

DOI: 10.17746/1563-0110.2016.44.1.123-136

E.T. Shev

*La Trobe University,
Bundoora, Victoria, 3086, Australia
E-mail: genetshev@gmail.com*

THE INTRODUCTION OF THE DOMESTICATED HORSE IN SOUTHWEST ASIA

This compilation of faunal data has allowed the development of a chronology of the dispersal of domesticated horses from the Eurasian steppe into Southwest Asia. During the late Pleistocene, horses were widespread throughout much of the Near East, however increasing aridification led to their extinction from the region. Their presence within the archaeological record of the Late Holocene therefore suggests their spread as a human-controlled domesticate. Early domesticated horses are found at Botai, Kazakhstan, although faunal data indicates that Anatolia, Iran, and the southern Levant contained surviving populations of wild horses during the mid-Holocene. If these remains from the Levant, western Iran, and Anatolia do not belong to native wild progenitors, their presence in Late Chalcolithic deposits indicate an introduction of domesticated horses to this region much earlier than previously assumed. The Buhen horse is the oldest dated domesticated horse in Egypt and was assumed to be anachronistic given the lack of contemporaneous Levantine specimens. However horses were present in the Levant prior to and contemporary with the Buhen horse, illustrating a steady southward distribution from the Eurasian steppe over two millennia dating from the Late Chalcolithic to the Late Bronze Age; a spread likely hastened by the widespread adoption of chariot warfare in the early 2nd millennium BC.

Keywords: *Horse domestication, Holocene faunal record, Southwest Asia.*

Introduction

The domestication of the horse led to a dramatic reconfiguration of long-distance trade and warfare throughout Eurasia. There is a significant chronological gap between the earliest archaeological evidence of horse domestication at around 3500–3000 BC in the Eurasian steppe site of Botai in Kazakhstan and the subsequent adoption of the animal by Bronze Age civilizations in the Near East. During the Second Intermediate period beginning in the seventeenth century BC, the domesticated horse *Equus caballus* first appears in Upper Egypt, discovered *in situ* underneath a destruction layer dating to 1675 BC within the southern fortress of Buhen (Emery, 1960; Clutton-Brock, 1974).

A review of archaeozoological remains distributed throughout Southwest Asia has been conducted in this paper in order to establish a chronology of *E. caballus* dissemination and determine the avenues of domesticated horse dispersal from the Eurasian steppe into the Near East. To complicate the picture, the faunal record suggests the continual survival of the wild predecessor of domesticated horses *Equus ferus* throughout the Holocene in the southern Levant, northwestern Iran, and central Anatolia, areas in which it was previously thought to have become extinct.

Botai in Kazakhstan yields the oldest well-supported evidence of early horse domestication. Several lines of evidence suggest the inhabitants of Botai were keeping horses for consumption and for ritual purposes (Levine,

Equid remains from sites in Southwest Asia

Site	Age	Location	Species	NISP	Percentage in faunal remains, %	Diagnostics	Source
1	2	3	4	5	6	7	8
Transcaucasia							
Alikemektepesi	LC, 4th millennium BC	N/A	<i>E. spp.</i>	N/A	N/A	N/A	(Eneolit SSSR, 1982: 134–135)
Mokhrablur	LC, 4000–3500 BC	"	<i>E. caballus</i>	"	"	P ₂ molar with >3mm bit-wear	(Anthony, 2007: 221)
Horom	EB, 3371–3136 BC	"	"	"	6.7	N/A	(Badjalian et al., 1994)
Anatolia							
Çatalhöyük	Late Neolithic, 7500–5700 BC	Building 52, Space 261, Cluster 11392	<i>E. spp.</i>	2 (1)*	N/A	Equid pelvis and tooth	(Twiss et al., 2005)
		Building 42, Levels V, IV	"	13	1.5	N/A	
		Same, Levels III–I	"	10	2.8	"	
Pınarbaşı	Late Neolithic, 7190 ± 80 BC	Context ABU	"	1	N/A	"	(Carruthers, 2004)
		Context ABJ	"	1	10	"	
	5195 ± 70 + 2600 ± 70	Site B, all contexts	"	254	10	"	
	5196 ± 70 + 2600 ± 70		<i>E. caballus</i>	1	1	"	
Köşk Höyük	Chalcolithic, 6200–6000 cal. BC	Areas E–F/8–9, pit features	<i>E. spp.</i>	N/A	45	"	(Arbuckle, 2007)
		Levels V–II	"	"	23	"	
		Level I	"	"	5	"	
Çadır Höyük	LC, 3500–3100 BC	L62, 770.900	<i>E. caballus</i>	1	N/A	Anterior phalange I (CD2015)	(Arbuckle, 2009: 216–217)
		L55, 770.890	"	1	"	Metacarpus III (CD99)	
		L58, 770.900	"	1	"	Posterior phalange I (CD1778)	
		L6, 760.900	"	1	"	M3 (CD1325)	
		L10, 770.880	<i>E. caballus</i> ?	1	"	P3 or P4 (CD1925)	
		L75, 770.890	"	1	"	P2 (CD2189)	
		LA, 800.930	<i>E. spp.</i>	1	"	P4 (CD829)	
		L97, 780.890	<i>E. caballus</i>	1	"	P2 (CD1381)	
		L106, 790.890	"	1	"	Metatarsal III (CD1086)	
Tilbeşar	MB, 2000–1600 BC	N/A	"	4	0.25	N/A	(Berthon, Mashkour, 2008)
Iran							
Zagheh, Qazvin plain	Late Neolithic – EC, 5370–4220 BC	Square E IX, Locus 401	<i>E. caballus</i>	1	N/A	Calcaneus	(Mashkour, 2003: 133–135)

	Square F XI	"	"	1	"	"	Same	
Godin Tepe	Unit D14, Layer mixed Unit AA2.185, Layer III.4 Unit A1.1156, Layer IV/V Unit DJ51, Layer IVA Unit DJ55A, Layer IV/III Unit AA2.193, Layer III.4 Unit AA2.185, Layer III.4 Unit A2.172, Layer III.4 Unit AA2.193, Layer III.4 Square EA/G13 II, Locus 401 Square O XXI / 3, Pit 2 Square O XXI / 3, Layer LX	"	"	3 (1)	"	"	P3, P4, M1	(Gilbert, 1991: 114–115)
	– EB I, ca 3100–3000 BC – EB II, 3000–2600 BC EB III, ca 2600 BC EB III – LB I, 2600–1500 BC	"	"	N/A	"	"	Humerus Metacarpus III	
		"	"	"	"	"	Same	
		"	"	2 (2)	"	"	Femur Tibia	
		"	"	N/A	"	"	Metatarsus III Phalanx I, II	
		"	"	"	"	"	Same	
Qabrestan, Qazvin Plain	EB, 2940 ± 50 + 2180 ± 50	"	"	6 (1)	"	"	Humerus, calcaneus, premolars (4)	(Mashkour, 2003: 133–135)
Sagzabad, Qazvin Plain	LB – IA II, 1322 ± 297 + 870 ± 30	"	"	4 (2)	N/A	"	Humerus (2), calcaneus (2) Calcaneus	(Ibid.)
Syria								
Tell Chuera	EB III, ca 2650 BC	E. caballus		3 (1)	N/A	"	Phalanx I, distal humerus, scapula	(Vila, 2006: 118, 120)
Tell Habuba Kabira	MB, ca 2100–1550 BC	"		5	"	"		(Driesch, von den, 1993: 54)
South Levant								
Wadi Hammeh 27, Jordan	Natufian, 12,500–12,000 BC	E. ferus		1	<4	"	Mandibular tooth (WH27- 359) N/A	(Edwards, Martin, 2013: 337–338) (Stiner, 2005: 256)
Hayonim Cave, Israel	Natufian, 11,403–10,370 cal BC	"		1	N/A	"		
Wadi Feinan, Jordan	Late PPNB, 6500–6000 BC ? Final PPNB, 6000–5500 ?	E. caballus ?		2 (1)	0.4	"	Distal metacarpal, pelvis Proximal femur	(Richardson, 1997: 500)
Ain Rahub, Jordan	Yarmoukian, ca 5500–5000 BC	E. ferus		4	7	"	First phalanges (4)	(El-Shiyab, 1997)
Ramat Saharonim, Israel	Late Neolithic, ca 5000 BC	E. caballus ?		1	<1	"	Metacarpus III	(Horwitz, Rosen, Bocquentin, 2011)
Shoham (north), Israel	LC (no accurate date)	E. caballus		3 (1)	<1	"	Distal metapodial (1)	(Horwitz, 2007)
Shiqmim, Israel	LC, 3800–3300 BC	"		3 (1)	<1	"	Humerus, metacarpal, radius	(Grigson, 1993)
Grar, Israel	Same	"		1	<1	"	Metacarpus Radius Tibia	(Ibid.)

