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Quarries as Places of Significance in the Lower Paleolithic Holy Triad of Elephants, Water, and Stone

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RESEARCH

ABSTRACT

Human dependency on stone has its origins in Lower Paleolithic times, and some of the most primordial elements in human-stone relationships are rooted in those early days. In this paper, we focus our attention on extensive Paleolithic stone quarries discovered and studied in the Galilee, Israel. We propose a triadic model that connects stone outcrops, elephants, and water bodies to shed light on what made stone quarries places of significance, beginning in the Lower Paleolithic, and continuing throughout the ages.

Résumé: La dépendance humaine à l'égard de la pierre tire ses origines de l'époque du Paléolithique inférieur, et certains des éléments les plus primordiaux des liens entre les êtres humains et la pierre sont ancrés dans cette ère des débuts. Nous nous intéressons en particulier dans cette article aux vastes carrières de pierre du Paléolithique ayant été découvertes et étudiées en Galilée, en Israël. Nous proposons un modèle triadique reliant les affleurements de pierre, les éléphants et les étendues d'eau pour mettre en lumière ce qui a fait des carrières de pierre des lieux chargés de sens, à compter du Paléolithique inférieur et par la suite tout au long des âges.

Resumen: La dependencia humana de la piedra tiene sus orígenes en el Paleolítico inferior, y algunos de los elementos más primordiales en las relaciones entre el hombre y la piedra tienen sus raíces en esos primeros días. En este artículo, centramos nuestra atención en extensas canteras de piedra del Paleolítico descubiertas y estudiadas en Galilea, Israel. Proponemos un modelo triádico que conecta afloramientos de piedra, elefantes y cuerpos de agua para arrojar luz sobre lo que hizo que las canteras de piedra fueran lugares de importancia, comenzando en el Paleolítico inferior y continuando a lo largo de los siglos.

KEYWORDS

Stone quarries, Elephants, Water, Lower Paleolithic

Introduction

Extensive Paleolithic stone quarries have been documented in the Galilee, Israel. We argue that human groups repeatedly returned to the same locales over many generations to procure stone and produce desirable tool kits (Finkel et al. 2023). These quarries became large industrial arenas, acting as landscape beacons and possibly aggregation sites for Paleolithic groups from near and afar (Finkel et al. 2016, 2019). But why return to specific locales when stone also can be found elsewhere? Why did specific stone sources in the landscape become places quarried over and over for many thousands of years, i.e., stone pilgrimages?

We make a bold attempt to connect elephants, water bodies, and stone outcrops, which were all essential components of Lower Paleolithic hominin adaptation and lifeways. We construct a model from this triad that will enable us to decipher the significance of the extensive stone quarries discussed herein and illustrate how these previously unconnected natural assets are related. Central to our argument is the significance of elephants in human diet and culture during Lower Paleolithic times in the Levant (Barkai 2021; Ben-Dor et al. 2011, 2020a, 2021; Dembitzer et al. 2022). Prehistoric research usually makes connections between elephant butchering sites and stone tools used to process the animal. However, scholars often neglect to examine the quarry sources for stone tools found at elephant butchering sites. Studies of the very long Lower Paleolithic period demonstrate that immense quantities of stone must have been procured, shaped, transported, used, and discarded. The extreme wealth of stone-tool assemblages retrieved at Lower Paleolithic sites bears silent testimony to the centrality of stone acquisition and use in the deep past (e.g., Goren-Inbar et al. 2018; Shemer et al. 2022; Solodenko et al. 2015; Yravedra et al. 2019).

Research on human migration routes usually focuses on the relations between topography, water sources, and animal kill sites but does not consider the location of stone sources along those routes in relation to embedded vs. direct procurement (see Binford 1979, 1980; Agam 2020). We combine these elements to demonstrate that the nexus between elephants, water, and stone sources made these quarries places of supreme significance for early human groups inhabiting the Levant during Lower Paleolithic times.

Elephants and humans depend on a steady water supply and Lower Paleolithic hunter-gatherers must have been aware that elephant tracks and pathways led to water sources. Elephants are known to create remarkable pathways in the landscape, and such Paleolithic highways are thought to have served early human groups in their journeys inside Africa and outside of the continent (Kübler et al. 2015, 2016). Given the enormous size and weight of an elephant, archaeological and ethnographic studies indicate that people would have primarily butchered the animal at the procurement locale and brought stone tools to the location (Agam and Barkai 2018; Lemorini et al. 2022 and see relevant ethnographic examples at Fisher 1993, 2001; Lewis 2015). Thus, we work under the assumption that early humans were constantly looking for stone sources near elephant pathways to produce the necessary butchering and processing toolkits. We can thus posit a geographical connection between elephant migration paths toward water sources and stone extraction and reduction complexes. In this paper we propose that the long-lasting procurement of elephant fat/meat in the Pleistocene Levant was established upon strong connections between elephant and human migration paths, water sources, and human ambush locations with the quarry sources for stone butchering tools. We will present relevant case studies to justify the model suggested for the nexus between elephants, water, and stone and argue that this Paleolithic triad was one of the foundations for the very long and successful human adaptation during Lower Paleolithic times.

