

# RIGHT OR LEFT? FRONT OR BACK? USE-WEAR ANALYSIS OF FLINT SICKLES IN THE BIBLICAL PERIOD OF THE LEVANT

¿Derecha o izquierda? ¿Delante o detrás?  
Análisis de huellas de uso de hoces de sílex del periodo bíblico de Levante

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**ABSTRACT** Microscopic analysis of use-wear on sickle blades from the Iron Age site Tel Dan (Israel) has revealed a high degree of uniformity, particularly of comet-shaped pits, in the way the blades were arranged in a haft. The uniformity is consistent with large geometric sickles from the Levant Middle Bronze II-Iron Age period (1900-850 BCE), suggesting the presence of a shared culture, which went beyond the political and ethnic boundaries defined by the ruling classes, and beyond periodic changes in these boundaries. Along with the possible evidence of sickle maintenance activities by specialists at the workshop, the high degree of standardization may also represent urban craft specialization, in comparison with the use and maintenance activities of the Neolithic period. In addition, the consistency in the sickle blade positioning and in the direction of tool movement negates the possibility that these blades were recycled as threshing sledge teeth.

**Key words:** Large Geometric Sickle, Use-wear, Levant, Iron Age, Comet-shaped Pit, Social Context.

**RESUMEN** El análisis microscópico de huellas de uso de las hojas de hoz del yacimiento de la Edad de Hierro Tel Dan (Israel) ha revelado un alto grado de uniformidad, particularmente de estrías en forma de cometa, en la manera en que las hojas se insertaban en el mango. La uniformidad es consistente con las grandes hoces geométricas del periodo Bronce Medio II-Edad del Hierro (1900-850 AEC) de Levante, lo que sugiere la presencia de una cultura compartida, que trascendió las fronteras políticas y étnicas establecidas por las clases dominantes, y más allá de los periódicos cambios producidos en dichas fronteras. Junto con la posible evidencia de actividades de mantenimiento de la hoz por los especialistas en el taller, el alto grado de estandarización también puede representar una especialización de artesanía urbana si la comparamos con el

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uso y las actividades de mantenimiento del período neolítico. Además, la consistencia en la disposición de la hoja de hoz y en la dirección del movimiento del útil anula la posibilidad de que estas hojas se reciclaran como piezas de trillos.

**Palabras clave:** Hoz geométrica grande, Huellas de uso, Levante, Edad del Hierro, Estrias en forma de cometa, Contexto social.

## INTRODUCTION

Comet-shaped pits formed on use-wear polish on stone tools indicate unidirectional movement of a stone tool (Semenov, 1964:119); the “head” of a comet points in the direction of tool movement (fig. 1). By examining Iron Age sickles from the southern Levant, this paper demonstrates that comet-shaped pits and their presentation can also reveal how sickle blades were hafted. Chronological and regional patterns may provide valuable information concerning the social context of the tool.

## SAMPLES AND METHODS

A total of 38 sickle blade pieces among the 123 pieces from Area B-west at Tel Dan (Iron Age I; Ilan, in press) were sampled. The Iron Age city of Dan represented the northern border of the biblical kingdom of Israel. A possible flint workshop specializing in sickles was found amidst a metallurgy workshop located near the site entrance. Evidence of bone working was also found in the area. Typologically, these sickle blades were classified as “Large Geometric sickles” used from Middle Bronze II (MB II) through Iron Age (1800 BCE-850 BCE) in the Levant, replacing sickles made of “Canaanite blades” in Early Bronze Age. Large Geometric sickles include such geometric forms as parallelograms, trapezoids and triangles.

The basic method of microscopic analysis is the *high power approach* to examine use-wear polishes (polished surfaces produced on tool edges by wear) (Keeley, 1980); the sample specimens were examined with an incident light microscope (Olympus BHM) at a magnifying power of mainly  $\times 100$  and  $\times 200$ . The sample surfaces were wiped with acetone prior to the examinations to remove finger grease. No additional chemical cleaning was performed, because of the distinctive polish presence that does not require intensive cleanings and of the occasional presence of possible haft residue on the surfaces.

