TRAVAUX DE LA MAISON DE L'ORIENT ET DE LA MÉDITERRANÉE
N° 49

ARCHAEOZOOLOGY OF THE NEAR EAST VIII

Actes des huitièmes Rencontres internationales
d'Archéozoologie de l'Asie du Sud-Ouest et des régions adjacentes

Proceedings of the eighth international Symposium on the
Archaeozoology of southwestern Asia and adjacent areas

TOME II

edited by

Emmanuelle VILA, Lionel GOURICHON,
Alice M. CHOYKE, Hijlke BUITENHUIS

Aswa VIII
Lyon 28 juin-1er juillet 2006
Lyon, June 28th-July 1st, 2006

Ouvrage publié avec la participation de la Région Rhône-Alpes et de l'UMR 5133,
Archéorient, Maison de l'Orient et de la Méditerranée

Tome II

Archaeozoology of the Near East VIII
TMO 49, Maison de l'Orient et de la Méditerranée, Lyon, 2008

ANIMAL ECONOMY DURING THE EARLY BRONZE AGE IN SOUTH-EAST ARABIA

Margarethe Uerpmann[1] , Hans-Peter Uerpmann[1]

Abstract

Animal remains from four Early Bronze Age sites in the UAE and Oman (Hili 8, Tell Abraq, Umm an-Nar and Maysar) are analysed with regard to the animal component of the economies represented. Archaeozoological information from sites at Ra's al-Jinz and Ra's al-Hadd (Oman) is used for comparison. The latter sites as well as Umm an-Nar are characterized by a very low contribution of domestic fauna to their subsistence economies. More than 90% (by bone weight) of the analysed faunal remains from these sites derive from marine animals (mostly dugong at Umm an-Nar and turtle at Ra's al-Jinz). Tell Abraq is intermediate with a contribution of *ca* 50% from the domesticates, while at the inland sites (Hili 8 and Maysar) domestic fauna provided over 90% of the analysed finds. The wild fauna at all sites corresponds well to the respective environments. The domestic fauna is dominated by cattle at the sites in UAE, while in Oman, sheep and goats were more important. Among these, goat is better represented at all sites. Ass remains are present at all sites with the exception of Umm an-Nar. Most likely they represent domestic donkeys. Dromedary remains are frequent at Umm an-Nar, but are rare or absent at the other sites. There are no indications for domestication of this animal during the Early Bronze Age. Cattle seem to have been used as draught animals in agricultural communities (Hili 8), but potentially also for overland transportation of goods. However, there are no indications for an exchange system which delivered preserved products of marine animals (*e.g.* dried fish) into the hinterland.

Keywords: Bronze Age, South-East Arabia, archaeozoology, donkey, dromedary, exchange systems.

Résumé

Les restes de faune de quatre sites des Émirats Arabes Unis et d'Oman datés du Bronze ancien (Hili 8, Tell Abraq, Umm an-Nar et Maysar) sont analysés en considérant les caractéristiques liées à l'exploitation des animaux dans les économies représentées. Les informations archéozoologiques des sites de Ra's al-Jinz et de Raa's al-Hadd (Oman) sont utilisées comme comparaison. Ces deux derniers sites, tout comme Umm an-Nar, sont caractérisés par une faible contribution des animaux domestiques à l'économie de subsistance. Plus de 90 % (d'après le poids des restes osseux) des vestiges de faune analysés de ces sites proviennent de la faune marine (principalement le dugong à Umm an-Nar et la tortue à Ra's al-Jinz). Tell Abraq présente une situation intermédiaire avec une contribution des animaux domestiques de 50 %

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environ, tandis que sur les sites de l'intérieur (Hili 8 et Maysar) les domestiques représentent 90 % des trouvailles analysées. La faune sauvage de tous les sites est en concordance avec leurs environnements respectifs. La faune domestique est dominée par les bovins sur les sites des Emirats, alors qu'en Oman, les moutons et les chèvres sont majoritaires. Sur tous les sites, les chèvres sont mieux représentées que les moutons. Les restes d'équidés sont présents partout excepté à Umm an-Nar. Il s'agit principalement d'ânes domestiques. Les vestiges de dromadaires sont fréquents à Umm an-Nar, mais rares ou absents sur les autres sites. Il n'y a pas d'indication de la domestication de cet animal au cours de l'âge du Bronze ancien. Les bovins domestiques semblent avoir été utilisés pour le trait dans les communautés agricoles (Hili 8), mais potentiellement aussi pour le transport de biens à travers la région. Cependant, il n'y a pas d'indices d'un système d'échange qui aurait livré des produits animaux préparés en vue de la conservation (comme par exemple du poisson séché) dans l'arrière-pays.

Mots-clés : *Âge du Bronze, Arabie du Sud-Est, archéozoologie, âne, dromadaire, système d'exchange.*

INTRODUCTION

The last 30 years have seen a steep rise in archaeological activities in the south-eastern part of the Arabian Peninsula, an area sometimes also called the Oman Peninsula, which today comprises the territories of the United Arab Emirates in the west and the Sultanate of Oman in the east. It has been realised that this area has a rich archaeological heritage, among which remnants of the Early Bronze Age—the period between about 3100 and 2200 BC—are outstanding. Obviously, the area flourished during this period. The so-called Umm an-Nar culture of the 3rd millennium BC occupied the whole peninsula between the shores of the southern Irano-Arabian Gulf in the west and the Arabian Sea to the east. It left many important monuments behind, consisting mainly of fortified and unfortified settlements and impressive collective grave-buildings. Finds from this period indicate contacts with Mesopotamia, Dilmun (Bahrain), Iran and the Indus valley. Apparently the area was part of a large-scale exchange system and open to influences from many sides. Copper from the Omani mountains was prominent among the contributions to this exchange system. Harbour sites on the south-eastern shore of the Gulf (Umm an-Nar and Tell Abraq) and at the eastern corner of the peninsula (Ra's al-Hadd, Ra's al-Jinz) were responsible for the outside contacts, inland sites were involved in copper production (*e.g.* Maysar) or must be seen as centres of trade and agricultural production (*e.g.* Hili). This paper will deal with animal remains from the above sites (*fig. 1*) in order to elucidate the role of animal economy in this area for the period under consideration.

Many ideas have already been formulated about economy and subsistence during the Early Bronze Age in SE-Arabia: recent observations and data derive mainly from coastal sites. In Oman this applies especially to sites at Ra's al Hadd (Cartwright, Glover 2002; Martin 2002; Mosseri-Marlio 2002; Cartwright 2004) and Ra's al-Jinz (Bökönyi 1992; Bökönyi, Bartosiewicz1998; Tosi 2000) in the north-east. These new data were incorporated into older models based upon the ecological diversity of the Oman peninsula and the knowledge of potential products. With regard to processes of model-building they strongly depend on anthropological studies concerning sub-recent Bedu societies living in the same areas (*e.g.* Lancaster, Lancaster 1992a, b).

As already formulated in 1989 by Cleuziou and Tosi, the Early Bronze Age society apparently consisted of "a highly integrated aggregation of farmers, fishermen and nomadic herders..." (Cleuziou, Tosi 1989, p. 17) that "... was grounded on a complex and efficient network of exchange which made life possible in various areas, by conveying very early on objects of prime necessity including food (in the shape of dried and salted fish from the coast for instance), in close association with items of more symbolic value, both of local and foreign origin. Dialectic relations of economic mutual interest and social (lineage) competition patterned this network. The apparent opposition between coastal and interior communities should be taken with some care. Regional studies in the Ja'alan area around Ra's al-Jinz have disclosed more complex systems of integration, with multiple resources used by a same community, where movement of people is at

least as important as exchange between nucleated sedentary communities" (Cleuziou, Méry 2002, p. 276). More explicitly Cleuziou said in a conference paper of 1996: "We can hypothesize that fish, processed on various ways (salted, smoked, dried) already travelled to the interior and that the coastal settlements moved from a subsistence oriented production to a larger scale export oriented production, thus becoming fully integrated into the exchange system built around the exportation of copper" (Cleuziou 1996, p. 61).

