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Plant use in the Lower and Middle Palaeolithic: Food, medicine, and raw materials

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ABSTRACT

There is little surviving evidence for plant use in the Lower and Middle Palaeolithic periods yet the evidence there is, clearly indicates the importance of plants in the diet, as medicines and as raw materials. Here, the current evidence for plants is summarised, and the way this can be used to enrich perceptions of the Lower and Middle Palaeolithic are explored. The evidence for plant food fits well with basic nutritional requirements while the presence of medicinal plants correlates with plant-based self-medication by animals. Many plant-based technologies are likely to have developed early in the Palaeolithic. Though investigating this is challenging due to a lack of evidence, the extensive evidence for use of plant materials as tools by chimpanzees provides a broad backdrop. The ecological knowledge carried by all hominins would have provided a safety net when moving into new regions, while varying levels of neophobia would have enabled adaptation to new environments as hominin populations moved and climates changed. Recent plant use among traditional societies in high latitudes shows that even in locations with reduced biodiversity, plant resources can fulfil essential dietary requirements.

1. Introduction

Plants were an integral and essential part of everyday life in the Palaeolithic, just as they are today. They provided nutrients, including essential carbohydrates (Hardy et al., 2015a), raw materials, medicines and, once fire had developed, fuel. The importance of plants in human evolution is such that Australopithecine species are in part defined on the physical and isotopic evidence for the differences in their plant-based diets (e.g. Lee Thorp et al., 1994, 2010; Strait et al., 2009). The earliest appearance of cut marked bones indicating animal butchery is 3.4 million years (McPherron et al., 2010) while the earliest evidence for flaked stone tools dates to 3.5 million years (Harmand et al., 2015). The implications of meat eating and stone tool manufacture are considered so significant in terms of behaviour and brain development that this, together with the limited evidence for plants in the early Palaeolithic, has meant that the roles of plants in the diet and technology has been largely eclipsed in these early periods.

Wide-ranging theories on Palaeolithic hominin behaviour and brain development have focused almost exclusively on the need for protein (e.g. Kaplan et al., 2000; Morgan et al., 2015; Richards and Trinkaus, 2009; Snodgrass et al., 2009; Snodgrass and Leonard, 2009). The technologies and use of plant-based raw materials have received little attention, while the link between cognition and technological innovation has focused primarily on lithic raw material acquisition patterns and stone tool technologies (e.g. de Beaune, 2004; Stout and Chaminade 2012; Toth and Schick 2018) .

Yet it is impossible from the dietary (Hardy et al., 2015a), unlikely from the medicinal (Huffman, 2016) and unrealistic from the technological perspectives, that plants were not a fundamental part of all aspects of Palaeolithic life. There is widespread acknowledgement that plants were eaten, and used in technology, throughout the Palaeolithic (e.g. Klein, 2009; Tyldesley and Bahn, 1983), identification of a profound problem of 'missing' data on the early use of plants (Ambrose, 2001), and the recognition that the vast majority of innovations have probably been lost (Reader, 2004). In archaeological contexts with exceptional survival of plant materials, fibre artefacts outnumber stone tools by a factor of 20 to 1, while in anaerobic conditions 95% of all recovered artefacts are either made from wood or fibre (Adovasio et al., 2007). This largely corresponds with chimpanzee tool use, in which tools made from organic materials/vegetation is far in excess of use of stone for tools, with proportions ranging from 11 to 18% for stone, against 78–83% for plant based materials (Reader, 2004). Most of the technological items used by chimpanzees today would not enter the archaeological record (McGrew, 2010a).

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The use of plants as medicine and for technological items is extensive among higher primates (Huffman 1997, 2001, 2003, 2016; Huffman and Seifu, 1989; Humle and Matsuzawa 2002; Koops et al., 2015; Masi et al., 2012; McGrew, 2010a, 2010b, 2013; Pansini and de Ruiter, 2011; Roffman et al., 2015; Russon et al., 2009; Sanz and Morgan 2007; Van Schaik, et al., 1996), while botanical knowledge has been recorded among chimpanzees (Janmaat et al., 2013). McGrew (2010a) suggests that anything done by a chimpanzee today was within the capabilities of the Last Common Ancestor (LCA), 6–7 million years ago. A broad ecological knowledge, which includes plants as well as other naturally occurring items, would have provided the foundation for adaptation to changing climates and environments as hominins spread into new regions (Hardy and Kubiak-Martens, 2016). Therefore, use of plants needs to be incorporated into perspectives on early Palaeolithic diet, dispersals, and behavioural, technological and cognitive development for, not to do so, results in partial perspectives (e.g. Guil-Guerrero 2017; Hosfield, 2016). For example, the availability and dietary need for carbohydrates should be taken into account when investigating survival limits.

Here, I outline the current evidence for the use of plants in the Lower and Middle Palaeolithic as food, medicine and raw materials and place this within a broader evolutionary perspective. I also examine ways in which this evidence can be used to enrich perceptions of these periods, in terms of diet, the use of non-nutritive plant secondary compounds, technological expertise, occupation of cold environments and pioneer populations.

