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The Site of Ain Hanech Revisited: New Investigations at this Lower Pleistocene Site in Northern Algeria

Mohamed Sahnouni

Area de Prehistoria, University of Rovira i Virgili, Place Imperial Tarraco, 43005 Tarrogona, Spain

Jean de Heinzelin

Institut Royal des Sciences Naturelles de Belgique, 29 rue Vautier, Brussels 1040, Belgium

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New archaeological investigations have been carried out at the Oldowan site of Ain Hanech in northeast Algeria. The archaeological horizons are delineated and positioned relative to the regional stratigraphy. Preliminary palaeomagnetic analysis reveals normal polarity for the Oldowan occurrences that may be correlated with the Olduvai subchron on the indication of the vertebrate faunal biozonation. Broken up bones associated with stone artefacts and contained in a silty deposit mixed with sand and gravels were excavated from two archaeological sites. The bone assemblage includes equids, bovids, elephant, and rhinoceros, and dominated by *Equus tabeti*. Taphonomic patterns indicate that bones were buried rapidly over a period of years and while the site was occupied. The lithic artefacts are fresh and represent a coherent assemblage, including small debitage. The artefacts, made of limestone and flint, include flaked cobbles, whole flakes, various fragments, and retouched pieces. A microwear study, undertaken on pieces made of flint, indicates the use of two simple flakes and of one denticulate for meat processing. The stone artefact assemblage may be considered as a North African variant of the Oldowan.

Keywords: AIN HANECH, EARLY PALAEOLITHIC, OLDOWAN, ALGERIA, NORTH AFRICA.

Introduction

The Ain Hanech site was discovered in 1947 by the French palaeontologist Camille Arambourg in the course of his palaeotological survey of the region around the town of Sétif in northeastern Algeria (Arambourg, 1947) (Figure 1). This site yielded a Lower Pleistocene fauna associated with Mode I technology artefacts (Arambourg, 1949*a*,*b*,*c*). The fauna included elephants, equids, bovids, hippo and rhino (Arambourg, 1970, 1979). The described artefacts then consisted primarily of flaked polyhedrons, and spheroids similar to some known at Olduvai Gorge (Bed I/Lower Bed II) (Sahnouni, 1985, 1987, 1993). This was the first time that an Early Pleistocene fauna was found associated with Lower Palaeolithic artefacts in North Africa.

However, in the absence of any systematic excavation techniques and of precise documentation, several questions remained unresolved, including: (1) precise and accurate stratigraphical information regarding the site and its surroundings; (2) age of the sediments and associated materials; (3) nature of the association between fossil bones and artefacts; and (4) overall behavioural implications of the archaeological occurrences.

To explore these questions new investigations were carried out at the Ain Hanech locality in 1992 and 1993. They consisted of surveying the area, conducting archaeological excavations at areas adjacent to the original site and at newly discovered localities nearby, studying the stratigraphy and sampling for palaeomagnetic analysis, assessing taphonomic patterns of animal bones, identifying the agents responsible for the concentration of the archaeological material, and analysing the artefact assemblage.

Stratigraphy and Dating

The stratigraphical investigations were centred on the upper reaches of the Ain Boucherit valley (Figure 1). The stratigraphical divisions are still in the informal stage and need to be substantiated more precisely. In terms of regional stratigraphy, three successive sedimentary formations were recognized, plus a variety of palaeosols, calcretes and colluvia which mantle dissected surfaces (Figure 2). Only one formation is formally defined, the Ain Hanech formation.

Oued Laatach formation (informal)

This formation consists of over 100 m of poorly stratified clay–silt sediments with occasional lenses or

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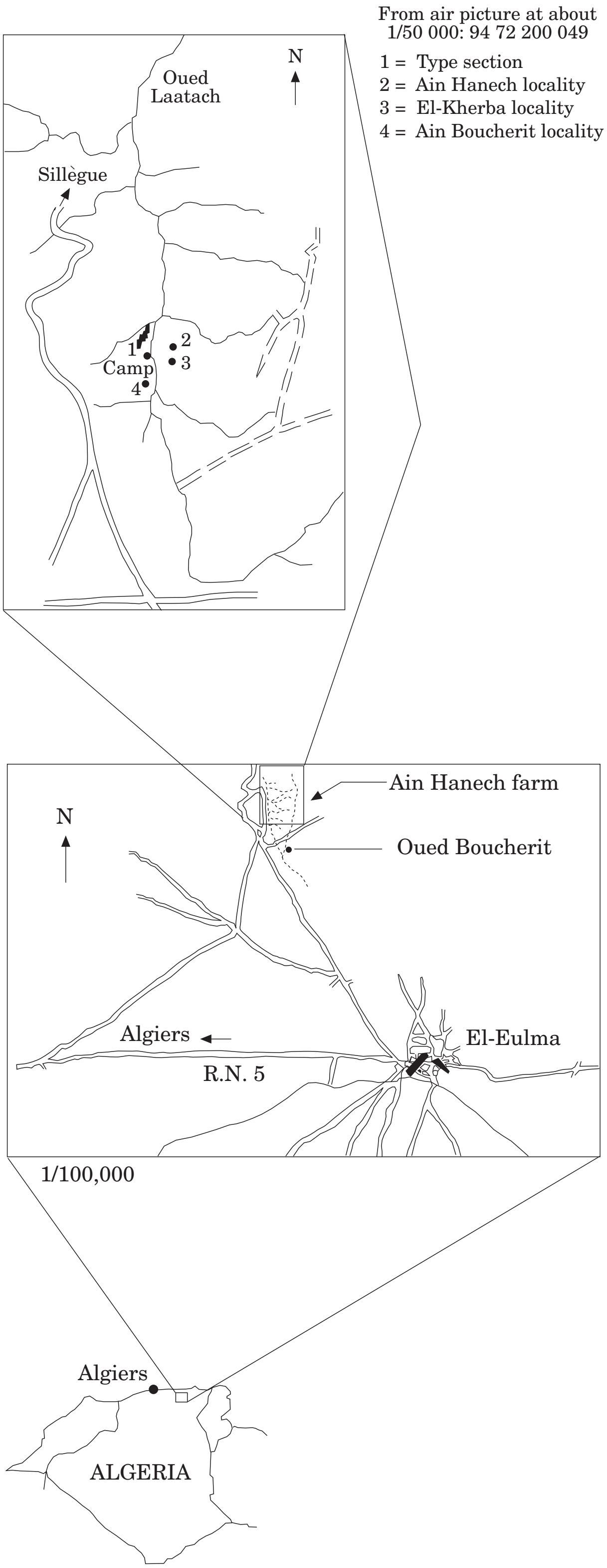


Figure 1. Geographical location of the Ain Hanech site and study area.

interbeds of sands, conglomerates, bleached horizons, and perhaps travertines. The colour is often yellowish red (5YR 5/6), at places darker or pure red ("argiles rutilantes"). This formation extends to the north, mantling the edges of the Beni Fouda basin which was not included in our study. It probably results from the internal infilling of the Beni Fouda basin when it was actively subsident; the directions of flow are unknown. The palaeotopography is presently affected by a structural slope of about 4° West.

Oued Boucherit formation (informal)

This formation is named after Arambourg's excavation of the palaeontological site of Ain Boucherit (Lower Villafranchian *c.* Upper Pliocene). It consists of rather sudden increases of coarse sands, lenses or tongues of very coarse, high energy conglomerates often cemented by carbonates; interbeds of silts commonly reddish yellow (5YR 7/6), and interbeds of lacustrine limestone. The fossil fauna recovered at Ain Boucherit derives from the upper part of this formation. Fossil animal bones were encountered at different places in the same formation. The direction of flow of the sediments is perceptible by ample evidence of sedimentary slope of interbeds facing south in a context of high energy deposits, the rapid infilling of a structural depression in front of the Tellian Atlas.

Ain Hanech formation (formal)

This formation is named after Arambourg's excavations of the site of Ain Hanech, on the right bank of Ain Boucherit and extended to the type section on the left bank. The lower contact with the preceding formation is almost everywhere concealed. It is apparently erosional. The change of sediments (texture and colour) and of diagenetic processes is diagnostic.

The type section on the left bank of Ain Boucherit is 30 m thick, of which the central part is covered (Figure 3). The sedimentation turned cyclothemic, fluvio-riverine with temporary expanses of very shallow water. The direction of flow of the sediments might have turned north. We recognized five to six sedimentary units: O=upper contact only; P and Q=from coarse gravel to clay–silt, thick, complex; R, S, and T=more regularly cyclothemic each with a stratified medium energy lower part, and a silty somewhat weathered upper part. The description of the type section is given in Appendix 1; lateral correlations are restricted to excavated areas at visible distance.

However, it is clear that we have to deal with a succession of stabilizing floodplains near the end of the infilling of some intramontane basin, possibly the same Beni Fouda basin as before after several episodes of tilting. In such a palaeogeographical context, we can

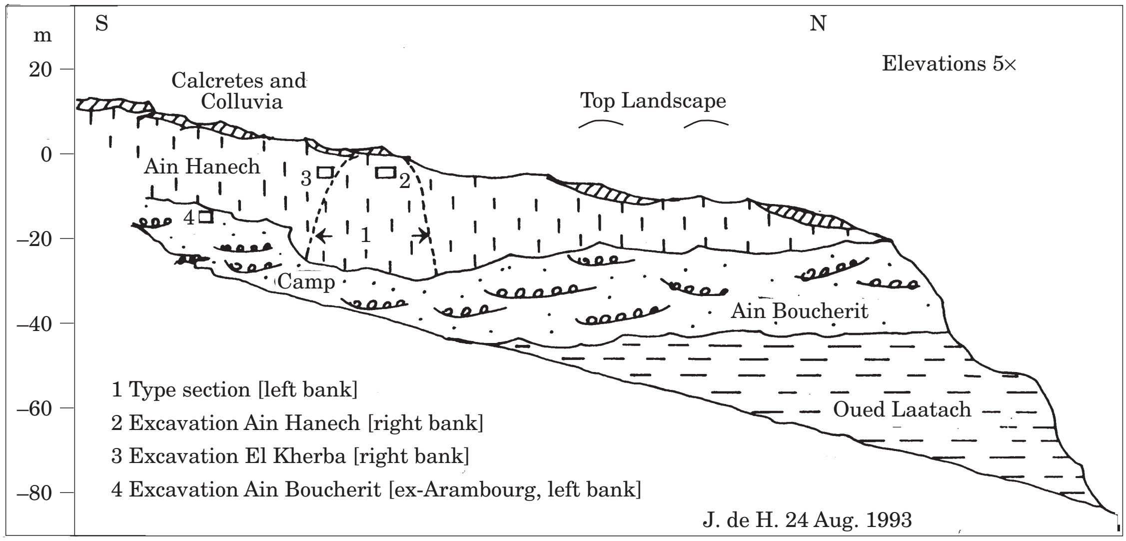


Figure 2. Synthetic view of the regional stratigraphy.

