A CANAANEAN BLADE WORKSHOP AT HAR ḤARUVIM, ISRAEL

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Introduction

Har Ḥaruvim is an Early Bronze Age settlement located near Kibbutz Hazorea in central Israel (Fig. 1). The site was surveyed in the 1950's and 60's (Meyerhof 1960), and is well known for its many Canaanean cores. Ceramic sherds date the site to the Early Bronze Age II-III. This article presents the flint assemblage collected in 1997 during a survey conducted by the authors on behalf of the Institute of Archaeology, Tel Aviv University. The survey covered only a small part of the Early Bronze Age site, and concentrated on (and around) a heap of rocks located at the highest part of the site (Fig. 2). It is suggested that the heap represents the remains of a Canaanean blade workshop.

Background

Research on the Canaanean blade industry in our region has thus far focused on the blades. Neuville (1930:205–206) first defined Canaanean blades by their trapezoidal section. Crowfoot added, "A Canaanean blade is characterized by the removal of the central ridge on the upper surface, before the core is struck, a deep negative bulb of percussion remaining on the upper surface of the bulbar end." (Crowfoot 1948:73). In addition traces of facetting are sometimes visible (Rosen 1997:48). In his research on Early Bronze Age flint assemblages, Rosen studied the Canaanean industry, addressing typological and raw material aspects of the blades (Rosen 1983) and pointing out aspects of specialization and trade (Rosen 1989 1997).

The Canaanean core was defined as a prismatic core with one striking platform shaped by facetting. Rosen (1997:46–48) suggests that the blades were produced with the aid of a punch, which might have been made of copper. The probable use of a copper punch for Canaanean blade production was identified at Hassek Höyük (Otte, *et al.* 1990).

The cores and Core Trimming Elements (C.T.E.) collected at Har Ḥaruvim are presented in order to emphasize a few elements of Canaanean core technology and blade production which have not previously been addressed, since no workshops from the region have yet been evaluated. The Canaanean technology of Har Ḥaruvim may not represent the entire range of the Canaanean blade industry, nevertheless, our observations may be important in understanding a facies of this technology.

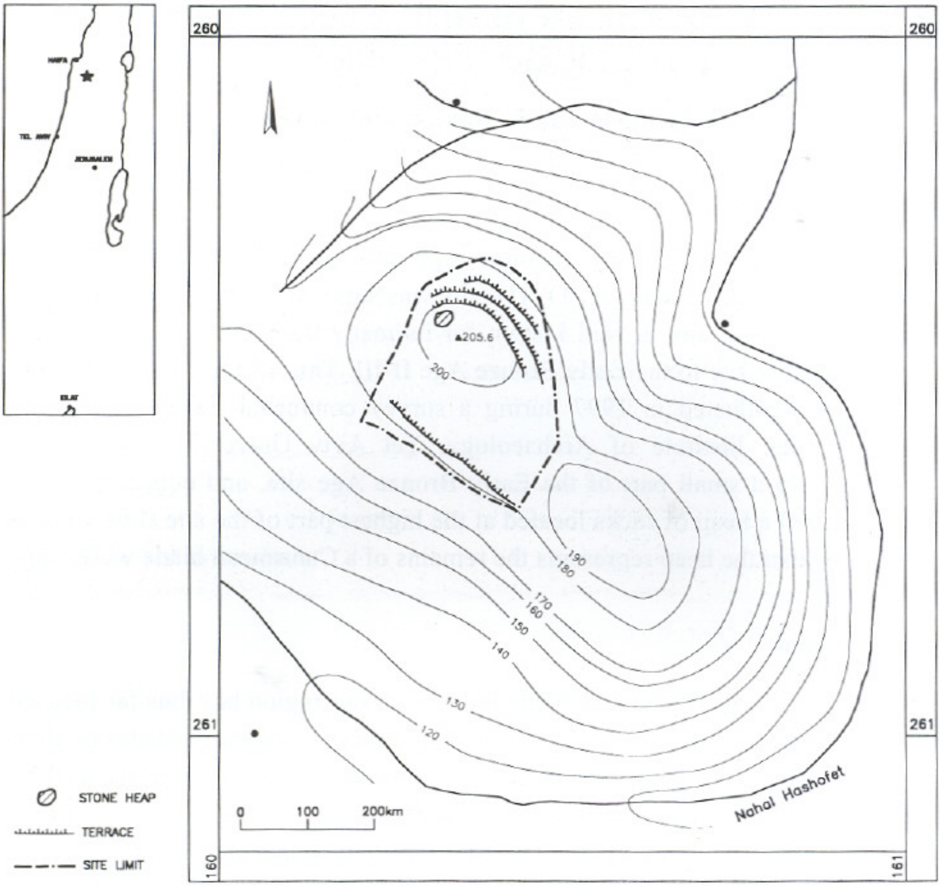

Fig. 1. Map with site topography showing rock heap (after Meyerhof 1960)

Although the rock heap was divided by a grid into eight separate units, analysis by unit revealed no patterning and therefore the assemblage is presented as a whole (Table 1).

Tools constitute the largest group (27.5%), and these are dominated by ad-hoc tools. Some of this may be the result of post-depositional processes.[1]

[1] A total of 163 tools were collected, of which 34 were shaped on primary elements. This indicates the preference of primary elements for tools, and might be the cause for the low value of primary elements in the debitage. 16 blade tools were collected, of which 10 are non-Canaanean blades. Most of the blade tools are broken fragments of retouched blades. Only one Canaanean blade had gloss. The rest of the tools includes 10 scrapers, two fan scrapers and two side scrapers, 61 retouched flakes (this group also includes broken retouched flakes without the bulb of percussion), 54 notches and denticulates, some of which might be the result of post-depositional processes, and 10 varia.

Fig. 2. General view of rock heap towards north.

Chunks comprise 22.3%, possibly a result of primary reduction of nodules (which was very rough). Flakes make up 17.4% including many hinge flakes. The relatively large group of C.T.E. (14%) may be characteristic of Canaanean core reduction, which required constant maintenance as will be discussed below. Primary elements compose only 5% of the assemblage. This seems low in light of our impression that the entire reduction sequence occurred on-site.