2. Archaeological evidence for plants

Table 1 summarises the evidence of plant use from the Lower and Middle Palaeolithic. This includes plant and wood fragments, evidence from phytoliths, and chemical and microfossil evidence extracted from dental calculus. It does not include results of use wear or dental microwear studies, these are discussed below. The evidence for fire has not been included. Arguments about the timing of the habitual, controlled use of fire have been extensively discussed elsewhere (Gowlett, 2016; Gowlett and Wrangham, 2013; Roebroeks and Villa, 2011; Wrangham., 2017; Wrangham and Carmody., 2010). Though the timing of the earliest use of fire remains unclear, hearths representing repeated, controlled use of fire are present in the archaeological record from around 400 ka (Karkanas et al., 2002; Shahack-Gross et al., 2014). The evidence for controlled use of fire is extensive in the Middle Palaeolithic (Albert et al., 1999, 2000, 2003, Albert, 2007; Allué et al., 2012; Badal et al., 2012; Cabanes et al., 2007, 2010; Esteban et al., 2017; Goldberg et al., 2012; Madella et al., 2002; Pastó et al., 2000; Vallverdú et al., 2005). The evidence for birch bark pitch, which can only be recovered through heating at high temperatures in an oxygen-free environment, on artefacts from a pre-MIS 6 context (Mazza et al., 2006), is perhaps the clearest indication that complex pyrotechnology was well established by the early Middle Palaeolithic.

3. Plants as food

Use wear traces from the Oldowan site of Kanjera (~2 Ma) were interpreted as the result of processing soft grit-covered plant materials such as underground storage organs (USOs) (Lemorini et al., 2014). USOs include roots, bulbs, tubers, corms and rhizomes, examples eaten today include potatoes, yams, onions and ginger.

Abundant Celtis seeds occur on several Lower and Middle Palaeolithic sites, including Dmanisi, Gran Dolina, Zhoukoudian, Vallonet, Terra Amata, Caune de l'Arago, Grotte du Lazaret, Mas des Caves, Douara Cave (Allué et al., 2015; Chaney, 1935; de Lumley, 1975; Laville and Renault-Miskovsky, 1977; Matsutani,1984). These are arguably the most common edible plant remains from early Palaeolithic periods, though Dennell (2008) argues for caution suggesting that other animals also eat these seeds. The survival of Celtis seeds is largely due to a process of biomineralization that assists in their preservation (Allué et al., 2015).

Further evidence for plants in the Lower Palaeolithic includes starch granules from two different plant sources, one of which may be from grass seeds, recovered from samples of dental calculus from the site of Sima del Elefante (1.2Ma) (Hardy et al., 2017). Fragments of nut shell from 7 species comprising wild almond (*Amygdalus communis* ssp. *Microphylla*; *A. korshinskii*) - this is toxic when raw (Zohary et al., 2012) -, prickly water lily (*Euryale ferox*), Atlantic pistachio (*Pistacia atlantica*), pistachio (*P. vera*), Palestine oak (*Quercus calliprinos*), Mt Tabor oak (*Q. ithaburensis*) and water chestnut (*Trapa natans*), were recovered from the 790 ka site of Gesher Benot Ya'aqov together with pitted basalt and limestone stones, possibly used for opening the nuts (Goren-Inbar et al., 2002, 2004). An additional assemblage of over 100,000 macrobotanical fragments was also recovered (Melamed et al., 2016). Though the assemblage was uncarbonised, and therefore cannot be ascribed with absolute certainty to human agency, Melamed et al. (2016) conducted a comparative study with the natural plant distribution from associated geological layers. This demonstrated a far higher proportion of edible plants in the archaeological layers, suggesting deliberate collection.

Boraginaceae, for which there is evidence from Lower Palaeolithic Dmanisi (Gabunia et al., 2000; Messager, et al., 2008) as well as Middle Palaeolithic Douara Cave (Matsutani,1984), comprise a family that has many taxa which are both edible and have a broad range of medicinal properties. Chemical compounds identified as polyunsaturated fatty linoleic and linolenic acids, most probably from pine nuts, were extracted from samples of hominin dental calculus from Qesem Cave (400–300 ka), indicating consumption of food items containing these essential fatty acids (Hardy et al., 2015b). A large assemblage of uncarbonised plant remains comprising edible and medicinal plants were recovered from Schöningen (300 ka). It is not clear though, whether these plants were brought to the site or are the remains of natural deposits (Bigga et al., 2015). Middle Palaeolithic sites where plant remains have been recovered include Theopetra Cave where many edible plant species including seeds, nuts, and fruits were recovered (Mangafa, 2000). At Ehringsdorf, Germany, charred linden tree fruits (*Tilia*) and Kornel cherry (*Cornus mas*) fruits were recovered while at Ributz, Germany charred hazelnuts (*Corylus avellana*) were found (Richter, 2016). Charred seeds from species that are edible, and some that have medicinal properties, were recovered from Neumark-Nord 2, Germany (Pop et al., 2016). A large assemblage comprising charred legume and other fragments of both edible and medicinal plants, were recovered from Kebara Cave, Israel (Lev et al., 2005). A wide range of phytoliths from Amud Cave, Israel (70–55 ka) suggest grass seeds may have been collected for food (Madella et al., 2002). DNA and chemical biomarkers demonstrating ingestion of starchy foods, mushrooms and medicinal plant species were extracted from the dental calculus of Neanderthals from El Sidrón, Spain (49 ka) (Hardy et al., 2012, Weyrich et al., 2017). Starch granules suggesting ingestion of plant food were recovered from dental calculus samples at several other Neanderthal sites (Henry et al., 2011; Power et al., 2018; Salazar García et al., 2013). Finally, charred pine nut and olive fragments were recovered from the late Neanderthal site of Gorham's Cave, Gibraltar (Barton et al., 1999; Barton, 2000).

The evidence displayed in Table 1 is not extensive, particularly considering the long period of time it covers, but it demonstrates a broad use of plants that differs from the theoretical frameworks that outline an incremental use of plants through the Upper