

***BOLORES (TORRES VEDRAS, PORTUGAL) ROCKSHELTER:
PRELIMINARY REPORT OF THE 2008 EXCAVATIONS***

May 2009

Submitted by

Dr. Katina Lillios - Department of Anthropology, University of Iowa, USA

With assistance of

Joe Alan Artz
Anna Waterman
John Willman
Dr. Richard Josephs
Bryan Kendall
Jonathan T. Thomas

Submitted to

Instituto de Gestão do Património Arquitectónico e Arqueológico (IGESPAR), Ministério da Cultura, Portugal

I. Dates of project, participants, condition of site at beginning of field season, excavation strategy, and methods

From July 2-14, 2008, a second season of excavation was conducted at the Late Neolithic-Early Bronze Age mortuary site of Bolóres (Torres Vedras), under the direction of Katina Lillios, University of Iowa (UI). Members of the field crew were: Leonel Trindade (independent archaeologist, Torres Vedras), Anna Waterman (Doctoral student and Project Bioanthropologist, UI), Joe Alan Artz (Director of GIS, Office of the State Archaeologist, UI), and John Willman (undergraduate major in Anthropology, UI). Funding for this season was provided by the Social Science Funding Program, the Department of Anthropology, and International Programs, all of the University of Iowa. The Câmara Municipal de Torres Vedras provided lunches in Ribeira de Pedrulhos for the crew.

Three principal objectives were outlined for the 2008 field season. First, we planned to complete the excavation of Unit 11 from Level 4 (bone bed) to the shale bedrock. In 2007, we partially excavated an articulated individual (denoted as Adult 1 in this report) in this unit and, for 2008, we planned to complete the recovery of this individual ([Figure 1](#)). Our second objective was to refine our procedure for documenting and point-plotting materials recovered in situ. Our third goal was to collect a series of micromorphology samples from the west profile of Unit 11. We were able to meet all of our objectives.

The site showed little signs of disturbance since our departure in July 2007, although much of the vegetation used to cover the site had been washed or blown downslope ([Figure 2](#)). We were able to locate the site data stakes we used for mapping in the 2007 season, and we used them again for our 2008 points. The first few days of the field season were devoted to removing the backfill from the 2007 excavations down to the level of the geotextile we had placed to mark the excavated level and to the level of the stone terrace wall we had built in 2007 as an erosional barrier ([Figure 3](#)).

The same excavation procedures and tools we used in the 2007 season were followed in 2008. Vertical excavation was controlled by natural levels. Recovered bones and artifacts were photographed *in situ* and plotted on photographs printed on-site ([Figure 4](#)), then plotted with a Nikon total station before they were removed and individually catalogued. Bones and artifacts recovered during screening were bagged by unit and level, and labeled with the date of their recovery. Total station points were also taken on all large stones recovered in units in order to gain information about the site's formation history.

II. Summary of unit excavated, principal findings, protection of the site, and stratigraphy

Unit 11 was the sole focus of our 2008 field season. Unit 11 is a 2.0 x 0.5 m unit that was opened in 2007 in Area III, at the south end of the rockshelter ([Figure 5](#)). In the 2008 season, it was excavated from the bone bed (Level 4) down to the shale bedrock

Human bones - fragmented and complete, adult and subadult - were found in dense concentrations throughout this unit, particularly in Level 4 (loose brown [10YR 4/4] sandy loam). The articulated individual (Bone Concentration 1) found in the north half of Unit 11 was fully excavated. Although many of the bones of this individual were articulated and in anatomical position, some were quite fragile ([Figures 6 and 7](#)). Beneath the lower body, an isolated mandible from another individual was recovered, which was submitted to Beta Analytic for AMS dating (see discussion below) ([Figure 8](#)). Also recovered in Level 4 were the skeletal remains of one rabbit ([Figure 9](#)), stone and shell beads, and a bone handle made from the distal end of a sheep tibia ([Figure 10](#)).

