NATUFIAN FLINT VERSUS GROUND STONE TOOLS:
A USE-WEAR PERSPECTIVE ON SUBSISTANCE CHANGE

Laure Dubreuil¹ and Hugues Plisson²

¹ Trent University, Department of Anthropology, Peterborough, Canada; dubreillaure@hotmail.com
² ESEP-UMR 6636, Aix-en-Provence, France; plisson@mmsh.univ-aix.fr

Abstract

Use-wear and technological studies suggest that Natufian flint assemblages share several characteristics with Mesolithic assemblages of Europe, as both regions show an extensive production of micro-lithic tools mostly devoted to animal procurement and exploitation. In the Levant, this association seems to be rooted in previous cultural traditions. In contrast to flint tools, ground stone tools show the development of a new technology partly related to the exploitation of plants. This paper discusses the implications and symbolic significance of this flint versus ground stone tool dichotomy for our understanding of Natufian subsistence and plant exploitation behavior.

Key words: macro-lithic tools, ground stone tools, sauveterrian, neolithization

INTRODUCTION

Indirect evidence of plant exploitation has long played a significant role in studies aimed at exploring changes in subsistence before the development of the full-fledged Neolithic societies in the Levant. Ground stone tools as well as flint implements, more specifically sickle blades, have been particularly discussed in this perspective. Drawing on previous studies (Plisson, 1985; Valla et al., 1991; Dubreuil, 2002, 2004, 2008; Dubreuil and Grosman, 2009a; Valla and Plisson, 2005; Plisson et al., 2008), this paper reassesses some of the hypotheses that have been put forward concerning the pattern of use and discard of the Natufian flint and ground stone tools and discusses the implication of these data regarding changes in subsistence economy during the Natufian period in the Southern Levant.

Our archaeological sample focuses on certain categories of flint and ground stone tools. Regarding ground stone implements, it centers on the non-cutting tools, also referred here as macro-lithic implements following Adams et al. (2009), which encompass the various types of abraders, grinding slabs, handstones, mortars and pestles (Fig. 1). Detailed analyses have been more particularly carried out for abraders, grinding slabs and handstones. Regarding flint stone tools, a focus is placed on the most common implements within Natufian assemblages, such as retouched and unretouched flakes or blades as well as microliths. Furthermore, in order to gain a better understanding of the Natufian flint industry, this paper builds on comparison with the Mesolithic of Europe – yet takes into consideration the limitations of this kind of approach (Belfer-Cohen and Goring-Morris, 2007).

The analysis of the Natufian flint and macro-lithic tools encompasses typological, technological and use-wear studies. Use-wear analyses are more particularly discussed and used to define the patterns of tool use and discard or tool management (i.e. kinetics, material processed by the tools and their use-life). Use-wear analysis is here considered in the perspective developed by Semenov (1964), as a means to investigate past material culture and to unravel the structure of a coherent system, and not as the functional study of a selected range of artefacts. Therefore, an endeavor
that the attempt to preserve the symbolic significance of hunting activities, and more generally to maintain traditional institutions might have been significant during the transition from foraging to farming, despite the probable growing importance of plants within the economy.

A USE-WEAR PERSPECTIVE ON NATUFIAN FLINT IMPLEMENTS

Main characteristics of the Natufian industry

Over the years, the Natufian industry has been described in several site reports and syntheses (e.g., Henry, 1973, 1989; Bar-Yosef, 1980, 1991, 1998; Valla 1984; Olszewski, 1986, 1988; Goring-Morris, 1987; Belfer-Cohen, 1988, 1991; Byrd, 1989, 1991; Edwards, 1991; Belfer-Cohen and Grosman, 1997; Goring-Morris and Belfer-Cohen, 1997; Weinstein-Evron, 1998; Valla et al., 2001, 2004; Weinstein-Evron et al., 2007; Nadel et al., 2008; Grosman and Munro, 2007; Ibanez et al., 2009). The Natufian flint industry can be characterized as a toolkit manufactured on irregular flakes and rough blades, some of which were retouched (Fig. 2). This industry is also characterized by the presence of notches and denticulates. Whereas the frequency of endscrapers and burins seem to be highly variable between sites, microliths and geometrics are less variable and always represent a significant proportion of the lithic assemblages. Compared to previous periods, the particularity of the Natufian material culture is expressed in the constant presence of drills and borers, as well as in specific types of microliths (e.g., Helwan or backed lunate), trapeze-rectangles and triangles. Heavier flint implements such as picks are also frequently represented in these sites, although in smaller numbers. As reported in earlier industries (Bar-Yosef, 1980; Anderson, 1991), glossed tools become more abundant in Natufian assemblages. Together with sickle shafts (e.g., Edwards, 2007; Le Dosseur, 2009), these tools clearly illustrate the development during the Natufian period of a technology devoted to harvesting activities. Yet, use-wear studies indicate that some of the Natufian flint tools with gloss were not used in plant harvesting (e.g., Unger-Hamilton, 1991; Anderson and Valla, 1996). In fact, significant
developments in the flint technological system related to plant harvesting seem to be more specific of later periods (e.g., Anderson and Valla, 1996; Anderson, 2000; Unger-Hamilton, 1991; Yamada, 2000; Ibanez et al., 2009).

