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An insight into the organisation of metal production in the Argaric society

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ABSTRACT

Metallurgy is a common topic when discussing Early Bronze Age societies, as its social impact has been traditionally used to support the appearance of social inequality. Different models have been proposed for the Bronze Age Argaric society of SE Iberia. One includes a highly centralised hierarchical production system, and the other consists of decentralised production at a local scale.

Though metallurgical debris has been found in more than 30 sites in the Argaric society, and despite metallurgy being a core subject of discussion, very little research has been conducted on these finds. In this article, we draw from provenance studies using lead isotope analysis to gain a better understanding of the organisation of metal production and distribution.

We present new MC-ICP-MS lead isotope and SC-ICP-MS trace element analyses of 23 arsenical copper and bronze objects from two Argaric sites: Cerro de la Encina and Cerro San Cristóbal. Both sites are located in the Granada basin. These results, contextualised with metallurgical evidence already published, allow us to depict a decentralised system of metal production in which different and distantly located copper mines were being exploited.

1. Introduction

One of the main subjects in the study of the late prehistory of the Mediterranean Basin is the emergence of increasingly complex societies, including how they became progressively more stratified and ultimately led to the appearance of early States. Studies on this topic usually focus on the Eastern Mediterranean region, such as the Levant, Egypt, Anatolia, Cyprus and the Aegean. The counterbalance in Western Europe would be exemplified by the Argaric society, which is located in Southeastern Iberia (c. 2200–1550 cal BC) and started to become known at the end of the 19th century (Siret and Siret, 1887). This is probably the largest and most intensely researched area in Iberia. However, the international impact of this research has been partially limited due to the publication of findings predominantly in Spanish following Siret's work in French (1987). Few exceptions to this trend have been evident (e.g., Gilman, 1987; Chapman, 1990), with specific research on early metallurgy through the *Studien zu den Anfängen der Metallurgie* (SAM) project (Junghans et al., 1960, 1968), *Arqueometalurgia de la Península Ibérica* (PA) project (Montero Ruiz, 1993) or technological studies of new materials by the British Museum (Hook et al., 1987). Only in the past decades has the concern for international dissemination grown (e.g., Lull, 2000; Aranda Jiménez and Molina González, 2006; Bartelheim, 2007; Bartelheim et al., 2012; Aranda Jiménez, 2013; Lull et al., 2013, 2014a,b; Aranda Jiménez et al., 2015). The large amount of archaeological evidence, effective preservation of archaeological sites and the fact that individuals were buried inside dwellings –allowing direct correlation between domestic and funerary realms– have made the Argar a key culture for the study of early social stratification.

Early Bronze Age Argaric communities are the result of a long process of increasing inequality that started in the Copper Age and that leads to profound social asymmetries and individualised identity (e.g., Lull and Estévez, 1986; Chapman, 2008). During the Argaric period, important changes occurred at the domestic and funerary realms, as well as in the settlement pattern. These changes led to an increase in population and a population concentration. Previous open-air settlements with round huts were exchanged for artificially terraced sites with square dwellings. These dwellings were preferably built on hilltops, although there are still sites in the plains. Individual inhumations within settlement areas were widespread at the time, although the reuse of megalithic monuments remains as a standing feature (see Aranda Jiménez, 2013, Aranda Jiménez, 2014; Aranda Jiménez, forthcoming; Aranda Jiménez and Lozano Medina, 2014). Researchers agree that artefacts in these communities changed typologically, including standardised shapes, copper-based ornaments and proper weapons such as swords and halberds (Lull, 1983; Chapman, 2008; Aranda Jiménez et al., 2015).

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Table 1
Metallurgical evidences from Argaric sites.

