Bolóres (Torres Vedras, Portugal) Rockshelter
Preliminary Report of the 2007 Excavations

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with the assistance of

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I. Project Background

Between July 1-July 31, 2007 excavations were conducted at the Bolóres rockshelter (Torres Vedras) by an interdisciplinary team directed by Dr. Katina Lillios (Department of Anthropology, University of Iowa, USA). The 2007 fieldwork and laboratory analyses were funded by a Social Science Funding Program Grant of $50,000 by the University of Iowa (Project Title: *Preliminary Excavation of the Late Neolithic Burial Site of Bolóres [Torres Vedras], Portugal*).

The primary aim for this season's work was to assess the site's potential contributions to a long-term interdisciplinary study of Late Neolithic human populations in the Sizandro and Alcabrichel river valleys that will be carried out in collaboration with Dr. Michael Kunst of the German Archaeological Institute of Madrid. Fieldwork at Bolóres combined extensive and intensive excavation methods in order to delineate the site's boundaries and to recover osteological and material cultural remains in good contexts. In addition, we sought to better elucidate the local geology and the geomorphological processes that may have impacted the lives of ancient populations in this area and the depositional history of the site.

Our broader goals are to contribute to a more holistic understanding of life and death during the Late Neolithic and Copper Age (3500-2000 BC) of Iberia, a period which presents a dynamic and challenging area of archaeological inquiry. Agricultural production intensified, social differentiation and craft specialization became more marked, and large-scale permanent settlements – a few with fortifications – became more common. Indeed, Bolóres is only 2km from Zambujal, one of the largest fortified hilltop settlements of the period in Portugal and currently being excavated by Dr. Kunst. The excavations at Bolóres are a rare opportunity to monitor the links between population centers and the ritual areas that surrounded them and may allow us to better understand the impact of agricultural intensification, population aggregation, and increasing long-distance exchange relationships on the individual people who lived at this time.

Members of the 2007 field team were:

•Dr. Joe Artz (Director of Geographic Information Services, Office of the State Archaeologist, University of Iowa, USA) - GIS/Geoarchaeology
•Emily Artz (student, Iowa City High School, Iowa City, Iowa, USA)
•Dra. Cherie Haury-Artz (Archaeologist, Office of the State Archaeologist, University of Iowa, USA)
•Dr. Bryan Kendall (Doctoral student, Department of Anthropology, University of Iowa, USA) - GIS/Geoarchaeology
•Dr. Jonathan T. Thomas (Doctoral student, Department of Anthropology, University of Iowa, USA)
•Sr. Leonel Trindade (Independent Archaeologist, Torres Vedras, Portugal) - Member of the 1986 Bolóres excavation team
•Dra. Anna Waterman (Doctoral student, Department of Anthropology, University of Iowa, USA) - Bioanthropology
•Dra. Estella Weiss-Krejci (University of Vienna, Austria) - Bioanthropology
•John Willman (BA student, University of Iowa) – Bioanthropology

II. Site Description and Condition of Site Prior to 2007 Fieldwork

The Bolóres rockshelter is located in the parish of Sta. Maria do Castelo e S. Miguel, in the municipality of Torres Vedras, in the district of Lisbon, Portugal (Figure 1). Its coordinates on the Portuguese national grid are y -100190, x - 63310. The site is situated at an elevation of approximately 36 m above sea level along an east-facing outcrop of Jurassic sandstone and shale. It overlooks a small valley that heads a few hundred meters to the south, and joins the Rio Sizandro valley about 80 m to the north (Figure 2a). Above and paralleling the Bolóres outcrop is a ridge that extends north from higher land to the north. The ridge top is modified by nine agricultural terraces, which descend, south to north, to the end of the ridge overlooking the Sizandro.

The natural slope from the outcrop to the valley floor has been modified into three agricultural terraces. Construction of the last and highest of these for a vineyard resulted in the discovery of the site in 1986 (Figure 3a-c). During clearance for this vineyard, local farmers recovered human remains and some artifacts, including a limestone cylindrical idol (Trindade and Kunst 1990: Taf. 4c). For two weeks in October 1986, Dr. Michael Kunst, Dr. João Zilhão, and Sr. Leonel Trindade excavated approximately 6 sq m of the site and recovered human remains and other objects characteristic of the Late Neolithic, including undecorated ceramics (small bowls and jars) and a flint blade (Figure 4a-e). These materials, as well as the excavation field notes and photographs, are housed in the Museu Municipal Leonel Trindade in Torres Vedras. João Zilhão took color slides of the 1986 excavations, copies of which were sent to Lillios in August 2007. Black and white photographs were taken by John Patterson when visiting the site in 1986 with Michael Kunst and are housed in the German Archaeological Institute in Madrid (copies of these photographs were sent to Lillios in January 2008).

