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Agriculture at the Phoenician site of La Fonteta (Alicante, Spain)

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Abstract
The Phoenician settlement of La Fonteta (Alicante, Spain) was founded in the late 8th cent BC at the mouth of the Río Segura. It has provided one of the most complete archaeobotanical records of all Phoenician Mediterranean sites which points to an agricultural system based on cultivating cereals, pulses and a wide variety of fruits such as grape, fig and pomegranate. These crops then spread to the surrounding indigenous settlements. Apart from integrating new crops, these local and regional indigenous sites progressively began to take part in a Mediterranean-wide network characterised particularly by trade in agricultural produce. The agricultural system of La Fonteta was not new to the Iberian Peninsula, as there is evidence that it arrived earlier at Phoenician colonies along its Mediterranean coastline. One of the most relevant aspects of the archaeobotanical record from La Fonteta is that it represents crafts there, as a large part of the remains correspond to plants which were burnt as fuel in its numerous metal working furnaces.

Keywords Phoenician colonisation · Archaeobotany · Iberian Peninsula · Iron Age

Introduction

The presence of Phoenician colonies along the western coastline of the Mediterranean (Aubet 2001, 2009; Botto 2014, 2018; Prados Martínez and Sala Sellés 2017) had a profound effect on the indigenous communities in southern and eastern Iberia, which led to a new economic and social order for both the local indigenous and eastern colonial populations.

The various indigenous groups living in this area of the Mediterranean originally had an agricultural tradition rooted in the Neolithic ways of cultivating annual crops of cereals, pulses and oil plants, a scheme that endured without major alterations in the western Mediterranean. However the Middle East underwent a secondary agricultural revolution during the 5th−3rd millennia BC resulting in major advances in fruit growing (Zohary and Spiegel-Roy 1975; Zohary et al. 2012; Abbo et al. 2015; Weiss 2015). This development was often linked to complex social transformations resulting in the beginning of cities and trade in agricultural products (McCorriston 2009; Marston 2017; Fuller and Stevens 2019).

Phoenician and Greek colonial enclaves began to appear in the western Mediterranean at the beginning of the 1st millennium cal BC, dotting the coastlines of North Africa, southern Italy, Sicily, Sardinia and Iberia before moving up to the south of France. The Phoenicians and Greeks, who were in contact with the various indigenous communities (Dietler 2010; van Dommelen 2012; Broodbank 2013), acted as agents in introducing a new way of farming which brought iron agricultural tools and new plants such as fruit trees with delayed yields, meaning that they could only be harvested after a number of years. However, the current view of this change is certainly distorted, as it is mostly based on archaeobotanical evidence from indigenous settlements

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and not from the Phoenician colonial enclaves themselves (Kroll 1993; Chamorro 1994; Català 1999; van Zeist et al. 2001; Montes Moya et al. 2015; Moricca et al. 2021) or from the Greek world (Buxó 1999; Bouby and Marinval 2000; Bouby 2014).

Historiography (Bondi 1995; Aubet 2001) has attempted to trace the Phoenician expansion throughout the western Mediterranean based on their search for metals. However, their pursuit of mining areas did not preclude an interest in agriculture, livestock and fishing (Alvar and González Wagner 1988; Aubet 2017). Moreover, there is evidence that the Phoenician colonists did not farm exclusively to feed themselves, but also to grow surplus produce to trade throughout both the eastern (Orendi and Deckers 2018; Schmitt et al. 2018; Orsingher et al. 2020) and western Mediterranean (Pérez-Jordà et al. 2021a).

Phoenician agriculture in the eastern Mediterranean (Badura et al. 2016; Orendi and Deckers 2018) was based on growing various cereals such as *Hordeum vulgare* (hulled barley), *Triticum aestivum-durum* (naked wheat) and *T. turgidum* ssp. *dicoccum* (emmer), as well as pulses such as *Cicer arietinum* (chickpea), *Lens culinaris* (lentil), *Vicia faba* (broad bean), *V. ervilia* (bitter vetch), *V. sativa* (common vetch) and *Pisum sativum* (pea). Fruits such as *Punica granatum* (pomegranate), *Vitis vinifera* (grape), *Olea europaea* (olive) and *Ficus carica* (fig) were also grown along with other crops, notably *Linum usitatissimum* (flax) and *Coriandrum sativum* (coriander). Furthermore, certain crops, in spite of being mentioned in biblical texts (Borowski 1987; Jensen 2012), have yet to be identified archaeologically in the Phoenicia region. These include *Panicum miliaceum* (broomcorn millet), *Setaria italica* (foxtail millet), *Prunus dulcis* (almond) and *Pistacia vera* (pistachio). Another Phoenician species is *Phoenix dactylifera* (date palm), evidenced only as charcoal from the site of Tel Kabri (Liphschitz 2002).

Archaeobotanical research indicates that new crops of oriental origin arrived at the end of the 2nd millennium cal BC to Sardinia (Sabato et al. 2015) and at the beginning of the 1st millennium cal BC along the coastlines of Tunisia (Kroll 1993; van Zeist et al. 2001; Montes Moya et al. 2015; López and Cantero 2016), the island of Motya, west of Sicily (Moricca et al. 2021), the south of the Iberian Peninsula (Pérez-Jordà et al. 2021b) and the Atlantic coast of Morocco (Pérez-Jordà 2001, 2005). The growing of new fruits, vine, olive, almond, pomegranate and *Morus* sp. (mulberry), as well as the vegetables and spices *Cucumis melo* (melon), *Foeniculum vulgare* (fennel) and coriander represented a change from the agricultural system of the first farmers who had arrived four millennia earlier.

The archaeobotanical finds from La Fonteta therefore serve to shed light on the agricultural economy of a Phoenician community based at the mouth of the Río Segura in the 8th century (c.) BC that endured until the final decades of the 6th c.BC (Rouillard et al. 2007; González Prats 2011; Prats 2014a, b; Lorrio Alvarado et al. 2021). This study also draws attention to the link between the archaeobotanical finds and other activities at the site, notably metal working.