Elephant Meat/Fat Acquisition and Stone Butchering Tools

Stone tools are the most conspicuous phenomenon in the prehistoric archaeological record. Solid archaeological evidence verifies the use of stone tools in animal carcass processing from their earliest production some three million years ago (Plummer et al. 2023). Throughout the Pleistocene and beyond, humans depended on stone tools to access the meat, fat, and marrow essential to their subsistence and adaptation (e.g., Assaf et al. 2020; Marinelli et al. 2021; Panera et al. 2014; Solodenko et al. 2015; Venditti et al. 2019, 2021; Yravedra et al. 2012; Zupancich et al. 2021). Archaeological evidence, coupled with experimental data, show that the iconic Lower Paleolithic handaxes mainly were used for processing animal carcasses

(Claud 2008, 2012; Claud et al. 2009; Gürbüz et al. 2023; Jones 1980; Keeley 1980:160–170; Machin et al. 2007; Mitchell 1996; Solodenko et al. 2015; Zupancich et al. 2021). Handaxes also were employed in other tasks (Dominguez-Rodrigo et al. 2001; Yravedra et al. 2017), and some scholars propose that the handaxe was a multipurpose tool, a sort of Paleolithic Swiss Army knife (Wynn 2002). We highlight the repeated association between handaxes and butchered animal carcasses in the archaeological record, as well as the efficiency of handaxes in processing and dismembering carcasses, and in particular carcasses of large-game taxa (Jones 1980, 1981, 1994; Key and Lycett 2015, 2017).

The recurrent association between handaxes and very large game at Lower Paleolithic sites in the Old World illustrates the dependency of Paleolithic humans on animal meat and fat (Ben-Dor et al. 2011, 2016, 2021; Zink and Lieberman 2016). It is well-accepted that carnivory supported human evolution, starting with the emergence of the genus Homo (Ben-Dor et al. 2021; Domínguez-Rodrigo and Pickering 2017; Plummer et al. 2023). During the Lower and Middle Paleolithic times, when megaherbivores roamed the landscape, they represented the highest biomass density and were likely the leading source of human nutrition (Ben-Dor and Barkai 2020a, b; Dembitzer et al. 2022). Human dependence on the consumption of plants did not occur until after the late Quaternary extinction of megafauna, some 40,000 years ago (Power and Williams 2018). Studies of Indigenous peoples craving for fat and meat are well documented (Biesele 1993; Tanner 2014). The presence of the remains of consumed prey and fat acquisition at archaeological sites suggest this craving extends deep into history (Ben-Dor et al. 2011, 2016; Blasco et al. 2019; Boschian et al. 2019; Morin 2020; Solodenko et al. 2015; Speth 2020). Fat and protein have been recognized as essential elements in the human diet during the Pleistocene (Barkai 2021; Ben-Dor et al. 2021; Bunn 2006; Domínguez-Rodrigo and Pickering 2017; Panera et al. 2014; Yravedra et al. 2012), with complementary calories having been obtained from vegetal sources (Hardy et al. 2015).

Lower Paleolithic humans appeared on the scene some two-and-a-half million years ago in Africa, equipped with extended brain capacity, large body size, and digestive and dental systems adapted towards high-energetic food digestion capable of sustaining the large brain and body (Aiello and Wheeler 1995; Domínguez-Rodrigo and Pickering 2017; Zink and Lieberman 2016). Animal fat and marrow provided the necessary food intake for the essential daily energy expenditure, especially in cases where plants were not available in abundance and before the habitual use of fire for cooking (Ben-Dor et al. 2011, 2021). Human dependency on meat and fat led to the regular acquisition of animal carcasses by hunting (as well as scavenging) and a preference for megaherbivores such as elephants, mostly because they provided large quantities of high-quality fat (Agam and Barkai 2016, 2018; Gaudzinski-Windheuser et al. 2023; Guil-Guerrero et al. 2018; Linares Matás and Yravedra 2021).

Elephant Migration Paths, Water Sources, and Early Humans

Like humans, elephants are obligate drinkers, consuming up to ~ 200 L daily (Wall et al. 2013). Research on African savanna elephants demonstrates that "Water availability is considered to affect elephant movement, both on a daily and seasonal basis and maybe a greater driver for elephant movement than mineral availability" (Sach et al. 2019:13). Elephants' spatial memory enables them to make decisions that repeatedly bring them along the same paths (up to ~ 50 km long) to the nearest water holes, with very high accuracy (Polansky et al. 2015; Tsalyuk et al. 2019; Wato et al. 2018). Paleolithic hunter-gatherer groups were surely aware of this ability; we can thus assume that humans used elephants as guides, following them on long-distance and seasonal migrations. Paleolithic hunter-gatherer groups likely followed elephant groups to water sources (perhaps also enjoying the open paths they created in thick, bushy terrain) and ambushed them when they could, along those paths, to supply themselves with fat and meat (Kübler et al. 2015; but see reservations in Lombard et al. 2021).