The disposition of the site in 2007 indicates that changes in the vegetational cover and soils near the site have occurred since 1986 as a result of agricultural activities. Some of

the original vineyards in the lower terraces have been turned into wheat fields, while the uppermost terrace, whose creation led to the discovery of the site, is now covered in oak shrubs and wild grasses. Soil erosion in the lower terraces (due to the use of heavy machinery in the harvesting of the wheat and the exposed soils under cultivation) appears to have also occurred, as suggested by differences in surface levels between the 1986 and 2007 photographs of the area (Figure 2a and b).

III. Field and Excavation Methods

A. Mapping (Bryan Kendall)

Before the 2007 field season at Bolóres, two datum points, 8001 (elev. 36.20 m) and 8002 (elev. 46.10 m), were established by Christian Hartl-Reiter (German Archaeological Institute, Madrid) and are related to the grid used at Zambujal, 2km away. The Zambujal coordinate system is also tied to the Portuguese national grid.

These datum points were used to establish the instrument station points, IS1 and IS2, used for the mapping of excavated material at Bolóres. The Bolóres grid is roughly parallel to the rock exposure and generally trends NNW. Steel rebars remain in place at all four mapping points to provide permanent reference points for future excavations. Instrument Station 1 was used to point plot materials recovered during excavation. Prior to mapping and excavation, the vegetation covering the rockshelter and the sandstone face was cut and cleared by members of the team (Figure 5).

The topography of the area surrounding the excavation was mapped using the total station. Areas that were mapped include the exposed face of the rock outcrop to the north and south of the site, the ridge top above the site, and the land surface from the rockshelter east to the nearest drainage valley. This map is the most detailed and extensive record of the topography of the area of Bolóres (Figure 6).

At the end of each day of excavation, total station data were downloaded from the data collector as ASCII text (txt) files. The text files were imported into Microsoft Access, and appended to an appropriate table. The table BolóresArtifacts contains XYZ coordinates for points shot on artifacts, ecofacts, and stones plotted during excavation. The table BolóresGrid contains XYZ coordinates of points shot on the outcrop that was cleared of vegetation, from the top of the outcrop to the base of the talus slope. Coordinates in the BoloresArtifacts and BoloresGrid are assigned with reference to an arbitrary coordinate of 500N 500E, and assigned to Instrument Station 1. A third table, ZambujalGrid, contains XYZ coordinates for topographic points shot using the grid system established for the site of Zambujal. All three tables are added as data layers to ArcGIS map documents, and their XYZ locations plotted in two (ArcMap) or three (ArcScene) dimensions. In the BoloresArtifacts table, points are grouped according to the Total Station Point number into points, lines, and polygons. Points are objects for which only one position (A) was recorded. Lines are objects that have two or three recorded points (A and B, or A, B, and C). Polygons are objects that have more than three recorded points. In ArcGIS, the ETWizard extension is used to connect line points into polylines, and polygon points into polygons, so that they can be properly represented in the GIS environment.

These procedures allowed each day's results to be visually inspected to make sure the data were being correctly captured by the total station and accurately processed during the download and importing process.

B. Excavation

Excavations followed natural stratigraphic levels within units of 1 meter by 1 meter. Trowels were used at the beginning of the excavation, but as the concentration of human bones increased, paintbrushes and bamboo sticks were used. Total station points were taken on all materials that were uncovered in situ during excavation. Points were established to record specimen location and orientation when possible. Notes were taken on catalog sheets and drawings were made to record more detailed descriptions of orientation. Approximately 800 individual bones were mapped during the 2007 field season. Total station points were downloaded onto a laptop computer (Nobilis) each day and 3D models were generated using GIS software. The detailed records will be used to refine the GIS model to include 3D representations of specimens.

All excavated soils were dry-screened using a 0.5 cm mesh. All bones and other cultural materials were bagged by unit and level. Soil samples were taken from all archaeological levels. Color photographs were taken at the opening and closing of levels and during excavation of all levels in order to record specific bone concentrations.

C. Geologic Methods (Joe Alan Artz)

Soil borings were conducted along a roughly southwest-northeast transect from the site with either a 2-cm-diameter Oakfield probe or a 6.35-cm-diameter bucket auger equipped with extensions allowing penetration to depths of 4 m (Figures 7 and 8). Excavation profiles were cleaned by plucking with a pocket knife, digitally photographed, and sketched. Total station points were taken to record boundaries separating strata. At the conclusion of fieldwork, the photographs were georeferenced and rectified to the total station points using ArcGIS. Profile drawings were digitized in ArcGIS from the rectified photographs.