**Pattern of use and discard of the Natufian industry**

In order to analyze the patterns of use and discard of the Natufian flint implements, a focus is placed on the more common tools encompassing retouched and unretouched flakes, blades, and microliths. The discussion builds especially on a use-wear study carried on the Late Natufian layer of Hayonim Terrace (Fig. 3). The sample from this site consists of 500 artefacts composed of various types of geometric microliths, notches and denticulates, burins, blades, bladelets and flakes (Valla et al., 1989; Valla et al., 1991; Valla and Plisson, 2005). The analysis of these tools suggest the following patterns of artefact use and discard: a very low proportion of the artefacts

**Fig. 2.** Top, Natufian flint tools with use wear, from Hayonim (modified from Valla, et al., 1991); Bottom, Natufian macro-tools from Mallaha. a: pestles; b–d: handstones; e: grinding-slab; f: mortar; g: shaft straighteners. Drawings from D. Ladiray
were used; the edges of the tools are mostly untouched and use-wear indicates light work and short use-lives; a limited range of activities is documented; these activities are mostly related to the procurement and processing of soft animal matters, such as meat and hide; and in general, geometric microliths and retouched bladelets were hafted projectiles (likely used to arm arrows).

Additional use-wear analyses support these interpretations about patterns of tool use and discard. For instance, the study of a sample of lunates from the Natufian layers of Salibiyah (Yamada, 2000) and Mureybet (Ibanez et al., 2009) also concluded that these tools were mostly used as hafted projectiles. The analysis of a sample of 409 implements from the Natufian layers of Ain Rabuh, Salibiyah I, and Hayomin Cave, demonstrated that activities related to the acquisition and processing of game were dominant among the microliths (Ritcher, 2007). Therefore, the Natufian flint technology seems closely associated with activities related to hunting.

As we will see, comparisons with the Sauveterrian, a Mesolithic industry of Europe, suggest that the Natufian flint industry retains elements that can be regarded as typical of mobile hunter-gatherers. First-hand analyses of various flint samples from both types of assemblages (Plisson, 1985; Valla et al., 1991; Pignat and Plisson, 2000; Valla and Plisson, 2005; Plisson et al., 2008) have highlighted several common points between the Natufian and the Sauveterrian. These similarities are related to typological traits, technological characteristics, as well as tool management methods. Comparing these two industries may help us gaining a better understanding of Natufian flint technology.

**Comparisons with the Mesolithic of Europe**

The Sauveterrian industry emerged around 10000 BP in the southeastern part of Europe and progressively spread into the western part of the continent. The Sauveterrian flint industry is characterized by highly standardized geometric microliths, which were produced using different knapping and retouch methods (e.g., Guilbert, 2003). These assemblages also encompass small irregular flakes and a few retouched artefacts, mostly scrapers.

In spite of significant differences in assemblage composition and production techniques, the Natufian and the Sauveterrian flint industries share a similar basic structure. Both consist of an expedient toolkit manufactured on irregular flakes and rough blades. A rather small amount of retouched artefacts is noticed in both contexts, as well as similar proportions of elaborated geometric microliths; notches and denticulates are also present.

