

The history and spread of donkeys in Africa

by

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Abstract

The domestication and historical development of the donkey are traced through archaeological and linguistic associations. The donkey is indigenous to the African continent and its wild progenitor is usually considered to be the Nubian wild ass. Historically, a chain of races of wild ass spread from the Atlas Mountains to the Red Sea and probably as far south as the border of present-day northern Kenya. The wild ass may well have been domesticated several times, given the semi-feral production systems under which it was managed until recently. Records of domestic asses begin in Egypt in the fourth millennium BC. The extent to which the wild ass penetrated the interior of Africa is unknown. Faunal remains and rock art representations are extremely rare, which is somewhat at odds with the widespread distribution and economic importance of the donkey in Africa today. This apparent contradiction can probably be explained by the fact that donkeys have been of most importance to poor households and have consequently had low prestige. The spread of the donkey across Africa was linked with the proliferation of long distance caravans. It is argued that greater attention to the nearly extinct wild ass and to traditional management systems could be helpful in the future development of the donkey in Africa.

Introduction

Donkeys are not conventional sources of meat, and their uses for packing and traction do not fit within the stereotyped perspectives of livestock development agencies. Nonetheless, they are essential to the subsistence strategies of many communities in semi-arid regions, relieving families of repetitive and energy-consuming tasks.

The early history of the donkey in Africa is difficult to reconstruct because of the sparse archaeological data. The wild relatives of the donkey have been hunted to virtual extinction making it difficult to collect the genetic data necessary to establish its ancestry in detail (and incidentally, has depleted the potential gene pool that might be used to revitalise domestic donkey

breeds). Although the use of the domestic donkey is well documented in Egyptian wall-paintings and other iconography, elsewhere in the continent it is remarkable chiefly for its absence, even where there are established rock-art traditions.

One strategy to fill this lacuna is the use of linguistics. Terms for donkeys and asses have been recorded in numerous African and Near Eastern languages. Compiling these terms and tracing the links between them makes it possible to propose some hypotheses both about the process of domestication and the routes along which it spread. This can be combined judiciously with modern ethnographic data to reconstruct the prehistory of the donkey in Africa.

Biogeography

The precise wild progenitor of the domestic donkey is disputed. Eisenmann (1995) has recently reviewed the competing arguments. Groves (1966, 1986) set out the possible ancestors of the donkey and indicated that present-day wild populations are no longer sufficiently homogeneous to resolve the question unambiguously. Bökönyi (1991) argued that domestication took place in Egypt and Clutton-Brock (1992) notes that the skeletons of three domestic donkeys have been found in an Egyptian tomb dated to 4500–4000 BC. There are comparably early skeletons in the Near East but whether these are domestic remains uncertain (Eisenmann, 1995). The wild ass, *Equus africanus*, is indigenous to the African continent and is usually divided into a chain of races of subspecies spreading from the Atlas Mountains eastwards to Nubia, down the Red Sea and probably as far as the border of present-day northern Kenya (Groves 1966, 1986; Haltenorth and Diller 1980; Kingdon 1987). The extent to which the wild ass penetrated the interior of Africa is controversial, but it is generally considered unlikely that it ever occurred in sub-Saharan regions.

The Nubian wild ass is cited in many textbooks as the progenitor of the donkey, although other races may also have contributed to the gene-pool (Epstein, 1984). Figure 1 shows the actual range

