about 4 years of age attested to some possible childhood tragedies.

In conclusion we can say that the human remains for the 1974 season at Tell Ḥesbân speak of people who suffered the same kinds of illness that people in any country experience today, except that there seems to have been somewhat less distress from tooth decay and a higher rate of infant mortality. People seem to have had less trouble with impacted wisdom teeth than most do today. A person with a bad tooth who got desperate enough apparently could find someone who would pull it out, but he could not find help with fillings or other restorations. Arthritis and rheumatism must have plagued people in their later years as much as they do now.

Table 7. Preliminary Physical Measurements on Skeletons from Tell Ḥesbân, 1974

INDEX	INDIVIDUALS			
	A.9:14	A.9:19	D.4:8	G.8:6
Cranial	81.45	79.25		77.46
Cranial Module	143.16	139.16		140.16
Cranial Length-Height	79.63	79.25		82.09
Cranial Breadth-Height	97.76	100.00	107.78	105.97
Mean Height	87.77	88.43		92.52
Frontal-Parietal	67.53	66.40	74.31	67.75
Total Facial			181.17	
Upper Facial		53.27	111.37	
Nasal	45.09	48.48	46.29	
Orbital	88.57	84.61	94.59	100.00
Maxillo-Alveolar	58.18	100.00	92.03	
Palatal	90.42	78.16	77.89	

Reference: Bass, William M., *Human Osteology: A Laboratory and Field Manual of the Human Skeleton.* (Columbia, Mo.: University of Missouri, 1971.)

DOMESTIC ANIMALS OF THE EARLY ROMAN PERIOD AT TELL ḤESBÂN[1]

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Introduction

The 597 bones analyzed here were unearthed from a subterranean installation (Locus D.3:57a-f) variously referred to by the excavators as a "cistern," "cave," and "storage-silo." Its shape was bell-like, and it measured ca. 2.00 m. deep and 2.20 m. in diameter. Its mouth measured approximately 0.30 m. in diameter.[2] The suggested date for the construction of the installation is the Late Hellenistic period (198-163 B.C.).[3]

The contents of the installation were excavated sequentially, beginning with the two clean-up layers a and b, and ending with the bottom layer e. The excavated material from layers a and b included 4 large rocks; metal, glass, bead, and flint objects; a stone measuring cup fragment; a limestone bowl fragment; a bronze pin; a date seed; five pails of predominantly Early

[1] The authors gratefully acknowledge their indebtedness to the Department of Sociology and Anthropology, Loma Linda University, for financial backing of the zooarchaeological enterprise during the 1974 season. Thanks are also due to Michael Toplyn, Ralph Stirling, Patricia Derbeck, Jennifer Groot, Dick Dorsett, Glenn Bowen, and John Lawlor for their diligent and thorough work in the bone laboratory. Computer programming and data processing was possible thanks to the tireless efforts of Paul Perkins.

[2] These dimensions are almost identical to the dimensions of some of the rock-cut cellars described by James B. Pritchard in *Winery, Defenses, and Soundings at Gibeon* (Philadelphia, 1964; Museum Monographs, The University Museum, University of Pennsylvania), pp. 1-27. The cellars at Gibeon appear to have been used as storage cellars for wine.

[3] Most of the data discussed in this Introduction is based on the information found in the field notes of the square supervisor, John Lawlor, and in the area report of the area supervisor, Larry Herr. Our reason for discussing these data here is so that the archaeological record of this particular deposit will be complete enough to allow future investigators to draw their own conclusions from the archaeological and zooarchaeological data reported here.

Roman pottery; and 132 bone fragments of which 79 (60%) were saved (See Table 8).

Layer c was the first uncontaminated layer, and its contents were sifted (as were those of layers d, e, and f). This more compact layer of soil yielded 4 glass objects, 1 worked stone, 1 iron object, 1 iron axe head, 2 Roman pottery juglets, 1 Roman cooking pot, 1 clay spindle whorl, 1 bronze Aretas IV coin (9 B.C.-A.D. 40), a large quantity of pottery (discussed below), and 671 bone fragments of which 395 (59%) were saved.