To date, use-wear analyses have been implemented for a dozen Sauveterrian sites, constituting a sample of approximately 5000 artefacts (Lemorini, 1990, 1994; Martinet, 1991; Rodriguez Rodriguez, 1993; Philibert, 1999, 2002; Pignat and Plisson, 2000; Khedhaier, 2003). Based on these studies, it can be stated that the patterns of use and discard of flint tools for this industry are very similar to what has been previ-
ously described for the Natufian. A limited range of activities has been identified. Use-wear generally indicates procurement and processing of soft animal matters, such as meat and hide. These traces are most frequently found on microliths, flakes, blades, and scrapers. Wood and bone-working are poorly represented activities.

The similarities between the Natufian and the Sauveterrian are particularly puzzling, as these industries were produced by groups with conflicting settlement patterns and socio-economic organizations: semi-sedentary groups occupying permanent houses in the Levant (see Boyd, 2006 for a discussion) and mobile hunters-gatherers living in forests and mountains in Europe. Interestingly, these dramatic differences in adaptation do not seem to be reflected in mundane flint toolkit implements.

Additional support for this view can be found when examining the evolution of flint assemblages and socio-economic organization during the various phases of the Natufian. Whereas significant cultural changes such as the emergence of plant domestication (e.g., Moore et al., 2000; Belfer-Cohen and Bar-Yosef, 2000; Bar-Yosef and Belfer-Cohen, 2002; Byrd, 2005) and the shift from a semi-sedentary to a more nomadic adaptation (e.g., Goring-Morris and Belfer-Cohen, 1997; Belfer-Cohen and Bar-Yosef, 2000; Bar-Yosef, 2001; Valla et al., 2001; Bar-Yosef and Belfer-Cohen, 2002; Munro, 2004) have been attributed to the end of the Natufian, flint knapping techniques and assemblage composition appear to remain stable throughout the Natufian sequence. No significant general diachronic change has been identified so far, with the exception of a reduction in microlith size and a progressive abandonment of the Helwan retouch technique (e.g., Valla, 1984; Belfer-Cohen, 1988; Valla et al., 2001; Belfer-Cohen and Goring-Morris, 2002; Valla and Plisson, 2005; Marder et al., 2006).

While the flint industry provides evidence for relative continuity in activities throughout the Natufian, other categories of artefact such as the macro-lithic tools, document significant modifications of the technical system over time. It is worth mentioning that macro-lithic tools are seldom known for the Sauveterrian. This might be partly related to a low visibility of these tools in sites produced by highly mobile groups as well as to biases in recovery methods (see Plisson et al., 2008 for a discussion). On the contrary, the development of macro-lithic tools is well documented for the Natufian.

A MACRO-LITHIC TOOLS PERSPECTIVE ON THE NATUFIAN

The Natufian macro-lithic tools of the Southern Levant

In the Southern Levant, elaborated macro-lithic tools have been found since the Upper Paleolithic (e.g., Ronen and Vandermeersch, 1972; Bar-Yosef and Belfer-Cohen, 1989; Gilead, 1991; Wright, 1992b, 1994). Yet, the Natufian shows a significant increase in the abundance of these implements, as well as a diversification of the tool types (e.g., Bar-Yosef, 1980; Wright, 1992a, 1994).

Basalt and limestone are the most common raw materials used for making macro-lithic tools in the Natufian of the Southern Levant. These raw materials vary in proportion between sites. Other types of raw material, such as sandstone or quartzite, are also represented although generally in smaller quantity. Most commonly, macro-lithic implements are made of raw material which is not as fine-grained as the flaked artefacts (e.g., Shoumaker, 1993; Schneider, 2002; Santallier et al., 2002; Adams et al., 2009). For this reason, the manufacture of these tools is associated with different ranges of techniques and operational sequences. So far, in situ production of ground stone artefacts has not been clearly identified for Natufian sites. The quarries or workshops that were exploited remain elusive (Weinstein-Evron et al.,1995, 1999, 2001). Traces observed on the artefacts show that the manufacture of the macro-lithic tools involved the removal of flakes, pecking, and abrasion. The operational sequences can be related to the shaping of blocks of appropriate size or of quarried blanks (Wright, 1992b; Dubreuil, 2002).