The upper body of the articulated individual, as well as the articulated tibia and fibula (left side) of another individual, the latter found in a breccia/Level 5, had been placed on a triangular limestone slab (approximately 50 cm x 50 cm, directly on the underlying shale bedrock. The breccia/Level 5 was only contacted above the limestone slab. Because it was too dense to excavate in the field, the breccia was removed as a block and transported back to the United States for excavation and for examination in our laboratory at the University of Iowa ([Figures 11 and 12](#)). In order to determine the conditions under which this breccia formed, Dr. Richard Josephs (University of Iowa, Department of Geoscience) collected a sample of the breccia for micromorphological analysis (see Section IIID, below).

In the rest of the unit, Level 4 was stratigraphically above Level 6. Within Level 6 were recovered additional bones, beads, and a quartzite bola ([Figure 13](#)); see Section IIIC, below, for further discussion.

At the conclusion of our second season of work (July 14, 2008), a column of sediment samples was taken for micromorphological analyses on the west profile of Unit 11 which extended from the 2007 profile ([Figure 14](#)).

Unit 11 was backfilled from bottom to top using, in order, rocks, finely-screened sand, geotextile, leca, smaller rocks to hold the geotextile in place, additional screened sand, and, finally, brush ([Figures 15, 16, 17](#)).

III. Specialist/scientific analyses conducted to date on materials recovered from the 1986, 2007, and 2008 field seasons

A. Human remains (Anna Waterman)

This section of the report details the results of the analysis of the human skeletal remains recovered from the 1986, 2007 and 2008 excavation seasons of Bolóres. These remains are temporarily housed at the European Archaeology Laboratory at the University of Iowa Department of Anthropology, where they are being cleaned, catalogued, and analyzed. To date, over 2000 human bones have been recovered from Bolóres. Approximately 1000 of these were point-plotted *in situ* with a total station during the 2007 and 2008 seasons, and the remaining 1000 are provenanced by unit and level.

The skeletal and dental materials were identified by criteria outlined in standard osteological texts and through comparison with the University of Iowa Department of Anatomy's skeletal collection. All bone fragments were catalogued according to body region, element, and portion (e.g. upper limb, humerus, distal end), and the following basic osteological data were collected:

Biological Sex: Due to the fragmentary nature of the remains, the biological sex of individuals was largely undeterminable by standard methods involving pelvic and cranial morphology. Other methods, such as discriminant function analyses, are being considered for further work on this collection.

Age-at-death: Subadult age-at-death was calculated by epiphyseal fusion or dental development using Baker et al. (2005), Moorrees *et al.* (1963), Scheuer and Black (2000), Schour and Massler (1941), and Smith (1991). Because the remains were highly fragmented, estimates for adult age-at-death were difficult and could not be calculated by the standard methods which score morphological changes in the pubic symphysis, the auricular surface of the ilium, and the sternal end of the fourth rib. In instances where partial or complete mandibles with *in situ* molars were recovered, age-at-death ranges were calculated based on the scoring of molar wear as outlined in Brothwell (1981).

Skeletal Pathology: Instances of pathology were noted and (when possible) scored according to the criteria outlined in Buikstra and Ubelaker (1994).

Occlusal Attrition: Occlusal attrition of *in situ* and isolated teeth was scored according to the 8-stage scoring system outlined in Smith (1984).

MNI: The MNI was primarily calculated by dental remains via the counting of duplicate tooth types with consideration of age-at-death as indicated by dental development. Alternative MNIs were also calculated using other skeletal elements in order to assess taphonomic factors that may have influenced the condition of this collection, or, alternatively, the possibility of selective burial (or reburial) of specific skeletal elements.

Despite the highly fragmented condition of most of the remains, a majority (79%) can be assigned to a body region ([Table 1](#)). Concerning the dental remains, 209 individual teeth have been recovered, of which 42% are subadult ([Table 2](#)). Using counts of identical tooth elements and other skeletal remains, the MNI for Bolóres – based on material excavated to date - is 13 (6 adults, 2 adolescents [age range: 10-21 years], 5 children [age range: 0-10 years]). With future excavation, we expect this number to increase. Lower MNI counts were generated when only refitted humeral and femoral fragments were used to determine MNI: 9, using humeral fragments; and 6, using femoral fragments (Dotzel 2009).

