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THE MIDDLE TO UPPER PALEOLITHIC TRANSITION IN THE SOUTHERN LEVANT: TECHNOLOGICAL CHANGE AS AN ADAPTATION TO INCREASING MOBILITY

by
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INTRODUCTION

For the past 35 years (GARROD, 1951) prehistorians working in the Levant have accepted, explicitly or implicitly, that there was an autochthonous evolution from a local, late Middle Paleolithic to the local early Upper Paleolithic. The nature of this development, however, has been seen in different ways by different prehistorians. Prior to the Second World War, the idea of a Middle to Upper Paleolithic developmental transition was firmly rejected (NEUVILLE, 1934; GARROD and BATE, 1937: 22-27) and a clear association was thought to have existed between the movement of modern man into the Levant and the arrival of Upper Paleolithic industries (NEUVILLE, 1934; GARROD, 1937). Just prior to the Second World War, excavations in the Lebanon at the caves of Ksar Akil and Abu Halka provided data which, when finally published preliminarily after the war (HALLER, 1946; EWING, 1947), led to a reevaluation and to a proposed local transitional industry, the Emiran (GARROD, 1951, 1955). This industry was felt to be temporally intermediate between the Mousterian of the Middle Paleolithic and the Aurignacian of the Upper Paleolithic, as well as being actually developmentally transitional between them (GARROD, 1951: 129).

Garrod was quite specific as to the technological and typological nature of this transition. The Emiran consisted of a flake element indistinguishable from that of the Late Mousterian (then called Upper Levalloiso-Mousterian); the new transitional features were the Emireh point (a Levallois point with bifacially thinned base), the appearance in increasing numbers of "true" blades (those with punctiform platforms) and typical narrow blade cores (GARROD, 1951: 128). Garrod specifically noted that there were no transitional forms, such as Upper Paleolithic tools on Levallois flakes or blades which might have been technologically transitional between Levallois and "true" blades. For her, the Upper Paleolithic element was an "invention of a new technique", rather than an evolution from the older flake technique (GARROD, 1951: 129). Those factors which might have led to such

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an innovation, its cultural acceptance, and final dominance were not addressed directly. On the other hand, it appears that Garrod would have been comfortable with a bioevolutionary explanation. She noted that the Upper Levalloiso-Mousterian was associated with Neandertals and that the Upper Paleolithic was associated with *Homo sapiens* and "it will be interesting to see whether the man of the Emiran stage, if he is ever found, will fill the evolutionary gap between the two" (GARROD, 1951: 129). Subsequent work (BAR-YOSEF and VANDERMEERSCH, 1972) established that Garrod's Emiran from the Palestinian caves, at least, were naturally mixed Middle Paleolithic and Upper Paleolithic assemblages.

Almost 20 years after the introduction of the Emiran, a quite different view was presented to explain the Middle to Upper Paleolithic transition in the Levant (BINFORD, 1968). Rather than seen as a reflection of either chance invention or as a necessary adjunct of bioevolutionary change, it was posited that the transition between these culture types reflected a major change in human ecology. It was suggested that this change, a shift in adaptation from generalized hunting to "a specialized exploitation of specific kinds of game" (BINFORD, 1968: 57), took place over a long period of time - first in evidence in the Late Mousterian - but that the technological shift from Levallois flake to Upper Paleolithic blade production might have occurred very rapidly and, so, may have been archaeologically invisible. While the data presented certainly did not justify the conclusions, this more sophisticated perception should have had a profound effect on thinking about the Levantine Middle to Upper Paleolithic transition. In fact, it had virtually none; her ideas are uncited in most later works (AZOURY, 1971; BAR-YOSEF, 1980; COPELAND, 1975, 1976, 1986).

About the same time, a new model was proposed for a northern Levantine Middle to Upper Paleolithic transition (COPELAND, 1970). Basing her work explicitly on materials from Antelias Cave, just a short distance from Ksar Akil, but certainly also utilizing information from the then unfinished restudy of Ksar Akil by AZOURY (1971), she suggested that Upper Paleolithic blade technology was not introduced as an invention, unrelated to existing Middle Paleolithic technology but, rather, developed out of an already "evolved" Levallois technology which tended to produce more elongated blanks than did the classic Levallois method. More importantly, there were actual transitional forms, in which the blank production was "evolved" Levallois, while the tools produced on them were Upper Paleolithic. The transition itself became recognizable when a shift to Upper Paleolithic tool production on these "evolved" Levallois blanks took place (COPLAND, 1970: 114). This was seen "as a sudden emphasis on tools (i.e., burins and endscrapers) which up till then had played a minor role in the underlying assemblages, accompanied by the virtual disappearance of those types ... which till then had dominated the Mousterian tool kit. At the same time, the previous older flint working techniques were still in use" (COPELAND, 1970: 137).

