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Analysis of the Late Chalcolithic-Period Flint Assemblage from Kafr 'Ana, Or Yehuda

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Introduction

The Newe Rabin excavations in Or Yehuda (see Arbel and Volynsky, this volume) yielded 107 flint artifacts. This report describes the flint types and presents the technological and typological characteristics of this small assemblage. In addition, it discusses the results of an analysis of a stain observed on one of the sickle blades—plausibly the remains of an adhesive.

Raw Material

Four major flint types were distinguished. The most common (Type 1) is a non-homogeneous flint of brown shades, with bright inclusions in the form of stripes and stains. Type 2 flint is homogeneous, gray to brown, with a smooth, matt surface. Type 3, occurring only in small quantities, is a distinctive semi-translucent flint, gray or brown in color. Type 4 is a homogeneous beige flint of Eocene origin. In addition, the assemblage contains a few chipped items of whitish coarse-grained material with a minute presence of silica, apparently not flint. Table 1 shows the frequencies of different artifact groups, divided by flint type.

Table 1. Composition of the Flint Assemblage according to Flint Types

	Type 1	Type 2	Type 3	Type 4	Other	Total
Primary Elements	6	1				7
Naturally backed knives	2					2
Flakes	28	1		1	1	31
Blades	2	1	2	1	2	8
Bladelets	1	2	1	1		5
Cores	2	4	1	0		7
CTEs	3	4				7
Total debitage	*44 (65.7%)*	*13 (19.4%)*	*4 (6.0%)*	*3 (4.5%)*	*3 (4.5%)*	*67 (100%)*
Tools	18 (62.1%)	4 (13.8%)	3 (10.3%)	4 (13.8%)		29 (100%)
Debris	11 (100%)					11 (100%)
Total	*73 (68.2%)*	*17 (15.9%)*	*7 (6.5%)*	*7 (6.5%)*	*3 (2.8%)*	*107 (100%)*

THE ASSEMBLAGE

Debitage constitutes the most prominent group in the assemblage (n = 67; 62.6%); tools (n = 29) comprise another 27.1%; and the remaining 10.3% of the items were defined as chunks (= debris).

Debitage

Primary Elements (N = 7).— These are all flakes; all but one are made of Type 1 flint. Cortex covers more than 50% of the surface.

Naturally Backed Knives (N = 2).— Both specimens found are fragmented and made of Type 1 flint.

Flakes (N = 31).— Flakes are the most common type of debitage; the absolute majority are made of Type 1 flint. Complete items are small to medium in size (Table 2).

Blades (N = 8).— These items vary in their raw material and metric characteristics. Two blades are made of Type 1 flint and two others are made of Type 3 flint. Flint Types 2 and 4 are each represented by one item. The width of the smallest blade is close to that of a bladelet (Table 2) and it is made of Type 3 flint. Two blades exhibit nibbling.

Table 2. Metric Characteristics of Debitage (in millimeters)

Debitage		Length	Width	Thickness
Flakes	Mean	33.88	29.43	6.94
	N	15	14	14
	Std. Deviation	10.42	5.96	2.79
	Minimum	16.20	22.30	3.20
	Maximum	56.80	39.60	14.30
Blades	Mean	36.67	17.35	5.06
	N	4	8	8
	Std. Deviation	7.91	3.82	1.07
	Minimum	26.70	12.10	3.90
	Maximum	45	24.50	6.70
Bladelets	Mean	34.84	9.94	3.64
	N	5	5	5
	Std. Deviation	4.80	1.921	1.02
	Minimum	29.50	7.50	2.50
	Maximum	42.00	11.90	5.20

Bladelets (N = 5).— The bladelets are not standardized, neither in their metric characteristics nor in the choice of raw material (Tables 2 and 1, respectively). Two bladelets are made of Type 2 flint, while Types 1, 3 and 4 are represented by one item each.

