RESEARCH PAPER

Preliminary Studies of Late Prehistoric Dog (*Canis lupus f. Familiaris* Linnaeus, 1758) Remains from the Iberian Peninsula: Osteometric and 2D Geometric Morphometric Approaches

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This paper aims to highlight developments in archaeological knowledge relating to dog remains found in deposits from Late Prehistoric contexts at sites along the Iberian Peninsula. Preliminary results from ongoing osteometric and 2D Geometric Morphometric studies applied to these remains are here presented and discussed to contextualize future studies by the author.

**Keywords:** Dog remains; Late Prehistory; Iberian Peninsula; Geometric Morphometrics

**Introduction**

Social inequality emerged during the Iberian Chalcolithic in the 3rd millennium BCE, and further widened during the Bell-Beaker horizon when preferential treatment of a select few of the human population took place. This inequality, however, is only observed in the funerary record, where differences in tomb types and grave goods are noted (Harrison 1977, Delibes 1977, Díaz-del-Río & García Sanjuán 2006). During this period, settlements comprise of features such as pits, hut structures and ditched or walled enclosures; the defensive character of the latter has been widely discussed in recent years (Díaz del Río 2003, Molina et al. 2004, Kunst 2010, Márquez & Jiméne 2010). Settlement patterns and inhumations changed slightly during the Bronze Age: new spaces were occupied and funerary rituals also changed (Bellido 1995, Benítez de Lugo 2011, Serrano 2012). Faunal studies have shown that domestic species were consumed regularly (Morales & Liesau 1994, Rodríguez & García 2011, Liesau 2011). However, dog remains are often retrieved from different conditions and contexts, suggesting that they were subject to different treatment compared to other species.

Earlier studies have documented the presence of dog remains placed in late prehistoric deposits at settlements along the Iberian Peninsula (Daza 2015: 14–20). The findings...
from the Polideportivo de Martos suggest that a *dog phenomenon* emerged during the Late Neolithic, given the proliferation of the practice of depositing the remains of complete dogs, or parts of them, inside structures (Lizcano et al. 1991, Lizcano & Cámara 2003) (**Figure 1**). This article outlines Late Prehistoric sites across the Iberian Peninsula from which deposits of dog remains have been documented. Secondly, it presents preliminary results from traditional osteometry and two-dimensional (2D) landmark-based geometric morphometric studies, which form part of the author’s doctoral research. In order to better understand this *dog phenomenon*, dog remains (mostly from Camino de las Yeseras) were analysed using morphological criteria to categorise the specimens.

**Figure 1:** Iberian settlements with dog remains mentioned in the text. 1: Can Roqueta (Sabadell, Barcelona); 2: Torre Romeu (Sabadell, Barcelona); 3: La Huelga (Dueñas, Palencia); 4: Las Matillas (Alcalá de Henares, Madrid); 5: Camino de las Yeseras (San Fernando de Henares, Madrid); 6: El Perdido (Torres de la Alameda, Madrid); 7: La Loma de Chiclana (Madrid); 8: Tejar del Sastre (Madrid); 9: El Espinillo (Madrid); 10: Caserío de Perales del Río (Getafe, Madrid); 11: El Juncal (Getafe, Madrid); 12: Cerro de la Cabeza (Ávila); 13: Valladares I (Illlescas, Toledo); 14: La Pijotilla (Badajoz); 15: Perdigões (Reguengos de Monsaraz, Portugal); 16: Camino del Molino (Caravaca de la Cruz, Murcia); 17: Casa Noguera (Caravaca de la Cruz, Murcia); 18: Glorieta de San Vicente (Lorca, Murcia); 19: Marroquías Bajos (Jaén); 20: Polideportivo de Martos (Martos, Jaén); 21: c/Dolores Quintanilla Nº 6 (Carmona, Seville) 22: Valencina de la Concepción (Seville). Information on the cultural periods for each of the settlements can be found in Table 1. Author’s own data plotted on map in collaboration with Patricia Ríos.
Dog Remains in the Late Prehistory of the Iberian Peninsula: A Proposal for Classifying Deposits

The faunal deposits from the archaeological sites, also defined as special deposits (Grant 1984), structured deposits (Richards & Thomas 1984) and Associated Bone Groups (Hill 1995) have been extensively studied by several authors to identify the species found within them. Methods of depositing and reasons for deposition have also been explored. Typologies, categories and interpretations have been put forward for these findings covering different periods and places (Grant 1989, 1991, Hill 1995, Liesau & Blasco 2006, Márquez 2006, Méniel 2008, Morris 2011, Albizuri 2011a, Liesau 2012, Liesau et al. 2013, Perri 2015).

Our study centres on the settlement of Camino de las Yeseras, a Chalcolithic ditched enclosure located in the region of Madrid (Figure 1: 5), at the centre of the Iberian Peninsula (Liesau et al. 2008, Blasco et al. 2011). Several dog remains were documented during the site’s excavation, and from these, we were able to infer the presence of three types of contexts in which dog remains were deposited: funerary contexts, outstanding locations and pits.

Based on this study of Camino de las Yeseras’ deposit types, we were able to identify these three same categories at other important sites in the Iberian Peninsula (Table 1).

During the Chalcolithic the presence of dog remains in funerary contexts, observed through the recovery of dog skeletons associated with tombs, is relatively frequent in the Iberian archaeological record. Complete articulated dog skeletons have been found in burials at sites such as El Cerro de la Cabeza in Ávila (Figure 1: 12, Table 1: 12) (Fabían & Blanco 2012: 110) and Casa Noguera in Murcia (Figure 1: 17, Table 1: 19) (García & Martínez, 2004). Similar practices have also been documented in collective burials such as those of Camino del Molino in Murcia (Figure 1: 16, Table 1: 18) (Lomba et al. 2009: 153), El Perdido (Figure 1: 6, Table 1: 4) (Daza 2005) and Camino de las Yeseras in Madrid (Figure 1: 5, Table 1: 5) (Daza 2011). The latter contains the remains of two dogs with evidence of perimortem violence, and had been deposited at the intersection of two pits within a Bell-Beaker burial (Figure 2) (Daza 2011: 215, Liesau et al. 2013: 283).

Other examples falling under the category of dogs in funerary contexts include Bronze Age tombs, especially child burials, such as at Caserio de Perales del Río (Figure 1: 10, Table 1: 6) (Blasco et al. 1991: 56) and Camino de las Yeseras (Figure 1: 5, Table 1: 5) (Daza 2011: 215). This latter site includes a complete dog skeleton, together with other faunal remains, accompanying a child burial.