This perception that there was a different tempo of change between the technology of blank production and the style of the tool types (COPELAND, 1970; AZOURY, 1986) was a major advance. It provided a mechanism for accommodating continuity in the face of change. Azoury (1986: 92, note 2; 234) felt, however, that no direct connection could be made between these "transitional" assemblages and those of the earlier Mousterian at Ksar Akil, while it is clear from Copeland's statement quoted above, and elsewhere (COPELAND 1986: 9), that she still perceives the sequence at Ksar Akil to be developmental from the Mousterian through the transitional levels - and beyond. Since Azoury saw no continuity at Ksar Akil between the Mousterian and the transitional levels, she did not try to explain the presence of the transitional attributes. COPELAND (1975: 337), on the other hand, seeing a developmental sequence at Ksar Akil, provided an explanation for this evolution in very much the same terms as had Garrod 24 years before. More recently, faced with the presence of both modern man and Neandertals in association with the Late Mousterian (VANDERMEERSCH, 1981; BAR-YOSEF *et al.*, 1986) she has seemingly retreated from this traditional bioevolutionary explanation (COPELAND, 1986: 12).

Attempting to provide a reasonable model to account for the observed changes in lithic technology and typology throughout a single sequence - that of Ksar Akil - is probably an impossible task. As noted by COPELAND (1986), the studied samples come from a relatively small area, the stratigraphic units were undoubtedly much larger than would be recognized today (up to 90 cm. deep) and, it turns out, the faunal material published by HOOIJER (1961) seems to represent a small portion of the material actually excavated (KERSTEN, personal communication). Most importantly, however, major changes in human adaptation, seen as changes from one technocomplex to another, do not take place in a single cave - such changes may be reflected in one cave through time but the scope of the processes involved must be much broader, involving whole regions with changeable climates and resources and man's interaction with them.

It is unlikely that any small area of the Levant can produce the data needed to fully describe and understand the historic, cultural, and even evolutionary processes which led from the Middle Paleolithic to the traditional Upper Paleolithic of the Levantine Aurignacian. Yet, the southern, climatically marginal zones of the Levant - the Negev and southern Jordan - have produced enough data so that a broad picture is emerging of some of the factors involved, not only in terms of the mechanics of the technological transition from a Middle Paleolithic Levallois technology to a consistant blade technology but, also, of the adaptive factors which may have encouraged these changes.

Yet, the Middle to Upper Paleolithic transition cannot be considered in isolation, either geographically or temporally: the Middle Paleolithic base from which it arose is also vitally important. Unfortunately, the Middle Paleolithic of the Levant is not as simple as once thought (COPELAND, 1975). The traditional view recognized two basic phases of post last interpluvial Mousterian development; a stratigraphically older Lower Levalloiso-Mousterian associated with the cool and wet climatic conditions of the early last pluvial (JELINEK, 1982: 71) and a stratigraphically younger Upper Levalloiso-Mousterian associated with somewhat warmer climatic conditions. This sequence was first described for Tabun Cave on Mount Carmel (GARROD and BATE, 1937). Although the terminology has changed, - the Lower Levalloiso-Mousterian of Tabun D is now called Early Levantine Mousterian or Phase 1, Levantine Mousterian (COPELAND, 1975), while the Upper Levalloiso-Mousterian of Tabun C and B is called Phase 2-3, Levantine Mousterian or Late Levantine Mousterian - the recent excavations at Tabun by JELINEK (1982), make the stratigraphic sequence there still a potential model for the Levant, as a whole.

Traditionally, it was believed that this particular sequence was both pan-Levantine (GARROD, 1962) and developmental (COPELAND, 1975). Although there is some evidence for developmental continuity, if not stratigraphic continuity in the Tabun sequence (JELINEK, 1982), there are now reasons to doubt both the pan-Levantine nature of the sequence, as well as the seeming evolution of the Late Levantine Mousterian (Tabun C and B) out of the Early Levantine Mousterian (Tabun D). It now seems that the two phases exhibit only relatively limited geographic overlap, with the Early Levantine Mousterian being very rare along the central and northern Levantine coast and the Late Levantine Mousterian being virtually absent in the climatically marginal zones of the southern Levant - the Negev and southern Jordan. Only along the central coastal zone of southern Lebanon and northern Israel do the two phases occur at the same sites (e.g., Tabun, Nahr Ibrahim, Ksar Akil, etc.). When they do occur together, however, the Early Levantine Mousterian is always found stratigraphically below the Late Levantine Mousterian.

The consistant stratigraphic positioning of the two phases might well argue for a generalized chronological sequence, if not a developmental one, but it has been argued (COPELAND, 1981) that at least one Late Levantine Mousterian site on the coast of the Lebanon, Naamé (FLEISCH, 1970), is older than the Early Levantine Mousterian at Tabun.

At the other end of the time scale, there are sites with assemblages of Early Levantine Mousterian type which come from highland caves in southern Jordan associated with pollen indicative of dry/warm conditions (HENRY, 1982; LINDLY, 1986). Given their elevations, these caves must have been occupied after the cool/wet part of the last Pluvial, making them broadly contemporary with the Late Levantine Mousterian of Tabun C. Thus, it appears that the Early Levantine Mousterian is temporally *both* early and late in the southern, climatically marginal zones of the Levant.

In addition, there is even debate about the degree and meaning of assemblage variability within the Late Levantine Mousterian. Some (e.g., COPELAND, 1975, 1981) believe that this phase can be divided into two temporal phases - thus, the Phase 2-3 above, - while others (e.g., RONEN, 1979) believe that the variability may be more functionally determined than developmentally derived.

