Rethinking Agriculture:
Archaeological and Ethnoarchaeological Perspectives

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CHAPTER 20

African Pastoral Perspectives on
Domestication of the Donkey: A First Synthesis

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INTRODUCTION

After millions of years as hunters and gatherers, people domesticated a
diversity of plant and animal species during the last 12,000 years. The domestication of large mammals provided early food producers with predictable
sources of animal food and raw materials and influenced the density and
mobility of human settlement, as well as trade, warfare and the develop-
ment of disease. Given their wide-ranging influence, surprisingly few large
mammals were ever domesticated, however, and most for food. Recent
zooarchaeological and genetic research has improved understanding of the
region and timing of domestication of many large mammals and suggests
multiple domestication events for horses, pigs, cattle, sheep and goats
(Bradley and Loftus 2000; Edwards et al. 2004; Ghulfr et al. 2000; Hanotte
MacHugh and Bradley 2001; Rosenberg and Redding 1998; Vigne et al. 2000;
Zeder and Hesse 2000). There are still gaps in information regarding the
place and timing of domestication of major livestock species, especially
from arid or tropical regions. Moreover, little is known about local contexts
domestication or the way that hunter-gatherers and early food produ-
cers combined isolated domesticates from their own and other regions in
the development of new farming systems and societies. Information on the
reasons for these ancient realignments of relations among animals, people
and environments can provide important insights on the trajectories of
ancient societies, as well as on the nature of global food systems, biodiver-
sity and geopolitical power structures today (Clutton-Brock 1989, 1999;
Diamond 1997; Harris 1996; Harris and Hillman 1989; Piperno and Pearsall

Donkeys are native to the arid tropics and subtropics of northeast Africa. They were the chief source of land transport for ancient Egyptians and Sumerians and are thought to have played an important role in the develop-
ment of ancient trade in western Asia and the Mediterranean. Together
with mules and horses, they remained the most important form of transport
in much of the world prior to the introduction of railways. In contemporary
rural societies of Africa, western Asia, central and South America, donkeys are an essential pack animal (Fielding and Pearson 1991; Starkey 2000). Donkeys are, however, among the least studied of the widely distributed large domestic mammals of the world.

The African wild ass (Equus africanus; Heuglin and Fitzinger 1866) has long been thought to be the ancestor of the domestic ass (Equus asinus Linnaeus, 1758) (Brehm 1915; Clutton-Brock 1992a; Epstein 1971; Heck 1899; Murdock 1959: 105; Zeuner 1963). They hybridise readily with domestic donkeys, are highly endangered today and are found only in the Horn of Africa at 9.56–18° N (Groves 2002: 101–02; Moehlman 2002; Moehlman et al 1998; terminology follows Gentry et al 1996, 2004). Because the distribution of Equus africanus is primarily African and donkey bones were found in Predynastic Egyptian sites (6000–5000 BP) (Peet 1914; Petrie 1914), donkeys have historically been considered an Egyptian domesticate. Since the nineteenth century scholars have thought that they were important to the development of trade in ancient Egypt (Brehm 1915; Clutton-Brock 1992a; Epstein 1971: 397; Heck 1899; Romer 1928; Zeuner 1963). Hassan (1988: 158–59, 161, 168, 1993: 557, 559, 565) has also suggested that donkeys played a role in the distribution and integration of nomes (territorial divisions) and management of the Egyptian state. In the 1980s, however, identification of possible E. africanus at sites in the Levant and Arabian Peninsula and the extensive analysis of early donkeys at sites such as Tal-e Malyan in Iran (c 2800 cal BC; c 4200 BP) directed attention to western Asia as a possible context for domestication of the ass. (Clutton-Brock 1986, 1992a; Meadow and Uerpmann 1991; Uerpmann 1987, 1991; Zeder 1986).

Recently, well-preserved specimens of Equus asinus have been recovered and studied from Africa, chiefly from Egyptian Predynastic and Early Dynastic sites such as Abusir, Buto and Hierakonpolis (Boessneck et al 1992; Driesch 1997; van Neer pers comm), but also from the Sudanese pastoral site of Wadi Hariq (Berke 2001). Donkeys have not been a focus of zooarchaeological research in Africa, however, and the low densities of wild ass or donkey bones at archaeological sites beyond the Nile have not encouraged specialised study of, or communication about, such specimens. As a result, while Asian scholars have subjected the equid archaeological record to scrutiny, Africanist archaeologists have not yet revisited the larger issues of the context and significance of the possible domestication of the ass in Africa.

Since the domestication of the ass in Egypt was first proposed, there has also been a significant shift in thinking regarding the nature and origins of the earliest domesticates in Africa and the beginnings of food production on the continent. Despite the presence of early ceramics in Africa (reviewed in Close 1995) and approaches to ‘non-centric’ domestication of plants conceived by Harlan (1971), studies of the beginnings of food production in Africa have been much influenced by Near Eastern paradigms (Garcea 2004). It has long been expected that similar domestic grains, contemporary or slightly later domestic animals and settled early agricultural communities
would be found in northern Africa (Clark 1976; Shaw 1977). Much research remains to be conducted to refine the exact timing and location of the appearance of domestic plants in Africa, but it is now clear that the sequence of domestication of plants and animals in Africa and the subsequent development of early food-producing societies differs in interesting ways from regions such as western Asia. It is accepted, largely on the basis of genetic evidence, that cattle were domesticated 9000–7500 BP in the Sahara. African plants were not, however, domesticated until significantly later, after c 4000 BP (Bradley and Loftus 2000; Gifford-Gonzalez 2005; Hanotte et al. 2002; Marshall and Hildebrand 2002; Neumann 2003, 2005; Wendorf et al. 2001). The earliest food producers did not cultivate domestic plants and were mobile cattle-based, wild grass-collecting herders, rather than settled agriculturalists as in Southwest Asia. Sheep and goat were introduced to Africa, possibly via the Sinai, by 7000 BP and incorporated into cattle-herding societies. Saharan pastoralists became increasingly mobile as the grasslands dried from c 7000 BP (Gautier 1987a; Marshall and Hildebrand 2002).

The early domestication of animals, late domestication of plants and continued use of wild resources influences the conceptual framework for, and trajectory of research on, domestication processes in Africa. Africanist scholars use the term ‘food production’ to refer to heavy reliance on domestic animals, domestic plants or both. It is understood that most early African food producers also maintained a wild resource base. This could be thought of as ‘ecodiverse food production’. Because pastoralism is an early food-producing system, rather than a later development associated with cities, and domestic animals were used earlier than domestic plants in Africa north of the equator, the terms ‘origins of agriculture’ and ‘the beginnings of food production’ are not used interchangeably as they are in many other regions. Research on the beginnings of food production in Africa has focused on several major themes including indigenous versus exotic origins of African cattle, adoption of cattle and sheep and goats by Saharan hunter-gatherers, the timing of appearance of African domestic plants and increasing group mobility against a backdrop of mounting aridity and highly variable rainfall. Classical scholarship drew attention to the Nile and an ancient Egyptian context for the domestication of the donkey in Africa. Thus far, archaeologists have not seriously considered the possibility that herders of northeast African grasslands domesticated another indigenous African mammal, the donkey, 7000–6000 years ago to solve transport problems posed by climatic deterioration and their increasingly mobile way of life (Beja-Pereira et al. 2004; Marshall 2003; see also Brewer et al. 1994: 99; Olsen 1996: 202). Domestication of donkeys and their incorporation into a society dependant on domestic cattle, Southwest Asian sheep and goat and African wild plants, are likely to have had significant consequences for development of African pastoralism and the spread of food production in Africa. In the following section I discuss ethnoarchaeological data on the significance of donkeys for contemporary African pastoral societies and use this information to develop a pastoral hypothesis for the domestication of the donkey in Africa. I go on to review
paleontological and archaeological literature that bears on this hypothesis, comparative archaeological data from Asia and the contributions of recent genetic and linguistic studies to understanding the timing, location and process of domestication of the donkey.

INFLUENCE OF THE DONKEY ON PASTORAL SOCIETIES: ETHNOARCHAEOLOGICAL INSIGHTS

Preliminary ethnoarchaeological study and synthesis of the available ethnographic literature on eastern and northern African pastoralists such as the Maasai (Jacobs 1975), Turkana (Little and Leslie 1999), Borana (Coppock 1994), Barbasaig (Klima 1970) and Tuareg (Nicolaïsien 1963; Nicolaïsien and Nicolaïsien 1997), suggest that donkeys play a key role in the organization of contemporary mobile herding societies in Africa. I discuss here the role that biology played in making the donkey the pack animal of choice, specific tasks for which donkeys are employed and the larger implications of the use of donkeys for the organisation of contemporary and prehistoric pastoral societies. Ethnoarchaeological data are the basis of my main hypothesis that donkeys were domesticated in northeastern Africa by herders.

Cattle (*Bos taurus* Linnaeus, 1758) are much more numerous than donkeys in pastoral societies, but donkeys are the main pack animal of Africa. Camels (*Camelus bactrianus* Linnaeus, 1758) are a more recent introduction (Rowley-Conwy 1988). The main advantage of donkeys over cattle as pack animals in Africa derives from their desert heritage and the mechanical efficiency of their gait. Donkeys are faster and energetically more efficient at walking and carrying loads than cattle, especially over steep and stony terrain (Dijkman 1991; Jones 1977: 5, 11; Yousef 1991). They have a labile body temperature, tolerate high levels of desiccation and rehydrate very quickly (Maloï 1970, 1971; Maloi and Boarer 1971). Donkeys do not require a rest period for rumination and are able to digest while dehydrated, unlike most large mammals. It is also argued that donkeys are especially intelligent and easy to train (Jones 1977: 9, 12). Because cattle are easily dehydrated, it is difficult to keep them in good condition as pack animals in arid African rangelands. Donkeys, by contrast, are adapted to the desert and very tough.

