Ait Metalurjik Buluntular. Arkeometri Sonuçları Toplantısı, XIV, 45-51.

- xxvii. (2000). Eski Anadolu Madencilğine ait Buluntular. In Cumhuriyetin 75. Yıldönümü Yerbilimleri ve Madencilik Kongresi: Bildiriler Kitabı. Ankara: MTA Genel Müdürlüğü (763-69).
- xxviii. Keskin, L. (2004). M.Ö. III. Binyılın Sonuna Kadar İzmir Bölgesi Maden İşçiliği. In Z. Çizmeli-Öğün, T. Sipahi & L. Keskin (Eds.), I-II. Ulusal Arkeolojik Araştırmalar Sempozyumu, Anadolu / Anatolia Ek Dizi No.1/ Supplement Series Nr. 1, (pp. 141-55).
- xxix. (2009). İzmir Bölgesi Maden İşçiliği: Başlangıcından M.Ö. III. Binyıl Sonuna Kadar Madeni Eser Üretimi ve Ticareti. Unpublished Dissertation submitted to Ankara University.
- xxx. (2011a). Metalworking in Western Anatolian Coastal Region during the 3rd Millennium BC. In V. Şahoğlu & P. Sotirakopoulou (Eds.) Across. The Cyclades and Western Anatolia during the 3rd Millennium BC. İstanbul: Sabancı University Sakıp Sabancı Museum (pp. 144–52).
- xxxi. (2011b). Anadolu'da Ele Geçen Halka İdoller. Tipolojik ve Kronolojik Bir Değerlendirme. *Anadolu*, 37, 195-222.
- xxxii. Kouka, O. (2002). Siedlungsorganisation in der Nord- und Ostägäis während der Frühbronzezeit [3. Jt. v.Chr.]. Rahden: Verlag Marie Leidorf.
- xxxiii. Kuckenburg, W. (1992). Dokumentation zur Rekonstruktion des Grossen Diadem aus dem Schatz A von Troia. *Studia Troica*, 2, 201-218.
- xxxiv. Lehner, J. W and 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*. New York: Springer Science+Business Media (pp 529-57).
- xxxv. Lengeranlı, Y. (2008). Metallic Mineral Deposits and Occurrences of the İzmir District, Turkey. In H. Erkanal, H. Hauptmann, V. Şahoğlu & R. Tuncel (Eds.), *The Aegean in the Neolithic, Chalcolithic and the Early Bronze Age. Proceedings of the International Symposium, October 13th–19th 1997, Urla – Izmir (Turkey)*. Ankara: Ankara University Research Center for Maritime Archaeology (pp. 355-68).
- xxxvi. Mehofer, M. (2014). Metallurgy during the Chalcolithic and the Beginning of the Early Bronze Age in Western Anatolia. In B. Horejs & M. Mehofer (Eds.), *Western Anatolia before Troy. Proto-Urbanisation in the 4th Millennium BC? Proceedings of the International Symposium held at the Kunsthistorisches Museum Wien, Vienna, Austria, 21–24 November, 2012*. Vienna: Austrian Academy of Sciences Press (463-90).
- xxxvii. (2016). Çukuriçi Höyük – Ein Metallurgiezentrum des frühen 3. Jts. v. Chr. in der Westtürkei. In M. Bartelheim, B. Horejs & R. Krauss (Eds.), *Von Baden Bis Troia. Ressourcennutzung, Metallurgie und Wissenstransfer. Eine Jubiläumsschrift für Ernst Pernicka*. Rahden: Verlag Marie Leidorf (pp. 359-74).
- xxxviii. Mellaart, J. (1970). *Excavations at Hacilar, Volume I*. Edinburgh: Edinburgh University.
- xxxix. Meriç, R. (1993). 1991 Yılı Alaşehir Kazısı. *Kazı Sonuçları Toplantısı*, 14:2, 355-63.
- xl. MTA (1970). *Arsenic, Mercury, Antimony and Gold Deposits of Turkey*. Ankara: MTA Enstitüsü Yayınları.
- xli. MTA (1975) *Türkiye Maden ve Diğer Yeraltı Kaynakları Genel Envanteri*. Ankara: MTA Enstitüsü Yayınları.
- xl.ii. Muhly, J. D. (1988). The Beginnings of Metallurgy in the Old World. In R. Maddin (Ed.), *The Beginning of the Use of Metals and Alloys. Papers from the Second International Conference on the Beginnings of the Use of Metals and Alloys, Zhengzhou, China, 11-26 October 1986*. Cambridge: MIT Press (pp. 2-20).
- xl.iii. (1991). Copper in Cyprus: the earliest phase. In J. P. Mohen & Éluère C. (Eds.), *Découverte du metal, Amis du Musee des Antiquites nationales*. Paris: Picard (357-74).
- xl.ii. Müller-Karpe, A. (1994). *Altanatolisches Metallhandwerk*. Neumünster: Wachholtz.
- xl.v. Niemeier, W.-D. (2000). Milet: Knotenpunkt im bronzezeitlichen Metallhandel zwischen Anatolien und der Ägäis? In Ü. Yalçın (Ed.), *Anatolian Metal I*. Bochum: Bergbau Museum (pp. 125-36).
- xl.vi. Ottoway, B. S. (2001). Innovation, Production and Specialization In Early Prehistoric Copper Metallurgy. *European Journal of Archaeology*, 4:1, 87-112.
- xl.vii. Pecorella, P. E. (1984). *La Cultura Preistorica Di Iasos In Caria*. Roma: Giorgio Bretschneider Editore.
- xl.viii. Pernicka, E., Seeliger, T.C., Wagner, G. A. and Begemann, F. (1984). Archäometallurgische Untersuchungen in Nordwestanatolien. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, 31, 533-99.
- xl.ix. Radivojević, M., Rehren, T., Pernicka, E., Šljivar, D., Brauns, M. & Borić, D. (2010). On the origins of extractive metallurgy: new evidence from Europe. *Journal of Archaeological Science*, 37, 2775-2787.
- l. Renfrew, C. (1967). Cycladic Metallurgy and the Aegean Early Bronze Age. *American Journal of Archaeology*, 71:1, 1-20.
- li. (1972). *The Emergence of Civilization. The Cyclades and the Aegean in The Third Millennium B.C*. London: Methuen.
- lii. Roodenberg, J., Thissen, L. and Buitenhuis, H. (1990). Preliminary Report on the Archaeological Investigations at Ilıpınar in the Northwest Anatolia. *Anatolica*, XVI, 61-144.
- lii.iii. Şahoğlu, V. (2002). *Liman Tepe Erken Tunç Çağı Seramiğinin Ege Arkeolojisindeki Yeri ve Önemi*. Unpublished Dissertation submitted to Ankara University.
- li.v. Sazcı, G. (2002). Troia Hazinesi. In E. Işın (Ed.), *Troya. Efsane ile Gerçek Arası Bir Kente Yolculuk*. İstanbul: Yapı Kredi Kültür Sanat Yayıncılık (pp. 66-73). (2007). *Troia Hazinesi*. İstanbul: Aygaz.
- li.v. Schliemann, H. (1874). *Atlas Trojanischer Alterthümer. Photographische Abbildungen zu dem Berichte über die Ausgrabungen in Troja*. Leipzig: Brockhaus.
- li.vi. Sevin, V. (2001). *Anadolu'nun Tarihi Coğrafyası I*. Ankara: Türk Tarih Kurumu.