The Natufian macro-lithic tool assemblages are characterized by the presence of two sets of tools, of mortars-pestles and grinding slabs-handstones (Figs 1 and 2). Both sets can be used to reduce a matter into finer particles (although
other functions are also possible, see for instance, Hayden, 2004; Dubreuil et al., 2004; Nadel and Rosenberg this volume; Dubreuil and Grosman, 2009a). Along with these typical grinding and pounding implements, diverse kinds of macro-lithic tools are also present (Fig. 2), encompassing various types of hammerstones and abraders (e.g., Perrot, 1966; Goring-Morris, 1987; Belfer-Cohen, 1988; Valla et al., 2001; Byrd and Colledge, 1991; Edwards, 1991; Wright, 1992b; Dubreuil, 2002; Edwards, 2007; Dubreuil and Grosman, 2009a). Analyses carried out by Wright (1992a, 1994, 2000) have confirmed the hypothesis of a rise in the importance of grinding-slabs and handstones accompanied by a decline of large portable mortars during the transition between the end of the Natufian and the beginning of the Pre-Pottery Neolithic. This pattern is well illustrated at Mallaha (Dubreuil, 2008) where the number of grinding-slabs and handstones increase during the Final Natufian, the last phase of the occupation (Fig. 4).

The hypothesis of a development of the grinding and pounding technology (Fig. 1) from hammerstones, to pounding tools (mortar and pestle), to grinding implements (grinding-slab and handstone) has been proposed by Kraybill (1977) and more recently discussed by De Beaune (2004). For the Levant, Flannery (1969) also suggested that ochre processing might have triggered the development of pounding and grinding implements, later adapted to the transformation of vegetal matters. This hypothesis was supported for this region by Wright (1992b, 1994) based on an extensive analysis of ground stone tools assemblages of the Levant which showed that macro-lithic tools with ochre remains are more abundant in Upper Paleolithic assemblages. Our use-wear study of a sample of Natufian macro-lithic tools also appears to substantiate some aspects of Flannery’s hypothesis by showing that despite functional variability among the Natufian implements, the rise in macro-lithic implements during this period seems, at least partially, the result of an intensification of plant exploitation (Dubreuil, 2002, 2004, 2008; Dubreuil and Grosman, 2009a).

A use-wear analysis of Natufian macro-lithic tools

The application of use-wear analysis to macro-lithic tools is relatively recent. Therefore, analyses for the moment are limited to a much smaller sample of tools compared to studies of flint. This paper draws on the study of 170 macro-lithic tools from four Natufian sites located in the Southern Levant (Table 1; Fig. 3): Hayonim Terrace, Hayonim Cave, Hilazon and Mallaha (Dubreuil, 2002, 2003, 2004; Dubreuil and Grosman, 2009a; Dubreuil and Grosman, 2009b). The analytical procedure involves low magnification observations using a stereomicroscope. Higher magnifications were also used to observe a sample of tools. Use-wear analysis has typically focused on basalt implements such as handstones, grinding slabs, polishers, and abraders. Experiments with mortars and pestle-types of artefacts are the object of ongoing research. In our sample, the proportion of flat implements varies across sites and is particularly significant at Mallaha during the Final Natufian (Fig. 4).

One of the most interesting results of the use-wear analysis of these tools is that only some of the artefacts classified by archaeologists as handstones or grinding slabs have been used for processing vegetal matter. Evidence of skin processing with ‘handstones’ has been found at Mallaha, Hayonim Cave and Hilazon (Fig. 5).
In addition to skin processing, our sample indicates that Natufian handstones and grinding slabs were also used for grinding three distinct matters: legumes, cereals, and minerals (Figs 5 and 6). Grinding of meat may have been performed with one of the handstones from Mallaha. However, additional analyses will be necessary to confirm this interpretation (Dubreuil, 2002).

As mentioned, the use-wear studies carried out thus far also appear to substantiate some aspects of Flannery’s broad-spectrum hypothesis (Dubreuil, 2004; Dubreuil and Grosman, 2009a): flat grinding implements associated with craft activities, such as hide processing, are proportionally more abundant in the early phase of the Natufian that in the later phases (Table 1, Fig. 7). The typological, technological, and use-wear study of Mallaha indicates that flat implements became more standardized and focused more heavily on plant processing during the Final Natufian (Dubreuil, 2002, 2004). Most of the use-wear characteristics observed on the grinding-slabs and handstones in the Final Natufian layers can be related to the grinding of legumes or cereals (Fig. 6).

