



HAL
open science

The earliest occupation of Atlantic Morocco: the Casablanca evidence

Jean-Paul Raynal, Lionel Magoga, Fatima-Zohra Sbihi-Alaoui, Denis Geraads

► **To cite this version:**

Jean-Paul Raynal, Lionel Magoga, Fatima-Zohra Sbihi-Alaoui, Denis Geraads. The earliest occupation of Atlantic Morocco: the Casablanca evidence. The earliest occupation of Europe, W. ROEBROEKS & T. VAN KOFSCHOTEN eds., University of Leiden, pp.255-262, 1995. halshs-00004666

HAL Id: halshs-00004666

<https://shs.hal.science/halshs-00004666v1>

Submitted on 19 Sep 2005

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Jean-Paul Raynal
Lionel Magoga
Fatima-Zohra Sbihi-Alaoui
Denis Geraads

13 The earliest occupation of Atlantic Morocco: the Casablanca evidence

Recent work in the Casablanca area considerably modified earlier interpretations of its prolific Palaeolithic record. New results reported in this paper stress the absence of traces of a very early human occupation. The main part of the rich Acheulean sequence at Casablanca dates from the second part of the Middle Pleistocene, though palaeomagnetic data suggests that the earliest traces of human activities date from before the Brunhes-Matuyama boundary (Thomas-1 quarry, level L). Throughout the Acheulean sequence the same lithic raw materials were used, which allows comparison of technological characteristics of the various assemblages.

1. Introduction

The Casablanca region, on the Atlantic coast of the Moroccan Meséta, is rich in Palaeolithic sites preserved in an exceptionally well developed series of littoral deposits (Fig. 1). This series formed the basis for the definition of the majority of the stratotypes of the classical stages of the Maghreb's marine Pleistocene (Neuville and Ruhlman 1941; Biberson 1961; Texier *et al.* 1985). The deposits yielded various fossils of hominids (Biberson 1956; Ennouchi 1969, 1972), which are at the origin of the first anatomically modern humans (Hublin 1991). Recent work has established a new lithostratigraphical (Texier *et al.* 1994; Lefèvre *et al.* 1994), biostratigraphical and archaeological framework (see Table 1), that will be used in this paper to discuss the age of the first occupation of the Casablanca region and to present some aspects of its Acheulean sequence.

2. From the Pliocene to the Middle Pleistocene

The base of the stratigraphic series of Casablanca is of Pliocene age (Raynal *et al.* 1990), dating from before the Quaternary volcanism of the Middle Atlas (El Graoui 1994).

The oldest fossiliferous site in the Casablanca sequence is the Lissasfa karst complex, developed in the top of littoral deposits that have their base at about 170 m above present sea level¹. Its microfauna, which contains *Paraethomys* sp., *Ruscinomys* sp., *Mus* sp. and Gerbillidae, suggests a Middle or Early Pliocene age.

Ahl-Al-Oughlam is a younger site, systematically excavated from 1989 onwards, and located in a shoreline cut in beach deposits at 108 m above sea level (Raynal *et al.* 1990). Its vertebrate fauna, by far the richest one of the North African late Cenozoic and only comparable to the rich sites of eastern Africa, suggests an age of around 2.5 Myr BP (Geraads 1993a; 1995). More than 70 species have been identified, belonging to all main groups: fishes, reptiles (giant tortoise, lizards, snakes, crocodiles and the rare Amphisbaenidae), various birds (with a remarkable coexistence of penguin and ostrich, and with pseudodontornithes, giant sea birds with false teeth) and mammals, the most common group. Carnivores are represented by 23 taxa, 13 of which are new (Geraads, in press), e.g. Hyaenidae (*Crocuta*, *Pliocrocuta*), a sabre-toothed felid, Mustelidae, Canidae (*Vulpes*, *Nyctereutes*), the oldest known bear from Africa and a morse. The herbivores comprise elephant, a mastodont, a fossil pig (*Kolpochoerus phacochoeroides*), a bovid-sized giraffe (*Sivatherium maurusium*), antelopes (*Kobus* and *Damaliscus*), a three-toed horse (*Hipparion*), a rhinoceros (*Ceratotherium*), a monkey (*Theropithecus*), as well as a large variety of rodents and insectivores. It is obvious that the large predators played a major role in the formation of this fossiliferous site, of which we have a representative sample now. Traces of hominids, be it as fossils or in the form of artefacts, are completely absent in this large assemblage, and the Ahl-Al-Oughlam site thus seems to date from before their arrival in the Maghreb.