- lvii. Stronach, D. (1962). Metal Objects. In S. Lloyd & J. Mellaart, *Beycesultan 1: The Chalcolithic and Early Bronze Age Levels*. London: British Institute of Archaeology at Ankara (280-92).
- lviii. Umurtak, G. (1996). Maden Eserler. In R. Duru (Ed.) *Kuruçay Höyük II. 1978-1988 Kazılarının Sonuçları. Geç Kalkolitik ve İlk Tunç Çağı Yerleşimleri*. Ankara: Türk Tarih Kurumu (pp. 56-59).
- lix. van Loon, M. N. (1973). The Excavations at Korucutepe, Turkey, 1968-70. Preliminary Report. *Journal of Near Eastern Studies*, XXXII:4, 357-444.
- lx. Wagner, G. A. and Öztunalı, Ö. (2000). Prehistoric Copper Sources in Turkey. In Ü. Yalçın (Ed.), *Anatolian Metal I*. Bochum: Bergbau Museum (pp. 31-68).
- lxi. Waldbaum, J. C. (1983). *Metalwork from Sardis: The Finds Through 1974*. Cambridge: Harvard University Press.
- lxii. Yakar, J. (1984). Regional and Local Schools of Metalwork in Early Bronze Age Anatolia. Part I. *Anatolian Studies*, 34, 59-86.
- lxiii. Yalçın, Ü. (1998). Frühe Eisenverwendung in Anatolien. *Istanbul Mitteilungen*, 48, 79-95.
- lxiv. (2008). Ancient Metallurgy in Anatolia. In Ü. Yalçın, H. Özbal & A. G. Paşamehmetoğlu (Eds.), *Ancient Mining in Turkey and the Eastern Mediterranean*. Ankara: Atılım University (pp. 15-40).
- lxv. Yener, K. A. (2000). *The Domestication of Metals: The rise of complex metal industries in Anatolia*. Leiden: Brill.
- lxvi. 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.

Annexure

Figure 1: Major Sites Mentioned in the Text