Although our use-wear study does not include mortars and pestles, these results suggest that the development of macro-lithic technology during the Natufian is at least partly associated with an increase of plant processing with grinding implements. This trend may reflect an intensification of plant exploitation as the grinding process allows the inclusion in the diet of plants that requires a removal of non-comestible parts (Stahl 1989). Intensification also derives from the fact...
that the process of grinding increases plant digestibility and therefore, its caloric returns (O’Dea et al., 1980; Wright, 1992b; Piperno et al., 2004).

The increase in plant processing with grinding-slabs and handstones observed at Mallaha may be more generally indicative of an intensification of the exploitation of cereals and legumes at the end of the Natufian (Dubreuil, 2004). This interpretation is based on the premise that the use of grinding-slabs and handstones for plant processing may have helped increase plant productivity by allowing changes in the organization of tool production and grinding tasks (Belfer-Cohen and Hovers, 2005) and/or the production of different by-products (Wright, 1992b). It is interesting to note that this last hypothesis appears to be supported at Mallaha by the analysis of human remains. These remains indicate a significant increase in dental caries in the Final Natufian compared to previous periods (Bocquentin, 2003, 2007). However, the proposed relationship between the rise of flat implements and the intensification of plant exploitation will require further testing on larger samples.

To summarize the results of the use-wear analysis, two points need to be emphasized. First, although there is functional variability among the Natufian macro-lithic tools, the hypothesis that the development of grinding technology in the Southern Levant is at least partly related to plant processing is supported by the data. Second, the use-wear results also suggest that the changes in macro-lithic tool assemblage composition observed at the end of the Natufian might indicate a trend toward an intensification of cereal and legume exploitation. This could also support the notion that the end of the Natufian was associated with significant cultural changes.

DISCUSSION: RELATING THE FLINT AND MACRO-LITHIC TOOLS DATA

The data presented above allow us to contrast Natufian flint and macro-lithic implements. The potential implications of these differences are successively discussed with respect to subsistence, mobility strategies, the social organization of work, and the symbolic system.

Subsistence strategies

The Natufian flint industry consists, for the most part, of small flakes, bladelets, and micro-
liths. These characteristics seem to be rooted in local traditions (Belfer-Cohen, 1991). The use-wear analyses of these tools indicate that the Natufian flint toolkit was mostly devoted to the procurement and processing of game. In parallel, a relatively new macro-lithic tool technology emerged during the Natufian period. This technology was based on different raw materials and necessitated the development of distinct manufacturing methods and concepts. The available use-wear data suggest that this technology was partly, but not exclusively, associated with the exploitation of vegetal resources.

There are of course some overlaps in the utilization of the two classes of tools. For instance, flint production was partially oriented toward the exploitation of plants, whereas some macro-lithic tools were used for skin processing. Nonetheless, the data presented in this paper suggest the existence of two general trends in the Natufian technical system; one system drew on traditional tools and concepts related to hunting activities, which contrasted with a second developing and changing system which testified to the expansion experiments pertaining to plant exploitation. In term of subsistence behavior, these trends may indicate both an effort to preserve a long-established system and to develop new avenues for resource exploitation during the Natufian period.

Flint and macro-lithic tools may also have been associated with different mobility strategies used to cope with resource variations; if correct, this interpretation would provide further support for the existence of two distinct technological trends during the Natufian period.

Mobility strategies

Comparisons with the Sauveterrian indicate that the flint industry in the Natufian preserved characteristics presumably associated with mobile hunter-gatherer adaptations. Microlithic industries have sometimes been viewed as an indication of decline in knapping abilities or as “minimal technical system”. However, the available data suggest that microlithism might have been one of the many strategies used by prehistoric groups for managing risk (Elston and Kuhn, 2002). In Europe, the development of microlithism was possibly associated with dramatic transformations of mobility patterns in relation to environmental change (Plisson et al., 2008). Comparisons between the Mesolithic and Upper Paleolithic industries from Europe (France) also suggest that microlithic industries were less dependent on good quality flint and that their development might have allowed more flexibility in the mobility pattern (Plisson, 1985). This hypothesis concurs with Flannery’s (1986) general proposition that mobility has long been a response to cope with resource fluctuation. Although an explanation for the emergence of the microlithism phenomenon is beyond the scope of this paper, it is proposed that microlithic industries might have been closely related to the maximization of resource procurement through mobile strategies.

