

INNOVATIVE HUMAN BEHAVIOR BETWEEN ACHEULIAN AND MOUSTERIAN: A VIEW FROM QESEM CAVE, ISRAEL

Ran BARKAI & Avi GOPHER

Department Of Archaeology and Near Eastern Studies, Tel-Aviv University, Israel, barkaran@post.tau.ac.il, agopher@post.tau.ac.il

Introduction

Qesem Cave is a sediment-filled karstic chamber cave some ~20 x 15m in size and ~10m high, located 12 km east of the Mediterranean. The excavation exposed a ~7.5m archaeological sequence. Subsidence, erosion, fracturing, deposition of various sediments and cementation were continuous or recurrent within Qesem Cave during the Middle Pleistocene, constantly changing the cave's landscape and conditions and finally acting as post-depositional agents shaping the preset cave and its sediments (Frumkin *et al.* 2009).

The stratigraphic sequence was divided into two parts – the lower (ca. 3m thick), consists of sediments with clastic content and gravel, and the upper (ca. 4.5m thick), of cemented sediment with a large ash component. The lower part was deposited in a closed karstic chamber cave, while the upper part was deposited when the cave was more open as indicated by the presence of calcified rootlets (Karkanas *et al.* 2007). The use of fire at the site is apparent not only by burnt bones and flints, but also by the presence of ash in the sediments. The micromorphological study indicates that fire was habitually used in the upper part of the sequence and present but less common in the lower part (Karkanas *et al.* 2007).

Intensive ²³⁰Th/²³⁴U dating on speleothems suggests human occupation starting ca. 400 kyr and ending prior to 200 kyr (Barkai *et al.* 2003; Gopher *et al.* 2010). This is supported by unpublished TL dates.

Qesem Cave yielded rich and well preserved faunal assemblages and lithics. The Qesem Cave sequence was assigned to the Acheulo-Yabrudian complex (hence forth AYCC) defined by Rust (1950). The AYCC included three major industries – Acheulo-Yabrudian dominated by handaxes and Quina scrapers; the Yabrudian dominated by Quina scrapers; and the Pre-Aurignacian/Amudian dominated by blades and shaped blades (Bar-Yosef 1994; Copeland 2000; Garrod 1956, 1970; Goren-Inbar 1995; Jelinek 1982, 1990; Monigal 2002; Ronen & Weinstein-Evron 2000). One of the most interesting aspects of this complex was the industry dominated by blade production



Figure 1 - Laminar items from Qesem Cave – Blade dominance at a glance.

(Garrod & Bate 1937; Rust 1950; Garrod & Kirkbride 1961) – the Pre-Aurignacian/Amudian.

Pre-Aurignacian/Amudian (hence forth Amudian) assemblages in the Levant are scarce and have been recovered in only a few sites (e.g. Garrod & Bate 1937; Garrod & Kirkbride 1961; Jelinek 1990; Rust 1950; Skinner 1970; and see Copeland 2000).

Stratigraphically, the AYCC postdates the Acheulian cultural complex of the Lower Palaeolithic period and predates the Mousterian cultural complex of the Middle Palaeolithic period, correlating to Jelinek's "Mugharan Tradition" (Jelinek 1990). Albeit some apparent difficulties, radiometric, absolute dates indicate the same scenario (Gopher *et al.* 2010).

It is within this framework, between Acheulian and Mousterian, that we will try to shortly present the major innovations