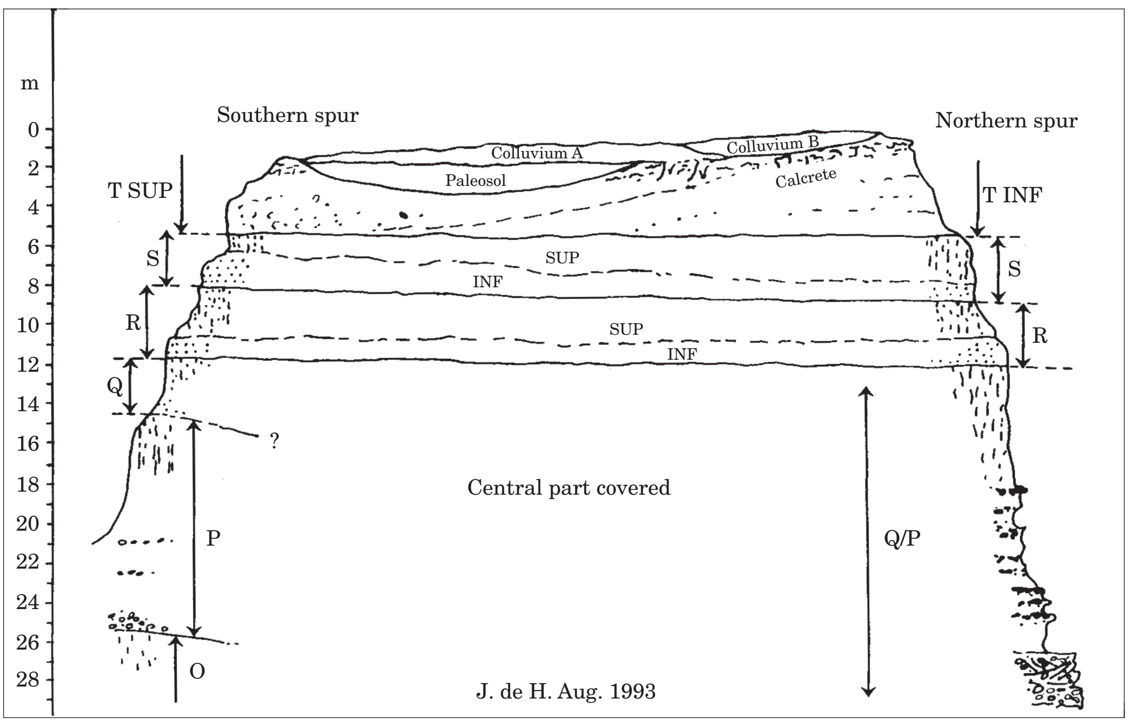


Figure 3. Ain Hanech formation type section.

visualize broad expanses of flat land and changing networks of fluvial distributary channels, among which early man wandered in search of food supply. Under a probably mild climate, a variety of biotopes were available, from shallow waterplaces to marshes, grass, shrubs and forest galleries and correspondingly a variety of faunal assemblages. The foregoing situations derive from the interpretations of the archaeological profiles that follow.

Complex of surfacial formations (undefined)

The complex of surfacial formations starts with the progressive dissection of the landscape. The upper part of the Ain Hanech type section illustrates the variety of features, including pebbles and gravels variously incorporated, several calcretes (crusts, blocky, ruin-shaped), decalcifying palaeosol and lateral pendants, colluvia varying in colour and content. The calcrete

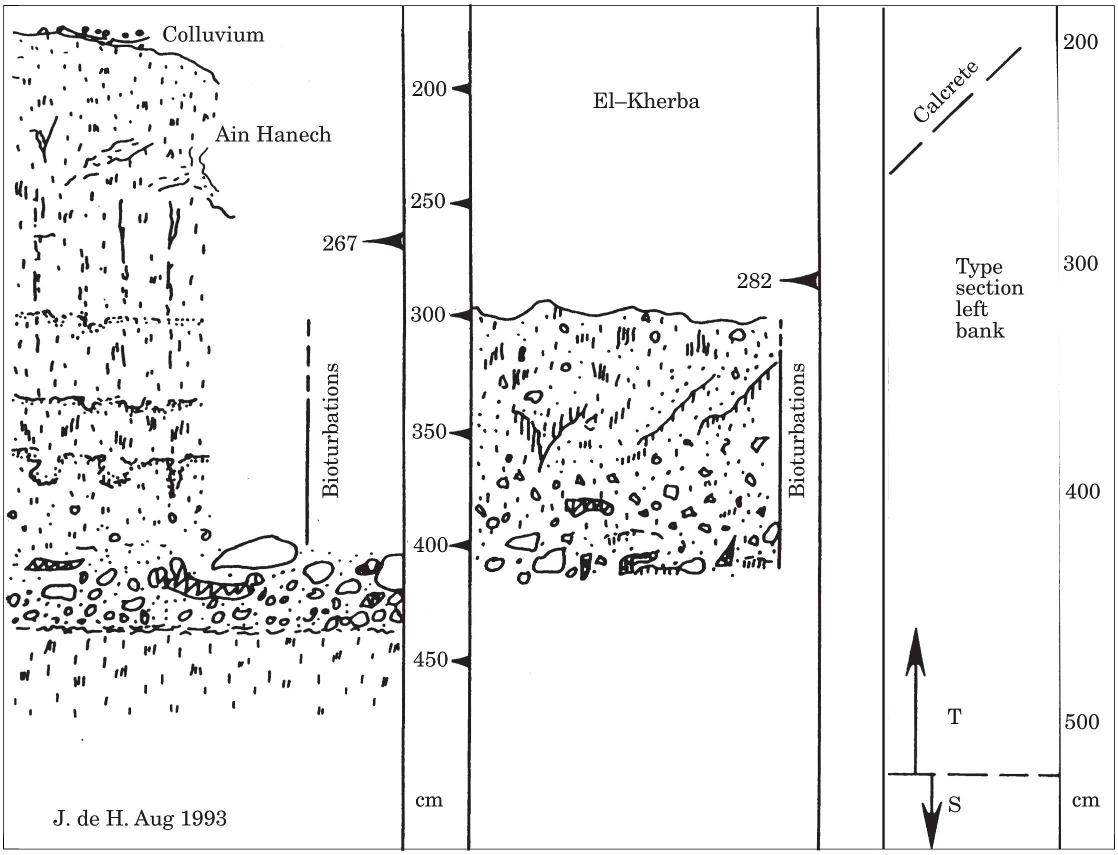


Figure 4. Stratigraphical profiles of the archaeological localities, and their correlation with the Ain Hanech formation type section.

cementation sealed the southern part of the Beni Fouda Basin from Ain Boucherit locality to the town of El-Eulma in the south. Later deposits, consisting principally of Capsian sites (human occupation occurring in the Late Palaeolithic or Epipalaeolithic) are on buttes and interfluves.

Stratigraphical profiles of archaeological localities

The stratigraphical profile of Ain Hanech locality, a total thickness of about 3 m, from base to top, includes the following features (Figure 4). (1) At the basis a layer of finely mottled silt with few calcic grains. The colour is white (10YR 8/1). There is no soil structure. The upper contact is marked by a thin calcic layer, perhaps a secondary deposit. (2) There is very heterogeneous and heterometric gravel in a mixture of sand, calcic granules, silt lenses. Fossil bones between gravels bear pressure marks and deterioration. The mode of transportation of large (multidecimetric) blocks is in question, they are probably manuports. (3) Mottled white (10YR 8/2) silts cap the gravel layer described above; they contain animal bones and stone artefacts. (4) The mottled silt is overlaid by three successive sandy layers interbedded with mottled silt. Traces of bioturbation diminish from base to top. (5) The upper part is 1·20 m thick and consists of mottled white (10YR 8/2) and light reddish brown silts (5YR 6/4). This layer includes vertical traces of roots and vague reduced traces of tree stumps.

The other excavated locality is the newly discovered site of El-Kherba situated about 350 m south of the classic site of Ain Hanech. The deposits are about 1·20 m thick, and are characterized by an unusual mixture of totally unsorted sediment, vaguely less coarse near the top, loaded with rolled and angular gravels (Figure 4). Artefacts, chips of stone and bones are in various positions, incorporated in a mottled silty matrix; there are mottles and carbonate lumps, more or less decalcified, traces of decayed organisms and trampling. In the upper part, larger mottled structures simulate sliding or mud flow. The colour near 0·60 m depth is yellow (10YR 7/6) to very pale brown (7/4), reddish yellow (7·5YR 7/6), and pure white. The colour near 1·10 m depth is light grey (10YR 7/2) and more reduced, pure white.

Based mainly upon direct altimetric evidence, a correlation of Ain Hanech and El-Kherba excavations with Unit T of the Ain Hanech formation type section on the left bank is highly probable. There are slight differences in facies and, as usual in fluviatile deposits, some overlap in time and heterochrony can be expected within a single unit.

Stratigraphical position of the Acheulean occurrences

Acheulean occurrences were suspected to be associated with the Oldowan when some participants in the II Panafrican Congress collected several bifaces from the surface in the immediate vicinity of Ain Hanech excavation (Arambourg, 1953, 1955; Arambourg & Balout, 1952). Currently, based upon stratigraphical as well as archaeological evidence, we firmly believe that Acheulean occurrences are entirely independent from the Ain Hanech Oldowan culture proper. It is in the same general area that isolated surface finds of Acheulean bifaces were collected by one of us (M.S.), some of which bear calcrete concretions. There is no doubt that those bifaces derive from calcretes, palaeosols and colluvia on dissected surfaces, located higher up in the stratigraphical sequence. They have no relationship whatsoever in time and space with the Oldowan horizons; therefore, they represent a later phase of hominid occupation.

Dating

Sediments from the Ain Hanech type section on the left bank as well as from the archaeological horizon on the right bank were sampled for palaeomagnetic analysis by one of us (MS), and thereafter analysed by F. H. Brown (University of Utah). The results reveal a shift from reversed polarity in units P, Q and R to normal in unit S and those containing the Oldowan occurrences (Figure 5). Taking into account the Villafranchian affinities of the vertebrate fauna (Table 1) and the archaeological context, the normal polarity is most likely the Olduvai (N) subchron, occurring between 1·95 and 1·78 Ma (McDougall *et al.*, 1992), rather than the onset of Brunhes (N) chron. Both faunal and archaeological arguments support this interpretation. Palaeontologically, mammal taxa of biostratigraphical interest represented at Ain Hanech, including *Mammuthus meridionalis*, *Equus tabeti*, *Sivatherium maurusium*, and *Kolpochoerus phacochoeroides*, are assigned to the Early Pleistocene (Arambourg, 1970, 1979; Geraads, 1981; Eisenmann, 1984, 1985; Sahnouni & Hadjouis, 1987). Furthermore, comparisons with faunal remains from East Africa indicate that the Ain Hanech locality may be correlated with Olduvai Bed I and Lower Bed II (Arambourg, 1970, 1979; Coppens, 1972) and dated between 2 and 1·47 Ma based on the absence of *Anancus*, the persistence of *Sivatherium*, and the presence of *Mammuthus* and *Equus* (Coppens, 1972). Archaeologically, the Ain Hanech artefact assemblage is very similar to that of the East African Oldowan (Sahnouni, 1993, 1996).

