EARLY BRONZE COPPER CIRCULATION AND TECHNOLOGY IN MIDDLE EUPHRATES REGIONS

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The recent archaeological researches carried out by the University of Rome « La Sapienza » at Zeytinlı Bahçe, and by the University of California, San Diego, at Titriş-Höyük (south-eastern Turkey), have led to many questions related to early metallurgy in these regions being reconsidered (Fig. 1). The new analyses on metal objects from Zeytinlı Bahçe and Titriş, combined with the few previously available for this area, point to new perspectives in the production and circulation of metal in the Taurus region during the earliest phases of the Early Bronze Age.

The middle Euphrates valley between the villages of Birecik and Carchemish is due to be flooded soon by new artificial water basins which will cover large areas of considerable archaeological interest. An international salvage excavation programme has therefore been undertaken in the region in collaboration with the Urfa Archaeological Museum. Since 1999, a team from the University of Rome « La Sapienza », directed by Marcella Frangipane, has been conducting surveys and systematic excavations at the site of Zeytinlı Bahçe[1]. This site consists of a roughly elliptic mound which has been heavily eroded by fluvial activity ; the north-western area of this mound is high and conical in shape, has steep slopes, and reaches a total height of 32 m above the plain.

Besides intensive, systematic surface collecting, two excavation campaigns have so far been carried out. Despite the limited extent of the excavation trenches, a series of architectural levels dating from the Early Bronze Age I ad II have been brought to light . Both the architectural remains and the archaeological finds suggest that the mound was quite intensively occupied during the first half of the III mill. BC.

Only 19 metal artefacts have so far been collected from these EBA levels, all of them in good contextual conditions. They consist of pins, awls and needles, as well as laminae whose fragments cannot be attributed to specific tools. Three crucible fragments which still bear traces of metal document a locally practised, though limited, metallurgical activity. Although such a small sample is insufficient to reconstruct the metallurgical activities performed in this site, the analyses of their composition can be compared with artefacts from other contemporary sites.

The analysis of the samples from Zeytinlı Bahçe disclose a relatively homogeneous metallurgy (Tab. 1 and Fig. 2). Arsenic is the only the minor element with values which are visible, the percentage of the other elements all being well below 1%. Nickel, in particular, which is usually present in metal

[1] The first surface collecting was carried out by a joint Turkish-American équipe : Algaze *et alii* 1994 ; Deveci, Mergen 1999. Systematic excavations and intensive survey were conducted by an Italian team. The reports of these last campaigns are in the volume : *Salvage Project of the Archaeological Heritage of the Ilısu and Carchemish Dam Reservoirs Activity in 1999*, Tuna N., Öztürk J., Velibeyoğlu J. (eds.), Middle East Technical University, Ankara 2001 : 65-131.

artefacts produced with minerals from eastern Anatolian and Transcaucasian sources, is totally absent at Zeytinlı Bahçe. Tin occurs in 14 out of the 16 samples analysed, its content in one case exceeding 36%, while in the remaining 13 samples it averages 1.26 %. Zeytinlı Bahçe is therefore one of the earliest sites in which tin is used for a local production of artefacts. The two samples in which tin is absent belong to the EBI, the remainder to EBII. This suggests that tin was first introduced at Zeytinlı Bahçe during the second quarter of the III millennium. A similar trend characterises the samples collected from the crucibles, with an insignificant presence of nickel, traces of tin and arsenic, and iron a minor element.

The mound of Titriş, 45 km north of Şanliurfa, was composed of a central acropolis surrounded by a much larger lower city and by an outer town on its northern side. The excavations, directed jointly by Guillermo Algaze and Timoty Matney, of the Universities of Akron and California respectively, have brought to light a complex urban settlement with specialised production areas. The main occupation period dates from between 2600 and 2200 BC, i.e. during the Middle and Late phases of the EBA[2]. Twenty-five metal objects, comprising pins, toggle pins, celts and rods, all from the EBA levels of the site, were analysed (Tab. 2 and Fig. 3).

As regards the minor elements, the average content of arsenic is 0.7 %, though it exceeds 1% in 5 cases and reaches 2.2% in one case. As at Zeytinlı Bahçe, the presence of nickel is insignificant, averaging 0.06 %. Ten objects were discovered to actually consist of bronze, with an average tin content of more than 3 % : in 4 objects it exceeds 5 %, and even reaches 9.27 % in one. To sum up, the metals from Titriş are composed of an arsenical copper, without nickel and with tin in highly varying amounts, which seems to suggest that it was added intentionally to obtain bronze.