Donkeys are used for a wide range of tasks in African pastoral societies. They are essential for moving pastoral household goods, small children and animals from one camp to another. This allows pastoral families to make frequent and at times long-distance moves with their animals and possessions. Spencer (1973: 14) notes that during the 1960s, Samburu women packed all their belongings onto donkeys for migrations approximately every five weeks. Turkana families use donkeys for dry season moves every few weeks over distances ranging from 10 to 50 km (Dyson-Hudson and Dyson-Hudson 1999: 79; Leslie and Dyson-Hudson 1999: 233; McCabe et al 1999: 108), and the Wodaabe Fulani still use donkeys for seasonal migrations of more than 100 km (Pao and Palin 2002: 119). Donkeys are also important for assisting with daily tasks such as collecting household water and firewood
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Donkeys are not generally eaten, but may provide an emergency source of meat and milk (Johnson 1999: 99; Leslie and Dyson-Hudson 1999: 233; Little et al 1999: 58; Nicolaien and Nicolaien 1997: 163, 164). They are, however, probably eaten more than is reported; the presence of wild ass in northeast African sites over the last 20,000 years shows that they have a long history of use for food in the region (Table 20.1). Nevertheless, the main role of the donkey in Africa today is as a pack animal. Most families do not own many donkeys, not more than six, but I know of no mobile pastoral groups living in semi-arid regions of Africa that do not use donkeys.

Many of the tasks for which donkeys are used are considered ‘women’s work’, and donkeys are often considered women’s animals and of relatively low status (Mohammed 1991: 187). The use of the donkey as a pack animal has far-reaching consequences, however, for organization of movement, land management and labour, as well as for human and livestock health and population dynamics. Employing donkeys to collect water from distant sources allows present-day pastoral camps to move as a unit to follow pasture far from permanent water (Jacobs 1975: 408, 417; Little et al 1999: 58, 60). Such residential mobility in turn allows conservation of dry season grazing and resources close to permanent water, a rapid response to erratic rainfall and flexible use of pastures. The role of the donkey in bringing water to small stock avoids the use of cattle for fetching water and improves the health of cattle and small stock, especially during droughts (Little et al 1999: 58). The consequent reduction in women’s labour also bears on long-term reproductive health. A recent study of Oromo villagers in southern Ethiopia suggests that reducing the time and energy spent obtaining water increases women’s fertility (Gibson and Mace 2002: 631, 636). Reproduction rates of both humans and livestock may be affected by using donkeys for transport of young. In summary, donkeys allow closer birth spacing and larger mobile populations of both humans and livestock, change the dynamics of women’s labour and allow rapid mobile response to erratic rainfall and pastoral survival in semi-desert regions.

DONKEYS BENEATH THE RADAR: TAPHONOMIC ISSUES

Ethnoarchaeological data provide useful insights into site formation processes affecting the likelihood of archaeological preservation and identification of E. asinus skeletal material on African pastoral sites. Despite their
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<th>Site</th>
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<th>Sample</th>
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<td><strong>Morocco</strong></td>
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<td>Mugharet el Aliya</td>
<td>Late Pleistocene</td>
<td><em>E. australis</em></td>
<td>Howe and Movius 1947;</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<tr>
<td>Grotte de Kieflan Bel</td>
<td>Late Pleistocene</td>
<td><em>E. australis</em></td>
<td>Romer 1928: 122;</td>
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<td>Gomari</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<td>Holocene</td>
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<td>Middle–Late Pleistocene</td>
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<td>Oued Seguin</td>
<td>Below Mousterian</td>
<td><em>E. australis</em></td>
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<td>Levels</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<td>Holocene</td>
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<td>Arambourg 1931: 174;</td>
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<td>(Ternifine: 26), zone 2</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<td>Romer 1928: 122;</td>
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<td>Arambourg 1931: 174;</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<td>Arambourg 1931: 174;</td>
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<td>Abd el Kadar</td>
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<td>Grand Rocher</td>
<td>Holocene, Neolithic</td>
<td><em>E. australis</em></td>
<td>Romer 1928: 122;</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<td>Grotte de Bou Zabaouin</td>
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<td>Romer 1928: 122;</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<td>No. 25 Near Garet et Tarf</td>
<td>Upper Paleolithic</td>
<td><em>E. australis</em></td>
<td>Romer 1935: 173–85;</td>
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<td>Churcher and Richardson 1978: 380, 412</td>
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<td>Garet et Tarf</td>
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<td><em>E. australis</em></td>
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<td>Aioun Beriche</td>
<td>Holocene</td>
<td><em>E. aequatorius</em>; more than 6 dental specimens</td>
<td>Churcher and Richardson 1978: 380, 412</td>
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<td>El Mouhaad, Ain Beida Region</td>
<td>Early Holocene, Capsian Shell Midden</td>
<td><em>E. aequatorius</em>; 30 dental specimens</td>
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<td>Site No. 12-Ain Beida region</td>
<td>Early Holocene, Capsian Shell Midden</td>
<td><em>E. aequatorius</em>; lower jaw, isolated teeth</td>
<td>Romer 1935: 173-85; Churcher and Richardson 1978: 412</td>
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<td>Oued Tamanrasset</td>
<td>Post-Pleistocene[?]*</td>
<td><em>E. aequatorius</em></td>
<td>Romer 1935: 177; Churcher and Richardson 1978: 380, 412</td>
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</tbody>
</table>

**Libya**

| Ti-n-Torha East             | 9th millennium BP        | *E. aequatorius*; 11 specimens              | Gautier and van Neer 1977-1982: 96, 100-103, 106 |
|                            |                         | *E. aequatorius*; 3 specimens               | Gautier 1987b: 286, 288 |

**Egypt**

| Ghafet et Tera              | Upper Palaeolithic earlier than 8000 BP; late Dabba, Lybico-Capsian | *E. aequatorius*[?]                     | Churcher 1974: 371 |
| Haoua Feah                  | Middle Stone Age        | *E. aequatorius*                            | Higgs 1967; Churcher 1972: 49, 1974: 374; Churcher and Richardson 1978: 412 |
| Bir Sahara                  | Middle Stone Age        | *E. aequatorius*                            | Gautier 1980, 1984 |
| Bir Tarfawi                 | Middle Stone Age        | *E. aequatorius*                            | Gautier 1980, 1984 |
| Qau                         | Holocene                 | *E. aequatorius*                            | Churcher 1972: 135 |
| Dakhleh, Sheik Muftah East  | Neolithic                | *E. aequatorius*                            | Churcher 1986: 419 |
| Kom Ombo                    | c 15,000–13,000 BP      | *E. aequatorius*                            | Reed and Turnbull 1969: 55-56; Churcher 1972: 49-52; 1974: 364, 367 |
| Abu Simbel east bank        | Early Palaeolithic–Late Neolithic | *E. aequatorius*                            | Uerpmann 1987 |

**Sudan**

| Wadi Shawc                  | 5000–3000 BP            | *E. aequatorius*                            | Uerpmann 1987: 28–29 |
| Wadi Shaw                   | c 15,000–9000 BP        | *E. aequatorius*                            | Gautier 1968; Churcher 1974:128, 133, 135 |
| Wadi Halfa area, ASG-G-25   | Abkan earlier than 5000 BP | *E. aequatorius*; 1 complete mandible     | Perkins 1965: 57-59; Nordström 1972; Gautier 1984: 49 |
| Singa                       | Middle Stone Age        | *E. aequatorius*[?]                        | Bate 1951: 3; Churcher and Richardson 1978: 380, 412; Gautier 1984: 45 |
| Abu Hugar                   | Middle Stone Age        | *E. aequatorius*[?]                        | Bate 1951: 3; Churcher and Richardson 1978: 380, 412; Gautier 1984: 45 |

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Table 20.1 (Continued)

