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# Nadaouiyeh Aïn Askar, an example of Upper Acheulean variability in the Levant

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## ABSTRACT

The site of Nadaouiyeh Aïn Askar is situated in The El Kowm oasis, located in the centre of modern Syria, presents an Acheulian sequence covering approximately the span between 550 ka and 325 ka ago. At least 32 levels of Acheulian occupations can be discerned that can be integrated into seven distinct cultural phases of hand axe traditions. Surprisingly, the oldest occupations discovered *in situ* present the most refined hand axes. The basic evolution goes from highly refined and standardized to less elaborate and more schematic and irregularly manufactured bifaces but not in straight lines. A common feature of all Acheulian groups from Nadaouiyeh Aïn Askar is the strong predominance of the *façonnage* concept for tool fabrication combined with a nearly complete absence of retouched flakes. The different archaeological units present a strong originality, each with diagnostic features differentiate from the others, demonstrating a strong cultural versatility. Such change can be far-reaching and swift. The variability encountered in Nadaouiyeh Aïn Askar stands for an acute dynamic of technological and particular stylistic changes within the Acheulian, contrarily to what usually is expected regarding this period.

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## 1. Introduction

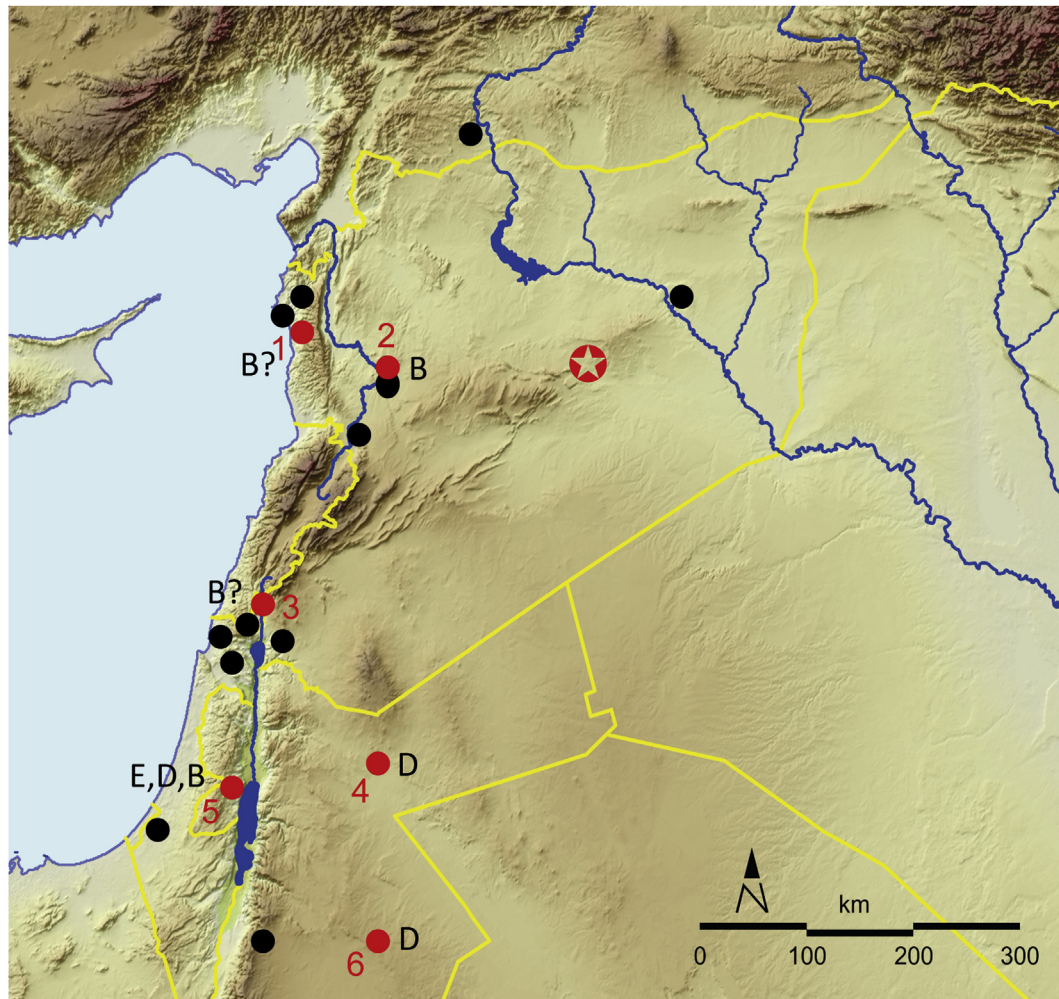
The site of Nadaouiyeh Aïn Askar is part of the dense cluster of wetlands that make the oasis of El Kowm, located in the geographic heartland of modern Syria (Fig. 1). The concentration of many natural springs within an arid environment attracted game and humans from afar throughout the Pleistocene (Jagher and Le Tensorer, 2011; Jagher et al., 2015). Human presence in El Kowm dates back to about 1.8 my (Le Tensorer et al., 2015) and continued continuously throughout the Pleistocene until today. Particular geological conditions on the local spring sites eventually created extremely deep stratigraphies, in many cases several tens of metres deep, each covering a long sequence of human history through all periods of the Palaeolithic (Besançon et al., 1982; Le Tensorer and Hours, 1989; Le Tensorer et al., 2001; Jagher and Le Tensorer, 2011; Jagher et al., 2015). Such a well-documented Palaeolithic record of open air sites in a continental environment is exceptional and is the most complete archaeological record within a single landscape of the Middle East.

Nadaouiyeh Aïn Askar was discovered in 1978 by the team of Jacques Cauvin (Cauvin et al., 1979) and was subject of a limited sounding in 1982 revealing the potential of the site (Hours et al., 1983). Between 1989 and 2003 excavations were conducted by the Institute of Prehistory of the University of Basel in close cooperation with the Directorate General of Antiquities and the University of Damascus (e.g. Le Tensorer et al., 1997; Jagher et al., 1997; Jagher, 2000, 2011) (Fig. 2). The deeply stratified open air site is located on a natural spring, flowing at least for the major part of the Middle Pleistocene, when discharge at this place ebbed in favour of close-by wells. The upwelling water from a deep artesian aquifer created a vertical karst system that regularly collapsed, creating extensive sinkholes at the surface. These depressions not only offered natural shelters for humans against the incessant wind in the open landscape but also permitted the accumulation fine grained sediments, rapidly covering and protecting the archaeological remains. The particular conditions in Nadaouiyeh Aïn Askar eventually resulted in a complex and interlaced stratigraphy, with a cumulated sediment column of more than 33 m, including 32 Acheulean levels and traces of later occupations (Jagher, 2011). The excavations revealed an important multiphase Acheulean occupation including the discovery of 12,415 hand axes and bifacial tools (Fig. 3). The bulk of the collection comes from one single erosional

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**Fig. 1.** Map of the Middle East with the localisation of Nadaouiyeih Ain Askar (star) and sites mentioned in the text; 1 Roudo, 2 Gharmachi, 3 Ma'ayan Baruch, 4 Azraq, 5 Umm Qatafa, 6 Al Jafr. Letters refer to the Acheulean facies of Nadaouiyeih Ain Askar (see text).

level, where artefacts from different periods were washed together. Additionally, a rich palaeontological material was collected, reflecting human subsistence and adaptation to an arid environment (Reynaud, 2011; Jagher et al., 2015).

During the lower phase, the stratigraphy is dominated by limnic and paludal accumulations that were deposited under changing conditions (Jagher, 2000; Pümpin, 2003; Kalbe et al., 2016). In the upper part, additionally to limnic deposits, the stratigraphy is influenced by clastic deposits from an increased erosion of the local surroundings, as a low spring mound rose a few metres above the surrounding landscape, with degradation nearly outbalancing build-up that almost completely obliterated the original geomorphological structure.

The oldest elements of the archaeological record comprise hand axes of clearly Middle Acheulean style that is only known from isolated artefacts out of their original context. The bulk of the prehistoric record in Nadaouiyeih Ain Askar is the complex of Levantine Upper Acheulean levels, divided by their geological context into six distinct facies. The presence of the Yabrudian and the Early Middle Palaeolithic (i.e. Hummalian – Wojtczak, 2011) and the classical Levallois–Mousterian of the Levant is confirmed in dislocated layers in the infilling of a later dolina (Hauck, 2010). The sequence is topped by a massive deposit sealing the site, inclosing in its upper part a perfectly stratified late Acheulean settlement.

The chronology of Nadaouiyeih Ain Askar relies on analogies, as no direct dating is yet available. Potentially the Upper Acheulean can be as old as Gesher-Benot-North (i.e. 660 ka) when considering the flint hand axes from this site (Sharon et al., 2010; Sharon, 2011, pers. comm.). The end of this period coincides with the transition to the Yabrudian around 325 ka (Mercier and Valladas, 2003; Mercier et al., 2013). Older claims for this transition are suggested, but have yet to be substantiated (Gopher et al., 2010; Mercier et al., 2013). The current age model for Nadaouiyeih Ain Askar includes the period between roughly 550 ka as maximum age for the deepest *in situ* levels and 325 ka with the appearance of the Yabrudian.

