Lower Palaeolithic settlements in the Maghreb: current state of knowledge and perspectives in the framework of the World Heritage Convention

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Introduction

The Maghreb refers to the area of North Africa that lies between 21° N and the Atlantic coast of Morocco to 2° N in the Libyan desert. It was named by the Arab geographers Maghrib ('westernmost limit'). The present discontinuous phylogeographic feature in this part of the African continent is the Sahara. In this, the world’s largest desert, the landscape has been shaped over time by wind, one of the most impressive environments on Earth, characterised by sheer slopes, shifting sand dunes, sand dune localities, dunes covered with gravel, seasonally inundated basins known as chotts and oases, and sparse large-depression cases fed by spring. Hence, the Sahara with its current intractable habitat conditions is a sort of natural burier impeding territorial movements of plants, animals and humans between sub-Saharan Africa and the northern part of the continent. Yet, palaeoenvironmental evidence indicates that the Sahara desert has undergone various climatic and environmental shifts since the Pleistocene period with periods of relatively wetter conditions when the Sahara formed a corridor allowing free movements of early humans and fauna in both directions.

Such periods of favourable environmental conditions must have allowed early hominids to disperse from the tropical savannas of Africa into the southern Mediterranean temperate regions. Indeed, recent studies have shown that there are a number of Lower Palaeolithic sites in the Maghreb that are located in a primary context, bearing witness to an earlier territorial settlement in this part of the African continent that was commonly assumed. For example, the site of Ain Hanech on the Algerian High Plateau presents Oldowan occurrences that date back c. 1.78 Ma with Oldowan industry, truly similar to that documented in eastern Africa. Furthermore, the site document a continuous archaeostratigraphic record and a thriving development of the Acheulean tradition characterised by important technological innovations and associated with fossils of Homo erectus. Unlike previous ideas that the North African Lower Palaeolithic assemblages are of little archaeological value (e.g. Clark, 1992), there are now many sites in sealed stratigraphic sequences providing ample opportunities for addressing early hominin behaviour and adaptations in the Maghreb. This chapter reviews the Lower Palaeolithic settlements in the Maghreb, emphasizing the current information and their chronological and behavioural implications in reference to the recent studies carried out at major sites (e.g. at Ain Hanech in Algeria and the Caulastra site in Algeria) and, to a lesser extent, to the knowledge emerging from previous studies. It also emphasizes the significance of Ain Hanech, Timna and the Caulastra sites for the world archaeological heritage and underlines the urgent need for their future conservation and inclusion in the World Heritage List of human origin sites in Africa.

Historical background

Power research on the Lower Palaeolithic of the Maghreb began with the colonisation of the region by the French. During the late nineteenth and early twentieth centuries, avocational prehistorians (military personnel, doctors, teachers, engineers and book-sellers), who were influenced by prominent figures of French prehistory (e.g. Abbé H. Breuil, M. Bois e R. Vaufrey) carried out the first explorations leading to the discovery of numerous Lower Palaeolithic sites: the most important of which are Sidi Abderraman in Morocco, Timna (formerly Trench 6 1/2 to Abiad in Algeria), and Sidi Dzir in Tunisia. Subsequently, major developments occurred in the Maghrebian Lower Palaeolithic research: for example, until the early 1950s, no pre-Africanian (in the sense of Oldowan antecedents) had been discovered in the Maghreb. That changed when Arambourg discovered the so-called 'paleolithic' assemblage associated with Pleistocene faunas at Ain Hanech in Algeria (Arambourg, 1949). This was followed by discoveries of more 'paleolithic' at Mersousia near Constantine by Laplagne-Jaussièche (1952) at Aoulef in the Central Sahara by Hugot (1955), and at the coastal sequence in Caulastra by Biernois (1981a, 1981b). In addition, fossil human remains were discovered, at Timna by Arambourg (1954, 1955, 1957) and at ‘Grande des Littorins’ in Caulastra by Biernois (1958b, 1964). The 1950s also saw the publication of three important syntheses on Maghrebian prehistory by Arambourg (1953), Vaufrey (1950) and Biernois (1950), providing for the first time a chronological framework of the successive Paleolithic cultures. The synthesis by Biernois in particular laid solid foundations for the North-African prehistoric chronology and revealed controversies about the authenticity of previously collected lithic materials, and the recording of industries and Paleolithic cultures. The 1960s was a time of progress, with more emphasis on refined methods of studying Lower Palaeolithic lithic industries. These included the work done mainly on the typology of ‘paleolithic’ by Ramond (1960) and Biernois (1967), and the study of bifacial tools by Biernois (1967). The period from the 1980s onwards is characterized by studies of lithic assemblages which were excavated from sites discovered in the 1950s, and the systematic re-investigations of major sites. The chronological analysis emphasized the technological and typological patterns of the assemblages, including Ain Hanech (Sahiboun, 1985, 1987; Timna) (Eyal-Mor, 1980) and Sidi Dzir (Bouassid, 1985). The sites re-investigated include Ain Hanech, Timna and the Caulastra sequence. The main focus of the investigations at Ain Hanech was to resolve the questions relating to the dating of the site and the nature of the association of the fossil bones with the Oldowan stone tools (Biernois, 1959, 1980; Biernois and de Heinzelin, 1980; Jammour et al., 1996; 2001; 2002). The research at Timna focused primarily on sediments analysis, dating the site, and typology of the faunal assemblages (Dima et al., 1997; Gaudiosi et al., 1997). The revised work of Caulastra put more emphasis on the chronostatigraphy of the sequence as well as descriptions of the associated industries (Rayal and Teissier, 1989; Rayal et al, 2001, 2003). In addition to the systematic reassessment of the sites above, new sites were discovered including the pre-Africanian site of ‘Monte Tosa’ (Thomas, 1973), both at Kau-En-Kau (Kebirkiche, 1880–1881), and Achakar sites of Kel Safane (Amine, 1981) and Ouled Hmida Cave in Morocco (Rayal et al., 1990).

The chronostatigraphic framework and its weaknesses

The Maghrenian Lower and Middle Palaeolithic deposits suffer from the absence of a precise chronological framework due to a lack of datable volcanic materials. Uranium series, electron spin resonan (ESR) and optically stimulated luminescence (OSL) dates are the most applicable for late-Middle and Upper Palaeolithic deposits. As a result, the dating of the Palaeolithic sites relies primarily on paleoecology and inferred correlations of sea-level sequences between the Atlantic coastal sites and the Mediterranean deposits. Indeed, the Caulastra coastal area offers the most extensive Palaeolithic stratigraphic sequence, which expose a series of fluctuating high and low sea levels interstratified with terrestrial sediments reflecting changes in climate. The sequence is used by geologists (Navarro and Ribot, 1941; Chauvet et al., 1965; Biernois, 1961a, 1971) as a chronostatigraphic framework for dating the prehistoric industries known from the region. It consists of a series of seven marine cycles, interstratified with six terrestrial episodes named after stratigraphic description of type-localities. The marine cycles include, from the oldest to the youngest, Maghrebian, Mesoussaria, Mahbien, Ararbian, Hamanian, Dzirian and Mahalian. The terrestrial cycles are Mosquadian, Sari-Khan, Amriki, Tensiftian, Pre-Sinditan and Saharan. The ‘paleolithic’ or pre-Africanian industries are distributed Mosquadian and Saharan terrestrial episodes, while the Arabician spanned from the Amriki to Pre-Sinditan (Biernois, 1971, p. 140). Although this chronostatigraphic system was defined for Atlantic Morocco, it became increasingly a classic scheme and a widespread Quaternary chronological framework for the entire Maghreb.