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<td>Midhishii</td>
<td>MSA/LSA</td>
<td>E. afer</td>
<td>Bunn quoted by Brandt</td>
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<td></td>
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<td>1986: 56</td>
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<td>Guli Waabay</td>
<td>MSA/LSA Magosian</td>
<td>E. africas;</td>
<td>Bate: 1954; Marshall pers</td>
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<td>level</td>
<td>1 cheek tooth</td>
<td>observation</td>
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<td>Buur Hakeba Rifle Range</td>
<td>MSA/LSA Doian</td>
<td>E. africas;</td>
<td>Bate: 1954; Brandt 1986: 66</td>
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<td>site</td>
<td>level</td>
<td>7 cheek teeth</td>
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<td>Hargeisa H.7</td>
<td>MSA/LSA Somaliland Stilbay</td>
<td>E. africas;</td>
<td>Bate 1954</td>
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<td></td>
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<td>6 cheek teeth</td>
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<td>Jordan</td>
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<td>Ra’s en Naqb</td>
<td>Natufian,</td>
<td>E. africas</td>
<td>Uerpmann 1991: 15–16</td>
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<td></td>
<td>Chalcolithic</td>
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<tr>
<td>Ain Ghazal</td>
<td>Natufian,</td>
<td>cf E. africas;</td>
<td>Driesch and Wodtke 1997: 530–33</td>
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<tr>
<td></td>
<td>Chalcolithic</td>
<td>several check teeth, numerous long bone ends</td>
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<td>Wadi Mataha</td>
<td>Early Natufian</td>
<td>cf E. africas;</td>
<td>Whitcher et al 2000: 43–44</td>
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<td></td>
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<td>1 central tarsal</td>
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<td>Syria</td>
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<td>Mureybit</td>
<td>earlier than 10,000–9000 BP</td>
<td>cf E. africas;</td>
<td>Ducos 1975, 1986</td>
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<tr>
<td>Shams ed-Din</td>
<td>c 5000–4500 BC,</td>
<td>1 metatarsal</td>
<td>Uerpmann 1986: 256, 259</td>
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<td>Halafian</td>
<td>2 first phalanges</td>
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<td>cf E. africas;</td>
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<td>E. hemionis present</td>
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<td>United Arab Emirates</td>
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<tr>
<td>Hili 8</td>
<td>Bronze Age, c 4400 BP (c 3000 cal BC)</td>
<td>cf E. africas or E. asinus; 6 cranial, 26 postcranial specimens</td>
<td>Uerpmann 1991: 15–16</td>
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<td>Oman</td>
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<td>Ra’s al-Hamra, RH-5, -6, -10</td>
<td>c 3500–2000 cal BC,</td>
<td>cf E. africas;</td>
<td>Uerpmann 1991: 14</td>
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<td>shell middens</td>
<td>2nd phalanx, Rh-5</td>
<td></td>
</tr>
<tr>
<td>Sada Arabia</td>
<td>c 5500 BC</td>
<td>cf E. africas;</td>
<td>Uerpmann 1991: 16; Zeder in Masry 1973: 236</td>
</tr>
<tr>
<td></td>
<td></td>
<td>also cf E. hemionis;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 specimens</td>
<td></td>
</tr>
<tr>
<td>Yemen</td>
<td>Ash Shumah</td>
<td>E. africas;</td>
<td>Cattani and Bökonyi 2002: 44–51</td>
</tr>
<tr>
<td></td>
<td>8th millennium BP,</td>
<td>930 specimens</td>
<td></td>
</tr>
<tr>
<td></td>
<td>shell date</td>
<td>(c 6684–6475 cal BC)</td>
<td></td>
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</tbody>
</table>

Importance, donkeys have relatively low status among African pastoral groups, especially in comparison to cattle. For this reason, and because donkeys are better at digging for water and deterring predators than are cattle, sheep and goats, donkeys are generally managed less than other livestock.
Many pastoralists such, as Maasai, Turkana, Borana and Orma, do not herd donkeys (Coppock 1994: 111; Ensinger pers comm 2002; Little et al 1999: 56). Donkeys are the only livestock not necessarily penned at night for protection from predators. They are not kept in large numbers and seldom eaten. As a result, their bones are not likely to have accumulated in ancient pastoral settlements. Furthermore, unlike cattle, donkeys were neither ceremonially buried, nor a common subject in symbolically important rock art. Taking settlement, burial and rock art data together, donkeys are likely to be under-represented in the archaeological record. Moreover, some of the same husbandry practices that contribute to the scarcity of donkeys in archaeological sites also suggest that they will be difficult to distinguish from wild ass. African herders place a premium on the strength of donkeys, and management of the donkey is minimal. Under such conditions there is not likely to be strong selection for size decrease or morphological change. As a result, donkeys are likely to be rare and difficult to identify in early pastoral sites.

**PASTORAL HYPOTHESIS FOR DOMESTICATION OF THE DONKEY IN AFRICA**

Cattle were domesticated in northern Africa at c 9000–8000 BP in order to facilitate intensive mobile use of the landscape (Hanotte et al 2002; Marshall and Hildebrand 2002). As this review shows, domestication of the donkey a few thousand years later could have radically changed the scale of strategic use of mobility and the organization of early herding groups. Domestic donkeys are not present at early pastoral sites such as Nabta Playa in the eastern Sahara at c 8000 BP, Enneri Bardaguè in the Tibesti, or Uan Muhaggiq in the Acacus at c 6800 BP (Gautier 1987a, 1987b). These herders, although mobile, would have been more tied to permanent water than contemporary pastoralists. At Nabta Playa, for example, the presence of visible hut floors and the structured use of space (Close and Wendt 1992) suggest greater investment in place than is common among recent pastoralists. Without abundant rainfall, such groups would have been vulnerable to depletion of local resources such as grazing, wild plant foods and firewood. They would have also been more reliant on frequent trips by small groups, made up of young men with mobile adult cattle, for targeted grazing of green flushes and the collection of salt, wood, clay, stone and other resources. When the whole settlement moved, families would have traveled shorter distances more slowly, responded less rapidly to erratic rainfall and carried fewer possessions. Groups could not have moved far or fast as a unit without endangering the health of people and herds.

After the wet period of the early Holocene the archaeological record shows progressive climatic deterioration in northeast Africa, with especially unpredictable rainfall and some marked droughts from 7000 BP (Cremašči 2002; Hassan 2002; Wendt et al 2001). Sites in the Acacus, and other regions of the Sahara after this time, provide evidence of shorter stays and higher mobility (Barich 2002; Cremašči et al 1996; di Lernia 2002; Gautier 1987b; Gautier and van Neer 1977–1982: 82). Rock art panels such as those
of the Tassili in the Sahara suggest that early herders may have used cattle to carry people and other loads (Holl and Dueppen 1999; Figure 20.1). Interpretation of such images is difficult and dates are unknown, but it is possible that the use of cattle for transport was an early solution to problems of group mobility. This would not have been without its problems: climatic deterioration was rapid and rainfall increasingly unpredictable. In semi-desert conditions donkeys would have been a much more efficient transport animal than cattle. Combining ethnographic perspectives on the utility of donkeys with archaeological perspectives on climatic variability and challenges for early pastoral groups, I hypothesise that early northeast African pastoralists domesticated the donkey under conditions of increased aridity c 7000–6500 BP in order to facilitate long-distance mobility while maintaining the growth and health of human, cattle, sheep and goat populations.

AFRICAN WILD ASS AND DONKEY IN THE ZOOLOGICAL AND ARCHAEOLOGICAL RECORDS

In order to evaluate this hypothesis, I review four different lines of evidence: zoogeography, zooarchaeology, linguistics and genetics. I discuss the modern distribution of Equus africanus in the region, zooarchaeological data on the ancient distribution of E. africanus on the continent, E. asinus from African and Asian archaeological sites, as well as recent African linguistic and African and Eurasian genetic research that bears on this question.

The Wild Ancestor: Nomenclature, Variation and Recent Distribution

The wild ancestor of the donkey, the African wild ass (Equus africanus), is phenotypically variable. It is possible that four distinct subspecies existed historically in Africa (Figure 20.1) (Groves 1986, 2002; Groves and Willoughby 1981; but see Yakult et al. 1986). The Somali wild ass are the largest of the African wild ass, with well-marked leg stripes and no shoulder cross (Groves 1974: 110, 1986, 2002; Groves and Willoughby 1981). The Nubian wild ass has no leg stripes, but two types of shoulder cross (Groves 1974: 109–10, 1986). Its distribution may have graded west into that of the Saharan wild ass. The latter is thought to be a smaller animal, greyer in colour, with a long, thin cross stripe (Groves 1986: 33–34, 2002: 103). Saharan wild ass probably existed in the Ahaggar, Tibesti and Fezzan, but have been little studied. An Atlas variety of African wild ass with a shoulder cross and striped legs may also have survived until c AD 300 (Antonius 1938; Clutton-Brock 1992a; Groves 1986: 33). Groves (1974: 161, 1986: 35–36, 62–65) notes that Nubian wild ass have commonly been considered the ancestor of the domestic donkey, but that there are differences in colour, marking and cranial morphology between both Somali and Nubian populations and domestic donkey. He argues that the ancestor of the donkey may be a form of wild ass now extinct (Groves 1976: 163). Museum collections of African wild ass are, however, very small and many aspects of morphological variability are unexplored.
Distinguishing *E. africana*, Zebra and Domestic Donkeys

In order to identify African wild ass in archaeological assemblages, and to differentiate them from domestic donkey, researchers use morphological criteria developed by Groves (1974: 185, 1986: 36–37) and Eisenmann and colleagues (Divé and Eisenmann 1991; Eisenmann 1986; Eisenmann and Beckouche 1986), as well as size data from Egyptian and other sites. Distinguishing African wild ass from other wild equids is not as challenging in Africa as in western Asia, where variation in similar-sized equids is greater. In Africa, Grevy’s zebra (*Equus grevyi* Oustalet, 1882) are sympatric but generally larger than African wild ass. Burchell’s zebra (*Equus burchelli* Gray, 1823) are generally distributed farther south than African wild ass; although similar in size, they are significantly more robust postcranially. Eisenmann (1986; Divé and Eisenmann 1991; Eisenmann and Beckouche 1986) has done much research on the relative proportions of postcranial elements of *E. africana*, especially metapodials, which are useful for differentiating African equids. Dental characteristics, especially those of the lower cheek teeth, are widely used to identify African wild ass (Bökényi 1985; Churcher and Richardson 1978; Eisenmann 1986; Groves 1974; Uerpmann 1991); cranial proportions are also useful (Eisenmann 1986; see also Groves 1986). Comparative specimens of modern *E. africana* are so rare, however, that little is known about variation in size and proportions.