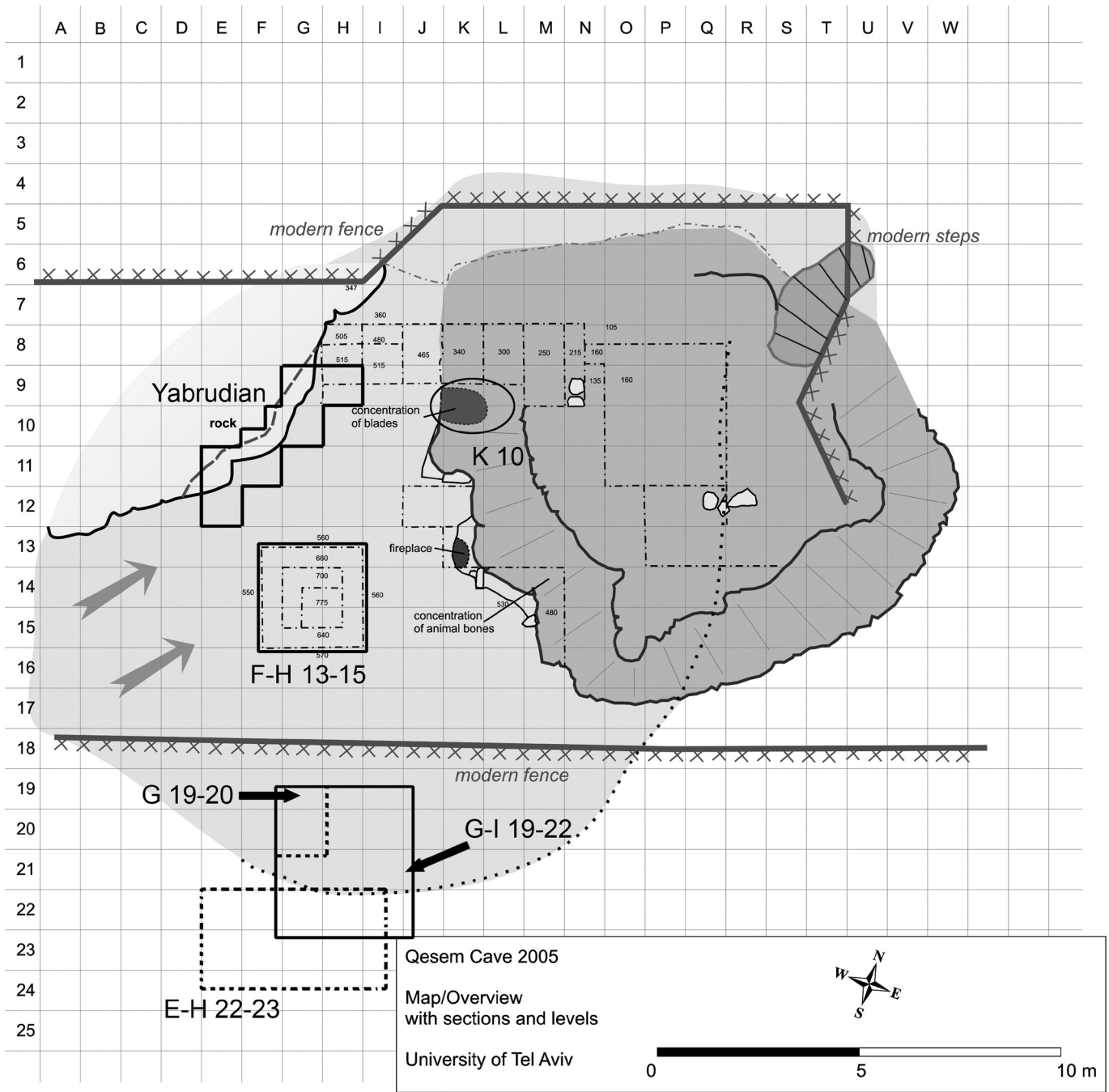


Figure 2 - A plan view of Qesem Cave with indication of the spatial location of the Amudian and Yabrudian assemblages presented in the paper. The areas marked by square numbers are Amudian. The location of two of the Yabrudian assemblages is specifically indicated.

of Qesem Cave and their significance to a better understanding of Middle Pleistocene human behavior. We concentrate on the lithic aspect although other finds of Qesem Cave that may contribute to this end will be mentioned and briefly discussed. The discussion will enlarge on the significance of Qesem Cave in the framework of the larger AYCC.

The lithic aspect of Qesem Cave

The lithic assemblages recovered at Qesem Cave during the salvage 2001 seasons and the 2004-2008 seasons is over 100,000 items of which we studied in detail over a half. These

cover spatially different parts of the cave and generally all of its major stratigraphic units. The density of lithic finds per cubic meter is usually around 2000 items while in specific cases, like Square K/10 it reaches over 9000 items per one cubic meter.

The lithic industrial sequence of the cave is mostly blade-dominated (Gopher *et al.* 2005) and attributed to the Amudian industry (fig. 1). Recently, Yabrudian, scraper-dominated assemblages were recovered and recognized in well defined parts of the cave. In this paper we briefly present the Amudian and comment on the Yabrudian (fig. 2).

The Amudian industry

Raw material

A variety of high quality flints was used at Qesem Cave. A study of raw material procurement strategies (quarrying versus surface collection) has been conducted using a method based on measuring the cosmogenic isotope ^{10}Be (Verri *et al.* 2004, 2005). Flint artifacts from the Late Lower Paleolithic cave sites of Tabun (E) and Qesem were sampled and analyzed. The results have shown that deep mined flint was used already around 400,000 years ago. Both sites also show use of flint extracted from shallow mined sources and collected from the surface. The results of an additional series of analyses show not only that some of the flint at Qesem Cave was quarried but that this quarried material was used for specific purposes (Boaretto *et al.* 2009). This indicates an intimate knowledge of the environment and the resources in the landscape around the cave. Preliminary surveys indicated the presence of potential raw material sources at the wadi slopes and wadi beds near Qesem Cave as well as in situ deposits of fractured flint blocks a few km from the cave. Raw material appears as rounded, amorphous or flat small fragmented slabs. The later were preferred for blade production.

