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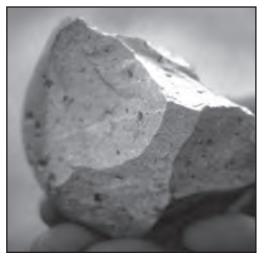
NUMBER 1

THE OLDOWAN:

Case Studies Into the Earliest Stone Age

Edited by Nicholas Toth and Kathy Schick



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COVER PHOTOS

Front, clockwise from upper left:

1) *Excavation at Ain Hanech, Algeria (courtesy of Mohamed Sahnouni).*
2) *Kanzi, a bonobo ('pygmy chimpanzee') flakes a chopper-core by hard-hammer percussion (courtesy Great Ape Trust).*
3) *Experimental Oldowan flaking (Kathy Schick and Nicholas Toth).*
4) *Scanning electron micrograph of prehistoric cut-marks from a stone tool on a mammal limb shaft fragment (Kathy Schick and Nicholas Toth).*
5) *Kinesiological data from Oldowan flaking (courtesy of Jesus Dapena).*
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7) *Experimental processing of elephant carcass with Oldowan flakes (the animal died of natural causes). (Kathy Schick and Nicholas Toth).*
8) *Reconstructed cranium of Australopithecus garhi. (A. garhi, BOU-VP-12/130, Bouri, cranial parts, cranium reconstruction; original housed in National Museum of Ethiopia, Addis Ababa. ©1999 David L. Brill).*
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Photographs of the Stone Age Institute. Aerial photograph courtesy of Bill Oliver.

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CHAPTER 3

THE NORTH AFRICAN EARLY STONE AGE AND THE SITES AT AIN HANECH, ALGERIA

BY MOHAMED SAHNOUNI

ABSTRACT

Palaeolithic archaeologists usually view the North African Early Stone Age of little archaeological value other than providing scanty information on a scarce human presence in this region. While this may be true for many reported sites due to various problems surrounding them, Ain Hanech in northeastern Algeria is a key locality for documenting North African hominin behavior and adaptation. The sites at Ain Hanech are estimated to date to 1.78 Ma based upon biostratigraphic and paleomagnetic evidence. The recent excavations uncovered a savanna-like faunal assemblage associated with Oldowan artifacts contained in a silty matrix. Taphonomic evidence suggests that the sites were minimally disturbed, and therefore preserving hominin behavioral information. The lithic artifacts, excavated from three distinct deposits at the original site of Ain Hanech and the newly discovered site of El-Kherba nearby, are fresh and represent coherent assemblages, including small debitage. The assemblages may be considered as a North African variant of the Oldowan Industrial Complex. Meat was likely a significant part of North African hominin diet.

INTRODUCTION

North Africa is likely the area which hominins inhabited before their spread out of the African continent. A number of early archaeological sites reported during the 1950's and 1960's are considered to be evidence of early human presence in this region. Located primarily in Morocco and Algeria, the most famous of these are the Casablanca sequence and the locality of Ain Hanech on the Algerian High Plateau. Until relatively recently, however, modern investigations had not been carried out at these archaeological localities, and there has been a lack of precise information regarding their stratigraphy and chronological framework, depositional context, and paleoenvironmental reconstruction. In addition, aspects of hominin behavior and ecology accessible by modern methods had not been addressed, including selection, production, use and transport of stone artifacts; food acquisition and processing; and land-use patterns.

To update our knowledge on the Northwest African Early Palaeolithic and document hominin dispersal and adaptation into this region, new investigations were carried out in two major Lower Palaeolithic areas during the last decade. The first area is the Casablanca sequence in Atlantic Morocco where a French team (Raynal & Texier, 1989; Raynal *et al.*, 1990; Raynal *et al.*, 1995; Raynal *et al.*, 2001) revised the work done by P. Biberson in the 1950's and 1960's. The second is the Ain Hanech area in northeastern Algeria where the author has initiated new research since 1992 (Sahnouni, 1998; Sahnouni & de Heinzelin, 1998; Sahnouni *et al.*, 1996). The research undertaken at Ain Hanech consisted primarily of systematic survey of the area, excavation of areas adjacent to the classical site and at newly discovered localities nearby, study of the stratigraphy and chronology, exploration of site formation processes, and analysis of the lithic artifact assemblages.

Many archaeologists consider that Early Palaeolithic assemblages throughout North Africa are of little archaeological value other than documenting a profusion of sites in the region and providing basic information on the spread of hominins into this region.

However, as it will be seen, the new investigations at Ain Hanech reveal that it is feasible to address early hominin behavior and adaptation in North Africa. Presently, Ain Hanech allows us to tackle various aspects of hominin behavior such as the manufacture, use, and discard of artifacts; acquisition and processing of animal subsistence; and vertical and horizontal distribution patterns of Oldowan occurrences. This chapter presents a synthesis on the current status of the Early Stone Age in North Africa, emphasizing the recent studies of Ain Hanech sites. Tentative conclusions are drawn on hominin occupation and adaptation in North Africa, hoping that the new interpretation of Ain Hanech sheds light on the time and nature of their dispersal into this region.

Status of the Earliest North African Archaeological Sites

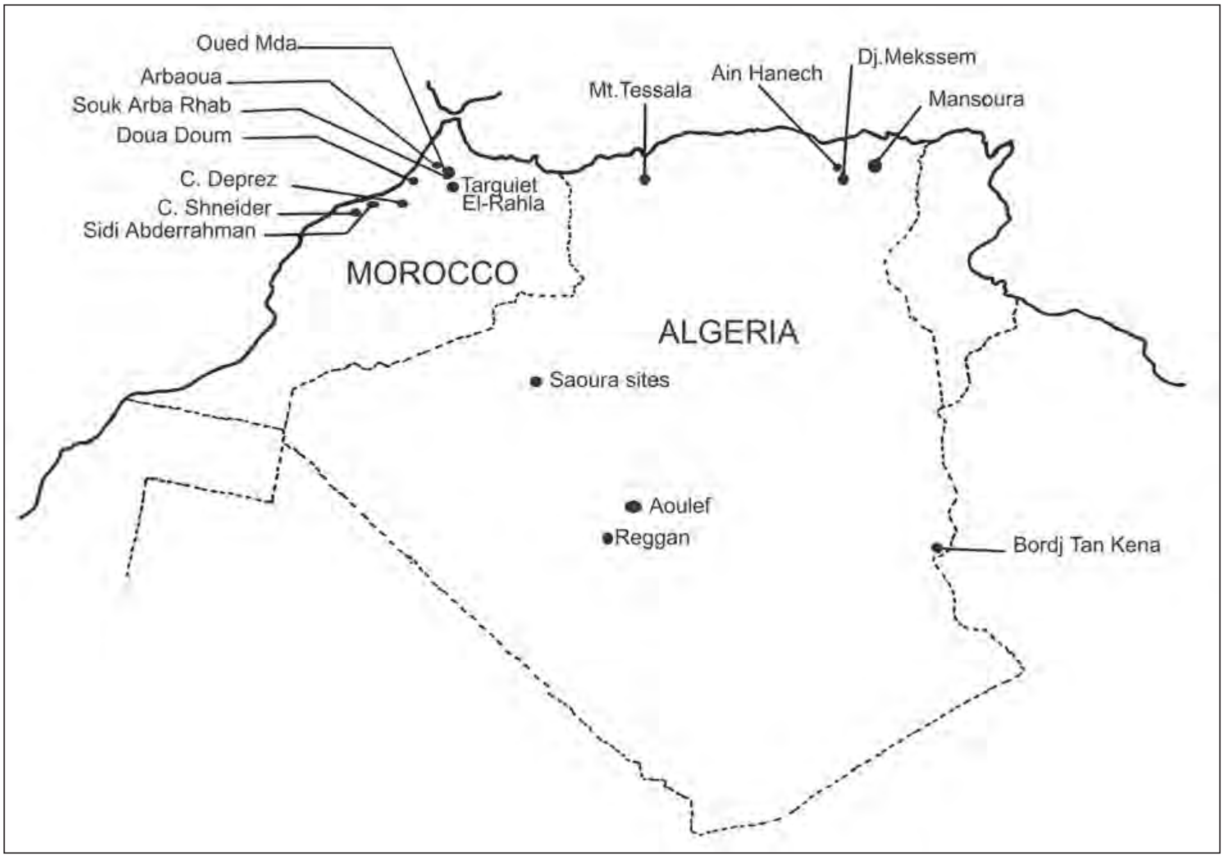
Figure 1 shows the reported earliest Northwest African archaeological sites, assigned to the Pre-Acheulean civilization formerly designated “the Pebble Culture”. These are mostly located in Morocco and in Algeria. A single find of bifacially flaked core/choppers encountered within a sandy-clay deposit has been reported in Tunisia (Gragueb & Oueslati, 1990). In Morocco, a series of sites located on the Atlantic coast in the vicinity of the town of Casablanca has been investigated by Biberson (1961). These sites are: Arbaoua, Oued Mda, Douar Doum, Terguiet el-Rahla, Carriere Deprez, Carriere Shneider (lower and upper), Chellah, Souk Arba-Rhab, and Sidi Abderrahman (niveau G). A number of these do not constitute well-defined archaeological sites but are localities from which mainly pebble tools were picked up from the surface. In Algeria, the archaeological sites assigned to the Pre-Acheulean industrial tradition are the following: Ain Hanech (Arambourg, 1949; 1970; Sahnouni, 1987; 1998), Mansourah (Laplace-Jauretche, 1956), Djebel Meksem (Roubet, 1967), and Monts Tessala (Thomas, 1973) (these sites are located in the north), Aoulef (Hugot, 1955), Reggan (Ramendo, 1963), Saoura (Alimen & Chavaillon, 1960), and Bordj Tan Kena (Heddouche, 1980) (these sites are located in the Sahara).

A recent review of the earliest Northwest archaeological sites (Sahnouni, 1998) indicates that the current available information on most of these sites, upon which the human antiquity in the Maghreb is based, is not suitable for current standards for Lower Palaeolithic studies. They provide outdated data and unreliable information due to problems related to the circumstances of their discovery, their stratigraphic and sedimentological contexts, the physical condition of the stone artifacts, and their dating and faunal associations. The status of knowledge on these sites is briefly outlined:

1. Most of all the Maghrebian Pre-Acheulean sites have been discovered without systematic archaeological survey. They have been located either casually or coincidentally in the course of urban development. Only a few of them have been encountered following geological or paleontological expeditions, and these have been investigated without a real archaeological perspective or appreciation. As a consequence, most of the archaeological materials were casually collected, with only the “pebble tools” being systematically selected and examined. Furthermore, these selected artifacts constituted the basis for a proliferation of typological and classificatory analyses. For each site there is almost always an invention of a specific type list and classification system, in which new “pebble-tool” types were created and added (Alimen & Chavaillon, 1962; Biberson, 1967; Heddouche, 1981, Hugot, 1955; Ramendo, 1963).
2. Very few Pebble Culture assemblages are reported to have been found in stratigraphic context or with depositional information. Such pebble tool assemblages have been considered as evidence of a very old human presence in Morocco (Biberson, 1961). Recently, workers who have been revising Biberson’s stratigraphic sequence have thrown serious doubts on the antiquity of the earlier Pebble Culture assemblages (Raynal & Texier, 1989; Raynal *et al.*, 1995).
3. With the exception of few sites, all the pebble artifacts encountered are abraded to varying degrees, making them not only inappropriate for hominin behavioral inferences, but also doubtful as proof of earlier human antiquity in the Maghreb. They were often collected from the surface or from eroded conglomerates. Such occurrences lack necessary contextual information, and some of them are merely pseudo-artifacts like those collected from Carriere Deprez cave site (currently Ahl Oughlam) (Raynal *et al.*, 1990).
4. With regard to dating, one of the crucial problems of North African palaeolithic archaeology is the lack of suitable material for dating, where there are no volcanic rocks to provide sound radiometric ages. Uranium-series dating is applicable only to the end of the Lower Palaeolithic sequence. Therefore, dating of the archaeological remains from earliest occupation sites relies on associated fauna. Unfortunately, not all the Maghrebian Pre-Acheulean sites include fossil animal bones of biostratigraphic interest.

In summary, archaeological occurrences identified throughout much of the 20th century were found without systematic survey, and were collected from either the surface or dismantled high-energy deposits. Only the “pebble tools” have been considered for description and analysis. These are usually abraded and rolled, indicating their secondary context, and of doubtful authenticity. The association of fauna is limited, and when it was available it was restricted to taxonomic study.

Figure 1



1. *North African Early Stone Age sites. The sites are mostly located in Algeria and Morocco, the most famous of which are Ain Hanech and the Casablanca sequence.*

Lastly, radiometric dating is impossible due to the lack of suitable materials such as volcanic rocks. There has clearly been a tremendous need for renewed investigations of the North African Palaeolithic record that incorporates systematic survey and excavation of in situ occurrences, firmer chronological control, analysis of complete artifact and faunal assemblages for possible behavioral information, and better understanding of the geological and environmental context. Such investigations will be profiled here looking at recent investigations in Morocco and especially a new round of investigations in Algeria at the site of Ain Hanech.

The Early Stone Age in Atlantic Morocco

Perhaps the most important Lower Palaeolithic cultural sequence in North Africa remains the one established by Biberson (1961). Large quarries on the Moroccan Atlantic coast, opened up for modern building materials, have exposed a series of marine deposits interbedded with terrestrial sediments, allowing Biberson to construct a cultural-historical sequence showing the evolution of the Lower Palaeolithic industries through time. He divided the “Pebble-Culture” into 4 successive stages. Stage I includes the oldest artifacts obtained using simple technological gestures (unidirectional). The site of Targuiet-el-Rahla illustrates this stage. His stage II incorporates “pebble tools” characterized by bidirectional flaking. The site of Carriere Deprez in Casablanca represents this stage. In stage III the multidirectional technique appeared where the artifacts are considered to be more evolved. This stage is represented by the site of Souk-el-Arba du Rhab. The last stage (IV) is represented by level G of the Sidi Abderrahman sequence, and is characterized by the emergence of the first Acheulean artifacts. Chronologically, Biberson correlated stages I and II with the marine climatic cycle Mesaoudien dated to Late Pliocene, and stages III and IV with the cycle Maarifien dated to Early Pleistocene. Biberson (1976) revised this cultural historical nomenclature by replacing the term “Pebble Culture” with Pre-Acheulean and condensing the four stages into two major phases. Based on the new classification, the “Pebble Culture” stages I and II constitute the Ancient Pre-Acheulean while the stages III and IV form its evolved phase: Evolved Pre-Acheulean.

However, recent systematic investigations of the Plio-Pleistocene and Pleistocene littoral deposits in the

Casablanca area have substantially modified Biberson's earlier interpretations on the earliest human antiquity in Morocco and the evolution of the Palaeolithic industries (Raynal & Texier, 1989; Raynal *et al.*, 1995; Raynal *et al.*, 2001). The revised investigations emphasize the total absence of evidence of a very early human presence in Atlantic Morocco, demonstrating that assemblages of Pebble Culture Stage I are either surface finds or reworked materials. Artifacts assigned to Pebble Culture stage II were extracted from high-energy deposits. Materials of Pebble Culture Stage III are from polycyclic colluviums. Stage IV of the Pebble Culture is reconsidered as Acheulean by these authors instead of a "Pebble Culture" tradition. In addition, new investigations at the site of Ahl Al Oughlam (formerly Carriere Deprez) in Casablanca (Morocco), indicate that Pebble Culture assemblages there, which had been assigned to the Stage II by Biberson, appear to be pseudo-artifacts generated by high-energy deposits (Raynal *et al.*, 1990).

Therefore, the new evidence suggests that the earliest human presence in Atlantic Morocco is later than Biberson assumed. The oldest occupation dates to late Lower Pleistocene, and appears to be Acheulean as illustrated by the level L of Thomas-1 quarry cave site. This site yielded an early Acheulean assemblage made of quartzite and flint, comprising bifacial choppers, polyhedrons, cleavers, bifaces, trihedrons, and flakes. The associated fauna, probably slightly older than that of Tighenif (ex Ternifine) in Algeria, includes hippo, zebra, gazelles, suid, and micromammals species. Based on fauna and paleomagnetic data, an age of 1Ma is suggested for the level L (Raynal *et al.*, 2001).

The Early Sone Age at Ain Hanech, Algeria

Historical Sketch

The Ain Hanech site is situated in northeastern Algeria on the High Plateau between the Tellian Atlas and the Saharan Atlas Mountains (Figure 1). The site was discovered by C. Arambourg (1947) in the course of his paleontological survey of the region around the city of Setif. First, Arambourg rediscovered the Pliocene site of Ain Boucherit, which had previously yielded some fossil remains to Pomel (1893-1897). He excavated this locality and retrieved a mammalian fauna comprising mastodon, elephant, suid, equids, and bovids. Then he discovered and excavated the nearby site of Ain Hanech, uncovering a Lower Pleistocene mammal fauna associated with Mode I technology artifacts. The fauna included elephant, hippo, rhino, bovids, and horse. The artifacts incorporated primarily polyhedrons, subspheroids, and few spheroids similar to those known at Olduvai Gorge (Upper Bed I/Lower Bed II) (Leakey, 1971). Although the core tools assemblage comprise very few spheroids, they have been termed as an industry of "spheroids à facettes" (Arambourg & Balout, 1952; Balout, 1955). The analysis of the industry reconstructed a sequence reduction showing the technological manufacture of core-forms (Sahnouni, 1987), and suggested the Oldowan character of the industry (Sahnouni, 1993).

On the occasion of the II Pan African Congress of Prehistory held in Algiers in 1952, a field trip to northeastern Algeria included a visit to Ain Hanech. Some participants picked up Acheulean bifaces from the surface in the vicinity of the excavation cleaned for the event (Arambourg & Balout, 1952). This led to the erroneous idea that Ain Hanech was an Acheulean site. However, subsequent research demonstrated the entire absence of Acheulean artifacts within the Oldowan occurrences (Arambourg, 1953). In fact, as it will be shown later in this chapter, these artifacts represent another human occupation occurring higher up in the stratigraphic sequence.

