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Craft production systems in a cross-cultural perspective

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Introduction

The papers collected in this volume were presented during a conference which took place from the 8th to 10th April 2016 in the Akademisches Kunstmuseum of Bonn University. The event was organized by the Graduiertenkolleg / Research Training Group *Archaeology of Pre-Modern Economies* which has been founded in 2013. It is a joint programme of the universities of Cologne and Bonn, funded by the Deutsche Forschungsgemeinschaft. It consists of about 20 PhD candidates and their supervisors plus three Postdoc researchers (www.wirtschaftsarchaeologie.de).

It is our aim to record and analyze economic systems and areas of pre-modern societies in their structure, capacities, and dynamics and to study their interaction with physiographical, political, social, religious and cultural components. The emphasis lies firmly on the material remains, though considering all relevant sources. The subjects treated by the colleagues and the doctorands cover a wide range from South and Mesoamerica until Mongolia with a focus on the Mediterranean and European cultures. So one of our not easy tasks is – besides the individual disciplinary dissertations – to compare and to link these case studies.

In recent years a considerable amount of research work has been dedicated to the study of pre-modern craft production systems. To take the example just of Classical Archaeology, in the last few years several monographs and at least 10 conferences dealing with production items and workshops in Greece, Rome and Preroman Italy were published, each of them focussing on different aspects and regions. In recent handbooks on ancient economy however – written mostly by historians – the archaeological evidence of production is only vaguely taken into account.

The main objective of this conference on one aspect of premodern economy – production systems in different cultural contexts – is a kind of experiment. We wanted to find out if and how it is possible to discuss this aspect in a broad cross cultural perspective.

Why should we do this? We think we already compare implicitly every time we describe cultural phenomena as we cannot do it from a neutral position but always in relationship with our own experiences. One important effect – if we compare one culture to another – is that we have to define and to reflect the characteristics of the particular culture we are studying and we may get a more critical perspective or distance to it. We might find similarities and differences which might inspire us to interpret things in a different way and maybe we find patterns or rules of cultural behaviour. Critics however say that by comparing we automatically have to simplify or generalize and to not take into account the complexity of each case study and culture.

Cross cultural comparison

There is a long scientific tradition in comparative studies of all kind[1]. Already ancient writers like Herodotus compared different cultures, defining "the other" for example as "barbarian" in contrast to his own greek culture. In modern research – starting in the nineteenth century – we can distinguish several approaches on a quite different scale:

- The first approach uses single cultural data or data sets for comparison. One of the most influential projects in this field is the "cross cultural comparison" mainly developed by George P. Murdock since the 1930s who has created a huge database now available online, the Human Relations Area Files (HRAF) (http://hraf.yale.edu/). There is a *eHRAF World cultures database* and also a *eHRAF Archaeology database* with different kind of data sets. In this method as many data from as many different cultures as possible are compared to find out patterns and universal rules.
- The second does not compare directly different data but specific cultural phenomena. One example is the "Interkulturelle Vergleich" of the German anthropologist Thomas Schweizer[2] (We leave this in German – if not we get confused with other english methods if we translate it). In his studies which appeared since the late 1970s he compares the results of in depth case studies (three or four) on specific phenomena from distant cultures which do not have contact with each other to exclude mutual influences. The aim is 'nomological', too, looking for certain patterns or rules.
- The third approach focusses on historical processes and less on single cultural elements. For example there is the "Controlled (Historical) Comparison" developed by Fred Eggan[3], altered by Sally Moore[4] and applied in the influential book by Jared Diamond on *Collapse* from 2005. For this kind of approach only well studied cultures can be taken into account.

Cross cultural perspective

We think that all these and more methods do not really fit to what we are trying to do. We have to keep them in mind, but as we are mainly specialists for one or two cultures and have to bring together a wide range of case studies we have to be less puristic and discuss them pragmatically in an as unbiased way possible looking for similarities, differences and thus learn from each other.

The case studies presented in this volume cover many different cultures and periods[5]: Meso- and South America (Cathy Costin)[6], Central and Southern Asia (Heather Miller, Susanne Reichert), Western Asia (Tobias Helms – Alexander Tamm)[7], Egypt (Paul Nicholson)[8], Prehistoric Europe (Tim Kerig)[9], Western Mediterranean Iron Age (Axel Miß, Albert Nijboer), Greece (Martin Bentz, Anne Segbers, Gerhard Zimmer), Rome (Allard Mees, Nicolas Monteix) and Medieval Europe

1 see comprehensively H. Kaelble – J. Schriewer (Hrsg.), Vergleich und Transfer. Komparatistik in den Sozial-, Geschichts- und Kulturwissenschaften (Frankfurt a. M. 2003)

2 Th. Schweizer, Methodenprobleme des interkulturellen Vergleichs (Köln 1978); ders., Perspektivenwandel in der ethnologischen Primär- und Sekundäranalyse: Zur historischen und zur gegenwärtigen Methodik des interkulturellen Vergleichs, Kölner Zeitschrift für Soziologie und Sozialpsychologie 41, 1989, 465–482.

3 F. Eggan, Social Anthropology and the Method of Controlled Comparison, American Anthropologist 56, 1954, 743-763.

4 S.F. Moore, Comparisons: Possible and Impossible, Annual Review of Anthropology, 34, 2005, 1-11.

5 For a complete list of the programme see http://www.wirtschaftsarchaeologie.de/en/events/conference-for-craft-production-systems-in-a-cross-cultural-perspective/ .

6 The paper given by Linda Manzanilla, "Different scales of craft production in the metropolis of Teotihuacan, Central Mexico" is not included in the publication.

7 The contribution by Patricia Wattenmaker, "Craft Production, Cosmology and Materiality: A Mesopotamian Perspective" is not included in this volume.

8 During the conference Thilo Rehren presented "Systems of Glass Production from Pharaoh to the Reformation".

9 The paper of Maikel Kuijpers, "Early Bronze Age metalworking craftsmanship; a world of specialists?" will be published in another volume.

(Timo Bremer, Ulrich Müller)[10]. The crafts considered comprise stone, ceramics and faïence, metal, textiles and tanneries.

Craft production is a subject that is well suited for a comparison, as the basic techniques are more or less the same everywhere: for example making a pot in South America, Europe, Africa or Asia ist done in two or three ways, formed by hand, turned on a wheel, decorated by painting, incision or relief. So it is possible to start a discussion not with these basics but at a more complex level.

As a base for our discussion we sent a list of items to the speakers when we contacted them. The first group of questions covered the variety of spatial organization and techniques of production and the reasons for it, as well as methodological approaches for analyzing theses items. The second group of questions was about social context, specialization, the important role of actors and institutions and social position of craftsmen as well as the issue of cultural contact and technological transfer. During the conference we had lively discussions on many of these aspects. Very stimulating were the frequent discussions on specialization issues in the different contexts, on technological transfer but also on methodological issues like the chaîne opératoire approach and social practise theory. These discussion have not been reported but have influenced many of the written versions.

A crucial aspect for every archaeologist is easy access to data. To facilitate future work and make the search for comparanda easier we have created a database on "Craft production sites of pre-modern economies" (http://www.wirtschaftsarchaeologie.de/en/output/data-bases/, see Ulrich Stockinger in this volume) which already covers data from all continents and will hopefully be further expanded in the future. Some of the participants of the conference have already provided us with new data from their own research projects.

We would like to thank the Deutsche Forschungsgemeinschaft (DFG) and the Philosophische Fakultät of Bonn University for the financial support which made this event possible.

We are very thankful to many colleagues who helped us during the editing process: the numerous anonymous reviewers, Caitlin Chaves-Yates who corrected the English of many contributions, Florian Birkner who unified the heterogeneous manuscripts, Dietmar Hofman and Susanne Biegert for the compositon of the volume. We owe special thanks to Ina Borkenstein who organized the whole event as well as parts of the editing process in a very efficient way together with our student assistants.

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[10] The paper by A. Cholakova, "Late antique glass workshops in the Balkans. Archaeological approaches to the socio-economic aspects of craft production" is not included in the publication.

Across cultures: The introduction of iron in the western Mediterranean, 10^{th} and 9^{th} centuries BC

Albert J. Nijboer

The transition from Bronze to Iron Age in the western Mediterranean during the 10^{th} and 9^{th} centuries BC is based on the awareness of the inherent advantages of the metal iron over copper-alloys when it comes to two contrary attributes, hardness and malleability. Both qualities of iron/steel could and were manipulated during smelting of the iron-ores and the subsequent smiting. It created perfect implements of all kinds, most of which can nowadays still be bought in hardware stores. The paper examines the structural, generic introduction of this novel metal in mainly Italy and Spain/Portugal. It presents well-published sites where relatively much early iron was excavated in combination with related radiocarbon dates. It turns out that the intrinsic qualities of iron are appreciated mainly in iron/steel knives from the 10^{th} century BC onwards after which the repertoire of iron tools and weapons rapidly enlarged till it became the prevailing metal for all tools and weapons in a couple of centuries. The technological transfer involved, appears related to the Phoenicians, who crossed the whole Mediterranean from the 11^{th} – 10^{th} century BC onwards, well before the establishment of permanent overseas settlements. Local overland networks on the Italian Peninsula and in the southern part of the Iberian Peninsula resulted in the distribution of the early iron artefacts. In Italy the accompanying technological know-how seems to have spread along these landlocked arteries as well.

Another benefit in this transition from bronze to iron is the availability of terrestrial metal-ores; iron-ores are far more ubiquitous than coper- and tin-ores necessary for the manufacture of bronze. Therefore, the growing use of iron as a base-metal and the local/regional exploitation of iron-ores inevitably resulted in its devaluation. This process of deflation is best recorded in the Near and Middle East from the 11^{th} – 10^{th} centuries BC onwards. However, it must successively have occurred in the western Mediterranean, especially during the 8^{th} century BC and later. These intricate topics concerning the introduction of iron are described with moderation since the associated archaeological data for the 10^{th} and 9^{th} century BC are improving but still remain somewhat patchy.

‘... hence men agreed to employ in their dealings with each other something
which was intrinsically useful and easily applicable to the purposes of life,
for example, iron, silver, and the like.’

Aristotle, Politeia 1257a, 35-40.[1]

Introduction

It is an intriguing feature of technological transfer that it can readily transcends ethnic and political boundaries. Cultural change is often more resilient. It seems that the passing on of technological expertise was part and parcel of the prospecting and early colonization movement towards the Western Mediterranean, first by the Phoenician city states from ca. 1000 BC onwards and secondly by Euboeans and other Greek speaking communities from ca. 800 BC onwards. Useful industrial know-how tends to spread swiftly once it is mastered and the dispersal of its savoir-faire not hindered by social-economic or political restrictions, given the prevailing networks of hands-on or dynamic interaction. One of the craft production systems that altered relatively fast in human evolution was the transition from copper-alloy tools and weapons to those of iron in the Mediterranean and beyond during the late 2nd and early 1st millennium BC; relatively fast when compared, for example, to the introduction of copper-alloys in the transition from the Stone to Copper Age though not as fast as the introduction of glassblowing in the decades during the late 1st century BC. '*Within half a century the art of glassblowing was transformed from a local Syro-Palestinian craft to an empire-wide enterprise*'[1].