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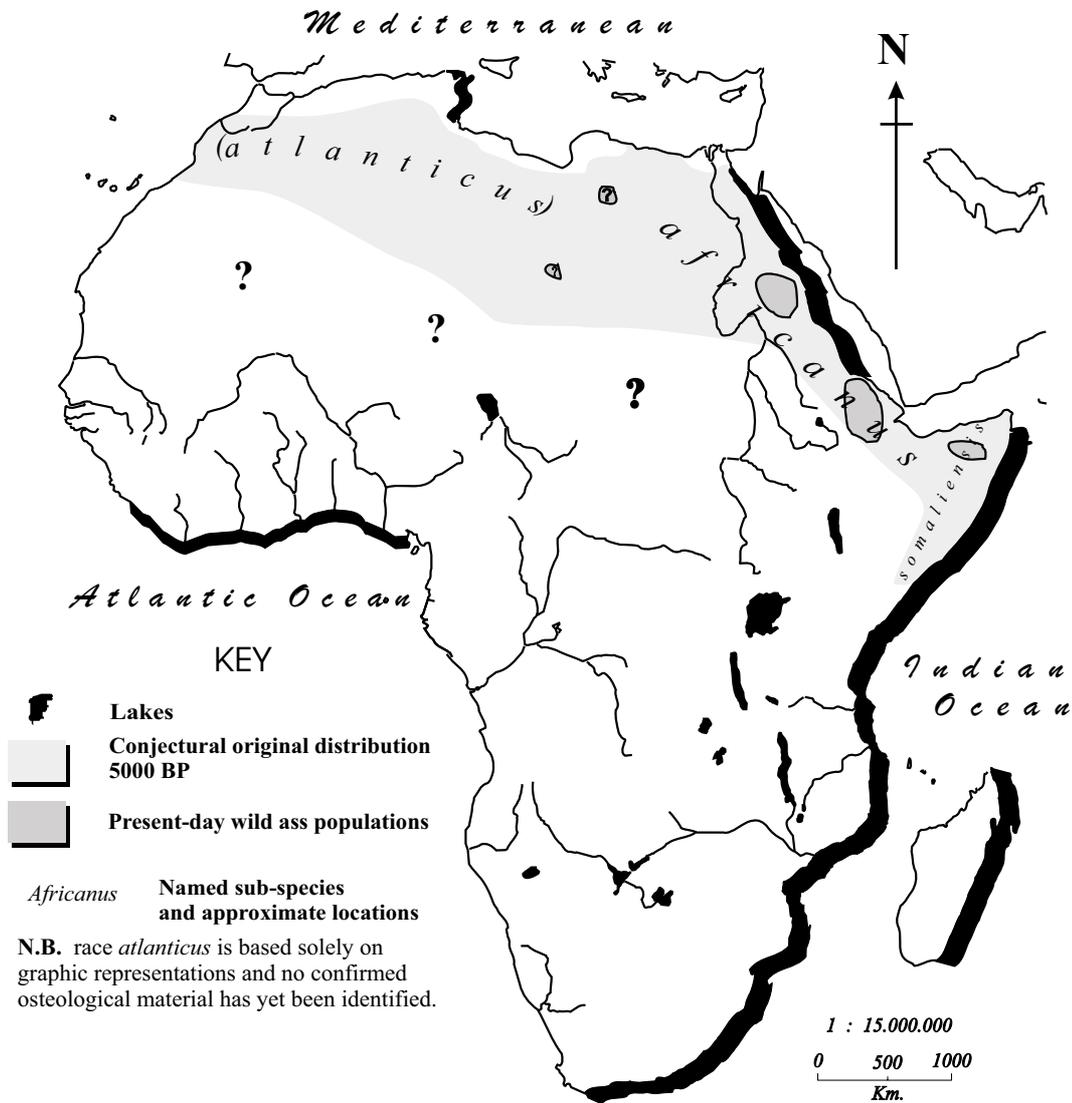


Figure 1: Current and historical distribution of wild asses

of the wild ass in the 1990s (Kingdon, 1997) superimposed on the hypothetical former distribution prior to Roman depredations in North Africa. Four notional races, *atlanticus*, *africanus*, *taeniopus* and *somaliensis* are located approximately as shown in earlier studies (Haltenthorn and Diller, 1980). However, two of these, *atlanticus* and *taeniopus*, have been rejected more recently and indeed the proposed *atlanticus* race turns out to have been based on misidentified

zebra bones (Kingdon, 1997). The main features differentiating races of wild ass are the number and type of stripes and the shoulder crosses. However, their characterisation may be somewhat blurred, since populations that survived into historical times have almost certainly crossed with feral donkeys, leading to a merger of characteristics.

Haltenthorn and Diller (1980) describe the characteristics of the African races of wild ass and

it seems that there is some correspondence between local forms of the donkey and the phenotypes of the wild ass. For example, *Equus asinus somaliensis* is notable for the leg rings on both fore and hind legs. The Somali donkey is described as having zebra markings on the legs (Mason and Maule, 1960). In contrast, West African donkeys usually have distinct shoulder crosses (shown in representations of the Atlas wild ass) but rarely any leg markings. Of these races, the wild ass of the Atlas Mountains became extinct by 300 AD and is known only through representations and possible skeletal material. Civil war in both Somalia and Eritrea may mean that their fragile wild populations have disappeared or are severely threatened. There are two doubtful populations of wild ass near Siwa oasis in Egypt and further south towards the Sahara proper. These may well be feral donkeys or populations substantially interbred with the domestic donkey. There are breeding animals conserved today in Basle Zoo and the Hai Bar Reserve in the Negev desert, and these may well be the last remaining genetically pure populations. The populations on the island of Soqotra are certainly feral donkeys. The wild ass is limited to the semi-arid regions through its susceptibility to the consequences of humidity, but the range of the domesticated donkey can be extended by careful management.

