A new Late Bronze Age weapon hoard from the Guadalquivir River in the Province of Seville, Spain

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The increasing number of Late Bronze Age finds appearing in the southern part of the Iberian Peninsula, both isolated and in hoards, suggests the need for a new approach to the economic role of bronze metallurgy in this region[1]. Since the discovery of the well known hoard from the Huelva estuary in 1923, many new metallurgical finds have been reported. Most of them have been found without any clear archaeological context and frequently without a clear geographical location, since many of them are in private collections. The best documented find with a precise chronological context is the very interesting carp's tongue sword found in the stratigraphic section of the excavation at the Cerro de la Miel (Moraleda de Zafayona, prov. Granada), published recently[2]. We can add another hoard discovered in the Guadalquivir river, which is the subject of this note.

The objects from this hoard we have managed to recover and study are three: a carp's tongue sword (Figure 1, A) a spear ferrule (Figure 1, B) and a socketed spearhead (Figure 1, C). We were informed that the pieces had appeared in dredging operations seven years ago, in a stretch of the river Guadalquivir between La Rinconada and Alcala del Rio, not far from Seville (see Map, Figure 2). It seems that there were other objects belonging to the same hoard, which probably consisted of many items. Today their whereabouts is unknown, but there is a possibility that the two swords mentioned by Ruiz-Galvez[3] as coming also from the river Alcala del Rio, are from this hoard. The presence of this hoard in the Guadalquivir river suggests yet again the close relation of these weapons with rivers. Most of them date to the Late Bronze Age. Until now the number of hoards of this date in riverine locations are more than thirty, of which twelve are Andulasian. Although the number of hoards is less in Andulasia, we have to take into account the fact that in many cases hoards have not been reported, which is the case of the one we are studying, or their origin is unknown. In Andulasia the most important finds are the swords, which appeared at: Huelva estuary[4] and Coto de Donana[5] in the province of Huelva; Guadalete river and Bornos in the province of Cadiz; Vado de Mengibar and Marmolejo[6] in the province of Jaen; Baeza[7] in the province of Granada; Alcala del Rio, Bellavista, Corta de la Cartuja[8], Remanso de las Golondrinas[9] and the one we are studying in the province of Seville. In all the Andulasian hoards and findspots, contrary to those from the Atlantic Horizon, there are no axes but spearheads, ferrules, swords and fibulae are common.