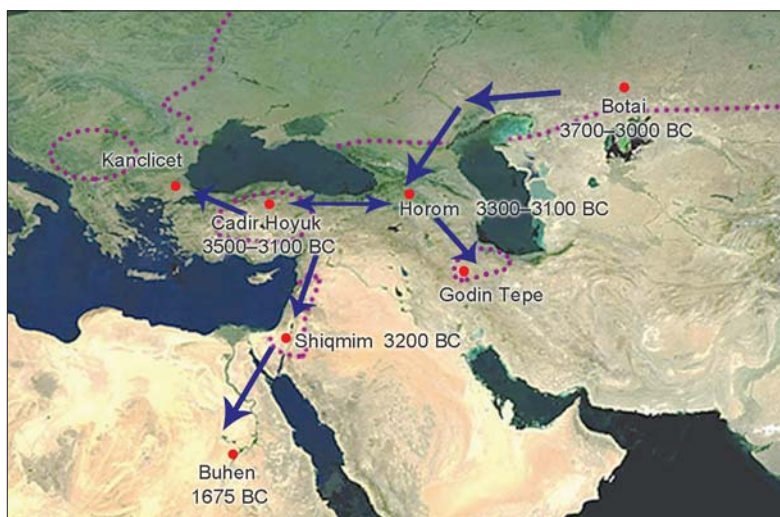
Table (end)

1	2	3	4	5	6	7	8
Arad, Israel	EB I, 3200/3150–3000 BC EB I, 3300–3000 BC	Stratum IV Area T, Locus 4114, Layer II Area T, Locus 2406, Layer III Stratum II	<i>E. caballus</i> ? <i>E. caballus</i> " <i>E. caballus</i> ?	1 2 (1) 1 1	N/A " " "	Phalanx 1 anterior Metacarpus 8672, fore- phalanx 8672 Metacarpus 5788 Phalanx 1 anterior	(Lernau, 1978: 110) (Davis, 1976) (Ibid.) (Lernau, 1978: 110)
Afridar, Israel	EB I, 3300–3000 BC	Area F Area G	" "	1 1	" "	Distal radius Distal tibia	(Kansa, 2004)
Tel Aphek, Israel	EB I, 3150–2850 BC MB IIA, 2000–1750 BC	Area B " Area A	<i>E. caballus</i> " "	10 3 (1) 1	7.7 0.4 N/A	Teeth " Tooth	(Hellwing, 2000: 294, 297, 306) (Alhauque, 2008)
Khirbet al-Baltrawy, Jordan	EB III, 2700–2200 BC EB IVB, 2200–2100 BC	Activity 3a Activity 3b Activity 2g Activity 2e	" " " "	5 (1) 5 (2) 4 (1) 7 (3)	5.6 2.5 14.3 10.3	N/A " " "	
Tel Michal, Israel	MB IIB, ca 1750 BC LB, 1600–1200 BC IA, 1000–700 BC Persian, 525–350/300 BC Hellenistic, 350–100 BC	Area A (most) " " " "	" " " " "	1 21 (1) 2 (1) 10 (4) 5	0.9 3 0.4 0.2 0.1	1x Centrocarpalia N/A " Metacarpus, metapodial, phalanx I (2), teeth (6) 1x Ulna, 1x Radius, 1x molar, 2x centrocarpalia	(Hellwing, Feig, 1989: 236–242)
Shiloh, Israel	LB, 1550/1500–1350 BC	Area D, Debris 407	"	3 (3)	N/A	N/A	(Hellwing, Sadeh, Kishon, 1993: 311, 314, 325)
Tel Sera, Israel	LB, 1500–1150 BC	–	"	1	N/A	Astragalus	(Oren, 1972)
Tell es-Safi/Gath, Israel	IA I, 1300–1000 BC	Area E, Locus 46002, Basket 460028 Area B-west, Stratum IVB	<i>E. caballus</i> ?	3 (2)	"	M1, M2, M3	(Lev-Tov, 2012: 594, 596)
Tel Dan, Israel	Late IA I, 1300–1000 BC	–	"	4	"	N/A	(Ilan, 2011: 150)
Tawilan, Jordan	IA I, II, 1220–539 BC	–	"	1	"	Maxilla with canine and incisor I.1.14a	(Köhler-Rollefson, 1995: 99)
Tel Bet Yerah, Israel	Hellenistic, 323–31 BC	Stratum I	"	10 (2)	9.3	N/A	(Cope, 2006: 171)

Note: LC – Late Chalcolithic, EB – Early Bronze Age, MB – Middle Bronze Age, LB – Late Bronze Age, IA – Iron Age.

*In parentheses, MNI is given (if known from the source).

Fig. 1. Possible dissemination of *E. caballus* in the Near East, and key sites discussed in this paper. Dotted lines indicate regions where wild horses continued to exist during the mid-Holocene (ca 5000 BC). Dates indicate the earliest evidence of domesticates within certain regions.



1999; Olsen, 2003: 98–101). Analysis by Brown and Anthony (1998) yielded at least four individual horses that demonstrate evidence of bit-wear on horse lower second premolars (P_2), a pathological indicator of domestic status.

Interestingly, the dissemination of the domesticated horse has been linked to the spread of Indo-European languages. For this reason, archaeozoological evidence indicating the geographical spread and chronology of horse dissemination has long been entangled with the Indo-European question. Gordon Childe (1926) highlighted commonly shared linguistic elements, or cognates, within ancient and contemporary Indo-European languages in theorizing of a common Proto-Indo-European culture. The Proto-Indo-European link to horsemanship is one that may have some credence given that the first domestication event likely took place in roughly the same region that was the homeland of all Indo-European languages.

The transmission of the domesticated horse from the Eurasian steppe into the Near East could have only occurred via a limited number of geographical corridors. As it stands, there is no evidence that horses were present in the Balkans or eastern Iran at a period contemporary with or shortly after horse domestication occurred at Botai. Transcaucasia, Anatolia, and northwestern Iran on the other hand do demonstrate populations of *E. ferus/caballus* between 3500–3000 BC, indicating Transcaucasia as a likely corridor of dissemination (Fig. 1).

Archaeozoological method for identifying *Equus caballus*

To ascertain the presence of equine species in the faunal record, an understanding of archaeozoological methods of identification is needed. All equid species share similar post-cranial elements so the accurate identification of

species can be problematic. Determining domestic status is another problem; early examples of domesticated horses do not exhibit the clear phenotypic variations from wild species that are observable in other domesticated animals such as the bovinds. Aside from osteological traits, domestic status can be determined by diagnostic pathological traits such as biting scars, and also from observable changes in butchery practices and the presence of artifacts such as riding equipment and objects that exhibit the horse as a ritual symbol (Anthony, 2007: 216–218, 221, 239).

Teeth are the most frequently encountered skeletal remains and are often used to distinguish between *E. asinus/hemionus*, *E. hydruntinus*, and *E. ferus/caballus* (Davis, 1980; Vila, 2006: 103). Observations of the buccal (external) fold and its depth of penetration towards the lingual (internal) fold is one method of identifying species. Caballine molar lingual folds are U-shaped and are the most recognizable dental feature attributable to horses (Davis, 1980; McGrew, 1944).

Distinguishing between wild and domesticated status from caballine remains is also problematic. Unlike the case with other domestic animals such as bovinds, variations in body size are not a reliable indication of domestic status in horses. Shifts in size may be related to the transmigratory habits of horse populations rather than due to controlled breeding (Anthony, Brown, 2011). On the other hand, certain elements of *E. caballus* skeletal morphology can exhibit alteration from that of wild stock; metapodials can undergo morphological change due to an increase in their load-bearing function when horses are utilized as beasts of burden (Outram et al., 2009). Wear on dentition is also another observable trait that has been linked to human actions. The biting of horses to fix harnesses can create scarification and wear on mandibles and teeth, characteristics that are pathological indicators of domestic status (Anthony, Brown, 2011). “Type 1” bit-

wear is caused by the pulling of reins and consists of a beveled edge of more than 3 mm on the occlusal surface of the mesial corner of P₂ molars (Anthony, Brown, 1991; Brown, Anthony, 1998).