Cores (N = 7).— This group comprises three flake cores and four bladelet cores (Fig. 1:1–3, 5), including one broken item, as well as one mixed bladelet/flake core (Fig. 1:4). The flake cores are made of Types 1 and 2 flint, whereas the bladelet cores are made of Types 2 and 3

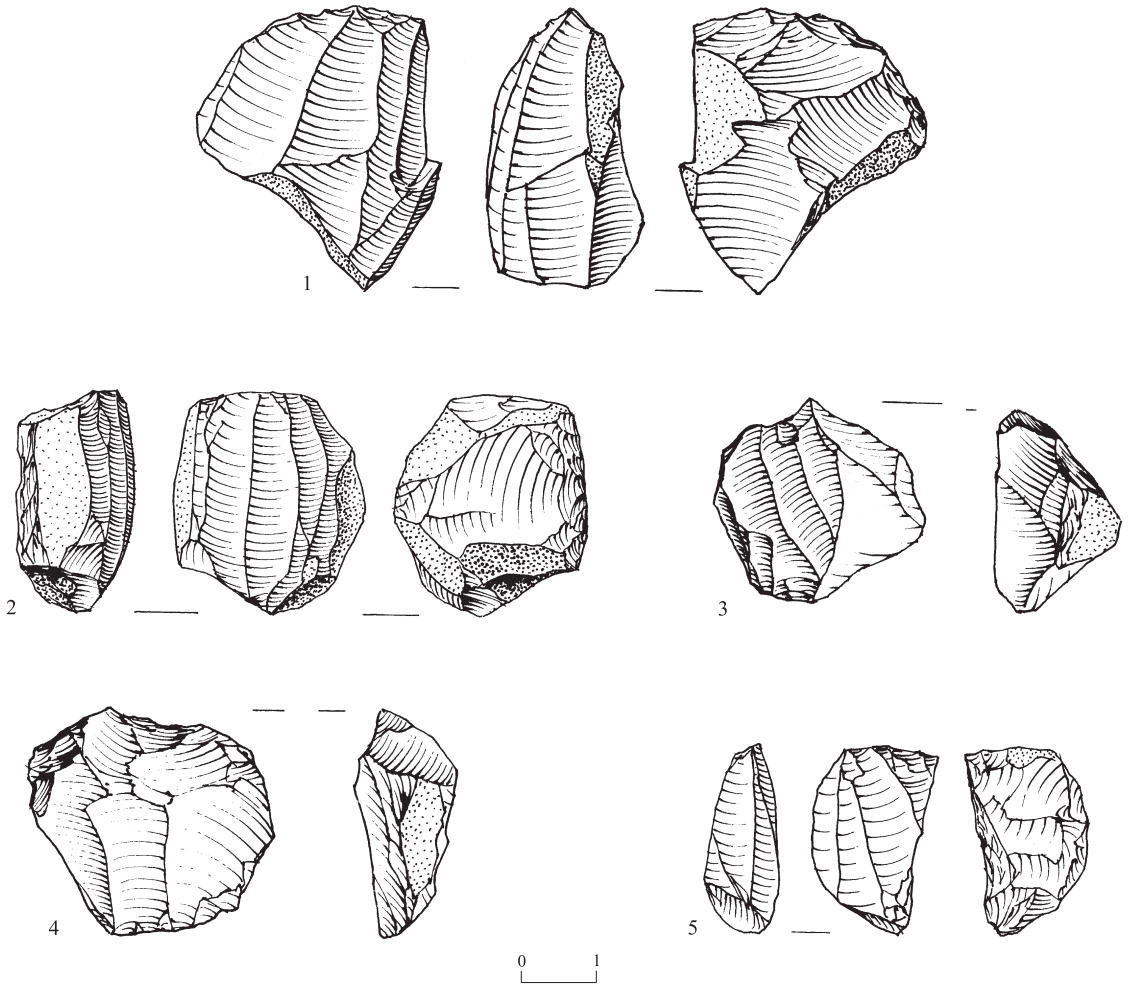


Fig. 1. Bladelet (1, 2, 3, 5) and mixed bladelet/flake (4) cores.