As to the possible relative chronology of the hoard, the

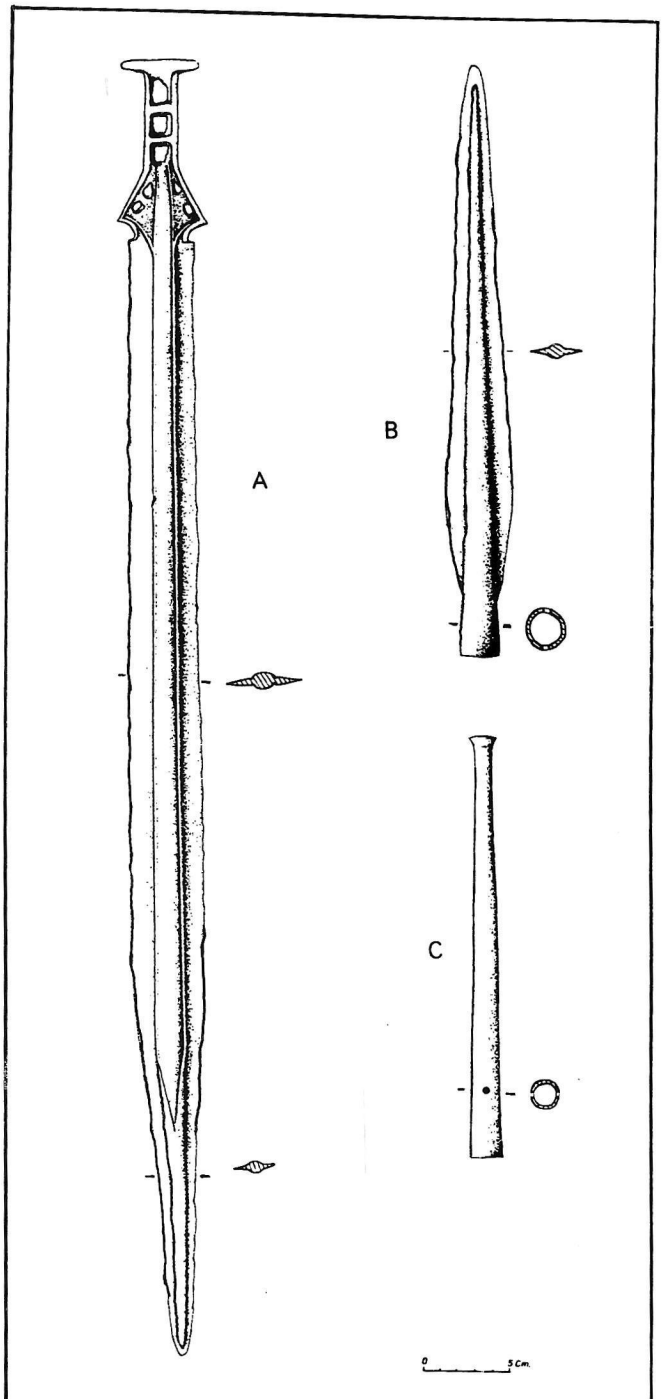

Figure 1: Objects from the Late Bronze Age weapon hoard in the Guadalquivir river.

swords are most important. Until now in the absence of archaeological contexts for the finds, investigators have used typology based on parallels with other European and Mediterranean finds, following the classical study of the Huelva hoard by Almagro Basch[10]. However, in the last year, a very important discovery has been made in a stratigraphic sequence: a carp's tongue sword in Cerro de la Miel, Moraleda de Zafayona, in the province of Granada. The present state of the investigation suggests that the date of the type of sword found at Cerro de la Miel and, thus, the finds associated with it, could be 950-850 BC.

Composition (XRF Semi-quantitative) and metallographic examination.

a) Ferrule (Figure 1, B; Photo 1)

Main Constituent	Cu
Secondary Constituent	Sn
Trace Elements	Fe, Pb

This specimen consists of an "as cast" structure, showing cored dendrites. The amount of $\alpha-\delta$ eutectoid present suggests that the tin content is probably less than 10 per cent. Also selective inter-dendritic corrosion is noticeable.

b) Carp's tongue sword (Figure 1, A; Photo 2)

Main Constituent	Cu
Secondary Constituent	Sn
Trace Elements	Fe, Pb, Ba

The structure still shows some of the remnant dendritic in which there are some of the $\alpha-\delta$ eutectoid. Superimposed on the dendritic structure there are recrystallised grains, some of then showing strain lines, suggesting that it has been cold worked.

c) Socketed spearhead (Figure 1, C; Photo 3)

Main Constituent	Cu
Secondary Constituent	Sn
Trace Elements	Fe, Pb

Although not so clear as in the sample from the sword, the structure seems to be quite similar. Recrystallized grains, some of them with strain lines, and pools of $\alpha-\delta$ eutectoid, superimposed on faint relics of dendritic shading. It has been cold worked.

Comments on the composition of the bronzes

All three samples examined are tin bronzes, with the tin content below 10% and iron and lead as trace elements, even in the spear ferrule, which was left "as cast". Barium is also present as a trace element in the sword, suggesting a different ore source for it. Barium is not normally included in the list of elements to be analyzed, although it seems to be characteristic of certain ore deposits such as Rio Tinto. In general, the composition of these bronzes agrees with the results of the analyses carried out on similar implements from the Iberian Peninsula[11], showing that the addition of lead in weapons which needed working after casting to increase their hardness was not usual. This is not the case in