However, the validity of the Caulastra chronostatigraphic system was questioned by a number of researchers (Braulet, 1969; Teissier et al., 1986, 1990). They argue that the system presents a number of weaknesses such as the antiquity of the pluvial-and-alternate principle, the complexity of correlating the Mediterranean climatic episodes with the European glacial chronology, and negligence of the link of the local Quaternary stratigraphic levels and tectono-movement controls affecting the deposition of the successive episodes. Based on a chronostatigraphic approach, Teissier et al. (1994) suggested an alternative chronology for the Pleistocene sequence, incorporating four main formations. These formations include, from the oldest to the youngest, Ouled Hmida Formation, Anfa Formation, Kaf of Haroun-Farouk and Dam Roussa Formation (Arlean and Rayal, 2002; Teissier et al., 2002). The Lower Palaeolithic sites, which consist basically of Arabician occurrence, spanned from Ouled Hmida Formation to Kaf of Haroun-Farouk, from 1 Ma to 1.63 Ma (Righo et al., 2000).

In the Sahara, the alternating emission-erosion cycles, in the absence of any other chronological criteria such as preserved fauna and debatable volcanic material, is varied as a guide to build up a chronological framework for the succession of the prehistoric industries of the Saurès region in the north-western Sahara (Amine, 1979; Chouaïd, 1964). Six erosional and depositional cycles have been identified. The ‘paleolithic’ culture is correlated with the Mansourian episode (Early Palaeolithic), and the Achakar with the Taurusian and Dougarian episodes (Middle Palaeolithic).
The Oldowan tradition

The earliest lithic artifacts attributed to Homo erectus that are presently known are in Eastern Africa and are dated roughly between 2.6 Ma and 1.5 Ma. Major sites include BO10, OCG12 and OCG17, Grace, Ethiopia (Semaw et al., 1999; 2002); Lubalaki, West Turkana, Kenya (Boche et al., 2002); Kibit-fera, East Turkana (Beck, 1997); Olduvai Gorge, United Republic of Tanzania (Easley, 1971, 1975); Melka Kunture, Ethiopia (Chavannes and Poggio, 2006). South-African sites that yielded Mode 1 artifacts include (Beledomeni (Kuman et al., 2005) and Swartkrans (Dart, 1932)). These artifacts are generally assigned to the Oldowan Industrial Complex, named for Olduvai Gorge in northern Tanzania. The Oldowan technology is simple but required mastering by early hominins of some fundamental stone-flaking techniques. The Oldowan assemblages incorporate cores and core-tools (choppers, polyhedrons, subhedral, spheroids), debris, and less-frequent retouched pieces as well. Similar assemblages are known from the earliest archaeological sites in the Maghreb, including Ain Hanech. These assemblages were generally referred to as ‘pebble culture’ and sometimes as pre-Acheulean.

Figure 1 shows the sites yielding ‘pre-Acheulean’ assemblages, most of which are located in Mesosoria and Algeria. Outilh these countries, only a single bifacially flaked core-chopper, encrusted within a sandy-clay deposit, has been reported in Tunisia (Graga and Ouelle, 1990). In Atlantic Morocco, Mode 1 assemblages recovered from investigated sites in the vicinity of Casablanca allowed Biberon (1968b) to construct a typological chronological sequence showing the evolution of the pre-Acheulean industry over time. He divided the pre-Acheulean previously identified ‘pebble culture’ into four successive stages. Stage I includes the oldest artifacts from simple technological gestures (undifferentiated). Stage II incorporates ‘pebble tools’ characterized by bifacial flaking. Stage III is characterized by a diversified tool kit where the artifacts are considered to be more evolved. The last stage IV seems to be the emergence of the first Acheulean tools. Stages I and II constitute the ‘Ancient Pre-Acheulean’ while Stages III and IV constitute the ‘Modern Pre-Acheulean’ forms Biberon, 1976). However, Raynal and Teves (1988) and Raynal et al. (1990, 2006) revised Biberon’s stratigraphic sequence casting doubts on the antiquity of the ‘pebble culture.’ They claim that the ‘pebble culture’ assemblages are either surface finds, worked materials, from polyhedral cobbles, or even pseudo-artefacts generated by high-energy deposits. The authors concluded that the earliest human occupation in Mesosoria is Acheulean estimated to a minimum of 1.2 Ma (Raynal et al., 1999; 2002).

Located on the edge of the eastern Algerian High Plateau, the site of Ain Hanech contains the oldest North African archaeological occurrences. Ain Hanech was discovered by Arambourg (1937; 1939) and yielded a Pleistocene fauna associated with Oldowan artefacts. Since 1993–95 this major site is subject to systematic investigations (Sahnouni, 1998a; Sahnouni and de Heinzelin, 1999), Sahnouni et al., 2002; 2004). Ain Hanech is not a single site but rather a Rock-Pebble site complex comprised of several palaeoarchaeological and palaeontological localities, including Ain Bachetit, Ain Hanchel and Eiffel. Ain Bachetit is a palaeontological locality and the oldest in the region, and it is situated stratigraphically 13 m below Ain Hanech. It has yielded a Late Pliocene fauna (Arribouans, 1970; 1979; Sahnouni et al., 2002). Ain Hanech is located near a small localised fauna Eiffel is a newly discovered Oldowan locality in the immediate vicinity south of Ain Hanech. Preliminary palaeoecological and biostratigraphic evidence indicate that both localities are estimated to date c. 1.77 Ma.

Major excavations were undertaken mainly at Ain Hanech and Eiffel yielding rich archaeological assemblages. The remains are contained in three distinct levels (A, B and C) wedged in a fine sedimentary matrix, indicating burial in a fluvial deposit, with a low-energy regime, and that minimal site recycling might have occurred. Flint tools are well preserved overall, except for a few that underwent some minor post-depositional alteration. They show neither a strongly preferred orientation nor high inclination. The stone artifacts are fresh with an overwhelming amount of debitage present.

The archaeological assemblages consist of Oldowan artefacts associated with fossil animal bones. The fauna is scavenged-like and comprises proboscideans (Amarus, Elephas moghrebinus), equids (Ehipparion bosium [Bocher], Equus mubius, Equus sabel), Hines (Gomphotherium mauretanum), hippus (Hippopotamus), calf (Kobus bubalus), griffins (Smilodon mastodon, Grifolultus), bison (Bison torquil, Gaella port, Ors elwakou, "Alouphas", Auroopia crassicornis), aurochs (Capra auro), camassus (Ca. lukes), yacess, Crocuta crocuta), Mammuthus, Crocidotherium and L Management. Some of the taxa, which were unknown previously from this area, point to its great diversity, particularly Amarus, Gompherma, Hines, Kobus bubalus, Equus mubius and Amargas (Amarus, Voss and de Parme, 2008; Nadasdi and Sahnouni, 2008). MAINLY from the early Pleistocene and Eiffel, the lithic assemblages incorporate a full range of Oldowan artefact categories, including cores, unifacial and bifacial choppers, polyhedrons, subhedrons, spheroids, whole flakes and retouched pieces (briefly scrapers and denticulates) (Figure 2). Several simple flakes and retouched pieces were used to cut meat as evidenced by the presence of meat polishes on their edges. The lithic artefacts from Ain Hanech and Eiffel are very similar to those known from Olduvai upper Bed I and lower Bed 2, especially in terms of flaking patterns and roulets artefact forms (Sahnouni, 2006).