The site of La Fonteta

La Fonteta is located in the Municipality of Guardamar del Segura on the southern border of the Province of Alicante. It today forms part of the dunes along the southern bank of the Río Segura where it flows into the Mediterranean Sea (Fig. 1). The landscape at the beginning of the 1st millennium BC differed greatly from that of today, as the site was then situated on a small promontory dominating the entrance of a bay at the mouth of the Segura. The earliest Phoenician colonisation in Iberia was along its southern and eastern coastlines (Aubet 2001) and La Fonteta represents the northernmost Phoenician presence on the Mediterranean coast. The choice of this geographical setting was deliberate as it was a natural port with access to both the Mediterranean and the interior of Iberia through the Río Segura (Rouillard et al. 2007; Almagro-Gorbea et al. 2021). However, La Fonteta was probably preceded at the start of the 8th c. BC by another Phoenician settlement, Cabezo Pequeño del Estaño which lies about 2 km upriver from the coast (Fig. 1) and which was abandoned around the middle of the 7th c. BC, probably due to silting of the estuary (Prados Martínez et al. 2018).

The site falls within the Thermo-Mediterranean bioclimatic area characterised by a current average rainfall of 271 mm. The area is today completely urbanised. Charcoal analyses suggest a vegetation dominated by *Pinus halepensis*, *P. maritima* and *Olea europaea* with an undergrowth of *Pistacia lentiscus*, *Erica multiflora* and pulses during the first half of the 1st millennium BC. These analyses also detected the presence of riverside vegetation with *Populus/Salix*, *Fraxinus* sp. and *Tamarix* sp. (Grau 2007). Although the strip along the coast was already covered by dunes, the nearby interior plain had extensive arable lands.

The archaeological excavations unearthed a Phoenician settlement capped by medieval Islamic constructions. The first phase of the excavation of the Phoenician levels took place in two different areas of the site between 1996 and 2002 (Fig. 2) and was carried out by A. González Prats and by P. Rouillard respectively (Rouillard et al. 2007; González Prats 2011). It must be noted that sediment samples were only collected in Area 3 which was excavated by P. Rouillard.

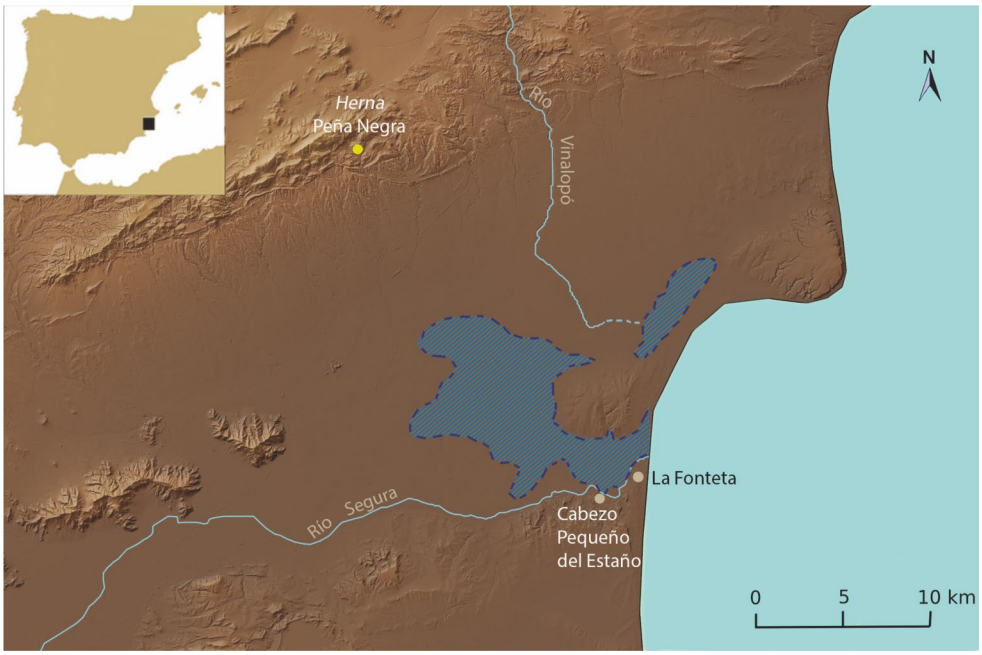

Fig. 1 Map showing the position of the Phoenician settlements of Cabezo Pequeño del Estaño and La Fonteta at the mouth of the Río Segura