A few Paleolithic archeological sites demonstrate the connection between elephant migration paths, early humans, and water bodies. Evidence from Kenya, dated to ~ 1.5 mya, suggests that *Homo erectus* migrated along water bodies shared by elephants and bovids (Roach et al. 2016). Kübler et al. (2015) proposed that Olorgesailie, a key site in the East African Rift Valley (~ 1.2 to ~ 0.5 Ma BP) with abundant evidence of large-mammal butchery including elephants, was a hunting ambush locale primarily due to limited alternative animal routes in its vicinity.

Finds from the 0.73–0.98 mya Acheulean biface-rich site of Kariandusi, Kenya "show that it occupied a unique window of opportunity in place and time for trapping mammals constrained to move through a narrowly defined topographic bottleneck between edaphically-rich areas." The conservation of faunal remains at this site is quite problematic, but despite the lack of direct evidence of elephants, the authors "infer that a full suite of African large mammals would have been available as prey for hominin exploitation" (Kübler et al. 2016:1).

Fossil footprints of both hominins and elephants were reported in Lower Paleolithic sites, supporting our claims for co-habitation in the same landscapes. The evidence includes the late Lower Paleolithic site of

Schöningen, Germany (Altamura et al. 2023), and 1.5 Ma tracks recovered near Ileret, Kenya (Roach et al. 2016). Later human lineages such as *Homo heidelbergensis*, Neanderthals, and modern humans, also left footprints that they walked along elephant trails, as recovered from Tora-Piccilli in central Italy (350 ± 3 Ka) (Palombo et al. 2018); the coastal dunes of Gibraltar on the southern tip of the Iberian Peninsula (28 ± 3 Ka) (Muñiz et al. 2019); the Last Glacial Maximum in the Arabian Peninsula (Stewart et al. 2020), and possibly during the Last Glacial Maximum in New Mexico (Bennett et al. 2020, though contested by Haynes 2022; Pigati et al. 2022). Thus, the ichnological evidence consistently illustrates human presence at the same locales as proboscideans whenever and wherever these two species co-existed on Earth.

We propose that early humans knew that elephants consistently walked along the same paths to waterholes and used this information to hunt/ambush elephants along these paths. In the course of hunting/ambushing elephants, humans repeatedly utilized specific quarry sites along the trails in preparation for butchering the large game. We present below archaeological evidence from two Paleolithic sites in the Jordan Rift Valley in the Galilee, the middle Lower Paleolithic Gesher Benot Ya'akov site and the late Lower Paleolithic Ma'ayan Barukh (MB), where more than 3500 flint handaxes were collected (Sharon et al. 2022). Both sites are located in the northernmost segment of the Dead Sea Rift, part of the Great African Rift System (Figure 1). At both sites, animal processing tools were brought to the locality from both nearby and distant sources in order to procure and butcher large prey.

A Model of Paleolithic Elephant Trails, Quarries, and Butchering Sites in the Eastern Galilee, Israel

The Eastern Galilee lies adjacent to the northern part of Jordan Rift Valley and was most probably one of the major routes connecting Africa and Eurasia during Pleistocene times. Human presence at this rejoin was documented as early as 1.4 million years ago at the site of Ubiediya, one of the earliest sites outside Africa, and continued during Lower Paleolithic times, as indicated by the sites of Gesher Benot Ya'akov and Ma'ayan Baruch (Bar-Yosef 1994), and later throughout the Paleolithic and Neolithic. Lower Paleolithic sites in the area are characterized by abundant stone-tool assemblages, in which the handaxe is especially prominent. Faunal assemblages are comprised of different animal taxa; however, ubiquitous elephant remains stood as central in the human diet (Ben-Dor et al. 2011). Early humans, most probably Homo erectus (sensu lato), inhabited this area for hundreds of thousands of years and most probably represent several migra-

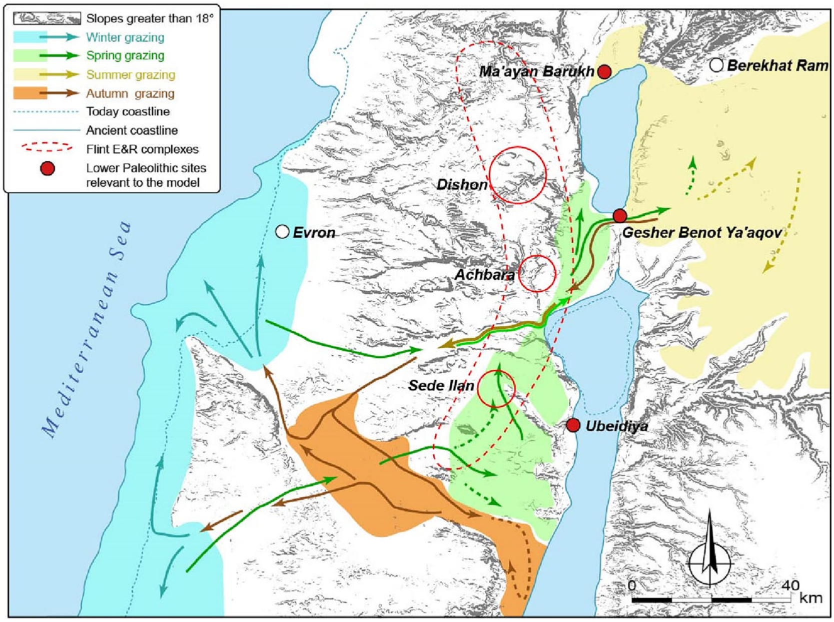

Figure 1. Map of the region with water bodies present during the Middle Pleistocene. The "triad" model in geographical terms: Note Acheulean GBY and MB and the flint extraction and reduction "strip" of the eastern Galilee in red (based on Devès et al. 2015 and with their permission). Grazing areas refer to potential elephant grazing. Hula Valley was filled during the Pleistocene by Hula Lake (northern lake in the map), situated between GBY and MB

tion waves out of Africa. The archaeological evidence suggests that the Eastern Galilee provided Lower Paleolithic early humans with their bare necessities, namely food, water, and stone and was thus a preferred landscape for human habitation.

