Donkeys in Modern Excavations: Two Case-Studies at Amarna

Fabien Balestra

UMR 7041-ArScAn (Aegean Protohistory), France

Abstract

Focusing on two examples at Amarna, this article explores the donkey's utility in modern excavations. The domestic donkey (*Equus asinus*), originating from the African wild ass (*Equus africanus*) *c.* 6000 years ago, has a long history in Egypt since the I^st^ Dynasty (*c.* 3000 bce) and possibly even earlier in the Predynastic period. Due to its robustness in arid regions, its ability to carry heavy loads, and its cognitive capabilities, the donkey played a crucial role in the development of ancient pastoral societies and remains valuable today. Primarily employed as a beast of burden for various tasks in ancient Egypt, the involvement of donkeys on excavation sites first moderates damage from motorized vehicles and then allows accessibility. Employing donkeys not only reduces environmental impact but also affects people's psyche and enhances community engagement. Eventually, the use of donkeys aligns with the principles of green archaeology, contributing to carbon-free practices on a small scale.

Keywords: donkeys, Amarna, modern excavations, Great Aten Temple, Workmen's Village, eco-friendly, community, companionship, sustainability
DOI: 10.31526/SEAS.2024.541

مع التركيزعلى مثالين من العمارنة، يستكشف هذا المقال فائدة الحمار فى الحفائر الحديثة يعود أصل الحمار المستأنس (*Equus asinus*)، إلى الحمار البرى الأفريقى (*Equus africanus*) وذلك منذ حوالى 6000 عام، كما له تاريخ طويل فى مصر منذ الأسرة الأولى (حوالى 3000 ق.م)، بل ربما قبل ذلك خلال عصر ما قبل الأسرات. نظرا لقوته، وقدرته على حمل أحمال ثقيلة، وقدراته الإدراكية فى المناطق القاحلة، لعب الحمار دورا هاما فى تطور المجتمعات الرعوية القديمة، ولا يزال ذا قيمة حتى يومنا هذا. وقد استخدم فى المقام الأول كحيوان لحمل أثقال فى مهام مختلفة فى مصر القديمة، تورط الحمير في مواقع الحفر أولاً يخفف الضرر الناجم عن المركبات الآلية ثم يسمح بالوصول. فاستخدام الحميرلا يقلل فقط من التأثير السيء على البيئة، بل يعين الناس ويعزز المشاركة المجتمعية. وفى نهاية المطاف، يتوافق استخدام الحمير مع مبادىء علم الآثارالأخضر، ويساهم فى ممارسات خالية من الكربون على نطاق محدود.

الكلمات المفتاحية: الحمير، العمارنة، الحفريات الحديثة، معبد آتون الكبير، قرية العمال، صديقة للبيئة، المجتمع، الرفقة، الاستدامة

1. Introduction

Over time, donkeys became a key to human existence, turning into a valuable socioeconomic asset for both ancient and modern people, facilitating household activities, agribusiness tasks, and general transport (Fernando and Starkey 2004; Wells et al. 2004). Before the introduction of the horse in the Second Intermediate Period, *c.* 1780 bce (Vernus and Yoyotte 2005: 535–543) and the camel around the beginning of the I^st^ millennium bce (Agut-Labordère 2018: 179–183), the domestic donkey (*Equus asinus*) played a crucial role in the development of ancient pastoral societies in Egypt (Marshall and Weissbrod 2011; Blench 2004: 25). Recent DNA analyses (mitochondrial variation) trace its domestication back to a unique African source from the African wild ass (*Equus africanus*) around the VI–V^th^ millennium bce, coinciding with the time when the Sahara became a desert region (Todd et al. 2022; Chadefaud 2021; Marshall and Weissbrod 2011: S403). In fact, two subspecies have been envisaged, the Nubian wild ass (*Equus africanus africanus*) and the Somalian wild ass (*Equus africanus soma-*

liensis), the first being the most probable (Kimura et al. 2013). Afterwards, donkey domestication slowly spread into Mesopotamia (Goulder 2020: 19–33) and across Africa (Blench 2004: 25-26), later expanding in every direction of the world (Jahy 2023; Mitchell 2018).

However, archaeological evidence is scarce, with only a few faunal ass remains unearthed from three Egyptian Predynastic settlements[1] suggesting, hence, early domestication. Two significant reasons might explain this occurrence. First, it seems that around the Predynastic period, (tame) donkeys were primarily used for long-distance travels and carrying loads by nomadic people prior to semi-nomadic and sedentary communities settled in the Nile Valley (Marshall and Weissbrod 2011: S402; Brewer et al. 1994: 99). Consequently, the rarity of faunal remains may partially result from the fact that many specimens might have died in nomadic environments or at unidentified nomadic sites. Given these difficulties, it becomes thus even more crucial to interpret as much accurately as possible earlier archaeological sites to help differentiate between wild and domesticated ass remains. Brewer et al. (1994: 99) pointed out a few examples from the Fayum regions where the bones were later identified as being of wild animals because the sites were believed to be associated with nomadic people rather than sedentary communities.

Secondly, despite their rarity in archaeological contexts, scholars have highlighted the challenge of distinguishing early domestic donkey bones from wild ones as well as from horses, based solely on morphology characteristics due to the long domestication process (Huang et al. 2023: 2; Vandenbeusch 2020: 39-40). Generally speaking, it is admitted that domesticated animals show a decrease in bone size compared to their wild counterparts. Yet, evidence suggests that these morphological changes might have taken much longer for donkeys due to the lack of controlled breeding (Goulder 2020: 33-34; Marshall and Weissbrod 2011: 398, 402, 404–407) and should be considered as a major factor in differentiating both species (Goulder 2020: 59-60). This issue hence highlights the importance of ancient DNA research (Goulder 2020: 33-34; Mitchell 2018: 32–34) despite the difficulty in data collection due to the near-extinction of wild relatives from extensive hunting and the scarcity of donkey remains (Blench 2004: 24).

The interactions between nomadic and sedentary groups likely facilitated the introduction of the animals to the emerging settled populations, who soon recognized its usefulness in pastoral environments, initially as a beast of burden and then for agricultural pursuits (Jones 2021: 178–185; Goulder 2020: 24–30; Brewer et al. 1994: 99). True evidence emerged with the discovery of donkey skeletons in mudbrick tombs at Abydos from the Ist Dynasty, *c.* 3000 bce. Unlike earlier instances only based on size measurements, the Abydonian remains, although similar to contemporary wild donkeys, displayed osteopathologies on their spine bones, indicating an extended and repetitive utilization of the animals for transporting heavy loads (Rossel et al. 2008: 3718-3719). These skeletal damages also indicate that these animals were likely forced to carry loads exceed-

1 The three Predynastic sites are El-Omari (c. 4600–4400 bce), Maadi (c. 4000–3500 bce), and Hierakonpolis (c. 3600 bce). Respectively, see Boesneck and von der Driesch 1990; Boesneck et al. 1989; Van Neer et al. 2004: 90 passim.

ing their weight limit since they were not aged specimens (Jones 2021: 182). Consequently, this material might represent the first evidence of poor animal welfare.

Examples of abuse might also be observed in the representations of donkeys in some Old and Middle Kingdom private tombs, where handlers are depicted holding the animal by one leg and one ear in an attempt to render it motionless (Jones 2021: 183–185) or beating him with a stick in the hope to make him obey (Delvaux 2023: 155-156; Diab 2017: 189). Some texts from Deir el-Medina provide further evidence of such mistreatment (Janssen 2005: 72). However, such behavior was not entirely accepted as other sources from the same site sometimes attest to lawsuits concerning donkey neglect. Some other texts may also indicate that donkeys were in fact looked after and, if needed, even cured (Janssen 2005: 72). Another example suggesting donkey-human links is given by texts in which donkeys' names appear (Janssen 2005: 71). This should be considered as a good indicator of the proximity between the animal and its owners as shown in most of the Old Kingdom representations (Mitchell 2018: 48-49), as it seems to be in most of the modern societies.

On the other hand, it is unlikely that donkeys were primarily raised specifically for meat consumption even though some bones with butchery marks have been discovered, but such evidence remains rare in the whole Egyptian documentation, and even in antiquity (Vandenbeusch 2020: 22–25, 219–224). Two hypotheses emerge from the literature. First, "the remains of nonfood animals are unlikely to be found in settlements," leading to their under-representation in food middens (Goulder 2020: 63). If the animals had died or were no longer capable of working or traveling, their carcasses would have been dragged out of the villages and abandoned to predators. Such examples still occur nowadays in the area around the site of Amarna where it is quite common to encounter donkeys' carcasses at the desert entrance and, more rarely, those of cattle on the side of the road, delivered to wild packs of dogs. In the latter case, the death may have resulted from disease. Moreover, regarding the rare bones with butchery marks, it is tempting to associate them, in the absence of burn traces, with the preparation of body parts for specific medicines as mentioned in medical papyri (Vandenbeusch 2020: 146–162; Closse 1998: 33-34).

The other assumption for the nonconsumption of donkey meat is due to taboo reasons which may vary from one region to another (Blench 2004: 24-25). For instance, in Egypt, some scholars suggest the association of the donkey with the god Seth, making it an unholy animal (Closse 1998: 34–37; Partridge 1996: 98), while others do not entirely agree with this relationship (Janssen 2005: 69, following te Velde). During the same period in Mesopotamia, for instance, donkey meat was not intended for the dietary regime of the population but was rather used to feed dogs and captive lions (Goulder 2020: 63; Marshall and Weissbrod 2011: S405). Although there is no evidence of it, one may wonder if the ancient pastoralists were reluctant to eat some of their working animals, even though they did eat their cattle, as is the case in some modern regions (Goulder 2020: 64-65).

In contrast, the consumption of donkey milk may have probably constituted a part of the pastoral people's diet along with that of cattle, and perhaps of goat (Vandenbeusch 2020: 150-151). This might be because the ancient communities already recognized its high nutritional content and benefits (Goulder 2020: 66; Fernando and Starkey 2004: 32). Nevertheless, the breeding of donkeys undoubtedly served originally to assist in agricultural and traveling purposes for millennia but with slow morphological change due to low levels of selection (Gouldel 2020: 65; Marshall and Weissbrod 2011: S407).

