'Atiqot 79, 2014

Animal-Based Economy and Local Ecology: The Early Bronze Age II Fauna from Qiryat Ata—Area S

Edward F. Maher[1]

Introduction

This article details a zooarchaeological analysis of a hand-collected animal-bone assemblage spatially limited to Area S at Qiryat Ata. The entire faunal assemblage originates from Phases 1–4 (General Site Stratum I), which is associated with Early Bronze Age II (see Golani, this volume).[2] The assemblage consists of 188 bones and bone fragments (of which 108, or 57%, were identified), from 8 different species (most of which are domesticated), representing the remains of at least 15 individual animal specimens. Study of this small faunal assemblage provides the opportunity to consider possible consumption patterns and the economic strategies followed at Qiryat Ata, as well as the nature of the local environment and how the inhabitants may have utilized and adapted to the available resources.

Methods

Species identification was assisted by Boessneck (1969), Schmid (1972), Payne (1985) and Prummell and Frisch (1986). Due to the morphological and size similarity between sheep and goats, most of their remains were combined into an ovicaprine category whenever precise taxonomic distinction was not possible. Identifications were verified by consulting the comparative vertebrate collection housed in the Department of Evolution, Systematics, and Ecology at the Hebrew University of Jerusalem. For the bones that could not be identified, a size-based taxonomy comprising three classes was used: small, medium and large mammals. Remains in an advanced state of fragmentation that could not be assigned to the size-based division were considered unidentifiable.

Estimated age at death for sheep and goats was determined by post-cranial epiphyseal fusion rates, dental eruption sequences (Silver 1969) and dental attrition scores (Payne 1973; Zeder 1991:93). The mortality data for cattle was based on post-cranial remains and dental eruption (Silver 1969). Measurements for all species were made according to von den Driesch (1976).

The data were quantified in two ways: NISP (Number of Identifiable Specimens), which provides a count of bone fragments per taxon, and MNI (Minimum Number of Individuals), calculated by siding the most commonly occurring element, while accounting for different stages of epiphyseal fusion (unfused, fusing and fused). Both methods have their merits and problems, and there is no single technique that adequately measures the relative proportion of animal abundance. As the actual number of specimens in any faunal assemblage lies somewhere between the total number of bone fragments and the MNI (Hesse and Wapnish 1985:114), using both measures of abundance is an effective approach toward overcoming quantification problems (Crabtree 1990:159–160).

Once identified to species and element, the remains were divided according to body part. For comparisons between sites in order to attain analytical and interpretive value, zooarchaeologists must define each body-part division in the same manner. A variety of suggestions have been proposed to determine which bones define what body-part divisions. This analysis follows Horwitz and Tchernov (1989) and Redding (1994). Lower limb bones identified as metapodials were excluded from this stage of the analysis as they could have come from either the front (metacarpal) or hind (metatarsal) limbs. Recognizing patterns in body-part distribution can indicate intra-site (or even inter-site) faunal variability. Since body-part distribution reflects specific choices regarding animal dismemberment, cut marks were considered in light of Binford (1981), whose work established how butchery intent can be inferred via cut-mark placement and orientation on the animal bones. The color of burnt bones was recorded by using the standardized color schemes of the Munsell soil color chart.

Zooarchaeological analysis in the ancient Near East must always contend with determining the time period to which an assemblage belongs. Unlike pottery or lithics, whose place in time can be approximated through typological analysis, there have been no major morphological changes in animal skeletons for tens of thousands of years, thereby rendering the same approach inapplicable (Davis 1987:31). In an attempt to limit the chronological contamination, the animal remains included in this study come from stratigraphically secure contexts, such as surface and debris layers.

RESULTS

Species

The assemblage consists of eight species, six of which are domestic stock, and, as at many other sites in the Southern Levant, represents the foundation of the community's animal-based economy (Table 1). Sheep (*Ovis aries*) and goats (*Capra hircus*) were the most commonly exploited animals in Area S, representing nearly half the identifiable species. Most of the bone fragments of medium-sized mammals are probably also from sheep and goats. Goat bones outnumber sheep remains by a margin of