Layer d—which had more clay-like dirt than layer c—contained 4 glass objects, 1 limestone measuring cup fragment, 1 Roman pottery juglet, 4 emmer wheat seeds, and 1489 bone fragments of which 827 (56%) were saved.

Layer e—which was more compact than the above layers and which consisted of a mixture of gray ash and rust colored pockets—contained 1 stone weight, I glass button, 1 metal object, 1 glass bowl rim, 1 metal coin, 1 worked stone, 3 common wheat seeds, and 454 bone fragments of which 290 (64%) were saved.

Locus D.3:57 f—which consisted of less compact material—was not really a layer, but a small deposit discovered by the excavators while they were drawing balks. It contained no objects, seeds, or bone fragments.

According to the excavators, the contents of layers c, d, and e were almost certainly deposited during the Early Roman period (63 B.C.-A.D. 135). This inference is based on the fact that from

A. RAW COUNTS	a	b	c	d	e	N	B. PERCENTAGES	a	b	c	d	e	C.
CHICKEN	1	0	13	11	3	28	CHICKEN	3.6		46.4	39.3	10.7	1.0
SHEEP-GOAT	10	11	63	278	109	471	SHEEP-GOAT	2.1	2.3	13.4	59.0	23.1	17.0
LARGE MAMMAL	2	7	17	39	33	98	LARGE MAMMAL	2.0	7.1	17.3	39.8	33.7	3.5
TOTAL SAVED AND STUDIED	13	18	93	328	145	597	TOTAL SAVED AND STUDIED	2.2	3.0	15.6	55.0	24.2	21.6
SAVED, NOT STUDIED	0	17	209	170	20	416	SAVED, NOT STUDIED		4.1	50.2	40.9	4.8	15.0
DISCARDED	25	28	276	662	164	1155	DISCARDED	2.2	2.4	23.9	57.3	14.2	41.8
TOTAL FOUND	38	63	578	1160	329	2168	TOTAL FOUND	1.7	2.9	26.6	53.5	15.2	

Table 8. A. Raw counts describing the occurrence rates of animal remains from Locus D.3:57, layers a-e, for each of seven bone aggregates. B. Percentages—computations based on totals in column N—describing the proportion of each bone aggregate in each layer. C. Percentages describing the proportion of each of the seven bone aggregates relative to the total number of bones found.

these three layers, 50 pails of pottery were recovered, of which the most recent and "the vast majority" was Early Roman. The presence of discernable layers in the installation would suggest that the contents were not accumulated all at once, but periodically over time.

The Nature of the Bone Material

Counts of all bone fragments saved and discarded indicated that 2765 bone fragments were unearthed from Locus D.3:57a-e. The 1155 (42%) discarded bones were mostly splinters of the domestic animal bones discussed here. "Scrap" such as this was discarded principally for strategical reasons.[4]

Table 8 shows raw counts and proportions describing the bone material found in D.3:57a-e. Whereas the "total saved and studied" is the sum of the chicken, sheep-goat, and large mammals saved, the "saved and not studied" pertain to bones which could not be identified as belonging to the above named bone aggregates —fish, wild birds, wild mammals, and reptiles. The latter are awaiting further study; and, hence, they are not reported in detail here. Suffice it to say that this aggregate includes a partially articulated fish skeleton with about 200 constitutent bones from c along with a number of other fish, rodent, and small mammal remains (including 1 dog vertebra from e) from the other layers.

Tables 9, 10, and 11 present the raw counts for the occurrence of the various skeletal remains of the domestic animals reported here. The scientific names of these animals have been reported elsewhere[5] as has the process whereby these data were gathered.[6]

[4] For an explanation of the strategical aspects of the zooarchaeological process at Tell Ḥesbân, see Øystein Sakala LaBianca, "Pertinence and Procedures for Knowing Bones," *Newsletter of the American Schools of Oriental Research*, No. 1 (July, 1965).

[5] Øystein LaBianca, "The Zooarchaeological Remains from Tell Ḥesbân," *AUSS* 11 (1973): 134.

[6] LaBianca, "Pertinence and Procedures."