Although donkeys were not considered a good food source, their economic significance likely grew due to their role in transporting products, supplies, and people within and between different provinces, as well as neighboring regions (Lashien 2020: 133). Despite being partially replaced by other animals over time, such as horses and camels, and more recently by the advent of motorized machinery, donkeys remain integrated into modern people's lives (Boum 2023; Farhat et al. 2020; Dijkman and Sims 2004: 229-230).

Given the continuous implication of the animal throughout human societies, this paper aims to discuss the advantages and reasons for its use in modern excavations. To answer these purposes, two case studies will be presented: the Workmen's Village and the Great Aten Temple excavations at Amarna (Figure 1). Ultimately, this article also seeks to demonstrate that employing donkeys not only aligns with the principles of green archaeology, contributing to carbon-free practices (Bell 2006), but also positively forms bonds with humans, helping along the way community engagement on various scales, as well as in a socioeconomic manner. However, before delving into the motivations behind their utilization in archaeological fieldwork, it is first essential to examine the main characteristic features of the animal and to provide a past-present overview of the benefits of employing this equine over other animals, especially oxen, with Egypt as a focus.

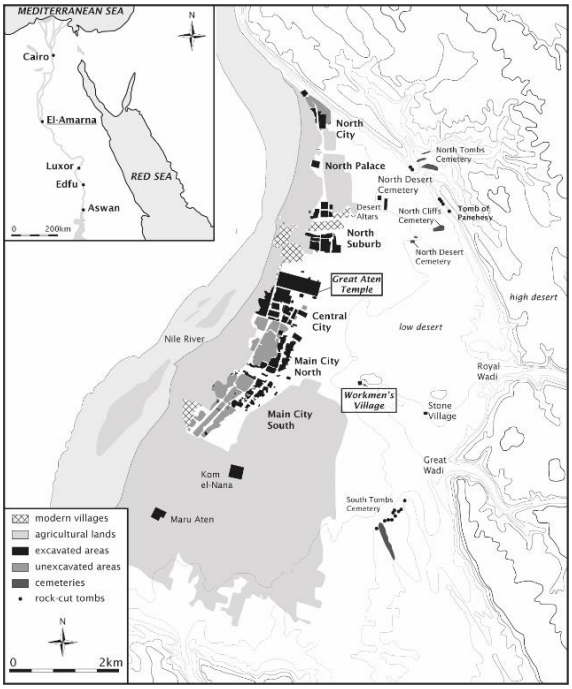

FIGURE 1: General map of Amarna, highlighting the Great Aten Temple and the Workmen's Village (after base map in Stevens et al. 2023: 93 fig. 1/the Amarna Project).

2. The Donkey's Main Characteristics: Physiology, Sociability, Behavior, and Intelligence

This section aims to provide a brief overview of the donkey's main characteristics that most likely contributed to its domestication and made it an important socioeconomic asset to humans. Donkeys are remarkable animals known for their unique combination of physiological effi-

ciency, sociability, behavioral resilience, and intelligence.

Donkeys are robust animals with strong, sturdy bodies well suited for carrying a variety of heavy loads, including humans, the morphology of their backs being designed to accommodate such activities. The use of adapted equipment like pack saddles further enhances the equitable and stable distribution of weight over their backs (Fielding 1988: 2). Recent studies revealed that the traction capability depends on the body weight of the animal, the donkey accounting between 24 and 40%, with an average carrying capacity of 33%. This means that they are capable of transporting between 100 and 150 kg per day, even up to 200 kg, while oxen can shoulder up to 300 kg but for a shorter time (Förster et al. 2013: 195; Köpp 2013: 3-4, 8 tabl. 1). When harnessed in pairs, donkeys can collectively generate a draught force equivalent to 15–20% of their combined body weight. This remarkable strength allows them to perform various tasks, including plowing (apart from the debate for ancient Egypt discussed below), without showing signs of fatigue over long periods, well beyond those of other working animals until the advent of the camel (Goulder 2020: 42; Yılmaz et al. 2012: 140).

Furthermore, donkeys are naturally more armed for rugged roads, both over short and long distances, and are more effective in traversing remote desertic regions thanks to their adapted hooves (Prévost 2021). Their adaptability to arid and semiarid regions makes the donkeys very suitable for undertaking long journeys, for either commercial or travel purposes. It has been reported that donkeys can endure up to two or three days without water, with great tolerance to high temperatures (Goulder 2020: 42; Förster et al. 2013: 195), but it is highly advised to provide them water once a day in sufficient quantity (Brodie 2008: 303).

In terms of feed-to-strength ratio, donkeys outreach cattle. While the former does not require specific food maintenance, the latter demands more nutrition and water to reach its maximum power (Goulder 2020: 37, 42). Donkeys' digestive system is highly efficient at extracting nutrients from fibrous plant material such as straw and hay (Goulder 2020: 95–98; Förster et al. 2013: 195). It is also said that donkeys are more drought-tolerant and less dependent on food supplements compared to other pack animals, whether they are working in fields or traversing desertic regions (Mitchell 2018: 226; Förster 2013: 307-308). Regrettably, the consequence of this is that donkeys may suffer from extended chronic undernutrition, especially during the dry seasons (Wold et al. 2004: 80-81). This is notably true if they are left to graze by themselves for insufficient time. In such cases, additional food is required to provide the animals with their dietary needs in order to maintain their good body condition (Goulder 2020: 90–92; Mitchell 2018: 23-24).

On another matter, donkeys happen to have a stronger resistance to illness compared to other livestock species (Brodie 2008: 303). While much of the pathologies observed in donkeys arise from their use as burden-carrying animals and the mistreatment they often endure (Farhat et al. 2020: 10-11; Wold 2004: 80), donkeys are also susceptible to various parasites acquired from other animals. Among the most significant are the gastrointestinal parasites, such as large and small strongyles which can severely com-

promise a donkey's overall health (Gebreab et al. 2004: 51). Donkeys are also prone to colic which can result from being fed wheat grains or other rich foods (Goulder 2020: 46), as well as from ingesting foreign bodies (Fahmy 2004: 240).

Furthermore, ethnoarchaeology revealed that most donkeys' health problems also come from ill-fitting or poorly designed harnesses made from unsuitable materials (Farhat et al. 2020; Mutua 2004: 99; Gebreab et al. 2004: 51). Ngendello and Heemskerk (2004: 124) noted that yoking systems designed for cattle were sometimes employed with donkeys, leading to neck wounds since donkeys' necks are not built to withstand such pressure and weight. Besides, sores on the back of the animal may also be caused by the lack of saddle or proper protection such as a saddle pad (Gebreab et al. 2004: 51). Farhat et al. (2020) observed that the cleanliness of the overall equipment also significantly affects the welfare of the animal, potentially aggravating skin injuries. Lesions from clothes or skin friction can also occur. Prolonged exposure to sunlight can exacerbate these injuries, potentially leading to infections. The use of improper collars can cause severe skin injuries due to friction (Farhat et al. 2020: 11; Fahmy 2004: 239–240).

In such cases, owners often apply a muddy patch over the infected areas, either as a preventive measure or as a therapeutic approach (Figures 2 and 7d). Although other traditional methods exist (Henein 1988: 122-123), it is highly recommended to bring the injured donkey to the nearest welfare facility, where professionals will provide the best possible treatment. In many countries, such infrastructures, including shelters, exist to help donkey owners and farmers (Duggal 2015: tabl. 2, 34–38). With proper care, donkeys can live up to 30–40 years, and by their fourth year, they are capable of efficiently transporting heavy loads, highlighting their enduring usefulness and reliability (Förster et al. 2013: 195; Brodie 2008: 303).

To prevent damage caused by poorly designed harnesses, several studies have been conducted in collaboration with farmers to develop improved systems and lighter carts, thereby enhancing donkey welfare (Mutua 2004: 99; Wold 2004: 81; Ngendello and Heemskerk 2004: 124). Nevertheless, donkeys overall demonstrate an impressive power of recovery compared to other equids, such as horses, further enhancing their value as reliable partners for work and transportation in various situations (Yılmaz et al. 2012: 140).

FIGURE 2: Anna, the older donkey, with a muddy patch over her forehead for sun protection during excavation at the Great Aten Temple in 2023 (© the author/the Amarna Project).

Apart from their endurance and strength, the versatility of donkeys likely played a crucial role not only in facilitating their domestication but also in their utilization. This enduring trait continues to make them invaluable companions and is often considered a mark of intelligence. Ethno-archaeological research demonstrated that donkeys can be trained for work in a remarkably short timeframe, usually from one week to one month, depending on the complexity of the demand (Sosovele 2004: 109) and the proximity with more experienced congeners (Goulder 2020: 80; Dijkman and Sims 2004: 230).

Unlike full herd animals, donkeys tend to have a calm and steady attitude, making them less prone to panic in stressful situations. This fearless disposition is beneficial for both work and safety. As a response, donkeys assess situations and obstacles cautiously before making any move and may even freeze to evaluate the handler's demand if they do not fully understand it (Goulder 2020: 37–40). In the presence of an incoming predator, for instance, they become immobile or group together to face the threat (Yılmaz 2012: 23).

Their proficient sense of orientation and exceptional memory for routes further enhance their utility for handlers, enabling them to cross familiar paths with ease at an average speed of 3-4 km/h (Förster et al. 2013: 195; Brodie 2008: 301). Besides, Goulder (2020: 40-41) notes that donkeys can safely return home alone without experiencing any memory loss related to the correct route. This particularity, along with being easier to work with, is especially appreciated by less experienced handlers, children, and women (Goulder 2020: 102–104; Sosovele 2004: 109). Yet, it is essential to remember that, whether in ancient or modern times, traveling with all sorts of caravans implies meticulous planning and organization, mostly when crossing over remote desertic regions is necessary to reach the destination. Knowing where to make stops for cooling the animals and the crew, as well as seeking shelter, is of fundamental importance to prevent any inconvenience along the way (Köpp 2013: 15–22).