The original motive for domesticating the donkey is unknown, and it is not certain that it would necessarily reflect its common usage today, as transport for people and goods. It may have been domesticated for its meat or milk, with its use for portage a later development. Certainly the fact that the wild ass and the donkey have remained interfertile suggests that there was little breeding and selection. This may reflect a management system based on the seasonal corralling of wild animals, rather like reindeer management among the Saami today. Such management systems were practised through much of Sahelian West Africa into the present century and were probably once considerably more common.

Donkeys in use

Donkeys are kept in Africa for four reasons: work, breeding, milking and eating. Of these, work is by far the most important. Donkeys are used mainly as pack animals, either for carrying loads or for riding. In arid regions they are used together with camels to pull water from deep wells. Less

commonly they are used in traction, for example, pulling carts or plows, although both of these technologies are post-European introductions in sub-Saharan Africa. In Ancient Egypt asses were used both for treading seed into the furrow and for threshing, but there seem to be no modern reports of these practices. Clutton-Brock (1992) reviews some of the existing literature although this focuses principally on horses.

Breeding donkeys can be a profitable business in certain regions of the Sahel. It is often more convenient for donkey-users in the south to buy animals from further north and replace them at the end of their working lives. Countries such as Niger and Mali have a considerable trade selling donkeys, usually males, to communities further south. Although ass's milk has an important symbolic value due to its prominence in certain near-eastern texts, the milking of donkeys in Africa is rare and of little economic importance. The western Maasai are reported to milk donkeys (Epstein, 1971) and donkeys' milk is used in magical remedies in parts of West Africa. Historically, donkeys were probably not milked because of the labour needed to catch them regularly in low-management systems and the availability of higher yielding alternatives.

The extent to which donkeys are eaten is probably greatly underestimated, since this is something of a taboo area for many observers. Nonetheless, the wild ass has been hunted to near-extinction for its meat and eating equids is common in many Eurasian pastoral systems. In West Africa the trade in donkeys for meat is essentially of old, sick or exhausted animals that have been used as work animals in the villages of the semi-arid zone. Because of its ambiguous status the trade in donkeys for meat remains poorly documented. Islam prohibits the consumption of donkey meat and many Christian and traditionalist groups also refuse to eat it.

Ibn Battuta, travelling in the Empire of Mali in 1352 noted with distaste the consumption of donkeys (Levtzion and Hopkins, 1981). Fernandes (1938) describes the Berber nomads of Mauritania as eating donkey in the early sixteenth century. Donkey meat was still eaten in the Malian Gourma at the turn of the century (Desplagnes 1907). Despite this, in Nigeria at least, there is a thriving trade in donkeys reaching southern markets and this is probably replicated along the West African coast (RIM, 1992). Formerly much

of the trade was in smoked meat, as donkeys bought in intermediate markets were slaughtered and skinned and the meat then prepared by drying and smoking. This practice now seems to have largely disappeared, and the trade is confined to live donkeys. The meat is sold as donkey meat locally, but is sometimes passed off as the more expensive beef outside the area.

In Eastern and Southern Africa donkeys are eaten in some regions. The Kamba people in Kenya are recorded as actually fattening donkeys for consumption and some of the other cultivators close to the Maasai may also eat donkeys (Epstein, 1971). Donkeys are commonly eaten in Namibia and occasionally in some regions of South Africa. In other countries, Zimbabwe for example, eating donkeys is widely stereotyped as distasteful. The notion that donkey consumption is distasteful or contrary to religion can lead to communities becoming ashamed of this practice.

Productivity of donkeys under traditional management

Fielding (1988) has reviewed the reproductive characteristics of female donkeys world-wide. Studies on the productivity of donkeys under traditional management in sub-Saharan Africa are sparse, consisting principally of data from two different systems in Mali (Wilson, 1980), the Twareg pastoral herds of Niger (Wilson, Wagenaar and Louis, 1984) and northern Nigeria (RIM, 1992).

In northern Nigeria the mean age at first foaling, 57 months (RIM, 1980), is substantially higher than in temperate countries where about three years is considered usual (Fielding, 1988). Donkeys in Nigeria are allowed to mate freely when herded, but restrictions on access to males when jennies are used for work can mean that oestrus is overlooked. Estimates from the literature suggest that the length of the oestrous cycle is about 24 days and the length of the oestrus itself 6–7 days (Fielding 1988). Donkeys are usually seasonal breeders in temperate regions but in the tropics they come into oestrus throughout the year. Variations in the annual pattern of foaling are most likely to reflect nutritional differences. Using published data on gestation length which showed considerable variation, Fielding (1988) calculated a mean gestation period for donkeys of 374 days.