## 2. Lithic industry

Additionally to previous studies (Le Tensorer, 2006; Jagher, 2011) the database of the Nadaouiyeih Ain Askar hand axes has been revised for this paper and omitted materials included, permitting a higher resolution on a firmer statistical base (this database is available as supplementary material to this paper). Formal tools are almost completely restricted to artefacts made by façonnage. Retouched flake tools are extremely rare compared to the numbers of core-tools (Table 1). Special attention was given to the edge preservation to avoid an arbitrary inflation of the numbers in this category. In a general trend flake tools become slightly more

important in the upper part of the stratigraphy, however, they are still clearly outnumbered by the hand axes and other core tools.

the preliminary shaping of hand axes in all levels has not been made on the site. Preparation flakes by far are underrepresented in

**Table 1**

Inventory of hand axes and bifacial tools from Nadaouiye Aïn Askar. For definitions of morphogroups see text. SPT = small pebble tools; ret. flakes = intentionally retouched flake tools; d.pat. = double patina; T.B. = tranchet blow, m<sup>2</sup> = excavated surface per unit.

facies	morphogroups											total	c-l CT	ret. flakes	double pat.	T.B.	m <sup>2</sup>	
	1	2	3	4	4.1	4.2	4.3	5	6	7	8							9
A		12		4				7	2		9	12	46	4	10	3	2	19.25
A/B	9	13	15	11				2	4	3	4	9	70	12	x	8	0	2.90
B1	4	11		7				16	11	4	11	19	83	27	15	7	0	10.25
B2	10	16	1	9				10	8	3	13	18	88	33	14	7	1	26.75
C1	11	9		2				7	3	5	4	23	64	3	7	3	0	14.25
C2	13	10				1		2		2	5	12	45	3	4	4	1	11.25
C3	10	8	2	3		1		2	1	1	10	21	59	2	6	2	1	11.25
D s.l.	5	31	3	1	12	22	21	13	5	6	19	48	186	3	6	11	35	x
Da	0	36	2	--	13	27	11	9	1	6	41	106	252	2	16	11	22	13.75
Db	2	21	2	--	6	23	13	5		4	16	49	141	0	9	4	23	12.25
Dc	5	19	6	--	28	45	39	11	3	7	21	65	249	2	19	10	66	14.25
Dd	11	17	7	--	18	34	46	7		8	11	39	198	2	13	9	71	12.75
E	46	68	11	11				31	11	12	17	23	230	4	24	27	1	5.00
F	3	28	22	7				5	1	6	2	2	76	0	4	4	2	6.75
total	129	287	71	51	77	153	130	120	48	67	174	434	1787	97	147	110	225	
1004																		

facies	morphogroups											c-l CT	ret. flakes	double pat.	T.B.		
	1	2	3	4	4.1	4.2	4.3	5	6	7	8					9	
A		x		x				x	x		x	x		x	x	x	x
A/B	13%	19%	21%	16%				3%	6%	4%	6%	13%		15%	x	11%	0%
B1	5%	13%		8%				19%	13%	5%	13%	23%		25%	15%	8%	0%
B2	11%	18%	1%	10%				11%	9%	3%	15%	20%		27%	14%	8%	1%
C1	17%	14%		3%				11%	5%	8%	6%	36%		4%	10%	5%	0%
C2	x	x						x		x	x	x		x	x	x	x
C3	17%	14%	3%	5%		2%		3%	2%	2%	17%	36%		3%	9%	3%	2%
D s.l.	3%	17%	2%	1%	6%	12%	11%	7%	3%	3%	10%	26%		2%	3%	6%	19%
Da	0%	14%	1%		5%	11%	4%	4%	0%	2%	16%	42%		1%	6%	4%	9%
Db	1%	15%	1%		4%	16%	9%	4%	0%	3%	11%	35%		0%	6%	3%	16%
Dc	2%	8%	2%		11%	18%	16%	4%	1%	3%	8%	26%		1%	7%	4%	27%
Dd	6%	9%	4%		9%	17%	23%	4%	0%	4%	6%	20%		1%	6%	5%	36%
E	20%	30%	5%	5%				13%	5%	5%	7%	10%		2%	9%	12%	0%
F	4%	37%	29%	9%				7%	1%	8%	3%	3%		0%	5%	5%	3%

Considering the débitage in the Nadaouiye Aïn Askar ensembles has to be adjusted to its producers; such as hand axes, associated core-tools and flake-cores. Hand axes made in an elaborate technique produced flakes that can clearly be associated to them during their later stages of shaping, and when reworked. However, when the applied technique was less elaborate, their flakes are no more recognisable as hand-axe-flakes by their morphology and can barely be differentiated from those originating from other bifacial tools and cores. Nevertheless, the flake-material clearly shows that

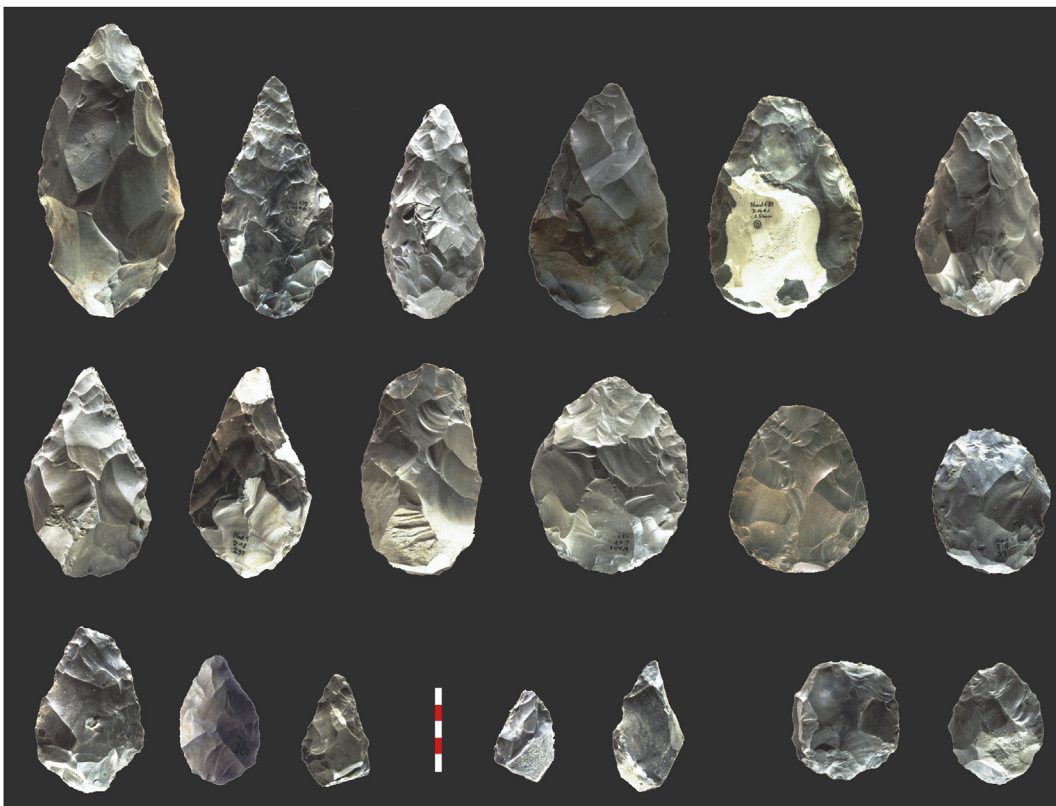
all assemblages demonstrating, that hand axes almost exclusively have been brought to the site as finished tools.

On the spot, hand axes and their homologues were reshaped more or less intensely as is demonstrated by the corresponding waste, but also by a steady percentage of artefacts with double or even triple patina (Fig. 4). The visibility of this phenomenon is strictly a taphonomic problem, as uniformly patinated artefacts show no direct information about a possible reshaping. This can be just marginally for re-sharpening a cutting edge, or the tools were





**Fig. 2.** General view of the excavations at Nadaouiyeħ Aĭn Askar.



**Fig. 3.** Selection of hand axes from different levels in Nadaouiyeħ Aĭn Askar.

completely overhauled totally changing their shape and clearly reducing their dimensions. This may occur during a single event or in successive stages. In most cases of double patinated bifaces, the negatives from overhauling can barely be distinguished from those

of the original stage, impeding to establish unambiguous criteria to recognise such reorganisations on uniformly patinated artefacts. This observation challenges considerations about hand axe morphologies and morphometry. Reshaping affects particularly the

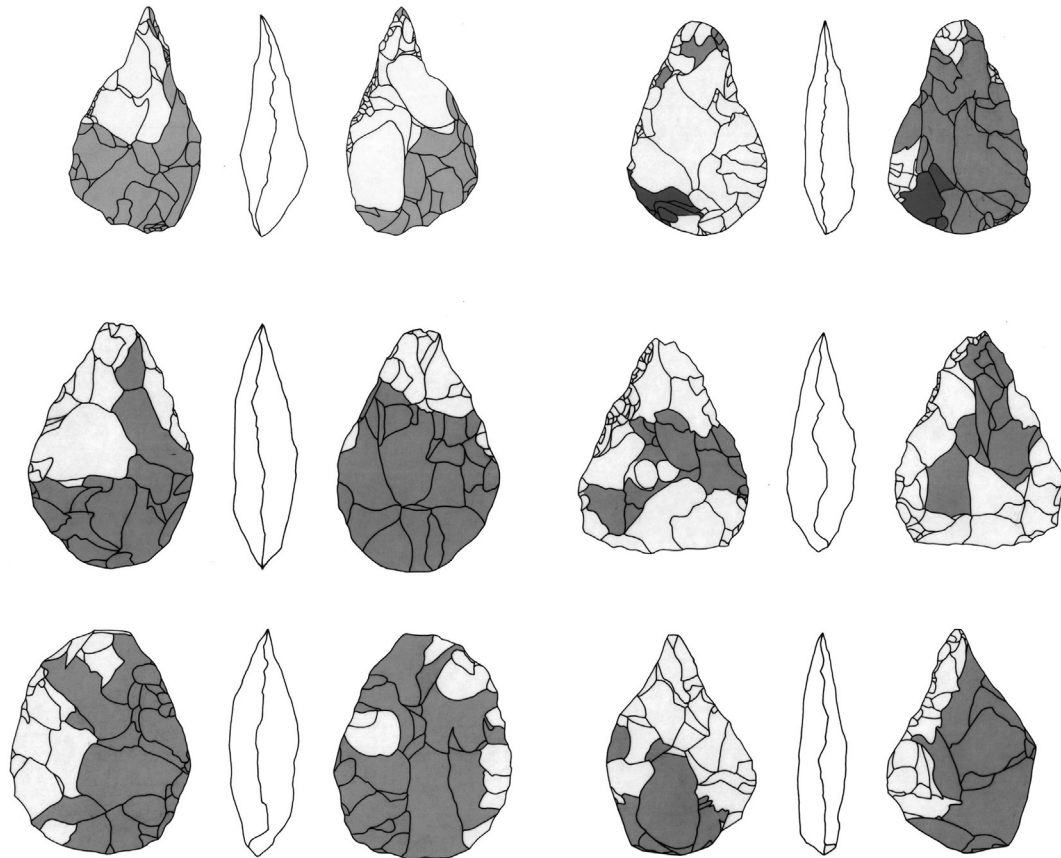


Fig. 4. Selection of hand axes with double patina.

contour, but does not permit to reduce the thickness at the same scale. In this respect it has to be noted, that hand axes with awkward sections potentially to be associated with excessive reshaping, are extremely rare. Obviously reorganisation of hand axes was abandoned while the tool presented still a balanced morphology. In this respect, perfectly executed little hand axes of less than 6 cm in length, have been conceived from the beginning as small tools, and do not represent standard sizes worn down to that size.

