THE CONTRIBUTIONS OF KATSUHIKO OHNUMA TO LITHIC TECHNOLOGY STUDIES IN THE NEAR EAST

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"I am very busy now, I must do checking…"
Katsuhiko Ohnuma to Christopher Bergman (London, sometime in the early to mid-1980s)

Introduction

My first encounter with Katsuhiko Ohnuma, the start of a decades-long friendship, occurred during late 1979 in London, England. The meeting took place in the basement of the Institute of Archaeology at a small boxed-shaped receptacle that was known as the "knapping pit." Flintknapping was part of the experimental archaeology emphasis of Mark Newcomer's research, which was further developed and then expanded by some of his "first generation" graduate students including Ohnuma and myself, Emily Moss, Romana Unger-Hamilton, Roger Grace, and Sandy Arndt, but also including our colleagues Nick Barton from the Donald Baden Powell Quaternary Research Center, Oxford, and Phil Harding, then part of the Wessex Archaeological Unit, but later known for his work as part of UK television's *Time Team*. Ohnuma and I were to spend the better part of two years flintknapping daily at that location, sometimes much to the chagrin of our fellow students, which I suspect was due to the airborne silica dust and continuous clacking noise. The knapping pit, and indoor flintknapping overall, has now apparently been abolished at the Institute due to health-related concerns and other issues [Mark Roberts, personal communication, 2016].

In late 1979, Ohnuma's research focus was Levallois operating chains, while I was concentrating on blade and bladelet technologies. My knapping efforts were centered upon understanding the various approaches to producing elongated débitage in the later Upper Palaeolithic levels (XIII-VI, 1937–1938 excavations) of Ksar Akil, Lebanon. Ohnuma was originally uncertain as to his dissertation subject, but leaning towards topics associated with the Levantine Middle Palaeolithic. Ultimately, he elected to study the Initial Upper Palaeolithic (IUP) and the Early Upper Palaeolithic (EUP) Northern Ahmarian levels (XXV-XVI, 1937–1938 excavations) of Ksar Akil [Bergman and Ohnuma 1987; Ohnuma 1988; Ohnuma and Bergman 1990]. His personal interest in the Levallois method proved invaluable for this purpose, as the IUP at Ksar Akil was thought by many scholars writing in the 1960s and 1970s to represent "The Transition" from the Middle to Upper Palaeolithic in the Levant [Azoury 1986].

Early Flintknapping Studies: Determination of Flaking Mode

Ohnuma's initial work at the Institute was focused upon the basics of flintknapping, specifically the flaking tools used to process stone and the 'fingerprints' they leave on the resulting débitage and retouched pieces. Perhaps no better example of his research at this time is a paper entitled "Experimental Studies in the Determination of Flaking Mode" [Ohnuma and Bergman 1982]. Ohnuma started with an earlier set of experiments by Newcomer [1975] involving the distinction between *flaking mode* or the tools (e.g., hard or soft hammers) used at different stages of stone tool manufacture, as opposed to *flaking method*, which concerns the specific means by which the raw material is processed (e.g., direct or indirect percussion). It was Ohnuma's belief that a higher degree of certainty could be obtained in discerning flaking mode as opposed to flaking method. In

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Newcomer's original review, he also discussed the lack of distinctive traits to effectively separate direct, free-hand, soft hammer struck blades from those detached using indirect percussion with a soft hammer punch.

The research design of this significant paper is one which I believe best characterizes Ohnuma's methodological approach. Starting with a simple, highly specific problem, he developed a series of experiments, with limited variables, aimed at isolating those traits that could be considered diagnostic indicators of flaking mode. The experimental framework for the study consisted of the manufacture of several hundred flakes detached with a deer antler hammer, as well as sandstone and quartzite hammerstones. All of the flakes were produced using the direct free-hand method with non-marginal flaking, resulting in large butts. Ohnuma then carefully examined the ventral surfaces of the flakes for the following features:

1) Presence or absence of a lip at the intersection of the butt and ventral surface;
2) Degree of development of a point and cone of percussion;
3) Presence of a pronounced or diffuse bulb; and
4) Presence or absence of conchoidal fracture marks on the bulb.