An electronic data bank with more than 3500 archaeological metal objects from the Near East has recently been set up at the « Istituto per le Tecnologie Applicate ai Beni Culturali » (C.N.R. Roma). Integrated with stratigraphical, typological and chronological information, this tool can now be used to compare several early metallurgical areas, such as western, central and eastern Anatolia, Cilicia, Transcaucasia, western Iran, northern and southern Mesopotamia, northern Syria and Palestine. The metallurgy practised in these regions during the III millennium made use of different minerals and alloys, which were experimented upon in varying degrees. Arsenic, for instance, which is extremely widespread in the metal objects in the Near East during the III millennium BC, sheds little light on the minerals used. The same can be said for antimony, which is found in eastern Anatolia and Transcaucasia, as well as in Palestine, though somewhat more sporadically. In this respect, the high values (between 1% and 25 %) discovered in the artefacts from the Nahal Mishmar Chalcolithic treasure[3], in the Judean desert, close to the Dead Sea, are exceptional and raise peculiar hypotheses as to their provenance. This, however, is a unique finding.

Metal analyses from Zeytinlı Bahçe and Titriş Höyük provide new interpretive clues as to the regional distribution of two elements in particular: nickel and tin. Although they are taken into consideration for different reasons and are here treated separately, both elements lead to the same conclusions.

Nickel was widespread above all in eastern Anatolia, Transcaucasia and southern Mesopotamia. It is found, together with arsenic, lead, and antimony, in varying, sometimes significant percentages, in all the polymetallic ore deposits. These minerals were certainly used during the EBA before sulphureous minerals, which constitute the core of the metalliferous ore deposits. The intensive exploitation of the mixed minerals on the surface of the ore deposits, and their subsequent depletion, brought about one of the most important technological changes in this field i.e. the smelting of calchopyrites through preliminary roasting, and the addition of fluxes during the smelting process. Evidence of this technology has not yet been found in eastern Anatolia before EBAI, but is well documented in the VIB2 levels of

[2]Algaze *et alii* 1995 ; 1996 ; Matney, Algaze 1995 ; Matney *et alii* 1997 ; 1999.

[3]Shalev, Northover 1993.

Arslantepe[4]. One of the consequences of this change was that metal in these areas became more widespread.

Zeytinlı Bahçe and Titriş might have represented link-sites between the eastern Anatolian cultures, where the metallurgical tradition was very well-established, and those in Mesopotamia, where the production of metal objects depended on the transaction of raw materials from adjacent regions. People from Zeytinlı Bahçe and Titriş, however, owing to the location of these sites below the imposing Taurus mountain ridge, may have had difficulty in maintaining a steady copper mineral supply from eastern Anatolia. In this respect, it is worth reconsidering the presence of nickel in metal objects on a regional scale in the various regions in the Near East. Such a comparison helps draw some general, though not definitive conclusions on some aspects of metallurgy in these areas.

In north-western Syria, the only 3 samples with a nickel content exceeding 1 % are from the Amuq and date from the Iron Age[5]. Seven samples from the end of the EBA and start of the MBA from Tell Mardikh contain an average content of 0.76, with a maximum of 1.10 %[6]. In Cilicia, the samples with a high nickel content belong to the MBA at Mersin, while the only two samples from Tarsus with a nickel content higher than 1% belong to EBAIII[7]. In Palestine, few objects, all from the Nahal Mishmar treasure, have a high Nickel content, in a context which is typologically dated to the Chalcholithic. In the polymetallic surface ore deposits, the association arsenic-nickel, or arsenic-antimony is quite frequent and is common in the earliest artefacts. Both their presence in such a high percentage and their association with as prestigious a collection as that of Nahal Mishmar, however, points to a non-local provenance of the minerals.

The few analyses made on artefacts from northern Mesopotamia highlight the almost total absence of nickel[8], which is in contrast to data from southern Mesopotamia, where this element is consistently present[9]. In this respect, the absence of nickel from the EBA Iranian sites (Geoy Tepe, Tepe Hissar, Tepe Sialk and the Luristan region)[10] suggests the use of a local, non-Anatolian mineral, while more southern sources, such as Oman, may have been exploited by the southern Mesopotamian populations from the beginning of the metallurgical activity. This is, however, a highly controversial hypothesis[11].