Regions examined

To establish the chronology detailing how the domesticated horse came into use in Mesopotamia and Egypt during the late 3rd and early 2nd millennium BC, an understanding of the faunal record of neighboring regions that are probable geographic routes of dissemination is needed. Between the Eurasian steppe and the Levant, Iran and Anatolia, lies the Transcaucasia region.

Transcaucasia. Domesticated horses likely disseminated from the Eurasian steppe into the Near East via Transcaucasia (Fig. 2). Horses appear in the Caucasus during the Maikop and Early Transcaucasian (ETC) cultural periods between 3500–3000 BC (Anthony, 2007: 221). Given that there is no evidence of wild early Holocene populations of horses throughout the Caucasus, they were likely imported either through the Pontic-Caspian steppe or via eastern Anatolia.

One of the earliest instances of *E. caballus* within the region dates to the late 4th millennium BC from the site of Alikemektepesi, Azerbaijan, in the steppe south of the Kura and Araxes rivers (Mallory, 1989: 232). At Alikemektepesi, two species of equids were identified, the larger of which was thought by Soviet archaeologists to be the earliest evidence of domesticated horses in

the Transcaucasian region (Eneolit SSSR, 1982: 134–135). The dating of these specimens suggests an early intrusion of horses from the Pontic-Caspian steppe and is synchronous with findings in Anatolia (Grigoriev, 2002: 336; Mallory, 1989: 232–233).

A more secure dating of what may be a domesticated horse comes from the site of Mokhrablur, Armenia, and dates to the Late Chalcolithic. Evidence of domestication is derived from bit-wear analysis on a 5-year old stallion discovered at Mokhrablur. Severe wear on the mesial edge of a P₂ molar demonstrates a bevel deeper than 3 mm, suggesting that this animal was bitted (Anthony, 2007: 221). The presence of this specimen in LC layers suggests that there was a dispersal of *E. caballus* into Transcaucasia prior to 3000 BC (Anthony, Brown, 1989: 102).

The site of Horom is located within the Shirak Plain in northwest Armenia and boasts an occupational history spanning around 5000 years, ranging from the EB I–Early Iron Age (IA I). Radiocarbon sampling of EB I material (sample no. AA-7767 at 1 sigma) taken from the 1990 sounding of the site gave a date range of 3371–3136 BC (Badjlan et al., 1992, 1993). During the 1992–1993 seasons, over six thousand faunal specimens were uncovered, many of them well-preserved. The domestic assemblage accounted for 92.4 % of all identifiable remains, suggesting an agro-pastoral subsistence strategy. Horse bones comprised 6.7 % of the EB I–IA I assemblage (Badjlan et al., 1994).

Anatolia. Recently uncovered evidence suggests the continued survival of *E. ferus* in central and eastern

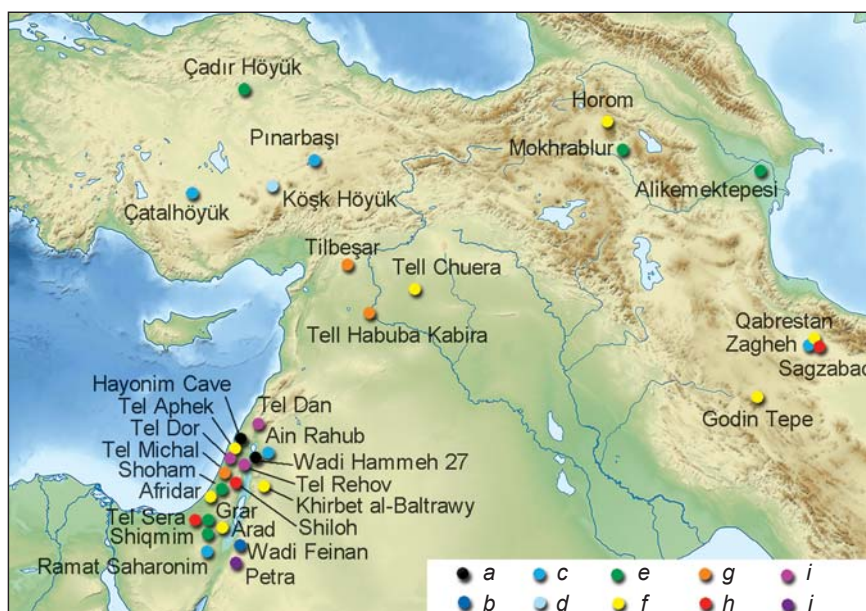


Fig. 2. Chronology and distribution of *E. caballus* remains in Southwest Asia.

a – Natufian; b – PPNB; c – Late Neolithic; d – Early Chalcolithic; e – Late Chalcolithic; f – Early Bronze; g – Middle Bronze; h – Late Bronze; i – Iron Age I; j – Iron Age II.

Anatolia well into the Holocene, confounding attempts to draw a linear direction of dissemination from the Eurasian steppe into the Near East. It is widely accepted that horses became extinct throughout much of the Old World at the end of the Pleistocene, existing only in scattered pockets throughout Europe (Anthony, 2007: 198). Contrary to this, recent research has indicated that wild horses were present throughout central and eastern Anatolia well into the Holocene. Faunal assemblages from the Neolithic settlements of Çatalhöyük and Pınarbaşı indicate that a small percentage of wild horses were hunted in the central plateau between 7400–6200 BC (Martin, 2013; Carruthers, 2013). Importantly, *E. ferus* remains have been uncovered across the central plateau during the 4th–3rd millennium BC, both in the Altınova Plain in eastern Turkey and the Eşkışehir region in the northwest of Anatolia (Arbuckle, 2009).

The Cappadocian region site of Köşk Höyük demonstrates a prevalence of the consumption of horsemeat dating to the 6th millennium cal BC. Five distinct occupational levels have been determined at Köşk Höyük encompassing the Neolithic to Chalcolithic periods (Arbuckle, 2007). The majority of equid remains were uncovered in areas E–F/8–9 from various pit features located on the fringes of the settlement, designated for the butchering of large animals (Öztan et al., 2005). Lower Phases V–II (6200–5200 cal BC) contained substantial quantities of equid remains, accounting for 23 % of the total assemblage. In some contexts, equid bones accounted for 50 % of the faunal remains. Of the three equid species uncovered at Köşk Höyük, *E. hemionus* and *E. hydruntinus* were represented by smaller-sized remains, and larger bodied equids fell into the size range of *E. ferus* (Arbuckle, 2007; Martin, Russell, Carruthers, 2002).

The Chalcolithic site of Çadır Höyük raises the prospect of an independent area of domestication (Sagona, 2011: 696). Çadır is one of many settlements that appeared in the Kanak Su basin during the 4th millennium BC. The stratigraphic sequence of the mound demonstrates continuous occupation from the Middle Chalcolithic (5200 cal BC) to 1100 AD (Arbuckle, 2009; Steadman et al., 2008). There is an abundance of equid remains at the site, accounting for 3 % (NISP = 71) of the total assemblage for all periods. Equid remains fluctuate from 14 % in the Late Chalcolithic/ Early Bronze Age assemblage to <1 % during the Byzantine era. Equid specimen CD2015 from Late Chalcolithic (LC) deposits (Late Chalcolithic Phase Ib, locus 62, trench 770.900) illustrates the presence of horses from the first half of the 4th millennium cal BC. Five separate specimens from Iron Age (IA) and LC/ EB I contexts exhibit butchering marks on metatarsals, metacarpals, and the distal aspect of one radius. Equid remains with butchery marks account for 7 % of total assemblage, reflective of subsistence patterns illustrated in some Eurasian steppe sites (Arbuckle, 2009).

There is no observable biometric variation in specimens from the LC to the IA, suggesting a steady continuation of phylogenetic morphology. This would not be expected if domesticated horses from a different region had been introduced in the 4th–3rd millennium BC. Many specimens from the Late Chalcolithic exhibit a high proportion of foot bone pathologies; 20 % (NISP = 30) of the specimens show pathological degradation that may be the result of being utilized as beasts of burden (Ibid.). If this data can be relied upon, the central plateau of Anatolia may represent an independent area of horse domestication.