He concluded that a clear point and cone of percussion, conchoidal fracture marks on the bulb, and a non-lipped butt and pronounced bulb were all indicative of the hard hammer mode. Soft hammer struck flakes were characterized by a combination of a lipped butt and a diffuse bulb or a diffuse point of percussion and a diffuse bulb.

In a series of blind tests, it was demonstrated that use of his criteria was over 90% successful in distinguishing hard hammer mode from soft hammer mode in the experimental samples [Ohnuma and Bergman 1982]. The results were less promising when the blind test attempted to distinguish flakes detached with different types of soft hammers, specifically an antler hammer and a soft sandstone hammerstone. In this instance, correct assignations of a specific soft hammer type decreased to only 62% at best [Ohnuma and Bergman 1982: 167].

Our dissertation supervisor Newcomer frequently decried those flintknappers who "dug through their waste piles and published experiments" without the essential comparison to archaeological material. He believed, as did Ohnuma and I, that experimental archaeology had value as an interpretive tool, leading to probable models for prehistoric behavior, which then required testing against actual archaeological assemblages. Following this guiding principle, Ohnuma applied the results of his flaking mode studies, as well as his other flintknapping experience, to the deeply stratified site of Ksar Akil, Lebanon.

Doctoral Dissertation: Initial and Early Upper Palaeolithic of Ksar Akil (1937–1938 Excavations)

For his doctoral research, Ohnuma elected to tackle the earliest part of the Upper Palaeolithic sequence at Ksar Akil from the 1937–1938 excavations, specifically levels XXV-XVI. Ingrid Azoury, my teacher at the American University of Beirut, originally examined this material in the late 1960s while at the Institute [Azoury 1986]. As expected for that time, her approach was largely typological, with some limited observations regarding technology. Ohnuma correctly believed that in order to examine development of the IUP and EUP Northern Ahmarian it was essential to consider technology. Azoury regarded the IUP levels as being characterized by an evolved Levallois technique [Azoury 1986: 81], a not unsurprising claim given the belief that these assemblages were thought to be "Transitional." As an aside, the purported evolutionary character of inanimate objects, like stone tools, was humorously scoffed at by Lorraine Copeland who often reminded Ohnuma and I of Jacques Tixier's thought that "humans evolve, but stone tools do not."

Ohnuma's study involved recording a series of variables, both quantitative and qualitative, aimed at describing technological traits for each of the assemblages spanning the IUP to the EUP Northern

Ahmarian levels [Ohnuma 1988]. Specifically he chose to examine technologically-relevant aspects of the débitage such as butt type, flaking mode, presence of cortex, dorsal scars, and flaking direction. These data showed marked changes over time, including the following:

1) Blades show an increase from the IUP to EUP Northern Ahmarian [Ohnuma 1988: Table 61];
2) Bladelets become more pronounced in the EUP Northern Ahmarian [Ohnuma 1988: Table 61];
3) Cores characterized as Levallois occur only in the IUP [Ohnuma 1988: Table 62];
4) Single platform blade cores are common in the IUP, opposed platform cores become more frequent in the EUP Northern Ahmarian [Ohnuma 1988: Table 63];
5) Plain platforms on cores show a marked increase in the EUP Northern Ahmarian [Ohnuma 1988: Table 66];
6) Faceted butts are more frequent in the IUP with an increase in plain butts in the EUP Northern Ahmarian [Ohnuma 1988: Table 64];
7) Butt size decreases markedly in the EUP Northern Ahmarian, especially among soft hammer struck débitage indicating the use of marginal flaking [Ohnuma 1988: Table 76];
8) Hard hammer and soft hammer mode are both used in the IUP, while soft hammer mode increases markedly in the EUP Northern Ahmarian [Ohnuma 1988: Table 75]; and
9) Dorsal scar patterns are most often unidirectional in the IUP with an increase in opposed dorsal scars in the EUP Northern Ahmarian [Ohnuma 1988: Table 78].