The Early Pleistocene of Casablanca, not well known in detail yet, is currently the object of systematical research, and various stratigraphical units have been identified between 45 and 100 m above sea level. No important fossiliferous site is known yet, and no stone artefacts have been recovered *in situ*. Finds recovered from deposits formerly attributed to the Maarifien, the Moulouyen or the Salétien are either *geofacts* collected from high-energy littoral facies (old collections of Biberson in the Déprez quarry and recent collections by J.P. Raynal and D. Lefèvre in the Bir As Smar pit), or are recent artefacts from superficial colluvial deposits, as in other sites in Morocco (Raynal and Texier 1989): at yet there is no 'Pebble Culture' *in situ* at Casablanca.

EPOCH	LITHOSTRATIGRAPHY		CHRONOLOGY		CASABLANCA CLASSIC SERIES		LITHIC ASSEMBLAGES		MAJOR SITES		HOMINID FOSSILS		LARGE MAMMAL FAUNA				
	After recent works (1978-1984) (1)		Altitude above sea level		Agas		isotopic stages		(BIBERSON, 1981)		Lithic technology and classification after recent works (1978-1984) (8)		Recent excavations in bold (9)		Neolithic - Homogeneous Potomediterranean (10)		Main taxa (14)
PLEISTOCENE UPPER	REDDAD BEN ALI FORMATION	0-2 m	3700-3500 BP	1	MELLAHAN	Neolithic	CP	Iberomaurusian	El Kifan	Yakizzo Cave	Neolithic - Homogeneous Potomediterranean (10)	Oldi Hemide 2 Quarry, El Kifan, top	Canis, Hippoboscus, Mammuthus, Ursus, Rhinoceros, Felis, Canis, Equus, Hippoboscus, Rhinoceros...				
	DAR BOU AZZA FORMATION	Labels Member		4 to 2	SOLTANAN	Aterian	CC	Aterian	*Red Silt* at Abderrahmane	Falls cave		Oldi Hemide 2 : Sidi Abderrahmane					
PLEISTOCENE MIDDLE	OUADJAJ MEL FORMATION	0-6 m	Amougep O (2)	5	OLLUN	Evolved Acheulian Stage VIII	T	Upper Acheulian	Cap Chabotier top	Cap Chabotier bottom		Oldi Hemide 1 : Ours Cave	Sidi Abderrahmane Quartzite, Ours Cave				
	ANFA GROUP	Formation 3	20-23 m		PRESLTANAN (D)	Evolved Acheulian Stage VI	S	Evolved Acheulian Stage VI	Litomes Cave	Sidi Abderrahmane Extension	Sidi Abderrahmane (1)	Oldi Hemide 1 : Ours Cave	Sidi Abderrahmane Quartzite, Ours Cave				
PLEISTOCENE LOWER	OUADJAJ MEL GROUP	Formation 2	16-20 m		TENSIFIAN (D, D')	Middle A. Stage VI	C	Middle A. Stage V	Thomas Quarry 1, Bed L	Thomas Quarry 1, Bed L	Thomas I and Thomas III (12,13)	Oldi Hemide 1 : Ours Cave	Ursus, Canis, Rhinoceros, Lynx, Ursus, Canis, Equus, Hippoboscus, Rhinoceros, Theropithecus...				
		Formation 1	17-20 m		ANFATIAN (G)	Middle A. Stage IV	CP	Lower A. I, II, III Public-C Stage IV	Lower Acheulian	Lower Acheulian		Oldi Hemide 1 : Ours Cave	Ursus, Canis, Rhinoceros, Lynx, Ursus, Canis, Equus, Hippoboscus, Rhinoceros, Theropithecus...				
PLIOCENE	OUADJAJ MEL GROUP	Formation 3	29-32 m		AMIRIAN (R)	Lower A. I, II, III Public-C Stage IV	CP	Public-Culture Stage III	Thomas Quarry 1, Bed L	Thomas Quarry 1, Bed L		Oldi Hemide 1 : Ours Cave	Ursus, Canis, Rhinoceros, Lynx, Ursus, Canis, Equus, Hippoboscus, Rhinoceros, Theropithecus...				
		Formation 2	32-35 m		AMIRIAN (J) and K-L-M-N-O Complete	Lower A. I, II, III Public-C Stage IV	CP	Public-Culture Stage II	Lower Acheulian	Lower Acheulian		Oldi Hemide 1 : Ours Cave	Ursus, Canis, Rhinoceros, Lynx, Ursus, Canis, Equus, Hippoboscus, Rhinoceros, Theropithecus...				