The introduction of iron can be considered a disruptive technology since it superseded the previous long-distance exchange of the Late Bronze Age for rarer resources such as copper- and tin-ores. Due to the near omnipresence of iron ores, being besides aluminium, the second most abundant metal in the earth's crust, the whole *chaine-opératoire*, from procurement of the ores to the final working of tools and weapons, could be structured on a more regional scale than that for copper-alloy tools and weapons. Yet, the Mediterranean Late Bronze Age, overseas, long-distance trading network probably contributed significantly to the wide acceptance of iron as a working metal in the centuries around 1000 BC. In most cultures where iron became adopted as a basic resource for tools and weapons, this shift did frequently not last longer than a couple of centuries. For the Mediterranean it coincides with the period that the Phoenicians crossed the whole Mediterranean and tapped into existing trading links of its Western part encompassing the main mining regions in central Italy/Sardinia and SW-Spain. Based on recent research into the absolute chronology of the Iron Age in the Western Mediterranean, it becomes finally feasible to separate the role of the Phoenicians from that of the Euboeans with regard to the introduction of iron. An often used model, still popular amongst scholars, indicates that Greece was the '*main mediator of the technology in the late 2nd and early 1st millennium BC*'[2]. However, it has become clear that the Euboeans or other Greek-speaking groups did not arrive in Italy prior to 800 BC while iron was locally worked from the 10th century BC onwards[3]. It appears that it took these Hellenic groups centuries before they moved once more towards the Western Mediterranean after the collapse of the Late Bronze Age, Mycenaean arrangements during the 12th century BC. The trigger for the emergence of the Iron Age in Italy and in Spain/Portugal did not depend on contacts with Greek speaking groups.

A culture in the Eastern Mediterranean, less affected by the demise of the Late Bronze Age palatial system, is collectively known as Phoenician, corresponding with the Iron Age city-states of present Lebanon. The breakdown of the Late Bronze Age network in the eastern Mediterranean might even have provided the Phoenicians an opportunity to open their mercantile empire by tapping into already existing regional networks that were maintained all over the Mediterranean, since they became less dependant on political bargaining of the large territorial states or empires that dominated before 1200-1150 BC[4].

Initial remarks on a new technology and adoption/devaluation of iron

This paper will not examine the few iron artefacts that precede the Iron Age, a couple of which are known for many cultures. Take, for example, the gold-handled dagger from Alacahöyük dated to 2300 BC[5] indicating that iron was worked occasionally in Anatolia before the Late Bronze Age Hittites or take the reports of 10th century BC ironworking in Late Bronze Age England[6]. This article neither states that the shift from bronze to iron was all-embracing; copper was still required for various commodities and even used for specific

1 Stern 1999, 442.
2 Vandkilde 2007, 159; Kristiansen 1998.
3 D'Agostino 2016; Nijboer 2016.
4 Cf. Knapp – Manning 2016.
5 Grave K; http://crm2.univ-lorraine.fr/mathcryst/pdf/istanbul/Nakai.pdf.
6 Collard et al. 2006.

weapons and tools. Moreover, during the first centuries in which iron was manufactured, metals in general such as copper, tin as well as iron, were frequently worked in a poly-technical metalworking environment. These workshops had not yet evolved into separate smithies for copper- and iron-working. In addition, the centralization and subsequent urbanization in large parts of the Mediterranean during the period 1000 to 500 BC, led to an increasing demand for all kinds of resources and not just for iron. During these centuries, the scaling up of economies in several regions in the Mediterranean is well established.

The paper does, however, focus on the structural use of iron/steel, especially stages 2 and 3 as defined by Snodgrass [7], characterizing the advance of the Iron Age. He described in general terms the development of iron technology as a process in three stages to which I elaborate further on the aspect of devaluation:

1. The first stage constitutes mainly the production of iron ornaments and luxury items. It reflects a high value of iron;

2. The second stage is marked by the introduction of iron tools with sharp cutting edges though in a smaller quantity than similar copper alloy tools, indicating a high to medium value. In terms of definition; the Iron Age definitely came about with this stage;

3. The third and final stage is identified by the prevalence of iron tools over copper alloy tools, marking a medium to low value of iron.

Though this scheme might be perceived as evolutionary and functional, to which many have theoretical objections nowadays, the incorporation of value opens avenues for a more symbolic reading of early iron artefacts. The scheme remains basic but is significant since it allows an archaeologist to concentrate on well-dated and published sites where comparatively much early iron was found. It permits a parting of data on industrial waste and the actual early working of iron in mining regions and smithies, which are still random for the early stages, from the repertoire of archaeological iron tools and weapons present in a community. This paper therefore concentrates on those sites in Italy and the Iberian Peninsula with radiocarbon dates and with early iron. It opens with a short introduction on the intrinsic qualities of iron and its inherent devaluation due to its preponderance as a resource in ore-form. Subsequently it will examine the role of iron knives in the development of Snodgrass' three stages and present the Phoenicians and their quest for metals, especially in the western Mediterranean.

Intrinsic qualities of iron, its inherent devaluation and the role of iron knives

A main disadvantage for any study on the technical development of iron is its oxidation rate; it corrodes easily. This complicates scientific research into early iron, together with the re-use of valuable scrap iron for producing new tools and weapons while demand increased especially during stage 2 and its transition to stage 3. Also the methodology of provenance-studies of iron artefacts to determine its ore, only works in specific cases but is on the whole insufficient. The article on the provenance of the iron dagger of Tutankhamun is an exception but deals with meteoric iron and not with terrestrial iron that is examined in this paper [8].

Having noted these biases, it becomes apt to focus on the qualities of iron, which centre around two contrary attributes, hardness and flexibility/malleability. The hardness of ancient iron can go up to 965 Hv (Hv is a measure for establishing the hardness of metals), while copper alloys when fully worked, almost never exceed 200 Hv. As a comparison to these figures, the hardness of lead is given; 3 to 6 Hv [9]. The harder a weapon or tool becomes, the sharper the cutting edges can be, which is a distinctive precondition for a good tool or weapon. Flexibility or malleability can be obtained by combining various grades of iron in one artefact, for example, by employing a wrought iron or low carbon steel for the core or shaft of a tool and high carbon steel for the edges. Table 1 lists the various grades of iron in combination with Carbon content, 'increase in hardness', 'increase in strength' and other properties such as malleability. Many archaeological, iron weapons and tools, of which the hardness could be examined, combine both attributes; hardness and flexibility [10]. In addition there are a number of smiting techniques that result in an increase of the carbon content or hardness on the exterior, along the edges of a weapon or tool. Evidently, expert craftsmanship results in high-quality artefacts, while the opposite will have occurred as well

7 Snodgrass 1980, 336–337.
8 Comelli et al. 2016.
9 Scott 1992, 82.
10 Cf. Tylecote 1987.

Carbon content %	Modern name		Archaeological name		Phases present	Properties				
0.000-0.008	wrought iron		wrought iron	'wrought iron'	ferrite mixed with carbon	+ slag in 'wrought iron'	very malleable	increase in hardness ↓		increase in strength ↓
0.008-0.07	wrought iron		wrought iron	'wrought iron'	ferrite mixed with carbon	+ slag in 'wrought iron'	very malleable	increase in hardness ↓		increase in strength ↓
0.07-0.15	wrought iron: dead mild	low carbon steel	carburized iron (steel)	'wrought iron'	ferrite + pearlite	+ slag in 'wrought iron'	very malleable	increase in hardness ↓		increase in strength ↓
0.15-0.25	mild	low carbon steel	carburized iron (steel)	'wrought iron'	ferrite + pearlite	+ slag in 'wrought iron'	very malleable	increase in hardness ↓	increase in hardness on quenching due to martensite ↓	increase in strength ↓
0.25-0.55	medium carbon steel		carburized iron (steel)	'wrought iron'	ferrite + pearlite	+ slag in 'wrought iron'	very malleable	increase in hardness ↓	increase in hardness on quenching due to martensite ↓; respond well to hardening by quenching	increase in strength ↓
0.55-0.85 0.85 0.85-0.9	high carbon steel		carburized iron (steel)		pearlite	+ slag in 'wrought iron'		increase in hardness ↓	increase in hardness on quenching due to martensite ↓; respond well to hardening by quenching	
0.9-1.6	tool steel				cementite + pearlite			increase in hardness ↓	increase in hardness on quenching due to martensite ↓; respond well to hardening by quenching	
2.5-5	cast iron: white grey		cast iron: white grey		graphite + ferrite + pearlite		very brittle: cannot be worked			

Table 1: Carbon-alloys of iron listing the various grades of iron in combination with Carbon content, 'increase in hardness' and 'increase in strength'.

since these reflect the dexterity and reputation of individual smiths.

Another main attribute of iron is the near omnipresence as a resource. Iron ores are ubiquitous and can be found on many locations in various forms from high-quality iron ores to low-grade ones that can still be operated and extracted. This is in contrast to the previous Bronze Age since copper- and tin-ores are relatively rare and therefore any substantial increase in the demand for copper-alloy tools and weapons, requires long-distance exchange since hoarded or scrap-metal would run out. From stage 2 to 3 of 'Snodgrass' scheme, it becomes increasingly more likely that regional iron-ores were exploited. The growing use of iron as a base-metal and the local/regional exploitation of iron-ores inevitably resulted in its devaluation, a benefit that might have been exploited by merchants who introduced iron to peoples elsewhere for whom it was still a novel metal. The most detailed evidence for the decline in value of iron in relation to other metals/commodities derives from Mesopotamia and the Near East. Moorey reports for stage 1, which he dates during the second Millennium to 1250 BC, ratios of iron to gold ranging from 1 : 8 to 1 : 10. The ratio for iron to silver would have been about 1 : 90. This indicates that iron was considered more valuable than precious metals during stage 1 in this region [11]. The high value of iron during Snodgrass stage I of the Late Bronze Age in the Near East and Eastern Mediterranean might also be based on export restrictions and control of iron working by Hittite rulers. Late Bronze Age letters requesting for iron by fellow-rulers were frequently not granted and indicate a limited surplus production of iron in the Hittite Empire [12]. Once the Late Bronze Age emissary trading or palatial system collapsed involving empires as well as the Mycenaean civilization, the knowledge of iron working seems to have spread relatively fast across particular regions pertaining to the Eastern part of the Mediterranean.