Primary elements and flakes were divided into "large blanks" (over 8.5 cm.) which included 10 primary elements and 4 flakes, and "small blanks" (up to 8.5 cm.). The large blanks were most likely produced at the beginning of the reduction of a nodule into a pre-form, while the smaller blanks cannot be attached to a specific stage in core reduction, and can be produced at any stage of core preparation or maintenance.

A comparison of the 1997 flint assemblage to the flint assemblage collected at the same site by Meyerhof (1960) presents difficulties. While our survey was limited to the stone heap only (a workshop area), the survey conducted by Meyerhof covered the entire Early Bronze Age site (including domestic areas). Accordingly his assemblage had more tool types.

TABLE 1. FLINT WASTE AND TOOL FREQUENCIES

Flint Category	*Amount*	*Percentage*
Primary Element Flake	19	3.2
Primary Element Flake: L	10	1.7
Flake	103	17.4
Flake: L	4	0.7
Canaanean Blade	24	4.1
Blade	7	1.2
Canaanean Core	22	3.7
Core	22	3.7
C.T.E.	83	14.0
Chip	3	0.5
Chunk	132	22.3
Tool	163	27.5
TOTAL	592	100.0

The source for the raw material is in close proximity to the site. Today, one can still observe the natural detachment of flint nodules from the rock surfaces of the mountain. We assume that, in the past, surface quarrying of the grey to light brown coloured flint was practiced. The advantage of the local raw material is its uniform texture. This is apparent from the relatively small amount of cores with imperfections such as cracks or chalk pockets. The amount of silicate in the flint varies, and even the best nodules are not consistent with the proper definition of "siliceous flint". The Canaanean industry however, required large and homogeneous flint nodules, rather than siliceous flint.

The Cores

Two different flint core reduction strategies were found at Har Ḥaruvim during the 1997 survey. One strategy is characteristic of most Early Bronze Age sites in the region, and consists mainly of flake cores which probably provided blanks for ad-hoc tools (Rosen 1997). Twenty such non-Canaanean cores were collected as well as two broken cores. Eighteen of these were flake cores and two were blade cores. Six of the cores had one striking platform (five pyramidal and one amorphous), while only one core had two striking platforms. Ten cores had three striking platforms or more. Three cores were catalogued as varia (one roughout and the two blade cores).

The other core reduction strategy is the Canaanean blade industry. Eighteen Canaanean cores (Fig. 3a-b) as well as four pre-forms (Fig. 4)[2] were collected. One of the main characteristics of the cores at Har Ḥaruvim is the shaping of the striking platform and its maintenance during the entire blade production process. We suggest that before the production of a blade, one flake (or more) was removed from the striking platform in order to prepare a specific platform and to emphasize the ridges intended to guide the next blade. This preparation flake was detached using the production surface as a striking platform for its reduction. This blank is defined here as a "Core Tablet Flake" or C.T.F. (Fig. 5). The expected number of C.T.F. may be lower than the number of blades since 1.) a C.T.F. is not needed for each blade reduction, and 2.) some C.T.F. may be detached without removing a recognizable part of the production surface.

The shape of the Canaanean pre-form is elongated. The production surface width remains constant except for a slight narrowing at the core base. Core widths range between 5.4–8.7 cm., with most measuring between 6–8 cm. The uniformity of the core width might imply that a specific size was required for using a support device. The desirable width was achieved by either a selective choice of nodules, in which case a high percentage of cortex remained (Fig. 4), or by bifacial flaking (excluding the future striking platform) when the nodule was too wide, in which case very little cortex was left, if any at all.

Striking platforms were first shaped by facetting, and during blade production C.T.F. blanks were removed. This core maintenance caused permanent changes in the striking platform topography. The initial state of the striking platform was rather planar but because of C.T.F. reduction the following may have developed:

1. C.T.F. reduction caused a small step at the corner between the striking platform and the production surface (Fig. 6.1).

2. If no measures are taken the step grows with every C.T.F. reduction until further blade production is unfeasible. Step formation does not directly prevent blade production because knapping is most likely indirect. The disturbance is caused because step formation prevents reducing additional C.T.F.'s, which is necessary for continued blade production (Fig. 6.2).

3. If the rear part of the striking platform is reduced by facetting in addition to C.T.F. reduction, the step effect may be prevented. The result will be an inclined striking platform (Figs. 6.3–4).

The disadvantage of this strategy is that every C.T.F. reduction decreases the production surface length.

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2 One must remember that the site was "robbed" during the last 30–40 years and the "best looking" cores were taken.

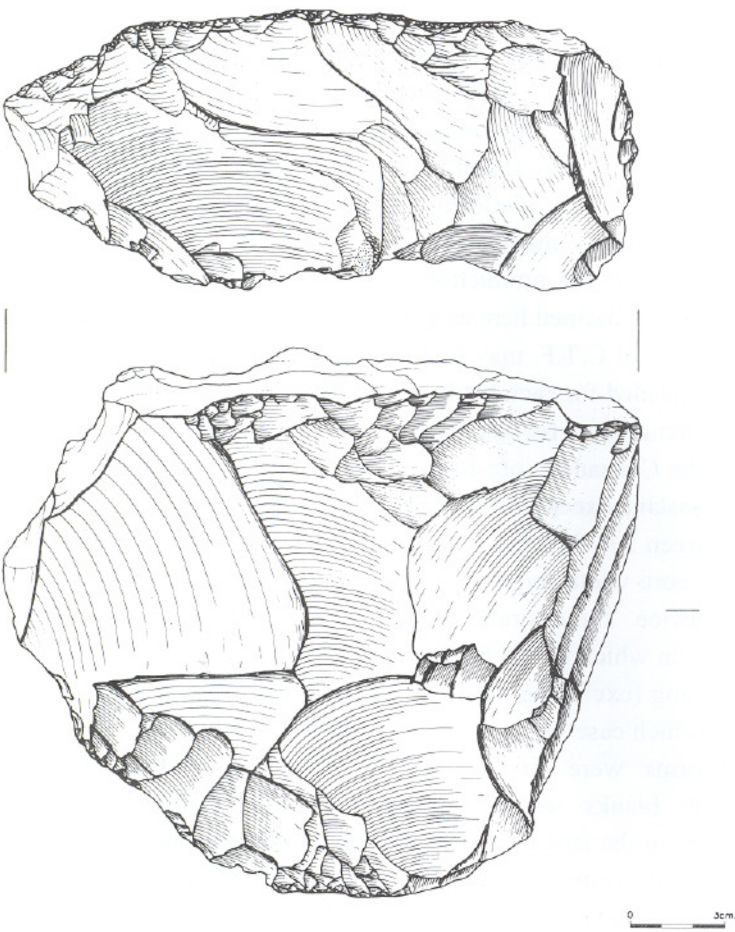

Fig. 3a. Canaanean core (four views).