The potential productivity of different areas in northern Israel during the Lower Paleolithic was analysed to assess the possible migration routes of large herbivores to their seasonal grazing grounds. Migratory paths were located by using topographic, edaphic, and soil water retention data (Devès et al. 2014, 2015; see also Kübler et al. 2019). Combining their data with archeological evidence of elephant remains unearthed at the sites of Ubiediya, Ma'ayan Baruch (MB), Gesher Benot Ya'akov (GBY), and Evron (Figure 1), they posited a close link between elephants, water bodies, and archaeological sites yielding handaxes. As no information is available regarding the stone sources used at Ubiediya and Evron, these sites will not be discussed here. However, we hope that future discoveries will allow us to combine these sites within the model presented here.

The extensive Paleolithic stone quarries and tool manufacturing workshops discovered and studied in the eastern Galilee provide the background for evaluating the significance of stone sources for early humans and their embeddedness in group memory and appreciation (Finkel et al. 2016, 2019, 2020, 2023). Flint extraction and reduction (E&R) sites, situated a day's walk east of the Jordan Rift Valley, are characterized by high-quality Eocene flint. We termed this region the Eocene flint E&R "strip" of the eastern Galilee (Finkel et al. 2019), which includes, from south to north, the Sede Ilan, Achbara (Figure 1) and Dishon flint E&R complexes (Figs. 1, 2, 3), where extensive Lower Paleolithic quarrying and knapping activities took place, including the production of large flakes for the manufacture of handaxes. Handaxes rejected during the production process were also unearthed in this area (Finkel et al. 2016). Early humans deliberately sought these high-quality flint sources, returning to them repeatedly.

Our triad model of elephants, water, and stone is demonstrated at the Middle Lower Paleolithic site of Gesher Benot Ya'akov (GBY, ~ 780 kya) (Goren-Inbar et al. 1994, 2018) and at the late Lower Paleolithic site of Ma'ayan Barukh (MB), where more than 3500 flint handaxes were collected (Sharon et al. 2022). Both sites are located in the northernmost segment of the Dead Sea Rift, part of the Great African Rift System (Figure 1).

Gesher Benot Ya'akov (GBY) is currently located on the banks at the outlet of the Upper Jordan River, south of the Hula Valley (Figure 1); however, during the Middle Pleistocene, the site was situated on the banks of an ancient lake. The terrain is basaltic. The waterlogged archaeological horizons contain numerous flint and basalt tools, as well as plenty of animal bones and even botanical remains. Excavations at the site were conducted during the 1990s by Goren-Inbar (Goren-Inbar et al. 2018). In Layer II-6, excavations yielded a butchered elephant skull associated with basalt and flint artifacts, including handaxes (Goren-Inbar et al. 1994). Each archaeological horizon at the site yielded elephant remains as well as handaxes (Rabinovich and Biton 2011; Sharon et al. 2011).

In additional excavations, primarily north of the Benot Ya'aqov Bridge (Gilead 1968; Sharon et al. 2010; Stekelis 1960), flint handaxes were found in very low numbers within the excavated layers (Sharon 2007), but hundreds of flint handaxes, usually well crafted, were collected from the different Acheulian localities in the vicinity of these sites. Detailed ICP-MS geochemical analysis of ten flint handaxes collected at the locality known as North of Bridge Acheulian (NBA, Grosman et al. 2011; Sharon et al. 2002, 2010) situated 600 m north of GBY, showed that nine of the ten were made of Eocene flint, similar to the high-quality flint found in the Dishon E&R complex, while the tenth was from either an Eocene or a Cenomanian source. This analysis, combined with geological surveys of