All of this suggests that the Middle Paleolithic studies in the Levant are quite healthy and far from over. It does, however, leave something of a problem deciding just from what did the transition to the Upper Paleolithic arise? While the present situation does not allow us to say which Mousterian phase was present just prior to the transition - in fact, it is likely that both were but in different parts of the Levant - their technological and typological characteristics do provide a good contrast from which to compare probable developmental trajectories to the transitional period.

Early Levantine Mousterian technology can be characterized by a tendency toward unidirectional and bidirectional core reduction, resulting in a relatively high percentage of elongated blanks, including true blades and Levallois points (CREW, 1976; RONEN, 1979; JELINEK, 1982). In addition, however, there are a number of other reduction strategies, including relatively rare, classic Levallois flake production, discoidal core reduction, as well as even bladelet core production. However, the tendency is toward "along-axis" flaking and for blanks with parallel to converging lateral edges (MARKS and VOLKMAN, 1986 a).

Typologically, this phase has many Levallois points, often elongated, but relatively few typical Mousterian tools such as Mousterian points and sidescrapers. In fact, in a number of Early Levantine Mousterian assemblages (CREW, 1976; MUNDAY, 1977; MARKS and VOLKMAN, 1986 a), there are fewer typical Mousterian retouched tools than there are typical Upper Paleolithic type tools such as burins and endscrapers.

The Late Levantine Mousterian, of Tabun C type, can be characterized technologically by the tendency to produce Levallois flakes from quite classic tortoise cores; there are few blades and only rare Levallois points (RONEN, 1979; JELINEK, 1982). Although blanks with parallel lateral edges are common, there is a shift from those with converging lateral edges to those with a broad, ovoid shape (JELINEK, 1982; MARKS and VOLKMAN, 1986 a).

Typologically, there are usually few Levallois points, a large number of typical Mousterian tools, and a relatively low number of Upper Paleolithic type tools, if they are present at all.

Given the description provided by COPELAND (1970) and AZOURY (1971, 1986) of the transitional assemblages in the Lebanon, it would certainly seem as if the Early Levantine Mousterian were a more obvious progenitor than the Late Levantine Mousterian. On the other hand, some Late Levantine Mousterian assemblages, such as that of Tabun B'do contain a somewhat higher percentage of Levallois points than most other Late Levantine assemblages; in that case, however, the nature of the artifactual accumulation makes it unclear whether the assemblage is comparable to others of the same phase

(JELINEK, 1982: 80). Still, some hold firmly to the position that the Late Levantine Mousterian (Phase 3) was the progenitor of the transitional phase (COPELAND, 1986: 10-11).

THE SOUTHERN LEVANT

Recent work in the Central Negev, Israel, and in southern Jordan has added some data relating to this question of transitional origins and, while not resolving all questions, certainly points to the Early Levantine Mousterian as the most likely ancestral base from which arose the Upper Paleolithic. These data come from a series of spatially separate sites which, for the most part, can only be relatively dated. Combined, however, they do provide a rather clear picture of a changing technology associated with environmental changes.

As noted, the temporally early Mousterian of the Negev is that of Phase 1: the Early Levantine Mousterian (CREW, 1976; JELINEK, 1981). Sufficient sites have been studied (CREW, 1976; MUNDAY, 1976, 1977) to permit a construction of a probable radiating settlement system centered around base camps placed adjacent to perennial springs, and with different exploitation camps in the surrounding terrain (MARKS and FREIDEL, 1977). This pattern is suggestive of relatively little residential mobility (MARKS, 1981) but, near the end of the early phase of the last Pluvial, this system appears to have come under increasing pressure from climatic deterioration as can be seen in decreasing residential stability at Nahal Aqev, the younger of the two base camps (MUNDAY, 1977, 1979).

Although it is impossible to be specific as to timing, it seems that the Negev was essentially abandoned by Mousterian groups as the climate continued to deteriorate. Yet, occupation of southern Jordan appears to have continued unabated, owing to its higher elevations which undoubtedly mitigated some of the effects of the climate change. Of the apparently large number of Middle Paleolithic sites in southern Jordan (COINMAN *et al.*, 1986), two have been studied recently which exhibit technological traits obviously evolved from the Early Levantine Mousterian as known from the Negev. Both sites occur at fairly high elevations and, as noted above, contain pollen indicative of warm/dry conditions, thus placing them into the post-early last Pluvial; that is, later than the Mousterian sites in the Central Negev.

Both sites are small and information is still preliminary (HENRY, 1982; LINDLY, 1986) but, given the nature of the even later Middle to Upper Paleolithic transitional assemblages, these sites fill an important developmental gap. The two sites, Tor Sabiha (HENRY, 1982) and Site 634 (LINDLY, 1986), have assemblages which, while still falling within the definition of the Early Levantine Mousterian, show a degree of technological and typological specialization which points directly toward the transitional assemblages. At both sites blanks with blade proportions represent about half of all blanks. The Levallois element is heavily dominated by Levallois points and prismatic blades are common. At neither site is there a typical, ovoid Levallois flake. Although tools are few, they are mostly of Upper Paleolithic type; at Tor Sabiha there are very few sidescrapers, while at Site 634 there is not a single typical retouched Mousterian tool.