These attributes allowed Ohnuma to develop a preliminary technological characterization of levels XXV-XXI [Bergman and Ohnuma 1987; Ohnuma 1988; Ohnuma and Bergman 1990]. He posited that two distinct stages were represented in these layers. The sample from levels XXV-XXIV was small, but characterized by opposed platform cores with parallel sides. Levels XXIII-XXI, on the other hand, contained numerous single platform blade cores with faceted platforms and converging sides. The triangular shape of the cores caused blade removals to converge, resulting in the production of blanks morphologically similar to elongated Levallois points. The blow used to detach the blades in these levels is well on to the striking platform (non-marginal flaking), resulting in relatively thick blanks with large butts. An analysis of the ventral surfaces of the blanks in these levels suggested that most blades were detached with soft hammers.

Although no clear-cut technological distinction existed between level XX and those immediately preceding it, there was a shift from cores with single, faceted platforms and converging sides [Bergman and Ohnuma 1987; Ohnuma 1988; Ohnuma and Bergman 1990]. These were replaced by parallel-sided cores with opposed, plain platforms. Cresting and the core tablet technique began to be used more often for preparation and maintenance. The blade blanks tended to be much thinner than in levels XXV-XXI and were produced by striking quite close (marginal flaking) to the edge of the core's platform, resulting in tiny butts. In order to avoid damaging the platform, abrasion was used extensively to remove overhang and thicken and strengthen the edge. The blades in these levels were overwhelmingly detached with soft hammers, probably by direct percussion.

The IUP assemblages in levels XXV-XXI were almost entirely composed of Upper Paleolithic tool types including varying percentages of chamfered pieces [Newcomer 1968–1969, 1972; Azoury 1986]. This artifact type, generally rare in the rest of the Levant, was made by a *tranchet* blow at the proximal or distal end of a flake or blade. Other components of the tool kits included end-scrapers and truncation burins, which were always more numerous than the dihedral types [Newcomer 1972]. Levels XX-XVI, EUP Northern Ahmarian, had tool assemblages consisting of end-scrapers and retouched blades and bladelets including backed and partially backed blades, as well as robust el-Wad points (over 15% of the tool kits) and *pointes a face plane* [Azoury 1986].

The IUP at Ksar Akil, based on his research, was largely Upper Palaeolithic in character involving blade production from opposed (earlier) and then single platform cores that were flaked nonmarginally, predominantly with soft hammers. The tool kit consisted of Upper Palaeolithic types found in other parts of the Ksar Akil sequence, with the notable exception of the chamfered pieces. The EUP Northern Ahmarian at Ksar Akil displayed further refinement in blade manufacture that included opposed platform cores, cresting for core preparation, and a heavy reliance on marginal, soft hammer flaking. Marginal flaking resulted in thinner blades and bladelets, which were used for el-Wad points, as well as backed and partially backed pieces.

The results of Ohnuma's work, and the earlier study of Azoury, have recently been verified by Leder [2014: 151; see also comments on page 118] who stated that statistical deviations, "in all three works are explicable by differences in applied methods and definitions whereas the overall assemblage character is essentially the same." Although Leder does point out important differences in regards to the analysis of core reduction, for which he provides considerable new detail, Ohnuma was among the first to successfully demonstrate a plausible local development of the EUP Northern Ahmarian from the regional IUP [see also Leder 2014: 203].

Although dating of the earlier part of the Ksar Akil sequence was not completed during Ohnuma's research, it is now known that the age of the anatomically modern child "Egbert" (Ksar Akil 1) from Level XVII or XVI (EUP Northern Ahmarian) is calculated at 40,850–39,200 cal BP (68.2% prob.) or 41,050–38,300 cal BP (95.4% prob.). For the IUP human specimen from level XXV, "Ethelruda" (Ksar Akil 2), the estimated ages are 42,400–41,750 cal BP (68.2% prob.) or 42,850–41,550 cal BP (95.4% prob.). These estimates are constrained by only a few age determinations from above and below Ethelruda and are, therefore, subject to future re-evaluation [Douka *et al.* 2013].