No.	Locus	Basket
1	219	3037
2	205	2014
3	110	1028
4	216	2095
5	210	2066

flint. The absolute majority of the cores have one striking platform. The scars on the flake cores correspond to small to medium-sized flakes and flake-based tools (see below).

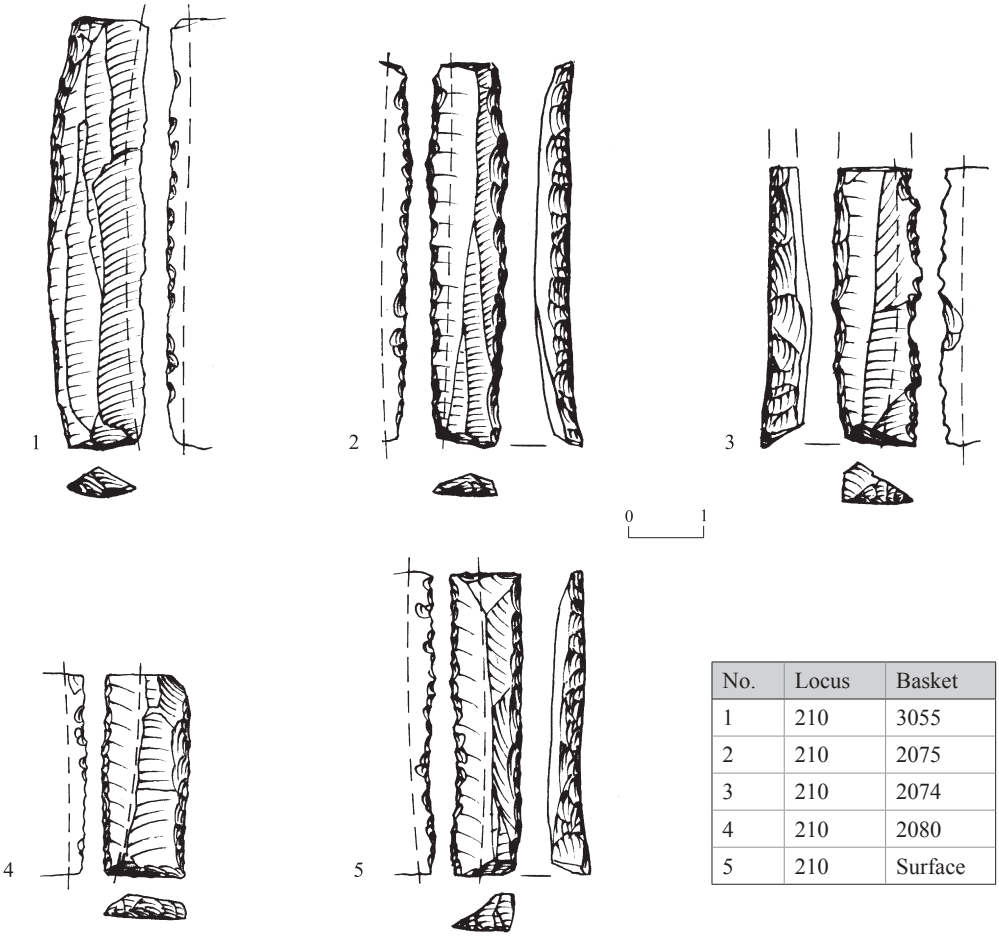
Core-Trimming Elements (CTE; N = 7).— Four items represent Type 2 flint and reflect blade and bladelets removals. Three others, made of Type 1 flint, are fragments of striking platforms and reflect flake removals.

Tools

The tool assemblage (N = 29) constitutes two major groups: indicative tools and ad hoc, i.e., expedient tools. The tool groups are described in detail below.