The reason for core discard is not clear. In fourteen of the cores hinge scars were apparent, but only six of those are rough and led to core abandonment (mainly because of the collapsed edge of the striking platform). Cracks and chalk pockets in the flint caused the abandonment of three cores. Two other cores were abandoned as a result of an error in C.T.F. reduction, which had destroyed the striking platform.

The Canaanean core industry is different from most blade industries of the southern Levant. We shall enlarge on three points regarding the differences:

1. The prismatic production.

2. The absence of a suitable angle between the striking platform and the production surface.

3. The absence of a uniform striking platform.

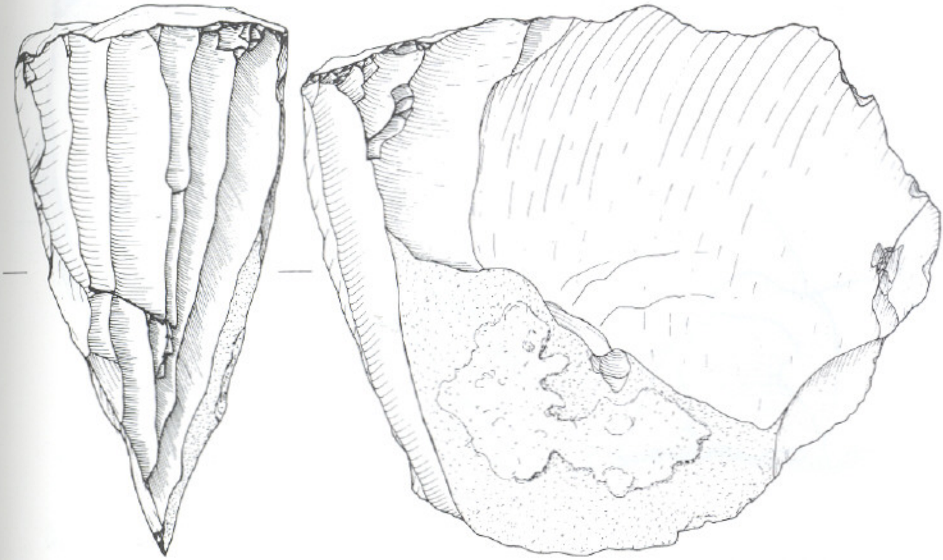

Fig. 3a. (Continued).

The Prismatic Production

A prismatic core has an almost flat production arc, while pyramidal cores have a more convex production arc (Fig. 7a). This arc emphasizes the ridges chosen for blade reduction (the smaller the arc radius, the bolder the ridges). The arc determines blade thickness and width, and the relationship between them. These can be mathematically calculated with reference to the arc radius[3] (Fig. 7e), and conversely, the arc radius from which a blade was produced can be calculated using blade width and thickness.

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3 The arc radius was calculated as follows (see Fig. 7e): $r = (X^2+Y^2)/(2Y)$. X = half of blade width. Y = blade thickness.

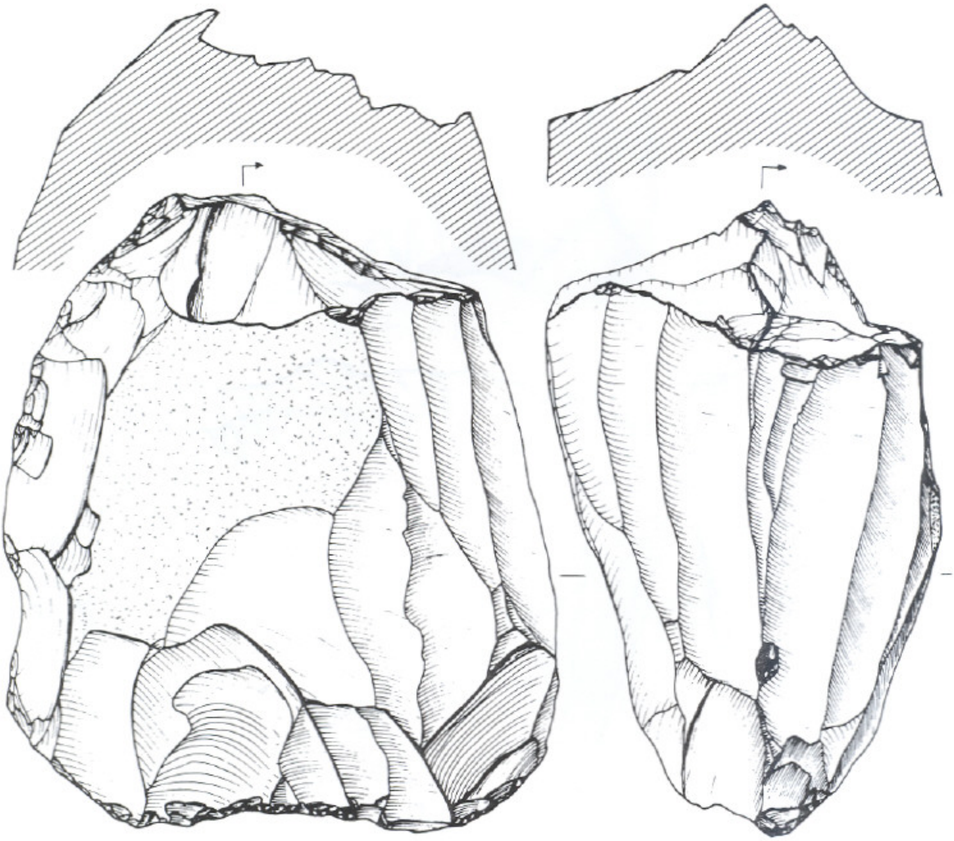

Fig. 3b. Canaanean core (three views).