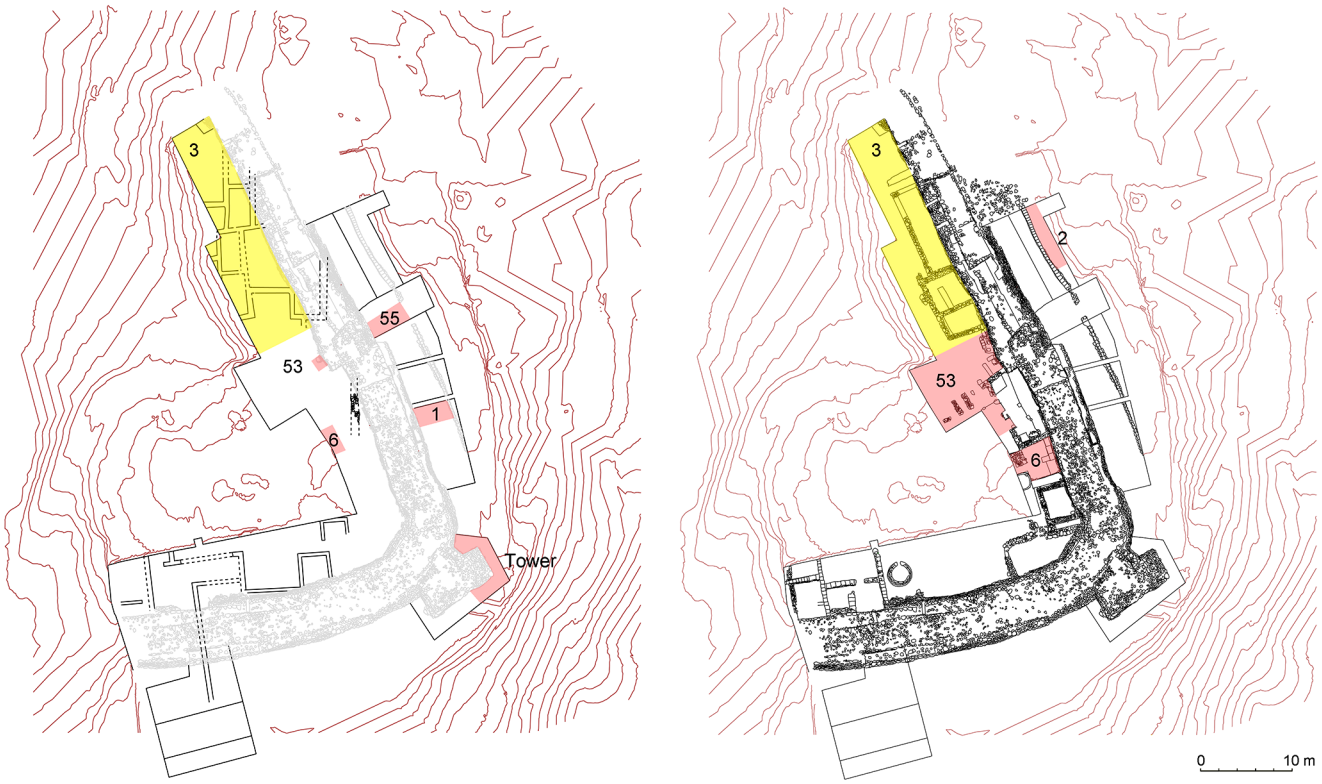

Fig. 2 Plans showing the two main chronological phases at La Fontineta; **a**, Archaic Fonteta; **b**, Recent Fonteta. Samples for archaeobotanical analyses were collected in Area 3 during the campaigns of the 1990s (yellow) and in later work in 2018–2019 (red)

These initial campaigns identified a sequence comprising two major occupations. The earliest, called *Fonteta Arcaica* (Archaic Fonteta) (Fig. 2a), corresponds to the levels preceding the construction of a wall. This early sequence can be sub-divided into three phases (Fonteta I, II and III). The subsequent occupation known as *Fonteta Reciente* (Recent Fonteta) (Fig. 2b) is sub-divided into five phases (Fonteta IV, V, VI, VII and VIII), and includes all features between the construction of the wall and the abandonment of the settlement. Another series of archaeological explorations

were undertaken more recently (2018–19) in a programme to preserve and evaluate both the more recent Phoenician levels, as well as the medieval Islamic structures in the area known as La Rábita.

These latest studies shed new light on the different Phoenician phases. The dating of Phases I and II (Archaic Fonteta), 720–700 BC and 700–650 BC respectively, derives from the study of Phoenician and Greek tableware. These include both Attic SOS amphora sherds and Proto-Corinthian ware from 720–680 BC (Lorrio Alvarado et al. 2021). These dates for Phase I also agree with a radiocarbon date from a fragment of *Stipa tenacissima* (esparto), Beta 298122, 2560 ± 30 cal BP (García Borja and Pérez-Jordà 2012). Phase III, after the first two phases, falls between 650 and 600 BC. Archaic Fonteta covered a larger area than Recent Fonteta (González Prats 2011). Moreover, the excavations of Archaic Fonteta revealed numerous features linked to metal working as well as domestic spaces in Area 3. This combination of domestic and craft activities repeats itself in Recent Fonteta with the first perhaps more important than the second.

The building of the wall in the subsequent phase IV (600/580 BC) enclosing an area of 1.5 ha (Lorrio Alvarado et al. 2021) also involved a complete remodelling of the settlement by dismantling earlier structures. Houses alternating with open spaces were then attached to the inner face of the wall. There then followed a series of remodellings of the spaces before the site was abandoned in 530/520 BC.

The mouth of the Río Segura was also a natural harbour from which to reach the island of Ibiza, a Phoenician enclave known to have served as a hub for routes northward and to Majorca and Minorca. These geographical factors highlight the key role of La Fonteta in a network of an intense commercial traffic routes extending from the north of Valencia and Catalonia to the south of France (Ramon Torres 1995, 2008; Martín et al. 2004; Vives-Ferrándiz Sánchez 2005; Dietler 2010; Py 2012). Proof of this role in trade and craftwork is shown by numerous amphorae imported from other Phoenician settlements in Iberia and elsewhere in the Mediterranean, as well as features linked to the making of a variety of objects, notably metal tools (Rouillard et al. 2007; González Prats 2011; Renzi 2013).

Materials and methods

Soil samples were collected in Area 3 during each of P. Rouillard's excavations in 1996–2002 (Fig. 2, yellow), leading to a first archaeobotanical publication (Pérez-Jordà 2007). However, an even more intense collection took place during the later excavation, preservation and evaluation campaign of 2018–2019 (Fig. 2, red). The current study thus serves to update the archaeobotanical findings from this site by offering an overview based on analyses of all of its samples.

The samples were processed using a flotation device equipped with a 1 mm mesh which yielded remains of fish, animals, snails as well as Egyptian scarab amulets, necklace beads, metal objects and slag. Only a small number of plant remains were collected from the heavy residue, notably mineralised materials, cereals and fruit fragments. The light remains were collected with a mesh of 0.25 mm and identified with a stereoscopic microscope (max. 50×).

Complete seeds and fruits were counted as individuals and also fragments retaining their embryo or, in the case of grapes, those with their peduncle. The quantification process took into account both the numbers of individuals and ubiquities of the taxa (Table 1; Fig. 3). Crop identifications follow the traditional binomial classification system (Zohary et al. 2012), whereas wild plants are named according to *Flora Ibérica* (Castroviejo 1986–2012).