Near Eastern Middle Palaeolithic: Hummal Level 1a and Amud Cave

Ohnuma's work with the present author on the Hummal Level 1a assemblage from the el-Kowm Basin, Syria, as well as his study with Takeru Akazawa on Amud Cave in the Upper Galilee, Israel, was concerned with more precisely characterizing aspects of flaking technology and, in the case of Amud, chronological placement of the assemblages. Hummal Level 1a, at the time of our work together, had only recently been described by Besançon *et al.* [1981, 1982] and Copeland [1982]. Copeland recognized the unique character of Hummal Level 1a (the Hummalian) assemblage, which was stratified within a sequence of Yabrudian and Mousterian layers, but displayed a developed blade industry with some tools appearing similar to Upper Palaeolithic types. Our current understanding of the Hummalian industry is that it dates to the Early Middle Palaeolithic, ca. 200 ka [Wojtczak *et al.* 2014].

In her preliminary analysis of the Hummalian, Copeland felt that the assemblage largely reflected the Levallois method of flaking. The blade sample we examined consisted of only 114 specimens, but was said to be representative by Copeland and Francis Hours [1983, personal communication]. It consisted of blades and related débitage, blade cores, and tools made on blades. Specifically, the following attributes were noted on the blade sample:

1) Eight crested blades in the sample indicated the occasional use of cresting for core preparation or maintenance;
2) Plain butts were identified on about 50% of the blade sample;
3) Hard hammer struck blades were most frequent (36 examples out of a total of 51);
4) Platform abrasion was occasionally used during striking platform preparation;
5) Majority of the blades had unidirectional (n = 54) or bidirectional opposed (n = 19) dorsal scars; and
6) Blade core reduction, in some instances, continued into the production of bladelets [Ohnuma and Bergman 1983].

Based on these attributes, we concluded that the blades were not produced by the Levallois method [cf. Boëda 1988a, 1988b]. To a large extent, this conclusion has been supported in recent work by Wojtczak *et al.* [2014], who elaborate to a greater degree on core reduction variability in the Hummalian. Based on examination of material from Levels 6a-7c of the recent excavations of Jean-Marie Le Tensorer and Sultan Muhesen, a more detailed picture of this industry has emerged involving blade production, use of truncated-faceted pieces, bladelet cores, and "burins" utilized as cores. While our work on the Hummalian was admittedly limited in terms of the artifacts examined, restricting our ability to reconstruct operating chains, it is clear that many of the original observations [Bergman and Ohnuma 1983] have been subsequently verified as follows:

1) The presence of blades produced by non-Levallois methods [Wojtczak *et al.* 2014: 28];
2) The presence of bladelets [Wojtczak *et al.* 2014: 27];
3) The presence of truncated-faceted pieces [Wojtczak *et al.* 2014: 28];
4) The predominance of the hard hammer flaking mode for blade production [Wojtczak *et al.* 2014: 26];
5) The occasional use of core striking platform abrasion [Wojtczak *et al.* 2014: 27];
6) The use of cresting for preparation and repair [Wojtczak *et al.* 2014: 27];
7) The reduction of blade cores leading to bladelet production [Wojtczak *et al.* 2014: 27];
8) The flaking of unidirectional and bidirectional cores to produce blades [Wojtczak *et al.* 2014: 28]; and
9) Blades with predominantly plain or partially faceted butts [Wojtczak *et al.* 2014:28].

Beyond the similarity in technological observations, Wojtczak *et al.* [2014: 28] fill in the missing elements of our limited study to suggest that the "Hummalian blade reduction [is] one uniform reduction strategy, where morphologically dissimilar, non-Levallois-like and Levallois-like, technological elements were involved in a single blade reduction system."