Amudian blade production

The most innovative aspect of the Qesem Cave lithics is systematic blade production. One of the Amudian lithic assemblages from Qesem cave was published recently (Barkai *et al.* 2005). This assemblage together with four additional assemblages studied recently ($N \approx \text{ca. } 25,000$ items) and insights from knapping experiments of Amudian blades conducted by Ron Shimelmitz in the framework of a Ph.D. program in the Institute of Archaeology, Tel Aviv University, are summarized here (for details see Barkai *et al.* 2009). It is important to note that the whole Chaîne Opératoire of blade production was recovered in the cave including, raw material blocks/nodules, cores, core trimming elements, debitage, shaped items, used items and various (resharpening and retooling) spalls.

The basic concepts of Amudian blade production technology practiced at Qesem Cave are as follows:

The Qesem Cave knappers preferred relatively small, flat and thin (ca. 10cm long and up to 5cm thick) nodules with cortex on both faces for blade production (fig. 3:1). Blade cores and raw material blocks found within the cave's strata indicate frequent use of small and flat nodule fragments, most probably split by the elements from large flat nodules as reflected by the weathered and patinated breakage/cleavage plains characterizing the cores and the nodules found at Qesem Cave. These cleavage plains are usually in a ~ 90 degree angle to the intended production surface at the narrow side of the nodule and thus serve as readily available striking platforms. Similar nodules and nodule fragments were found in the vicinity of Qesem Cave and were used in the knapping experiments.

The technique used was direct hard-hammer percussion. Blades were removed by powerful follow-through blows that occasionally removed parts of the distal end (base) of the core and

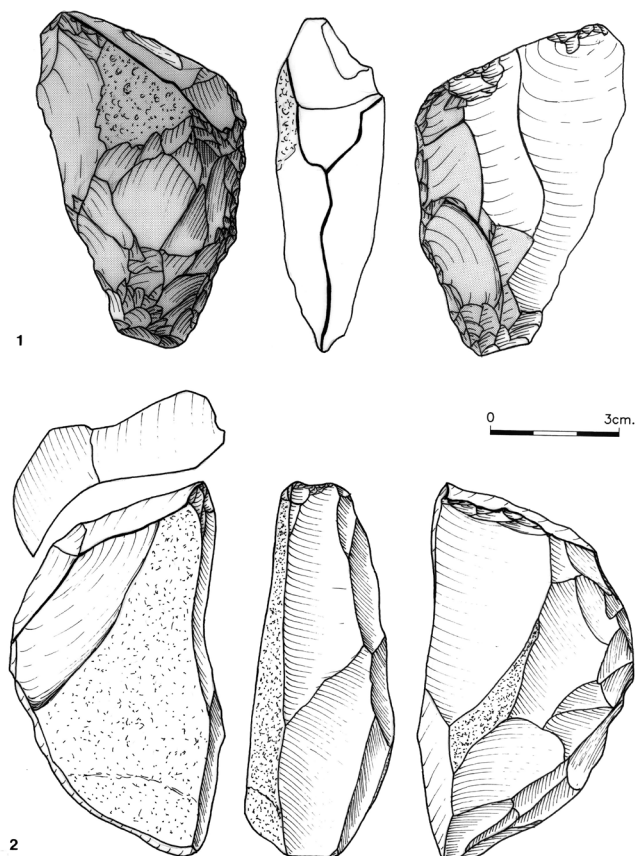


Figure 3 - 1: Patinated handaxe transformed into a blade core from Qesem Cave, 2: typical blade core on flat nodule fragment from Qesem Cave.

resulted in an over-passing end termination. The blows were mostly delivered at the inside of the striking platform and not close to the edge of the core as indicated by thick platforms and large protruding bulbs of percussion.

Cores were minimally prepared prior to blade production. Cortex was not removed in advance and many of the blades (especially the NBK's and primary blades but many of the "central" blades as well), carry a strip of cortex at one of the lateral edges or at the distal end (figs. 4-5). Striking platforms were mostly prepared by a single removal at the initial stage of preparation while the use of natural, unprepared (corticated or old cleavage surfaces) is common as well. Production surfaces were mostly created at an angular corner of the selected flat nodule thus enabling the removal of the first cortical blades following existing ridges with no investment in shaping the production surface and creating primary guiding ridges for blade production.

Core maintenance during blade production was minimal. Core convexities were maintained by the removal of over-passing items that removed small parts of the core's distal end (base) and maintained the desired angle between the striking platform and the production surface throughout systematic blade production. The fact that many blades bear a distal over-passing end termination seems to indicate that in the Amudian blade technology target blanks served as core maintenance elements as well. While the systematic, sequential removal of over-pas-

