



1600 – Kultureller Umbruch im
Schatten des Thera-Ausbruchs?
1600 – Cultural change in
the shadow of the Thera-Eruption?

4. Mitteldeutscher Archäologentag
vom 14. bis 16. Oktober 2011 in Halle (Saale)

Herausgeber Harald Meller, François Bertemes, Hans-Rudolf Bork
und Roberto Risch



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herausgegeben von
Harald Meller,
François Bertemes,
Hans-Rudolf Bork
und Roberto Risch

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Political collapse and social change at the end of El Argar

Vicente Lull, Rafael Micó, Cristina Rihuete Herrada and Roberto Risch

Zusammenfassung

El Argar, eine der politisch und wirtschaftlich am weitest entwickelten Gesellschaften im bronzezeitlichen Europa, brach kurz nach 1600 v. Chr. zusammen. Zu diesem Zeitpunkt wurden alle Siedlungen aufgegeben oder nach neuen architektonischen Prinzipien umstrukturiert. Die strikte Einhaltung der intramuralen Bestattungsriten, die dazu dienten, die Position der Angehörigen der Argar-Gesellschaft nach Geschlecht, Alter und Klasse zu kennzeichnen, verschwinden vollständig. Keramik und andere Aspekte der materiellen Kultur änderten sich in ihrer Form und Struktur als die Subsistenzstrategien plötzlich zunehmend vielfältiger wurden. Interdisziplinäre Forschungen, die während der letzten Jahrzehnte durchgeführt wurden, erlauben eine klarere Darstellung der sozialen sowie ökologischen Ursachen für diese Veränderungen. Eine Schlüsselfrage ist jene nach der Zeitlichkeit der verschiedenen wirtschaftlichen, sozialen und ökologischen Veränderungen. Wandeln sich alle Aspekte der sozialen Struktur gleichzeitig oder ist es möglich, eine Kette von Ereignissen zu beobachten? In diesem Sinne müssen die inneren Veränderungen, die in der Endphase von El Argar auftreten, detailliert analysiert werden.

Summary

El Argar, one of the politically and economically most developed societies in Bronze Age Europe, collapses around 1550 B.C.E. All the settlements are abandoned or restructured according to new architectural principles at this time. Moreover, the strict observance of intramural burial rites, which serve to signify the position of the members of the Argaric society according to sex, age and class, disappear completely. Pottery and other aspects of material culture change in their form and structure as subsistence strategies suddenly become more diversified. Interdisciplinary research carried out during the last decades allows us to make a clearer account of the social as well as environmental causes of these changes. A key question which needs to be addressed is the chronology of the different economic, social and environmental transformations. Where all aspects of the social structure shifting simultaneously or is it possible to observe a chain of events? In this sense, the internal changes occurring during the final moments of El Argar need to be analysed in detail.

El Argar stands as a unique socio-economic and political entity in the west Mediterranean between ca. 2200 cal. B.C.E. and 1550 cal. B.C.E. Archaeologically its most salient features are 1–6 ha hilltop settlements with a variety of stone buildings, including specialised workshops, storage rooms, large water reservoirs and other monumental buildings; as well as a very particular intramural burial ritual, organised along rather strict sex and age and social class divides. During its 650 years of existence, the Argaric society went through a series of changes which led to larger and architecturally more complex urban or proto-urban centres, from where the control over a territory of ca. 33 000 km² was exercised, extending over the whole of the south-east of the Iberian Peninsula. The forces of production as well as the funerary rituals characteristic of the last two centuries of the Argaric period point towards a growing social and economic differentiation, as well as in relation to neighbouring or peripheral regions¹.

Since the excavations of the Belgian engineers H. and L. Siret, El Argar became known for its intramural burial rite

in stone cists, large pottery urns, pits, and so-called *covachas*, artificial caves cut into the bedrock, with one, sometimes two and exceptionally three or more individuals placed within². While similar burial customs are well known from the eastern Mediterranean and the Balkans, they appear somehow as a strange phenomenon in western Europe, including the Iberian Peninsula itself. Equally outstanding are the grave offerings placed in some of these burials, including a rather limited set of metal weapons, tools and ornaments, as well as highly standardised and finely burnished clay vessels, which the Sirets classified according to eight basic shapes (Siret/Siret 1887, Pl. XVIII). Some of these pottery vessels are unknown outside the El Argar territory, such as the chalice shaped cup or goblet (form 7). On the other side, no other Early Bronze Age society in western Europe placed such a high number of copper-based halberds and swords, as well as silver diadems and other ornaments in funerary contexts.

While the highly regular patterns shown by the grave goods associations was already noted by the Sirets, statis-

¹ Based on settlement sequences and absolute chronology rather than on purely typological criteria, El Argar can be divided into at least

three phases. The last phase can be dated around 1750–1550 cal. B.C., according to the available ¹⁴C dates (for a recent summary of

the Argaric archaeological evidence and further references, see Lull et al. 2011).

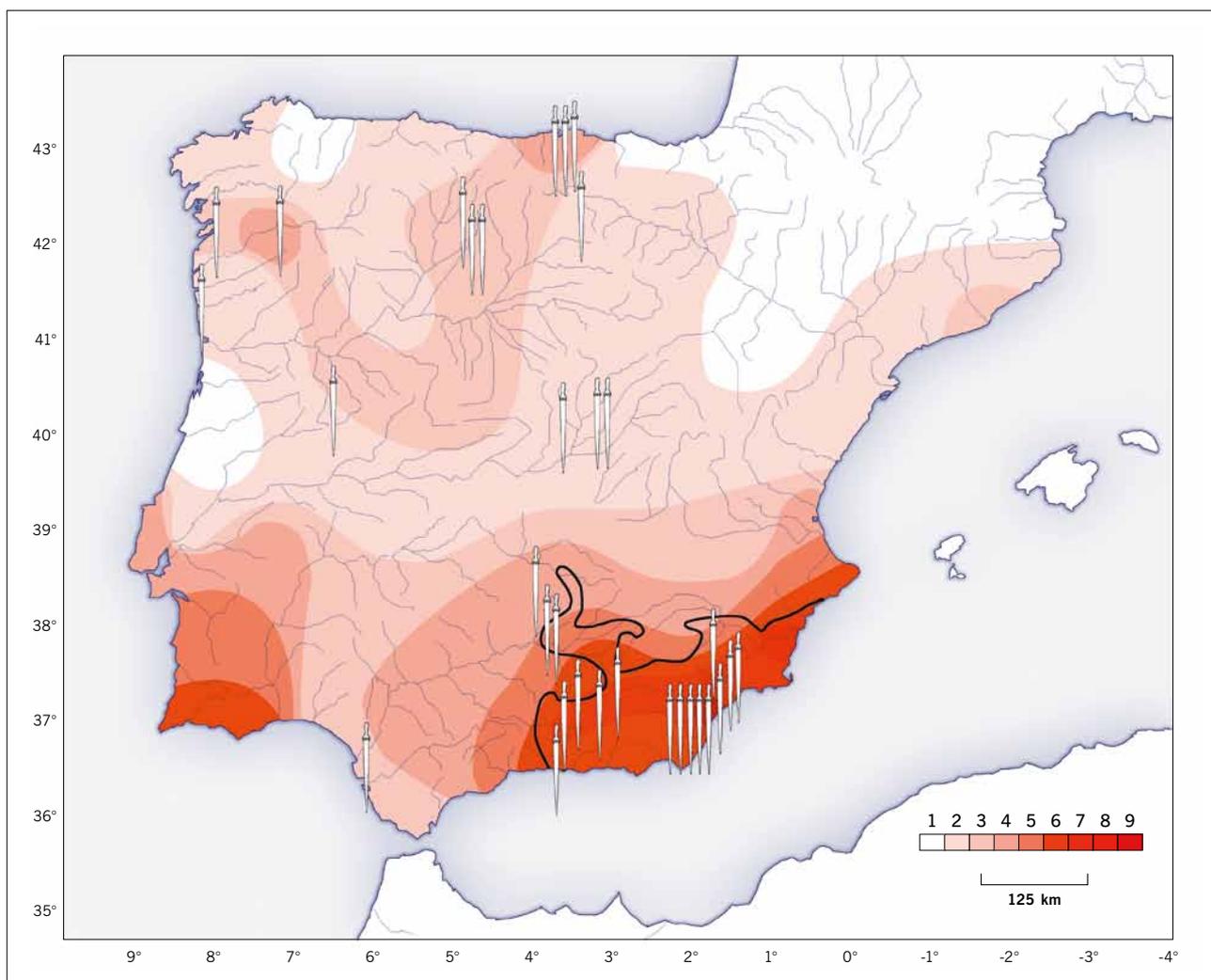


Fig. 1 The maximal expansion of the Argaric territory around 1700 cal. B. C. E., density of riveted artefacts and distribution of swords in the Iberian Peninsula during the Early Bronze Age. The densities increase exponentially between $>1E-5$ and $5E-2$ artefacts per km^2 by province and region.

tical analysis has revealed the social norms underpinning these ritual practices, which made clear distinctions not only between the sexes, but also according to fixed socio-economic positions (Lull/Estévez 1986). Moreover, the analysis of the abundant infant burials strongly suggests that around 1950 cal. B. C. E., these social positions started to become hereditary, supporting the idea that El Argar was the first class society developing in western Europe (Lull/Risch 1995; Lull et al. 2005). The possibility that El Argar developed into a state organisation, with institutionalised mechanisms of surplus production in the hands of a ruling minority, is now also sustained by the economic analyses of the productive forces in a growing number of settlements³.

From the early Argaric times, access to metallurgy seems to have been restricted to certain settlements and social groups⁴. The economic impact of Argaric metallurgy is apparent not just in the spatial distribution of its organisation,

with mining and smelting centres clearly separated from melting and forging workshops, but also, because of that, in the scale of production and consumption⁵. If we consider, for example, the concentration of riveted artefacts (knives, awls, halberds and swords) from the first half of the Iberian Bronze Age, meticulously recorded by D. Brandherm (2003), the Argaric south-east shows a much greater capacity to consume metal products than the rest of the peninsula (Fig. 1). As we move further away from this region (as well as from the south-west, close to the important copper outcrops of Río Tinto and Ossa Morena) the concentration of metal items falls dramatically. Economic distances become even greater if we bear in mind that the bulk of Argaric production dates only from the 19th to 16th century cal. B. C. E. The survival of the use of tanged daggers in northern regions does not substantially alter this impression; rather, it underscores the distancing of these areas in relation to the transformations that

2 Siret/Siret 1887; Lull 1983; Schubart/Ulreich 1991.

3 Risch 1995; Risch 2002; Delgado-Raack 2008.

4 Lull 1983; Lull et al. 2010; Lull et al. 2010a.

5 An indicator of the importance of the production, circulation and use of metal in different societies is the length of its useful life, that is to say, the frequency with which tools, ornaments and weapons for every day tasks

can be replaced. The quicker the replacement of equipment because of wear, accidental loss or voluntary disposal, the bigger the volume of production that was necessary.