Table 1. Species Diversity and Abundance

	NISP	NISP %	MNI	MNI %
Sheep	1	0.9	1	6.7
Goat	7	6.5	2	13.3
Ovicaprine	43	39.8	4	26.7
Cattle	47	43.5	2	13.3
Pig	2	1.9	1	6.7
Wild pig	4	3.7	1	6.7
Dog	1	0.9	1	6.7
Small equid	1	0.9	1	6.7
Fallow deer	1	0.9	1	6.7
Sea turtle	1	0.9	1	6.7
Medium mammal	29			
Large mammal	43			
Unidentified	8			
Total Identified	*108*			
Total Assemblage	*188*	*100.0*	*15*	*100.0*

7:1 (see Table 1), which differs from most other ancient sites where sheep tend to be the more common of the two species. The small sample size available for study here undoubtedly plays a role in such a marked difference in the sheep/goat ratio. At least some, if not all, of the goats were domesticated, as demonstrated by a twisted horn core. Cattle are nearly as abundant as sheep and goats, which underscores their economic importance. Unidentified bones designated as large mammals are likely from cattle. It is possible that some cattle may actually be wild auroch (*Bos primigenius*).

Other domesticates include pigs (*Sus scrofa*), a dog (*Canis familiaris*) and a small equid, but are much fewer in number. Domestic pigs were slaughtered for consumption. As there is no evidence that the dog was consumed, it could have been a pet, an aid for hunts, pest control, general security, or, perhaps, a combination of these. The small equid bone may be that of the domestic donkey (*Equus asinus*), which would have been a useful pack animal.

Very few wild animals are present in the assemblage, comprising less than 6% of the identifiable remains. Fallow deer

Table 2. Bone Measurements (based on von den Driesch 1976)

Species	Bone	Measurements (mm)[i]
Cattle	Horn core	45: 44.3, 46: 37.50
Cattle	Mandible	15a: 74.10
Cattle	Scapula	BG 42.22, LG 51.81, GLP 56.77
Cattle	Humerus	Bd 68.1, Bt 69.64
Cattle	Ulna	SDO 41.31, DPA 56.31
Cattle	Metacarpal	Bp 54.45
Cattle	1st phalanx–fore	Bp 34.09, Bd 31.11, GLpe 57.17
Cattle	1st phalanx–fore	Bp 33.01, Bd 30.81, GLpe 59.64
Cattle	Tibia	Bd 57.44
Cattle	Astragalus	GLm 55.77, GLl 61.31, Bd 40.88
Cattle	Calcaneum	GL 124.96, GB 36.08
Cattle	Metatarsal	Bd 56.5
Cattle	3rd phalanx	MBS 20.92
Goat	Humerus	Bd 31.50
Goat	Humerus	Bd 35.78
Goat	1st phalanx–fore	Bp 12.05, Bd 12.32, GLpe 34.71
Dog	Ulna	SDO 20.02, DPA 23.89
Pig (wild)	Ulna	BPC 22.52, DPA 40.3, SDO 31.72
Pig (wild)	2nd permanent upper molar	B 20.16, L 26.52

[i] 15a = height of mandible; 45 = greatest diameter of horn core base; 46 = least diameter of horn core base; B = breadth; Bd = breadth of distal end;BG = breadth of glenoid cavity; Bp = breadth of proximal end; BPC = greatest breadth across coronoid process; Bt = breadth of trochlea; DPA = depth across processus anconaeus; GLpe = greatest length of peripheral half; GLl = greatest length of lateral half; GLm = greatest length of medial half; GLP=greatest length of glenoid process; L=length; LG=length of glenoid cavity; MBS = mid-breath of sole; SDO = smallest depth of olecranon.

(*Dama mesopotamica*) is also known from contemporaneous assemblages at Qiryat Ata (Horwitz 2003) and Me‘ona in the western Galilee (Horwitz 1996).

Six fragments were identified as pig, of which four are wild pig, as suggested by the length of a second permanent upper molar (Table 2; see Payne and Bull 1988). This tooth was situated next to a fragmentary upper first permanent molar, both of which were affixed to a maxillary fragment, indicating the head and teeth of a wild pig. The size of an ulna (Table 2) is within the range to be expected for a wild pig, especially given that it is from a juvenile specimen; it would have been larger had the animal survived to maturity.

The assemblage also included the fragmented edge of a sea turtle carapace. Exploitation of aquatic resources at the site has been previously demonstrated by fish (Horwitz 2003:229) and shells (see Ktalav, this volume; Reese 2003). Based on the modern zoogeographic distribution ranges of extant hard-shelled species of sea turtle, possible candidates include the logger-head (*Caretta caretta*), leather-back (*Dermochelys coriacea*), and the green sea turtle (*Chelonia mydas*). Of the three species, *C. caretta* is the most abundant in modern times.