The analysis focused on comet-shaped pits formed on the glossed sickle edges in order to reconstruct the positing of sickle blades in a haft. Comet-shaped pits indicate that the tool was moved in the same direction as the comets “fly” (fig. 1). In the case of a sickle, the comet-shaped pits can indicate which end of the sickle was placed on a particular side of the harvester, since harvesting is made possible primarily by pulling rather than pushing motions. That is, the end of a sickle blade, which the comet head points, was placed in the proximal side of the harvester when a blade was inlaid in a haft (fig. 1). Then, assuming the handedness of the

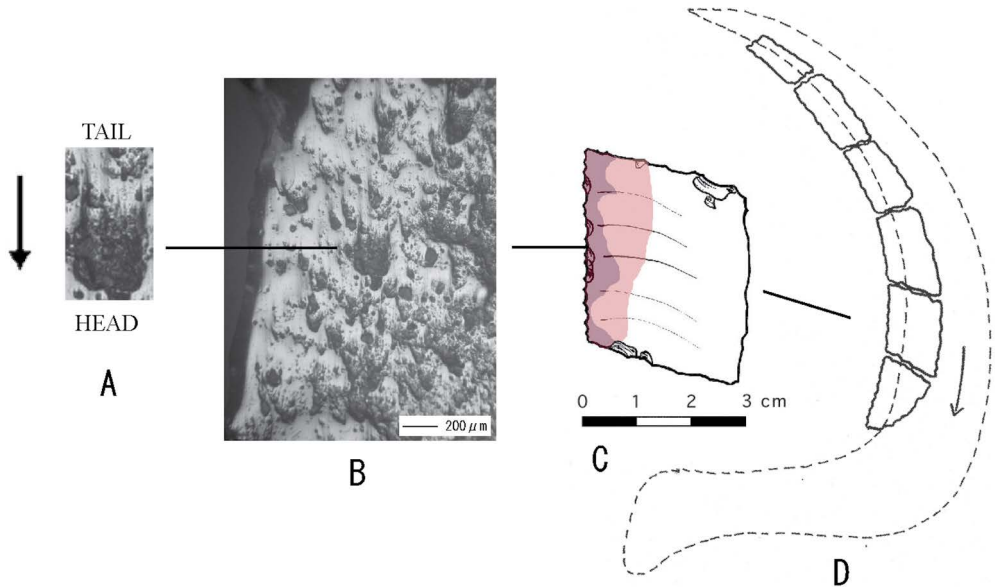


Fig. 1.—Comet-shaped pits and the alignment of Large Geometric sickle blades. A) High magnification of comet-shaped pit; B) Cluster of comet-shaped pits on the edge covered with sickle gloss; C) Sickle blade with the working edge on the left side and the ventral surface facing up; D) Reconstruction of sickle blade inlaid in a haft. An arrow indicates the direction of the comet's head (i.e., the direction of the sickle movement).

harvester, we can determine whether the dorsal or ventral surface of the sickle blade was facing up or facing down (i.e., facing toward the ground) during use. When a sickle is held in the right hand, the blade's cutting edge must be located on the left side of the sickle handle, when viewed from the top (fig. 1). Since the comet direction indicates the specific end of the blade that is hafted, the facing direction is also known. In the case of the sickle blade in figure 1, the ventral surface, which is shown in the figure, must have been placed up when used with the right hand. In the case of a faux (a long-handed sickle), a different reconstruction could obtain, but Egyptian tomb paintings of the New Kingdom Period show short-handled sickles (Coqueugniot, 1991).

Since most people are right-handed, it follows that most sickles were held in the right hand. If different tendencies in the sickle use habit of which surface (dorsal or ventral) was kept up or down during the harvesting are found regionally or chronologically, this may provide information on possible inter-group relationships. Table 1 summarizes the numbers of ventral/dorsal up for Neolithic sickle assemblages examined by this author. Despite the small sample, a pattern is evident. A mixed occurrence of the two cases (ventral surface up and dorsal surface up) is found in Neolithic assemblages (Yamada, 2000, 2003, 2012, n.d.) in the southern Levant. At the Nahal Zehora I Site (the Wadi Raba culture at the end of Pottery Neolithic), most cases are dorsal surface facing up (Yamada, 2012).