Of particular significance developmentally are the Levallois points, since they continue as a major morphological componant into the Middle to Upper Paleolithic transition (AZOURY, 1986; MARKS and VOLKMAN, 1983; MARKS and KAUFMAN, 1983). At Tor Sabiha half of the Levallois points were produced from bidirectionally reduced point cores, while at Site 634, it appears that almost all come from such cores. In addition, almost all the Levallois points from both sites have blade proportions, as compared with only about 20 % from the Early Levantine Mousterian site of Rosh Ein Mor in the Central Negev (CREW, 1976).

Technologically, these two assemblages exhibit marked tendencies toward increased elongation of blanks and of Levallois points, in particular. The origin of this development may be seen first at the younger base camp in the Central Negev, Nahal Aqev (MUNDAY, 1977), where the Levallois points alone show a vectored change toward increasing laminarity as the site, on the whole, exhibited increasing residential instability (JONES, 1985: 557). Thus, these two Jordanian sites not only fall temporally after the Early Levantine Mousterian of the Central Negev, but they are also developmentally between it and the somewhat later Middle to Upper Paleolithic transitional assemblages to be discussed briefly below.

Although NEUVILLE (1951) put an assemblage from the Judean Desert site of et-Tabban which might well have been transitional into his earliest Upper Paleolithic, it was only with the discovery of Boker Tachtit in the Central Negev that a clear picture has emerged of this highly important transition in the extreme southern Levant (MARKS and KAUFMAN, 1983; VOLKMAN, 1983; HIETALA, 1983). The site contains four stratified living floors, each sealed by sterile overbank pond deposits (GOLDBERG, 1983; HOROWITZ, 1983). The assemblages provide a clear picture of the progressive technological changes which took the local terminal Mousterian from a specialized Levallois method to a consistant blade producing technology.

The dominant core reduction strategy in the Level 1, terminal Mousterian called for the preparation of an elongated Levallois point core through, initially, an overall shaping using a *lame à crête* technique and then through bidirectional removals of blades from along the axis of the main flaking surface of the cores (Fig. 1). The final blow removed an elongated point, which clearly showed its origin from such bidirectional preparation (Fig. 2a - f, h). This is the same apparent technique used at the earlier Jordanian sites.

The tool assemblage from Level 1 is strongly elongated (54 % has blade proportions) and, aside from the Levallois points, the tools are exclusively of Upper Paleolithic type - endscrapers, burins, and retouched blades. Only three Emireh points add to its Middle Paleolithic "aspect". Yet, the dominant presence of this specialized Levallois point production, with its even earlier anticedents, as well as the importance of the Levallois points in the tool inventory (43.9 %), indicate that even with only Upper Paleolithic retouched tools, this assemblage should be considered terminal Mousterian. After all, the proportional dominance of Upper Paleolithic tool types, relative to Mousterian ones, was already present in the temporally early Levantine Mousterian of the Central Negev (CREW, 1976) and elsewhere (MARKS and VOLKMAN, 1986 a).

Without question, Level 1 at Boker Tachtit appears very similar to Site 634 in the Jordanian highlands. Yet, Boker Tachtit was occupied during a period of renewed terrace aggradation and, more generally, of improving local climatic conditions. This would place its occupation after that of the Jordanian sites, since when it was getting wetter in the Central Negev, it was getting quite cold in highland Jordan (HENRY, 1982). The actual date for this initial occupation of Boker Tachtit is hard to fix, in spite of a series of radio-carbon dates (MARKS, 1981) and Thorium/Uranium dates on a nearby travertine containing Boker Tachtit - like artifacts (SCHWARCZ *et al.*, 1979); it is simply a bit too old for radio-carbon dating. The excellent correspondence between the radio-carbon dates and the Thorium/Uranium dates, however, indicates that this terminal Mousterian should date to about 47,000 B.P. This is well prior to the accepted end of the Late Levantine Mousterian in the Central and Northern Levant (HENRY and SERVELLO, 1974; COPELAND, 1976; BOUTIÉ, 1979; BAR-YOSEF and VANDERMEERSCH, 1981).

From this specialized Levallois base, it is possible to trace in some detail the technological changes which led to a true and consistant blade technology at Boker Tachtit. Levels 2 and 3 exhibit a step-wise vectored change which leads clearly to the earliest Upper Paleolithic in the uppermost level, 4. This change was documented through the reconstruction of 180 cores from all four levels and, since it has been described in detail in several publications (MARKS and VOLKMAN, 1983, 1986 b; VOLKMAN, 1983), it need not be described in detail here, as well.

From a general point of view, the changes began with the highly uniform and specialized opposed platform blade and Levallois point production in Level 1, passed through a phase of considerable technological heterogeneity and experimentation but with continued consistancy in blank shape (Fig. 2 d-h) in Levels 2 and 3, and finally, in Level 4, arriving at another uniform reduction technology, still producing some similar blanks but now from single platform blade cores (Fig. 2 i-l). While the majority of these blade cores produced only blades, when they were pyramidal in shape (Fig. 3), they produced some triangular points, as well.