Results

Most of the soil samples were collected from various ancient waste dumps. Unfortunately, none were gathered from Phases IV and V corresponding to the period of the construction of the wall and immediately after. Moreover, the flotation of samples from Phases I and II yielded a far greater number of finds in terms of quantity and volume when compared to the other four phases. Of the 90 samples (7,340 L) from 55 stratigraphic units (SU), 73 yielded seeds and fruits (Table 1) consisting of 2,419 individuals that were identified as 15 cultivated and 31 wild taxa. Although most of the plant finds were charred, certain fruits (fig and pomegranate) were both charred and mineralised.

Most remains were of cereals (Table 1). There is clear evidence of *Hordeum vulgare* (hulled), *Panicum miliaceum*, *Setaria italica*, *Triticum aestivum/durum*, *T. turgidum* ssp. *dicoccum* and *T. monococcum* (einkorn). As many grains could not be identified to species level, they were simply grouped as *Panicum/Setaria* sp. or *T. monococcum*/*dicoccum*.

The variety of cultivated pulses is relatively great despite the small numbers: *Lens culinaris*, *Lathyrus* sp. (vetchlings), *Pisum sativum*, *Vicia sativa* and *V. faba*. Others are also present although it is impossible to define either their species or genus. More frequent are fruit remains, notably *Ficus carica*, *Punica granatum* and *Vitis vinifera*. Oil plants could not be confirmed as the record contained only a single seed of cf. *Linum* sp., presumably flax.

The wild plant assemblage is very varied, consisting mainly of weeds and ruderals. Similarly, there are

Table 1 List of the archaeobotanical finds from La Fonteta by phase of occupation; fragments, rhizomes and unidentified items are not included in the sum of remains

Phase		I	II	III	VI	VII	VIII
Chronology (yrs BC)		725-700	700-650	650-600	580-560	560-530	530-520
Volume (L) / samples (*n*)		1,032 / 11	4,609 / 31	170 / 4	320 / 8	453 / 12	438 / 7
Remains (*n*) / density 10 L^{-1}		315 / 3	1,672 / 3.6	155 / 9.1	210 / 6.6	43 / 0.9	24 / 0.5
No. of cultivated / wild taxa		9 / 13	13 / 25	5 / 13	9 / 12	4 / 11	3 / 5
Cereals	*Hordeum vulgare* (hulled)	109 (29)	542 (231)	13 (160)	7 (11)	(3)	5 (1)
	H. vulgare frag.	3	76		3	1	
	Panicum miliaceum	1	4		5		
	Setaria italica			4	2	2	
	Panicum/Setaria sp.		2	2		1	
	Triticum aestivum-durum	33	140		4	2	2
	T. turgidum ssp. *dicoccum* (cf.)		19 (9)	9	1		
	T. monococcum (spikelet fork)		1 (1)		(1)		
	T. monococcum/dicoccum	2	3				
	Triticum sp.	22	103		1	3	6
	Cerealia (frag.)	57 (22)	29 (132)		(12)	(9)	2 (7)
Legumes	*Lens culinaris* (cf.)	1	19 (3)	4			
	Lathyrus sp.		1				
	Pisum sativum	2	1				
	Vicia faba		1				
	V. sativa		1				
	Vicia/Lathyrus sp.		2				
	Vicia/Pisum sp. cotyledons	5					
	Fabaceae		6				
Fruits	*Ficus carica* (mineralised)	9 (11)	3 (22)	(13)	81	10	
	Punica granatum (mineralised)	1 (1)	4 (1)		1		
	Punica granatum fruit coat frag.		4				
	Vitis vinifera	4	51		1		2
Oil seeds	cf. *Linum* sp.				1		
Fuel plants	*Pinus halepensis* scale (seeds)	2	29 (2)	23			
	Pinus sp. scale (frag.)	(2)	22 (33)			(3)	7 (1)
	Pinus sp. cone		2	1			
	Pistacia lentiscus		283		1	1	
	Juniperus oxycedrus (*Juniperus* sp.)		1 (1)				
	Stipa tenacissima rhizome	518	841				60
Wild plants	*Ajuga* sp. (mineralised)		2				
	Amaranthus sp./*Chenopodium* sp.						1
	Asteraceae		1				
	Avena sp.	3	3				
	Beta vulgaris		1				
	Brassicaceae	1		1		1	
	Bromus sp.				3		
	Calendula sp.	1		4			
	Carex sp.		3		1		
	Cerinthe major			1			
	Chenopodium album		1	5	2		
	Cistus cf. *crispus* fruit		5	1			
	Cistus sp. fruit (frag.)		3 (2)				
	Euphorbiaceae		1				
	Galium sp.	1	3				
	Geranium sp.		2				
	Lolium temulentum		2				
	Lolium sp./*Festuca* sp.	1	28		10	1	
	Malva sp.	2	3	26	1	1	
	Melilotus sp./*Ononis* sp.		1	3	2	1	
	Phalaris sp.	4	5		2	1	
	Plantago sp.			8			
	Poaceae	4	36		1	1	2
	Raphanus raphanistrum		1	1			
	Rosmarinus sp. leaf		2				
	Rubus fruticosus		1				
	Rumex sp.	1	1		1	1	
	Sherardia arvensis		4	2			
	Suaeda sp.	3	1		61	8	1
	Teucrium sp.	1		9			
	Thymelaea sp.	2	3		6	2	1
	Vaccaria pyramidata			1		1	
	Valerianella sp.			11			
	Unidentified (frag.)	7	29 (3)	1 (1)	5	3	

Fig. 3 Graphs indicating the ubiquity (left) and absolute percentages (right) of cultivated plants at La Fonteta over time

a few wild woody plants (*Pinus halepensis*, *Pinus* sp., *Pistacia lentiscus*, *Juniperus oxycedrus*, *Juniperus* sp. (juniper) and rhizomes of *Stipa tenacissima* (esparto grass) grouped under the heading of fuel plants (Table 1; Fig. 4).