Northwestern Iran. Northwestern Iran lies on the southeastern border of the Transcaucasia region and is therefore a likely candidate for the dispersal of *E. caballus* southward at the end of the 4th millennium BC. There are a few sites that demonstrate the presence of domesticated horses, both in the Qazvin Plain and also in the mountainous Zagros region. However, there is also evidence that, like eastern Anatolia, western Iran may have also supported small, isolated populations of *E. ferus* well into the Holocene. Remains of *E. ferus* are present in small numbers within the Chalcolithic site of Zagheh, northwest of Tehran. These specimens precede the earliest evidence of domestication in the Eurasian steppe. Radiocarbon samples have established a site chronology demonstrating occupation from Late Neolithic/ Transitional Chalcolithic to the Early Chalcolithic ca. 5370/5070–4450/4220 cal BC (Fazeli, Wong, Potts, 2005). *E. ferus* skeletal elements at Zagheh include teeth, a humerus, a calcaneus, and several second and third phalanges dating from the 6th millennium BC (Mashkour, 2003: 134–135). These specimens represent a further geographical extension of Holocene era *E. ferus* than previously thought, just as recent research has revealed a Holocene presence of wild horses in central and eastern Anatolia.

Qabrestan in the Qazvin Plain demonstrates the presence of horses at a later date, contemporary with examples uncovered in central Anatolia and Transcaucasia. At Qabrestan, an equid calcaneus that fits into the size range of *E. caballus* was uncovered, dating to the early 3rd millennium BC (Ibid.: 134).

Godin Tepe is located 1600 m above sea level in the Kangavar Valley of western Iran. Its stratigraphic sequence contains at least ten defined cultural phases, the earliest of which dates to around 4500 BC (Young, 1969). Godin IV (3000–2600 BC) is marked by evidence of an intrusion by Yanik/ ETC culture from the north; it also contains the oldest *E. caballus* remains at the site (Burney, Lang, 1971: 52–53; Gilbert, 1991: 75–76; Young, 1969: 19–20). During the 1967–1973 seasons, excavation of Godin III and IV yielded a substantial assemblage of faunal material (Gilbert, 1979). Equid bones are best represented during Godin IV (NISP = 146), the majority

of which were identified as *E. hemionus*. The remaining 6 % of the equid remains were determined to fit within *E. caballus* size ranges (Gilbert, 1991: 78, 87). Two securely identifiable caballine remains were uncovered from Godin IV/V, a complete right metacarpal III, and a right mandibular cheek-tooth. The metacarpal exhibited the caballine traits of mediolateral eminences and a weak dorsal relief (Ibid.: 96).

Determining species from the cheek teeth was problematic due to poor preservation conditions and the presence of hybridized traits. However, many of the analyzed cheek teeth also demonstrated the caballine trait of *sulcus externus*, a deeply penetrating metalophid fold between the hypoconid and protoconid cusps. Of all analyzed cheek teeth, only two individual specimens demonstrated solely hemione traits, while only one demonstrated solely caballine traits; even so, this single tooth also shows minor signs of blending (Ibid.: 88). Gilbert (pers. comm., 2013) is currently analyzing the DNA of faunal remains from Godin IV to examine the possibility of equid hybridization at the site.

Syria. Given the likely northern Eurasian steppe or possible Anatolian origins of the domesticated horse, it is logical to investigate the archaeozoological record of Late

Chalcolithic and Early Bronze Age sites in the northern Levant as a means of dispersal to the southern Levant and Egypt. Several species of equids existed in Southwest Asia during the Pleistocene, however increasing aridity occurring at the beginning of the Holocene period saw equid diversity diminish dramatically and a decrease in previously abundant *E. ferus* populations (Orlando et al., 2009). However, there are a number of settlements in southerly regions that demonstrate the continual presence of wild horses throughout the Holocene (Fig. 3, 4).

There are only scattered examples of 3rd millennium BC remains found, most significantly at the site of Tell Chuera in northeast Syria. Tell Chuera is situated between the Khabur and Balikh rivers approximately 11 km south of the Syrian-Turkish border and covers an area of around 65 ha. The settlement was possibly established by migrants from the wetter areas of the Upper Khabur in Anatolia at around 2900 BC (Akkermans, Schwartz, 2003: 256, 259). A number of equid bones were uncovered at Tell Chuera that exceed the size range of *E. asinus* and *E. hemionus*. Uncovered from the temple sector (Tell Chuera IC), dating to the middle of the 3rd millennium BC was a first phalanx, the distal extremity of a humerus, and a scapula, all of which were within caballine size ranges.

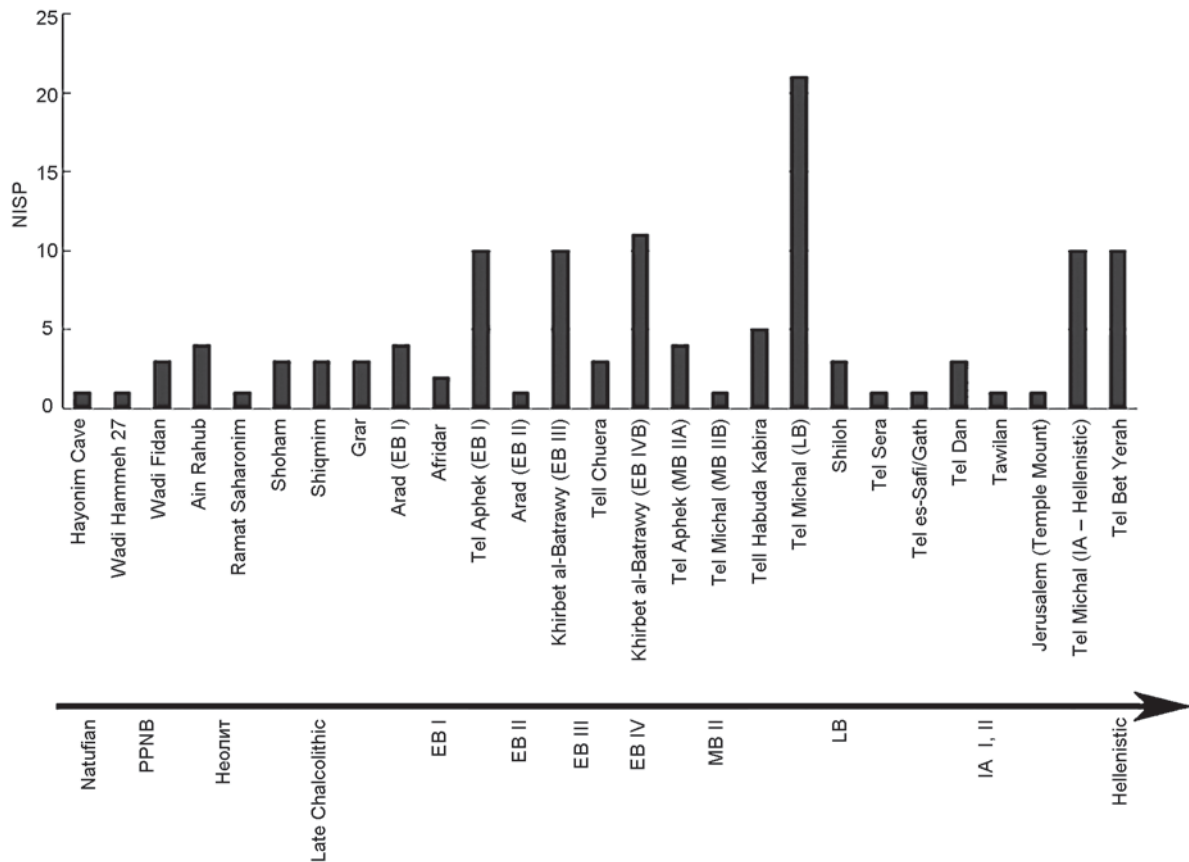


Fig. 3. Number of individual specimens (NISP) of *E. caballus* remains from Levantine sites, ordered chronologically. PPNB – Pre-Pottery Neolithic B, EB – Early Bronze Age, MB – Middle Bronze Age, LB – Late Bronze Age, IA – Early Iron Age.