Below is a discussion of the 13 individuals in terms of their context, degree of preservation, age/sex, pathologies, AMS dates, and stable isotope determinations. Their find spots, by excavation units, are indicated in [Figure 18](#).

Adult 1 is the most skeletally complete individual recovered from Bolóres. Elements from Adult 1 were recovered in Unit 11, Level 4 in 2007 and 2008. For this individual, multiple skeletal elements were recovered in anatomical position, representing what appears to be a tightly flexed burial with the individual buried on the left side and the head oriented to the northwest, toward the wall of the rockshelter. Elements recovered from Adult 1 include a complete set of teeth in maxillary and mandibular fragments, arm and leg bones, rib and vertebral fragments, and pelvic fragments. Skeletal remains are too fragmented to determine biological sex. More systematic measurements of morphological features and their comparison to other individual at Bolóres and other contemporary populations may provide more conclusive determination of biological sex. The teeth of Adult 1 exhibit three instances of dental caries; two lesions were quite severe, consuming almost the entire crown of the upper left first molar and a large part of the crown area of the upper left second molar ([Figure 19](#)). The maxillary left first molar was missing premortem and may indicate a previous incidence of carious lesions. Substantial exposure of tooth roots indicates the possibility of periodontal disease in this individual. Using the Brothwell (1981) method for assessing age-at-death by dental attrition, Adult 1 died between the ages of 35-45 years. An AMS date for Adult 1, of unburned bone fragments from this individual, of 4050±40 BP (Beta 235488), cal BC 2840-2480 was obtained. To assess the diet of this individual and others from the site, isotopic determinations were conducted (Beta Analytic). The $^{13}\text{C}/^{12}\text{C}$ (-) ratio for Adult 1 was 19.6, and the $^{15}\text{N}/^{14}\text{N}$

(+) ratio was 9.0. These results indicate a diet composed of mainly terrestrial animals and C3 plants, as indicated by other studies of stable isotope ratios and diet in this region (see Lubell et al. 1994) ([Figure 20](#)).

Adult 2 was recovered from the North end of Unit 11, Level 4 in 2008 and was found beneath the torso of Adult 1. This individual is represented by LLM1, LLM2, LLM3, LRM1, and LRM2 in a nearly complete (but broken) mandible. An AMS date was obtained on a fragment of this individual's mandible: 4150 \pm 40 BP (Beta 249032); cal BC 2910-2710. Ratios of $^{13}\text{C}/^{12}\text{C}$ (-) and $^{15}\text{N}/^{14}\text{N}$ (+) were 19.5 and 9.5, respectively ([Figure 2](#)). The degree of occlusal attrition on the molars of this individual suggests this was a younger adult who was in the 17-25 years age range at the time of death (Brothwell 1981).

Adult 3 is represented by a mandible fragment with LLM3 in situ. This fragment is a loose find and was recovered from the surface of Units 9 and 10 in 2007. This individual has not been dated, and no age estimation is possible because of the limited dental remains recovered.

Adult 4 is represented by a mandible fragment and teeth recovered in Unit 2, Level 1 in 2007. The mandible fragment was found with the LRM1, LRM2, and LRM3 in situ. Additionally, isolated LLM1 and LLM3 that match the morphology and wear patterns were found a few cm from the mandible, and we presume these are from the same individual. An AMS date was obtained on a fragment of this individual's mandible: 3910 \pm 40 BP (Beta 256325); cal BC 2610-2460. Ratios of $^{13}\text{C}/^{12}\text{C}$ (-) and $^{15}\text{N}/^{14}\text{N}$ (+) cluster with those values obtained for Adults 1 and 2, at 19.7 and 9.6, respectively ([Figure 20](#)). The degree of occlusal attrition on the molars of Adult 4 suggests a younger adult in the 17-25 year age range at the time of death, similar to Adult 2 (Brothwell 1981).

