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Early Bronze Age Fauna from Tel Lod

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Introduction

Archaeological excavations in the Remez Neighborhood at Tel Lod (Site 41; see Brink et al. 2015:142, 144, Table 1, Fig. 2) yielded a small zooarchaeological assemblage.[1] This assemblage dates primarily to Early Bronze Age IB (Strata VII–IV), while the material from the latest occupation (Strata III–II) dates to very late EB IB or the EB IB/EB II transition (Table 1; see Golani, this volume). The sample was collected from over 40 loci and consists of nearly 700 bone fragments, of which 274 specimens (39.1%) were identified. These remains represent over 30 individual animals from at least a dozen different species. Although small, the sample enables general observations to be made regarding consumption patterns, economic strategies, refuse disposal, symbolism and site formation processes.

Methods

The faunal sample was recovered primarily by hand, although certain loci, such as floors, surfaces, debris above floors and fills in pits or ceramic vessels, were sifted through a 10 mm mesh screen. Identification was difficult in a few instances, where hard-packed sediment adhered to bone and tooth surfaces and could not be readily removed, either chemically or mechanically, without compromising the structural integrity of the specimens. Such adhering sediment also obscured evidence of bone modifications, such as butchery marks, pathologies and carnivore damage, and impeded bone and tooth measurement.

Species identification was assisted by the following manuals: Boessneck (1969), Halstead Collins and Isaakidou (2002), Lister (1996), Schmid (1972), Payne (1985) and Prummell and Frisch (1986). Identifications were checked via consultation with the modern comparative vertebrate collection stored in the National Natural History Collections of the

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Hebrew University of Jerusalem. Most of the sheep and goat remains were pooled into a general 'ovicaprine' category, due to the high morphometric similarity between the two species. Remains of mammals that could not be identified to taxa were classified into size groups: small, medium and large. Remains in an advanced stage of fragmentation that could not be assigned to a size group were considered unidentifiable. The question of whether cattle, sheep/goats and pigs were butchered on-site, or merely imported to the site as choice body parts, was assessed by allotting identified specimens to five body-part categories: crania (skull, mandible and maxilla), forelimb (scapula, humerus, ulna, radius and metacarpal and carpal bones), hind limb (pelvis, femur, patella, tibia and metatarsal and tarsal bones), axial elements (ribs and vertebrae) and feet (phalanx). The representation of animal body parts holds the potential of illuminating how communities processed their animals, considering that some bones bear more meat than others and are presumed to be of high utility. Bones of low meat utility, such as post-cranial slaughter offal—phalanges, tarsals, and carpals, should correspond to slaughter waste, while those of high utility should correspond to butchery refuse (Hellwing and Gophna 1984; Horwitz 1999).

The age at death of individual animals was estimated based on the fusion rates of post-cranial epiphyses and dental eruption sequences (Silver 1969; Bull and Payne 1982; Schmid 1972); dental attrition scores were also employed for aging sheep and goat (Payne 1973; Zeder 1991:93). Metric data were generally obtained from fairly complete specimens in accordance with Driesch (1976); the measurement of pig canine teeth was based on Mayer and Brisbin (1988). The data were quantified in two ways: the number of identifiable specimens (NISP) that provides a count of bone fragments per taxon, and the minimum number of individuals (MNI) that was calculated by siding the most commonly occurring bone or tooth and accounting for the portion preserved (proximal/distal end or mid-shaft fragment) and stages of epiphyseal fusion (unfused, fusing and fused). Both approaches have their advantages and limitations and neither method alone accurately measures the relative proportion of animal abundance. Since these proportions must lie somewhere between the NISP and the MNI (Hesse and Wapnish 1985:114) both measures of abundance provide a probable range of frequency (Crabtree 1990:159–160).

The color of each burned bone was coded using the *Munsell Soil Color Chart* (1954), which offers a standardized replicable method of description. This color reflects the fire temperature to which the bones were exposed, wherein brown and black bones are associated with temperatures that were cooler than those that produced white or blue-gray bones, as demonstrated experimentally (Shipman, Foster and Schoeninger 1984; Nicholson 1993).

Zooarchaeological material from chronologically non-secure loci, such as topsoil, balk trim and general fill deposits, were excluded from the study, as such faunal remains cannot be directly dated; no significant morphological alterations in skeletal anatomy of Near Eastern mammals are evident in the last ten thousand years that could be diagnostic of chronology (Davis 1987:31; Hesse and Rosen 1988:118). Such methodological selection attempts to restrict the impact of stratigraphic mixing and contamination. The remaining assemblage was retrieved from debris deposits, associated with surfaces, accumulations above floors

Table 1. Distribution of Fauna by Types of Contexts

Period / Context	EB IB (Strata VII–IV)		EB IB or EB IB/EB II (Strata IV/III)		EB IB/EB II (Strata III–II)		Total	
	NISP	% NISP	NISP	% NISP	NISP	% NISP	NISP	% NISP
Debris accumulation	235	80.8	36	76.6	162	46.8	433	63.3
Debris on surfaces					82	23.4	82	11.8
Debris below surfaces	51	17.5					51	7.5
Surfaces	5	1.7	2	4.3	60	17.3	67	9.8
Debris within kiln					43	12.4	43	6.3
Fill (probe)			9	19.1			9	1.3
Total	*291*	*100.0*	*47*	*100.0*	*347*	*100.0*	*685*	*100.0*

and fills of a well-defined spatial extent (Table 1). These remains are generally taken to represent the Early Bronze Age animal economy and life-ways at Tel Lod, although it is noteworthy that some degree of contamination with material of a later date is a possibility.