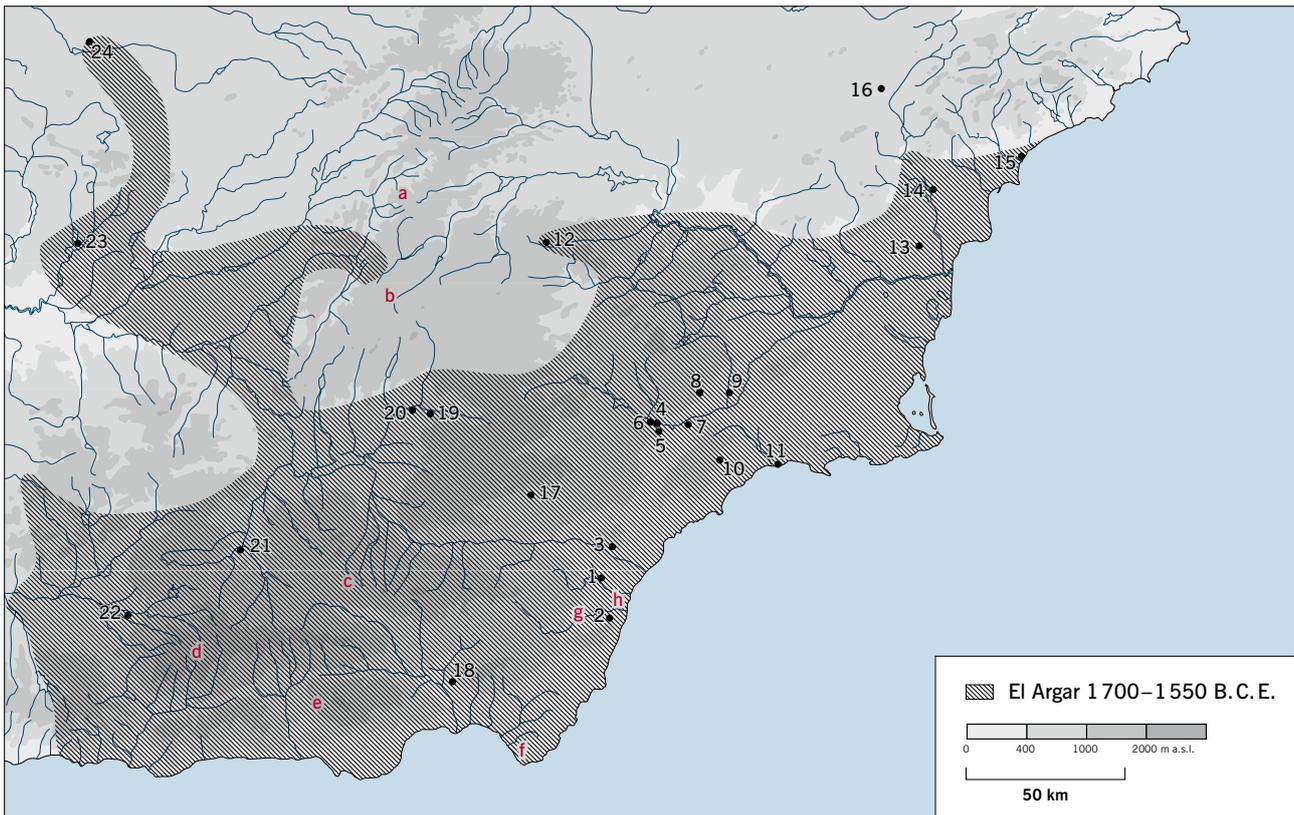


Fig. 2 El Argar settlements and location of pollen profiles mentioned in the text. 1 El Argar; 2 Gatas; 3 Fuente Álamo; 4 Lorca; 5 Los Cipreses; 6 Murviedro; 7 Cerro de las Víboras; 8 La Bastida; 9 Tira del Lienzo; 10 Cabezo Negro; 11 Punta de Gavilanes; 12 Barranco de la Viuda; 13 Cabezo Pardo; 14 Caramoro I; 15 Illeta dels Banyets; 16 Cabezo

Rendondo; 17 El Picacho; 18 Cerro de Enmedio; 19 Cerro de la Virgen; 20 Castellón Alto; 21 Cuesta del Negro; 22 Cerro de la Encina; 23 Peñalosa; 24 Cerro de la Encantada. Pollen profiles: a Siles; b Cañada de la Cruz; c Cañada del Gitano; d Laguna Río Seco; e Berja; f Cabo de Gata; g Aguas T4a; h Cortijo del Campo.

took place in the south-east. The models for the consumption of silver objects across the Iberian Peninsula are very similar to that of copper-based artifacts.

Around 1950 cal. B.C.E., and especially after 1750 cal. B.C.E., the power structures resting on the larger hilltop settlements managed to gain control over cereal production, and possibly textile manufacture. Storage structures, the concentration of large amounts of grinding equipment in certain sites and specialised workshops, the production of grinding tools and looms at a large scale, an increasingly uniform palaeobotanical record dominated by hulled barley, and uniform husbandry strategies, irrespective of local environmental conditions, express the scale of the economic and political control exercised by the dominant classes from this hilltop centres over territories of 100–1000 km² up to several thousand inhabitants. At the same time, common and clearly recognisable ritual practices and aesthetic norms, as expressed in the burial customs and pottery production, from Granada in the west to Alicante in the east, and from Almería at the coast to Ciudad Real in the Spanish Meseta, hints towards a high degree of communication and unification, at least between the ruling classes of the different regions.

In short, El Argar reached a level of economic development that was far higher to that of the rest of the Iberian Peninsula and had a direct influence on its neighbours, a social and productive model from which to defend themselves collectively and, at the same time, something to be emulated by emerging local elites in other regions. Around 1550 cal. B.C.E., this focal point of hegemonic power was eliminated. The burnt levels that seal some prominent Argaric settlements point towards a violent end. While the archaeological analysis of the socio-economic and political relations of the Argaric state has been covered elsewhere⁶, this paper will focus on the end of this particular social organisation. After establishing the temporal scale of this historical break, we will focus on the nature of the late Argaric society taking into account the post-Argaric situation, which must represent to an unknown extent a final product of the first. Another »mirror« of unsustainable social organisations is the environment, as the depletion of natural resources frequently goes hand in hand with social exploitation when surplus production has become the driving economic force. By opposing two social and natural situations, we hope to reach an explanation for the end of El Argar and its possible relation to the wider changes in the Mediterranean.

6 E.g., Castro et al. 1998; Castro et al. 1999; Risch 2002; Lull et al. 2010; Lull et al. 2011.

Establishing the end of El Argar

If we consider the available stratigraphic sequences, the end of the archaeological entity of El Argar is marked by at least three material changes. The most visible aspect is undoubtedly the abandonment of the Argaric intramural burial rite, which in its final phase follows strict norms of age, sex and class differentiation⁷. A second signal is provided by the architectural and economic structures, which are marked by the disappearance of the most monumental constructions in the hilltop settlements and their specialised workshops. Finally, diagnostic pottery types, such as the goblet with foot stand (form 7) and the S shaped vessel (form 4) came to an end; also, other vessel types, such as the carinated ones (form 5), are strongly modified in general morphology. However, these three signals of socio-economic rupture did not occur simultaneously in all settlements of the large Argaric region. In Fuente Álamo (Almería) the most monumental constructions are abandoned some time before the intramural burial rites ceased and a new pottery production begins (Schubart et al. 2001). Regarding the appearance of new decorative styles – the so-called Proto-Cogotas pottery types –, these apparently occurred first in the north-western fringes of the El Argar territory, as findings in the Argaric settlement of Peñalosa (Jaén) have shown (Contreras Cortes et al. 2000).

Once the main archaeological criteria for the end of El Argar have been set, it is possible to approach the temporality of its final downfall. At the moment, around 330 radiocarbon dates are available for El Argar and about 26 dates for

the post-Argaric or Late Bronze Age period, although not all fulfil the necessary contextual and analytical criteria of a reliable result. As the »final event« may not have taken place simultaneously in all settlements and regions in a territory of ca. 33 000 km², the absolute dates of each settlement should be analysed separately. Taking into account that the exact moment of a social, stratigraphic rupture can rarely be determined – except if the »victims« themselves are found – the only possible approach, is to establish the temporality of the last El Argar levels and, where possible, the first post-Argaric ones. As precise contextual information is not always at hand for all ¹⁴C dates, it seems convenient to use only short-lived samples from stratified sites, and/or sequences of dates from individual settlements. In this exercise, we have decided to calculate the final temporality of the 15 dated settlements taking into account the latest dates obtained, preferably, from a short-lived sample, and all the results falling into the previous 50 radiocarbon years⁸.

In view of this information, it can be concluded that not all settlements were occupied until the end of El Argar (Fig. 3; Tab. 1). According to the ¹⁴C dates, three settlements out of 15 were abandoned shortly after ca. 1850–1700 cal. B. C. E. These settlements are either lowland sites (Los Cipreses) or small to medium sized hilltop sites (Castellón Alto, Barranco de la Viuda), probably dependent on other larger centres. If this pattern is confirmed by future investigations, it would imply that the final phase of El Argar started with territorial re-organisation and population movements at an over-regional scale, as the three settlements stray from the present day provinces of Granada to Murcia⁹.

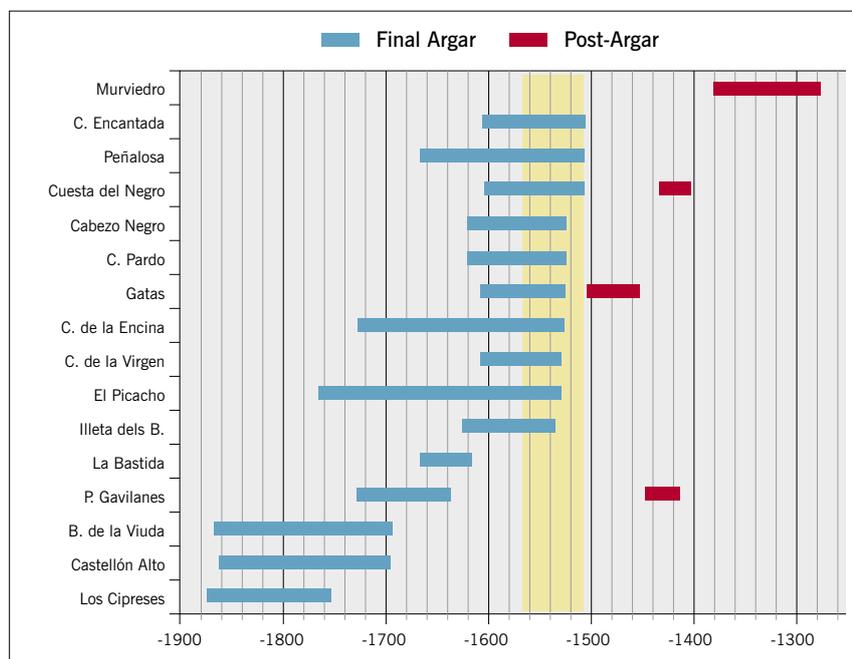


Fig. 3 Averages of the latest ¹⁴C dates of different Argaric settlements and of post-Argaric occupations (using a 1 σ probability range; for the considered ¹⁴C dates see Tab. 1).