Conversely, the increasing use of grinding implements during the Natufian period, including non-portable ones (e.g., Eitam, in press), may have contributed to fostering the establishment of permanent fixed places in the landscape (e.g., Schlanger, 1991; Wright, 1992b; Nelson and Lippmeier, 1993). As discussed in this paper, the development of a macro-lithic tool technology probably indicates the concern for maximizing calorific returns. This technology may have been particularly important in a context of possible circumscription of the foraging territories (Tchernov, 1991, 1995; Goring-Morris and Belfer-Cohen, 1997; Munro, 1999, 2004; Belfer-Cohen and Bar-Yosef, 2000; Bar-Yosef and Belfer-Cohen, 2002; Shewan, 2004; Byrd, 2005).

If the relationships proposed here between, on one hand, micro-lithic industry and maximization of resource exploitation through mobile strategies and, on the other hand, macro-lithic industry and the development of fixed places in the landscape, are correct then each technology could have been related to different strategies in term of mobility and settlement pattern.

Social organization of work

The dichotomy between flint and macro-lithic implements was perhaps reinforced by a sexual division of production activities. Several studies of human remains indicate that muscular stress and sexual dimorphism observed on Natufian specimens might signal a sexual division of labor (Peterson, 1998, 2002, 2006; Bocquentin, 2003; Eshed et al., 2004). In particular, it has been suggested that grinding or pounding tasks
were preferentially carried out by women while hunting activities would have been performed by males (Peterson, 1998, 2002, 2006; Eshed et al., 2004). Potential differences in the diet of men and women reinforce this hypothesis. Isotope analyses, as well as the study of dental caries suggest that the diet of Natufian women possibly included more vegetable resources than men (Sillen and Lee-Thorp, 1991; Boquettin, 2003, 2007), although these dental patterns may result from a higher propensity of females for dental caries (e.g., Bocquentin, 2003; Lukacs, 2008). Ethnographic accounts generally support a sexual division of labor as proposed for the Natufian period. In most foraging societies males are associated with the acquisition of large game which has a high risk of pursuit failure but generates prestige and sharing opportunities with members of the community (Murdock, 1949; Sahlin, 1972; Murdock and Provost, 1973; Testart, 1982, 1986; Bird, 1999; Hawkes et al., 2001; Wiessner, 2002a; Bliege Bird and Bird, 2008). Conversely, cooking and plant processing is one of the activities typically associated with women in traditional societies (Murdock and Provost, 1973). As outlined by Bird (1999), among foraging groups, women tend to focus on resources that are more commonly acquired, come in smaller sizes, have relatively low risk of pursuit failure, and are associated with high processing costs. In the Natufian context, this could have included greater proportions of small, slow-moving game such as turtles, other reptiles, shellfish (Munro, 2004; Bridault et al., 2008), and vegetal resources. If this interpretation is correct, than female activities would then have been increasingly significant for subsistence activities during the transition from hunting-gathering to farming in the Southern Levant. This would support Forest’s (2006) view that women played a central role in the Neolithic revolution.

However, despite the apparent growing importance of plant resources in Natufian diet, hunting activities may have retained high symbolic status during the Natufian period, while the evidence for a high symbolic status associated with plant processing activities is less conspicuous for this period. This, perhaps, indicates some form of conservatism, as well as the supremacy of male values in Natufian society.

### Symbolic system

During the Natufian period, the production of elaborated and decorated ground stone tools, as well as the association of some of these implements with graves, provide clear indication of the symbolic dimensions of grinding technology (e.g., Belfer-Cohen, 1991; Wright, 1992b; Belfer-Cohen, 1995; Weinstein-Evron, 1998; Ronen, 1999; Bar-Yosef, 2002; Boquettin, 2003; Hayden, 2004; Dubreul and Grosman, 2009a). Yet, grave goods generally decrease in frequency after the Early Natufian period (e.g., Belfer-Cohen, 1995; Boquettin, 2003; Bar-Yosef Mayer, 2005). However, Late Natufian sites do provide evidence of macro-lithic tools associated with burials (e.g., Grosman et al., 2008; Dubreul and Grosman, 2009a; Nadel and Rosenberg, this volume). Yet, according to Ronen (1999), the intentional deposition of ground stone tools in burials declined significantly during the transition from the Natufian period to the PPNA. Moreover, Wright’s (1992b, 2000) analysis confirms that the number of decorated implements as well as the quality of the macro-lithic tools drops after the Early Natufian period. This evolution seems in contradiction to the increasing use of grinding technology during the transition from foraging to farming and suggests that the symbolic dimension of these tools was not directly related to their significance in daily activities.