Six columns of soil samples were taken at 5 cm intervals from excavation profiles. Samples were also taken from intervals of selected soil borings in the valley and on the ridge top. Soil was placed in plastic bags and returned to the United States for analysis in the Soils Laboratory of the University of Iowa Department of Geosciences under the direction of Dr. E. Arthur Bettis III.

Magnetic susceptibility was measured in the field. Readings were recorded at 3 cm intervals from soil columns.

Soil micromorphology samples were obtain by using a rubber mallet to hammer plastic, electrical junction boxes (Josephs and Bettis 2006) into the profile face within the soil columns. The box was labeled with the sample provenience and an arrow indicating the "up" and "down" ends of the box. The box was then removed, wrapped in aluminum foil, fastened with strapping tape, and labeled for transport to the U.S.

IV. Fieldwork Strategy

Our goals for the 2007 field season were 1) to map, recover, and analyze the human

remains and material culture from the site in order to reconstruct the site's history and its spatial extent and 2) to better understand the history of the landscape of Bolóres before, during, and after the site's use.

We were able to locate the two areas (A and B) excavated during the 1986 season through the use of site plans in the archives of the Museu Municipal Leonel Trindade and with the assistance of Sr. Leonel Trindade, who participated in the 1986 excavations. For the 2007 season, we wanted to understand the relationship between these areas and to determine the probable extent of the site. Three areas (Areas I-III) were defined, and eleven units, each 1 square meter in area, were gridded (Figure 9).

Joe Artz and Bryan Kendall carried out the mapping of exposed bedrock in the vicinity of the site, collected soil and micromorphology samples from the site, and conducted borings and soil sampling along transects in the site vicinity.

V. Fieldwork: Geology (Bryan Kendall)

The bedrock near Bolóres is largely composed of sandstone and shale units (Figure 10). A thick, generally poorly-cemented, sandstone unit forms the ceiling of the rockshelter. A shale unit and thinner well-cemented sandstone underlie this sandstone. The units dip gently to the north. The units can be followed to the south and an additional shale unit underlies all of these units. One area, 115 m to the south of the excavation, likely contains some faulting. A massive limestone unit is exposed at the top of the outcrop 200 m south of the site. An additional rock outcrop 155 m to the east of the site was described. This outcrop contained limestone, conglomerate and shale units. None of the units to the south of the fault or the east of the site can be related conclusively with the units immediately surrounding the site. The dip of the units does suggest that they may be stratigraphically below the units at the site.

All bedrock units above and below the site of Bolóres have no calcium carbonate in the rock, although exposed surfaces often have a carbonate crust. The bedrock is inferred to be Jurassic in age (Serviços Geológicos de Portugal 1992). Bedding observed in the sandstone to the south of Bolóres (Figure 10, Outcrop Section 3) suggests a stream channel deposit. Charcoal contained in the sandstone also indicates a terrestrial depositional environment.

VI. Fieldwork: Geomorphology (Joe Alan Artz)

Borings in the valley below the site of Bolóres (Figure 8) encountered 3-4 meters of alluvium over bedrock. Three major stratigraphic units are recognized in the valley sediments: an upper unit of gravelly, calcareous loam and sandy loam with weak to absent soil development; a middle unit of nongravelly, noncalcareous loam to clay loam in which one or more soils with A-Bw horizons are formed; and a lower unit of calcareous, gray-colored alluvium. In Geologic Test (GT) 11, burned sandstone, burned earth, and charcoal indicate the possibility of multiple cultural levels in the middle unit between 160 and 225 cm. The upper, gravelly unit probably represents heavy, cultivation-induced erosion of the adjacent valley slopes and uplands. The middle unit

represents an interval of geomorphic stability, in which sediment delivery from uplands was slow enough to allow soils to form. A deposit of well-sorted channels sands, encountered in GT 9, suggests that a stream with a well-established channel and sustained stream flow was present in the valley at this time. The lower unit likely represents an episode of valley alluviation.

At its east end, the cross valley transect climbed onto a relatively level terrace or bedrock bench. Several borings were attempted on this landform, but none were able to penetrate deeper than 64 cm before refusing on gravel. The stratigraphy and geologic interpretation of the landform are not known.

At its west end, the transect ascends onto the highest agricultural terrace that fronts the Bolóres site. Borings at 1 m interval on the terrace encountered an upper unit of gravelly sediments that is perhaps colluvial in origin. In GTs 1-3, this unit is 58-75 cm thick and overlies an abrupt, horizontal contact with shale In GTs 1-9, the unit is thicker and overlies sandstone.