New Investigations

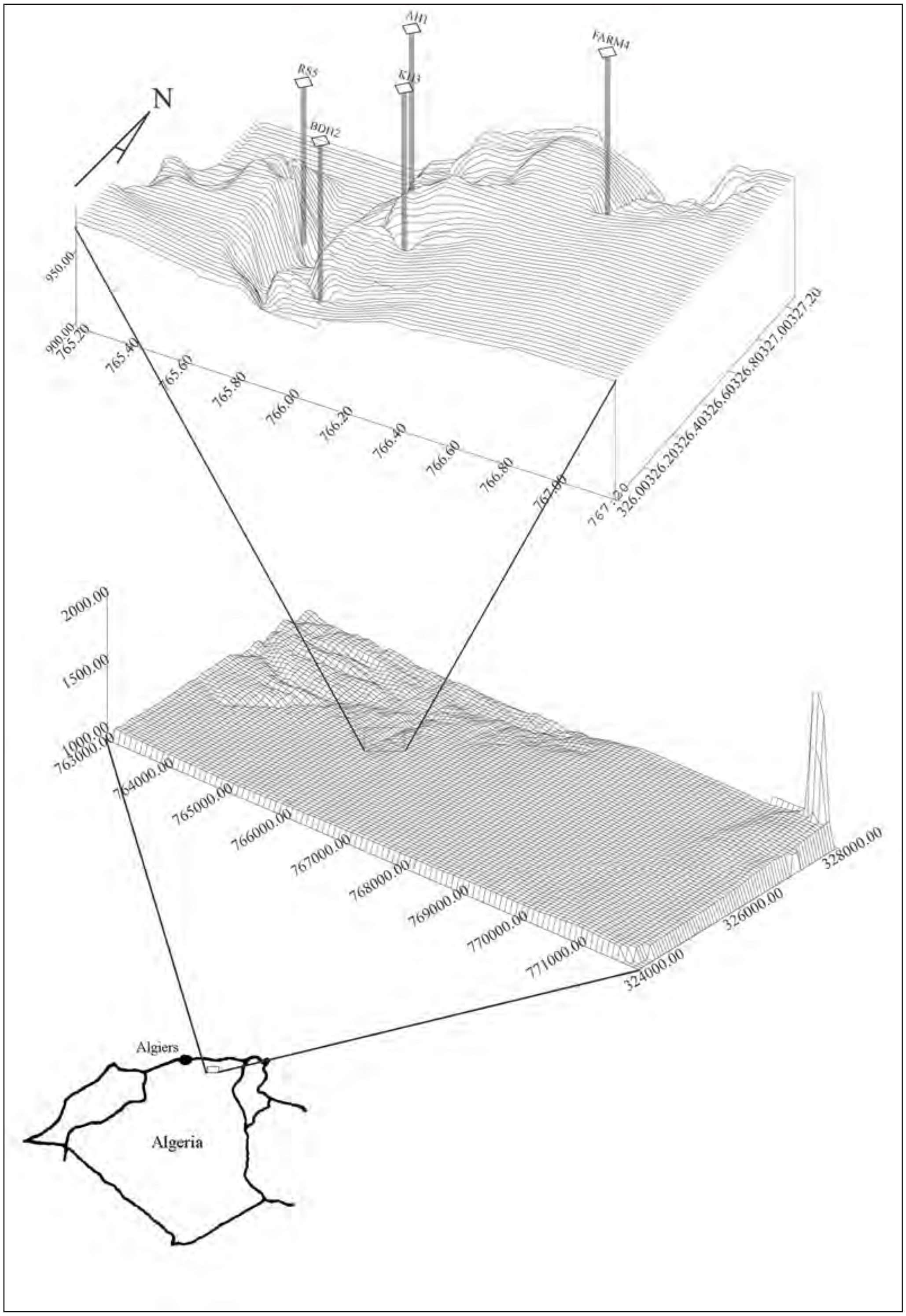
The paleontological investigations carried out by Arambourg had definitely established the occurrences of Plio-Pleistocene fauna in northeastern Algeria. Moreover, an Oldowan industry was discovered for the first time in North Africa. However, Arambourg excavated Ain Hanech without the methodological rigor used these days in palaeolithic archaeology. Thus, several questions remained unresolved, including: 1) accurate stratigraphical information concerning the site and its surroundings, 2) the age of the sediments and associated materials, 3) the nature of the association between the fauna and artifacts, and 4) the behavioral implications of the archaeological occurrences.

To address these pertinent issues, new investigations were initiated at Ain Hanech in 1992-93 and 1998-1999 (Sahnouni *et al.*, 1996; Sahnouni & de Heinzelin, 1998; Sahnouni *et al.*, in press). These consisted of surveying the area, excavating areas adjacent to the original site and newly discovered localities nearby, studying the stratigraphy and chronology, investigating site formation history, and analyzing the lithic artifacts. These renewed investigations are still in progress. A synthesis of the major results thus far is presented in this chapter.

The Sites at Ain Hanech

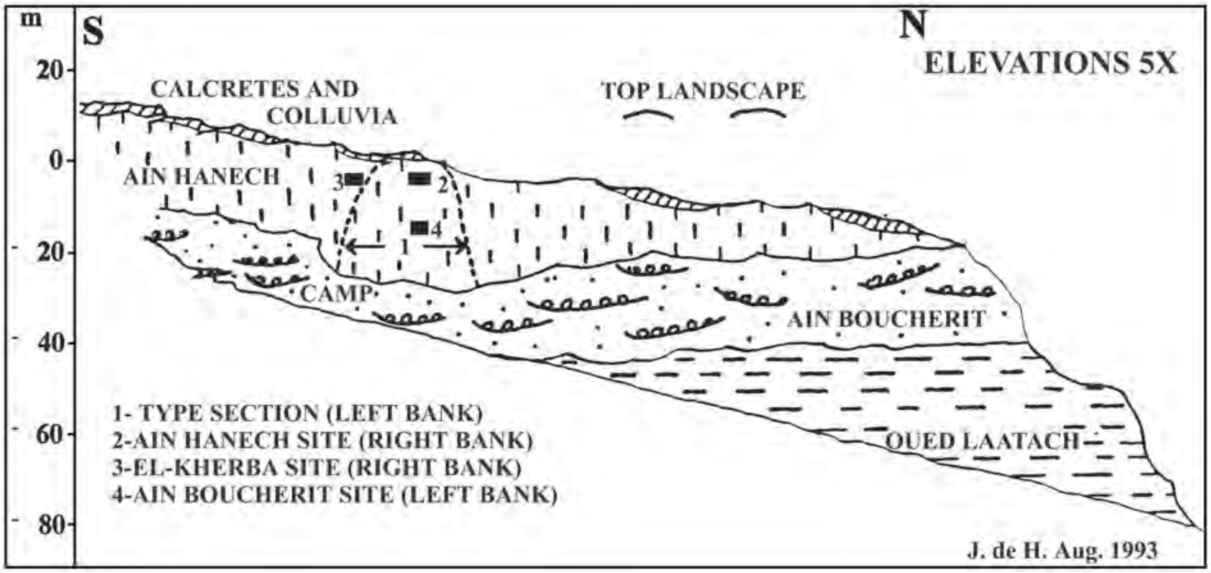
The new explorations show that Ain Hanech is not a single site but rather it is an area with a complex of Plio-Pleistocene sites expanding over an area of approximately one km² (Figure 2). The sites include Ain Boucherit, Ain Hanech, El-Kherba, and El-Beidha. Ain Boucherit is a paleontological locality situated approximately 200m to the southeast of Ain Hanech on the west side of the Ain Boucherit stream. It had yielded a Late Pliocene fauna including the following taxa: *Anancus osiris, Mammuthus africanavus, Hipparion libycum, Equus numidicus, Kolpochoerus phacocheroides,*

Figure 2



2. *Digital Elevation Model (DEM) map of the Ain Hanech research area (after El-Eulma map # 94, 1/50.000, scale: UTM). Middle: General view of the area surrounding Ain Hanech. The Ain Hanech area is depicted in the rectangle. Top: Detailed view of Ain Hanech site, including Ain Hanech Farm (FARM4), Ain Hanech classical site (AH1), the newly discovered localities of El-Kherba (KH3) and El-Beidha (BDH2). RS5 refers to the reference stratigraphic section where the Ain Boucherit fossil-bearing stratum is located towards the bottom, and the Acheulean finds are contained in the calcrete deposit sealing the stratigraphic sequence.*

Figure 3



3. *Synthetic view of the regional stratigraphy. Note that Ain Hanech (2) and El-Kherba (3) sites are altimetrically equal levels. Ain Boucherit (4) is located 13m below Ain Hanech (by J. de Heinzelin).*

Sivatherium maurusium, *Hippopotamus*, *Bos palaethiopicus*, *Parantidorcas latifrons*, *Damaliscus cuiculi*, *Orenagor tournoueri*, and *Canis anthus primaevus* (Arambourg, 1970; 1979). The site of Ain Hanech is located near a small local cemetery on the private property of the Thabet family in a sedimentary outcrop cut by the deep ravine of the seasonal Ain Boucherit stream. The newly discovered archaeological localities of El-Kherba and El-Beidha are situated in the immediate vicinity south of the classical site and at distance from it of about 300m and 800m, respectively. While archaeological investigations are well underway at Ain Hanech and El-Kherba, the site of El-Beidha has not been explored so far. However, elephant fossil bones associated with a few lithic artifacts were recovered at El-Beidha in the course of digging a test trench (Sahnouni, 1998).

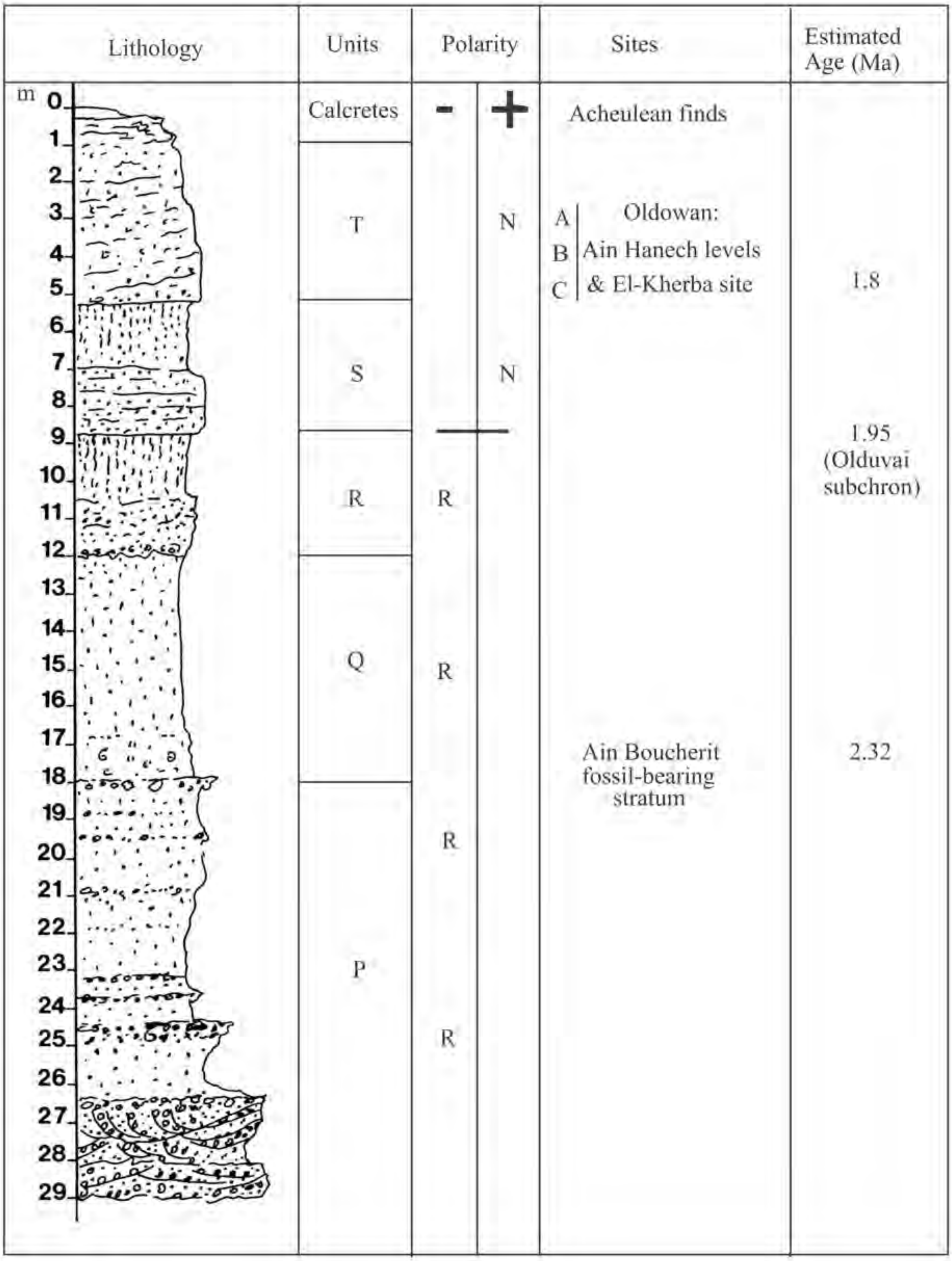
Stratigraphic and Chronological Background

Basin deposits occur in pockets throughout the Eastern Algerian Plateau, consisting of a very thick sequence of fluvial and lacustrine sediments sometimes reaching a depth of several hundred meters (Vila, 1980). The Ain Hanech region is formed within the Beni Fouda sedimentary basin with deposits ranging from the Miocene through the Pleistocene and Holocene. In the Ain Hanech vicinity the deposits comprise three main formations, from oldest to youngest, Oued El-Attach Formation, the Ain Boucherit Formation, and Ain Hanech Formation (Figure 3). The Ain Hanech Formation (Figure 4) is a 30 m-thick sequence of cyclothemic layers, from O to T, of primarily fluvial origin. The site is correlated with Unit T Upper (Sahnouni & de Heinzelin, 1998).

Dating

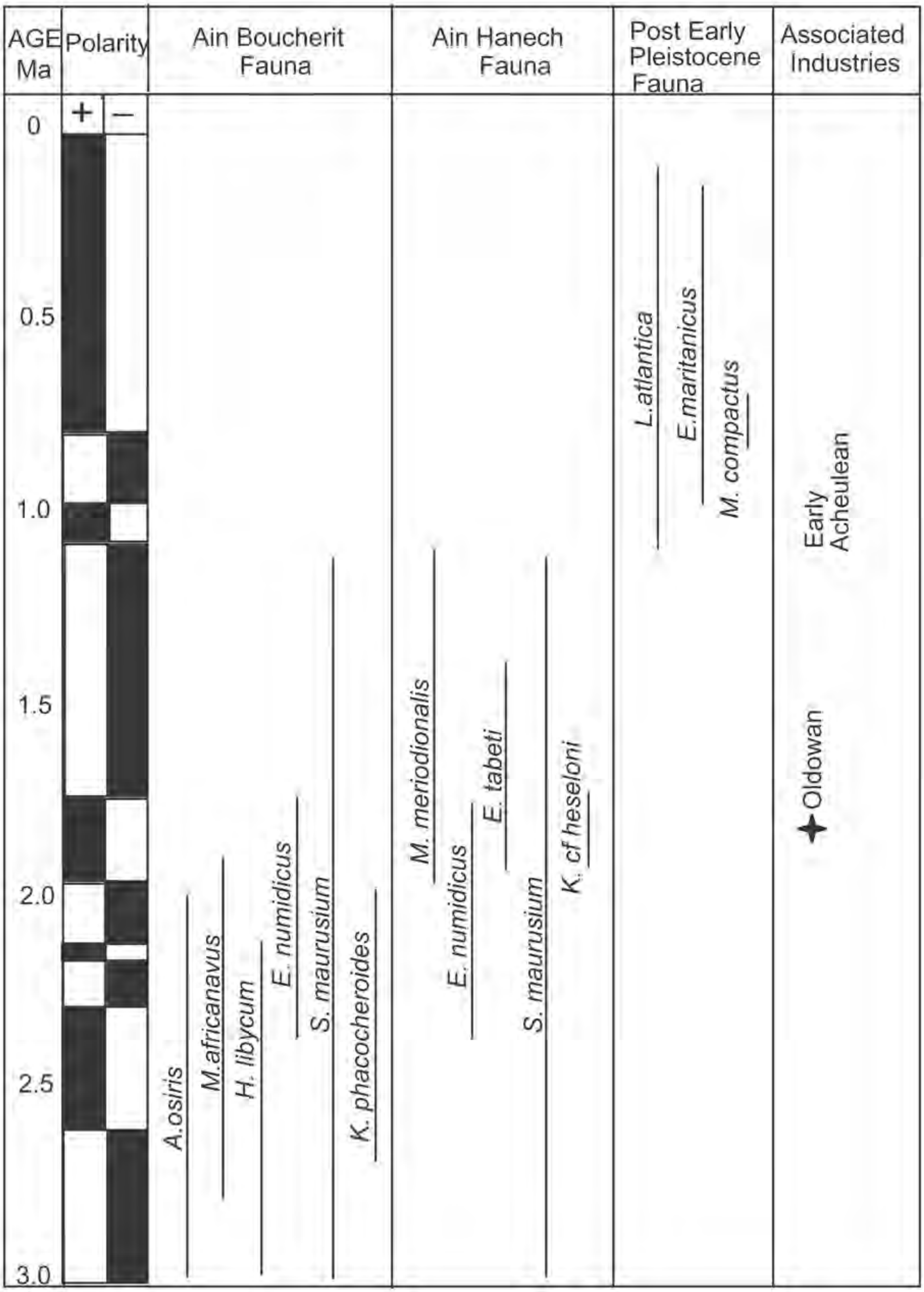
Paleomagnetic analysis of the Ain Hanech Formation indicates that Unit T and underlying Unit S have normal polarity, and that Units P, Q and R below show reversed magnetic polarity (Figure 4). Taking into account the Plio-Pleistocene affinities of the vertebrate fauna and archaeological context, the normal polarity would fit best within the Olduvai (N) subchron, occurring between 1.95 and 1.77 Ma, rather than the Jaramillo (N) subchron (Sahnouni *et al.*, 1996). Paleontologically, Ain Hanech fauna incorporates biochronologically relevant taxa that went extinct before the Jaramillo Event (Figure 5), including *Kolpochoerus*, *Equus numidicus*, *Equus tabeti*, and *Mammuthus meridionalis*. The Ain Hanech *Kolpochoerus* is within the range of *K. heseloni* from the *Notochoerus scotti* zone at Koobi Fora (Sahnouni *et al.*, in press). At Koobi Fora, *K. heseloni* is below KBS tuff dated to 1.88 Ma. *E. numidicus*, found at the Late Pliocene site of Ain Boucherit, persisted at Ain Hanech (Sahnouni *et al.* in press). *E. numidicus* is close to *Equus* from Shungura Member G (G4-13) (Eisenmann, 1985) dated to 2.32-1.88 Ma (Brown, 1994; Brown *et al.*, 1985). *E. tabeti* is recorded in other Early Pleistocene sites, including Koobi Fora (Kenya) from the *Metridiochoerus andrewsi* and *Metridiochoerus compactus* zones of the Koobi Fora Formation (Eisenmann, 1983), and at Ubeidiya in Israel (Eisenmann, 1986), which is estimated to date to 1.4 Ma