Nevertheless, modern domestic donkeys are significantly smaller than *E. africana* and most zooarchaeologists distinguish African wild ass from domestic donkeys on the basis of size. Morphological characters are also important for recognising domestication. Groves (1986: 36) argues that the occipital crest is square in wild asses and shorter and rounder in domestic asses. He also notes that the nasofrontal suture of donkeys is much straighter than that of the wild ass. Eisenmann and colleagues (Divé and Eisenmann 1991; Eisenmann and Beckouche 1986) note significant differences between the proportions of the lower limbs, especially front limbs, metacarpals and phalanges of African wild ass and donkeys.
Together, size and contextual information are the criteria most widely used by Africanist zooarchaeologists for distinguishing the bones of domestic donkey from those of African wild ass. Because African wild ass continued to be hunted by groups using early domestic donkeys – they are depicted in Egyptian hunting scenes as late as the New Kingdom as in the tomb of Tutankhamen and the Temple of Ramses III at Medinet Habou (Closse 1998: 32; Houlihan 1996: 29) – zooarchaeologists are conservative in identification of early domestic donkey. For these reasons and because ethnographic data shows that selection processes on lightly managed early domestic donkeys are likely to have been associated with limited size and morphological changes, zooarchaeologists recognise late, rather than early or transitional, forms of domestic donkey. This raises the question of fit between definitions of domestication and morphological criteria for identification of early domestic donkeys.

Definitions of domestic animals focus on domestication as a microevolutionary process, with associated genetic change, as well as on the effect of animal domestication on human societies (Clutton-Brock 1992b: 79; Russell 2002). Clutton-Brock (1999: 32) defines a domestic animal as ‘one that has been bred in captivity for purposes of economic profit to a human community that maintains total control over its breeding, organization of territory, and food supply.’ Not all zooarchaeologists agree with the emphasis on profit. Meadow (1984) stresses a change in focus from the dead to the living animal and Ingold (1980) and Ducos (1989) emphasise the importance of ownership. Genetic change results from intentional mechanisms such as selective breeding, but also unintentionally. Tolerance of animals in human environments, protective tending or taming may cause unintentional changes in diet, relations with predators and increases in population densities that result in selection (Clutton-Brock 1992b; Hemmer 1990). Intentional changes such as selective breeding are more likely to occur in the later rather than earlier stages of domesticatory relations. Morphological characters for identification of domestication have more easily been brought to bear on evolutionary changes than changes in property relations, and on the later rather than earlier stages of domesticatory relations.

Following Harris’s (1989) concept of a continuum of people-animal interactions, neither protection of wild ass, including taming and protective herding, nor the early stages of domestication, including breeding of donkeys by settled agriculturists or nomadic pastoralists, are currently recognizable through conventional zooarchaeological measures of size or morphological change. There are, however, several lines of evidence that have potential for recognising earlier domesticatory relations. Geoarchaeological lines of evidence for identification of concentrations of cattle dung on African pastoral sites (Shahack-Gross et al 2003) can be adapted for identification of the dung of African wild ass and used to identify sites where tame *E. africanus* or early domestic donkeys were penned. But if they were kept in small numbers, or for short periods, this method will not be
as successful for donkeys as for cattle or horses. The study of pathologies indicative of heavy use may be more successful for donkeys and Early Dynastic Egyptian specimens are currently under investigation. Geometric analyses of long bone shafts also show potential for documenting the work life of wild ass or donkeys. This research is still in the early stages, however, and the current literature reflects significant methodological problems in distinguishing early domestic donkeys from wild ass and the later rather than earlier stages of domestication.

**E. AFRICANUS AND E. ASINUS IN THE AFRICAN FOSSIL RECORD**

A survey of the existing information on the locations and dates of *E. africanus* specimens in Africa shows that sites are distributed from the North African coast across the northern Sahara and through the Horn (Figure 20.2, Table 20.1). There are at least 15 rockshelter sequences from Morocco and Algeria in the ancient range of the Atlas wild ass. Many of these are from classic sequences such as Mugharet el Aliya or el Mouhaad and were studied by famous palaentologists Romer (1928, 1935) and Arambourg (1931). A concentration of nine sites also occurs from the fringes of the Sahara in Libya to the Nile in Egypt and the northern Sudan. Churcher (1972, 1974, 1986; Churcher and Richardson 1978) is known for his work on material from Kom Ombo and review of African equid fossils. Very few sites fall within the modern distribution of the African wild ass in the Sudan and Horn, including Eritrea, Ethiopia, Somalia and Djibouti. This almost certainly reflects the distribution of research, because the few sites that have been excavated in this region, such as Midish in Somaliland and Guli Wabayo and Buur Heybe in Somalia, preserve wild ass (Table 20.1).

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**Figure 20.2** Distribution of sites with African wild ass, *E. africanus* (selected from Table 20.1).
Most specimens from African sites reviewed here are not well dated, but range in age from c 40,000 BP to recent. No complete skeletons were recovered from these sites and in general the number of isolated specimens that could be identified as wild ass, and differentiated from zebra, is fairly small (Table 20.1). As a result this review is somewhat tentative and one cannot be certain that specimens from more recent periods might not be attributable to early or large domestic donkey.

In the remainder of this section I review zooarchaeological research on domesticated donkeys (*E. asinus*) from African archaeological sites. During the last fifteen years a number of zooarchaeologists have collected important data on early *E. asinus* in Egypt. Driesch (1997: 31) notes that domestic donkeys occur earlier in Egypt than previously thought and that they are large. The dating of the earliest donkeys lacks precision, but early domestic donkeys are found at six Egyptian Predynastic sites, including El Omari, thought to date to c 4600–4400 BC (c 5700–5500 BP) (Boessneck and Driesch 1998: 99–101), Maadi dating to the first half of the 4th millennium BC (c 6100–5700 BP) (Boessneck et al 1989: 90–92; Bökényi 1985: 495–98), and the Naqada I settlement at Hierakonpolis (McArdle 1982: 120, 1992: 56) (Table 20.2, Figure 20.3).

Clutton-Brock (1992a: 65; Burleigh et al 1991: 10) has obtained the only direct dates for Predynastic/Early Dynastic equid material from Egypt. This work points out that context cannot be assumed, especially for excavations from the early years of the century. Direct dates from the ass specimens from Badari, considered to date to the end of the Predynastic, showed that the specimen was intrusive. The context-based First Dynasty dates for Tarkan (Petrie 1914) were, however, supported by direct dates, eg c 4390 ± 130 BP, (OXA-566) (Burleigh et al 1991: 10; Clutton-Brock 1992a: 65). Although there are very few AMS dates, it seems clear that domestic donkeys were present in Egypt by c 4000 cal BC (c 5200 BP) (Hollmann 1990: 71) (Table 20.2).

There are relatively few complete skeletons, an exception being the three donkeys buried at Abusir (Boessneck et al 1992: 1–10). Nevertheless, sufficient specimens have been studied to document changes in size through time (Boessneck et al 1992: 2; Boessneck and Driesch 1998: 497; Driesch 1997: 31). Predynastic donkeys from Maadi and Hierakonpolis are large (Boessneck et al 1989: 91; Bökényi 1985: 497; McArdle 1982: 120, 1992: 56). Donkeys from other Predynastic and Early Dynastic sites such as Elephantine and Buto appear smaller than those from Maadi and larger than Tell e-Dab’a (Boessneck 1976: 22; Boessneck et al 1992: 2; Driesch 1997: 31; Hollmann 1990: 72). The First Dynasty donkeys from Abusir are considerably smaller (Boessneck et al 1992: 2). It is thought that Predynastic donkeys were used for transport (Hollmann 1990: 71). A burned specimen from Maadi suggests that they may also have been eaten, and it is likely that donkeys played a role in Predynastic burial ritual, possibly associated with the god Seth (Hollmann 1990: 71). Continued hunting, or capture, of wild ass is also documented at a number of sites such as Elephantine and Buto (Driesch 1997: 25, 31–32; Hollmann 1990: 71).
Table 20.2 Information on sites with early domestic donkey, *E. asinus* (Figure 20.3)