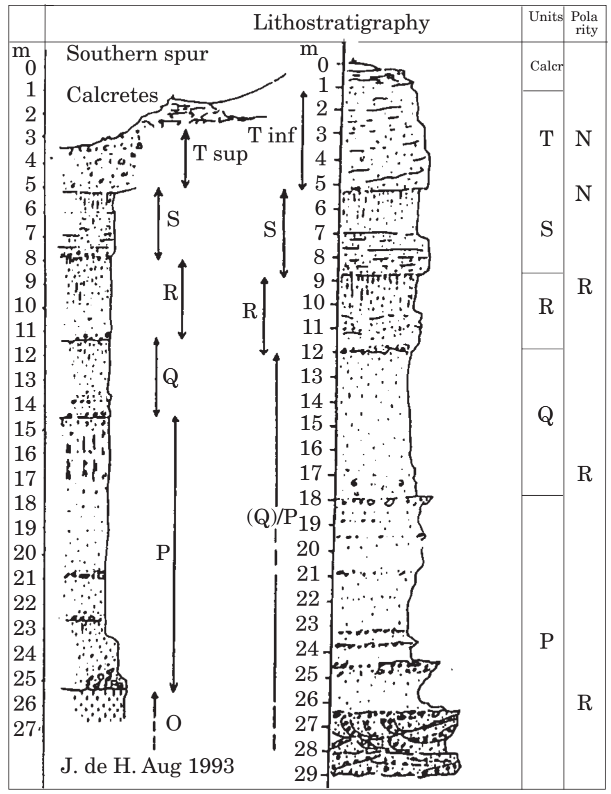


Figure 5. Reference profiles of the Ain Hanech formation geomagnetic. The polarity of the archaeological site is equated to T.

Table 1. Faunal species from Ain Hanech previous assemblage. Frequencies are calculated based on Arambourg's data (Arambourg, 1970, 1979)

Animal species	NISP	%
Mammuthus meridionalis	9	0·63
Ceratotherium mauritanicum	11	0·77
Equus tabeti	1286	90·69
Hippopotamus amphibius	9	0·63
Kolpochoerus phacochoeroides	2	0·14
Sivatherium maurusium	16	1·12
Girrafa (?) *pomeli*	4	0·28
Bos bubaloides	9	0·63
Bos praeafricanus	12	0·84
Numidocapra crassicornis	1	0·07
Gazella pomeli	23	1·62
Taurotragus gaudri	2	0·14
Canis cfr. atrox	3	0·21
Crocuta crocuta	6	0·42
Oryx el eulmensis	2	0·14
Alcelaphus sp.	2	0·14
Gorgon mediterranus	21	1·48
Total	1418	100

Excavations

Two archaeological localities were excavated; the classical site of Ain Hanech and that of El-Kherba (Figure 6). At Ain Hanech, the excavations were expanded northward in an area adjacent to Arambourg's trench. An area of 50 m^2 by 1 m depth was excavated. The other excavated area was the newly discovered archaeological locality of El-Kherba, located 350 m southwest of the original Ain Hanech site. Here, an area of 12 m^2 by 0·44 m depth was excavated. At both localities a rich archaeological

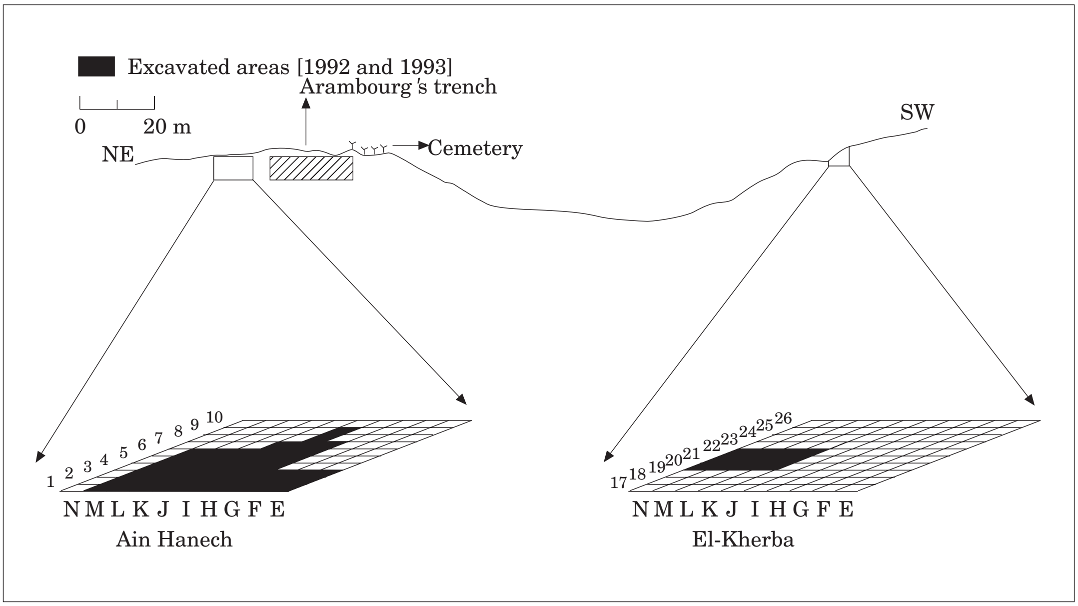


Figure 6. The grid system and the excavated areas at Ain Hanech and El-Kherba during the 1992 and 1993 field seasons.

Table 2. Archaeological remains recovered in the excavations at Ain Hanech and El-Kherba

Sites	Excavated areas	Fossil bones	Stone artefacts	Total
Ain Hanech	50 m^2 × 1 m	355	2157*	2512*
El-Kherba	12 m^2 × 0·44 m	84	510*	594*
Both sites	62 m^2 × 1·44 m	439	2667	3106

*These numbers include artefacts below 2 cm of length.

material was recovered, although in low density. On average, the density is 50 archaeological finds per m^2 (50·2/m^2 at Ain Hanech and 49·5/m^2 at El-Kherba). A volume of 95·28 m^3 of sediments including overburden was removed, 90 m^3 from Ain Hanech and 5·28 m^3 from El-Kherba.

A total of 3106 archaeological remains were recovered, including 439 fossil bones and 2667 stone artefacts (Table 2). At Ain Hanech 2512 finds were unearthed, consisting of 355 fossil bones and 2157 artefacts (including small fragments). The fossil bones include 91 identifiable elements. At El-Kherba the archaeological remains included 84 fossil bones and 129 stone artefacts (excluding small fragments).

There is no doubt in our mind that lithic artefacts and fossil bones compose a spatio-temporal association and that they potentially reflect behavioural events. The excavations at Ain Hanech have exposed a partial skeleton of a large-sized animal in a curled articulated position and associated with several stone artefacts (Figure 7, square J2). The skeleton includes the scapula, vertebra and pelvis. At El-Kherba the excavations uncovered the association of an elephant bone surrounded with stone artefacts (Figure 8, square M22). The study of the faunal remains and their behavioural implications is currently under way.

Faunal Remains

A total of 439 fossil animal bones were recovered in the recent excavations undertaken at Ain Hanech (excluding small fragments), 84 specimens of which are from El-Kherba. Only 72 fossil bones can be determined anatomically (61 elements from Ain Hanech and 11 from El-Kherba), and 19 bones, mostly teeth, are taxonomically identifiable (Table 3). The following preliminary taxa are recognised by palaeontologist Y. Saoudi (Sahnouni *et al.*, 1996): *Equus tabeti* (NISP=73·5%), *Hippopotamus* sp. (5%), Bovidae sp. (15·7%) and *Gazella* sp. (5%). With the exception of *E. tabeti*, bone identification at the species level is not possible due to the fragmentary condition of the material. As can be noted, the bulk of the fauna is assigned to *E. tabeti*, which was also very abundant (NISP=90·6%) in the previously known assemblages (Arambourg, 1979).

Deposition of Archaeological Material

Ain Hanech archaeological occurrences were thought by several researchers to be unsuitable for behavioural inquiry. For instance, Professor J. Desmond Clark in a recent publication, synthesizing the North African Lower Palaeolithic, wrote about them: “They are in secondary context and usually, but not always, fluvially abraded”, and he went on to say, “it is surprising, however, that no other artifacts—flakes, for example—were found and it may be that all lighter

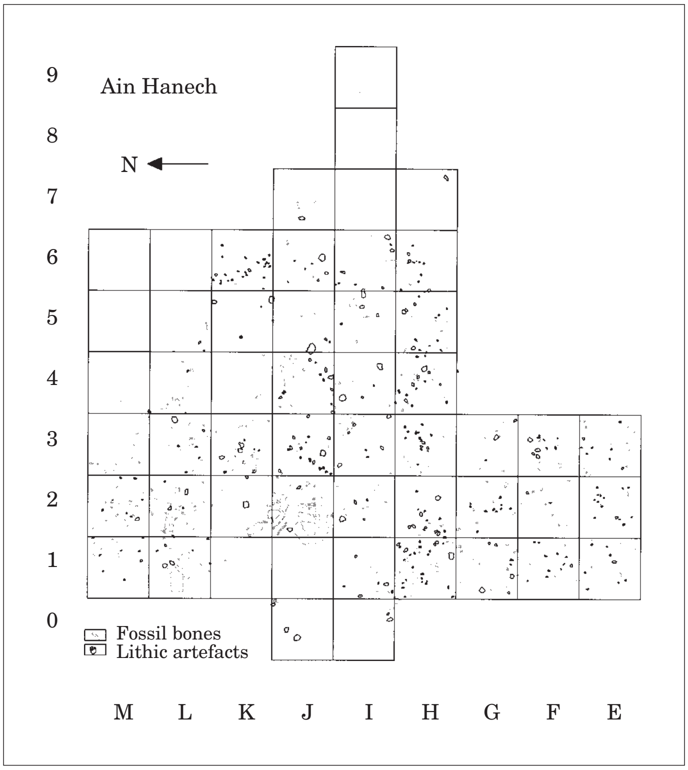


Figure 7. Horizontal distribution of the archaeological material at the Ain Hanech locality.

material was fluvially transported out of the area of the subsequent excavation. Alternatively, these heavier artifacts could have come downslope from the original activity area" (Clark, 1992: 20). Similar statements were common and widespread among scholars in the African Early Stone Age (Keeley, Schick, Toth, pers. comm.).

One of the goals of the recent investigations at Ain Hanech was to shed light on the question, "Which agents, geological or behavioural, were primarily responsible for the accumulation of Ain Hanech archaeological materials?" This significant question is tackled by inspecting Ain Hanech and El-Kherba archaeological materials in terms of sedimentary matrix in which they were buried, taphonomic conditions of bones and the concentrations of artefacts.

Sedimentary context of archaeological remains bearing strata

The sedimentary matrix is formed by fine grained particles, primarily silt loaded with a heterometric and heterogeneous phase. These sediments include the following size classes: (1) granules and small pebbles (>0·25 mm)=39%; (2) fine sand (0·25–0·104 mm)=19%; (3) very fine sand and coarse silt (0·104–0·045 mm)=35%; and (4) medium silt to clay (<0·045 mm)=7%. Silty sediment besides eolian deposits are most common in flood basins, deposited at lower flow velocity (Hassan, 1978). Therefore, based on this line of evidence, the Ain Hanech archaeological occurrences appear to have been subject to minimal hydraulic reworking. Observed disturbances are bioturbations, flux and trampling on-the-spot, together with the inclusion of coarse heterometric elements, among them artefacts, manuports and bones.