The other trait of donkeys' intelligence is probably their cognitive abilities and their inherent social nature toward their fellows, other livestock, as well as humans, making them perfect companions (Artemiou et al. 2021; Panzera et al.: 2020). When a genuine profound bond of trust is established between a person and a donkey, the animal often exhibits signs of joyfulness and playfulness. Donkeys become eager and willing to interact with humans, demonstrating their affection and connection to their trusted companions. The Brooke,[2] a charity organization, notes that a healthy, well-cared donkey can increase its owner's productivity. Overall, donkeys' qualities facilitated their integration into human societies and enhanced their value in agriculture, transport, and companionship.

3. The Benefits of Donkey Utilization: Past and Present

The aforementioned characteristics have played a pivotal role in shaping the donkey's impacts on human societies. Despite its popular reputation for having a challenging temperament and being considered a less favorable animal (Del-

[2] https://www.thebrooke.org/ [Accessed 28 June 2024].

vaux 2023: 120; Prévost 2023; Vandenbeusch 2020: 253–255), the donkey has proven its worth since domestication, revealing a multitude of invaluable advantages (Sosovele 2004: 109) that makes it a precious asset for various activities. It has been thoroughly argued that the donkey's adaptability and efficiency largely participated in the development of ancient pastoral societies (Goulder 2020; Marshall and Weissbrod 2011; Fernando and Starkey 2004).

Ancient Egyptians were among the first societies to use donkeys, certainly after having observed their endurance and resilience when used by nomadic groups they interacted with (Goulder 2020: 101; Mitchell 2018: 226-227). These characteristics are vividly illustrated in the agricultural scenes depicted in tombs from the Old to Middle Kingdoms (Figure 3). There, donkeys are shown contributing to the harvest, transportation, and discharge of the produce from the fields to the storage facilities (Delvaux 2023: 111–172; Jones 2021; Lashien 2020). Old Kingdom reliefs also frequently show accidents occurring *en route* but disappear in the Middle Kingdom and perhaps in the succeeding periods. This observation may suggest either a misarrangement of the pack system (Fielding 1988) or, as recently debated, is the result of technological advancement in the confectionery of pack saddles and double bags which enables better stability of the loading on the animal (Delvaux 2023: 138–143).

Like oxen, and less commonly sheep, donkeys could also participate in the threshing process of harvested crops by treading the ears to separate the grains (Lashien 2020). To achieve the desired outcome, donkeys were arranged in line on a raised circular flooring structure, where the sheaves would have previously been spread (Closse 1998: 30). Discipline was required to uniformly tread the area and to keep the animals in order since handlers frequently held a stick with one hand to guide them, while the other directed one of the donkeys.

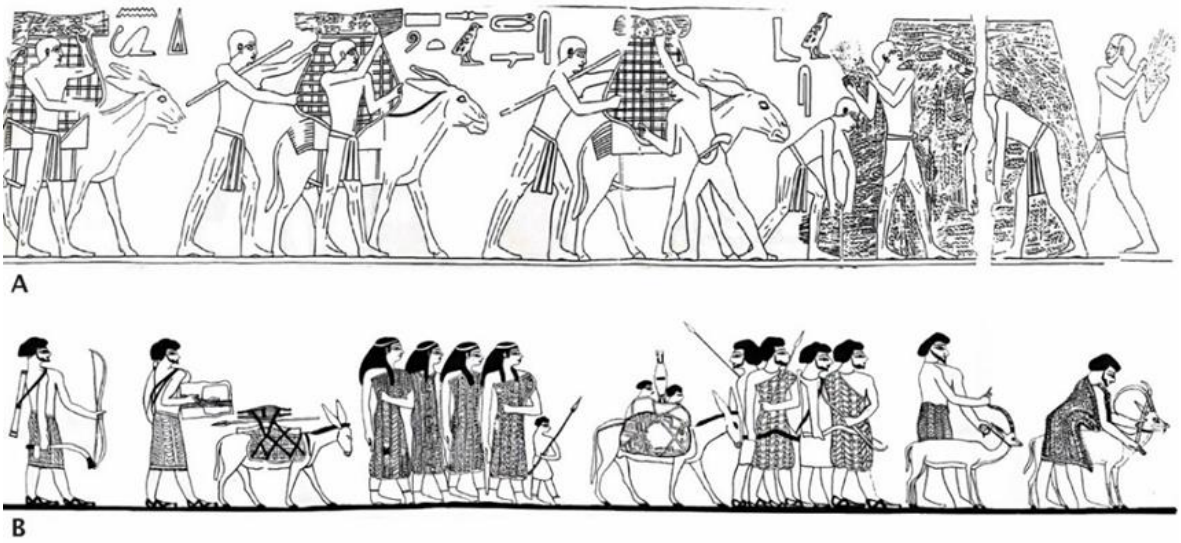

FIGURE 3: (A) Donkeys transporting the crops in the mastaba of Akhethotep at Saqqara (after Ziegler 1993: 136-137), and (B) foreign tributes accompanying donkeys in the tomb of Khnumhotep II at Beni Hassan (Newbery 1893: pl 31 modified following pl 30).

More rarely observed (or identified) is the use of donkeys as draught animals in agriculture (Brewer et al. 1994: 100), as evidenced in Ankhtifi's tomb at El Moalla dating to the Eighth/Ninth Dynasty, *c.* 2160 bce (Prévost 2022: 89-90; Vandenbeusch 2020: 20 n. 34), of which very few textual sources may support it. Written examples include on the one hand the stele of Hornakht (CG 20499) dated to the Second Intermediate Period, *c.* 1650–1550 bce, and two papyri on the other hand, respectively, the Papyrus Lansing and the so-called Prophecy of Neterfi, both dating to the New Kingdom, *c.* 1550–1295 bce (Prévost 2022: 90; Closse 1998: 30).

The use of donkeys for traction in plowing aimed to prepare the field for seeding. Usually, this practice was done by oxen and cows since they could pull the plow deeper into the soil (Lashien 2020: 126; Goulder 2020: 5). In the case of Ankhtifi, Jones argued that, based on Ankhtifi's autobiography, the use of donkeys as draught animals in this context might have been due to a significant drought occurring at the time which had led to widespread starvation and forced people to eat cattle more than usually (2021: 179). Hence, Anthtifi would have wanted perhaps to show in his tomb that he had participated in the well-being of his community during this rough time. Jones, following Vandier, also noted that the design of the plow had been adapted to donkey use, changing from a yoke to a harness system (2021: 179). As Janssen before (2005: 73), Prévost wondered (2022: 91) if donkeys were used in soil preparation and seeding during the Ramesside era by discussing the meaning of the verb *r sk3*, understood as cultivating rather than plowing (Moreno-Garcia 2008: 55).

However, although the depictions of donkeys involved in agricultural pursuits continue into later periods, their number seems to decrease and eventually totally disappear for some as time progresses. For the latter, this is particularly evident in depictions of the threshing activity and the scenes showing the animals returning from the stores with empty bags (Prévost 2022: 89). The explication remains unclear among scholars, but a change in the status of donkeys and ideology within the Egyptian society has been forecasted as potential reasons (Prévost 2022: 98; Jones 2021: 180–182; Moreno-Garcia 2008).

Besides, the donkey's role as the primary beast of burden for transporting all sorts of freights during military campaigns, trade expeditions, and mining excursions mirrors the depiction of agricultural scenes found in Egyptological evidence (Figure 3). These pictorial representations may also be less common to those involving horses and horse-drawn chariots after their introduction to the region even though they were mainly used for human transportation rather than for transporting goods (Köpp 2013: 2-3, 9–11). This observation seems to equally align with textual sources that further detail the loads carried by the donkey caravans since the bags in reliefs could be closed, not allowing to know their contents (Rommelaere 1991: 22–29).

First, the cargo was laden with the necessary equipment to fulfill their missions including the supplies for the men, namely, food and water. Secondly, texts also inform on the nature of the goods acquired after completion of the missions. In most cases, they consisted of the products from the visited, looted regions, including mining areas, loaded in bags at-

tached to a pack-saddle (Prévost 2022: 93-94; Goulder 2020: 124-125; Closse 1998: 30-31).

By contrast, even though horses arrived later in Egypt, the evidence of donkeys transporting humans is exceptional throughout Egyptian history and seems to be largely associated with foreigners (Prévost 2021; Diab 2017: 183; Janssen 2005: 69) and ill individuals incapable of walking (Delvaux 2023: 242–244; Köpp 2013: 7-8) or related to unpleasant circumstances (Prévost 2022: 95; Diab 2017: 183).

Indeed, it appears that ancient Egyptians did not like riding donkeys, contrary to the Asiatics as shown on the stelae of Serabit El-Khadim in Sinai dating to the Middle Kingdom who rode them side-saddle (Closse 1998: 31; Brewer et al. 1994: 100). Instead, the Egyptians preferred to go on foot or, possibly, used carrying chairs (Partridges 1996: 88–94). This assumption is at least the impression given by the reliefs. Partridge (1996: 97) made the argument that it is challenging for an artist to represent a mounted donkey in regard to artistic conventions but is not surprised by the representations, though rare, of individuals riding a horse (1996: 102–104). However, Vandenbeusch (2020: 20-21) questions the practice of horse-riding by pointing to the almost total absence of depictions showing a mounted horse, despite being considered to have a more noble status (Prévost 2022: 95). Nevertheless, it is important to remember that horses were primarily meant to be driven while attached to a chariot, as evidenced by several depictions of horse-drawn chariots, particularly in military, hunting, and procession scenes. Furthermore, the material regarding the use of donkeys with chariots remains unclear, mostly because of its scarcity. This lack of evidence leads to difficulties in understanding the extent and nature of such a practice (Mitchell 2018: 48). However, the use of specially trained donkeys or hybrid equids is not excluded either (Prévost 2022: 97).

Moreover, donkeys being seen as potential manifestations of the god Seth (Closse 1998: 34–37) could also explain why artists, or tomb owners, did not want to be represented riding a donkey whereas they likely did so during their lifetimes (Partridge 1996: 98). This practice may have in reality been used particularly by common people (El-Menshawy 2009: 55-56) as well as high-ranking persons while conducting duties in the long distance but were unwilling to be viewed in such posture in reliefs (Prévost 2022: 96; Diab 2017: 181).