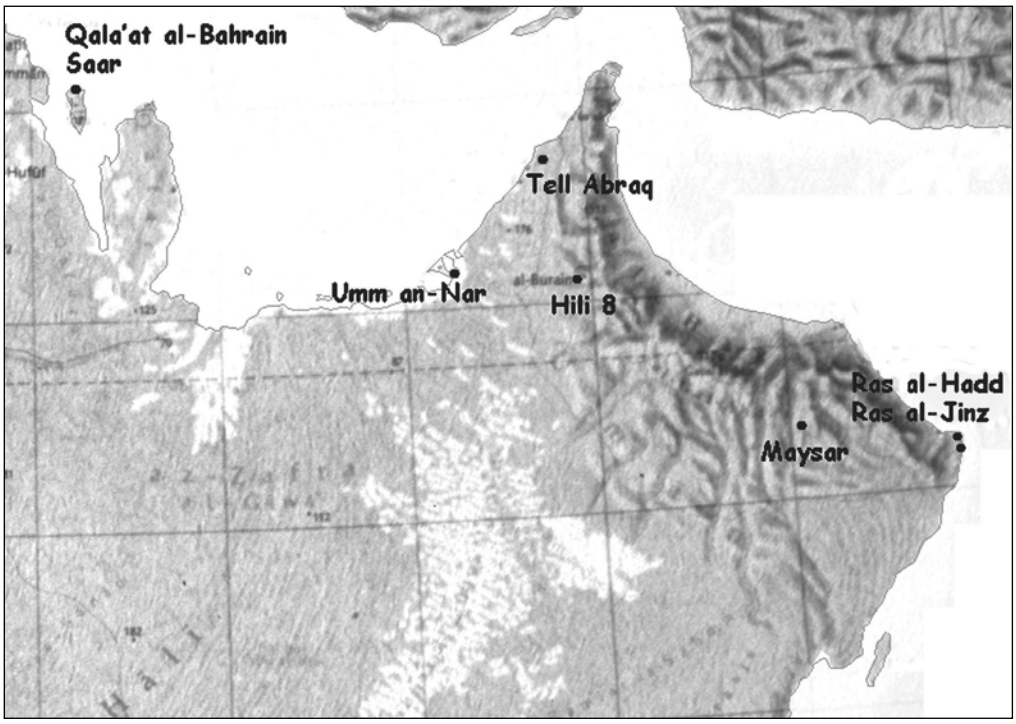

Fig. 1—Sites dealt with in this paper.

These citations circumscribe an economic system from the Early Bronze Age which is both plausible and in good accordance with the overall appearance of that period. However, some of the assumptions of this model are testable against the archaeo-biological evidence, and this is one of the aims of this paper. It is also intended to enlarge the database concerning Early Bronze Age subsistence. The focus will be on the animal economy based on the evaluation of archaeological faunal remains.

The faunal remains studied derive from key sites of the Umm an-Nar culture and of the preceding Hafit period: they include the inland sites of Hili 8 (*e.g.* Cleuziou 2002, 2003) and Maysar (*e.g.* Weisgerber 1980, 1981) and the coastal sites of Umm an-Nar (*e.g.* Frifelt 1991, 1995) and Tell Abraq (*e.g.* Potts 1993, 2000). For comparative purposes, our findings from Bahrain and from Ra's al-Jinz and Ra's al-Hadd studied by other authors will also be included.

The faunal materials from Hili 8 and Maysar were already analysed some twenty years ago by H.-P. Uerpmann. The number of bone-finds is relatively low, especially for Maysar. In order to gain as much information as possible, a lot of effort was put into the restoration and identification of badly preserved bone fragments. As agreed with the excavators, detailed presentations of the results were planned to be included in the final publications of the respective sites. As such final publications are not yet in sight, the general results of our studies will be provided here. Since the methods of archaeozoology have improved since the 1980s, a partial re-study of the finds from Hili 8 and Maysar was recently undertaken by M. Uerpmann.

In contrast to the other sites, conditions for bone preservation were quite good at Tell Abraq. From this site—where the archaeological sequence starts with layers of the Umm an-Nar culture in the late

3rd millennium and ends with the ed-Dur period at about 300 BC—more than 100,000 specimens of animal bone were studied.[2]

A new series of faunal remains from the famous reference site of Umm an-Nar were studied in 2001 by M. Uerpmann. The material was retrieved in 1994 and 1997 by the Al-Ain Department of Antiquities.[3] Part of it was found during the restoration of houses, which had already been unearthed by the Danish excavations in the sixties. The rest derives from the excavation of new mounds in the settlement area of the site.[4]

HILI 8

Of the sites studied, Hili 8 is the oldest one. The earliest EBA assemblage from this site is radiocarbon dated to around 3000 BC. Hili 8 has an unbroken sequence of occupation covering the entire Early Bronze Age.[5] While the total sample of analysed material (*table 1*) is sufficient for quantitative analyses, some of the phases are not well represented by animal remains (*fig. 2*). Most of the faunal remains come from contexts from the second sub-phase (Ib), whereas finds from the third sub-phase Ic are again few. The same is true for the Umm an-Nar phase at Hili 8, classified here as phase II. The animal bones from all sub-phases of phase II together only amount to 136 identified specimens. Looking at sample sizes, secure statistical statements are therefore only possible for sub-phase Ib. Nevertheless, the uniformity of the faunal spectrum throughout the whole sequence is remarkable. The unit of quantification in diagram 1 is bone weight—first because it is well correlated to the meat weight provided by the respective animals, and secondly because it is not influenced by fragmentation.[6]

From the earliest occupation of Hili 8 through the early Early Bronze Age more than 90% of the consumed meat derived from domestic animals. Cattle contributed around 60%, while the small ruminants —sheep and goats—provided the rest. During the Hafit period (phase I) sheep seem to slightly outnumber the goats. The small sample from the Umm an-Nar period signals a reverse of the sheep/goat proportions. In any case—during the entire sequence of Hili 8 animal husbandry appears to have been stable and sufficient for the meat supply, because hunting was of no importance (*fig. 2B*). There are a few gazelle bones from all phases except the poorly represented sub-phase Ia. From subphase Ib there are 4 camel bones, the status of which is debatable. We will deal with the question of camel domestication later on. It should be noted, however, that there are no camel remains from the Umm an-Nar phase of Hili 8. The ass is another species which could be wild or domestic. Here we interpret the increase of donkey bone weight from phase I to phase II as an indication of domestication, but it is also possible that the earlier ass remains derive from domestic animals as well. The occurrence of the wild ass during the Late Stone Age is well documented in SE-Arabia (H.-P. Uerpmann 1987; M. Uerpmann, H.-P. Uerpmann 2000; H.-P. Uerpmann, M. Uerpmann 2003, p. 213-214). Due to the small number of finds it cannot easily be decided when this animal came into

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2. By Hans-Peter and Margarethe Uerpmann and Elisabeth Stephan, who published a preliminary report for the first two seasons (Stephan 1995). A synthesis covering the complete time of occupation of the site was published in 2001 (M. Uerpmann 2001).

3. We want to thank Dr Walid Yassin al-Tikriti (Department of Antiquities, Al-Ain) for providing this material for study.

4. Animal bones studied here are from the following localities: between walls from house 1014 (1994), house 1014 during restoration, Mound C (1996); Mound A, room 2 (1997); Mound A, top layer of the rooms (1997); Mound A, room 1, 6-8 (1997); Mound A, sift, Danish excavation near house (1997).

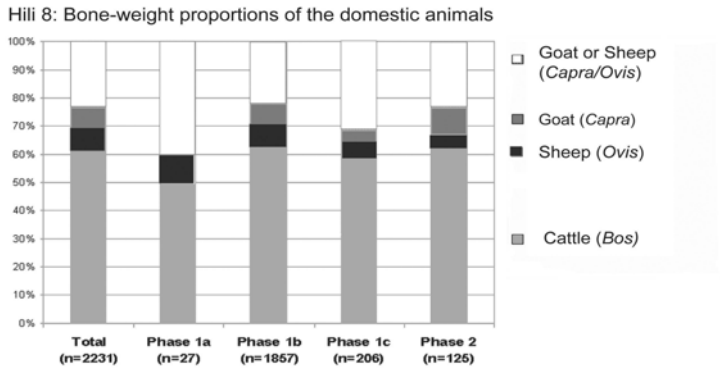
5. Cleuziou (2002) separates 5 stages (Hili 1-5), which we use here for the relative chronology of the sites dealt with in this paper. However, for the bone finds from Hili 8 we have to use the older separation in two phases (I and II) with several subphases each.

6. It is possible to break a bone into many identifiable pieces, thus increasing the fragment count, but it is impossible to increase its original weight by breaking a bone.