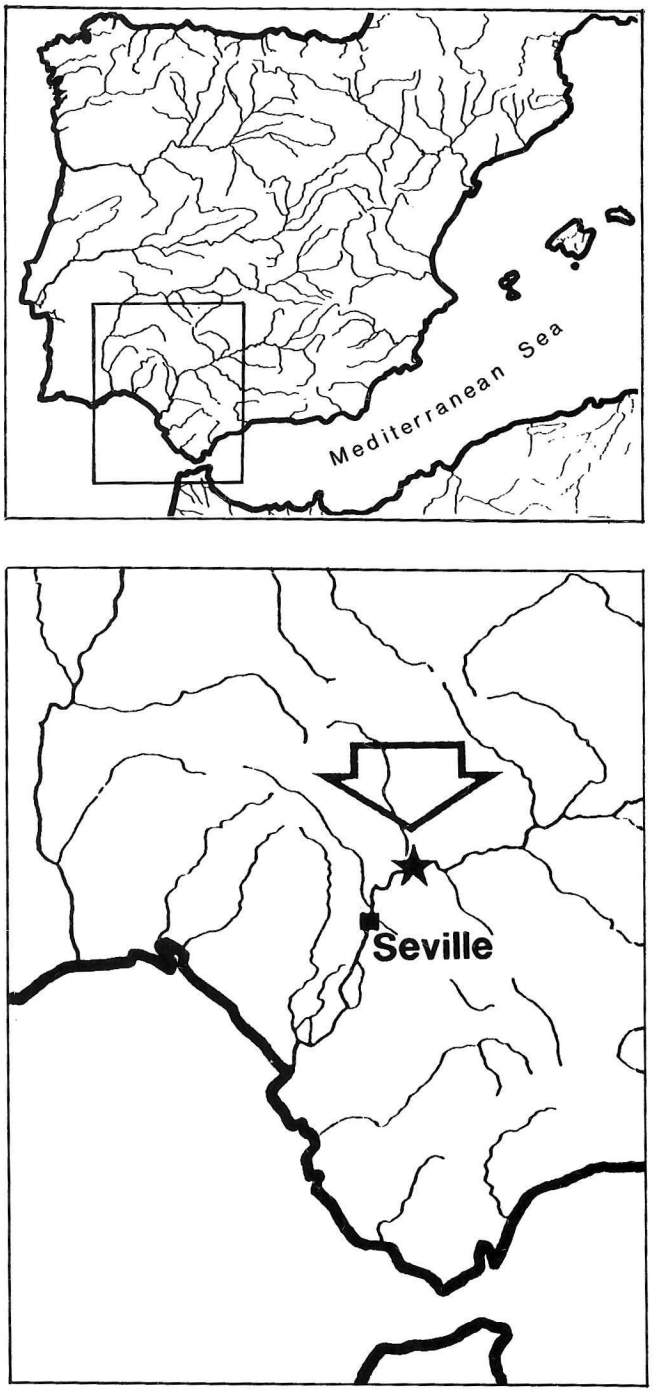

Figure 2: Geographical location of the hoard.

other types of implements in which the hardness was not so important and in which the addition of lead became common in the Late Bronze Age[12]. At Tejada la Vieja, prov. Huelva[13] all of the twenty analyzed copper-alloys samples were tin bronzes with an average of 6.5 per cent tin. Only two (a loop and a nail) were leaded bronzes. At Tejada, as in the three samples we are studying, the iron content is much higher than the lead, although both are present as trace elements. Another carp's tongue sword found at Tabernas, prov. Almeria, is composed of tin bronze (5.5% Sn) but the rivets of the hilt are made of only copper, showing that

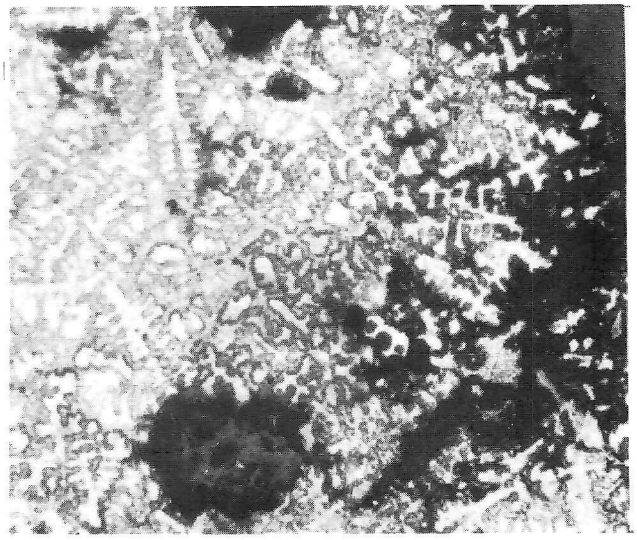

Photo 1: Ferrule. Etched with alcoholic ferric chloride, x 25.