In textual sources, donkey riding also seems to have been mainly performed by foreigners, especially as expressed in New Kingdom material, *c.* 1550–1295 bce (Prévost 2020:94-95), confirming Assyrian texts written in Sumerian or Akkadian (Jahy 2023: 1988–1990). Additionally, it appears that the word “ass” bore in ancient Egypt a concept of mockery and was used as an insult, much like it is today (Prévost 2022: 95; Closse 1998: 34; Brewer et al. 1994: 100).

Less common would be the carrying of individuals seated or kneeling either on a litter or on a palanquin supported by a pair of donkeys, but such attestations remain unusual (Vandeneusch 2020: 20-21, 68-69). The use of such devices is only attested on three Old Kingdom private tombs, that of Khuwiwer at Giza and those of Niankhknum and Khnumhotep at Saqqara, all belonging to the Fifth Dynas-

ty, *c.* 2500–2421 bce (Jones 2021: 185; Lanshien 2020: 122). Partridge (1996: 97-98) discussed the system and concluded its nonpracticality for both the occupant and the animals.

Another notable aspect is the low upkeep requirements of donkeys, making them a social and economic investment for small-scale farmers and rural communities in both ancient and modern times (Goulder 2020: 151-152; Mitchell 2018: 35–38). Research conducted in developing regions has demonstrated, on the one hand, that donkeys significantly contribute to the family economy by transporting farm products to markets (Fernando and Starkey 2004). This task is often handled by children or women since donkeys are easier to manage than other working animals, allowing men to focus on other household duties. In this regard, donkeys also generate additional income by carrying other various materials such as charcoal, water, firewood, and building supplies for instance (Farhat et al. 2020: 10–13; Gebreab et al. 2004: 48–50). Furthermore, the draught ability of donkeys has become essential and widely used in these communities. Besides their continued use in agricultural work and travel, donkeys also enhance transport capacity and efficiency when equipped with carts, providing a low-cost alternative to motorized vehicles (Dijkman and Sims 2004: 231).

On the other hand, donkeys remain invaluable in areas with rugged terrains and inadequate road infrastructures, hindering the circulation of vehicles (Goulder 2020: 104). These animals are also crucial during times of crisis, such as war conflicts or natural disasters (Mitchell 2018: figure 8.4). When no other motorized vehicles have access to the area, donkeys are the perfect candidates to transport supplies and move disabled or inanimate individuals (Boum 2023; Gebreab et al. 2004: 49).

Consequently, there is no doubt that donkeys hold considerable utility in modern archaeology. The two case studies presented hereafter will serve as excellent examples, highlighting their advantages for the fieldwork, the community investment, and the overall animal-human association. Additionally, donkeys embody a sustainable model for the environment, offering significant ecological benefits for the planet.

4. The Workmen's Village

It is highly possible that donkeys played an important role in excavations, but evidence for earliest missions remains limited. Meticulous research on the Amarna archives conserved at the Egypt Exploration Society enabled the observation of at least two photographs from the 1923 expedition in which donkeys appear in the very back of the images (Figures 4a-b). However, the lack of information makes it difficult to determine if the animals were solely used for the transportation of a limited number of workmen due to their small number, or if their presence suggests additional activities such as carrying materials and findings.

One plausible piece of indirect evidence hinting at the use of donkeys is provided by one of Pendlebury's letters, now in the Amarna archives (TA.WAD.01.044). In a letter dated September 1932, he wrote to architect James Hilary Waddington, addressing several points, notably emphasizing in capital letters and underlining that there were no cars present at Amarna. Nevertheless, this statement and the context does not clarify as whether auto-

mobiles were entirely absent from the region or simply forbidden on site. Thus, the question regarding the use or prohibition of motorized vehicles in the area remains, implying the potential use of other means, such as donkeys.

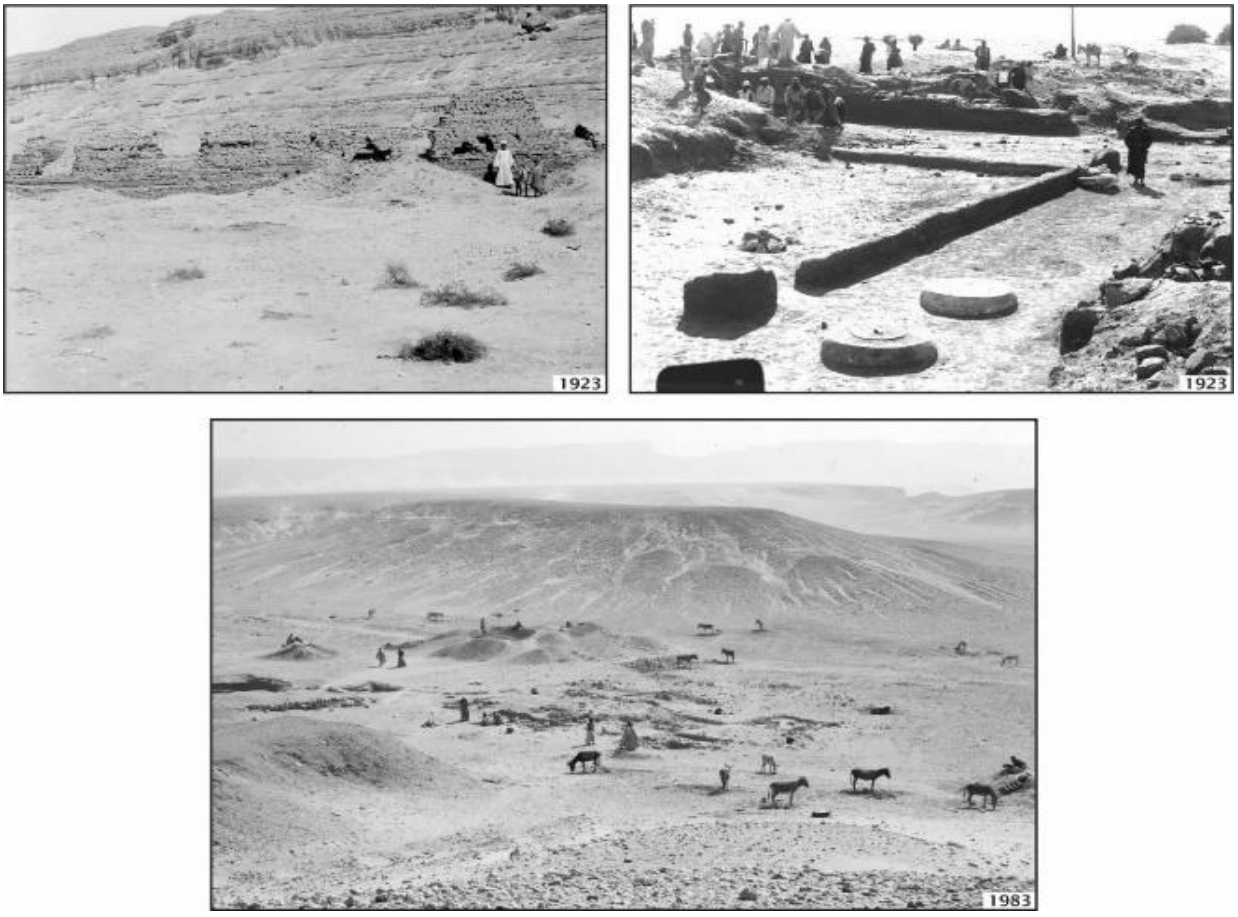

FIGURE 4: Donkeys at Amarna, (A) in front of the North Dig House before being excavated (courtesy of The Egypt Exploration Society, TA.NEG.23.054), (B) tethered to a post at the North Palace during excavation, both photographs taken in 1923 (courtesy of The Egypt Exploration Society, TA.NEG.23.073), and (C) view of the zir-area during excavation at the Workmen's Village in 1983 (courtesy of B. J. Kemp, 1983.4.24).

Therefore, due to the scarcity of motorized vehicles in the region until quite recently, except for a few tractors, it is essential to consider that donkeys may have been utilized for excavation purposes. Although there are no proper records indicating the use of donkeys or other pack animals for such activities, it is highly likely that they were indeed employed for such tasks during the former excavations like at Amarna or Deir el-Medina, for instance.

One of the earliest and best examples of donkeys' utilization for modern excavation was conducted at the Workmen's Village at Amarna (Figure 4c). The site, located in the desert east of the city of Amarna, consists of a square-walled mudbrick village on a sloping valley floor within the low plateau. It comprises 72 houses, each of roughly standard size and

design, with adjacent tombs, chapels, garden plots, and animal pens (Figure 5). Partly recognized as the residence of the workers involved in the rock-cut tombs' construction situated in the eastern cliffs and, also, used for policing the desert, the village (*c.* 1346 bce) was partially identified during Petrie's survey (1894). Initial excavations occurred in 1921/22 on behalf of the Egypt Exploration Society (Peet and Woolley 1923), before further campaigns were conducted between 1979 and 1986 under the same auspices (Kemp 1987). It was mainly during these last investigated seasons that donkeys were employed at the Workmen's Village with certainty.