TABLE 1  
 NUMBER OF DORSAL UP *VS.* VENTRAL UP NEOLITHIC SICKLES IN THE SOUTHERN LEVANT

| <i>Period</i> | <i>Site</i>        | <i>No. of Dorsal up</i> | <i>No. of Ventral up</i> | <i>Reference</i> |
|---------------|--------------------|-------------------------|--------------------------|------------------|
| PN            | Nahal Zehora I     | 14                      | 1                        | Yamada 2012      |
| PPNB          | Kfar HaHoresh 1992 | 4                       | 4                        | Yamada 2000      |
| PPNB          | Kfar HaHoresh 2003 | 1                       | 4                        | Yamada n.d.      |
| PPNB          | Abu Gosh           | 3                       | 7                        | Yamada 2003      |

## RESULTS

This report is limited to the major points of the analysis; more detailed data and discussions will be published in a Tel Dan site report (Yamada, in press). Under the microscope, all the sickle gloss found on Tel Dan sickle blades are confirmed to be regular polished surfaces produced by silica-rich plants (figs. 1, 3). Striations and comet-shaped pits, as well as the polish distribution pattern found on the specimens, indicate that all the edges showing sickle gloss were used in a cutting motion parallel to the edge line.

The observation of comet-shaped pits has led to a very interesting result. Except for two pieces on which comet-shaped pits were not observed, all the specimens



Fig. 2.—Location of Tel Dan and Ras Shamra.

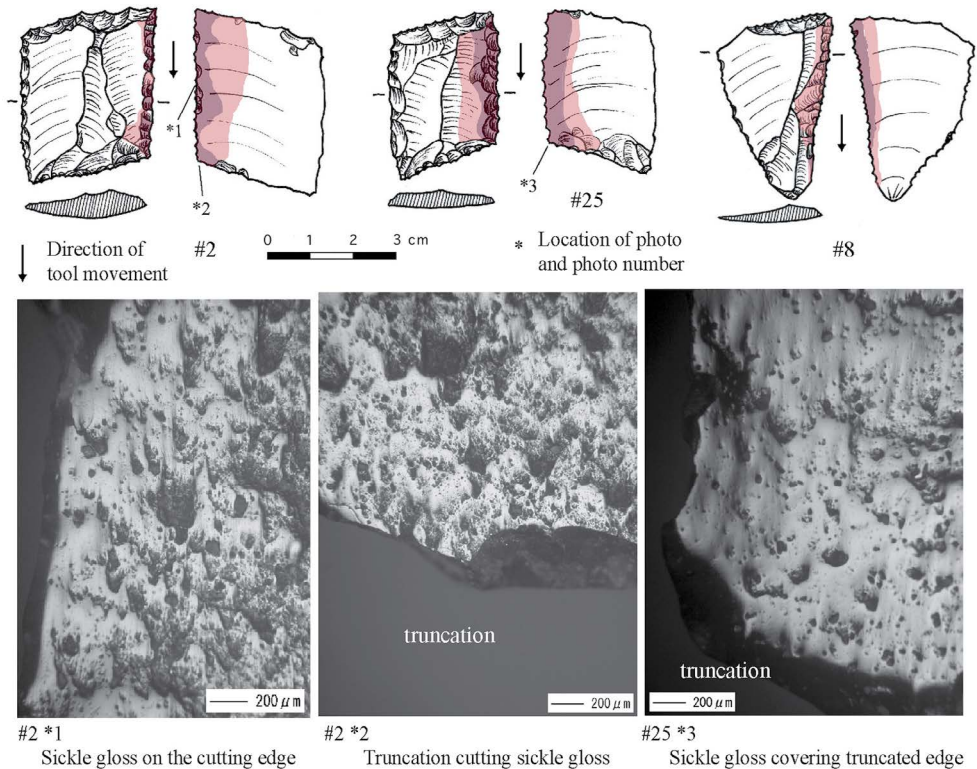


Fig. 3.—Use-wear polish on Tel Dan sickles. All the sickle blades were pulled downward in the figure, as indicated by comet-shaped pits heading downward.

(N=36) present the same direction of tool movement relative to the “anatomical parts” of a sickle blade. That is, if a sickle blade is placed, as shown in the figures, with the working edge right when the dorsal surface faces up, and the working edge left when the ventral surface faces up, all the comet-shaped pits “fly” downward, meaning that the sickle blade was pulled downward (fig. 3). This means that if the user was right handed, all the sickle blades were hafted with the ventral surface facing up, and the dorsal surface facing toward the ground.