Table 3. Epiphyseal Fusion Data for Ovicaprine Bones

Bone	Quantity	Approximate Age at Death (months)
Unfused scapula	2	< 6–8
Fused distal humerus	2	> 10
Fused proximal phalanges	1	> 13–16
Unfused distal metacarpal	1	< 18–24
Fused distal tibia	5	> 18–24
Unfused distal radius	1	< 36
Fused proximal humerus	1	> 36–42
Fused distal femur	3	> 36–42
Unfused distal femur	1	< 36–42
Fused proximal tibia	1	> 36–42

Table 4. Epiphyseal Fusion Data for Cattle Bones

Bone	Quantity	Approximate Age at Death (months)
Fused scapula	1	> 7–10
Fused distal humerus	3	> 12–18
Fused proximal radius	3	> 12–18
Unfused proximal radius	1	< 12–18
Fused proximal phalanges	2	> 18
Fused distal metatarsal	1	> 24–30
Fused distal tibia	2	> 24–30
Fused proximal femur	1	> 42
Fused calcaneum	1	> 36–42
Unfused distal femur	1	< 42–48
Fused ulna	1	> 42–48
Unfused ulna	1	< 42–48

As habitat range can vary over time, the precise taxonomic identity of the sea turtle carapace fragment from Qiryat Ata remains uncertain.

Ageing

A small assemblage of 18 sheep and goat bones (Table 3) was available for estimating age at death. Some animals were killed for meat, as evidenced by juvenile specimens; however, others were allowed to mature. Dental attrition of three specimens indicates a range in culling schedules of 6–12 months, 1–2 years, and 3–4 years. One young ovicaprine died before 3–6 months old, as evidenced by its unerupted permanent lower first molar. Although complementary, the results derived from both analytical techniques are still problematic in recognizing widespread culling practices due to the small sample size. Minimally, it may be suggested that the economy was generally oriented toward meat consumption and extracting secondary products such as wool, hair, dung, etc.

The assemblage for assessing cattle mortality was also small (Table 4). Each of the four age classes are represented. With only three unfused bones from juvenile animals, it reflects a rather minor interest in beef consumption.

Table 5. Body-Part Distribution of Cattle and Ovicaprines

Body Part	NISP	%
Cattle		
Cranial	15	36.6
Fore	8	19.5
Hind	9	22.0
Trunk	4	9.8
Foot	5	12.2
Total	*41*	*100.0*
Ovicaprines		
Cranial	20	44.4
Fore	7	15.6
Hind	16	35.6
Trunk	1	2.2
Foot	1	2.2
Total	*45*	*100.0*

One unerupted permanent lower third molar indicates the animal's death before it had turned 2 years of age. Their main worth seems to align with their capacity to provide a reliable source of power.

Body-Part Distribution

The distribution of animal bones was considered in two ways. In the first, the bones were divided into five categories consisting of cranial, forelimb, hindlimb, trunk and foot bones (Table 5), following Horwitz and Tchernov (1989). Remains from all sections of the body are present. Generally speaking, the remains from Area S are represented in similar frequencies to those reported for EB II fauna from Areas A–G (Horwitz 2003:233). In some instances, they are either identical or nearly identical, which suggests similarity in some of the disarticulation procedures between different areas of the settlement. The main point of departure centers on the occurrence of trunk elements. In Area S they comprise 2% of the identifiable ovicaprine assemblage, and 10% of the identifiable cattle assemblage. This contrasts with trunk remains from other excavation areas, where they comprise 21% of the ovicaprine and 26% of the cattle assemblages. The varied trunk abundance may be a result of the small faunal sample from Area S, or it may be linked to inter-site variability that reflects area-specific functions.

Table 6. Proportion of Non-Meat and Meat-Bearing Bones of Cattle and Ovicaprines

	NISP	Non-Meat/ Meat Ratio
Cattle		0.31:1
Non meat-bearing bones	4	
Meat-bearing bones	13	
Ovicaprine		0.24:1
Non meat-bearing bones	4	
Meat-bearing bones	17	
Total	*38*	

Body-part distribution was also considered by observing the proportion of meat and non-meat bearing post-cranial remains (Table 6). Although the sample is very small, the ovicaprine and cattle samples mainly consist of meat-rich bones, illustrating that the area was a center for food consumption.