Species list for Hili 8	NISP	*NISP%*	WISP	*WISP%*
Cattle, *Bos*	662	*27.7*	11250.0	*58.5*
Sheep, *Ovis*	179	*7.5*	1281.0	*6.7*
Goats, *Capra*	174	*7.3*	1296.0	*6.7*
Sheep or goats, *Ovis/Capra*	1105	*46.2*	4198.0	*21.8*
Total domestic animals	2120	*88.6*	18025.0	*93.7*
Unidentified small ruminant	147	*6.1*	278.0	*1.4*
Wild ass (*Equus africanus*) or donkey (*E. asinus*)	33	*1.4*	599.0	*3.1*
Total wild or domestic animals	180	*7.5*	877.0	*4.6*
Unidentified small rodents	25	*1.0*	1.0	*0.0*
Hare, *Lepus* sp.	1	*0.0*	1.0	*0.0*
Camel, *Camelus dromedarius*	4	*0.2*	73.0	*0.4*
Gazelle, *Gazella* cf. *gazella*	51	*2.1*	264.0	*1.4*
Unidentified reptiles	13	*0.5*	2.0	*0.0*
Total wild animals	94	*3.9*	341.0	*1.8*
Total identified bones	2394	*100.0*	19243.0	*100.0*
Unidentified medium sized animals	181	*35.4*	244.0	*16.8*
Unidentified medium to large sized animals	170	*33.2*	330.0	*22.8*
Unidentified large sized animals	161	*31.4*	875.0	*60.4*
Total unidentified	512	*100.0*	1449.0	*100.0*
Identified bones	2394	*82.4*	19243.0	*93.0*
Unidentified bones	512	*17.6*	1449.0	*7.0*
Total animal bones	2906	*100.0*	20692.0	*100.0*

Table 1—Hili 8, total sample of analysed material.

A



B

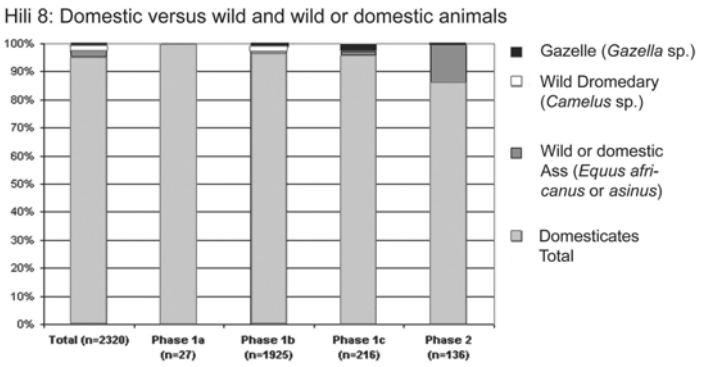


Fig. 2—Bone weight proportions for Hili 8: A) Domestic animals; B) Domestic versus wild and wild or domestic animals.

use as a domestic animal, nor if domestication happened locally. One can, however, assume that the wild ass became a donkey during the Umm an-Nar period at the latest, because there is pictorial evidence from grave 1059 at Hili, where a rider is depicted on an animal which is clearly not a camel and which cannot be a horse, because this animal was still unknown in Arabia at that time. The increase of ass finds from phase I to phase II at Hili and its stable representation at other sites like Tell Abraq and Maysar and some morphological changes in the bones provide additional evidence (H.-P. Uerpmann 1991).

MAYSAR

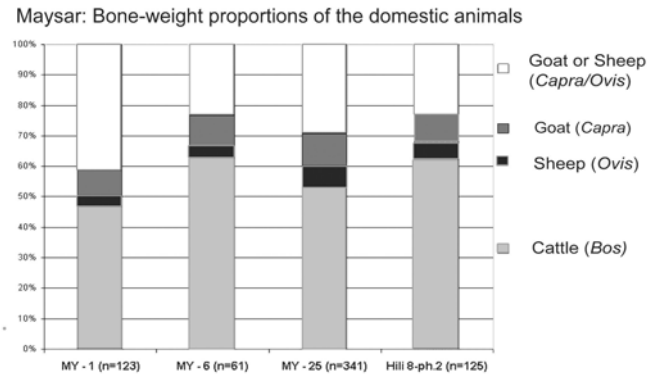
Maysar belongs to the late Umm an-Nar period (stages 4 and 5 of Hili 8 according to Cleuziou 2002). The faunal remains from Maysar (*table 2a-d*; *fig. 3*) derive from 3 different parts of the site. Two of them are open settlement areas—Maysar 1 (Weisgerber 1980, p. 77-89; Weisgerber 1981, p. 191-197) and Maysar 6 (Weisgerber 1981, p. 205)—while Maysar 25 (Weisgerber 1981, p. 198-204) is a fortified round tower. Most of the animal remains from Maysar 25 are from the shaft of the central well (*table 2d*). At the very bottom of this well a complete skeleton of an ox was found, which is not contained in table 2d and figure 3, because it would have outweighed all other bones, and because it was dumped in the well as a carcass and not as bone refuse from animals eaten by inhabitants of the site.

Obviously the species proportions of the domestic animals from the different units of Maysar are not only quite similar between the areas, but also resemble the pattern for the Umm an-Nar phase at Hili 8. The slight preponderance of goat over sheep in all columns of the graph should be noted. The resemblance to Hili 8 is especially evident for Maysar 6—interpreted as a dwelling site—in contrast to Maysar 1, which is considered to have been an industrial area. Hunting of camel and gazelle seems to have been practised slightly more often than at Hili 8, but in fact there is only one camel bone in the small sample from Maysar 6, whereas gazelles are better represented among the finds from the well shaft of Maysar 25. The importance of hunting is however equally low at Maysar if we assume—as already discussed above—that the ass remains derive from domestic donkeys. The finds from Maysar actually do present morphological features of domestication (H.-P. Uerpmann 1991). The potential importance of donkeys as beasts of burden for the production and trade of copper does not need to be discussed any further.

Species list for Maysar 1	NISP	*NISP%*	WISP	*WISP%*
Cattle, *Bos*	14	*10.6*	149	*41.9*
Sheep, *Ovis*	2	*1.5*	12	*3.4*
Goats, *Capra*	7	*5.3*	27	*7.6*
Sheep or goats, O*vis/Capra*	100	*75.8*	132	*37.1*
Total domestic animals	123	*93.2*	320	*90.0*
Unidentified small ruminant	7	*5.3*	5	*1.4*
Wild ass (*Equus africanus*) or donkey (*E. asinus*)	2	*1.5*	31	*8.7*
Total wild or domestic animals	9	*6.8*	36	*10.1*
Total identified bones	132	*100.0*	356	*100.1*
Unidentified medium sized animals	161	*55.7*	106	*43.4*
Unidentified medium to large sized animals	30	*10.4*	53	*21.7*
Unidentified large sized animals	98	*33.9*	85	*34.8*
Total unidentified	289	*100.0*	244	*99.9*
Identified bones	132	*31.4*	356	*59.3*
Unidentified bones	289	*68.6*	244	*40.7*
Total animal bones	421	*100.0*	600	*100.0*

Table 2a—Species list for Maysar 1.

A



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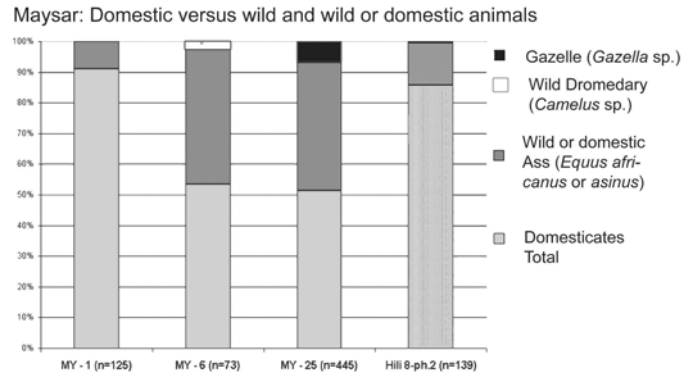


Fig. 3—Bone weight proportions for Maysar: A) Domestic animals; B) Domestic versus wild and wild or domestic animals.