A common trait to all El Kowm Palaeolithic sites is the proliferous use of the excellent local raw material of the Eocene Arak formation occurring in dense rows of nodules or extensive slabs (Medvedev, 1966; Oufland, 1966; Jagher et al., 2015). Virtually more than 99% of the artefacts are made of this material (Bourg, 2007; Hauck, 2010; Wojtczak, 2014), as it also the case for the Nadaouiyeah Ain Askar hand axes. The closest outcrops of this resource occur at four to five kilometres from the site. This flint is extremely homogenous, and specific locations cannot be distinguished neither macro- nor microscopic (Julig et al., 1999; Diethelm, 2004). Samples of Arak flint do not show any difference over a distance of 235 km. Hence “imported” pieces cannot be distinguished from local material and nothing can be said about their potential circulation. Hand axes and other core tools made of clearly allochthonous raw materials are present with less than 0.4% of the total corpus. This permits some reflections about the circulation of hand axes and other “heavy tools”: as the Arak flint occurs along a limited East–West running strip, a movement exclusively along this axis can be ruled out for Palaeolithic hunters and gatherers, who certainly also moved forth and back to the Euphrates oasis about 70 km to the North, leaving no visible record in the archaeological material. As a model it may be asked if those heavy

tools didn't stay in place and their maker travelled without heavy luggage, completing their toolbox on the spot; especially in an area where raw material was plentiful, of excellent quality and easily accessible. In this respect also the multiple patinated hand axes have to be considered, which have been recycled after a period of abandon when people left the place.

Another characteristic of the local raw material is that size does not matter. Without shortage, nodules and blocks from large slabs easily exceed 20 or 30 cm, permitting the production of core tools in appropriate dimensions. Mean lengths throughout the Nadaouiyeah

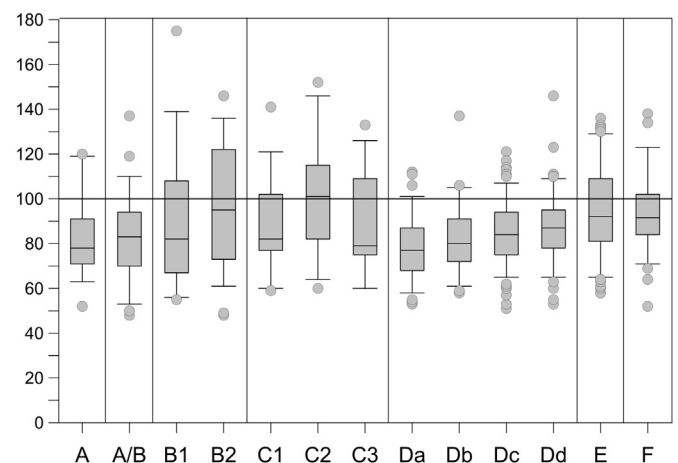


Fig. 5. Distribution of lengths of typical hand axes from the main archaeological units of Nadaouiyeah Ain Askar. Whiskers are set at 5/95 percentiles.

Ain Askar sequence nevertheless are between 78 and 95 mm; however, with a considerable variability (Fig. 5). Less than 6% of all hand axes exceed 120 mm in length with an absolute maximum of 175 mm out of measured 1077 pieces. It can be positively stated that the limitation of size observed in Nadaouiyeah Ain Askar is a human choice and definitely not imposed by the raw material.

### 3. Classifying hand axes

As imposed by the nature of the archaeological discoveries, the present paper is focusing on the hand axes and other bifacial tools produced with *façonnage* concepts. The considerable numbers of these artefacts in all archaeological units from Nadaouiyeah Ain Askar impose a quantitative comparative approach in favour of purely morphological observations. The central point in this respect is the issue which aspects are frequent, representing a certain mainstream and what is rare or exceptional and obviously of lesser impact when considering a collection as a whole.

When classifying hand axes a number of constraints converge, including the original intentions of the maker and the appreciation of the academic, both linked by the object, which was part of daily life for the former and an object of intellectual studies for the latter. It has to be kept in mind, that these tools have been produced individually on not standardised blanks. Reproduction of shape and dimensions, but also the style of execution (in part a sign of personal skill), is only possible to a limited extent and variability is inherent to this system. Furthermore, it has to be respected how much formal reproduction was important to the producer, and to what extent he depended on a precise template or rather on a general scheme. In addition, hand axes were regularly subject to reshaping, modifying their morphology in a considerable extent. Consequently what does the present shape of hand axes tell us today about the original intentions of their makers and the reasons of their discard? Only repeated observations on a sound statistical base permit to identify original patterns and to recognise the maker's intentions.

These basic preconditions have to be considered when adopting a system of classification, which is clearly a prehistorian's concept prone to fall far short of prehistoric reality. In an attempt to overcome the entanglements of preconceived classifications developed for different periods and locations with their specific contexts (e.g. Tixier, 1957; Bordes, 1961; Isaac, 1968, 1977; Roe, 1968; Leakey, 1971; McPherron, 2006) after an ineffective attempt with these specifications, a different approach was chosen for the Nadaouiyeah Ain Askar finds. It rapidly became clear, that basic categories derived from the direct observation of the material were needed. In this respect an original collection of more than 950 hand axes and bifacial tools were laid out in a body at the former Laboratory of Prehistory at the University of Basel. This synoptic observation was done in a first approach by individual level and archaeo-stratigraphic units and subsequently crosschecked by morphological aspects alone without the proper archaeological context. This approach clearly demonstrated the limits of conventional classification systems as the inherent variability of morphologies, shapes and sizes was obviously visible. Nevertheless, this empirical approach permitted to recognise basic and immanent morphologies that consistently appeared in the material. Eventually a classification was adopted on this experience and condensed to nine generic classes, subsequently labelled "morphogroup" (Jagher, 2000, 2011). Contrary to classical typological schemes, requiring a close formal conformity permitting little variability, morphogroups may encompass a certain variation in the biological sense of morphs, including different forms of individual gestalt as it may be present in a polymorphic species (Ford, 1940). Besides the basic definition for each morphogroup the context for a given artefact, i.e.

the archaeological unit, has to be respected for a definite attribution. With this procedure irregular and exceptional shapes or morphologies due to different styles of execution or constraints due to the raw block, can be absorbed without creating new classes.

The Nadaouiyeah system of morphogroups eventually is subdivided in two main groups, the typical hand axes and atypical bifacial tools, comprising the following classes for hand axes: MG (morphogroup) 1: elongated hand axes with definitely stretched proportions with a clearly pointed tip; MG-2: classical drop-shaped forms comprising the classical cordiform and amygdaloid shapes; MG-3: pointed ovate shapes combining a broad contour with a well-developed short tip, i.e. showing a distinct longitudinal axis with a clear base and top; MG-4: oval hand axes with a bipolar contour without definite bottom or top. By their style of execution oval hand axes of the MG-4 are immediately discerned from the *pièces bifaciales* (see below); MG-5: irregular hand axes, i.e. tools with a clearly inferior style in manufacture than the mainstream of the concerned facies, basically combining the above defined shapes; MG-6: triangular hand axes with a transverse base that is clearly offset from the sides converging into a well-developed tip, and finally MG-7: comprising all the miscellaneous shapes, that do not fit the other groups. Eventually less than 6% of all typical hand axes from Nadaouiyeah fall into this category, indicating the soundness of the adopted system.

Additionally to the typical hand axes among the Nadaouiyeah Ain Askar material, there are large numbers of bifacial tools that are clearly different by their morphology. The quality of workmanship of manufacture is considerably inferior from that of the hand axes and in many cases they give the impression of being spontaneously made tools in a very *ad hoc* way. Their morphology clearly prevents these tools to be considered as the final state of reworked hand axes. The construction of the volume and the style of *façonnage* clearly show that these tools have been conceived as they are right from the beginning of their production. In many cases a strong influence of the original raw stone is still visible in the end-product a feature rarely perceivable in typical hand axes. The management of the volume is poor and flaking accidents are frequent. Obviously they are implements produced without seeking a precise form beyond a general shape. By their basic morphology, atypical bifaces can be divided in two categories: atypical bifaces (MG-8), these are clearly elongated artefacts with an explicit longitudinal axis and presenting a more or less distinct base and tip. The second category of atypical hand axes are the *pièces bifaciales* (MG-9) (Jagher, 2000, 2011), they present a distinct discoidal shape and are rather small tools about 5–8 cm across, presenting little morphological standardisation with the retouch usually completely covering their two faces. In many cases, such artefacts could be classified as cores. Against this option speaks the general management of the volume, with two equivalent surfaces, that meet with an angle between 40° and 60° which is not appropriate for purposeful *débitage* (Boëda, 1995). Additionally the circumferential edge lies strictly on the equatorial plane as the upper and lower sides volumetrically are symmetrical. There is no real preparation for striking platforms and the circumferential rim of these artefacts is clearly designed as a cutting edge and is not subordinated to the prerequisites of a core.