The lone fallow deer bone is a phalanx (toe bone). As it did not exhibit wear usually associated with carnivore consumption (e.g., Horwitz 1990; Maher 2006/2007), its introduction to the settlement is assumed to be of cultural rather than natural agency. Bones from the lower extremities, such as carpals, tarsals and phalanx, are commonly left inside an animal's hide once separated from the carcass (see Perkins and Daly 1968 for their discussion of the "schlep effect"). It is possible that the deer was partially processed at a distant kill site, skinned at that location, then disarticulated further as certain parts were transported back to the settlement wrapped in the animal's own hide. The deer phalanx may be a remnant of such a procedure.

Bone Modifications

Butchery marks were only found on two cattle bones, one a mandibular condyle, the other on the anterior margin of an unfused proximal radius (from a juvenile specimen aged 15–18 months),

Table 7. Species-Specific Spatial Distribution of Animal Bones

	External Areas	Structure 1	Structure 2	Structure 3	Structure 4	Structure 5	Undetermined	Total
Sheep/goat	26		3	5	4	3	10	51
Cattle	31		3		3	1	9	47
Pig	6							6
Dog	1							1
Small equid	1							1
Deer					1			1
Sea turtle	1							1
Medium-sized mammal	20	1		1	4	1	2	29
Large mammal	30		4	1	3	1	4	43
Unidentified	3		2		2		1	8
Total	*119*	*1*	*12*	*7*	*17*	*6*	*25*	*188*

both reflecting dismemberment. A limb bone shaft of a large mammal was also chopped.

The lone small-equid bone in the assemblage, a scapula, had its spine ground down low enough (preserved length 142 mm) that its remaining base extends minimally from the scapular blade. Such workmanship effectively created a wider and flatter surface, which may have made it usable as a type of digging tool (see below).

Only two bones, both medium-sized mammal-limb fragments, were burnt. One comes from a locus external to Structure 1, while the other was found in Structure 4. The dark surface coloration of both bones (black, 10YR 2/1; very dark brown, 10YR 2/2) is likely the result of meal preparation rather than refuse disposal.

Rodent gnaw marks were only recorded on a cattle proximal ulna. The permanent dwellings attracted commensal animal species that could have easily subsisted on the discarded debris of meal leftovers.

There was no evidence for pathological development on any of the bones or teeth studied. The small sample size undoubtedly contributes to this, as such altered remains generally represent a rather small portion of any recovered zooarchaeological assemblage.

Diachronic and Synchronic Distribution

Faunal distribution was considered by chronological contexts as defined by the four distinct phases of occupation in Area S. Bones were recovered in each phase, most of them associated with Phase 3 (n = 69); the fewest from Phase 4 (n = 7). Most species were found in all phases with a few exceptions: the deer, dog and donkey originated in Phase 2, the sea turtle in Phase 3, and pigs in Phase 4. Ovicaprines and cattle were most abundant in Phases 2 and 3.

Faunal distribution was also examined by its spatial context as related to the five structures indentified in Area S (Table 7). Most of the remains (NISP = 119) derived from areas located outside the structures, indicating that after consumption, faunal remains were often discarded into the street. Within the structures, most material originated in Structure 4 (NISP = 17), the fewest in Structure 1 (NISP = 1). Four species (dog, small equid, pig and sea turtle) were associated exclusively with exterior areas. Ovicaprines were present in each structure

Table 8. The Faunal Assemblages from Qiryat Ata (for Area N, see Agha, this volume)

	EB IB: Areas A–G[i], L[iii]		EB II: Areas A–G [i], H[ii], L[iii], S	
	NISP	NISP %	NISP	NISP %
Domestic Species				
Sheep	4	0.8%	6	0.6%
Goat	5	1.0%	16	1.7%
Ovicaprine	187	36.0%	398	42.3%
Cattle	160	30.8%	354	37.6%
Pig	122	23.5%	105	11.2%
Dog	6	1.2%	8	0.9%
Donkey	2	0.4%	5	0.5%
Wild Species				
Auroch	3	0.6%		
Pig			7	0.7%
Red deer	1	0.2%	1	0.1%
Fallow deer	6	1.2%	6	0.6%
Cervid sp.	6	1.2%	12	1.3%
Mountain gazelle	8	1.5%	16	1.7%
Hyaena	2	0.4%		
Bear	2	0.4%	3	0.3%
Bird	4	0.8%		
Hippopotamus			1	0.1%
Sea turtle			1	0.1%
Fish	1	0.2%	2	0.2%
Total	*519*	*100.0%*	*941*	*100.0%*

[i] Horwitz 2003.
[ii] Sade 2007.
[iii] Sade 2000.

except for Structure 1, cattle in Structures 2, 4 and 5, and deer in Structure 4. Structure 4 features the greatest species diversity, including cattle, deer, sheep and goats.