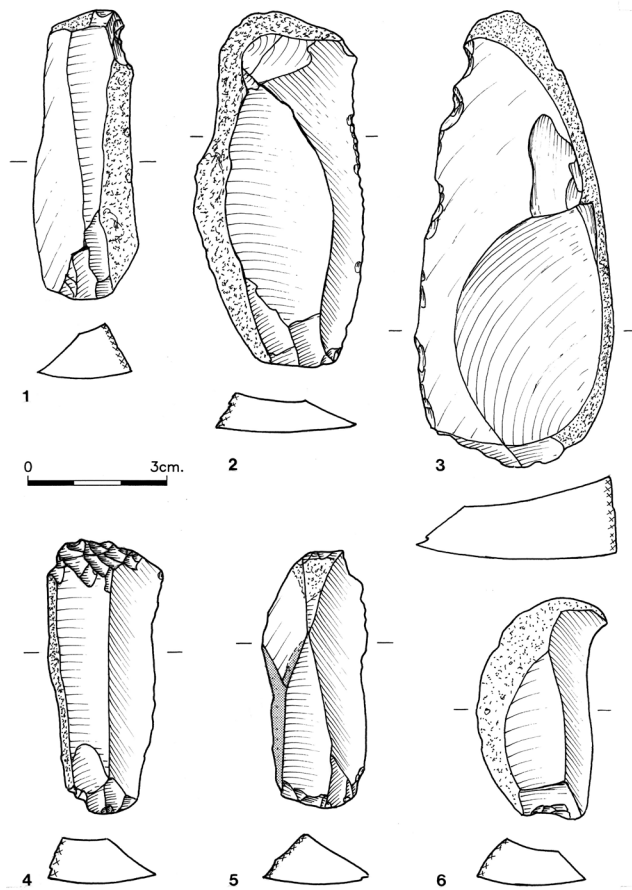


Figure 4 - Naturally backed knives with overpassing end termination from Qesem Cave.

ing blades enabled continuous production with minimal maintenance, some of these blades removed a substantial part of the core's distal end and lateral edges and can thus be regarded as items removed to control core convexities. It is indeed sometimes difficult to differentiate target blanks with a "minor" overpassing end termination from a true overpassing blades aimed at correcting the angle between the striking platform and the production surface, since in the Amudian technology practiced at Qesem Cave, blank production and core maintenance were achieved by a single blow. In some cases ridges were prepared and maintained and striking platforms were renewed by core tablets or faceting flakes, but this is rather uncommon.

Laminar items (a general term for the three types of blades) produced included primary blades, NBK's and common/central blades, all part of a single continuous production sequence.

Blades are characteristically short (mostly between 41-60mm) and thick (mostly between 6-13mm). Striking platforms are usually plain and thick, and bulbs of percussion are pronounced.

Naturally Backed Knives and central blades are the most conspicuous blade categories in the Amudian industry at Qesem Cave.

The Amudian blade reduction sequence led to a high percentage of laminar items in the assemblages (25-58% of the debitage

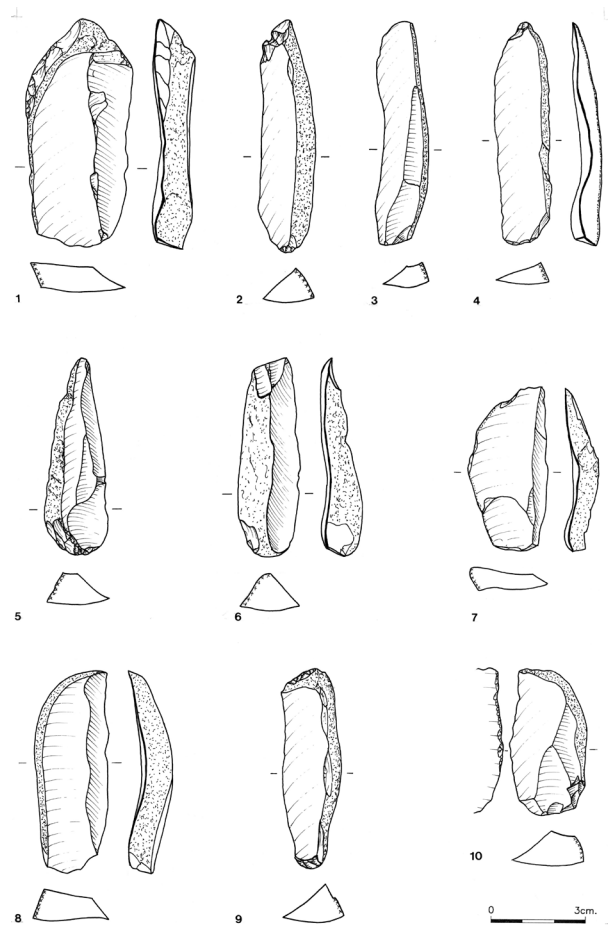


Figure 5 - Naturally backed knives from Qesem Cave, items 8-10 have an overpassing end termination.

and shaped items) with a minimal reduction of non-blade by products.