Canaanean blades (24+6 tools) were measured for width and thickness in order to calculate the arc radius (it varied from 1.0–2.4 cm.). When the production surface radius of Canaanean cores was measured (with a device used for measuring the radius of ceramic sherds), the arc radius ranged from 3.5–10 cm.

The arc radius calculated from the blades is quite different from the arc radius calculated from the cores. This complete mismatch has to be explained. Before attempting to explain the difference between the arc radius calculations, we wish to present another observation and a comment:

Some cores have been abandoned in the course of blade production not because they were exhaused or deformed, but because of a raw material problem (crack, limestone pocket, etc.). Being "potentially" active they should maintain the "original" arc radius, and it is anticipated that it should match the one calculated from the blades. However, when measured these cores also show

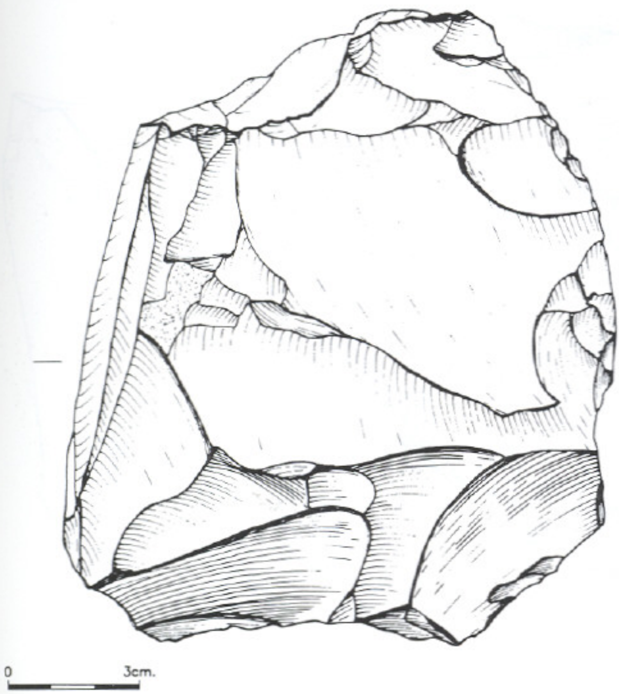

Fig. 3b. (Continued)

an arc radius ranging from 3.0–3.5 cm., which again disagrees with the expected size based on the calculation.

Some cores probably represent a discard state, so calculating their arc radius is of little use in understanding the above mismatch. It is possible that one of the reasons for core discard is a production surface arc that is too flat, which reduces the prominence of ridges and prevents the production of blades. A case relevant here may be the cores with a production surface arc radius of 10 cm., which is too large to enable removal of thick enough blades (assuming an average width for the blades).

When attempting to relate the production surface arc radius to the reduction sequence of Canaanean blades, the following emerges: in pyramidal blade core production surfaces, the arc radius is convex and close to the one calculated from the blades (but still larger than in Canaanean prismatic cores).

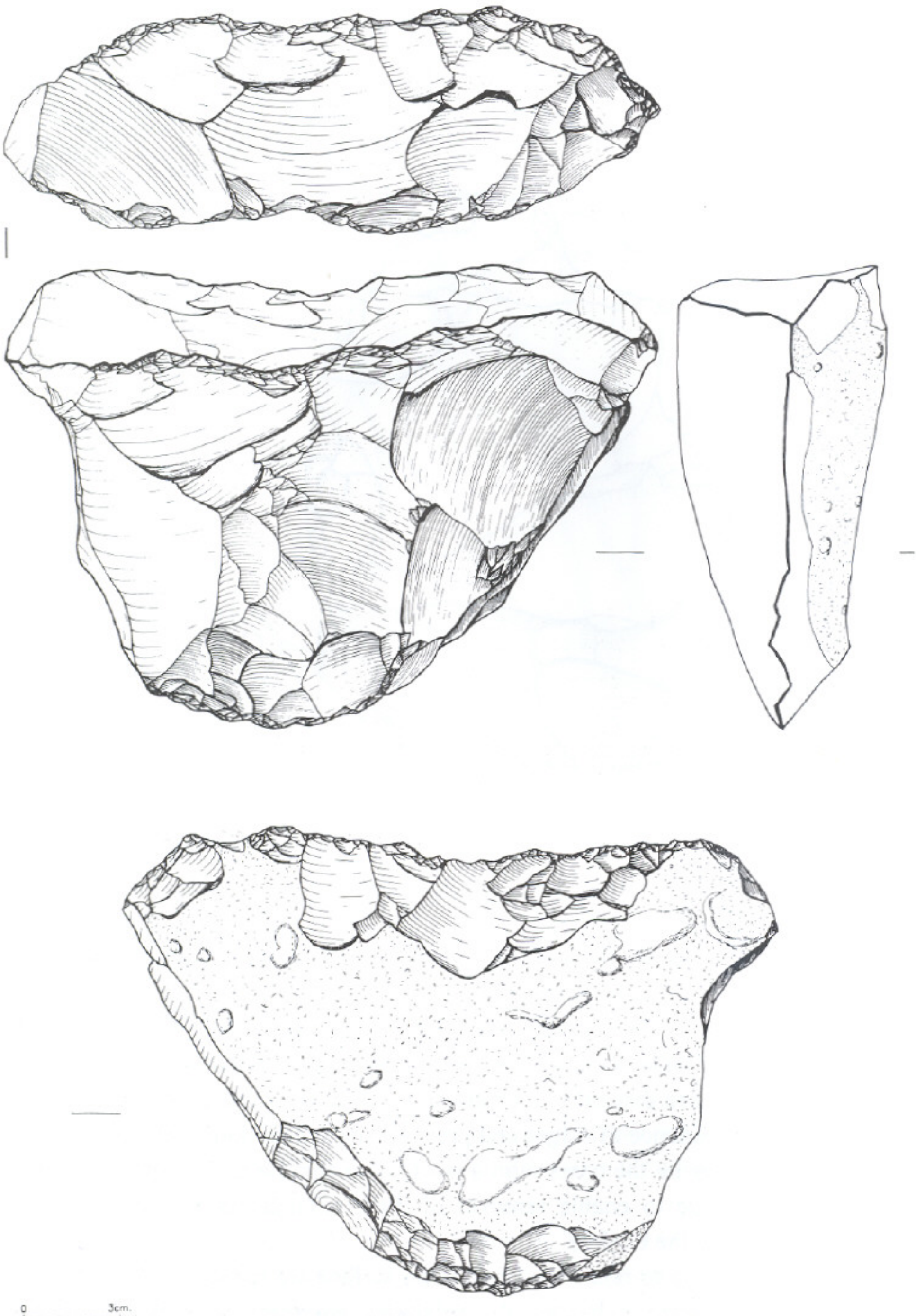

Fig. 4. Canaanean core pre-form (four views).