Table 1. Synthetical survey of the Casablanca Palaeolithic record and its geological context.

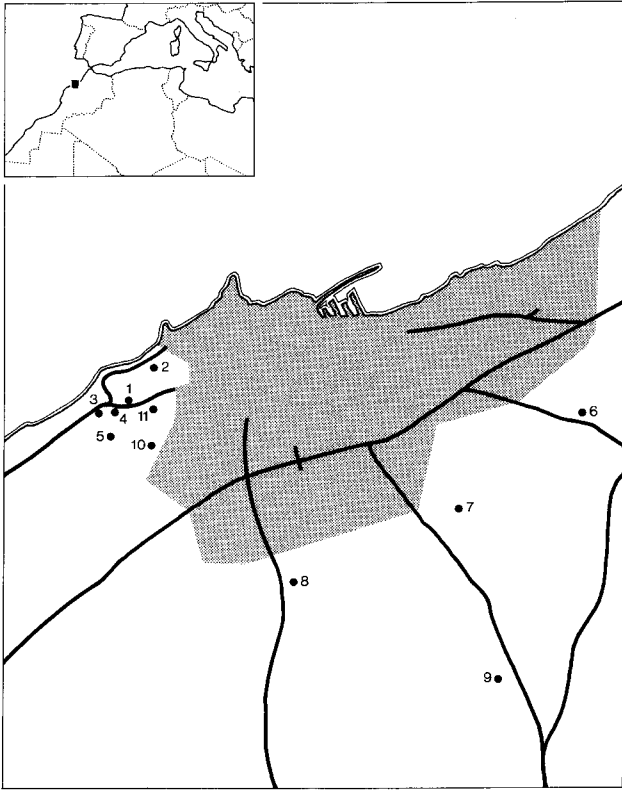


Fig. 1. Location of sites in the Casablanca area: 1. Sidi Abderrahmane; 2. *Grotte des Ours*; 3. Sidi Abderrahmane Extension; 4. Thomas 1; 5. *Grotte des Rhinocéros* Oulad-Hamida 1; 6. Ahl-Al-Oughlam; 7. Bir As Smar; 8. Sidi Messaoud; 9. Lissasfa; 10. Ghaudour Ben Habib; 11. Sidi Al Khadir East.

3. The Middle Pleistocene

The Middle Pleistocene is characterized by abundant human occupation. Deposits of this period are very well developed and display great lithostratigraphical detail: seven marine units are identified, stepped between 9 and 35 m above present sea level and covered by continental fossiliferous deposits (Texier *et al.* 1994). The abundant finds discovered in the quarries of Sidi-Abderrahmane, Thomas-1 and Oulad Hamida-1 allow us to characterize the contemporary 'animal' environment and to establish the main lines of the local Acheulean sequence.

Throughout the sequence arkoses and cambrian feldsparic quartzites – often referred to as El Hank quartzites – form the principal raw materials. They were abundantly present in various sizes on the former beaches and rocky outcrops, and give the assemblages a rather 'archaic' character. Experiments with these rocks have given us a good idea of their flaking characteristics. The raw materials are very tough and

massive, and very hard to flake, though knapping is facilitated by making use of plane surfaces, natural or arteficial ones. Fractures are very clear: hard percussion created decorticated surfaces with well marked negative scars and also entailed frequent knapping accidents such as breakage of flakes or pebbles along the axis of percussion (Siret breaks, accidentally broken pebbles, *galets à un enlèvement fendus*).

Flint constitutes only about 5% of the raw materials, up until the Upper Acheulean, when flint was sought for more systematically. Flint is locally available in the form of small pebbles (1 to 5 cm in diameter) in various coarse grained littoral deposits.