The use of blades

A use-wear study was performed on the lithics retrieved from square K/10 (Lemorini *et al.* 2006). The best preserved 253 items were studied and diagnostic traces were found on 74 artifacts including 37 shaped items and 37 unshaped items. In the case of the former, the wear traces were mostly found on the unshaped (non-retouched) parts of the items. The major activity recognized was cutting (58% of the diagnostic items) followed by scraping activities (25% of the diagnostic items). The cutting is associated with the working of soft material, mainly fleshy tissues. The unshaped edges were used for the different cutting activities, while shaped edges were more often used for scraping. The use of these cutting tools was not intensive and items were discarded after a short time. The results demonstrate the efficiency of NBK's as cutting tools and can be summarized as follows:

- 1) Considering the age of the site, the state of preservation is outstandingly high and permits a detailed functional reconstruction.
- 2) The major use of blades in the studied assemblage was in butchering. The use wear is mainly related to cutting and defleshing of soft tissues. There is a correlation between working edge morphology (straight edge) and cutting activities.
- 3) The use of blades for cutting tasks seems to have been short,

as indicated by the degree of development of wear traces and the general lack of resharpening.

Additional typological comments

- Blade tools are dominant in the Amudian assemblages (24%-61% of the tools) including a variety of retouched and backed blades (fig. 6) as well as burins and endscrapers.
- Handaxes are very few (only 5 in all excavated assemblages).
- Scraper frequencies vary between assemblages (1-10% of the tools).
- Polyhedrons – made of limestone, appear in small numbers in a specific location in space and stratigraphy.

A comment on recycling

Recycling of lithic artifacts is quite common at Qesem Cave including the use of patinated old items and the reuse of old flakes in many different ways. One interesting way is what we call "cores on flakes" (fig. 7). These are flakes used as cores to produce small, double ventral products, removed from their ventral face – very specific small flakes. Preliminary results of a use wear analysis on these flakes indicate the use of these small flakes for cutting soft tissues. Another interesting example is a patinated hanaxe transformed into a blade core (fig. 3:2).

Summary of Amudian assemblages

Thorough studies of Amudian lithics, usually on small samples, have been undertaken for Tabun (Jelinek 1990; Monigal 2001, 2002; Wiseman 1993), Yabrud I (Vishnyatsky 2000), Abri Zumoffen (Copeland 1983), and Masloukh (Shmookler 1983). Qesem Cave is a significant addition to this list with large Amudian assemblages.

We summarize our results as follows: The Amudian industry of Qesem Cave is characterized by systematic blade production and a major component of shaped blades as well as Naturally Backed Knives. Alongside blade production, flakes also appear in the Amudian as well as some side scrapers and single handaxes (Barkai *et al.* 2005).

The blades reflect strict standards of raw material procurement and an established and crystallized "Chaîne Opératoire" for blade production, shaping, use and discard.

Amudian blades at Qesem Cave were reduced from specific flat nodule fragments and small nodules that were either collected or quarried from the sub-surface (Verri *et al.* 2004, 2005; Barkai *et al.* 2009; Bualetto *et al.* 2009). These nodules enabled the implementation of the Amudian conception of blade production, i.e. serial production of cutting implements, preferably with one cortical, steep lateral edge and an opposed sharp edge, with very little effort invested in core preparation and maintenance (some sort of Debitage Direct, e.g. Meignen 2007). Amudian blade knappers developed a very efficient technology for the production of cutting tools that looks very simple at first glance, but is actually sophisticated and highly effective. Blank production and core convexities were achieved by follow-through blows constantly removing overpassing and debordant laminar items.

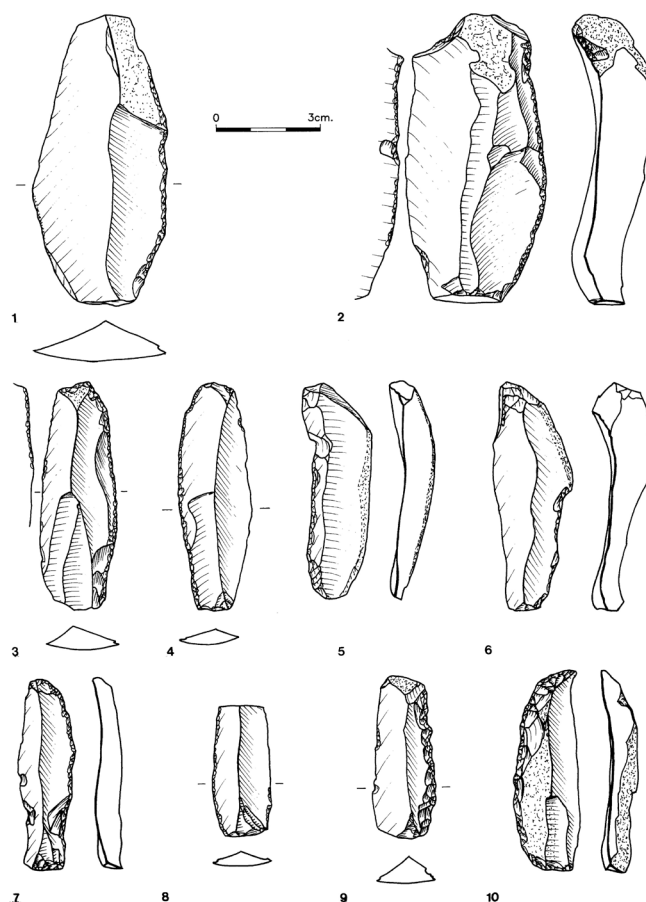


Figure 6 - Shaped laminar items from Qesem Cave.