Archaeology and history

Records of domestic donkeys begin in Egypt in the fourth millennium BC with clear representations of working donkeys by the middle of the next millennium (Epstein, 1971). Winkler (1938, 1939) identified wild asses in the rock-art of the Eastern desert. There are no donkeys in the faunas of the Fayum and Merimde (4500-4000 BC), but they appear, already domesticated at Maadi (4000-3500 BC) (Midant-Reynes, 1992). At about the same period there are textual records of extremely large herds of donkeys, many of which were apparently used for portage. The expeditions to Punt (Ethiopia) consisting of large trade caravans usually included numerous donkeys (Kitchen, 1993). The extent to which the donkey departs from its wild relatives can be tracked through Egyptian wall-paintings, where the dark shoulder-stripe of the ass gradually disappears from the donkeys as the Old Kingdom gives way to the Middle Kingdom (Brewer et al, 1994).

Donkeys from the second millennium BC occur at Shaqadud in the Butana grasslands of Sudan (Peters, 1991). The historical and archaeological evidence for domestic donkeys in the Maghreb is reviewed by Camps (1988). Donkeys were found in the faunal assemblages at Carthage of the Roman period in the first to fourth centuries AD (Levine, 1994). Kaache (1996) reviews the evidence for donkeys in Morocco; there are possible finds of ass bones at the 'Neolithic' sites of Dar-es-Soltane and Tangier but no certain representations in rock art. The donkey is found only rarely in rock paintings and engravings of the central Sahara. It is present after about 5000 BC from Oued Djerat (Tassili) or Mathendous (Libya). Despite its status in Egypt, no Saharan rock art shows an unambiguous scene of a domesticated donkey. In the Maghreb there are donkeys in the faunas of several Neolithic sites but we have no evidence for its domestication there before historical times. This is rather surprising, but it is confirmed by substantial data on both archaeological material and rock art. Similarly, and perhaps more surprisingly, there appear to be no representations of wild asses or donkeys in the Horn of Africa (Phillipson, 1993). The donkeys from the Saharan Atlas are similar to those in rock pictures in the central Sahara and illustrated in Roman mosaics. They seem to represent the same type of wild donkey, with the

black shoulder cross often wide and well-marked. In some rare cases (eg, at El Richa) the legs show chevron stripes. Neither the size, nor the black cross, nor the coat colour, nor other details are clear enough to attribute the representations to one of the two subspecies, the Somali (*Equus asinus somaliensis*) or the Nubian (*Equus asinus africanus*). Definitive discrimination of these subspecies on the basis of gross visual criteria is difficult (Groves, 1986).

Archaeologically, there are few records of donkeys in sub-Saharan Africa. There is, moreover, a problem of identification. There is considerable evidence for the widespread use of ponies in West-Central Africa, a cultural pattern which evolved from the adaptation of North African horses to the ecology of the sub-Saharan region (Blench, 1993). West African ponies are extremely small and it remains to be demonstrated that they can be reliably distinguished from donkeys and mules.

Bearing this in mind, the earliest record of a donkey in West Africa is at Siour in Senegambia (MacDonald and Hutton MacDonald, 2000). The stratigraphy of this site appears to be reliable and the donkey bone is dated to between 0–250 AD. After this, the next finds of donkey bones are at Akumbu in Mali with a date of 100–600 AD. However, bones are extremely rare even in sites such as Tegdaoust, where there have been extensive finds of other domestic species.

Equine teeth have been recovered from excavations in Central Nigeria from Rock Shelters at Kariya Wuro (Allsworth-Jones, 1982) and Rop. The Rop teeth, in particular, which are dated to first millennium BC, have been identified as those of a wild ass or donkey (Sutton, 1985). This seems most unlikely, unless either the stratigraphy at Rop is misleading or these are in fact pony teeth.

Historical sources on the spread of the donkey are scanty. The Arabic sources for West-Central Africa mention donkeys several times. Al-Bakri noted the use of donkeys to carry salt in the Kingdom of Ghana and Al-Umari commented on their small size in the Empire of Mali (Levtzion and Hopkins, 1981) They pass unnoticed in Ethiopian historical chronicles (Pankhurst, 1968). It is only with the European trading voyages that there are a few references, and even these are scarce.