During stage 2 which Moorey dates from 1250 to 850 BC, iron was still considered relatively expensive since it is listed in royal inventories. To indicate its value, Moorey mentions that around 1000 BC, one '*iron dagger was worth two full-grown rams*' or 2 shekels of silver. He reports for stage 3, which is dated by him from about 850 to 350 BC, ratios of iron to silver ranging from 240 : 1 to 840 : 1, probably depending on the quality of the iron [13]. These records reflect the gradual devaluation of iron from stage 1 to 3 in the course of a couple of centuries. It demonstrates the transition of iron from precious to base metal, from a luxury to an ordinary commodity. A comparable decline will have occurred in the Western Mediterranean during the transition from stage 2 to 3. Once the technology of iron smelting and smiting was mastered on a regional level, its devaluation became inevitable. Consequently, this will have modified working conditions and the economic significance of the mineral resources of many regions, which often consist merely of iron ores. A comparable process of devaluation is recorded for glass vessels after the introduction of glassblowing or for the slightly more abundant metal aluminium during the period 1850- 1900 AD [14].

At least from the 10th century BC onwards the Eastern and Western part of the Mediterranean became linked thanks to long-distance trade by Phoenicians

[11] Moorey 1994, 287–291; see the iron dagger of Tutankhamun mentioned above.
[12] Cf. Jean 2001.
[13] Moorey 1994, 287–291.
[14] Cf. Dwight 2002.

	Moesta	idem	Moorey	Crew	Tylecote	Cleere
Ore	3,800	19,000	180	7.6	7 to 15	90
Charcoal	4,000	20,000	300	28	7 to 15	120
Iron bloom	360	2,000	18	1.7	1	9

Table 2: Resources required during the smelting of iron ores in kg.

who brought with them, amongst others, their version of the alphabet and novel metal, iron. From the 11th/10th century BC onwards they reinforced contacts with the other half of the Mediterranean that in addition seems to have been less affected by the decline in long-distance exchange recorded in the eastern Mediterranean for the 12th century BC.

Having focussed so far on intrinsic qualities of iron and its devaluation, it is fundamental to point out that the processing of iron ores into blooms and bars is energy- and labour intensive. It therefore requires a considerable organization and infrastructure. The increase or decrease in the output of iron/steel factories is nowadays still considered to be an indicator for pending economic growth or decline. Table 2 provides some figures from pre-industrial societies or experimental work dealing with procuring iron ores into bloom. It registers roughly that on average the production of 1 kg. iron bloom required in many pre-industrial societies, approximately 10 kg. iron ore and 10 to 15 kg. charcoal for which 100 to 150 kg. wood is needed. The production of 1 kg. iron bloom might amount to 25-30 working days [15]. Indirectly it also registers that the transition from stage 2 to 3 that frequently lasted only a couple of centuries, is accompanied by a significant industrial input that might affect prevailing, local social-economic conditions.

The emergence of Snodgrass stage 2 in the transition to a fully fledged Iron Age is frequently reflected by an increasing number of iron knives, also in the Western Mediterranean. It was in knife blades that iron found its earliest acceptance for functional use since the hardness of steel was beneficial for cutting into softer materials and did not require the toughness /malleability necessary for striking tools such as axes. It is relevant to note here that in many communities/societies during large parts of the preceding Copper and Bronze Age, knives were still made of flint due to its superior hardness when compared to copper-alloys.

The increased demand for iron knives is recorded for the early Iron Age in many regions of the Mediterranean and beyond, for example in the Aegean [16] or in Italy and Spain/Portugal where most knives of the 9th century BC are made of iron [17]. Gualtieri [18] notes for Calabria that knives are the first objects to be made in iron and that they appear to be numerous at major sites during the early Iron Age. This intermediate stage is furthermore recorded at the necropolis of Osteria dell'Osa in Old Latium. Bietti Sestieri writes that from ca. 825-800 BC onwards all knives were of iron [19]. This indicates that the transitional period towards a fully-fledged Iron Age or Snodgrass stage 3 in Latium Vetus but also elsewhere in Italy corresponds to the 8th century BC (see below). Beyond the Mediterranean, in central Europe for example, Hallstatt C or the early Iron Age emerges around 800 BC and it is remarkable that at a site such as Statzendorf in Austria, all knives are of iron and these seem to appear without an earlier prototype in bronze [20].

Phoenicians and their quest for metals as recorded in the western Mediterranean; early Iron Age distribution maps, 10th – 9th century BC

During the conference in Bonn, one question concerned the actual evidence for early ironworking in present Lebanon. This query remains open to debate due to limited archaeological research. Few excavations were and are carried out in Lebanon and this near exclusion of the archaeological record referring to the homeland of the Phoenicians during the Early Iron Age itself, can not be rectified in this paper. I would think that these

15 Nijboer 1998.
16 Snodgrass 1971, 229.
17 Mielke – Torres Ortiz 2012.
18 Gualtieri 1977.
19 Bietti Sestieri 1992; for revised absolute chronology Bietti Sestieri – de Santis 2008.
20 Below – see Vandiver 1982; Tite et al. 1983.

sites in present Lebanon deserve more internationally funded research and protection.

In general terms, Moorey [21] assigns Snodgrass' stage 3 in the Near East to the 9th and 8th century BC (see above). Waldbaum [22] dates it to the 10th century BC. Publications on early ironworking in regions immediately surrounding Lebanon make it unlikely that the Phoenicians themselves were not involved in extensive ironworking during the 10th century BC.

In modern Israel, or the southern Levant that was partially dominated by the Phoenicians, local iron smelting and smithing is recorded from the 10th century BC onwards [23]. Other archaeological data indicate as well that in the southern Levant, stage 3 becomes evident from 10th century BC onwards [24].

Muhly and Kassianidou [25] refer to the role of Cyprus in the transmission of the ironworking technology to Crete during the 11th-10th century BC even though the actual evidence in the form of industrial debris remains limited on the island. Kassianiadou [26] documents for Cyprus a limited number of iron tools, mainly knives, till the 13th century BC while during the 12th century BC knives are prevailing but the first weapons appear as well. It is from the 11th century BC onwards that the number of recorded iron tools and weapons increases significantly. Furthermore, ethnic labelling for groups living on Cyprus during the Early Iron Age is difficult and the polities involved fragmented [27]. However, in this context, I would like to quote Bikai; *'The fact however that more than half of the tombs at Palaepaphos-Skales had 11th to 10th century Phoenician pottery in them leads one to ask whether the trade route through Kition, Amathus and now Paphos, ended here?'* [28]. We now know that it did not end on Cyprus. Also the question when exactly Phoenician groups started to control parts of Cyprus during the Early Iron Age remains open to debate and not the issue here since the paper examines the first indications for a common use of the metal iron in relation to exchange activities with Phoenicians based on the theme 'Metals make the World go round'.

For Crete Karageorghis [29] states that Phoenician presence is incontestable as early as the 10th – 9th centuries BC.

It follows that the Iron Age Phoenician city-states in Lebanon require fundamental archaeological research on account of their extensive trading network from the 11th century BC onwards. In the meantime, it should be clear that ironworking had advanced considerably by the 10th century BC in the Levant and Eastern Mediterranean while in the Western Mediterranean it was still a novel metal.

In Tunis, Spain and Portugal, archaeologist obtained more funds for research on the early Phoenicians. Kaufman et al. wrote a perceptive article on the evidence for an iron industry at Carthage from its foundation, around 800 BC (my date), to its final destruction by the Romans in 146 BC [30]. Their paper contains a section with numerous references on *Phoenician iron metallurgy and political economy* (pp. 35-9) that is significant for the present argument. I quote some of their lines as an up-to date summary of the renowned quest for metals by Phoenicians in the Western Mediterranean:

'Early Phoenician colonial activities were centrally planned around a strategy of grafting Tyrian economic demand onto previously established trade networks, in what can be called a cooperative mercantile economic system that encouraged surplus production for export. For example, the Tyrians were able to negotiate commercial relationships with local tribes to access the mineral wealth of the Iberian Peninsula. In the 10th and 9th century BC, so called "Orientalizing" influences in the Central and Western Mediterranean are usually referred to as "proto-colonization" or "precolonization" initiated by Phoenician merchants plying foreign waters searching for mineral resources to exploit.'

'The new international economy was based on shared incentives and is characterized archaeologically by an increase in metallurgical production and warehousing.'

'Relationships were forged with Andalusian and Tartessian chieftains who were able to increase their own status by the acquisition of finished Phoenician products in exchange for silver, including iron which was unknown to them before Orientalizing contact in the final Bronze Age …' (see Figure 2 for a rare example of this phenomenon though the Tomb at Roça do Casal do Meio

21 Moorey 1994.
22 Waldbaum 1980, 1999.
23 Eliyahu et al. 2012; 2013.
24 Gottlieb 2010.
25 Muhly – Kassianidou 2012.
26 Kassianiadou 2012.
27 Iacovou 2013.
28 Bikai 1983, 405.
29 Karageorghis 2003, 343.
30 Kaufman et al., 2016.

(W-Portugal) does not contain iron but ivory). The words 'cooperative' and 'shared incentives' are vital since it reflects conditions in which technological expertise could be transferred; a condition that seems to have lasted in large parts of the Western Mediterranean at least till the 7th century BC.

In contrast to Kaufman et al, my paper is especially on the 10th and 9th century BC when the Early Iron Age with its increasing use of the metal iron/steel, became structural in both the Italian as well as the Iberian Peninsula. Others may refer to terms such as proto- or pre-colonization for the period before 800 BC but I rather refer to a prospecting phase since it precedes the foundation of permanent, overseas Phoenician settlements that emerge from ca. 800 BC onwards and that seems to be characterized by warehousing, which opens the possibility for directional trade [31]. The Tanit and Elissa shipwrecks, west of Ashkelon, indicate Phoenician directional trade from at least 750 BC onwards [32]. So far, these shipwrecks do not indicate Euboean/Greek involvement and the cargo appears to be quite homogenous, which is in contrast to many other ancient shipwrecks that often document cabotage, indirect trade, from port to port, loading and offloading merchandise resulting in a cargo of mixed provenance.

Kaufman et al. [33] also state that *'The precipitation in the local consumption of iron "prestige objects" stands in contrast to the lack of iron production in the Iberian Peninsula during the precolonial phase. In other words Phoenician and indigenous populations traded iron goods, but only the former produced them until the technology itself was transmitted as opposed to just the objects.'*

'It is therefore necessary to understand that the Phoenician and Neo-Assyrian supply of base and precious metals was predicated on the corollary demand of the indigenous groups for Phoenician ferrous alloys and other technologies.'