Adult 5 and 6 are represented by upper right first incisors, which were recovered as loose finds. In total, 10 URI1s were recovered. While it is possible to assign several of these to already identified individuals, the high degree of occlusal attrition on several of these teeth indicate the presence of adults not yet accounted for. In particular, two of these URI1s have occlusal attrition scores of 6 and 8, using the 8-stage scoring system in Smith (1984); these most likely indicate the presence of two older adults.

Adolescent 1 was recovered from the South end of Unit 11 in 2008. This individual is represented by maxillary fragments as well as dental remains, including the ULM2, URP4, URM1, URM2, ULM1, ULP3, and ULP4. The stage of root formation on the 2nd molars of this individual suggests that he or she was between 10 and 15 years old at death.

Adolescent 2 is represented by a partial mandible with the LLI1, LLI2, LLC1, LLP3, LLP4, LLM1, LLM2, LLM3, LRI2, LRC1, LRP3, LRM1, LRM2, and LRM3. These remains were recovered in the South end of Unit 11, Level 4 in 2008. Open apices on the 2nd molars in conjunction with 3rd molars in the beginning stages of root formation

suggests a slightly older subadult than Adolescent 1, with an estimated age-at-death range of 15-21 years. This individual also shows evidence of hypoplastic defects. These defects formed between the ages of 3.6 and 5.6 years old (Reid and Dean 2000).

Child 1 is estimated to have been between 9 months and 2 years old at the time of death, based on dental development (deciduous tooth roots were not fully formed, and permanent teeth were in the initial stages of development). Dentally, this child is represented by LLdm2, LLM1, LRdm2, LRM1, URdi1, and URM1, all of which were recovered in Unit 4, Level 1 in 2007. Within this unit, numerous subadult skeletal elements were also recovered, at least some of which appear to be of a similar age range as these teeth.

Child 2 was recovered in the 1986 excavation from Unit B10. This child is represented by dental remains that include an URdm1, URdm2, as well as a LRdm2 and LRI2 in a mandible fragment all of which are slightly more developed than Child 1. Other skeletal elements assigned to this child include a proximal end of a radius. Based on dental development, this child was approximately 2 to 4 years old at time of death.

Child 3 was recovered in the North end of Unit 11 in Level 4 in 2007. Child 3 is represented by a cluster of isolated maxillary teeth which, given the similar stages of dental development, size, and morphology, appear to be all from the same individual. The teeth of Child 3 include ULdm2, ULI2, ULM1, ULP3, URC1, URdm2, URI2, URP3, and URP4. The stages of dental development represented by these teeth (root initiation on the upper premolars and canine) suggest that, at time of death, this child was between 4 and 7 years of age.

Child 4 is represented by dental remains recovered in the South end of Unit 11, Level 4 in 2008. These remains include an ULdm1 ULM1, ULP3, and URM1. Like Child 3, Child 4 dental development suggest that this child died between the ages of 4 and 7 years, while a duplicate tooth type distinguished this Child 4 from Child 3.

Child 5 is represented by duplicate deciduous tooth types that are not accounted for by the other subadult individuals. In particular, an ULdc1 and ULdm2 recovered from Unit 4 mark the presence of an additional child.

Overall, pathology rates for the Bolóres burial population are quite low. In our analyses, no instances of cribra orbitalia and porotic hyperostosis (skeletal markers of anemia) were recorded; however, because of the fragmentary nature of the assemblage, these are difficult to discern. Mild osteoarthritis was noted on some vertebrae and phalanges. One instance of a small bony growth on a fibula fragment was also recorded; the exact nature of this growth is still unclear, and further investigation is underway. Dental pathologies were also rare at Bolóres; only 4 out of 209 teeth (1.91%), representing 2 out of 13 individuals (15% of the burial population), exhibited evidence of dental caries. The rate of hypoplasia was slightly higher than the caries rate for this population, with 17 out of 209 teeth (3.3%) exhibiting hypoplasia, and 3 out of 13 individuals (23% of the population) affected.