The presence of dogs in outstanding locations is a noteworthy occurrence (Liesau et al. 2013–2014: 53–54, 66). Dog remains have been linked to areas whose location or arrangement characteristics are extraordinary within the settlement. These relate to distinctive ideology, ritual purposes or the management of the space by human populations (i.e. ditched enclosures and the interruptions in them, interpreted as entrances). At Valencina de la Concepción in Seville, 32 complete dog skeletons were uncovered from a ditch (Figure 1: 22, Table 1: 20) (Hain 1982: 93, 140); at Marroquíes Bajos in Jaén (Figure 1: 19, Table 1: 16) a complete specimen was recovered from inside a ditch (Burgos et al. 2001b: 425); and at El Juncal in Madrid, complete dog skeletons were recovered from structures located at the ends of the ditches (Figure 1: 11, Table 1: 11) (Martínez et al. 2014: 157, Martínez et al. 2015: 248–252). Similarly, two dog skulls were found inside a ditch at Perdigões in Portugal (Figure 1: 15, Table 1: 15) (Valera 2008: 30). At Camino de las Yeseras a complete skeleton was located in a pit at the bottom of a ditched enclosure, next to the entrance. Another pit was found opposite, where another complete
| No. | Settlement                      | Type of Deposit                        | Remains                                      | Cultural Period | References                        |
|-----|--------------------------------|----------------------------------------|----------------------------------------------|-----------------|------------------------------------|
| 1.  | Can Roqueta II (Barcelona)     | Dog in a pit                           | 1 complete dog in partial articulation       | Bronze Age      | Albizuri 2011b: 148                |
|     | Can Roqueta II (Barcelona)     | Dogs in a pit                          | 2 complete articulated dogs                  | Bronze Age      | Albizuri 2011b: 148                |
| 2.  | Torre Romeu (Barcelona)        | Dog in a pit                           | 1 dog skull                                  | Bronze Age      | Albizuri 2011b: 63; Oliva & Terrats 2005; Piña & Saña 2004. |
|     | Torre Romeu (Barcelona)        | Dog in a pit                           | 1 complete articulated dog                   | Bronze Age      | Albizuri 2011b: 63; Oliva & Terrats 2005; Piña & Saña 2004. |
| 3.  | La Huelga (Palencia)           | Dogs in a pit                           | 2 partial articulated dogs                   | Bronze Age      | Liesau, Esparza & Sánchez 2014.    |
| 4.  | El Perdido (Madrid)            | Dogs in funerary context               | At least 3 articulated dogs                  | Chalcolithic    | Daza 2015: 35–38                   |
|     | Camino de las Yeseras (Madrid) | Dog in outstanding location (inside ditched enclosure and next to the entrance documented) | 1 complete articulated dog                   | Chalcolithic    | Liesau et al. 2013–2014: 60–61, 65 |
| 5.  | Camino de las Yeseras (Madrid) | Dog in outstanding location (close to an entrance documented) | 1 complete articulated dog                   | Chalcolithic    | Liesau et al. 2014: 196–199, Daza 2015: 28–30 |
|     | Camino de las Yeseras (Madrid) | Dogs in funerary context               | 2 complete articulated dogs                  | Chalcolithic    | Daza 2011: 214–215, Daza 2015: 31–34 |
|     | Camino de las Yeseras (Madrid) | Dogs in a pit                           | 7 dogs, mainly represented by skulls         | Chalcolithic    | Liesau et al. 2008: 107, Daza 2015: 24–27 |
|     | Camino de las Yeseras (Madrid) | Dog in funerary context                | 1 complete articulated dog                   | Bronze Age      | Daza 2011: 215.                   |
| 6.  | Caserío de Perales del Río (Madrid) | Dog in funerary context               | 1 complete articulated dog                   | Bronze Age      | Blasco et al. 1991: 56.            |
| 7.  | Tejar del Sastre (Madrid)      | Dog in a pit                           | 1 complete articulated dog                   | Bronze Age      | Quero 1982: 218                    |
| 8.  | Loma de Chiclana (Madrid)      | Dog in a pit                           | 1 dog skull                                  | Chalcolithic    | Díaz-Andreu et al. 1992: 88       |
| 9.  | Las Matillas (Madrid)          | Dog in a pit                           | 1 dog skull                                  | Chalcolithic    | Díaz del Río 2001: 201            |
| 10. | El Espinillo (Madrid)          | Dog in a pit                           | 1 complete articulated dog                   | Chalcolithic    | Baquedano et al. 2000: 26         |
| Number | Location                        | Type of Deposit                                                                 | Deposited Dogs                                                                 | Age | References                                                                 |
|--------|---------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------|
| 11     | El Juncal (Madrid)              | Dogs in outstanding location (ditched enclosures)                               | Complete articulated dogs                                                       | Chalcolithic | Martínez et al. 2014: 157, Martínez et al. 2015: 248–252                |
| 12     | Cerro de la Cabeza (Ávila)       | Dog in funerary context                                                         | 1 complete articulated dog                                                       | Chalcolithic | Fabián & Blanco, 2012: 110.                                             |
| 13     | Valladares I (Toledo)            | Dog in a pit                                                                    | 1 complete articulated dog                                                       | Chalcolithic | García et al. 2008: 137–138                                             |
| 14     | La Pijotilla (Badajoz)           | Dog in a pit                                                                    | 1 complete articulated dog                                                       | Chalcolithic | Hurtado 1991: 50–56                                                     |
| 15     | Perdigões (Évora, Portugal)      | Dog skulls in outstanding location (ditched enclosure)                           | 2 dog skulls                                                                     | Chalcolithic | Valera 2008: 30.                                                        |
| 16     | Marroquís Bajos (Jaén)           | Dog in outstanding location (ditched enclosure)                                 | 1 complete articulated dog                                                       | Chalcolithic | Burgos et al. 2001a: 407.                                               |
|        | Marroquís Bajos (Jaén)           | Dog in a pit                                                                    | 1 complete articulated dog                                                       | Chalcolithic | Burgos et al. 2001b: 425.                                               |
| 17     | Polideportivo de Martos (Jaén)   | Dogs in a pit                                                                   | 5 complete articulated dogs                                                       | Neolithic   | Lizcano & Cámara, 2003: 238                                             |
|        | Polideportivo de Martos (Jaén)   | Dog in a pit                                                                    | 1 complete articulated dog                                                       | Neolithic   | Lizcano & Cámara, 2003: 238                                             |
|        | Polideportivo de Martos (Jaén)   | Dog in a pit                                                                    | 1 complete articulated dog                                                       | Neolithic   | Lizcano & Cámara, 2003: 238                                             |
| 18     | Camino del Molino (Caravaca de la Cruz, Murcia) | Dogs in funerary context                                        | More than 50 articulated dogs                                                   | Chalcolithic | Lomba et al. 2009: 153                                                 |
| 19     | Casa Noguera, (Archivel, Caravaca de la Cruz, Murcia) | Dog in funerary context                                        | 1 complete articulated dog                                                       | Chalcolithic | García & Martínez, 2004                                                 |
| 20     | Valencina de la Concepción (Seville) | Dog in a pit                                                                          | 1 complete articulated dog                                                       | Chalcolithic | Abril et al. 2010: 95                                                   |
|        |                                | Dogs in outstanding location (ditched enclosure)                                | 32 complete dogs                                                                 | Chalcolithic | Hain 1982: 93, 140                                                      |
| 21     | c/ Dolores Quintanilla Nº 6 (Carmona, Seville) | Dog in a pit                                                                      | 5 complete articulated dogs                                                       | Chalcolithic | Román & Conlin 2001: 135                                               |
|        |                                | Dog in a pit                                                                      | 1 dog skull                                                                      | Chalcolithic | Román & Conlin 2001: 530                                               |

**Table 1:** Dog remains found in Iberian settlements and their types of deposits (dogs in funerary contexts, dogs in outstanding locations, dogs in pits) The numbers in the left column correspond to those in Figure 1.
skeleton was found deposited together with a stone axe (Figure 1: 5, Table 1: 5), (Liesau et al. 2014b) (Figure 3).