Archaic Fonteta Phases I-III, 720–600 BC

The various soil samples were collected from different layers containing organic remains of charcoal, seeds, animal, fish and snail remains, iron working waste, bronze objects, ostrich egg shells, numerous potsherds, etc. The nature of

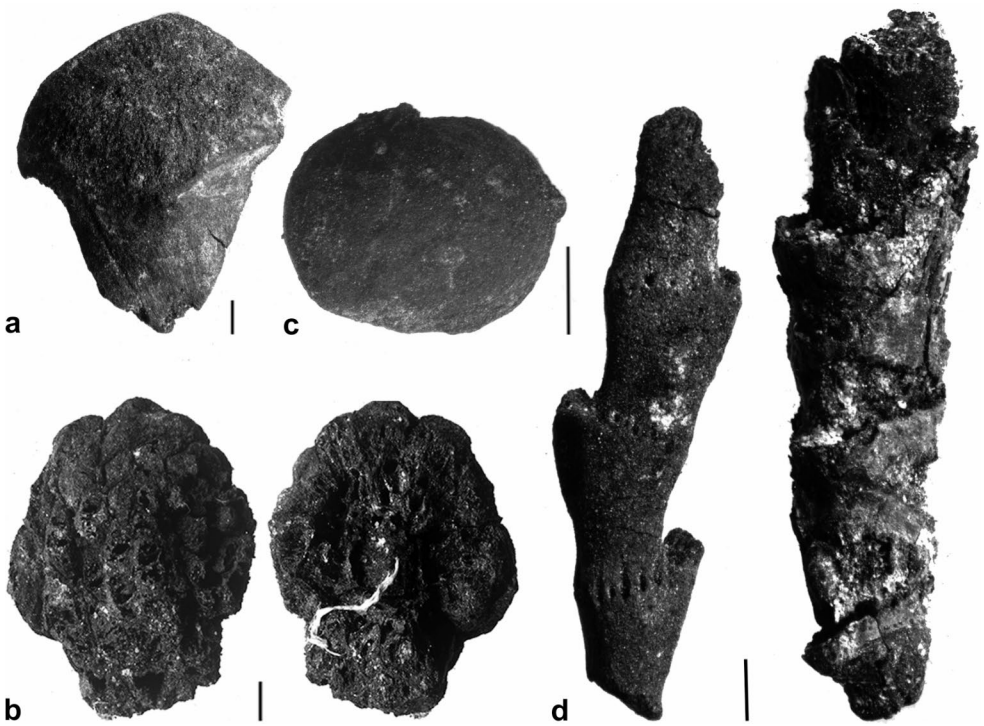

Fig. 4 Photographs of fuel plants, **a** *Pinus halepensis* cone scale, **b** *Pinus* sp. cone, **c** *Pistacia lentiscus* seed, **d** *Stipa tenacissima* rhizome; scale bars = 1 mm

the finds indicates the layers to be accumulations of waste from both domestic activities and craftwork.

Practically all the samples reveal a repetitive pattern marked by the presence of cereals and esparto grass rhizomes (Table 1). The cultivated plants (Fig. 3) are clearly dominated by cereals, notably barley grains. Naked wheat is less common and broomcorn millet, foxtail millet and hulled wheat are rare. These cereals are represented by grains which had been processed for consumption, and only two einkorn spikelet bases were found.

Other taxa such as fruits appear repeatedly, but in much smaller numbers than cereals. The three taxa present since the initial levels, fig, grape and pomegranate, tend to increase over time (Fig. 3). Furthermore, while pulses are limited to the richest contexts, their numbers and ubiquity are always modest. Lentils are the most frequent followed by pea, broad bean and common vetch, which appear to play a minor role.

Wild plants are abundant in certain samples (pine cone scale, *Pistacia lentiscus* seeds, *Cistus* fruits and *Lolium* seeds) and can be divided into several groups. Taxa such as *Pinus* sp., *Pistacia lentiscus*, *Cistus* sp. and *Stipa tenacissima* most likely served as fuel. A second more modest group consists of *Avena*, *Lolium*, *Phalaris* and *Galium* which may have arrived in the settlement with the cereals as they are known to grow as weeds together with crops.

Spatial and chronological analyses of each plant group reveal different distributions. Cultivated plants from Phases I, II and III of Area 3 (Fig. 2a) show values between 30 and 65% which can be linked to domestic structures (Fig. 5a). The percentages for weeds and ruderals are high, whereas fuel plants only appear in single samples. The backfills of the earlier Archaic period (Phase I) systematically reveal a clear dominance of fuel plants and, to a lesser extent, cultivated plants and even fewer weeds (Fig. 5b). This trend partly changed in Phase II with a mixture of different remains, at times dominated either by crops or fuel plants.

Recent Fonteta, Phases IV-VIII, 600–520 BC

The assemblages from the later periods at Fonteta, with the exception of some samples from Phase VI, generally yielded few remains. Cereals are the only crops present in all three phases, with a clear dominance of barley and, to a lesser extent, naked wheat, foxtail millet and emmer. There is no indication of pulse cultivation and the three fruit species (fig, pomegranate and grape) only emerge in Phase VI. Remains of what appear to be flax were found for the first time from this period.

The wild plants differ in this phase. Those used as fuel decrease while weeds are concentrated among specific samples. However, salt tolerant plant taxa such as *Suaeda* sp. and *Thymelaea* sp. are more abundant (Table 1).