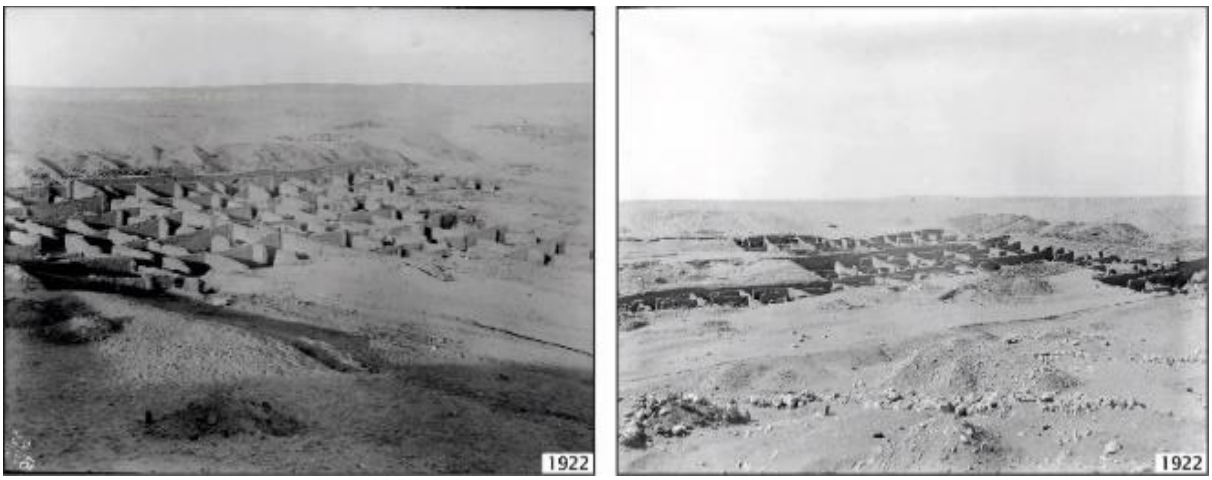

FIGURE 5: The Workmen's Village as exposed in 1922, facing northeast and northwest (courtesy of The Egypt Exploration Society, TA.NEG.22.032 and TA.NEG.22.062).

Before the major irrigation project in the area, which runs to the east of the dig house, became operational, the fields had been prepared but the irrigation water had not yet been connected.[3] Consequently, there was an open desert between the house and the excavation site, with only a large floodwater embankment to be crossed about halfway. Each morning, nearly 20 workmen would arrive at the dig house, each accompanied by his donkey. The men would bring their lunch along with some greens for the donkeys and collect any necessary equipment. The site's water supply consisted of a couple of large *zir*-potteries sunk into the desert. Another individual delivered fresh water to fill them, using his own donkey with plastic jerrycans hung over the saddle exactly like in the New Kingdom (Kemp 1983: 65–80).

The rock-cut tomb of Mahu at Amarna provides a plausible unique parallel scene of transported supplies to the village in which three donkeys are involved, one of which is even carrying two jars on its sides (Davies 1906: pl XXIV). This scene offers a tangible connection to the logistical challenges faced by ancient Egyptians, illustrating their reliance on donkeys for transporting essential goods. Indeed, without wells on-site, inhabitants would have had to transport fresh water from

[3] Barry Kemp, formerly the director of the excavations for the EES and later of the Amarna Project, fondly recalled the presence of donkeys during that time and kindly shared his memories with me, for which I am deeply grateful [personal communication, 17 Feb. 2024].

the city of Amarna located further down in the valley along paths that are still visible nowadays (Fenwick 2004). Once arrived at the destination, the water supplier would have poured the liquid within large *zir*-potteries sunk into the desert, situated at the village's entrance (Driaux 2016: 49–53). Mahu's relief thus provides valuable insight into the daily realities and challenges of life in ancient Egypt, underscoring the significance of donkeys in facilitating everyday tasks and activities.

Throughout the working part of the day, the men's donkeys were tied up on the relatively flat area near the site of the ancient buried *zirs* (Figure 5b). Each donkey had a pile of green fodder, usually the Egyptian clover, *berseem* (*Trifolium alexandrinum*), which the farmers grow for this purpose as early as the ancient pastoralists (Dost et al. 2014; Badr et al. 2008). Initially, two night guards slept at the site in straw huts, making the donkeys particularly useful for the return journey when boxes of potsherds and other finds would be loaded onto their saddles. This particular scene would have certainly evoked the ancient donkeys' caravans returning from a victorious military campaign laden with loot or a prosperous trade expedition. It is a poignant reminder of the enduring legacy of displacement that continues in some areas of the Saharan regions, interweaving the threads of history and tradition between past and present (Prévost 2021; Förster et al. 2013; Förster 2013).

Even today, the Workmen's Village remains partially inaccessible by car due to the environmental conditions of the area. The main challenge arises from crossing an ancient riverbed originating from the Great Wadi, which can still flood during heavy rains (Figure 1). As a result, vehicles must stop a few meters away from this point, and individuals must continue their journey on foot for approximately 15 minutes to reach the ancient village. In other words, there is no proper road leading to the site.

This situation allows visitors to envision the past by reducing reliance on vehicles and promoting walking. Utilizing donkeys as a sustainable transport method minimizes environmental impact and preserves the archaeological integrity of the area. It also serves as a reminder of traditional transportation methods and encourages a more sustainable way of exploring historical sites as long as veterinary care is maintained (Duggal 2015).

5. The Great Aten Temple

The Great Aten Temple, situated at the heart of Amarna (*c.* 1353–1336 bce), stands as a testament to Pharaoh Akhenaten's vision and devotion as stated in his boundary's stelae. Known at this time as *pr ítn*, the "House of the Aten", the site held the most important Sanctuary dedicated to the Aten (Figure 6a). Despite its historical importance, excavations conducted since the late 19th century mainly focused on the stone buildings, leaving the vast surrounding spaces relatively unexplored. These expansive areas, which encompass the temple, raise questions regarding its potential functions, including the possibility of hosting large gatherings as well as serving alternative motives (Kemp 2018: 347; Kemp 2012: 117). Recognizing the need for a deeper understanding of these empty spaces, the current British Mission of the Amarna Pro-

ject[4] has been initiating since 2021 new excavations to the rear of the Great Aten Temple (Balestra forthcoming; Idem 2023; 2021). Situated 750 m east of the stone-built Long Temple front, the area was briefly excavated in 1932/33 by archaeologist John Pendlebury (Pendlebury 1951: chapter II, III).

This subsidiary project aims to delve into the area's functions, exploring its connections to the city of Amarna, its relationships with other Egyptian settlements, and potential interactions with foreign counterparts. Eventually, the project seeks to comprehensively document the site, as it faces threats from encroachment and potential destruction from wheeled vehicles, human and animal traffic, and natural hazards like thunderstorms and sandstorms. Through these efforts, the Amarna Project endeavors to preserve and shed light on this crucial aspect of ancient Egyptian history.

To address the threat of modern encroachment on the temple complex, a practical approach was adopted in 2023 (Figure 6). Two donkeys with a cart were employed from Et-Till Beni Amran, a village located on the north side of the site, to transport archaeological equipment to the excavation zone. Deliberately opting for nonmotorized vehicles, the project aimed to minimize the risk of destruction. In contrast to the Workmen's Village, the team met the donkeys directly on-site next to the long-built Long Temple, where they awaited to be loaded with gear, including a ladder and one to two wheelbarrows depending on the day. From there, the whole crew headed to the excavation area which took roughly 15 minutes to reach (Figure 7).

Although it was not very complicated to find the donkeys, as many locals own at least one, finding available ones posed more difficulty. Indeed, in the periphery, donkeys are commonly employed early in the morning for agricultural tasks in the surrounding fields, as well as for transporting people and children to various destinations. For these reasons, they were only utilized at the beginning and end of each day, allowing them to return to their main activities. Hence, donkeys were not present at the site during the working day.

The decision to use donkeys emerged from the observation that the current ground surface overlays the ancient levels by only 5 to 10 cm (Figure 6c). The visible tire tracks, etched into the desert sand since at least the first half of the 20th century, serve as a reminder of the potential damage caused to the ancient underground by mechanized transportation. The problem is not only the wheel itself but rather the weight of the engines and their repeated passage over the same dips for days or generations. The consequences of this impact became evident during the three seasons of excavations, revealing damage not only to the trampled floor but also to the structures constructed with brickwork (Figure 6d). This demolition may increase the difficulty of comprehending archaeological discoveries leading to more incomplete interpretations.

[4] Preliminary reports of the Great Aten Temple can also be downloaded from the Amarna Project webpage. These cover work at both the Eastern Gateway and the Long Temple in the western part of the temple enclosure since 2012. Available at https://www.amarnaproject.com/pages/recent_projects/excavation/great_aten_temple/ [Accessed 13 Feb. 2024].