Some Observations Pertaining to Tables 8-10

Table 8. 1) Chicken bones are most numerous in the upper layer c. Large mammal bones are most numerous in the bottom layer e. The chicken bones are extremely light, the large mammal bones quite heavy. *2)* Sheep and goat bones constitute the largest proportion of the animal bones studied. *3)* Layer d, which had relatively little pottery, had the largest quantity of bones.

	a	b	c	d	e	N
BONES OF THE SKULL	2	0	5	8	14	29
HORN CORE				2	2	4
MAXILLA	2				5	7
MANDIBLE			3	3	2	8
TEETH			1	1	3	5
INDETERMINATE			1	2	2	5
VERTEBRAE	2	1	16	82	26	127
ATLAS		1	2	3		6
CERVICAL			3	4	4	11
THORACIC			2	44	2	48
LUMBAL	1		3	17	11	32
SACRAL			1	2	5	8
INDETERMINATE	1		5	12	4	22
BONES OF THE BREAST	0	2	2	70	27	101
RIB		2	2	70	27	101
BONES OF THE SHOULDER	0	0	1	13	3	17
SCAPULA			1	13	3	17
BONES OF THE FORELIMB	1	1	5	33	6	46
HUMERUS			1	14	2	17
RADIUS	1	1	2	14	2	20
ULNA			1	5	1	7
METACARPAL			1		1	2

	a	b	c	d	e	N
BONES OF THE HIP GIRDLE	1	0	2	10	7	20
PELVIS	1		2	10	7	20
BONES OF THE HINDLIMB	2	2	15	38	11	68
FEMUR	1		4	16	1	22
TIBIA	1		3	11	6	21
ASTRAGALUS			4	6	1	11
CALCANEUS			2	5		7
METATARSAL		2	2		3	7
OTHER LIMB BONES	2	4	6	6	9	27
METAPODIAL			2			2
LONGBONE	1	3	1	1	1	7
PHALANX I	1	1	1	3	2	8
PHALANX II			2	2	5	9
PHALANX III					1	1
INDETERMINATE		1	11	18	6	36
INDETERMINATE		1	11	18	6	36
GRAND TOTAL	10	11	63	278	109	471

Table 9. Raw counts describing the occurrence rates of various sheep and goat remains from Locus D.3:57, layers a-e (N = sum of a + b + c + d + e).

Table 9. 1) The most numerous bones are vertebrae (27%), ribs (21.5%), hind limbs (14.4%) and fore limbs (9.8%). 2) There is a conspicuous absence of atlases and calcanea in layer e; of metacarpals and metatarsals in layer d; of maxillae and horn cores in layer c. *3)* The meat rich bones of the axial skeleton, shoulder, hip girdle, humerii, radii, femurs, and tibiae comprise 73% of the total bone corpus.

Table 10. Vertebrae and ribs predominate. Longbones and teeth are also numerous.

		a	b	c	d	e	N
BONES OF THE SKULL		0	2	1	3	6	12
HORN CORE	BOS					2	2
MANDIBLE	BOS				1		1
	MAM					1	1
TEETH	BOS		2	1		2	5
	SUS					1	1
INDETERMINATE					2		2
VERTEBRAE		0	0	5	4	16	25
CERVICAL	MAM				1		1
THORACIC	MAM					1	1
LUMBAL	MAM			1		1	2
INDETERMINATE	MAM			4	3	14	21
BONES OF THE BREAST		1	0	3	9	2	15
RIB	MAM	1		3	9	2	15
BONES OF THE SHOULDER		0	0	1	7	1	9
SCAPULA	BOS				2		2
	MAM			1	5		6
	ASS					1	1
BONES OF THE FORELIMB		0	1	1	3	1	6
HUMERUS	BOS			1	1		2
	SUS		1				1
RADIUS	BOS				1		1
	ASS				1		1
ULNA	MAM					1	1

		a	b	c	d	e	N
BONES OF THE HIP GIRDLE		0	0	2	1	2	5
PELVIS	BOS			1		1	2
	MAM				1	1	2
	CAB			1			1
BONES OF THE HINDLIMB		0	0	1	1	0	2
TIBIA	MAM				1		1
METATARSAL	CAB			1			1
OTHER LIMB BONES		1	2	3	6	2	14
PHALANX I	BOS			1	1		2
PHALANX II	BOS				3		3
PHALANX III	BOS				1		1
METAPODIAL	CAM			1			1
LONGBONE	MAM	1	2	1	1	2	7
INDETERMINATE		0	2	0	5	3	10
INDETERMINATE	BOS				3	1	4
	MAM		2		2	2	6
GRAND TOTAL		2	7	17	39	33	98