Conventional classifications usually include too many classes comprising overcome and outdated formal categories often with quite theoretical and rather close types (e.g. Bordes, 1961; Roe, 1968; McPherron, 2006). Such a system could work in a qualitative approach, but would impede a statistical comparison. With an increasing number of categories the size of the required database raises considerably in order to obtain stable results. On the other hand, the reduced number of morphogroups permits a smaller size of the underlying database, nevertheless still quite important for hand axes. The considerable inventories from Nadaouiyeah Ain



Askar permitted to verify in a simulation the reproducibility of random samples for subsets of a bigger database. To stay within a confidence level of  $\pm 5\%$  for nine morphogroups, at least 50 objects were needed, a prerequisite rarely met in Acheulean sites in general. A survey of Acheulean sites from Syria, excluding the Nadaouiye Aïn Askar materials, revealed only 13 inventories out of 224 sites that produced 50 or more hand axes (Muhesen and Jagher, 2011) basically permitting such a statistical approach. However, nearly all of the rich sites are surface collections with little stratigraphic control that are prone to considerable palimpsests.

#### 4. The Acheulean of Nadaouiye Aïn Askar

By its stratigraphical position within distinct geological contexts the archaeological material can be assigned to seven definite phases subsequently designated as facies. This unique sequence allows for the first time to follow the evolution or rather the history of the Levantine Upper Acheulean. The different geological units are separated by more or less visible, but clearly established hiatuses (Jagher, 2000; Pümpin, 2003; Le Tensorer et al., 2007; Kalbe et al., 2016). The Nadaouiye Aïn Askar stratigraphy clearly comprises longer periods of stagnation than time recorded by the sediments. But also erosions took their toll on the geological and archaeological record of the site. This intermittent nature of the Nadaouiye Aïn Askar stratigraphy has to be kept in mind for the interpretation of the archaeological sequence.

In all archaeological facies, the production of formal tools is dominated by façonnage methods. Sizes start around 50 mm in length upwards, smaller hand axes and atypical bifaces, originally labelled microbifaces occur sporadically but always in small numbers throughout the sequence (Fig. 5). Fully fledged and perfectly shaped hand axes between 50 and 60 mm long, were suggested to be a kind toy tools for children (Röder, 2010), a hypothesis difficult to substantiate as such small pieces are just at the lower end of a natural distribution and variability within the concerned facies.

The absence of smaller tools throughout the Upper Acheulean sequence of Nadaouiye Aïn Askar is emphasised by the extremely low numbers of retouched flakes being just a marginal phenomenon compared to the core tools (Table 1). Perhaps the high criteria for the acceptance of a modified edge as purposefully retouched adopted for the Nadaouiye Aïn Askar material, may accentuate this observation against other sites, however, clearly shows the inherent trend.

Even as there are statistically significant collections available for the different stages of the Upper Acheulean in Nadaouiye Aïn Askar; the disparity of data between the different facies has to be considered. This concerns in particular the extent of the excavated surfaces (Table 1) and the density of finds or the number of levels included in the same unit. Another factor is the intensity of settlement activity within the investigated sector. As this concerns open air settlements with no proper topographical constraints except possible pond shores or swampy areas, their centre is elusive. In this respect, excavations are located somewhat at random and technical limitations, such as 5–6 m of archaeological overburden may limit the extension of excavation sectors. Such basic factors have to be kept in mind, when comparing the different Upper Acheulean facies in Nadaouiye Aïn Askar. In the following a short presentation of the different archaeological facies is presented in chronological order from oldest to youngest.

In the oldest known *in situ* stratified archaeological facies, Nad-F the hand axes are characterised by an exceptionally high standard in elaboration that is surprising for their stratigraphic position. As a general trait they show an astonishing uniformity and perfection in shape and symmetry, exceeding by far pure functionality (Le

Tensorer, 2006). The sense of standardisation is also reflected by an extremely low morphological variability with an unusual monotony of shapes. The two main classes, the cordiform (MG-2) and the pointed ovates (MG-3) present a close affinity in their making and shapes, as the two classes are rather the two extremes of the same continuum. These two groups represent nearly three quarters (70%) of all bifacial tools, demonstrating the narrow concepts of their makers (Fig. 6). The highly esthetical aspect of the hand axes and outstanding craftsmanship is never again achieved in the subsequent younger facies with such uniformity. In fact, the effort given to the manufacture of the hand axes of facies Nad-F persistently exceeds by far the basic investment to produce such tools and technical challenges were deliberately accepted and mastered in perfection, being the hallmark of this facies. Informal core tools such as *pièces bifaciales* and atypical bifaces occur at the lowest ratio within the Nadaouiye Aïn Askar sequence. The evidence of such an “evolved” assemblage at this stratigraphical position was quite a surprising at the time of its discovery being strongly against the prevailing theories.

Separated by a substantial stratigraphical hiatus, in the subsequent facies Nad-E the quality of elaboration of hand axes clearly diminishes, compared to the preceding period. Two distinctly different basic shapes of elongated (MG-1) and cordiform (MG-2) hand axes dominate the inventory. By their uniform proportions the two groups clearly are separated and show each a strong formal standardisation with only exceptionally transitional morphologies. Common to both is a uniform and still high level of elaboration. In contrast to this, there is good proportion of irregular hand axes (MG-5) which are conceived and realised in a much more liberal way. In comparison to its precursor, facies Nad-E shows several inherent changes: the uniformity of fabrication style decreases whereas formal variability increases to some extent. The formal spectrum presents two clearly defined groups; each produced with its corresponding procedure. Informal bifacial tools, i.e. atypical bifaces and *pièces bifaciales*, make their first distinct appearance illustrating a wider concept in tool making than in the older Nad-F facies.

The transition to facies Nad-D features a profound shift in the spectrum of hand axes. Elongated and pointed shapes typical for Nad-E disappear to a large extent in favour of hand axes with oval contours and blunt tips sharing a frequent application of transversal tranchet blows at their distal end. Over all, pointed hand axes are clearly outnumbered. The style of execution and the level of refinement are somewhat inferior compared to the preceding period Nad-E. Additionally to the typical hand axes informal bifacial tools are making a striking emergence compared to the older facies. The preference for discoid and oval shapes among bifacial tools is also expressed by a surprisingly important proportion of *pièces bifaciales*. However, the closely related atypical bifaces are still rare, accentuating the concept of rounded shapes. The 358 analysed oval hand axes in facies Nad-D permitted a clear subdivision of this group into three distinct classes; MG-4.1: presenting the classical oval concept without a precise base or tip; MG-4.2: comprises oval hand axes with a clear longitudinal axis and more or less parallel lateral sides. In most cases both sides are clearly offset from the base, whereas at the top the contour is running into a rounded end; MG-4.3: showing a close morphology to the precedent group, with the same configuration at the base but with clearly converging sides. Proportions are still broad, as is requested for the shapes of MG-4, and definitely differ from cordiform contours. With the high frequency of oval hand axes (MG-4), an according proportion of pointed ovates (MG-3) could be expected, which is not the case, demonstrating the difference between these two morphogroups. One of the distinct features of Nad-D is the frequent use of tranchet blows at the distal end of hand axes in order to install a perfect