This blade technology supplied large numbers of cutting tools with relatively few by products.

Amudian blades were mostly used in cutting, butchering and defleshing activities on soft tissues and were practically conceived as disposable tools, cut and throw-away implements (Lemorini *et al.* 2006).

The Yabrudian industry

Recently, we realized that Qesem Cave includes another component of the AYCC – the scraper dominated Yabrudian industry. This indicates variability and more complex human behavior in the cave rather than specialized blade-related activities only.

The Yabrudian is limited to two well defined parts of the cave (fig. 8) and seems to be contemporaneous with the Amudian. One of these areas was further excavated in summer 2008 and stratigraphic as well as sedimentological studies are now underway focusing on the nature of the Yabrudian occupational area and its position vis a vis the Amudian. A speleothem embedded within the Yabrudian layer was dated by Th/U to ca. 300 kyr (Gopher *et al.* 2010) and a series of dosimeters was inserted in the area to enable further TL and ESR dating.

Technological and typological aspects

The Yabrudian assemblages are conspicuous in two respects; one, the dominance of scrapers in the shaped items (almost

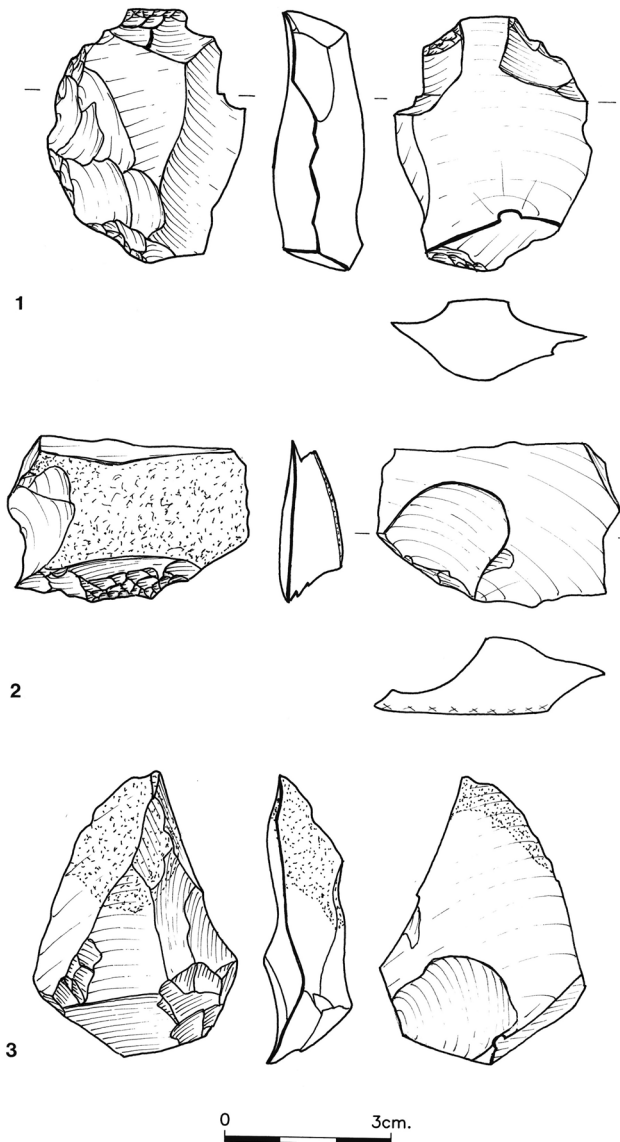


Figure 7 - Cores on flakes from Qesem Cave, removals are from the ventral face.

50%), and two, the scarcity of blades. A few preliminary comments can be made on the scrapers:

- They are made on thick flakes including transversal and dejeté flakes (fig. 9).
- A sample of eight scrapers showed that these are made on raw materials with low ^{10}Be content, indicating either quarrying or collecting raw material from primary geological sources or shortly exposed.
- Resharpener and retooling of scrapers at the site is evident both by typical removals on some of the scrapers and by the presence of characteristic spalls.
- As opposed to the case of blade production, the "Chaîne Opératoire" for scraper production cannot be followed in the cave. We may assume that the flakes or finished scrapers were imported into the cave.

We reiterate the fact that the Yabrudian assemblages do include small numbers of blades and they seem to be quite similar to the Amudian blades and by the same token, the Amudian in-



Figure 8 - The "shelf" area - a Yabrudian activity area at the north-western side of Qesem Cave. The sediments below the shelf yielded scraper-dominated assemblages while adjacent assemblages are dominated by blades.

cludes a few scrapers and they are similar to those found in the Yabrudian. It is of importance to note that at present no handaxes were found within the Yabrudian assemblages.