Table 10. Raw counts describing the occurrence rates of various large mammal remains from Locus D.3:57, layers a-e (N = sum of a + b + c + d + e; BOS = cattle; MAM = large mammal; SUS = pig; ASS = donkey; CAB = horse; CAM = camel).

	a	b	c	d	e	N
INDETERMINATE	1		1			2
CLAVICLE			2		1	3
FEMUR			2		1	3
FIBULA			1	1		2
LUMSACRAL VERTEBRAE			1			1

	a	b	c	d	e	N
CARPOMETACARPUS				1		1
TARSOMETATARSUS			4			4
STERNUM				3		3
TIBIOTARSUS			2	3	1	6
ULNA				3		3
GRAND TOTAL	1	0	13	11	3	28

Table 11. Raw counts describing the occurrence rates of various chicken bones from Locus D.3:57, layers a-e (N = sum of a + b + c + d + e).

The Number of Different Animals Represented

Since in vertebrates the various bones of which the skeleton is constituted occur in predictable frequencies—i.e., sheep have only one right femur—it is possible to ascertain the minimum number of individuals of different animals represented by their skeletal remains. When dealing with zooarchaeological remains, however, care must be taken to ensure that such counts are based on unambiguous data. Thus, in the case of fragmented femurs—or any other fragmented longbone—one must tabulate the frag-

ment which occurs most frequently—right or left, fused or unfused, proximal or distal end, proximal or distal epiphysis. Similarly, pelves and scapulae can be counted only if the specific identity of their fragments are known.

Estimates of the number of different animals represented are also affected by the archaeological situation. Thus, as a general rule it will be observed that as the discrimination of contextual units increases, so does the estimated minimum number of individuals. This is because increased discrimination by the excavators results in fewer fragments per contextual unit, and hence, less duplication of like skeletal parts. Table 12 shows the outcome of counts of the minimum number of animals represented by the data from D.3:57a-e. Note that in the case of camels and pigs, there is a discrepancy between the data contained here and that presented in Table 10. The additional ones (1 camel in d, 1 pig in c, and 1 pig in d) were obtained from "bone reading records"—as is also the case with the fish, small mammal, and rodent remains—which do not contain information about bone types.

There is an approximate 1:1 correspondence between the totals shown in Table 12 and those in Table 8.A and B. By dividing the totals for each layer in Table 12 into the totals for each layer in Table 8.A, we can obtain an estimate of the average number of bones from individual skeletons in each layer: for layer a we get 10.5; layer b, 15.7; layer c, 50.0; layer d, 72; layer e, 36.5.

	a	b	c	d	e	N		a	b	c	d	e	N
SHEEP			2	4	1	7	PIG		1	1	1	1	4
GOAT				1	1	2	CHICKEN	1		4	3	1	9
SHEEP OR GOAT	1	1				2	DOG					1	1
CAMEL			1	1		2	SMALL MAMMAL				1	1	2
CATTLE		1	1	1	1	4	RODENT			1	1		2
LARGE MAMMAL	1	1	1	3	1	7	FISH	1		1			2
DONKEY					1	1							
HORSE			1			1	TOTAL	4	4	13	16	9	46

Table 12. Estimates—based on counts of most frequently occurring discrete elements of each animal group—of the number of different animals represented in Locus D.3:57, layers a-e (N = sum of a + b + etc.).

The Sheep and Goat Remains

We have already observed that contents of Locus D.3:57a-e are Early Roman. This situation makes it possible to lump the sheep and goat data and thus permits us to make additional statistical summaries and generalizations about it. Table 13 summarizes the anatomical characteristics of the 471 skeletal elements of sheep and goat.[7] The large number of whole bones in this corpus (20 or 4.2%) is of interest because it is consistent with a similar discovery pertaining to an Ayyūbid-Mamlūk cistern (D.6:33) where whole bones accounted for 5.89% of the bone corpus.[8] This phenomena is probably the result of the comparatively protected context of bones from subterranean installations.