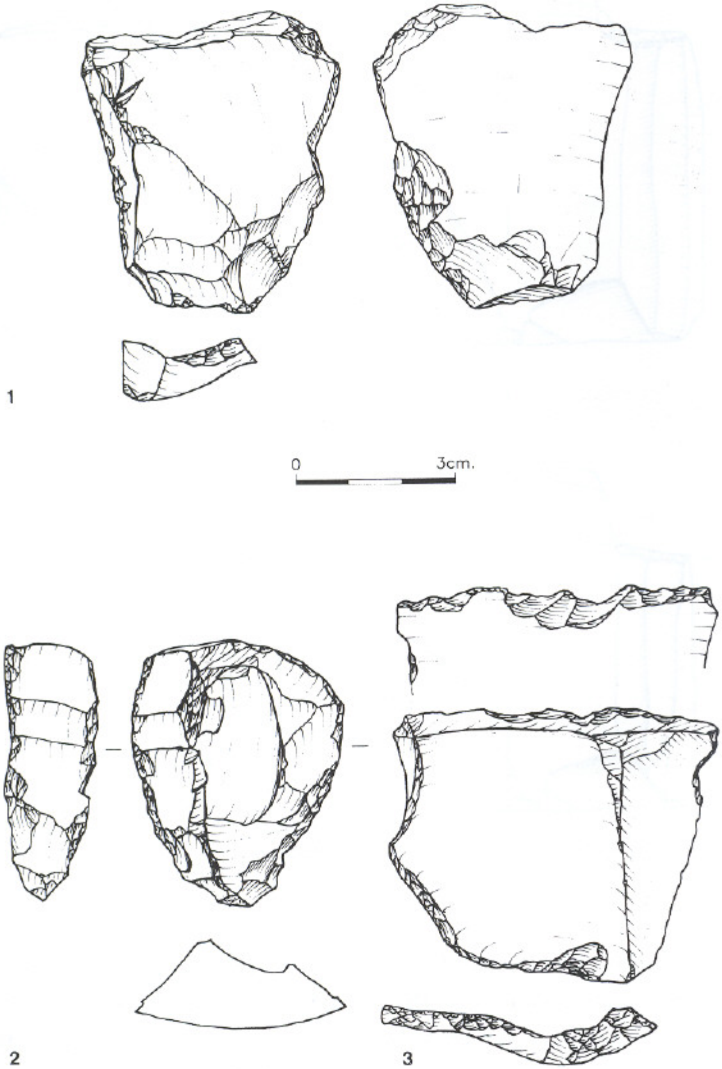

Fig. 5. C.T.F. from Har Ḥaruvim

However, since the difference is small, blade reduction can be done at different places around the production surface. This is not the case for the studied Canaanean cores where the core production surface has an almost "flat arc" (and a large difference between the arc radius as calculated from cores and blades). Thus, in order to produce a blade, one needs a small arc radius for the production surface - a quality not found in the sample of Canaanean cores studied. We suggest that both calculated radii do match, but the reduction sequence "hides" the match by making the real arc radius invisible.

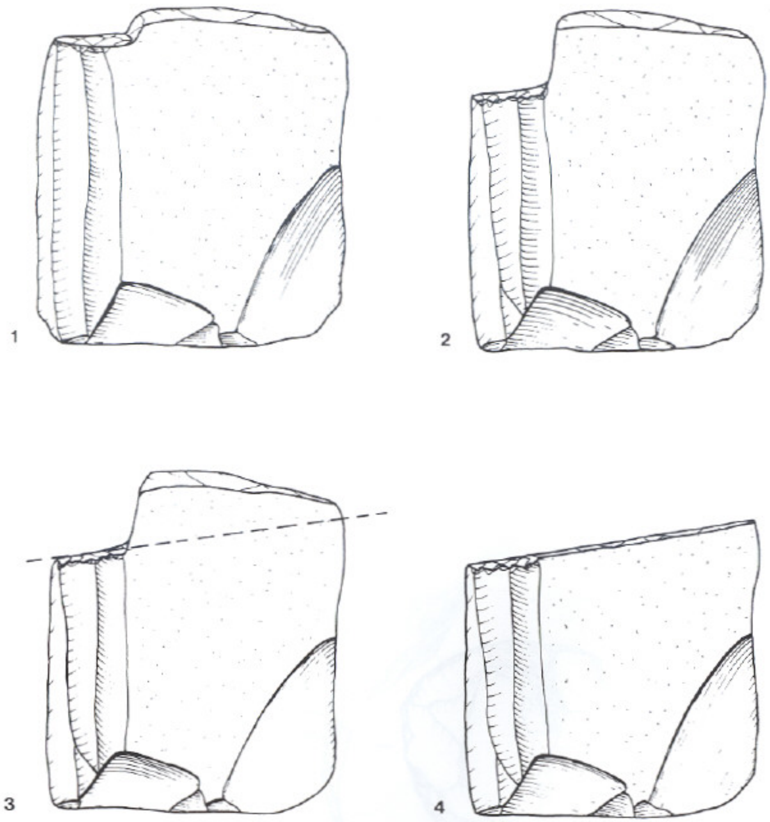

Fig. 6. The striking platform and C.T.F. reduction

The production surface of the core is elongated and has two "corners" located at the meeting points of the production surface with the sides of the core (Fig. 7b). These are the only two points on the core which relate to the calculated arc radius of the blades. Thus, blade reducing is achieved by detaching a series of blades from left to right or right to left in a sequence (Callahan 1984:92). Every blade reduction moves the arc radius and emphasizes the ridges for the next blade (Figs. 7c-d). This enables the use of a "flat" production surface in order to achieve wide blades (but still not too thick). The problem with this is that a failure in blade production in the mid-area of the production surface will be difficult to overcome. Note that removing blades from the corners of the core is possible, however, this will prevent production of wide and relatively thin blades. It seems to us that the Har Ḥaruvim industry focused on wide thin Canaanean blade production, therefore an attempt was made to maintain a flat production surface arc.