The paper by Kaufmann *et al.* focuses on Carthage and the southwest of the Iberian Peninsula after 800 BC. This contribution examines the two centuries prior to the foundation of Carthage and includes Italy. It is indeed unclear to what degree the associated iron technology was transmitted to indigenous groups living on the Iberian Peninsula before the late 9th century BC but in Italy it was, due to the repertoire of local ornaments in iron. In that sense both peninsulas reveal resemblances as well as differences in the production, trade and consumption of early iron. Based on the iron artefacts recovered in Italy it can be argued that by 800 BC, thus by the time the Euboeans arrived as well, it was on the brink to Snodgrass stage 3 (see below).

There are two relevant sites in Tunis and SW-Spain that predate the foundation of Carthage; Utica and Huelva. Recent excavations at Utica provided a context that is radiocarbon dated to the 9th century BC, if not to the late 10th century BC [34]. López Castro and his co-authors interpret the data from Utica as the first stage towards a permanent settlement and therefore define the finds as *the most ancient horizon of the Phoenician colonization in Central and Western Mediterranean*. The radiocarbon dates pertain to a water-well in disuse, filled with remains and linked to a building. The associated radiocarbon dates indicate the period 925-850 BC. The contents of the well are striking since they contain ceramics from mainly Libyan and Phoenician origin (ca. 65%); the rest of the pottery consists of local imitations of Phoenician vessels, Sardinian, Greek, Villanovan and Tartesian ceramics (in order of decreasing proportion). The assemblage records the wide exchange network maintained by the Phoenicians all over the Western Mediterranean, including Iron Age, mainland Italy (Villanovan ceramics) from at least the 9th century BC onwards. It supports the notion of Villanovan contacts with Phoenicians prior to the arrival of Euboeans [35]. The associated finds in the well also document communal banqueting coupled with exchange between Libyans and Phoenicians. The zoo-archaeological and ceramic remains indicates that the well was filled intentionally with bones of consumed animals, drinking cups, plates, and bowls, as well as transport-amphorae [36]. This mode of interregional commerce, combining banqueting with trade, is still reflected around 650 BC in a context excavated at *Satricum* (central Italy) that contains weights, units of volume, an iron bloom, metal artefacts and symposium wares (ribbed, bronze bowl and ceremonial stand, a *holmos* [37]). From the 10th till 7th centuries BC, it does not reflect an interregional, basic buying and selling or

31 Nijboer 2016.
32 Stager 2003.
33 Kaufman et al. 2016.
34 López Castro et al 2016.
35 Cf. Nijboer 2016.
36 Cardoso et al 2016.
37 Nijboer 1998.

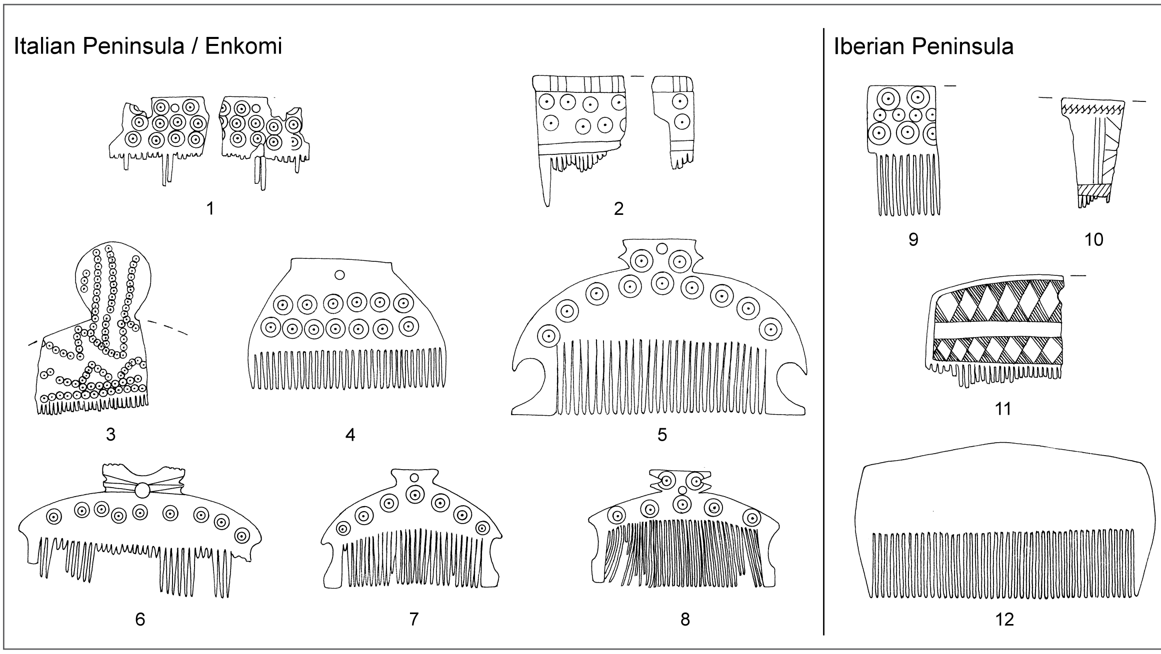

Fig. 1: Selection of combs in ivory and related materials from Italy, Enkomi (no. 5; Cyprus) and the Iberian Peninsula during prospecting phase, Final Bronze Age/Early Iron Age.

'silent trade' but marks trade with communal meals and active contact, which could incorporate the transfer of technological know-how as argued here.

The radiocarbon dates for Utica are consistent with those from the town deposit at Huelva, on the Atlantic coast in SW Spain [38]. This deposit documents an emporium, a harbour with evidence for production and overseas, interregional trade between Phoenicians and indigenous groups. The deposit records:

– Thousands of local and Phoenician ceramics as well as some from Greece, Sardinia and mainland Italy. All in all around 85,000 fragments were recovered.
– Industrial debris of crafts such as the processing of copper, iron, silver and ostrich eggs.
– The Phoenician alphabet was introduced at Huelva during the 9th century BC as well as quantified exchange marked by some shekel units [39].

The average calibrated date of the radiocarbon analyses of the Huelva town deposit is 930 to 830 BC (94% probability), which is just slightly older than the conventional dates associated with this deposit being 900 to 770 BC. Moreover an average date indicates that some artefacts in the town-deposit at Huelva might be older and others younger.

Both sites, Utica and Huelva, illustrate that the Phoenicians maintained an extensive trading network during the 10th and 9th century BC covering the whole Mediterranean prior to the arrival of Euboean or other Greek-speaking groups in Italy. In many of the ports of call, the guest banquet appears to have been the traditional response to their arrival, from the start, as the evidence from Utica indicates where analyses mark banquets in which mainly oxen, sheep/goat and pigs were consumed [40]. It appears that from the earliest contacts with communities in the Western Mediterranean, the guest-meal or banquet was associated with transfer of customs, know-how and exchange. This statement is also reflected in the ceramics at Utica that includes local imitations of Phoenician vessels.

The interregional exchange during 10th and 9th century BC is furthermore marked by distribution maps that cover various parts of the Mediterranean and beyond, from the Levant till the Atlantic coast. This aspect was presented elsewhere but here the Achziv – Huelva fibulae and ivory combs are mentioned [41]. The origin of the archetype of the Achziv – Huelva fibula is probably the Iberian Peninsula [42]. It would require more finds and precise dating tools though its distribution in various

38 González de Canales Cerisola et al. 2004; 2006; Nijboer – van der Plicht 2006.
39 Kroll 2008; Ruiz-Gálvez Priego 2008; Nijboer 2008.
40 Cardoso et al. 2016.
41 Nijboer 2008.
42 Mederos Martin – Jiménez Ávila 2017.

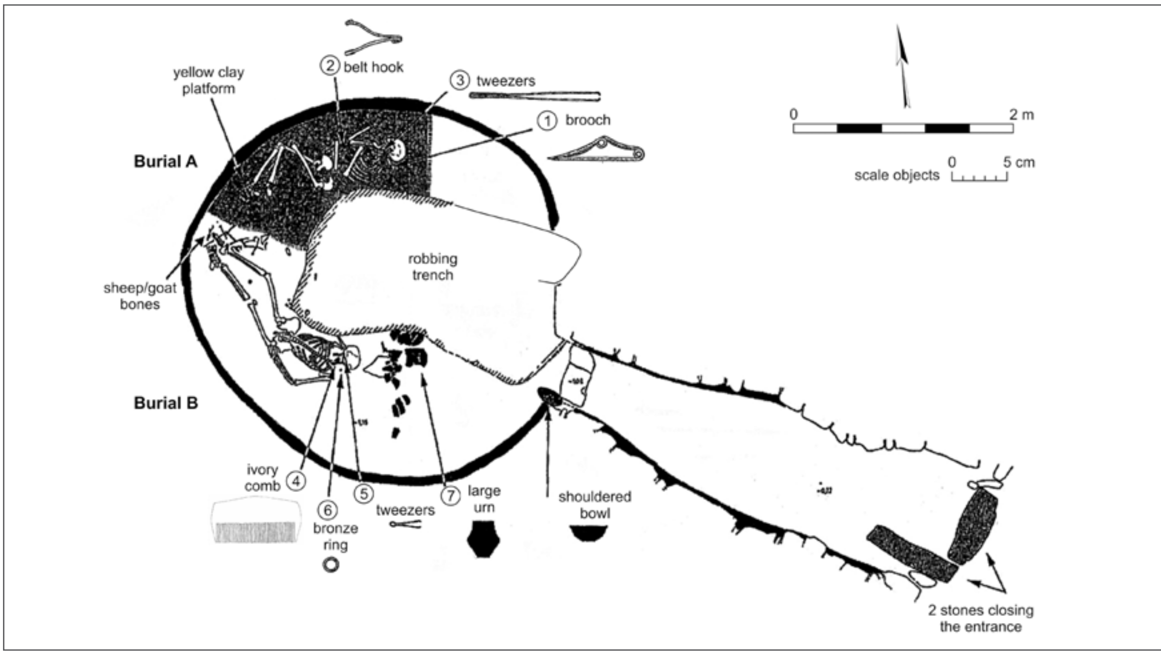

Fig.2: Plan of the tomb at Roça do Casal do Meio (W-Portugal); amongst others with ivory comb and a fibula. Lately the tomb was radiocarbon dated: GrA-13501 2760 ± 40 BP and GrA-13502 2820 ± 40 BP.

10th century BC contexts of which at least two are from 'warrior-trader' tombs, records banqueting and long-distance exchange covering the whole Mediterranean.

Another material category that must have arrived during the transition from the late Bronze to Iron Age in both the Italian and Iberian Peninsula are combs of ivory and related materials (Figure 1). Some of the combs in Figure 1 were made bone or horn but their form refers to ivory combs in the Levant[43].

