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What happens around a fire: Faunal processing sequences and spatial distribution at Qesem Cave (300 ka), Israel

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ABSTRACT

The technological innovation involving the controlled use of fire represents a decisive change in human subsistence. Hearths and the spatial distribution patterns associated with them constitute a valuable element in deepening our knowledge on human behaviour and its evolution. Studies focused on hearths and on the use of fire in general are diverse and carried out through different perspectives. Thus, hearths are studied for their meaning in terms of diet, caloric and light capacity and spatial organisation as well as for their role as communication and socialization focal points. The site of Qesem Cave (Israel) shows evidence of the controlled use of fire as early as 400 ka, judging by the burned bones from the lowest units of the stratigraphic sequence. A particular superimposed central hearth that was repeatedly used as a focus for human activities *ca.* 300 ka is the topic of this study. This succession of hearths at the same location in the cave yields dense faunal and lithic remains as well as evidence for spatial differentiation between areas. Here, we present faunal taphonomical data from this specific archaeological context, which includes not only the hearth area (approximately 4 m^2) but also the surrounding areas (approximately 11 m^2). The most common prey species is the Mesopotamian fallow deer (*Dama* cf. *mesopotamica*), which displays a wide age range and a biased anatomical profile including mainly marrow-rich bones such as long-limb bones. These characteristics, especially those regarding the relative abundance of infantile and young fallow deer, lead us to propose that social hunting techniques were practised following a seasonal regime. This paper provides data on human subsistence behaviour during the formation of the hearth and the archaeological unit around it, comparing the two from a taphonomical perspective. Elements such as size (length) of bone fragments and intensity of burning are spatially plotted to show differential space division. All these data are considered in the reconstruction of subsistence strategies and hominin behaviour in the Acheulo-Yabrudian Cultural Complex in the Levant.

1. Introduction

Most authors agree that the use of fire implies significant variations in the lifestyles of Pleistocene human groups (e.g., Roebroecks and Villa, 2011; Shimelmitz et al., 2014 and references therein). Identifying the time frame in which fire became a regular part of human behaviour is crucial for understanding evolutionary history, not only from a biological perspective (e.g., Wrangham, 2009; Wrangham and Carmody, 2010) but also from a social and territorial point of view (e.g., Rolland, 2004; Gowlett, 2006; Stiner et al., 2011; Twomey, 2011, 2013, 2014; Gowlett and Wrangham, 2013; Wiessner, 2014). Rolland (2004) argues that the use of fire implies centrally placed foraging —a major shift from earlier hominin land use patterns. According to this author, two main types of habitation sites can be distinguished based on the nature of using fire. Rolland (2004) differentiates between core areas and home bases, maintaining that meat processing in core areas had to be conducted at locations different from those for activities such as socialising and sleeping. Places where food was being procured, processed and consumed could attract predators; therefore, hominins needed safe daytime places protected from the threat of predation and somewhere to sleep. In contrast, home bases would be places where individuals were safe, where the production and

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maintenance of stone tools could be developed as a regular activity, where grooming and sleeping could take place, and where meat and other foodstuffs could be brought, consumed and shared among group members. This eventually leads to the proposition that the emergence of home bases could be indirectly correlated with the emergence of the controlled use of fire. Important for the evolution of cognition, home bases may have changed the way hominins perceptualized the world around them and, particularly, the way they moved about the landscape and procured food and other resources. The habitual, controlled use of fire may have also changed the way hominins interacted socially (Twomey, 2011, 2013, 2014; Wiessner, 2014). Home bases would provide an ideal setting for the intergenerational transmission of knowledge through prolonged learning of shared technological, socio-economic and cultural traditions (Rolland, 2004; Twomey, 2011; Blasco et al., 2013a; Assaf et al., 2016).

Fire provides light, heat and protection, but perhaps most importantly, as soon as hominins learned to control it and discovered its culinary advantages [e.g., Groopman et al. (2015) highlight the importance of cooking in increasing dietary energy returns, and Carmody et al. (2011) show that cooking substantially increases the energy gained from meat, leading to elevations in body mass], they included it as an integral part of their food *chaine operatoire*. This is why the evidence of burning on faunal remains might also be indicative of anthropogenic processing and consumption. There are several ethnographic studies that analyse the use of fire and its manifestation in the archaeological record (e.g., Binford, 1981; Brain, 1981; Brain and Sillen, 1988), and others focused on establishing diagnostic criteria to differentiate between intentional anthropogenic fires and fires of natural origin (e.g., Grayson, 1988; David, 1990; Lyman, 1994; Mentzer, 2012). Sergant et al. (2006) and Preece et al. (2007) indicate that there is not only a problem in differentiating natural fire from intentional fire, but other processes may also conceal or hide the actual sedimentary thermal alteration generated by a fireplace. That is, the absence of evidence for domestic hearths may be the result of taphonomic processes rather than the absence of fire use. Some sites may not exhibit the kind of preservation potential that is required for evidence of a fireplace to survive (Gowlett, 2006). In these cases, spatial distribution becomes an essential tool for locating possible fireplaces. For instance, Sergant et al. (2006), based on the colour variations on the bones depending on their distance from and exposure to the hearth focus, detect possible fireplaces in Mesolithic sites of NW Europe where there are problems with the conservation of sedimentary thermal impact. A similar case can be observed at Gesher Benot Ya'aqov, Israel (Goren-Inbar et al., 2004), where Alperson-Afil et al. (2009) identify the presence of fireplaces based on an analysis of the spatial distribution of burned flint micro-artefacts using geographic information systems (GIS).