Ellert (1993) quotes Portuguese documents describing the Zambezi Valley in 1758 which note

the donkey as already present among Shona populations. It is likely that these donkeys, like the pig and some exotic plant species, were brought into northeast Zimbabwe along the gold routes from Sofala in Mozambique. Donkeys and mules from Persia were apparently first landed at the Cape by the Dutch East India Company in 1689 (Boettger, 1958). Little is known of its subsequent history, but it seems likely that the Boer farmers were the initial agents of its spread into the interior. Figure 2 shows the approximate distribution of working donkeys in Africa in 1996, with arrows marking the possible routes of diffusion of donkeys through the continent. It should be emphasised that some of these are highly speculative, as are any dates attached to such movements.

In part, the absence of donkeys in both textual records and rock art must relate to their low status. While the painters of rock art in the Sahara focused on the high prestige horse and later the camel, they omitted the donkey because of its lowly status. However, it may also be that the spread of donkeys was at first very slow and scattered and its importance perhaps came with the evolution of long-distance trade. This would explain the extremely sparse material in West Africa.

Names for the donkey in Africa

Another way of approaching the history of the donkey is through the vernacular names in the languages of sub-Saharan Africa. Two authors, Skinner (1977) and Bender (1988), have looked at the potential for reconstruction in specific language groups, respectively Chadic and Omotic. Donkeys may be represented by a ramified terminology; there can be separate terms for wild ass, jenny, young donkey etc. These are often quite obscure words and lexicographers not specialised in livestock do not always record these words. Further research may thus reveal connections and extensions of root forms not at present apparent. The principal names identified are *kuur* (widespread in Africa), *harre* (Ethiopian languages) and *ayul* (Berber).

The most probable source for *harre* are the Oromoid words for zebra. Zebras are not part of the fauna of the Ethiopian highlands but they are widespread in the lowlands south of the Plateau and are very familiar to pastoral groups such as the Borana. Borana has *harre dida* for zebra, with *dida* meaning outdoors or open air. The term

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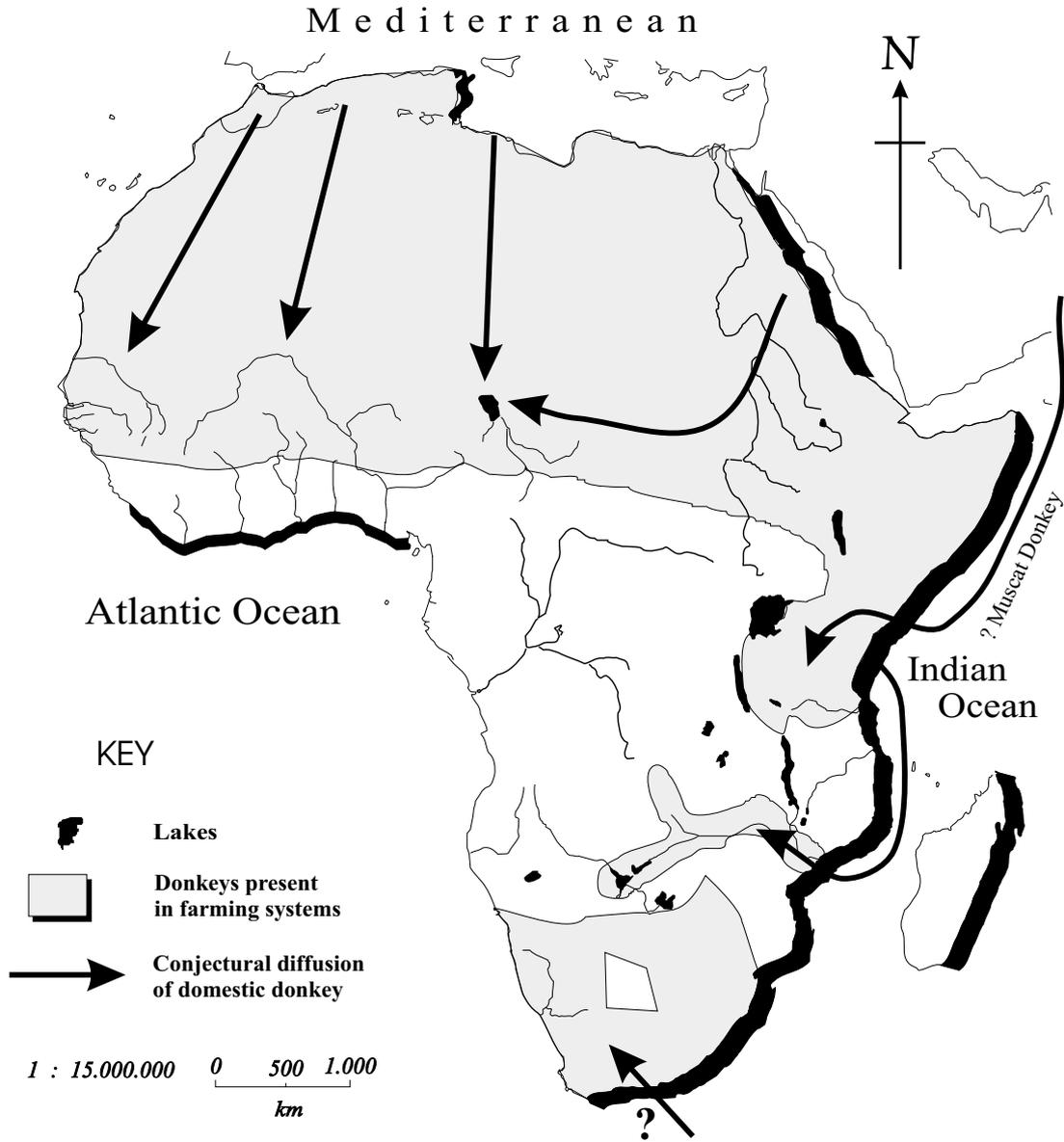