The final category of dog remains which were deposited within pit settlements is here referred to as dogs in pits. In this category, articulated individuals are distinguished from isolated or dismembered deposits, such as skulls. Examples of complete articulated skeletons are noted from La Pijotilla in Badajoz (Figure 1: 14 Table 1: 14), (Hurtado 1991: 50–56), Valladares I in Toledo (Figure 1: 13, Table 1: 13), (García et al. 2008: 137–138), Marroquíes Bajos in Jaén (Figure 1: 19, Table 1: 16), (Burgos et al. 2001b: 407), Valencina de la Concepción (Figure 1: 20, Table 1: 20), (Abril et al. 2010: 95) and Dolores Quintanilla Street (Figure 1: 21, Table 1: 21), (Román & Conlin 2001: 530), the latter two in Seville. Similar deposits were also found in the Madrid region at El Espinillo (Figure 1: 9, Table 1: 10), (Baquedano et al. 2000: 26). Additional examples were observed at Bronze Age sites including Can Roqueta II (Figure 1: 1, Table 1: 1), (Albizuri 2011b: 148) and Torre Romeu in Barcelona (Figure 1: 2, Table 1: 2), (Albizuri 2011b: 63, Oliva & Terrats 2005, Piña & Saña 2004), La Huelga in Palencia (Figure 1: 3, Table 1: 3) (Liesau, Esparza & Sánchez 2014) and Tejar del Sastre in Madrid (Figure 1: 8, Table 1: 7), (Quero 1982: 218).
Disarticulated skulls from Chalcolithic strata were discovered at Dolores Quintanilla Street (Figure 1: 21, Table 1: 21), (Román & Conlin 2001: 530) in Seville, at Las Matillas (Díaz del Río 2001: 201) and La Loma de Chiclana (Figure 1: 7, Table 1: 8) (Díaz-Andreu et al. 1992: 88) in Madrid. At Camino de las Yeseras the remains of at least seven dogs were discovered in a large pit comprising the incomplete skeletons, mainly heads, of a minimum of seven individuals (Figure 1: 5, Table 1: 5), (Liesau et al. 2008: 107, Daza 2015: 24–27) (Figure 4). This is a unique case in Late Prehistoric Iberia. Later, in the Bronze Age, a dog skull has been found at one site: in a pit at Torre Romeu in Barcelona (Figure 1: 2, Table 1: 2), (Albizuri 2011b: 63).

Figure 3: Plan of the entrance of the fourth ditch at Camino de las Yeseras (Madrid) with the dog remains located at both sides. Image courtesy of Argea Consultores S.L.

Methods: Traditional Osteometry vs Geometric Morphometrics

The application of traditional osteometric methodology has been in place ever since Harcourt’s (1974) publication, which revisited Koudelka’s factors (1885) to estimate the shoulder height of dogs. These estimations, along with cephalic indices, have been studied for European dog remains from the Mesolithic, and especially from the Iron Age onwards (Degerbol 1961, Clutton-Brock 1963, Harcourt 1974, Benecke 1987, Clark 1995, De Grossi Mazzorin 2000, Sanchís & Sarrión 2004). These analyses are also useful for understanding and interpreting the dog phenomenon, as such indices have been applied to zooarchaeological measurement databases. These databases have produced results which allow characteristics of dog specimens to be derived from both long bones and cephalic indices. This has made it possible to compare osteometric data of wolves and dog breeds, and to allocate the archaeological specimens to morphotypes. Therefore, this provides useful data to the study of the dog phenomenon.

Here, traditional osteometrics have been used to compile a database. Shoulder height indices have also been used (Koudelka 1885, Harcourt 1974, Clark 1995). However, subtle changes in the shape of some bones may be difficult to detect. In order to answer some of the questions relating to the possible selection of differentiated specimens for these deposits, we used landmark-based geometric morphometrics to observe these subtle
changes in the shape of the bones (Kendall 1977, 1981; Bookstein 1982, 1991; Toro-Ibacache et al. 2010).

The mandible was selected for this study as it is frequently found in the archaeological record as it is relatively robust, and because the mineralization of the teeth may favour its preservation. Also, flat bones are useful for two-dimensional (2D) geometric morphometric study. The configuration of the mandible may provide information relating to the musculature and behaviour of the animal, and even its degree of domestication (Wayne 1986, Zeder 2012). The differential development of mandibular components might reveal ontogenetic aspects related to the animal’s mechanical traction or masticatory function (Biknevicius & Leigh 1997, Segura & Flores 2009).

Eight landmarks were selected (described in Table 2, shown in Figure 5) to characterise the shape of the mandibles. Two statistical analyses were applied: Principal Component Analysis (PCA) and Canonical Variate Analysis (CVA). PCA is a variable reduction procedure, useful when data on a number of variables has been obtained (particularly where a large amount has been obtained and it is thought that there is some redundancy in those variables). In this case, redundancy means that some of the variables correlate with one another, possibly because they are measuring the same construct. It is possible to reduce the observed variables into a smaller number of principal components (artificial variables) that will account for most of the variance in the observed variables (Hatcher 1994: 2). CVA is a method to find the set of axes (or linear combination of variables) that allows for the greatest possible ability to discriminate between two or more groups. It can plot the mean of each group’s CVA axes scores on a CVA axes plot. The CVA axes,
determined by a number of known groups, can assign unknown specimens to one of the known groups.

Material

For this study 53 mandibles were sampled from a range of different canid species, including archaeological individuals (n = 13), modern breeds of dogs (n = 16), wolves (n = 5) and foxes (n = 11), in addition to other canid species such as fox (Vulpes vulpes), arctic fox (Alopex lagopus), dhole (Cuon alpinus) and golden jackal (Canis aureus) (Table 3). The archaeological materials was kindly provided for this study by Corina Liesau from the Department of Prehistory and Archaeology in the Universidad Autónoma de Madrid and the directors of the archaeology companies Argea S.L. and Trébede, Patrimonio y Cultura S.L. Access to the dog and wolf comparative collection was kindly granted by Professor Arturo Morales from the Laboratorio de Arqueozoología at the Universidad Autónoma de Madrid. Modern-fox mandibles from southern Iberia were kindly loaned to the author by Dr Concepción Azorit from the Department of Animal and Plant Biology and Ecology at the Universidad de Jaén.

Most of the archaeological samples are from Camino de las Yeseras. These derive from both from special deposits – which follow the types of deposit explored above – and from other pits without relevant information or material. It is important to note that further research is ongoing as part of the author’s doctoral thesis, with forthcoming results exploring a number of additional specimens.