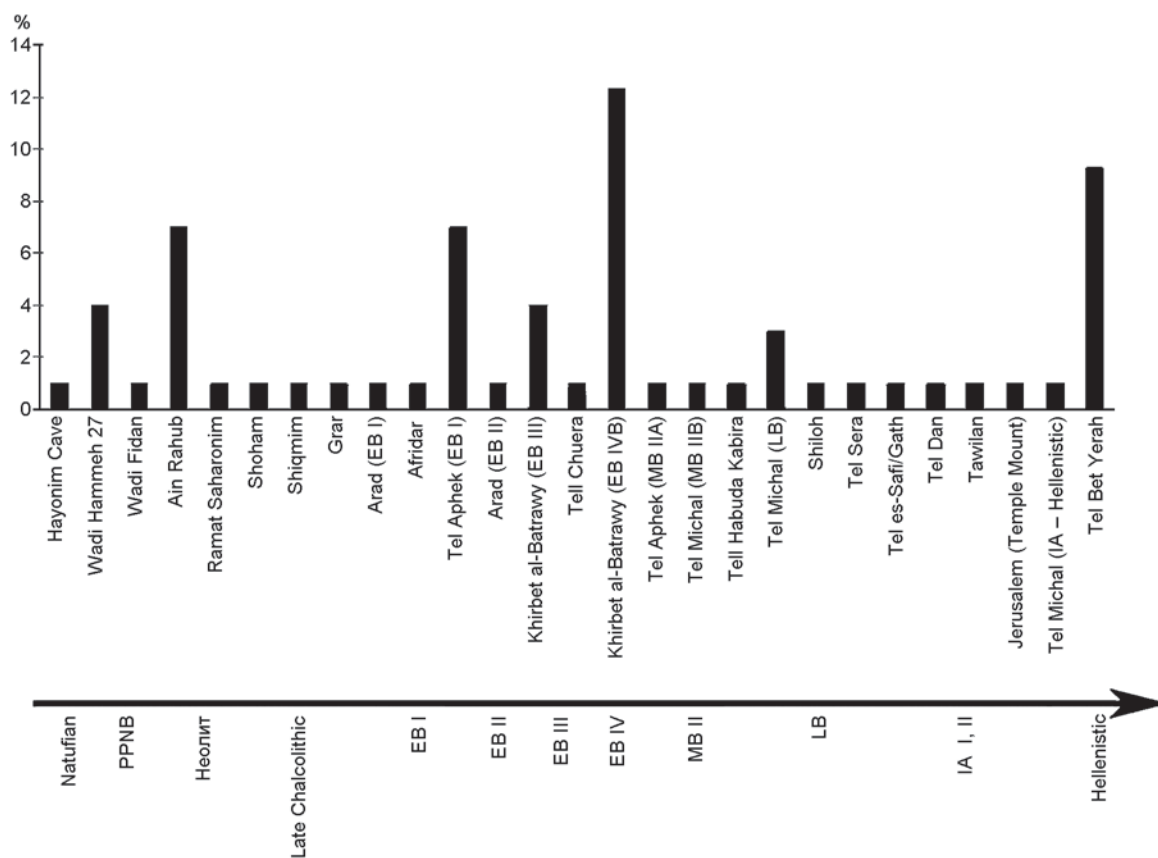


Fig. 4. Percentage of *E. caballus* remains within the total faunal assemblages from Levantine sites, ordered chronologically. Legend same as on Fig. 3.

These specimens indicate the presence of domesticated horses in Syria at around 2650 BC (Vila, 2006: 118, 120).

Southern Levant. Wadi Hammeh 27 in the Jordan Valley is a Natufian period settlement that contains evidence of *E. ferus* in the southern Levant at the end of the Pleistocene. Wadi Hammeh 27 dates to around 12,000 cal BC and contains early evidence of the harvesting of wild grain (Edwards, 2007). Faunal analysis revealed that equids account for 2 % of the total NISP at Wadi Hammeh 27. A single mandibular tooth (specimen WH27-832) was classified as belonging to *E. ferus* due to its U-shaped lingual fold with an intermediate penetration towards the lingual fold (Edwards, Martin, 2013: 337). Further evidence of the presence of *E. ferus* during the Natufian period is exhibited at Hayonim Cave in Upper Galilee. Contained within Hayonim Layer B (11,403–10,370 cal BC) was found a single post-cranial element that was identified as *E. ferus* (Stiner, 2005: 256).

Remains of *E. ferus* from the ceramic Yarmoukian period are found in northwestern Jordan. The site of 'Ain Rahub is located on the lower terrace of the west bank of Wadi er-Rahub, approximately 13 km northeast of the modern settlement of Irbid (El-Shiyab, 1997: 593). The later Yarmoukian layers however revealed

four first phalanges identified as horses, accounting for 7 % of the total identifiable faunal assemblage of this period. These phalanges were identified as *E. ferus* due to their solid middle shafts and the presence of developed distal supra-articular tuberosities (Ibid.: 594–596). Contemporarily with the Yarmoukian specimens of 'Ain Rahub is the presence of an equid metacarpal that falls into the size range of a small horse found at the site of Ramat Saharonim in the Negev Desert (Horwitz, Rosen, Bocquentin, 2011). Excavation of Tumulus 28–30 and Shrine 4 fixed a contemporaneous date of around 5000 BC for the structures (Porat et al., 2006; Rosen et al., 2007). Discovered in context with human remains was a single, fused distal metacarpus III, osteometric analysis of which affirmed a size within that of the *E. caballus* range, similar to the Late Bronze Age Egyptian Soleb horse (Clutton-Brock, 1974). According to Horwitz, Rosen, and Bocquentin (2011), this specimen may be representative of either a large previously unidentified equid species, an unusually large *E. africanus*, or the continued habitation of the southern Levant by *E. ferus*.

The Late Chalcolithic burial caves of Shoham (north) in the Lod Valley may contain evidence of the presence of *E. ferus*. The faunal assemblage of Cave 4 demonstrates

an abundance of equid remains accounting for 32.8 % of the total identifiable skeletal elements. Of these, 226 specimens were identified as belonging to *E. asinus*, while three postcranial elements were acknowledged as belonging to a larger equid species, either *E. caballus* or *E. africanus*. A single distal metapodial derived from context L202, B2043, exhibited a breadth measurement (Bd) of 47.9 mm (Horwitz, 2007). The mean breadth measurement for *E. caballus* distal metapodials is 52.3 mm, indicating that this specimen could be within the size range of a horse (Clutton-Brock, Burleigh, 1979). However it must be noted that these three postcranial elements identified as large equids were discovered within the baulk just below the topsoil, rendering their dating as ambiguous.

Several sites in the northern Negev demonstrate equid remains that fall within caballine size ranges. One of these sites, Shiqmim, contains a rich assemblage of cultural material and evidence of relatively advanced metallurgy dating between 4500–3200 BC (Gilead, 1989). During the 1989 excavation season at Shiqmim, the proximal humerus of an equid was uncovered that was comparable in size to specimens of *E. caballus* from the Roman period site of Gamla (Grigson, 1993). The Shiqmim humerus (bone no. shq 89.1054) had a proximal breadth of 92.6 mm, compared to the Roman period specimen from Gamla at 91.2 mm (Levy et al., 1991). The prospect of intrusion from later strata seems unlikely given that seven horse bones were uncovered from well-stratified Chalcolithic layers at two different Negev sites, Shiqmim and Grar. The Shiqmim humerus was discovered above the floor of an underground room that had been sealed by aeolian fill radiocarbon dated to 3240 ± 75 cal BC, thus confirming a 4th millennium date for the specimen. Additionally, metacarpals attributed to *E. caballus* at Shiqmim demonstrate exostoses on the sides of the distal end of the shaft, indicative of osteopathic wear associated with draft-labor (Grigson, 1993).

The Early Bronze Age city of Arad in the northern Negev contains the remains of a large equid dating to a few hundred years after Shiqmim. Arad is situated at an elevation of 550 m, approximately 31 km east of the modern day city of Beersheba. The city contains occupation levels dating to EB I and EB II within strata IV–I, roughly corresponding the First and Second Dynasties of Egypt, 3100–2950 BC and 2950–2650 BC respectively (Davis, 1976; Kuhrt, 1995: 118). The faunal assemblage from the 1971–1974 seasons contained a single metacarpus that falls into the size range of *E. caballus*. Several equid remains were uncovered at Arad including numerous phalanges, three intact metacarpals, and one left mandible containing cheek teeth. Of the three metacarpals, one specimen was comparatively robust (Davis, 1976). Osteometric analysis of the robust metacarpus (specimen no. 8672,

locus 4114, layer II) yielded a maximum length of 219 mm and a proximal width of 51.8 mm. Comparing this to a known domesticated specimen from Soleb (Egypt, Dynasty XVIII) indicated that the Arad bone was notably larger. The Soleb specimen measured a maximum length of 215 mm and a proximal width of 48.6 mm, indicating that the Arad specimen fell into the range of domesticated horses (Clutton-Brock, 1974; Davis, 1976).