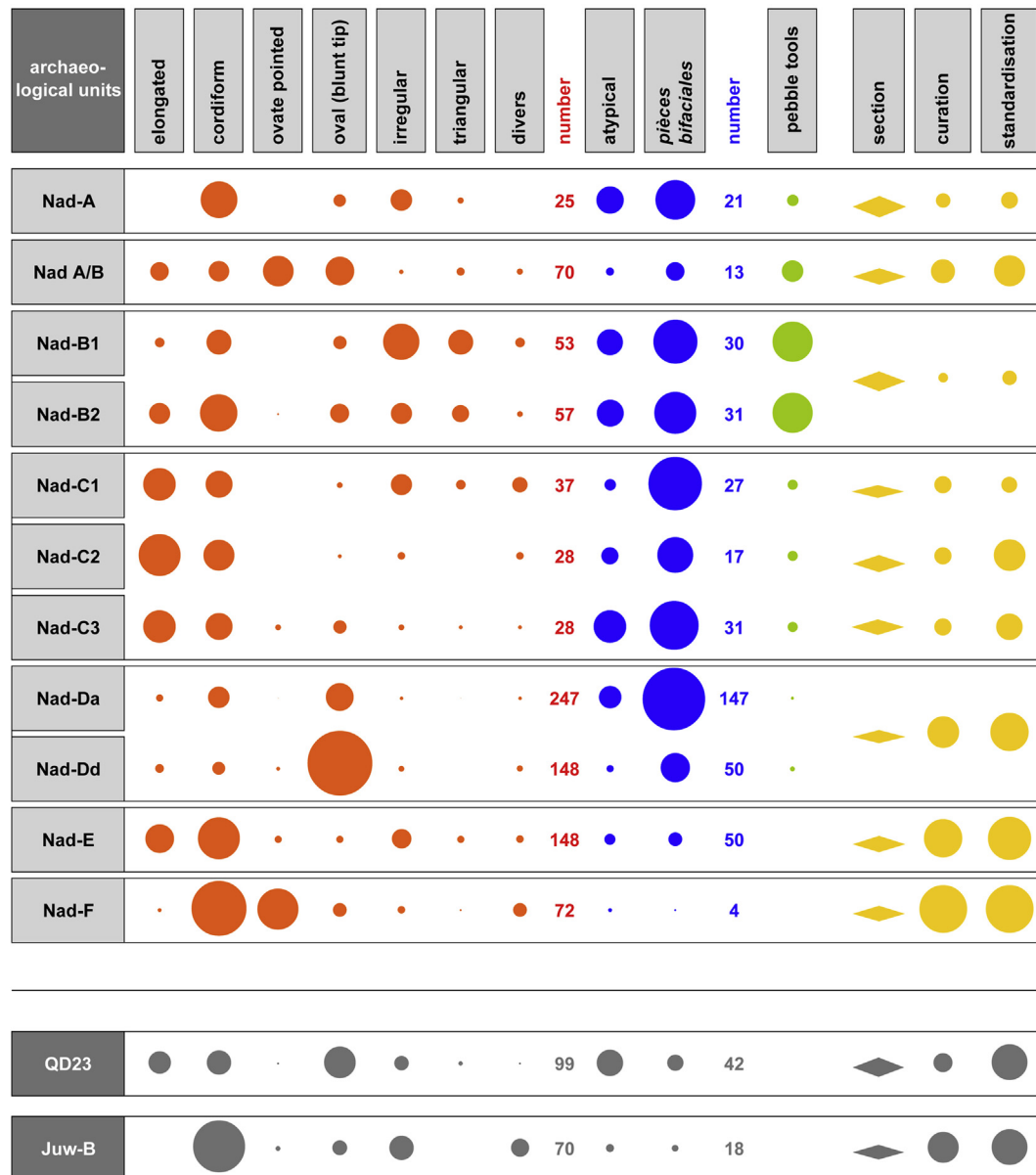


Fig. 6. Variation of the hand axe and core tool spectra through the archaeological stratigraphy of Nadaouiye Aïn Askar. At the base for comparison the spectra of Juwal Aïn Zarqa and Qdeir Aïn Ojbeh (size of dots is according to their respective percentage).

cutting edge (Fig. 7). They were applied only in rare exemptions on atypical bifaces and *pièces bifaciales*. Tranchet blows occur either on one or both faces and can be uni- and bilaterally struck, with no obvious preference of one of these alternatives. With the laterally struck blow, a more or less transversal, slightly convex cutting edge was added to the distal end of the tool. The typical waste flakes are present in substantial numbers and demonstrate that such cutting edges have been restored again and again. The numbers of such flakes indicate a much higher frequency of this method, than is visible on the hand axes themselves. Nevertheless, such re-sharpening was not until a point of no return, as systematically worn down hand axes by this process are absent. Despite their transversal cutting edge, these tools cannot be pronounced as true “cleavers” as they do not really fit the definition of this class, not even the one for “*hacheraux biface*” (Tixier, 1957; Bordes, 1961) as the general volumetric concept of the Nadaouiye Aïn Askar hand axes is completely different and the “cleaver” aspect originates from a secondary modification of an already existing shape.

By its stratigraphical and geological build-up, the Nad-D unit can be divided into four distinct sub-units labelled from bottom up Nad-Dd to Nad-Da. This succession exhibits close affinities such as the preference for oval shapes, the frequent use of tranchet blows and a steadily superior quality of workmanship throughout the sequence. However two evolutionary trends can clearly be traced: One concerns a steady change in the spectrum of hand axes with a progressively increase of cordiform shapes at the expense of oval types, especially those with converging sides (MG-4.3). Despite a cursory affinity of these two morphologies, this change is remarkable, as the two emanate from well different concepts. Parallel to this evolution, there is also a continuous and strong increase of *pièces bifaciales*, changing from a secondary implement (20% in Nad-Dd) becoming a predominant element (42% Nad-Da) of the tool set. Parallel to the *pièces bifaciales*, but to a clearly lesser extent, there is also a steady rise of atypical bifaces. The general evolution of facies Nad-D over all occurs in a continuous pace with a more or less gradual exchange of specific elements. This development



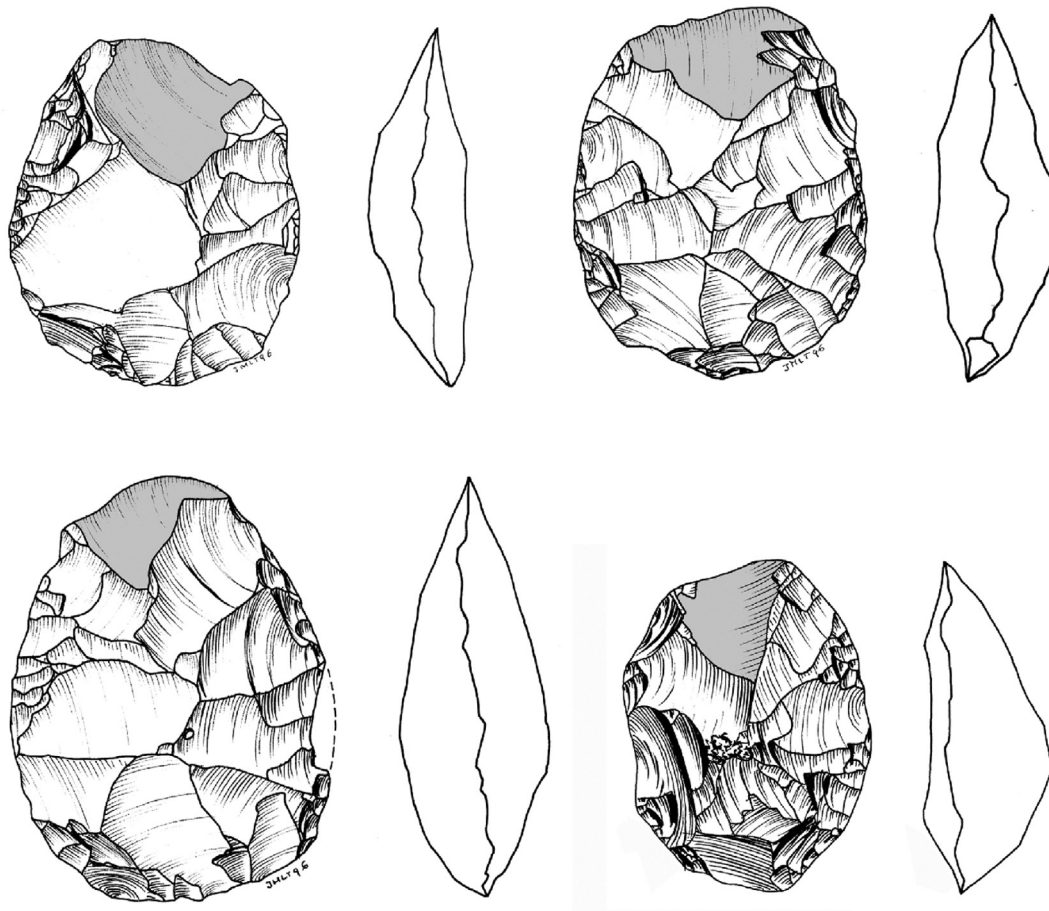


Fig. 7. Hand axes from facies Nad-D with terminal tranchet blows (shaded negatives), drawings J.-M. Le Tensorer.

comprises not only morphology but also the conception of the tool set in its integrity. The difference between the initial (Nad-Dd) and final state (Nad-Da) is substantial and without the intermediate stages, it would be difficult to establish a clear link between them (Figs. 6 and 8). Such a far-reaching change is surprising as it must have occurred within a rather short period as geoarchaeological observations indicate a rapid sedimentation, possibly within a few millennia (Rentzel, 1998; Pümpin, 2003). Palaeontological data show no evident change of environmental conditions throughout facies Nad-D nor can there be seen a shift in subsistence (Reynaud, 2011). Eluding a sound interpretation, other mechanisms must have been the origin for the swift changes particular to facies Nad-D.

Facies Nad-C at first sight recalls to a certain extent Nad-E, an impression supported by the high frequency of elongated hand axes (MG-1). However, the direct comparison shows that hand axes in facies Nad-C were manufactured in a completely different style with more massive and frequently plano-convex sections, completely alien to its older equivalence. The prevalent elongated shapes were produced with more or less straight edges against clearly convex ones in Nad-E. The second principal component among the hand axes are the cordiform (MG-2) presenting in Nad-C much more liberal concepts in their making, proportions and sense of standardisation than their analogues from Nad-E. In contrast the exceptionally well calibrated *pièces bifaciales* are numerous and represent one third of the *façonnage* tools. The subdivision of facies Nad-C into three sub-units according to their stratigraphical position permits a number of observations. The seemingly dominance

of elongated hand axes in facies Nad-C2 is just a statistical artefact, has the number of bifacial tools ( $n = 45$ ) is below the threshold defined above ( $n = 50$ ). Despite the difference, the observed frequency fits perfectly within the expected coincidence for samples of that size. The better documented older sub unit Nad-C3 and the youngest, Nad-C1, show barely any difference. The slightly increased number of atypical bifaces in Nad-Cc, is compensated in Nad-Ca by a higher number of irregular hand axes. As both morphogroups are closely related and separated basically by their style of execution, this difference should not be overestimated. Over all the way core tools were produced is quite homogenous within Nad-C, but is clearly the least elaborated since facies Nad-F.