Diagnostic Tools

Sickle Blades (N = 9; Figs. 2; 3).— Seven items in this group are backed and truncated (Fig. 2). Two of these were found complete with both truncations (Fig. 2:2, 5), while the rest



No.	Locus	Basket
1	210	3055
2	210	2075
3	210	2074
4	210	2080
5	210	Surface

Fig. 2. Backed sickle blades.

are fragments. The width of the backed sickle blades varies from 8.8 to 16.1 mm (Table 3). Gentle serration was observed on six items (e.g., Fig. 2:2, 3, 5). One of the backed sickle blades is made on a ridged blade; this particular item has very little gloss and no serration or nibbling on the sharp edge. The majority of the backed sickle blades (n = 5) were produced of Type 1 flint; two are made of Type 3 flint and one, of Type 2 flint (Table 4). The only non-backed sickle blade is made on a medial fragment of a bladelet, 9.5 mm wide (Fig. 3). The item is made of Type 2 flint and exhibits two parallel ridges from previous removals, creating a trapezoidal cross-section characterizing Canaanean blades. A beige stain was observed along the longitudinal axis of this sickle blade's dorsal surface. The composition of the stain, as well as the blade surface, was investigated using SEM/EDS analysis (see below).

Table 3. Metric Characteristics of Backed Sickle Blades (in mm)[i]

	Length	Width	Thickness
Mean	40.35	11.95	4.68
N	8	8	8
Std. Deviation	13.06	2.52	1.59
Minimum	19.20	8.80	2.50
Maximum	57.10	16.1	7.70

[i] The length was measured also for the fragments; the metric characteristics of the two complete items can be seen in Fig. 2.

Table 4. Composition of the Tool Assemblage according to Flint Types

	Type 1	Type 2	Type 3	Type 4	Total
Sickle blade	5	2	2		9
Microliths	1		1		2
Tabular scraper				1	1
Bifacial				1	1
Retouched flakes	6	2			8
Retouched blades				1	1
Notch/ denticulate	4				4
Sidescraper	1				1
Awl				1	1
Truncation	1				1
Total	*18 (62.1%)*	*4 (13.8%)*	*3 (10.3%)*	*4 (13.8%)*	*29 (100%)*

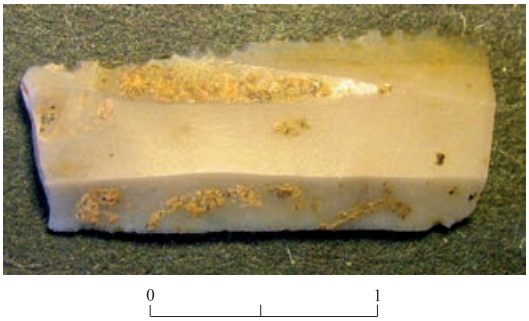


Fig. 3. Stained sickle blade.

Microliths (N = 2; Fig. 4:1, 2).— These comprise a micro-point—a bladelet with a distal end modified by two obliquely oriented truncations—and a micro-endscraper (Fig. 4:1, 2, respectively). The tools differ in their metric characteristics and in their flint type. The micro-point is minute (26.8 mm long, 5.9 mm wide) and made of Type 3 flint, while the micro-endscraper is larger (43.5 mm long, 8.6 mm wide) and made of Type 2 flint (Table 4).

Tabular Scraper (N = 1; Fig. 4:4).— This scraper is made of Type 4 flint (Table 4) and is represented by a distal fragment. The cortex of the tool was smoothed through grinding as evinced by parallel striations that are clearly observable on the surface. The lateral edges of the item were modified, producing a denticulate and a notch.

Bifacial (N = 1; Fig. 4:5).— This is a distal fragment of a polished bifacial tool, most probably an adze, made of Type 4 flint (Table 4).