Table 1 (right page) ¹⁴C dates used to establish the final occupation of El Argar settlements (dates according to Castro et al. 1996; López Padilla 2009, 257; Martínez/Ponce 1999; García Martínez et al. 2010, Cámara/Molina 2009; Contreras Cortés et al. 2001, 32–35, and unpublished dates from La Bastida). * The dates from the Kiel laboratory measured in the years between 2009 and 2011 are still undergoing a process of revision, due to confirmed technical problems in the processing of the samples. ** Dates Ua-39409 and Ua-39408 obtained from human collagen have been excluded, as they seem to be deviant results. No indicators of the quality of the sample have been published so far.

⁷ The possibility of a marginal continuity of the intramural burial rite has been suggested for Cerro de la Encina (Granada: Aranda et al. 2008, 251). A bone sample from burial 15 dates into the 15th century cal. B. C. E., but the lack of information concerning the quality of the ¹⁴C date does not allow to exclude a possible contamination or

poor preservation of the bone collagen, a situation which is not unusual among the Argaric bone samples. Obviously, we cannot rule out the practice of occasional, sporadic intramural post-Argaric burials.

⁸ For example, if the latest date of a settlement is 1350 B. C. E., the final temporality will

be established considering all available dates falling in the range 1350–1400 B. C. E. ⁹ Cerro de Enmedio (Almería) might be another settlement abandoned around this time, as its pottery production suggests (Schubart 1980). Unfortunately, no systematic excavations were carried out nor ¹⁴C dates obtained from this site.

Settlements	Lab-Numbers	¹⁴ C date (B. P.)	Sum probabilities (1 σ)	Averages (1 σ)
Los Cipreses (Murcia)	KIK-1474/KIA-11225	3475 \pm 30	1878–1749	1875–1754
	KIK-1486/KIA-11235	3475 \pm 30		
	KIK-971/UtC-7937	3490 \pm 30		
	KIK-242/UtC-2738	3510 \pm 90		
Castellón Alto (Granada)	Ua-37887	3425 \pm 40	1872–1691	1863–1695
	Ua-37889	3435 \pm 40		
	Ua-37886	3445 \pm 40		
	Ua-37880	3455 \pm 40		
	Ua-37885	3475 \pm 40		
Barranco de la Viuda (Murcia)	KIA-35570	3465 \pm 35	1872–1686	1767–1693
	KIA-35559	3465 \pm 35		
	KIA-35571	3425 \pm 35		
	KIA-35569	3400 \pm 35		
El Picacho (Almería)	OxA-5050	3390 \pm 65	1867–1536	1766–1530
	CSIC-157	3390 \pm 120		
Cerro de la Encina (Granada)	UGRA-14	3290 \pm 140	1770–1454	1727–1526
	Ly-2656	3350 \pm 100		
	UGRA-116	3360 \pm 150		
Punta de Los Gavilanes (Murcia)	KIA-32357	3370 \pm 40	1734–1629	1728–1637
	KIA-32365	3380 \pm 25		
	KIA-32366	3385 \pm 35		
La Bastida (Murcia)*	KIA-39252	3330 \pm 25	1687–1610	1666–1617
	KIA-39261	3355 \pm 25		
	KIA-40101	3355 \pm 25		
Peñalosa (Jaen)	Beta-16722	3300 \pm 70	1665–1500	
Illeta dels Banyets (Alacant)	Beta-152947	3290 \pm 40	1660–1527	1625–1534
	Beta-236821	3320 \pm 40		
	Beta-236823	3340 \pm 40		
Cerro de la Virgen (Granada)**	Ua-39397	3286 \pm 34	1660–1454	1608–1529
	Ua-39416	3323 \pm 31		
	Ua-39418	3326 \pm 30		
Gatas (Almería)	OxA-3962	3260 \pm 60	1657–1495	1608–1525
	KIK-54/UtC-1436	3280 \pm 60		
	OxA-3964	3285 \pm 60		
	OxA-3966	3300 \pm 60		
	OxA-3963	3310 \pm 60		
Cabezo Negro (Murcia)	KIK-175/UtC-2629	3300 \pm 40	1620–1524	
Cabezo Pardo (Alacant)	Beta-258467	3300 \pm 40	1620–1524	
Cerro de la Encantada (Ciudad Real)	CSIC-426	3250 \pm 50	1616–1495	1606–1502
	CSIC-425	3260 \pm 50		
	CSIC-402	3280 \pm 50		
	CSIC-401	3290 \pm 50		
Cuesta del Negro (Granada)	Ua-39465	3242 \pm 30	1608–1499	1604–1506
	Ua-39491	3254 \pm 33		
	Ua-39462	3275 \pm 30		
	Ua-39494	3276 \pm 34		
	Ua-39466	3281 \pm 30		
	Ua-39492	3287 \pm 32		
	Ua-39489	3288 \pm 34		

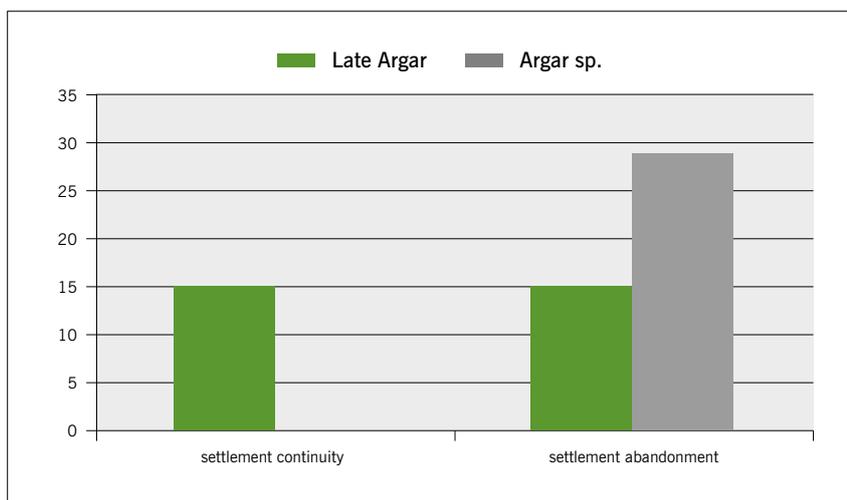


Fig. 4 Rate of settlement continuity or abandonment between the Argaric and the post-Argaric phase. Settlements with a Late Argaric occupation are distinguished from settlements with no precise absolute or relative chronological indicators.

Towards the end of the 17th century two new sites might have been abandoned. One is the over 4 ha large hill settlement of La Bastida (Totana, Murcia) and the second Punta de los Gavilanes (Mazarrón, Murcia), 35 km from the first and one of the few known coastal sites of El Argar. In view of the recent investigations at La Bastida, it seems that Punta de los Gavilanes belonged to the territory controlled by this proto-urban site. This possible interdependency would explain the simultaneous abandonment of both. However, the absolute dating of La Bastida depends at the moment on resolving technical problems encountered by the Kiel Radiocarbon laboratory, which has been responsible for the absolute dating programme of the La Bastida Project between 2009 and 2011.

All other more or less systematically dated domestic and funerary sites were occupied during the 17th and part of the 16th century (Fig. 3). The average final occupation dates of this group of settlements scattered over the whole of the El Argar territory, from Ciudad Real to Alicante, falls between 1606–1516 cal. B. C. E. (considering a 1 σ probability). Additionally, Gatas has provided the oldest well contextualised dates from Post-Argaric occupation layers, immediately covering the final Argaric destruction and abandonment level. According to the sum probability of this ¹⁴C series based on short lived material (seeds and fauna), the first post-Argaric occupation would develop sometime between 1605–1432 cal. B. C. E. The large ¹⁴C data set available for Gatas allows the application of Bayesian statistics in order to define more precisely this Argar – post-Argar transition. If the probability of the terminal limit of El Argar is calculated against the probability of the beginning of the Late Bronze Age, the most probable date for the shift between the two archaeological entities must have occurred sometime around 1550 cal. B. C. E.¹⁰ In the settlement of Fuente Álamo, located ca. 20 km north of Gatas, the Argar –

post-Argar break also occurred sometime between 1600–1550 cal. B. C. E.¹¹ As the ending of the El Argar settlements seems to have been a generalised phenomenon taking place within a time span of a few decades at most, we can conclude that the collapse of this economic and political organisation took place rather abruptly over the whole of south-east Iberia around the mid 16th century B. C. E. The available radiometric data also show that this event was not contemporary to the Thera eruption, which would have occurred ca. 50–70 years earlier (Friedrich in the present volume).

Settlement continuity or discontinuity

One important aspect which requires closer investigation is the abandonment rate of the El Argar settlements. Again, the number of stratigraphic sequences is crucial in order to determine how many of the Late Argaric sites continued to be inhabited after ca. 1550 cal. B. C. E. If we begin by considering only settlements with evidence of an occupation during the 18th–16th centuries B. C. E., coming either from ¹⁴C dates or from typological and stratigraphic criteria, it appears that half of the settlements were abandoned and not reoccupied in the post-Argar period (Fig. 4). Among those which continued to be inhabited, only Gatas, Fuente Álamo and Cuesta del Negro have dated post-Argaric levels. While the settled space of the first two was restructured immediately or shortly after the destruction of the last Argaric habitat, available ¹⁴C dates suggest that Cuesta del Negro (Granada) was reoccupied after a hiatus of 50–100 years¹². The only Late Bronze Age date from Punta de los Gavilanes (Murcia) points in a similar direction¹³. The post-Argaric site of Murviedro (Murcia) cannot be considered either as a continuation of the neighbouring settlement of Lorca, which was one of the main social and political centres of El Argar¹⁴. In this

¹⁰ Bayesian statistics has been carried out with BCal.: <http://bcal.sheffield.ac.uk> (Buck et al. 1999).