Previous studies of sheep and goat bones from Tell Ḥesbân have shown that the size of bone fragments may be a function of culture, or of the physical context of bones, or both.[9] For this reason, each fragment was measured for size on a scale consisting of an 8½ x 11 inch sheet of paper with lines drawn across at 5mm. intervals and with incremental numbers (1-54) at the end of each line. These absolute measurements are useful when the respective humeri of sheep and goat from one period, for example, are compared to the humeri of those animals from another period.

The illustration in Table 14 shows the average size of fragments of sheep and goat from Locus D.3:57a-e. Note that the shortest fragment—2nd phalanges—are at the top, and the longest—horn cores—are at the bottom, with the other fragments ranked in between according to size. Sixteen out of the twenty

[7] Readers are referred to our report on "The Anthropological Work," *AUSS* 13 (1975): 243-245 for a clarification of many of the categories employed and for the purpose of comparison with bone data from other deposits at Tell Ḥesbân.

[8] Øystein LaBianca, "A Study of the Post-Cranial Remains of Sheep and Goat from Tell Ḥesbân, Jordan," unpublished manuscript, Harvard University, Anthropology 207 (May 24, 1973): 54.

[9] Ibid., pp. 53-54, and LaBianca, "The Zooarchaeological Remains," pp. 240, 245.