B. AMS dates and stratigraphy

Four AMS radiocarbon dates (Beta Analytic) were obtained from four different individuals ([Table 3](#)) excavated at Bolóres. Dates 3 (Adult 1) and 4 (Adult 2), both from Unit 11, Level 4, are coeval with Date 2 (Adult 3), from Area I/Unit 2, Level 1. and, therefore, we suggest that the contexts from which they were found are coeval ([Figure 21](#)). The most recent date for Bolóres (Date 1: cal BC 1960-1750), from a subadult recovered in the 1986 excavations at the site in Area B, cannot be directly correlated to any of the levels excavated by our team. Indeed, we recovered few human remains in later deposits, such as Area 1, Level 0 and Unit 11, Levels 1-3. Date 1 may represent a sporadic use of the rockshelter in the early 2nd millennium BC (the Early Bronze Age). It is also possible that materials from more surficial levels have eroded downslope. Further excavation in more intact deposits closer to the wall of the rockshelter will better determine the intensity of the site's use in this later cultural phase. Date 1 represents a use of the site that is contemporary to Phase V at Zambujal.

C. Artifacts (Jonathan T. Thomas, Doctoral student, Department of Anthropology, University of Iowa)

i. Ceramics

Approximately a dozen ceramic sherds were recovered in the 2007 and 2008 field seasons at Bolóres. They display a dark reddish-brown exterior and black interior, and they are comprised predominantly of large, poorly sorted, angular quartz grains. An Hitachi S-3400 SEM/EDX (scanning electron microscope with energy dispersive X-ray analysis), housed in the University of Iowa's Department of Geoscience, was used to perform compositional analysis on select sherds (as well as on the ochre, discussed below). The results indicate that the paste has a high iron content (8-10%) and is dominated by a mixture of smectite and illite clays along with other impurities.

ii. Beads

Eight small beads, none larger than 50 mm in diameter, were recovered from various areas of the site. Most were found in Unit 11, Level 4 ([Table 4](#)). They were manufactured from a variety of materials including shell, limestone, and shale. Because of their small size and the compositional similarity (CaCO₃) between shell and limestone, it was often difficult to determine the exact raw material from which they were made ([Figure 22](#)).

iii. Bone handle

A bone handle (for a knife or other tool), measuring 6.5 cm long and 1 cm in diameter, and broken in two pieces, was recovered from Unit 11N/Level 4 ([Figure 23](#)). The handle was made from the distal end of a sheep tibia (James Enloe, personal communication 2008). It has two small perforations at one end, which may have been for decoration or to attach cordage, and its surface has a polished appearance, likely resulting from extensive use prior to burial. Similar bone handles have been recovered at Zambujal (Sangmeister

and Schubart 1981: Tafel 59i, k; Tafel 63) and are on display in the Museu Municipal Leonel Trindade.

iv. Bola

An unusual discoidal object, made from a quartzite cobble and with a pecked groove around its midsection, was recovered in Unit 11S/Level 5/6. It is 6.5 cm in diameter and weighs 345 g ([Figure 24](#)). Other than the pecked groove, the surface of this object is extremely smooth, with no evidence for percussion; thus, its use as a hammerstone is unlikely. While rare in Late Neolithic/Copper Age Iberian sites, comparable objects have been reported in the Portuguese Estremadura from the burial sites of Cabeço da Arruda 1 (Torres Vedras) and Palmela (hipogeu 2), as well as the settlements of Pedrão (Early Copper Age level) and Leceia (Level C. 2, Calcolítico Pleno) (Soares 2003:89).

v. Ochre

Several fragments of red and yellow ochre were recovered from different areas at the site, including beneath the limestone slab in Unit 2, Level 1 ([Table 5](#)). SEM/EDX analysis of the fragments indicates that the red and yellow ochres are compositionally distinct. The red ochre is predominantly composed of an iron oxide (anhydrate hematite, Fe_2O_3), calcium carbonate, and other impurities. The yellow ochre is elementally distinct from both the red ochre and the surrounding soil, and contains a relatively high percentage (20-25%) of barium and sulfur, in addition to having a high iron content. This suggests that the yellow ochre is made up of a mixture of a yellow iron oxide (hydrate hematite) and barite (BaSO_4). Barite is a common stabilizer or filler in modern yellow pigments, often co-occurring with limestone formations (Komov et al. 1994: 255-6).