Faunal remains

The faunal assemblages are rich and well preserved throughout the stratigraphy and the dominant hunted species is fallow deer. Other species include aurochs, horse, wild pig, tortoise and red deer. Not all body parts of fallow deer are present (the trunk is under represented and cranial elements over represented), indicating that carcasses were first processed out of the site and only selected parts were brought to the cave. Cut marks were found on the bones and indications of marrow extraction were recognized (Gopher *et al.* 2005; Lemorini *et al.* 2006; Stiner *et al.* 2009). Many bones show burning signs. Faunal remains are now being prepared for publication.

Discussion

Qesem Cave

The relative chronology of Qesem Cave is based on comparative lithics and stratigraphy of parallel sites in the region and

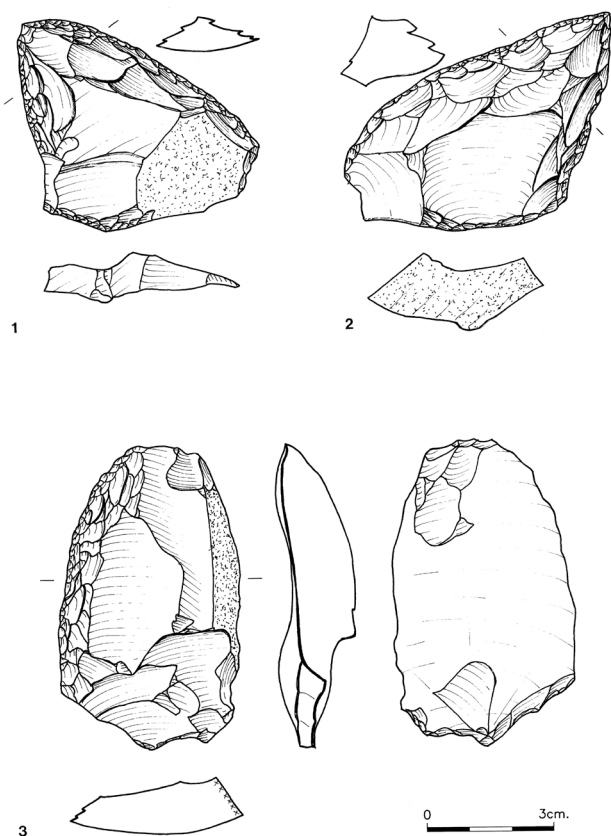


Figure 9 - Typical Yabrudian scrapers from Qesem Cave.

it indicated that Qesem Cave is clearly part of the Acheulo-Yabrudian complex, i.e. between Acheulian and Mousterian. The absolute chronology based on a large set of U-series dates (Barkai *et al.* 2003; Gopher *et al.* 2010), shows a general range of 400-200 kyr. Preliminary unpublished TL readings show a range of 360-230 kyr.

Qesem Cave was repeatedly visited by Hominins during the Middle Pleistocene, as early as 400 kyr ago when the cave was a large empty karstic chamber and until slightly prior to 200 kyr ago when anthropogenic sediments filled the cave almost completely. The human use of Qesem Cave is related to the AYCC with no indication of earlier or later activities. The stratigraphic sequence of ca. 7.5 meters can be characterized by three major cultural traits repeatedly found from bottom to top: the first is systematic blade production [with an age starting around ca. 400 kyr (Barkai *et al.* 2003; Gopher *et al.* 2010) this is one of the oldest systematic blade production industries known], the second is the habitual use of fire and the third is the dominance of fallow deer within the fauna. It is the coexistence of these three aspects that reveals the uniqueness of the Qesem Cave Amudian.

It is beyond the accidental that large numbers of blades appear together with large numbers of fallow deer body parts. It seems likely that Amudian blades at Qesem Cave were mostly used in butchering these prey animals. The habitual use of fire too might be connected to the consumption of meat at the site due to the abundance of burnt bones at the site (Stiner *et al.* 2009). Stray hand-axes and small numbers of scrapers found in Amudian assemblages might indicate a wider range of activities

than blade-related tasks, but the dominance of blades reflects their centrality in the Amudian of Qesem Cave. As for the Yabrudian component, it may reflect yet another activity related to the consumption and use of animals taking place on-site, most probably at the very same time that the other activities took place. This may suggest that Qesem Cave was not a specialized hunter's camp but rather a home base where space division reflects different activity areas.

The Acheulo-Yabrudian complex – a general view

The AYCC is, in our view the latest part of the Lower Paleolithic following the Acheulian and preceding the Mousterian and Qesem Cave is an integral part of this complex.

The special stance of Qesem Cave within the AYCC stems from the fact that while the Amudian aspect usually constitutes a small component within the AYCC stratigraphy, hardly separated from overlying and underlying Yabrudian and Acheulo-Yabrudian layers (Garrod 1970; Rust 1950:28-34), the Qesem Cave sequence shows a major Amudian component throughout its thick stratigraphic sequence. However, the presence of a Yabrudian component in the cave is now clearly established and we are thus obliged to engage in the discussion on variability within the AYCC. Actually, variability within the AYCC was never discussed thoroughly as was the case with the Mousterian debate (e.g. Binford 1973; Bordes 1961, 1973; Bordes & Bordes 1970; Dibble 1991; Mellars 1970, 1986) although it provides a glance into similar problems at much earlier dates. Although a detailed discussion is beyond our scope here, we might as well make a few comments.