The Oldowan site of Ain Hanech may be viewed as a spot for shortterm occupations by early hominins. The site was near a shallow seasonal water body, where raw materials were accessible from nearby mud beds, and with plenty of game for acquiring meat. The technology used by Ain Hanech hominins is simple (Mode 1 technology), expedient and characterized by a low degree of standardization. There is no evidence for longdistance raw material transport. The industry is primarily composed of core-choppers, flakes, fragments and occasional retouched pieces that are the main characteristics of early stone artefact assemblages assigned to the Oldowan. Stones belonging to different animal taxa such as equids, large and small bovids, hippo and elephant were recovered in association with the lithic artefacts. One bovid (equid) appears to dominate the faunal assemblage. Whole flakes and retouched pieces were used to process soft animal tissue, suggesting that meat was a major component of early hominid diet in North-Africa. An in-depth study is under way for documenting subsistence patterns, the strategy employed for meat acquisitions and breaking bones for marrow.

1. The major Lower Palaeolithic sites in the Maghreb. © M. Sahnoun

2. Ain Hanech (Oldowan Industry). A–B: Core Forms made from (A) core; (B) large and small flakes made from handaxe. C–D: Cut and retouched pieces made from (C) flint. E–I: usual tools made from flint. J–K: tools made from bone. © M. Sahnoun

3. "Ain Hanech" (Oldowan Industry). D–G: Core Forms made from (D) core; (E) large and small flakes made from (F) handaxe; (G) large and small flakes made from flint. H–J: usual tools made from flint. K–L: tools made from bone. © M. Sahnoun
Monts Tessaou

Another potentially important Oldowan site is Monts Tessaou in north-western Algeria where the localities of Dousar Kaiba near Ouad Tifat and Dousar El Guermene near Sidi have yielded in situ Oldowan artefacts (Thomas, 1975). These localities are situated at the limits of the sub-coastal valleys and the southern Teil (Tessaou and Dousar El Guermene) of the Dersan region. Stratigraphically, the artefacts were contained in a deltaplatform deposits comprising alluvial and braided gravelly sediments in the lower fluvial deposits. The lithic assemblages, consisting of 217 artifacts recovered from Kaiba and 187 from El Guermene, were collected from the riverine and braided deposits with a dominance of flaked and chipped artifacts. Based on Binovers's classification system, the industry is assigned to the 'rubble horizon' Stages III or IV.

Oldowan-like artefacts from the Sahara

Oldowan-like artefacts have also been found in at least four localities in the vast Algerian Sahara landmass. These include Azelfin (Huguet, 1995), Reggane (Aziz and Chouaidi, 1986; and Beni Bou Idriss (Houotibache, 1980). While the specimens from Azelfin and Reggane are surface collections, those from the Tessaou (Ny et al. 2002) and Beni Bou Idriss were excavated in situ. At this latter site (1970-71, 1972-73; Houotibache 1980-83) has excavated 154 'flaking tools' (Figure 38) from a Glacial type deposit. However, a single flake was recovered associated with the fossil faunas, which makes the issue of site stratigraphy. The assemblage incorporates alluvial and braided choppers, discoids, and a partial biface and a bifacial flint tool made by Neolithic. Because of the abundance of bifacial flint tools, Houotibache (1980-83) assigned the industry to the later stages of the Excavated Pre-Acheulean of Blommes's classification system. The Azelfin and Reggane collections comprise 50 and 121 specimens respectively. The artefacts include a range of types: unifacial, bifacial, bifacally flaked pebbles, discoids, and whole flakes made from variable raw materials (quartz, quartzite, sandstone, flint, fossil wood and other exploitable rocks) (Figure 4). Interestingly, the surface collections from Reggane includes a flake that with nicely with a bifacially flaked chopper made from quartz (Figure 4a) (Beni Bou Idriss, 1984). If the flake was not removed as a result of post-depositional processes, these combined pieces suggest that the assemblage may not have been heavily disturbed by natural agencies.

In the Sasso region, Alimen and Chassallou (1962) collected 110 'pebble tools' in situ from several localities contained in alluvial and braconite deposits dated to the Lower Pleistocene. Made primarily from quartzite and quartz, the 'pebble tools' include split pebbles, and unifacial and bifacial choppers with an alternate flaking reduction (Figure 4b-f). Sediments and pollen analysis indicate that the climate was fairly humid during the Mauretanian episode (Alimen, 1961).

The Acheulean

The Acheulean is much better represented than the Oldowan. There are numerous sites distributed all across the Maghreb and the Sahara showing remarkable technological development over time. The major sites are in the Atlantic Morocco, on the High Plateau and in the Sahara.

The Acheulean of Atlantic Morocco

A very informative Acheulean sequence is remarkably represented in the Casablanca area. The sequence was first explored by Neukircher and Rubinstein (1941), extensively studied by Blommes (1982a), and recently revised by French researchers (Raynal and Teseur, 1996; Kayal et al., 2002). These studies showed the long development of the Acheulean tradition over time in the Atlantic Morocco. While the broader lines of the sequence from previous studies remain unchanged, the recent revised work especially enhanced the chronological framework using a range of dating means and techniques, such as magneto-chronology, biostratigraphy, GIS and ESR.

Beginning with the Lower Acheulean at the Thomas Quarry 1 Unit L, the sequence spans c. 1.0 Ma to 1.6 Ma. According to Raynal et al. (2002), Thomas Quarry 1, represents the oldest human occupation in the Atlantic Morocco. Comprised of two stratigraphic units 11 and 15), this site has yielded typical Acheulean artefacts associated with a small faunal assemblage. The faunal assemblage included a few diagnostic elements: Lisowysia afarensis, Equus antiquus, Gaudini antilope and apparently Edaphophaga. Soil data indicate a maximum age of 998 kya (Kayal et al., 2006). The OSL age is particularly consistent with the biocenology of diagnostic elements of the large mammal fauna recovered at the site. The stone artefacts, made from quartzite and flint, comprise bifaces, bifacial choppers, discoids and large flakes obtained from boulder cores. Other artefacts include unifacial and bifacial choppers, polyhedrons and spheroids, as well as a few denticles.
The Middle Axialum is illustrated at Rhinoseros Cave and Thomas Quarry Horned Cave. CSR-dating at Rhinoseros Cave made on Rhino tooth enamel shows a wide range of dates. For example, first calculated ages gave 2794/414 Ka for early uptake and 4756/57 Ka for later uptake (Morales et al., 1996). The recalculated ages are considerably older than those just published due to the revised sediment geomorphic data used at the site. The new dates at 4754/574 Ka for early uptake and 7575/728 Ka for linear uptake (Rhodes et al., 2000). The excavations at Rhinoseros Cave have yielded a faunal assemblage in which white rhino remains are abundant suggesting ‘specially hunted’ by hominids Burley et al., 2002, p. 69. The associated lithic assemblage is characterized by an increase of dossal cores, flakes, nas cleavers and large ‘leaffish’ pieces. Thomas Quarry Horned Cave has yielded hominid remains, fauna, and artefacts deposited in secondary context with materials from outside washed into the cave (Blundell et al., 2005). The faunal are rare, and therefore appear to be responsible for collecting much of the fauna remains. With similar composition of artifacts to Rhinoseros Cave and Thomas Quarry Horned Cave, the Sidl-Khiidi-Heliasa Quarry, Styc quarry, Bees Cave, Littites Cave and Cap Chandelier sites are also assigned to the Middle Axialum.

Sid-Ahmed-Khan-Extension in the Cokelonia area is the main site representing the Upper Axialum. The OSL estimate is 5755±34 Ka (Blundell et al., 2002, p. 71). The assemblage is characterized particularly by predominated flake productions, thin small bifaces made on large flakes, and some cleavers.

The Axialum on the High Plateaus

The Axialum is known from a number of localities across the High Plateaus in Algeria, including Tighennif, Keft Sefiane, Enqerey, Lac Karar and Sid Zin in Tunisia.