Species list for Maysar 6	NISP	*NISP%*	WISP	*WISP%*
Cattle, *Bos*	30	*40.0*	129	*33.2*
Sheep, *Ovis*	2	*2.7*	8	*2.1*
Goats, *Capra*	7	*9.3*	21	*5.4*
Sheep or goats, *Ovis/Capra*	22	*29.3*	48	*12.4*
Total domestic animals	61	*81.3*	206	*53.1*
Unidentified small ruminant	2	*2.7*	2	*0.5*
Wild ass (*Equus africanus*) or donkey (*E. asinus*)	11	*14.7*	170	*43.8*
Total wild or domestic animals	13	*17.4*	172	*44.3*
Camel, *Camelus dromedarius*	1	*1.3*	10	*2.6*
Total wild animals	1	*1.3*	10	*2.6*
Total identified bones	75	*100.0*	388	*100.0*
Unidentified medium sized animals	81	*66.4*	59	*39.1*
Unidentified medium to large sized animals	9	*7.4*	17	*11.3*
Unidentified large sized animals	32	*26.2*	75	*49.7*
Total unidentified	122	*100.0*	151	*100.0*
Identified bones	75	*38.1*	388	*72.0*
Unidentified bones	122	*61.9*	151	*28.0*
Total animal bones	195	*100.0*	533	*100.0*

Table 2b—Species list for Maysar 6.

Species list for Maysar 25 settlement	NISP	*NISP%*	WISP	*WISP%*
Cattle, *Bos*	6	*13.3*	69	*51.1*
Sheep, *Ovis*	1	*2.2*	3	*2.2*
Goats, *Capra*	1	*2.2*	8	*5.9*
Sheep or goats, *Ovis/Capra*	11	*24.4*	16	*11.9*
Total domestic animals	19	*42.1*	96	*71.1*
Unidentified small ruminant	26	*57.8*	39	*28.9*
Total wild or domestic animals	26	*57.8*	39	*28.9*
Total identified bones	45	*100.0*	135	*100.0*
Unidentified medium sized animals	22	*37.3*	13	*21.3*
Unidentified medium to large sized animals	26	*44.1*	15	*24.6*
Unidentified large sized animals	11	*18.6*	33	*54.1*
Total unidentified	59	*100.0*	61	*100.0*
Identified bones	45	*43.3*	135	*68.9*
Unidentified bones	59	*56.7*	61	*31.1*
Total animal bones	104	*100.0*	196	*100.0*

Table 2c—Species list for Maysar 25 settlement.

Species list for Maysar 25 settlement	NISP	*NISP%*	WISP	*WISP%*
Cattle, *Bos*	6	*13.3*	69	*51.1*
Sheep, *Ovis*	1	*2.2*	3	*2.2*
Goats, *Capra*	1	*2.2*	8	*5.9*
Sheep or goats, *Ovis/Capra*	11	*24.4*	16	*11.9*
Total domestic animals	19	*42.1*	96	*71.1*
Unidentified small ruminant	26	*57.8*	39	*28.9*
Total wild or domestic animals	26	*57.8*	39	*28.9*
Total identified bones	45	*100.0*	135	*100.0*
Unidentified medium sized animals	22	*37.3*	13	*21.3*
Unidentified medium to large sized animals	26	*44.1*	15	*24.6*
Unidentified large sized animals	11	*18.6*	33	*54.1*
Total unidentified	59	*100.0*	61	*100.0*
Identified bones	45	*43.3*	135	*68.9*
Unidentified bones	59	*56.7*	61	*31.1*
Total animal bones	104	*100.0*	196	*100.0*

* without complete ox skeleton from the bottom of the well.

Table 2d—Species list for Maysar 25 well.

TELL ABRAQ

Tell Abraq, settled from about 2200 BC to 300 BC (Potts 2000), is a famous site near the former south shore of the Umm al-Quwain lagoon in the Emirate of the same name. Its Umm an-Nar layer is contemporaneous with stages 3 to 5 of Hili 8. The faunal remains from this layer are listed in table 3 and

Species list for Tell Abraq-UaN layers*	NISP	*NISP%*	WISP(g)	*WISP%*
Cattle, *Bos*	152	*5.0*	2931.9	*18.4*
Sheep, *Ovis*	23	*0.8*	128.8	*0.8*
Goat, *Capra*	28	*0.9*	198.0	*1.2*
Sheep or Goat, *Ovis/Capra*	477	*15.6*	1392.2	*8.7*
Dog, *Canis*	2	*0.1*	4.9	*0.0*
Total domestic animals	682	*22.3*	4655.8	*29.3*
Unidentified small ruminant	1	*0.0*	1.0	*0.0*
Wild ass (*Equus africanus*) or donkey (*E. asinus*)	12	*0.4*	435.0	*2.7*
Wolf (*Canis lupus*) or dog (*Canis familiaris)*	8	*0.3*	39.0	*0.2*
Total wild or domestic animals	21	*0.7*	475	*3.0*
Small unidentified rodents	10	*0.3*	0.2	*0.0*
Hare, *Lepus* sp.	1	*0.0*	0.7	*0.0*
Wolf, *Canis lupus*	24	*0.8*	64.9	*0.4*
Fox, *Vulpes vulpes*	1	*0.0*	0.8	*0.0*
Hyena, *Hyaena hyaena*	2	*0.1*	4.0	*0.0*
Small unidentified carnivore	1	*0.0*	0.2	*0.0*
Medium sized unidentified carnivore	1	*0.0*	0.5	*0.0*
Sea cow, *Dugong dugon*	4	*0.1*	77.0	*0.5*
Wild dromedary, *Camelus dromedarius*	37	*1.2*	2188.8	*13.8*
Arabian oryx, *Oryx leucoryx*	16	*0.5*	232.0	*1.5*
Goitred gazelle, *Gazella subgutturosa*	3	*0.1*	85.0	*0.5*
Gazelle, *Gazella* sp.	41	*1.3*	96.0	*0.6*
Total wild mammals	141	*4.6*	2750.1	*17.3*
Socotra cormorant, *Phalacrocorax nigrogularis*	741	*24.2*	1173.2	*7.4*
Unidentified birds	31	*1.0*	14.4	*0.1*
Total birds	772	*25.2*	1187.6	*7.5*
Green turtle, *Chelonia mydas*	20	*0.7*	772.0	*4.9*
Hawksbill turtle, *Eretmochelys imbricata*	1	*0.0*	13.0	*0.1*
Unidentified turtles, Chelonidae indet.	366	*12.0*	5450.1	*34.3*
Total reptiles	387	*12.7*	6235.1	*39.2*
Total fish[1)]	1055	*34.5*	608.8	*3.8*
Total identified	3058	100.0	15912.4	100.0
Unidentified small animals	2	0.1	60	0.2
Unidentified medium sized animals	1120	80.6	1300.3	44.3
Unidentified medium to large sized animals	78	5.6	472.5	16.1
Unidentified large sized animals (cattle size)	183	13.2	1042.2	35.5
Unidentified very large animals (camel size)	1	0.1	70	0.2
Unidentified	5	0.4	108	3.7
Total unidentified	1389	100.0	3053	100.0
Identified bones	3058	*68.8*	15912.4	*83.9*
Unidentified bones	1389	*31.2*	3053	*16.1*
Total animal bones	4447	*100.0*	18965.4	*100.0*

[1)] for details see Uerpmann, Uerpmann (2005a).

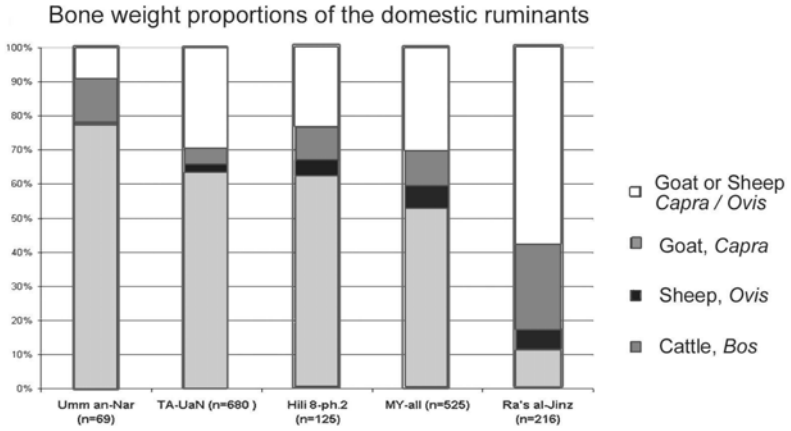
Table 3—Species list for Tell Abraq—UaN layers.

the spectrum of domesticates from Tell Abraq—henceforth abbreviated as "TA"—is seen in column 2 of figure 4. For the domestic ruminants the situation is the same as at Hili and Maysar. Cattle provided some 60% of the meat—the rest came from the small ruminants, again with a slight preponderance of the goat. However, looking at all identified bones the animal economy from Tell Abraq clearly differs from the two other sites.