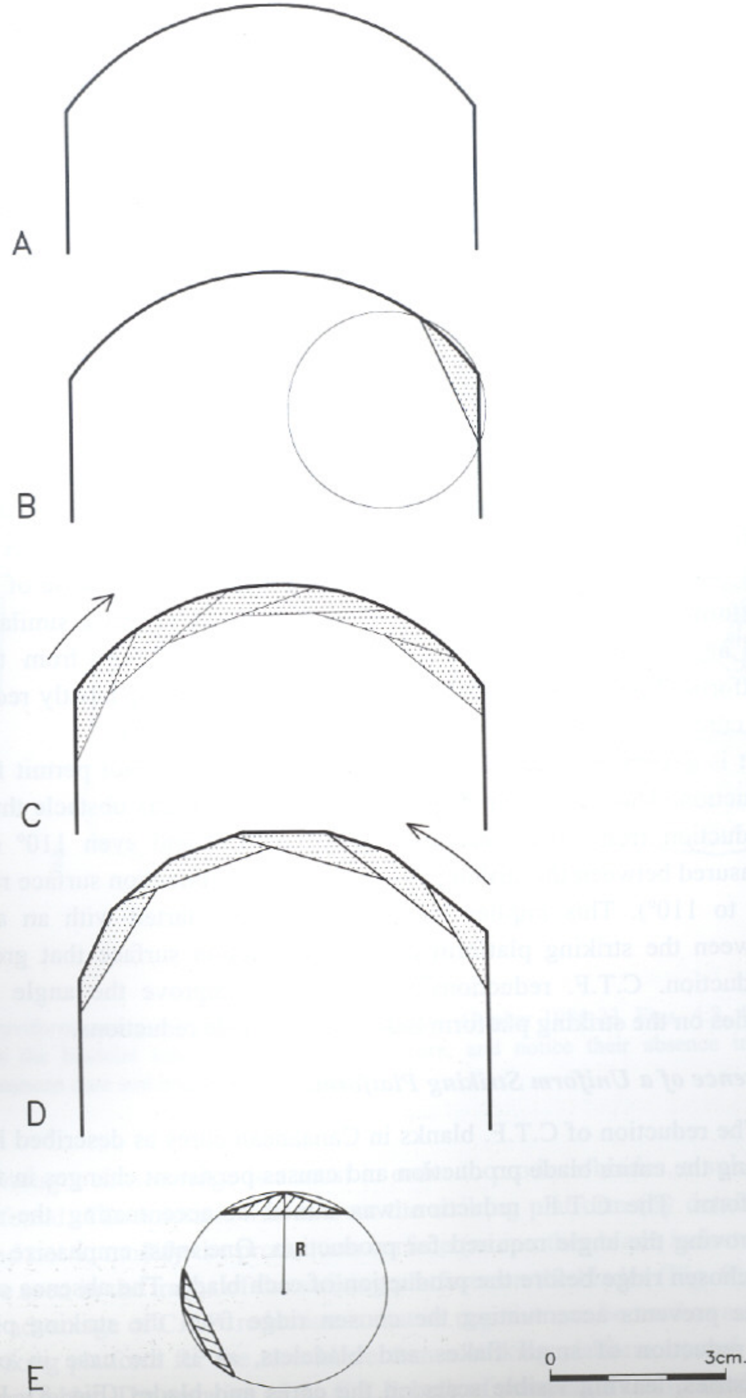

Fig. 7. Production arc and suggested blade production process.

This complex reduction sequence is done in order to achieve wide blades, most of which have a trapezoidal section. At Har Ḥaruvim 30 Canaanean blades were found (mostly broken) of which 19 have trapezoidal cross sections and 11 have triangular cross sections. Trapezoidal cross sections in Canaanean blades are dominant in most EBA assemblages. The technological reconstruction presented here supports an assumption that trapezoidal cross-section blades have been a major target of this industry.

The Absence of a Suitable Angle

The uniformity in blade scars and the "stepped" striking platform of the Canaanean cores studied indicate that the blades were produced using indirect contact, since the "step" formation does not permit direct contact with a hammerstone. It has not yet been determined if indirect production was by pressure or with the aid of a punch. Either way, indirect production required different core maintenance than the maintenance required for direct production. It is possible that a 90° angle is needed to prevent the collapse of the striking platform edge. Pressure-core production industries reveal a similar case with 90° angles, and sometimes the use of reducing flakes from the striking platform. These flakes improve a "local" angle, and are mostly reduced when the core is nearly exhausted (Callahan 1984; Wilke 1996).

It is generally assumed that an angle over 90° does not permit further core reduction. The Canaanean blade industry overcame this obstacle thus enabling production from cores reaching angles of 100° and even 110° (the angles measured between the striking platform and the production surface ranged from 45° to 110°). This implies that core reduction started with an acute angle between the striking platform and the production surface that grows during production. C.T.F. reductions were used to improve the angle at specific locales on the striking platform before single blade reductions.

Absence of a Uniform Striking Platform.

The reduction of C.T.F. blanks in Canaanean cores as described here occurs during the entire blade production and causes persistent changes in the striking platform. The C.T.F. reduction was aimed at accentuating the ridges and improving the angle required for production. One must emphasize and isolate the chosen ridge before the production of each blade. The absence of a regular angle prevents accentuating the chosen ridge from the striking platform by the reduction of small flakes and bladelets, as is the case in other blade industries, leaving visible scars on the cores and blades (Fig. 8). In contrast, the Canaanean cores and blades presented here do not show this phenomenon.