Drawing on the hypotheses developed by various authors (Wright, 2000; Bar-Yosef, 2002; Hayden, 2004; Belfer-Cohen and Hovers, 2005), it is tentatively suggested that the symbolic significance of grinding and pounding implements arose from their context of use: considerable efforts might have been put in the manufacture of tools playing a key role in events involving the whole community such as the communal preparation of meal or brewage and the sharing of these items. If this hypothesis is correct, the changes observed in ground stone tool manufacture and decoration during the Natufian period might be attributed to a decline of their role in events involving the community or in the symbolic significance of the activities that were carried out with the tools. The decrease in the use of macro-lithic tools as grave goods might also stem from the same phenomenon, although interpreting intentional deposition of ground stone tools in graves
can be problematic (e.g., Valla, 1995; Ronen, 1999; Dubreuil and Grosman, 2009a).

The changes observed in ground stone tool decoration and manufacture might also be related to an evolution of cooking and dining customs, as suggested by Wright (2000) and, more recently, by Rosenberg (2008), confining food-related activities to constricted and private places. These modifications may have signaled a shift toward the establishment of a new basic economic unit, the nuclear family, as suggested for later periods (e.g., Flannery, 2002; Banning, 2003). Yet, flint industry provides little evidence for broad organizational changes during the Natufian.

Indeed, borrowing on an argument made by Valla and Plisson (2005), it is suggested that the efforts put into the production of microliths during the Natufian period are indicative of the symbolic importance given to these tools and their associated activities. Furthermore, in a context of increasing sedentarity, associated with an overexploitation of certain faunal resources (Stiner et al., 1999, 2000; Munro, 1999, 2004; Stutz et al., 2009), Valla and Plisson (2005) propose that microliths became “overinvested,” perhaps as a way to reemphasize traditional values in a changing society. The symbolic significance of hunting activities likely remained strong in the Southern Levant during the Pre-Pottery Neolithic, in spite of the increasing contribution of domesticated animals in the diet (e.g., Cauvin, 1994; Ibanez and Urquijo, 2007). Conservatism and a desire to preserve traditional ways of life might have been significant during the transition from foraging to farming in the Southern Levant and could have favored the coexistence of old and new institutions during this process as described by Wiessner (2002b) in her analysis of the transformation of the Enga in New Guinea.

CONCLUSION

This paper reconsidered some conception of Natufian flint and ground stone tool function drawing mostly on a use-wear approach. Our aim was to examine whether these implements suggest economic changes indicating the development of full-fledged Neolithic societies in the Levant.

The results presented here suggest that many common Natufian flint implements such as flakes, retouched flakes, bladelets and microliths were used to perform a limited range of activities, mainly focused on game hunting and processing. Regarding the macro-lithic tools, whereas there is functional variability, the development of grinding-slab and handstone types of implements seem to be associated with an increasing use of these tools for the processing of vegetable matter for consumption. It is suggested that this basic broad opposition between the flint and macro-lithic tool functions may indicate the existence of two technological trends: one associated with traditional hunting technology, mobile adaptation and male-related activities and another with the development of a new technology, fostered by the increasing importance of plant matter in the diet, related to the establishment of fixed places in the landscape and mostly associated to female activities. Investment in tool production seems to indicate that technology associated to hunting activities retains its symbolic value during the Natufian period. Yet, in spite of the probable growing importance of plant in the diet, a relative decline in the investment in the manufacturing of macro-lithic tools is noted as well as a decline in their role of grave goods. These data suggest that the endeavour to preserve traditional values may have been significant during the transition from foraging to farming.

Enlarging the use-wear sample for flint and macro-lithic implements is of primary importance in order to further test the hypotheses proposed in this paper. Broadening the scope of the methodological approach implemented for functional analysis by developing, for instance, quantification of use-wear, high magnifications analysis of macro-lithic tools, as well as residues analysis, is also regarded as essential to accomplish this goal.

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