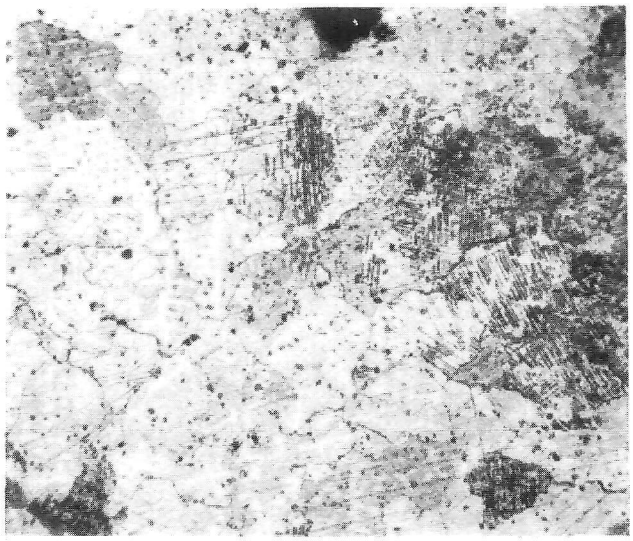

Photo 2: Sword. Etched with alcoholic ferric chloride, x 25.

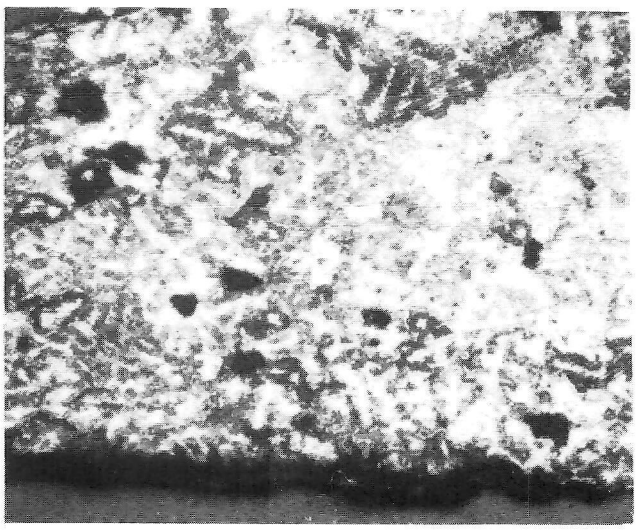

Photo 3: Spearhead. Etched with alcoholic ferric chloride, x 10

a softer metal was wanted[14]. In this case neither lead nor barium were found.

It is almost certain that the trace elements of the samples from the Guadalquivir hoard came from the smelting of copper ore. The iron content in the copper has been considered recently by Craddock and Meeks[15] as an indicator of the smelting process used to produce the copper. The fact that iron oxide fluxes were introduced when high grade copper ores (such as malachite) became scarce was the reason for the increase of iron content in the copper produced in such quantities that a subsequent refining process was needed. Thus, a 0.3% iron content level would indicate a process involving slagging, whilst the 0.05% iron level would indicate that a simpler smelting process was employed, without tapping the slag and using high grade copper ores. If this theory is right, then our bronzes would have been smelted in a process in which the slag was tapped, and the copper later refined, in order to reduce the iron content and make the metal workable.

Summary

This paper refers to a new Late Bronze Age weapon hoard from the Guadalquivir river (prov. Seville, Spain) consisting of a carp's tongue sword, a ferrule and a socketed spearhead. The absence of archaeological context for this kind of weapon hoard has made dating difficult, but recently a carp's tongue sword has been found in a stratigraphic sequence, giving a date of 950-850 BC. The three samples are tin bronzes. The ore source and the copper smelting process used could be indicated by the barium and iron contents respectively. The lead contained came from the smelted ore. The metallographic examination indicated that one specimen had an "as cast" structure and the two others had been cold worked.

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