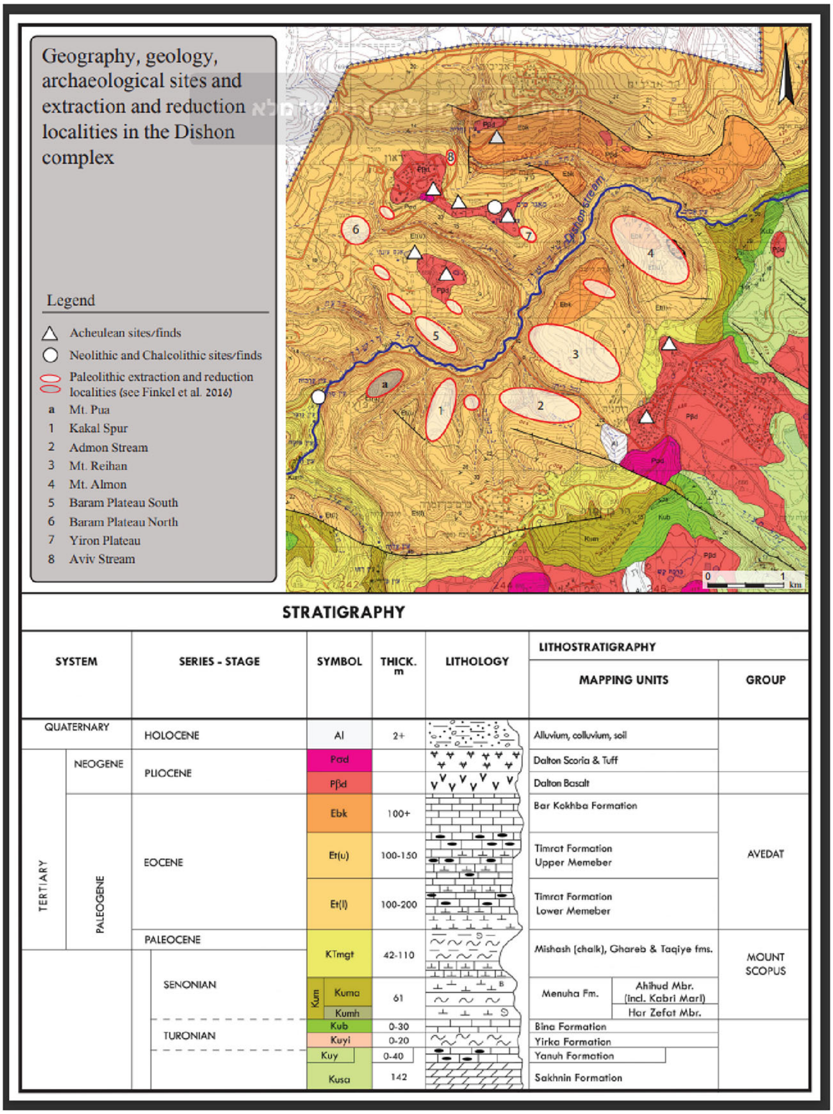

Figure 2. Geography, geology, archaeological sites, and E&R localities in the Dishon E&R complex area (geological map: Levitte and Sneh. 2013)

rock exposures and streambeds of multiple streams flowing into the Hula Valley from possible primary flint sources, demonstrated that suitable flint for the production of the GBY handaxes was either collected from a limited secondary Eocene source at the Dishon streambed located eight km

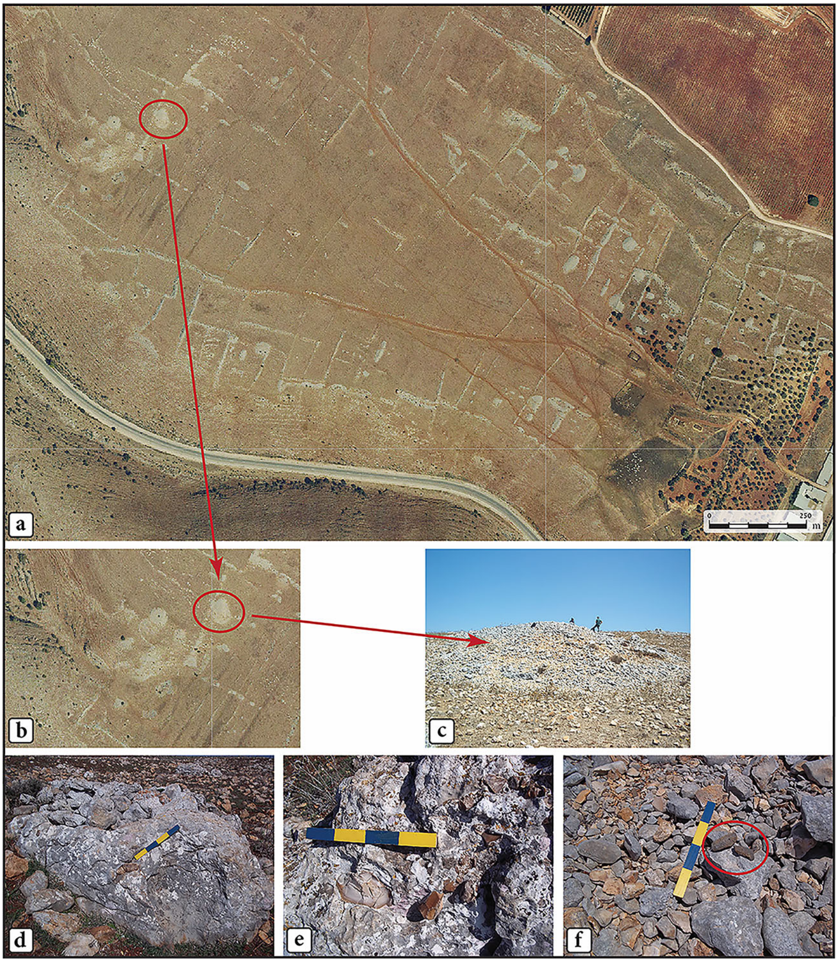

Figure 3. **a**, **b** Aerial photo of extraction and reduction locality No. 3—Mt. Reihan, within the Dishon flint E&R complex, with a surveyed pile marked by the circle (Finkel et al. 2016); **c** ground photo from the south; **d** flint nodule in limestone karren; **e** flint nodules in limestone; **f** limestone, flint (all over) and basalt (circled) on the surveyed pile