Vertical dispersion of archaeological remains

The excavations at both Ain Hanech and El-Kherba reveal that the archaeological occurrences are spread in a relatively thick stratigraphical layer. At Ain Hanech the archaeological material is contained in a 1·20 m thick bedded silt and sand. However, the bulk of stone artefacts and bones are densely concentrated within 20 cm in the bottom of this archaeological horizon (Figure 9). The remaining material is scattered higher up. It is remarkable that at both sites the floor of the occupation is convex or oblique (compare Figures 9 and 10). This is suggestive of levee situations inside a low floodplain and repeatedly drowned at high water. It is especially so at Ain Hanech while the picture is less complete at El-Kherba. Although only a thickness of 0·44 m has been excavated at El-Kherba, the vertical distribution of the occurrences indicates comparable patterns (Figure 10). Yet, at both localities it seems that post-depositional factors, such as trampling and bioturbation, might have affected the original

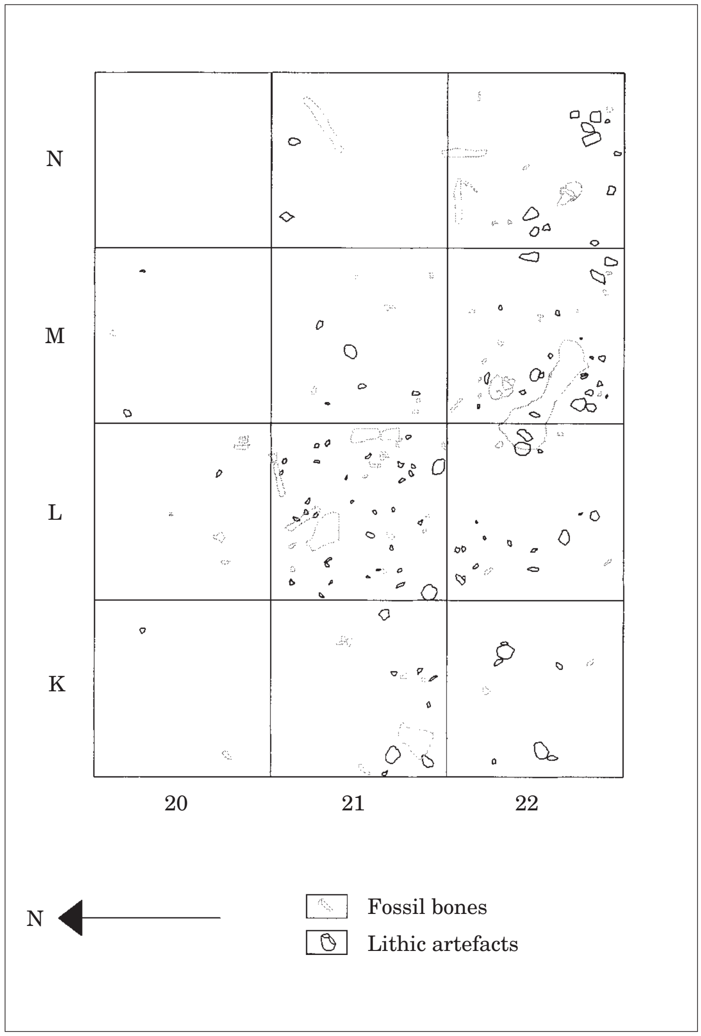


Figure 8. Horizontal distribution of the archaeological material at the El-Kherba locality.

Table 3. Frequencies and status of Ain Hanech and El-Kherba bone remains examined in this study

Status	Ain Hanech	El-Kherba	Total
Total bone remains	355	84	439
Bones anatomically defined	61	11	72
Bones taxonomically defined	17	2	19
Observed weathered bones	288	39	327
Observed abraded bones	50	0	50

disposition of the material; preliminary data suggest a single or short-term occupation of the site by hominids.

Taphonomic states of bones

Taphonomic states of bones were assessed with regard to weathering, abrasion, skeletal part representation, orientation and inclination. In terms of subaerial exposure, patterns of weathering were observed on bones recovered at both localities. The method used is the one proposed by Behrensmeyer (1978), based on descriptions provided in this publication and on comparisons with a set of casts of bone surfaces at different weathering stages provided through J. Sept by A. K. Behrensmeyer. Because excavations at Ain Hanech and El-Kherba sites have yielded very few complete bones, bone fragments were also examined. Only well preserved specimens and those displaying mechanical weathering features were considered in the analysis. Bones that showed other aspects of taphonomic modifications, such as chemical alteration and hydraulic abrasion, were not included in this study.

Evidence of temporary subaerial exposure is present in both Ain Hanech and El-Kherba faunal assemblages. Fossil bones from both sites are characterized by four weathering stages, namely 0, 1, 2 and 3 (Figure 11). Surface bones of stage 4 or stage 5 were not observed. At Ain Hanech, the majority of bones showed weathering patterns of stages 1 and 2. Nearly

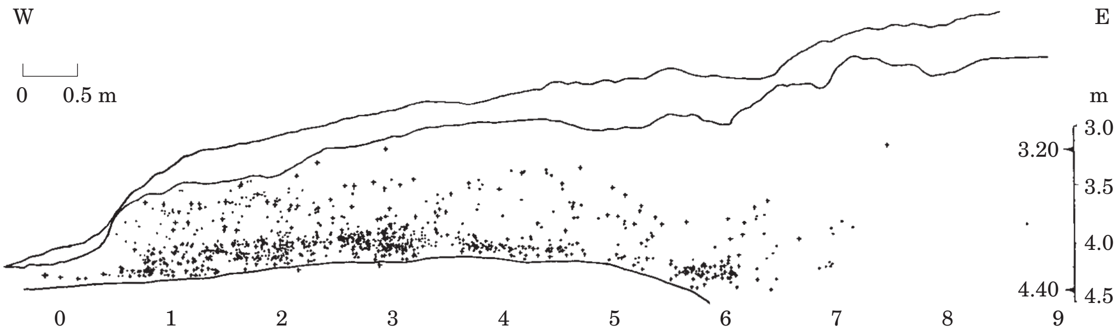


Figure 9. Vertical dispersion of the archaeological material at the Ain Hanech site. ●, Bones; +, artefacts.

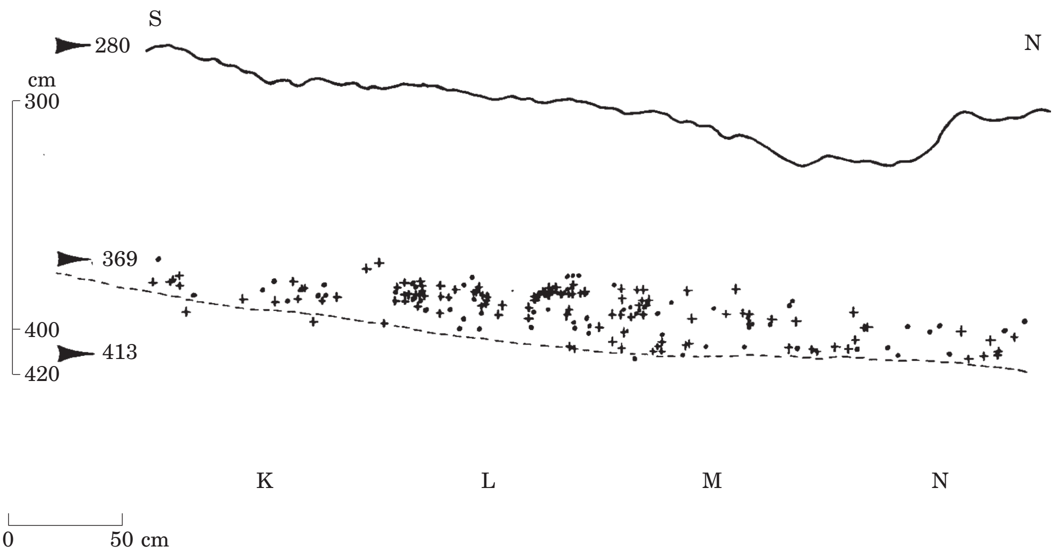


Figure 10. Vertical dispersion of the archaeological material at the El-Kherba site. ●, Bones; +, artefacts.

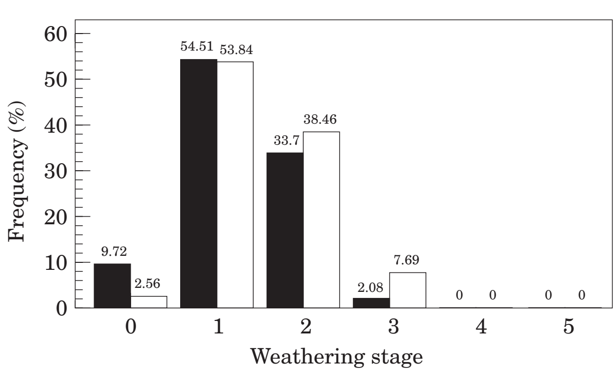


Figure 11. Ain Hanech (288) and El-Kherba (39) bone weathering patterns. Classes according to Behrensmeyer, 1978. ■, Ain Hanech; □, El-Kherba.

10% of bones are very "fresh" and display neither cracking nor flaking. Very few fossil bones are characterized as stage 3 (2%). Similar weathering patterns were noted in fossil animal bones exhumed at the site of El-Kherba. Weathering stages 1 and 2 characterize the bulk of the bones, representing 53% and 38%, respectively. Bones with very fresh surfaces are rare (2%), and those exhibiting weathering stage 3 are relatively more common (7%). Since weathering stages are indicative of subaerial exposure of bones prior to their burial (Behrensmeyer, 1978), fossil bones from Ain Hanech and El-Kherba were probably exposed to climatic conditions for less than 3 years after the death of the animals.

A quantity (50) of bone fragments from the Ain Hanech and El-Kherba assemblages exhibit some alterations that might be assigned to abrasion. All these abraded specimens are small bone fragments. Their mean length is approx. 46 mm for bones from Ain Hanech and about 36 mm for those from El-Kherba. Since these bone fragments show various amounts of deterioration, abrasion was assessed as: (1) fresh or non-abraded; (2) slightly abraded (very little rounding of the bone surface); (3) moderately abraded (moderate rounding of the bone surface, yet its anatomical details are present); and (4) heavily

Table 4. Skeletal parts represented in Ain Hanech and El-Kherba bone assemblages with references to Voorhies groups

Voorhies groups	Skeletal parts	Ain Hanech *N*	Ain Hanech %	El-Kherba *N*	El-Kherba %
Group I	Ribs (fragments)	3	5·66	0	0
	Vertebra (including fragments)	7	13·20	0	0
	Scapulae	3	5·66	1	14·28
	Phalanges	8	15·09	1	14·28
	Carpal and tarsal bones	4	7·54	0	0
	Femorae	2	3·77	1	14·28
	Subtotal	27	50·92	3	42·84
Group II	Tibia	0	0	1	14·28
	Metapodial	1	1·88	1	14·28
	Pelvis	2	3·77	0	0
	Subtotal	3	5·65	2	28·56
Group III	Teeth	18	33·96	2	28·57
	Teeth fragments	5	9·43	2	28·57
	Subtotal	23	43·39	4	57·14
	Total	53	100	7	100

abraded (accentuated rounding of the bone surface and loss of anatomical details).

The slightly abraded specimens are the most abundant. Neither moderately abraded nor heavily abraded specimens are more frequent than 10%. El-Kherba faunal assemblage includes less abraded bone fragments than Ain Hanech. The bulk of the specimens are slightly abraded, representing 27% of the total.