All of this took place within a mode of hard hammer detachment, so that all those attributes associated with hard hammer flaking - faceting of platforms, large bulbs of percussion, maximum blank width at or near the platform, etc. - pertained throughout the sequence. Even the points were produced in the latest phase but not regularly or very predictably. In fact, the technology of Boker Tachtit, Level 4, is also found in Levels 23 through 21 at Ksar Akil.

Typologically, there is little change from Level 1 through 4; really, it is only an intensification in the production of endscrapers at the expense of less formal tools. The Emireh point is present in Level 1, becomes common in Level 2, but is gone by Level 4. Thus, the typological transition from Mousterian tools to Upper Paleolithic tools does not take place at Boker Tachtit; it occurred earlier, fully associated with a Middle Paleolithic technology, although probably with one already dominated by the production of elongated blanks.

Both technologically and typologically, the trends which finally led to a consistant blade technology with a wholly Upper Paleolithic typology took a very long time to develop and, it seems, had their roots in the Early Levantine Mousterian of the early last Pluvial. In this context, the technological transition can be seen not as either innovation or as a shift toward "evolved" Levallois method from a more classic one but as a shift within an already existing technological base toward ever greater intensification and efficiency in the production of elongated blanks.

DISCUSSION

Although it is possible to document a series of technological adjustments which led from the temporally early Early Levantine Mousterian to an initial Upper Paleolithic, the adaptive advantages of such shifts are more difficult to establish. It does seem, however, that the geographic distribution of the Early Levantine Mousterian points in a certain direction.

The long term continuity of the Early Levantine Mousterian only in the climatically marginal zones of the southern Levant suggests that its technology was better adapted to deteriorating climatic conditions than was the technology of the Late Levantine Mousterian. Yet, at the beginning, during the early last Pluvial, the southern marginal zones experienced a climatic optimum, while regions farther north were apparently cold and dry. Thus, the original development of the Early Levantine Mousterian took place either in a good Mediterranean or in a cold/dry zone and, in itself, cannot be considered an adaptive response to warm/dry conditions. In fact, the radiating settlement system of the Early Levantine Mousterian in the Central Negev (MARKS and FREIDEL, 1977; MARKS, 1981) indicates an adaptation to environmentally rich conditions: This pattern also appears to have been present in southern Jordan (COINMAN *et al.*, 1986), suggesting it was a wide-spread settlement system and that these southern areas then saw intensive exploitation of relatively small zones. This settlement system centered around base camps to which the Early Levantine Mousterian returned often and at which they spent relatively large amounts of time. The spatial association between these base camps and large perennial springs might indicate a cultural, rather than an environmentally determined, choice on the part of the inhabitants, since during the early last Pluvial the local conditions were good and surface water must have been common, if not plentiful.

The radiating settlement system was probably dependent upon two major factors - the desired perennial springs with their predictable water supplies and sufficient food resources nearby to permit relatively little mobility. As the climatic conditions of the southern area began to deteriorate after the early last Pluvial, at *ca.* 75,000 B.P., there must have been a gradual decline in the density of food resources. Surely, this would not have happened abruptly or consistantly, but through time the landscape rich in vegetation and the animals which lived off of it gave way to sufficiently sparse vegetal cover that the area began to experience deflation and massive surface erosion (GOLDBERG and BRIMMER, 1983). With a drop in the density of plants, there would have been a parallel decline in animal resources and, at least seasonally, in ephemeral water sources. All of this would have slowly added pressures for increasing mobility (MUNDAY, 1979), for greater seasonal scheduling of resource exploitation over larger areas, and for shorter stays in any one place.

Ultimately, it appears that the Central Negev and, perhaps, the lower elevations of southern Jordan were mainly abandoned, with populations remaining mostly in the highland zones of southern Jordan, on and around the Jordanian plateau. Although environmental conditions appear to have been better there than in the lower elevations, it is unlikely that a radiating settlement system could have been maintained. Rather, data suggest marked seasonal mobility, covering relatively short distances but rather great elevational ranges (HENRY, 1982; COINMAN *et al.*, 1986).

Even seasonal mobility on that level would have meant that decisions concerning site location must have been more strongly dictated by surface water and seasonal food resources than by known flint sources. Thus, there must have been many occasions when camps had to be placed well away from any flint source. Through time, therefore, core reduction strategies which maximized flint nodule utilization should have become adaptive. The older, radiating settlement system associated pattern of economizing flint resources by decreasing the size of the acceptable blanks (MUNDAY, 1976, 1979) had marked limitations in areas where flint was not available, at all. Since the Early Levantine Mousterian technology contained systems both for elongated blank and discoidal blank production, it was not, in theory, difficult to emphasize the efficiency of along- axis flaking, while giving up the tendency to make smaller and smaller blanks. This shift can be seen at Tor Sabiha and at Site 634, both located in areas with dispersed flint sources.