D. Micromorphology (Richard L. Josephs, Dept. of Geoscience, University of Iowa)

A micromorphological investigation was conducted by Dr. Richard L. Josephs on sediment samples collected from the Bolóres rockshelter during the 2007 and 2008 field seasons. Micromorphology is the study of intact, oriented samples of soil or sediment at the microscopic level. As a geoarchaeological technique, micromorphology's principal objective is to evaluate and differentiate among anthropogenic, geogenic, and biologic processes that have impacted the Bolóres site. The technique can also detect high resolution, sedimentologic and pedologic, evidence for climate change. The micromorphological samples were collected by hammering slightly modified, plastic electrical outlet (gang) boxes into select test unit profiles with a rubber mallet ([Figure 25](#)). The collection procedure is outlined in Josephs and Bettis (2003). The sample locations are identified in [Figure 26A](#), [B&C](#), [D&E](#), and described in [Table 6](#).

Preliminary results reveal a complex accumulation of clastic, chemical, and biologic sediments. These deposits evince a combination of pre-, syn-, and post-depositional, natural and cultural, processes with respect to the archaeological component. The endogenous and exogenous accumulations are the result of wind, water, chemical weathering (attrition), ceiling collapse (breakdown), and organisms, including humans.

The sediments contain a mixture of organic and inorganic material. The organic constituents are comprised of plant residues and wood fragments (some carbonized, [Figure 27](#)) in various stages of decomposition, along with fecal pellets deposited by fossorial organisms such as earthworms and mites ([Figure 28](#)). Inorganic residues of biological origin include bone and shell fragments ([Figure 29](#)). Both endogenous and exogenous, mono- and polymineralic grains were observed in the thin sections. The monomineralic grains consist of quartz, alkali feldspars, plagioclase feldspars, muscovite, and biotite. The polymineralic grains (rock fragments) include micaceous (lithic) sandstone ([Figure 30](#)), siltstone/shale, and limestone. This suite of rock and minerals is consistent with derivation from local bedrock sources. The only purely anthropogenic material observed was a ceramic (micro)sherd ([Figure 31](#)).

The majority of the samples display a complex microstructure with a coarse enaulic coarse/fine related distribution pattern (c/f RDP). A complex microstructure simply means that more than one type of microstructure is present throughout the sediment. In the case of the Bolóres samples, crumb and granular microstructures predominate. Crumb microstructure takes its name from the fact that the material is separated into individual, rounded to sub-rounded, aggregates that resemble cookie crumbs. Granular microstructure is similar to crumb microstructure in that the material is individually-separated; however, the aggregates are smaller and generally less porous. An enaulic c/f RDP is one in which the smaller grains form aggregates which occur in the interstitial spaces between the larger grains. The modifying term *coarse* means that the larger, single grains are smaller than the aggregates. Crumb microstructure suggests that these aggregates were transported as slopewash into the cave and are presumably pedorelicts from soils formed on landscapes above the rockshelter. Reddish-brown (ferruginous) anorthic nodules, present in many of the crumb aggregates, are also indicative of soil material transported into the cave. Anorthic nodules are exogenous, pedogenic features (pedorelicts).

Both endogenous and exogenous sediments were deposited within the shelter before, during, and after its use by humans. At least one episode of post-occupational ceiling collapse is recorded. Because of the shelter's geographic location, specifically its latitude and elevation, hydration spalling and the expansion of joints or fractures in the bedrock by water movement are the most likely causes for initiating roof fall.