<table>
<thead>
<tr>
<th>Site</th>
<th>Time Period</th>
<th>Sample Description</th>
<th>References</th>
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<tbody>
<tr>
<td><strong>AFRICA</strong></td>
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<tr>
<td><strong>Egypt</strong></td>
<td></td>
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<tr>
<td>Buto</td>
<td>Predynastic and Old Kingdom</td>
<td><em>E. asinus</em>; 32 specimens</td>
<td>Driesch 1997: 25, 31–32</td>
</tr>
<tr>
<td>Elephantine</td>
<td>Predynastic</td>
<td><em>E. asinus</em>; 12 <em>E. afericanus</em> and 53 <em>E. asinus</em></td>
<td>Hollmann 1990: 70–73</td>
</tr>
<tr>
<td>Tarkhan</td>
<td>Early Dynastic, 4390 ± 130 BP (OXA 566, c 2850 cal BC)</td>
<td><em>E. asinus</em>; donkey burials; one cranium, originally 3 skeletons</td>
<td>Petrie 1914; Burleigh 1986: 234; Burleigh et al 1991: 10; Clutton-Brock 1992a: 65; Eisenmann 1995: 10</td>
</tr>
<tr>
<td>Abydos</td>
<td>Early Dynastic</td>
<td><em>E. asinus</em>; 10 complete skeletons (2003); two specimens (1911)</td>
<td>Peet 1914: 6; Roessel pers comm 2003</td>
</tr>
<tr>
<td>Abusir</td>
<td>First Dynasty</td>
<td><em>E. asinus</em>; burial of 3 individuals more than 5 individual animals</td>
<td>Boessneck et al 1992: 1–10</td>
</tr>
<tr>
<td>Tell el-Dab’a</td>
<td>Predynastic–Dynastic</td>
<td></td>
<td>Boessneck 1976: 21–24; Boessneck and Driesch 1992: 23–24</td>
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<td><strong>Sudan</strong></td>
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<tr>
<td>Kerma</td>
<td>Late fifth–early fourth millennium BP (third millennium BC)</td>
<td><em>E. asinus</em></td>
<td>Chalix and Grant 1987: 78</td>
</tr>
<tr>
<td>Wadi Hariq</td>
<td>3560 ± 130 BP (KN-5318, 1920 ± 200 cal BC)</td>
<td><em>E. asinus</em>; 1 complete skeleton</td>
<td>Berke 2001: 233–256</td>
</tr>
<tr>
<td>Shaqadud</td>
<td>Mid-fourth millennium BP</td>
<td><em>E. asinus</em>; 1 os tarsi centrale</td>
<td>Peters 1991: 222</td>
</tr>
<tr>
<td>Kenya</td>
<td></td>
<td><em>E. asinus</em> several teeth</td>
<td>Gifford-Gonzalez and Kimongiich 1984: 470; Marshall pers observation 2003</td>
</tr>
<tr>
<td>Narosura</td>
<td>Third millennium BP</td>
<td><em>E. asinus</em></td>
<td></td>
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<tr>
<td><strong>Ethiopia</strong></td>
<td></td>
<td><em>E. asinus</em>; 2 specimens</td>
<td>Cain 2000: 66</td>
</tr>
<tr>
<td>Axum</td>
<td>Axumite, c AD 630–770</td>
<td><em>E. asinus</em></td>
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<td><strong>ASIA</strong></td>
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<tr>
<td>Iran</td>
<td>c 4200 BP (c 2800 cal BC); Banesh and Kaffari phases (c 3400–1800 cal BC)</td>
<td>Banesh; 27 specimens; Kaffari; 139 specimens</td>
<td>Zeder 1986</td>
</tr>
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(Continued)
### Table 20.2 (Continued)

<table>
<thead>
<tr>
<th>Site</th>
<th>Time Period</th>
<th>Sample</th>
<th>References</th>
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<tr>
<td><strong>Iraq</strong></td>
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<tr>
<td>Abu Salabikh</td>
<td>Sumerian c 3900 BP (BM-1365 A-D), c 2400 cal BC</td>
<td>metatarsal III</td>
<td>Burleigh 1986: 234;</td>
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<td></td>
<td></td>
<td></td>
<td>Clutton-Brock 1986:</td>
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<td>Ducos 1986: 240-42;</td>
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<td></td>
<td></td>
<td></td>
<td>Eisenmann 1995: 11;</td>
</tr>
<tr>
<td>Tell Madhur</td>
<td>Sumerian, Early Dynastic I, c 2200 cal BC</td>
<td>2 skeletons</td>
<td>Burleigh 1986: 234;</td>
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<td></td>
<td></td>
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<td>Clutton-Brock 1986:</td>
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<td>210-12;</td>
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<td><strong>Syria</strong></td>
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<tr>
<td>Apamee</td>
<td>c 4300 BP (2300-1800 cal BC)</td>
<td>metatarsal III</td>
<td>Ducos 1986: 240-41;</td>
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<td></td>
<td></td>
<td></td>
<td>Eisenmann 1995: 11;</td>
</tr>
<tr>
<td>Tell Brak</td>
<td>c 4000 BP (c 2500 cal BC)</td>
<td>6 donkey skeletons</td>
<td>Chilton-Brock 2003</td>
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<td><strong>Israel</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tell Duweir</td>
<td>Early Bronze Age, early third millennium BC (3000–2850 cal BC)</td>
<td>6 metatarsal III</td>
<td>Ducos 1986: 240-41;</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Burleigh 1986: 232;</td>
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<td></td>
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<td>Clutton-Brock 1986:</td>
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<td>212;</td>
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<td></td>
<td></td>
<td></td>
<td>Eisenmann 1995: 11;</td>
</tr>
<tr>
<td>Tell Gat</td>
<td>Early Bronze Age, mid-fourth millennium BP (c 1720 cal BC)</td>
<td>metatarsal III</td>
<td>Ducos 1986: 240-41;</td>
</tr>
<tr>
<td>Jericho</td>
<td>Middle Bronze Age, mid-fourth millennium BP</td>
<td>metacarpal</td>
<td>Burleigh 1986: 234</td>
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<tr>
<td><strong>Oman</strong></td>
<td></td>
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<tr>
<td>Maysar-6-25</td>
<td>M-6, Early Bronze Age, M-25, Bronze Age (late 3rd–early 2nd millennium BC)</td>
<td>n = 9, n = 19</td>
<td>Uerpmann 1991: 15-16;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>metatarsal III, first phalanx posterior</td>
<td>Eisenmann 1995: 11, 18, 22;</td>
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<tr>
<td></td>
<td></td>
<td>size between wild and domestic</td>
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</tbody>
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**Figure 20.3** Distribution of sites with early domestic donkey, *E. asinus*. (Selected from Table 20.2).
By contrast with the Nile, attempts have not usually been made to distinguish *E. africanus* from *E. asinus* on prehistoric Saharan pastoral sites. Thus at Uan Muhaggiaq in Libya, specimen attribution and dating are unclear, but a specimen identified as *E. africanus* (Gautier 1987b: 286, 288) could be early *E. asinus*. The same is true of specimens identified as *E. africanus* by Romer (1935: 173–85) and others from Holocene Capsian sites such as Ain Beida and El Mouhaad in Algeria, Muhareet el Aliya, and other North African sites (Figure 20.2, Table 20.1). Secure identifications of *E. asinus* are limited to the later pastoral sites of Wadi Hareq, dated to c 3460±150 BP (KN-5318) (c 1920± 200 cal BC), where a small complete skeleton was recovered (Berke 2001, pers comm 2003), and a few isolated specimens at Shaqadud at c 3000 BP in the Sudan (Peters 1991: 222) and Narosura at c 3000 BP in Kenya (Gifford-Gonzalez and Kimengich 1984: 470). Sodmein, the only Holocene site excavated in the Red Sea Hills area in Egypt, has not yielded early domestic donkey (Vermeersch et al 1996). Eritrea appears a key area for the distribution and possible domestication of both the Nubian and Somali wild ass, but no long Holocene sequences have so far been excavated in the region. Early donkeys have not been identified, nor has much research been conducted in the areas of primary distribution of the Somali wild ass: lowland Ethiopia, Djibouti and Somalia (see Brandt 1980, 1986; Clark 1954; Guerin and Faure 1996).

**E. AFRICANUS AND E. ASINUS IN THE ASIAN FOSSIL RECORD**

This paper focuses on possible African contexts for the domestication of the donkey, but cannot be divorced from considerations of the possible domestication of donkeys in Asia. Following this review of the age and geographic distribution of ancient *E. africanus* and *E. asinus* in Africa, I examine similar data from Asia.

Over the past 50 years thinking about the wild ancestor of, and geographic location for, domestication of the donkey has changed considerably. The onager, or half ass (*Equus hemionus*) was smaller than the wild ass of Iran and areas to the east and existed in Southwest Asia until the 1930s. It used to be thought that the onager was domesticated by ancient Sumerians and was ancestral to domestic donkeys of western Asia (reviewed in Clutton-Brock 1992a: 87; Zeuner 1963: 367). When crossed with donkeys hemiones do not produce fertile offspring; they are also difficult to tame (Clutton-Brock 1999: 123; Epstein 1971: 396). As a result, since the 1980s zooarchaeologists and epigraphers working in western Asia have argued that *Equus hemionus* was never domesticated (Clutton-Brock 1986: 210–11, 1992a: 37; Postgate 1992: 165–66; Zarins 1986: 189). Researchers have focused instead on *Equus africanus* as the ancestor of the domestic donkey. The question that arises, then, is whether *Equus africanus* might in the past have existed in parts of western Asia, as well as in Africa, and whether it could have been domesticated in Asia.
The possibility of the existence of African wild ass in Asia was raised as early as the 1920s (Antonius 1922: 249; Groves 1974: 115–16, 1986: 45). As Uerpmann (1986: 260) points out, Arabia is geologically part of Africa and often considered part of the African floral and faunal province. It is subject to the same rainfall regime as the Horn of Africa (Cleuziou et al 2002: 11–12), and there are strong biogeographic reasons to think that *E. africanus* was distributed in parts of the Arabian Peninsula.

Evaluating the possible fossil evidence for the presence of African wild ass in Asia has been complicated because of the difficulty of differentiating small samples of possible *E. africanus* from *E. hemionus*. Two other wild equids, *E. hydruntinus* and *E. caballus*, the horse, were also distributed in parts of western Asia during ancient times. In the 1960s Ducos (1975, 1986) identified a metatarsal from the Jordanian Natufian site of Mureybit as having the size and proportions of *E. africanus* rather than *E. hemionus*. This identification was not widely accepted at the time (Buitenbuis 1991: 41) and there has been debate over whether wild *E. africanus* and *E. hemionus* could have co-occurred in Southwest Asia. Since then, however, a small but growing body of data suggests the possible presence of *E. africanus* at sites in the Levant and the Arabian Peninsula (Cattani and Bökényi 2002: 44–51; Driesch and Wodtke 1997: 530–33; Uerpmann 1986: 259–61, 1991; Whitcher et al 2000: 43–44) (Table 20.1). Uerpmann (1991: 29–30) argues that well-identified specimens of wild ass are present at four sites, Mureybit and Shams et Din in Syria, Ra’s en Naqb in southern Jordan, and Ra’s al-Hamra shell midden in Oman. Driesch and Wodtke (1997: 530–31) have also tentatively identified *E. africanus* at the site of Ain Ghazal in Jordan (see Figure 20.2, Table 20.1).