This preliminary overview, which obviously requires further research for confirmation, points to a use of minerals with a low nickel content to produce metal artefacts in the regions south of the Taurus ridge at least until the MBA, when a more widespread presence of metal objects and ores is documented. A prevalence of a low nickel content in the metallurgy of the southern areas suggests that as yet unidentified copper ore deposits existed on the southern slopes of the Taurus mountains and that natural or cultural barriers hampered the exploitation of copper ore deposits in the north east. The suggestion that an advanced technical process was able to eliminate minor elements during the smelting is, it should be said, more appealing than likely.

Although this perspective requires further investigation and the analysis of a larger sample, the hypothesis according to which metallurgy south of the Taurus range was based on mineral sources that were different from those in the north-eastern Anatolian regions may be supported by archaeological findings. During the first phases of the EBA, relations between the upper Euphrates sites and the Syro-

[4]Caneva *et alii* 1985 ; Frangipane, Palmieri 1994-95 : 70-75 ; Palmieri, Frangipane, Hauptmann, Hess 1999.

[5]Braidwood *et alii* 1951.

[6]Analyses carried out at C.N.R.- I.T.A.B.C., not yet published. Many thanks to Augusto Calì for careful sample preparation.

[7]Esin 1969.

[8]Tell Brak : Mallowan 1947 ; Tepe Gawra : Tobler 1950 : 212.

[9]Tell Asmar : Frankfort 1934 : 58-59 (analisi di C.H. Desch) ; Uruk : Pernicka 1993 ; Khafajah : Delugaz 1940 : 151-152 ; Ur : Woolley 1934 ; Susa : Tallon 1987.

[10]Burton Brown 1951 : 188-197 ; Riesch, Horton1937 ; Ghirshman 1939 : 203-208 ; Moorey 1964.

[11]Muhly 1973 : 229.

Mesopotamian regions were somewhat complex. These relations are well documented throughout the EBA by several archaeological indicators, including southern Mesopotamian wares and vessels, with, in particular, the late reserved slip ware in the former, and a number of eastern Anatolian and Transcaucasian components in the latter. Nevertheless, though the cultural relations between these regions were consistent, their political and economic background is not clear, and the sources of raw material supply on the plateau may have been difficult to reach for the southern populations. In this regard, it should be pointed out that some of the upper Euphrates sites, such as Norşuntepe, Tülintepe, Tepecik and Arslantepe, were rearranged as fortified centres during the EBAI[12], probably because they represented centres of élitarian groups with control over their respective territories. It is possible that access to precious copper ore deposits, such as the long-used Ergani-Maden sources, was, as a result of the emergence of these local hierarchies, administred and possibly denied to the populations south of the Taurus. Consequently, a search would have been made for new sources.

Tin deserves a separate analysis. Due to its rarity in nature, its use in the copper-tin alloy during the Early Bronze Age raises a number of technological and political issues which are still a significant matter of debate. Tin was found to be widely used in the Near East at the beginning of the II millennium. Although very rare in earlier times, during the second half of the III millennium this element suddenly occurs in numerous objects. The main problem is related to the fact that there were few areas in which tin minerals could be exploited by ancient metallurgists. Given the presence in these regions of other precious raw materials, such as lapislazuli, from Afghanistan, it is likely that Afghan tin sources were those used most in the past[13]. Two main tin mineral areas have been found in Afghanistan : the first is located south of Kandahar, in the Badakhshan province, in the north-east of the country, the second in the Herat province, in the west. The Misgaran zone, which contains both copper and tin minerals, is particularly interesting[14]. Other sources might have been those on the Iranian plateau, in the valley of the Sarkar river, whose alluvial sands show a high tin content[15]. The Sarkar valley lies less than 50 km from Misgaran, which indicates that the whole region is rich in tin deposits. Tin is commonly found as a tin oxide, cassiterite, associated with polymetallic minerals which contain copper, lead, gold and, more rarely, clorite. In this case, as in all types of alloys, the problem is whether tin was intentionally added to copper in the artefact production. According to some authors, an 0.1 % or 0.05 % tin content is the limit below which the presence of this metal cannot be considered intentional[16]. Since the effects of tin on the alloy are irrelevant when below 1 %, its use in proportions below this limit may have rendered the smelting process easier as opposed to improving the mechanical characteristics of the artefacts[17]. The analyses made on the Zeytinlı Bahçe and Titriş samples revealed an average tin content of 1.26 % and 2.29 %, respectively, though the content varies considerably in each sample. In the region, the presence of tin in copper artefacts seems to date back to the beginning of the IV millennium, as the figurines from Tell Judeideh (Amuq final phase G, early H) would suggest[18].