Tighennif

Situated in north-western Algeria, Tighennif (formerly Beni Abdo or Beni Abdes) is among the most significant Axialum sites not only for North Africa but also for the entire Old World. The site was discovered in the nineteenth century in the course of sand quarry exploitation, where vertebrate fossil bones and lithic artefacts were collected. Subsequent sporadic investigations by Pommel and Paillet showed the importance of the site. Between 1954 and 1956 Amranburg carried out large-scale excavations that led to the discovery of the oldest African hominid remains associated with a rich fauna and very informative Axialum assemblage (Amranburg and Hoefnagel, 1962). The fauna joy and large belonged to the base of the Middle Pliocene. A revised list includes particularly (Lioprotomus atlantica, Cenotherium sinum, Equus macrourus, Mioloboschus campbelli, Geotria d. pentom, Otosaurus gauffii, Chronobates, Cuscatrichia, Pliomerychus c. sosdoid, Hominia erectus and three forms of gazelle (Gerasadi et al., 1996).

The lithic assemblage comprises Obiobin and Axialum artefacts, including choppers, polyhedrons, trinucleates, bifaces (Figure 56 S-S); cleavers, cores, retouched pebbles, large and small flakes, and fragments. The artefacts are made from quartzite, sandstone, limestone and flint. The industry is assigned to the Lower Axialum based on the use of hard hammer percussion and proportions of pebble-tools (x=8% per cent), inhumation and bifaces with cortex base (x=28% per cent) and proto-cleavers (x=65% per cent) (Blundell et al., 1967). Pieramico (1985) considered the small flint flakes (10 per cent) which used retouched as a chronologically separate lithic assemblage but there is no stratigraphic proof of this. The technology employed is particularly sophisticated, suggesting a higher level of hominid skill and intelligence. In addition to a fairly motile symmetry on the bifaces and the successful production of large cutting tools, the hominid used a novel flaking technique called Kombewa.

The Kombewa technique involves manufacturing flake with dual ventral faces, providing the hominids with the advantage of shaping down with a convex edge and large scrapers (Blauy, 1997; pp. 728-729; Dauvill, 2001).

In spite of the additional research carried out at Tighennif, its age still remains uncertain, for example, palaeomagnetic studies made on the lower deposits indicated (probable) a normal polarity, which is confirmed with the Brunhes (Chron c. 0.8 Ma) (Gerasadi et al., 1996), yet the Lamaline Subchron might not ruled out. Biostratigraphically, the fauna contains a hallmark of Homo habilis. The similarities between the two sites are limited to a few taxa that persisted throughout the Pliocene, i.e. rhino, hippo and hyena. In contrast, the taxa that are biologically older and are found only at Ain Hanech and not at Tighennif, e.g. elephant, Equus, Hesperotherium, and Pliopithecus. Given the great fossil evidence between the two sites, a late Lower Pliocene age for Tighennif is plausible. In fact, both the taxa-mammals and the lithic assemblage are very similar to that of Thomas Quarry. This level is at least 2.0 Ma as older as radiometrically dated (c. 1.6 Ma dated (Rhodes et al., 2000); see above. Nonetheless, rethinking the site of Tighennif is totally warranted.

Based on stratigraphic evidence, it can be inferred that Tighennif hominids carried out their activities near a lake. The site has been minimally disturbed as judged by the very low density of archaeological materials recovered at the site (0.8 tons/m2) (Gerasadi et al., 1996), as well by hominid musculoskeletal in the accumulation of the faunal remains (Dany et al., 1985). Evidence of outliers seen on hippo and antelope bones suggests that the hominids hunted or scavenged animal carcasses falling on the lake banks (Dany et al., 1984, p. 480 and processed them with their teeth. However, the most notable activity at Tighennif is the hominid manufacture of bone tools. A small equid metapodial bone, found during the excavations, exhibits an intentional notching on its distal part forming an ahup point (Dany et al., 1984, plate 1). A similar retouched metapodial from the Middle and Upper Bed 1 at Olduvai Gorge also attests to an early use of bone tools (Saylor, 1971, plates 36, 40).

Keft Sefiane and Enqerey

Keft Sefiane and Enqerey are two newly discovered Axialum sites in Algeria. Keft Sefiane is situated in the north-eastern High Plates, and consists of three main Axialum horizons notably separated by interstratified deposits. Limited test trenches have yielded a total of fifty-one artefacts made from limestone, most of which are bifaces. Other artefacts include choppers, cleavers and adze points. Using Bordes typology, Amran (1981) concluded that the horizon represent three stages of a local development of the Axialum tradition. Lower Axialum, Middle Axialum and Upper Axialum. Yet, no fauna or obblige elements were recovered due to thin preserved chalcedony dissolution which would have been active in the travertine formations (Amran, 1981, p. 147).

Enqerey is located 45 km east of Tighennif on the western High Plateau. It is situated in both sides of Bouskoura ravine, cut by different phases of the gully active in the region. There are two archaeological levels separated by a sterile consolidated reddish sand deposit (Darioli, 2002-2005). The lower level yielded a typical Axialum industry contained in a gravel and sandy matrix. The assemblage incorporated choppers, polyhedrons, simple cores, cleavers, bifaces, as well as large and small flakes made from quartzite, sandstone and flint. The industry is very similar to that of Tighennif in terms of both raw material usage and techno-typological characteristics (forgetfully, unlike Tighennif, there is no fauna associated with the lithic assemblage.

Lac Karar and Sid Zin

Lac Karar was discovered by Germain in 1984 north of Tiemcen city in north-western Algeria. This site presents some similarity with Tighennif at least with regard to its location on an aridian spring. Bachi (1990) studied the fauna and associated artefacts. The fauna includes (Lioithronine atlantica, Equus Macrourus, Cenotherium sinum, Hypohippalea amphibius, Sscapula, Cervus, Antil lupus, Conchochemis gnu, Onopha sp. and Homotherius unicolor). The artefacts, assigned to the Upper Axialum, comprise biface and conform bifaces, cleavers, as well large and small flakes. Bachi (1995) argued that the Lac Karar occurrence are heterogeneous and they may incorporate a mixture of different prehistoric cultures. Thomas (1997) considered the site to be slightly older (≤200 Ka) than Tighennif.

The site of Sid Zin near Keft in north-western Tunisia has been studied by Gobert (1950). It consists of a sequence of three archaeological levels sealed by a tuff deposit. The lower and middle level yields Axialum assemblages dominated by biface and conform bifaces (Figure 6, 1-2). The upper level is rich in unfinished points and cleavers. In the tuff strata the Axialum disappears entirely and it was replaced by a Middle

Killed in 1984 south of Timcen city in north-western Algeria. This site presents some similarity with Tighennif at least with regard to its location on an aridian spring. Bachi (1990) studied the fauna and associated artefacts. The fauna includes (Lioithronine atlantica, Equus Macrourus, Cenotherium sinum, Hypohippalea amphibius, Sscapula, Cervus, Antil lupus, Conchochemis gnu, Onopha sp. and Homotherius unicolor). The artefacts, assigned to the Upper Axialum, comprise biface and conform bifaces, cleavers, as well large and small flakes. Bachi (1995) argued that the Lac Karar occurrence are heterogeneous and they may incorporate a mixture of different prehistoric cultures. Thomas (1997) considered the site to be slightly older (≤200 Ka) than Tighennif.

The site of Sid Zin near Keft in north-western Tunisia has been studied by Gobert (1950). It consists of a sequence of three archaeological levels sealed by a tuff deposit. The lower and middle level yields Axialum assemblages dominated by biface and conform bifaces (Figure 6, 1-2). The upper level is rich in unfinished points and cleavers. In the tuff strata the Axialum disappears entirely and it was replaced by a Middle
Paleolithic-like assemblages. Balout (1955) assigned the industry to the Late Acheulean. The fauna associated with the lithic assemblages includes Elephas, Equus, Rhinoceros, Bos, Gaviala and Lepus, but is of no help for dating the site.