BONES OF THE SKULL		**BONES OF THE FORELIMB**	
HORN CORES	4 TOTAL	HUMERI	17 TOTAL; 2 L. U. PROX. ENDS (SHEEP); 1 L. U. PROX. SHAFT; 1 F. PROX. END; 1 U. PROX.
MAXILLAE	7 TOTAL; 3 R.; 2 L.		EPIPHYSIS; 7 R. F. DIS. ENDS (2 SHEEP, 1 GOAT); 1 R. SHAFT;
MANDIBLES	8 TOTAL; 2 R. AND 1 L. RAMUS; 1 L. HORIZONTAL RAMUS; 3 L. HORIZONTAL RAMUS WITH EVIDENCE OF SYMPHYSIS; 1 WHOLE MANDIBLE		1 R. WHOLE BONE, F. BOTH ENDS (SHEEP); 1 R. WHOLE BONE, U. PROX. END (SHEEP); 1 L. WHOLE BONE, F. BOTH ENDS (SHEEP); 1 L. WHOLE BONE, U. PROX. END (SHEEP)
TEETH	5 TOTAL; 1 INCISOR; 2 PRE-MOLARS OF THE MAXILLA; 1 MOLAR OF THE MANDIBLE	RADII	20 TOTAL; 2 R. F. PROX. ENDS; 5 L. F. PROX. ENDS (SHEEP); 1 F. PROX. END (GOAT); 1 R. U. DIS. EPIPHYSIS; 2 L. U. DIS. SHAFTS; 1 L. U. DIS. EPIPHYSIS; 3 U. DIS. SHAFTS; 1 L. U. SHAFT;
INDETERMINATE	3 TOTAL		
AXIAL SKELETON: VERTEBRAE			
ATLASES	6 TOTAL		
CERVICLE	11 TOTAL; 1 CENTRUM; 2 NEURAL CANAL WITH SPINE AND WING REMNANTS; 3 VERTICALLY SPLIT CENTRUM; 1 ARTICULATING STRUCTURE; 4 WHOLE	ULNAE	2 L. WHOLE BONES, U. BOTH ENDS (SHEEP)
THORACIC VERTEBRAE	48 TOTAL; 5 CENTRUM; 15 SPINE; 22 NEURAL CANAL WITH SPINE AND WING REMNANTS; 1 ARTICULATING STRUCTURE; 3 WHOLE		7 TOTAL; 1 R. F. PROX. END; 2 R. U. PROX. ENDS; 1 L. F. PROX. END; 1 L. U. PROX. ENDS; 2 SHAFTS
LUMBAR VERTEBRAE	32 TOTAL; 3 SPINE; 17 NEURAL CANAL WITH SPINE AND WING REMNANTS; 3 VERTICALLY SPLIT CENTRUM; 5 ARTICULATING STRUCTURES; 4 WHOLE	METACARPALS	2 TOTAL; 1 R. WHOLE BONE (SHEEP), F. DIS. END; 1 R. WHOLE BONE, U. DIS. END
SACRAL VERTEBRAE	8 TOTAL	**BONES OF THE HIP GIRDLE**	
INDETERMINATE	22 TOTAL	PELVES	20 TOTAL; 1 R. AND 1 L. ILIUM, NO EVIDENCE OF PIT; 1 R. AND 1 L. ISCHIUM, NO EVIDENCE OF ACETABULUM (1 SHEEP); 2 R., 1 L. U. AND 3 L. ILIUM, EVIDENCE OF PIT (4 SHEEP, 1 GOAT); 1 L. U. ISCHIUM, EVIDENCE OF ACETABULUM (1 GOAT); 2 R. AND 2 L. PUBIS, EVIDENCE OF ACETABULUM, 3 R. F. ACETABULUM, EVIDENCE OF ILLIUM AND ISCHIUM (3 SHEEP); 1 R. F. and 1 L. F. FRAGMENT WITH UNFRAGMENTED FORAMEN OBTURATUM AND EVIDENCE OF ACETABULUM (2 SHEEP)
AXIAL SKELETON: BONES OF THE BREAST			
RIBS	101 TOTAL; 23 R. AND 29 L. PROX. ENDS; 49 SHAFTS		
BONES OF THE SHOULDER			
SCAPULAE	17 TOTAL; 4 BLADES WITH EVIDENCE OF SPINE BUT NO GLENOID; 3 BLADES WITH NO EVIDENCE OF SPINE OR GLENOID; 1 PROX. END WITH GLENOID ONLY; 3 R. AND 2 L. F. DIS. ENDS WITH GLENOID AND SPINE PRESENT (SHEEP); 1 L. U. DIS. END WITH GLENOID AND SPINE PRESENT (GOAT)		
BONES OF THE HIND LIMB			
FEMURS	22 TOTAL; 3 R. F. AND 1 L. F. PROX. ENDS (3 SHEEP, 1 GOAT); 1 R. U. AND 4 L. U. PROX. SHAFTS; 1 R. U. AND 2 L. U. PROX. EPIPHYSES; 2 U. PROX. BALLS; 2 R. F. and 3 L. F. DIS. ENDS; 1 R. U. DIS. EPIPHYSIS; 1 SHAFT; 1 L. WHOLE BONE, F. DIS. END (SHEEP)		
TIBIAE	21 TOTAL; 1 R. F. and 1 L. F. PROX. ENDS; 1 R. U. AND 4 L. U. PROX. SHAFTS; 1 R. U. and 1 L. U. PROX. EPIPHYSIS; 2 R. F. AND 3 L. F. DIS. ENDS; 2 L. U. DIS. ENDS; 3 R. U. AND 2 L. U. DIS. EPIPHYSIS		
ASTRAGALI	11 TOTAL; 6 L. AND 1 R.		
CALCANEUM	7 TOTAL; 3 R. F. AND 3 L. F. (5 SHEEP, 1 GOAT); 1 L. U.		
METATARSALS	7 TOTAL; 1 R. F. PROX. ENDS; 3 L. F. PROX. ENDS; 2 F. DIS. ENDS (SHEEP); 1 R. WHOLE, U. DIS. END		
OTHER LIMB BONES			
PHALANX I	8 TOTAL; 1 R. AND 4 L. F. PROX. ENDS; 1 R. AND 2 L., INDETERMINATE FUSION		
PHALANX II	9 TOTAL; 2 R. AND 6 L. F. PROX. ENDS; 1 L., INDETERMINATE FUSION		
PHALANX III	1 L. WHOLE BONE		
METAPODIALS	2 TOTAL; 1L. F. PROX. END, 1 U. DIS. EPIPHYSIS		
LONGBONES	7 TOTAL		
OTHER BONES	36 TOTAL		

Table 13. Raw counts and descriptions of 471 fragments of sheep and goat from Locus D.3:57 layers a-e (R = right; L = left; F = fused; U = unfused; PROX = proximal; DIS = distal).