DISCUSSION

The faunal data from Area S, when combined with that from Areas A–G (Horwitz 2003), Area H (Sade 2007) and Area L (Sade 2000), results in over 1400 identifiable bones from the Early Bronze Age (Table 8). The species exploited at Qiryat Ata are dominated by domestic animals, the most common being sheep and goats. Although Area S yielded a small sample of seven goat bones and one sheep bone, it complements contemporaneous faunal data reported from other areas of the site where goat bones were nearly twice as abundant as those of sheep (Horwitz 2003:229). In contrast, sheep tend to outnumber goats from most other Early Bronze Age sites such as ʻArad (Davis 1976; Lernau 1978), Tel Yarmut, Tel ʻErani (Horwitz and Tchernov 1989), Naḥal Tilla (Kansa, Kansa and Levy 2006), Megiddo (Wapnish and Hesse 2000) and Tel Ḥalif (Seger et al. 1990:24–31). However, a focus on raising goats over sheep has been noted from Taur Ikhbeineh (Horwitz et al. 2002) and Jericho (Horwitz and Tchernov 1989). The goat to sheep ratio from all areas at Qiryat Ata,[3] derived from an admittedly small sample, suggests a focus on goat exploitation, an animal better suited to arid localities (Redding 1984:232–233, Fig. 8), even though a water source was located only 4 km away at Naḥal Qishon (Golani 2003:3). Water could have easily been transported back to the settlement in ceramic vessels on the backs of donkeys, as evidenced by a small equid bone (possibly donkey) in the assemblage, and further suggested by a zoomorphic figurine (donkey or bull) with remnant negative impressions on both sides of the body indicating it hauled storage vessels (Golani 2003:207, Fig. 7.4:1). Since cattle, pigs and deer all prefer densely vegetated habitats with access to water (Horwitz and Tchernov 1989:290), the species list reported here and elsewhere (Sade [2007] identified hippopotamus in an EB II assemblage from Area H) suggests that Qiryat Ata was located in or near a similar environment. It seems that an ovicaprine herd, comprising mainly goats, was grazed some distance away from the well-watered areas near the settlement, an interpretation also applied to Early Bronze Age sites in Naḥal Besor (Horwitz et al. 2002). This herding strategy would complement land use within the immediate vicinity of the community (see below).

Sheep and goats were culled at various stages of life, demonstrating that their meat was a valued commodity, but so too were their secondary products. Contemporary spindle whorls (Shamir 2003:209) indicate a local industry that spun fibers, which could have included animal-based products (goat hair or sheep wool).

Cattle were the second most economically important animal in general in all areas. Their mortality profile suggests a community with a limited preference for beef consumption. Most of the bones belong to mature animals, indicating a worthwhile economic gain in maintaining a herd comprised of older specimens. One strategy consistent with this data might have cattle employed as sources of power, perhaps to assist with local agricultural operations. This suggestion agrees with other faunal data—only two cattle bones bore cut marks, none on unequivocally mature animals, suggesting they were more valued alive than dead. One can also consider the proportions between cattle and other species identified in the assemblage. The overall ratio between cattle and ovicaprines, 0.83:1, in all areas, is consistent with baselines established by Redding (1994), suggesting that the areas around Qiryat Ata were used for agricultural production. This aspect of Redding's model also predicts a high occurrence of goats, which represent a noteworthy feature of the EB II fauna from Qiryat Ata. Land clearance would have reduced the amount of available pasture, requiring ovicaprines to graze in peripheral areas farther away from the site (Hopkins 1997:29–30). Mazar (1990:118) speculated that the animal-drawn plow may have been an important innovation in the Early Bronze Age. Based on archaeological, epigraphic, and pre-modern data, Rosen (1986) suggested that plow-based economies are evident when cattle comprise at least 20% of the domestic ruminant assemblage. The proportion of domestic ruminants represented by cattle at EB II Qiryat Ata exceeds this threshold, illustrating the involvement of cattle in agricultural production. Faunal evidence demonstrating cattle use with plows is known from even earlier periods (fourth millennium BCE) in the Levant and Anatolia (Hesse 1997:443). Non-faunal data also point to Qiryat Ata's agricultural economy: sickle blades for crop harvest (Bankirer 2003) and groundstone implements to process grains (Rowan 2003). It should also be noted that Qiryat Ata is situated on the fringes of the fertile Zevulun Valley (Golani 2003:1). The local iconography featuring figures and animal shapes on cylinder-seal impressions (Golani, this volume: Fig. 21:2; Greenberg