During the first half of the III millennium, tin occurs in numerous sites in the Near East, though very sporadically. At Tarsus, in Cilicia, tin already occurs in 6 EBII samples, exceeding 2.5 % in 3 of these[19].

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[12]Esin 1998 ; Di Nocera 2001.

[13]As far as a summary on this matter is concerned see : Pernicka 1995 : 52-55 ; Beale 1973 ; Tosi, Piperno 1973 ; Herrman 1968 ; Lamberg-Karlovsky 1972 ; 1975 ; Majidzadeh 1982.

[14]Stech, Piggott 1986 : 44-45.

[15]Berthoud *et alii* 1982 ; Cleuziou, Berthoud 1982.

[16]Stech, Pigott 1986 : 53.

[17]Berthoud *et alii* 1982 : 48.

[18]Braidwood *et alii* 1951.

[19]Esin 1969.

In the Syro-Palestinian area, the use of tin becomes regular only at the beginning of the II millennium, though the earliest evidence of a tin-copper alloy is in a late EBIII sword from Bab edh-Dhra, east of the Dead Sea[20].

In the Mesopotamian area, the tin-copper alloy appears considerably earlier. A pin from the VIII level of Tepe Gawra (beginning of the III millennium) has a tin content of 5.62 %[21]. The use of this alloy at Gawra before level VI, in the akkadian period is, however, rare. In southern Mesopotamia, tin was used by the Protodynastic III, though earlier isolated cases are documented[22]. Susa, in Iran, is the only site where a considerable quantity of tin is documented by period D, though earlier evidence is rare both at Susa and in other sites on the Iranian plateau[23]. The use of bronze in southern Mesopotamia, where raw materials for metallurgical activities are absent, can probably be ascribed to a form of commercial control of these products. The absence of tin minerals in the Mesopotamian sites suggests that these metals were smelted in the extraction zones. The limited use of tin on the Iranian plateau, concentrated above all in sites which lay along the trade routes, suggests that a direct link existed between the two areas, without local intermediaries[24].

Anatolia is the only Near-eastern area west of Mesopotamia in which the tin-copper alloy was regularly used from the second half of the III millennium BC onwards. The regions involved are the Troad, central Anatolia and the Upper Euphrates, but also include the Taurus sites, such as Zeytinlı Bahçe and Titriş. The recent discovery of tin minerals in the mine area of Kestel, close to Çamardy, in south-central Anatolia, and the excavation of the nearby EBA II and III site of Göltepe may shed new light on the bronze metallurgy of the adjacent areas. Slag, minerals, metallurgical implements and installations have been discovered at this site[25]. In the Caucasian regions, the metallurgy dating from the first half of the III millennium, though quite complex, consists mainly of artefacts of arsenical copper. Tin, in these regions, is a prerogative of the II millennium, typical of the Trialeti culture, though the earliest, sporadic evidence of a tin-copper alloy already appears in the final phase of the Kura-Araxes culture, during the second half of the III millennium[26].

The Zeytinlı Bahçe and Titriş sites are, therefore, linked by a homogeneous metallurgy which is based on daily-life implements (not weapons) of arsenical copper with tin, lacking nickel. These features point to the use of minerals from areas characterised by the same peculiarities, such as south-central Anatolia or regions further east, as documented by later written sources, based on a complex exchange system[27]. It is likely that this exchange phenomenon can be ascribed to difficulties in access to the Upper Euphrates minerary sources, due to as yet unknown reasons, but probably related to the socio-economic relations between these regions.

[20] Philip 1991 : 93.

[21] Speiser 1935 : 102.

[22] Stech, Piggott 1986 : 42, 48.

[23] Talon 1987 : samples n. 405 and 343 ; Berthoud 1979 : table 5 ; Heskel, Lambert-Karlovsky 1980 : 256-257.

[24] Stech, Pigott 1986 : 48.

[25] Yener 1994 ; Yener, Vandiver 1993 ; Yener 2000 : 71-123. See also different opinions about ancient Anatolian tin sources in Pernicka 1995 : 54.