BONE	N	$\bar{X}$
PHALANX I	3	20.00
PHALANX II	9	28.00
ASTRAGALUS	11	29.05
ATLAS	6	39.15
THORACIC	48	46.04
CERVICAL	11	48.15
RADIUS	10	49.00
PELVIS	8	50.00
SACRAL	8	50.00
LUMBAL	32	50.00
HUMERUS	8	51.25
MAXILLA	7	52.85
FEMUR	17	56.16
SCAPULA	11	59.54
ULNA	7	65.71
TIBIA	21	71.90
RIB	101	72.00
METAPODIAL	20	78.18
MANDIBLE	8	83.75
HORN CORE	4	127.50

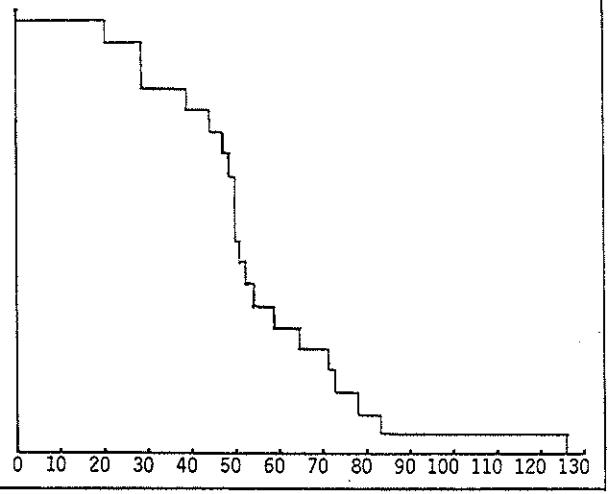


Table 14. Average size of fragments of sheep and goat bones from Locus D.3:57 a-e (N = number of bones; X = mean, in millimeters).

fragments have measurements clustered between 50 and 85 mm. The mean size for all the fragments is 59 mm.

The procedure for estimating the age of animals at the time of their death has been described elsewhere.[10] Table 15 presents the raw data on counts of fused versus unfused epiphyses among sheep and goat bones from Locus D.3:57a-e. Because the data available yield relatively small counts, the figures in groups B and C along with those in D and E have been combined. Of

GROUP	BONE	FUSED	UNFUSED	N.A.
A. EPIPHYSIS FUSING WITHIN 1 YEAR	PROXIMAL RADIUS	8	2	0
	DISTAL HUMERUS	11	0	6
	SCAPULA (TUBER.)	5	1	11
	PELVIS	5	2	13
B. EPIPHYSIS FUSING AFTER ABOUT 1.5 YEARS	PHALANX I	8	0	1
	PHALANX II	5	0	3
C. EPIPHYSIS FUSING AFTER 2 YEARS	DISTAL TIBIA	5	2	5
D. EPIPHYSIS FUSING AFTER 2.5 YEARS	DISTAL METAPODIAL	3	2	6
E. EPIPHYSIS FUSING AFTER ABOUT 3-3.5 YEARS	PROXIMAL FEMUR	4	6	5
	DISTAL FEMUR	6	0	1
	DISTAL RADIUS	0	9	2
	PROXIMAL TIBIA	2	5	2

Table 15. Raw counts of fused versus unfused epiphyses among sheep and goat bones from Locus D.3:57 a-e (N.A. = not applicable).

[10] Ibid., p. 239.

the bones in Group A, 29 out of 34 (85%) were fused; in Group B+C, 18 out of 20 (90%) were fused; in Group D+E, 15 out of 37 (40%) were fused. These findings suggest that 90% of the animals from D.3:57a-e reached an age of at least two years, and from among these that survived, only 40% reached an age of three years or older.

Interpretive Conclusions

Having limited this report to the analysis of data from one isolated deposit, we have attempted to achieve strengthened control over the available data as well as greater accuracy and thoroughness in reporting our findings. It is with much caution and even hesitation that we venture the subsequent interpretive conclusions which will be based, then, on our analysis principally of 597 bones from five Early Roman strata unearthed from a subterranean installation at Tell Ḥesbân.

The archaeologist's interpretation that D.3:57 was probably a dry storage area—possibly for the storage of grains or wine—is supported by this study in that the 2765 bones that were excavated were extremely well preserved. Although they were somewhat fragile upon reaching the light of day, this condition is accounted for by the dampness of the deposit.