The borings may represent the construction sequence that transformed the original hillslope into a stairstep-like terrace. Consistent with photographs from the 1986 excavation (Figure 11), the upper part of the hillslope was cut down into the shale to create a level surface. The excavated materials were pushed east to raise the downslope surface, extending the terrace eastward. If this scenario is correct, then the east-sloping contact at the base of the terrace fill may represent the original hillslope surface. The terrace fill was exposed in a profile, designated Profile 3 (Figure 8), which was cut on the terrace scarp. In an auger hole drilled at the base of the profile, alluvial sediments were encountered at a depth of 200 cm, and this contact may represent the original valley floor over which the terrace fill was deposited.

Borings on the ridge above the rock shelter encountered highly eroded surface soils overlying shale and sandstone bedrock. The depth to bedrock ranges from a few centimeters to 2 m. Where 2 m thick, the soil overlying bedrock is a highly oxidized (5YR-hue) loamy residuum interpreted as having formed from the deep weathering of sandstone.

VII. Fieldwork: Natural Stratigraphy

Rock shelter sediments are comprised of fragmented rock, with a fine-grained matrix that fills interstices between rocks (Laville et al. 1980). The sediments can be autochthonous, or originating from within the shelter itself; for example, stones can detach by physical weathering from the shelter roof. Shelter sediments can also be allochthonous, or derived from sources outside the shelter, and transported into the shelter by geologic processes such as wind, water, or gravity. Understanding rock shelter stratigraphy, and in particular identifying sediment sources, is essential to understanding what the shelter was like at the time of its use by prehistoric people, and the postoccupation, geologic processes that buried the archaeological materials (Mandel and Simmons 1997).

At Bolóres, the principal autochthonous sediment source is the outcrop in which the shelter is formed, comprised mostly of sandstone, with interbedded shale and sandstone at the base (Figure 10, Outcrops 2-3, Figure 12). Allochthonous sources to be considered include fine-grained sediments transported from the ridge top, either over the edge or

down bedrock fissures. Eolian processes may also have carried fine-grained, windblown sediments into the site.

Sediment from these sources forms an east-facing talus slope at the foot of the outcrop. Terrace construction in 1986 encroached into this talus slope, creating a nearly vertical cut (Figures 3c and Figure 12) that exposed an abrupt contact between the light-colored and rocky talus deposit and the underlying dark-gray shale bedrock. The contact is relatively level, but rises abruptly at the south. Similarly, in 2007, the contact was relatively level at an elevation of 37.1-37.4 m in Units 2, 4, and 11, rising to 38.4 m in Profile 4 (Figures 12, 13, 14, and 15). A similar incline appears to occur between the shelter's Back Wall profile (Figure 16) and Unit 11, at the front of the shelter, and at the north end of the site between Units 2 and 7 (Figure 17).

The mortuary deposit consists of human bone and other cultural materials in a zone 30-40-cm-thick overlying the bedrock contact (Figure 12). The nature of the contact strongly suggests that interment occurred in a 5-6 m long, flat-bottomed basin excavated into bedrock. The mortuary matrix is a gravelly sandy loam sediment, except where pigmented by red ocher.

The mortuary level is covered by a rock fall layer that includes large boulders and probably represents the collapse of the shelter overhang. This layer is thicker, with more massive boulders, in Areas I and II, where no overhang is present, than in Area III, where the overhang is preserved and where large boulders were removed during the 1986 excavation.

Large boulders rest directly on the mortuary layers, with spaces between them filled by deposits of smaller-sized rubble. In Unit 4, this rubble is comprised of thin tabular sandstone, many of which lie flat atop the boulders. These may derive from the collapse of the thinner-bedded sandstone unit that lies above the massive sandstone channel sand.

Following roof collapse, gravelly colluvium accumulated on the talus slope, apparently completely filling the shelter. Within the shelter, the colluvium is 120 cm thick at the front of the shelter, decreasing to 10 cm at the back. Initially (Profile 1, stratum f; Figure 18), 70-80 percent of the colluvium by volume was larger than coarse sand. About half of this coarse material is gray shale, indicating derivation from bedrock units at the base of the outcrop. Above this layer, shale is rarely seen in the shelter fill, perhaps indicating that the shale contact along the outcrop and within the shelter was covered over in the early phases of shelter filling. Stratum f was observed only in Profile 1, and did not extend to the front of the shelter.

