Journal of Human Evolution 78 (2015) 122–143

Contents lists available at ScienceDirect

Journal of Human Evolution

journal homepage: www.elsevier.com/locate/jhevol

Were Upper Pleistocene human/non-human predator occupations at the Témara caves (El Harhoura 2 and El Mnasra, Morocco) influenced by climate change?

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ARTICLE INFO

Article history:
Received 19 February 2014
Accepted 14 August 2014
Available online 3 October 2014

Keywords:
North Africa
Aterian
Carnivores
Taphonomy

ABSTRACT

The influence of climate change on human settlements in coastal areas is a central question for archaeologists. This paper addresses this issue by focusing on the Témara region in Morocco. The study area was selected for two main reasons. First, it contains numerous caves with Upper Pleistocene deposits, which have yielded remains of anatomically modern humans in association with Aterian and Iberomaurusian artifacts. Second, these caves are currently located on the shore, thus this region is particularly sensitive to major climate change and sea level fluctuations. Diachronic taphonomic study of faunal remains from two sites in the region, El Harhoura 2 and El Mnasra caves, shows alternating human/non-human predator occupations. The lower layers of El Mnasra Cave dating to Oxygen Isotope Stage (OIS) 5 have yielded diverse ungulate remains with significant anthropogenic impact marks, together with numerous mollusk shells, *Nassarius* shell beads, hearths, lithics, some bone tools and used pigments. Faunal remains from the upper layers dating to OIS 4, 3 and 2 of El Harhoura 2 and El Mnasra caves, largely dominated by gazelles, provide evidence of carnivore activities, such as tooth marks, numerous semi-digested bones and coprolites alongside some anthropogenic signatures (cut marks and burnt bones). Non-human predators appear to be the main agents responsible for faunal modifications and accumulations. The 'non-intensive' nature of human occupation is confirmed by analyses of the lithic industry at El Harhoura 2. The 'intensive' human occupations date to OIS 5 and could have taken place during wet periods in connection with high sea levels, which allowed the exploitation of shellfish in this area. 'Non-intensive' human occupations generally correspond to arid periods and lower sea levels, during which the Témara area was further inland and may have been less attractive to humans.

Introduction

Climate change has played a major role in human evolution, cultural adaptation, behavioral changes, territorial occupations and dispersal within and outside Africa (e.g., deMenocal, 1995, 2004; Derricourt, 2005; Aouraghe, 2006a; Osborne et al., 2008; Carto et al., 2009; Castañeda et al., 2009; d'Errico et al., 2009; Trauth et al., 2009; Balter, 2011; Abbate and Sagri, 2012; d'Errico, 2012; Garcea, 2012a,b; Larrasoaña, 2012; Stewart and Stringer, 2012; Boivin et al., 2013; Delagnes et al., 2013). The Upper Pleistocene (Oxygen Isotope Stage [OIS] 5 to OIS 2) is a key period for the dispersal of anatomically modern humans (AMH) out of Africa (e.g., Stringer, 2000; Mellars, 2006; Macchiarelli, 2009; Boivin et al., 2013). This period was subject to significant palaeoenvironmental changes caused by glacial cycles, which notably modified the territories crossed by humans and other animals (e.g., Aouraghe, 2006a,b; Abbate and Sagri, 2012; Larrasoaña, 2012; Garcea, 2012a), including changes in the location of the shoreline. Thus, during glacial phases of the Pleistocene, the continental shelf was

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http://dx.doi.org/10.1016/j.jhevol.2014.08.008
0047-2484/

exposed due to lower sea levels (e.g., Shackleton, 2000; Jouzel et al., 2002; Waelbroeck et al., 2002). Several researchers have suggested that coastal areas could have played a crucial role in AMH dispersal (e.g., Stringer, 2000; Mellars, 2006), even if recent data highlight the importance of inland regions (Boivin et al., 2013).

North Africa is located close to the 'out of Africa' routes and could have been the "launch pad for modern human migrations" (Balter, 2011: 20) ~100 ka (thousands of years ago) (Balter, 2011; Garcea, 2012a). The human populations that inhabited North Africa at this time are associated with a technological industry known as the Aterian (e.g., Debénath, 1976, 1979–1980, 1992, 2000; Ferembach, 1976, 1998; Roche, 1976; Hublin, 1991, 2000; Balter, 2011; Jacobs et al., 2011; Oujaa and Hublin, 2012). The Aterian is a Middle Stone Age (MSA) North African technological complex (e.g., Nespoulet et al., 2008a; Nami and Moser, 2010; Barton and d'Errico, 2012; Linstädter et al., 2012; Dibble et al., 2013; Scerri, 2013a,b), dating to approximately 170/130–50/30 ka (OIS 6 to 4/3) (e.g., Cremaschi et al., 1998; Bouzouggar et al., 2007; Mercier et al., 2007; Barton et al., 2009; Schwenninger et al., 2010; Richter, 2010, 2012; Richter et al., 2010, 2012; Jacobs et al., 2011, 2012a,b; Linstädter et al., 2012; Jacobs and Roberts, 2012a,b; Janati-Idrissi et al., 2012a,b; Dibble et al., 2013; Scerri, 2013a; Douka et al., 2014). The lithic industry is characterized by a Levallois knapping system and the presence of tanged tools in several assemblages (Tixier, 1967; Camps, 1974; Debénath et al., 1986; Debénath, 1992, 2000; Pasty, 1999; Bouzouggar et al., 2002; Nami and Moser, 2010; Debénath and El Hajraoui, 2012; Nespoulet and El Hajraoui, 2012a; Dibble et al., 2013; Scerri, 2013a). Shell beads (*Nassarius* sp.) indicating symbolic activities have been found in layers attributed to the Aterian and date to OIS 5 (e.g., Vanhaeren et al., 2006; Bouzouggar et al., 2007; d'Errico et al., 2009; Nami and Moser, 2010; Steele and Alvarez-Fernandez, 2011; Barton and d'Errico, 2012; Dibble et al., 2012; El Hajraoui et al., 2012a; Stoetzel et al., 2014). The recent discovery of an early anatomically modern human with archaic features at Contrebandiers Cave, dating to 110–80 ka (e.g., Balter, 2011; Jacobs et al., 2011; Oujaa and Hublin, 2012), complements previous remains found in the Témara caves and other parts of Morocco for this period (e.g., Debénath, 1976, 1977–1978, 1979–1980, 1992, 2000; Ferembach, 1976, 1998; Roche, 1976; Hublin, 1991, 2000; Smith et al., 2007).