The Acheulean in the Sahara

The Sahara is rich in Paleolithic resources and an enormous amount of material was collected during the nineteenth-century colonial explorations by the French military. Subsequent scientific expeditions have also shown the overwhelming presence of the Acheulean in much of the Sahara. The major sites include Tassili-n’Ajjer (the Central Sahara), in Algeria (Amorebieta, 1948; Amorebieta and Balout, 1955; Pigeard, 1935), Sacus in the northern Sahara, in Algeria (Chauvet, 1964; Altmann, 1978) and Oua Ouara Valley in southern Morocco (Bilenmen, 1954, 1963; Nocera, 2002). Tassili is among the most important sites in the Sahara, yielding an abundant Acheulean industry associated with mammalian fauna. The site is situated north-east of the Ahaggar area belonging to the Tassili n’Ajjer plateaux in Algeria. It consists of four localities (Tassili 1, 2, 3, and 4) spanning from the Lower Paleolithic to the Neolithic. The Acheulean site (Tassili 1) was discovered in 1961 and has been investigated primarily by Amorebieta (1948), Amorebieta and Balout (1955) and Thomas (1977). The Acheulean deposits consist of red and brown beds partially covered by dunes of the current erg. The Acheulean artefacts and associated fauna were contained in lacustrine sediments with diatomite and it is high proportion of charcoal dated during the first lacustrine episode of the formation of the lake. Thomas (1977) correlated the site with the middle level of Siib Zv, and estimated its age to be at least 520 kya. The fauna of the Tassili type is a mixture of wild taxa such as Elephas, Equus, Milodon, Genus Castor, Otocyon, Cercotherium, Taurotragus and Antilopus, and Saharan sabertooth taxa such as Gaviala and Otocyon. There is no precise account of the biota and its environment (Figure 7) collected from surface from the earlier expeditions. However, Gaudzinski (1972) analysed 100 complete biotas, which are primarily ovine and bovids, as well as numerous biotas that are finer and thinner compared with those known from Tighenif.

The northwestern Sahara has a long sequence of Acheulean sites, especially in the two sites of Sacus and Toubkal-Saheghet. Chauvet (1964) and Altmann (1978) undertook a comprehensive study of the flintstone deposits of the region and showed a developmental sequence of the local Acheulean tradition. The lithic assemblages, made up of local metamorphic rocks, occur in gravel terrains and in fine- and coarse-grained sediments. The sequence consists of seven stages grouped into three major periods. The earliest period (Stages 1 and 2) is correlated to the sediments. Tassiliian type, and is characterized by over 50 per cent ‘pebble tools’, crucial tridittos, new bifaces, nucleus and flakes. The second period (Stages 9, 10 and 11) rich in Acheulean assemblages, is dated to the Ougaritian depositional episode. In this period, the ‘pebble tools’ form only 16 per cent of the bifaces were produced using the soft hammer-stone. Cleavers are numerous, and Levallois flakes are already present making up to 24 per cent of the total flakes. There are also assorted types of nucleus (Kombewa, West Victoria, Levallois). The third period (Stages VI and VII) is correlated with the final Ougaritian cycle. In this period, finely made bifaces and cleavers predominate the assemblages followed by retouched flakes which were mainly scrapers. ‘Pebble tools’ become rare at this stage.

In southern Morocco, Antoine and Bilenmen (1954) and Bilenmen (1955) explored the Tafraout Basin and Wadi Draa, respectively. Bilenmen (1955) outlined the development of the Acheulean in the region based on surface materials collected primarily from diatomite sediments. Based on an in-depth technological and typological analysis, Nocera (2000) concluded that the Acheulean in Tafraout is characterized by the predominance of the Levallois technique and tools on flakes with few bifaces and cleavers.

Development of the Acheulean

The oldest Acheulean occurrences are recorded in East Africa and are dated to around 1.8–2 Ma in Kombewa (Ethanpop) and West Turkana (Rungai). Beynon, 2004). Roche et al., 2003). By this time new technological innovations appear in the archaeological record, such as bifaces, picks and cleavers often made from boulder cores. The major Acheulean sites in East Africa are Kalakalale 4–6 (in West Turkana (Beynon et al., 2000), Kombewa (Bowen et al., 2002; Beynon, 2004), Olukok 6 and 7 (Beynon and Riny, 1993), Percus (Beynon, 1993; Isaac and Curtis, 1994), Nkela Kuroute (Chauvet and Riny, 2004), East Turkana (Beynon 1970), and St John Hinton (Kurane et al., 2003). Technologically, the Acheulean bifaces are the result of the conceptual development from bifacial (Chappey 1967, Salards 1987, p. 170), and it is not supplanting that Olukok the Developed Olukok with bifaces and the Acheulean overlapped (Layton and Riny, 1996). Even though it lasted for approximately 1.5 Ma, trends are seen in the Acheulean to the extent that it is hard to date Acheulean assemblages on typological and technological grounds (Van 1996). Nonetheless, late Acheulean assemblages, particularly bifaces and cleavers (c. 250 A.D) can straightforwardly be discriminated from earlier ones. In contrast to the early Acheulean, the late Acheulean assemblages incorporate remarkably systematic and thinner bifaces, well-made cleavers, as well as predefined techniques for standardized flake production.

Unlike East Africa, there is no record of chronological transition from the Olukok to the Acheulean in the Maghreb. Here, whereas the Olukok site is dated to c. 1.78 Ma (e.g. Ar Aherat and El Khatib), the oldest securely dated Acheulean is only dated to around 1.8 Ma, for example Thomas Quary 1 unit and possibly Tighenif. Thus, there is a huge chronological hiatus between the Olukok and Acheulean in this part of the African continent probably due to either the lack of systematic follow-up or the preservation of transitional sites. There are three sites with potentially early Acheulean occurrences, including the Ali Aherat upper level deposits, Morts Tesara and Bodi Ten Kana. At Ali Aherat, crucial bifaces and large flakes are found in alternate sediments/levels found in the Olukok horizons (Salards, 1980). The pre-Acheulean assemblages from Mount Tesara (Thomas, 1972) and Bodi Ten Kana (Hedibache, 1961–62) have a very small frequency of proto-bifaces and crude bifaces. On typological grounds, these assemblages can be characterized as Acheulean. Neglected, although, in none of these assemblages can be securely dated.

The North–African Acheulean tradition has been divided into several phases reflecting stages of development over time in order to date the Acheulean assemblages. The proposed stages include:

- four stages (I, II, III and IV) for the Maghreb (Bilout, 1955),
- three stages for the Atlantic Massif (lower, middle and upper) (Bilout et al., 1958; and technological specialization of manufacturing cleavers (Taylor, 1957). However, as stressed by several Paleolithic archaeologists, time trends in the Acheulean are not strong, and thus not appropriate for dating the Acheulean assemblages (e.g. Kirk, 1999). With regard to the Acheulean of the Maghreb, the Middle Acheulean stages are not clearly defined. For example, Sidi Ali Khouli-Naoullia Quarry and Bean Cave sites are considered Middle Acheulean in spite of the absence of bifaces in the former and the heavy mottled clastic nature of the remains in the latter (Bilout et al., 1952, p. 71). The frequency of artefacts such as ‘pebble tools’ versus bifaces and blade industry are often based on assemblies lacking integrity due to their secondary geological context. Moreover, shape of bifaces may have been impacted by the quality of raw materials used.