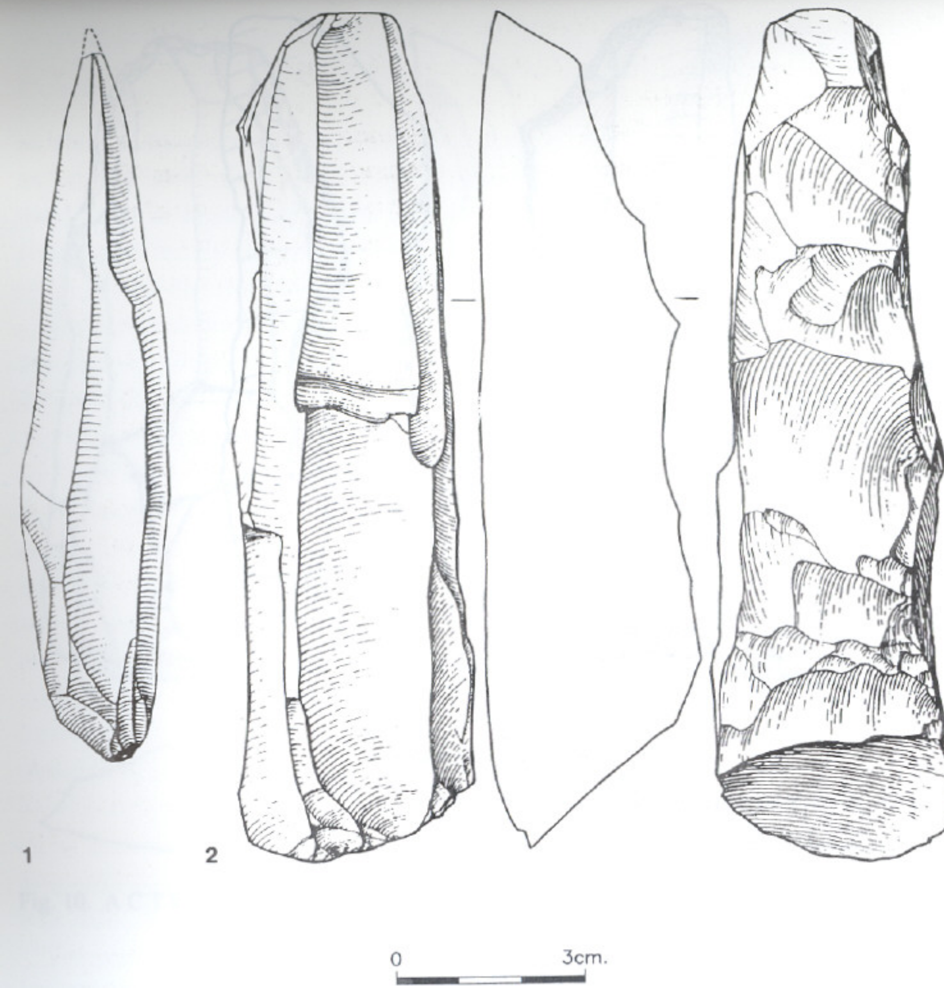

Fig. 8. A Naviform core and blade from PPNB Munḥata (Gopher 1989:23, Figs. 4:8, 4:10). Note the bladelet scars on the blade and core, and notice their absence in the Canaanean core and blade in Figs. 3, 10.

Since accenting a chosen ridge is a must in order to produce blades, a solution had to be found. The solution was to treat the striking platform (by detaching C.T.F.), and not to modify the production surface (as in other blade industries). This can be seen in the traces of the striking platform on the blades (Fig. 9).

Another advantage of C.T.F. reduction is that its negative can be used as a more suitable striking platform for the next blade than a striking platform treated by a common core tablet. The negative of the C.T.F. bulb of percussion can be used as a foothold for the punch or the pressure tool. This technological aspect is known from Neolithic industries of the Near East and was discussed by Wilke (1996).

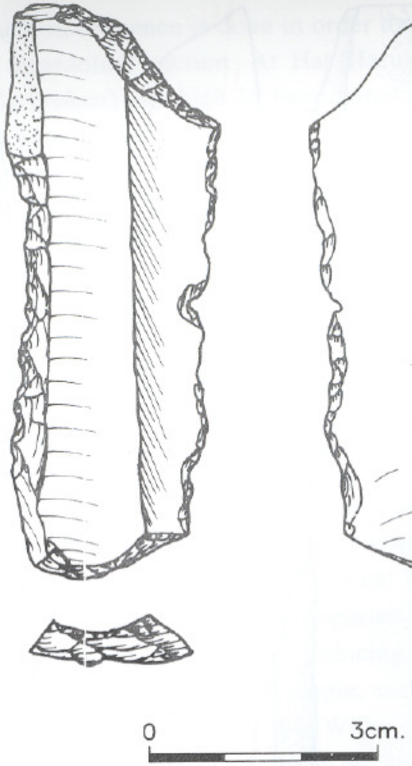

Fig. 9. A blade with preparation of the striking platform.

Core Trimming Elements from Har Ḥaruvim

The C.T.E. here are different from other known C.T.E. of blade industries in the southern Levant, mainly because of the different core reduction strategy. Most blade industries are characterized by C.T.E. such as core tablets and ridge blades, but those are rare in the Canaanean industry. Of the 83 C.T.E. collected during our survey the largest group is the C.T.F. (38.6%). These blanks are reduced from the striking platform, but in contrast to a common core tablet that removes the whole or most of the striking platform, these remove only a small part of it and thus the term "Core Tablet Flake". Most of these C.T.F. are hinge flakes. Unfortunately many of the C.T.F. reductions are too small (mainly in the proximal end), so they do not bear any traces of the production surface, and thus could not be identified as C.T.F. It is possible that a large number of the hinge flakes found were the result of C.T.F. reduction.