In addition, the sequential order of polish and truncation have been examined. Truncated ends of Large Geometric sickles are expected to show use-wear polish covering truncation retouch scars. However, at Tel Dan there are significant numbers of cases in which truncation retouches cut use-wear polish. This observation suggests that either the trimming of the truncated edges or the adjustment of the length of a sickle blade appears to have been practiced quite commonly at the workshop after a certain period of use. Traces of skilled resharpening retouches also suggest work by specialists (Yamada, in press).

## DISCUSSION

### Uniformity in morphology and direction

Compared with the PrePottery Neolithic B cases shown in Table 1, the uniformity in the surface placing at Tel Dan is striking. First of all, the Large Geometric sickles themselves are highly uniform in their morphological direction. Among the 38 specimens examined, 28 pieces are parallelograms in a broad sense, all of which are tilted in the same direction. That is, if looked at on the ventral surface with the working edge placed horizontally, it is always tilted to the right, as shown in figure 4. There are no parallelograms in the Tel Dan assemblage that tilt to left. Parallelograms from other sites have the same tendency. In published and unpublished reports on other flint assemblages in the southern Levant from the Middle Bronze Age II through Iron Age, I have found so far only five parallelograms and three semi-parallelograms that are left-tilted when seen on the ventral surface: at Lachish (Rosen, 2004), as well as one left-tilted parallelogram at Tel Es-Safi/Gath (Rosen *et al.*, 2012).

The uniformity in the direction of the parallelograms makes sense, because they need to be tilted in the same direction to be aligned in a haft without gaps between them, if all the sickle blades present the same surface (dorsal or ventral) to the same side. Triangular pieces are normally thought to have been placed at the ends of a sickle blade row in a haft, as demonstrated by examples from Sha'ar Ha-Golan (Stekelis, 1972) and Gaza (Petrie, 1932). However, triangular pieces also show a biased direction at Tel Dan. When looking at the ventral surface with the working edge placed up horizontally, one always finds a pointed end on the left (<), not on the right (>) (fig. 4). Comet-shaped pits indicate that these pieces were moved toward their pointed end (with the ventral surface facing up). Assuming a user is right-handed, this means that triangular pieces examined in this study are only placed at

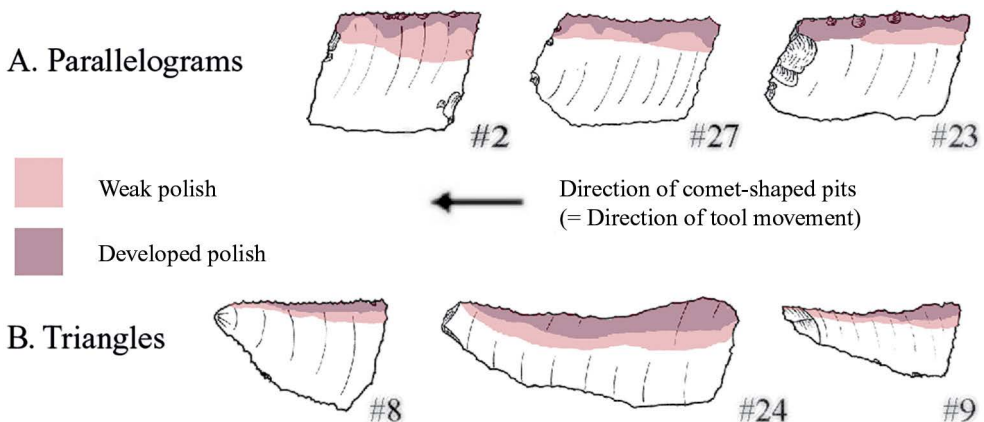


Fig. 4.—Direction of sickle blades seen on the ventral surface.

the proximal end of a sickle haft (that is, a harvester's side). This also appears to be the case for many other MB II-Iron Age sites in the southern Levant; the majority of triangular pieces are left-pointed. At Ras Shamra (Late Bronze Age; Ugarit), the majority of the triangles are left-pointed but there are significant numbers of right-pointed ones as well (Coqueugniot, 1991). Coqueugniot asserts that the latter were not pieces placed at the distal end of a sickle, but at the proximal end of a sickle for left-hand users. Except for the presence of left-pointed triangles, the discovery of the direction of sickle blade movement noted at Tel Dan is in accordance with that recognized by Coqueugniot at Ras Shamra. While Coqueugniot first analyzed the uniformity in sickle morphology and then checked the direction of comet-shaped pits, this author first found the uniformity in comet-shaped pit direction and then noted the uniformity in the direction of sickle blade morphology.