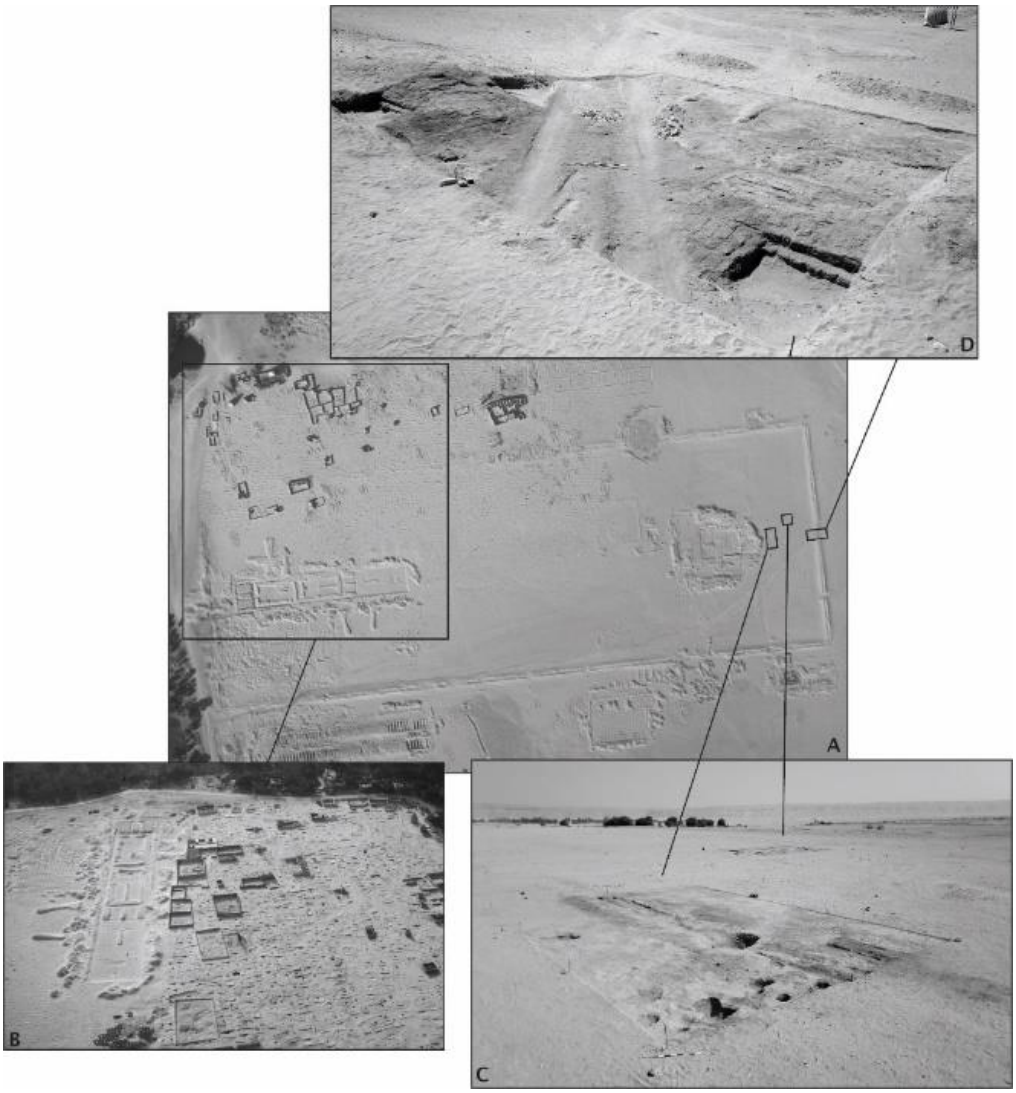

FIGURE 6: Encroachment at the Great Aten Temple, (A) aerial photograph in 1964 (© IGN), (B) aerial photograph in 1993 (© G. Owen/the Amarna Project), (C) area at the back of the Sanctuary during the 2023 excavation, and (D) the Eastern Gateway during the 2021 excavation (© the author/the Amarna Project).

Moreover, the team could quickly notice the famous adaptability and sociability of both donkeys. Within the span of just one week, the animals familiarized themselves with the trail and knew exactly where to stop at the destination, undisturbed by the presence of wild dogs in the nearby desert area. Despite the open surroundings, the donkeys navigated confidently and efficiently. In the same timeframe, the donkeys clearly became integral members of the team, eagerly awaited by everyone each day. Undoubtedly, the animals provided invisible emotional support to the entire team, likely increasing the oxytocin levels (the love hormone) in their bodies. Conversely, the team's care and interactions with the animals likely reciprocated this effect, leading to a decrease in cortisol levels (the so-called stress hormone).

While research on this subject is relatively new and challenging due to the sample

collection (Lürzel et al. 2020: 3-4; Rault et al. 2017: 6–8) and has been primarily conducted for dogs, cattle, pigs, and sheep (Lürzel et al. 2020; Rault et al. 2017), the same conclusion can likely be extrapolated for donkeys. In addition, this suggests that the human-donkey bond has been initiated, indicating at the same time mutual positive interactions and well-being (Rault et al. 2020: 5-6). As a result, the donkeys would sometimes bend their heads toward the men, looking for cuddles, which were readily offered. Thus, despite the heat, the men found themselves in better spirits (Bartz et al. 2011: 305-306), and the donkeys felt reassured, safe, and respected by their environment (Rault et al. 2020; Lürzel et al. 2020: 16). However, a basic understanding of donkeys' behavior and postures is preferable for better interactions with them (Artemiou et al. 2020: 5; Panzera et al. 2020: 9 fig 2).

FIGURE 7: Donkeys Anna (white) and Tutu (grey) employed at the Great Aten Temple excavation in 2023 with the owner and the team (A). Ready to go, (B) upon arrival at the destination, (C) returning to departure, and (D) while unloading the archaeological material (© the author, M. Bertram/the Amarna Project).

Another heartwarming event highlighting the positive impact of interacting with the donkeys occurred when the younger donkey managed to escape. The rope around its neck was not tightly secured due to its thickness, allowing the youth to slip free (Figure 8). Delighted by its newfound freedom, the young donkey raced around the team and its congener and more surprisingly made playful jumps. Everyone could sense the joy of "being free". Remarkably, the donkey galloped all the way to the top of a nearby spoil heap, continuing to bound on itself with unrestrained enthusiasm. However, despite having the opportunity to completely escape, the donkey eventually halted, turning back to its companion as if awaiting it. This touch-

ing demonstration exemplifies the inherently affectionate nature of the animal. Eventually, the donkey returned home, walking nonchalantly along the cart.

These examples of human-donkey and donkey-donkey interactions may explain why donkeys have been increasingly incorporated into rehabilitative programs in several countries, alongside other animals like dogs, cats, and obviously its cousins the horses. Although comprehensive data are still lacking (Portaro et al. 2020; Panzera et al. 2020: 7), few recent studies indicate that donkeys are being used in animal-assisted interventions mainly to support children and individuals with specific pathologies or having general difficulties in interacting with their environment (Panzera et al. 2020; De Rose 2011).

FIGURE 8: Tutu, the younger donkey, fleeing with youthful vigor after slipping free from his neck-rope (© S. Kelly/the Amarna Project).

To maximize the therapeutic benefits of donkey-assisted interventions, an ethological and physiological assessment of the presupposed donkeys is essential (Panzera et al. 2020: 17). Additionally, it is crucial to thoroughly address the clinical pathologies of patients beforehand so that the therapists can offer their expertise more effectively. Based on this evaluation, a personalized therapeutic plan is developed, incorporating specific activities and interactions with the appropriate donkeys. These activities can include grooming, feeding, riding, and playful interactions, each carefully designed to meet particular therapeutic objectives. The therapy's progress is continually monitored, and the plan is adjusted as necessary to ensure the best possible outcomes for the individual, as well as the animal welfare (Portaro et al. 2020: 391; De Rose 2011: 391-392).

However, it appears that horses and donkeys differ in their therapeutic applications. While horses are particularly beneficial for physical issues related to psychomotor aspects, donkeys significantly improve various psychological, cognitive, and psychiatric domains (Panzera et al. 2020: 1-2; Portaro et al. 2020). Overall, donkey-assisted therapy is versatile and effective for a wide range of individuals, including those with physical disabilities, developmental disorders, mental health issues, and those recovering from trauma or stress, as well as people experiencing anxiety.

6. What's Next?

The three first sections of the article revisit the history of donkey domestication, underscoring its main advantages over other pack animals in both ancient and modern Egypt. The case study of the Workmen's Village illustrates that donkeys were mostly employed due to the absence of motorized vehicles in the region. On the contrary, at the Great Aten Temple, their utilization aimed at minimizing the threat of encroachment, which has significantly impacted the site since its abandonment.

While at the Workmen's Village donkeys were mostly a practical solution to local circumstances of the time, their role at the Great Aten Temple reflected a more sustainable archaeology objective and concept. Although the notion of sustainability carries diverse and controversial definitions depending on one's standpoint, here the term mainly refers to the preservation of archaeological material, from simple artifacts to the complexity of the entire landscape (Guttmann-Bond 2019; Hutchings and La Salle 2019; Carman 2016: 137–148). This also inevitably implies the need to protect the site from modern urban development or plunder, for instance. In this context, community engagement becomes a highly valuable aspect to ensure the success of such projects, where shared interests, transparent communication, and mutual trust are not only important but also necessary resources (Schofield et al. 2012: 302-303; Moser et al. 2002).

However, perceptions and definitions of site degradation may vary between populations and over time. In reality, it has been argued that land degradation results more from the lack of maintenance than direct human actions, although both factors can interweave (Schofield et al. 2012: 299-300; Hill 2009: 160–162; Fisher 2009: 213–217). The Great Aten Temple stands out as a prime example of a site under such threats, having been widely an open quarry since antiquity, rendering it more vulnerable to looting and material spoliation (Kemp and Gabolde 2022).

Today, the sight of Westerners riding or leading donkeys might trigger the curiosity of local communities. This presents an opportunity to engage them in discussions about the purpose behind this practice, fostering understanding and concern for the sustainability of the archaeological environment. Sharing the team's dedication to preserving as much as possible the site for further research, tourism, and educational visits is part of a broader community engagement and heritage management initiative started in 2017 at Amarna. Numerous events have been organized for and in partnership with the local people at the Visitor Centre located in Et-Till Beni Amran, near the river bank. (Tully forthcoming; Idem 2023).

Ultimately, donkeys represent an eco-conscious choice compared to wheeled vehicles or machinery, emitting minimal carbon and leaving a negligible ecological footprint. Their use not only promotes sustainable practices but also reduces dependency on fossil fuels, making a significant contribution to environmental conservation initiatives.

Throughout ancient and modern times, donkeys have played a pivotal role in Egyptian society thanks to their adaptability, efficiency, and emotional and natural intelligence in a multitude of tasks. Employing donkeys in excavations aligns with green archaeology principles, improves community involvement, benefits the owners' economy, and enhances the well-being of the animals.

By choosing nonmotorized vehicles like donkeys and carts, archaeological fieldwork projects would aim to mitigate further damage to sites, especially those facing serious preservation challenges (Figure 9). This approach also underscores the commitment to safeguarding cultural heritage, ensuring the conservation of sites for future studies and appreciation. Overall, the enduring qualities of donkeys remain invaluable today, even with technological advancements.

FIGURE 9: The team returning from the excavated area situated at the back of the temple complex (© M. Bertram/the Amarna Project).

Conflicts of Interest

The author declares no conflicts of interest.

Acknowledgments

The author extends heartfelt gratitude to his colleagues at the Amarna Project for their support throughout the integration of donkeys into modern excavations and the subsequent publication of this paper. Special thanks are owed to the late Prof. Barry Kemp (†), to whom this article is dedicated, for his generosity and steadfast encouragement in enabling fieldwork at the rear of the Great Aten Temple. The author is also grateful to Delphine Driaux, Anna Hodgkinson, and the two anonymous reviewers for their invaluable feedback on an earlier draft, as well as to the local field team for all their hard work and dedication. The author acknowledges that no financial support was received for the publication of this article. However, the 2023 Autumn Season at the Great Aten Temple, including the employment of donkeys, was made possible by grants from the Amarna Trust, the Amarna Research Foundation, and The Thames Valley Ancient Egypt Society, for which the author wishes to express his deep gratitude.