[26] Kavtaradze 1999 : 84-85.

[27] Reiter 1997 : 206-261 ; 1999 ; Archi 1993.

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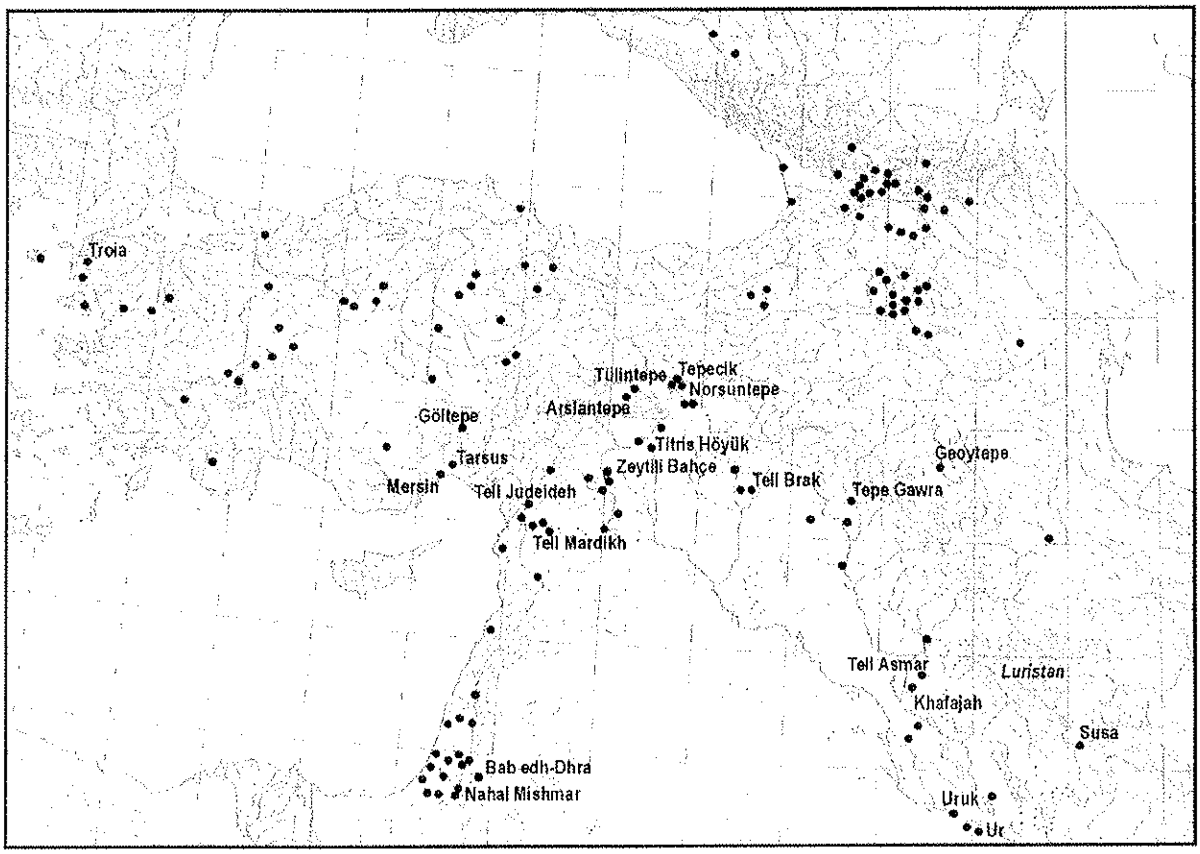

Fig. 1 - Distibution of mentioned sites and settlements with chemical analyses. The analyses are available in the database at the Istituto per le Tecnologie Applicate ai Beni Culturali, C.N.R. Roma.