In the case of Qesem Cave, Israel, the presence of a repeatedly used superimposed central hearth, which was identified based on mineralogical and microscopic criteria —Micromorphology and Fourier Transform Infrared (FTIR) microspectroscopy (Shahack-Gross et al., 2014), provides evidence for the controlled use of fire as early as 300 ka (Falgueres et al., 2016), while burned items are recorded as soon as 400 ka at the cave. This is also supported by an account on the use of fire at Tabun Cave some 350 ka (Shimelmitz et al., 2014). The succession of fireplaces at the same location in Qesem Cave suggests a repeated behaviour in the use not only of the cave but also of the occupied space. This situation generated a significant quantity of faunal and lithic remains as well as evidence for the spatial differentiation of activities around the hearth. Our aim in this study is to provide data on human subsistence strategies during the formation of this particular archaeological feature and its surroundings as well as to tentatively characterize activity areas from a taphonomical and spatial point of view.

2. Qesem Cave

Qesem Cave is located at 90 m above sea level some 12 km east of Tel Aviv near the present-day eastern Mediterranean coast (Fig. 1) within the Cretaceous limestone of the Bi'na Formation. Its stratigraphic sequence is divided into a lower sequence (>5 m thick) with clastic sediments and gravel, and an upper sequence (≈4.5 m thick) —with cemented sediment and a large ash component (Karkanas et al., 2007). The sedimentary deposits of Qesem Cave were dated by the Uranium–Thorium (U–Th) series as well as by thermoluminescence (TL) and Electron Spin Resonance (ESR) to between 420 ka and approximately 200 ka (Barkai et al., 2003; Gopher et al., 2010; Mercier et al., 2013; Falgueres et al., 2016).

The macromammal record of Qesem Cave consists of Palearctic species only, thus differing from earlier and later faunal records of the southern Levant, where more African influences (such as gazelles) have been registered. Qesem Cave shows an association composed largely of fallow deer (cf. *Dama mesopotamica*), followed by red deer (*Cervus* cf. *elaphus*), roe deer (cf. *Capreolus capreolus*), aurochs (*Bos*), horses (*Equus ferus*), wild ass (*Equus hydruntinus*) and wild boar (*Sus scrofa*) (Stiner et al., 2009, 2011; Blasco et al., 2014). Zooarchaeological analyses suggest cooperative hunting strategies addressed mainly at fallow deer and the transport of selected ungulate body parts to the cave, where hominins carried out the last phases of carcass processing (Stiner et al., 2011; Blasco et al., 2014). Bone seems to have played a minor role as potential material for the shaping (retouching) of lithic artefacts (Blasco et al., 2013b, 2014; Rosell et al., 2015). The bone retouchers from Qesem Cave show the typical morphological and functional features described in similar or later chronologies (e.g., Rosell et al., 2011; Mallye et al., 2012; Hutson et al., 2013; Daujeard et al., 2014; Rosell et al., 2015).

Qesem Cave has provided a well-preserved microvertebrate assemblage composed of typical Middle Pleistocene micromammals (soricids, microtines, murids and gerbils), including uncommon bats, and hyraxes and squirrels. A significant proportion of lizards, chameleons and agamas have also been documented, together with rare snakes, amphibians, bats, and scarce fish (Maul et al., 2011; Horáček et al., 2013; Smith et al., 2013). The palaeoenvironment analyses based on the ecological preferences of these taxa and their close relatives carried out by Maul et al. (2011) and Smith et al. (2013) suggest a landscape with a mosaic of open and woodland habitats.

The sequence is entirely attributed to the Acheulo-Yabrudian Cultural Complex (AYCC) of the late Lower Palaeolithic (Gopher et al., 2005; Barkai et al., 2009; Barkai and Gopher, 2013). The AYCC is a local cultural entity differing from the preceding Acheulean and the following Mousterian. The AYCC consists of three industries of which two are registered at Qesem. The blade-dominated Amudian industry constitutes the majority of the cave sequence, and the Quina scrapers-dominated Yabrudian industry appears in stratigraphically distinct units in three areas of the cave (Barkai et al., 2009). Hand axes are extremely rare at Qesem, and only a few were recovered within Amudian and Yabrudian assemblages (Barkai et al., 2013). Evidence of lithic recycling has been detected throughout the stratigraphic sequence and in significant proportions in some of the assemblages examined by Assaf et al. (2015) and Parush et al. (2015). The use-wear traces on recycling products indicates a wide range of activities, especially in processing soft to medium materials, most likely involving butchery activities (Barkai et al., 2010) and plant processing (Lemorini et al.,