With a change back toward ameliorating climatic conditions at about 50,000 B.P., the Central Negev became open again for, at least, seasonal occupation. While seasonal mobility was long the norm in southern Jordan by then, the improved conditions in the relatively low elevations of part of southern Jordan and most of the Central Negev provided an opportunity for increasing the area to be exploited by increasing residential mobility into areas where the location of local flint sources was long forgotten. By that time, however, the process of technological adjustment had brought about the very specialized bidirectional Levallois core reduction strategy which produced almost only blades and Levallois points, as seen at Boker Tachtit, Level 1.

This bidirectional reduction strategy had a drawback similar to that faced earlier in the Early Levantine Mousterian when to economize blanks were merely made smaller; there was a rapid reduction in effective core length as the two platforms had to be refaceted time and again (Fig. 1). With the larger areas to be exploited under better climatic conditions, this problem of size seems to have been a concern. From the amount and kind of core reduction variability seen at Boker Tachtit, Level 2 (VOLKMAN, 1983) it seems clear that various approaches were tried to overcome this drawback. One way, within the technological knowledge of the Early Levantine Mousterian since their appearance in the Central Negev, was to utilize only a single platform but, at the same time, maintaining the production of the desired elongated blanks. This was achieved as a minority effort in Level 2 but became the only reduction strategy by Level 4. It depended upon the selection of tabular flint for core reduction or the modification of nodules into tabular form. Larger blocks were utilized but they had to have converging edges, so that blades and points, rather than flakes, would be produced. Original core size was not increased but effective blank size was (HIETALA, 1983).

The fact that this shift in technology can be seen at a location where both water and flint were predictably abundant shows that the process of change and its motivations were not a response to highly local conditions. Rather, they must relate to conditions on a regional level. The sudden appearance of Boker Tachtit, Level 4, technology at Ksar Akil, in Level 23, points to the postulated increasing mobility at that time. For the first time, since the disappearance of the Early Levantine Mousterian in Level 27 at Ksar Akil, is there evidence for connections between the extreme southern Levant of the Central Negev and southern Jordan and the more northerly area of the Lebanon.

In summary, it appears that the most likely explanation for the intensification of the Early Levantine Mousterian bidirectional core reduction strategy was increasing pressure for efficiency in flint utilization as a response to increasing mobility at the end of the early last Pluvial. The maintenance of this strategy and, in fact, its refinement and dominance at later Jordanian sites, can be seen as an adaptation to continued residential mobility. With the opening of the lower elevations during the climatic amelioration at ca. 50,000 B.P., there was another increase in residential mobility to exploit the newly improved environments. This final adaptation of still increasing residential mobility led to the ultimate shift in core reduction strategy, from bidirectional to consistant single platform blade technology. Thus, this transition can be seen as being long term, with the adoption of single platform blade production as only a last, relatively small step. It was to be several thousands of years before this early hard hammer blade producing technology was significantly modified by the introduction of the soft hammer for blade removals. Only then did the Upper Paleolithic, as traditionally defined, appear. However, it is now clear that there was a long period prior to then which was both technologically and typologically Upper Paleolithic.

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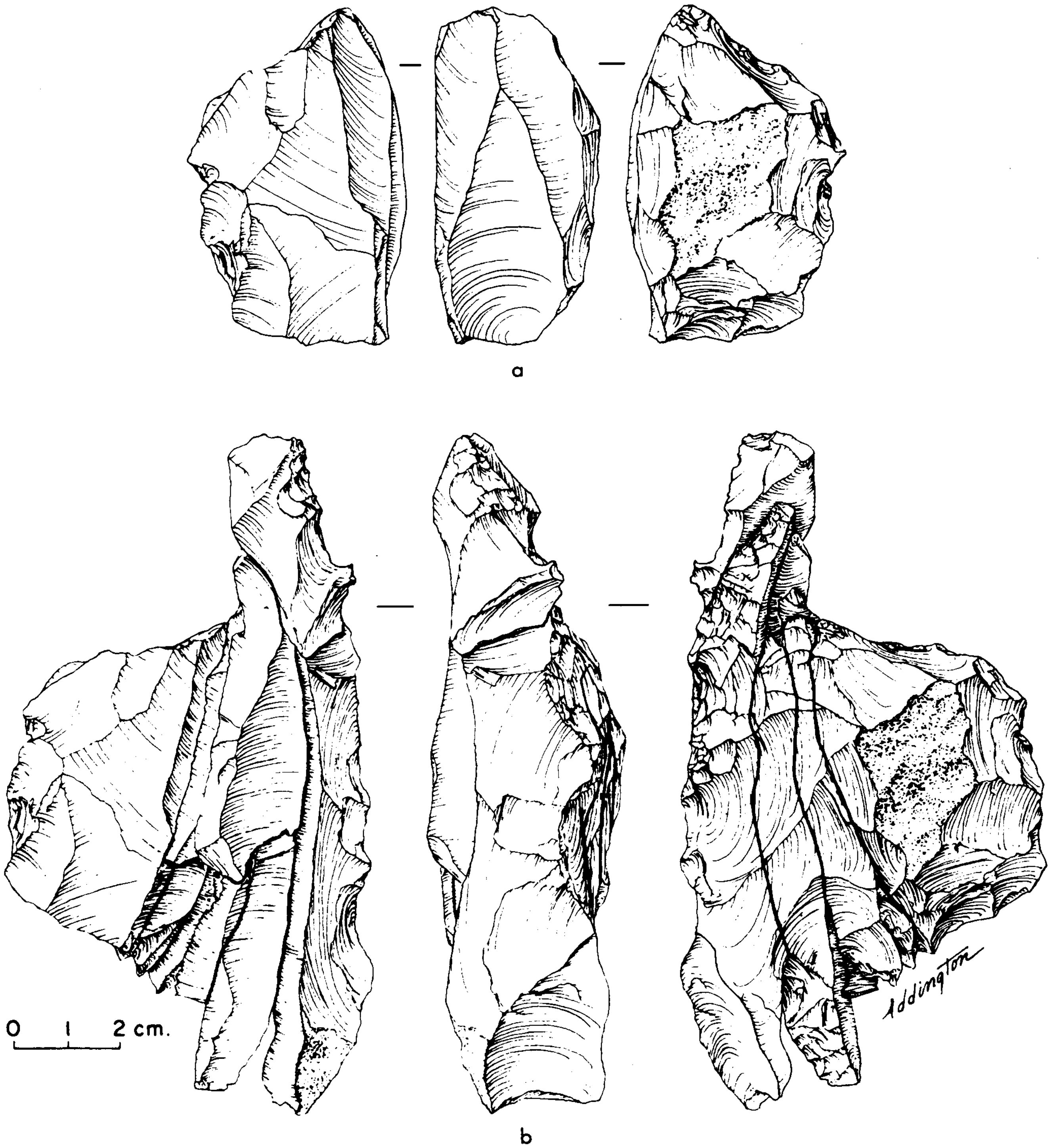