Figure 4



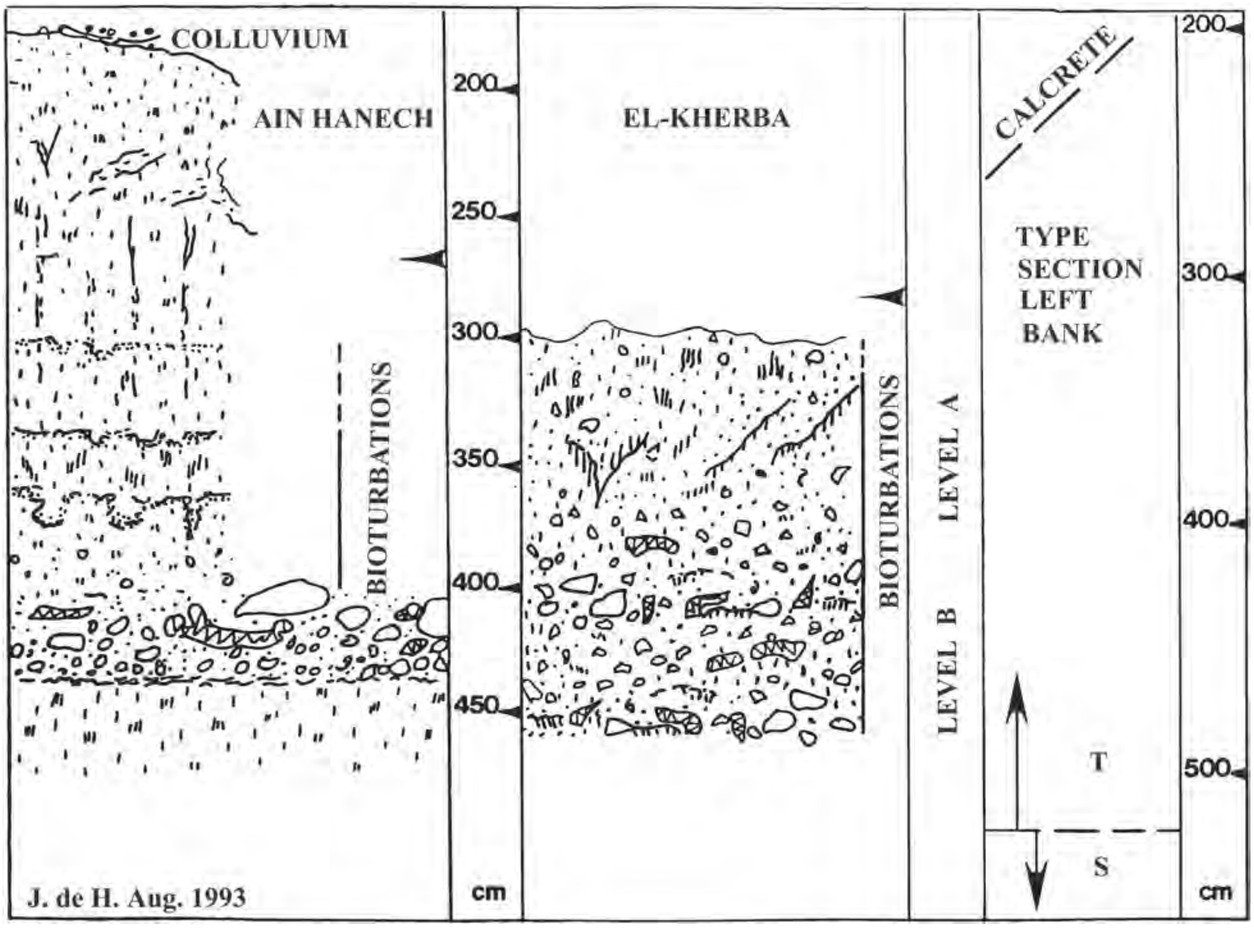
4. *Reference profiles of Ain Hanech Formation, showing its component sedimentary units, their geomagnetic polarity, and the associated sites. The Ain Boucherit fossil-bearing stratum with Plio-Pleistocene fauna is contained in the Unit Q with reverse polarity. Ain Hanech Oldowan levels and the newly discovered locality of El-Kherba are contained within the Unit T with normal polarity. The Acheulean finds derive from the calcrete deposit sealing the stratigraphic sequence.*

Figure 5



5. Chronological range of mammalian taxa of biochronological significance from Ain Boucherit, Ain Hanech, and post Early Pleistocene in Northwest Africa. Note that taxa found at Ain Hanech went extinct before the Jaramillo (N) paleomagnetic subchron, suggesting that Ain Hanech normal polarity is most likely Olduvai (N) subchron dated to 1.95-1.78 Ma.

Figure 6



6. Stratigraphical profiles of the archaeological sites, and their correlation with the Ain Hanech Formation type section.

(Bar-Yosef & Goren-Inbar, 1993). *M. meridionalis* did not persist beyond the Early Pleistocene in North Africa (Coppens *et al.*, 1978), and by 1 Ma it was replaced by *Loxodonta atlantica* in Thomas Quarry (Unit L) (Raynal *et al.*, 2001). Archaeologically, the Ain Hanech artifact assemblage is very similar to that of the East African Oldowan (Sahnouni, 1993; 1998).

Stratigraphic Position of the Acheulean Occurrences

Bifaces were previously thought to be associated with the Oldowan (Arambourg & Balout, 1952; Arambourg, 1953). Presently, based upon stratigraphic and archaeological evidence in current investigations, it is certain that Acheulean artifacts are totally independent from the Ain Hanech Oldowan industry proper. These are contained in the calcretes deposit located six meters higher up in the stratigraphic sequence (Figure 4). I collected several Acheulean bifaces from eroded calcrete areas, and most of them still bear calcrete concretions. Therefore, the Acheulean occurrences represent a later phase of hominin occupation. No Acheulean artifacts have been found in 166 m^2 of excavation of the underlying Oldowan-bearing deposits, which have yielded 1502 of fresh unabraded Oldowan artifacts.

Stratigraphic Profiles of Ain Hanech and El-Kherba Sites

Two archaeological localities have been recently excavated. The first is Ain Hanech adjacent to Arambourg's trench, and the second is the newly discovered locality of El-Kherba. Based mainly upon altimetric and stratigraphic evidence, the two stratigraphic profiles are correlated with Unit T of the Ain Hanech Formation type section on the left bank (Sahnouni & Heinzelin, 1998) (Figure 6).

Stratigraphic Profile of Ain Hanech Site

The stratigraphic profile of the Ain Hanech locality consists of a 3.5m thickness and includes the following features from bottom to top (Figure 6): 1) at the base, a 50 cm thick layer consisting of dark sandy clay with limestone cobbles of medium size dimensions (ca. 80x60x40mm) and black flint pebbles, containing vertebrate fossil animal bones and Mode I artifacts; 2) a layer of finely mottled white silt with few calcic grains;

3) heterogeneous and heterometric gravels in a mixture of sand, calcic granules, and silt lenses; fossil bones contained in the upper part; 4) mottled silt overlain by three successive sandy layers interbedded with mottled silt; traces of bioturbation diminishing from base to top; 5) the upper part, 1.20m thick consisting of mottled white and light reddish brown silts, with vertical traces of roots and vague reduced traces of tree stumps.

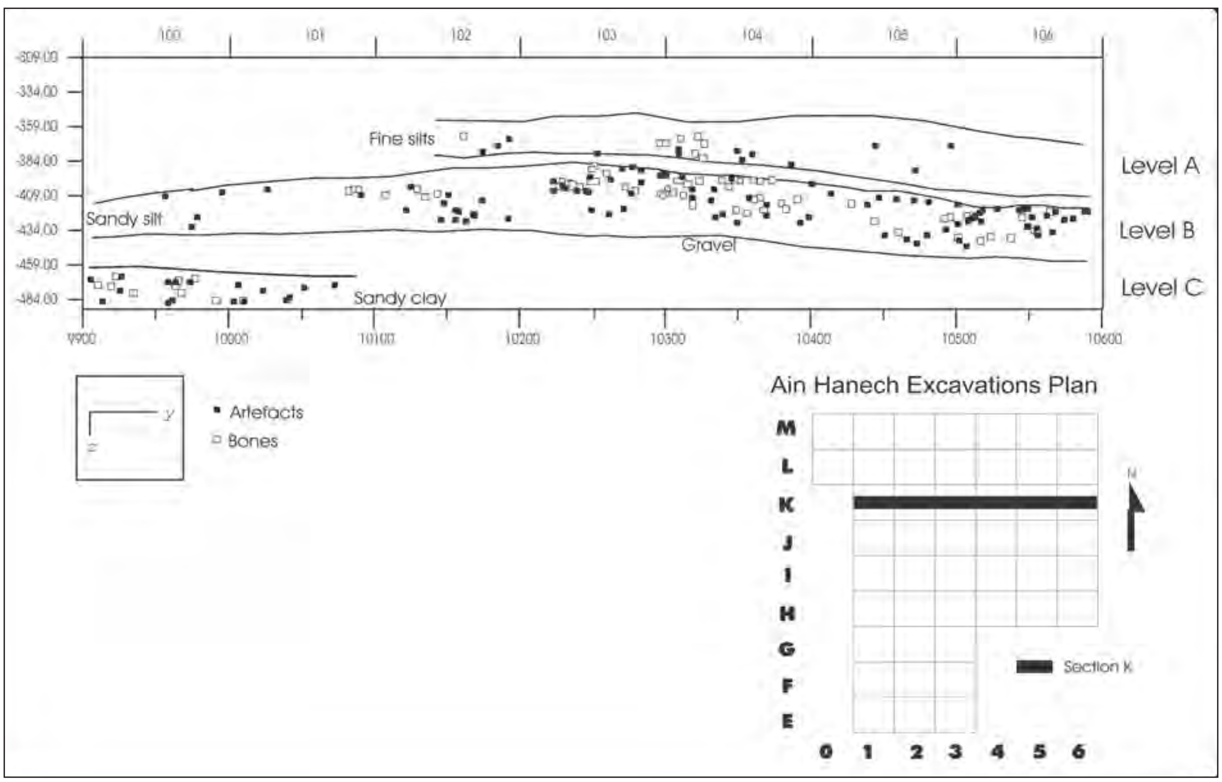
Stratigraphic Profile of El-Kherba Site

The deposits at El-Kherba are about 2 m thick (Figure 6). Artifacts and bones are in various positions and are incorporated in a mottled silty matrix. There are mottles of carbonate lumps, more or less decalcified, and traces of decayed organisms and trampling. In the upper part, larger mottled structures simulate sliding or mud flow. The color near 0.60m depth above the base of excavation trench is yellow to very pale brown, reddish yellow, and pure white. The color near 1.10m depth is light gray and a more reduced pure white.

Archaeological Levels at Ain Hanech

Stratigraphic studies and, especially, the expansion of the archaeological excavations at Ain Hanech allowed us to identify three Oldowan deposits (Sahnouni *et al.*, in press). They are from the youngest to the oldest, A, B, and C (Figure 7). Level C was recognized in the course of digging a stratigraphic test trench below the conglomerate supporting the base of level B. This layer is easily discernible, as it is separated from level B by 1m of sterile deposits. However, layers B and A are hard to delineate because they are contained in a rather homogeneous sedimentary matrix. Stratigraphically, levels A and B include, at the bottom, a gravel layer abruptly overlain by a silty stratum. These sedimentary deposits suggest an alluvial floodplain cut by a meandering river channel. By the time of deposition of level A, the river had probably created an oxbow lake. It may be inferred that the hominid activities took place during level B on the riverbank, and during level A on the floodplain proper.

Figure 7



7. *The discerned archaeological levels at Ain Hanech site, namely A, B, and C. Level C is still unexplored, as it was exposed in the course of a limited test trench. The position of the section (referred to K) relative to the grid system is shown in bold below.*

Fauna and its Paleoecological Implications

The faunal remains retrieved from the new excavations are currently under analysis, and therefore, a complete faunal list is not provided in this study. What can be said presently, however, is that in addition to previously published taxa, preliminary data point to the presence of species that were not known previously at Ain Hanech, such as *Kolpochoerus* cf *heseloni* and *Equus numidicus* (Sahnouni *et al.*, in press). There is also a new species of *Pelorovis* (Sahnouni *et al.*, 2002).

Table 1 presents the faunal species list published by Arambourg (1970; 1979). Several elements suggest the antiquity of the site, such as the elephant, equid, suid, giraffid, and bovids. They also suggest an open savanna-like environment as inferred from the presence of *Gazella pomeli*, *Numidocapra,* and probably *Connochaetes* (Geraads, 1981). Carbon isotope analysis carried out by T. Cerling (in Sahnouni, 1998) on two equid molar teeth suggests a C_3 plant dominated diet for Ain Hanech equids, and corroborates the faunal environmental inferences. C_3 plants, with δ^{13} C values ranging between -33 and 22 per mil, grow in temperate regions with winter rainfall and cool temperatures (Vogel, 1978).

The new excavated faunal assemblage also incorporates modified bones bearing hominin and carnivore signatures. For example, the upper specimen (cat. #: AH98-M102-50) is a femur diaphysis fragment of a medium-sized animal, likely of an antelope, which appears to have been broken intentionally by hominins (Figure 8, upper). The maximum dimensions are: 90mm, 23mm, and 14mm, respectively length, breadth, and thickness. The longitudinally-fractured bone bears typical human-made breakage patterns (Lyman, 1994), such as an impact point of percussion, oval scar, opposite rebound point, and concave fracture surface.

Another bone specimen (Figure 8, lower) (cat. #: AH98-L105-35) that bears tooth marks is a rib proximal end fragment of a large-sized animal, probably an adult rhinoceros. Its dimensions are: length 85mm, breadth 50mm, and thickness 31mm. The tooth marks are located on both surfaces of the bone. On the medial surface a series of four linear marks or grooves are present. On the lateral surface there are two pairs of circular-shaped punctures. The size of these punctures suggests that a canid probably made them.

Context of the Ain Hanech Sites

Many archaeologists had thought that Ain Hanech occurrences were unsuitable for behavioral inquiry because they might have been disturbed by hydraulic agencies (Clark, 1992). To shed light on the issue, the new investigations undertaken at Ain Hanech also focused on assessing the site formation processes of the occurrences. The question was tackled by inspecting the excavated archaeological material in terms of sedimentary matrix in which they were accumulated, taphonomic conditions of bones, and the concentration of artifacts. The detailed results of that study have recently been published (Sahnouni, 1998; Sahnouni & de Heinzelin, 1998). They are briefly summarized here.

Table 1

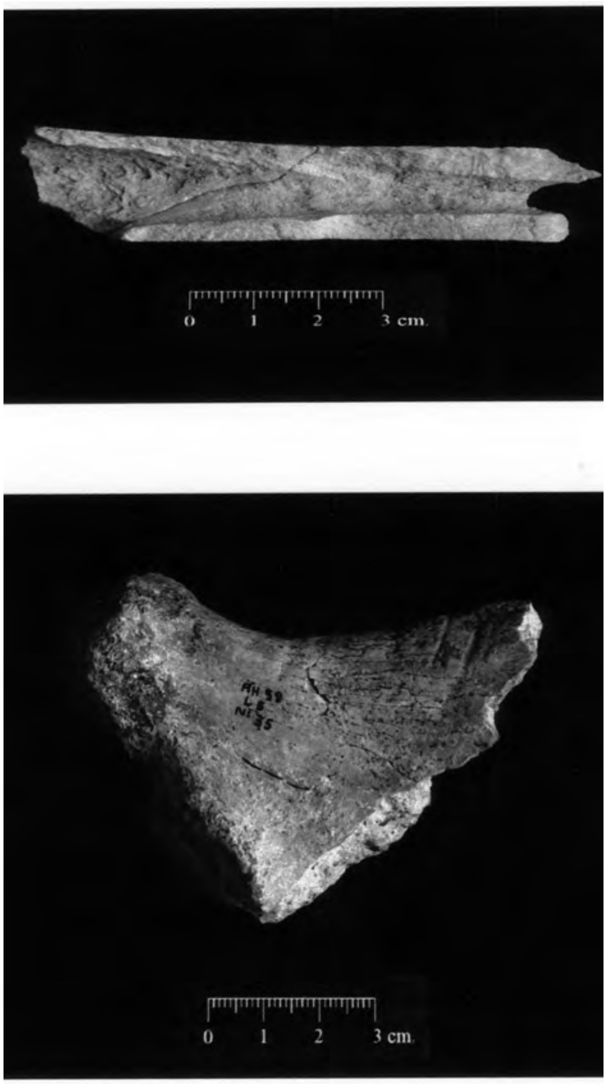
Animal species	Common names
Mammuthus meridionalis	Elephant
Ceratotherium mauritanicum	Rhinoceros
Equus tabeti	Horse
Hippopotamus amphibius	Hippo
Kolpochoerus phacochoeroides	Suid
Sivatherium maurusium	Giraffe
Crocuta crocuta	Hyena
Oryx el eulmensis	Antelope
Girrafa (?) pomeli	Giraffe
Bos bubaloides	Cattle
Bos praeafricanus	Cattle
Numidocapra crassicornis	Ovicaprid
Gazella pomeli	Gazelle
Taurotragus gaudri	Eland
Canis cfr. atrox	Canid
Alcelaphus sp	Alcelaphine
Connochaetes	Wildebeest

1. *Animal species recovered previously at Ain Hanech according to Arambourg (1970 & 1979) and subsequent changes made by other authors (Geraads, 1981; Eisenmann, 1985).*

All the inspected criteria converge to the same conclusion: that Ain Hanech and El-Kherba cultural remains were minimally disturbed and likely preserved behavioral information. The remains were contained in a fine sedimentary matrix, indicating burial in a floodplain deposit as a result of a low velocity regime. However, minimal site reworking and rearrangement of small remains might have occurred.