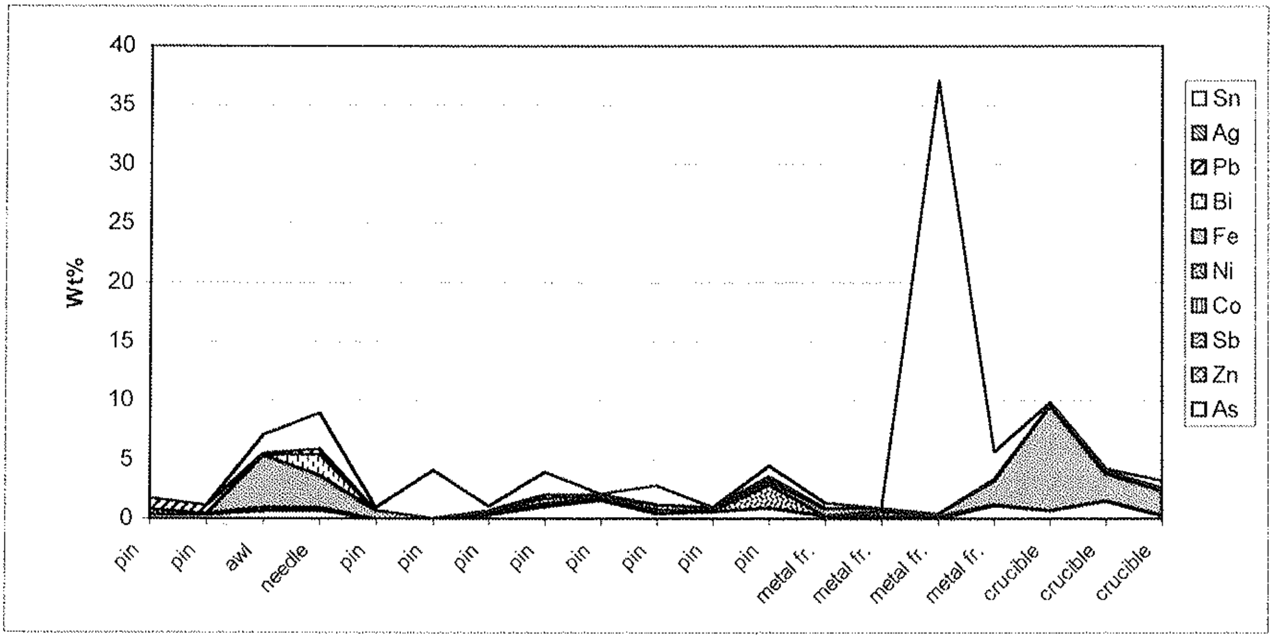

Fig.2 - Plot shows minor and trace elements contents in the samples from Zeytinlı Bahçe.

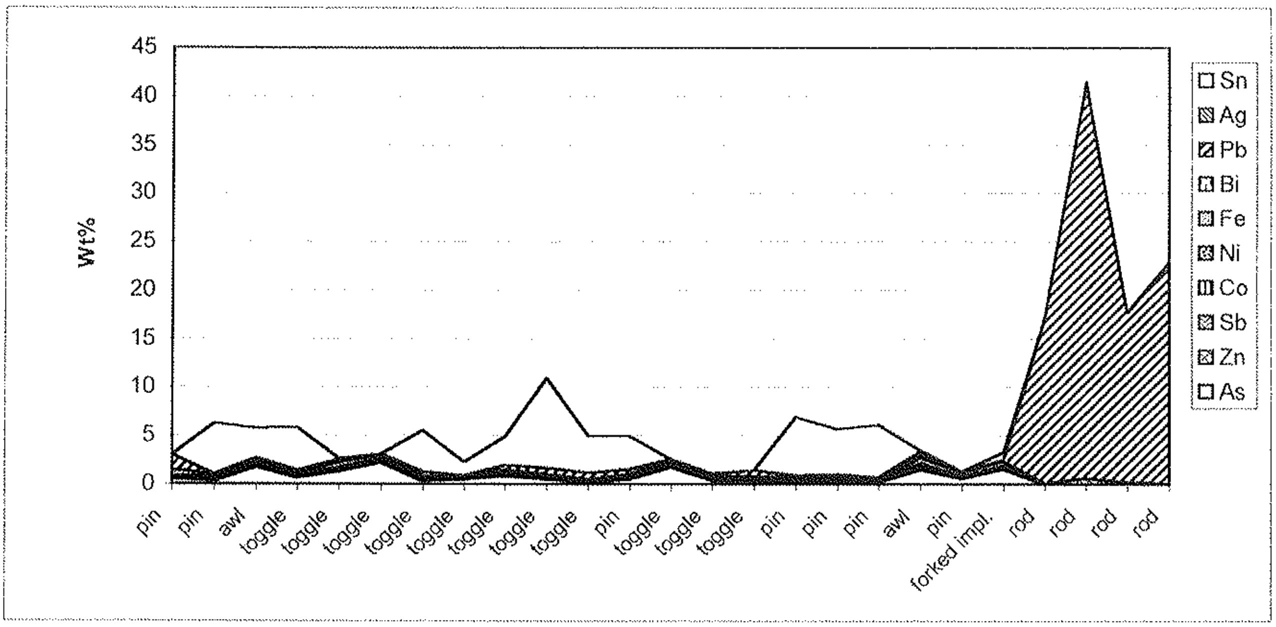

Fig. 3 - Plots shows minor and trace element contents in the samples from Titriş Höyük.