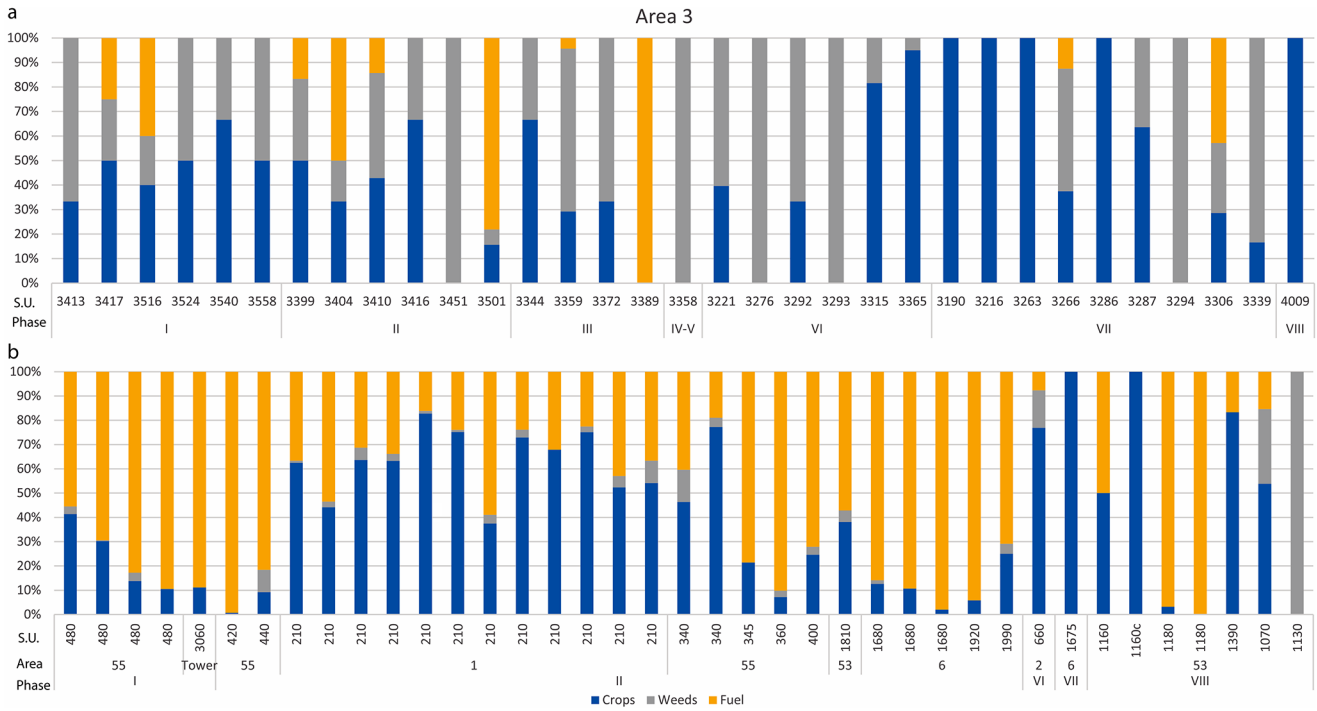

Fig. 5 **a** percentages of cultivated plants, weeds and fuel plants from Area 3, **b** from the 2018–2019 campaigns

Discussion

Domestic and craftwork areas

Since La Fonteta is a settlement with areas sharing both domestic activities and craftwork, context plays a major role when assessing the archaeobotanical material. It is thus essential to define the links between these activities and the remains.

A large part of the samples were collected from fills containing an assortment of plant remains and a wide range of other materials including small mammals, fish, snail and animal remains, pottery, vitreous paste and metalworking remains. These layers are linked to structures such as ovens, basins, furnaces and smithing hearths which were used for refining and working copper, silver, lead and iron (Renzi 2013). Unfortunately, the metallurgical structures unearthed in this area were not sampled. Thus, the waste that could shed light on their use does not come from primary contexts, but nearby dumps.

The presence of combustion structures linked to both craftwork and domestic activities suggests that certain plant remains represented fuel. These include *Pinus* cone scales, *Pistacia lentiscus* seeds, *Rosmarinus* leaves and *Cistus* sp., known to generate short-lived flames. The most common are *Stipa* rhizomes, by-products of the grass used to weave baskets and other items. This group of fuel plants (Table 1; Fig. 4) possibly included other taxa such as *Suaeda* sp. or *Thymelaea* sp. that grew nearby and could have been used as fuel regardless of whether the fire was of artisanal or domestic nature.

There is also evidence of a systematic blend of plant remains linked to fuel with others consumed as food. Differences do nonetheless emerge when comparing the percentages of the cultivated remains, weeds/ruderals and fuel plants (Fig. 5).

La Fonteta is characterised by peculiarities that differentiate it from other sites of the 1st millennium BC in Iberia. Its archaeobotanical record from Phases I, II and III is presumably conditioned by the fact that the samples were collected in an area dominated by metalworking structures, features that outnumber by far domestic structures. The archaeobotanical record of the neighbouring indigenous sites, by contrast, is dominated by cultivated plants (Pérez-Jordà 2013). This prevalence is because most of the samples were collected from inside dwellings or adjoining streets. (González Prats 2011; Renzi 2013). Therefore, the craftwork can explain the particularities of the archaeobotanical record from La Fonteta. Yet one must emphasise that there is no clear division between the domestic and craftwork areas. The features of Area 3 (Fig. 5a) thus appear to have been dwellings. The percentages of crops and weeds are greater than those in the samples from the excavated dumps (Fig. 5b), with perhaps the exception of SU 210. The percentages of crops and even those of weeds among the other samples are low and generally dominated by fuel plants.

Finds from the other areas of the settlement (Fig. 5b) thus appear to highlight the key role of craftwork there. Obviously, the lack of samples from the craft structures themselves complicates this interpretation. However, the archaeobotanical differences between La Fonteta and the other sites from the 1st millennium BC in Iberia support this interpretation, especially when taking into account the presence of metal slag in the same samples. In short, it is possible that craftwork was the most important activity carried out in this part of the site at least until the construction of the wall in about 600 BC.

Agriculture at a Phoenician settlement

La Fonteta is the Phoenician colony with the most complete archaeobotanical record in the Iberian Peninsula. The samples from the other Phoenician settlements such as Ebussus (Pérez-Jordà et al. 2018), Castillo de Doña Blanca (Chamorro 1994), Cerro del Villar (Català 1999), Adra and Villaricos (López Castro 2003; Pérez-Jordà 2013; Pardo Barrionuevo 2015) are so scarce that they are difficult to interpret. More data can be gained from indigenous sites that maintained close ties with the colonies in both Andalusia (Pérez-Jordà et al. 2017) and Valencia (Pérez-Jordà 2013).