¹¹ A more refined chronological analysis is not possible here as mainly large charcoal samples were dated, some of which seem to come from re-deposited contexts (Pingel 2001a; Schuhmacher 2003, 56 ff.).

¹² According to the sum probability of the three available ¹⁴C dates (GrN-7284, GrN-7285, BM-2542) the post-Argaric occupation of Cuesta del Negro ranges between 1495 and 1386 cal. B. C. E. However, it must be taken into account that the two early dates correspond to charcoal samples, while the date obtained from cereal (GrN-7284)

is significantly younger.

¹³ KIA-32364: 1452–1409 cal. B. C. E.

¹⁴ The sum probability of the two dates obtained from faunal material (KIK-3945/KIA-29173, KIK-3944/KIA-29172) places the occupation span of Murviedro to ca. 1400–1300 cal. B. C. E.

sense, it cannot be simply assumed that all settlements or regions with a Late Argaric – post-Argaric sequence were inhabited without interruption in the second half of the 16th and the beginning of the 15th century B. C. E. (Fig. 4).

In most cases, reliable chrono-typological evidence is only available for the large hilltop sites, as they tend to be the main target of archaeological explorations. If the non-systematically excavated or only surveyed settlements and, hence, mainly lowland and hilltop sites of less than 1 ha in surface area are included in this discussion, the abandonment rate reaches 100 % (Fig. 4). This contrast between the larger and better explored settlements would imply that the collapse of El Argar was experienced more severely by the smaller communities, which would have represented the dependent population in the late Argaric economic and political organisation. If their geographical position was the result of a territorial wide social exploitation, the disappearance of the political superstructure offered the possibility to migrate and to choose new places and forms of residence.

Considering that at least 50 % of the large settlements were abandoned too, either completely or temporary, the end of El Argar must have triggered off a migratory event at a scale that was unseen during the previous 600 years. Only a small number of sites, generally among the larger Argaric centres, continued to exist during the Late Bronze Age after undertaking notorious architectural and economic changes as we will see next. How far this migration implied demographic loss for southeast Iberia is difficult to say, as few areas have been systematically surveyed. While, for example, in the Vera Basin – a core region of El Argar society – the total number of settlements is similar before and after the 16th century B. C. E. (Castro et al. 1995), other areas such as the north-west of the present day province of Murcia seem to have been completely abandoned or populations became more mobile and, hence, less visible archaeologically (López García 1991). On the other side, the better known sites have not been excavated thoroughly, which restricts the assessment of any changes in their size and consequently in the population numbers of the settlements. At the 3 ha sized settlement of Cerro de la Encina, where four separate areas have been explored so far, only zone A – covering the central part of the site – shows an occupation during the Late Bronze Age (Friesch 1987, 8; Aranda et al. 2008, 251). In any case, most researchers would probably agree that the Late Bronze Age remains are much more scarce and dispersed than those from El Argar period.

Architectural change and settlement organisation

Late Argaric (ca. 1750–1550 cal. B. C. E.) extensively excavated hilltop settlements display a monumental construction phase. Tower – like structures with 0,85–2,3 m thick walls dominated the summit – sometimes also called *acropolis* – of settlements such as Cerro de la Encina (Granada), Fuente Álamo (Almería) and Cerro de las Víboras (Bajil, Murcia), among others¹⁵. While the so-called ›bastion‹ of Cerro de la

Encina was destroyed by fire at the end of Argaric times, the multi-storey construction O of Fuente Álamo was abandoned and apparently dismantled sometime before 1550 cal. B. C. E., for unknown reasons. Storage jars containing cereals and pulses were found inside the building of Bajil (Eiroa 1998, 135), and similar vessels were placed in two rows in a room attached to the bastion of Cerro de la Encina, although the chronology of this context has not been clarified yet (Molina 1983, 103; Molina/Cámara 2009, 200). Internally and, particularly, around the tower O of Fuente Álamo, 16 grinding slabs have been recorded, indicating that cereal processing was carried out here at a considerable scale (Risch 2002, 197–200). This building also attracted ca. 80 % of the chalice shaped vessels (Siret's Form 7) recorded in domestic contexts of late Fuente Álamo (Schuhmacher 2003, 166–172). This peculiar pottery shape is often associated with the richer Argaric graves of the late phase. The bastion on top of Cerro de la Encina also stands out for its exceptional quantity of faunal remains (62 % of all the studied material of this phase) and, in particular, horse bones, which represent ca. 30 % of the remains found inside the building in terms of bone weight (Friesch 1987). This archaeological evidence leads us to interpret these architecturally and topographically outstanding buildings as central granaries, specialised grain processing areas, as well as spaces of conspicuous but socially restricted consumption. The absence of graves separates these towers also at a ritual level from the common domestic contexts of the Argaric settlements.

Further public works of many Late Argaric hill settlements are large scale hydraulic structures such as cisterns, with a capacity ranging between 50–200 m³¹⁶. During the last years we have been able to unearth a completely different type of hydraulic construction in La Bastida. Here, a 19,6 m long by 4,2 m wide stone dam was constructed at the mouth of a natural depression, which was enlarged and furnished with stone and daub stands in order to reach the deeper parts of the artificial water basin. Taking into account that the preserved height of the dam reaches 1,7 m, the water reservoir would have had a minimum capacity of ca. 360 m³. All these hydraulic structures implied large scale communal building activities and required a regular maintenance. Certainly, their purpose was to store and to control a vital resource in the settlement.

Recent investigations at La Bastida have brought to light other singular constructions which also seem to have had a supra-domestic character given their ground plan, set up and absence of graves. Even more outstanding is the discovery of a nearly 1000 m² large architectural complex on the hill of Tira del Lienzo (Murcia), which might have functioned as a fortified administrative outpost of La Bastida. In this rectangular building dominating the top of the hill, a silver sheeting workshop has been identified (Ache et al. forthcoming) as well as series of rather narrow storage rooms and specialised activity areas surrounding this central building. Similarly to La Bastida, this settlement was abandoned between 1600 and 1550 cal. B. C. E. and never occupied again during prehistoric times.

15 Arribas et al. 1974; Schubart et al. 2001; Eiroa 1998.

16 Fuente Álamo: 90 000–100 000 litres (Pingel 2001, 106); Peñalosa (Moreno et al. 2008):

ca. 200 000 litres; Illeta dels Banyets-Cistern 1: 50 000 litres (Soler Díaz 2006, 110).

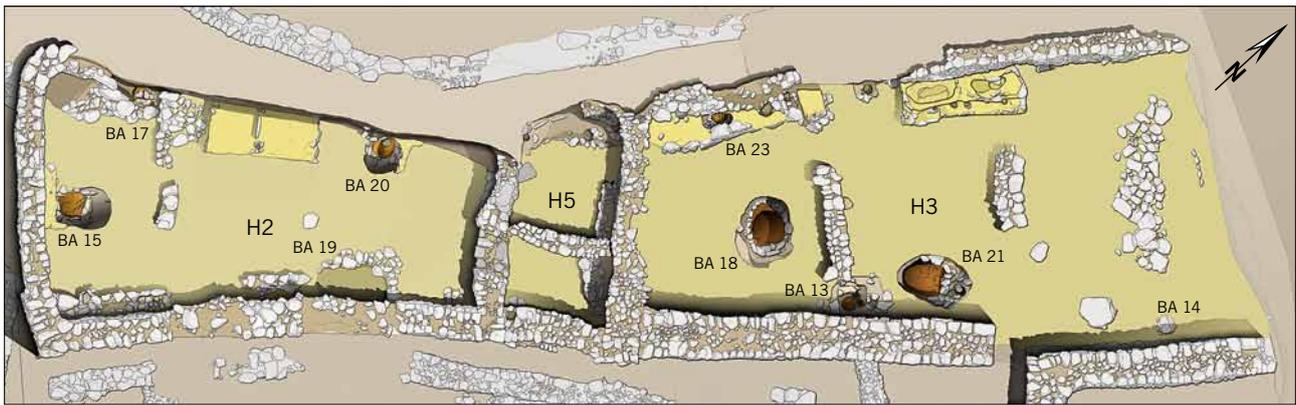


Fig. 5 La Bastida, Totana, Murcia. Polygonal buildings H2-5 and H3, characteristic of the last phase of La Bastida.

Although a considerable variability can be observed among common houses in terms of size, ground plan and construction techniques, the prominent constructions in the principal Late Argaric settlements were more or less rectangular or polygonal, up to 6,5 m wide and 13 m long (Fig. 5). Most of their inner surface varies between 50–60 m² and perhaps some of them could have been two-storey constructions. These spacious houses frequently contain an extraordinary quantity of macro-lithic tools. Use wear analysis suggests that a variety of activities were carried out in these places. Particularly illustrative of the work force associated with specialised workshop areas are the sets of grinding slabs, in some cases over a dozen, placed over the floor or in benches next to each other¹⁷. Other activities identified in these multifunctional buildings where weaving, bone working or copper melting and forging. So far, the only Argaric site where the smelting of copper minerals has been well documented and was carried out at a supra-domestic scale is the fortified settlement of Peñalosa at the north-western border of the El Argar territory¹⁸. An increasing number of lead isotope analyses support the idea that copper from this area with rich ore deposits around the modern town of Linares (Jaén) was in circulation throughout the Argaric territory¹⁹.

After the abandonment, burning or destruction of the late Argaric settlements, the space in the new hilltop settlements was reorganised under new principles. While some of the previous structures continued to be in use or were reformed, such as the previously mentioned bastion of Cerro de La Encina or the cistern of Fuente Álamo, domestic architecture changed drastically. The large rectangular or polygonal buildings, characteristic of the Late Argar, disappear and were replaced by smaller and more irregularly shaped buildings (Fig. 6). A good example of this is provided by Fuente Álamo, where a grid of irregular walls was constructed on the top of the hill (Schubart/Pingel 1995; Schubart et al. 2001). A considerable number of macro-lithic tools have been identified in these 20–40 m² rooms, although many are broken and it is not possible to establish if they might represent re-deposited Argaric material. However,

contrary to the specialised character of the Argaric workshops, most of the spaces contained practically the same range of macro-lithic tools, suggesting that similar activities were carried out in all dwellings. Five out of the seven excavated spaces have also provided evidence of some form of metal working, including artefacts related to melting processes, such as a mould and a crucible, which are absent in Argaric levels where only forging and polishing/sharpening tools are found (Risch 2002). The same situation is observed in Gatas, where all the moulds and crucibles found so far belong to Post-Argaric contexts (Risch 1995, 492–498). In the newly discovered settlement of Murviedro (Lorca, Murcia) melting and forging activities are also present in several structures (Delgado-Raack 2008). Consequently, metal production seems to have been organised in a completely different way than during El Argar: in post-Argaric times raw materials and technology became much more accessible to communities and households (Delgado-Raack/Risch 2008).