In very rare cases, as at Taforalt, a non-Levallois flake industry tentatively attributed to the MSA has been recognized after the Aterian. The industry recorded at Taforalt dates to around 25 ka (OIS 3) and remains poorly defined (e.g., Barton et al., 2005, 2013; Linstädter et al., 2012).

The Iberomaurusian culture occurred in several North African localities from approximately 20 to 10 ka (OIS 2 to the beginning of the Holocene). These lithic industries are rich in microlithic tools, primarily backed bladelets (e.g., Barton et al., 2005, 2007, 2013; Bouzouggar et al., 2008; Linstädter et al., 2012; Sari, 2012, 2014). Humans from this period have a completely modern anatomy. They buried their dead, sometimes in large cemeteries and used artistic representation (molding clay statuettes) as well as various types of ornamentation (e.g., Hachi et al., 2002; Barton et al., 2005, 2007; Hachi, 2006; Bouzouggar et al., 2008; Mariotti et al., 2009; Belcastro et al., 2010; Humphrey et al., 2012; Aoudia-Chouarki, 2013).

Aterian and Iberomaurusian archaeological records have been found in different areas of North Africa, such as in mountains (e.g., Nami, 2003; Aumassip, 2004; Bouzouggar et al., 2007; Nami and Moser, 2010; Barton et al., 2013; Sari, 2014), in the desert (e.g., Cremaschi et al., 1998; Pasty, 1999; Aumassip, 2004; Garcea, 2004, 2012b) or on the coast where numerous sites have been identified (e.g., Bouzouggar et al., 2002, 2010; Aumassip, 2004; El Hajraoui et al., 2012b; Sari, 2014). This raises the question whether North African Regions, currently located in coastal areas, were occupied permanently. It also stresses the issue of the impact of sea level shifts on these occupations. Initial insights on these issues have been gained through the study of lithic industries and chronological data in the Témara caves, located on the Atlantic coast near Rabat (Morocco). These first results have shown discontinuous human occupations. According to optically stimulated luminescence (OSL) dates, there are three episodes of MSA occupation, dating to approximately 110–90 ka, 75 ka and 55 ka, in connection with the wetter OIS 5c, 5a and OIS 3 periods separated by archaeologically sterile layers (Jacobs et al., 2012b). In addition, the Iberomaurusian culture is also present in the upper part of some sequences (Nespoulet et al., 2008a).

In this paper we examine a number of questions. Were humans the main agents responsible for faunal modification/accumulation? Did shifts of occupants occur in the caves over time? Were the occupations identified by Jacobs et al. (2012b) always of similar 'intensities'? Which factors influenced these changes of occupations? We use taphonomic studies to identify if predators accumulated and/or modified the large mammal faunal assemblages throughout time in two caves in the Témara region, El Harhoura 2 (EH2) and El Mnasra (EM). Results are compared to past global climatic shifts, local environmental records and sea level fluctuations in order to understand the influence of these factors on the occupation of the Témara caves by past human populations.

Témara region

Location and geological context

The Témara region, located south-west of Rabat, contains several coastal caves (Doukkala 1 and 2 caves, Contrebandiers Cave, El Mnasra Cave, El Harhoura 1 and 2 caves, Dar es Soltane 1 and 2 caves) (Fig. 1). The region is formed by a sequence of consolidating dunes alternating with marine and continental deposits (Akil, 1985; Chahid, 2011). The Témara caves were formed before OIS 5, approximately 130 ka, by karstic and/or marine erosion of the calcarenites (secondarily consolidated dune or ouljian palaeocliff). They open onto a narrow coastal plain ('Oulja'), which is protected by the primary consolidated dune. This dune overlooks a platform with rocks and water pools where the waves break (Fig. 2) (Mhammdi et al., 2008). However, the landscape of the Témara region has differed in the past. The slope rupture at the edge of the continental platform is located between approximately −200 to −130 m on the Moroccan Atlantic coast. The continental platform extends to the Casablanca region (south–west of Témara) over 49 km and into the Kénitra region (north–east of Témara) where it narrows, over 20 km (Joly, 1950; Cirac et al., 1979). Thus, during periods of marine regression, the Témara caves could have opened onto a continental plain, which may have extended for several kilometers. During OIS 4 and 3, marine regression would have moved the shoreline away from the caves, but certainly to a lesser extent during OIS 3. During OIS 2 (the Last Glacial Maximum), the shore was further from the caves.

The sedimentary record of the caves dates between approximately 120 and 6 ka BP (e.g., Jacobs et al., 2011, 2012a,b; Richter, 2012; Jacobs and Roberts, 2012a,b; Janati-Idrissi et al., 2012a,b). These sequences cover the Upper Pleistocene and the Holocene, and have recorded human and non-human occupations of the caves in correlation with climate changes, therefore allowing us to tackle the questions outlined above.

Current climate and environment

Currently, the Témara region is characterized by a Mediterranean climate with dry summers associated with mild and humid