For the purpose of analysis, the data from the different strata were largely grouped into two assemblages, one of EB IB (Strata VII–IV) and another of EB IB/EB II (Strata III–II), due to the small sample size. Nonetheless, the relationship between the fauna and the architectural remains and contexts of each stratum is described in separate subsections. A small assemblage (n = 47) from loci for which the stratigraphic attribution was not clearly determined, and that were generally ascribed to Strata IV/III, was also examined. Although this material is presented below at the end of the section on the EB IB assemblage, it may include remains of either EB IB or the subsequent EB IB/EB II transition.

Results

Early Bronze Age IB

Strata VII–IV

A collection of nearly 300 animal bones, of which 112 (37.3%; Table 2) were identified, was retrieved from these strata. Most of the remains were found in debris accumulations (n = 235, 78.3%), while the remainder were associated with surfaces (n = 56, 18.6%). The most common identified taxa comprise domestic species: cattle, ovicaprines, pigs and a small equid. Sheep remains (n = 4) were slightly more abundant than those of goats (n = 2). The presence of mountain gazelle (*Gazella gazella*) was determined based on the morphology of its horn core (see Tchernov, Dayan and Yom-Tov 1986–87). Other wild species include fallow deer (*Dama dama mesopotamica*) and hare (*Lepus capensis*).

Table 2. Species Composition and Abundance by Period

Period / Species	EB IB (Strata VII–IV)				EB IB or EB IB/EB II (Strata IV/III)				EB IB/EB II (Strata III–II)				*NISP Total*
	NISP		MNI		NISP		MNI		NISP		MNI		
	N	%	N	%	N	%	N	%	N	%	N	%	
Sheep/goat (*Ovis/Capra*)	71	63.4	4	29	12	75	1	33	77	52.7	6	33.3	*160*
Sheep (*Ovis aries*)	4	3.6	1	7					8	5.5	1	5.6	*12*
Goat (*Capra hircus*)	2	1.8	1	7					6	4.1	1	5.6	*8*
Cattle (*Bos taurus*)	23	20.5	1	7	3	18.8	1	33	19	13.0	2	11.1	*45*
Dog (*Canis familiarus*)									19	13.0	3	16.7	*19*
Pig (*Sus scrofa*)	6	5.4	2	14					4	2.7	1	5.6	*10*
Wild boar (*Sus scrofa*)									9	6.2	1	5.6	*9*
Deer (*Cervidae*)									1	0.7	1	5.6	*1*
Fallow (*Dama dama mesopotamica*)	1	0.9	1	7									*1*
Red (*Cervus elaphus*)									1	0.7	1	5.6	*1*
Donkey (*Equus asinus*)	1	0.9	1	7	1	6.2	1	33					*2*
Mountain Gazelle (*Ga-zella gazella*)	2	1.8	1	7									*2*
Cat (*Felis sp.*)	1	0.9	1	7									*1*
Hare (*Lepus capensis*)	1	1.0	1	7									*1*
Aves sp. (*unidentified*)									2	1.4	1	5.6	*2*
Small mammal									1				*1*
Medium mammal	118				15				126				*259*
Large mammal	33				10				43				*86*
Unidentified	28				6				31				*65*
Total identified	*112*	*100.0*	*14*	*100*	*16*	*100.0*	*3*	*100*	*146*	*100.0*	*18*	*100.0*	*35*
Total	*291*				*47*				*347*				*685*

A small collection of 19 ovicaprine post-cranial bones from Strata VII–IV (Table 3) provided ageing data, demonstrating whether animals were culled for their meat or other economic purposes. Identifying clear patterns in slaughter schedule is problematic with such a small sample, and at a minimum, the evidence shows the exploitation of sub-adults (< 30 months), indicating the use of the herd mainly for meat. An ovicaprine mandible, for which dental attrition was documented, indicated the same age class.

Table 3. Epiphyseal Fusion Data for the Main Domestic Animals from Early Bronze Age IB Strata VII–IV

Species/Bone	Quantity	Age at Death
Cattle		
Fused proximal phalange	3	>18 months
Fused distal tibia	1	>24–30 months
Fused distal metapodial	1	>24–36 months
Unfused proximal ulna	1	<42–48 months
Ovicaprine		
Fused proximal radius	3	>10 months
Fused proximal phalange	3	>13–16 months
Unfused distal metacarpal	1	<18–24 months
Fused distal metacarpal	1	>18–24 months
Unfused calcaneum	3	<24–30 months
Unfused proximal femur	2	<24–30 months
Fused proximal femur	1	>24–30 months
Unfused distal radius	2	<36 months
Unfused distal femur	1	<36–42 months
Fused distal humerus	2	>36–42 months
Pig		
Fused distal metatarsal	1	>27 months
Total	*26*	

Even fewer bones (n = 6; Table 3) provided the basis for ageing cattle. An unfused ulna indicated the presence of an animal less than 48 months old at death, while the rest of the ageable bones demonstrated the presence of younger individuals, sub-adults and adults. Animals reaching ages beyond 42 months indicate that the breeding strategy was concerned with maintaining long term herd viability and security, and aimed at obtaining secondary products such as dairy and labor. Extracting these products would not require the animal's death, and culling of aged animals would have taken place when their productivity waned.

Only one pig bone provided useful mortality data (Table 3): a fused distal end of a hog metatarsal belonged to an individual at least 27 months old that may have been kept for breeding purposes. An unerupted lower third molar from a younger specimen, aged less than 19–23 months (see Bull and Payne 1982), indicates that the animal was likely exploited for pork.