In the following facies Nad-B any sense for standardisation disappeared. Compared to the older facies hand axes and other bifacial tools present a surprisingly “archaic” appearance. Retouch is crude and rather schematic as the execution of the hand axes present little refinement and sections are the most massive in the whole sequence. The archaic appearance of the of the hand axes is also expressed by an unproportioned ratio of irregular hand axes (MG-5) which have not to be confused with atypical bifaces. However, there are a few exceptional objects, which were executed in a much more sophisticated way, alluding past techniques. This opposition of reduced effort for producing tools, and the ostensible skills when originally wanted, clearly indicate a human choice and are not an inherent disability, but a deliberate style. The immanent abandon of standardisation is not only expressed in broad morphometric variability, but also by the renouncement of specific morphologies resulting in a broad spectrum of shapes without particular

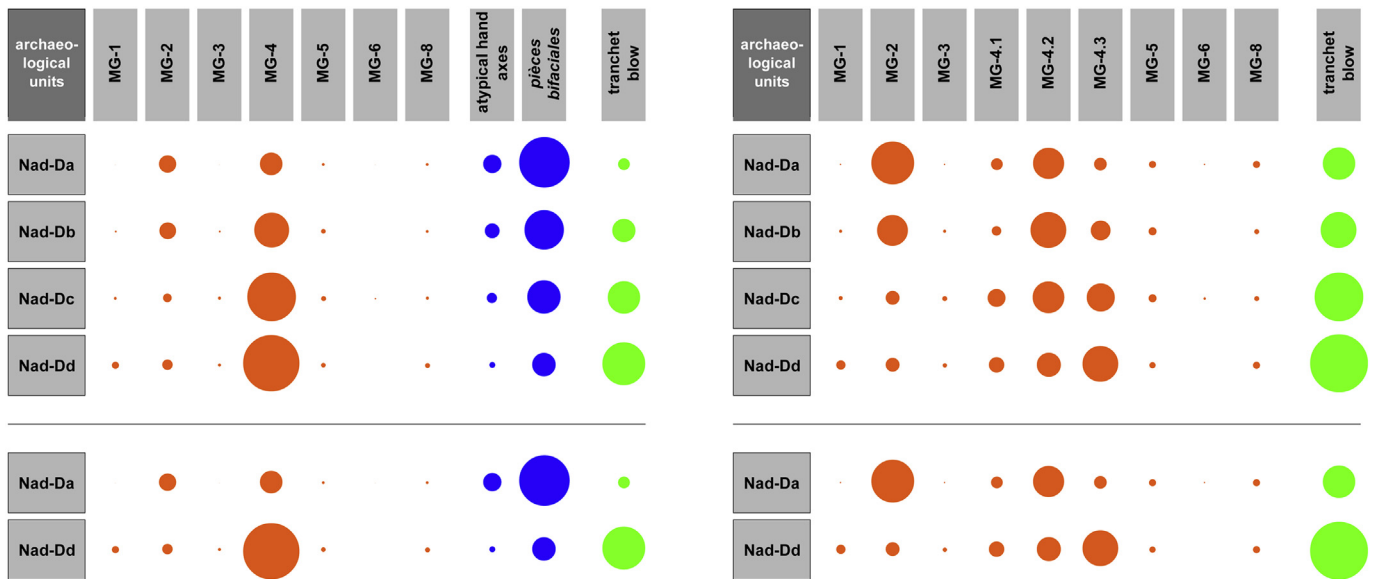


Fig. 8. Variation of the hand axe and core tool spectra during facies Nad-D (size of dots is according to their respective percentage).

preference. Additionally to the proper hand axes from facies Nad-B, a strong proportion of atypical bifaces and *pièces bifaciales*, as a new element, small core-like pebble-tools are introduced in high numbers. They were made on small alluvial blocs of local flint, with an initial negative used as a plain striking surface from which on one side a short sequence of a few short flake were struck. In all cases exploitation ceased with no obvious reason as the available volume clearly would have permitted to carry on producing flakes. Even if present in older and younger facies, however in clearly smaller proportions, the core-like chopping-tools with their substantial numbers are one of the characteristics of Nad-B. The apparently archaic aspect of Nad-B compared to the older facies is expressed by a poor standardisation and simple style manufacture. The easiness how these tools were manufactured display a resourceful reduction to the essential with the least effort, a kind of efficiency easily overlooked. This is also recognisable in the use of alluvial blocs, a resource only exceptionally exploited in older facies, which is available in shorter distance than the primary outcrops. Through geological observations, facies Nad-B can be divided into an older (Nad-B2) and a younger phase (Nad-B1) with no significant differences between them. Although the geological situation is well defined, the Nad-B facies is a kind of palimpsest, combining the finds of 16 distinct archaeological levels and covers by far the longest time period among the Nadaouiyeh Aïn Askar archaeological units. Nevertheless, the different subsets of facies Nad-B show close affinities to each other in all its characteristics and none of them is really out of the ordinary distinctive for this facies.

The last definitely Upper Acheulean facies Nad-A/B (formerly labelled Nad-T) was discovered in a geological sounding during the final phase of excavations in Nadaouiyeh Aïn Askar, when the outlines of the archaeostratigraphy were already defined. Contrary to its precursor (Nad-B), there is again an explicit homogeneity among the hand axes concerning execution and shapes. Albeit not expressed by the morphogroups, a definite archetype is clearly dominating, with the maximum width located well above the base, resulting in rather oval shapes but consistently with a clear base and tip. However, this kind of unity of doctrine is not represented in the formal spectrum as standardisation is poorly developed and morphological variation is considerable. *Pièces bifaciales* and atypical bifaces are still present but in a clearly lower proportion than in Nad-B. The same goes for small

core tools made on small blocks. All in all Nad-A/B is clearly an individual facies with little in common with its precursor.

The most recent Acheulean facies in Nadaouiyeh Aïn Askar, Nad-A, was discovered in a stratigraphic context definitely post-dating the Yabrudian and Hummalian occupations and must be undeniably contemporaneous to the older Levalloiso-Mousterian (Hauck, 2010). The evaluation of this facies is prevented by the limited number of hand axes permitting only presenting a general picture. Among the just 25 typical hand axes, cordiform shapes are the most frequent. In opposition to this, there is a strong component of atypical bifaces and *pièces bifaciales*. Small tools are limited to atypical bifaces and *pièces bifaciales* and as reminiscence to its predecessors, some rare nucleus-like chopping-tools are still present. Retouched flakes are still as scarce as in all the older Acheulean facies. Although there is a substantial number of cores; a well-structured production of flakes is absent, as all of them are exploited in an opportunistic and basic procedure. Everything remembering the distinct technologies of the Yabrudian, Hummalian or Levalloiso-Mousterian is strictly missing in the Nad-A facies.

Summarising the evolution of the Acheulean in Nadaouiyeh Aïn Askar a changeful picture emerges (Figs. 6, 9 and 10). Against original expectances of an evolutionary approach, stating a primitive and archaic ancestor leading to a developed and refined descendent can clearly be ruled out (Hours, 1981, 1982, 2000; Muhesen and Jagher, 2011). Obviously the history of the Levantine Upper Acheulean is less linear than supposed. Despite its richness, the Nadaouiyeh Aïn Askar stratigraphy doesn't show the complete picture, as the local archive is incomplete and hiatuses hide away missing parts.

Although information from Nadaouiyeh Aïn Askar is fragmentary in some way, it is possible to draw a basic picture: Despite the stated changes and differences there is a strong bracket to all Acheulean facies with the strong prevalence of the *façonnage* concept in all its aspects based on core tools with no particular interest in formal tools made on flakes. However, the question of the small tools remains, as *façonnage* does not permit a size reduction below a certain limit, which is in the case of Nadaouiyeh Aïn Askar between 45 and 50 mm. Without direct observation, it has to be admitted, that light duty tasks must have been done with plain flakes. These were produced in very generic and opportunistic

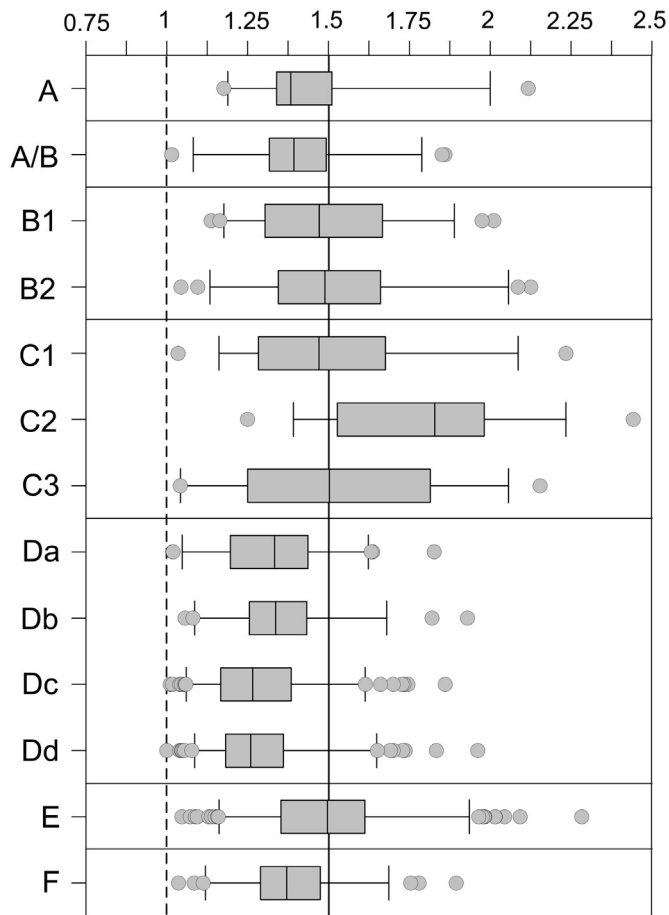


Fig. 9. Length–width proportions of hand axes in the main archaeological units of Nadaouiyeih Ain Askar. Whiskers are set at 5/95 percentiles.

way, as evidence for developed flaking procedures are missing throughout the sequence.