Except for a few that underwent some post-depositional alteration, fossil animal bones are well-preserved. When observable, they do not exhibit the types of cracking or flaking that imply long periods of exposure (Behrensmeyer, 1978; Sahnouni & de Heinzelin, 1998) (Figure 9). Anatomically, the bone assemblages include all categories of skeletal elements, eliminating the possibility of substantial hydraulic sorting. In addition, they show neither a strongly preferred orientation nor high

Figure 8



8. *Modified bone surfaces bearing hominid and carnivore signatures. Top: femur diaphysis fragment (cat. #: AH98-M102-50) of a medium-sized antelope, bearing human-made breakage patterns, such as an impact point of percussion, oval scar, opposite rebound point, and concave fracture surface. Bottom: rib proximal end fragment of an adult rhinoceros (cat. #: AH98-L105-35). Four grooves are located on the medial surface, and two pairs of circular-shaped punctures are present on the lateral surface.*

inclination. Detailed taphonomic analysis of the fauna is underway.

Likewise, stone artifacts are fresh, displaying a coherent assemblage composition, including cores and debitage (Figure 10), with debitage overwhelmingly represented. In addition, small flakes (<2cm of maximum dimension) exhibit similar patterns (Sahnouni & Heinzelin, 1998: 1093) to that produced by Schick (1986) in her experimental work, suggesting that flaking occurred in the site. The lithics do not show any significant dip or inclination, but they do display slight preferred orientation patterns. Microscopic analysis of well-preserved artifacts made of flint, reveal microwear polishes preserved on some specimens, making it unlikely they underwent significant hydraulic disturbance.

Excavations at Ain Hanech and El-Kherba

Two main archaeological localities were excavated; the original site of Ain Hanech and that of El-Kherba. At Ain Hanech an area of 118m^2 by 1.50m depth was excavated, and a volume of 177m^3 of sediments was removed. At El-Kherba an area of 33m^2 by 1m depth was dug and 33m^3 of sediments were removed. At both archaeological sites a rich assemblage was recovered, though in low density. On average, at Ain Hanech the density is 25 finds per m^3 in Level B and 4 finds per m^3 in Level A. At El-Kherba the density is 5 finds per m^3. A total of 2475 archaeological remains was recovered at Ain Hanech, including 1243 fossil bones and 1232 stone artifacts (these totals exclude small fragments <2cm). At El-Kherba the excavations yielded 631 archaeological finds, including 361 bones and 270 stone artifacts.

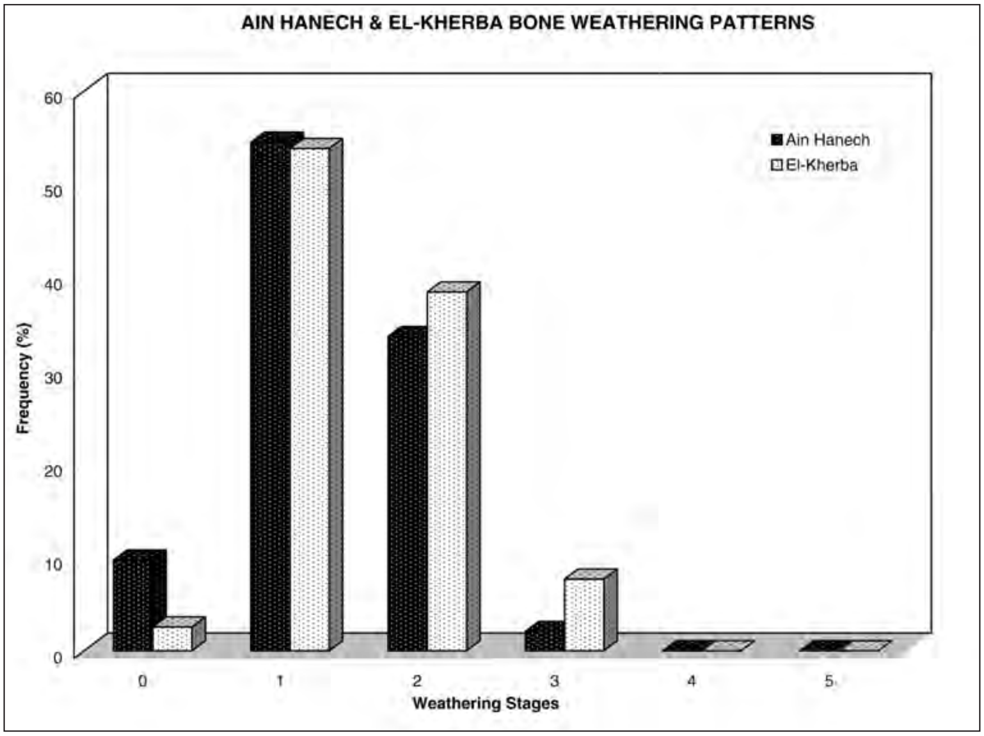
There is no doubt that lithic artifacts and fossil animal bones form a spatio-temporal association, likely reflecting behavioral activities. For instance, the excavations at Ain Hanech in Level B exposed a partial skeleton of a rhino in an articulated position and associated with several stone artifacts (Figure 11: square J2). The skeleton includes the scapula, vertebra, and pelvis, with a humerus located slightly further away. At El-Kherba the excavations uncovered the association of several animal remains (equid, giraffid, and small and large bovids) surrounded with stone artifacts (Figure 12). The behavioral implications of these archaeological associations are currently under study.

The Artifact Assemblages

Overall Presentation

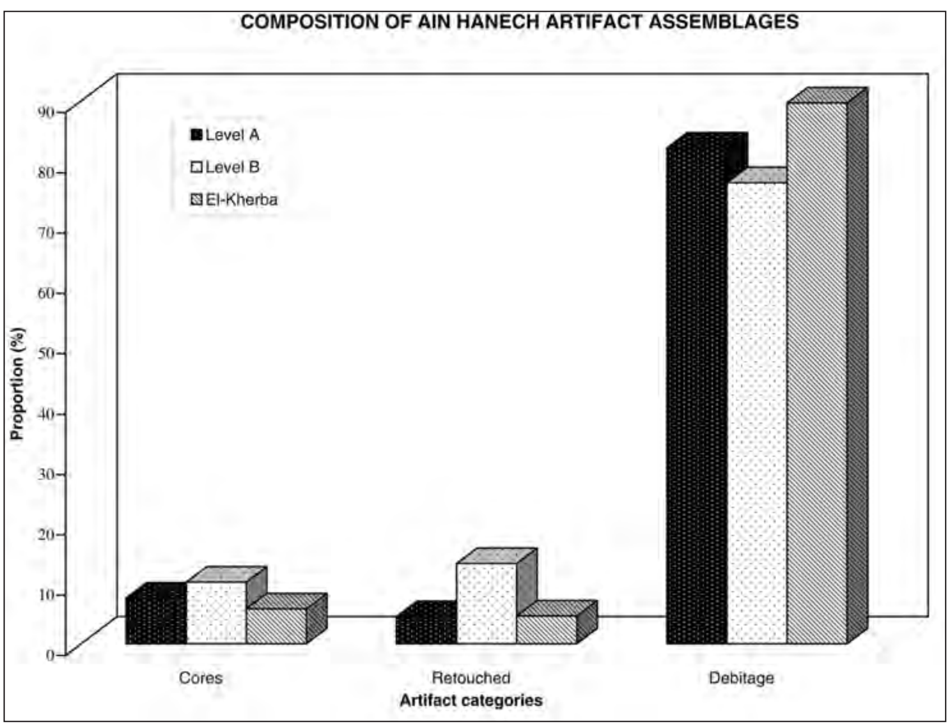
The new excavations at Ain Hanech yielded a total of 1502 lithic artifacts (excluding elements <2cm in maximum dimension, which total 2405). This analysis will only consider artifacts greater or equal to 2cm in maximum dimension. This general total breaks down as follows: Level C: n=31 (2%); Level B: n=947 (63%); Level A: n=254 (16.9%); and El-Kherba: n=270 (17.9%). The artifacts from Level C are not included in the analysis since they represent a small assemblage excavated from a test trench. As can be seen from table 2, the assemblage from Level B is the most abundant. The assemblages from Level A and El-Kherba are nearly evenly represented. They are all coherent assem-

Figure 9



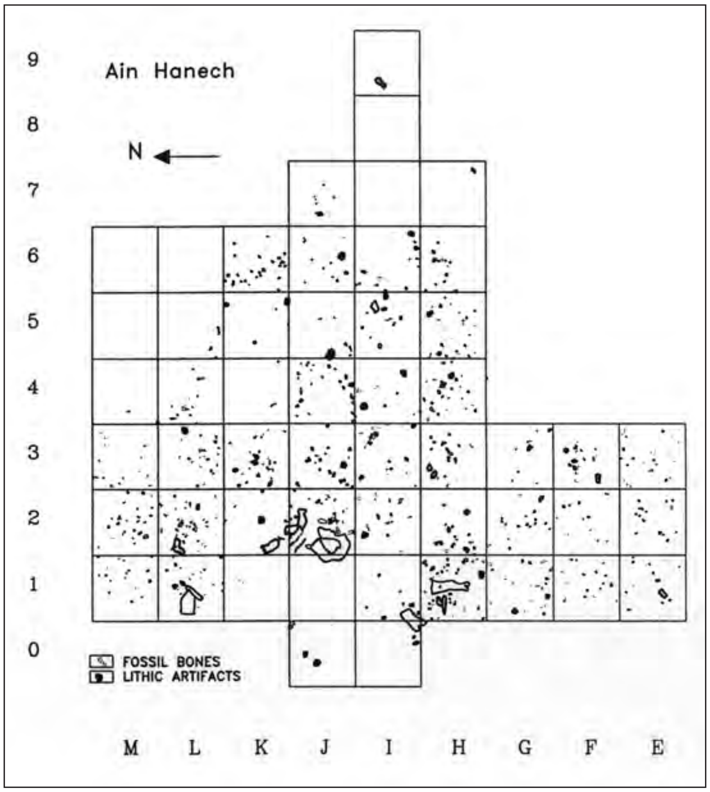
9. *Ain Hanech (n=288) and El-Kherba (n=39) bone weathering patterns. Classes are according to Behrensmeyer, 1978.*

Figure 10



10. *General artifact assemblage composition of the Ain Hanech sites, including elements equal or below 2cm in maximum dimension. Ain Hanech Level A (n=827), Level B (n=2097), and El-Kherba (n=952). Note the high frequencies of debitage in all the assemblages. Small debitage totals: n=573 (69.2%) for Level A, n=1150 (54.8%) for Level B, and n=682 (71.6%) for El-Kherba.*

Figure 11



11. Horizontal distribution of the archaeological material at Ain Hanech (Level B). Note the rhino remains in squares J2 and H1.

blages and include small debitage. Although their frequency in Level B is relatively low, overall the small elements <2cm are fairly well-represented in all the assemblages. This suggests a minimal disturbance of the occurrences and that the lithic production occurred at the sites. In terms of artifact composition, the assemblages comprise the following categories (Table 2): Cores (22.3%), whole flakes (22.3%), retouched pieces (27.3%), and fragments (25.4%). The frequency of the retouched pieces is slightly inflated, especially in Level B, because a portion of the blanks constitutes pebbles that were directly modified into tools (see section on retouched pieces below). Identifiable percussors (hammerstones) are only present in Level A and El-Kherba assemblages.

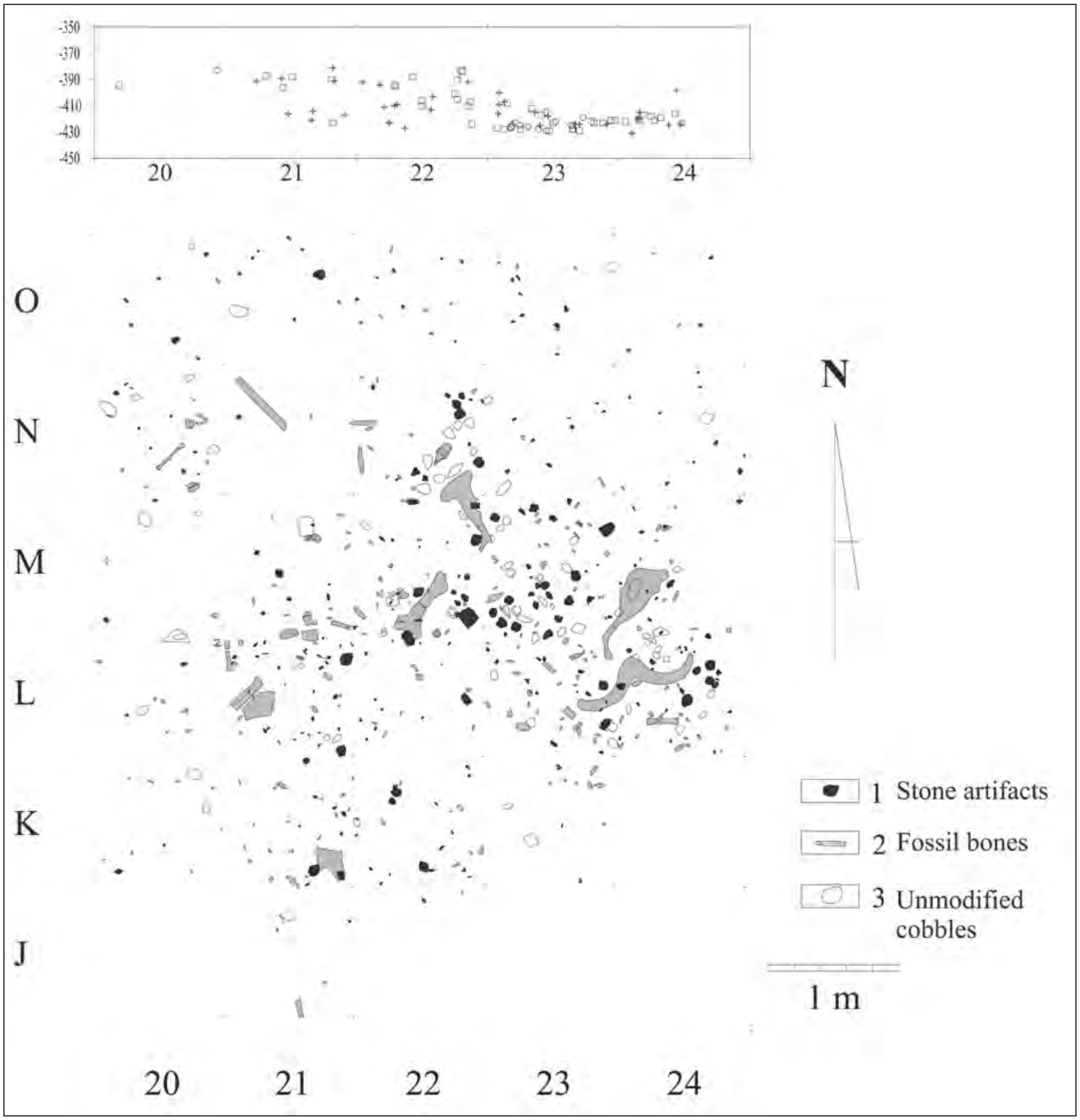
Raw Materials

With the exception of a very few pieces made of quartzite and sandstone, all artifacts from Ain Hanech and El-Kherba were made of limestone and flint. Based on the geological map (Map of El-Eulma # 94, 1/50.000, 1977), the limestone component includes several varieties formed during the Cretaceous (Campanian-Maestrichtian, Cenomanian, and Santonian stages). Although the flint component displays homogenous textural patterns, it includes a variety of colors: black, dark brown, light brown, gray, and green. The black flint is the most predominant and represents a rock formed in the Ypresian-Lower Lutecian stage. The primary geological sources of limestone and flint were the rocky hills surrounding the Beni Fouda basin. Pieces of limestone and flint would break up over time and would have been transported by streams draining into the alluvial plain. They became water-smoothed cobbles and pebbles mostly characterized by a polyhedral shape because of their short transport, and were deposited in beds of river and stream courses. Thus, these two rocks were readily available to hominins as a source of raw material.

In terms of artifact number, flint (56.3%) is relatively more common than limestone (43%). The use of quartzite and sandstone, recorded only at Ain Hanech locality, was negligible. If frequencies of rock types are compared between the two archaeological localities, flint is found in somewhat higher frequencies at El-Kherba (61.2%) than at Ain Hanech (54.7%). Inversely, limestone was slightly more frequent at Ain Hanech (44.8%) than at El-Kherba (38.7%).

Figure 13 shows frequencies of categories of artifacts based upon rock types. As can be seen, all categories of artifacts were manufactured by both limestone and flint. Whole flakes were nearly equally in limestone and flint. Fragments are proportionally somewhat more common in limestone compared to flint. Interestingly,

Figure 12



12. *Horizontal distribution of the archaeological material at El-Kherba. Note the concentration of fossil animal bones with artifacts. The animal remains include a new species of Pelorovis (horn cores in square L24), hippo (pelvis bones in squares M24 and N22), and Sivatherium (femur in square M22). The graph in the top shows the vertical dispersion (in mm) of the remains from squares L20 to L24. (□ = fossil bone; + = stone artifact; ○ = unmodified stone).*

Table 2

Artifact categories	Level B		Level C		Level A		El-Kherba		All assemblages	
	N	%	N	%	N	%	N	%	N	%
Cores	6	0.3	212	22.3	62	24.4	55	20.3	335	22.3
Retouched Pieces	15	0.9	276	29.1	37	14.5	83	30.7	411	27.3
Whole flakes	6	0.3	194	20.4	72	28.3	63	23.3	335	22.3
Fragments	4	0.2	239	25.2	71	27.9	68	25.1	382	25.4
Percussors	0	0	0	0	2	0.7	1	0.3	3	0.1
Split cobbles	0	0	26	2.7	10	3.9	0	0	36	2.3
Total	31	2	947	100	254	100	270	100	1502	100

2. General breakdown of the lithic assemblages greater or equal 2cm in maximum dimension. The artifacts from Level C represent a small sample as they have been excavated in a test trench. Fragments include snapped and split flakes, and other fragments.

the retouched pieces are much more frequent in flint than in limestone. This trait can be explained by the fact that a significant proportion of retouched pieces were manufactured on pebbles.

When the frequencies of rock types within each site are considered, we find that both limestone and flint were used but somewhat differently. For instance, limestone is relatively more frequent than flint at Ain Hanech level A (9.7% versus 6.3%). In contrast, flint is more heavily flaked than limestone in both Ain Hanech level B (36.2% versus 28%) and El-Kherba site (11.3% versus 7.5%).

Cores

The cores (Figures 14 and 15) total 329 specimens and are fairly variable with respect to raw materials, dimensions, technological patterns, and overall morphology. They were likely flaked primarily for flake production. In terms of raw materials, the cores are primarily made of limestone (30.8%) followed by flint (12.9%).

With regard to dimensions, the cores are extremely variable (Table 3). The reason is that the limestone and flint are different in size clasts. The limestone is primarily available as cobbles while flint is particularly small and abundant as pebbles (Figure 16). The mean for the maximum dimension for all cores is 69.97mm. However, the maximum dimension mean varies between cores made of limestone and those made of flint, respectively 83.04mm and 47.23mm.