The exploitation of the same raw materials throughout the Acheulean sequence at Casablanca allows a comparison of the technological characteristics of some representative series. They are presented here along the lines of the classification model developed on basis of a study of the assemblages from Unit L of the Thomas quarry, briefly explained below. This model is based on the character of the working surfaces, their disposition and exploitation; it integrates dynamic aspects (sequences of production of flakes and of shaping, reduction of objects, re-use etc.) and functional ones (specific morphology, transformation by usage...). Seven main groups are discerned:

- Group 1: flaking carried out by using cortical striking platforms
- Group 2: flaking from one non-cortical striking platform, possibly re-adjusted
- Group 3: flaking using two non-cortical striking platforms for one and the same working surface
- Group 4: flaking using three to five non-cortical striking platforms for one and the same working surface
- Group 5: flaking from non-cortical striking platforms belonging to various working surfaces
- Group 6: exploitation/shaping of flakes and fragments
- Group 7: objects transformed by usage

The group-subdivisions thus repose upon technological and/or secondary morphological criteria (such as re-use of striking platforms, recurrence of flake removals, length of blanks (both arteficial and natural ones), surface size of flake removals and presence/absence of cortex).

Group 4 contains most objects with multiple flake removals. Starting with flaking from cortical striking platforms (group 1) and followed by an increase of flaked surfaces this group contains the majority of complex and/or typical objects. The most complete bifaces as well as the best exploited cores are within this group. Group 6, with cores on flakes and fragments and tools on flakes testifies to the final stages of the knapping process.

Items transformed by usage or re-utilization are at the origin of part of the observed assemblage variability. Table 2

surveys some characteristics of four representative series of the Acheulean sequence at Casablanca, as assembled from 1978 onwards during excavations by the *Mission préhistorique et paléontologique française au Maroc* and the *Institut National des Sciences de l'Archéologie et du Patrimoine* at Rabat: member L of the Thomas-1 quarry (TH L1 and TH L5), the *Grotte des Rhinocéros* of the Oulad Hamida-1 quarry (GDR) and Sidi-Abderrahmane Extension (SAE). Table 1 only considers the effective totals of the various groups with exclusion of (natural) blanks.

Table 2: see text for explanation

Sites:	TH L1		TH L5		GDR		SAE	
Age:	>0.78 Myr BP		?		±0.4 Myr BP		<0.4 Myr BP	
Groups	n	%	n	%	n	%	n	%
1	18	6	18	4.8	77	15	31	5.4
2	56	18.8	79	21.2	71	13.8	62	10.7
3	38	12.8	11	2.9	23	4.5	96	16.6
4	124	41.6	61	16.4	110	21.5	199	34.5
5	18	6	66	17.7	35	6.8	5	0.9
6	36	12.1	97	26	100	19.5	181	31.4
7	8	2.7	41	11	97	18.9	3	0.5
Total	298	100	373	100	513	100	577	100

The earliest occupation known yet has been discovered in the Thomas-1 quarry, in level L of the Formation 1 of the Oulad-Hamida Group (Raynal and Texier 1989). The assemblage contains flakes struck from discoidal cores and from polyhedrons. Besides chopping-tools, polyhedrons and some cleavers, bifaces form the most characteristic element within the tools. They are often partial only and usually display lateral or lateral-distal concavities, that make up the point of the bifaces.

The fauna from this site is dominated by hippopotamus, like the probably somewhat younger site of Tighenif (Ternifine) in Algeria, and contains furthermore elephant, zebra and gazelles. Palaeomagnetic data suggests an age in excess of 0.78 Myr BP for the main part of this local early Acheulean sequence (Sen, *in litteris*).

Various sites (Sidi Al Khadir, Gandhour Ben Habib, Oulad Hamida 1) have yielded small assemblages dominated by debitage. These assemblages are being studied now, and can be dated in the first part of the Middle Pleistocene (Group of Oulad Hamida). The main part of the Acheulean sites from the Casablanca sequence, including the hominid sites from the Thomas quarries (Geraads *et al.* 1980), however date from the second half of the Middle Pleistocene (Anfa Group). The *Grotte des Rhinocéros* of the Oulad-Hamida-1 quarry (Raynal *et al.* 1993) yielded a rich lithic industry and an abundant fauna with about 50

vertebrate species (Geraads 1993b,1994) that indicate a rather open and dry environment. ESR-dating of tooth enamel of *Ceratotherium simum* (Rhodes *et al.* 1994) gives the assemblage an age of about 400 Kyr BP. The abundant remains of white rhinoceros suggest specialized hunting by hominids. Compared to the local early Acheulean one can observe an increase of discoidal cores and of flake production; cleavers are rare while bifacial pieces are larger, characterized by convex and/or concave edges that constitute a pointed extremity (cf. Fig. 2).