The proportion of meat from domestic animals is only around 30% at TA whereas it is over 90% at the sites dealt with before. At TA about two thirds of the meat is from wild animals. Among the terrestrial mammals the proportion of hunted dromedaries is remarkable. Nevertheless, all together the hunted terrestrial mammals are clearly less than the animals of the sea. Turtles may be somewhat over-represented because of their heavy carapaces. In any case it is difficult to compare meat yields between different animal classes—mammals versus reptiles, or fish, or birds, in terms of their bone weight—whereas the results are good within the different animal classes. But even if the turtles are somewhat over-represented, their contribution is in any case remarkable. Turtles were hunted at sea, because the bones indicate animals which were too young to come ashore for nesting.

Contrary to turtles, fish might be somewhat under-represented, because sieving was not regularly applied during the excavation. However, the fact that the proportion of fish increases dramatically in the Late Bronze Age at Tell Abraq (M. Uerpmann, H.-P. Uerpmann 2005a)—although sampling methods were the same—indicates that the minor importance of fish in the early layers is a valid observation.

A



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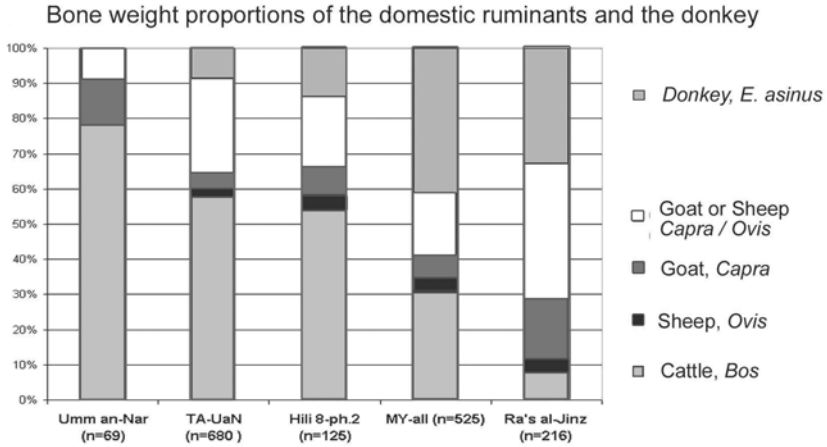

Fig. 4—Bone weight proportions of the domestic ruminants (A) and of domestic ruminants plus donkey (B) for all sites.

UMM AN-NAR

At Umm an-Nar domestic fauna is almost absent among the bone finds which we studied. As shown in table 4 and column 1 of figure 4 cattle are dominant. Sheep bones were not identified. Umm an-Nar is otherwise well known with regard to its archaeozoology, because faunal remains from the Danish excavations at the site were well described by E. Hoch (1979, 1995)—even though she refrained from quantifying the species. Therefore only our own data could be included in column 1 of figure 4 and column 4 of figure 5.

Even more than at Tell Abraq, the predominant part of the meat eaten by the Bronze Age inhabitants of Umm an-Nar derived from the sea. Marine mammals—sea-cows (*Dugong dugon*) and whales—as well as turtles and fish (M. Uerpmann, H.-P. Uerpmann 2005a) played the most important part in the ancient subsistence economy (*fig. 5*).

Species list for Umm an-Nar (exc. 1994-1997)	NISP	*NISP%*	WISP(g)	*WISP%*
Cattle, *Bos*	36	*1.0*	677.6	*2.1*
Goat, *Capra*	9	*0.3*	109.1	*0.3*
Goat or sheep, *Capra/Ovis*	24	*0.7*	79.9	*0.2*
Total domestic animals	69	*1.9*	866.6	*2.6*
Unidentified small ruminants	9	*0.3*	7.2	*0.0*
Total domestic or wild animals	9	*0.3*	7.2	*0.0*
Dolphins and whales, Cetacea	2	*0.1*	209.0	*0.6*
Sea cow, *Dugong dugon*	494	*13.9*	16279.8	*49.6*
Wild dromedary, *Camelus dromedarius*	91	*2.6*	3459.8	*10.5*
Arabian oryx, *Oryx leucoryx*	38	*1.1*	489.0	*1.5*
Gazelle, *Gazella subgutturosa*	2	*0.1*	80.0	*0.2*
Total wild mammals	627	*17.7*	20517.6	*62.5*
Socotra cormorant, *Phalacrocorax nigrogularis*	533	*15.0*	751.3	*2.3*
Tern, Sternidae indet.	1	*0.0*	1.0	*0.0*
Unidentified birds	9	*0.3*	8.6	*0.0*
Total birds	543	*15.3*	760.9	*2.3*
Green turtle, *Chelonia mydas*	18	*0.5*	822.7	*2.5*
Hawksbill turtle, *Eretmochelys imbricata*	1	*0.0*	41.0	*0.1*
Chelonidae indet.	538	*15.2*	8496.3	*25.9*
Total reptiles	557	*15.7*	9360.0	*28.5*
Total fish[1)]	1737	*49.0*	1328.9	*4.0*
Total identified	3545	*100.0*	32842.8	*100.0*
Unidentified small animals	1	*0.8*	0.3	*0.1*
Unidentified medium sized animals	14	*11.5*	38.0	*8.9*
Unidentified medium to large sized animals	3	*2.5*	14.5	*3.4*
Unidentified large sized animals (cattle size)	32	*26.2*	87.0	*20.4*
Unidentified very large animals (camel size)	17	*13.9*	243.7	*57.0*
Unidentified	55	*45.1*	44.0	*10.3*
Total unidentified	122	*100.0*	427.5	*100.0*
Identified bones	3545	*96.7*	32842.8	*98.7*
Unidentified bones	122	*3.3*	427.5	*1.3*
Total animal bones	3667	*100.0*	33270.3	*100.0*

[1)] for details see Uerpmann, Uerpmann (2005a).

Table 4—Species list for Umm an-Nar (excavations 1994-1997).

The contribution of cormorants—mainly *Phalacrocorax nigrogularis*, but also some *Ph. carbo*—to the diet of the inhabitants of both Umm an-Nar and Tell Abraq is also quite remarkable (*fig. 5* "Birds"). They must be added to the marine component as well. Compared to animals from the sea, the land animals—both domesticates and hunted prey—are clearly in the minority.

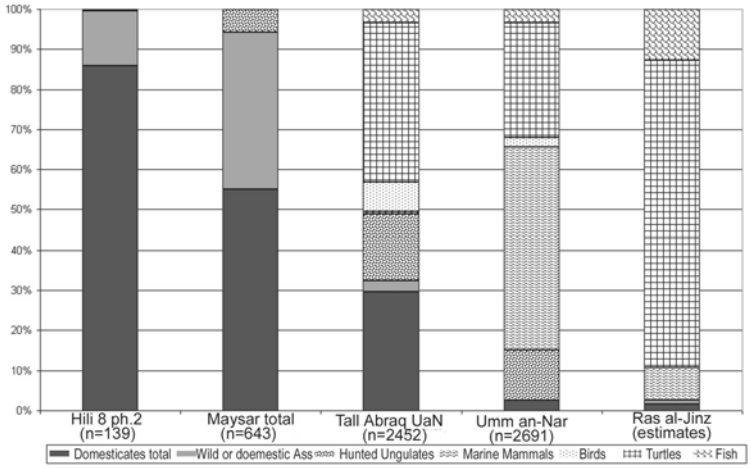

Fig. 5—Bone weight proportions of the domestic ruminants, ass or donkey and wild animals for all sites.