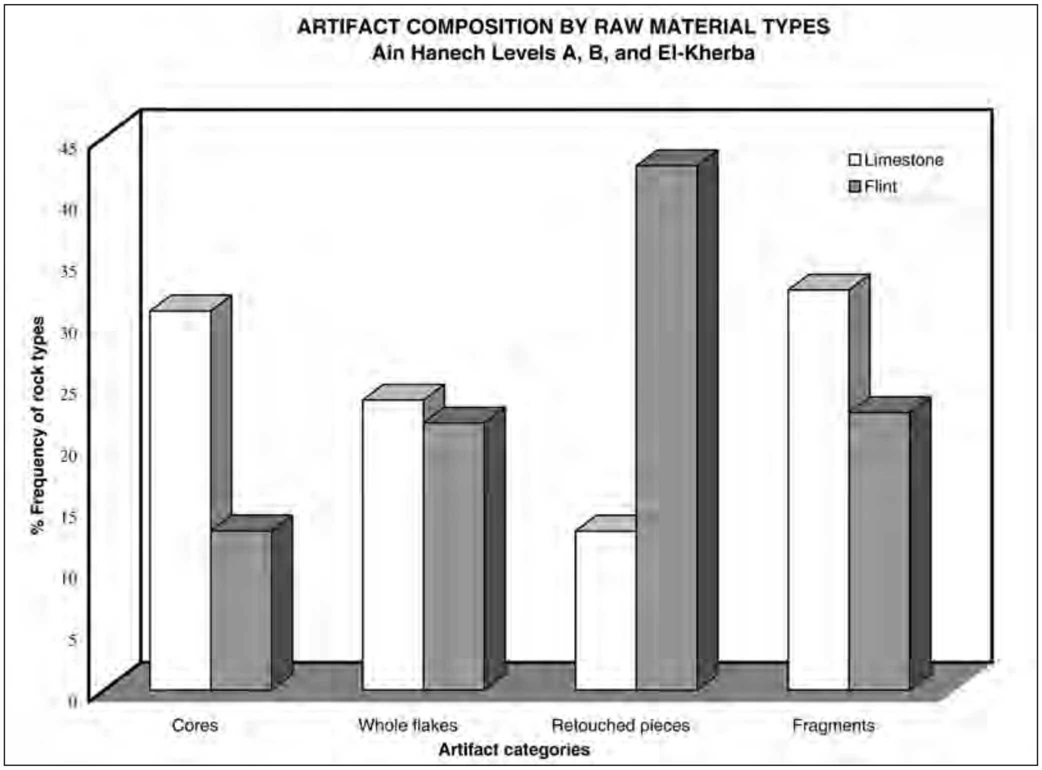
Technologically, the cores are considerably variable and are characterized by an absence of stereotypic forms. On the whole, they show a whole range of flaking intensity, preserving residual cortical areas though in variable degrees. The specimens preserving no cortex are very few totaling near 3%. The number of scar counts varies between 2 and 28, suggesting a lack of standardization and variability in exploitation of cores. In terms of flaking methods, the employed modes are unidirectional, and to a lesser extent bidirectional. The edge angle varies as well, ranging between 59º and 130º, with a mean of 94.11º. The variability is likely due to the type of rocks flaked. For example the mean angle for cores made of limestone is 97.26º while the mean angle for those made of flint is 85º.

Typologically, the limestone cores may also comprise specimens that were flaked for a desired shape or for useful edges. They are usually unifacially, bifacially, and polyfacially flaked. Using Mary Leakey's typological system, several morphological types may be recognized (Figure 14) including unifacial and bifacial choppers, polyhedrons, subspheroids, and facetted spheroids. Overall, the polyhedrons are the most dominant category (67%) and are moderately to heavily trimmed on at least three different faces. The spheroids represent only 1.89% (4 specimens).

Whole Flakes

A total of 329 flakes greater or equal to 2cm was recovered at Ain Hanech sites (Figure 17), including 72 in Level A, 194 in Level B, and 63 in El-Kherba. The flakes are made nearly equally of flint (50.45%) and limestone (48.93%). Except for Level A where flakes in limestone prevail (12.76% versus 8.81%), those made of flint predominate in both Level B (30.09% versus 28.57%) and El-Kherba (11.55% versus 7.59%). There is a single flake made of quartzite and occurs in Level B.

Figure 13



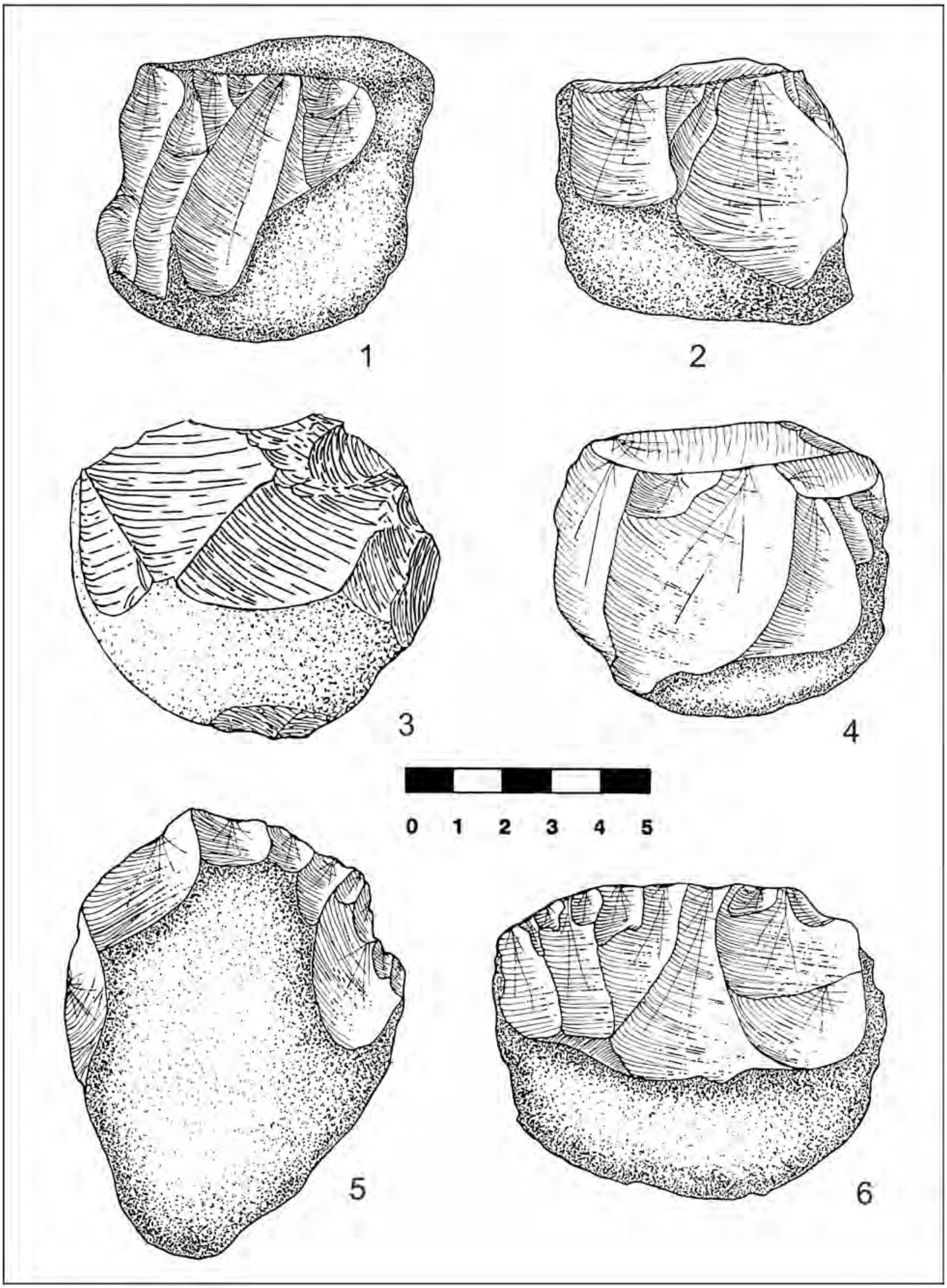
13. *Artifact composition by raw material types. Note that retouched pieces are numerous in flint.*

Table 3

Sites	Variable	Mean	Std. Dev.	Range
Ain Hanech A (n=51)	Length	76.33	24.08	25-145
	Breadth	66.76	21.49	20-122
	Thickness	53.82	20.28	10-93
Ain Hanech B (n=212)	Length	72.44	31.63	21-208
	Breadth	60.72	27.29	15-183
	Thickness	48.56	23.55	25-111
Ain Hanech C (n=7)	Length	64.57	20.68	31-90
	Breadth	53.14	17.32	23-74
	Thickness	43.28	21.78	9-72
El-Kherba (n=53)	Length	63.22	27.53	21-128
	Breadth	52.35	25.30	10-117
	Thickness	39.77	21.86	9-91

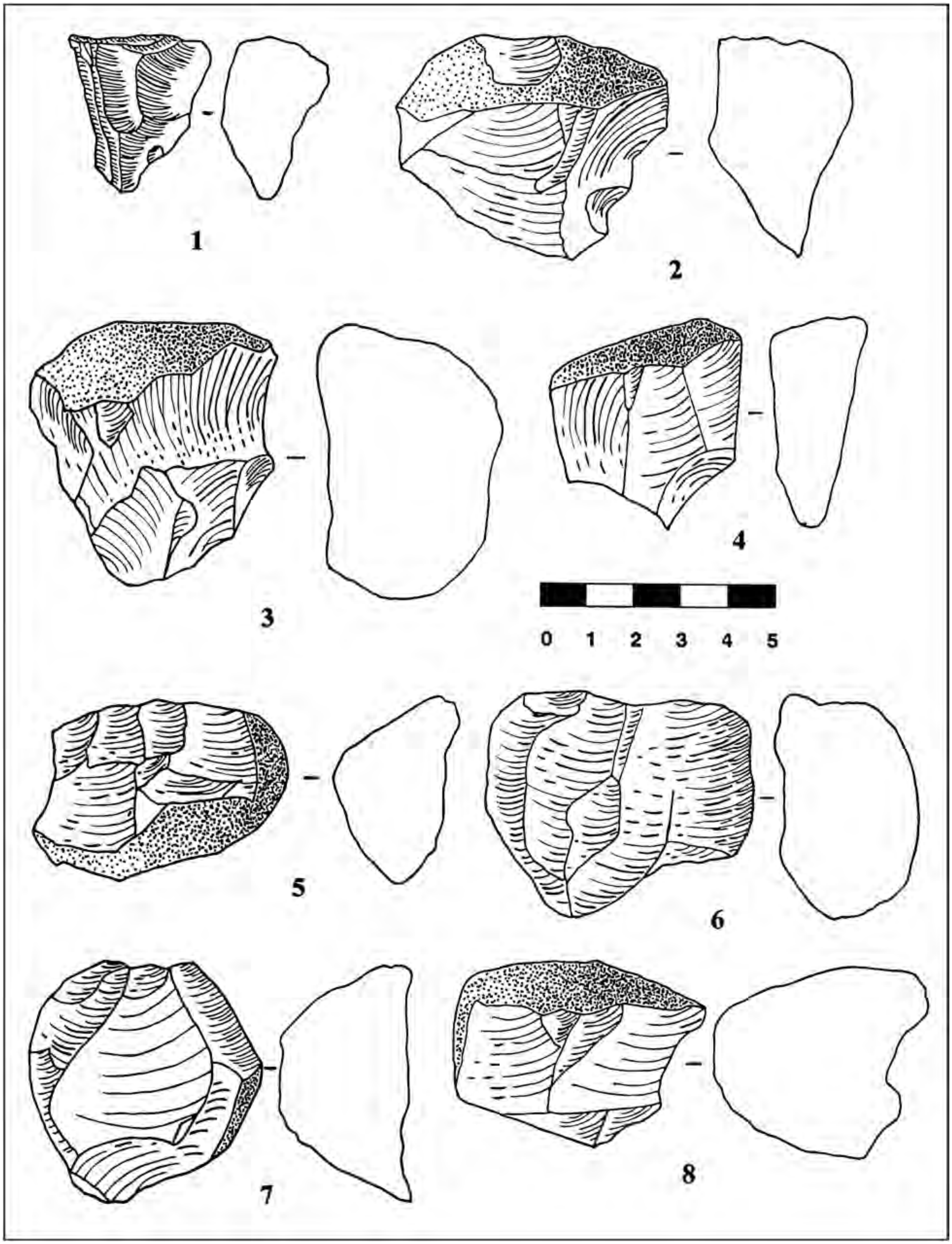
3. *Comparison of core dimensions from Levels A, B, and C, and from El-Kherba site.*

Figure 14



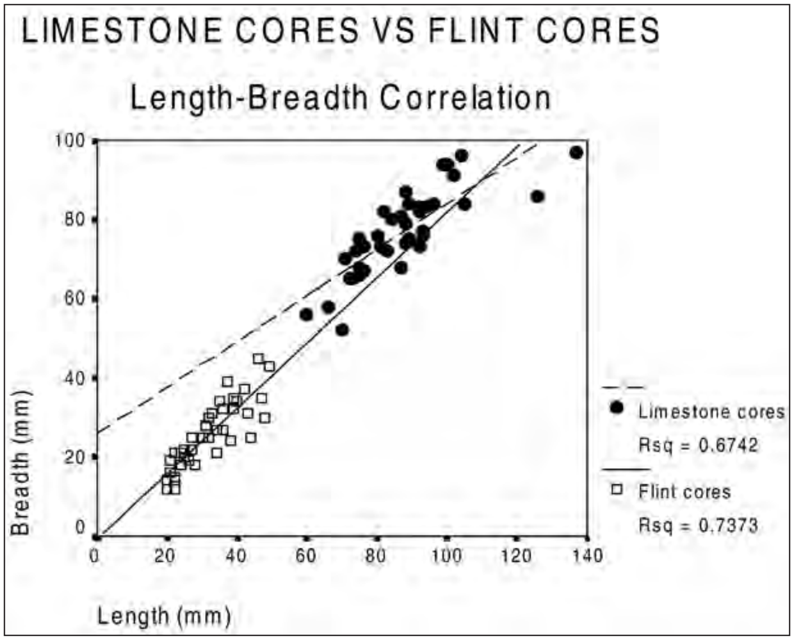
14. Examples of cores made of limestone from Ain Hanech sites, including 1, 2: unifacial and bifacial cores from Level A; 3, 4: unifacial core and polyfacial core from Level B; 5, 6: unifacial core and bifacial core from El-Kherba.

Figure 15



15. *Examples of cores made of flint from Ain Hanech sites, including 1-3 from Level A; 4-5 from Level B; 7 from Level C; 6 and 8 from El-Kherba.*

Figure 16



16. Limestone cores versus flint cores based on length-breadth correlation. Note that limestone cores (black dots) are significantly bigger than cores made of flint (squares).

Table 4

Sites	Variable	Mean	Std. Dev.	Range
Ain Hanech A (n=71)	Length	38.16	16.57	13-106
	Breadth	27.10	13.72	11-84
	Thickness	11.06	6.11	4-45
Ain Hanech B (n=194)	Length	37.86	16.73	13-106
	Breadth	27.91	14.03	8-84
	Thickness	10.91	6.21	3-45
El-Kherba (n=63)	Length	34.00	15.54	17-96
	Breadth	23.29	10.76	8-64
	Thickness	9.94	4.79	4-30

4. Dimensions of flakes from Ain Hanech Levels A and B, and from El-Kherba site.

Table 5

Statistics	Level A	Level B	El-Kherba	All
Mean	95.03	98.34	90.08	94.48
Std. Deviation	17.17	16.32	18.22	17.23
Minimum	58	59	53	53
Maximum	127	140	123	140

5. Interior platform angle statistics of flakes from Ain Hanech Levels A and B, and from El-Kherba.

Whole Flake Dimensions and Shape

Overall, the flakes are small. The maximum dimension ranges between 13mm and 106mm, with a mean of 36.67mm. However, the maximum dimension varies slightly from assemblage to the other (Table 4). The mean of length is: 38.16mm for Level A, 37.86mm for Level B, and 34mm for El-Kherba. El-Kherba flakes are particularly smaller (Figure 18) because they are primarily made of flint, which occurred in small clasts. Flakes from Level A and B show a greater size range. Based upon experimental studies (Toth, 1982), smaller flakes tend to be preferentially produced by the manufacture of flake scrapers, and flakes, whose length ranges between 27.8mm and 35.1mm were produced by manufacturing larger artifacts such as choppers and polyhedrons. Both trends are observed in Ain Hanech flakes.

The variability in flake dimensions is due to differences in raw materials. As can be seen in (Figure 19), flakes made of limestone are larger than those made of flint. Raw material shape and size account for these differences: limestone flakes were removed from large and thick cobbles, whereas those made of flint were detached from smaller pebbles.

To have an indication of flake shapes, two ratios were calculated: breadth-length (B/L) and thickness-breadth (T/B). The plot of these two ratios (Figure 20) suggests that Ain Hanech sites flakes are primarily moderately long and relatively thick. Although rare, there are also flakes with extreme shapes, such as short and thin and slightly long and very thick. According to experimental flaking (Toth, 1982), flakes resulting from manufacturing Acheulean artifacts such as bifaces, picks, and flake scrapers tend to be shorter and thinner, while flakes produced by flaking choppers, polyhedrons and core scrapers are relatively longer and thicker. Thus, the majority of the Ain Hanech flakes correspond to those produced in the production of Oldowan-type cores.

Flake Types

Figure 21 shows the overall breakdown of flakes types for each assemblage based on presence/absence of cortex on the dorsal surface and platform of the flake (Toth, 1985). These include the following types:

Type I: Cortical platform with all cortical dorsal surface;

Type II: Cortical platform with partially cortical dorsal surface;

Type III: Cortical platform with non-cortical dorsal surface;

Type IV: Non-cortical platform with all cortical dorsal surface;

Type V: Non-cortical platform with partially cortical dorsal surface;

Type VI: Non-cortical platform with non-cortical dorsal surface.

In general, all the types are represented in the flake population. Nevertheless, the first three flake types, those with cortical platforms (types I, II, and III), are the most abundant amounting to 69.1%, 57.3%, and 60.4%, respectively in Level A, Level B, and El-Kherba. Differences in flake types are also observed within assemblages, especially Level A and El-Kherba (Figure 22). In both assemblages, limestone flakes type I are highly numerous, and flakes type IV are relatively uncommon in Level A. The proportion of flakes type VI in flint is high at El-Kherba. The flake types study shows that flaking occurred at the sites because all flake stages are depicted, and the assemblages were minimally disturbed by water action. The discrepancies in flake types suggest an overall light reduction of limestone cores, and a relative heavy reduction of flint cores.