Results

Traditional indices for shoulder height suggest a mean measurement of 44–47 cm, and a 7–9 range mean for the stoutness of our specimens (Appendix 1).

The PCA analyses did not reveal groups or striking differences between these archaeological specimens (Figure 6), whereas the application of CVA did show a different spread to that obtained through PCA (Figure 7).

The archaeological mandibles appear less similar than initially interpreted. Figure 7 shows that although the archaeological mandibles all fall within a similar range on the y-axis, a division can be observed within the results. This suggests the presence of two distinct groups within the archaeological samples. The first group in the CVA appears close to that of modern dog breeds. These specimens were recovered from special deposits at Camino de las Yeseras. Point number 1 is one of two dogs associated with the Bell-Beaker tomb which had evidence of sacrifice. Point number 7 represents a dog from a Bronze

Table 2: Description of the landmarks chosen.

| No. of Landmark | Description |
|-----------------|-------------|
| 1.              | Anterior end of the symphysis between the dentary bones. |
| 2.              | Posterior edge of the canine alveolus. |
| 3.              | Posterior edge of the 2nd molar alveolus. |
| 4.              | Rearmost point of the coronoid process. |
| 5.              | Rearmost point of the angular process. |
| 6.              | Point in the mandibular ramus below posterior edge of the mandibular foramen. |
| 7.              | Point in the mandibular ramus below anterior edge of the 1st molar. |
| 8.              | Posterior end of the symphysis between the dentary bones. |
Age child burial. Finally, point number 6 represents a dog found on one of the sides of a ditch (Figure 3, Table 1).

The variability put forward by CVA analyses allow to consider differences among dog mandibles in the archaeological record studied.

**Discussion and Conclusions**

The important social role of dogs can be inferred by the typical presence of numerous complete skeletons late prehistoric sites in the Iberian Peninsula. As previously mentioned, dog remains have been recovered from a range of different contexts, including burials, pits, and outstanding locations. The different contexts which dog remains have been recovered from may suggest that dogs were used for numerous different purposes in the Iberian Peninsula during Late Prehistory (Figure 1, Table 1). Additionally, this may also reflect the manner in which dogs were perceived by human societies. It may be that this varied across sites, or that dogs encompassed an important role in ideology and symbolism within Late Prehistoric Iberia. The repeated placement of dog remains in particular as special deposits (Grant 1984, Hamerow 2006: 1–2) is something I consider to be sufficiently noteworthy to be considered a dog phenomenon.

The preparation of a catalogue of deposited dog remains allows for a series of commonalities to be observed amongst registered dog osteological remains. Differences are also noted, which leads us to propose ordering these deposits in different typologies. This research has demonstrated both the location and quantity of dog remains deposits from the Iberian Peninsula and also the different contexts in which they are placed. Important contrasts have been found which, I argue, refer to different reasons for placement. Further research will consider the importance of the archaeological data alongside bone assemblages and also investigate possible ethnographic parallels.

Morphological differences and their interpretation as indicators of a diversity of life-function is an issue that has so far not been demonstrated in dogs due to the homogeneity of the population (Sanchís & Sarrión 2004: Figure 5: Lateral view of the mandible of the archaeological individual from La Huelga (Palencia). Location of the 8 landmarks proposed for the mandibles is noted.
| No.  | Code          | Provenance of the Material                  | Chronology/Breeds/Species |
|------|---------------|---------------------------------------------|---------------------------|
| 1.   | YESEA21-001   | Camino de las Yeseras – Dog in funerary context | Chalcolithic              |
| 2.   | YESEA40-003   | Camino de las Yeseras – Dog in a pit         | Chalcolithic              |
| 3.   | YESEA40-004   | Camino de las Yeseras – Dog in a pit         | Chalcolithic              |
| 4.   | YESEA40-005   | Camino de las Yeseras – Dog in a pit         | Chalcolithic              |
| 5.   | YESEA40-006   | Camino de las Yeseras – Dog in a pit         | Chalcolithic              |
| 6.   | YESEA54-010   | Camino de las Yeseras – Dog in a ditch       | Chalcolithic              |
| 7.   | YESEA134-013  | Camino de las Yeseras – Dog in funerary context | Bronze Age               |
| 8.   | YESEA132-017  | Camino de las Yeseras – Dog in a pit         | Roman Period              |
| 9.   | HUELG36C-019  | La Huelga – Dog in a pit                     | Bronze Age                |
| 10.  | SCHNAU-020    | LAZ-UAM Comparative collection              | Schnauzer*                |
| 11.  | PODORI-021    | LAZ-UAM Comparative collection              | Podenco orito*            |
| 12.  | PODORI-022    | LAZ-UAM Comparative collection              | Podenco orito*            |
| 13.  | GALGO-023     | LAZ-UAM Comparative collection              | Greyhound*                |
| 14.  | PAGUAS-024    | LAZ-UAM Comparative collection              | Perro de aguas*           |
| 15.  | MASPARI-025   | LAZ-UAM Comparative collection              | Mastiff*                  |
| 16.  | PASTAL-026    | LAZ-UAM Comparative collection              | German Shepherd*           |
| 17.  | VIRING-028    | LAZ-UAM Comparative collection              | Viringo*                  |
| 18.  | BULLDOG-029   | LAZ-UAM Comparative collection              | Bulldog*                  |
| 19.  | HUSKY-030     | LAZ-UAM Comparative collection              | Husky*                    |
| 20.  | LABRA-031     | LAZ-UAM Comparative collection              | Labrador*                  |
| 21.  | BOXER-032     | LAZ-UAM Comparative collection              | Boxer*                    |
| 22.  | TERRANO-033   | LAZ-UAM Comparative collection              | Terranova*                |
| 23.  | TECKEL-034    | LAZ-UAM Comparative collection              | Dachshund*                |
| 24.  | CARLIN-035    | LAZ-UAM Comparative collection              | Pug*                      |
| 25.  | LASAPSO-036   | LAZ-UAM Comparative collection              | Lasha Apso*               |
| 26.  | YORKTER-037   | LAZ-UAM Comparative collection              | Yorkshire Terrier*         |
| 27.  | CHACAL-038    | LAZ-UAM Comparative collection              | Golden jackal (Canis aureus) |
| 28.  | CUON-039      | LAZ-UAM Comparative collection              | Dhole (Cuon alpinus)      |
| 29.  | ZORROART-040  | LAZ-UAM Comparative collection              | Artic fox (Alopex lagopus) |
| 30.  | VULPES-041    | LAZ-UAM Comparative collection              | Fox (Vulpes vulpes)       |
| 31.  | CANLUP-042    | LAZ-UAM Comparative collection              | Wolf (Canis lupus)        |
| 32.  | CANLUP-043    | LAZ-UAM Comparative collection              | Wolf (Canis lupus)        |

Contd.
Demonstration of the specific use of dogs has been possible in very few cases; for example as pack animals (Albizuri et al. 2011, Liesau, Esparza & Sánchez 2014: 111), for consumption of meat (Driesch & Boessneck: 1980), or fur procurement (Sanchís & Sarrión 2004: 180). Several researchers have indicated that these dogs would play a role to assist in hunting or cattle-keeping, though this interpretation is only possible from indirect evidence (Sanchís & Sarrión 2004: 162, 179, Ruiz et al., 2014). However, at present, osteological techniques are yet to be used on dog remains to confirm whether certain dogs were specialized for certain, specific tasks.