This section on early Phoenician exploits in the western Mediterranean is concluded with a tomb from the Iberian Peninsula that illustrates features mentioned above. Tombs of the 10th and 9th century BC are rare in Spain/Portugal and therefore most data on early iron derives from settlements (see below). However, the tomb at Roça do Casal do Meio (W-Portugal), of which Figure 2 presents a plan, is one of the exceptions and contains both an ivory comb and a fibula with prototypes from elsewhere. Lately the tomb was radiocarbon dated:

– GrA-13501 2760 ± 40 BP and
– GrA-13502 2820 ± 40 BP (Vilaça – Cunha 2005).

These radiocarbon determinations coincide with those from Utica and Huelva. By now enough radiocarbon dates with sound archaeological contexts have become available around 2900-2800 BP, or the 10th century BC, to characterize the final stages of the Bronze Age in Spain and Portugal.

Having reflected on the prospecting phase of the Phoenicians towards the western Mediterranean during the 10th and 9th centuries BC, we move on the examine data on early iron, first on the Italian peninsula and subsequently on Spain/Portugal.

Italian Peninsula

The last phase of the final Bronze Age in Italy is dated around 1000 BC and confirmed by Wiggle-Matching Dating (WMD) results[44]. The subsequent Iron Age in Italy starts in the decades around 950 BC and not around 900 BC as maintained in the Conventional Absolute Chronology[45].

The Early Iron Age on the Italian Peninsula is divided into phases I and II, essentially from 950-800 (I) and from 800 to 725 BC (II). This paper concentrates therefore of Early Iron Age I (or Primo Ferro I (PF I) in Italian), also referred to as the early Villanovan period during which a network of Villanovan centres emerged that stretch from NE to SW Italy[46]. There is

[43] Cf. Ben-Shlomo – Dothan 2006.
[44] Van der Plicht – Nijboer 2008, 105–108; forthcoming; Weninger – Jung 2009.
[45] Cf. Bietti Sestieri – De Santis 2008; Nijboer – van der Plicht 2008.
[46] Cf. Pacciarelli 2000; Bietti Sestieri 2012.

a considerable number of Early Iron Age I tombs that contain iron, some of which are mentioned, but two sites with relative much iron stand out at present; Torre Galli, on the Tyrrhenian coast of Calabria and the inland site of Fossa in the Abruzzo region.

Early production sites and/or smithies, where iron was worked, are rarely recorded for Italy as elsewhere in the Mediterranean, and this leads to speculation about the transmission of the necessary technology[47]. This paper deals less with Snodgrass stage 1 in Italy for which many data remain for me contentious. It examines more the structural use of iron tools and weapons, mainly stage 2. If one looks at specific regional artefacts in iron, not or hardly found elsewhere, it becomes clear that local iron working in Italy took place from the 10th century BC onwards. There are indications that early encounters with Phoenicians might have triggered the Iron Age in Italy. The finds at Torre Galli in Calabria are in this context relevant since it is the only site in Italy with a significant quantity of iron from the earliest phases of the Iron Age while the site has clear links with the Levant[48]. Figure 3 illustrates Torre Galli tomb 36 that contains an iron fibula, typical for the region, and an iron dagger with ivory adornment. The catalogue of the necropolis contains 205 Early Iron Age tombs that could be assigned to either Torre Galli phase IA (89 tombs) or phase IB (116 tombs) roughly dated here from 950 to 900 and from 900 to 850 BC[49]. Of these 205 tombs, 56 contain one or more iron artefacts. Thus more or less 25 % of the Early Iron Age tombs at Torre Galli contained iron, amongst other artefacts. Several iron weapons are associated with ivory parts according to the authors. From Table 3 with its number and variety of iron artefact types, it is deduced that iron was not an exceptional metal at Torre Galli during its phase 1A. It rather reflects conditions as in Snodgrass stage 2. Local iron-working in Calabria at least from the 10th century BC onwards is implied by the regional artefact types in iron such as the *fibula serpeggiante meridionale*[50]. In addition Torre Galli is also known for its imports from the Levant[51] and the site is not associated with early contacts with Euboea or other parts of modern Greece. Thus its Aegyptiaca belong to the oldest found on the Italian peninsula[52]. In addition, faience beads, scarabs, semi-precious and cut stones as well as ivory were recovered, occasionally in combination with other Levantine artefacts. These oriental commodities, found in 10 % of the Torre Galli tombs, were most likely carried overseas by Phoenicians since they definitely crossed the whole Mediterranean from this period onwards. This matches well the premise by Kaufman et. al.[53] that the local elite were able to increase their own status by the acquisition of finished Phoenician commodities. In addition, the data from Torre Galli blends in well with the Villanovan ceramics recovered at Utica in Tunis and at Huelva in SW Spain (see above).

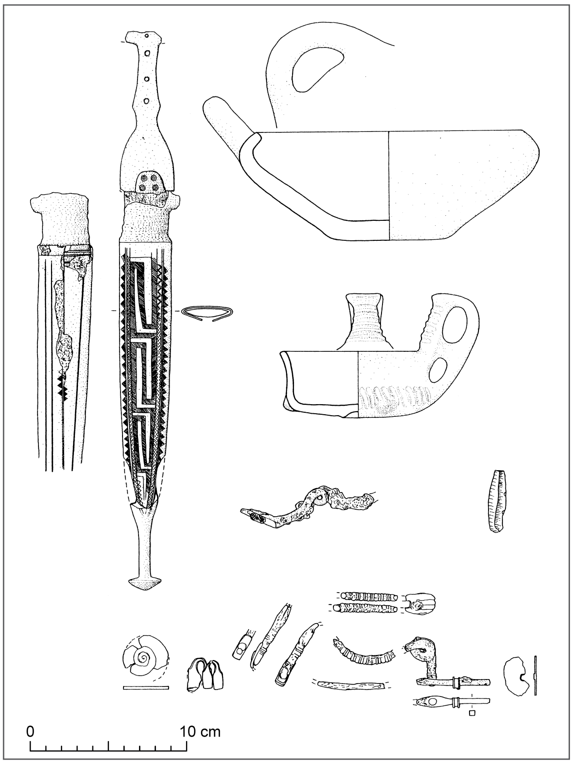

Fig. 3: Tomb 36 from Torre Galli with iron dagger, fibula and ivory, dated around 950-900 BC.

At another main Early Iron Age site in Calabria, Torre del Mordillo, a range of 37 iron artefacts in various tombs are assigned to 9th century BC in the conventional absolute chronology[54].

[47] Giardino 1995, 114-119; 2005; 2010; Hartmann 1985, 285–289; Gualtieri 1977, 213–229; Delpino 1988; Giardino 2005; Tartari 2014/15.
[48] Pacciarelli 1999, 61–62, 101–102; Sciacca 2011.
[49] Pacciarelli 1999, 62–65.
[50] Pacciarelli 1999, 133.
[51] Sciacca 2011.
[52] De Salvia 1999, 213–217.
[53] Kaufman et. al. 2016.
[54] Tartari 2014/15; Fig. 1.7 represents an ivory comb from Torre Mordillo.

Phase	Fibula *Serpeggiante*	Other fibula types	Knife	Shaft	Lance point	Sword, mainly short ones
1 A	5	2	9	2	2	8
1 B	11	2	14	–	2	4
+ few ringlets / rings						

Table 3: Number of iron artefacts per phase at Torre Galli (ca. 950-850 BC); local production iron due to native typology of ornaments and weapons.

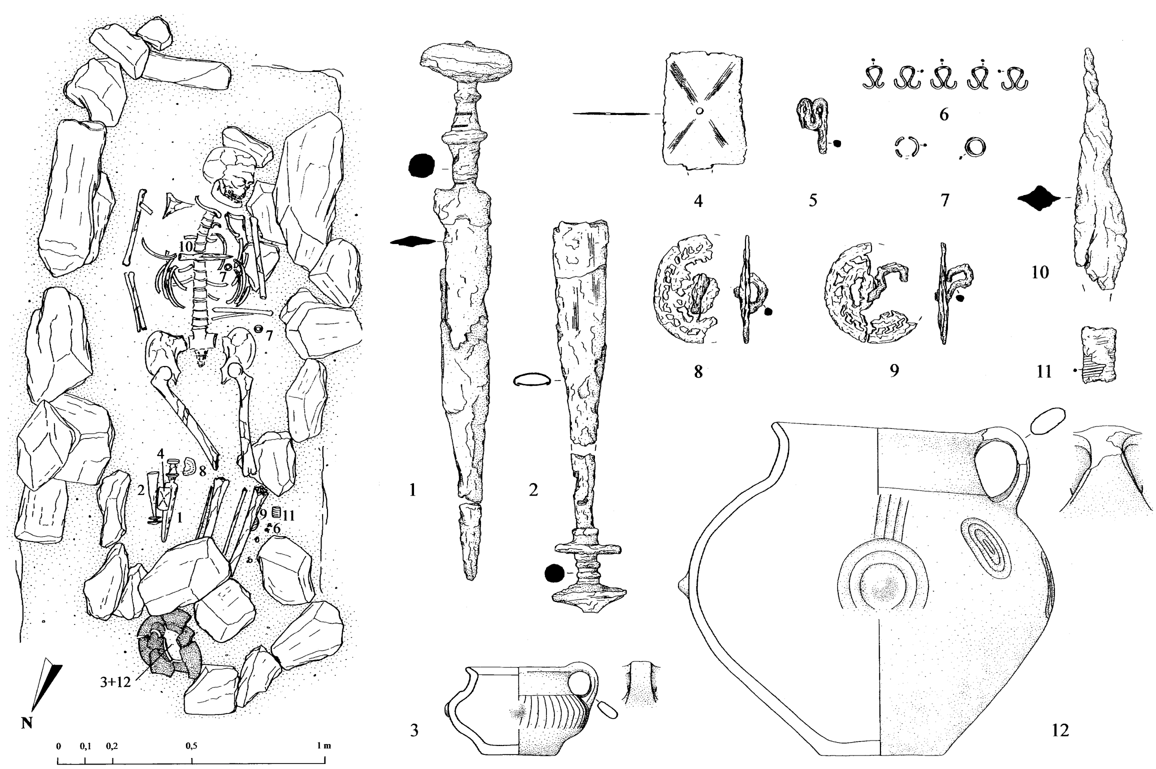

Fig. 4: Tomb 15 at Fossa with a range of artefacts assigned to the earliest phase of Fossa 1A, dated around 800 BC.

The progress of the use of iron in Italy is next recorded well in the tombs at Fossa in the Abruzzo. It is an important inland site in the centre of present Italy and the evidence indicates that in this region iron had replaced copper as basic metal for tools and weapons by 800 BC. It appears that in ca. 150 years, during the period 950 to 800 BC, we go from Stage 1 to 3 though iron dated prior to the late 9th century BC is hardly recorded in and around Fossa. Fig. 4 provides an example of one of the early tombs containing more iron than other artefacts.