Flake Platform Types and Interior Platform Angle

Figure 23, displaying flake platform types for flakes greater or equal to 2cm, shows that near 60% of platforms are cortical represented by flake types I, II, and III. These are followed by platforms with one scar, amounting 35.9%. The platforms with more than one scar constitute only 4.23% of flakes. These platform patterns do not significantly change when assemblages are compared, except that cortical platforms are relatively numerous at Ain Hanech Level A and El-Kherba and non-cortical platforms are frequent at El-Kherba. Similar patterns are also observed between platforms made of limestone and those made of flint. However, it should be pointed out that platforms with more than one scar are largely made of flint, suggesting that flint cores were more exhaustively flaked than the limestone ones.

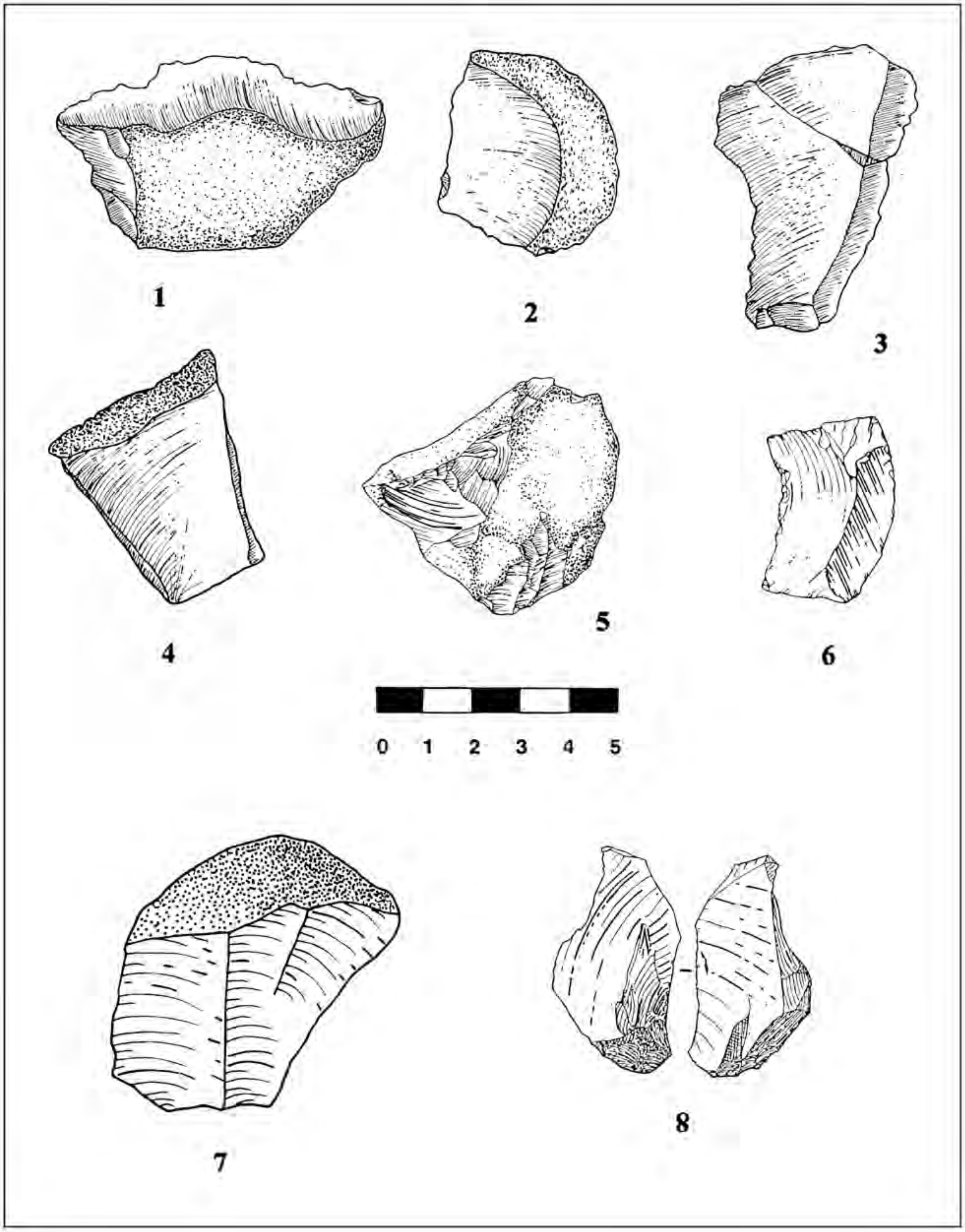
Flake platform trends observed in Ain Hanech and El-Kherba assemblages are compatible with Oldowan technologies. The cortical platforms and those with one scar are the byproduct of unifacial and bifacial cores, respectively. The platforms with more than one scar are rare, likely due to the absence of core preparation for producing sophisticated artifacts known in more advanced traditions, such as bifaces, cleavers, etc.

The interior platform angle formed by the platform and flake ventral surface is variable, ranging between 53º and 132º (Table 5). The mean is 94.48º. The interior platform angle variability is likely due to rock type. Overall, flakes made of flint have an obtuse flaking angle, while those of limestone have an acute flaking angle.

Flake Dorsal Scars and Scar Patterning

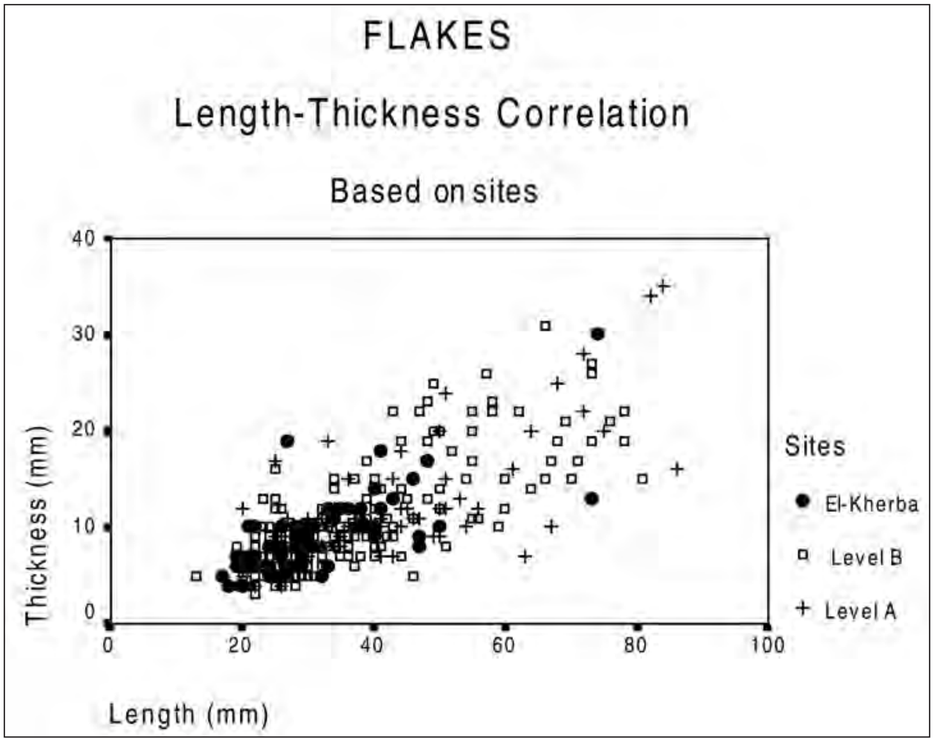
The number of scars counted on flake dorsal surfaces varies between 0 (all cortex) and 11 (Figure 24). Overall, flakes show few dorsal scars (45.2% with no or one scar, 38% with 2-4 scars, and 17% with 5 scars and above). Overall, these patterns indicate that extremely heavy flaking was not common. In terms of raw materials, however, significant differences appear between

Figure 17



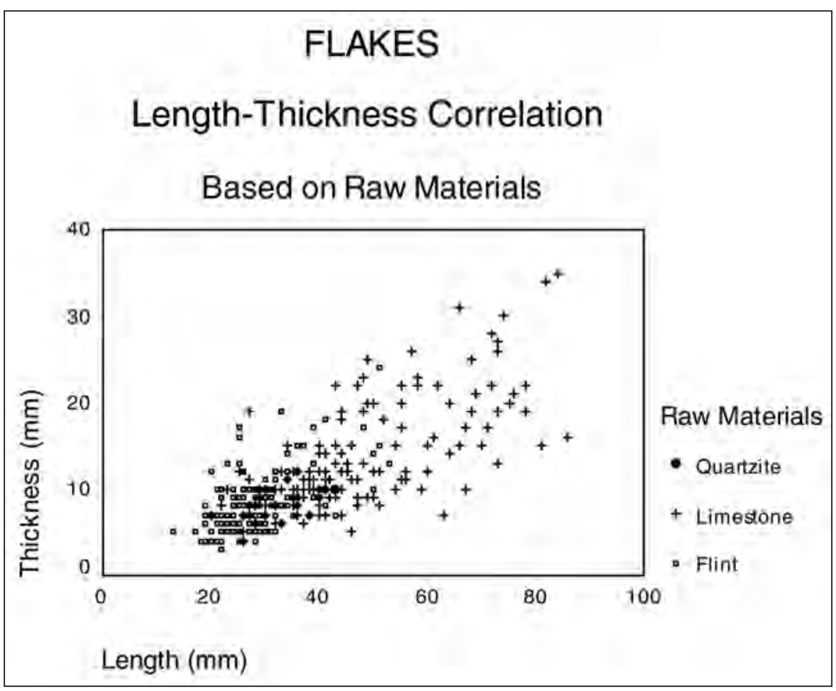
17. *Example of whole flakes from Ain Hanech sites, including 1-3 from Level A (limestone); 4-6 from Level B: 4 is made of limestone, and 5 and 6 are made of flint; 7 is made of limestone and is from Level C; and 8 is made of flint and is from El-Kherba. Flakes 6 and 8 were interpreted as meat cutting tools as evidenced by usewear analysis.*

Figure 18



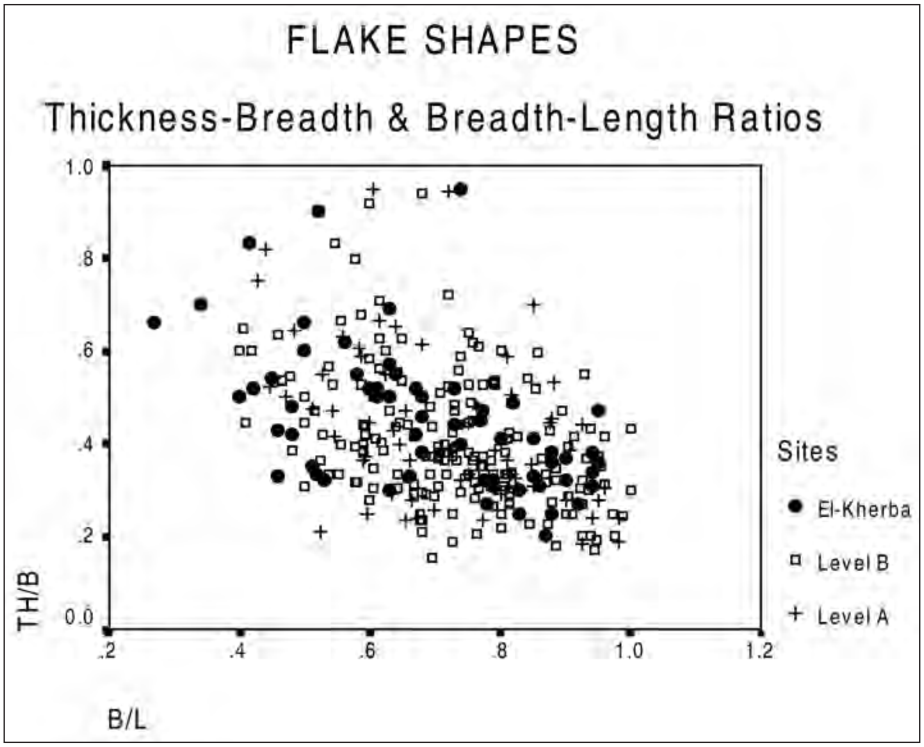
18. Scatter plot showing whole flakes dimensions (length by thickness) based on sites. Note that El-Kherba flakes are primarily small because the majority are made of flint.

Figure 19



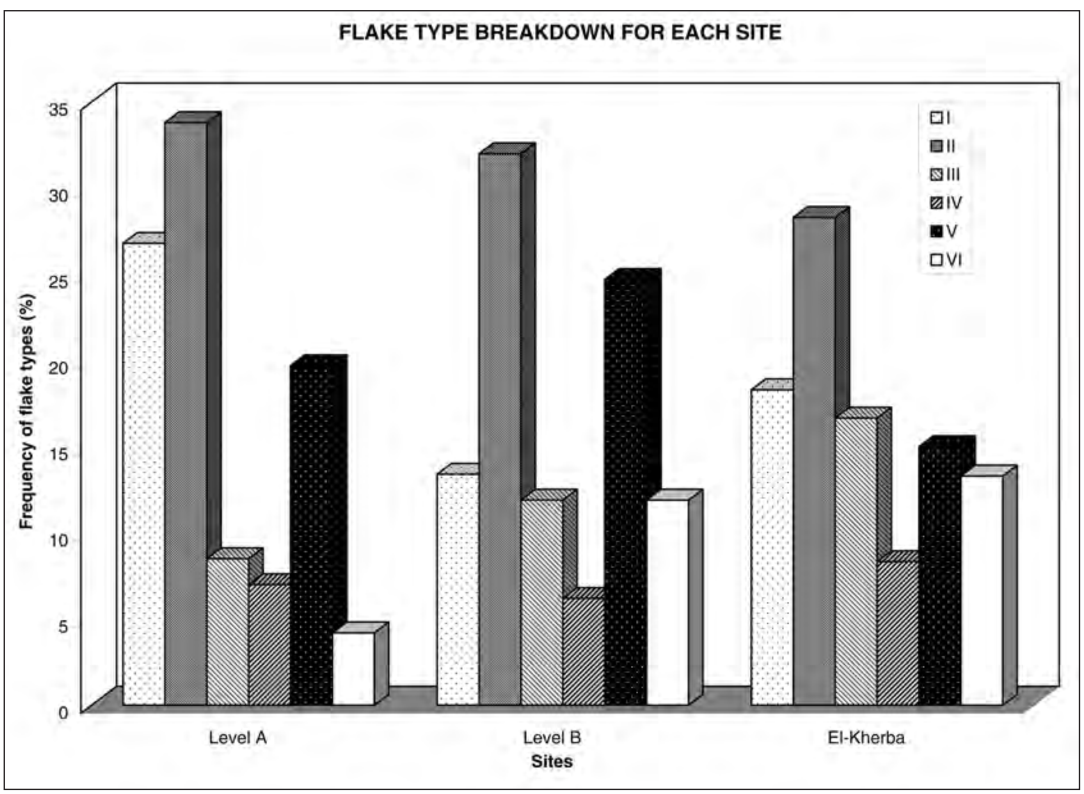
19. Scatter plot showing whole flake dimensions (length by thickness) based on raw materials. Note that flakes made of flint are smaller overall due to the use of small-sized flint cores.

Figure 20



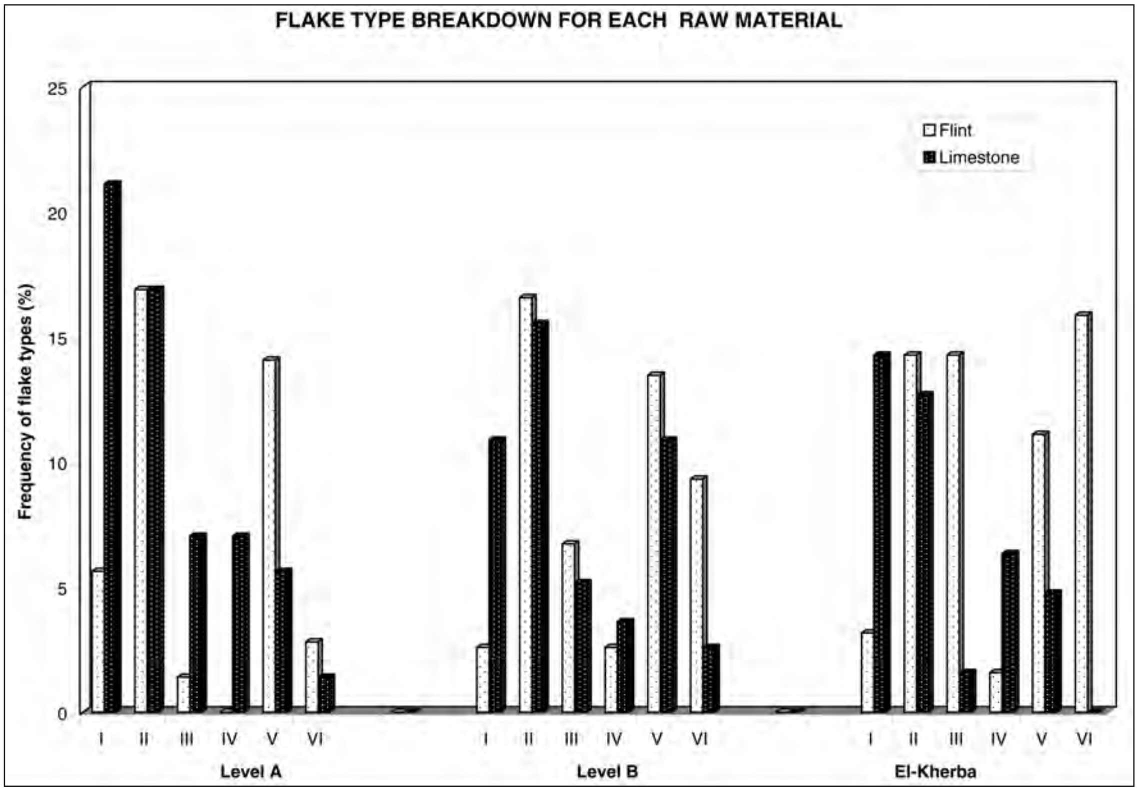
20. Scatter plot showing flake shape for each site using thickness-breadth and breadth-length ratios. Overall, the flakes are moderately long and relatively thick in all assemblages. These flake shapes are compatible with the categories of artifacts producing flakes found at Ain Hanech sites, e.g. choppers, polyhedrons, and cores.