In the Thomas-1 cave the level that yielded the human mandible in 1969 is now under excavation. The recovered assemblage is quite different from the series of the *Grotte des Rhinocéros*, as it is dominated by flaked pebbles, and comparable to the series collected at the time of the discovery of the jaw (Geraads *et al.* 1980). This variability can probably be explained by the small size of the sample recovered from the infill yet.

A more recent stage is well illustrated at Sidi-Abderrahmane-Extension. Here we observe an important use of block-fragments and frequent recycling of rolled artefacts with multiple scars. Flakes are mainly produced from discoidal cores and polyhedral forms are quite rare. So are predetermined flakes, but these coexist with a diverse toolkit on flakes. Bifacial pieces are generally made on flakes and mostly display convex sides and tend towards ovate forms, even to discoidal ones. Cleavers are rare here.

The upper part of the Acheulean sequence is represented at the Cap Chatelier site, with an age in excess of 200 Kyr (optically stimulated luminescence dates by Rhodes 1990): production of predetermined flakes and thin, small bifaces, a diverse set of tools on flakes and very few cleavers (Debenath *et al.* 1982).

The Acheulean series of Casablanca are thus characterized by a large homogeneity, which is to a large extent the result of the use of the same mineral resources over various hundreds of thousands of years. The raw material, abundantly available in all sizes, allowed a production of large flakes or voluminous fragments of pebbles and blocks. The only constraint consisted in the transport of heavy objects, making voluminous flaked items rare in the excavated sites. The various types of blanks introduced to the sites are very well recognizable in the bifaces of the various series.

The industries testify to a certain stability throughout the Middle Pleistocene (lateral dissymmetry proper to a partial shaping, for example), but they also bear witness of an increasing complexity of elementary modes of reduction and of a continuous technological enrichment in which earlier acquisitions resurge (the polyhedral proximal part of some bifaces of the *Grotte des Rhinocéros*, for example). The observed changes in the morphology of the various