Another change is the increasing diversity of settlement types emerging after 1550 cal. B.C.E. While many settlements were abandoned and others transformed into apparently small scale habitation areas, at some sites more important buildings were erected. At the hilltop settlement of Gatas, an over 14 m long by 1 m wide wall was constructed using mostly travertine rocks, which had to be quarried at some distance from the site (Castro et al. 1993). The function of this building is unclear, as its inner space has not been explored at this point. Instead, the living area extending in front of it included six functioning and five broken grinding slabs arranged in groups of two to four, as well as a stone mould, metal sharpeners and other stone tools (Risch 1995, 492–494). Although from a slightly later date (ca. 1400–1300 cal. B.C.E.), a square or rectangular building with 0,8 m thick walls has also been identified in Cuesta del Negro (Purullena, Granada). Inside, storage vessels with cereals and a set of grinding slabs were identified (Molina/Pareja 1975, 28). The architectural diversity between settlements and regions mirrors economic differences, which are also observed among the macro-lithic assemblages and faunal remains²⁰. According to this evidence, the falling apart of a

17 Risch 1995; Risch 2002; Delgado-Raack 2008.

18 Contreras Cortés et al. 2000; Moreno/Contreras Cortés 2010; Lull et al. 2010; Lull et al. 2010a.

19 Stos-Gale et al. 1999; Castro et al. 1999, 206–208; Montero-Ruiz/Murillo 2010.

20 Risch 1995; Risch 2002; Castro et al. 1999.

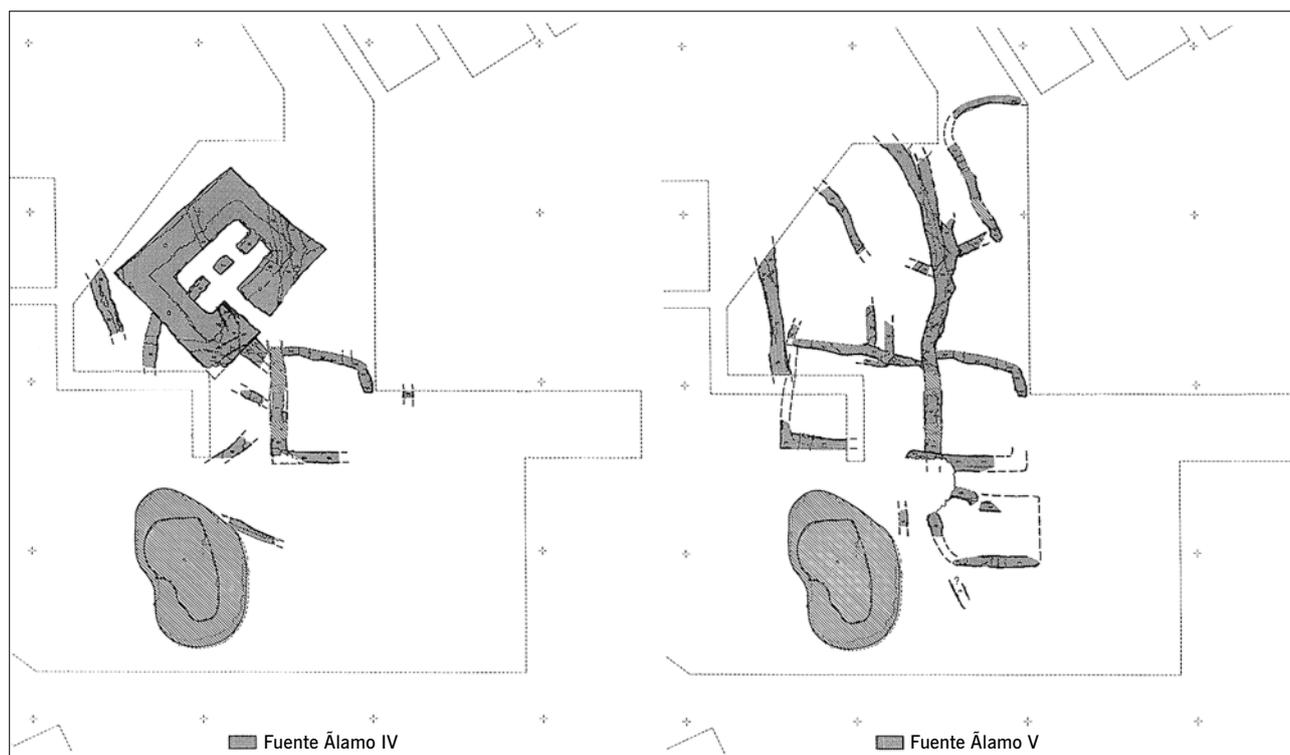


Fig. 6 Plan of the »acropolis« of Fuente Álamo, phase IV (Late El Argar) and phase V (post-Argar). Distance between + is 4 m.

rather homogenous Argaric territory would have allowed local communities to follow different economic, and possibly also social and political developments. In one of these, at Cabezo Redondo (Villena, Alicante), beyond the north-western border of the former Argaric territory (Fig. 2), the rise of an architectural and economic organisation can be traced from 1550 cal. B.C.E., which strongly resembles the aforementioned structures of Late El Argar (see Hernández et al. in the present volume). The similarities between the buildings, infrastructures and macro-lithic assemblages is so marked, that the question emerges if formerly Argaric groups took shelter in the upper Vinalopó Valley after the 1550 B.C.E. collapse in an attempt to re-instate in this area the once known socio-economic system.

Late Argaric subsistence practices and its environmental implications

During the final centuries of El Argar the basic subsistence production seems to have become more and more monotonous. Following the results of the systematic carpological studies, nearly all the hill settlements – independent of their position in the arid coastal regions of Almería or the slightly wetter inner regions of Granada and Jaén – are characterised by the absolute dominance of barley over all other botanical species, representing usually around 90% of the samples²¹. This pattern is confirmed or even reinforced by the ongoing carpological analysis from the large scale excavations at La

Bastida (H.-P. Stika, personal communication). Wheat is also found in most of the settlements, but only represents between 1% and 9% of the cultivated species, except in Cerro de la Virgen and Castellón Alto (Granada), where barley and wheat show an inverse relationship (Buxó 1997, 207–210; Rovira 2007, 282). Pulses (*Vicia*, *Lens* and *Pisum*) generally account for less than 2% of the findings. Flax seeds are recorded, as well as olives, vine and figs, although there is no consensus yet about whether these fruits were cultivated or not (Buxó/Piqué 2008, 48–51; 162–163).

The predominance of barley has led to suggest that Argaric agriculture became an extensive monoculture towards the final phase of its development (Ruiz et al. 1992). Both the small size of seeds as well as isotopic analyses strongly support the idea of a dry farming economy on the marls of Tertiary basins²², often located at several kilometres from the central hilltop settlements. Monoculture has the risks inherent in any strategy lacking biological diversity (crop diseases and soil exhaustion), but barley is a species well adapted to water shortages and can be grown on soils with medium to low fertility (Wilson/Witcombe 1985, 36). Its low and variable yields would not have been a problem as long as there was sufficient labour force and land available. Deforestation and land clearance in order to create the necessary agricultural land would explain the massive presence of *maquia* species among the charcoal record of the last Argaric phase of Gatas²³. Moreover, the identification of halophytic plants, such as *Salsola*, *Atriplex* or other Chenopodiaceae suggests that some soils were already undergoing the problems of

21 Stika 1988; Stika 2001; Hopf 1991; Clapham et al. 1994; Clapham et al. 1999; Buxó 1997; Castro et al. 1999; Peña 2000.

22 Hopf 1991, 400; Stika 1988, 34–36; Araus et al. 1997.

23 Castro et al. 1998, 81; Castro et al. 1999, 185–187.

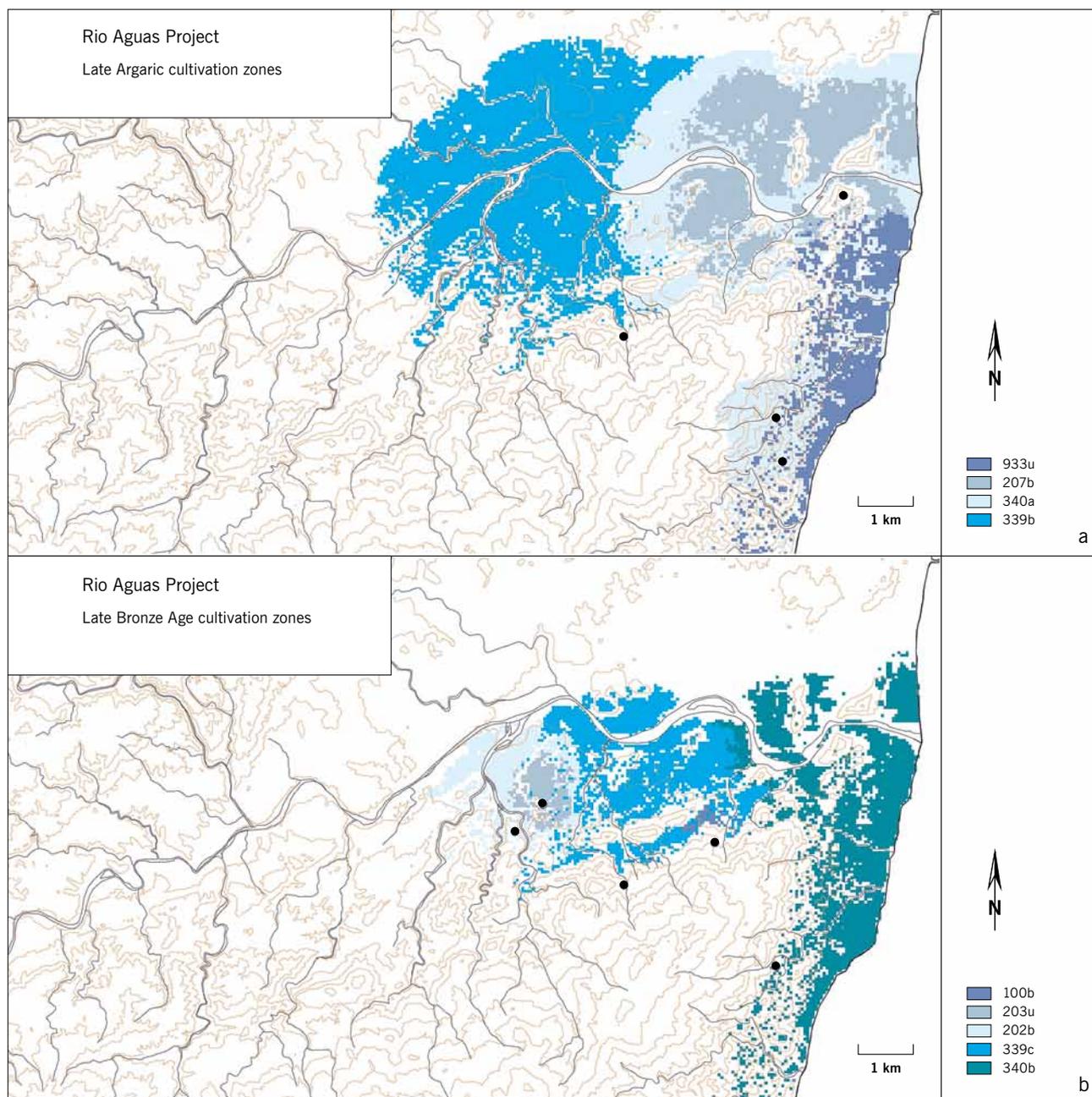


Fig. 7 Spatial modelling of the agricultural territories during the Late Argaric (a) and post-Argaric (b) periods in the lower Aguas Valley (Almería).

drought induced by salinization²⁴. Finally, the long-term degradation caused by these strategies seems to become visible in the exploitation of poorer quality and less variable wood species during the post-Argaric period (Castro et al. 1998; Castro et al. 1998a).