Salvage excavations conducted in the Afridar neighborhood of Ashqelon have revealed an extensive EB I settlement (Golani, 2008). Four thousand identifiable animal bones were uncovered at Afridar, making it one of the largest EB faunal assemblages in the southern Levant. Most of the diagnostic equid remains were identified as *E. asinus*, verifying an early spread of domesticated donkeys into the region from Egypt, the earliest evidence of which was found at El Omari dating to 4600–4400 BC (Boessneck, Driesch, von den, 1990: 99–101). There were a few post-cranial elements that exceeded the size range of *E. asinus* and corresponded with that of larger equids. Area E, Locus 33 contained thirty-two equid bones, mandibles and maxillae, comprising the majority of remains (NISP = 27). The assemblage represents an MNI of four individual equids, three donkeys, and one horse. Contained within Areas F and G were two large equid limb bones, a distal radius with a breadth of 66.4 mm, and a distal tibia with a breadth of 74.5 mm (Kansa, 2004). These measurements fit well within caballine dimensions, suggesting that wild horses persisted in the southern Levant, if indeed these specimens were not domesticated.

The appearance of *E. caballus* in Egypt by the 17th century BC is best explained by the transmigration of technology and trade from the Levant to the northeast. There are three Early to Middle Bronze Age sites in the southern Levant that contain *E. caballus* remains that are largely contemporary with or closely predate the Buhen horse: Tel Aphek, Khirbet al-Batrawy, and Tel Michal.

Due to its strategic location adjacent to the headwaters of the Yarkon River and its situation along ancient trading routes, Tel Aphek contains an extensive history of settlement spanning several occupation events from Early Bronze I Phase C (3150–2850 BC) until the early 20th century AD. Tel Aphek was one of a number of fortified settlements that emerged in the Levant at the beginning of the 3rd millennium BC. Contained within the settlement are two areas that contained remains of *E. caballus/ferus*; areas A and B (Kochavi, 1977: 15). Within Early Bronze I strata of Area B were found ten *E. caballus/ferus* skeletal fragments, accounting for an MNI of one individual horse. Within Middle Bronze IIA strata of Area A was uncovered one fragment within pre-palace Area A and three fragments within Area B strata, these remains dating to approximately 2000–1750 BC. The majority of identified *E. caballus* remains consisted of teeth (Hellwing, 2000: 294, 297, 305).

The Jordanian Early Bronze Age site of Khirbet al-Batrawy, excavated since 2005 by La Sapienza University, clearly demonstrates the presence of *E. caballus/ferus* from the EB III during the mid-3rd millennium BC. An earthquake around 2700 BC destroyed much of the site however the settlement subsequently increased in size after the disaster (Nigro, 2013). Within Activity 3a and 3b EB III layers dating after the earthquake, at least ten caballine skeletal elements (MNI = 3) were uncovered. A further eleven caballine bones were discovered in EB IVB layers, indicating the presence of *E. caballus* at the site from around 2700–2100 BC (Alhaique, 2008).

E. caballus remains chronologically closer to the dating of the Egyptian Buhen horse were found at the settlement of Tel Michal, located on the coastal plain of Israel approximately 12.5 km north of Jaffa (Herzog, Rapp, Muhly, 1989: 3). Tel Michal was originally settled during the Middle Bronze Age IIB (1800–1550 BC) and was occupied until the early Arab period. Site A, covering an area of approximately 1600 m², contains the majority of studied cultural and faunal remains (Herzog, Negbi, Moshkowitz, 1978; Herzog, Rapp, Muhly, 1989: 5).

Faunal analysis of Middle Bronze Age strata revealed small numbers of *E. caballus* remains, accounting for 0.9 % of the total assemblage. Late Bronze Age (1700–1200 BC) strata revealed substantial amounts of *E. caballus* remains at 21 fragments (MNI = 1). Within Iron Age, Persian and Hellenistic era strata *E. caballus* remains were also uncovered, however it must be noted that horse remains were absent from subsequent strata (Hellwing, Feig, 1989: 236–242). The faunal assemblage of Tel Michal illustrates that by the seventeenth century BC the domesticated horse can safely be identified in the Levantine faunal record. Tel Michal is important, as its emergence is contemporary with the advent of Hyksos rule in Lower Egypt and the introduction of the domesticated horse there.

Discussion

Horses are relatively obscure in the archaeological record of sites both before and after the Late Bronze Age advent of chariot warfare. At the biblical city of Shiloh, three *E. caballus* skeletal remains can be accounted for in Late Bronze Age levels but did not appear in later Hellenistic and Roman strata when their existence is well attested in the region (Hellwing, Sadeh, Kishon, 1993: 311, 314). Megiddo IV contains seventeen pillared buildings dating to the eighth century BC theorized to have functioned as stables. However, there is a distinct lack of *E. caballus* remains at Megiddo IV that suggests that these structures may have served another function (Cantrell, 2006: 630–640).

Domestic status is impossible to determine unless bit-wear studies or conjunctural archaeological materials are found *in situ* to indicate as such, although it can be assumed that by the seventeenth century BC Levantine *E. caballus* remains are likely of domestic stock. So why there is a distinct presence of *E. caballus/ferus* throughout the Levant, Iran, and Anatolia during the Holocene prior to well-documented use of domesticated horses for chariot warfare and as beasts of burden? The answer may lie in that small pockets of feral populations may have continually inhabited these areas long after they were assumed extinct.

If domesticated horses were dispersed into the Levant from the Eurasian steppe at the end of the 4th millennium BC, it is evident that *E. caballus* did not supersede *E. asinus* in the role of favored pack animal. Horses had already spread from the Eurasian steppe via Transcaucasia into Anatolia, Iran, and Syria by the start of the 3rd millennium BC, nonetheless for unknown reasons there was not a further dispersal of *E. caballus* into the literate societies of Mesopotamia to the south, the Harrapan civilization to the southeast, and Egypt to the southwest until the late 3rd–early 2nd millennium BC (Postgate, 1992: 161; Bökönyi, 1997; Emery, 1960). This may be due to the inherent issues and expense in keeping horses or the general unavailability of good grazing land. Horses would have been an especially unattractive option when other cheaper and more easily managed draft animals were already being utilized in these areas.

E. caballus was not prolific in the Near East until the invention of the chariot permitted the use of horses for long-distance trade and warfare at the end of the 3rd to early 2nd millennium BC. The earliest dated chariots are found in Sintashta settlements within the Eurasian steppe region near the Ural Mountains. Horse-drawn chariots and harnessing equipment feature commonly in Sintashta burials within the Volga-Don forest-steppe region ca 2000 BC (Kuznetsov, 2006). If the chariot was a Sintashta invention, there may be some credence to the proposed connection between Indo-European language and the spread of horsemanship. The Sintashta culture has been tentatively linked to the Indo-Aryan branch of Indo-European languages due to their burial practices, ritual feasting on horses, and other practices alluded to within the Rig Veda. This has led some archaeologists to propose that Sintashta communities spoke an early form of Indo-Aryan language (Kuzmina, 2001; Anthony, 2007: 409). If this was true, Indo-Europeans may have been responsible for the spread of chariotry, but as the archaeozoological evidence suggests, not for the dissemination of the domesticated horse.

The scarcity of *E. caballus* remains in the Levant throughout the Holocene may be explained by specific horse-keeping practices, comparative to treatment of other domesticated animals that were used solely for primary

or secondary products. According to Caroline Grigson (pers. comm., 2014), rarity of *E. caballus* remains is commonplace in later periods post-dating the Late Bronze Age, even from sites that literary evidence suggest should have kept them. Most faunal samples are of animals that are butchered and consumed onsite; the absence of horse carcasses may be due to the fact that they were not eaten and any remains may therefore be located offsite. The problem of *E. caballus* scarcity may have to do with an oversight in archaeological method; if horses were being “taken out to pasture”, perhaps archaeozoologists are not looking in the right place.