2003:203–205, Fig. 7.1:3), an impressed pattern on a storage jar (Golani 2003:219; Fig. 7.8:19) and zoomorphic ceramic figurines (Golani 2003:208, Fig. 7.4), all underscore the significance of animals to community life.

The wild game in Area S, comprising 5.6% of the identifiable assemblage, is nearly identical to the overall proportion of non-domestics exploited during EB II at Qiryat Ata at 5.2% (Table 8). Wild animals are typically meager at Early Bronze Age sites that demonstrate a heavy reliance on resources derived from domestic animals. The low frequency of wild pig and fallow deer may relate to an emphasis on agricultural production requiring cultivatable land at the expense of wild habitats. As fallow deer and wild pig prefer wooded areas (Horwitz 1996), initiatives centered on land clearance would have effectively reduced their natural habitats in proximity to Qiryat Ata.

Hunting wild pigs would have added variation to the local diet, but they were also killed because of the damage they inflict on crops (Payne and Bull 1988:28). The twofold benefits of removing a food competitor that could be consumed by members of the community would have been realized.

Sea turtle, another wild species from Area S, has also been identified in the Early Bronze Age assemblage from the coastal site of Afridar (Kansa 2004). The taxonomic identity of the specimen from Qiryat Ata could not be firmly established. Sea turtles and their eggs are eaten by humans, and their nests, sometimes as many as 15 per km, can be found along the Mediterranean shore (Sella 1995:419). Nesting zones must be located far enough inland to avoid flooding by waves, and to ensure egg incubation they must achieve a temperature of 28° C, accomplished by depositing clutches at a depth of c. 30 cm into the sand (Sella 1995:420). On average, egg size, clutch size, and nesting frequency vary by species (Van Buskirk and Crowder 1994:68, Table 1). Harvesting sea turtle eggs from readily identifiable nesting grounds would have been a relatively simple and risk-free venture, and would also have provided a fairly substantial caloric reward, regardless of the species of sea turtle. A somewhat closer Mediterranean coastline to Qiryat Ata in the mid-third millennium BCE (Golani 2003:2, Fig. 1.1) would have facilitated the retrieval of sea turtles and their eggs. It is possible that the modified small-equid scapula (or a tool very much like it) with its ground-down spine, wide, flat shape and narrow edges, functioned as an ideal digging tool for uncovering clutches of sea-turtle eggs buried on nearby sandy shores.

CONCLUSIONS

Although the EB II faunal sample from Area S at Qiryat Ata is small, it complements previous zooarchaeological research at the site as well as the overall picture of the Early Bronze Age animal economy in the region. The assemblage exhibits primary reliance on domesticated species, and includes ovicaprines, followed by slightly fewer cattle and even less pigs. Sheep and goats were the most commonly exploited animals; when taxonomic distinctions are possible, goats outnumber sheep. The species profile suggests that cattle were involved in agricultural operations in nearby fields, while flocks of sheep and goats were pastured further away from the settlement, a strategy that juggles agricultural productivity in one area with managing the food requirements of sheep and goats in another. Wild game, represented by fallow deer, wild pig, and sea turtle, though rare, would have diversified the local diet. Sea turtle in this assemblage is the first such occurrence at the site, and is a noteworthy inclusion in the local menu as it further demonstrates exploitation strategies that included not only terrestrial resources, but aquatic ones as well.

NOTES

[1] North Central College, Naperville, Il.

[2] I would like to thank Amir Golani for inviting me to study the faunal assemblage from Qiryat Ata, Area S. I also extend gratitude to Liora K. Horwitz and Rivka Rabinovich, who helped with some of the problematic identifications, and also granted access to the skeletal collection housed in the National Natural History Collections, Institute of Archaeology at the Hebrew University of Jerusalem.

[3] Excluding Area N, which was not available at the time of writing; see Agha, this volume.

REFERENCES

Agha N. This volume. Faunal Remains from the Early Bronze Age Site at Qiryat Ata–Area N.