RA'S AL-JINZ AND RA'S AL-HADD

The observations made at sites on the Gulf coast can be compared with results from the other end of the geographical range of the Umm an-Nar civilisation. As was noted in the beginning, much new information has recently come from the area of Ra's al-Hadd and Ra's al-Jinz. Smaller samples of Early Bronze Age faunal remains from al-Hadd were published by British colleagues (Cartwright, Glover 2002; Martin 2002; Mosseri-Marlio 2002; Cartwright 2004), whereas for Ra's al-Jinz there are reports by the late Sandor Bökönyi (1992 and Bökönyi, Bartosiewicz 1998) for RJ-2. The site can be paralleled with the Umm an-Nar occupation at Hili 8 stage 2-5 (Cleuziou 2002). For RJ-2 only counts of the identified specimens were published. To make the results comparable to the other sites, bone weights were estimated for the collection from Ra's al-Jinz based on Bökönyi's account of some 12,000 thousand bones published in 1992. Hypothetical weights were obtained by multiplying the numbers of finds per species with the average bone weights of the respective taxa at Tell Abraq. It is obvious that this procedure is based on the assumption that bone fragmentation was similar at the two sites, which empirically seems plausible enough to be applied under the particular circumstances. In any case, the results (column 5 of *fig. 5*) are strikingly similar to the faunal spectrum of the reference site of Umm an-Nar itself.

At Ra's al-Jinz the contribution of wild animals to the diet is similar or even slightly higher than at Umm an-Nar. The main difference with Umm an-Nar is that hunted terrestrial animals were of no importance at Ra's al-Jinz. Here the emphasis is on turtles, fishing and whaling. The dugong, which was so important at Umm an-Nar, does not and did not occur in the seas around the eastern capes of Oman, which in turn have remained the most important areas for turtles and the best fishing grounds since the Bronze Age. Whales are also more frequent in the open Indian Ocean than in the Arabian Gulf, where Umm an-Nar is situated. Thus, the differences seen between the two sites reflect the respective environments, while the similarities—the low proportion of domesticates—are of archaeological importance and need to be considered further.

Environmental differences may also account for the composition of the domestic animals at RJ-2, which differs from all the other studied sites (column 5 of *fig. 4*)—in particular with regard to the low

proportion of cattle. The high proportion of donkeys is another interesting aspect. It compares well with Maysar and is clearly higher than at Hili 8 and Tell Abraq as well as Umm an-Nar, where the donkey is completely absent. This absence of the donkey is in contradiction to the assumption that this animal was used as a beast of burden during the Umm an-Nar period. There is no completely convincing solution to this problem, but the biology of the donkey and the nature of the respective environments might give a clue: Maysar and Ra's al-Jinz are in mountainous areas where most of the ground surface is hard, or even rocky. This is the kind of ground to which the donkey is well adapted. If we look at the sites in the west (*fig. 6*), it is obvious that Umm an-Nar is well separated from the mountains. To reach Umm an-Nar from the mountain area one has to traverse the desert. Donkeys are not well adapted to walking long distances in soft sand, especially when carrying a load. At Tell Abraq—also a coastal site in the west, but with some donkey remains in an Umm an-Nar context—the situation is different. Visible on the satellite photograph (*fig. 6*) as a grey band, the gravel of Wadi al-Dhaid forms a kind of a natural donkey-road from the mountains almost to the coast.

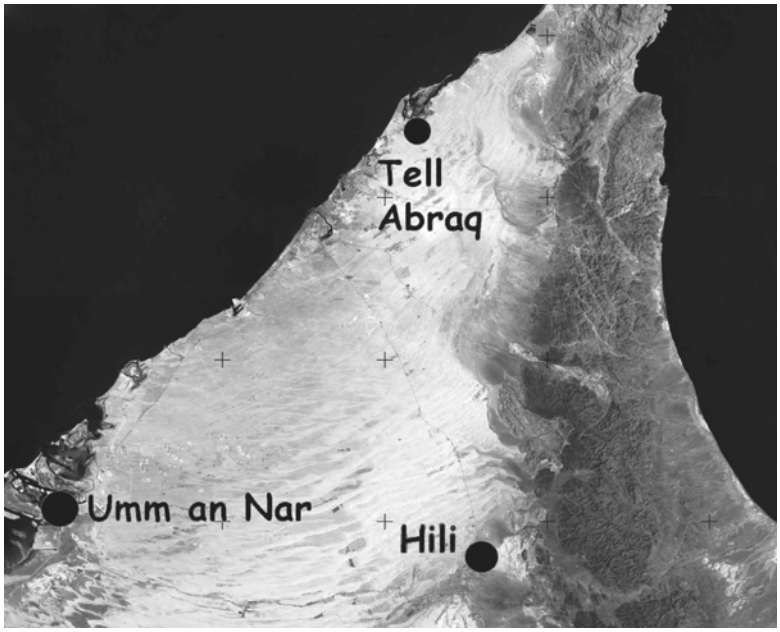

Fig. 6—Satellite view of the locations of Umm an-Nar, Tell Abraq and Hili.

DISCUSSION

The questions concerning the donkey inevitably stimulate discussions about the problem of camel domestication. The many dromedary remains from Umm an-Nar were often interpreted as coming from domestic animals.[7] The amount of infantile and juvenile animals was the main argument—based on the assumption that culling of the surplus of young animals was a characteristic trait of herding economies trying to avoid a rapid, uncontrolled increase of herd size. This assumption is not really applicable to camels because of their naturally slow rate of reproduction. In addition it was assumed that genuine hunters would have behaved differently: in order to maintain the wild populations, and thus their vital resources, they are thought to hunt preferentially for adult or at least subadult and if possible male animals. Based on these

7. The assumption of domestic dromedaries in the Early Bronze Age was first expressed by E. Hoch (1979) but was shown to be unlikely by Uerpmann, Uerpmann (2002).

two assumptions, one might conclude that the dromedary remains at Umm an-Nar were from domestic animals. But both aspects of this model cannot be applied to the conditions in Umm an-Nar. Neither were the inhabitants of Umm an-Nar "real" hunters and gatherers nor are there convincing biological indications for camel husbandry on Umm an-Nar Island during the Early Bronze Age. First, the island is too small for a viable number of herded dromedaries, especially when the massive architecture discovered at the site is taken as evidence for year-round occupation of the settlement. Thus, camel herds would have had to be kept on the mainland quite far from the settlement. Second, the camel remains indicate quite large animals. Present domestic dromedaries in SE Arabia are slightly smaller on average, even though domestic camel size seems to have increased again since the pre-Islamic period. A clear decrease in size is visible from the Late Bronze to the Early Iron Age (H.-P. Uerpmann, M. Uerpmann 2002).

Opinions concerning the inhabitants of Umm an-Nar and the significance of their settlement differ from author to author (Cleuziou 2003). However, there is basic agreement that Umm an-Nar was a harbour site. Its inhabitants—or at least a major part of them—had to manage an exchange of goods, physically as well as mentally. And they had to maintain their community with all its private and public installations in a very difficult environment from which they had to extract the major part of their subsistence. Meeting the food demands of a substantial group of people during the entire year would certainly not have been an easy task. Due to the desert nature of the island, the possibilities for animal husbandry and cultivation of plants must have been quite limited. Producing some crops and domestic animals on the neighbouring mainland was certainly an option, but would have involved extra investment in time and labour to overcome the distance. Apparently, exploiting the wild resources of the surroundings was the easier option. In any case, the mentality of real subsistence-hunters can not be expected under these circumstances from people mainly engaged in trade and specialized crafts. Satisfaction of momentary needs would probably have dominated over considerations about sustainability.

As natural members of the local fauna, wild dromedaries must have been available in the area. They would have been attracted to the flat coasts of the lagoons and bays around Abu Dhabi, by the halophytic plants of the salt-marshes and by the rich stands of *Avicennia* mangrove[8] along the shorelines. The natural concentration of wild dromedaries in this environment must have been relatively high. Heavily exploited by the inhabitants of Umm an-Nar, these coastal wild dromedaries—although replenished from the desert hinterland—would soon have undergone a change in population structure towards an increase in young animals. This is a known reaction of wild ungulate populations to heavy hunting pressure (*e.g.* Koike, Ohtaishi 1987). It can be assumed that dromedaries were hunted not only in the close vicinity of the archaeological site but all along the neighbouring shorelines. Boats must have been used for transporting the carcasses of the hunted animals and perhaps also for approaching them from the sea and the mangroves, where approaching hunters would have found more cover than on the open land.

There are also more general arguments against the existence of domestic dromedaries at Umm an-Nar. If Umm an-Nar already had the domestic dromedary, how would one then explain the absence of dromedary bones from the contemporary layers at Hili 8, or their complete absence at the sites of Ra's al-Hadd and Ra's al-Jinz? And what would then be the meaning of the much later occurrence of sudden morphological changes, which correspond well with the effects of domestication? Good evidence for the use of dromedaries as beasts of burden is available from Iron Age sites. Tell Abraq is a key site for this question where both the disappearance of the wild camel and the appearance of the domestic form are visible in the stratigraphic sequence (Uerpmann, Uerpmann 2002).