Figure 2: Current distribution of donkeys in Africa and possible routes of diffusion

harre was probably originally a word for zebra in lowland Oromoid and was transferred to the donkey once it was fully domesticated. The zebra would then become the donkey of the plains. Formations such as *konso harr-etita* for zebra would be calques of the Borana expression, already using the borrowed word for donkey. The development of the donkey as pack animal is probably reflected in the *beja harri* meaning anything ridden, from a camel to a train.

The linguistic evidence suggests that individual branches of the Afro-asiatic language phylum seem all to have quite distinctive lexical items for wild ass/donkey. In most cases, the speakers would have been familiar with the wild ass, and so would have named this creature in the pre-domestication era. Only the k-r root is widespread in Central Africa and seems to have been carried from the Cushitic-speaking regions in the Horn of Africa to the Lake Chad Region. This

is consonant with the hypothesis that the donkey was taken into domestication several times around the fringes of the Sahara.

Patterns of spread of the domestic donkey

The spread of the domestic donkey can be divided into two key phases: the diffusion of domestic donkeys prior to European contact and the subsequent era. These two eras are not, as is common, distinguished by documentation and there are many gaps in the historical record.

Documentation

By and large there are no records to indicate the spread of the donkey in the pre-contact era. For example, although donkeys are widespread in West Africa, and may have been there for up to 2000 years, if the archaeological sites are correctly interpreted, there are no references to them in the Arabic chronicle material describing this region. The same is true in Ethiopia, despite fairly copious text material from about 1200 onwards.

Land or sea

The diffusion of the donkey in pre-contact times seems to have been strictly via land; most notably crossing the Sahara, but usually simply spreading gradually from farmer to farmer. However, once the donkey became seen as a productive animal for all of semi-arid Africa, it seems to have been brought to southern Africa in ships, hence its uneven distribution.

There is a reference to so-called Muscat donkeys in Tanzania in the 1950s (Mason and Maule, 1960). These were light-coloured donkeys associated with the Arabs and may have thus been brought from the Gulf region or from Egypt where they have a long tradition of use.

It should be emphasised that the informal diffusion of donkeys continues even today; the clearing of savannah forest south of the Sahel and the consequent decline in tsetse challenge has permitted donkeys to spread southwards. Donkeys can survive on poor quality diets and can find food in the peri-urban wastelands surrounding many African towns. Similarly, deforestation and land degradation leads to decreased biodiversity; donkeys can feed on the shrubs that persist under these conditions.

Present-day use of donkeys in West Africa is closely related to road infrastructure and the pricing of rural transport. In Nigeria, for example, the oil boom era led to massive importation of

small pickups and these became the preferred means of transporting farm produce to market. Prices of both vehicles and fuel were so low that many farmers sold their donkeys and breeders in the semi-arid region turned to other enterprises. However, once the recession set in at the end of the 1980s, the economics of motorised rural transport became more doubtful and farmers became anxious to acquire donkeys again. Having receded in Nigeria, the donkey is once again spreading.