For three tombs of the necropolis during its earliest phase (Fossa 1A), 14C results were published:
– Tomb 56; 2660 +/- 40 BP (GX-26588-AMS), contains the skeleton of a female associated with 14 artefacts, 7 of which are of iron [55],
– Tomb 100; 2650 +/- 40 BP (GX-26584-AMS), contains an adult male, based on the presence of a bronze razor and in iron, a knife and the pointed shaft of a spear [56] while
– Tomb 190; 2630 +/- 40 BP (GX-26583-AMS [57]), contains the skeleton of a female with 13 artefacts of which 7 are of iron [58].

When calibrated, these 14C results document a date for Fossa 1A to the late 9th and early 8th century BC since the radiocarbon calibration curve is quite steep around this period resulting in relatively precise, absolute dates. In addition it is appropriate for

[55] Cosentino et al. 2001, 83–85.
[56] Cosentino et al. 2001, 94.
[57] Castiglioni – Rottoli 2004, 233.
[58] Cosentino et al. 2001, 104–107.

fibulae	knives	lances and shafts	short swords	scabbards	pins and wire	cut-out discs	bracelets	pendant	rings and chains	hooks and plate
12	5	8	4	3	4	11	3	1	6	15

Table 4: Number of iron artefacts in the 13 tombs at Fossa assigned to the late 9th, early 8th century BC (Phase 1 A); local production iron due to native typology of ornaments and weapons.

our discussion on the Early Iron Age in Italy to note that these early tombs contain more tools, weapons and ornaments in iron than in bronze.

The necropolis of Fossa emerged during the late 9th century BC and was subsequently in use for almost 800 years. All in all 13 tombs could be assigned to Fossa phase 1A, and each of them contains iron (Table 4). The repertoire of iron artefacts during this phase, sometimes combined with elements in copper-alloy, consists of various types of fibulae, amongst which serpentine fibulae, large and small knives, lances, shafts, short swords, scabbards, pins, typical cut-out discs, bracelets, pendants, rings, hooks and plate (Table 4) [59]. Local iron working is demonstrated by the broad repertoire of iron artefacts of which some are characteristic for this part of Italy, such as the cut-out discs and other ornaments. The deposition of numerous types of iron weapons, tools and ornaments continues at Fossa during the subsequent phases. The conditions at Fossa rather reflect Snodgrass stage 3 than 2.

At Fossa around 800 BC there are no materials or artefacts that record direct or indirect contacts with the Levant or Euboea. This indicates that the technology of ironworking in and around Fossa was transmitted through the overland network of indigenous sites. The dense network of Early Iron Age centres, incorporating amongst others Fossa as reflected in some of the Villanovan artefacts deposited, seems to have contributed significantly to the spread of iron-working in Italy during the 9th century BC.

In other parts of Italy, iron was deposited to a much lesser extent than at Torre Galli or Fossa during the 10th and 9th centuries BC. Nonetheless it is assessed that iron was worked locally in central Italy from the Early Iron Age onwards, looking at the repertoire of iron artefacts available. At Tarquinia, for example, some fibulae, spears, a bracelet, sword and dagger are assigned to its phase I while in its phase II or the 8th century BC, the range of iron artefacts becomes significantly larger [60]. An example of a context with early iron at Tarquinia is Tomb 73 of the Villa Bruschi Falgari (VBF) necropolis (Figure 5). This tomb was dated using the 14C method (2820 ± 60 BP; GrA-16430) and it clearly pertains to the 10th century BC, probably to its second half, 950 to 900 BC. [61] VBF Tomb 73 is at the moment allocated to Tarquinia phase 1A-1B1, thus to the Early Iron Age I and contains a fragment of a typical Villanovan fibula. So far there are hardly any indications for Phoenician influences during Tarquinia phase I and thus the presence of early iron at the site is reconstructed as the result of local arrangements. Another option is that bar-iron was imported overland from southern Italy. The rich deposits of metal-ores in Etruria make this option less likely.

Based on the distribution of early iron artefacts in Italy, it is reconstructed that Snodgrass stage 2 existed in its southern part during the 10th and 9th century BC and that the technological know-how of ironworking rapidly spread across the peninsula assisted by the network of Villanovan and related settlement centres. Emerging contacts with the Phoenician exchange system might have supported the adoption of iron as a structural, basic metal. The evidence from Fossa, in the interior, implies that in this region iron had already replaced copper-alloys as main metal for weapons, tools and other artefacts by the decades around 800 BC.

59 Cosentino et al. 2001; 2004.
60 Hartmann 1982.
61 In collaboration with Flavia Trucco we have dated some tombs of the VBF necropolis using the 14C method. We obtained for this necropolis a useful sequence in time from 1000 to 800 BC as we did for Latium Vetus (Nijboer – van der Plicht 2008; Bietti Sestieri – de Santis 2008). The 14C-research for Tarquinia awaits full publication pending the seriation of all tombs excavated in the VBF necropolis. The radiocarbon sequence and the associated tombs imply that the transition of Tarquinia phase I to II is dated around 800 BC as is the transition of Latial phase II to III. See also the radiocarbon dates from Fossa 1A centring around 800 BC mentioned above. On account of some artefacts found at Fossa, its phase 1A coincides with Etruria Phase IIA1 (Cosentino et al. 2001, 174–183; D'Ercole – Benelli 2004, 229–232).

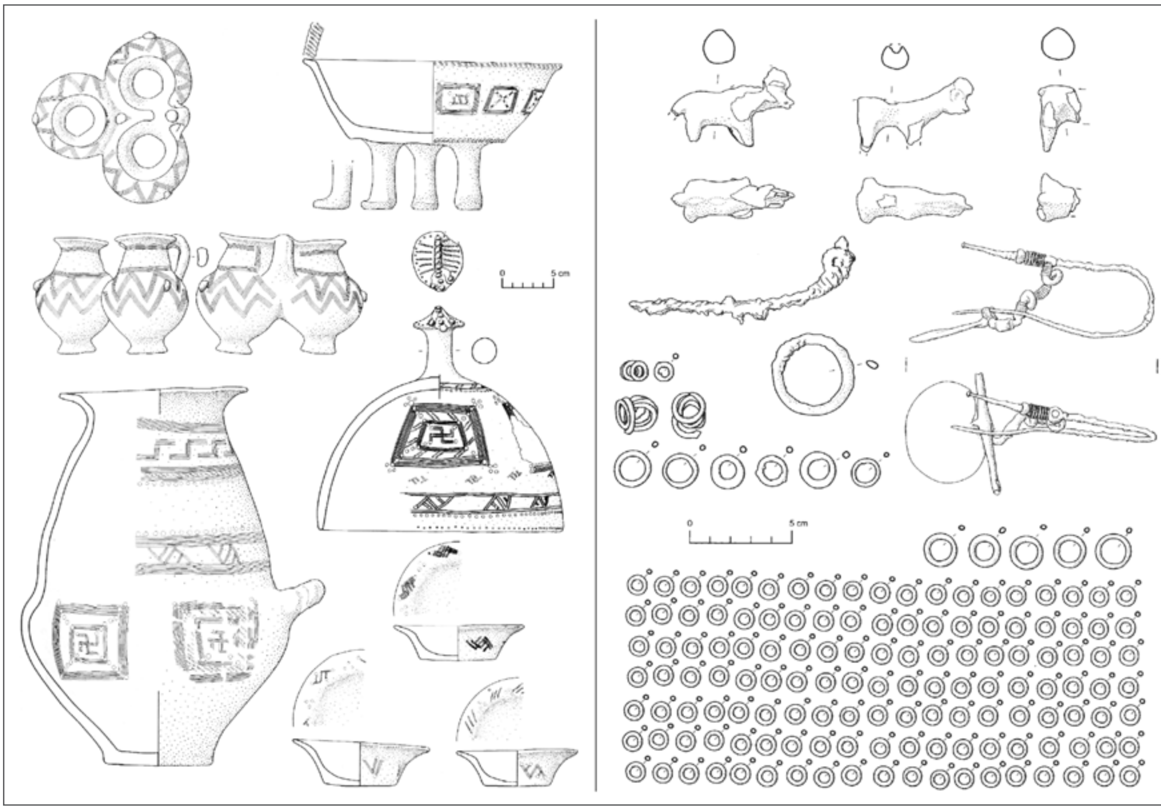

Fig. 5: Tarquinia, Villa Bruschi Falgari necropolis, Tomb 73 with remains of iron fibula. Tomb assigned to the transition of Tarquinia phase 1A to 1B1, radiocarbon dated (GrA-16430: 2820 ± 60 BP) around 950-900 BC.

The data for Etruria, *Latium Vetus*/Old Latium and northern Italy are less abundant but Snodgrass stage 2 can definitely be assigned to the 9th century BC. During the 8th century BC, iron tools gradually replaced copper alloy tools almost in the whole peninsula and this records a considerable investment in labour and resources [62].

Iberian Peninsula

The early use of iron in Spain is one of the characteristics of its Orientalizing phenomenon [63]. This is also recorded for Portugal with radiocarbon dates centring around 2900-2800 BP [64]. The associated 14C analyses suggest a date as early as the 12th century BC for the first iron artefacts on the Iberian Peninsula but I will examine mainly the emergence of Snodgrass stage 2 and the 10th and 9th century BC for which the evidence is considered sound. Though I do not regard myself a specialist on the archaeology of the Iberian Peninsula, I do consider the comparative examination with Italy striking. The introduction of iron on the Iberian Peninsula is the result of contacts with Phoenician merchants/craftsmen. Snodgrass stage I seems unclear while the Phoenician prospecting phase, apart from Huelva, is predominantly reflected in distribution maps of specific artefact types. This might suggest to some that ironworking was an indigenous invention. However the appearance of iron/steel working tools during the 10th and 9th centuries BC requires an explicit know-how of the *chaîne opératoire* of the metal. This know-how was transmitted according to many and me; see, for example, the model by Kaufman et al. [65], presented above. On the Iberian Peninsula, Euboeans or other Greek-speaking groups seem hardly involved prior to 800 BC but neither much in subsequent centuries. These far later Greek settlements in Spain are even labelled by Rouillard *'Hispanic emporia'*; small, modest settlements with a limited number of Greek-speaking inhabitants [66]. To phrase it differently, Iron Age archaeology of the Iberian Peninsula is so far less affected by a

[62] Snodgrass stage 3; Nijboer 2011a.
[63] Cf. Neville 2007.
[64] Vilaça 2006; 2013.
[65] Vilaça 2006; 2013.
[66] Rouillard 2009.