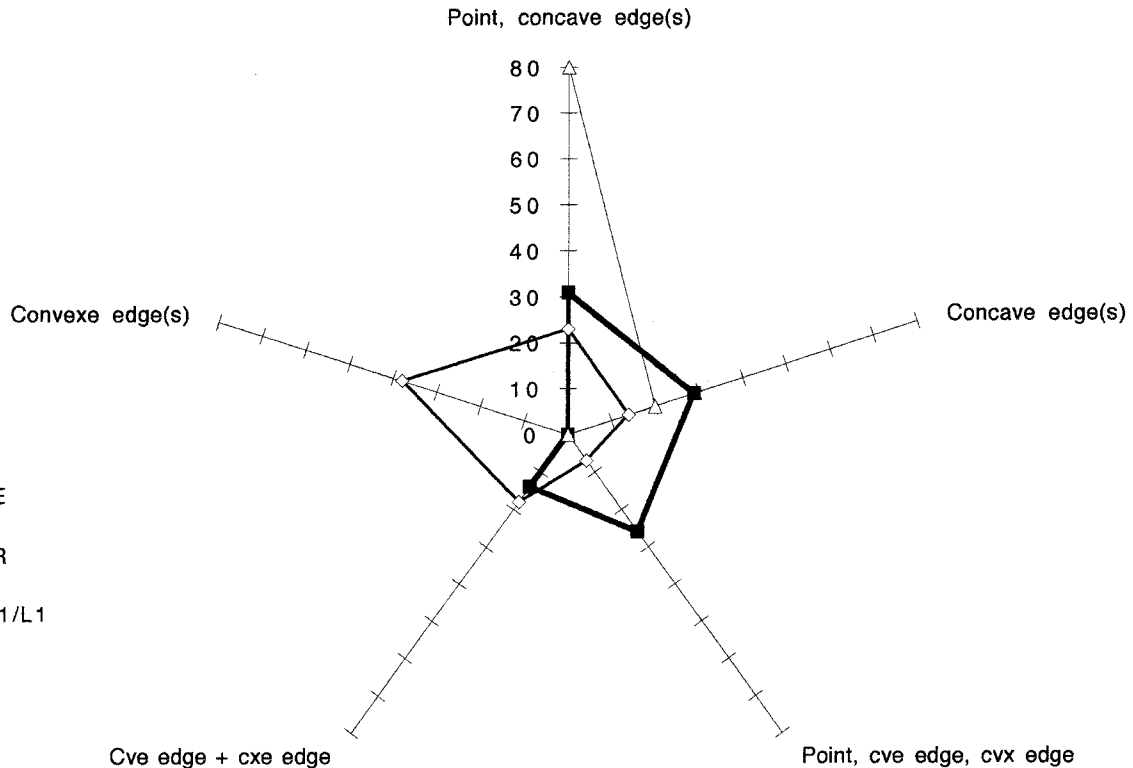


Fig. 2. Distribution (in %) of various biface edge-types of the assemblages – SAE (Sidi Abderrahmane Extension), GDR (Grotte des Rhinocéros), TH1/L1 (Thomas 1 Quarry, Level L1).

objects can be quantified; for instance the remarkably regular change over time of the angle formed by the directions of the two flake removals that delimit a sequence of flake removals on one (or two) working surfaces. The neat correlation between the number of flake removals and the number of striking platforms (cf. Fig. 3) is a technological constant (a succession of x flakes originating from one platform), verified in experiments and determined by the mechanical characteristics of the raw material. Within this 'Acheulean' unity the changes within the bifaces reflect in our view a morpho-functional evolution, relayed in time by a more systematic production of flakes, including predetermined ones.

A comparison of the probable use of the objects identified in our classification with experimental results (Toth 1985) leads to the following conclusions regarding the activities performed at the sites: Thomas-1 L1: some stone working, hide slitting, heavy duty butchery, bone breaking; Thomas-1 L5: stone working dominates, light duty butchery; *Grotte des Rhinocéros*: stone working

important, hide slitting, light and heavy-duty butchery, bone breaking; Sidi-Abderrahmane Extension: stone working important, hide slitting, light duty butchery, bone breaking.

The large scale excavations that are in progress now at Casablanca will allow us to develop these preliminary interpretations in more detail and to propose more specific functional hypotheses for the various sites discussed here.

4. Conclusions

As a result of the recent and ongoing work in the Casablanca region a few concluding points can be stressed here:

- as yet the Casablanca region has not yielded any evidence of very early human occupation of the Moroccan Atlantic coastal area
- palaeomagnetic data suggests that the earliest traces of human occupation date from (just?) before the Brunhes-Matuyama boundary (0.78 Myr BP)