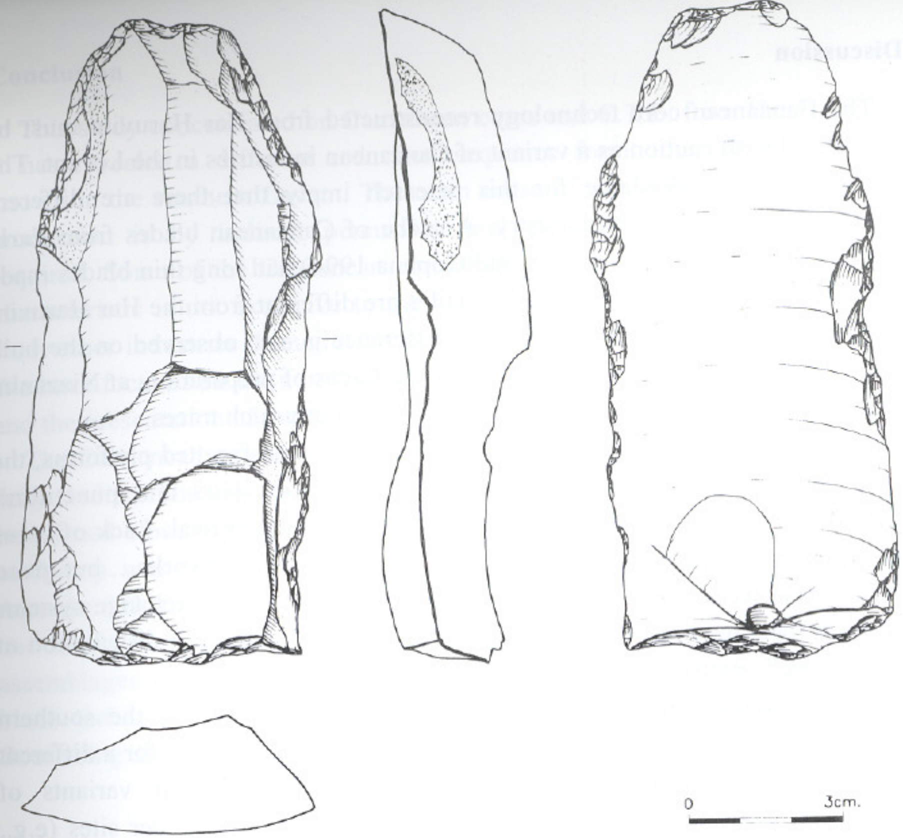

Fig. 10. A C.T.E. showing the front of the striking platform.

Other C.T.E. of the Canaanean blade industry include two large flakes and one thick blade that reduced most of the core production surface (Fig. 10). In a way, these are similar to overshot blanks since they reduced and renewed the production surface. Only one C.T.E. of facetting was found. This blank was a large part of the striking platform, but one cannot say if it was reduced from the pre-form, or if it was the result of an attempt to prevent "step" formation. One overshot was reduced from the base of the core, probably a "secondary" use of an abandoned Canaanean core.

The rest of the C.T.E. cannot be distinguished from the non-Canaanean ad-hoc flake industry found on-site. Five ridge blades were found, of which four were rough and short, and only one was long and could be related to the Canaanean core industry. Many C.T.E. have not been categorized, most of which are probably part of the ad-hoc flake industry.

Discussion

The Canaanean core technology reconstructed from Har Ḥaruvim must be considered with caution as a variant of Canaanean industries in the Levant. The few assemblages available for this research imply that there are different variants of the Canaanean industry. A cache of Canaanean blades from Early Bronze Age Nizzanim (Yekutieli and Gophna 1994) had long thin blades made of high quality siliceous flint. These blades are different from the Har Ḥaruvim blades which are thicker and wider. A difference is also observed on the bulb of percussion. While at Har Ḥaruvim it bears traces of preparation, at Nizzanim it is a pointed bulb of percussion too small to bear any such traces.

Betts noted that "While Canaanean blades have wide facetted platforms, the Mesopotamian blades have trimming of the mid-rib spurs and punctiform platforms, thus suggesting a different method of blade removal. Lack of cores on Mesopotamian sites have led scholars to suggest trade networks… but given the different technology, it seems likely that Mesopotamian exchange systems operated separately from those in Syria/Palestine with regard to distribution of flint blades." (Betts 1992:129).

The appearance of both these types of striking platform in the southern Levant (the one in Har Ḥaruvim and the other in Nizzanim) calls for a different explanation. An attempt to learn more about the different variants of Canaanean blade technology using published materials from other sites (e.g., Macalister 1912:126; Hours 1979; Futato 1990) was not successful. This was due to the limited description added to the published cores, and the fact that only "front" views of the cores have been presented.

Rosen presented differentiation in Canaanean blanks, which in his opinion presents different trajectories in Canaanean blade technology (Rosen 1983:23–26). Canaanean blade caches support this suggestion (*idem* 1997:107). Yet, one must realize that the technological reconstruction of prismatic cores has shown different blades at different stages of the same reduction sequence. Clark, who reconstructed the manufacturing process of prismatic cores from central America has shown three different stages. In the first stage, a series of wide and thick blades is detached from the core. The second stage reduced the "classical" average-sized blanks of this industry. The third stage is the reduction of the exhausted core, in which the blades are wide and short (Clark 1985). Similarly, in the Canaanean blade industry presented here, a variety of blades "types" was produced.

Conclusion

This study concentrated on Canaanean cores and C.T.E. from Har Ḥaruvim. It has revealed a different reduction sequence from other blade industries known in the southern Levant. The main cause of this difference is that blade production is by indirect percussion and the different core maintenance required. Some of the Canaanean cores had an angle of 90° or more, but this characteristic is not exclusive to the Canaanean blade industry and is known from other industries throughout the world (e.g., Clark 1982; Callahan 1984). We have focused on the non-uniform striking platform of the Canaanean cores, and the presentation of the Core Tablet Flakes is our main contribution.

The Canaanean core industry is an advanced flint industry that is yet to be fully studied. The most potential sites for further study are workshops likely to be located close to raw material sources or at production centres. Recently a workshop was found in the "suburbs" outside the city of Titris Höyük in Anatolia (Algaze, *et al.* 1996:135; Matney, *et al.* 1999[4]). Such finds can enrich our understanding of specialization and trade involving the blades. More assemblages are required for tracking the origin of the Canaanean core and blade technology as well as understanding the rise of this technology, its flourishing and its disappearance.

Acknowledgements

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[4] S.A. Rosen tells us that in the summer of 1999 many more aspects of a specialized production centre of Canaanean blades came to light at Titris Höyük.

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