### **Uniformity in large geometric sickle blades in MB II through Iron Age**

Although use-wear analysis has been undertaken only on a few assemblages (other than Ras Shamra and Dan, a total of about 45 pieces from five sites in the southern Levant by my unpublished analysis), the strong correlation between morphological features and the method of hafting revealed in the analysis of the Tel Dan assemblage suggests that the principles found at Dan are very likely to apply to other Large Geometric sickle assemblages, as well, because of the consistency in the morphological features. Therefore, not only the basic shapes of sickle blades but also the precise method of hafting (and thus, the way they were used) did not change for two thousand years, despite changes in political regimes and ethnic territories known from other evidence, including Biblical texts. This fact should not be interpreted as a sign that the flint sickle is a poor reflection of its social context. Instead, it conveys information on the specific social context to which the flint tools belonged.

While it is possible that uniformity in Middle Bronze II–Iron Age sickle morphology has some functional explanation, it suggests, overall, the action of exchange and the continuity of tradition in sickle use across the Levant in this period. This principle has also been noted for the other lithic types of the second millennium BCE by Rosen (2004). The fact should not be interpreted as a sign that the flint sickle is a poor reflection of its social context. On the contrary, uniformity reflects a shared cultural tradition going beyond political and ethnic boundaries during the Middle Bronze II–Iron Age continuum.

As evidenced by traces of truncations cutting use-wear polish at Tel Dan, the maintenance of sickles was also under the control of sickle makers. In the Neolithic period, farming tools were perhaps produced and used more domestically, and each individual user carried out the adjustments and maintenance of their own tools for themselves, which resulted in less uniform positioning of ventral/dorsal surfaces. However, in the period of Large Geometric sickles, the evidence indicates that farmers became passive consumers of commercial sickle products, created and maintained by specialists.

## The possibility of a threshing sledge

Can the Large Geometric sickles examined here be threshing sledge teeth, as has been claimed for Early Bronze Age Canaanite sickle blades (Anderson *et al.*, 2004)? The answer is no. First, morphological features of Large Geometric sickle in general (i.e., finely denticulated edges and the occurrence of a certain ratio of triangular pieces) clearly indicate these were primarily sickle blades inserted in a haft. The possibility that these sickles were recycled to serve as threshing sledges is also disproved by the consistency in their positioning and in the direction of tool movement known from the comet-shaped pits; it is highly unlikely that such precise positioning of blades was required when they were used as threshing sledge teeth.

## CONCLUSIONS

Microscopic analysis of use-wear on sickle blades, particularly of comet-shaped pits, at Tel Dan has revealed a high degree of uniformity in the way the blades were arranged in a haft as well as in their morphology; (1) all the sickle blades were placed with the ventral surface facing up when used; (2) a triangular piece was placed primarily at the proximal end of the haft; (3) parallelograms were tilted right and triangular pieces are pointed left when placed horizontally with the ventral surface facing up. The uniformity appears to have been common in the Levant in the MB II-Iron Age period (1900-850 BCE), suggesting a shared culture, which went beyond the political and ethnic boundaries defined by the ruling classes, and beyond periodic changes in these boundaries. The trace of “re-truncation” undertaken at the Tel Dan workshop suggests that specialists maintained the sickles at the workshop, thereby rendering farmers as consumers of a commercial product.

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her review at the end of the conference, she kindly referred to my presentation on the formation mechanism of use-wear polish, saying “I learned a lot about sickle polish today.” Her comment was exciting and greatly encouraging to me as a young researcher from the Far East, who ventured to present a paper at my first international use-wear conference in Europe. I remained in contact with Dr. Odell in my later years at Harvard, and have a pleasant memory of getting together with him at the use-wear conference commemorating Sergei Semenov in St. Petersburg in 2000. It is my great honor to contribute this paper to a volume dedicated to these great scholars.

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