Bankirer R.Y. 2003. The Flint Assemblage. In A. Golani. *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata* (IAA Reports 18). Jerusalem. Pp. 171–182.

Binford L.R. 1981. *Bones: Ancient Men and Modern Myths.* New York.

Boessneck J. 1969. Osteological Differences between Sheep (*Ovis aries* Linne) and Goat (*Capra hircus* Linne). In D. Brothwell and E.S. Higgs eds. *Science in Archaeology: Survey of Progress and Research* (2nd ed.). London. Pp. 331–358.

Crabtree P.J. 1990. Zooarchaeology and Complex Societies: Some Uses of Faunal Analysis for the Study of Trade, Social Status, and Ethnicity. In M.B. Schiffer ed. *Archaeological Method and Theory* 2. Tucson. Pp. 155–205.

Davis S.J.M. 1976. Mammal Bones from the Early Bronze Age City of Arad, Northern Negev, Israel: Some Implications Concerning Human Exploitation. *JAS* 3:153–164.

Davis S.J.M. 1987. *The Archaeology of Animals*. New Haven–London.

Driesch A. von den 1976. *A Guide to the Measurement of Animal Bones from Archaeological Sites* (Peabody Museum Bulletin 1). Cambridge, Mass.

Golani A. 2003. *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata* (IAA Reports 18). Jerusalem.

Golani A. This volume. Rescue Excavations at the Early Bronze Age Site of Qiryat Ata—Area S.

Greenberg R. 2003. Cylinder-Seal Impressions. In A. Golani. *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata* (IAA Reports 18). Jerusalem. Pp. 203–207.

Hesse B. 1997. Cattle and Oxen. In E.M. Meyers ed. *The Oxford Encyclopedia of Archaeology in the Near East* I. New York–Oxford. Pp. 442–443.

Hesse B. and Wapnish P. 1985. *Animal Bone Archaeology: From Objectives to Analysis.* Washington, D.C.

Hopkins D.C. 1997. Agriculture. In E.M. Meyers ed. *The Oxford Encyclopedia of Archaeology in the Near East* I. New York–Oxford. Pp. 22–30.

Horwitz L.K. 1990. The Origin of Partially Digested Bones Recovered from Archaeological Contexts in Israel. *Paléorient* 16/1:97–106.

Horwitz L.K. 1996. The Faunal Remains from Me‘ona. *‘Atiqot* 28:37–39.

Horwitz L.K. 2003. Early Bronze Age Animal Exploitation at Qiryat Ata. In A. Golani. *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata* (IAA Reports 18). Jerusalem. Pp. 225–241.

Horwitz L.K. and Tchernov E. 1989. Animal Exploitation in the Early Bronze Age of the Southern Levant: An Overview. In P. de Miroschedji ed. *L'urbanisation de la Palestine à L'âge du Bronze ancien: Bilan et perspectives des recherches actuelles* (BAR Int. S. 527). Oxford. Pp. 279–296.

Horwitz L.K., Tchernov E., Mienis H.K., Hakker-Orion D. and Bar-Yosef Mayer D.E. 2002. The Archaeozoology of Three Early Bronze Age Sites in Naḥal Besor, North-Western Negev. In E. C.M. van den Brink and E. Yannai eds. *In Quest of Ancient Settlements and Landscapes: Archaeological Studies in Honour of Ram Gophna.* Tel Aviv. Pp. 107–133.

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* 45:279–297.

Kansa E.C., Kansa S.W. and Levy T.E. 2006. Eat Like an Egyptian? A Contextual Approach to an Early Bronze I "Egyptian Colony" in the Southern Levant. In M. Maltby ed. *Integrating Zooarchaeology (Proceedings of the 9th Conference* *of the International Council of Archaeozoology, Durham, August 2002)*. Oxford. Pp. 76–91.

Ktalav I. This volume. Molluscs from the Early Bronze Age Site at Qiryat Ata—Area N.

Lernau H. 1978. Faunal Remains, Strata III–I. In R. Amiran. *Early Arad—The Chalcolithic Settlement and Early Bronze City* I: *First–Fifth Seasons of Excavations, 1962–1966.* Jerusalem. Pp. 83–113.

Maher E.F. 2006/2007. Imminent Invasion: The Abandonment of Philistine Ekron. In T.P. Harrison ed. *Cyprus, The Sea Peoples and the Eastern Mediterranean: Regional Perspectives of Continuity and Change* (*Scripta Mediterranea* 27–28). Toronto. Pp. 323–337.