A few of the remains bore evidence of cultural modification. One limb bone shaft of a medium-sized mammal from a debris accumulation (Stratum IV, L136) was highly polished, and may have been part of a tool. A total of 20 burned bones, of which only six were recovered from burned contexts, were found in association with various surfaces and debris accumulations. Burned remains belonged to cattle (n = 3), fallow deer (n = 1), ovicaprines (n = 6) and medium-sized mammals (n = 10). Most of the burned remains of the EB IB

strata (n = 11) were retrieved from Stratum IV, and were of axial elements, mainly ribs, and limb bones. Eleven burned bones were either black (10YR 2/1) or brown (10YR 3/2, 10YR 4/2), suggesting their direct exposure to fire, likely in the context of meal preparation. This conclusion is reinforced by the observation that most of the burned bones were meat-rich rib and limb portions. The remaining nine burned bones, mostly found in Building 4 of Stratum IV, were of gray (10YR 5/1) and dark gray (10YR 4/1) colors, indicating exposure to yet higher fire temperatures. These small concentrations of burned bones included axial and limb elements, as well as less meaty bones among them phalanges, a carpal and a metacarpal. Exposing bones of low meat utility to high fire temperatures may be related to refuse disposal by burning rather than meal preparation.

The available data on foot and limb bones for Strata VII–IV (Table 4) are too small to allow evaluating body-part representation for all species. Nonetheless, the presence of both meaty and non-meaty bones for both cattle and ovicaprines suggests that some on-site butchery took place. Still, butchery refuse of sheep and goats seems to be somewhat overrepresented in the assemblage, suggesting that these animals were mainly processed away from the settlement and later brought to the settlement as joints of meat.

Stratum VII.— It is noteworthy that the Stratum VII fauna (n = 67), which was not associated with architectural remains and was retrieved from accumulations of burned debris and small stones, yielded the only equid specimen from a clearly dated context of the excavation, probably belonging to a donkey. These deposits also produced four burned bones that included a fallow deer phalanx.

Stratum VI.— A small sample from Stratum VI (n = 8) consisted of two cattle bones, five bones of a medium-sized mammal and one bone from a large mammal. These remains were found exclusively within an enclosed area (L141) with two entrances, possibly used for animal penning. The stone walls of this enclosure (W24 and W33) seemed to have been built to partition space rather than to serve as weight-bearing architectural features. No zooarchaeological remains were found outside and to the east of the enclosure. A pivot stone found adjacent to one of the two entrances, situated on the eastern side of the enclosure, may have been part of a wooden gate, controlling access to it. A rounded mud-brick installation (L158) that obstructed the other enclosure entrance, situated on its southern side, yielded one of the burned bones mentioned above, a gray-colored (10YR 5/1) cattle vertebrae, which was found among ashy debris. The bone appears to have been part of the combustion event within the installation, which was likely constructed at a later time than the enclosure (see Golani, this volume).

Stratum V.— The Stratum V sample consists of only three bones, an ovicaprine metacarpal and two medium-sized mammal bone fragments, all of which were found in Sqs A/2–3. No bones were found in association with another large enclosure constructed at this time that resembled the Stratum VI enclosure in its general layout and canceled the previous structure.

Table 4. Fragmentation of Limb and Foot Elements of Early Bronze Age IB Strata VII–IV

Species/Bone	Preserved Part					Total
	Distal	Fragment	Proximal	Shaft	Complete	
Cattle	2	4	4	1	3	14
Carpal		1			2	3
Humerus				1		1
Metapodial	1					1
Metatarsal			1			1
1st Phalanx		1	1			2
2nd Phalanx					1	1
Pelvis		2				2
Tibia	1					1
Ulna			2			2
Deer		1				1
1st Phalanx		1				1
Hare				1		1
Tibia				1		1
Sheep/goat	4	11	13	5	3	36
Calcaneum		2	1			3
Femur			1	2		3
Humerus	1			1		2
Metacarpal	1		2		1	4
Metapodial			1	1		2
Metatarsal			2			2
1st Phalanx			1			1
2nd Phalanx					1	1
3rd Phalanx					1	1
Pelvis		6				6
Phalanx			1			1
Radius	1		2	1		4
Scapula			1			1
Tibia	1					1
Sheep	1		1		1	3
Astragalus					1	1
Femur			1			1
Humerus	1					1
Pig	1					1
Metatarsal	1					1

Stratum IV.— This occupation produced the largest faunal assemblage of EB IB in the excavation (n = 190). The fauna-bearing loci were grouped according to their association with three mud-brick buildings and an open area located between them (Table 5). Most of the animal remains came from Building 4, while the remainder originated mostly from Buildings 1 and 3. Only a few remains came from the open area and none were found in Building 2, of which only a very small part was exposed. Limited information could be gleaned from the spatial distribution of the fauna due to the small sample size. Building 4 yielded the majority of cattle remains, and the only specimens of a mountain gazelle, a hare and what seems to be a domestic cat (*Felis* sp.). Ovicaprines were most abundant in Building 1, where the only pig remains were found. The distribution of animal body parts provided only limited insight. Of possible significance are the observations that foot bones from all animals were found only in Building 3 and that forelimbs were only associated with Building 4 (Table 6). The two sides of the body of cattle and ovicaprines generally occur in nearly equal numbers in the different buildings and the open area, except for the ovicaprine remains in Building 4 that were asymmetrically represented (nine left and two right specimens; Table 7). The distribution of eleven burned bones of Stratum IV is as follows: one in Building 1, four in Building 3 and six in Building 4.