Expedient (Ad Hoc) Tools

Retouched Flakes (N = 8).— This group comprises two complete large items, one measuring 61.3 × 49.6 × 16.7 mm, and the other, 63 × 41.6 × 6.5 mm. Notably, there are no cores in the assemblage that reflect removals of such large flake blanks. The rest of the retouched flakes are represented by fragments. Retouched flakes were produced mostly on Type 1 flint (Table 4).

Notches/Denticulates (N = 4; Table 4).— Three items were modified on thick flakes and one more on a blade. The flake-based items are all made of Type 1 flint and two of them exhibit ventral retouch. The blade-based item, made of Type 4 flint, is represented by a medial fragment and both of its edges are denticulate.

Retouched Blade (N = 1; Fig. 4:3).— The single example recovered is distinctively large (100.8 mm long, 21.2 mm wide, 7.6 mm thick), made of Type 4 flint (Table 4) and modified by alternate retouch.

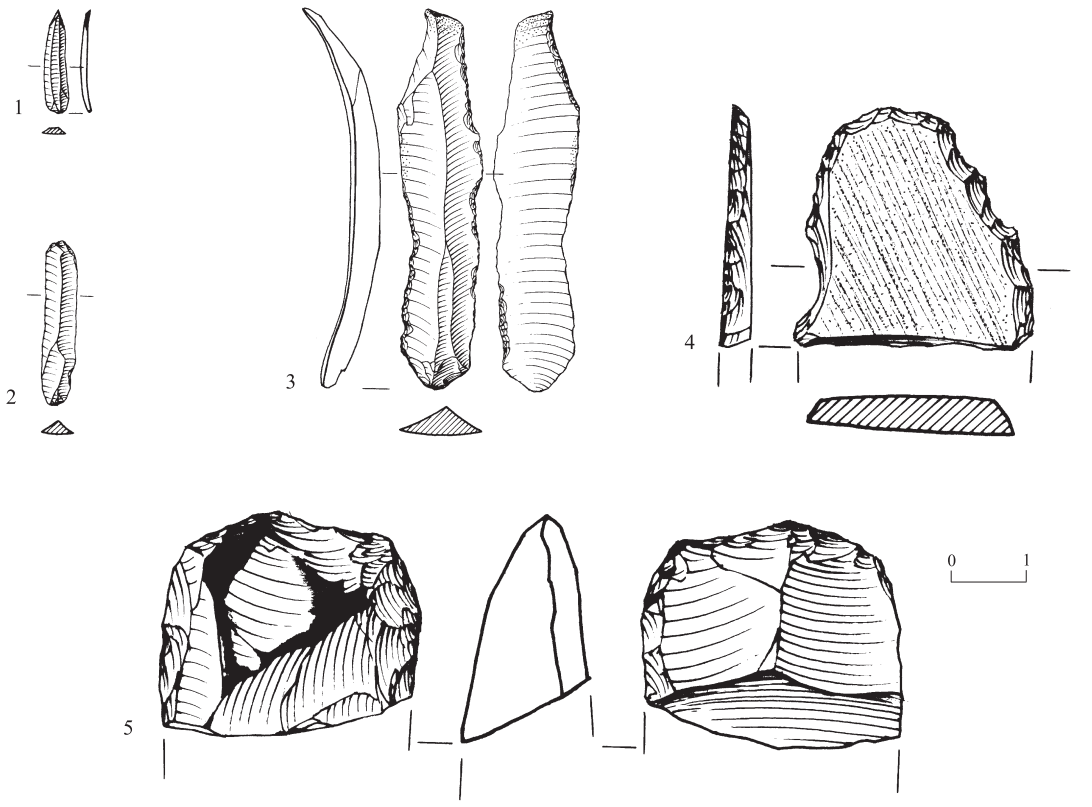


Fig. 4. Flint tools: micropoint (1); micro-endscraper (2); retouched blade (3); tabular endscraper (4) and adze (5).

N	Locus	Basket
1	204	2027
2	210	2097
3	219	3038
4	204	2041
5	210	3001

Three additional expedient tools constitute an awl prepared on a flake of Type 4 flint, a scraper modified on Type 1 flint and a truncation made on a blade of Type 1 flint (see Table 4).