Within Eastern and Southern Africa, the situation appears to be rather different. Donkeys are well established in West Africa and their work and climatic aptitudes known to the various societies where they are used. Across the continent donkeys are still spreading and their use and value is gradually being discovered in many rural areas. The drought that took place between 1990 and 1995 led to extensive mortality among work oxen. Farmers throughout the region have been increasingly using donkeys for packing and traction, often in the face of official policy, which tends to be opposed to donkeys (Starkey, 1995).

Conclusions and further research

The donkey is certainly derived from the African wild ass, although it may have been domesticated several times in regions of its former range no longer represented by its present-day distribution. This appears to be confirmed by studies of terms for donkey in various African language families. Egypt remains the most likely centre for its early development for agricultural work, although without further archaeology outside the Nile Valley this is uncertain.

Although at least one archaeological site appears to confirm the donkey crossed the Sahara to West Africa some 2000 years ago, it may have been as a rare exotic, since both bones and rock-paintings are otherwise scarce. It is probable that donkey use only took off in West Africa with the rise of the long-distance caravan trade from about 1000 AD. Although donkeys and mules are extremely common in Ethiopia today, the same may be true there. Rock art and faunal remains are scarce, and the use of a common term, *harre*, that is extremely widespread and appears unchanged in many languages, suggests a relatively recent spread.

Understanding the ancestry and genetic makeup of the donkey and its relation to the wild ass should not be dismissed as mere antiquarianism. Wild asses represent an important pool of variation that

could be used to broaden what may be quite a narrow genetic base in present-day domestic donkeys. Disease and drought resistance might both be improved if we understood better the relationships between donkeys and asses. The extreme threat to the few remaining asses and the possibility of introgression from the domestic donkey make this research a matter of some urgency.

In the same vein, recent enthusiasm for the donkey, especially by NGOs, has not necessarily created an understanding of the broader parameters of donkey use and its role in the economic system of its owners. To remedy this, studies of productivity under traditional management such as those reported here need to be replicated in other parts of the continent and stratified both according to ecological zone and production strategy. To understand the present we need to know considerably more about the donkey in the past.

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References

- Allsworth-Jones P, 1982. Kariya Wuro faunal report. *Zaria Archaeology Papers* 4:6-9.
- Bender M L, 1988. Proto-Omoti: Phonology and Lexicon. pp. 121-162 in: Bechhaus-Gerst M and Serzisko F (eds), *Cushitic-Omoti: Papers from the International Symposium on Cushitic and Omotic Languages*. Buske Verlag, Hamburg, Germany.
- Blench R M, 1993. Ethnographic and linguistic evidence for the prehistory of African ruminant livestock, horses and ponies. pp. 71-103 in: Shaw T, Sinclair P, Andah B and Okpoko A (eds), *The Archaeology of Africa. Food, Metals and Towns*. Routledge, London, UK.
- Blench R M, 2000. A history of donkeys, wild asses and mules in Africa. pp. 339-354 in: Blench R M and MacDonald K (eds), *The origins and development of African livestock: archaeology, genetics, linguistics and ethnography*. University College London Press, London, UK. ISBN 1-84142-018-2
- Boettger C R, 1958. *Die Haustiere Afrikas*. Jena.
- Bökönyi S, 1991. The earliest occurrence of domestic asses in Italy. pp. 178-216 in: Meadow R H and Uerpmann H P (eds), *Equids in the Ancient World Volume II*. Ludwig Reichert, Wiesbaden, Germany.
- Brewer D J, Redford D B and Redford S, 1994. *Domestic plants and animals: the Egyptian origins*. Aris and Phillips, Warminster, UK.
- Camps G, 1988. Ane. *Encyclopédie berbère* 5: 647-654.
- Clutton-Brock J, 1992. *Horse power: a history of the horse and the donkey in human societies*. Harvard University Press, Cambridge, Massachusetts, USA. 192p.
- Desplagnes L, 1907. *Le plateau central nigérien, une mission archaéologique et ethnographique au Soudan français*. Paris.
- Eisenmann, V. 1995. L'Origine des ânes: questions et réponses paléontologiques. *Ethnozootechnie*, 56, 5-26.
- Ellert H, 1993. *Rivers of gold*. Mambo Press, Gweru, Zimbabwe.
- Epstein H, 1971. *The origin of the domestic animals of Africa. (2 vols)*. African Publishing Corporation, New York, USA.
- Epstein H, 1984. Ass, mule and onager. pp. 174-184 in: Mason I L (ed), *Evolution of domesticated animals*. Longman, London, UK.
- Fernandes V, 1938. Description de la côte d'Afrique de Ceuta au Sénégal. In: de Cenival P and Monod Th (eds), *Publications du comité d'études historique et scientifiques de l'Afrique occidentale française*. Series A no 6. Larose, Paris, France.
- Fielding D, 1988. Reproductive characteristics of the jenny donkey, *Equus asinus*: a review. *Tropical Animal Health and Production* 20:160-166.
- Groves C P, 1966. Taxonomy. pp. 2-11 in: Groves C P, Ziccardi F and Toschi A. Sullasino Selvatico Africano. Supplement to *Ricerche di Zoologia Applicata alla Caccia* 5.
- Groves C P, 1986. The taxonomy, distribution and adaptations of recent equids. pp. 11-51 in: Meadow R and Uerpmann H P (eds), *Equids in the Ancient World*. Reichert, Wiesbaden, Germany.
- Haltenorth T and Diller H, 1980. *A field guide to the mammals of Africa, including Madagascar*. Collins, London, UK.
- Kaache B, 1996. L'Origine des animaux domestiques au Maroc: état des connaissances. *Préhistoire et Anthropologie Méditerranéenne* 5:85-92.
- Kingdon J A, 1997. *The Kingdon field guide to African mammals*. Academic press, San Diego. 465p. ISBN 0-12-408355-2.
- Kitchen K A, 1993. The land of Punt. pp. 587-608 in: Shaw T, Sinclair P, Andah B and Okpoko A (eds), *The Archaeology of Africa: food, metals and towns*. Routledge, London, UK.
- Levine M A, 1994. The analysis of mammal and bird remains. pp. 314-317 in: Hurst H R (ed), *Excavations at Carthage, the British Mission. Vol II*. British Academy and Oxford University Press, Oxford, UK.
- Levtzion N and Hopkins J F P, 1981. *Corpus of early Arabic sources for West African history*. Cambridge University Press, Cambridge, UK.
- MacDonald K and Hutton MacDonald R, 2000. The origins and development of domesticated animals in arid West Africa. pp. 127-162 in: Blench R M and MacDonald K (eds), *The origins and development of African livestock: archaeology, genetics, linguistics and ethnography*. University College London Press, London, UK. ISBN 1-84142-018-2