Strata IV/III

This small assemblage comprises remains from loci that could not be securely attributed to either Stratum IV or III. Of the total of 47 bones from these contexts 16 (34%; Table 2) could be identified. The majority of the remains came from debris accumulations, and a few fragments were associated with surfaces and well-delineated contexts of fill. The identified

Table 5. Spatial Distribution of Species in Stratum IV

Context / Species	Building 1	Building 3	Building 4	Open Area	Total
Cattle	1	1	9		11
Sheep/Goat	25	9	15	1	50
Sheep	2		1		3
Goat				1	1
Cat (domestic?)			1		1
Gazelle			1		1
Hare			1		1
Pig	2				2
Large mammal	7	3	9		19
Medium mammal	15	25	36	5	81
Unidentified	1	10	9		20
Total	*53*	*48*	*82*	*7*	*190*

Table 6. Spatial Distribution of Animal Body Parts in Stratum IV

Context / Species/Body Parts	Building 1	Building 3	Building 4	Open Area	Total
Cattle	1	1	9		11
Crania			3		3
Foot		1			1
Forelimb			1		1
Hind limb	1		1		2
Metapodial: lower fore/hind limb			4		4
Ovicaprines	27	9	16	2	54
Axial bones	1	1	1		3
Crania	19	2	4	1	26
Foot		3			3
Forelimb			7		7
Hind limb	7	3	3	1	14
Metapodial: lower fore/hind limb			1		1
Pig	2				2
Crania	1				1
Hind limb	1				1
Total	*30*	*10*	*25*	*2*	*67*

Table 7. Representation of Animal Body Side in Different Buildings of Stratum IV

Context / Species/Side	Building 1	Building 3	Building 4	Open Area	*Total*
Cattle	1		1		*2*
Left	1				*1*
Right			1		*1*
Ovicaprine	22	2	11	1	*36*
Left	10	1	9	1	*21*
Right	12	1	2		*15*
Total	*23*	*2*	*12*	*1*	*38*

remains belong to ovicaprines, cattle and a donkey. The ovicaprine remains could not be distinguished as to species.

Only a few of the remains could be aged: the sheep/goat bones included a fused proximal radius (>10 months), an unfused distal metacarpal (<24–30 months), an unfused distal radius (<36 months) and an unfused ulna (<36 months). A fused *Bos* calcaneum (>36–42 months) and a fused proximal end of a first phalange (>13–15 months) of a small equid were also found.

The few modified bones comprise a pelvic fragment of an ovicaprine ilium from a surface locus (L121) that was the only bone with cut marks; and four burned bones, three black-colored (10YR 2/1) and one gray (10YR 4/1), that were found in debris accumulations (L124 and L161). The predominantly black color of these burned bones and the fact that they belonged to meat-rich body parts (limb shafts and an axial fragment) suggest that the animals were prepared for consumption.

EARLY BRONZE AGE IB–II TRANSITION

Strata III–II

These strata yielded a total of 347 animal bones, of which 146 (42.1%; Table 2) could be identified. Most of the fauna is derived from debris accumulations, while the remainder was associated with a pottery kiln. Most of the Strata III–II assemblage comprises domestic species: cattle, sheep, goats, pigs and a donkey. A goat horncore with a twisted cork-screw shape demonstrated morphological evidence for the domestic status of this individual. Sheep remains (n = 8) were slightly more abundant than those of goats (n = 6). The few remains of wild species indicate the presence of a wild boar (see below), an antler tine fragment of an unidentified deer species and the phalange of a red deer (*Cervus elaphus*). Two fragments of unidentified bird bones were also found.

Here as well, ageing data could be retrieved from only a few specimens, consisting of sheep and goat bones (n = 22; Table 8). The available data demonstrate that mostly yearlings and sub-adults were culled, while a few animals beyond the age of 30–42 months were present. The dental attrition scores from five ovicaprine mandibles with associated premolars and molars indicated the presence of two individuals culled at the age of 1–2 years and three mature individuals aged 6–8 years. Although the small sample prohibits a precise determination of the culling strategy, it is observed that various age classes are represented in the assemblage, indicating a mixed economy combining the use of animals for their meat, secondary products (dairy, wool and hair) and labor, and that herds were maintained at least in part for breeding purposes.

Seven bones provided ageing data for cattle (Table 8), revealing the absence of calves and yearlings, and the presence of individuals culled before the age of 42–48 months, based on three unfused bones; it was not possible to determine how much younger these animals were at death than the age of 42–48 months, underscoring one of the limitations of this aging method. At least one fully mature animal (>48 months) is evident in the assemblage. One pig bone, an

Table 8. Epiphyseal Fusion Data for the Main Domestic Animals from Early Bronze Age IB–II Transition Strata III–II

Species/Bone	Quantity	Approximate Age at Death
Cattle		
Fused scapula	1	>7–10 months
Fused proximal radius	1	>12–18 months
Unfused calcaneum	1	<36–42 months
Unfused ulna	2	<42–48 months
Fused distal ulna	1	>42–48 months
Fused proximal tibia	1	>42–48 months
Ovicaprine		
Unfused scapula	1	<6–8 months
Fused scapula	2	>6–8 months
Unfused distal radius	1	<10 months
Fused proximal radius	1	>10 months
Fused proximal phalange	2	>13–16 months
Fused distal metacarpal	1	>18–24 months
Fused distal tibia	2	>18–24 months
Unfused proximal femur	2	<24–30 months
Unfused calcaneum	2	<24–30 months
Unfused proximal ulna	1	<30 months
Fused distal ulna	3	>30 months
Unfused proximal tibia	1	<36–42 months
Unfused proximal humerus	1	<36–42 months
Fused distal humerus	2	>36–42 months
Pig		
Unfused distal ulna	1	<36–42 months
Total	*30*	

unfused ulna, indicated the presence of an individual less than 42 months at death (Table 8). An erupted upper third molar of a pig came from an individual at least 18 months old (Schmid 1977, Table 10a; Fig. 1).