Formal changes intervene at different degrees that are connected to each other or not, concerning a broad spectrum of observations. This applies in particular to formal standardisation, i.e. the concentration on a particular shape or the preference of just a few well defined designs, as it is the case for the older facies Nad-F up to Nad-C, or in contrary, a complete abandon of defined shapes as it is characteristic for the younger facies Nad-B to Nad-A. Another point is the frequency of atypical bifaces and *pièce bifaciales* which are quite rare in the lower facies Nad-F and E, becoming in numbers nearly the equivalent of typical hand axes in Nad-B and C and subsequently diminishing in Nad-B and A/B and dominating again during the final stage of Nad-A. On the other hand the quality of workmanship for hand axes, being at its top in the oldest facies Nad-F gradually decaying through the subsequent stages Nad-E–D–C, being at its lowest in Nad-B and again gaining a certain degree of refinement during Nad-A/B and swinging back to a lesser elaboration in Nad-A. This observation is also reflected in the sections of the hand axes (Fig. 10). Furthermore additional tools may appear, such as the pebble-tool-like instruments, which are nearly absent in the oldest facies Nad-F to D, making a shy appearance during Nad-C and became popular during Nad-B and fading again in the subsequent phases of Nad A/B and A.

The reasons for these changes are difficult to identify. Changes in the local environment are subtle as arid desert conditions prevailed in El Kowm during the whole Pleistocene (Jagher et al.,

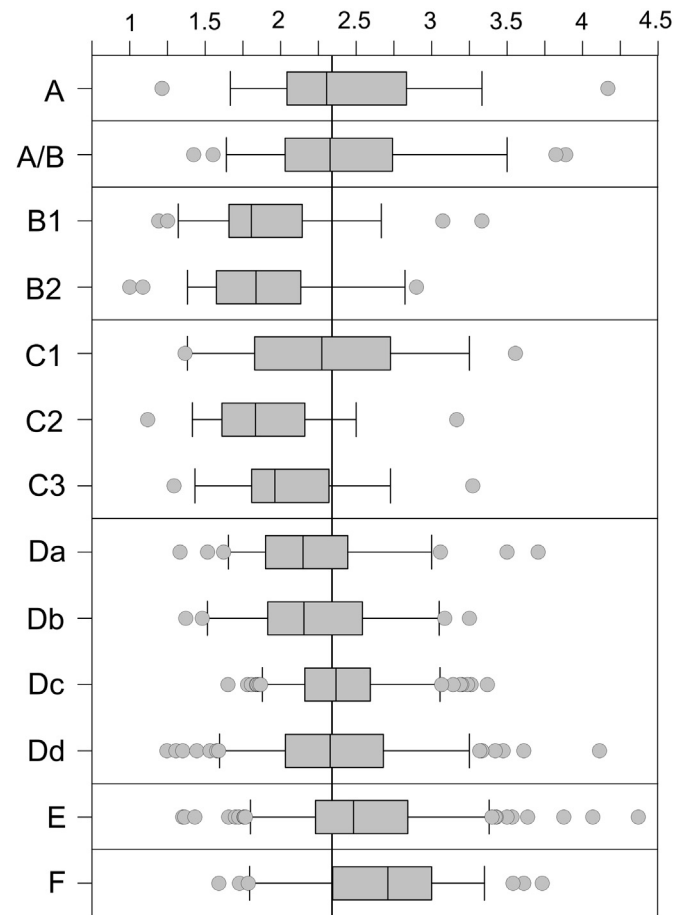


Fig. 10. Distribution of width–thickness ratios of hand axes in the main archaeological units of Nadaouiyeih Ain Askar. Whiskers are set at 5/95 percentiles. Vertical line is set at 2.35 the value according to Bordes (1961) separating thin (at left) from thick sections (at right).

2015). However, Nadaouiyeih Ain Askar was just a leg in the yearly movements of the Upper Acheulean hunters and gatherers covering extensive areas of the Levant. It is well possible, that factors not evident in the local record are responsible for the observed changes.

Although the stratigraphic sequence presents a clear historical succession, this does not prove an evolution in the sense of phylogeny. Cultural history is driven by human choices in response to exogenous or endogenous stimuli. Basically man is adapting to his environment, a fundamental momentum for cultural change. But transformation can also be driven by cultural constraints with no recognizable reasons.

An unexpected outcome at Nadaouiyeih Ain Askar was the discovery of a typical Acheulean tradition, being contemporaneous to the Levallois-Mousterian. Until now, this unique observation in the Levant is difficult to be explained. Is it an isolated manifestation of a small, perhaps short lived cultural group leaving little evidence in the archaeological record of the Levant, or was it part of a much more widespread but yet underestimated phenomenon? It has to be kept in mind, that the Middle East is covered to a vast extent by deserts, a habitat often underestimated by archaeologists and therefore less investigated. However, increasing evidence in recent years illustrates an active human presence in the Arabian Desert since the Middle Pleistocene. On the other hand an incursion of groups with their home range in the adjacent mountains of the Taurus and Zagros, could also be possible.



## 5. Discussion

In an attempt to test the Nadaouiyeh Aïn Askar model as a general framework to place other sites within this scheme, the materials of the Acheulean sites of Juwal Aïn Zarqa and Qdeir Aïn Ojbeh, both excavated in the El Kowm oasis at a distance of 2.0 and 3.4 km from Nadaouiyeh Aïn Askar were included in this study. At both sites hand axes and façonnage tools dominate as much as in Nadaouiyeh Aïn Askar and perfectly fit into the scheme defined by this site. The two sites were subject to periglacial events during MIS 12 also observed in Nadaouiyeh Aïn Askar at the base of facies Nad-B (Le Tensorer et al., 2007; Jagher et al., 2015). Not only by their geologic setting but also by their stylistic features Juwal Aïn Zarqa and Qdeir Aïn Ojbeh integrate perfectly with the lower archaeological sequence of Nadaouiyeh Aïn Askar. Each of the two sites presents a distinct composition of the hand axe spectrum but also is specific in the configuration of their atypical bifaces and *pièces bifaciales*. In both site retouched flake tools are as rare as in their Nadaouiyeh Aïn Askar counterparts. Even with this explicit reference, no unambiguous placement is possible as intermediate stages to the Nadaouiyeh Aïn Askar phases are conceivable. Even if would be tempting, there are no arguments to declare these complementary sites the precursor or descendant of a specific Nadaouiyeh facies, as reasoning is possible from both ends. Thus the Qdeir Aïn Ojbeh material could be placed between Nad-E and Nad-Dd or alternatively between Nad-Da and Nad-C3. The same goes with the Juwal Aïn Zarqa finds that tentatively could be positioned between Nad-F and E or even at the base of Nad-F. This clearly illustrates the limits of evolutionary interpretations, as no linear trends are visible supporting such a tentative assignment.

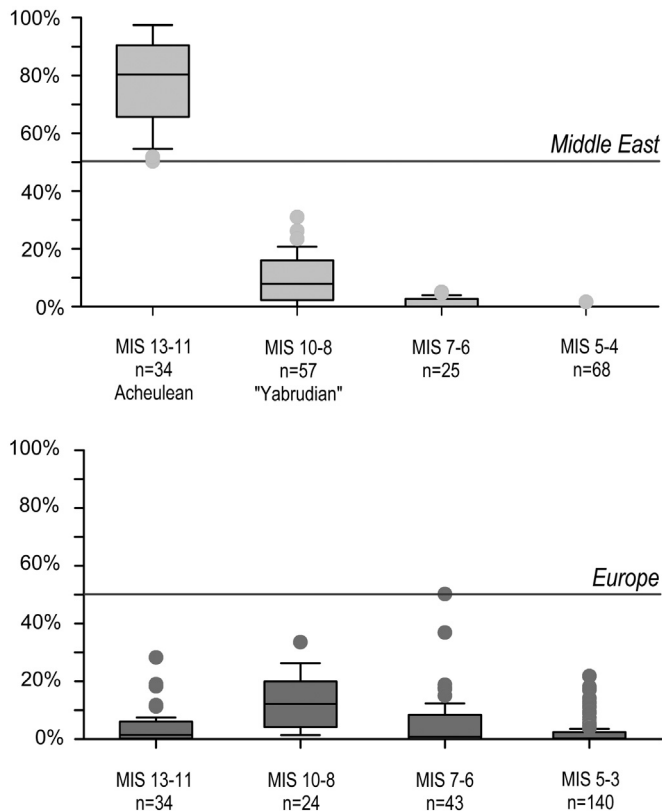
Obviously Upper Acheulean diversity in the Levant must have been much more important than suggested by the Nadaouiyeh Aïn Askar stratigraphy and the Juwal Aïn Zarqa and Qdeir Aïn Ojbeh discoveries alone. This observation is certainly not limited to the El Kowm oasis but applies in all probability for the whole of the Levant. As multi-phased Upper Acheulean sites in the Levant are scarce, it is difficult to evaluate the Nadaouiyeh Aïn Askar scheme on a greater geographical scale. The only available reference so far is the stratigraphy of Umm Qatafa that presents a definite correspondence with the Nadaouiyeh Aïn Askar sequence (Neuvillie, 1931, 1951). According to Neuvillie's 1931 description of the substantial collections of hand axes ( $n = 594$ ), an analogous picture to that of Nadaouiyeh Aïn Askar emerges. At the base layer E1 with the highest refinement in style presents strong affinities to facies Nad-E. The subsequent layer D1 is characterised by broad shapes of hand axes and the presence of tranchet blows has its potential equivalence in Nad-D. The uppermost layer D2 shows close affinities to Nad-B in different aspects. As a case example Umm Qatafa illustrates, that the Nadaouiyeh Aïn Askar sequence is not singular and thus can be considered as a basic model inherent to the Levant.