References

- Akkermans P.M.M.G., Schwartz G.M. 2003**
The Archaeology of Syria from Complex Hunter-Gatherers to Early Urban Society, ca. 16,000–300 BC. Cambridge: Cambridge Univ. Press.
- Alhaique F. 2008**
Appendix A: Faunal remains. In *Khirbet al-Batrawy II. The EB II city-gate, the EB II–III fortifications, the EB II–III temple. Preliminary report of the second (2006) and third (2007) seasons of excavations*, L. Nigro (ed.). Rome: pp. 327–358. (Studies on the Archaeology of Palestine & Transjordan; vol. 6).
- Anthony D.W. 2007**
The Horse, the Wheel, and Language: How Bronze-Age Riders from the Eurasian Steppes Shaped the Modern World. Princeton: Princeton Univ. Press.
- Anthony D.W., Brown D.R. 1989**
Looking a gift horse in the mouth: Identification of the earliest bitted equids and the microscopic analysis of wear. In *Early Animal Domestication and its Cultural Context*, P.J. Crabtree, D.V. Campana, K. Ryan (eds.). Philadelphia: The Museum Applied Science Center for Archaeology, pp. 99–116.
- Anthony D.W., Brown D.R. 1991**
The origin of horseback riding. *Antiquity*, vol. 65 (246): 22–38.
- Anthony D.W., Brown D.R. 2011**
The secondary products revolution, horse-riding and mounted warfare. *Journal of World Prehistory*, vol. 24 (2): 131–160.
- Arbuckle B.S. 2007**
Zooarchaeology at Kösk Höyük. *Kazı Sonuçları Toplantısı*, vol. 29 (2): 124–136.
- Arbuckle B.S. 2009**
Chalcolithic caprines, Dark Age dairy, and Byzantine beef: A first look at animal exploitation at Middle and Late Holocene Çadır Höyük, north central Turkey. *Anatolica*, vol. 35: 179–224.
- Badjalar R.S., Edens C., Gorny R., Kohl P.L., Stronach D., Tonikjan A.V., Hamayakjan S., Mandrikjan S., Zardarjan M. 1993**
Preliminary report on the 1992 excavations at Horom, Armenia. *Iran*, vol. 31: 1–24.
- Badjalar R.S., Edens C., Kohl P.L., Tonikjan A.V. 1992**
Archaeological investigations at Horom in the Shirak Plain of north-western Armenia, 1990. *Iran*, vol. 30: 31–48.
- Badjalar R.S., Kohl P., Stronach D., Tonikjan A.V. 1994**
Preliminary report on the 1993 excavations at Horom, Armenia. *Iran*, vol. 32: 1–30.
- Berthon R., Mashkour M. 2008**
Animal remains from Tilbeşar excavations, southeast Anatolia, Turkey. *Anatolia Antiqua*, vol. 16: 23–51.
- Boessneck J., Driesch A., von den. 1990**
Animal bones. In *El Omari: A Neolithic settlement and other sites in the vicinity of Wadi Hof, Helwan*, F. Debono, B. Mortensen (eds.). Mainz: pp. 99–101.
- Bökönyi S. 1997**
Horse remains from the prehistoric site of Surkotada, Kutch, late 3rd millennium B.C. *South Asian Studies*, vol. 13 (1): 297–307.
- Brown D.R., Anthony D.W. 1998**
Bit wear, horseback riding, and the Botai site in Kazakhstan. *Journal of Archaeological Science*, vol. 25 (4): 331–347.
- Burney C.A., Lang, D.M. 1971**
The Peoples of the Hills: Ancient Ararat and Caucasus. New York: Praeger.
- Cantrell D.O. 2006**
Stable issues. In *Megiddo IV The 1998–2002 Seasons*, I. Finkelstein, D. Ussishkin, B. Halpern (eds.). Tel Aviv: Emery and Claire Yass Publications in Archaeology, pp. 630–642.
- Carruthers D. 2004**
Hunting and herding in central Anatolian prehistory: The 9th and 7th millennium site at Pınarbaşı. In *Archaeozoology of the Near East VI: Proceeding of the sixth international symposium on the archaeozoology of southwestern Asia and adjacent areas*. Groningen: pp. 85–95. (Arc Publicaties; vol. 63).
- Carruthers D. 2013**
Bone Ref# 116 (Animal Bone). In *Pınarbaşı 1994: Animal Bones*, D. Carruthers (ed.) (Released: 2013-03-05). Open Context. URL: <http://opencontext.org/subjects/TESTPA0000003982> (Viewed 01.05.2014).
- Childe V.G. 1926**
The Aryans: A study of Indo-European Origins. London: K. Paul, Trench, Trubner & Co.
- Clutton-Brock J. 1974**
The Buhen horse. *Journal of Archaeological Science*, vol. 1 (1): 89–100.
- Clutton-Brock J., Burleigh R. 1979**
Notes on the osteology of the Arab Horse with reference to a skeleton collected in Egypt by Sir Flinders Petrie. *Bulletin of the British Museum of Natural History (Zoology)*, vol. 35: 127–200.
- Cope C.R. 2006**
The fauna: Preliminary results. In *The Tel Bet Yerah Excavations, 1994–1995*, N. Getzov (ed.). Jerusalem: Israel Antiquities Authority, pp. 169–174.
- Davis S. 1976**
Mammal bones from the Early Bronze Age city of Arad, northern Negev, Israel: Some implications concerning human exploitation. *Journal of Archaeological Science*, vol. 3 (2): 153–164.
- Davis S.J. 1980**
Late Pleistocene and Holocene equid remains from Israel. *Zoological Journal of the Linnean Society*, vol. 70: 89–312.
- Driesch A., von den. 1993**
Faunal remains from Habuba Kabira in Syria. In *Archaeozoology of the Near East: Proceedings of the first*

international symposium on the archaeozoology of southwestern Asisa and adjacent areas, H. Buitenhuis, A.T. Clayson (eds.). Leiden: Universal Book Services.

Edwards P.C. 2007

A 14 000 year-old hunter-gatherer's toolkit. *Antiquity*, vol. 81 (314): 865–876.

Edwards Y.H., Martin L. 2013

Animal bones and archaeozoological analysis. In *Wadi Hammeh 27, an early Natufian settlement at Pella in Jordan*, P.C. Edwards (ed.). Boston, Leiden: pp. 321–352.

El-Shiyab A.H. 1997

Faunal remains from "Ain Rahub". In *The Prehistory of Jordan, II: Perspectives from 1997*, H.G.K. Gebel, Z. Kafafi, G.O. Rollefson (eds.). Berlin: Ex oriente, pp. 593–600.

Emery W.B. 1960

A preliminary report on the excavations of the Egypt Exploration Society at Buhen, 1958–1959. *Kush*, vol. 8: 7–10.

Eneolit SSSR. 1982

V.M. Masson, N.I. Merpert (eds.). Moscow: Nauka. (Arkhologiiya SSSR).

Fazeli H., Wong E.H., Potts D.T. 2005

The Qazvin Plain revisited: A reappraisal of the chronology of the northwestern Central Plateau, Iran, the 6th to 4th millennium B.C. *Ancient Near Eastern Studies*, vol. 42: 3–82.

Gilbert A.S. 1979

Urban taphonomy of mammalian remains from Bronze Age of Godin Tepe, western Iran. Ph.D. Thesis, Columbia Univ. Ann Arbor. (XVII, p. 448: ill).

Gilbert A.S. 1991

Equid remains from Godin Tepe, western Iran: An interim summary and interpretation, with notes on the introduction of the horse into Southwest Asia. In *Equids in the Ancient World*, R.H. Meadow, H.P. Uerpmann (eds.), vol. 2. Wiesbaden: Dr. Ludwig Reichert Verl., pp. 75–122.

Gilead I. 1989

Grar: A Chalcolithic site in the northern Negev, Israel. *Journal of Field Archaeology*, vol. 16: 377–394.

Golani A. 2008

The Early Bronze Age site of Ashqelon, Afridar – Area M. *'Atiqot*, vol. 60: 19–51.

Grigoriev S.A. 2002

Ancient Indo-Europeans. Chelyabinsk: Rifei.

Grigson C. 1993

The earliest domestic horses in the Levant? – new finds from the fourth millennium of the Negev. *Journal of Archaeological Science*, vol. 20 (6): 645–655.

Hellwing S. 2000

Faunal remains. In *Aphek-Antipatris I: Excavations of Areas A and B the 1972–1976 Seasons*, M. Kochavi, P. Beck, E. Yadin (eds.). Tel Aviv: Emery and Claire Yass Publ. in Archaeol., pp. 293–314.

Hellwing S., Feig N. 1989

Animal bones. In *Excavations at Tel Michal Israel*, Z. Herzog, G.R. Rapp Jr., O. Negbi (eds.). Minneapolis: The Univ. of Minnesota Press, pp. 236–247.

Hellwing S., Sadeh M., Kishon V. 1993

Faunal remains. In *Shiloh, the Archaeology of a Biblical Site*, I. Finkelstein, S. Bunimovitz, Z. Lederman (eds.). Tel Aviv: Tel Aviv Univ., pp. 309–350.

Herzog Z., Negbi O., Moshkowitz S. 1978

Excavations at Tel Michal, 1977. *Journal of the Institute of Archaeology of Tel Aviv University*, vol. 5: 99–130.