A small number of bones were culturally altered: a limb bone shaft from a medium-sized mammal (Stratum III, L117, Room 1) exhibited a polished surface, and may have been part of a tool; an ovicaprine femur shaft from a debris accumulation (L113) bore cut marks; fourteen burned bones came from various contexts of surfaces and debris accumulations (L106, L107, L108, L111, L114, L117, L123 and L138) that did not provide any other evidence of burning. Of the burned assemblage, most of which (n = 11) came from Stratum III, two bones were identified as a sheep and a goat, while the others were recognized as originating from medium- and large-sized mammals. Four blackened bones (10YR 2/1)

were limb shafts, possibly indicating meal preparation, and ten gray-colored bones (10YR 3/1, 10YR 4/1, 10YR 5/1, and 10YR 6/2) may reflect refuse disposal through burning, a suggestion that may be reinforced by the observation that these bones were of low nutritional yield (e.g., a phalanx and an astragalus). The gray-colored bones also included limb bone shafts.

As noted above for the EB IB occupation, the sample of available foot and limb bones for Strata III–II (Table 9), while it is rather small, demonstrates the combination of both meaty and non-meaty bones for both cattle and ovicaprines. Animals of the latter group were likely butchered mostly off-site and later delivered to the settlement as meat-bearing portions.

Stratum III.— This occupation produced the largest assemblage of any one stratum in the present study (n = 241), which was associated with remains of stone and mud-brick architecture. Very small samples of poorly preserved remains of medium-sized mammals were obtained from two rooms of this stratum (Room 1: n = 5; Room 2: n = 17). The finding of limbs and axial fragments of meat-rich ribs in these rooms indicates that these were the remains of consumption refuse.

The remainder of the Stratum III fauna included 29 bones from Sqs B/2–3, most of which were limb shaft fragments of large- and medium-sized mammals, while a few of the bones were identified as those of cattle, sheep and goats. Also found in this area were the two deer remains mentioned above, the antler tine in Sq B/3 (L131) and the phalanx of a red deer from a surface locus (L126) in Sq C/3. The largest Stratum III sample was retrieved from Sqs C/2–3 (n = 190), most of it coming from Sq C/3 (n = 129), and comprising cattle, ovicaprines and dog remains.

The pottery kiln in Sq C/3 (L160) yielded 43 animal bones, belonging to juvenile and adult sheep, goats and canines. The remains of at least three puppies, the only dog remains from this excavation, comprise cranial, forelimb and hind-limb fragments. As all three individuals were younger than 9 months at death, based on the identification of three unfused distal humerii, they may have belonged to the same litter. None of the bone remains from the kiln were burned, although they were found in the midst of ashy debris. It seems therefore, that their deposition in the kiln occurred after it had fallen out of use. The absence of ceramic wasters from pottery production in or near the kiln reinforces the possibility that the nature of human activity in this area changed prior to the deposition of the bones within the kiln (see Golani, this volume). The bones may have been deposited in the enclosed space of the kiln as a means of refuse disposal, or perhaps the animals used the kiln as shelter.

Stratum II.— This stratum produced a sample of 79 animal bones, all from Sq C/2. The bones were associated with meager remains of beaten-earth surfaces and walls, which did not configure into a clear architectural plan. A pig maxilla, teeth and an ulna were part of this assemblage. Measurement of the adult pig maxilla and associated dentition were compared to published data on domestic and wild hogs (Payne and Bull 1988:54–57, Table

Table 9. Fragmentation of Limb and Foot Elements of Early Bronze Age IB–II Transition Strata III–II

Species/Bone	Preserved Part					Total
	Distal	Fragment	Proximal	Shaft	Complete	
Cattle	2	3	6		3	14
Astragalus					1	1
Calcaneum					1	1
Femur			1			1
Metatarsal			1			1
1st Phalanx					1	1
3rd Phalanx		1				1
Pelvis		1				1
Radius			1			1
Scapula	1	1				2
Tibia			1			1
Ulna	1		2			3
Deer					1	1
1st Phalanx					1	1
Dog		9				9
Femur		3				3
Humerus		6				6
Sheep/goat	9	7	12	8	8	44
Astragalus					2	2
Calcaneum					2	2
Femur			2	2		4
Humerus	1			1	1	3
Lateral malleolus					1	1
Metacarpal	1					1
Metapodial				1		1
Metatarsal			5			5
1st Phalanx					1	1
2nd Phalanx					1	1
Pelvis		5				5
Radius			2	4		6
Scapula	2	2	1			5
Tibia	2		1			3
Ulna	3		1			4
Pig	1					1
Ulna	1					1

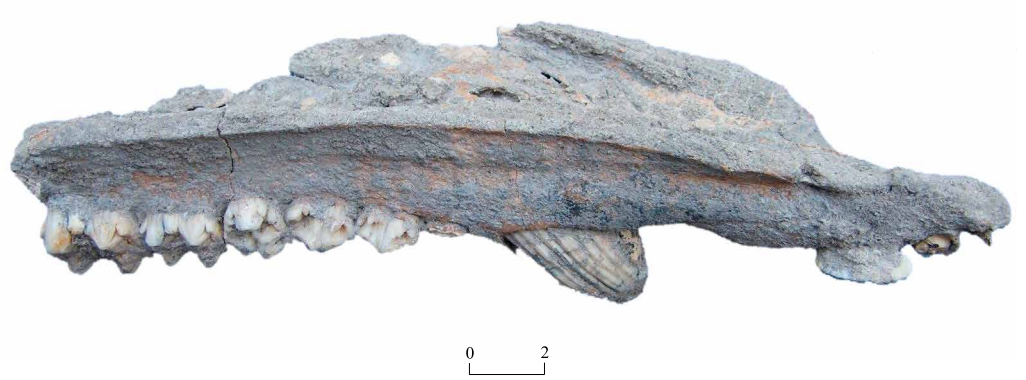

Fig. 1. Upper left jaw (maxilla) and dentition of a female wild boar from EB II Stratum II.

Fig. 2. Enlarged view of upper canine tooth of the wild boar maxilla from Stratum II.