Figure 21



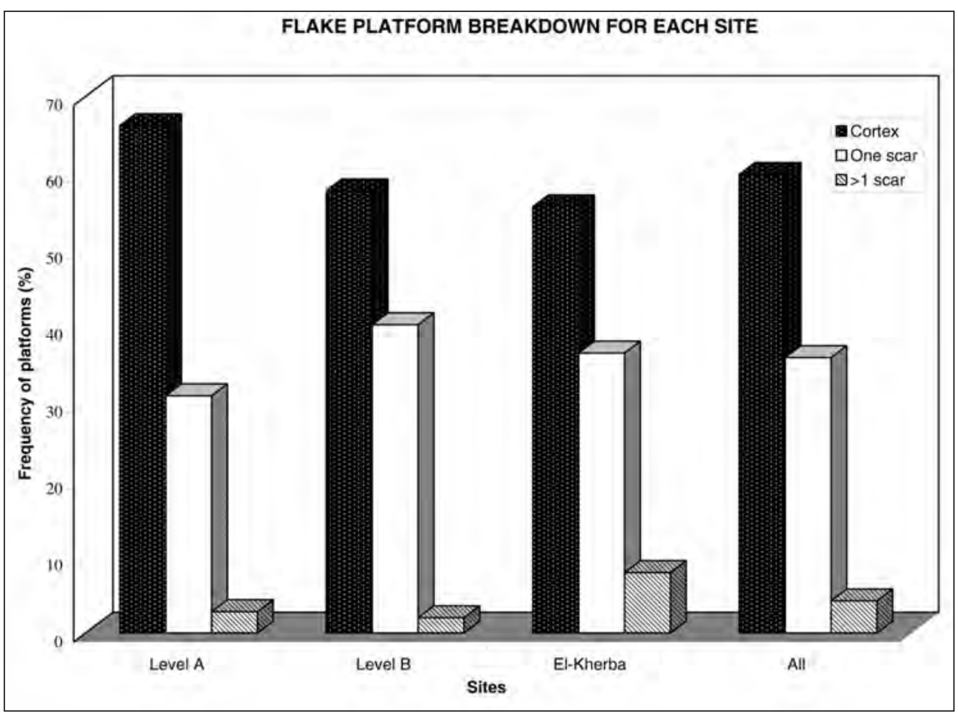
21. Overall flake type breakdown for the three sites. All the types are present, suggesting that all stages of flaking are represented and minimal disturbance of the occurrences.

Figure 22



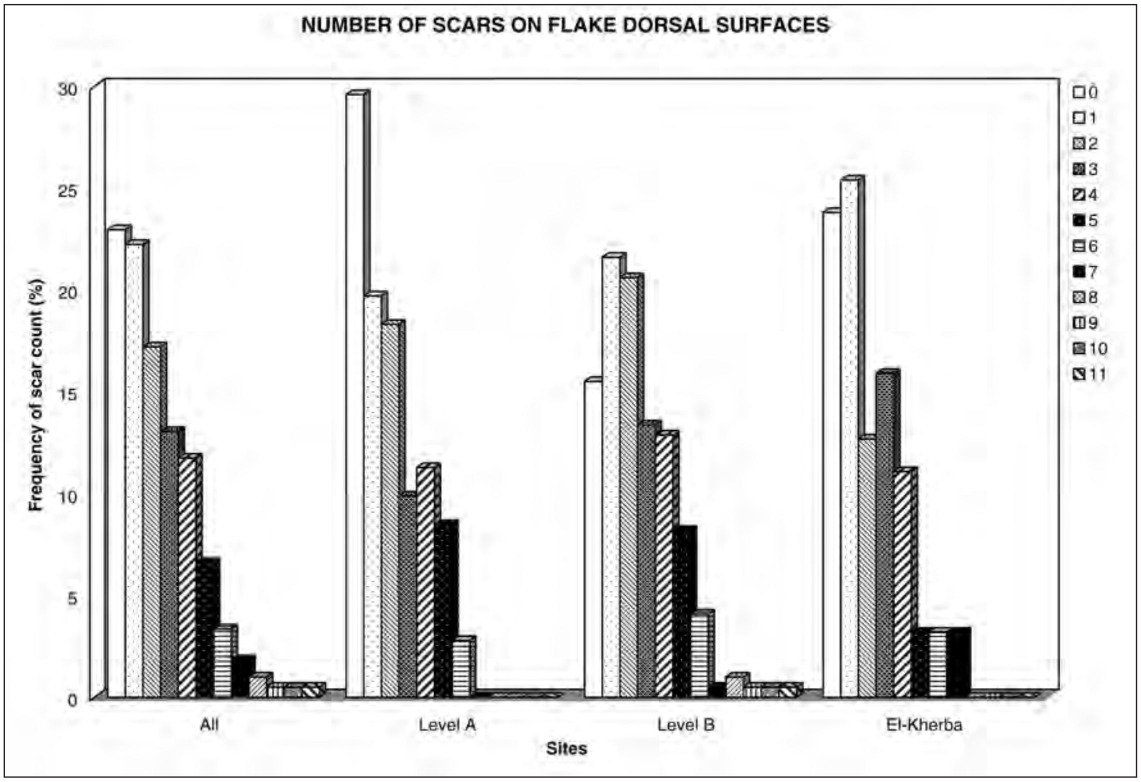
22. Flake type breakdown based on raw materials. Note the relative variability between sites with Level A being somewhat similar to El-Kherba. In these two assemblages, flakes type I, made of limestone, are numerous, suggesting a primary and minimal flaking of limestone cores. Flakes type VI, made of flint, are more frequent at El-Kherba, indicating heavy flaking of flint cores.

Figure 23



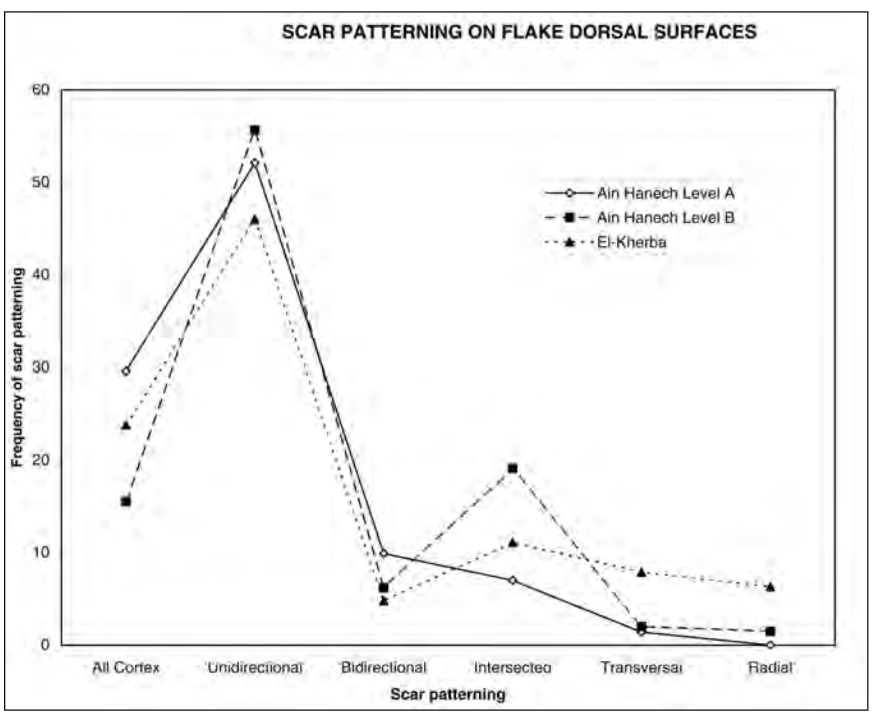
23. Flake platform breakdown for each site. Cortical and one-scar platforms are the most common, suggesting the absence of extensive platform preparation and, perhaps, minimal flaking of cores.

Figure 24



24. Diagram showing number of scars on flake dorsal surfaces. Overall, scars are not numerous on dorsal surfaces, suggesting minimal core preparation. Note that there is a slight variability between sites.

Figure 25



25. Diagram showing scar patterning on flake dorsal surfaces. Note that unidirectional flaking patterns predominate.

scar counts on dorsal surfaces of flakes made of limestone and those made of flint. In limestone flakes, dorsal surfaces with total cortex and those with one scar predominate. On the contrary, in flint flakes, dorsal surfaces with total cortex are not common at all, while those with 1, 2, 3, 4, and 5 represent the highest frequencies, suggesting heavy flaking of flint cores.

There is a relative variability in number of scars on flake dorsal surfaces between assemblages. Dorsal surfaces with total cortex are the most common in Ain Hanech Level A, while those with one scar are numerous at both Ain Hanech Level B and El-Kherba. This is due to the substantial presence of flakes made of flint in the two later assemblages.

In terms of scar patterning, the most common flaking direction encountered is the unidirectional, averaging 51.26% for all assemblages (Figure 25). This is followed by the intersected scar patterning (a scar crossed over by a perpendicular scar) (12.4%), indicating the removal of flakes at right angles. Lastly the bidirectional and radial scar patternings represent the lowest frequencies. The bulk of limestone and flint flakes are characterized by unidirectional scar patterning, indicating that this flaking mode prevailed for both types of rocks.

Retouched Pieces

The recent investigations yielded a total of 411 retouched pieces at Ain Hanech (Figure 26), including 37 (2.4% of the general total) in Level A, 276 (18.37% of the general total) in Level B, and 83 (5.52% of the general total) in El-Kherba. The test trench in Level C yielded 15 specimens. Figure 27 displays the breakdown of retouched types by site and overall. Six categories are recognized: scrapers, denticulates, notches, endscrapers, awls, and burins. The most abundant types are scrapers and denticulates, totaling 50% and 32% respectively. Endscrapers (8.5%) and notches (7%) are relatively frequent. Lastly, awls and burins are very rare. Similar frequencies of retouched pieces categories are observed in the other assemblages.

Raw Materials and Blanks

The retouched pieces were primarily made of flint (77% of the total of retouched pieces), while those made of limestone total just 21%. Within each assemblage, specimens made of flint still predominate although those made of limestone are relatively numerous in Level B (16.5%) (Figure 28).

There are three types of blanks that were used to shape retouched pieces at Ain Hanech sites: flakes, fragments, and small pebbles. The fragments comprise split and snapped flakes, and angular fragments. These three types of blanks are more or less evenly represented. However, the pebbles were slightly more retouched than the other blanks, especially in Level B (Figure 29). In Level A the blanks are primarily flakes, and at El-Kherba fragments represent the most commonly retouched blanks. The modified blanks are of medium size, ranging from 2cm to 8.5 cm with a mean of 3.4cm. Those from El-Kherba are slightly smaller (Table 6).

Retouch Characteristics

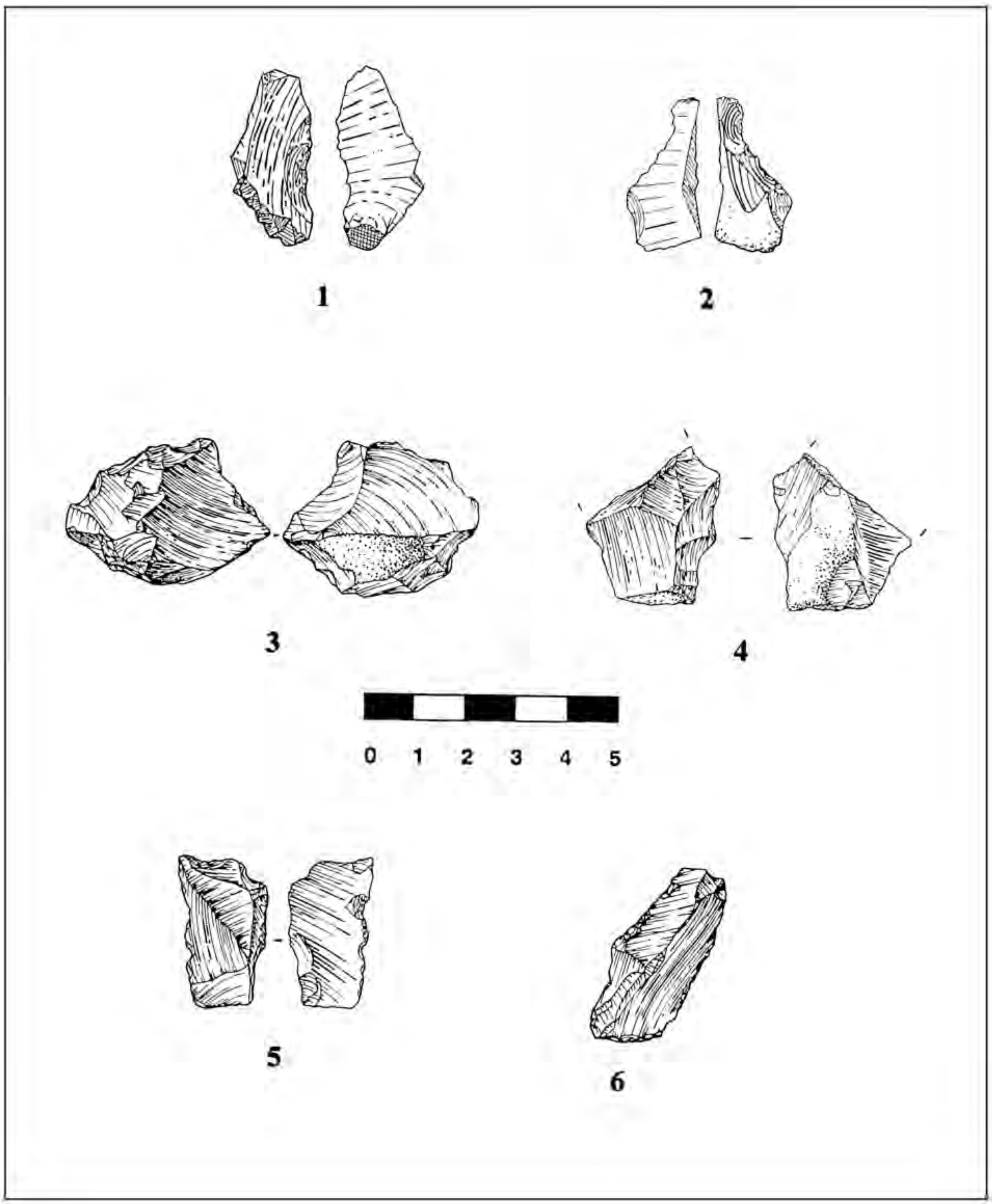
In all the assemblages the retouch is chiefly marginal, extending a few millimeters from the edge. Very few specimens are characterized by a slightly extended retouch on the surface. The retouch is commonly located on the lateral and distal sides of the blanks. The types of retouch inclination characterizing the tools are primarily abrupt (>90º), semi-abrupt (between 60º and

Table 6

Sites	Variable	Mean	Std. Dev.	Range
Ain Hanech A (n=37)	Length	37.38	14.34	20-86
	Breadth	26.32	11.29	12-58
	Thickness	12.41	4.78	5-25
Ain Hanech B (n=276)	Length	35.88	12.88	20-83
	Breadth	25.43	10.06	8-67
	Thickness	11.66	4.97	4-37
El-Kherba (n=83)	Length	29.75	12.23	19-83
	Breadth	20.35	9.21	4-73
	Thickness	9.58	3.76	2-23

6. Dimensions of retouched pieces from Ain Hanech Levels A and B, and from El-Kherba site.

Figure 26



26. Examples of retouched pieces from Ain Hanech sites, including 1-2: scrapers from Level A; 3-5: denticulates-like from Level B; and 6: scraper from El-Kherba. All the specimens are made of flint.

90º), and simple (between 30º and 60º). Of these, simple retouch is the least common. The mean retouch angle is 77.6º. It is hard to infer the precise implications of these retouch inclination patterns without an in-depth functional analysis. However, they may signify that retouched pieces were employed for various tasks, seemingly not only those necessitating very sharp edges.

Summary of the Lithic Assemblages

To summarize the lithic assemblages in this study, the following points may be highlighted:

1. In all assemblages, two types of rock were primarily used to manufacture the artifacts: limestone and flint. Flint was used more commonly in Ain Hanech Level B. These rocks were available in the general vicinity of the site in riverbeds in the form of cobbles and pebbles. There is no evidence indicating long-distance transport of raw materials, but selection of gravel suitable shapes for flaking did occur.

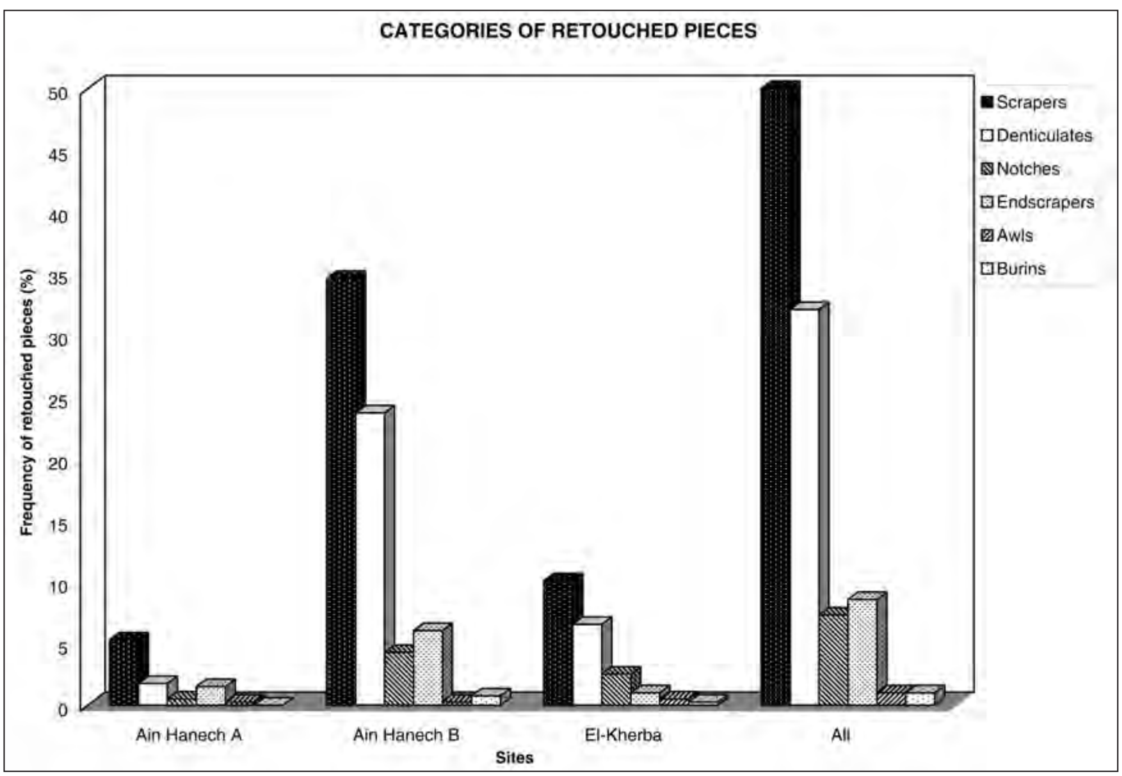
2. Although debitage of both limestone and flint were modified into retouched pieces, Ain Hanech toolmakers apparently had a preference for blanks made of flint in manufacturing retouched tools. Moreover, small pebbles were also directly transformed into tools, suggesting a probable expedient component of the industry.