Table 3: Sample of mandibles used in the geometric morphometrics study. The left column shows the number used for the statistical analysis. Archaeological materials are shown in bold. All specimens with * correspond to Canis familiaris.
Figure 6: Analysis of the Principal Components (PC1 and PC2). The mean is represented by a large symbol for each group. While foxes or brachycephalic dogs from the modern dogs collection are clearly separated, most of the other modern breeds and archaeological specimens are largely mixed. See Table 3 for the identifying number for each individual.

when trying to identify subtle morphological differences. The limited number of results obtained when applying indices to the (often badly preserved) archaeological material, made this a difficult task to undertake. These applications show apparent homogeneity between individuals. Geometric Morphometrics could provide important information in this regard.

Geometric Morphometrics have been used to determine issues relating to the origins of domestication, providing important results in addition to the development of new lines of multi-disciplinary combined research (Larson et al. 2014, Drake et al. 2015). Here the study focuses on domestic species. Studies from later periods have allowed assignment of archaeological dog remains to different morphotypes of dogs based on differing osteometry and statistics (Morales et al. 2015). In our sample of dog remains from Iberian Late Prehistory, we have to deal with very subtle osteological/morphological differences between individuals, and, often the remains are in a poor state of preservation. Overall the application of Geometric Morphometrics seems to have a great potential that should be further developed and investigated.

Our preliminary results from the 2D geometric morphometric study have provided interesting preliminary results regarding the selected archaeozoological material. Using the same skeletal element for different individuals, it was possible to detect slight differences in the osteological remains. Considering bone preservation, the number of mandibles present per site and the fact that mandibles usually exhibit zones useful to osteometric and morphological study, these preliminary results proved useful in guiding the author’s future research.
The CVA analysis appears to show that there is a specific configuration of the mandible in some dog specimens from the archaeological sample. Most morphological features are subtle and relative to changes in shape, so that statistically significant differences could only be detected and discussed using the results from the geometric morphometrics analysis. This technique seems to reveal that archaeological dogs might present a morphotype variability that went undetected by the standard osteometry indices. We have begun assigning some dogs to the closest morphological group represented by modern specimens.

Following these preliminary results, further research will allow additional interpretations to be made. This aims to explore whether these dogs were intentionally selected for placement in particular deposits because of their morphological characteristics. In such cases, this could represent a different symbolic connotation.

Ongoing PhD research by the author is extending the preliminary research presented in this paper, expanding both the sample size and the geometric morphometrics-based approach. Further results are to be subjected to rigorous statistical analysis as part of the doctoral thesis, and to consider whether the separate groupings form a distinct pattern. From this, it will be possible to provide a comprehensive overview of deposited dog remains in the Later Prehistory of the Iberian Peninsula.

**Additional File**
The additional file for this article can be found as follows:
Appendix 1. Results of shoulder height and bone stoutness for specimens found in Iberian Late Prehistoric Sites through the application of indexes from some authors (Harcourt 1885, Koudelka 1974, Clark 1975) to measurements. Individual measurements with * from Sanchís and Sarrión (2004). Individual measurements with ** from Liesau, Esparza and Sánchez (2014). DOI: https://doi.org/10.5334/pia-487.s1

Acknowledgements
In studying the material presented here I have benefitted greatly from the help of numerous people. I am most grateful to Corina Liesau (Department of Prehistory and Archaeology, UAM), Arturo Morales (Department of Biology, UAM and Laboratorio de Arqueozoología LAZ-UAM) and Concepción Azorit (Department of Animal and Plant Biology and Ecology, UJA) for sharing knowledge and materials with me. Laura Llorente (University of York and LAZ-UAM) and Carlos Arteaga (Department of Geography, UAM) kindly read and commented on an earlier version of this paper. I also wish to thank Patricia Ríos (Department of Prehistory and Archaeology, UAM) for her help with the geographical information, and for her and Laura Llorente’s comments on the final version of this manuscript. I am also grateful to Argea Consultores S.L. and Trébede, Patrimonio y Cultura S.L. for the archaeological materials. Finally, I would like to extend my sincerest thanks to Markus Bastir (National Museum of Natural Sciences, MNCN and Superior Council of Scientific Research, CSIC), Daniel García (MNCN-CSIC) and Soledad de Esteban-Trivingo (Miquel Crusafont Catalan Institute of Paleontology, ICP and Transmitting Science) for advice on future analysis.

Competing Interests
This research was performed as part of the project “Las sociedades calcolíticas y su marco temporal en la región de Madrid. Una revisión a la luz de nuevos datos (HAR 2011 28731)” (PI: Corina Liesau), funded by the Ministry of Economy and Competitiveness of the Government of Spain. A. Daza Perea’s work was funded by the Spanish Ministry of Economy and Competitiveness through a FPI PhD grant (grant code BES-2012-056461).

Author Information
Financial support was provided by Project HAR 2011 28731 “Las sociedades calcolíticas y su marco temporal en la región de Madrid. Una revisión a la luz de nuevos datos” and a PhD grant BES-2012-056461 from the Ministry of Economy and Competitiveness of the Government of Spain.

References
Abril, D, Nocete, F, Riquelme, J A, Bayona, M R and Ináció, N 2010 Zooarqueología del III Milenio A.N.E.: El barrio metalúrgico de Valencina de la Concepción (Seville). Complutum, 21(1): 87–100. Available at: https://revistas.ucm.es/index.php/CMPL/article/view/CMPL1010120087A.

Albizuri Canadell, S 2011a Animales sacrificados para el cortejo fúnebre durante el bronce inicial (2300–1300 cal BC). El asentamiento de Can Roqueta II (Sabadell, Barcelona). Quaderns de prehistòria i arqueologia de Castelló, 29: 7–26. Available at: http://www.raco.cat/index.php/QuadernsPrehistoriaCastello/article/view/261129.

Albizuri Canadell, S 2011b La ofrenda animal durante el Bronce Inicial en Can Roqueta II (Sabadell, Vallés Occidental). Arqueozoología del ritual funerario. Unpublished thesis (PhD), Universidad de Girona.

Albizuri, S, Fernández, M and Tomás, X 2011 Evidencias sobre el uso del perro en la carga durante el Bronce Inicial en la Península Ibérica: el caso de Can Roqueta II (Sabadell, Barcelona). Archaeofauna, 20: 139–155.

Baquedano, Mª I, Blanco, J F, Alonso, P, and Álvarez, D 2000 El Espinillo: un yacimiento calcolítico y de la Edad del Bronce en las terrazas del Manzanares.
Arqueología, Paleontología y Etnografía, 8. Available at: http://www.madrid.org/bvirtual/BVCM001010.pdf.