1a–b; Grigson 1995:443, App. 10.3), indicating that it belonged to a wild boar (Fig. 1; Table 10). The small size and shape of the pig canine tooth (Fig. 2) suggest that it belonged to a female: it extended ventrolaterally rather than protruding upward out of the socket in an anteriolateral direction, and was generally triangular rather than trapezoidal in cross-section (Mayer and Brisbin 1988:411–412). This tooth also featured defined concave seams that ran along its length. The boar maxilla, found in association with a surface (L106) and next to W4, may have been transported to the settlement from a distant kill site, perhaps intended for public display as a trophy to commemorate a successful hunt. Since animal heads provide less nutritional yield than other meat-rich parts of the body, such as limbs and axial elements, it is unlikely that the maxilla was brought to the settlement merely for consumption purposes.

Table 10. Metric Data for the Main Domestic Animals[i]

Species and Bone/Tooth	EB IB (mm)	EB IB/EB II (mm)
Cattle		
Astragalus		GLm 58.0, GLl 62.4, Bd 41.9
Calcaneum		GB 39.6
Metatarsal	Bp 48.6	
		Bp 42.4
3rd Phalange		HP 42.1, Ld 71.4, MBS 34.1
Goat		
Metacarpal		Bd 24.7
Scapula		BG 21.9, LG 27.3, GLP 35.5
Sheep		
Astragalus	GLm 30.9, GLl 31.7, Bd 22.3	
Femur	DC 23.9	
Humerus	Bd 30.5	Bd 30.5
Pig		
Canine upper		Exposed length 28.0, socket length 37.1
Incisor upper		B 6.4, L 19.3
1st molar upper		B 15.2, L 18.8
2nd molar upper		B 18.3, L 23.8
3rd molar upper		B 22.0, L 31.5
Maxilla		Distance between alveoli M3–canine (measurement 26) 71.9, length of cheek tooth row (measurement 27) 161.8, length of cheek tooth row M3–Pm2 (measurement 27a) 122.8, length of molar row (measurement 28) 80.7
2nd premolar upper		B 6.7, L 13.7
3rd premolar upper		B 9.8, L 15.3
4th premolar upper		B 14.5, L 15.0

[i] For abbreviations of measurements, see Driesch 1976.

Discussion

Interpretation of the results from the analysis of the Early Bronze Age faunal assemblage from Tel Lod must take into account the effect of sample size. This is also the case with conducting inter- and intra-site comparisons. The relatively small assemblages retrieved from the present excavation are in part a result of the considerable disturbance of the subsurface layers in the urban environment of modern Lod. Moreover, despite the fact that the excavation extended over a substantial area (c. 120 sq m) and employed screening (see

above), it is evident that certain small bones, either the smaller bones of large species or those of small species, such as fish and rodents, are absent from the assemblage. The further impact of differential preservation due to hydrodynamic sorting of the bones, involving their movement and redistribution by running water, should also be considered in this regard (see, e.g., Wolff 1973; Behrensmeyer 1975; Shipman 1981). It was noted that the surface of the excavation area was covered by extensive alluvial sediments (see Golani, this volume), most likely deposited by the nearby Naḥal Ayyalon. The combined impact of coarse screening and differential preservation is indicated in the faunal assemblage by the low representation of small elements, including phalanges, unfused proximal and distal epiphyses of long bones and isolated teeth. Smaller, lighter and less dense bones, particularly those of younger animals, are the most likely candidates for displacement and removal (e.g., Gutiérrez and Kaufmann 2007; Kaufmann et al. 2011). It is possible that seasonal floods had selectively removed parts of the faunal assemblage.

Intra-Site Diachronic Comparison

The proportion of identified bones, while it was somewhat variable among the strata, was nearly identical for the two largest samples from Strata IV and III (Stratum VII: 47.8%; Stratum VI: 25%; Stratum V: 33.3%, Stratum IV: 36.8%, Stratum III: 36.1%; Stratum II: 62%). Among the small samples, those that were relatively large (Strata VII and II; NISP >60) yielded elevated rates of identification, while those that were very small (Strata VI and V; NISP <10) yielded suppressed identification rates, indicating a strong sample-size effect. It may be suggested, therefore, that the agents affecting the assemblages of different strata were similar in their nature and intensity. These agents likely included cultural activities that directly affected the bones (butchery, meal preparation and discard) and others that indirectly affected them, e.g., leveling operations required for construction.

Although the number and composition of taxa varied from stratum to stratum the remains of domestic animals dominated all the assemblages. The exploitation of wild resources, although of limited extent, generally indicates a wide and varied resource base. Aquatic resources were not found in the present excavation, but they were exploited as fish was previously documented in Site 19 at Tel Lod (Brink et al. 2015:189, Tables 6, 9). The similarity in composition of exploited species among the different strata suggests the ecological stability in the region during the fourth millennium BCE.

The remains of wild species, which were either hunted (deer, gazelle and wild boar) or snared (hare), were most abundant in Stratum IV, but also occurred in small numbers in Strata VII, III and II, and were likely exploited at the excavation site throughout the EB sequence. Wild animal parts were often transported to Early Bronze Age settlements, although they were obtained at a distance from them, and it is quite likely that they were of some utility for the hunters. For example, deer antlers, which could have been collected after shedding or at a kill site, would have represented valued raw material intended for many uses. The antler tine from EB IB–II Stratum III could have served as an effective tool in flint knapping, or as an awl for leather working. The polish identified on a medium-sized mammal limb bone

fragment in Stratum III Room 1 may also have been employed in working animal skins. The finding of two deer phalanges (toe bones), one in Stratum VII and the other in Stratum III, indicates that hunted game was transported to the settlement in the animal's skin, retaining the foot bones that were of little nutritional value (see Perkins and Daly 1968:101–104). It is noteworthy that neither of these bones exhibited any signs of carnivore feeding (e.g., Horwitz 1990; Maher 2006–2007) that could indicate their introduction to the settlement by natural means. The deer first phalanx from Stratum VII was found in stratigraphic proximity to the polished bone from Stratum IV and therefore, there may have been a functional relationship between the two items.