Figure 1 - Specialized, opposed platform Levallois point core from Boker Tachtit, Level 1.a, abandoned core; b, the same core partly reconstructed, showing both the use of the lame à crête technique and the extreme loss of core length due to refaceting of both ends.

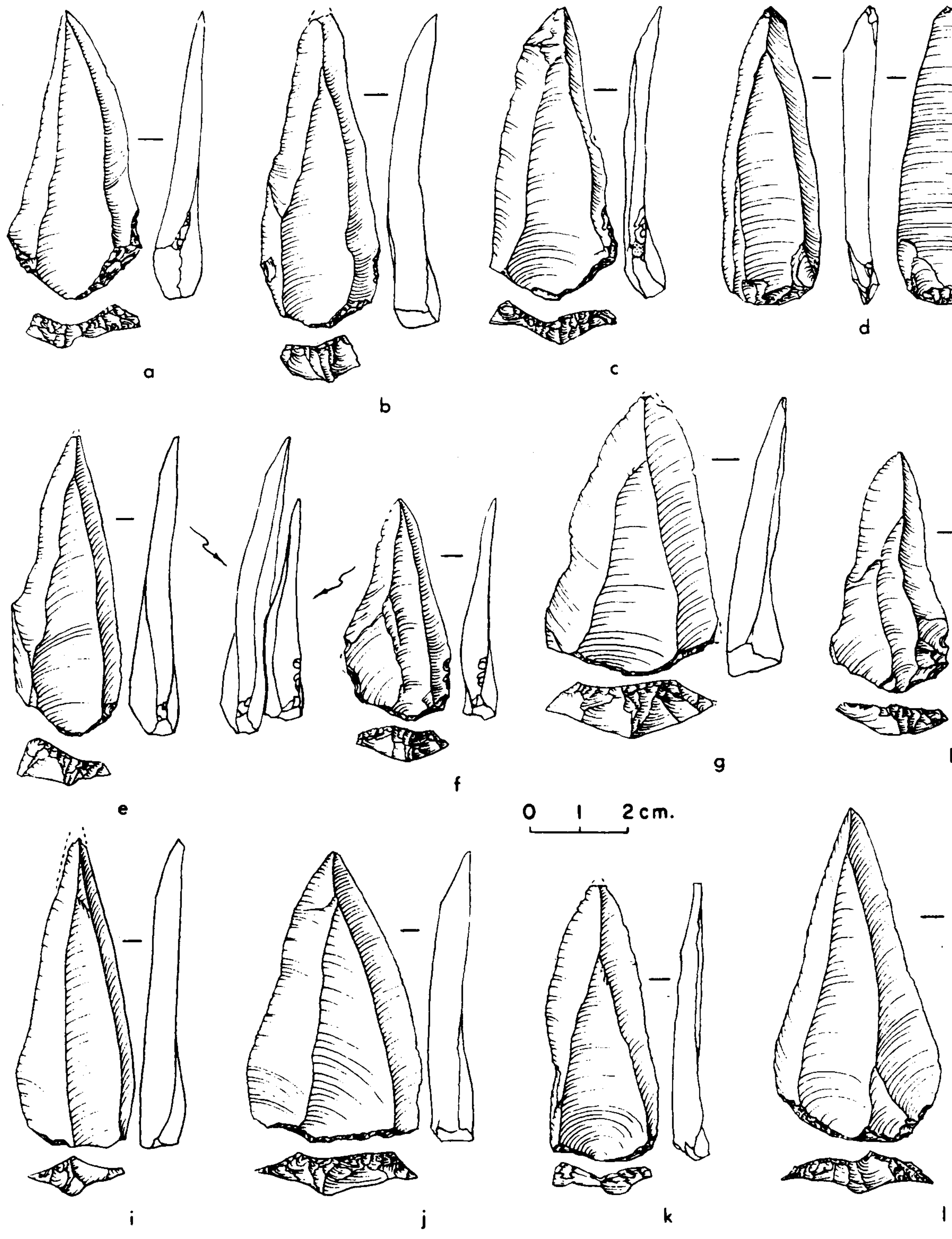

Figure 2 - Points from various levels at Boker Tachtit. a - c, from Level 1; d, Emireh point from Level 2; e - h, Levallois points from Levels 2 and 3. Note