EDS Analysis of the Stained Sickle Blade

The stain and flint surface of a non-backed sickle blade (Figs. 3, 5) were investigated using scanning electron microscopy (SEM) in conjunction with energy-dispersive x-ray spectroscopy (EDS).[1] Two samples were taken from the stain (Figs. 6:b; 7:a), and one

[1] I would like to thank Dr. Alex Berner from the Department of Materials Engineering, Technion, for the SEM and EDS analyses of the stained sickle blade.

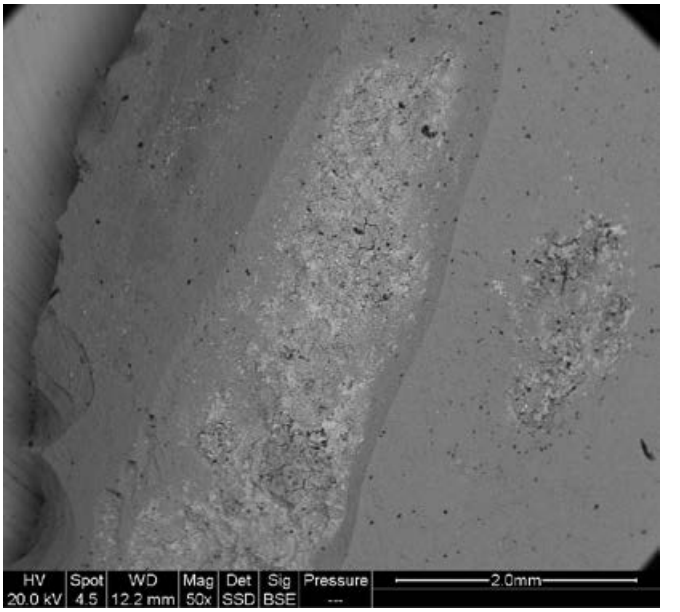


Fig. 5. SEM image of the stain material on the sickle blade.

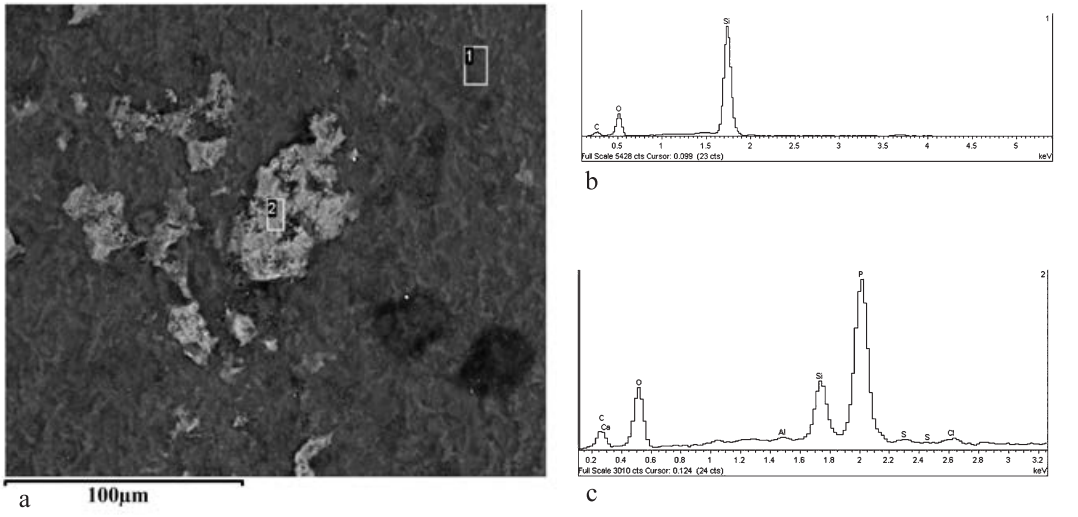


Fig. 6. SEM image of the stain material on the flint surface (a);
EDS elemental composition of the flint (b) and of the stain material (c).