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8. The north-eastern shores of Abu Dhabi Island and the coasts near Umm an-Nar are presently covered with *Avicennia* mangroves. It was assumed that mangroves in the vicinity of Umm an-Nar should have been recognizable by means of *Terebralia* shells among the archaeological finds from the settlement itself. The absence of these shells among the archaeological finds does not, however, indicate the absence of mangrove stands as well. Apparently the past and present distribution of *Terebralia palustris* did not and does not reach very far into the Arabian Gulf and may never have included the immediate environment of Umm an-Nar Island (but see Hellyer, Aspinal 2006).

On the other hand—if there was no domestic dromedary and if the donkeys could not easily cross the sands—how then was Umm an-Nar, as an important harbour, connected to the exchange of goods with the interior? Would not the camel have been essential for this connection? The answer is that the transportation of goods would certainly have been easier with the camel—as it is nowadays with a truck—but it was definitely not impossible without truck or camel. The classic animals used for transportation in ancient times were cattle. Cattle were the most important animals for subsistence economy at the inland sites and, among the domesticated animals, at Umm an-Nar itself. In the cattle skeleton, hard work as a draught animal leads to pathological alterations of the foot bones. Some cattle finds from Phase I at Hili 8 clearly display such alterations. The same is true for the ox skeleton from the well at Maysar 25. The use of cattle as draught animals was therefore clearly known to the Bronze Age inhabitants of the area. The question of carts can at present not be dealt with because of the lack of finds, but simple sleds may have been better vehicles than carts on the loose sand of the desert. Water and fodder supply for the cattle on the route between Hili and Umm an-Nar would also not have been a problem along the chain of oases visible at the bottom of figure 6, particularly during the 3rd millennium BC, when ground water levels were higher than today.

Unlike donkey bones, cattle remains are present at Umm an-Nar. The few cattle finds from the Danish excavations were described as deriving from juvenile and subadult animals. Their age structure indicated that they were brought from outside and that they were used for labour and meat rather than for milking (Hoch 1979, p. 516). The cattle remains from the new excavations at Umm an-Nar are in accordance with these observations. However, specimens with clear anatomical indications for labour are missing, but this may be due to the small number of well preserved finds.

In regard to cattle sizes, the relative uniformity of cattle remains from Early Bronze Age sites in the wider Gulf area is remarkable (*fig. 7*).[9] This uniformity even seems to include Neolithic cattle from the sites of Buhais 18 (M. Uerpmann, H.-P. Uerpmann 2000) and Ra's al-Hamra 5 (H.-P. Uerpmann, M. Uerpmann 2003)—although the small samples sizes from the earlier sites may not provide sufficient evidence.

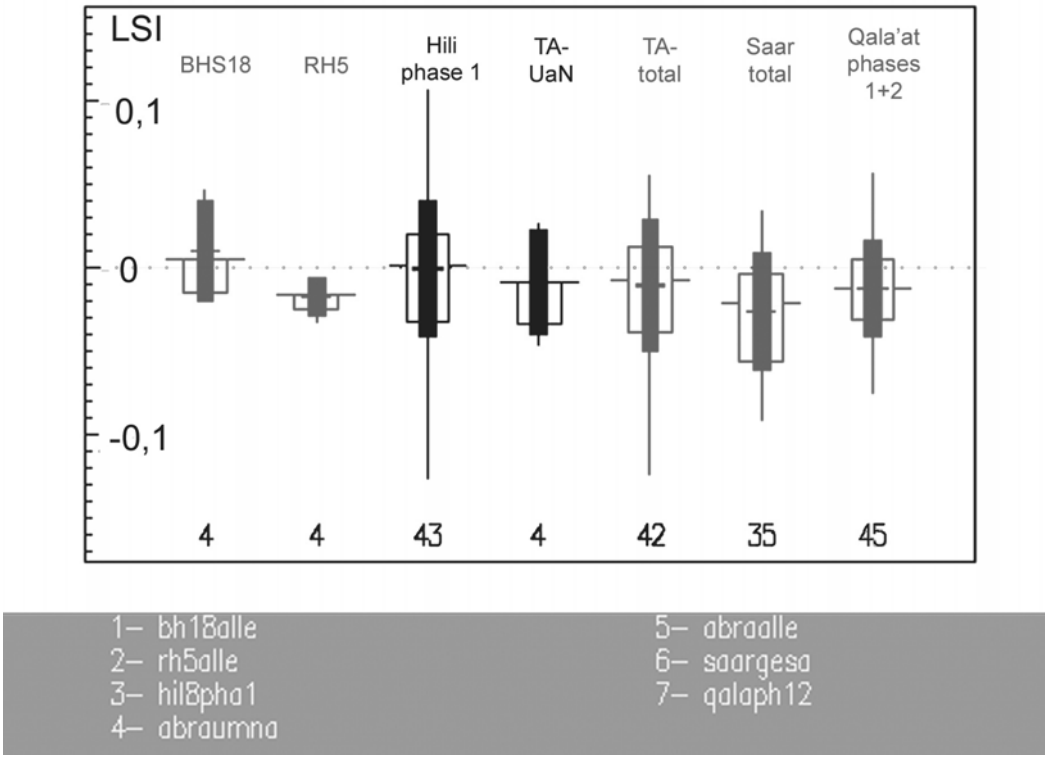

Fig. 7—LSI-Distributions of cattle bone sizes from Neolithic and Bronze Age sites in the Arabian Gulf area.

9. A middle-sized local cow from the area of Tell Abraq (UaQ) was used as standard animal for the LSI calculations.

For the Neolithic period it was speculated that cattle were exclusively kept for meat. For the Early Bronze Age only the finds from phase I of Hili 8 provide insight into the age structure of the slaughtered animals (*fig. 8A*). The data indicate that the majority of the animals (80%) were slaughtered before they reached the age of 4 years, which points to their main use as a source of meat. It is the finds of older animals which show the traces of labour mentioned before.

From the same context there are enough data to look into the exploitation patterns of sheep and goats as well (*fig. 8B*). The slaughtering curves display a difference between the two species: the curve for the sheep resembles that for cattle and indicates that sheep were mainly kept for meat production. The kill-off pattern for the goats was similar for the first two years, but after that goats were spared more than the sheep. About half of them lived beyond 36 months and some 20% lived longer than 4 years. This pattern indicates some use of live goats, presumably for milking.

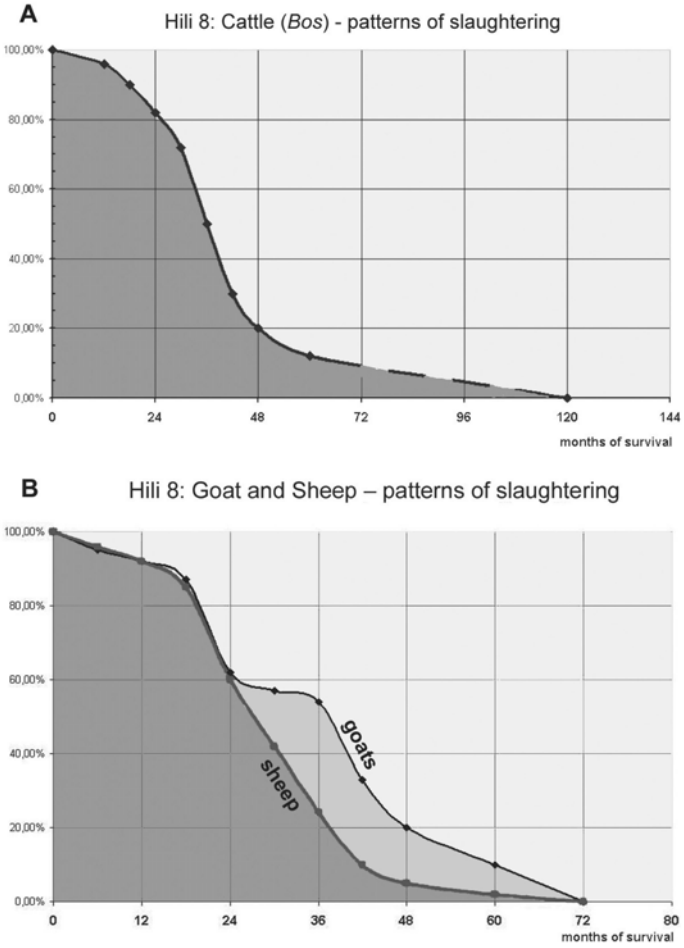

Fig. 8—Survival curves for cattle (A) and for sheep and goats (B) at Hili 8.