**Bellido Blanco, A** 1995 La problemática de los “Campos de Hoyos”: Una aproximación a la economía y el poblamiento del Calcolítico y la Edad del Bronce en la Submeseta Norte. Memoria de Licenciatura. Universidad de Valladolid. Available at: https://www.academia.edu/504762/Los_campos_de_hoyos_Inicios_de_la_econom%C3%ADa_agr%C3%ADcola_en_la_Submeseta_Norte.

**Benecke, N** 1987 Studies on Early Dog Remains from Northern Europe. *Journal of Archaeological Science*, 14: 31–49. DOI: https://doi.org/10.1016/S0305-4403(87)80004-3

**Benítez de Lugo, L** 2011 Las motillas del Bronce de La Mancha: treinta años de investigación arqueológica. In: Bueno et al Arqueología, sociedad, territorio y paisaje. Estudios sobre prehistoria reciente, Protohistoria y transición al mundo romano. Homenaje a Mª Dolores Fernández-Posse, Bibliotheca Praehistorica Hispana vol. XXVIII. Consejo Superior de Investigaciones Científicas. Madrid: 141–162.

**Biknevicius, A R and Leigh, S R** 1997 Patterns of growth of the mandibular corpus in spotted hienas (Crocuta crocuta) and cougars (Puma concolor). *Zoological Journal of the Linnean Society*, 120: 139–161. DOI: https://doi.org/10.1111/j.1096-3642.1997.tb01276.x

**Blasco, C, Sánchez, M L, Calle, J, Robles, F J and González, A** 1991 Enterramientos del horizonte Protocogotas en el valle del Manzanares. *Cuadernos de prehistoria y arqueología de la Universidad Autónoma de Madrid*, 18: 55–112. Available at: http://www.uam.es/otros/cupauam/pdf/Cupauam18/1804.pdf.

**Bookstein, F L,** 1982 Foundation of Morphometrics. *Annual Review of Ecology and Systematics*, 13: 451–470. DOI: https://doi.org/10.1146/annurev.es.13.110182.002315

**Burgos, A, Pérez, C and Lizcano, R** 2001a Actuación arqueológica realizada en la piscina comunitaria de los bloques A1, A2, A3, A6, A7, y A8 del sector UA-23 de Marroqués Bajos de Jaén, *Anuario arqueológico de Andalucía, Actividades de urgencia*, 3 (1): 402–413.

**Burgos, A, Pérez, C and Lizcano, R** 2001b Actuación arqueológica realizada en el espacio destinado a la instalación del ovoide del vial 4 de la UA-23, Marroqués Bajos. Jaén, *Anuario Arqueológico de Andalucía* 1998, 3 (1): 422–428.

**Clark, K M** 1995 The later prehistoric and protohistoric dog: the emergence of canine diversity. *Archaeozoologia*, 7 (2): 9–32.

**Clutton-Brock, J** 1963 The origins of the dog. In Brothwell, D and Higgs, E (Eds.) *Science In Archaeology*, 269–274. London, Thames and Hudson.

**Conlin Hayes, E** 2003 Los inicios del III milenio a.C. en Carmona: las evidencias arqueológicas, Carel: Carmona. *Revista de estudios locales*, N°. 1: 83–143. Available at: http://www.carmona.org/publicaciones/carel/Art4.pdf.

**Daza Perea, A** 2011 Los depósitos de Perros. In Blasco, C, Liesau, C and Ríos, P (Eds.) *Yacimientos calcolíticos con campaniforme de la región de Madrid*. Patrimonio Arqueológico, 6. Universidad Autónoma de Madrid: 211–222.

**Daza Perea, A** 2015 La fauna en el Calcolítico de la Región de Madrid: Los depósitos de canes. Másteres de la UAM. Año Académico 2011–2012 (Colección de Trabajos Fin de Máster para publicación digital), *UAM Ediciones*. ISBN: 978-8344-452-8.

**Degerbøl, M** 1961 On a find of a Preboreal domestic dog (*Canis familiaris L.*) from Star Carr, Yorkshire, with remarks on other Mesolithic dogs. *Proceedings of the Prehistoric Society* 28: 33–55. DOI: https://doi.org/10.1017/S0079497X0001598X

**De Grossi Mazzorin, J** 2000 Morphological and osteological changes in the dog from the Neolithic to the Roman Period in Italy. In Crockford, J (Ed.) *Dogs through...*
Time: An Archaeological perspective, British Archaeological Report (BAR) International Series 889, Archaeopress, Oxford: 141–161.

Delibes de Castro, G 1977 El vaso campaniforme en la Meseta Norte española. Universidad de Valladolid. Departamento de Prehistoria y Arqueología. Valladolid.

Díaz-Andreu, M, Liesau, C and Castaño, A 1992 El poblado calcolítico de Loma de Chiclana (Vallecas, Madrid). Excavaciones de urgencia realizadas en 1987. Arqueología, Paleontología y Etnografía 3, Madrid: 31–116. Available at: http://www.madrid.org/bvirtual/BVCM000363.pdf.

Díaz del Río, P 2001 La formación del paisaje agrario: Madrid en el III y II milenio B.C. Arqueología, Paleontología y Etnografía, 9. Comunidad de Madrid. Available at: http://www.madrid.org/bvirtual/BVCM002085.pdf.

Díaz del Río, P 2003 Recintos de fosos del III milenio AC en la Meseta Peninsular. Trabajos de Prehistoria, 60(2). DOI: https://doi.org/10.3989/tp.2003.v60.i2.81

Díaz del Río, P and García Sanjuán, L (Eds.) 2006 Social Inequality in Iberian Late Prehistory. British Archaeological Report, BAR International Series 1525.

Drake, A G, Coquerelle, M and Colombeau, G 2015 3D morphometric analysis of fossil canid skulls contradicts the suggested domestication of dogs during the late Paleolithic. Nature. Scientific reports, 5. DOI: https://doi.org/10.1038/srep08299

Driesch, A V D and Boessneck, J 1980 Die Motillas von Azuer und Los Palacios (Prov. Ciudad Real). Untersuchung der Tierknochenfunde, Studien über frühe Tierknochenfunde von der Iberischen Halbinsel 7: 84–121.

Fabían García, J and Blanco González, A 2012 Cuatro enterramientos calcolíticos en hoyo del Cerro de la Cabeza (Avila). Complutum, 23 (1): 99–120. Available at: http://revistas.ucm.es/index.php/CMPL/article/view/39533.
Daza Perea: Preliminary Studies of Late Prehistoric Dog (*Canis lupus f. Familiaris* Linnaeus, 1758) Remains from the Iberian Peninsula

Hatcher, L 1994 A step-by-step approach to using the SAS system for factor analysis and structural equation modeling. Cary, NC: SAS Institute Press. Available at: http://support.sas.com/publishing/pubcat/chaps/61314.pdf.

Hill, J D 1995 *Ritual and Rubbish in the Iron Age of Wessex*. Oxford, British Archaeological Report British Series 242.

Hurtado Pérez, V 1991 Informe de las excavaciones de urgencia en La Pijotilla. Campaña de 1990, *Extremadura Arqueológica*, 2 (Ejemplar dedicado a I Jornadas de Prehistoria y Arqueología en Extremadura): 45–68.