The next episode of shelter filling (stratum e in Profile 1; Figure 18) was characterized by sandstone-dominant colluvium with interbeds of clayier-textured, yellowish red sediment. The interbeds are interpreted as mudflows derived from the washing of upland-derived subsoil materials over the bluff edge into the shelter. In Profile 2 (Figure 19), at the front of the shelter, a mudflow deposit up to 20 cm thick was present immediately on top of the roof-collapse stratum. It thinned with distance north toward the shelter center. As Profile 2 was cleaned back for sampling, the mud layer divided into two strata (c1 and c2 in Figure 19). In the shelter interior (Profile 1; Figure 18), evidence of mudflows was limited to a few thin lamina of yellowish red sediment in an otherwise yellowish brown matrix.

In grain size analysis, the units with the upland derived, reddish sediments are slightly higher in clay and fine silt. In Profile 1, this effect was very prominent in Stratum c,

where upland-derived mudballs were abundant (Table 1). In Profile 2, the effect was more pronounced in Stratum c, where the "red clay" beds were identified.

The third episode of shelter filling is represented by loamy sediments with 20-70 percent sandstone rock fragments (stratum c in Profiles 1 and 2), with a layer of cobbles and small boulders (stratum d in Profile 1) that represents debris flows or minor roof collapse.

During the fourth episode (Stratum b in the Unit 4 and shelter profiles), the colluvium is dominated by rounded to subrounded clasts interpreted as "mudballs" that were rolled by water action as they washed into the shelter. In contrast to the earlier mudflows, which suggest that sediment was being washed from bluff face exposures immediately above the shelter, the stratum b mudballs indicate transport to the outcrop along erosion rills, or perhaps through bedrock fissures.

Stratum b appears to have completed the filling of all but the front of the shelter (Profile 1 and Backwall Profile). The final fill deposit (Stratum a in Profiles 1-2 and Unit 4) lacks upland-derived clay clasts, indicating the cessation of severe upland erosion.

VIII. Excavation Results

A. Area I

1. Background

Area I (Units 1-4, 9, 10) was opened on July 5 in order to understand the relationship between Areas A and B, excavated in 1986, and because the density of finds in Areas A and B suggested that this area would be a rich zone for recovering human and cultural materials. Once excavation began in these units, it became clear that the density of human remains was extremely high. We, therefore, focused our excavation on only two of these units - Units 2 and 4 – which we believed we could excavate to a sterile level (the shale unit) by the end of the field season. Sterile soil was indeed reached throughout most of Units 2 and 4. Future excavations will be devoted toward completing the excavation of these units. Following the excavation of surface level (Level 0), which was made up of loose sandy loam sediments (2.5Y 4/4, olive brown), mixed with human bone fragments, snail shell fragments and roots, Level 1 was reached. The sediments in this level were compact sandy loam of the same color (2.5Y 4/4) as Level 0. Level 1 constitutes the site's bone bed, and extended down to the sterile shale unit.

2. Unit 4

In Unit 4, Level 1, two Bone Concentrations (BC 1 and BC 2) were exposed. BC 1 was located in the northern area of the unit behind a flat rock (rock 3). Before removal, rock 3 was tilted at a slight angle that allowed debris to accumulate behind it. Once it was removed numerous small bone fragments intermixed with shells and seeds were recovered. BC 2 (Figure 20) extends from the southern boundary of this unit (up to the eastern edge of rock 2) across to the northern edge of the square forming a long bone shelf. BC 1 may have been produced as the result of bones eroding out of BC 2 and lodging themselves behind rock 3. As an area, BC 2 is densely packed with small

disarticulated human bone fragments, a large portion of which are subadult. Although in certain regions of this bone concentration there appear to be clusters of particular elements (for instance, ribs), in general it does not seem likely that we are encountering bones that were interred in anatomical position.

It seems more likely that BC 2 is a secondary burial deposit, or that these bones were disturbed and disarticulated in this area itself (for example, moved aside and mixed to inter a new individual). However, in the deeper sediments of BC 2, vertebrae in anatomical connection were recovered. Two types of burial deposits – primary in the lower areas and secondary on top – may have occurred here. Alternately, these differences in preservation may be due to the differential effects of rockfall and water infiltration (which would have more significantly impacted bones closer to the surface – especially the fragile subadult bones).

Although BC 2 in Unit 4 has been recorded as occurring in only one level (1), it is possible that the bones found in the deeper sediments may belong to another stratigraphic level. With increasing depth, the soil became increasingly reddish in color, which may have marked the transition to another level. However, because the bones did not indicate any patterned orientations there was never a point at which the bones, through their orientation, appeared to demarcate a transition from an earlier deposit to a later one. Alternatively, it may be possible that the reddish soil is the result of red ochre being deposited with the bones and that the color is better preserved in the deeper sediments of Level 1. The excavation of BC 2 in Unit 4 allowed us to cut a small profile in the most western region of this unit. It is clear from this profile that the bone concentration extends back into Unit 3, as many bone fragments are jutting out from the profile.