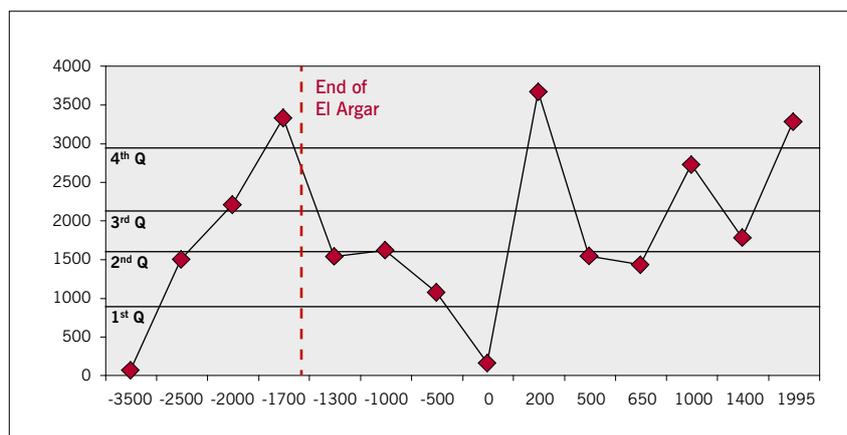
In order to gain a better understanding of the implications of land-use strategies such as the Late Argaric cereal monoculture, a paleoagrarian analysis based on the spatial modelling through GIS of demographical, botanical and ecological variables has been carried out in the lower Aguas Valley²⁵. In this area, nearly 2150 ha of high grade and middle quality land are available (Land Quality 1, 2 and 3),

and another 750 ha only suited for extensive agriculture on Tertiary plains (Q4), which in modern times often means one harvest every four to ten years. Beyond this threshold, agriculture becomes extremely marginal and inefficient. If the Late Argaric period agricultural practices – as inferred from the carpological data of Gatas (Nr. 339 in Fig. 7) – and population numbers – estimated through paleodemographic calculations – are applied to the ecological setting of the lower Aguas Valley, it becomes clear that the entire lowlands area suffered deforestation and was transformed into arable land, that is if cereals were not imported from other areas (Fig. 7a; Fig. 8). From an economical point of view, the pro-

²⁴ Schoch/Schweingruber 1982; Stika 1988; Carrión 2004.

²⁵ For the methodological details of this modelling, see Castro et al. 1998.

Fig. 8 Agricultural territories (ha) during the last 5500 years and productive thresholds (Q) in the lower Aguas Valley, Almería.



ductivity obtained with this extensive strategy is very low, especially on the Q₄ soils. In contrast to this situation, land requirements were considerably lower after 1550 B. C. E. due to lower population numbers, a more dispersed settlement pattern and more diverse agricultural strategies (Fig. 7b; Fig. 8).

The carpological studies of Gatas and Fuente Álamo show a decrease in the importance of barley at the same time as wheat and pulses become more significant. The appearance of *Vitis* sp. and *Olea* sp. in the seed records would be another aspect of this trend towards an economic diversification²⁶. It still needs to be confirmed if this evidence marks the introduction of a Mediterranean »policulture« or »triad« into the Iberian Peninsula, an agricultural strategy which combines cereal with olive and vine cultivation and widens the possibilities to store and circulate wealth. The post-Argaric diversification of subsistence strategies also included a change in the hunting strategies. While, on average, wild animal bones, excluding rabbits, represent 2,8 % of the Argaric faunal assemblages, in the post-Argaric settlements, they make up to 7,7 % of the faunal record. The abandonment of an important part of the Late Argaric fields would have offered wild species new grassland and shrub formations in the lowlands, thereby becoming a more abundant food supply for smaller or more dispersed communities.

The above mentioned modelling of socio-natural interaction in the lower Aguas Valley also shows that in only four periods agriculture was extended into low quality land: the last phases of El Argar, the Roman Empire, the Ummayyad Caliphate and modern capitalism (Fig. 8). At least in the three historical cases, we know that land tenure was markedly unequal and labour force was under a high degree of exploitation. In the case of El Argar, the exploitation of Tertiary plains probably had the most important environmental consequences, as the original *maquia* vegetation was deforested for the first time on these soils and never seemed to recover again. The environmental degradation caused by this economic and political system apparently had long term effects for the region.

Climatic and environmental change

In order to address the question of the possible effect of the Thera eruption at the end of the 17th century B. C. E. on the Late Argaric society, environmental data with a high chronological resolution is required. Generally speaking, during the last 20 years our understanding of the environment during the later prehistory of south-east Iberia has improved significantly. Geomorphological, paleobotanical and isotopic data offer a more or less coherent picture of the environmental changes of the last 9000 years. According to these studies, during El Argar times the process of aridification and deforestation increased in relation to the previous Copper Age²⁷, although this picture might have been more or less pronounced depending on the region considered. Climatically, the end of the 3rd millennium in the coastal south-east was dominated by high temperatures and low rainfall, as indicated by the formation of 20–85 cm thick salt beds near Mazarrón between ca. 2380–2000 cal. B. C. E., or the eroded surfaces of beach ridges in Campo de Dalías around 2200 cal. B. C. E. (Goy et al. 2003; Rodríguez-Estrella et al. 2011). Isotopic analysis ($\Delta^{13}\text{C}$) of carbonised wheat seeds from inland Granada (where sampling is more complete) show that water inputs in rain-fed agriculture regime during the grain filling period (from the second half of April to the end of May) dropped in average ca. 15 % between the Copper Age and the El Argar period, from an average of ca. 109 mm to 93 mm (data from Ferrio et al. 2005, Tab. 1). An exhaustive isotopic analysis carried out on firmly dated sea shells (*Glycymeris*) from the settlement of Gatas, show that the mean sea water temperature was 0,33–0,44 °C higher during the first half of the 2nd millennium B. C. E. than it is today. Winter temperatures, in particular, were milder, resulting in lower seasonal differences. However, after ca. 1550 cal. B. C. E. a steady sea temperature decrease is observed at least until 1200–1100 cal. B. C. E., when maximum and minimum temperatures were respectively 2,92 °C and 1,15 °C lower than today (Pätzold et al. 1999).

Vegetation changes shown in pollen analysis can be used as proxies in order to determine even relatively short term

26 Clapham et al. 1994; Clapham et al. 1999; Stika 1988; Stika 2001.

27 Castro et al. 1998; Fuentes et al. 2005; Anderson et al. 2011.

climatic or environmental changes. However, the temporality of pollen profiles, sometimes covering more than nine millennia, is rarely established with more than ten radiocarbon dates. The temporal scale of the entire core is obtained by interpolating these few absolute dates to the entire sedimentary core. In order to overcome this burden, we propose to focus only on the changes observable on those segments of the available pollen diagrams which are directly associated with ^{14}C dates (Fig. 2). Unfortunately, rarely more than one result is available at any particular point of a profile, while current standards in archaeology would recommend a series of dates in order to reduce taphonomic and measuring uncertainties. However, until such practices become common in palynology, the only option is to use the largest possible number of different dated sedimentary contexts and to check if recurrent patterns can be identified in approximately the same chronological phases (Tab. 2).

Table 2 shows that all the vegetation trends initiated at ^{14}C dated pollen contexts during the first half of the 2nd millennium cal. B.C.E. correspond to moments of abrupt or gradual changes towards an increasingly open environment, independent of the distance from the coast or topographic situation of the pollen core (Fig. 2). This progressive environmental degradation would be the expected effect of the extension of a barley monoculture and more intense husbandry practices, which characterise the El Argar economy after ca. 1900 cal. B.C.E. Although the influence of possible climatic changes continues to be a matter of debate, the evidence of more frequent fire events in southeast Iberia is an indicator of the anthropogenic pressure after ca. 2000 cal. B.C.E., particularly in the more populated regions near the Sierra de Baza and Sierra de Gádor, in Granada and Almería respectively (see also Gil-Romera et al. 2010). An abrupt vegetation change possibly related to slightly dryer climatic conditions has been observed in the Cañada de la Cruz Basin in the Segura Mountains (Jaén). However, this well dated episode appears to have occurred during the first half of the 17th century, i.e. just before the Thera eruption (Tab. 2).

Pollen profiles and other paleobotanic remains suggest that the 16th and 15th century environmental conditions after the collapse of the El Argar society must have been dominated by an open and, possibly, highly degraded landscape, at least in the lowlands²⁸. The first sign of recovery has been dated in the pollen sequence of Siles, in the Segura Mountains, around 1400 cal. B.C.E. (Carrión 2002), although the general situation until the end of the 2nd millennium continued to be marked by arid environmental conditions (Tab. 2).