Mean number of flake removals compared to number of striking platforms

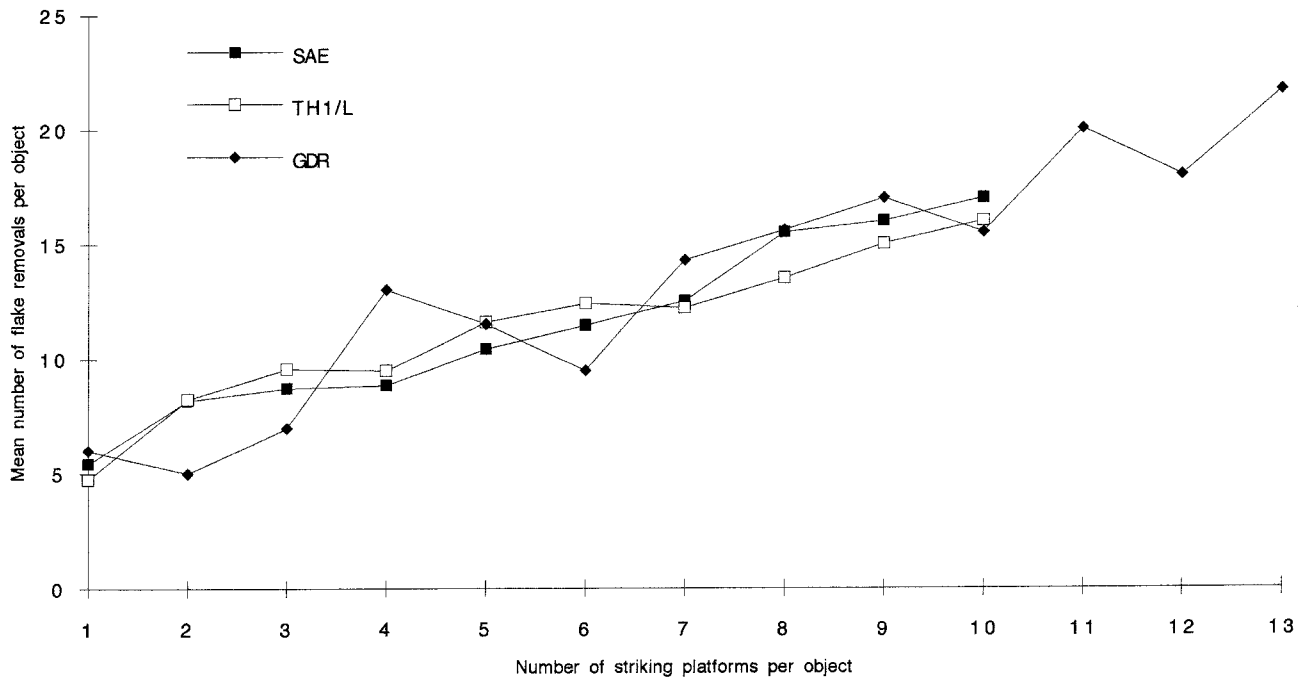


Fig. 3. Mean number of flake removals compared to number of striking platforms, for three assemblages: SAE (Sidi Abderrahmane Extension), GDR (Grotte des Rhinocéros), TH1/L1 (Thomas 1 Quarry, Level L1).

– throughout the variability demonstrated by our recent excavations various morpho-technological stages are discernable. These do not allow a formal subdivision of the Acheulean sequence but the appearance of predetermined flaking techniques, applied to the principal raw material (quartzite), nevertheless characterizes a rather recent phase of this sequence.

Finally, our current state of knowledge is presented here in the form of the synthetical table 1; while significantly

modifying earlier data, the current framework reflects only a provisional stage of our ongoing research.

Autorisation de publier no. 462 du 14 juin 1995

note

1 The site was discovered May 17th 1995, by D. Lefèvre and J.P. Raynal.

references

- | | | |
|--------------|------|---|
| Biberson, P. | 1956 | Le gisement de l'Atlanthrope de Sidi Abderrahmane, <i>Bulletin d'Archéologie marocaine</i> 1, 38-92. |
| | 1961 | Le cadre paléogéographique de la Préhistoire du Maroc atlantique et Le Paléolithique inférieur du Maroc atlantique, <i>Publications du Service des Antiquités du Maroc</i> , Rabat. |