Sample	Period	Object	As	Zn	Sb	Co	Ni	Fe	Bi	Pb	Ag	Sn	Cu
ZB-237/99	EBA I	pin	0,3250	0,0075	0,0025	0,0000	0,4225	0,0363	0,0013	0,9463	0,0000	0,0000	87,9750
ZB-217/99	EBA I	pin	0,3483	0,0045	0,0045	0,0000	0,0518	0,0360	0,0060	0,6749	0,0000	0,0165	62,6426
ZB-344/2000	EBA II	awl	0,6683	0,0390	0,0000	0,0098	0,2341	4,4049	0,0000	0,1561	0,0000	1,6049	61,2683
ZB-171/2000	EBA II	needle	0,6962	0,0577	0,0654	0,0115	0,1192	2,7308	1,8100	0,3923	0,0000	3,0308	58,2308
ZB-214/99	EBA II	pin	0,0000	0,0051	0,0051	0,0000	0,0044	0,6750	0,0000	0,0015	0,0000	0,2618	79,0882
ZB-175/99	EBA II	pin	0,0018	0,0018	0,0000	0,0000	0,0105	0,0221	0,0004	0,0199	0,0000	4,0371	64,1197
ZB-177/99	EBA II	pin	0,3474	0,0074	0,0578	0,0000	0,2335	0,0355	0,0000	0,0215	0,0000	0,3606	74,7855
ZB-174/99	EBA II	pin	1,0069	0,0243	0,1667	0,0000	0,0938	0,4184	0,0017	0,3490	0,0000	1,9045	95,9028
ZB-216/99	EBA II	pin	1,5592	0,0066	0,0296	0,0000	0,1826	0,1694	0,0000	0,0872	0,0461	0,0378	87,5658
ZB-374/2000	EBA II	pin	0,4510	0,0387	0,0026	0,0077	0,3222	0,3660	0,0000	0,0773	0,0000	1,5412	72,3196
ZB-345/2000	EBA II	pin	0,5991	0,0025	0,0076	0,0094	0,1549	0,1589	0,0000	0,0181	0,0007	0,0054	66,5457
ZB-172/2000	EBA II	pin	0,9080	0,0380	0,0000	0,0280	1,8860	0,3660	0,0000	0,3500	0,0000	0,9080	69,0000
ZB-102/99	EBA II	metal fr.	0,2427	0,0105	0,0126	0,0000	0,0094	0,5910	0,0000	0,0209	0,0136	0,4320	39,0377
ZB-352/2000	EBA II	metal fr.	0,2793	0,0057	0,0047	0,0006	0,3459	0,2502	0,0000	0,0119	0,0000	0,0117	57,7795
ZB-170/2000	EBA II	metal fr.	0,0025	0,2125	0,0000	0,0025	0,0169	0,1769	0,0000	0,0419	0,0000	36,6250	52,1125
ZB-357/2000	EBA II	metal fr.	1,1361	0,0039	0,0359	0,0031	0,0615	2,0306	0,0000	0,0526	0,0200	2,3370	88,6096
ZB-146/1999	EBA II	crucible	0,7205	0,0000	0,0103	0,0038	0,0115	8,8410	0,0000	0,0564	0,0000	0,1910	46,3077
ZB-146/1999	EBA II	crucible	1,5109	0,0087	0,0065	0,0043	0,0630	2,2500	0,0000	0,2000	0,0000	0,2261	79,1304
ZB-346/2000	EBA II	crucible	0,2750	0,0069	0,0000	0,0035	0,0701	2,0313	0,0000	0,2542	0,0000	0,5903	32,6250

Tab 1 - ICP chemical analysis of EB I-II metal objects from Zeytinlı Bahçe.