3. Unit 2

Unit 2 overlaps with Area A, excavated in 1986. Many human remains of variable preservation were recovered. Some fairly complete and large elements, such as a lumbar vertebra, a phalanx, and a nearly complete, though broken, mandible, were intermixed with very fragmented bones (Figure 21a). The lumbar vertebra was found beneath the left mandible; both were found on a triangular shaped, flattened piece of sandstone and abutting another flat piece of sandstone (Figure 21b). When the lower slab was lifted, pronounced red staining (which appears to be ochre) was found both on the rock and on the soil below the rock (Figure 21d). Samples of the stained soil were sampled for analysis. Root growth and rodent burrows (with seeds) were found throughout this unit, pointing to at least some of the sources of disturbance. In this unit, one of the few artifacts from the season's excavations was found: a small shell bead, 0.5 cm in diameter (Figure 21a and c). Overall, Unit 2 appears to have been much more disturbed than Unit 4.

4. Units 9 and 10

These units, immediately to the east of Units 2 and 4, were gridded but were not excavated because of lack of time. A large number of human skeletal remains were found on the surface (Level 0) of these units. It is unclear whether these remains were brought to these units from upslope or represent in-situ deposits exposed by erosion (or a combination of both). *These units will be targeted for future excavation as they will allow us to delineate the eastern extent of the site, much as Units 5-8 allowed us to demarcate*

the northern boundary of the site.

B. Area II

Area II (Units 5-8) was opened on July 6 to help determine how far north archaeological sediments extended as well as to determine whether well-preserved sediments might be found beneath the large (2m x 1m) sandstone boulder found here. This boulder was clearly part of the rockshelter overhang, and had broken and tumbled downslope, so that the weathered/patinated face was facing toward the back of the rockshelter (an identical patination was found in a number of locations, facing east, along the sandstone outcrop). A more detailed discussion of this area's stratigraphy is found above in *Section VI. Fieldwork: Geomorphology*, in the description of Unit 7.

C. Area III

Area III (Unit 11) was opened on July 17 to expose a profile for sampling and analysis, to help determine the southern extent of the site, and to expose a bone concentration (BC 1) that was visible prior to excavation in the unit's northeast corner and excavate it to prevent further erosion downslope.

In Levels 1-3, a large number of densely packed fragmented bones were recovered. Level 1 was a very pale brown (10YR 7/4) loose loam, with inclusions of calcic crust pebbles up to 1cm in diameter, and mixed with shells and small animal bones. Level 2 was a compact dark yellowish-brown (10YR 4/4) clay loam with calcic crust inclusions,

However, in Level 4 articulated elements (humerus, radius and ulna, partial maxilla and mandible with teeth, rib fragments, vertebrae, and femur) were exposed (Figure 22). This is the most complete individual skeleton recovered from Bolóres, and it provides evidence of relatively undisturbed deposits at the site, as well as the existence of both primary and secondary burials. South of BC 1 in Area III, a series of fragmented but mostly complete crania were recovered, as well as other skeletal elements and one flint flake. Time did not allow for the excavation of some of these crania, but their placement, side by side, suggests that this area of the site has experienced less post-depositional disturbance than Area I. *Future fieldwork will focus on excavating this area to sterile soil*.

VIII. Description of Material Recovered from Site

A. Artifacts

Few artifacts were recovered during this season. Other than the perforated shell bead found in Unit 2 (Figure 21c), various flakes of flint debitage and undiagnostic and small fragments of ceramics were recovered. Small pieces of orange and yellow ochre were also recovered during excavation; Jonathan T. Thomas is currently carried out elemental analyses of the ochre at the University of Iowa.

B. Osteological Remains (Anna Waterman)

The following is a summary of the human skeletal materials recovered from units in the three areas (I-III) excavated in 2007, by Area and Unit. For each unit (or other location) the number of identified specimens (NISP) is tallied and the minimal number of

individuals (MNI) is calculated. The total NISP and MNI for each area and for the entire excavation are also presented. Recovered specimens fall into two categories: 1) those recovered from soil screening or displaced during excavation and non-point-plotted (=non PP), and 2) those which were point-plotted using a total station electronic distance meter (EDM) (=PP). All the human skeletal remains from the excavation are in the process of being analyzed in the European Archaeology Laboratory at the University of Iowa. The MNIs in this report are provisional and will likely change as the identification, cataloguing, and analysis of these remains are completed in the spring 2008.