- Debenath, A.,
J.P. Raynal,
J.P. Texier
- 1982 Les industries des *Homo erectus* marocains: chronologie, typologie, *Premier Congrès international de Paléontologie humaine, Résumés*, 84-85, Nice.
- El Graoui, M.
- 1994 *Contribution à l'étude des formations littorales quaternaires de la région de Casablanca (Maroc): sédimentologie, microfaciès et minéraux lourds*. Thèse de l'Université de Bordeaux 1.
- Ennouchi, E.
- 1969 Découverte d'un Pithécantropien au Maroc, *C.R. Acad. Sci. Paris D*, 269, 763-765.
- 1972 Nouvelle découverte d'un archanthropien au Maroc, *C.R. Acad. Sci. Paris D*, 274, 3088-3090.
- Geraads, D.,
P. Beriro,
H. Roche
- 1980 La faune et l'industrie des sites à *Homo erectus* des carrières Thomas (Maroc). Précisions sur l'âge de ces hominidés, *C.R. Acad. Sci. Paris* 291(II), 195-198.
- Geraads, D.
- 1980 La faune des sites à *Homo erectus* des carrières Thomas (Casablanca, Maroc), *Quaternaria* 22, 65-94.
- 1993a *Kolpochoerus phacochoeroides* (Thomas, 1884) (Suidae, Mammalia) du Pliocène supérieur de Ahl al Oughlam (Casablanca, Maroc), *Géobios* 26(6), 731-741.
- 1993b Middle Pleistocene *Crocidura* (Mammalia, Insectivora) from Oulad Hamida 1, Morocco, and their phylogenetic relationships, *Proceedings Kon. Ned. Akademie v. Wetenschappen* 96(3), 281-294.
- 1994 Rongeurs et Lagomorphes du Pléistocène moyen de la "Grotte des Rhinocéros", Carrière Oulad Hamida 1 à Casablanca, Maroc, *N. Jb. Paläont. Abh.* 191(2), 147-172.
- 1995 Rongeurs et insectivores (Mammalia) du Pliocène final de Ahl Al Oughlam (Casablanca, Maroc), *Géobios* 28(1), 99-115.
- in press Carnivores du Pliocène terminal de Ahl Al Oughlam (Casablanca, Maroc), *Géobios*, submitted.
- Hublin, J.J.
- 1991 *L'émergence des Homo sapiens archaïques: Afrique du Nord-Ouest et Europe occidentale*. Thèse d'Etat de l'Université de Bordeaux 1.
- Lefèvre, D.,
J.P. Texier,
J.P. Raynal,
S. Occiatti,
J. Evin
- 1994 Enregistrements-Réponses des variations climatiques du Pleistocène supérieur et de l'Holocène sur le littoral de Casablanca (Maroc), *Quaternaire* 5(3-4), 173-180.
- Occhiatti, S.,
J.P. Raynal,
P. Pichet,
J.P. Texier
- 1993 Aminostratigraphie du dernier cycles climatique au Maroc atlantique, de Casablanca à Tanger, *C.R. Acad. Sc. Paris* 317(II), 1625-1632.
- Raynal, J.P.,
J.P. Texier
- 1989 Découverte d'Acheuléen ancien dans la carrière Thomas I à Casablanca et problème de l'ancienneté de la présence humaine au Maroc, *C.R. Acad. Sci. Paris* 308(II), 1743-1749.
- Raynal, J.P.,
J.P. Texier,
D. Geraads,
F.Z. Sbihi-Alaoui
- 1990 Un nouveau gisement paléontologique plio-pléistocène en Afrique du Nord: Ahl Al Oughlam (ancienne carrière Déprez) à Casablanca (Maroc), *C.R. Acad. Sci. Paris* 310(II), 315-320.

- Raynal, J.P.,
D. Geraads,
L. Magoga,
A. Hajraoui,
J.P. Texier,
D. Lefevre,
F.Z. Sbihi-Alaoui
- 1993 La Grotte des Rhinocéros (Carrière Oulad Hamida 1 – anciennement Thomas III, Casablanca), nouveau site acheuléen du Maroc atlantique, *C.R. Acad. Sci. Paris* 316(II), 1477-1483.
- Rhodes, E.
- 1990 *Optical Dating of Quartz from Sediments*. Thèse de doctorat. University of Oxford: Oxford.
- Rhodes, E.,
J.P. Raynal,
D. Geraads,
F.Z. Sbihi-Alaoui
- 1994 Premières date RPE pour l'Acheuléen du Maroc atlantique (Grotte des Rhinocéros, Casablanca), *C.R. Acad. Sci. Paris* 319(II), 1109-1115.
- Texier, J.P.,
J.P. Raynal,
D. Lefèvre
- 1985 Nouvelles propositions pour un cadre chronologique raisonné du Quaternaire marocain, *C.R. Acad. Sc. Paris* 301(II), 183-188.
- 1994 Contribution pour un nouveau cadre stratigraphique des formations littorales quaternaires de la région de Casablanca (Maroc), *C.R. Acad. Sci. Paris* 318(II), 1247-1253.
- Toth, N.
- 1985 The Oldowan Reassessed, a Close Look at Early Stone Artifacts, *Journal of Archaeological Science* 12, 101-120.

Jean-Paul Raynal and Lionel Magoga
Université de Bordeaux 1
Institut du Quaternaire
UMR 9933 CNRS and GDR 1122 CNRS
Avenue des Facultés, F-33405 Talence Cedex
France
and
Mission préhistorique et paléontologique française au Maroc

Fatima-Zohra Sbihi-Alaoui
Institut National des Sciences de l'Archéologie et
du Patrimoine
Avenue John Kennedy, Casier Postal
Rabat-Souissi
Maroc

Denis Geraads
Laboratoire de Paléontologie des vertébrés et
Paléontologie Humaine
Université de Paris VI, case 106
4 place Russieu, 75252 Paris cedex 05
France,
UMR 152 CNRS, Musée de l'Homme
Place du Trocadéro, 75116 Paris
France
and
Mission préhistorique et paléontologie française au Maroc