In addition to the rockshelter sediments, a sample extracted from a bone breccia (Unit 11, Level 5) – an indurated mass of sandy loam containing numerous human bone fragments – was also examined micromorphologically. The breccia has a subangular blocky microstructure with a single-spaced porphyric c/f RDP. A porphyric c/f RDP is one in which the larger (sand-size) grains occur in a dense groundmass of smaller, primarily silt- and clay-size, grains. *Single-spaced* means that the distance between the larger grains is less than their mean diameter. The rock and mineral grains observed in this sample were consistent with those previously identified. One of the primary reasons for preparing a thin section from this mass was to look for microscopic evidence of bone dissolution, or bone mineralization, that may have acted as a cementing agent, i.e., a hydroxyapatite cement. The results were inconclusive. The primary cementing agent appears to be

calcium carbonate (CaCO₃), as evidenced by high interference colors and a crystallitic (speckled) birefringence fabric (b-fabric) in the matrix.

In order to construct a more accurate stratigraphic, sedimentologic, and paleoenvironmental framework for the Bolóres rockshelter using micromorphology, it is imperative that a better sampling strategy be implemented, specifically the collection of a much larger number of vertically-contiguous samples, horizontally-spaced across the entire site. This is one of the primary objectives for future work at the site.

IV. Plans for future research

Future excavation seasons are planned for 2010 and 2011, pending the receipt of additional funding. Excavation will proceed toward the rear of the rockshelter where we expect better preservation of the human remains (as roof fall will not have impacted the mortuary deposit). Because attention must be paid to supporting the shelter's existing sandstone roof, which exhibits several extensive cracks, we will need to consult with a professional engineer in Torres Vedras to design a support system to prevent collapse. If prefabricated shoring cannot be found locally, materials will be obtained to build a supporting framework that will meet professional safety standards (e.g., O'Connell 2005).

V. Works published/presented on Bolores excavations, to date:

- In 2008, the preliminary report for the 2007 excavations was submitted to IGESPAR and posted online at www.uiowa.edu/~anthro/documents/BoloresreportforWWW_004.pdf. This report was coauthored by Katina Lillios, Joe Alan Artz, Bryan Kendall, Anna Waterman, and John Willman.

- In 2008, a report of the 2007 field season was also submitted to the Jahresbericht (Annual Report) of the German Archaeological Institute by Katina Lillios.

Since the 2007 field season, members of the Bolóres team have presented lectures and conference papers on the excavations and specialist analyses of the Bolóres site.

- In March 2008, at the 73rd Meeting of the Society for American Archaeology, in Vancouver, BC. Anna Waterman, John Willman, and Katina Lillios presented a poster entitled: *Health Status and Diet of the Human Population at the Late Neolithic Collective Burial of Bolóres (Torres Vedras), Portugal: Preliminary Results*.

- In April 2008, at the Annual Meeting of the American Association of Physical Anthropologists, a poster entitled: *The Late Neolithic Collective Burial of Bolóres (Torres Vedras), Portugal: Preliminary Results* was presented by Anna J. Waterman, John C. Willman, and K.T. Lillios.

•Also in April 2008, Katina Lillios and Bryan Kendall gave a lecture entitled: *Geoarchaeological Investigations at Bolóres, Portugal* for the Quaternary Brown Bag series, in the Department of Geoscience, University of Iowa.

•In March 2009, at the GIS Seminar at Iowa State University, Joe Artz presented: *Site Structure and Landscape Context of the Chalcolithic Mortuary Site of Bolores, Portugal*.

•Also in March 2009, Katina Lillios presented *The Archaeology of Social Collapse: A View from the Neolithic-Early Bronze Age Mortuary Site of Bolóres, Portugal*, at the Iowa City Public Library, International Mondays lecture series.