Hellenocentric bias than that of the Italian Peninsula. This might account for the academic rift between Italy and Spain/Portugal when it comes to classical archaeology for which Greek and Latin speaking groups are leading. Especially Etruscologists highlight mainly links between Etruria and Greek-speaking groups even after the rise of Rome around 400 BC[67]. Much of the western Mediterranean is usually left out in Classics before its Roman conquest. This results in unsustainable positions; while Phoenicians went to the far West by at least the 10th century BC their presence in Italy is still referred to as an 8th century BC affair. Going from Lebanon to the Atlantic Ocean, they would have had to make an effort not to land on Sicily, Sardinia or the mainland Italy. It is moreover contradicted by the Villanovan and Nuragic ceramics found in the past decade at Huelva and at Utica (see above) or by early Phoenician/Levantine finds at Sant' Imbenia in the NW of Sardinia, Torre Galli and Castel di Decima on the Tyrrhenian coast of Italy. I suggest for the archaeology of Etruria and Early Rome a slight shift towards the Western Mediterranean, to which it geographically belongs. This would however necessitate a somewhat different academic curriculum in pre-Roman Classics by incorporating other parts of the Mediterranean besides Greece and Etruria. A motivating article published by Mielke and Torres Ortiz in 2012 reflects well the different attitude between both Peninsulas to the early Iron Age. They wrote a comprehensive paper on the transfer of technological knowledge to the Iberian Peninsula in the context of Levantine-Phoenician contacts during the Iron Age. The article does not just examine the early adoption of iron but also later innovations in pottery production and architecture that could easily include the Italian Peninsula by examining, for example, the gold granulation technique, the widespread *impasto rosso* ceramic tradition or the architecture of Building β at Tarquinia.

Figure 6 summarizes the data on early iron in Spain/Portugal, differentiating between the 11-9th century BC, or the prospecting phase, and the period after ca. 800 BC when some small Phoenician, permanent settlements emerged in south and south-west Spain. The finds record that the use of iron in large parts of Spain/Portugal predates the foundation of these permanent settlements. It is however a debate to what extend iron was locally worked, apart from the trading and manufacturing centre Huelva[68]. The majority of the iron artefacts of the 11th – 9th century BC are knives and other small tools found in settlement contexts. Neither these nor other early iron artefacts document local/regional types, characteristic for the Iberian Peninsula. In addition, the number of iron artefacts is limited when compared to the data on ironworking of the 8th and 7th century BC. Thus for the Iberian Peninsula it remains an option that during the 11th – 9th century BC iron itself was imported from overseas or worked at Huelva and possibly a few other temporary, small, indigenous-Phoenician trading sites along the coast. Subsequently the finished iron/steel artefacts were transported to the interior employing the local overland network of settlements. This would conform to the model by Kaufmann and her co-authors[69] who wrote that the consumption of iron *"prestige objects"* is not based on local smiting during the 11th – 9th centuries BC. Trade in iron artefacts is recorded between Phoenicians and indigenous groups during this period but not the transfer of technological know-how. This can not be contradicted though I consider it a minimal position, as indicated by Mielke and Torres Ortiz[70]. In general, metal artefacts are less common in settlements, which form the bulk of the archaeological contexts with early iron on the Iberian Peninsula for the 10th and 9th century BC. This is in contrast to early iron on the Italian Peninsula, where tombs are dominant. The fact that the majority of finds concern knives and some other small tools indicates that Snodgrass stage 2 had emerged on the Iberian Peninsula by the 10-9th century BC since iron/steel utensils started to replace those of a copper-alloy. In addition a variety of iron tools/artifacts were excavated in a normal hut at El Berrueco (Salamanca) while at Outeiro dos Castellos de Beijós (Carregal do Sal) and at Peña Negra de Crevillente (Alicante) iron tools were found in a hut with evidence for bronze-working[71]. Furthermore Vilaça mentions the existence of early bimetallic artifacts of copper-alloy and iron,

67 Nijboer 2015.
68 González de Canales Cerisola et al. 2004; 2006; Nijboer – van der Plicht 2006.
69 Kaufman et al 2016; see above.
70 Mielke – Torres Ortiz 2012.
71 Mielke – Torres Ortiz in 2012.

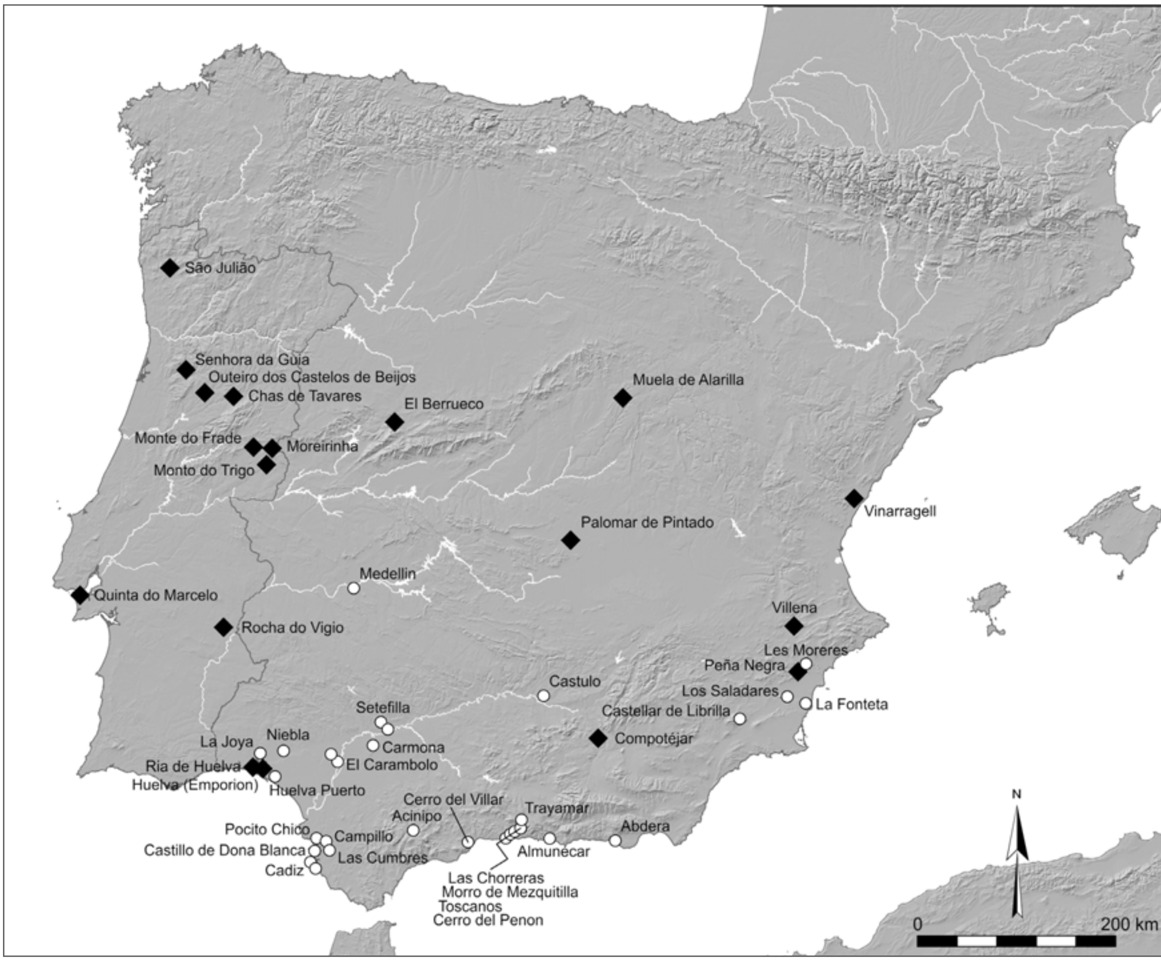

Fig. 6: Early iron on the Iberian peninsula, mainly from settlements
1. Black symbol; prospecting phase (11th – 9th century BC) iron finds and production only at Huelva and
2. White dots; colonial iron production + iron finds (late 9th – 7th century BC).

which indicates that iron was worked in combination with copper-alloys from the 11th century BC onwards[72].

Based on the distribution of early iron tools on the Iberian Peninsula, the near lack of iron ornaments and on account of the fact that the sharper cutting edges of iron/steel tools were acknowledged and valued due to the high proportion of iron/steel knives recorded, it is reconstructed that Snodgrass stage 2 definitely existed in its southern part during the 9th century BC. It is open to debate to what extend the technological know-how of ironworking spread across the peninsula. Iron-working in Spain/Portugal was originally triggered by contacts with the Levant. The radiocarbon dates, associated with the refuse of iron-smiting at the emporium of Huelva, centring around 2755 ± 15 BP (calibrated 930-830 BC; 94% probability[73]), documents that iron was worked in SW-Spain from the late 10th century BC onwards. However, the context indicates that this early processing of iron might have been controlled by Phoenicians. Nonetheless it seems improbable that Phoenicians and indigenous groups were parted strictly during these early encounters. Snodgrass stage 3 emerged from the 8th century BC onwards though it seems to progress slower than on the Italian Peninsula because urbanisation rates in Spain/Portugal appear to linger.

Epilogue

Snodgrass stage 2 or the rise of the structural, generic use of iron as reflected in knives and other tools/weapons with sharp cutting edges is recorded for both the Italian Peninsula and Spain/Portugal from the 10th century BC onwards. The evidence from Italy is for some sites more encompassing since weapons and ornaments

72 Vilaça 2013.

73 Nijboer – van der Plicht 2006.

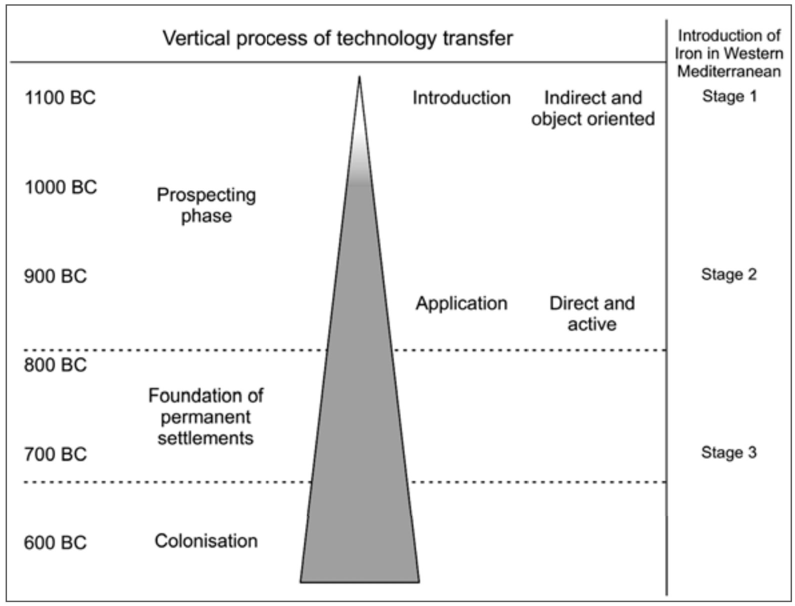

Fig. 7: Schematic representation of the introduction of iron in the Western Mediterranean.

are almost absent on the Iberian Peninsula but this might be due to the different archaeological contexts involved; intentional deposition in tombs versus the often accidental preservation of metals in settlements.