In a posthumous paper, Bökényi (Cattani and Bökényi 2002: 34, 44–51) argues for the presence of *E. africanus* or early *E. asinus* at the shell midden site of Ash Shumah in Yemen. A substantial sample of more than 900 specimens, with ample measurable dental and postcranial specimens, provides strong support for the presence of *E. africanus* on the west coast of the Arabian Peninsula, across the Red Sea from Eritrea, by c 7770±95 BP (c 6684–4675 cal BC). This is the largest known sample of *E. africanus* from any archaeological site in Africa or Asia. More than 90% of the identifiable specimens are attributed to ass; domestic cattle are also present. On the basis of variability in tooth size and enamel patterns, as well as patterns of body-part representation, Bökényi (Cattani and Bökényi 2002: 45) suggests that donkeys at this site were in the process of domestication. The body-part data are open to many interpretations, but the dental information is suggestive. Nevertheless, the date of Ash Shumah is earlier than conventionally associated with domestication of the donkey.

Bökényi (Cattani and Bökényi 2002: 50; Cleuziou et al 2002: 11–12) notes the similarity of the Ash Shumah fauna, which includes ostrich (*Struthio camelus* Linnaeus, 1758), gazelle (*Gazella* sp.) and cattle, but no sheep (*Ovis aries* Linnaeus, 1758) or goat (*Capra hircus* Linnaeus, 1758), with those of northeast Africa. He points out geological, climatic, and faunal similarities between Arabia and the Horn of Africa as well as mid-Holocene cultural contacts between the regions. Bökényi argues that in parts of Arabia mobile herders
used early cattle to exploit arid lands in a strategy similar to that used in Africa, without dependence on sheep and goat (Cattani and Bökényi 2002: 50).

Regardless of whether the animals were domestic or not, the identification of African wild ass at Ash Shumah is secure. At most other sites in western Asia small sample sizes present interpretive problems and only one or two specimens are complete enough to make size or morphologically based identifications of *E. africanus*. As a result, there is currently tentative, but not overwhelming evidence for *E. africanus* at sites in the Levant and strong evidence for *E. africanus* or possibly early domestic donkeys in Yemen.

**Early Donkeys in Asia**

Based on fragments found at archaeological sites it is difficult to differentiate early, large domestic donkey from *E. africanus*, or even from *E. hemionus*. Large samples or complete skeletons are needed for secure identifications. As a result, there are many sites where early donkey may exist in Southwest Asia, but few that are considered reliable. The earliest well-documented domestic donkeys are the easternmost in distribution, dating to c 2800 cal BC in the ancient city of Anshan at Tal-e Malyan in Iran (Zeder 1986) (Figure 20.3, Table 20.2). These animals are slightly smaller than modern African wild ass, but larger than contemporary donkeys of the region (Zeder 1986: 407).

Osteological evidence for early donkeys or donkey/hemion hybrids is also known from Sumerian sites, the best documented being Abu Slabikh (c.2400 cal BC) and Tell Madhkur (Early Dynastic I) in Iraq (Clutton-Brock 1986). Sumerian cuneiform texts dating to 2600 cal BC provide another line of evidence that suggests the presence of domestic donkeys in western Asia by the late fourth millennium and during the third millennium BC (Postgate 1986: 200; Zarins 1986: 180–89). Postgate (1986: 194, 1992: 166) thinks that these texts may refer to at least three different equids: donkeys indigenous to western Asia, wild onagers ‘equid of the desert’, and onager/donkey crosses. The wild onagers were reported to have been kept, but used for breeding rather than as draught animals (Postgate 1992: 166; Zarins 1986: 188–89). They are now thought by many epigraphers and zooarchaeologists to have been untameable.

Zooarchaeological evidence from Syria and Israel suggests the possible presence of early domestic donkeys at Apamee (2300–1800 cal BC) (Ducos 1986: 240–41; Eisenmann 1995: 11), Tell Duweir (3000–2850 cal BC) (Burleigh 1986: 232; Ducos 1986: 240–41; Eisenmann 1995: 11), and Tell Gat (Ducos 1986: 240–41). Donkeys are also present somewhat later during Middle Bronze Age Jericho (c 1720 cal BC) (Burleigh 1986: 234) (Table 20.2). Clutton-Brock (1992a: 65) notes that by 2500 cal BC the donkey was widely used and that by 1000 cal BC it was the most common means of transport in Egypt and western Asia. In the less arid regions of Asia and Europe the horse occupied a similar role. The donkey in Asia was, however, primarily used for ploughing or transport of heavy burdens, and not for speed and warfare in the same way as the donkey/onager hybrid and the horse. The donkey played an important role in transport of goods for early cities and in the
long-distance trade of the Sumerians (Postgate 1992: 166; Zeder 1986: 372). Early use of donkeys may have influenced urban production and exchange at cities such as Anshan (Zeder 1986: 372).

AFRICAN LINGUISTICS

Historical linguists have contributed considerably to thinking about the origins and spread of food production in Africa, providing archaeologists with hypotheses regarding routes and the sequence of the spread of early Cushitic and Nilotic-speaking African pastoralists, and the origins and spread of African crops such as sorghum (Bechhaus-Gerst 2000; Blench 1997; Ehret 1997, 1998, 2002). Recently Blench (2000) and Ehret (1998, 2002) have analyzed linguistic evidence for the history of the donkey in Africa, focusing on terms for donkeys, African wild ass, mules and zebra, and roots for variation in, and timing and geographic spread of terms.

Blench (2000: 346) and others (Ehret 2002: 77, 90–91) identify at least three principal base forms for donkey: #kur-, or *Kwer-, *harre-, or *Harr- and #d-q-r- or *dakw-. All of these ancient root words for donkey are found in the Afroasiatic language phylum. Lexical terms for donkey appear to have been borrowed from Afroasiatic into other African language phyla such as Niger-Congo or Nilo-Saharan. Niger-Congo speakers are the most numerous in Africa; there are few Nilo-Saharan language speakers and these are distributed in North Africa.

Further information on the likely area of domestication of the donkey in Africa can be drawn from an examination of the distribution of principal base forms within the Afroasiatic phylum. The Afroasiatic phylum is made up of three main families: Omotic, Cushitic-Chadic and North Afroasiatic. Because early splits in the Afroasiatic phylum occurred between Omotic and Cushitic families of the Horn, many scholars (Ehret 1998; Blench 2000 and references therein) think that Afroasiatic originated in the eastern parts of the southern Sahara, or farther south.

Blench (2000: 349, 352) thinks that it is significant that all three branches of the Afroasiatic language phylum have different lexical terms for wild ass or donkey. On the basis of this variation in ancient root words for donkey he argues that donkeys were domesticated more than once around the edges of the Sahara. Ehret (1998: 11, 2002: 77, 90–91) points to the southern Red Sea Hills, the source of the proto-Afroasiatic language, and reconstruction of terms for donkey in proto-Afroasiatic and proto-Cushitic (Blench 2000: 349; Ehret 2002: 90–91). Because Afroasiatic is so ancient and there are proto-Afroasiatic words for donkey, Ehret (2002: 77) suggests that the domestication of the donkey may have occurred in the southern Red Sea Hills area earlier than currently thought, almost as early as the domestication of African cattle. His analysis of the geographic distribution of terms emphasises, therefore, domestication in the southern Sahara or Horn of Africa, but does not rule out additional domestication in the central
Sahara by proto-Chadic-speaking people (Ehret 2002: 77, pers comm 2003). In summary, African linguists concur that at least one and possibly two domestications of the donkey occurred in the Horn and possibly in the south-central Sahara. Their interpretations have not been widely discussed or accepted by Africanist archaeologists.

MODERN DNA

Recent studies of genetic variability in contemporary donkeys and *E. africanus* contribute to considerations of pastoral rather than urban contexts for domestication of the donkey in Africa and to ongoing debates over whether donkeys were domesticated in Africa or Asia (Beja-Pereira et al 2004; Oakenfull 2000, 2002).

Albano Beja-Pereira and colleagues (Beja-Pereira et al 2004) recently analyzed mitochondrial DNA from donkeys from 52 countries in Africa and Eurasia. Mitochondrial DNA is maternally inherited and can be used to provide a particularly interesting record of genetic change through time. They studied a highly variable region, region 1 (HVRI) of the mtDNA control region, sequencing 479 base pairs. Sequences are grouped with one of several equid haplogroups, differentiated by distinctive base pair changes. Subsequently neighbour-joining and other methods are used to construct dendrograms of relationships from genetic distances.

Beja-Pereira and colleagues’ phylogenetic analysis suggests at least two clades – one incorporating African wild ass and domestic donkeys, and the other the Asiatic wild asses (Beja-Pereira et al 2004). This study demonstrates unequivocally that the African wild ass, and not the Asian wild ass or hemione, is the ancestor of the domestic donkey. This supports earlier genetic research (Oakenfull 2000) and hypotheses based on Egyptian archaeology and the historic distribution of the African wild ass. It also fits with zooarchaeological and epigraphic data that precluded the onager as an ancestor to the domestic donkey. Finally, this study lays to rest Zeuner’s (1963) earlier arguments for domestication of the onager and the onager as an ancestor of Near Eastern donkeys (see also Clutton-Brock 1992a: 87).