In my opinion, only the early and late Acheulean stages can be obviously characterized in the Maghreb. The early Acheulean is remarkably well represented in the sites of Thomas Quary 1 unit, Tighenif and Kruzy, although northwestern Sahara in addition to typical Acheulean tools including cleavers, the early Acheulean assemblages contain a large number of bifaces, tridittos, cleavers, discord cores and flakes produced using hard hammer stone. Sometimes, the Oldowan
artefacts may total over 50 per cent of the assemblages at Tighenif (Balout et al., 1987). The bifaces are overall thick, triangular and/or sub-triangular, and characterized by large and deep scarps. The cleavers are made from large flakes, and the ‘proto-cleaver’ type usually predominates. This type of cleaver represents the smallest and probably the earliest form of lithic artefact. It is produced on a long, concave flake with its lateral sides slightly retouched to shape the distal edge into a transverse cutting edge (Troncoso, 1997).

The late Acheulean is roughly estimated between 0.6 Ma and c. 100 Ka. The major sites representing this stage are Said-Zin (Types I–II), El-Aai-Abad (Figure 6E), Beens Cave, Cap Chatelot, Sidi-Abderrahman-El-Touini (Figure 6D), Thibaudine (Figure 7), and assemblages dated to the late Acheulean (Mousterian stage from the North Saharan Sahara, especially Tellabat-Techentif). The density of the Oldowan-type artefacts is low, and the typical Acheulean specimens are generally thin and retouched. The bifaces display particularly a well-developed symmetry, and are usually ovate, lanceolate and cordiform. Likewise, the cleavers show a high degree of renitence and generally outnumber the hand-axes. Of particular interest are the cleavers from Tellabat-Techentif (Figure 6B) manufactured using a novel technique of core preparation and flake detachment. As described by Troncoso (1997), the method involved predetermining the shape of the cleaver before knocking in its core. This technique is a variant of the Proto-Levallois prepared core method. The use and generalization of these technological innovations probably coincided with the gradual emergence of Neanderthals in Europe, with the appearance of Homo sapiens 400–300 Ka.

Hominid association

All the hominids discovered so far in the Maghreb are associated with the Acheulean activity (Table 1). They are known from Tighenif in Algeria and from several Moroccan sites. The Tighenif hominids include three mandibles (Figure 8), a fragment of a partial and isolated teeth (two incisor, a canine, two premolars and four molars) (Amiard & Trifaux, 1994; Amiard & Jahiel, 1996), and isolated teeth (Amiard & Trifaux, 1994). The age of Tighenif is estimated at c. 0.8 Ma (Genade et al., 1986). The only post-cranial remains known in the region come from Aïn Mouloua near El-Hajeb, Morocco. It is a left femoral shaft displaying both H. erectus and archaic H. sapiens features (Hulbert, 1982). Based on fauna, Aïn Mouloua is believed to be older than Thomas Quarry 1 and slightly younger than Tighenif (Genade et al., 1986; Genade, 2002). At the adjacent site of Hemerd of Thomas Quarry 1 and Ould Hamid 1 (formerly Thomas Quarry 0), post-cranial remains have been collected. These include an incomplete mandible (Ennouchi, 1969) and three teeth (Rwand et al., 2002) at Thomas Quarry 1, and a nearly complete skeleton of the face, the right frontal, temporal, and isolated teeth (two canines, four premolars and two molars) (Ennouchi, 1969). The Sidi Abderrahman-El-Touini site was added two mandibular fragments consisting of a posterior part of the right mandibular corpus with three molars, and a left part symphysis part with 17. The two mandibular parts are not articulate but apparently belong to the same individual (Amenbrambique and Blumen, 1936). The Utinoue case sequence is believed to be contemporaneous with the lithic Stage 1 (-c. 400 Ka) (Rwand et al., 2002). At Sidi, workers exploring quarries on the Atlantic coast recovered a partial-complete calvarium (Figure 9A) associated with a fragment of the upper left mandible (32–42), and a natural endodermal cast (Jaejer, 1975). The calvarium was found isolated but appears to come from a shallow deposit corresponding to the Amanian maximum transgressive marine episode dated to 200 Ka (Jaejer, 1975). However, Hulbert (1988, p. 204) considers, that the Sidi Hammad hominin is rather older and can probably be dated up to 400 Ka. Workers digging the Mhitou Gouda Quarry in Rabat (Morocco) fortuitously found a mandibular fragment, a fragment of left upper maxilla and several cranial fragments (Niederer, 1964). Based on earlier stratigraphic deposits by senior authors, Jarige (1975) assigned the deposit believed to have yielded the hominid remains to the Middle Tertiary. The formation was recently redefined as belonging to the Upper Bed of Member 3 of the Gourou formation, which is correlated with the cold lithozone Stage 10 (264–134 Ka) (Risseeuw et al., 2002, p. 24). As a whole, the hominids of the Maghreb appear to form two groups that are chronologically and morphologically distinct. The first group is older, encompassing hominids from Tighenif, Aïn Mouloua, Hemerd of Thomas Quarry 1 (H. erectus) and Ould Hamid 1 (H. erectus and archaic H. sapiens). The second group is slightly younger and comprises hominids from Sidi Abderrahman, Sidi and Rabat (H. erectus). Taxonomically, the Tighenif and the Sidi Abderrahman hominids are closely related to Asian (H. erectus, but they cannot be identified precisely to this group. Because of this variation, Abarmin considered them as a local geographic subspecies of A. africanus (H. erectus) and the Tighenif and the Sidi Abderrahman hominids are closely related to Asian (H. erectus, but they cannot be identified precisely to this group. Because of this variation, Abarmin considered them as a local geographic subspecies of A. africanus (H. erectus). The Tighenif and the Sidi Abderrahman hominids are closely related to Asian (H. erectus, but they cannot be identified precisely to this group. Because of this variation, Abarmin considered them as a local geographic subspecies of A. africanus (H. erectus). The Tighenif and the Sidi Abderrahman hominids are closely related to Asian (H. erectus, but they cannot be identified precisely to this group. Because of this variation, Abarmin considered them as a local geographic subspecies of A. africanus (H. erectus).
taxonomy of the Maghrebian hominids, the consensus of most authorities is that they probably represent an australopithecine stock from which the local ‘h’ sapiens developed, for example human fossils from Djebel Irhoud, ‘Xuxa’, Dar Saltane and Sanger.

Subsistence patterns

Only limited information on early hominid subsistence in the Lower Paleolithic of the Maghreb is available, which is based on studies of microwear on lithic artefacts and food bone modification patterns. The evidence from both studies indicates that early hominids processed primarily meat with their lithic tools, for example, microwear analyses carried out on a selection of Acheulean artefacts made from biotite shows that both simple flakes and retouched pieces were utilized for meat cutting (Figure 10) (Sahouni and de Heinzelin, 1998; Vergés Bosch, 2002). An ongoing study of Arik Hanecch faunal remains points to the presence of bones with hominid-inflicted butchery marks and carnivore-inflicted tooth marks, suggesting possible competition with carnivores for early access to animal carcasses.

Evidence of Acheulean hominid butchering marks is present on antelope and hippo pelvis bone fragments from the Acheulean site of Tighemir. The antelope remains were probably broken as a result of marrow extraction. The hippo bone fragments bear a deer-carcass mode for cutting the oblique internal muscle of the abdomen (Sens et al., 1984). Wood-working and bone-cutting activities are evident on several Acheulean artefacts edges (quartzite and sandstone) from Thomas Quarry (ind B-site) (Byers and Ritchie, 1982). These include two choppers, a polyhedron, a flake and a denticulate (Thomas-Quarry 1); and two bifacial choppers and two flakes (from Thomas Quarry 3) (currently Oulad Hamida).