northwest of the site or retrieved from a primary source—the Dishon Plateau E&R complex, located ~ 20 km west of GBY and some 800 m above the Hula Basin floor. It should be noted that while the Dishon streambed flint could have sufficed for very limited handaxe production, the source for the hundreds of discovered handaxes was probably the Dishon Plateau flint E&R complex (Finkel et al. 2023).

A note regarding GBY basalt tools is in order here. Flint, limestone, and basalt were transported to each archaeological horizon of GBY from a different source, and the desired stone was quarried, shaped, and brought to the site to be used for the planned task (Goren-Inbar et al. 2018:413). The 473 basalt handaxes found at GBY were shaped from large flakes removed from giant basalt cores (Goren-Inbar et al. 2018:238), likely quarried from "basalt flows in the vicinity of the site, as the size and weight of these cores suggest that they were not transported over very long distances" (Goren-Inbar et al. 2018:322).

Following an ethnographic example, Goren-Inbar et al. (2018) also speculated that the site's inhabitants conducted quarrying expeditions. Flint was sourced from somewhat greater distances than basalt. Still, whatever the stone type or its source, the authors interpret the biface-rich layers of the site as part of a long-term strategy "to exploit very large mammals (elephants, hippos, rhinos) that were driven to the lake margins, killed, and processed there" (Goren-Inbar et al. 2018:419). They further explain that equipping is an essential stage in preparation for the hunting of large mammals. The opportunity to acquire an enormous amount of fat, marrow, and meat requires preparation and complex planning. It necessitates the acquisition of appropriate rock, its transportation, and its modification into suitable tools. It is impossible to carry out the entire chain of production of the tools simultaneously with the hunt; this must take place earlier and the tools need to be placed in proximity to the intended location of the kill, as the large carcass would be difficult to move (Goren-Inbar et al. 2018:419).

Direct procurement of the basalt used to produce the GBY basalt handaxes, the proximity of a water source, and the association with the remains of butchered elephants thus demonstrate another facet of the elephant—water—stone model we propose.

The late Acheulian site of Ma'ayan Barukh (MB) is located on the northern edge of the Hula Valley (Figure 1), most probably near the Pleistocene Hula Lake. The site has not been excavated, and thus, the local microgeology of the site is not fully understood (Ronen et al. 1980; Stekelis and Gilead 1966). However, since the 1930s, thousands of exceptionally well-made flint and basalt handaxes have been collected from the site's surface and several trenches. Elephant remains also were retrieved. Although MB is located on top of Hazbani basalts that formed ca. 0.9 mya (Heimann and Sass 1989), there are only 20 basalt handaxes out of the ca. 3500 flint handaxes recovered and stored at the Upper Galilee Museum of Prehistory at Kibbutz Ma'ayan Barukh (Lister et al. 2013; Rosenberg et al. 2015; Sharon et al. 2022). Stekelis and Gilead (1966) postulated that the flint source for the MB handaxes was an Eocene flint outcrop located some 6 km north of the site, even though this source in southern Lebanon has not been located. Ten MB flint handaxes were geochemically analyzed, all presenting Eocene flint, similar to flint found in the Dishon E&R complex (Finkel et al. 2019, 2023). Given the very large amount of flint needed for producing 3500 handaxes—around 3.5 tons (Finkel et al. 2023 and references therein)—a large, primary source must have been utilized, most probably at the Dishon Plateau.

Given the potential evidence pointing at elephant grazing areas surrounding the paleo Hula Lake (Devès et al. 2015), the presence of Acheulian sites containing elephant remains such as GBY, MB, and Ubeidiya is far from surprising. It is suggested that elephant herds moved routinely, using well-established tracks, between seasonal grazing areas in the Galilee and thus could be anticipated and followed by early humans. The site of GBY, as a matter of example, was repeatedly visited by early humans for at least 50,000 years, and each of its archaeological horizons contains elephant remains (Rabinovich and Biton 2011; Sharon et al. 2011), indicating that elephants provided for the site's inhabitants for many generations. The presence of butchered elephant remains associated with many handaxes (Goren-Inbar et al. 1994) strengthen the linkage between these megaherbivores and the specific butchering and processing tools used for this task across the Pleistocene Old World for hundreds of thousands of years (Barkai 2021; Finkel and Barkai 2018, 2021). The prolonged dependency of calories extracted from elephants in the Hula Valley area necessitated a constant and plentiful supply of stone to produce numerous handaxes and other relevant stone tools. The Dishon quarries and workshop sites likely provided the toolstone source for sites in the Hula Valley. We work under the assumption that the rich Eocene outcrops of the eastern Galilee were not unnoticed by Acheulian early humans, who were intimately acquainted with the environment and the benefits it provided. So as we see it, the combination of elephant trails, water bodies, and plentiful flint sources supported human presence in the Galilee for many thousands of years throughout the Pleistocene. This perspective could also be relevant for the sites of Ubeidiya, at the southern rim of the Hula Valley, and the site of Evron in the western Galilee, both containing elephants and handaxes. However, geochemical analyses of Ubeidiya and Evron stone artifacts are needed to determine if the toolstone is associated with the Dishon, Achbara, or Sede Ilan quarries, or other unknown quarry sites in the northern coast of Israel, along posited migration routes.