The abraded elements of both Ain Hanech and El-Kherba faunal assemblages are bone fragments; there is not a single abraded articulated or complete bone. These fragments might have been introduced from close distance in the course of channel aggradation or simply result from local trampling. Indeed, abraded bones are usually found within floodplain deposits as a consequence of channel lateral aggradation and bone reworking through bank erosion in a fluvial system (Behrensmeyer, 1982; Behrensmeyer & Chapman, 1993).

Fossil bones from Ain Hanech and El-Kherba were inspected for sorting of skeletal parts, referring to results of experimental investigations conducted by Voorhies (1969). Table 4 displays the skeletal elements represented at both faunal assemblages. They vary from elements transported in the first place, such as ribs and vertebra, to those in lag deposits, such as teeth. Other skeletal parts, resistant to hydraulic transport, such as skull bones (rhinoceros, horse and gazelle), were also recovered previously from the same archaeological horizon adjacent to the modern Ain Hanech excavations (Balout, 1958; Arambourg, 1970). Since Ain Hanech and El-Kherba faunal assemblages incorporate skeletal parts from all three Voorhies Groups, it is unlikely that bones were subject to hydraulic sorting. These data corroborate other evidence, that consists of a partial skeleton of a large animal, including the pelvis, vertebra and scapula recovered at Ain Hanech in anatomical position.

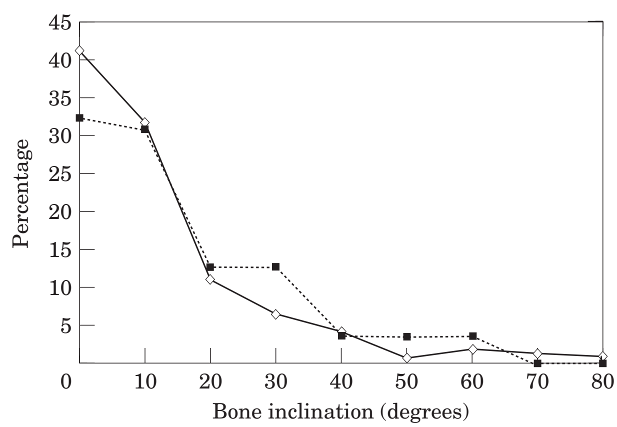


Figure 12. Ain Hanech (—◇—; N=305) and El-Kherba (···■···; N=55) bone inclination patterns.

Preferred orientation and high inclination of bones may provide valuable indications of some disturbing factor at work within an archaeological horizon (Shipman, 1981). To assess the orientation and inclination of Ain Hanech and El-Kherba bones, measures of these variables were systematically taken, using a compass and an inclinometer, in the field prior to their collection from their sedimentary matrix. Diagrams of bone orientation were calculated but they were not significant. A faint preferential orientation north–south at Ain Hanech is denoted, seemingly due to a gentle water current, which agrees with the field observations of sedimentation subcycles sand to silt.

Bone inclinations from Ain Hanech and El-Kherba archaeological localities are not pronounced. The majority of specimens have an inclination less than 15°, 73% for Ain Hanech bones and 63% for El-Kherba bones (Figure 12). Based on indications provided by flume experiments (Shipman, 1981), this would suggest that bones at both sites have been affected by low velocity flow. Otherwise, the inclination of bones might

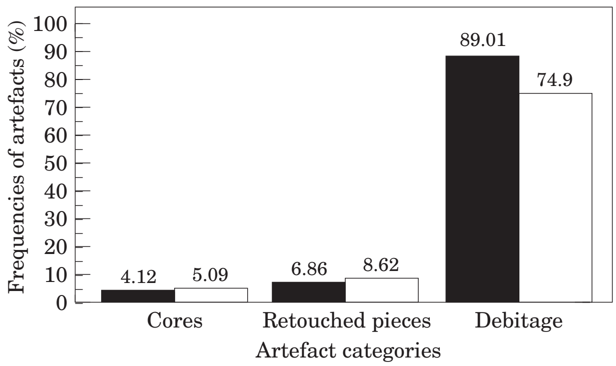


Figure 13. Ain Hanech (■; N=2157) and El-Kherba (□; N=510) artefact assemblage composition.

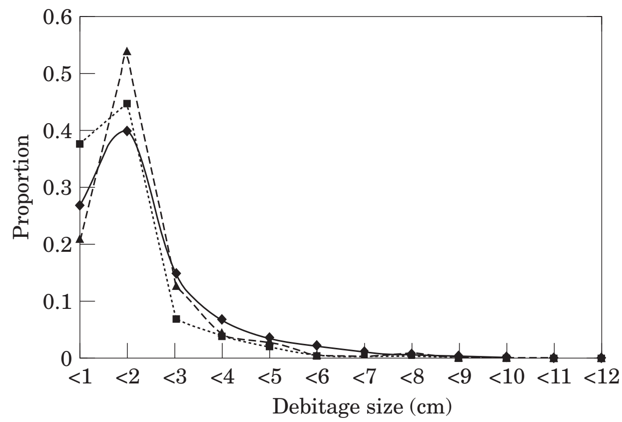


Figure 14. Ain Hanech (···■···; N=1540) and El-Kherba (- - -▲- - -; N=336) debitage size distribution with reference to the experimental curve (—◆—). Experimental curve according to Schick (1986).

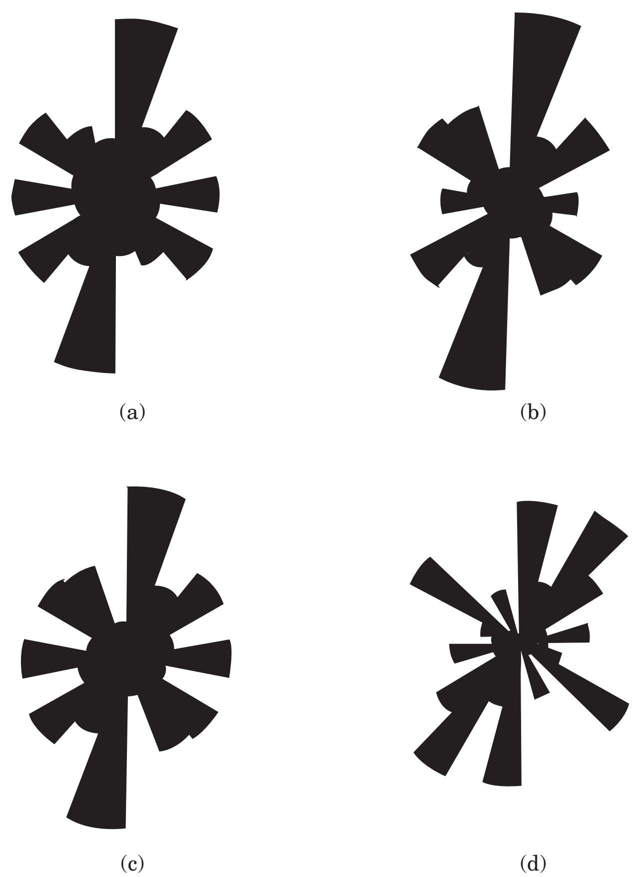


Figure 15. Rose diagrams showing stone artefact orientation patterns. (a) Ain Hanech all artefacts (N=338), (b) Ain Hanech artefacts >4 cm (N=112), (c) Ain Hanech <4 cm (N=226), and (d) El-Kherba all artefacts (N=57).

as well be attributed to bioturbation and trampling (Behrensmeyer, 1982). Microstratigraphical evidence shows that these two actions indeed occurred at both archaeological localities.

Concentration of artefacts

Ain Hanech and El-Kherba stone artefact concentrations were investigated according to a set of analytical criteria, designed by Schick (1986) in order to gauge disturbances caused by post-occupational natural agents. These criteria involve artefact assemblage composition, debitage size distribution, patterns of orientation and inclination, and spatial configuration of artefacts in the sites.

Both Ain Hanech and El-Kherba assemblages exhibit a coherent artefact composition. Figure 13 presents stone artefact composition of the assemblages. As can be seen in the histograms, at both localities the debitage category depicts the highest frequency, while cores represent the smallest.

Analysis of size distribution of flakes and fragments at both Ain Hanech and El-Kherba localities indicates no major disturbance (Figure 14). Both size distributions resemble the one produced by experimental knapping made by Schick (1986). Thus, Ain Hanech and El-Kherba sites seem to represent areas where early hominids did manufacture their artefacts. The debitage was probably rapidly buried subsequently by low velocity floods.

Regarding the rose diagrams of artefact orientation at El-Kherba and Ain Hanech, the patterns are similar to those of bone orientation, completely scattered in the first case and faintly orientated north–south in the second case (Figure 15).

Figure 16 displays artefact inclination at both archaeological localities. At Ain Hanech, most of the artefacts are only slightly inclined. Nearly 70% of the artefacts have a dip ranging between 0 and 10°; slightly more than 20% show a dip from 20 to 30°; less than 10% of the total assemblage has a dip greater than 30°. Overall, these inclination patterns indicate low velocity currents, if any. The inclinations at El-Kherba show similar patterns, yet with minor differences. 68% of artefacts have a dip varying between 0 and 10°; nearly 25% a dip between 20 and 30°; only less than 7% of a dip greater than 30°. As at Ain Hanech, El-Kherba artefacts are only slightly inclined, suggesting that they

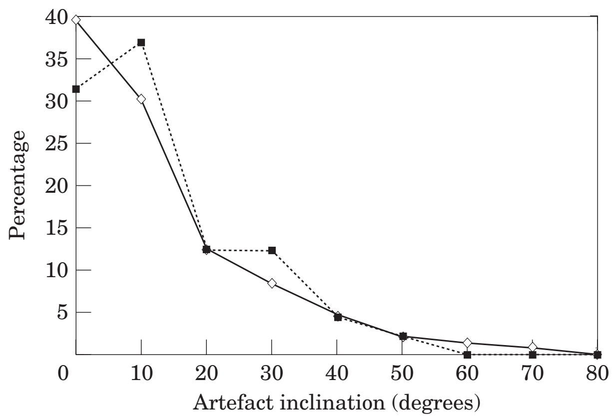


Figure 16. Diagram showing Ain Hanech (—◇—; N=363) and El-Kherba (- - -■- - -; N=89) stone artefact inclination.

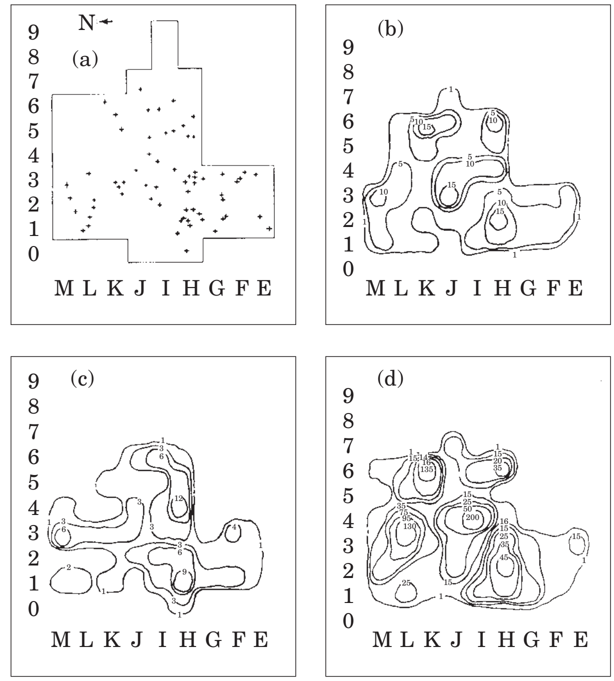


Figure 17. Spatial distribution and contour intervals for density of Ain Hanech artefacts according to their size categories. (a) Cores; (b) debitage between 2 and 4 cm; (c) debitage between 4 and 8 cm; (d) debitage <2 cm.

were not affected by high velocity currents. Bioturbation and trampling might also be responsible for at least a part of the relatively high inclination.