Interestingly Beja-Pereira and colleagues’ (Beja-Pereira et al 2004) phylogenetic analysis also suggests at least two clades of domestic donkeys, each grouping associated with a different possible wild ancestor. They argue for two separate domestication events from two distinct wild populations or subspecies of *E. africanus*, Nubian and Somali, respectively (Beja-Pereira et al 2004: 1781). Nubian and Somali clades of domestic donkeys occur in both Africa and Asia, with the Nubian clade being somewhat more common in Africa and the Somali clade somewhat more common in Asia. Nucleotide diversity is, however, higher for both lineages in northeast Africa than in Eurasia. As a result, Beja-Pereira et al (2004: 1781) argue that it is likely that both domestication events took place in Africa. They cannot, however, completely rule out domestication of donkeys of the Somali clade in Asia.
SOCIAL CONTEXTS FOR DOMESTICATION AND CREATION OF NEW AGRICULTURAL SYSTEMS: A REVIEW

Historically researchers have focused on urban or peri-urban contexts for domestication and integration of donkeys into mixed agricultural traditions of settled villages and towns of the Mediterranean and western Asia. These agricultural traditions relied upon wheat, barley and pulses and cattle, sheep and goats. Donkeys were used for ploughing, threshing and to pull carts. Donkey caravans were the chief source of land transport for the ancient Egyptians and Sumerians (Brewer et al 1994; Clutton-Brock 1992a; Hassan 1988; Postgate 1992). It is likely that donkeys played a significant role in urban production and exchange in Asia (Zeder 1986: 372). It has also been suggested that donkey transport played a role in the spacing of Egyptian nomes and management of the ancient Egyptian state (Hassan 1988, 1993). Donkey caravans influenced the distribution of goods and the development of trade among ancient cities of ancient Egypt and western Asia. It is known from textual evidence that the Sumerians used donkeys to carry grain over the mountains to Atarra and tin and textiles over the Taurus Mountains (Postgate 1992: 166). The role of donkeys in ancient Egyptian long-distance trade is similarly well documented, with caravans moving between Egypt, the Levant and sub-Saharan Africa (Brewer et al 1994). During the Fifth Dynasty, the caravan master of King Meren-Re, for example, returned from his third trip to Yam with 300 donkeys carrying incense, ebony and grain (Brewer et al 1994: 100).

There has been much less emphasis on the role of the donkey outside of trade. As ethnoarchaeological data show, donkeys played an equally important subsistence role among African herders who lived a nomadic life under arid conditions. Donkeys allowed rapid mobile responses to unpredictable rainfall, flexible management of pasture away from permanent water, residential household mobility and improved health of livestock, women and children. The pastoral hypothesis suggests that donkeys played a significant role in the spread of early pastoral societies in Africa. It is likely that the subsistence role of the donkey was equally important outside of Africa, and that the finding that the donkey is often a woman’s animal – especially significant for household tasks, collecting water and firewood – has implications for understanding social roles, the organisation of women’s labour and factors affecting population growth in other areas of the world.

DISCUSSION

Prominent in Early Dynastic art and found buried in tombs, donkeys have long been assumed to have been domesticated by ancient Egyptians. It is well known that domestication of the donkey would have had a significant impact on urban commerce and the development of trade in Egypt and western Asia. The ethnoarchaeologically based hypothesis that early Northeast African pastoralists domesticated the donkey in order to facilitate long-distance mobility
as the Sahara dried c 7000–6500 BP, suggests a non-urban context for domestica-
tion of the donkey in the arid tropics or subtropics. It also has significant
implications for the development of pastoralism and the spread of food pro-
duction in Africa. In the following sections I discuss some of the key themes
arising from this hypothesis.

An African Pastoral Context for Domestication of the Donkey?

The geographic location and timing of zooarchaeological evidence for early
domestic donkeys is central to testing the African pastoral hypothesis.
Support for an African pastoral context for domestication of the donkey
would be provided by earlier evidence for domestic donkeys in pastoral
contexts of the Sahara, Sudan or Horn than in the Egyptian Nile valley.
Early dates for domestic donkey in the Egyptian Nile would not support,
nor would they rule out, an African pastoral context for domestication of
the donkey. The relative amount of archaeological research undertaken in
these regions, sample sizes and preservation issues should be considered.

Zooarchaeologists have recently conducted rigorous metrical and morp-
holological studies of wild ass and donkeys from Egyptian Predynastic and
Early Dynastic sites. Scholars working in Egypt now argue that domestic
donkeys were present in Egypt c 6000 years ago, considerably earlier than
previously thought. Early domestic donkeys are large, difficult to differen-
tiate from African wild ass, and consequently could have been present in
Egypt earlier than currently recognised.

In contrast, archaeologists working in the Sahara and the Horn have not
focused on zebra or ass in archaeological sites. This is largely because, as pre-
dicted by ethnoarchaeological findings, ass are not very common in pastoral
sites. The few reported remains are often identified in broad terms as ‘equid’
or ‘cf. E. africanus’. In cases where E. africanus has been identified in mid to late
Holocene sites, such as the cave sequences of the Magreb, early pastoral sites
of the Sahara such as Uan Muhuggiag, and rockshelters from Somalia such as
Guli Wabayo, it is unclear whether specimens should be attributed to
E. africanus or whether they might be domestic donkeys. Furthermore, except
for a few isolated sites, neither the archaeology of the refuge of the Nubian
wild ass in the Red Sea Hills area of Sudan and Eritrea, nor the key areas for
distribution of the Somali wild ass – lowland Ethiopia, Djibouti or Somalia –
have been studied. These gaps highlight areas for future research, but make it
difficult to test the pastoral hypothesis with current zooarchaeological data.

The earliest securely documented donkey in a prehistoric pastoral con-
text dates only to c 3600 BP at Wadi Hariq in the northern Sudan. This is
c 2500 years after donkeys appear in Egypt. As a result, zooarchaeological
data suggest domestication of the donkey by ancient Egyptians. However
recent biogeographic, historical linguistic and genetic studies necessitate
revision of zooarchaeological interpretations of the domestication of the
donkey and point towards the role of ancient African herders in multiple
domestication events.

It is interesting to consider conditions that might have promoted two domestication events by African pastoralists. The archaeology of early pastoralism in northern Africa suggests that the independent domestication of the Nubian and Somali wild ass and the spread of the idea of domestication among local pastoralist populations are both possible. With increasing aridity from 7000 years ago and increasingly variable rainfall, use of pastures farther from water, and increased mobility of groups of people and cattle, motivation for the domestication of the donkey may have been strong throughout the Sahara and Horn, an area of more than 20 million square miles.

The location and timing of possible domestication of the Nubian wild ass by African pastoralists are limited, however, by the ancient distribution of the Nubian wild ass, the timing of the development and spread of herding societies in northern Africa and the appearance of early domestic donkeys in ancient Egypt. The earliest evidence for early herders in Africa is found 9000–8000 BP in the deserts of southern Egypt and regions to the west (Close and Wendorf 1992; Marshall and Hildebrand 2002; Wendorf et al 2001). Through a combination of movement of herders and contact with local hunter-gatherers, food production spread patchily to the west and then to the south, accelerating as aridity in the Sahara increased from c 7000 BP (Marshall and Hildebrand 2002).

In ancient times, the Nubian wild ass had a broad distribution from northern Eritrea, across the Sudan to parts of the Sahara, and north to Egypt (Groves 2002: 101–03) (Figure 20.1). The linguistic evidence points to the Red Sea Hills for early domestication of the donkey (Ehret 1998, 2002). There is no archaeological evidence for this region, but the first evidence for the appearance of early herders with domestic stock in the adjacent Khartoum area of the northern Sudan dates only to c 6000 BP, at sites such as Kadero (Gautier 1984; Kryzaniak 1991; Marshall 2000). Early domestic stock appears later to the east, between the Nile and the Red Sea Hills, and to the south in Ethiopia, the Horn, southern Sudan and northern Kenya. The earliest domestic stock in the Atbara region of the eastern Sudan dates to around 5th–4th millennium BP (Marshall 2000; Peters in Sadr 1991). Domestic donkeys appear in Egypt by at least 6000 BP. Therefore, if Nubian wild ass were domesticated by herders prior to their appearance
in ancient Egypt, domestication must on current evidence have taken place in the central Saharan regions where the earliest pastoralists lived and north of the Sudanese Nile or Red Sea Hills.

The probable area, social context for and timing of domestication of Somali wild ass appear even more tightly circumscribed. It is unlikely that the Somali wild ass were ever found farther north than Eritrea, at about 11.6° N; populations center on northern Somalia (Groves 2002: 102). No long archaeological sequences have been excavated in Eritrea and the culture history of the region is unknown. In Ethiopia and Somalia excavation has been limited, however, early herders and their domestic livestock, ie cattle, sheep and goats, appear significantly later than in regions to the north. Early domestic stock has been identified at c 3500 BP at Lake Besaka, Gobeda, Baati Ataro and Kawlos in Ethiopia (Brandt 1980; Marshall 2000; Negash 2001; Phillipson 1977) and at Buur Heybe in Somalia (Brandt 1986). In these regions, as in the Sudan, the spread of herders appears to result from contact between local hunter-gatherers and early herders, as well as a southward movement of pastoral groups (Marshall and Hildebrand 2002). Consequently, if early herders, rather than hunter-gatherers, of the Horn domesticated the Somali wild ass, it is likely to have occurred after c 4000 BP (uncalibrated). Some archaeologists think the timing and location of domestication is the result of poor archaeological sampling (Brandt pers comm 2002; Phillipson pers comm 2002). If domestication of the Somali wild ass did in fact take place significantly later than domestication of the Nubian wild ass, it could have occurred following contact with donkey-owning herders from farther north or west.

