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The economic and ritual utilization of plants at the Raqefet Cave Natufian site: The evidence from phytoliths

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ABSTRACT

The Natufian culture marks a dramatic in the cultural evolution of our species, the shift from mobile to sedentary communities. Within this framework, analysis of their use of plants is pivotal for social and economic reconstruction. While most researchers believe the Natufians collected the grains of grasses, little direct evidence (e.g. macrobotanical remains) has been found. This current study uses phytoliths (opal silica bodies) to interpret Late Natufian plant use at Raqefet Cave (Mt. Carmel, Israel). We analyzed a wide range of sediment samples for microbotanical phytoliths remains. This analysis, of an assemblage of 35 samples, was aimed at exposing plant use at the site both in burial contexts and hewn bedrock features (e.g. mortars, cupmarks).

The results indicate economic use of grass seeds, including both small-seeded varieties and large-seeded grasses such as barley and wheat. They also suggest an opportunistic approach to grass seed collection. Phytoliths found in the burials of Homo 19 and Homo 22 may be the remnants of a final meal. The phytolith assemblages from burial contexts also show abundant morphotypes from dicotyledons that are rare elsewhere in the cave. The evidence suggests that a multi-species layer of vegetation including flowering plants and *Phragmites* lined the graves, accompanying the dead. This adds new insights to the range of known Late Natufian mortuary practices.

Introduction

Natufian plant exploitation is a core archaeological issue as it lies at the center of debates on the origins of agriculture, and most researchers agree their subsistence strategies were subject to climatic and socio-economic pressures (e.g. Bar-Yosef, 1998, 2002; Bar-Yosef and Belfer-Cohen, 1989, 1991, 1992, 2002; Bar-Yosef and Meadow, 1995; Belfer-Cohen and Bar-Yosef, 2000; Grosman, 2003; Henry, 1985, 1989). Researchers have long known that the Natufians had intensive subsistence strategies that included the use of grass seeds and many other Mediterranean forest plants and animals (Moore and Hillman, 1992; Munro, 2004). Although direct archaeobotanical evidence is scarce, recent studies support an increase in grass-seed use during the Early to Late Natufian shift, but this pattern has not yet been established in the Mount Carmel region (Colledge and Conolly, 2010; Rosen, 2010; Rosen and Rivera-Collazo, 2012).

Archaeological remains suggest that there were many social and economic changes between the Early and Late Natufian in the Southern Levant. For example, the low mobility of the Early Natufians was in many cases replaced by greater mobility (Goring-Morris and Belfer-Cohen, 2008). Likewise researchers have determined that during the Late Natufian, socio-economic pressures may have coalesced to ignite new symbolic behaviors (e.g. Bar-Yosef and Belfer-Cohen, 1999; Grosman et al., 2008; Valla, 1995). Mortuary behavior is one fertile realm for the expression of symbolism and ritual (e.g. Belfer-Cohen, 1991; Bocquentin, 2003; Bocquentin et al., 2010; Byrd, 1989, 1994; Byrd and Monahan, 1995; Weinstein-Evron, 2009). Dramatic social and economic changes should be reflected in the way plants were exploited by Late Natufian populations in the Southern Levant. This paper uses phytoliths recovered from the site of Raqefet Cave to address this challenge and to provide new evidence of Natufian plant utilization.

Background

The cultural and climatic chronology

The Early Natufian (~15,500/15,000–13,700 cal. BP; Blockley and Pinhasi, 2011; Stutz, 2009; Weinstein-Evron et al., 2012) is defined by the first emergence of sizable settlements such as at Eynan in northern Israel (Perrot, 1966; Perrot and Ladiray, 1988;

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Valla et al., 2004, 2007). The large Early Natufian sites in the Mediterranean core-area are interpreted as hallmarks of a revolutionary change in human organization (Bar-Yosef, 1998; Bar-Yosef and Belfer-Cohen, 1992, 2002; Henry, 1985, 1989; Valla, 1995). Unsurprisingly, the Natufian period is known for its multi-faceted innovations including immobile stone artifacts and new ritualistic expressions (Boyd, 2006; Grosman et al., 2008).

The Late Natufian lasted for almost 2000 years, from ~13,700 to 11,600 cal. BP. This period saw people returning once again to smaller occupational sites and higher mobility strategies (Bar-Yosef, 1998; Belfer-Cohen and Bar-Yosef, 2002; Henry, 1989; Valla, 1995). Some have proposed an increased reliance on the wild wheat and barley (large-seeded grasses) and small-seeded grass consumption, involving specialization (Colledge and Conolly, 2010; Rosen, 2010). Most researchers accept that climatic events occurring during this period impacted Natufian culture, to varying degrees (Bar-Yosef and Belfer-Cohen, 1989; Henry, 1989; Maher et al., 2011a; Rosen, 2007a; Rosen and Rivera-Collazo, 2012), particularly the Younger Dryas which coincided with the Late Natufian, lasting from ~13,600 cal. BP to ~11,400/11,200 cal. BP. The oxygen isotope curves from Nahal Soreq Cave in Israel indicate rapid cooling and drying in the eastern Mediterranean at this time (Bar-Matthews et al., 1999, 2003).