References

Agut-Labordère, D. (2018). L'introduction du dromadaire dans le désert occidental égyptien au I^er millénaire avant J.-C. In: Tallet, G. and T. Sauzeau (eds), *Mer et désert de l'Antiquité à nos jours*. Rennes: PUR, Histoire, pp. 175–196.

Artemiou, E., P. Hutchison, M. Machado, D. Ellis, J. Bradtke, M. M. Pereira, J. Carter and D. Bergfelt (2020). Impact of Human-Animal Interactions on Psychological and Physiological Factors Associated with Veterinary School Students and Donkeys. *Frontier in Veterinary Science*, vol 23, 701302. DOI: 10.3389/fvets.2021.701302.

Badr, A., H. H. El-Shazly and L. Watson (2008). Origin and ancestry of Egyptian clover (Trifolium alexandrinum L.) as revealed by AFLP markers. *Genetic resources and Crop Evolution,* vol 55 (1), pp. 21–31.

Balestra, F. (2021). Great Aten Temple excavation report of squares EZ38–39, FA38–39 & FB38. *The Akhetaten Sun*, vol 27 (2), pp. 30–51.

Balestra, F. (2023). The Great Aten Temple: East gateway Excavations, Autumn 2022. In: Stevens, A., G.R. Dabbs, F. Balestra, G. Tully, S. Schiødt, P. Rose, A.J. Clapham, P. Docherty, A. Garnett and M. Bertram. Tell el-Amarna 2022. *Journal of Egyptian Archaeology*, vol 109 (1-2), pp. 90–99.

Balestra, F. (forthcoming). The Great Aten Temple: Third season at the rear of the Temple. In: Stevens, A., G.R. Dabbs, F. Balestra, D Driaux, St. Boonstra, J. Bos, P. Docherty, T. Lakin, V. Gasperini, P. Rose, G. Tully, and M. Bertram. Tell el-Amarna 2023. Journal of Egyptian Archaeology, vol 110.

Bartz, J. A., J. Zaki, N. Bolger and K. N. Ochsner (2011). Social effects of oxytocin in humans: context and person matter. *Trends in Cognitive Sciences*, vol 15 (7), pp. 301–309. DOI: 10.1016/j.tics.2011 .05.002.

Bell, M. (2006). Archaeology and Green Issues. In: Bintliff, J. (ed.), *A Companion to Archaeology*. 2nd edition, Oxford: Blackwell Publishing Ltd, pp. 509–531.

Blench, R. (2004). The history and spread of donkeys in Africa. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 22–30.

Boesneck, J., A. von den Driesch and R. Ziegler (1989). Die Tierreste von Maadi und Wadi Digla. In: Rizkana, I. and J. Seeber (ed.), *Maadi II: The Non-lithic Small Finds and the Structural Remains of the Predynastic Settlement*. *Archäologische Veröffentlichungen des Deutschen Archäologischen Instituts, Abteilung Kairo*, vol 80. Mainz am Rhein: Philipp von Zabern, pp. 87–128.

Boesneck, J. and A. von den Driesch (1990). Tierreste aus der vorgeschichtlichen Siedlung von el-Omari bei Heluan/Unterägypten (Appendix III). In: Debono, F. and B. Mortensen (eds), El *Omari: A Neolithic Settlement and Other Sites in the Vicinity of Wadi Hof, Helwan. Archäologische Veröffentlichungen des Deutschen Archäologischen Instituts, Abteilung Kairo*, vol 82. Mainz am Rhein: Philipp von Zabern, pp. 99–107.

Boum, A. (2023). Donkeys and Mules–Motors of the High Atlas Mountains. [online]. Available at: https://themarkaz.org/donkeys-and-mules-motors-of-the-high-atlas-mountains [Accessed 09 June 2024].

Brewer, D. J., D. B. Redford and S. Redford (1994). Domestic Plants and Animals: The Egyptian Origins. Westminster: Aris & Phillips Ltd.

Brodie, N. (2008). The donkey: an appropriate technology for early bronze age land transport and traction. In: Brodie, N., J. Doole, G. Gavalas and C. Renfrew (eds), *Horizon. A Colloquium on the Prehistory of the Cyclades*. Cambridge: McDonald Institute for Archaeological Research, pp. 299–304.

Carman, J. (2016). Educating for Sustainability in Archaeology. *Archaeology: Journal of the World Archaeological Congress*, vol 12 (2), pp. 133–152.

Chadefaud, C. (2021). Des compagnons indispensables : ânes et bovins dans la vie quotidienne de l'Égypte ancienne (3200–1580 av. J.-C.). In: *L'animal et l'homme: de l'exploitation à la sauvegarde*. [online] Paris : Éditions du Comité des travaux historiques et scientifiques, pp. 1–16. Available at: http://books.openedition.org/cths/15515 [Accessed 19 Feb 2024].

Closse, K. (1998). *Les ânes dans l'Egypte Ancienne*. *Anthropozoologica*, vol 27, pp. 27–39.

Davies, N. de G. (1906). *The rock tomb of el-Amarna, Part IV: Tombs of Penthu, Mahu, and Others*. London: Egypt Exploration Society.

Delvaux, S. (2023). L'Âne. In: Delvaux, S. (ed.), *Les modes de transport terrestre en Egypte à l'Ancien et au Moyen Empire*, *CENiM*, vol 38, tome 2.

De Rose, P., E. Cannas and P.R. Cantiello (2011). Donkey-assited rehabilitation program for children: a pilot study. *Ann Ist uper Sanita*, vol 47 (4), pp. 391–396. 10.4415/ANN_11_04_11.

Diab, A. M. (2017). Images of Riding, Loading and Treated Donkey as Burden Beast in Ancient Egypt. *Journal of Faculty of Tourism and Hotels-University of Sadat City*, vol 1 (2/1), pp. 179–196.

Dijkman, J. and Br. Sims (2004). From beast of burden to multi-purpose power source: challenges for the use of donkeys in Bolivia. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 228–232.

Dost, M., B. Misri, M. El-Nahrawy, S. Khan and A. Serkan (2014). *Egyptian clover (Trifolium alexandrinum). King of Forage Crops.* Cairo: FAO Regional Office for the Near East and North Africa.

Driaux, D. (2016). Water Supply of Ancient Egyptian Settlements: The Role of the state. Overview of a relatively equitable scheme from the Old to New Kingdom (ca. 2543–1077 BC). *Water History*, vol 8(1), pp. 43–58.

Duggal, G. (2015). The Donkey Sanctuary. Caught in The Middle: A report highlighting the issue for working donkeys in the Middle East. [online] Available at: http://www.animalslebanon.org/images/stories/9690-144742750139.pdf [Accessed 11 June 2024].

El-Menshawy, S. (2009). Uses of Domesticated Donkeys: Evidence from Old Kingdom Tombs Scenes. *Abgadiyat*, vol 4 (1), pp. 51–62. DOI: 10.1163/2213860909X00046 [Accessed 11 June 2024].

Fahmy, S. W. (2004). The health and husbandry of donkeys used by Zabbalin rubbish collectors in Cairo Egypt. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 238–240.

Farhat, S. F., A. K. McLean and H. F. F. Mahmoud (2020). Welfare Assessment and Identification of the Associated Risk Factors Compromising the Welfare of Working Donkeys (*Equus asinus*) in Egyptian Brick Kilns. *Animals*, vol 10, 1611, pp. 1–16. DOI: 10.3390/ani10091611. [Accessed 17 June 2024].

Fenwick, H. (2004). Ancient roads and GPS survey: modelling the Amarna Plain. *Antiquity*, vol 78 (302), pp. 880–885.

Fernando, Pr. and P. Starkey (2004). Donkeys and development: socio-economic aspects of donkey use in Africa. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 31–44.

Fisher, Chr. T. (2009). Abandoning the Garden: The population/land degradation fallacy as applied to the lake Pátzcuaro basin in Mexico. In: Chr.T. Fisher, J.Br. Hill and G.M. Feinman (eds), *The Archaeology of Environmental Change: Socionatural Legacies of Degradation and Resilience.* Tucson: The University of Arizona Press, pp. 209–231.

Förster, Fr. (2013). Beyond Dakhla: The Abu Ballas Trail in the Libyan Desert (SW Egypt). In: Förster, Fr. and H. Riemer (eds), *Desert Road Archaeology in Ancient Egypt and Beyond*. *Africa Praehistorica*, vol 27. Köln: Heinrich-Barth-Institut, pp. 297–337.

Förster, Fr., H. Riemer and M. Mahir (2013). Donkeys to El-Fasher or how the present informs the past. In: Förster, Fr. and H. Riemer (eds), *Desert Road Archaeology in Ancient Egypt and Beyond*. *Africa Praehistorica*, vol 27. Köln: Heinrich-Barth-Institut, pp. 193–218.

Gebreab, F., A. G. Wold, Fr. Kelemu, A. Ibro and K. Yilma (2004). Donkey utilisation and management in Ethiopia. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 46–52.

Guttmann-Bond, E. (2019). The ethics of sustainable archaeology. *Antiquity*, vol 93 (372), pp. 1666–1668.

Goulder, J. (2020). Working Donkeys in 4th-3rd Millennium BC Mesopotamia: Insights from Modern Development Studies. *UCL Institute of Archaeology Publication*, vol 70.

Henein, N. H. (1988). *Mari Girsis, Village de Haute Egypte*. 1st edition, Cairo: IFAO.

Hill, J. Br. (2009). What Difference Does Environmental Degradation Make? Change and its Significance in Transjordan. In: Fisher, Chr.T., J.Br. Hill and G.M. Feinman (eds), *The Archaeology of Environmental Change: Socionatural Legacies of Degradation and Resilience*. Tucson: The University of Arizona Press, pp. 160–173.

Huang, B., M. Z. Khan, W. Chai, Q. Ullah and C. Wang (2023). Exploring Genetic Markers: Mitochondrial DNA and Genomic Screening for Biodiversity and Production Traits in Donkeys. *Animals*, vol 13 (17), 2725, pp. 1–23. Available at: https://doi.org/10.3390/ani13172725 [Accessed 12 Feb 2024].