It can be concluded that the available environmental evidence suggests that within a global climatic phase of relatively high temperatures and gradually increasing aridity, El Argar developed an extensively rain-fed agriculture, which must have been highly resource consuming in terms of fertile land and tree/shrub vegetation cover. The consequences of this economic strategy would be a degraded environment, as indicated by the paleobotanic data of the second half of the 2nd millennium B.C.E. Changes directly attributable to

the Thera eruption cannot be accurately identified in the geomorphological and botanical records. Nevertheless, one can imagine that in a scenario of extensive land exploitation and degradation, a drought peak of one or more years around 1620 cal. B.C.E. – which still needs to be confirmed by paleoclimatology and volcanology – would have had a severe impact on the rain fed barley agriculture of El Argar, which represented the main food supply of the population at the time. Ongoing isotopic analysis of barley seeds ($\Delta^{13}\text{C}$) from settlement contexts in Almería and Murcia dating immediately before and after 1600 cal. B.C.E. might be one possibility to gain insight into this question.

Burial and death at the end of El Argar

Towards the later phases of its development, the characteristic intramural burial of El Argar expresses increasing social distinctions inside the community, at the same time as it becomes increasingly standardised. While children were included in the burial customs from ca. 1950 cal. B.C.E. onwards, since ca. 1800 cal. B.C.E. a larger variety of grave goods was used to underline age, sex and class differences. One particularly interesting burial practice, which emerges at the end of El Argar, is the treatment devoted to certain adult and subadult females. One example is the rich tomb Nr. 2 discovered by Pedro Flores and Louis Siret in the settlement of Gatas on the 27th of January, 1886. According to the original excavation diary, this woman was buried in a large pottery vessel, placed under a »dolmen«. During the 2001 excavations in Gatas we managed to locate the remains of this construction on the top of the settlement. Fragments of an exceptionally large *pithos* (Form 4) were recovered under the remains of three heavy and well worked travertine slabs, quarried at some distance from the settlement. They seemed to have protected the funerary urn, forming a table-like construction. According to Siret and Flores, the woman was wearing rich ornaments made of silver, copper, greenstone, bone and *dentalium*, the most notable being the silver diadem placed on her head (Fig. 9a). Next to the woman lay fragments of a bowl, a copper knife and a copper awl inserted in a wooden handle, which was wrapped by a silver ribbon. A recent re-examination of the awl at the Musées Royal d'Art et d'Histoire in Brussels showed that this 22,2 cm long and 1,1 cm wide silver sheet was carefully attached to the wooden handle with five tiny silver rivets (Fig. 9b–c). Anthropological examination of the skull, currently on display in the Brussels museum, has confirmed that this woman was at least 45 years old when she died.

A very similar female assemblage was found in the cist burial Nr. 9 of Fuente Álamo, one of the richest funerary contexts of the final El Argar period, which was constructed with large sandstone slabs quarried at a considerable distance from the site (Siret/Siret 1887, Tab. 89). The woman of this double burial was wearing the same type of silver diadem, silver bracelets, rings and spirals, as well as a necklace including imported ivory and segmented faience beads. She

28 Araus et al. 1997; Castro et al. 1998; Jalut et al. 2000; Silva et al. 2008.

Pollen profile	Date	Changes observed	Reference
Aguas T4a 100 m a.s.l. Middle Aguas River (Almería)	2135–1980 cal. B. C. E. ???	<ul style="list-style-type: none"> • Gradual reduction of evergreen <i>Quercus</i>, <i>Tamarix</i>, <i>Cistus</i>, after maximum arboreal presence (ca. 39%) • Increase of steppic elements (<i>Artemisia</i>, <i>Chenopodiaceae</i>, <i>Poaceae</i>) • Basin desiccation (<i>Pseudoschizaea</i>) 	Schulte et al. 2008
Berja 1530 m a.s.l. Sierra de Gador (Almería)	2124–1946 cal. B. C. E. 3645 ± 45 b. p.	<ul style="list-style-type: none"> • Rapid replacement of deciduous <i>Quercus</i> by <i>Pinus</i> cf. <i>nigra</i>, and Mediterranean scrub taxa (<i>Erica</i>, <i>Pistacia</i>, <i>Cistus</i>) • Higher fire frequency – ca. every 100 years (+ charcoal remains) • Drier climatic conditions (<i>Artemisia</i>; increased <i>Pseudoschizaea</i> at the expense of <i>Zygnemataceae</i> and <i>Cyperaceae</i>) 	Carrión et al. 2003
Cabo de Gata coast (Almería)	2021–1781 cal. B. C. E. 3570 ± 60 b. p.	<ul style="list-style-type: none"> • Steady decrease of evergreen sclerophyllous taxa • Increase in <i>Chenopodiaceae</i>/steppic vegetation 	Jalut et al. 2000
Laguna Río Seco 3020 m a.s.l. Sierra Nevada (Granada)	1895–1778 cal. B. C. E. 3525 ± 20 b. p.	<ul style="list-style-type: none"> • Expansion of steppic elements (<i>Artemisia</i>, <i>Chenopodiaceae</i>), at the expense of forest species (mainly <i>Pinus nigra-sylvestris</i>) • Increased fire events (+ charcoal remains) 	Anderson et al. 2011
Cañada del Gitano 1900 m a.s.l. Sierra de Baza (Granada)	1911–1771 cal. B. C. E. 3520 ± 50 b. p.	<ul style="list-style-type: none"> • Reduction of <i>Pinus nigra-sylvestris</i> and deciduous <i>Quercus</i> • Increase of evergreen <i>Quercus</i>, and Mediterranean trees/shrubs (<i>Erica</i>, <i>Juniperus</i>, <i>Cistus</i>) • Expansion of steppic elements, at the expense of forest species • Increased fire events (+ charcoal remains) • Basin desiccation (<i>Pseudoschizaea</i> and Type 128) 	Carrión et al. 2007
Cañada de la Cruz 1595 m a.s.l. Segura Mountains (Jaén)	1706–1626 cal. B. C. E. sum of 3350 ± 40 b. p. 3370 ± 20 b. p. 3385 ± 30 b. p.	<ul style="list-style-type: none"> • Significant forests regression (deciduous <i>Quercus</i>, <i>Pinus nigra</i>) and hygro-/hydrophilous species (<i>Polygonum</i>) • Sharp increase of xerophytic vegetation (<i>Poaceae</i>, <i>Artemisia</i>, <i>Juniperus</i>) • Drier and colder climate (<i>Ephedra nebrodensis</i>, non-pollen polymorph Type 128) • Increased erosion/sedimentation rate 	Carrión et al. 2001
Cortijo del Campo 20 m a.s.l. Lower Aguas River (Almería)	1631–1513 cal. B. C. E. 3300 ± 50 b. p.	<ul style="list-style-type: none"> • Slight increase in the importance of trees/shrubs (<i>Pinus</i>, <i>Olea</i>, evergreen <i>Quercus</i>, <i>Cistus</i>) • Continued domination of steppic vegetation (80–90%) 	Stevenson 1998
Siles 1320 m a.s.l. Segura Mountains (Jaén)	1489–1315 cal. B. C. E. 3125 ± 60 b. p.	<ul style="list-style-type: none"> • Recovery of <i>Pinus nigra</i> • Increase in pollen concentration 	Carrión 2002

Table 2 Vegetation transitions between ca. 2200–1300 cal. B. C. E. observed at absolutely dated contexts of pollen sequences (calibration of dates [10] was undertaken with Calib 6.1.0)

was also buried with a copper awl and a knife, representing the distinctive tool set of the richer female graves since the beginning of El Argar, as well as several type 7 chalices. No anthropological data are available for this burial.

Other similar rich female burials of the final El Argar period are tomb 111 of Fuente Álamo, containing a 16–18 year old girl, and tomb 21 of Cerro de la Encina (Monachil, Granada), also sheltering a girl of the same age who shared

the grave with a 22–24 year old man (Schubart et al. 2004; Aranda et al. 2008). Apart from being exceptional funerary constructions, all these tombs stand out from the rest of the Argaric interments because of the presence of abundant copper and silver ornaments, carefully prepared necklaces and the presence of highly burnished ceramics, in particular the chalice or type 7. Those excavated in recent times, also include cattle bones representing special meat offerings.



Fig. 9 Female burial Nr. 2 of Gatas. a female skull and grave offerings; b awl with wooden handle and silver ribbon; c detail of the last silver nail used to attach the ribbon to the handle.

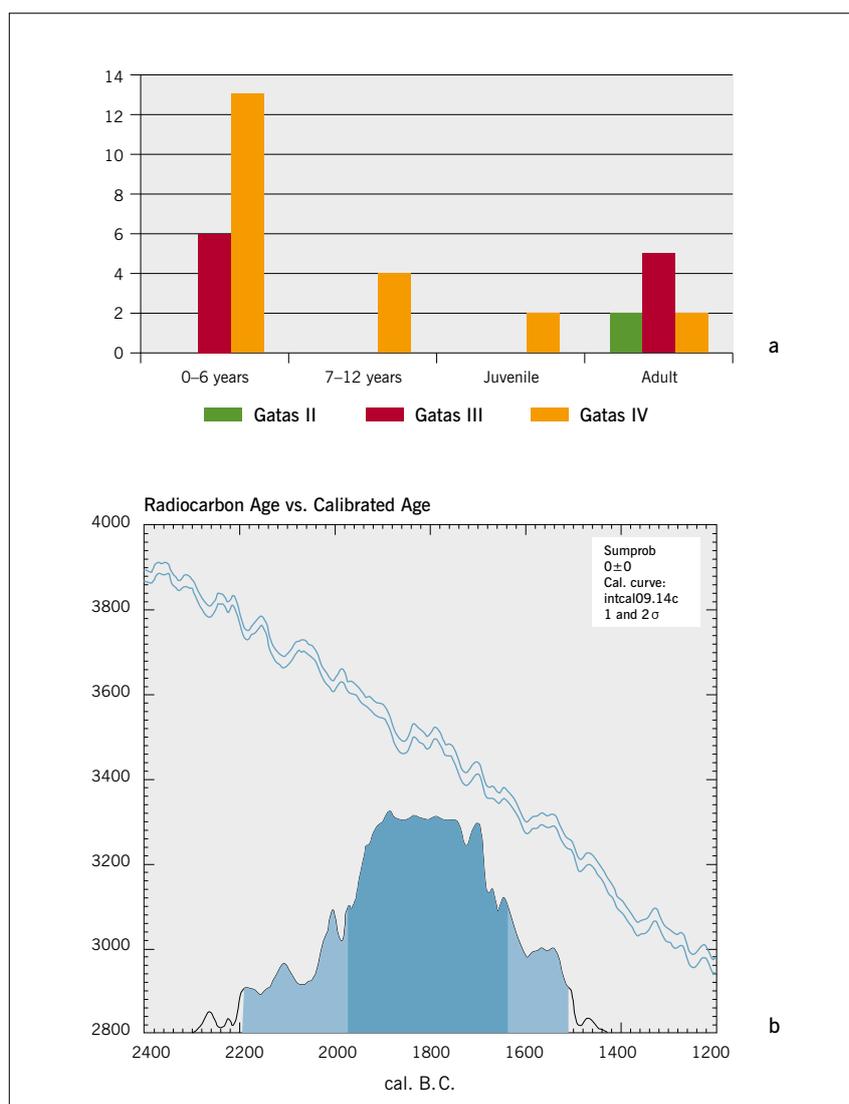
The social recognition of certain women from a young age onwards is further underlined by the fact that the standardised metal tool sets with a clear gender reference – knife/dagger and awl in the case of women, and knife/dagger and axe in the case of men – can accompany certain girls from six years onwards, whereas boys need to reach at least juvenile age in order to deserve the male specific tools or weapons (Lull et al. 2005, 261).