Sites of the AYCC such as Tabun (E) and Yabrud I show assemblages dominated by handaxes and/or scrapers with only low numbers of blades or no blades at all, and assemblages, usually quite small in scale, dominated by blades. This was interpreted by the pioneers of AYCC studies as a reflection of the presence of different human groups in the Levant, each characterized by a different lithic industry (Garrod 1956; Rust 1950). Another interpretation claimed that this possibly reflects a different array of activities for each such assemblage/industry (e.g. Jelinek 1990). The possibility of intra-site contemporaneous, activity-related industries was also briefly mentioned as an option for Yabrud I and in a more pronounced manner at the site of Abri Zumoffen (Garrod 1970; Garrod & Kirkbride 1961; Solecki & Solecki 1986).

The contemporaneity of the different industries within the AYCC was derived from the geological logic of interfingering. The successive alternating lithic industries, i.e. layers or sub-layers, appearing with no repeated order in the different sites, were viewed as indicating the contemporaneity of independent industries (facies). Each site has generally been considered as a sequence of successive industries while the different industries have been presented as alternating entities within the general, large scale AYCC.

Although Yabrudian-Amudian coexistence at Qesem Cave is now a viable option since both appear in the same elevations, it still needs confirmation and will be the focus of field work

and sediment analysis in the coming years. This, in turn may support a spatially related interpretation of the variability at Qesem Cave suggesting different activity areas within the cave. Notwithstanding the typological differences between the Amudian and Yabrudian assemblages, the two share, as mentioned above, major technological traits - i.e. typical Amudian blades were produced on a small scale in the Yabrudian while typical Yabrudian scrapers appear in small numbers in the Amudian.

In a general framework, the Acheuleo-Yabrudian Cultural Complex as an independent cultural entity would be summarized as follows:

- Time frame: 400-200 kyr.
- Space: Levant (Israel, Lebanon and Syria).
- Three major distinctive industries expressing both inter-site (regional) variability and/or possible intra-site activity-related variability.
- Lithic complexity is reflected in the presence of handaxes, Quina scrapers and blades showing intra and inter-assemblage variability.
- Flint procurement is variable including both quarrying and surface collection.
- Fire was habitually used leaving massive ash accumulations.
- Hunting and butchering of medium sized (and large) mammals was common.
- Hominin: unknown

As a major entity of the late Lower Paleolithic of the region, between Acheulian and Mousterian, the AYCC shows both patterns of continuity and change:

- Acheulian cultural traits that did not continue in the AYCC are Acheulian large and small flake tool traditions.
- Acheulian cultural traits that continued in the AYCC, but never made it to the Mousterian, include mainly the long tradition of handaxes production.
- Acheulian cultural traits that continued in the AYCC and in the Mousterian include the use of fire; hunting and butchering and flint quarrying.
- Unique AYCC innovations unknown in the Acheulian that did not continue to the Mousterian include systematic non-Levallois blade production – an innovative lithic, blade produc-

tion "running ahead of its time" (although non Levallois blade production trajectories are known from early Middle Paleolithic contexts, these are different in conception than the Amudian blade technology (e.g. Mignen 2000, 2007) ; the production of Quina scrapers; and special butchering tool-kits.

- The Levallois technology is absent in AYCC assemblages (Qesem Cave, Tabun Cave, Yabrud I). This is an interesting issue considering the fact that a growing data base indicates that this technology had its origins in the late Acheulian. Thus the Levallois technology seems to have skipped the AYCC and became dominant in the later Mousterian.

Considering all this we may view the cultural complex between Acheulian and Mousterian as an independent, long, creative and innovative cultural entity reflecting dynamic human behavior and flexible local adaptations.

In recent years the habitual use of fire, systematic hunting and butchering techniques, division of space in human occupation sites (specific activity and discard areas), blade production and we may add recycling of stone, were, amongst other aspects, viewed as behaviors practiced by modern humans in the Middle Paleolithic Mousterian starting ca. 200 kyr ago. The possible Lower Paleolithic origins of these sets of human behavior have become a research focus only in recent years. The late Lower Paleolithic layers of Qesem Cave, Israel, yielded rich, exceptionally well preserved lithic and faunal assemblages as well as evidence for the habitual use of fire providing an opportunity to suggest that the origins of some of these patterns of human behavior were indeed pre Mousterian (<200 kyr). Moreover, the new discovery of hominin teeth at Qesem Cave, at present under study, provides an opportunity to assess evolutionary processes concerning the shift from *Homo erectus (sensu lato)* to modern humans and may shed new light on such patterns of modern human behavior.

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