- Mason I L and Maule J P, 1960. *The indigenous livestock of eastern and southern Africa*. Technical Communication No. 14 of the Commonwealth Bureau of Animal Breeding and Genetics, Commonwealth Agricultural Bureaux. Farnham Royal, UK.
- Midant-Reynes B, 1992. *Prehistoire de l'Égypte. Des premiers hommes aux premiers pharaons*. A Colin, Paris, France.
- Pankhurst R, 1968. *Economic history of Ethiopia, 1800-1935*. Artistic Printing Press, Addis Ababa, Ethiopia.
- Peters, J, 1991. The faunal remains from Shaqadud. pp. 197-235 in: Marks A E and Mohammed-Ali A (eds), *The late prehistory of the Eastern Sahel*. Southern Methodist University Press, Dallas, USA.
- Phillipson D W, 1993. The antiquity of cultivation and herding in Ethiopia. pp. 344-357 in: Shaw T, Sinclair P, Andah B and Okpoko A (eds), *The Archaeology of Africa: food, metals and towns*. Routledge, London, UK.
- RIM, 1992. *Nigerian National Livestock Resource Survey. (VI vols)*. Report by Resource Inventory and Management Limited (RIM) to FDL and PCS, Abuja, Nigeria.
- Skinner N A, 1977. Domestic animals in Chadic. pp. 175-198 in: Newman P and R M (eds), *Papers in Chadic Linguistics*. Afrika-Studiecentrum, Leiden, The Netherlands.
- Starkey P, 1995 (ed). *Animal power in South Africa: empowering rural communities*. Development Bank of Southern Africa. Gauteng, South Africa. 160p. ISBN 1-874878-67-6
- Sutton J E G, 1985. The antiquity of horses and asses in West Africa: a correction. *Oxford Journal of Archaeology* 4:117-118.
- Wilson R T, 1980. Livestock production in Central Mali: structure of the herds and flocks and some related demographic parameters. ILCA Programme Document. Bamako, Mali.
- Wilson R T, Wagenaar K and Louis S, 1984. Animal production. pp. 69-144 in: *Pastoral development in central Niger*. Swift J J (ed). Final report of the Niger Range and Livestock Project. Government of the Republic of Niger.
- Winkler H A, 1938, 1939. *Rock-drawings of Southern Upper Egypt (2 volumes)*. Egypt Exploration Society, London, UK.