Mazar A. 1990. *Archaeology of the Land of the Bible, 10,000–586 B.C.E.* New York.

Munsell Soil Color Charts. 2000. Baltimore.

Payne S. 1973. Kill-Off Patterns in Sheep and Goats: The Mandibles from Aşvan Kale. *Anatolian Studies* 23:281–303.

Payne S. 1985. Morphological Distinctions between the Mandibular Teeth of Young Sheep, *Ovis*, and Goats, *Capra. JAS* 12:139–147.

Payne S. and Bull G. 1988. Components of Variation in Measurements of Pig Bones and Teeth, and the Use of Measurements to Distinguish Wild from Domestic Pig Remains. *ArchaeoZoologia* 2:27–65.

Perkins D. and Daly P. 1968. A Hunter's Village in Neolithic Turkey. *Scientific American* 219: 97–106.

Prummell W. and Frisch H.J. 1986. A Guide for the Distinction of Species, Sex, and Body Side in Bones of Sheep and Goat. *JAS* 13:567–577.

Redding R.W. 1984. Theoretical Determinants of a Herder's Decisions: Modeling Variation in the Sheep/Goat Ratio. In J. Clutton-Brock and C. Grigson eds. *Animals and Archaeology* 3: *Early Herders and Their Flocks* (BAR Int. S. 202). Oxford. Pp. 223–241.

Redding R.W. 1994. The Vertebrate Fauna. In S.C. Herbert. *Tel Anafa* I, i: *Final Report on Ten Years of Excavation at a Hellenistic and Roman Settlement in Northern Israel.* Ann Arbor. Pp. 279–322.

Reese D.S. 2003. Marine and Freshwater Shells from Qiryat Ata. In A. Golani. *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata* (IAA Reports 18). Jerusalem. Pp 253–261.

Rosen B. 1986. Subsistence Economy of Stratum II. In I. Finkelstein. *'Izbet Ṣarṭah: An Early Iron Age Site near Rosh Ha'ayin, Israel* (BAR Int. S. 299). Oxford. Pp. 156–185.

Rowan Y.M. 2003. The Groundstone Assemblage. In A. Golani. *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata* (IAA Reports 18). Jerusalem. Pp. 183–202.

Sade[h] M. 2000. Animal Bones from Qiryat 'Ata, Area L. *Tel Aviv* 27:57–60.

Sade M. 2007. The Fauna from the Early Bronze Age II Stratum at Qiryat Ata. *Qamma* 1:35*–38*.

Schmid E. 1972. *Atlas of Animal Bones: For Prehistorians, Archaeologists and Quarternary Geologists.* Amsterdam–London–New York.

Seger J.D., Baum B., Borowski O., Cole D.P., Forshey H., Futato E., Jacobs P.F., Laustrup M., O'Connor-Seger P. and Zeder M. 1990. The Bronze Age Settlements at Tell Halif: Phase II Excavations, 1983–1987. In W.E. Rast ed. *Preliminary Reports of ASOR—Sponsored Excavations 1983–87* (BASOR Supplement 26). Baltimore Md. Pp. 1–32.

Sella I. 1995. Sea Turtles in the Eastern Mediterranean and Northern Red Sea. In K.A. Bjorndal ed. *Biology and Conservation of Sea Turtles (Proceedings of the World Conference on Sea Turtle Conservation, Washington, D.C., 26–30 November 1979).* Washington, D.C. Pp. 417–423.

Shamir O. 2003. Spindle Whorls. In A. Golani. *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata* (IAA Reports 18). Jerusalem. Pp. 209–215.

Silver I.A. 1969. The Ageing of Domestic Animals. In D. Brothwell and E.S. Higgs eds. *Science in Archaeology: A Survey of Progress and Research* (2nd ed.). London. Pp. 283–302.

Van Buskirk J. and Crowder L.B. 1994. Life-History Variation in Marine Turtles. *Copeia* 1994:66–81.

Wapnish P. and Hesse B. 2000. Mammal Remains from the Early Bronze Sacred Compound. In I. Finkelstein, D. Ussishkin and B. Halpern eds. *Megiddo* III: *The 1992–1996 Seasons* (Tel Aviv University Institute of Archaeology Monograph Series 18). Tel Aviv. Pp. 429–462.

Zeder M.A. 1991. *Feeding Cities: Specialized Animal Economy in the Ancient Near East.* Washington D.C.–London.