The Stratum II wild boar maxilla may have been brought to the settlement as part of a complete skull for display as a trophy rather than for consumption purposes. The need for such symbolic communication may have been heightened during the EB IB–II transition, at a time of increasing population density in settlements and early urbanization. The meanings conveyed through the public presentation of animal head trophies would have been decoded, understood and evaluated by the resident population.

Although the faunal assemblages were generally too small to enable clear-cut identification of specialized activity areas, some general observations can be proposed, based either on the spatial distribution of bones or the architectural evidence. The Stratum VI enclosure wall may have been used as an animal pen, protecting domestic livestock from natural predators and human thievery. Situating the pen within the settlement rather than in an isolated and distant location probably ensured better security. The puppy skeletons found in the Stratum III pottery kiln appear to represent opportunistic disposal and should not be confused with purposeful dog burial known from other contexts, such as Chalcolithic-period Gilat (Levy 1995:237), EB IA Ashqelon Afridar (Kansa 2004:291–292) and many sites of the later Iron Age, Persian and Hellenistic periods (e.g., Haas 1971; Wapnish and Hesse 1993; Maher 2005; Horwitz 2015; Horwitz, Wolff and Ortiz 2017; Lev-Tov et al. 2018; Hesse and Maher, in prep.).

The possibility that the wool and hair of sheep and goat were exploited at Tel Lod in addition to their meat is suggested by the meager data available on herd mortality patterns from both EB IB and EB IB–II. These products may have been used as traded commodities, especially perhaps at the time of EB IB Stratum IV, when Egyptian imports such as ceramic storage jars and bowls are attested at the site (see Golani, this volume). Such imported ware is absent in subsequent Strata III and II. Wool and hair from livestock would be ideal products for trade as they were convenient to transport due to their light weight and the fact that they did not spoil. Transportability and trade would also be assisted by the availability of small equids, presumably donkeys.

Inter- and Intra-Site Synchronic Comparison

A comparison of faunal data from Stratum IV of the present excavation with those of the contemporary EB IB fauna from Site 19 in the Newe Yaraq Neighborhood at Tel Lod, previously studied by Horwitz (Brink et al. 2015:142, 144, Table 1, Fig. 2), reveals the

presence of the same domestic species (sheep, goat, cattle and pig; Table 11) and some of the game animals (gazelle, deer and wild ass) at both sites. This resemblance indicates similarity in economic strategies between different parts of the Early Bronze Age settlement at Tel Lod. The remains of dogs, birds and fish were identified only at Site 19, while those of hare and a small cat were found only in the present excavation. The relative abundance of each species based on the NISPs reveals large discrepancies for the most abundant species, ovicaprines, cattle and pigs, while the rare species show similar values. The most likely reason for this variance rests with the small sample size of the two faunal assemblages and hence, it may be surmised that the relative abundance derived from these assemblages do not provide a precise reflection of the EB IB animal management strategies in the area.

Previous research at another site with EB IB occupation strata, Naḥal Tilla, has identified temporal variation in animal exploitation strategies during this time, between an early phase of EB IB occupation that pre-dated the first appearance of Egyptian material culture and a late phase of EB IB occupation that already contained such finds (Kansa, Kansa and Levy 2002:88–89). The late EB I faunal assemblage, associated with Egyptian material culture, had fewer cattle, fewer sheep compared to goats, more pigs, older sheep that tended to be male and more juvenile male and female goats used for meat consumption; these differences were attributed to the ethnicity of the population. A similar stratigraphic and

Table 11. Intra-Site Comparison of Species Composition and Relative Abundance for Early Bronze Age IB

Species	Strata VII–IV		Site 19, Stratum IVa–b (see Brink et al. 2015: Table 6)	
	NISP	% NISP	NISP	% NISP
Sheep/Goat (*Ovis/Capra*)	71	63.4	192	40.9
Sheep (*Ovis aries*)	4	3.6	10	2.1
Goat (*Capra hircus*)	2	1.8	16	3.4
Cattle (*Bos taurus*)	23	20.5	159	33.9
Dog (*Canis familiarus*)			8	1.7
Pig (*Sus scrofa*)	6	5.4	69	14.7
Fallow deer (*Dama dama mesopotamica*)	1	0.9	2	0.4
Donkey (*Equus asinus*)	1	0.9	7	1.5
Mountain Gazelle (*Gazella gazella*)	2	1.8	3	0.6
Hare (*Lepus capensis*)	1	0.9		
Bird (*Aves* sp.)			2	0.4
Cat (*Felis* sp.)	1	0.9		
Fish (*Pisces* sp.)			1	0.2
Total NISP identified	*112*		*469*	

cultural sequence was uncovered in the excavation of EB IB occupations in Site 19 at Tel Lod, where Stratum IVb lacked Egyptian material that subsequently appeared in Stratum IVa (Brink et al. 2015:159); however, temporal variation in the fauna of these two strata was interpreted mainly as the effect of sample size.