•In April 2009, at the 74th Meeting of the Society for American Archaeology meeting, in Atlanta, Georgia, five papers were presented by members of the Bolóres team on different aspects of the project:

1) Artz, Joe

2009 *Site structure and landscape context of the Neolithic-Bronze Age mortuary of Bolóres, Rio Sizandro, Portugal*

2) Kendall, Bryan

Stratigraphy of human and landscape interaction at Bolóres rockshelter, Portugal

3) Lillios, Katina

Excavations at the Neolithic-Bronze Age burial of Bolóres (Torre Vedras, Portugal): a contribution toward the study and analysis of collective tombs

4) Waterman, Anna and John Willman

Demographic and health status patterns from the Late Neolithic collective burials of Bolóres (Torre Vedras), Portugal: Methodological considerations and results

5) Horwath, Briana

Dental evidence for biological affinity in Neolithic Portugal: An analysis of two Neolithic burial sites – Feteira II and Bolóres

•In May 2009, two University of Iowa undergraduate honors projects in Anthropology were conducted based on research on the Bolóres materials:

1) Dotzel, Krista

2009 *An analysis of the human long bones from the Late Neolithic-Early Bronze Age site of Bolóres, Portugal*

2) Horwath, Briana

2009 *Dental evidence for biological affinity in Neolithic Portugal: An analysis of two Neolithic burial sites – Feteira II and Bolóres*

VI. Report Bibliography

- Baker, B. J., Tosha L. Dupras, and Matthew W. Tocheri. 2005. *The Osteology of Infants and Children*. College Station: Texas A & M University Press.
- Brothwell, D. R. 1981. *Digging up Bones*. Ithaca: Cornell University Press.
- Buikstra, J. E., and Douglas H. Ubelaker, editors. 1994. *Standards For Data Collection From Human Skeletal Remains. Arkansas Archaeological Survey Research Series No. 44*. Fayetteville, AR: Arkansas Archaeological Survey.
- Dotzel, Krista. 2009 *An analysis of the human long bones from the Late Neolithic-Early Bronze Age site of Bolóres, Portugal*. Anthropology Honors Thesis, University of Iowa.
- INTAL04 2004. INCAL04 radiocarbon calibration. *Calibration Issue of Radiocarbon* 46(3).
- Josephs, R.L. and E.A. Bettis III. 2003. A practical alternative to Kubiena boxes for the collection of samples for micromorphological analysis. *Geoarchaeology* 18(5):567-570.
- Komov, I.L. A. N. Lukashev, and A. V. Koplus. 1994. *Geochemical Methods of Prospecting for Non-Metallic Minerals*. Utrecht: VSP.
- Kunst, M. and L. Trindade. 1990. Zur Besiedlungsgeschichte des Sizandrotals: Ergebnisse aus der Küstenforschung. *Madriider Mitteilungen* 31:34-83.
- Lubell, D., Jackes, M., Schwarcz, H., Knyf, M., Meiklejohn, C. 1994. The Mesolithic-Neolithic transition in Portugal: isotopic and dental evidence of diet *Journal of Archaeological Science* 21:201-216.
- Moorrees, C. F. A., Elizabeth A. Fanning, and Edward E. Hunt. 1963. Age variation of formation stages for ten permanent teeth. *Journal of Dental Research* 42:1490-1502.
- O'Connell, John P. 2005. *Emergency Rescue Shoring Techniques*. Tulsa, Oklahoma: PennWell Books.
- Reid, D. J., and M.C. Dean. 2000. Brief communication: The timing of linear hypoplasias on human anterior teeth. *American Journal of Physical Anthropology* 113:135-139.
- Sangmeister, E. and H. Schubart. 1981. *Zambujal. Die Grabungen 1964 bis 1973*. Mainz am Rhein: Phillip von Zabern.
- Scheuer, L., and Sue Black. 2000. *Developmental Juvenile Osteology*. San Diego: Academic Press.
- Schour, I., and M. Massler. 1941. The development of the human dentition. *Journal of the American Dental Association* 28:1153-60.
- Smith, B. H. 1984. Patterns of molar wear in hunter-gatherers and agriculturalists. *American Journal of Physical Anthropology* 63:39-56.
- Soares, J. 2003. *Os hipogeuos pré-históricos da Quinta do Anjo (Palmela) e as economias do simbólico*. Setúbal: Museu da Arqueologia e Etnografia do Distrito de Setúbal.
- Talma, AS and JC Vogel 1993. A simplified approach to calibrating C14 dates. *Radiocarbon* 35(2):317-322.