The Amud Cave study [Ohnuma *et al.* 1988] focused upon the material from Layer B that had previously been described by Hiroshi Watanabe as representing the Middle to Upper Palaeolithic Transition. Given his doctoral research on the "Transitional" assemblages from Ksar Akil (now assigned to the IUP), he was uniquely placed to study Amud Layer B. Ohnuma concluded that typologically there was no evidence to suggest a similarity with the IUP tool kits of Ksar Akil, Antelias, and Abu Halka. Given Amud Cave's geographic position, comparison with the Lebanese material was not a surprising choice for Watanabe. However, it is now understood that there is geographic variability in the IUP and a typologically and technology homogeneous cultural expression simply does not exist. For example, in the southern Levant, Bokerian assemblages [cf. Leder 2014] lack chamfered pieces, but instead have numerous Emireh points, which are very rare in the north. Ohnuma's analysis further revealed that Watanabe mistakenly classified intentionally broken flakes as chamfered pieces. Using an attribute analysis similar to that of his doctoral dissertation, it became clear that Amud Layer B represents a variant of the Levantine Mousterian, with points and flakes produced by the Levallois method and retouched tools more typical of the Middle Palaeolithic.

Continuing Flintknapping Research: A Return to the Levallois Method

Perhaps one of Ohnuma's most interesting papers, based on his decades-long flintknapping experience, appeared in 1997 and was concerned with how stone working knowledge and skills are transmitted, either verbally or non-verbally. It was an ambitious decision to frame the experiments around Levallois flake manufacture, a somewhat difficult technology to master, but in many ways not surprising since this was always his primary research focus. Working from a premise current at that time, which posited pre-anatomically modern human populations like Neanderthals may have had a less developed capacity for communication, Ohnuma and his colleagues designed a flintknapping experiment.

The experiment consisted of groups of students with varying levels of understanding in regards to lithic technology, but who apparently had little or no hands-on flintknapping experience. Divided into two groups of 10, one set of students received both verbal and visual instruction of the *méthode linéale* of Levallois flake production. The students had three practice sessions where they were allowed to ask questions to which the demonstrator replied verbally along with physical gestures. The second group of students was instructed entirely non-verbally and was shown how to produce Levallois flakes only by physical gestures. These students also had three practice sessions, in which questions and answers were given and responded to only by gestures. In the case of both groups, there was a final test. In tabulating the results, Ohnuma *et al.* were able to show that nine of the 10 students in the verbal group and eight of the 10 students in the non-verbal group could grasp the essential principles of Levallois flake production. Additionally, six of the students in each group "were successful in Levallois flake production, although one subject in each group detached an atypical flake" [Ohnuma *et al.* 1997: 165].

In their concluding remarks, Ohnuma *et al.* [1997] note the apparent success in producing Levallois flakes in both groups, an especially surprising result for the group receiving non-verbal instruction. They probably would modify their conclusion that Levallois flake production in the Stone Age "belonged to a different level of subsistence activity from that which necessitated language," given the present view of the biogeography of prehistoric human populations, as well as the development of behavioral modernity. Nonetheless, their experiments demonstrate that complex linguistic skills were not a necessity for transmitting the procedures required to successfully implement stone tool production. Unlike modern flintknappers, who recreate technological processes, prehistoric peoples developed the required skill sets as part of lived traditions. This study clearly showed that proficiency in complicated tool production was likely to have been acquired very rapidly even among juveniles.

Conclusion

The lithic technology studies of Katsuhiko Ohnuma have a modest, but confident character that reflects his personality. Taking a focused approach to various problems as outlined above, he developed effective experiments to test his hypotheses and elucidate aspects of the behavior of prehistoric populations. His efforts were always geographically centered upon the Near East and most specifically the Middle Palaeolithic. Although his research diverged from work on the Levallois method, especially during his recent and large research project regarding the Bronze Age of Syria, Ohnuma continued to ponder this most complicated of ancient technological expressions. For me personally, perhaps his most enduring wisdom is something he imparted to me (verbally I might add!) over 30 years ago, "I am very busy now, I must do checking…" This sage advice on the necessity to check, verify, and proof was, and is, at the heart of his approach to lithic technology and is something that succeeding generations of students would do well to heed.

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