This issue is reevaluated here. The EB IB fauna from the present excavation (Site 41) (Strata VII–IV), which yielded evidence of Egyptian influence, is compared with the EB IB fauna from Site 19, Stratum IVa (Egyptian) and Stratum IVb (local), as well as with data from the corresponding strata at Naḥal Tilla. Among the zooarchaeological attributes proposed by Kansa, Kansa and Levy (2002:89, Table 5) as criteria for identifying variable economic strategies three could be explored here, due to the limitations of sample size. All but one of these assemblages demonstrate the same rank order of species abundance where sheep/goats predominate, followed by cattle and finally dogs (Table 12); the frequency of sheep/goat at Site 19, Stratum IVb, is nearly the same as that of cattle. The proportions of cattle at Tel Lod, Sites 19 and 41, are comparatively high in late EB IB strata featuring Egyptian influence (32.8 and 20.5%, respectively), in disagreement with the observations for Naḥal Tilla, where cattle were less abundant in late EB IB than in its early phase (8.8 and 15.2%, respectively). The proportions of pigs are comparatively high in all the assemblages from Tel Lod (5.4–15.8%), also failing to divulge the pattern observed at Naḥal Tilla. Furthermore, the sheep to goat ratios at Tel Lod fall short of those seen at Naḥal Tilla, in both the early and late phases of EB IB (2:1 and 1.4:1, respectively). The ratio for the preceding early EB IB occupation at Site 19 (Stratum IVb) is 1:1, less than half of that observed at Naḥal Tilla for the corresponding period, containing only local material culture. A different ratio that emphasized goats over sheep, based on data pooled from the two

Table 12. Inter- and Intra-Site Comparison of the Relative Abundance of the Main Domestic Species for Early Bronze Age IB

Species	Late EB IB Stratum VII–IV: Egyptian Material Culture		Tel Lod, Site 41[i] late EB IB Strata VII–IV: Egyptian Material Culture		Tel Lod Site 19[ii] late EB IB Stratum IVb: Local Material Culture		Naḥal Tilla[iii] late EB IB: Egyptian Material Culture		Naḥal Tilla[iii] late EB IB: Local Material Culture	
	NISP	% NISP	NISP	% NISP	NISP	% NISP	NISP	% NISP	NISP	% NISP
Sheep/goat (*Ovis/Capra*)	71	63.4	150	42.4	42	36.5	808	87.9	2065	83.5
Cattle (*Bos taurus*)	23	20.5	116	32.8	43	37.4	81	8.8	376	15.2
Pig (*Sus scrofa*)	6	5.4	56	15.8	13	11.3	30	3.3	31	1.3
Total NISP identified	112		354		115		919		2472	

[i] Data on Site 41 at Tel Lod from Brink et al. 2015: Table 1.

[ii] Data on Site 19 at Tel Lod from Brink et al. 2015: Table 6.

[iii] Data on Naḥal Tilla from Kansa, Kansa and Levy 2002: Table 3.

Table 13. Summary of Observations on Inter- and Intra-Site Comparisons of Relative Abundances of the Main Domestic Species for Early Bronze Age IB

Species	Naḥal Tilla[i]		Tel Lod Site 19,[ii] Stratum IVa; Site 41, Strata VII–IV
	Contexts with Egyptian Material Culture	Contexts with local Material Culture	Contexts with Egyptian Material Culture
Sheep/goat utilization	Meat focus, wool production	Meat focus, wool production	Meat and wool production
Sheep to goat ratio	1.4:1	2.1:1	0.71:1
Cattle abundance	Low	High	High
Pig abundance	High	Low	High

[i] Data on Naḥal Tilla from Kansa, Kansa and Levy 2002:89.

[ii] Data on Site 19 at Tel Lod from Brink et al. 2015: Table 6.

coeval occupations of Sites 19 (Stratum IVa) and 41 (Strata VII–IV), characterizes the late EB IB phase at Tel Lod (1:1.4). The lack of consistency among the data from Tel Lod and Naḥal Tilla (Table 13) is likely the outcome of sample size effects. Considering the much larger assemblages of Naḥal Tilla in comparison with those of Tel Lod, the results from the former site can be regarded as more accurate and representative.

CONCLUSIONS

The small faunal assemblage from Tel Lod dates to two main phases of the Early Bronze Age: EB IB and EB IB–II transition. The fauna of both phases is dominated by domestic stock, comprising sheep, goats, cattle and pigs. Wild animals such as boar, gazelle, deer and hare were also exploited on occasion. Domestic animals were used both for primary products, such as meat, and secondary products, such as dairy, wool, hair, traction and breeding purposes. Secondary products may have been extracted in part for the purpose of exchange. Wild animals would have been valued for their meat but also for their extractable secondary products, such as hides and antlers for leatherworking, and perhaps as hunting trophies and symbols of prestige used among an emerging urban community.

Comparison of the data from this excavation with those of previous studies of Early Bronze Age fauna revealed similarities in the modes of animal exploitation and herd management, as shown by rank order of the abundance of domestic species. Sheep/goats are followed by cattle and pigs, suggesting that general animal use among local Levantine and Egyptian communities followed similar patterns of herd management. Ultimately, the small sample from Tel Lod is insufficient to offer any meaningful conclusions regarding the differences between how Egyptians and local groups managed their animal herds. It is also possible that the Egyptian and Levantine pastoralist economies were similar enough that they left behind little to no discernible zooarchaeologically detectable traces of variation.

The available evidence suggests that the animal remains were subject to fluvial displacement, the effect of which, although difficult to quantify, cannot be ignored. The hydraulic displacement of the fauna is suggested by the bias in body-part representation, with a dominance of larger and heavier bones from mature animals, a low occurrence of isolated teeth and a near absence of smaller, lighter and less dense bones, particularly those from smaller species or juvenile specimens. Fish bones and other microfaunal remains are completely absent, despite the sifting procedures carried out during excavations. Most burned bones were not found in burned contexts, which further reinforces the possibility that they were displaced via hydraulic sorting. Fluvial activity would have affected sample size, species representation, body part representation, spatial distribution and mortality estimates. Thus, the apparent evidence for localized site formation processes should be considered when assessing the available faunal data from Site 41 at Tel Lod.

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