Natufian subsistence

Although a considerable amount of information is available on Natufian hunting practices (e.g. Bar-Oz et al., 2004; Edwards, 1989; Munro, 2004; Yeshurun et al., 2013), direct evidence regarding their use of plant foods is less available. Yet, understanding plant utilization is critical to explaining the new relationships of cultivation and domestication that would subsequently emerge. Widespread plant use is evident from micro-wear of flint sickles and grinding implements, which are associated with cereal harvesting and processing (e.g. Dubreuil, 2004; Unger-Hamilton, 1989). However, few Natufian sites in the Southern Levant have produced floral remains which could reveal more detailed information (Bar-Yosef, 1998). Although in the Northern Levant a small number of sites such as Abu Hureyra and Dederiyeh Cave preserve plant remains (Colledge and Conolly, 2010; Moore et al., 2000; Nishiaki et al., 2006), in the Southern Levant only scarce isolated charred seeds have been reported, some of which derive from questionable contexts (Table 1). Multi-cell phytoliths from Natufian contexts at Eynan near Lake Hula confirmed grass seeds were collected; these included wheat and barley but predominantly were comprised of small-seeded grasses (Rosen, 2004, 2007b). It is clear that consumption of grass seeds has a long history in the Levant (Henry et al., 2011; Piperno et al., 2004; Portillo et al., 2010; Weiss et al., 2004). However, the dominance of small-seeded grass phytoliths shows Natufians were targeting an array of species without specializing on wheat or barley (Rosen, 2010). Rosen (2010) explained small-seeded grass grain use as an adaptation stimulated by the declining availability of forest staples (e.g. carob, pistachio, almond and acorn) during the climatic deterioration of the Younger Dryas. Although grass seeds are energy rich, many hunter-gatherers prefer to prioritize other plant foods such as nuts due to lower processing costs (Keeley, 1992; Mason, 1995).

Plant processing

Deciphering changes in groundstone technology is a core issue of understanding Pleistocene – early Holocene subsistence. Plant-processing installations are a valuable proxy for understanding trajectories in plant exploitation (Dubreuil, 2004; Eitam, 2009; Wright, 1994). The nature of subsistence change from the Early Epipaleolithic to the Neolithic is increasingly being understood as a changing system of resource specialization and preparation rather than a shift to new staple foods. According to Wollstonecroft (2007, 85), from the Early Epipaleolithic, hunter-gatherers adopted progressively more specialized food procurement and processing technologies. Groundstone technology, which has been shown to relate at least partly to plant processing (Dubreuil and Plisson, 2010), became more common across the Levant from the Early Epipaleolithic onward (Wright, 1994). Increases in the number and frequency of groundstone implements at Levantine sites were also accompanied by the development of deep bedrock features and pestles (Eitam, 2009; Nadel and Rosenberg, 2010). This technological investment is manifested at Raqefet in the site's abundant bedrock features (Nadel and Lengyel, 2009). In the Early Natufian, groundstone technology appears to have become more economically important than in preceding periods. Subsequently the technology remained present throughout the Natufian. More intense food preparation with groundstone would decrease plant food particle-size and thus increase bioavailable energy but with the trade-off of increased cost in processing (Wright, 1994).

Symbolic realms and burial practices

Natufians are distinguished from their predecessors by their material manifestations of symbolic behaviors. Less mobility undoubtedly created new social pressures that influenced belief systems and behavior. An intensification of social complexity may relate to an unprecedented expansion of symbolic activity in the Natufian (Belfer-Cohen, 1991; Grosman et al., 2008). This is

Table 1
Plant genera and species with evidence of exploitation by Natufians in the Southern Levant. Seed total is <70. Remains from Nahal Oren and Raqefet 1970s excavations) were not found in secure archaeological contexts. The new Raqefet results are excluded.

Plant species	Fossil type	Site
Amygdalus communis Almond	Shell	Hayonim[a]
Lens sp. Lentil	Seed	Raqefet[c]
cf. *Pisum* sp. Pea	Seed	Hayonim[a], Raqefetc[c]
Vicia sp. Vetch	Seed	Nahal Oren[d]
Lupinus pilosus Lupine	Seed	Hayonim[a]
Olea spp. Wild olive	Seed	Nahal Oren[d]
Vitis sp. Grape	Seed	Nahal Oren[d]
Hordeum spontaneum Wild barley	Seed	Hayonim[a]
Hordeum sp. Barley	Phytolith	Eynan, Hilazon Tachtit[b]
Triticum sp. Wheat	Phytolith	Eynan, Hilazon Tachtit[b]
Small-seeded grasses	Phytoliths	Eynan, Hilazon Tachtit[b] Natal Oren[d]

[a] Hopf and Bar-Yosef (1987).
[b] Rosen (2010).
[c] Garrard (1980).
[d] Noy et al. (1973).