Following the extensive evidence from the Upper Galilee, we propose a triad model that connects key ingredients for early human survival: calories, water, and stone. As elephants provide both calories and access to fresh water sources, we propose that early human movement patterns and habitat selection can be better reconstructed and understood if we "look for the elephant". Although the connection between elephant migration routes, water sources, and early human survival is well known, our model adds the previously ignored stone sources to the equation.

To extract the nutrients from large game, humans needed a constant supply of stone processing tools, and thus, the optimal location must have included plentiful stone outcrops in the vicinity of elephant migration routes. This model works beautifully in the case of the Upper Galilee and provides a coherent framework for understanding Lower Paleolithic human endeavours documented in the region, manifested both at habitation sites like GBY and MB and at the extensive Dishon flint E&R complexes. The model combines human habitation and stone quarrying sites into an integrative settlement pattern that enables a better understanding of Lower Paleolithic humans' complex adaptation mode. Our model also reflects early humans' profound and intimate acquaintance with the landscape, environment, the behaviour of related animal species, and the potential of stone outcrops to sustain their needs for generations. We believe that such ancient ecological knowledge was at the root of the successful adaptation of early humans in the Levant and beyond during the very long Paleolithic period. We now proceed to describe, in brief, test cases that can be viewed in the framework of our model to gain a better understanding of the Lower Paleolithic mode of adaptation at other locations in the Old and New Worlds where humans closely interacted with megaherbivores.

Applying the Model to Other Lower Paleolithic Sites

Olduvai, Tanzania

Our elephant-water-stone triad can be applied to several archaeological localities at Olduvai Gorge, Tanzania, where elephant butchery sites, handaxes, and a flint quarry source are found near an ancient lake margin. The MNK chert/flint quarry site, dated to ~ 1.6 mya, is situated ~ 1 km from a lake margin (Kimura 1997), where early humans left two elephant butchery sites, MNK and FLK (Dominguez-Rodrigo et al. 2014; Leakey 1971). The EF-HR site, situated ~ 4k northwest of MNK, revealed hundreds of handaxes (de la Torre et al. 2018).

Manzanares Valley, Spain

The Manzanares Valley near Madrid, an area described as "A good country for Proboscideans and Neanderthals" (Panera et al. 2014), can also be viewed in light of our triad model. The area yielded numerous archaeological sites where proboscidean remains and stone tools were found, all situated along the riverbed (Panera et al. 2014). At the Preresa (Yravedra et al. 2012) and Edar Culebro 1 (Yravedra et al. 2014) sites, cut marks made by stone tools were identified on proboscidean bones, providing direct evidence for the processing of these megaherbivores using stone tools. At the nearby site of Áridos 1, the remains of a disjointed female *Elephas antiquus* were found in association with Acheulian lithic remains, and at the site of Áridos 2, a partial skeleton of an adult male *Elephas antiquus* was found associated with Acheulean stone tools. Both sites are dated to ~ 380 kya (Yravedra et al. 2010). Of special interest here are cut marks identified on elephant bones at the site of Áridos 2, reflecting flesh and viscera extraction by Middle Pleistocene hominins. Handaxes were sometimes used as butchering tools at the site, reinforcing the suitability of these large cutting tools as ultimate elephant processing cutlery (Yravedra et al. 2010). At Los Ahijones, within an 8–12 km range of those sites but not in the Manzanares Valley itself, several flint quarrying sites revealed extensive Acheulean handaxe production from primary flint sources dated to 150–115 kya—the last quarter of the Middle Pleistocene (Barez del Cueto et al. 2016). These chronologies seem to overlap with the dates obtained for the four excavated proboscidean butchering sites along the Manzanares River mentioned above. These findings encouraged the authors to conclude that hunter-gatherer groups "used the biotic and lithic resources of this environment in a chronological range spanning hundreds of thousands of years (Barez del Cueto et al. 2016:333)". This area might thus fit well with the model presented here.

Wonderboom, South Africa

The Acheulean site of Wonderboom is located ~ 800 m from a river passing through the Magaliesberg Range. The Range forms a topographic barrier through the narrow pass, providing lookout points across grazing plains and the valley. Forty-six handaxes made of quartzite were found at the site. While no evidence for butchering was found at the site, reconstruction of the paleoenvironment suggests a wide variety of game, including two species of elephants. Lombard et al., (2021:1) wrote,

> the locality provided a permanent, predictable water source and access to wetland zones north and south of the mountain. Quartzite outcrops in a sheltered valley with direct evidence of flake quarrying for later Acheulean tool knapping contributes to the strategic attraction of the Wonderboom landscape for early humans within a diverse and rugged biotope.