3. A relative variability is noted between the assemblage of Level B and those of Level A and El-Kherba, especially in terms of artifact density, core categories and flaking extent, and flake type proportions. This variability supports the stratigraphic distinction of the archaeological levels (Levels A, B, C, and El-Kherba site), and may reflect diachronic occupations with different activities. The nature of these activities and their implications still requires detailed studies.

Use of Artifacts

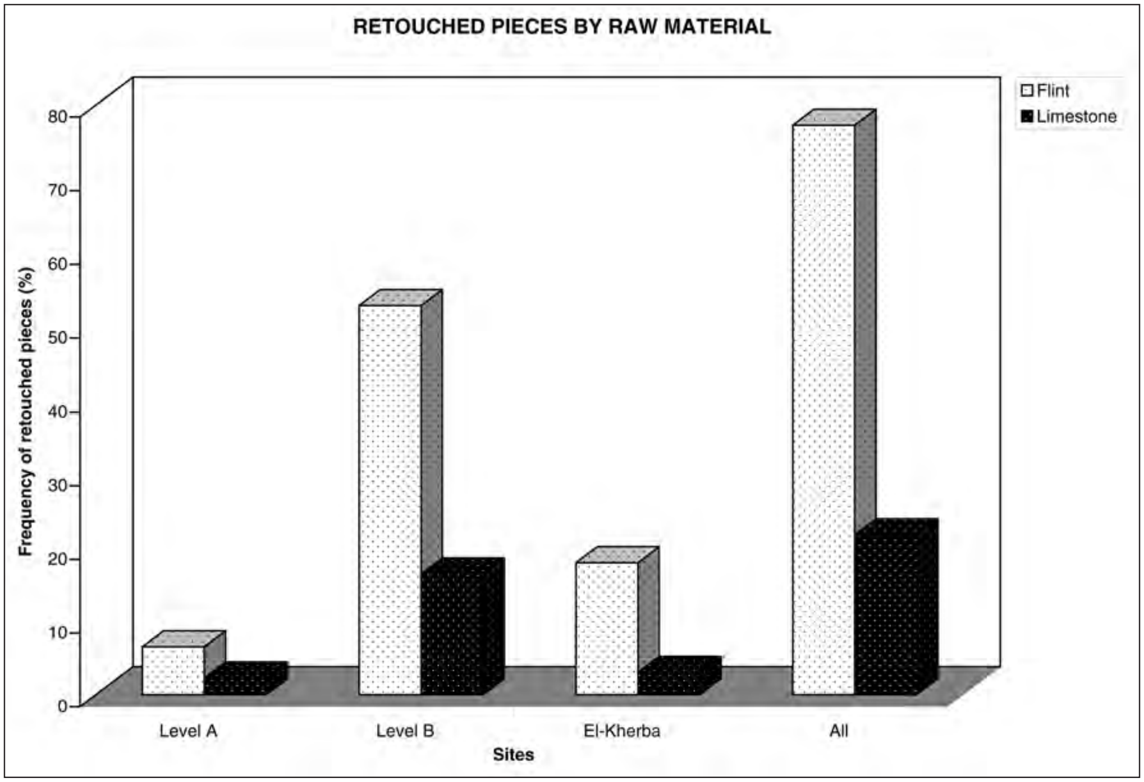
The Ain Hanech assemblages yielded a considerable quantity of artifacts made of fresh high quality flint. Flint is an ideal material for usewear studies (Keeley, 1980). Lawrence Keeley carried out a preliminary microwear study on a sample of artifacts made of flint (in Sahnouni & Heinzelin, 1998). Evidence of microwear was found on three specimens from Ain Hanech Level B. Both meat and bone polishes were identified on two whole flakes and on a denticulate-like retouched fragment. The evidence shows that Ain Hanech stone artifacts were used for food processing, indicating that meat was a component of hominin diet in this area.

Figure 27



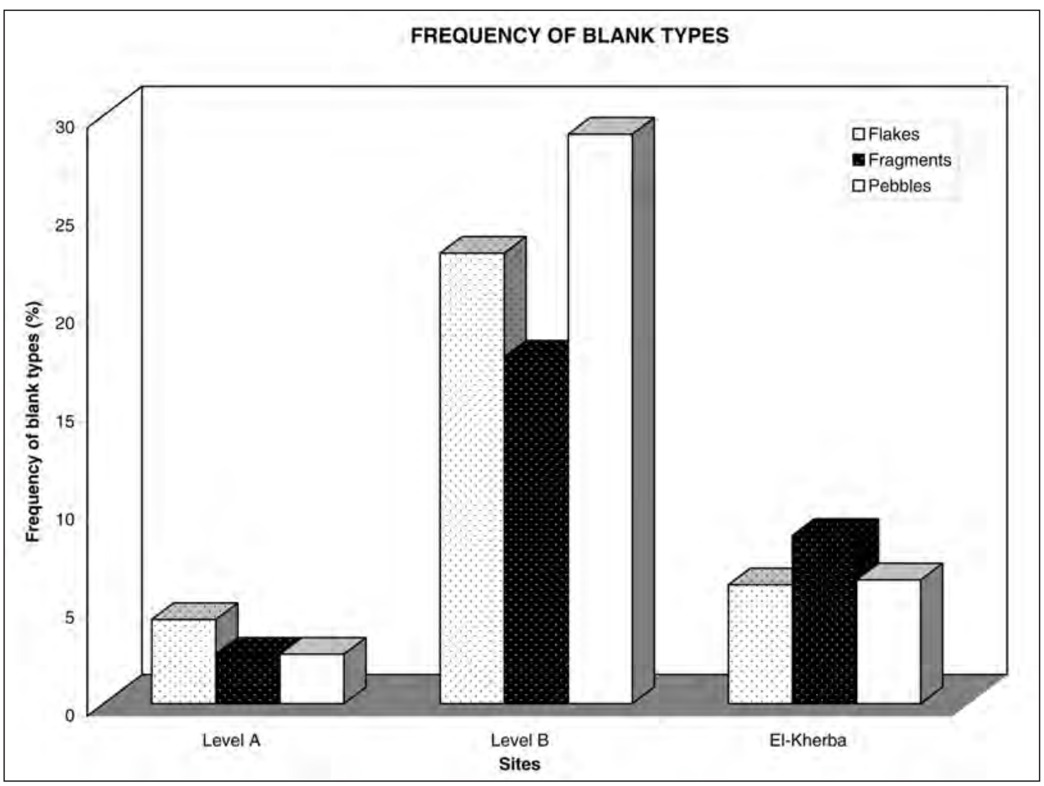
27. *Diagram showing categories of retouched pieces identified at Ain Hanech sites. Note the most common categories are scrapers and denticulates.*

Figure 28



28. Frequency of retouched pieces by raw materials. Note retouched pieces are primarily made of flint.

Figure 29



29. Frequency of blank types. Note several kinds of blanks were transformed into retouched at Ain Hanech sites, especially small pebbles that were directly modified into tools, suggesting the expedient component of the artifacts.

The Place of Ain Hanech Industry Within the Oldowan Industrial Complex

The lithic study shows that Ain Hanech assemblages are formed by two fundamental groups of artifacts. The first group represents cores, and the second group includes flakes, fragments, and retouched pieces. It must be strongly emphasized that not a single biface or even protobiface was recovered from the extensively excavated archaeological horizons. Moreover, the 2002 field season yielded hundred of Oldowan artifacts but yet not a single Acheulean artifact. Acheulean artifacts occur 6 meters higher in the stratigraphy of Ain Boucherit/Ain Hanech sequence. In this respect, the Ain Hanech assemblages clearly belong to the Mode I Technology tradition (Clark, 1969) characterizing the oldest known lithic technologies, e.g. Oldowan Industrial Complex. It may be also seen as a variant of Oldowan technological entity in North Africa.

However, it is worthwhile to ascertain as much as possible the place of Ain Hanech industry relative to other Oldowan assemblages defined elsewhere in Africa. This will help document the regional diversity of the African Early Pleistocene Paleo-cultural entities. Based on the presence/absence of categories of artifacts, the Ain Hanech assemblages are briefly compared with those from Olduvai in Tanzania (Oldowan and Developed Oldowan-A-) and Koobi Fora in Kenya (KBS Industry and Karari Industry). Unfortunately there is no other integral mode I technology assemblage in North Africa with which it can be compared. Although the difference of classification systems employed by each author and raw materials that might have influenced the final product, the comparison emphasizes what are the most common Oldowan artifacts depicted in Ain Hanech assemblages compared to other African Oldowan assemblages.

The Oldowan tradition at Olduvai Gorge is dated to 1.85-1.6 Ma and occurred through the Bed I and lower Bed II (Leakey, 1971). The Developed Oldowan-A- is restricted to the lower Bed II and lower part of Middle Bed II. The KBS Industry and Karari Industry, ranging from approximately 1.9 to 1.3 Ma, are defined as variants of the Oldowan Industrial Complex based upon a number of archaeological occurrences located at Koobi Fora in Kenya. The KBS Industry is older and restricted to the Lower Member of the Koobi Fora Formation (Isaac, 1976), and is correlated with the Oldowan. The Karari Industry is younger, dated to the Upper Member of the Koobi Fora Formation, and is considered as a variant of Oldowan (Harris, 1978).

Table 7 compares artifact frequencies between Ain Hanech and Olduvai, and Ain Hanech and KBS Industry and Karari Industry. With few exceptions, all Oldowan artifacts known at Olduvai and Koobi Fora are found at Ain Hanech. The Ain Hanech assemblages lack only discoids and protobifaces. The other categories are present although with slight differences in their frequencies. Despite the absence of discoids and protobifaces, the Ain Hanech assemblages composition is closer to Olduvai assemblage than to KBS and Karari ones. Both Ain Hanech and Olduvai include subspheroids and spheroids, although Ain Hanech spheroids are faceted. These two artifact categories are entirely absent from both KBS Industry and Karari Industry. They also incor-

Table 7

Artifacts	Ain Hanech[1] (n=1471)	Oldowan[2] (n=537)	Dv.Oldowan[2] (n=681)	KBS Industry[3] (n=24)	Karari Industry[4] (n=511)
Choppers	4.4	51.0	26.0	45.8	21.7
Proto-bifaces	0	1.3	2.3	—	2.54
Polyhedrons	7.2	10.0	4.8	12.5	17.22
Discoids	0	9.1	2.9	8.3	17.40
Subspheroids & Spheroids	2.65	6.0	23.5	0	0
Heavy duty scrapers	0.3	8.6	2.6	—	17.02
Light duty scrapers	26.3	10.2	9.4	8.3	21.13
Burins	0.3	1.7	—	—	0
Awls	0.3	—	2.8	—	0
Sundry tools	—	2.0	6.2	8.3	2.93

7. *Comparison of Ain Hanech assemblages with Oldowan, Developed Oldowan, KBS Industry, and Karari Industry (1Ain Hanech industry includes assemblages from Level A, Level B, and El-Kherba; 2after M. Leakey, 1975; 3after Isaac, 1976; 4after Harris, 1978).*

porate other artifacts, such as choppers, polyhedrons, heavy-duty scrapers, light-duty scrapers, burins, and awls. Furthermore, technological similarities between Ain Hanech and Olduvai core assemblages were demonstrated (Sahnouni, 1993).

Conclusions

This chapter has presented current knowledge on the North African Early Stone Age, focusing on the new study of the sites at Ain Hanech in northeastern Algeria. As shown in this study, North Africa yields archaeological sites with Oldowan industries. Furthermore, new investigations show that Ain Hanech provides valuable information on North African hominins behavior and adaptation. The new investigations have included study of the stratigraphy and chronology, assessment of site formation processes, analysis of the lithic assemblages, and exploration of the overall behavioral implication of the Oldowan occurrences. Tentative conclusions include:

1. There is a claim tending to promote a sort of "short chronology" scenario for the earliest human presence in North Africa (Raynal *et al.*, 2001). This scenario proposes that the earliest occupation in this region is Acheulean and is dated to 1 Ma. While this may apply to Atlantic Morocco, the Ain Hanech evidence reaffirms and strengthens the remote human antiquity in this part of the African continent. The site of Ain Hanech is the oldest archaeological occurrence in North Africa. The human presence in this region is Oldowan and may go back to 1.78 Ma (Figure 30), suggesting an earlier dispersal of hominins into North African than commonly assumed.

2. The Ain Hanech industry may be considered as a North African variant of the Oldowan Industrial Complex. The lithic assemblages incorporate a full range of artifact categories from cores to microdebitage, and are similar to those recovered in East African Plio-Pleistocene sites, e.g. Olduvai Bed I and Lower Bed II, and Koobi Fora sites. Like other Oldowan assemblages, the Ain Hanech industry is characterized by a simple technology and a low degree of standardization reflected by the variability of flaking on cores and by the retouch on flakes and fragments. Moreover, the assemblages comprise categories of artifacts similar to those found in East African Oldowan assemblages.

3. Although it is still premature to discuss subsistence patterns because detailed results of the faunal analysis are not available yet, preliminary evidence indicates that animal tissues likely constituted a significant part of Ain Hanech hominin diet. Remains of various animal species were recovered, including equid, large and small bovids, rhino, hippo, and elephant. Manufactured artifacts were used for processing the animal carcasses, such as meat cutting and bone scraping. Bones bearing carnivore signatures were also recovered, suggesting that there was likely acquisition of meat resources at these sites. A detailed study will be carried out to document subsistence patterns, including strategies employed for meat acquisition, and assessment of consumption patterns.

4. In terms of site interpretation, it can be visualized that the Ain Hanech area witnessed repeated occupations by hominins at a shallow river embankment, perhaps directed by the availability of good quality raw materials and game for meat acquisition. In ongoing archaeological explorations, material from the three Oldowan deposits is being analyzed and compared/contrasted to investigate behavioral patterns, including artifact manufacture, transport and discard, subsistence acquisition, and land use.

Acknowledgments

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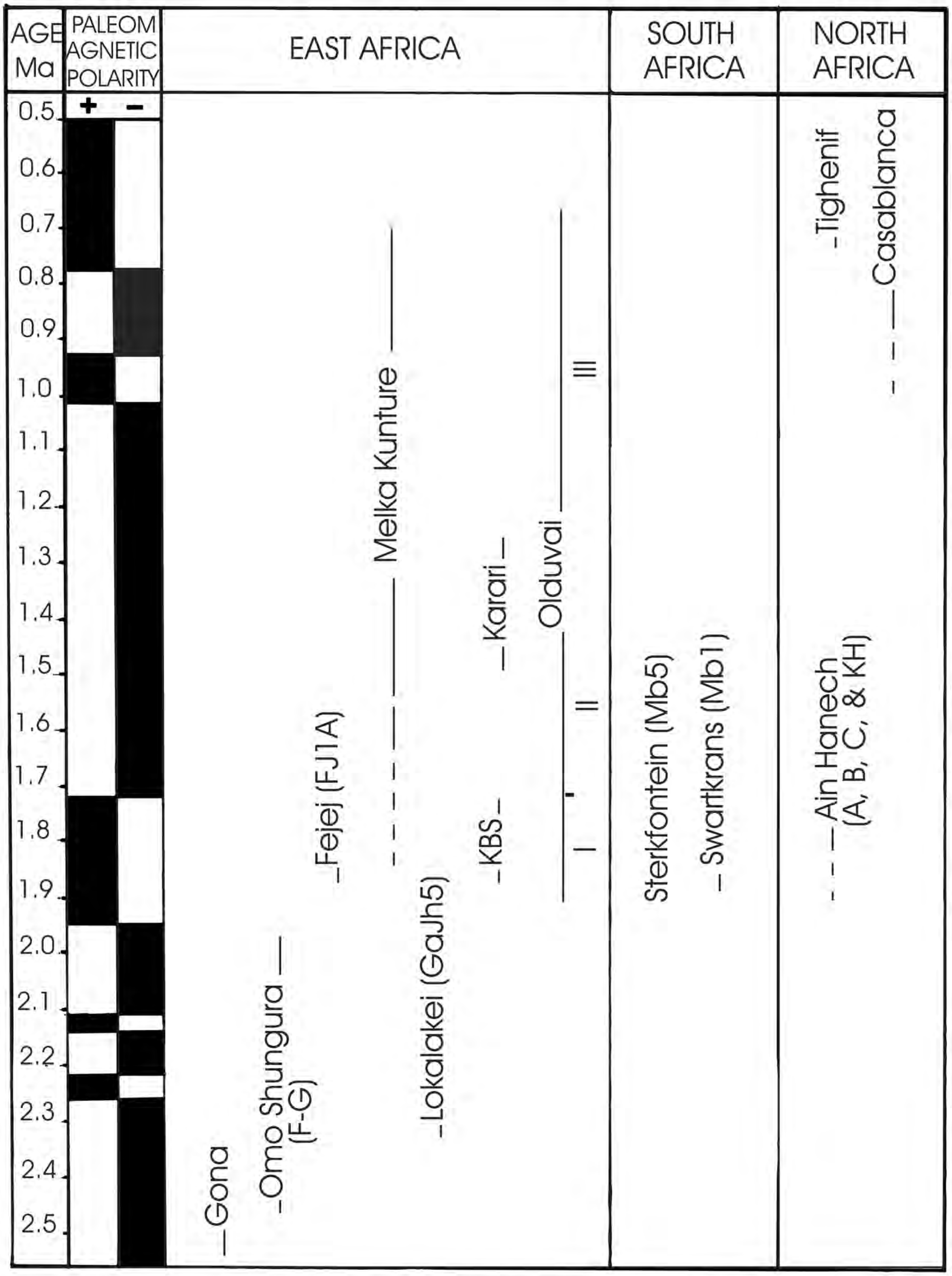
Figure 30



30. Chronological position of the Ain Hanech sites relative to other early East African earliest archaeological sites.

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