Kendall, D G 1977 The diffusion of shape. *Journal of Applied Probability*, 9: 428–30. Available at: http://www.jstor.org/stable/1426091. DOI: https://doi.org/10.1017/S0001867800028743

Kendall, D G 1981 The statistics of shape. In Bartnett, V *Interpreting multivariate data*. New York, John Wiley & Sons: 75–80.

Koudelka, F 1885 Cited by Harcourt, Das Verhältnis der Ossa longa zur Skeletthöhe bei den Säugetieren. *Verhandlungen Naturforschung Vereins*, 24 Brünn.

Kunst, M 2010 Zambujal. A dinâmica da sequência construtiva. In Gonçalves, V S, and Sousa, A C (Eds.): *Transformação e mudança no centro e sul de Portugal: o 4.º e o 3.º milênios A.N.E*. Cascais: 131–153.

Larson, G, Dobney, K, Cucchi, T, Evin, A, Linderholm, A, Loog, L, Ardern Hulme-Beaman, A H and Perri, A 2014 Deciphering dog domestication through a combined ancient DNA and Geometric morphometric approach. *Poster ICAZ International Conference in San Rafael, Argentina*. Available at: https://www.academia.edu/8664066/Deciphering_dog_domestication_through_a_combinedAncient_DNA_and_geometric_morphometric_approach.

Liesau, C and Blasco, C 2006 Depósitos con fauna en yacimientos del Bronce Medio en la Cuenca del Tajo. In: Weiss-Krejci, E (Ed.) *Animais na Pré-história E Arqueologia da Península Ibérica*. Actas do IV Congresso de Arqueologia Peninsular (Faro, 2004): 81–92.

Liesau, C, Blasco, C, Ríos, P, Vega, J, Menduñia, R, Blanco, J F, Baena, J, Herrera, T and Petri, A 2008 Un espacio compartido por vivos y muertos: El poblado calcítico de fosos de Camino de las Yeseras (San Fernando de Henares, Madrid). *Complutum*, 19 (1): 97–120. Available at: https://revistas.ucm.es/index.php/CMPL/article/view/CMPL0808110097A.

Liesau, C, Daza, A, Llorente, A and Morales, A 2013 More questions than answers: the singular animal deposits from Camino de las Yeseras (Chalcolithic, Madrid, Spain). *Anthropozoologica*, 48 (2): 277–286. DOI: https://doi.org/10.5252/az2013n2a6

Liesau, C, Esparza, A and Sánchez, A 2014 ¿Huesos en la basura o depósito ritualizado? Los perros descuartizados de La Huelga (Dueñas, Palencia) *Zephyrus*, LXXIV: 89–115. DOI: https://doi.org/10.14201/zephyrus20147489115

Liesau, C, Vega, J, Daza, A, Ríos, P, Menduñia, R and Blasco, C, 2013–2014 Manifestaciones simbólicas en el acceso Noreste del Recinto 4 del Foso en Camino de las Yeseras (San Fernando de Henares, Madrid). *Saldvie: Estudios de prehistoria y arqueología*, 13–14: 53–69. Available at: http://saldvie.unizar.es/sites/default/files/Saldvie_13_14_Liesau_et_al.pdf.

Liesau, C, Vega, J, Menduñia, R, Daza, A, Ríos, P and Blasco, C 2014 El simbolismo animal en áreas de tránsito de un recinto de fosos: el ejemplo de Camino de las Yeseras (San Fernando de Henares) In Actas de las X Jornadas de Patrimonio Arqueológico en la Comunidad de Madrid. Organizadas por la Dirección General de Patrimonio Arqueológico en el Museo Arqueológico Regional de la Comunidad de Madrid durante los días 21 y 22 de noviembre de 2013. *Dirección general*
Daza Perea: Preliminary Studies of Late Prehistoric Dog (*Canis lupus f. Familiaris* Linnaeus, 1758) Remains from the Iberian Peninsula.

---

**Liesau von Lettow-Vorbeck, C** 2011 *Los restos de mamíferos del ámbito doméstico y funerario.* In Blasco, C, Liesau, C and Ríos, P (Eds.) *Yacimientos calcolíticos con campaniforme de la región de Madrid.* Patrimonio Arqueológico, 6. Universidad Autónoma de Madrid: 171–198.

**Liesau von Lettow-Vorbeck, C** 2012 *Depósitos con ofrendas de animales en yacimientos Cogotas I: antecedentes y características.* In: Rodríguez, J A, and Fernández, J (Eds.), *Cogotas I, Una cultura de la Edad del Bronce en la Península Ibérica.* Homenaje a María Dolores Fernández-Posse. Universidad de Valladolid, Consejería de Cultura y Turismo. Junta de Castilla y León: 219–257.

**Lizcano, R, Cámara, J A Riquelme, J A, Cañabate, M L, Sánchez, A and Afonso, J A** 1991–92 *El Polideportivo de Martos: Producción económica y símbolos de cohesión en un asentamiento del Neolítico Final en las Campiñas del Alto Guadalquivir.* *Cuadernos de prehistoria y arqueología de la Universidad de Granada*, 16–17: 5–101. Available at: http://revistaseug.ugr.es/index.php/cpag/article/view/1259.

**Lizcano Prestel, R and Cámara Serrano, J A** 2003 *Producción económica y sedentarización.* *El registro arqueológico del Polideportivo de Martos (Jaén).* In: II Jornadas temáticas Andaluzas de Arqueología. Resúmenes. Ronda: 229–248.

**Lomba, J, López, M, Ramos, F and Avilés, A** 2009 *El enterramiento múltiple, calcolítico, de Camino del Molino (Caravaca, Murcia).* Metodología y primeros resultados de un yacimiento excepcional. *Trabajos de Prehistoria*, 66 (2): 143–159. DOI: https://doi.org/10.3989/tp.2009.09025

**Márquez, J E** 2006 *Sobre los depósitos estructurados de animales en yacimientos con fosos del sur de la Península Ibérica.* In: Weiss-Krejci, E (Ed.) *Animais na Pré-história e Arqueologia da Península Ibérica.* Actas do IV Congresso de Arqueologia Peninsular (Faro, 2004): 15–25.

**Márquez, J E and Jiménez, V** 2010 *Recintos de Fosos. Genealogía y significado de una tradición en la Prehistoria del sureste de la Península Ibérica (IV-III milenios AC).* Servicio de publicaciones de la Universidad de Málaga. Málaga.

**Martín, V, López, O and Moreno, E** 2014 *El poblado calcolítico de El Juncal (Getafe, Madrid).* In: Actas de las novenas jornadas de Patrimonio Arqueológico de la Comunidad de Madrid. Organizadas por la Dirección General de Patrimonio Histórico en el Museo Arqueológico Regional de la Comunidad de Madrid durante los días 15 y 16 de noviembre de 2012. *Dirección general de Patrimonio Histórico.* Consejería de Empleo, Turismo y Cultura. Comunidad de Madrid: 149–158.