The current archaeobotanical record from La Fonteta casts new light on the agricultural activities of its residents. Previous research (Pérez-Jordà 2007) could not confirm fruit growing at La Fonteta until Phase III. The new data reveal this mode of cultivation in Phase I for figs, pomegranates and grapes. This trend began with the adoption of a diversified agricultural model with new fruits and cereals such as millets.

The earliest evidence of a Phoenician presence at the mouth of the Río Segura is probably from the site of Cabezo Pequeño del Estaño, a short distance upstream from La Fonteta (Fig. 1). It was founded before La Fonteta, during the first decades of the 8th c. cal BC (Prados Martínez et al. 2018). As Cabezo Pequeño has no archaeobotanical record, it is not possible to determine if there was any arboriculture in the area before La Fonteta. This leaves open the possibility that fruit growing was a local development. Yet, it must be kept in mind that La Fonteta was engaged in maritime trade of these products as evidenced by the great number of finds of amphorae from the other Phoenician sites in the south of Iberia. In any case, observations at Huelva in southwestern Iberia prove the presence of vineyards as early as the end of the 9th and the 8th c. BC. Other evidence from Huelva supports the hypothesis of the expansion of vineyards throughout the 8th and 7th c. BC (Vera and Echevarría 2013). Therefore, it is reasonable to suggest that the Phoenician type of farming including fruit growing was started at La Fonteta from its earliest phases.

The archaeobotanical data from Phase II reveal no changes from Phase I. Phase III, in contrast, lacks a number of taxa including crops such as pomegranate, pea and millet, which can be explained by the smaller number of samples. It is therefore conceivable that the inhabitants of La Fonteta farmed by mainly growing two cereals, hulled barley and naked wheat, between the late 8th and the middle of the 7th c. BC, accompanied to a lesser extent by others such as hulled wheat, millets and pulses. Furthermore, from the beginning of this period onwards there are large and increasing amounts of fruit (Fig. 3).

Therefore, this new farming system mainly growing cereals and, to a lesser extent, fruits and pulses (Pérez-Jordà 2013) represented a break from the earlier indigenous traditions, and spread relatively rapidly throughout the region of Valencia from ca. 800−500 BC. It is presumably in the7th c. BC that winemaking began in the indigenous settlements, as shown by wineries at Alt de Benimaquia (Denia) (Gómez Bellard et al. 1993).

In this period a number of new fruits (apart from grapes and figs) started to be grown, such as olives and *Malus/Pyrus* (apples or pears) (Pérez-Jordà et al. 2021a). By contrast, pomegranate is only recorded from La Fonteta and its immediate surroundings such as Peña Negra. This suggests that local communities were quick to adopt fruits such as grapes, while the incorporation of others took longer. Moreover, the introduction of millet into the Valencian region appears to have had links to the Phoenician presence there. Recent research points to two routes of entry of this crop into Iberia. The first introduction, dating to around 1300 cal BC, was presumably from France, based on the evidence from sites such as Cova de Punta Farisa (Alonso and Buxó 1995) and Vincamet (Alonso et al. 2006). The Río Ebro appears to be the southernmost border of this route. The second route for millets, from the south, dates from the beginning of the 1st millennium cal BC, from the Phoenician settlements along the coast of Andalusia (Pérez-Jordà et al. 2017) and only reached the region of Valencia later, in the 8th c. cal BC (Alonso and Perez-Jordà 2023).

Recent research has shed new light on the dissimilarities between sites to the south and to the north of the Río Ebro (Fig. 6; Alonso and Pérez-Jordà 2019; Pérez-Jordà et al. 2021a). While the sites to the south of the river reveal a diversity of fruit, those to the north are limited exclusively to grapes and figs. La Fonteta, the northernmost Phoenician site on the Mediterranean coast of Iberia, is the last one with a wide range of fruits. The absence of *Prunus dulcis* (almond) at La Fonteta is the main difference from the assemblages from the south of Andalusia. Further research needs to be done on the area between the Ríos Segura and

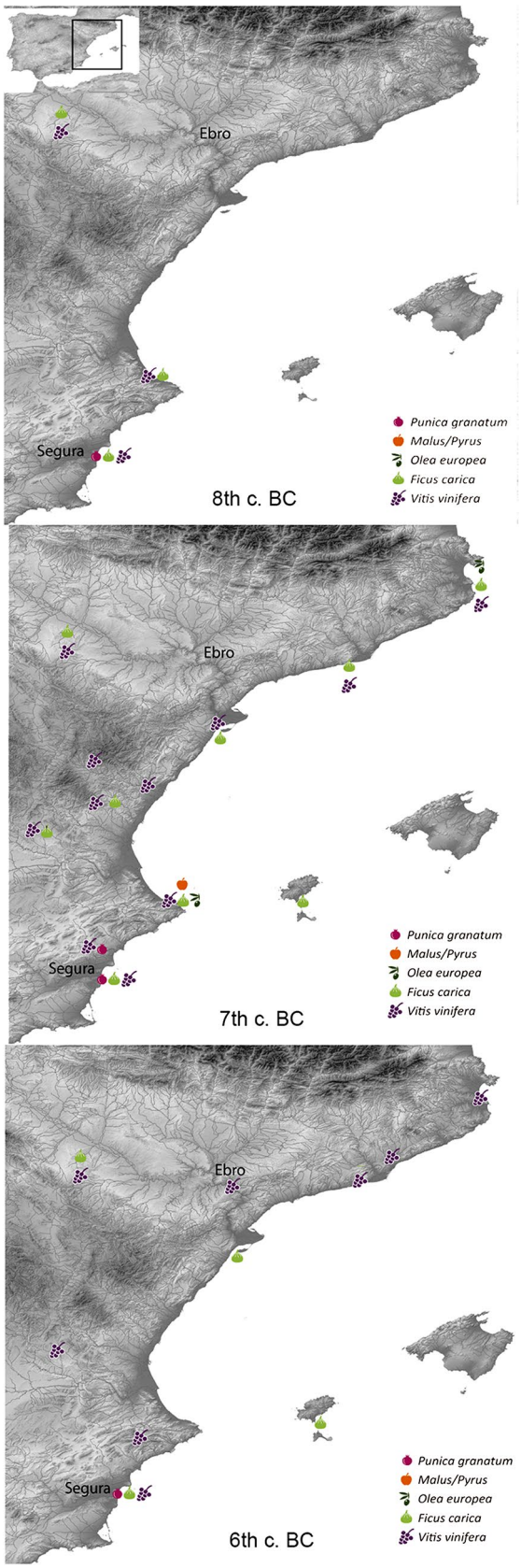

Fig. 6 Distribution of sites with evidence of fruit crops along the Mediterranean coast of Iberia in the 8th, 7th and 6th c. BC

Ebro where there are numerous gaps in information about the northward spread of certain fruit taxa.