Finally, we inspected the spatial configuration of artefacts. A trend surface analysis of the site distribution artefact patterns, using the excavation grid system, was conducted for Ain Hanech. (Since excavations at El-Kherba were very limited, artefact spatial configuration at this locality is discarded.) Three categories of artefacts were considered based on their size and technological classification, including (1) cores regardless of their size (3·5%); (2) debitage ranging between 80 and 40 mm length (6%); (3) debitage ranging between 40 and 20 mm length (13%); and (4) all debitage below 20 mm maximum dimension (76%). With the exception of minor differences, the proportion of these debitage size categories are comparable to those produced by flaking experiments (Schick, 1986: 23–27).

Figure 17 shows distribution and contour intervals for density of Ain Hanech artefacts according to artefact size categories described above within adjacent metre square units. Overall, artefact spatial configurations do not exhibit any spatial trends produced by fluvial modification as observed in simulation of hydraulic site disturbance, such as linear patterns of artefacts with long axis, core-rich area, concentration of high proportion of debitage, spatial gaps, gradation with regard to artefact types and composition, and downstream trends in assemblage composition (Schick, 1986). Rather, our spatial trends are indicative of minimal disturbance.

In summary, Ain Hanech and El-Kherba cultural material were both minimally disturbed and probably preserve behavioural information. The archaeological remains were concentrated in a relatively thick horizon, suggestive of a short-term occupation, after which bones and artefacts moved in the sediments due to bioturbation. Furthermore, they are contained in a fine sedimentary matrix buried in some floodplain deposit at a low velocity regime. However, minimal site reworking and rearrangement of small remains might have occurred. Fossil animal bones are relatively well preserved. When observable, they do not exhibit the type of cracking or flaking that implies long periods of exposure. Anatomically, the bone assemblage includes all categories of skeletal elements, eliminating the hypothesis of substantial hydraulic sorting. In addition, bones show neither a strongly preferred orientation nor high inclination.

Likewise, stone artefacts are very fresh, edges are sharp unless battered by percussion and in the latter case the bruised impacts, although prone to disappear by erosion, are perceptible to the eye. The assemblage composition is coherent, including cores and debitage. The debitage is overwhelmingly represented. In addition, small flakes below 2 cm exhibit a similar curve to that produced experimentally by Schick (1986), suggesting that flaking occurred at the site. The lithics do not show high inclinations, or preferred orientation patterns. In reply to prior concerns that Ain Hanech cultural remains occurred in secondary context, we state to the contrary that these occurrences are suitable for the study of early hominid behaviour in North Africa.

Artefact Assemblage

Overall presentation of the assemblage

The recent excavations yielded a total of 2667 artefacts, 2156 from Ain Hanech and 510 from El-Kherba. They

Table 5. Overall frequencies of artefact categories

Artefact categories	Ain Hanech		El-Kherba		Total	
	N	%	*N*	%	*N*	%
Flaked cobbles and cores	89	4·12	26	5·09	115	4·31
Retouched pieces	148	6·86	44	8·62	192	7·19
Whole flakes	65	3·01	18	3·52	83	3·11
Fragments	129	5·98	40	7·84	169	6·33
Subtotal	431	19·98	128	25·09	559	20·95
Debitage <2 cm	1726	80·01	382	74·90	2108	79·04
Total	2157	100	510	100	2667	100

Table 6. Frequencies of rock types according to categories of artefacts

Artefact categories	Limestone		Flint		Sandstone	
	N	%	*N*	%	*N*	%
Flaked cobbles and cores	68	12·16	45	8·05	2	0·35
Retouched pieces	36	6·44	156	27·90	0	0
Whole flakes	49	8·76	34	6·08	0	0
Fragments	90	16·10	79	14·13	0	0
Total	243	43·47	314	56·17	2	0·35

are very fresh and display a coherent assemblage composition, including cores and debitage. The assemblage is typical of Mode I Technology (simple Oldowan-type core forms and debitage) and characterized by a low degree of standardization. It incorporates the following categories: (1) flaked cobbles and cores (4%); (2) retouched pieces (7%); (3) whole flakes >2 cm (3%); and (4) miscellaneous fragments (6%). The frequencies of artefact categories at both archaeological sites are nearly similar (Table 5).

Raw materials

Artefacts from Ain Hanech and El-Kherba are primarily made of flint (56%) and limestone (43%). There are only two pieces made of sandstone. The flint comprises several colours: dark brown, black, light brown, green and grey. The dark brown and black varieties are predominant. In terms of categories of artefacts, the flaked cobbles (all varieties) are chiefly made of limestone while small cores are exclusively flaked in flint (Table 6). Interestingly, the retouched pieces are much more frequent in flint (27%) than in limestone (6%). The whole flakes are nearly equally in limestone (8%) and flint (6%). These types of rock would have been available to Ain Hanech hominids in the general vicinity of the site in the form of cobbles and pebbles. Presently, limestone cobbles can be found eroding out of the fossil conglomerates dating to the Early Pleistocene, with clasts of the same limestone in sizes and shapes like those uncovered in the excavations (Sahnouni, Schick & Toth, 1997). The lithology and original source of limestone and flint as well as the significance of their exploitation still require detailed study.

Flaked cobbles and cores

A total of 115 flaked cobbles and cores were recovered, 89 of which are from Ain Hanech and 26 from El-Kherba. The flaked cobbles (Figures 18 and 19), representing 68 specimens, are in limestone. Their maximum dimensions are relatively variable (min=44 mm, max=137 mm, mean=83·6, s.d.=15·6). With some exceptions, the initial shape of these flaked limestone cobbles is polyhedral providing natural surfaces used as striking platforms to remove flakes easily.

Technologically, the flaked cobbles are characterized by a large variability and lack of stereotype forms. For instance, they show an entire range of flaking extent, including light (flaking extending to 1/4 of the cobble surface), moderate (flaking covering from 1/2 to 3/4 of the cobble surface) and heavy (flaking covering from 3/4 to the entire surface). The lightly and heavily flaked cobbles are comparably frequent with 33%. The moderately flaked specimens represent 31%. On the whole, they preserve residual cortical areas although in variable degrees. The specimens wholly without cortex are rare, representing only 4%. The number of scar counts ranges between 2 and 30 scars, indicating the absence of standardization. The scars are obtained primarily with opposed and orthogonal flaking modes, using mostly cortical platforms. These flaking modes are indicated by the frequent presence of specimens bearing more than two striking platforms (57%). The edge angle also varies considerably (71–130°) but, overall, is obtuse with a mean of 106°.

Typologically, they may be classified into three broad categories, such as unifacial, bifacial and polyfacially flaked cobbles. The unifacially flaked cobbles (N=9) along with some bifacially flaked cobbles (N=2) (unifacial and bifacial shoppers in Mary Leakey's typological system) show minimal flaking and a fairly acute edge angle (mean=79°). The polyfacial flaked cobbles comprise three categories, namely "polyhedrons", "subspheroids" and "spheroids". The polyhedrons, the most dominant category (N=32), are moderately to heavily flaked on at least three different faces and with some relatively acute edges (mean=106°). The subspheroids (N=23) are heavily flaked usually on many more than three faces and with yet more obtuse angles (mean=112°). The spheroids, the

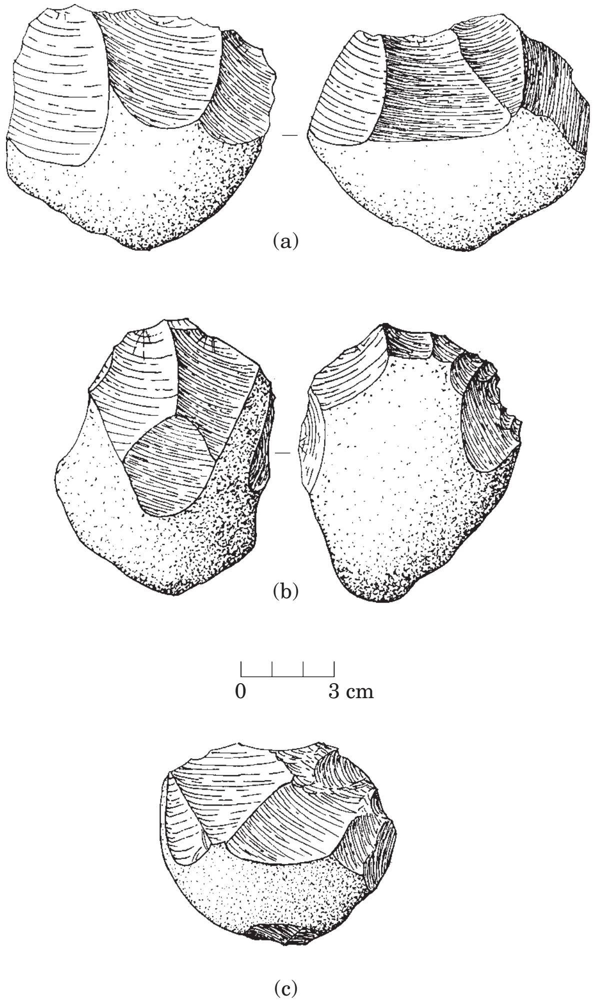


Figure 18. Examples of limestone flaked cobbles/core forms recovered in the recent excavations. (a) and (b) Bifacial core forms from the El-Kherba site (KH 93-L21-LV1-15 and KH 93-M22-MV2-11, respectively, redrawn by J. de Heinzelin); (c) a unifacial core form from the Ain Hanech site (AH 93-E2-EB1-1, drawn by J. de Heinzelin).

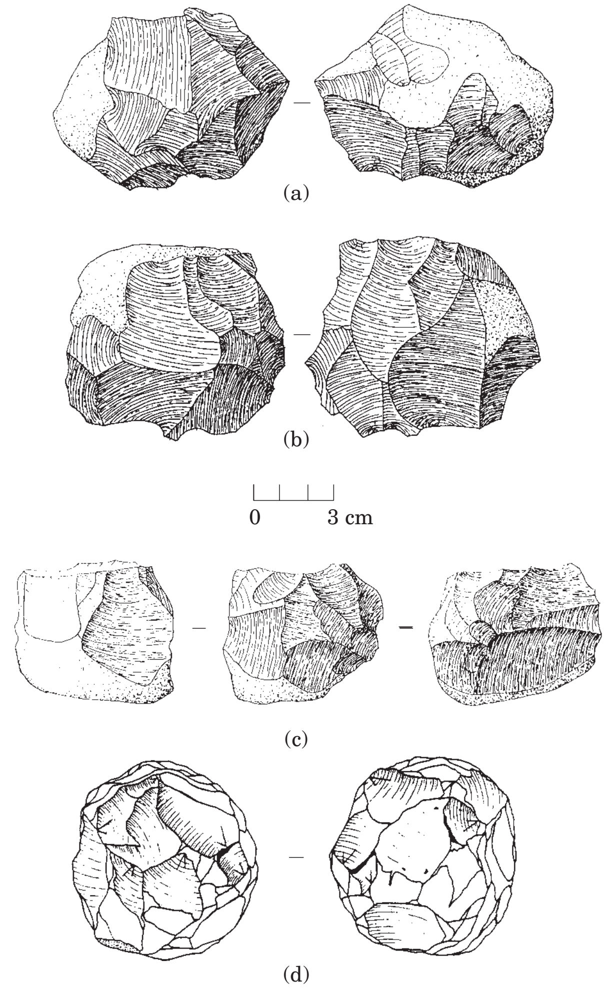


Figure 19. Examples of multifacial limestone flaked cobbles/core forms. (a), (b) and (c) are polyhedrons from the Ain Hanech site (AH 92-H5-10, AH 93-K7-KG3-3, AH 93-I5-2, respectively, redrawn by J. de Heinzelin); (d) a multifaceted spheroid from Ain Hanech (AH 93-I6-14, drawn by D. Wilkerson).

least frequent ($N=2$), are heavily flaked over much or all of the exterior with very obtuse angles (mean = 125°).