For both regions the chronology and character of stage 1 is somewhat elusive because there are no evident, consistent data that record mainly the production of iron ornaments and luxury items. However the limited evidence for the more lengthy stage 1 is common for many regions partially on account of their novelty, corrosion rate and/or reuse of valuable scrap iron. Stage 2 of Snodgrass' scheme definitely existed by the 9th century BC on both Peninsulas and its relatively sudden appearance points to Phoenician involvement since they crossed the whole Mediterranean at least from the 10th century BC onwards.

Stage 3 emerged in the 8th century BC. During this stage iron/steel weapons and tools gradually superseded those of copper-alloys. It is accompanied by a considerable devaluation of the metal iron. Stage 3 is documented in certain regions of Italy around 800 BC while in Spain/Portugal the transition from stage 2 to 3 appears to have been lengthier since it seems that iron-smelting and working emerged later in the local, inland settlements. Nonetheless for both peninsulas the 8th century BC is crucial in quantitative terms. In Spain this seems to be triggered by the foundation of permanent Phoenician settlements along its southern coast (Figure 6). In Italy the 8th century BC is decisive due to the considerable growth of the Villanovan and other indigenous settlements. Permanent settlements by various Greek-speaking groups from overseas, emerged on some locations in the south of Italy from 750/725 BC onwards. The evidence from the Latin centre *Satricum* corresponds well with that of the eastern Mediterranean since its oldest votive deposit of the 8th to 6th centuries BC contains a large variety of iron objects documenting Snodgrass stage 3 [74].

Taking into account the above considerations, the three stages of the introduction of iron are schematically represented in Fig. 7. The process of technology transfer is labelled vertical because it is based on the premise that contacts with other cultures, especially with the various mercantile city-states in present Lebanon, were instrumental for the advance in the use of iron in the western Mediterranean. Nonetheless this argument is more apparent for Spain/Portugal than for Italy where ironworking was adopted swiftly by various indigenous communities; see, for example, the data from Fossa presented above.

A main difference between both peninsulas is the North-South dichotomy that looks far more pronounced in Spain than it is for Italy. Apart from Etruria where it surfaced during the 10th century BC, the Iron Age in Northern Italy definitely emerged during the 9th century BC. It seems that iron was much later introduced in Northern Spain. This is also reflected in alterations of the ceramic craft from ca. 800 BC onwards. While in a number of coastal regions of Italy evidence for the fast potter's wheel and advanced kilns is available from ca. 800 BC onwards with a speedy transition from imports to local imitations (Fig. 8), Mielke an Torres Ortiz reconstruct this process as emerging in the south – south-west of Spain during the 8th century BC gradually expanding to central Spain by the 6th/5th century BC [75].

[74] Nijboer 1998, Figs. 50 to 56; Abbingh – Nijboer 2014.

[75] Mielke – Torres Ortiz 2012.

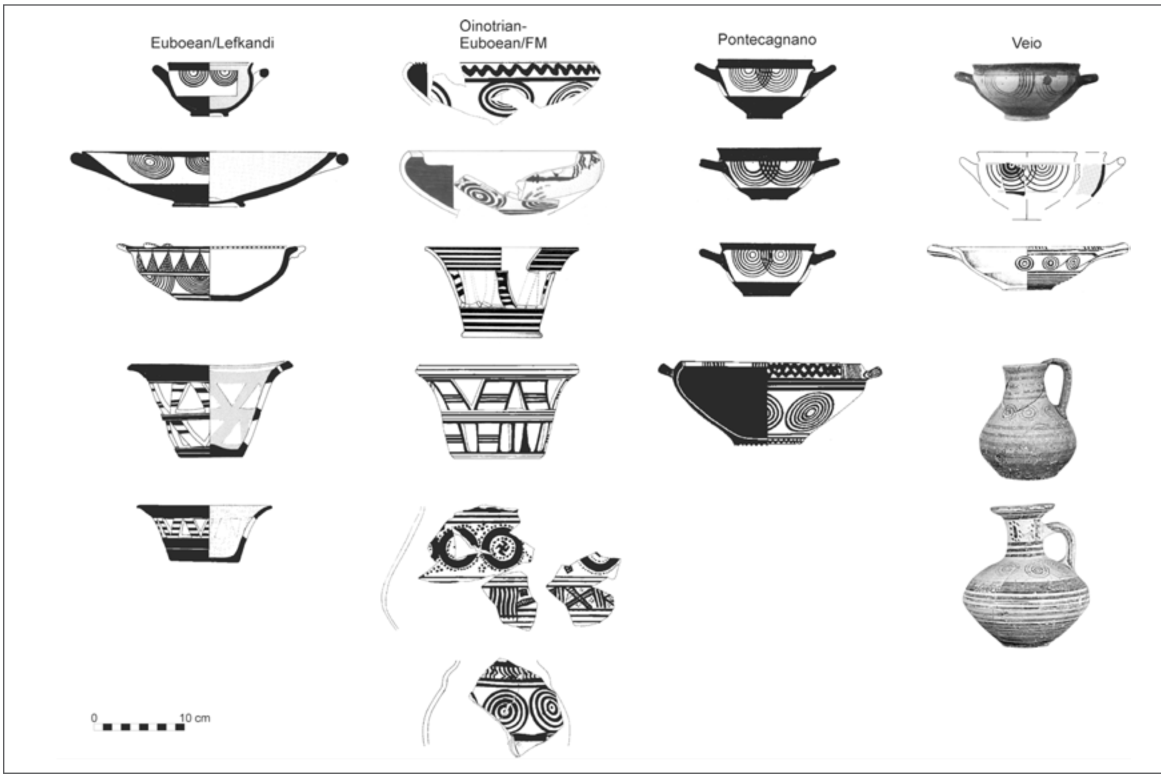

Fig. 8: Some Euboean and locally produced ceramics of the late 9th–8th century BC from Lefkandi and Italy (FM: Francavilla Marittima; Pontecagnano and Veio). Note that comparable Euboean ceramics were found at Huelva, South-West Spain, in a context that abounds in local and Phoenician ceramics (González de Canales Cerisola et al. 2004, 86–94).

As mentioned, the transition towards Snodgrass stage 2 in the western Mediterranean is assigned to 10th century BC and definitely existed during the 9th century BC. It involved direct technological transfer based on personal, hands-on contacts that existed during the prospecting phase with Phoenicians, who crossed the whole Mediterranean ca. 5 to 6 generations prior to their establishments of permanent overseas settlements around 800 BC. Technological transmission is assumed due to the specific know-how of the *chaine-opératoire* from iron-bloom to a tool/weapon that combines hard, sharp edges with malleability. This requires expert craftsmanship and detailed understanding. Combined with the fact that on both Peninsulas stage 2 emerged during the 10th century BC since the qualities of iron/steel knives were evidently valued, it is probable that transfer of iron utensils and know-how was involved that came originally from the Levant.

In Italy, the Phoenicians were joined by the Euboeans from ca. 800 BC onwards. They applied initially a comparable, cooperative mode of contact with indigenous groups as the Phoenicians had, which can be detected in the adoption of the Euboean alphabet or by the technological transfer in the ceramic craft. In Italy, the transmission of Euboean know-how in the production chain of table-wares is mainly visible in ceramics from ca. 800 BC onwards as recorded in Figure 8, illustrating Euboean ceramics, their imports and Italic imitations as well as adaptations revealing a mix of indigenous vessel forms with imported decorative schemes or the other way around as well as native decorative schemes or production modes with Euboean/Greek vessel forms [76]. It might be difficult to imagine such constructive living together revealing integration during the 10th till 7th century BC, but an example could suffice. Indigenous, Italic *fibulae* were produced in the smithy excavated at Pithekoussai [77]. A recent network analysis of the finds at Pithekoussai corresponds with the co-existence of several groups and not with Euboean/Corinthian hegemony from

[76] Kleibrink 2006; Attema 2012; Jacobsen 2007; Jacobsen – Handberg 2012; Jacobsen et al. 2008/09; Mittica 2010; Nijboer 2011b; Fasanella Masci 2016.

[77] Buchner 1983; Zimmer 1990; Nijboer 1998.

the beginning [78]. In the early Phoenician settlements, such as Utica in Tunis and the *emporium* Huelva in south-west Spain on the Atlantic, the material assemblages document as well a cooperative system. From the onset, prospecting and early colonization appear to have been associated with guest banquets as reflected in the finds at Utica [79]. Homer made Odysseus say that civilization was characterised by hospitality to foreigners and a Pantheon that was feared [80]. Evidently not just Greek-speaking groups were hospitable or civilized. In archaeology, cordiality materialized in communal banquets. These meals, often in an elite setting, accommodated much of the passing down of concepts, culture as well as technological know-how. In such a setting the coastal Classical Mediterranean world emerged during the period 1000-500 BC. Colonization, in terms of appropriation of agricultural land, surfaced after 800 BC and was a lengthier process. On and of, it will have led to less constructive encounters between indigenous groups and settlers from overseas.

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[78] Donnellan 2016.
[79] Cardoso et al 2016; López Castro et al 2016.
[80] Homer, Odyssey 9, 174–176.

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Fig. 1: Adapted from Betelli – Damiani 2005; Almagro-Gorbea 1996.
Fig. 2: Adopted from Vilaça – Cunha 2005.
Fig. 3: After: Pacciarelli 1999.
Fig. 4: After: Cosentino et al. 2001.
Fig. 5: After: Trucco et al. 2005.
Fig. 6: Adapted from: Mielke – Torres Ortiz 2012.
Fig. 7: Adapted from: Mielke – Torres Ortiz 2012.
Fig. 8: compiled from Popham et al. 1979-80; Popham – Lemos 1996; Jacobsen 2007; Mitica 2006-7; Kourou 2005; Boitani 2005; Berardinetti – Drago 1997; Buranelli et al. 1997 and Toms 1997.

Table 1: After: Cronyn 1990, table 5.1, p. 177.
Table 2: Table by author based on Nijboer 1998; Moesta 1983; Moorey 1994; Crew 1991; Tylecote et al. 1971; Cleere 1970.
Table 3: After: Pacciarelli, 1999.
Table 4: After: Cosentino et al. 2001; 2004.