Torralba and Ambrona, Spain

These two Lower Paleolithic sites received a lot of scholarly attention during the past century, acting as major case studies for deciphering human-elephant interactions and resolving the hunting versus scavenging debate. Ambrona bears relevance to our model, as it shows plentiful remains of butchered elephants along handaxes and other flint items deposited in a swampy area (Villa et al. 2005). It is clear that stone toolkits were brought to the site in order to butcher the elephants. However, no specific stone sources have been identified in the case of the handaxes and it is suggested that these items were brought from afar. In any case, this is an interesting combination that might fit very well the model presented here.

Sites Presenting Different "triads"

Other large herbivores can stand in for elephants in our triad model. In Gombore II-2, Melka Kunture, Ethiopia, for example, a hippo butchering site dated to ~ 700 kya was discovered on a lake shore along with evidence of flint knapping activity (Altamura et al. 2018). Another example is Nadaouilyeh Ain Askar in El Kowm Oasis, Syria, where camel bones and flint handaxes dated to the late Acheulean located in the vicinity of Pleistocene springs and the Arak formation flint outcrops (Jagher 2016; Jagher et al. 2015). Finally, at the Boxgrove Lower Paleolithic horse butchery site, numerous handaxes were produced and used. According to a recent paper by Sánchez-Romero et al. (2023), "the excavation area designated Q1/B was excavated between 1995 and 1996 and provided a particularly deep and complex record of early human activity centered upon a pond or waterhole within the wider landscape." A detailed analysis indicated that the cliffs to the north of the site provided all the flint needed for the extensive butchery operations at this locale (Pope et al. 2020). Although a Middle Paleolithic site, we note that the butchery site of Nahal Mahannayeem Outlet, which is adjacent to GBY, exhibits a similar nexus between large aurochs processing (Martin-Viveros et al. 2023; Yaroshevich et al. 2023), a water source, and an elaborate lithic toolkit which flint source was not in the Hula Valley.

Concluding Remarks

Our long-term investigations of the extraction and reduction flint complexes in the eastern Galilee are the basis for a new triad model that adds these significant stone sources to the nexus between Lower Paleolithic human dependency on elephants, stone tools, and water. Early human modes of adaptation, settlement patterns, and interactions with the environment can be better understood in the framework of this model. We suggest that our model applies to other cases in which the evidence points to a long-lasting dependency of humans on large game, water, and stone tools, such as in the late Early Pleistocene transition (~ 0.87 mya) (Muttoni et al. (2010) when humans and elephants shared migration routes along the north coast of the Mediterranean. The Lower Paleolithic complex of sites near Evron, in northern Israel, is another example of a locale that yielded large numbers of handaxes as well as elephant remains (Gilad and Ronen 1977; Ronen and Amiel 1974). Evidence of substantial stone outcrops supporting human adaptation still awaits discovery, and we hope that the model we propose here will encourage the search for such significant stone sources in these locales.

Stone quarries are considered places of potency, powerful locations, and even sacred places in many present-day Indigenous societies worldwide, such as in southern Ethiopia (Arthur 2018) and Australia (Binford and O'Connell 1984; Brumm 2010; Jones et al. 1988). We see this as part of a universal phenomenon in the ontology and cosmology of human groups who have depended on stone for their successful adaptation and well-being since time immemorial.

We further suggest that recurrent visits to the same stone sources over generations enhanced these localities in human memory and perception as traditional places of plenty, sustaining human subsistence throughout the very long Paleolithic epoch. The significance of these quarries in human-stone and human-landscape relationships is reflected not only in the numerous recurring visits to these locales that must have been experienced as a living memory in the minds of the Paleolithic visitors/workers but also in the caches that were found deposited on top of exhausted extraction fronts (Barkai and Gopher 2011). Moreover, these quarries were rarely used after the Paleolithic, despite the large quantities of usable stones that could still be found there. As the Galilee was favored by prehistoric human groups throughout prehistory, it is hard to imagine that these extensive Paleolithic industrial areas, including the ubiquitous potential flint outcrops within, went unnoticed by later prehistoric inhabitants of the region. In fact, direct evidence of Epi-Paleolithic and Neolithic settlements was recovered just at the foot of Mount Pua (Shimelmitz et al. 2004; Yerkes and Barkai 2013), right below one of the major Paleolithic quarry complexes. However, only stray evidence of Neolithic visits to the nearby extensive Paleolithic quarries was found (Barkai and Gopher 2011; Barkai et al. 2002; Finkel et al. 2016). This pattern repeats itself at other Paleolithic quarries in the Galilee. We suggest that the most parsimonious explanation for the strange avoidance of these quarries and stone sources by later prehistoric humans is the potency and reverence ascribed to these locales by the early ancestral human lineages who used them. Recent research has shown that recycled patinate flint tools were conceived as mnemonic items and that early Lower Paleolithic humans appreciated and cared about the stone creations of their ancestors (Efrati 2021; Efrati et al. 2022). We thus propose that early humans considered stone sources as far back as the Lower Paleolithic with reverence. As described in this paper, our model provides coherent reasoning for the central role stone played in human adaptation, both in practical and well as perceptual terms, since time immemorial.

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