The archaeobotanical record of La Fonteta decreases from the end of the 7th c. BC as the number of samples is smaller and only provide information from between 580 and 520 BC. Although this dearth of data leads to problems of interpretation, there is nonetheless no indication of any change during the 6th c. BC, apart from what appears to be evidence of flax.

Data from settlements of the 6th c. BC in the south and east of the Iberian Peninsula suggest that there was a change not only affecting the crops grown, but also what they were grown for. There is evidence for a collapse of a system in which a large proportion of its agricultural production had been for trade. Evidence of land restructuring in Huelva reflects a change from vineyards to fields of annual crops (Vera and Echevarría 2013). A drop in amphora traffic (Ramon Torres 1995) and an abandonment of sites linked to wine making such as Alt de Benimàquia (Gómez Bellard and Guérin 1995) also support the theory of a change in agriculture. The changes at La Fonteta coincide with the construction of a defensive wall and, ultimately, with a modification of the nature of the site itself. However, the change in farming is not reflected in the archaeobotanical record, as the crops remained fundamentally the same. However, other archaeological evidence supports this idea.

A Phoenician type of agriculture?

Contacts between Phoenicians and local people in the south and east of the Iberian Peninsula led the indigenous populations to adopt a new agricultural system. Although sharing many agricultural traditions, these contacts between the two peoples led to the introduction and expansion of a series of new crops. The most obvious was the introduction of fruits that were apparently previously unknown in the area. This contrasts with the case of Sardinia (Sabato et al. 2015) where these taxa arrived earlier, towards the end of the 2nd millennium cal BC. It nonetheless requires more results from future research on sites dating to the end of the 2nd millennium BC to confirm or refute this hypothesis. Similarly, current data also link the Phoenicians with the expansion of millets throughout the south and east of Iberia, where these crops have only been confirmed between the 9th and 7th c. cal BC (Rovira 2007; Pérez-Jordà 2009; Pérez-Jordà et al. 2017, 2018; Alonso and Pérez-Jordà 2023).

Novelties such as *Cucumis melo* (melon) (Pérez-Jordà et al. 2017) appear exclusively from waterlogged samples from the south of Iberia. However, the absence of this species elsewhere can be explained by the fragility of its seeds. Other new elements such as *Morus* sp., *Lupinus albus* (lupin), *Ziziphus* sp. (jujube etc.) and *Foeniculum vulgare*,

although recorded from Phoenician-Punic contexts in Tunisia (Kroll 1993, 2007; van Zeist et al. 2001; López and Cantero 2016), have yet to be identified from Iberia.

Apart from the arrival of new crops, the beginning of the 1st millennium BC saw the integration of some parts of the Iberian Peninsula into a broad Mediterranean system (Broodbank 2013) with agricultural products forming yet another facet of commercial activity. For the first time, and relatively rapidly, different areas in the south and east began to take part in agricultural changes (Alvar and Wagner 1988; Pérez-Jordà et al. 2021a). The new agricultural model was largely growing fruits for their products, represented in the south and east for the most part by *Olea europaea* (oil) and *Vitis vinifera* (wine). The agriculture to the north of the Ebro, by contrast, was mainly on the growing of cereals to trade (Alonso and Pérez-Jordà 2019; Prats et al. 2020). Hence, the presence of the Phoenician colonies and the integration of local populations into participation in Mediterranean trade led to large-scale transformations of traditional agriculture.

However, current research on these issues is plagued by questions regarding the different paths adopted by the colonial and indigenous agricultural systems for these changes in farming and trade. The chronologies are not precise enough to reconstruct the process in detail. The indigenous settlements neighbouring the colonial enclaves appear to have rapidly adopted the new way of farming. Moreover, there is evidence that vine growing spread rapidly, but other fruits more slowly. This led to a process of assimilation of new ways of farming by the local communities apart from incorporating new crops. The differences between the various areas thus appears to fundamentally relate to the proximity of colonial enclaves, shown by a decrease in the variety of fruits at sites both inland and to the north (Pérez-Jordà et al. 2021a), thus away from the areas settled by the Phoenicians (Fig. 6).

Conclusions

The archaeobotanical record of La Fonteta, despite its limitations, is unique to date as it sheds light on the agriculture of Phoenician settlements as it spread along the eastern and southern coast of the Iberian Peninsula. Despite the lack of data from its final phase, it is possible to paint a portrait of a community moving towards a new way of farming based on cultivating a variety of cereals, pulses and fruits. The effects of the Phoenician colony at La Fonteta on the surrounding social environment were thus widespread, as the changes there during the first half of the millennium were reflected not only through material elements such as pottery or dwelling and settlement construction techniques. La Fonteta at the economic level thus played a vital role in spreading an agricultural system throughout the southeastern Iberian coastal areas, based on long distance trade, whose impact extended beyond the abandonment of the site in the last decades of the 6th c. BC.

The archaeobotanical record of La Fonteta was likewise conditioned by intense activity in smelting metals. Apart from remains linked to food, this assemblage clearly shows the collection of plants for fuel in different types of furnaces. The archaeobotanical finds are thus parts of the archaeological record that can yield highly relevant information.

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