The cores, totalling 47 pieces, are different from flaked cobbles in dimensions, raw material, and overall technological patterns (Figure 20). In terms of dimensions, the cores are particularly small. The means for the length, breadth and thickness are, respectively, 30 mm, 23 mm and 16 mm. They are chiefly made of flint, initially the size of small pebbles. Unlike the flaked cobbles, the cores are predominantly lightly flaked and have a relatively acute edge angle (mean = 86°).

Whole flakes

A total of 83 whole flakes were unearthed, 65 from Ain Hanech and 18 from El-Kherba (Figure 21). The flakes made of flint are more frequent than those in limestone, 56% versus 43%. Nearly 60% of flakes have cortical butts, followed by butts with one scar (27%). The multifaceted butts constitute only 7%. Flakes with dorsal faces are primarily cortical and bear only one scar. The bulk of dorsal faces with more than one scar (17%) are in flint. The most common flake scar pattern is unidirectional (49%), distantly followed by bidirectional patterns (7%). Unidirectional flaking prevailed on both flint and limestone material.

Retouched pieces

The recent excavations yielded 129 retouched lithic pieces, 148 from Ain Hanech and 44 from El-Kherba (Figure 22). The blanks on which they were manufactured are occasional and include two varieties: debitage elements and unflaked blanks. The debitage elements represent 69% and consist of whole flakes and

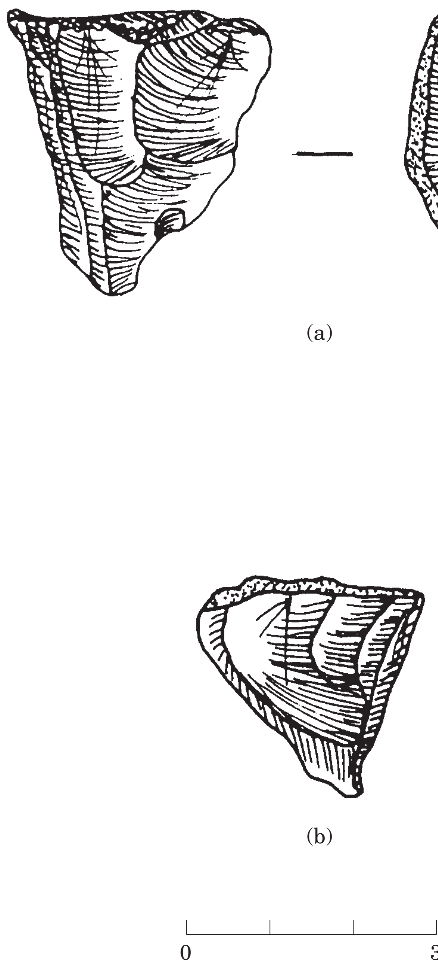


Figure 20. Examples of cores made of flint from Ain Hanech (drawn by C. Fillah). (a) AH 93-L1-LA3-10; (b) AH 93-J3-JC1). Note the small size of the cores compared to the flaked cobbles in Figures 18 and 19.

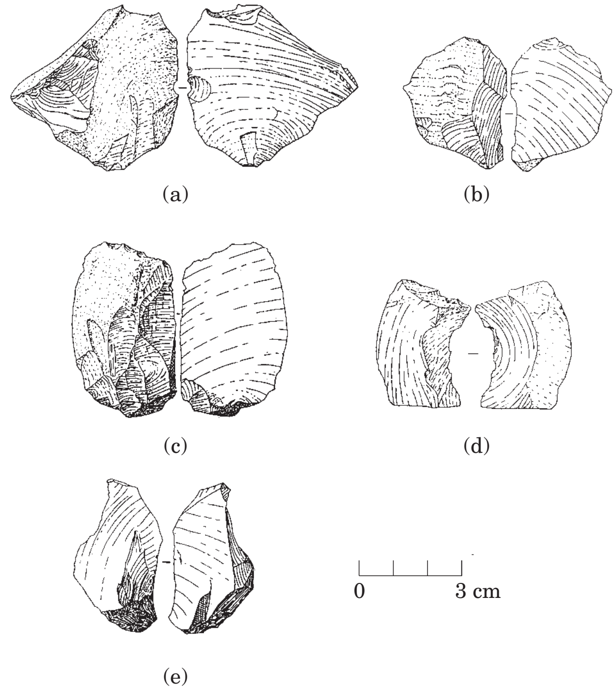


Figure 21. Examples of whole flakes (redrawn by J. de Heinzelin). (a) Thick flake (148 mm) made of dark grey flint (AH 93-F3-FC4-9); (b) thin flake made of flint bearing microwear traces (AH 93-L6-LF3-5001); (c) flake in flint with small denticulations on the distal edge probably due to trampling (AH 93-L1-LA1-1); (d) flake, in very fine grain light brown flint bearing meat and bone polishes (AH 93-G1-GA2-17); (e) flake in brown chert with small retouches on the convex edge (KH 93-M21-MV2-10). Flakes (a) to (d) are from the Ain Hanech and (e) from the El-Kherba sites.

miscellaneous fragments. The other type of blank constitutes 30% and incorporates two kinds, miscellaneous chunks in flint and small flat pebbles often in limestone. The retouch is usually abrupt, and affects most often the lateral side of the blanks. The retouch is also casual and informal leading to a rather indistinct typology. However, six broad categories can be recognized. The most abundant categories are scrapers and denticulates totalling 50% and 22%, respectively. Three other categories are relatively frequent, including end-scrapers (10%), multiple retouched edges (7%) and notches (6%). Lastly, awls and burins are extremely rare, representing 1% each.

In summary, the technological study of the lithic occurrences points to the Oldowan character of the Ain Hanech assemblage. This latter displays a simple technological design, which requires a simple knowledge limited to collecting raw materials and removing flakes from cores. The artefacts also show a low degree of standardization reflected by the disparity of flaking on trimmed cobbles and by the casual retouch on flakes and fragments. In addition to these simple technological trends, the Ain Hanech assemblage includes artefacts similar to those found in East African Oldowan assemblages, such as Olduvai in Tanzania (Leakey, 1971, 1975; Toth, 1985) and Koobi Fora in Kenya (Isaac, 1976; Isaac & Harris, 1976; Harris, 1978). It may be considered as a North African variant of the Oldowan Industrial Complex.

Evidence of Microwear

As the recent excavations carried out at Ain Hanech yielded a considerable quantity of stone artefacts made of flint, a very suitable raw material for functional studies (Keeley, 1980), a preliminary microwear analysis was undertaken by Professor Lawrence Keeley from the Department of Anthropology at the University of Illinois at Chicago. Eleven pieces made of flint were selected by Keeley for observation, nine of which are from the locality of Ain Hanech and two from El-Kherba. They were cleaned with ammonia-based detergent, 10% solution hydrochloric acid (HCl), and 10% solution potassium hydroxide (KOH). They were examined with a bright-field illumination microscope at 100–500 magnifications (Olympus BHM metallurgical microscope).

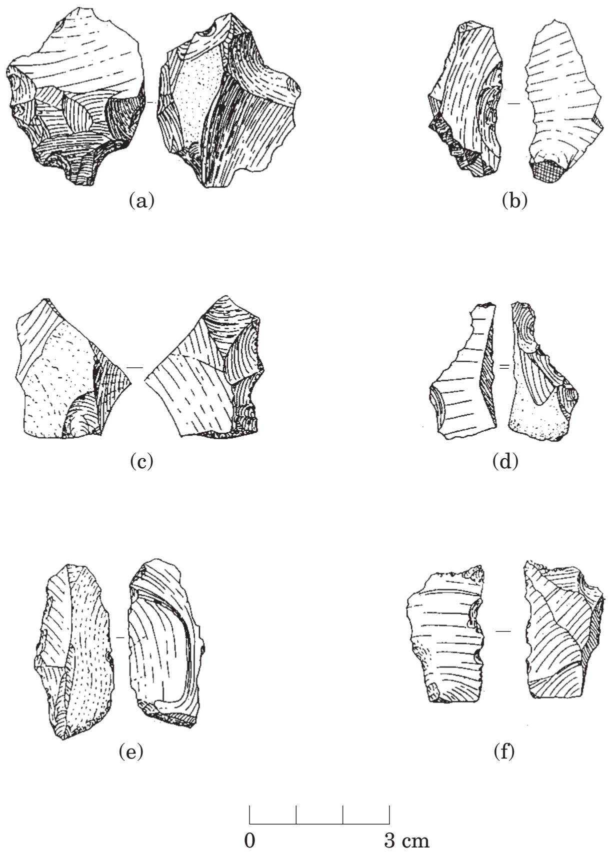


Figure 22. Examples of retouched pieces (redrawn by J. de Heinzelin). (a) Denticulate in very fine grain light brown chert, the blank is a core fragment, bears an undefined use-wear (AH 93-L1-LA5-20). (b) Minimally retouched flake in chert (AH 93-L4-LD4-4). (c) Denticulate-like piece modified on a flake fragment in dark brown chert (AH 93-E2-EB1-1). (d) Retouched pieces on a flake fragment made of dark chert, the retouches are continuous on the concave edge and inverse on the distal part (AH 93-M2-MB4-14). (e) Flake made of dark flint with continuous retouches on the left edge (KH 93-M21-MV1-11). (f) Awl-like retouched pieces in black flint with various retouches of utilization on its edges (AH 93-J4-JD2-30). Retouched pieces (a) to (d) and (f) from Ain Hanech site, and (e) from El-Kherba site.

Evidence of microwear was found on three lithic pieces. The first worn piece, catalogued as AH 93-G1-GA2-17, is a flake made of brown flint. Two polishes were identified on the transversal edge of this whole flake. One is meat polish, located on the ventral face (bulbar aspect) at the left part of the edge, a wear from soft animal tissue (Figure 23(a)). The other is a bone polish on the dorsal face at the right part of the edge attesting tool action, such as cutting and/or slicing (Figure 23(b)). The second worn lithic piece, catalogued as AH 93-L6-LF3-9001 is also a whole flake and made of dark brown flint. An indeterminate bilateral polish is identified on the lateral side of this very fresh sharp flake. The last specimen (AH 93-L1-LA5-20) is a denticulate-like retouched fragment. The utilized part is located on the retouched side reflecting a possible meat polish (Figure 24). The tool action was not determined on this piece.