Herzog Z., Rapp G., Jr., Muhly J.D. 1989

Introduction. In *Excavations at Tel Michal, Israel*, Z. Herzog, G.R. Rapp Jr., O. Negbi (eds.). Minneapolis: The Univ. of Minnesota Press, pp. 3–9.

Horwitz L.K. 2007

Faunal remains from Late Chalcolithic – Bronze Age dwelling and burial caves at Shoham (North), Lod Valley. *'Atiqot*, vol. 55: 1–16.

Horwitz L.K., Rosen S.A., Bocquentin F. 2011

A Late Neolithic equid offering from the mortuary-cult site of Ramat Saharonim in the central Negev. *Journal of the Israel Prehistoric Society*, vol. 41: 71–81.

Ilan D. 2011

Household gleanings from Iron I Tel Dan. In *Household Archaeology in Ancient Israel and Beyond*, A. Yasur-Landau, J.R. Ebeling, L.B. Mazow (eds.). Leiden: Brill, pp. 133–154.

Kansa S.W. 2004

Animal exploitation at Early Bronze Age Ashqelon, Afridar: What the bones tell us – initial analysis of the animal bones from Areas E, F and G. *'Atiqot*, vol. 45: 279–297.

Kochavi M. 1977

Aphek-Antipatris: Five seasons of excavation at Tel Aphek-Antipatris (1972–1976). Tel Aviv: Tel Aviv Univ.

Köhler-Rollefson I. 1995

The animal bones. In *Excavations at Tawilan in Southern Jordan*, C.M. Bennett, P. Bienkowski (eds.). Oxford: Oxford Univ. Press, pp. 97–100.

Kuhrt A. 1995

The Ancient Near East: c. 3000–330 BC. London: Routledge.

Kuznetsov P.F. 2006

The emergence of Bronze Age chariots in eastern Europe. *Antiquity*, vol. 80: 638–645.

Kuzmina E.E. 2001

The first migration wave of Indo-Iranians to the south. *Journal of Indo-European Studies*, vol. 29 (1–2): 1–40.

Lernau H. 1978

Faunal remains, Strata III–I. In *Early Arad, the Chalcolithic Settlement and Early Bronze City, I: First–Fifth Seasons of Excavation, 1962–1966*, R. Amiran, U. Paran, Y. Shiloh, R. Brown, Y. Tsafir, A. Ben-Tor (eds.). Jerusalem: Israel Exploration Soc., pp. 83–113.

Levine M.A. 1999

Botai and the origins of horse domestication. *Journal of Anthropological Archaeology*, vol. 18 (1): 29–78.

Levy T.E., Alon D., Grigson C., Holl A., Goldberg P., Rowan Y., Smith P. 1991

Subterranean Negev settlement, *National Geographic Research*, November: 394–413.

Lev-Tov J.S.E. 2012

A preliminary report on the Late Bronze Age and Iron Age faunal assemblages from Tell es-Safi/Gath. In *Tell es-Safi/Gath I: The 1996–2005 Seasons*, A.M. Maeir (ed.). Wiesbaden: Harrassowitz Verl., pp. 594–596.

Mallory J.P. 1989

In Search of the Indo-Europeans: Language, Archaeology and Myth. New York: Thames and Hudson.

- Martin L. 2013**
11392.X14 (Animal Bone). In *Çatalhöyük Zooarchaeology*, D. Orton (ed.) (Released: 2013-02-14). Open Context. URL: <http://opencontext.org/subjects/193552A8-5A02-4A1A-E535-C71F5047B2B1> (Viewed 01.05.2014).
- Martin L., Russell N., Carruthers D. 2002**
Animal remains from the Central Anatolian Neolithic. In *The Neolithic of Central Anatolia: Internal developments and external relations during the 9th–6th millennia cal BC*, F. Gérard, L. Thissen (eds.). Istanbul: Ege Yayınları, pp. 193–216.
- Mashkour M. 2003**
Equids in the northern part of the Iranian central plateau from the Neolithic to Iron Age: New zoogeographic evidence. In *Prehistoric steppe adaptation and the horse*, M. Levine, C. Renfrew, K. Boyle (eds.). Cambridge: McDonald Inst. for Archaeol. Res., pp. 129–138.
- McGrew P.O. 1944**
An early Pleistocene (Blancan) fauna from Nebraska. *Field Museum of Natural History Chicago Geological series*, vol. 9: 33–69.
- Nigro L. 2013**
Khirbet al-Batrawy: An Early Bronze Age city at the fringes of the desert. *Syria*, vol. 90: 189–209.
- Olsen S.L. 2003**
The exploitation of horses at Botai, Kazakhstan. In *Prehistoric steppe adaptation and the horse*, M. Levine, C. Renfrew, K. Boyle (eds.). Cambridge: McDonald Inst. for Archaeol. Res., pp. 83–104.
- Oren E. 1972**
Tel Sera' (Tell esh-Shari'a). *Israel Exploration Journal*, vol. 22: 167–169.
- Orlando L., Metcalf J.L., Alberdi M.T., Telles-Antunes M., Bonjean D., Otte M., Martin F., Eisenmann V., Mashkour M., Morello F., Prado J.L., Salas-Gismondi R., Shockey B.J., Wrinn P., Vasil'ev S.K., Ovodov N.D., Cherry M.I., Hopwood B., Male D., Austin J.J., Hänni C., Cooper A. 2009**
Revising the recent evolutionary history of equids using ancient DNA. *Proceedings of the National Academy of Science USA*, vol. 106 (51): 21754–21759.
- Outram A.K., Stear N.A., Bendrey R., Olsen S., Kaspárov A., Zaibert V., Thorpe N., Evershed R.P. 2009**
The earliest horse harnessing and milking. *Science*, vol. 323: 1332–1335.
- Öztan A., Özkan S., Erek C.M., Faydali E. 2005**
Yılı Köşk Höyük kazıları. *Kazı Sonuçları Toplantısı*, vol. 27: 379–392.
- Porat N., Rosen S.A., Boaretta E., Avni Y. 2006**
Dating the Ramat Saharonim Late Neolithic desert cult site. *Journal of Archaeological Science*, vol. 33 (10): 1341–1355.
- Postgate J.N. 1992**
Early Mesopotamia: Society and Economy at the Dawn of History. Oxon: Routledge.
- Richardson J.E. 1997**
An analysis of the faunal assemblages from two Pre-Pottery Neolithic sites in the Wadi Fidan. In *The Prehistory of Jordan, II. Perspectives from 1997*, H.G.K. Gebel, Z. Kafafi, G.O. Rollefson (eds.). Berlin: Ex oriente, pp. 497–510.
- Rosen S.A., Bocquentin F., Avni Y., Porat N. 2007**
Investigations at Ramat Saharonim: A desert Neolithic sacred precinct in the Central Negev. *Bulletin of the American Society for Oriental Research*, vol. 346: 1–27.
- Sagona A. 2011**
Anatolia and the Transcaucasus: Themes and variations ca. 6400–1500 B.C.E. In *The Oxford Handbook of Ancient Anatolia*, S.R. Steadman, G. McMahon (eds.). Oxford: Oxford Univ. Press, pp. 683–703.
- Stadman S.R., Ross J.C., McMahon G., Gorny R.L. 2008**
Excavations on the north-central plateau: The Chalcolithic and Early Bronze Age occupation at Çadir Höyük. *Anatolian Studies*, vol. 58: 47–86.
- Stiner M.C. 2005**
The faunas of Hayonim Cave, Israel: A 200,000-year record of Paleolithic diet, demography and society. Cambridge: Harvard Univ., Peabody Museum Press. (Am. School of Prehistoric Research Bull.; No. 48).
- Twiss K., Martin L., Pawłowska K., Russell N. 2005**
Animal bone. In *Çatalhöyük 2005 Archive Report: Çatalhöyük Research Project*, pp. 120–130. URL: http://www.catalhoyuk.com/archive_reports/2005/ar05_21.html (Viewed 22.09.2013).
- Vila E. 2006**
Data on Equids from late fourth and third millennium sites in Northern Syria. In *Equids in time and space: Papers in honour of Véra Eisenmann*, M. Mashkour (ed.). Oxford: Oxbow Books, pp. 101–123.
- Young T.C. 1969**
Excavations at Godin Tepe: First progress report. Toronto: Royal Ontario Museum. (Art and Archaeology Occasional Paper; No. 17).

Received June 23, 2014.

Received in revised form February 25, 2015.