Taken together, archaeological, genetic and linguistic evidence provide tentative support for domestication of the Nubian wild ass by ancient Egyptians and later domestication of the Somali wild ass by African herders. The domestication of the Nubian wild ass by African herders north of the Sahel is not ruled out, however, and nothing is yet known about the possible domestication of the Atlas wild ass. These research developments provide a new framework for thinking about the beginnings of food production in Africa, the spread of African pastoralism, the domestication of the donkey in Africa and multiple patterns of animal domestication and point to many areas for future research.

**African or Asian Domestication of the Donkey?**

The archaeological and genetic material reviewed in this paper contribute to current debates regarding an African or Asian ancestry of the donkey. Beja-Pereira et al’s (2004) modern genetic data rule out the onager as an ancestor of the Asian donkey. The zooarchaeological data suggest, however, that *E. africanus* was present in Asian sites such as Mureybit (Ducos 1975, 1986), Ra's en Naqb (Uerpmann 1991), Ain Ghazal (Driesch and Wodke 1997) and Ash Shumah (Cattani and Bökényi 2002) and raise the question of an Asian domestication of the donkey. There has been little or no discussion of which subspecies of wild ass might have been present in
Asia (see Eisenmann 1995). On geographic grounds the wild ass of the Levant might be expected to have been more closely related to the Nubian wild ass of the Sahara than to the Somali wild ass of the Horn of Africa. However, donkeys of both the Somali and Nubian clades are found in Asia, and because of the lack of genetic diversity among Asian donkeys, it is much more likely that both Nubian and Somali wild ass were domesticated in Africa (Beja-Pereira et al 2004).

The zooarchaeological evidence tentatively supports the African hypothesis. Metrical and morphological analysis of wild ass and donkey specimens recently excavated in Egypt show that domestic donkeys were present in Predynastic Egypt by c 5500–6000 years ago. Securely identified domestic donkeys in Asia date significantly later, to c 2800 cal BC (c 4200 BP) in the ancient city of Anshan at Tal-e Malyan in Iran (Zeder 1986). Just as in Africa, morphological identification is difficult, and domestic donkeys could have been used earlier than currently thought.

There are hints, such as at Ash Shumah, that donkeys could have been domesticated in Asia, and this is not completely ruled out by the genetic data (Beja-Pereira et al 2004). In order to make the argument that donkeys were domesticated in Asia it is necessary for there to have been a greater reduction in genetic diversity among donkeys in Asia than in Africa. Mechanisms could include less interbreeding among domestic and wild ass, founder effects related to more extensive trade in Asia and eradication of local populations due to disease. If donkeys were domesticated in Asia, Beja-Pereira et al’s (2004) data on the distribution of Somali and Nubian haplotypes suggest that it was the Somali, rather than the Nubian wild ass, that was domesticated. From this perspective, it is interesting to consider the Ash Shumah faunal assemblage of the western coast of Yemen, which suggests the possibility of the existence of populations of Somali wild ass in the Arabian Peninsula, across the Red Sea and adjacent to their historic distribution in Eritrea, Djibouti and Somalia. Bökönyi (Cattani and Bökönyi 2002: 45) argues there is evidence for ongoing domestication of African wild ass by c 7000 BP at Ash Shumah. He goes on to propose that this took place among mobile cattle herders, without sheep and goat, and to stress the African nature of this site and pattern of domestication (Cattani and Bökönyi 2002: 46–50). Bökönyi’s argument admits a possible pastoral context for domestication of the Somali wild ass in the Arabian Peninsula and provides a way to reconcile aspects of the zooarchaeological and genetic data. At present, however, the evidence for domestication at Ash Shumah is weak.

The proximity of Ash Shumah to Africa suggests an alternative interpretation. If donkeys were domesticated early in the Horn of Africa, as Ehret (2002: 77) suggests on the basis of linguistic data, then animals at Ash Shumah might be early African domestic donkeys. There has been increasing recognition among Africanist and Arabian archaeologists that close ties existed among mid-Holocene hunter-gatherers across the narrow straits of the Red Sea. In particular, there is evidence for importation of obsidian from the Horn of Africa to Yemen during the middle Holocene, and prehistoric
pastoral African rock art styles exist in Arabia (Cerviçek 1979; Cleuziou et al. 2002; Fattovich 1996a). Subsequently, there was well-documented trade between Africa and Asia along this route (Fattovich 1996a, 1996b: 24; Zarin 2002: 420–21). It might make sense that the donkey was imported from Africa to the coast of Yemen as the early engine of this trade.

We are already aware of the problems of recognition of early domestic donkey zooarchaeologically. It is abundantly clear that early donkey are large, and ethnoarchaeological data suggest multiple reasons why selection processes for small donkeys might not have been strong on early pastoral sites. In addition pastoral sites are ephemeral and there are many reasons why, if donkeys were not numerous, they would not be well represented in the faunas from such sites. It also true that the key areas of Eritrea and the Red Sea Hills are archaeologically unexplored. Perhaps we have simply ‘missed’ early domestication of the donkey by African hunter-gatherers of the Horn. In this case one would have to argue that in addition to Ash Shumah, the specimens identified as *E. africanus* at sites in the Levant, such as Mureybit and Ain Ghazal, were early African donkey. Such has already been argued for later *E. africanus* at the site of Maysar in Oman (Eisenmann 1995). It is interesting that Eisenmann (1995) notes that the Mureybit specimen is small for African wild ass in Africa.

It is time for a major paradigm shift in thinking about the domestication of the donkey. At present it is difficult to reconcile faunal with genetic evidence on this topic and the zooarchaeological data from Ash Shumah, Yemen, with that from other regions. It is also evident that there are significant methodological barriers to zooarchaeological recognition of early donkeys, particularly in the context of mobile herding societies. Additional studies of modern DNA, especially microsatellites from both modern donkey and wild ass, as well as studies of ancient mitochondrial DNA, and further detailed research on the morphology of African wild ass will help to resolve these issues. Genetics may help to resolve ancestor and place; archaeology and zooarchaeology are necessary to clarify social context and timing. Further research is also badly needed on the Holocene archaeology of the eastern Sahara, Horn of Africa, and Arabia.

**CONCLUSION**

In conclusion, recent genetic studies suggest that a number of large mammals, including sheep, pigs and taurine cattle were domesticated more than once in different geographic regions. Given the very few large mammals, or even plant species, ever domesticated in the world, archaeologists have tended to look upon domestication of plants or animals as rare events resulting from the unusual convergence of particular social and ecological circumstances (Harris 1996: 570). It has long been argued by zooarchaeologists, however, that certain mammals are behaviourally more suited for domestication than others. Many species of bovines, including water buffalo, humped cattle (*Bos indicus*) and unhumped taurine cattle (*Bos taurus*), were domesticated,
for example, although antelope and deer were not (Clutton-Brock 1999; Hemmer 1990). *Bos taurus* was domesticated twice, in both Africa and western Asia (Bradley and Lofts 2000; Hannotte et al 2002). For all this there has been little anthropological focus on the occurrence of, or social contexts for, multiple domestication events within one geographic region. In fact, it is only geneticists that have so far identified such events. This is largely because the archaeological record is sparse, providing few data points, and because parsimony has suggested that for a species in a particular region, one domestication event was more likely than two. Genetic findings have prompted archaeologists to reconsider this issue for animals such as pigs, sheep and cattle. Currently, extensive research is being carried out on animals of temperate regions, especially pigs and goats. The donkey appears to be an unusual case, however, with possible multiple domestications within one geographic region. Pastoral perspectives are therefore timely, as they provide a social context in which this event could easily have occurred in the arid tropics and subtropics of Africa and possibly Asia.

Domestication of the donkey has significant implications for the development of African pastoralism, domestication of African plants and the spread of food production in Africa. Integration of the domestic donkey into cattle-based herding systems of the Sahara and Horn of Africa reinforced the mobility of early herders, creating a more productive and sustainable herding system. The increased mobility of early herders generated circumstances that would have reduced continuous directional selection on local plants, contributing to early reliance on domestic herds and late domestication of African plants (Marshall and Hildebrand 2002). Because mobile cattle, sheep, goat and donkey-based herding developed early, food production spread through the northern half of Africa as a result of migration of early herders and through cultural contact among herders and hunter-gatherers, rather than through the influence of settled villagers. Mobile use of the landscape preserved local resources, lessening direct competition and allowing hunter-gatherers to coexist with early herders. It also encouraged continued use of wild plants and patchy spread of food production (Marshall and Hildebrand 2002). Continued use of wild plants and their domestication by later, more settled herders across many regions of the Sahel contributed to the non-centric pattern of plant domestication characteristic of Africa.

Mobile herding systems are still the most efficient form of food production in arid lands of Africa today (McCabe 2004). The domestication of the donkey was a turning point in the organization of movement, land management and labour of ancient herders; it also contributed to the development of distinctively African patterns of food production and plant domestication.

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