that e and g both have only a single scar originating from the distal end; i - l, points struck from single platform blade cores in Level 4. Point k was struck from the core shown in Figure 3, along with three other points.

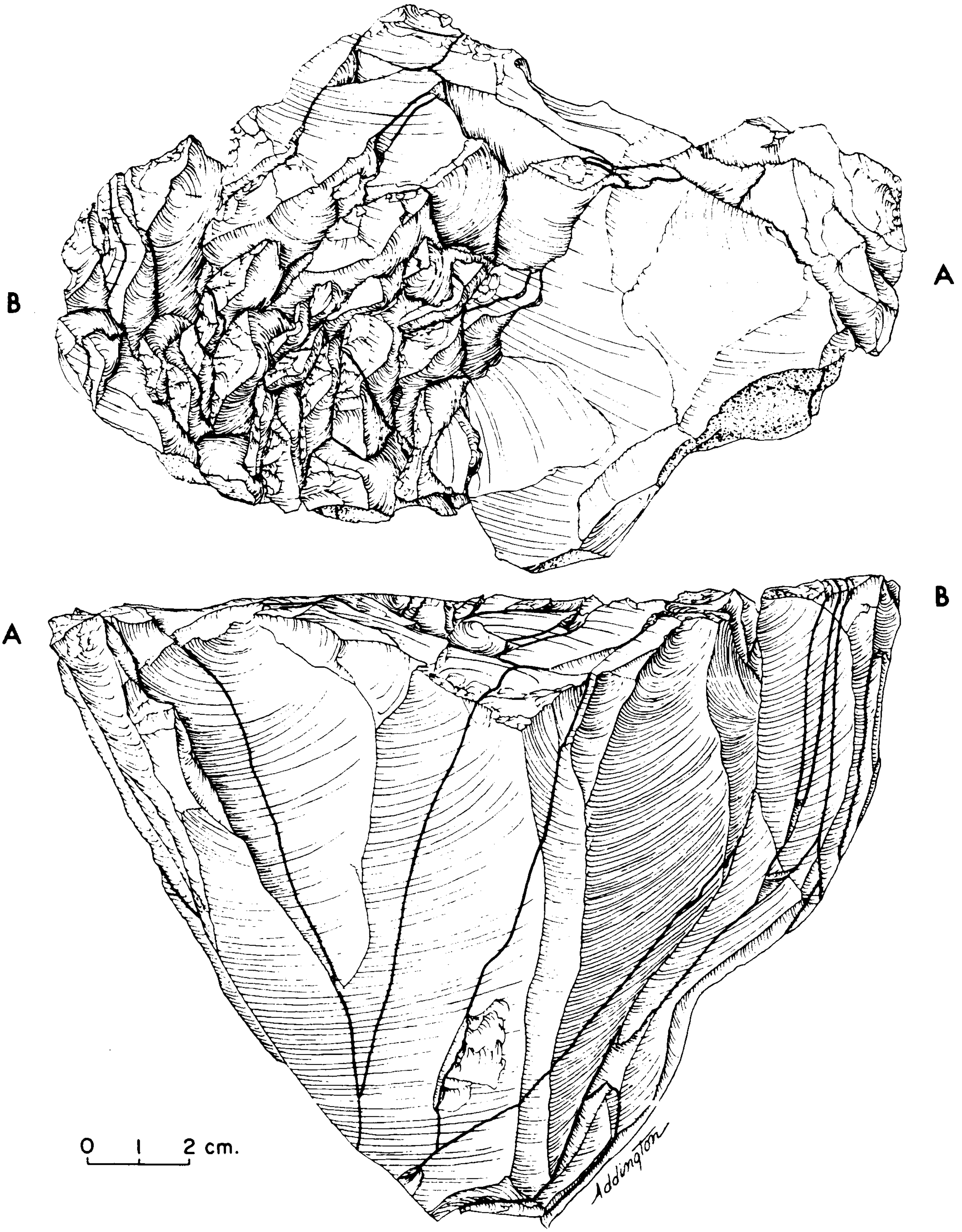

Figure 3 - *Partly reconstructed single platform blade core which produced, as well, four points of Levallois aspect. Note the variability in platform type of the blades, as shown in the top view.*