It should be noted that a small number of faunal remains were also recovered in 2007. These remains also appear in the catalogue. In general only the remains of small animals (rodents and rabbits) were recovered (NISP < 50).

1. Area I

a. Units 1-4, Level 0 – Surface (Table 2)
Surface cleaning of Units 1-4 prior to excavation recovered several human bone fragments from at least one adult individual. Most of these fragments came from Unit 4.

b. Units 9, 10, Level 0 - Surface (Table 3)
Surface cleaning from Units 9 and 10 recovered a larger amount of human remains than in Units 1-4. Many of the recovered remains likely originated from Units 1-4 and were transported downslope into Units 9 and 10. Dental remains from both an adult and a child (3 to 5 yo) were recovered during this surface cleaning.

c. Unit 2, Level 1 (Table 4)
A large number of human remains (n=137) were recovered from this unit and level. The majority of the remains recovered were disarticulated, commingled, and highly fragmented. Some showed signs of disturbance from burrowing rodents. The remains of at least two individuals were recovered from this unit, one of which is a subadult. This calculation is based upon the recovery of a mixture of adult and subadult skeletal elements. Based on the dental wear, the adult was most likely middle-aged or older at the time of death. No subadult teeth were recovered or other elements for which clear age ranges are easily discerned, but the recovery of an unfused metacarpal head suggests that the child was less than 12 years of age.

d. Unit 4, Level 1 (Table 5)
The highest concentration of skeletal fragments excavated in the 2007 season was recovered from this unit and level. As in Unit 2, Level 1, the majority of the remains were disarticulated, commingled, and highly fragmented. However some articulated skeletal elements were identified – such as several subadult vertebrae – in the deeper sediments of Level 1. Two areas were defined as bone concentrations (BC 1 and BC 2).

The remains of at least 6 individuals were recovered, three of which are subadults. Based on dental development, the three subadults fall into the following age ranges at the time of death — 9 months to 2 years, 3 to 5 years, and 9-11 years.

e. Area I Summary (Table 6)

In sum, a large number of human remains were recovered from Area I, the majority of which were recovered from Units 2 and 4 (although excavations are not complete in Units 1, 2, 9, and 10). In general the remains were highly fragmented, disarticulated and commingled, although some elements were in correct anatomical position (suggestive of a primary or at least an articulated burial). When each unit is considered individually, the total MNI is 11 (5 subadults and 6 adults). However when calculating the MNI for Area I as a whole it is necessary to take a more conservative approach because of the strong possibility that we are encountering elements of the same individual scattered across several units. As the remains of three children of different ages were recovered we can be sure that at least three subadults were interred in this area. Additionally 5 adult scaphoids (carpal bones) were recovered from unit 4, clearly representing at least 3 adult individuals. Therefore, for Area I a MNI of 6 (3 subadults and three adults) has been tabulated.

2. Area II
No human remains were recovered from Area II (Units 5-8).

3. Area III (Table 7)
Area III (Unit 11) encompasses a 2 by 1 meter region just south of Area B from the 1986 excavation season. Bone Concentration 1 was identified prior to excavation in the northeast corner of the unit. In the upper level of bone concentration 1 there was a large number of densely packed fragmented bones, which appeared to be quite similar in their level of preservation and degree of fragmentation to BC 2 in Unit 4. However, in level 4 of this concentration articulated elements were recovered. In particular, an articulated humerus, radius and ulna with a partial maxilla and mandible (with teeth), rib fragments, vertebra fragments and a femur were unearthed. This is the most complete individual skeleton that has been recovered from the site (Figure 22).

South of BC 1 were identified a series of fragmented, but mostly complete crania were uncovered. Unfortunately time constraints did not allow many of these crania to be excavated and they, along with many other skeletal elements will need to be recovered in subsequent excavation seasons. Although more than three adult crania were recognized during the excavation of Unit 11, we can only tabulate a MNI of two adults and one subadult from the human remains that were removed from this area during this excavation season. The subadult and adult MNI are calculated from dental remains. The articulated adult individual was most likely a middle-aged or older adult as evidenced by advanced dental wear. This individual has extensive dental pathology in the form of several large carious lesions. The other adult individual is known from both skeletal and dental remains, and the extensive wear on one canine associated with this individual suggests an older adult. Based on dental development, the subadult in Unit 11 was most likely between the ages of 4 and 7 at the time of death.