Like the cattle of Hili 8, the goats do not differ in size from the stock existing in south-eastern Arabia since the Neolithic. Goats seem to have been fairly similar throughout the Lower Gulf area during the Bronze Age.

For the sheep, the presently available information on size indicates the existence of three size groups in the Gulf area during the Neolithic and the Early to Middle Bronze Age. These are visible in figure 9 from left to right: fairly large sheep, which could be called “Mesopotamian sheep”, were found at Qala’at al-Bahrain (M. Uerpmann, H.-P. Uerpmann 1994, 1997) and Harappa (Meadow 1991), a medium-sized form occurred earlier at Tepe Yahya (based on Meadow 1986) and is found at Hili 8 and also at Saar

(M. Uerpmann, H.-P. Uerpmann 2005b), while the smaller group already existed in SE Arabia during the 5th millennium BC at al-Buhais 18 and during the 4th millennium at Ra's al-Hamra (H.-P. Uerpmann, M. Uerpmann 2003). Apparently it still occurred at Maysar and during the Umm an-Nar period at Tell Abraq.

The reasons for this diversity can be manifold: the large sheep may have been consciously disseminated from Mesopotamia to Dilmun and Harappa and may have been kept there with special care under particular circumstances. The medium-sized sheep may have come from southern Iran and might indicate migrations from there to SE Arabia at the transition from the 4th to the 3rd millennium BC, while the group of small-sized animals could represent the local Neolithic stock—a possibility which should be considered seriously, given the indications for settlement continuity along the north-eastern coast of Oman from the 4th into the 3rd millennium BC. It must of course also be taken into account that the sheep may have reacted to environmental changes and that there might be no archaeological meaning for these differently-sized groups.

On the whole, we may say that there are only slight indications of outside influence on the domestic animals of the area, which were the means of primary food production.

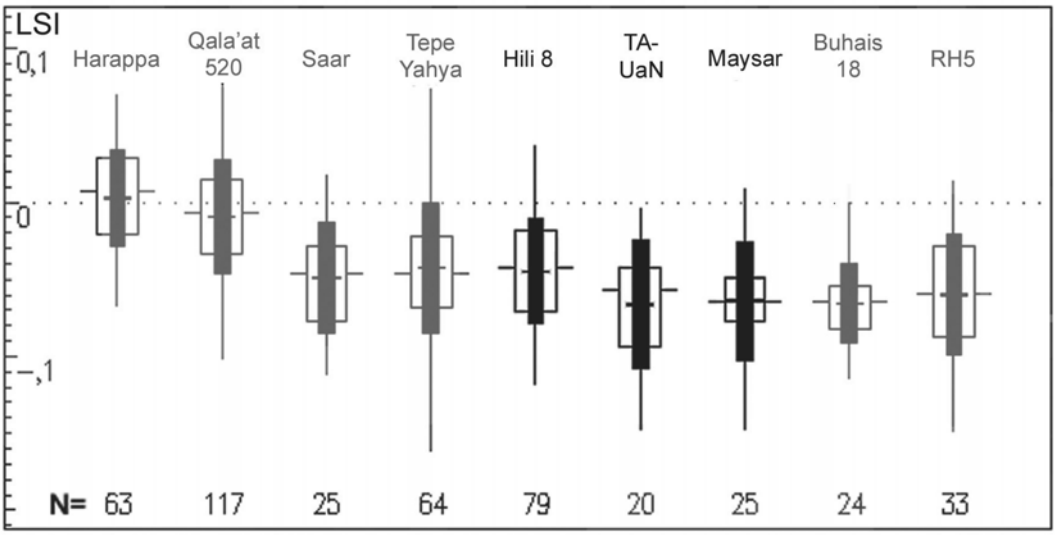

Fig. 9—Size Indices (LSI) for Neolithic and Bronze Age sheep from SE Arabia and adjacent areas.

RESULTS

How do these new results about the animal economy match the prevailing models about subsistence in the Early Bronze Age? The existence of different systems in the interior and on the coast is clearly confirmed. This is expressed by the quite different importance of husbandry for one and hunting, fishing and foraging for the other. Inland sites are characterized by their nearly exclusive reliance on domestic animals, whereas the coastal sites obtained their animal protein predominantly from wild resources. It is remarkable that in spite of its differing contribution to subsistence, animal husbandry reveals a common pattern throughout the Early Bronze Age. This concerns the numerical relation of sheep and goats to cattle, but also the body sizes of the respective species. Even the way in which they were used seems to have been similar: cattle and sheep were mainly raised for their meat, living goats also produced a product in the

form of milk. Cattle and donkeys were used for labour. These patterns comply with the often mentioned Early Bronze Age homogeneity in cultural (and thus social and economic) phenomena and are observed in neighbouring regions as well, *e.g.* in Makran (Desse 1997).

Although an exchange network is presumed between the sites of the Early Bronze Age there is not much supporting evidence from the animal sector of the economy: the small amount of domesticates on the coastal sites might indicate a slight contribution of the interior to the subsistence on the coast, but could also be explained as coming from animals raised independently in the coastal environment. There is no positive evidence for an exchange in the other direction—that is from the coast to the interior—. The inland sites of Hili 8 and Maysar did not provide any fish bones or other marine food remains. This is not a question of preservation: there are numerous finds of fish bones from Iron Age and later sites in the interior. For example the bones of several fish species were retrieved at Rafaq in the Emirate of Ras al-Khaimah—25 km from the Gulf of Oman—. Tuna remains were in the majority (Beech 2004, p. 162-164, 210). At Thuqeibah—near the Omani border in the Emirate of Sharjah and more than 70 km from either coast —marine fish remains as well as *Terebralia* shells are found in some quantity.[10] Whether the fish came fresh or preserved to these sites cannot be decided. It is in any case tempting to see the appearance of fish and shell remains in the interior as being in connection with the use of the domestic dromedary, which also began in the Iron Age.

We cannot of course exclude the possibility that fish was brought to the interior in dried or salted form without the bones. In order to obtain a final answer to these open questions it will be necessary to apply modern methods of scientific archaeology to the human skeletal remains from Bronze Age graves. Isotopic research would indicate potential contributions of marine organisms to the diet of the interred and would also allow differentiation between animal and plant food. Animal remains should of course be included in this kind of research. For the time being, the available evidence for the animal component of the subsistence economy confirms the existence of developed exchange networks between the coast and the interior for the Iron Age, but not yet for the Bronze Age. It is hoped that the advance of archaeological methodology will soon provide further insight into the complexity of prehistoric economies.

The final question with regard to subsistence systems that we should ask ourselves concerns the sustainability of the respective constellations. While no indications for an over-exploitation of local resources are visible at the inland sites, there are such signs at Ra's al-Hadd (Cartwright 2004, p. 50), and in particular at Umm an-Nar island, where vulnerable resources in the form of slowly reproducing wild animals—in particular camels and dugongs—were exploited. To what extent a non-sustainable animal economy contributed to the end of the settlement on Umm an-Nar island[11] can unfortunately not be detected due to the incomplete, fragmentary and selective nature of the archaeological evidence.

At Tell Abraq—where settlement continues after the Umm an-Nar period—shifts in the animal economy are visible (M. Uerpmann 2001, fig. 1). These can also be interpreted as signs of over-exploitation of certain resources. The contribution of wild animals dropped considerably as a whole; turtles, wild camels, oryx and gazelles were replaced to some extent by the hunting of whales and dugongs—resources which also declined afterwards when fish became the main source of protein. During the following Iron Age of Tell Abraq the dependence on wild resources was minimal, indicating that living from domestic resources on the coast was possible, but that apart from fishing, the wild resources were probably no longer available for large-scale human exploitation.

10. Personal observations by the authors.

11. Hoch speculates about this: "It should not be forgotten, however, that the human population of Umm an-Nar in the third millennium BC may have exploited the local fauna and general environment to a degree surpassing natural regeneration at a necessary pace, which situation could have effected a decline in health and prosperity for man, then a collapse of townlife with the abandonment of the island as a consequence" (Hoch 1995, p. 250).

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