To adopt the Nadaouiyeh Aïn Askar scheme to other Upper Acheulean sites in the Levant is ambiguous. The versatility and the flexibility how things change make it difficult to attribute other sites with the patterns observed in Nadaouiyeh Aïn Askar. To get a minimal control, a perfect agreement with the original sample must exist and always respecting a minimal database of hand axes as exposed above. The latter prerequisite already clearly reduces the number of potentially related sites. The relation of Umm Qatafa layer E1 and Nad-F essentially depends on morphological and technological affinities, as well as the analogous stratigraphical position. The coherence of Nad-D and Umm Qatafa layer E1 is based on a similar line of arguments as for layer E1. Additionally, Azraq Aïn Soda produced an identical industry to Nad-D (see below) and to a lesser extent the material from al Jafr can be included in this group (Rollefson et al., 1997, 2005). There is a potential number of

sites that could be associated with Nad-B such as Gharmachi (Muhesen, 1985), Ma'ayan Barukh (Stekelis and Gilead, 1966; Gilead, 1973; A. Ronen pers. comm.) and possibly Roudo (Copeland and Hours, 1979; Besançon et al., 1994) (Fig. 1). However, the true kinship is difficult to establish as particularly the Nad-B group presents a discrete diagnostic for such an application and has to be adopted carefully. However, the lack of sites to be assimilated with the Nadaouiyeh Aïn Askar facies, does not contradict the scheme outlined for this site, as the observed changes were swift and drastic. As the Upper Acheulean in the Levant covers a period of more than 300ka, combined with the versatility of cultural expression observed in the El Kowm sites alone, it has to be expected, that every site significant enough for a proper analysis would show its proper characteristics, separated from most others.

A particular phenomenon are the numerous hand axes in facies Nad-D with a terminal cutting edge produced with a tranchet blow described above, that are in a kind a hallmark for this facies. In a broad sense, the more or less transverse cutting edge could qualify these tools as cleavers, an attribution to be considered carefully. The transverse terminal edge is clearly a product of a secondary modification and not inherent to the morphology of the initial production. Among the 582 studied hand axes from Nad-D only two show a transverse terminal edge made by conventional retouch, compared to 206 hand axes with tranchet blows. Furthermore, the profile of the tranchet blows is clearly more convex than straight and the angle of the blows rarely shows a really transversal direction. The basic construction of these artefacts challenges the definitions of the cleaver, placing the Nadaouiyeh Aïn Askar tools rather with the *hachereau biface* (Tixier, 1957; Bordes, 1961). Albeit tranchet blows may occur in every morphogroup, they are most frequently on oval shapes (MG-4). Interestingly, the morphologically closely related *pièces bifaciales* were modified with tranchet blows only in a very few exceptional cases. With the decrease of the oval shapes in the course of Nad-D, also the frequency of tranchet blows steadily declines. Corresponding tools from the Upper Acheulean in the Levant have been described as "Azraq cleavers" from Azraq oasis in Jordan (Rollefson et al., 1997, 2006). Through the kind permission of G. Rollefson it was possible to the author to do a personal evaluation of the Azraq 'Ain Soda collection in Mai 2014. Surprisingly this material proved to be an almost identical twin of the Nad-D material. Again there is a strong preference for broad, oval shapes with the characteristic offset base and the way the tranchet blows are executed and the formal spectra of the two sites barely show any difference. There is also a strong percentage of *pièces bifaciales* and a noticeable ratio of atypical bifaces at Azraq Aïn Soda. The only noticeable differences are the somewhat bigger dimensions in Azraq and thinner sections, the latter due to the use of thin flint slabs. A quite similar industry has also been reported from al-Jafr in southern Jordan (Quintero and Wilke, 1998; Rollefson et al., 2006; Quintero et al., 2007). The presence of tranchet blows in the Levant has occasionally been described from diverse sites of different age (e.g. Stekelis and Gilead, 1966; Gilead, 1973; Matskevich, 2006). As in all the other facies in Nadaouiyeh Aïn Askar, its occurrence is always rare and anecdotic. In front of this background, the high frequencies in Nad-D and the Jordanian sites is rather outstanding and together with a clear formal consensus, they can be combined into a cultural entity to which may also belong level D1 of Umm Qatafa. The geographic distribution of these sites covers a vast area of the Levant (Fig. 1), however to declare this group a desert Acheulean would stress the currently available database.

The persistence of the façonnage concept for the production of tools is not a peculiarity of the Nadaouiyeh Aïn Askar materials but a widespread phenomenon among the Levantine Upper Acheulean



**Fig. 11.** Evolution of the hand axe-index as relationship between bifaces and retouched flakes in the Middle East (top) compared to Europe (bottom) for the same periods.

sites. In a basic approach, 92 statistically significant inventories of the “Acheulean” and “post-Acheulean” have been tested for the relation of hand axes against retouched flakes. Chronologically this corpus has been divided into Acheulean and “Yabrudian” including contemporaneous sites, i.e. about the periods of MIS 13–11 (528–364 ka) and MIS 10–8 (363–242 ka). The frequency of hand axes definitely separates the two periods (Fig. 11); they clearly dominate the Acheulean inventories, whereas the Yabrudian and its contemporaries present a distinct dominance of retouched flakes. In a second step a comparison with coeval periods in Western Europe was compiled. During the same periods as defined above, a completely different picture emerges. While hand axes dominate in the Levant, in Europe they occur in startlingly low numbers with only some rare exceptions (Fig. 11). In the subsequent period, the percentage of hand axes is more or less at the same level in both areas. Later on in the Middle Palaeolithic (MIS7–6 and MIS 5–4), hand axes disappear from the archaeological record in the Levant, whereas in Europe they steadily persist in low numbers.

## 6. Conclusions

The El Kowm sites today as in the past were well located within the desert zone of the Middle East showing the capacities of lower Palaeolithic peoples to cope perfectly with such ostensible hostile environments. With surprising steadiness, Acheulean hunters and gatherers exploited the resources of these arid environments and the question is permitted to what extent such a cultural package enabled early hominids to venture much deeper into these deserts, which by their vastness and diversity nevertheless must have had a considerable potential for human settlement.

Except for the marginal zones (including El Kowm) these areas until now are to a large extent terra incognita as these region

slowly come into the focus of archaeologists. In this approach the question is permitted if one shouldn't consider the Palaeolithic of the Levant rather from its interior, than from the ostensibly privileged coastal areas along the Mediterranean rim. Despite the convenience of increased rainfall the limited extension and difficult topography is barely sufficient for a stable human population depending on a foraging subsistence.

The Nadaouiye Aïn Askar cultural stratigraphy permits for the first time in the Levant to understand the evolution of the Upper Acheulean in detail on significant arguments. The experience of the Nadaouiye Aïn Askar example clearly contradicts a traditional approach based on horizontal stratigraphy, as the way of change is not subdued to a linear evolution. The case study of other El Kowm sites of the Upper Acheulean well showed the problem to assimilate isolated sites even in close topographic proximity and reasonable age control to the Nadaouiye Aïn Askar scheme.

Stratigraphical and geoarchaeological considerations indicate rather short periods of sedimentation followed by considerable gaps in the geological record. Hence many more cultural entities may have left any trace at this place. Considering these constraints the conclusion is permitted that the duration of the different cultural phenomena must have been quite short, i.e. a few ten thousand years at best. For the particular geological setting of facies Nad-D an even shorter period can be considered. Such a short time table for cultural change in the Acheulean applies not only for the El Kowm sites, but can be considered as valuable for the Levant, giving an idea of what can be expected.

Despite the fragmentary record of the Upper Acheulean within the Nadaouiye sequence, it can be considered as a perfect case study of cultural variability within the Lower Palaeolithic. Despite the ostensive gaps and incompleteness of the sequence, the emerging picture shows a surprisingly lively cultural tradition being much more versatile than once supposed for such an ancient period. How drastic and swift the observed changes were, they stay within a well-defined spectrum dominated stubbornly by the *façonnage* concepts. Other approaches to produce stone tools never were adopted systematically as far as can be stated today. In this respect the cultural changes seen at Nadaouiye Aïn Askar, but also at other sites in El Kowm and the Levant, is rather a question of style than technology. Despite the differences, the diverse cultural units from Nadaouiye Aïn Askar and other sites are connected by a close cultural spirit, as the basic approach and tradition in the tool-making stays within a limited repertoire, which is reinterpreted over and over again with surprising results.

Considering the readiness and speed of change visible in the Nadaouiye Aïn Askar stratigraphy and further observations about the Upper Acheulean in the El Kowm area, it could be expected every Levantine Upper Acheulean to be different from each other. However observations made at Nadaouiye Aïn Askar can also be noticed at other Levantine Upper Acheulean sites and close cultural relationships can be stated. For example the phenomenon of the Azraq cleaver and its associated cultural context reveals the expected far reaching extent of early human wanderings. To a lesser extent, such statements tentatively are possible also for other groups. Considering the long period of the Levantine Upper Acheulean and the potential different expressions, it is rather exceptional to recognise such relationships by means of the currently available documentation.

Compared to other regions, the Levantine Upper Acheulean presents unmistakable traits clearly different from its European coevals. In other neighbouring areas such as northern Africa or Western Asia, the database is yet too limited for clear statements. It looks like the Levantine Upper Acheulean represents a distinctive cultural entity of its own deeply rooted in the Middle East. How

much of tith spirit radiated to distant areas, or where the initial input came from, for the time being remains to be solved.

The Nadaouiye Aïn Askar cultural sequence certainly is not the solution for understanding the evolution of the Levantine Upper Acheulean. The proposed structure remains too incomplete to tell the whole history and propose a definite framework valid for the whole of the Middle East. Nevertheless the emerging picture challenges traditional concepts of slow and linear change during the Middle Pleistocene. In any case, it provides a perfect showcase permitting to develop a basic model for this remote period, revealing human behaviour and transformation of cultural concepts in exceptional detail, revealing a period much more dynamic than imagined.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.quaint.2016.02.006>.

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