sample from the surface of the blade (Fig. 6:a). The analysis of the flint surface identified two main components, oxygen and silica, at a 2:1 ratio, which is characteristic of flint. The samplings of the stain revealed that it is organic (high presence of carbon) and contains substantial amounts of phosphor and calcium. The presence of these two components may be an indication of the remains of a bone (collagen)-based adhesive (O'Connor 2000;

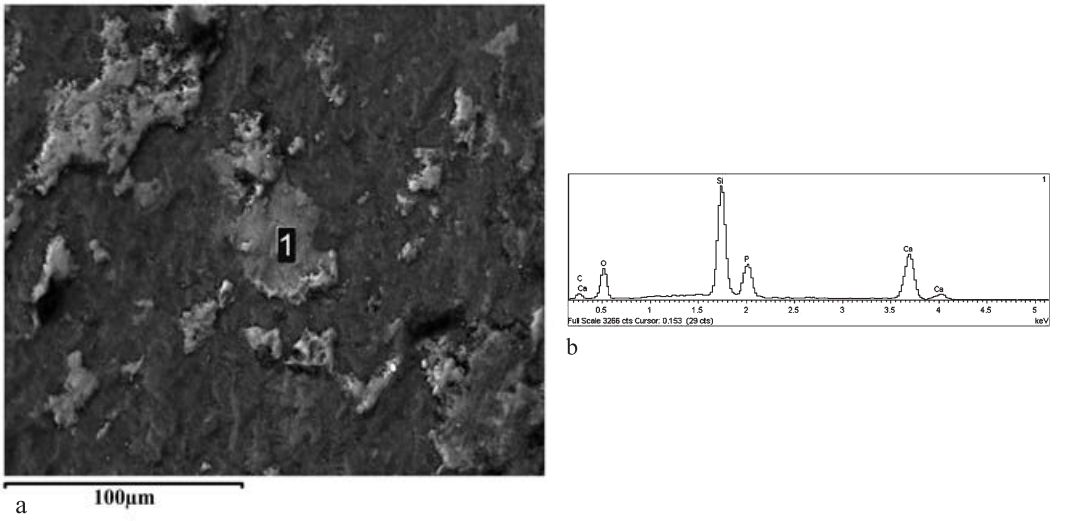


Fig. 7. SEM image (a) and EDS elemental composition of the stain material (b).

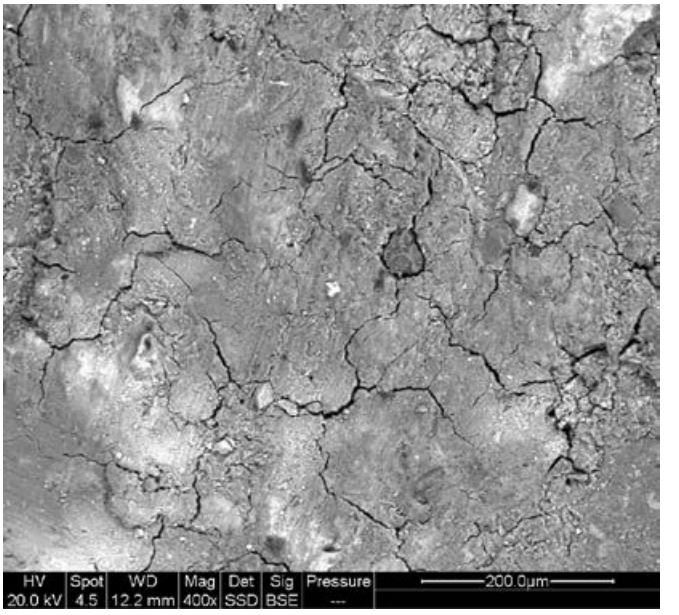


Fig. 8. SEM image of linear striations on the surface of the stained sickle blade.