Sample	Period	Object	As	Zn	Sb	Co	Ni	Fe	Bi	Pb	Ag	Sn	Cu
TTR1	EBA	pin	0,5531	0,2189	0,0636	0,0105	0,0741	0,6294	0,0000	1,4566	0,0105	0,0154	81,1420
TTR3	EBA	pin shaft	0,3571	0,1961	0,0991	0,0134	0,1793	0,1188	0,0011	0,0893	0,0327	5,2091	73,6134
TTR4	EBA	awl	1,7653	0,2527	0,1493	0,0000	0,0253	0,3607	0,0000	0,1033	0,0233	3,0607	96,1400
TTR5	EBA	toggle	0,6560	0,2120	0,0720	0,0140	0,2680	0,0990	0,0000	0,0980	0,0150	4,4290	76,8790
TTR6	EBA	toggle	1,3130	0,2475	0,0574	0,0191	0,0981	0,5259	0,0000	0,2426	0,0062	0,1580	96,5593
TTR7	EBA	toggle	2,2301	0,3268	0,0157	0,0111	0,0869	0,3131	0,0229	0,0582	0,0098	0,0131	98,1072
TTR8	EBA	toggle	0,3033	0,2507	0,0000	0,0013	0,0433	0,2800	0,0000	0,4267	0,0113	4,2440	77,5460
TTR9	EBA	toggle	0,5311	0,1870	0,0266	0,0000	0,0593	0,0757	0,0000	0,0661	0,0085	1,3808	68,4407
TTR10	EBA	toggle	0,8347	0,2153	0,0867	0,0000	0,3307	0,0653	0,0000	0,4613	0,0153	2,8913	85,7600
TTR11A	EBA	toggle	0,5220	0,1893	0,0827	0,0000	0,0653	0,1520	0,0660	0,5973	0,0100	9,2740	75,7400
TTR11B	EBA	toggle	0,1416	0,1838	0,0091	0,0000	0,0370	0,0831	0,0422	0,6948	0,0201	3,8019	75,7013
TTR12	EBA	pin	0,4987	0,2078	0,0386	0,0039	0,1712	0,1078	0,0007	0,5020	0,0222	3,3725	84,7843
TTR13A	EBA	toggle	1,8130	0,2135	0,0085	0,0075	0,1645	0,1225	0,0455	0,1875	0,0060	0,0330	91,5300
TTR13B	EBA	toggle	0,3800	0,1860	0,0073	0,0060	0,1460	0,1473	0,0387	0,1580	0,0273	0,0560	86,5600
TTR14	EBA	toggle	0,3180	0,1840	0,0400	0,0007	0,0493	0,2973	0,0000	0,5667	0,0060	0,0167	95,8400
TTR15	EBA	pin	0,2906	0,1646	0,0000	0,0037	0,0250	0,2264	0,0009	0,2275	0,0079	5,9931	85,2694
TTR19	EBA	pin	0,3119	0,1801	0,0713	0,0191	0,2482	0,1235	0,0018	0,0729	0,0244	4,6333	91,3683
TTR20	EBA	pin	0,2249	0,1287	0,0000	0,0008	0,0366	0,0233	0,0010	0,3357	0,0062	5,3543	71,3541
TTR21	EBA	awl	1,4887	0,2847	0,3193	0,0020	0,1060	0,5780	0,0000	0,2233	0,3333	0,1580	88,3600
TTR22	EBA	pin	0,5978	0,2079	0,0007	0,0534	0,0245	0,3733	0,0000	0,0390	0,0065	0,0087	84,8448
TTR27	EBA	forked impl.	1,5748	0,2172	0,0583	0,0000	0,0556	0,4947	0,0000	0,0781	0,0060	0,8192	92,0066
TTR16	EBA	rod	0,0173	0,0363	0,0203	0,0000	0,0073	0,0186	0,0000	17,0984	0,0250	0,0009	2,0035
TTR16BIS	EBA	rod	0,0075	0,6145	0,0145	0,0019	0,0107	0,0239	0,0019	40,7547	0,0289	0,0025	1,7862
TTR17	EBA	rod	0,0000	0,1489	0,0224	0,0000	0,0054	0,0115	0,0859	17,3802	0,0412	0,0013	1,3099
TTR18	EBA	rod	0,0000	0,0148	0,0228	0,0000	0,0068	0,0084	0,0288	22,7200	0,0236	0,0000	1,0320

Tab 2 - ICP chemical analysis of EBA (2600-2200 a.C.) metal objects from Titriş Höyük.