4. Summary of Areas I-III (Table 8)
In sum, a large number of skeletal remains were recovered from the 2007 field season of Bolóres (n=1041). In general the remains were highly fragmented and commingled; however, some mostly complete and articulated skeletal elements were also recovered. Cataloguing and identification of the human remains are still underway, but preliminary

analyses indicate that we have recovered the remains of at least 4 subadults and 3 adults. If we accept the premise that there is no overlap of individuals across Areas I and III, then we can calculate a slightly higher MNI of 4 subadults and 5 adults. From the large number of human remains that we can observe embedded in the sediments, the MNI will substantially increase when the site is fully excavated.

IX. Protection/Preservation of Site

At the end of the field season, the entire site was backfilled and units that had not been excavated to shale (Areas I and III) were covered with geotextile, stones, pumice stones, sediment, and brush (Figure 23).

X. Other Analyses

A. AMS dates
Samples of two human bone fragments were sent to Beta Analytic Inc. (Miami, FL) on October 3, 2007 for dating. Our aim in this dating was to 1) assess the hypothesized Late Neolithic date for the site, as presumed from the artifacts and 2) to begin to bracket the site's use, in its earliest and latest phases. One sample (Beta-235487, field no. B1H10B240) was selected from 0-5cm depth; this was an unburned humeral head (from a subadult) from the 1986 excavation. A second sample (Beta 235488, field no. B1114B93) was selected from 23cm depth; this was a fragment of an unburned rib from an adult recovered in the 2007 excavation. Osteological remains from both the 1986 and 2007 excavations were gently cleaned with dry brushes and not treated with consolidants.

The AMS dates for these two samples were:

Sample	13C/12C	Conventional RC Age	2 Sigma Calibration
Beta 235487	-20.4 o/oo	3530 +/-40 BP	Cal BC 1960-1750
Beta 235488	-19.6 o/oo	4050 +/-40 BP	Cal BC 2840-2810 AND Cal BC 2670-2480

The collagen and stable carbon ratios of both samples were normal. If there was any rejuvenation from surficial carbon material impacting the more recently dated sample, it would have also affected the sample recovered 20cm below, given the porous sediments at the site. Furthermore, the pretreatment and decontamination process of the laboratory should have taken care of this.

Beta 235488 confirms a Late Neolithic use of the site; however, the more recent date (Beta 235487) indicates that the site was in use in the Late Copper Age/Early Bronze Age as well. These dates correspond with the dates of the early and terminal phases at Zambujal, located 2km from the site. It, therefore, is reasonable to consider the possibility that Bolóres was a burial site for the occupants of Zambujal. The significant time depth represented at this relatively shallow site points out the importance of

determining the site's microstratigraphy.

B. Geoarchaeology and Micromorphology
Geoarchaeological studies are underway by Dr. Bettis and Bryan Kendall and involve grain-size analyses (primarily sand fractions) to document depositional processes and deposit source(s) and micromorphology to refine our understanding of site depositional processes, cultural additions/modifications and post-depositional alterations. Their work will help us understand the history of Bolóres, including the degree of erosion and disturbance of the archaeological levels since their original deposition.

XI. Plans for Future Work

Our aim is to excavate Bolóres during the summers of 2008 and 2009. Our four-week excavation campaign in 2007 demonstrated that 1) the site is rich in well-preserved human remains dating to the Late Neolithic through Early Bronze Age, including those of adults and subadults in primary and secondary burial contexts, 2) the site is vulnerable to looters (some crania left in situ from testing in 1986 were gone in 2007) and, thus, it needs to be excavated in its entirety, and 3) the areal extent of the site is modest in size (approximately 15 square meters) and, therefore, it can be fully excavated in two additional seasons. Some funding has been secured for the 2008 season, and other funding (Wenner-Gren Foundation) is pending.

XII. References

Josephs, Richard L. and E. Arthur Bettis, III
2006 A practical alternative to Kubiena boxes for the collection of samples for micromorphological analysis. *Geoarchaeology* 18:567-570.

Laville, Henri, Jean-Philippe Rigaud, and James Sackett
1980 *Rock Shelters of the Perigord*. New York: Academic Press.

Mandel, Rolfe D. and Alan H. Simmons
1997 Geoarchaeology of the Akrotiri Aetokremnos rockshelter, Southern Cyprus. *Geoarchaeology* 12(6):567-605.

Serviços Geológicos de Portugal
1992 *Carta Geológica de Portugal* (5a edição). 1:500,000. Lisbon.

Trindade, Leonel and Michael Kunst
1990 Zur Besidelungsgeschicte des Sizandrotals: Ergebnisse aus der Küstenforsshung. *Madrider Mitteiliungen* 31:34-83.