Goffer 2007; and see Vardi 2011 for a summary on adhesive materials used to haft flint sickle blades) and/or of a bone shaft. In addition, the observations through SEM showed two groups of linear striations, one parallel to the longitudinal axis of the blade and the other oblique to it (Fig. 8). These striations may represent use-wear related to harvesting.

DISCUSSION AND CONCLUSIONS

A number of distinct industries characteristic of the Late Chalcolithic period (Rosen 1997; Vardi and Gilead 2013) are represented in the flint assemblage from the Newe Rabin neighborhood of Or Yehuda. The first industry is that of rather standardized backed and truncated sickle blades; however, it is variable in terms of the flint types used for their production. The absence of corresponding blade cores may suggest that the sickle blades were brought to the site from elsewhere. The presence of bladelet cores, core-trimming elements, indicating bladelet removals and bladelet blanks, attests that the production of microliths—the second distinctive industry—was carried out on-site, using mostly flint Types 2 and 3. The disproportionate ratio of bladelet cores to bladelet blanks and microliths may be explained by the fact that the sediments were not sieved and at least part of the small tools and blanks may have gone unnoticed. The polished adze and the ground tabular scraper, both made on Type 4 flint, represent two additional industries characteristic of the Chalcolithic period. Again, the absence of debitage related to their production may suggest that they were produced off-site. Ad hoc tools, predominantly made on flakes of Type 1 flint, were clearly produced on-site, as indicated by the presence of flake cores, core-trimming elements, naturally backed knives and numerous flake blanks of the same raw material.

The assemblage closely resembles that of another Late Chalcolithic site at Kafr ʻAna, excavated in 1996–1997 on behalf of Tel Aviv University, just a few hundred meters east of the present excavation (Gophna, Taxel and Feldstein 2005; 2007; Shimelmitz 2007). The similarity in the typological and technological characteristics of the artifacts in both excavations is obvious, including the phenomenon of two distinct blade-oriented industries, reflected in standardized sickle blades, on the one hand, and non-standardized blade blanks, on the other, as well as the presence of bladelet and ad hoc industries.

While in previous excavations in Kafr ʻAna blade and bladelet-based tools outnumber those made on flakes, in Newe Rabin these two groups are equally represented. That said, since the Newe Rabin debitage is flake dominated, the statement about the preference of blade/bladelet blanks for tools production still holds true for the presently described assemblage.

The flint assemblage from Newe Rabin, though relatively small, has all the typological and technological features characteristic of the Late Chalcolithic period. Its similarity to the assemblage from a nearby excavation in Kafr ʻAna suggests that the two sites were related, though the character of this relationship is not yet clear. The occurrence in the Or Yehuda flint assemblage of the non-backed sickle blade with the trapezoidal cross-section, reminiscent of Canaanean sickle blades, is of interest. The presence of Canaanean blades—one of the hallmarks of the Early Bronze Age—in Chalcolithic contexts is a well-known phenomenon (see, e.g., Rowan and Levy 1994; Milevski et al. 2011; Vardi and Gilead 2013), which had been frequently explained as being post-depositional, i.e., an intrusion (but see Bar and Winter 2010 for a different view). Recently, a growing body of evidence of Canaanean

blades found in Ghassulian sites that are not superimposed by Early Bronze Age deposits (e.g., Faẓael 2, Faẓael 7 [Bar and Winter 2010; Bar 2014]), Agamim and several other sites, not yet published, but presented in scientific meetings, support a Late Chalcolithic date for this distinct technology. Whether such items were imported to the Southern Levant or were locally produced remains an enigma. The present excavation at Or Yehuda did not expose an Early Bronze Age layer, nor were any finds associated with this period found. The clean context, as well as the excellent preservation of the blade, containing remains of an adhesive for hafting, and the clean context in which it was found, support the assumption that the Canaanean blade was an integral part of the Late Chalcolithic-period toolkit at the site.

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