Hutchings, R. M. and M. La Salle (2019). Sustainable archaeology: smoothing rhetoric for an anxious institution. *Antiquity*, vol 93 (372), pp. 1653–1660.

Jahy, F. K. (2023). The Reprensation of the Donkey in Ancient Ira. *Journal of Namibian Studies*, vol 33, pp. 1983–1993.

Jones, P. L. (2021). *Animal Husbandry in Ancient Egypt during The Old and Middle Kingdoms*. Wallasey: Abercromby Press.

Kemp, B. J. (1984). Report on the 1983 Excavations: Commodity Delivery Area (Zir-Area). In: Kemp, B.J. (ed.), *Amarna Reports* I. London: Egypt Exploration Society, pp. 60–80.

Kemp, B. J. (1987). The Amarna Workmen's Village in Retrospect. *Journal of Egyptian Archaeology*, vol 73, pp. 21–50.

Kemp, B. J. (2012). *The City of Akhenaten and Nefertiti: Amarna and its People*. London: Thames & Hudson.

Kemp, B. J. (2018). *Ancient Egypt: Anatomy of a Civilization*. 3rd edition. Routledge: Taylor & Francis Group.

Kemp, B. J. and M. Gabolde (2022). Rediscovering an old discovery: F. G. Newton's cartouche pot. *Horizon*, vol 22, pp. 27–37.

Kimura, B., F. Marshall, A. Beja-Pereira and C. Mulligan (2013). Donkey domestication. *African Archaeological Review*, vol 30 (1), pp. 83–95.

Köpp, H. (2013). Desert travel and transport in ancient Egypt. An overview based on epigraphic, pictoral and archaeological evidence. In: Förster, Fr. and H. Riemer (eds), *Desert Road Archaeology in Ancient Egypt and Beyond*. *Africa Praehistorica*, vol 27. Köln: Heinrich-Barth-Institut, pp. 297–337.

Lashien, M. (2020). Donkeys in the Old and Middle Kingdoms According to the Representations and Livestock Counts from Private Tomb. *Etudes et Travaux*, vol 33, pp. 121–137.

Lürzel, St., L. S. Waiblinger and J.-L. Rault (2020). Salivary oxytocin in pigs, cattle, and goats during positive human-animal interactions. *Psychoneuroendocrinology*, vol 115, 104636. DOI: 10.1016/j.psyneuen.2020.104636 [Accessed 12 June 2024].

Marshall, F. and L. Weissbrod (2011). *Domestication Processes and Morphological Change: Through the Lens of the Donkey and African Pastoralism*. *Current Anthropology*, vol 52 (S4), pp. S397–413.

Mitchell, P. (2018). The donkey in Human History: An Archaeological Perspective. Oxford: Oxford University Press.

Moreno-Garcia, J. C. (2008). Quelques observations sur l'emploi de l'araire en Egypte ancienne. *Groupe de recherches archéologique française et internationale sur les métiers depuis l'Antiquité*, vol 9-10, pp. 53–60.

Moser, S., D. Glazier, J. E. Phillips, L. el Nemr, M. S. Mousa, R. N. Aiesh, S. Richardson, A. Conner and M. Seymour (2002). Transforming archaeology through practices: strategies for collaborative archaeology and the Community Archaeology Project at Quseir, Egypt. *World Archaeology*, vol 34 (2), pp. 220–248.

Newberry, P. E. (1893). *Beni Hasan I. Archaeological Survey of Egypt*, vol 1. London: Kegan Paul.

Ngendello A. M. and W. C. S. Heemskerk (2004). Pack donkeys, bicycles and carts: a case-study from Sukumaland in northwest Tanzania. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 122–126.

Panzera, M., D. Alberghina and A. Statelli (2020). Ethological and Physiological Parameters Assessment in Donkeys Used in

Animal Assisted Interventions. *Animals (Basel)*, vol 10 (10), 1867. DOI: 10.3390/ani10101867.

Peet, T. E. and C. L. Woolley (1923). *The City of Akhenaten I: Excavation of 1921 and 1922 at El-'Amarna*. London: Egypt Exploration Society.

Petrie, W. M. F. (1894). *Tell el Amarna*. London: Methuen and Co.

Prévost, M. (2023). L'âne humanisé et l'homme animalisé en Égypte ancienne: Rapprochements et identifications entre l'homme et l'âne dans les textes et les images du Nouvel Empire. [online] *Aitia*, vol 13 (1). Available at: https://journals.openedition.org/aitia/10895 [Accessed 20 Dec 2023].

Prévost, M. (2022). L'âne au travail dans l'Egypte ramesside. Données textuelles et iconographiques. In: Poinsot, D. and M. Spruyt (eds), *Le Cheval, l'Âne et la Mule dans les Empires de l'Orient ancien. Des Néo-Assyriens aux Sassanides, du monde méditerranéen à l'Asie centrale*, Actes du Colloque International de Paris, INHA and Domaine de Chantilly, 12-13 octobre 2018. Paris: Route de l'Orient III, pp. 87–102.

Prévost, M. (2021). Partir avec des ânes dans le désert: Les caravanes des anciens Égyptiens (IIIe et IIe millénaires av. n. è.). In: Spruyt, M., A. Vorsanger, M. Prévost and T. Salmon (eds), *Routes Communications et Circulation: Approches croisées, en Orient et dans le monde méditerranéen, du IVème millénaire avant notre ère au XVème siècle de notre ère*. Actes de la journée Jeunes Chercheurs, Paris, 22 mai 2018. Paris, pp. 78–95.

Portaro, S., G. Maresca, A. Rafa, G. Gemelli, B. Aliberti and R. S. Calabrò (2020). Donkey Therapy and Hippotherapy: wo faces of the same Coin?. *Innovation in Clinical Neuroscience*, vol 17(1–3), pp. 20-21. Available at: https://pubmed.ncbi.nlm.nih.gov/32547842/ [Accessed 19 June 2024].

Rault, J.-L., S. Waiblinger, X. Boivin and P. Hemsworth (2020). The Power of a Positive Human-Animal Relationship for Animal Welfare. *Frontier in Veterinary Science*, vol 7, 590867. DOI: 10.3389/fvets.2020.590867 [Accessed 14 June 2023].

Rault, J.-L., M. van den Munkof and F. T. A. Buisman-Pijlman (2017). Oxytocin as an Indicator of Psychological and Social Well-Being in Domesticated Animals: A Critical Review. *Frontier in Psychology*, vol 8, 1521. DOI: 10.3389/fpsyg.2017.01521.

Rommelaere, C. (1991). *Les Chevaux du Nouvel Empire égyptien. Origines, races, harnachement*. Bruxelles: *Coll Connaissance de l'Egypte Ancienne*, vol 3.

Rossel, St., F. Marshall, J. Peters, T. Pilgram, M. D. Adams and D. Conner (2008). Domestication of the Donkeys: Timing, Processes, and Indicators. *Proceeding of the National Academy of Sciences,* vol 105 (10), pp. 3715-3720. Available at: https://www.pnas.org/doi/full/10.1073/pnas.0709692105#bibliography [Accessed 20 Feb 2023].

Schofield, J., R. Kiddey, Br. D. Lashua (2012). People and Landscape. In: Skeates, R., C. McDavid, and J. Carman (eds), *The Oxford Handbook of Public Archaeology*. Oxford: University Press, pp. 296–318

Sosovele, H. (2004). Donkey traction in Tanzania: some critical issues. In: Starkey,

P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 107–109.

Todd, E. T. et al. (2022). The genomic history and global expansion of domestic donkeys. *Science*, vol 377 (6611), pp. 1172–1180. Available at: 10.1126/science.abo3503 [Accessed 12 Feb 2024].

Tully, G. (2023). Community engagement. In: Stevens, A., G. R. Dabbs, F. Balestra, G. Tully, S. Schiødt, P. Rose, A. J. Clapham, P. Docherty, A. Garnett and M. Bertram, Tell el-Amarna 2022. *Journal of Egyptian Archaeology*, vol 109 (1-2), pp. 112–114.

Tully, G (forthcoming). Community engagement. In: Stevens, A., G.R. Dabbs, F. Balestra, D Driaux, St. Boonstra, J. Bos, P. Docherty, T. Lakin, V. Gasperini, P. Rose, G. Tully, and M. Bertram. Tell el-Amarna 2023. Journal of Egyptian Archaeology, vol 110.

Vandenbeusch, M. (2020). *Sur les pas de l'âne dans la religion égyptienne*. Leiden: Sidestone Press.

Van Neer, W., V. Linseele and R. F. Friedman (2004). Animal burials and food offerings at the elite cemetery HK6 of Hierakonpolis. In: Hendrichx, S., R.F. Firedman, K.M. Cialowicz and M. Chlodnicki (eds.), *Egypt at its Origins. Studies in Memory of Barba Adams. Proceedings of the International Conference 'Origin of the Sate. Predynastic and early Dynasty Egypt', Kraków, 28th August–1st September 2002*, *Orientalia Lovaniensia Analecta*, vol. 138. Leuven: Peeters Publisher, pp. 67–130.

Vernus, P. and J. Yototte (2005). *Bestiaire des pharaons*. Paris: Agnès Viénot Editions Perrin.

Wells, D., R. C. Krecek and J. A. Kneale (2004). Socio-economic and health aspects of donkeys in North-West and Eastern Cape Provinces, South Africa. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 203–208.

Wold, A. G., A. Tegegne and A. Yami (2004). Research needs of donkey utilisation in Ethiopia. In: Starkey, P. and D. Fielding (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ANTESA)*. Wageningen: ACP-EU Technical Centre for Agricultural and Ural Cooperation, pp. 77–81.

Yılmaz, O. (2012). Domesticated Donkey. Ankara: Veni Vidi Vici Publications.

Yılmaz, O., S. Boztepe and M. Ertuğrul (2012). The domesticated donkey: III - Economic importance, uncommon usages, reproduction traits, genetics, nutrition and health care. *Canadian Journal of Applied Science*, vol 2, pp. 139–157.

Ziegler, Ch. (1993). *Le Mastaba d'Akhethetep, une chapelle funéraire de l'Ancien Empire*. Paris: Réunion des Musées Nationaux Edition.