Palaeoecological settings

Only a few palaeoenvironmental and palaeoclimatic reconstructions are known to be associated with Lower Paleolithic sites in the Maghreb. The available information is mainly derived from research recently undertaken on some sites, and the reconstruction-attempts were inferred from stratigraphy, fauna, carbon isotope ratios and pollen. At the Oulouane sites of Ain Hanecch and El-Kherba, sedimentological evidence indicates an alvar floodplain setting possibly traversed by a meandering channel. The fauna suggests an open arid and landscape, inferred from the presence of more hypsodontic bovines, an increase in the abundance of rodents, and the disappearance of the quagga (Equus quagga) inhabitant species (Sahouni et al., 2010, 2011). Yet, hippopotamuses and crocodiles at El-Kherba indicate the presence of standing water or a seasonal environment. A stable-carbon isotope study of El-Kherba pedogenic carbonates corroborates the indications provided by the fauna. The carbon-isotopic evidence suggests that El-Kherba palaeovegetation predominantly consisted of C4 types of plant, both woody and grasses. Moreover, the evidence shows a general positive trend of increasing δ13C values as depth increases, suggesting a temporal increase in C4 vegetation and in aridification as shown by the δ18O values of pedogenic carbonates (Figure 11) (see details in Sahouni et al., 2011), which is consistent with the global Plio-Pleistocene continental trend of increasing aridification and greening expansion. When correlated with El-Kherba archaeological stratigraphic profile, the temporal trend in grassland expansion and aridity seems to be closely related to level A. If this correlation is true, unlike their predecessors in the level B below, the Oulouane hominids in level A existed in an open grassland and environment. An open landscape would provide a shortage of food resources and water supplies as opposed to a riparian habitat, which offers an abundance of water and food supplies. Therefore, it can be inferred that the evidenced climate change at El-Kherba probably limited Oulouane hominids foraging capabilities during level A by imposing them to the risk of carnivore predation and the lack of opportunities of plant and animal resources.

The Acheulean hominids lived in both lacustrine and alluitic, and savannah-like habitats. For example, at Tighemir the taphonomic conditions of microvertebrate fossils indicate a primary accumulation in a closed lake environment fed by aridian upwellings and the drainage of water flows into the lake (Sens et al., 1987). Allochthonous, galea and galeid pollen dominate the faunal assemblages, pointing to an open and dry environment, but hippopotamuses and amphibian remains still suggest the presence of water (Cansado et al., 1986). Carbon isotope studies on Tighemir terrestrial fossil animals showed a nearly exclusive diet of C3 plants suggesting an open C3 grassland ecosystem (Bohernbacher et al., 1998). At Thomas Quarry, the environment consisted of a near water-shed depression in which an intermittent braided channel drained, with probable ponds and sparse vegetation (Koos et al., 2003). The abundance of allochthonous, galea and galeid dominants suggest an open savannah but inside, poecispine and slynea reflect a rugged landscape (Cansado, 1986).

In the Sahara, Paleolithic occupations are associated with alternating humid-arid climatic periods. The humid periods correspond to lacustrine and fluvial deposits whereas the arid episodes are related to elaius deposits and the disarticulation of wads. In the north-western Sahara, Oulouane occupations dated to the early Pliocene are found within lacustrine sediments and associated with pollen of Mediterranean flora (Kheir). Similarly, it is thought that Oulouane hominids occupied the area during a humid period (Ahmar, 1981). Similarly, the Acheulean occupation took place primarily during a humid period with a great deal of rainfall. Fluvial deposits found in conglomeratic deposits within Acheulean occurrences indicate the presence of Mediterranean species along with topisra (leuchneri) in Ahmar, 1981. Lastly, according to Thomas (1977), the intraggreny of Tighemir fauna was due to fluctuations between humid and arid climate. For example, while Creathreusun strium, Daemonogale cf. stenole, Alephalus bouskoulus, Connochaetes cf. progonus and Caras aff. avus correspond to wooded savannah, Gadenia and Gephyrotherium indicate a desert environment. The vegetation cover was characterized by a mixture of Mediterranean and semi-desertic species.
Perspectives in the framework of the World Heritage Convention

As is clearly shown throughout this chapter, the Maghreb has a wealth of Lower Paleolithic sites; sites that are significant not only for the fields of paleoanthropology and prehistory but also for the world archaeological heritage. Of these sites, the Ain Hanech/Bouchert sequence and Tighert (formerly Tifernalt) in Algeria, and the Casablanca sites in Morocco, are particularly relevant for documenting the history of humanity in North Africa. For example, the site of Ain Hanech preserves the oldest archaeological occurrences in North Africa (1.8 Ma) that contrast of Oldowan stone artefact assemblages associated with a “Plio-Pleistocene fauna of biochronological and palaeoecological interest. Many of the fossil bones bear evidence of hominid-inflicted/interacting marks reflecting patterns of subsistence acquisition by early humans and their interaction with the animal biomass. Further, Ain Hanech records an environmental and climatic change, which seemingly impacted on hominid foraging activities. The site of Tifernalt is important for yielding the oldest human remains in North Africa pertaining to Homo ergaster/venus dated to 0.8 Ma. The hominid remains are associated with a technologically rich Acheulean industry and a savannah-like fauna with direct implications on the palaeoecology of the region, as well as on hominid adaptation and behavioural patterns. The Casablanca sites are equally pertinent and consist of a long Acheulean sequence displaying nearly a million years of lithic technological evolution and changing patterns of hominid ways of life. In addition, the Casablanca sites have yielded a series of hominids of different ages and morphologies, including, along with postcranial remains showing early human physical traits changing over time. In sum, the other sites in eastern and southern Africa; the Lower Paleolithic of the Maghreb has direct implications on our understanding of the larger picture of early human evolution in Africa and the early migration of hominids to diverse regions and habitats on the continent. Furthermore, the Maghreb sites have direct implications for questions regarding major Plio-Pleistocene palaeoenvironmental and palaeoclimatic changes in the Northern part of Africa and represent a great potential for providing clues for a plausible route of early human colonisation of Europe possibly through the strait of Gibraltar.

However, these sites relevant to World Heritage need special international attention because of the threat of destruction through the urbanization development they are facing. Although internationally known, the sites remain relatively unprotected. For example, the Casablanca Acheulean sites, where only core a site is legally protected, are subject to everyday irreversible damages, such as quarry exploitation and urbanization extensions (Dhia-Meski and Raynal, 2002, p. 3). The site of Tifernalt, though legally protected, could be impacted because a large urban extension, with constructions totally surrounding it, might lead to a total obliteration in the future unless adequate action is taken. As for the site complex of Ain Hanech, although it is located in the countryside, urbanisation also threatens its integrity. For example, at the time of writing it was occupied by people of the nearby village that a private builder was digging foundations to construct a house on the Ain Bouchert Oldowan site, which is dated to 2.0 Ma. A legal protection request has been filed with the Algerian Ministry of Culture to protect the entire Ain Hanech complex site, and the process of officially protecting is under way.

Considering that the three sites are subject to an increasing threat of destruction by development, and that they have potential for World Heritage candidacy, it is strongly recommended that these sites be submitted to the Tentative List for the future recognition, conservation and research of sites relating to the process of human evolution in Africa within the framework of the Action Plan of the World Heritage Thematic Programs, Human Evolution: Adaptations, Dispersals and Social Developments (HEDAS). The sites are suitable candidates for inclusion on such a list, given that they fulfill the criteria being set by the international experts for the selection of African human origin sites, including the presence of hominins (Tighert and some Casablanca sites), artefacts and fauna, appropriate dating, availability of palaeoenvironmental data, and publication in international peer-reviewed journals. The recognition and inclusion in the World Heritage List of African human origin sites will better ensure their long-term conservation and the management of their specific vulnerability, as well as their promotion for multidisciplinary international research and diffusion of knowledge.