Elsewhere we have discussed the archaeological and anthropological evidence, which appears to suggest that El Argar was organised according to matrilocal/avunculocal and matrilineal kinship rules (Castro et al. 1993–1994; Lull 2000). If this reading is correct, certain women seem to have played a central political role in the Late Argaric society from a very young age onwards. How far women like those buried in tomb 2 of Gatas or tomb 9 of Fuente Álamo can be seen just as a public or formal representation of the Argaric state system or, instead, acted as political leaders in their own right, is difficult to answer at the present. In any case, these outstanding female tombs express the need to establish deeper and more qualified social distinctions during the final moments of El Argar. The funerary practices reserved for this group of juvenile and adult women must have repre-

sented a powerful ceremonial act and affirmed the social distance of the dominant class with respect to the rest of the community. Contrary to the situation observed during the early and middle phases of El Argar, when elite male burials, identified by the presence of halberds, also appear in low land and smaller size settlements, these outstanding female tombs are restricted to the large centres. Consequently, the dominant rituals and powers seem circumscribed to the strategically placed hilltop settlements during the final centuries.

These prominent female burials are statistically associated to the richest male graves, which can be distinguished from 1800/1700 cal. B.C.E. onwards by the presence of swords (Lull/Estévez 1986; Castro et al. 1993–1994). The paradigmatic example of a woman with abundant silver ornaments, including a diadem, associated to a sword carrying man is the aforementioned cist burial 9 of Fuente Álamo. The recently discovered sword from Peñalosa (Jaén), with six silver rivets, a silver but and four silver nails to reinforce the handle (Moreno/Contreras Cortés 2010), underlines again the visual importance of silver artefacts and persons of the dominant Argaric class, as already seen in the case of the awl from Gatas tomb 2 or the knife with six silver rivets found in

Fig. 10 **a** Age groups buried during the different phases of Gatas (only excavation areas B and C; GA II: 2200–1950; GA III: 1950–1700; GA IV: 1700–1550 cal. B.C.E.); **b** Sum probability of the 86 dated adult individuals.



the aforementioned tomb 21 of Cerro de la Encina (Aranda et al. 2008). The relationship between the sword and men pertaining to the dominant classes implies a change in combat strategies and probably also indicates an escalation in violence at the end of El Argar, as can be seen quite clearly in a burial from Caramoro I (Elche, Alicante), with an 18 month-old child killed by a sword blow on his or her forehead (Cloquell/Aguilar 1996). Clearly, the sword measuring more than 60 cm long appeared on the Iberian Peninsula as an innovation in weaponry after 1800/1750 cal. B.C.E. It probably spread from the Argaric south-east, where its concentration is highest, to the north (Fig. 1), at approximately the same time as swords are introduced to central and northern Europe from the Balkans and the Carpathian area. Another weapon type, which appears more or less simultaneously in Late El Argar and in eastern, central and northern Europe is the metal spearhead²⁹. Unlike the sword, this artefact was never conceived as an acceptable grave offering, neither in El Argar nor in other parts of Europe, except the Aegean.

These synchronic changes in weapons and thus combat practices as well as in their ritual use underlines the involvement of El Argar society and particularly its dominant classes in long-distance trading networks, which might be understood as a form of *Koine* among the Early Bronze Age elites.

Another funerary aspect marking the final moments of El Argar are the growing numbers of infant burials. In settlements such as Gatas or La Bastida, where burials can be placed in stratigraphic order and have been analysed anthropologically, it becomes evident that children from the earliest age onwards, including newborns, represent most of the interments of the Late Argaric phase. In the case of Gatas, where a considerable number of child burials has been ¹⁴C dated, it is very clear that children are included in the Argaric intramural burial after ca. 1950 cal. B.C.E., representing around half of the total interments (Fig. 10a). While the number of adults decreases again during the final 150 years of the Argaric occupation of the site, the infantile

²⁹ A spearhead mould is known from the metal production site of Peñalosa (Jaén) (Moreno/Contreras Cortés 2010, 65), while the wooden

shaft preserved in one out of four recently found spearheads from Cabezo Redondo (Villena, Alicante), located at the margins

of the Argaric territory has provided a ¹⁴C date of 1628–1527 cal. B.C.E. (Beta 189003; Hernández Pérez 2009, 299).

burials become more frequent and reach 80% of all the buried individuals. The scenario observed in La Bastida over the last years' excavations confirms this pattern. Moreover, if we use the 86 absolute dates for adults, randomly sampled in 18 different Argaric settlements, as an indicator of the buried population it must be concluded that most adult interments occurred between ca. 1950–1700 cal. B. C. E., irrespective of the wiggles in the calibration curve (Fig. 10b). Given that all better explored central settlements provide clear signs of economic intensifications and demographic increase during the final phase, this probability curve of the adult interments cannot mirror the development of the living Argaric population between 1700–1550 cal. B. C. E.³⁰ Consequently, the combination of the stratigraphic information from Gatas and La Bastida, and the available radiocarbon dates for adult graves would suggest that the funerary practices between 1700–1550 cal. B. C. E. favoured child burials and certain men and women, including the distinguished group buried with exceptionally rich silver ornaments.

The abundance of newborn and very young individuals can be explained as the result of increased child mortality, as a change in the burial rites, or as a combination of both. The frequent pathologies related to malnutrition and infections observed among the child burials from Gatas and other sites (mainly, *cribra orbitalia* and porotic hyperostosis) would appear to support the first hypothesis (Buikstra et al. 1999; Robledo/Trancho 2003), but the disproportion – in merely biological terms – between relatively few adults and a large number of infant burials remains. As children of young age have a direct physical relationship with their mothers or other breastfeeding women, it seems reasonable to question if this shift in the funerary sphere represented a further manifestation of female presence at the ceremonial level during the Late Argar. It might be suggested that the ritual attention paid to children expresses the social relevance of the female population, in a context of intense economic development and demographic increase, achieved principally at the cost of the female population. In a situation of extreme economic exploitation and growing social asymmetries, combined also with an increasingly limited burial ground in the living spaces, the intramural burial rights became more selective for the adult population. On the other hand, an increase of around 25–40% from the middle to the Late Argaric phases of the population not necessary living, but dependant on and involved in the productive forces of the central settlements³¹, would account for part of the rise of infant burials. The remaining increased rate of child mortality would be explained by progressively more insalubrious living conditions and poverty during the final phases, a combination of social, psychosocial and epidemiological factors defined by medical anthropology as »the violence of inequality« (Nguyen/Peschard 2003).

Conclusion

In view of the available archaeological, anthropological and palaeoecological information, the socio–natural situation of south-east Iberia during the 17th and beginning of the 16th century B. C. E. was driven by the following forces:

1. Rapid economic growth and centralisation in the larger settlements, where larger habitation, production and storage structures were required and lead to a monumental architecture, which also supported the political superstructure.
2. This economic process was not achieved through technological improvements, but through an intensification of the work force involved, as seen by a marked quantitative increase of production means and residues in the archaeological record.
3. This labour intensification demanded a growing population and/or the closer tying of the communities to their economic and political centres, resulting in a general increase of the number of intramural interments.
4. A subsistence strategy based increasingly on an extensive, rain-fed, barley monoculture fed this growing or more dependant population, but at the cost of soil depletion and salinisation processes, which in turn forced agricultural expansion and a progressive deforestation evident in the palaeobotanical records.
5. Anthropological and pathological observations hint towards a growing morbidity and mortality in a context of malnutrition and insalubrious living conditions, which could perfectly respond to harsher work requirements and a deficient diet based on an unbalanced consumption of carbohydrates, especially those obtained from barley, considered a low quality cereal.
6. The social gap between the dominant classes and a large part of the serving population became wider and apparently more impervious, as seen in the funerary record and the productive differences between dwellings and settlements.
7. Physical violence, exercised with new and more effective weapon types such as the sword, seems to have been the necessary means to perpetuate the social asymmetries and the highly degrading economic system of the Late Argaric society.

Considering the implications of these seven driving forces individually as well as jointly, it is of no surprise that the El Argar state proved to be an unsustainable organisation, independently of any external input. Whether several years of extreme draught at the end of the 17th century would have led to a first crisis, remains as a working hypothesis that needs empirical support. In any case, most settlements were destroyed or abandoned around the middle of the 16th century. Destruction levels, as those observed in Gatas or Cerro de la Encina suggest that violence played a significant role in this sudden end. But one distinctive trait of the post-Argaric

³⁰ For a summary of the main palaeodemographic evidence, see Lull et al. 2011.

³¹ These figures derive from the paleodemographic and economic calculations carried out at Gatas and the lower Aguas River

(Castro et al. 1998), and at Fuente Álamo (Risch 2002, 232 ff.).

societies provides, in our view, a clear indication that a social revolt was responsible of this political, economic and social turnover: the Argar intramural burial rites, which basically served to visualise, celebrate and perpetuate age, sex and, above all, class differences, ceased to exist completely in southeast Iberia after 1550 B.C.E. This cancelling of the Argaric funerary norm is particularly meaningful at the periphery of the El Argar, where it represented the clearest expression of the El Argar territorial expansion in previous times.

Besides the abandonment of the monumental architecture, other sharp material upheaval was, not surprisingly, the abrupt end of the highly standardised pottery production, restricted to eight basic undecorated types over a territory of 33 000 km², which also acted as a means of enforcing social bonds as well as class distinctions inside El Argar. As production technologies and tools continued largely unchanged in post-Argaric times, it is possible to suggest

that it was most of the local population in the first place which brought the system to an end. In absence of evidence for large scale migration and natural catastrophes, the collapse of El Argar may represent a further historical case where social forces put to an end an extremely exploitative system through revolutionary practice.

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Source of figures

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| 1 | authors and S. Gili Suriñach, based on data from Brandherm (2003) | 6 | Schubart/Pingel 1995, Abb. 6–7 (modified by the authors) | 9 | drawing Siret/Siret 1887, Tab. 59; photographs by J. A. Soldevilla at the MRAH, Brussels |
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