**Martín, V, Moreno, E, Gallego, C and López, O** 2015 *El yacimiento inédito de El Juncal (Getafe).* *La arqueología en el trazado ferroviario del sur de la Comunidad de Madrid. Un aventura fascinante.* ADIF AV (Administrador de Infraestructuras Ferroviarias-Alta Velocidad): 243–280.

**Méniel, P** 2008 *Manuel d’archéozoologie funéraire et sacrificielle (Âge du Fer).* (Ed.) Infolio Archeodvnvm, Gollion.

**Molina, F, Cámara, J A, Capel, J, Nájera, T and Sáez, L** 2004 *Los Millares y la periodización de la Prehistoria Reciente del Sureste.* *III Simposio de Prehistoria Cueva de Nerja*, Vols. II–III. Fundación Cueva de Nerja, Nerja: 142–158.

**Morales, A and Liesau, C** 1994 *Arqueozoología del Calcolítico en Madrid: Ensayo crítico de síntesis.* In: Blasco, C (Ed.) *El Horizonte Campaniforme de la región de Madrid en el centenario de Ciempozuelos.* Patrimonio Arqueológico del Bajo Manzanares, 2: 227–247.
Morales, A, López, J, Casado, S and Llorente-Rodríguez, L 2015 Caracterización morfométrica de los perros de la unidad estratigráfica 26 del pozo-depósito de la Tabacalera (Canis familiaris). In Fernández-Ochoa, C, Orejas, A, García, P, Gil-Sendino, F (Eds.), La Fábrica de Tabacos de Gijón: Arqueología e Historia de un espacio milenario: 238–245.

Morris, J 2011 Investigating Animal Burials: Ritual, Mundane and Beyond, BAR British Series 535. Oxford, Archaeopress.

Oliva, M and Terrats, N 2005 Cited by Albizuri 2011 Análisi arqueozoològica de restes de fauna recupertas al jaciment de Can Roqueta/Torre Romeu (Sabadell, Vallès Occidental), Campanya 2002/2003. Excavation memory deposited in the Servei d’Arqueologia de la Generalitat de Catalunya. Inedit.

Piña, A and Saña, M 2004 Cited by Albizuri 2011 Análisi arqueozoològica de restes de fauna recupertas al jaciment de Can Roqueta/Torre Romeu (Sabadell, Vallès Occidental), Campanya 2002/2003. Excavation memory deposited in the Servei d’Arqueologia de la Generalitat de Catalunya. Inedit.

Quero Castro, S 1982 El poblado del Bronce Medio de Tejar del Sastre (Madrid) Estudios de prehistoria y arqueología madrileñas, 1: 183–248.

Richards, C and Thomas, J 1984 Ritual activity and structured deposition in Later Neolithic Wessex. In Bradley, R and Gardiner, J (Eds.) Neolithic Studies: a Review of some Current Research. Oxford, British Archaeological Report British Series 133: 189–218.

Rodríguez Hidalgo, A and García Cabezas, M 2011 Datos preliminares sobre la fauna del yacimiento Calcolítico de La Atalaya (Torrequemada, Cáceres), In Bueno Ramírez et al. (Eds.) From the Origins: The Prehistory of the Inner Tagus Region, British Archaeological Report, BAR International Series 2219: 233–240.

Román Rodríguez, J M and Conlin Hayes, E 2001 Excavaciones arqueológicas de urgencia en la calle Dolores Quintanilla nº 6. Carmona (Seville), Anuario arqueológico de Andalucía 1997, 3: 529–535.

Ruiz, C, Vázquez, J M, Lomba, J, Avilés, A, Haber, M, Orenes, M and Gil, C 2014 El yacimiento Calcolítico “Camino del Molino” (Caravaca de la Cruz, Murcia): una oportunidad excepcional para estudiar los cánidos que poblaron el sur de la Península Ibérica hace 4000 años. Primeros resultados. Orígenes y raíces. Revista de Estudios Historiológicos y Etnográficos de las Tierras Alas del Arhos, Quipar y Alhárbab, 6: 5–7. Available at: http://www.historiaveterinaria.org/update/articulo-revista-origenes-y-raices-2014-1457371055.pdf.

Sánchez, A, Rueda, C and Bellón, J P 2005 Nuevos datos sobre la Zona Arqueológica de Marroquines Bajos: el quinto foso. Trabajos de prehistoria, Vol. 62, N° 2: 151–164. Available at: http://tp.revistas.csic.es/index.php/tp/article/view/73/73 DOI: https://doi.org/10.3989/tp.2005.v62.i2.73

Sanchís, A and Sarrión, I 2004 Restos de cánidos (Canis familiaris ssp.) en yacimientos valencianos de la Edad del Bronce. Archivo de prehistoria levantina, 25: 161–198. Available at: http://www.museuprehistoriavalencia.es/web_mupreva/publicaciones/?q=es&id=760.

Segura, V and Flores, D 2009 Aproximación cualitativa y aspectos funcionales en la ontogenia craneana de Puma concolor (Felidae). Mastozoología Neotropical, 16 (1): 169–182. Available at: http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S0327-93832009000100014.

Serrano Ariza, R 2012 Fortificaciones y estado en la cultura argárica. Arqueología y Territorio, 9: 49–72. Available at: http://www.ugr.es/~arqueologytbereitorio/Artics9/Artic9_4.htm.

Toro-Ibacache, M, Manríquez, M V and Suazo, G I 2010 Morfometría geométrica
y el estudio de las formas biológicas: De la morfología descriptiva a la morfología cuantitativa. *International Journal of Morphology*, 28 (4): 977–990. DOI: https://doi.org/10.4067/S0717-95022010000400001

**Valera, A C** 2008 O recinto calcolítico dos Perdigões: fossos e fossas do Sector I. *Apontamentos de Arqueologia e Património*, 3: 19–27. Available at: http://www.nia-era.org/publicacoes/cat_view/1-revista-apontamentos/14-apontamentos-3-2008.

**Wayne, R K** 1986 Cranial morphology of domestic and wild canids: The influence of development on morphological change. *Evolution* 40: 243–61. DOI: https://doi.org/10.2307/2408805

**Zeder, M** 2012 Pathways to animal domestication In Gepts, P, Famula, T R, Bettinger, R L, Brush, S B, Damania, A B, McGuire, P E, Qualset, C O (Eds.), *Biodiversity in Agriculture: Domestication, Evolution and Sustainability*, Cambridge University Press, Cambridge: 227–229. Available at: https://anthropology.si.edu/archaeobio/cm/Zeder%20Geptsetal%202012.pdf. DOI: https://doi.org/10.1017/CBO9781139019514.013

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**How to cite this article:** Daza Perea, A 2017 Preliminary Studies of Late Prehistoric Dog (*Canis lupus f. Familiaris* Linnaeus, 1758) Remains from the Iberian Peninsula: Osteometric and 2D Geometric Morphometric Approaches. *Papers from the Institute of Archaeology*, 27(1): Art. 12, pp. 1–21, DOI: https://doi.org/10.5334/pia-487

Submitted: 20 December 2014  Accepted: 30 October 2015  Published: 13 April 2017

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