No.	Site	Ore	Technical ceramics[a]	Slag	Prills/metallic lump	Casting moulds	Anvil/hammer/ grinding stone	Scrap	Reference
1	Peñalosa	X	X (SM + M)	X	X	X	X		Contreras (2000)
2	Siete Piedras		X						Moreno and Contreras (2010)
3	Cerro de la Encina		X	X	X[a]				Arribas Palau et al. (1989: 75)
4	Pago Al-Rután		X						Montero Ruiz (1991: 319)
5	Terrera del Reloj	X	X	X	X[a]		X		Arribas Palau et al. (1989: 77)
6	Cerro de la Virgen		X	X		X	X		Delgado-Raak (2013: 111ff)
7	Castellón Alto		X						Bashore Acero et al. (2014)
8	Cerro del Fuerte		X						Montero Ruiz (1991: 269)
9	Barranco de la Cera					X			Montero Ruiz (1991: 263)
10	El Picacho		X				X		Montero Ruiz (1991: 258)
11	Fuente Vermeja					X[b]	X		Siret and Siret (1890: Lám. 14)
12	Lugarico Viejo		X	X			X[a]		Siret and Siret (1890: Lám. 16)
13	Cerro de las Viñas	X	X	X		X			Montero Ruiz (1991: 358)
14	Fuente Álamo	X			X	X	X		Montero Ruiz (1991: 230)
15	El Argar		X (SM + M)	X	X	X	X	X	Siret and Siret (1890: Lám. 27)
16	Gatas	X			X	X		X	Siret and Siret (1890: 222, 275)
17	La Alquería	X							Montero Ruiz (1991: 359)
18	Rincón de Almendricos			X					Montero Ruiz (1991: 442)
19	La Finca de Félix	X							Montero Ruiz (1991: 360)
20	El Oficio[c]	X	X[a]		X	X	X		Siret and Siret (1890: 243, 245)
21	Cuesta del Negro		X	X		X			Arribas Palau et al. (1989: 76)
22	Cerro de las Víboras, Bagil			X		X			Lull et al. (2010: 336)
23	Lorca			X	X?	X			Martínez Rodríguez et al. (1996: 44; 48)
24	Los Cipreses						X	X	Delgado-Raack and Risch (2006)
25	Las Anchuras	X				X			Siret and Siret (1890: 124)
26	La Bastida	X?	X		X	X	X		Lull (1983: 318–319)
27	Ifre							X	Siret and Siret (1890): Lám. 18
28	Cerro de la Campana					X			Montero Ruiz (1991: 351)
29	Cobatillas or Peñica de Santomera		X						Montero Ruiz (1991: 355), Lull (1983: 335)
30	El Puntarrón Chico					X			Montero Ruiz (1991: 354)
31	San Antón		X	X			X		Simón García (1998: 29)
32	Laderas del Castillo		X	X		X	X		Simón García (1998: 42)
33	El Tabayá		X	X	X	X			Simón García (1998: 71)

[a] SM = smelting; M = melting.
[b] After Lull et al. (2010: 336). Original references are not provided and we have not found further descriptions of these metallurgical evidences.
[c] These metallurgical evidences are consider post-Argaric by Lull et al. (2010: 334).

The development of metal objects increased almost fivefold compared with the Chalcolithic period (Montero Ruiz, 1991, 1993). Significant technological innovations, such as tin–bronze alloys, silversmithing and annealing were developed (Montero Ruiz, 1991; Rovira and Gómez Ramos, 2003). The fact that silver metallurgy production outgrew other contemporary Bronze Age societies from Iberia and Western Europe[3] was especially remarkable (Bartelheim et al., 2012; Murillo-Barroso, 2013; Lull et al., 2014b). The typology of metal objects also changed. Metal ornaments, bracelets, pendants, earrings, rings, diadems and beads indicate novel design concepts of personal ornaments during this period (Murillo-Barroso and Montero-Ruiz, 2012). These items represent more than half of all Argaric metal objects. The increasing demand of these objects stimulated some of the technological innovations mentioned above, such as silver metallurgy, annealing and the development of tin–bronze alloys in c. 1800 cal. BC (Aranda Jiménez et al., 2012; Murillo-Barroso et al., 2014). Finally, it is worth noting that metallic tools –axes, knifes and awls– gained importance and replaced Chalcolithic tools, which were made of stone and bone (Lull et al., 2009, 2010).

Two different perspectives have emerged regarding changes in Argaric metallurgy. Some authors consider this activity a full-time craft specialisation, in which the exchange of raw materials and finished products triggered the process of social stratification. As a result, a tributary system was developed from territories of agricultural villages (mainly located in the plains) to hilltop sites where social elites lived and controlled the manufacture and distribution of metal objects (Chapman, 2008; Lull et al., 2010). According to this view, metallurgical production would have been organised centrally by Argaric elites in what is called 'a hierarchical production system'. Only specific sites, such as Peñalosa, would have developed the smelting process,[4] whereas others carried out the casting. Most settlements would have remained excluded from metallurgical production (Lull et al., 2010). This view suggests a specific isotopic pattern, whereby the same isotopic signature should be detected in most objects throughout the Argaric area. This isotopic signature would be the one detected in Peñalosa (and its copper catchment area) as the main metal supplier, i.e., the isotopic signature of the mining district of Linares (Hunt Ortiz et al., 2012).

Alternatively, metallurgy may be viewed as a low-scale, decentralised system of production. Accordingly, the restricted access to metal objects imposed by the Argaric elite is believed to reflect social inequalities whose origins are not directly related to metallurgical craft specialisation (see Montero Ruiz, 1992; Montero Ruiz, 1993; Gilman, 2001, 2013;

[3] Recent studies have quantified 792 silver objects and 34 silver–copper alloys (Murillo-Barroso, 2013: 233).

[4] The site of Peñalosa is described by its excavators as a 'metallurgical settlement' where production was controlled by the elite. Control of other areas, however, is hazy, as several elite groups sharing the same ideology are proposed (see e.g. Moreno and Contreras, 2010).