The preliminary microwear analysis shows that Ain Hanech stone artefacts were used for food processing, indicating that meat was a component of an early hominid diet living in this area. Soft animal tissue was processed by both whole flakes and retouched pieces. This suggests that flakes were as important as other Oldowan stone artefacts, i.e. flaked cobbles. Similar evidence has also been reported in studying microwear on Koobi Fora flakes (Keeley & Toth, 1981).

Conclusions

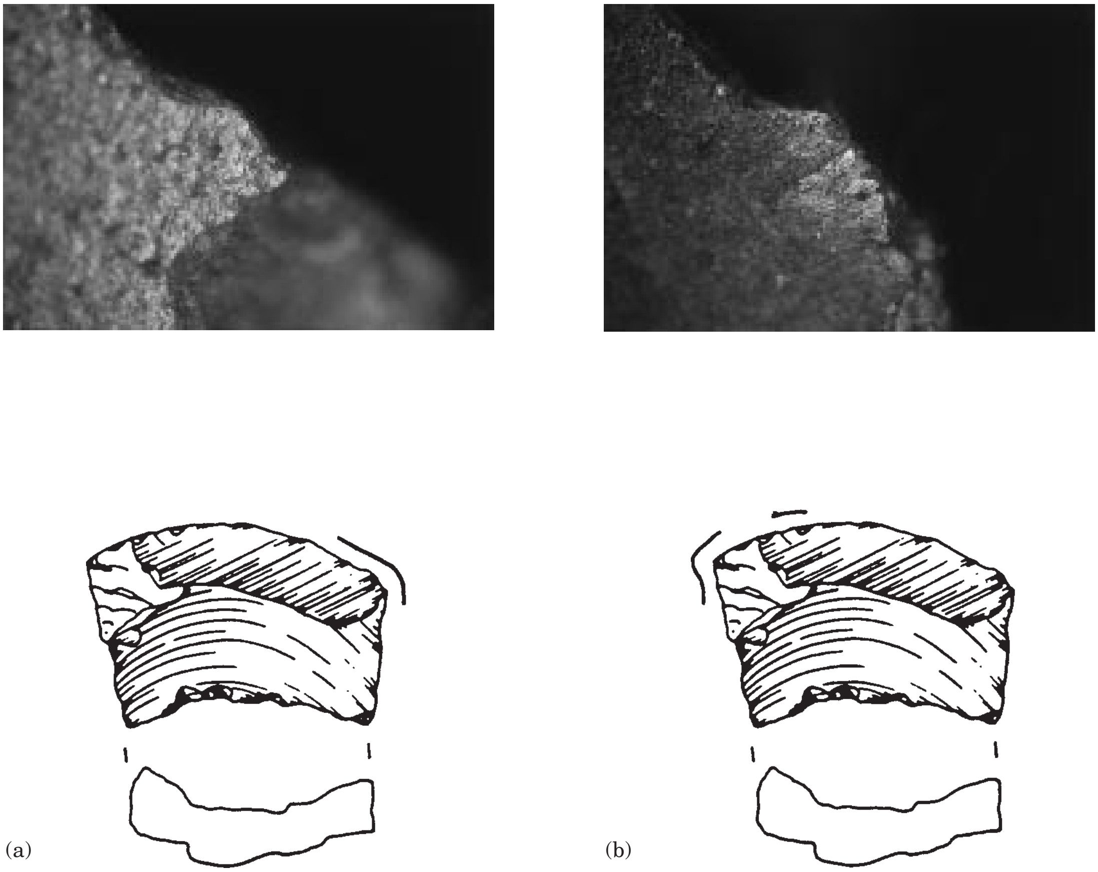
The results of 1992–1993 archaeological investigations undertaken at the Lower Palaeolithic site of Ain Hanech in northeastern Algeria are reported here. These studies have involved investigations bearing on stratigraphy, dating, nature of the association between broken up bones and stone artefacts, lithic assemblage analysis, and overall behavioural implications of the archaeological occurrences. Based on these investigations, the following tentative conclusions are drawn:

(1) The site of Ain Hanech is among the oldest archaeological occurrences in North Africa. Although recently some doubt raised in respect to the Early Pleistocene age of archaeological horizons in the Casablanca sequence (Raynal & Texier, 1989), the Ain Hanech evidence reaffirms and strengthens a remote human antiquity in the Maghreb. Human presence in this part of the African continent may go back to 1·8 million years ago (Figure 25), suggesting an earlier spread of hominids into North Africa than commonly assumed.

(2) Contrary to what has been assumed, Ain Hanech occurrences are not from a secondary depositional context. All the relevant evidence, including the sedimentary matrix, physical aspect of the occurrences, and disposition of the archaeological material show clearly that these occurrences were minimally disturbed, local trampling and flux being part of the process. The archaeological material accumulated continuously and buried rapidly in fine-grained sediments due to low energy flow. Therefore, Ain Hanech occurrences are appropriate for behavioural studies of early hominid occupations in North Africa.

(3) Recent archaeological investigations at the site of Ain Hanech yielded, for the first time in the Maghreb, a coherent Mode I Technology artefact assemblage similar to those recovered in East African Plio-Pleistocene sites, e.g. Olduvai Bed I and Lower Bed II and Koobi Fora sites. The Ain Hanech assemblage is characterized by a low degree of standardization, and may be considered as a North African variant of Oldowan Industrial Complex.

(4) The Ain Hanech investigations demonstrated definitely that the Acheulean occurrences were not associated with Oldowan materials. Bifaces derive from



(a) (b)

Figure 23. (a) Meat polish on the ventral face of a flake made of brown flint (AH 93-G1-GA2-17) (× 100). (b) Bone polish on the dorsal face of a flake made of brown flint (AH 93-G1-GA2-17) (× 100).

calcretes higher up in the Ain Hanech stratigraphical sequence.

(5) Preliminary evidence indicates that animal tissues probably constituted some part of Ain Hanech hominid subsistence. Manufactured artefacts were used for processing animal carcasses, including meat cutting and bone working. A broader overview of subsistence patterns is not yet available.

(6) As a synthetic and somewhat free rendition of our field experience, we visualize a single or short-term occupation by early hominids at some water-hole or at a shallow river embankment, some strategic choice directed by the provision of limestone cobbles and flint pebbles in a nearby river bed and by an obliged passage of game, propitious to meat acquisition.

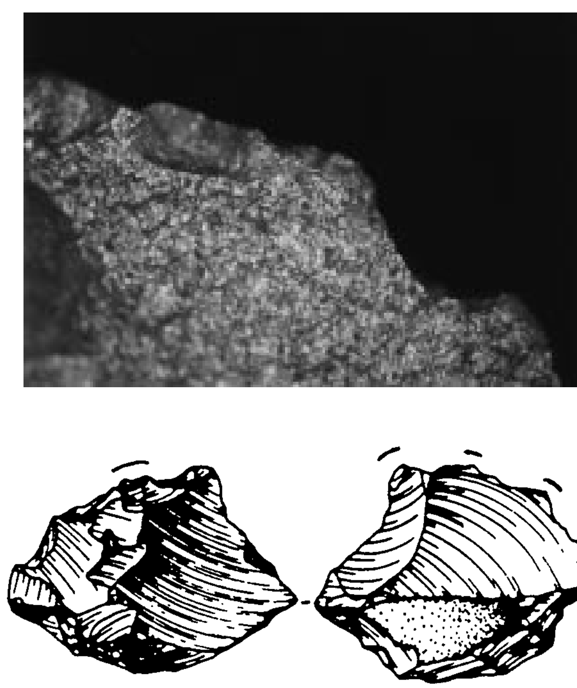


Figure 24. Possible meat polish on the retouched side of a denticulate-like retouched fragment made of flint (AH 93-L1-LA5-20) (× 100).

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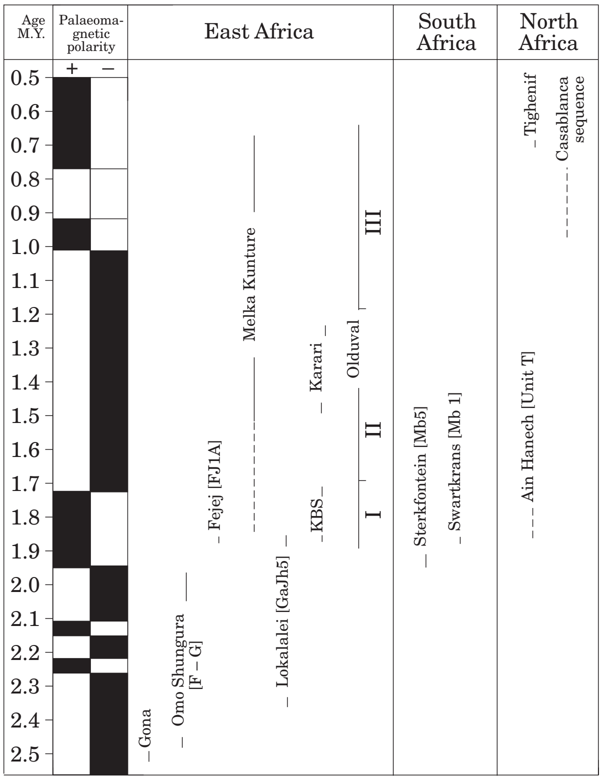

Figure 25. Chronological position of the Ain Hanech site relative to East and South African earliest archaeological sites.

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Appendix 1

Description of Ain Hanech formation

The formation of Ain Hanech is divided into six sedimentary units (from O to T), based upon the type section on the left bank of Ain Boucherit stream and correlating the northern and southern spurs.

At the northern spur the sedimentary units include (Figure 5): (1) unit O is a compact pink (7·5YR 7/4) silt; (2) in unit P, at about 3 m thick from the bottom is a subunit starting with unsorted and not orientated pebbles contained in mottled silt passing to very pale brown silt 10YR 8/4. At about 8 m this unit starts with gravel interbeds in silt, then mottled silt with very pale brown (10YR 7/3) calcic concretions, then very pale brown (10YR 8/3) and reddish yellow (7·5YR 6/6) reduced root traces, and finally disturbed soil horizon; (3) unit Q is about 3 m thick. It consists of scattered angular gravel passing to mottled silt, and clay–silt; (4) unit R is about 3·5 m thick, including many scattered gravels capped by stratified silty sand, and then silt; (5) unit S is about 2·5 m thick, and is a cyclothemic sequence similar to unit R; (6) unit T consists of the upper part of obliquely layered sediment (T. Upper), a silt rich in nodular calcic concretions.

The southern spur comprises the following sedimentary units, from bottom to top: (1) unit (Q)/P is 17 m thick, and includes 2·5 m of coarse gravel and high energy stratification, then interbeds of gravels, sands and silt; and a bed of about 1 m of pure grey silt containing well preserved gastropod and white ostracod shells (5Y 8/1). The upper part is rather of compact silt and clay–silt; (2) unit R is similar to the one at the northern spur; (3) unit S is also similar to one at the northern spur; (4) unit T includes only the lower part (T. Lower), consisting of an oblique calcic silt with traces of stratification. The contact between T. Upper and T. Lower is oblique as well, T. Upper being modified.