Conclusions

This chapter summarises the current evidence on the Lower Paleolithic record in the Maghreb (Figure 12). The Maghreb deposits major Lower Paleolithic sites in a varied and periphery context, and a large number of these sites have yielded pertinent information on the time, nature and palaeoecology of ancestral hominid sedentism in this region of Africa. The Ain Hanech archaeological evidence shows that the human presence in this region dating back to 1.73 Ma, and the earliest artefact tradition was the Oldowan (Sahnouni, 2006a; Sahnouni and Hamdani, 1996; Sahnouni et al., 2002, 2004). An Oldowan East African Oldowan (e.g. Leakey, 1971, Sahnouni et al., 1997, Sahnouni, 2002) is found in the site of the Tighert. While this model may be appropriate for the East African, it cannot be extrapolated to the entire Maghreb. In contrast, the long chronology model for an early human occupation in the Maghreb fits relatively well in the generally accepted scenarios regarding hominid expansion into the Northern Hemisphere. The current evidence indicates that early hominids colonized the European landscapes shortly before 2 Ma. Indeed, the oldest presence of hominids out of Africa is documented in the Caucas at the site of Dmanisi in Georgia. Dmanisi is dated to 1.8 Ma, and has yielded several humen finds associated with an early Pliocene fauna and Oldowan-like artefacts (Gabunia and白斑, 1995; Gabunia et al., 2001, 2002; de Lumley et al., 2005). Model artefacts from China are dated to 1.6 Ma at Mpekegou (Kifowei bai) (Shu et al., 2004), and possibly older than Longgou estimated to 1.8 Ma (Budd et al., 2011). There is now evidence that hominids and Oldowan-like artefacts dated to more than 1 Ma has been found in southern Europe, including Alqueva in Spain, with hominids dated to 1.2 Ma (Cattaruzza et al., 2003); Berrana Leon and Flueto Navea 3 (Guadarrama basin, southern Spain) dated to 1.3 Ma and 1.2 Ma respectively (Díaz, 2008, Díaz et al., 2005; Vian-Adjeoyi et al., 2005); and Positano (southern Italy) dated to 1.1 Ma (Acocella et al., 2009).

The Oldowan tradition is followed by a fairly complete Acheulean record. Spanning roughly 1.0 Ma to 0.1 Ma, the Acheulean in the Maghreb embodies the assembly of two stages, early Acheulean and late Acheulean. The evidence for the Middle Acheulean in the Maghreb is scant. In both stages, the Acheulean exhibits technological innovations and a continuous development of the morphology of the artefacts. An excellent Exaltation is the manufacture of Kontumbia Flake, which is characterised by dual ventral faces offering the hominids the advantage of shaping sharp crevices. In the late Acheulean the technological process is even more perceptible, such as the use of soft hammerstones for more precision on trimming and shaping flakes with a well-defined geometry, and predetermining Balking techniques for manufacturing standardized artefacts. A good example of the latter is the Taladaban-Schirgat technique that ensures pre-shaping the flake prior to retouching it from the core. These technological novelties, probably coincided with the emergence of the North African modern humans around 300 Ka.

Palaecologically, the Maghrebian Lower Palaeolithic hominids lived in both savanna and lacustrine environments. The fauna indicate open and savannah habitats as inferred from the presence of equids and gazelles, yet hippopotamuses emulates the presence of a permanent body of water. Stable carbon isotope studies provide more precise palaeoclimatic and climatic conditions. For example, at El Hikrema Oldowan site a climatic temporal change is recorded showing gradual expansion and increased aridity over time. It is likely that this environment had impacted on early hominid foraging activities, limiting its occupation and movement.
their acquisition of food resources and water supplies. In spite of the changing ecology, meat probably constituted a major part of early human diet, as indicated by the presence of cutting meat bones on stone tools and hominid-inflicted butcher marks on fossil animal bones. No Oldowan hominids have been discovered so far, but those responsible for the Acheulean activities may form two groups. A. angustidens (a late A. erectus) and late A. erectus from which the modern humans of the Maghreb might have emerged.

To summarize, the Lower Palaeolithic evidence from the Maghreb shows that part of the African continent has the potential for contributing significantly to a better understanding of early human adaptation to the Mediterranean ecology, and for providing possible clues on the time and route of their subsequent dispersal into Europe. For this reason, sites yielding pertinent knowledge of the history of humanity—particularly A. huncoti, the Calandaoina sequence and Tighennif—need to be further considered for their potential inclusion in the World Heritage List of human origin sites in Africa for future conservation.

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Bibliography


Northern Africa

6
Desert environment: background and consequences for conservation of early archaeological sites in North Africa

Rudolph Kuper

The Egyptian-Libyan desert is suitable to man’s activities in arid, very different sense. Having been subjected to wind erosion for a great period of time, evidence of its past successive human occupations are all concentrated together on the present surface. Hence if appreciable progress is to be made in the interpretation of the human past in this desert it seems probable that the practical methods involving comparative statistics concerning the surface density and distribution of the various types of artifacts will be necessary. But, alas, human nature is such that the temptation to pick up and remove ancient artifacts seems on the ground is almost irresistible. Even now the original statistical pattern of artifact distribution must in some places have already split (Begleit 1960).

Introduction

The above quote from Ralph Bagnold, one of the best-known early explorers of the Libyan desert, clearly presents the dilemma that we face when trying to implement arrangements to protect the cultural and environmental heritage in desert areas. In this chapter, we do not deal with desert parks in general but try to focus – mainly from the viewpoint of an archaeologist, for whom the desert is an open book of history, on some problems of the management of protected areas arising mainly from their remoteness and the impracticability of organizing any kind of control. Most of the pertinent problems, however, are not specific to protected areas but concern the conservation of desert heritage in general. Protected areas do, however, provide a chance to focus on certain threats and to develop means and methods that can then be implemented on a larger scale for the general protection of the environment and archaeology.

UNESCO has repeatedly stressed the need for a more balanced and crédible list of cultural and natural World Heritage sites and mentioned the less-represented sites, especially the desert landscape of the Sahara and the culture that have developed within it. This part of the world, which for so long has been regarded as an empty without history, has played a crucial role in the particularly important phase between 10,000 BC and 5000 BC, when favourable climatic conditions allowed the development of the first African pastoralist societies. At the end of this harsh phase, around 5000 BC, the progressive aridity of the Sahara and the consequent movements of people towards the Nile valley and the sub-Saharan areas set in motion the processes which led to the development of the Egyptian civilization and the great African migrations. It is in this special historical role that puts this region at the centre of African history and justifies measures for the protection of its heritage.

The cradle of African pastoralism

Looking at the stunning assemblage of hundreds of cattle skulls around the second-millennial BC tombs at the city of Kerma in Nubia (Chau, 2001; Bonnet, 2006) or the early Neolithic burials from Seppara in Egypt (Benedetti, 1954), and recognizing the pride and intricate relations between humans and cattle expressed by courtesy much older records from all over the Sahara (Figure 1), it becomes evident that cattle pastoralism with its related biological background must have played an important role in and northwest Africa for thousands of years. Pastoralism based on cattle, often combined with sheep and goats, is still the prevailing subsistence strategy in the arid and semi-arid zones of Africa which today make up more than one-third of the continent. The origins and developments of this cultural phenomenon are far beyond the chronological reach of cultural anthropology, and it is one of archaeology’s strengths to be able to record cultural behavior over long periods of time and to differentiate between changes of various time depths. On the other hand, prehistoric evidence is scarce due to the frequency poorly-developed...