The agents responsible for depositing the materials described here were principally human beings. This can be inferred from the observation that the bones were highly selected—meat rich bones constituted 73% in the case of sheep and goat. Similarly, the deposition remains of artifacts such as pottery, metal, glass, bead, and flint objects, as well as such food remains as date seeds and grain can perhaps most easily be attributed to human agents. There was no instance of an articulated skeleton of sheep, goat, or other large mammal having been deposited as a result of an inadvertent accident whereby the animal fell into the installation.

Dogs may also have been responsible for depositing certain remains. The presence of a number of bones of "unclean" animals

such as donkey, horse, and dog in the deposit is best attributable to dogs, since human beings tend to avoid contact with the remains of these animals.

We have seen that it has been possible to infer from the presence of distinct strata that the excavated materials were deposited over time and not all at once. The history of deposition is further illuminated by the fact that there is a significant variance between the strata as to the quantity of bone in each. Thus, layers a and b produced very meager amounts when compared to layers c and e. Especially noteworthy is the large quantity of bone found in layer d. The fact that this layer contained comparatively little pottery raises an interesting question for future study: Is there a predictable relationship between bone and pottery in certain deposits?

The post-depositional history of the excavated materials is also illuminated by our findings. It seems apparent that the bone material from this subterranean installation was comparatively better protected against the elements, man, and animals because of the enclosure provided by the deposit. This can be inferred from the presence of many more whole bones and also from the high state of preservation of the entire bone corpus—an observation which is reflected in the percentage of bones saved. Similarly, the mean size of fragments (59 mm.) is greater for these bones than for bones from unprotected fill areas.[11]

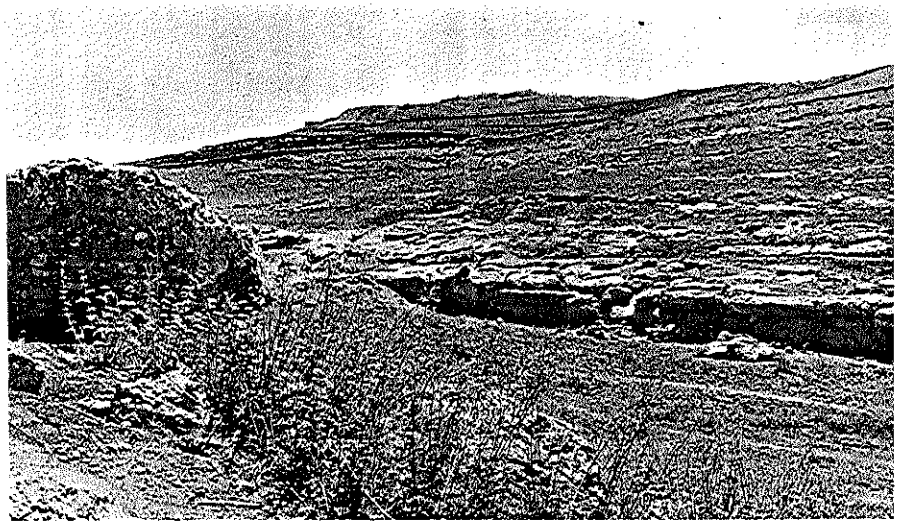
The observation that light bones, such as chicken bones, were most abundant in the upper layer c and that heavy bones, such as large mammal bones, were most abundant in the lowest layer e, presents an interesting situation if this phenomenon could be determined to be the result of post-depositional factors. The situation would raise the question of whether the weight of bones must be reckoned with in determining the circumstances of their original deposition.

Finally, our investigations have illuminated certain aspects

[11] Ibid, pp. 240-241.

pertaining to the animal husbandry and meat preparation practices of the ancients at Tell Ḥesbân during the Early Roman period. Thus, sheep and goat emerge here, as during the other periods of occupation at Tell Ḥesbân,[12] as the principal source of red meat, followed closely by cattle. Camel and pig, along with poultry (principally chicken) and fish were also eaten. We have already observed that most of the sheep and goat were slaughtered between the ages of two and three years. Because most of the bones of the animals eaten as food were meat rich ones, it seems reasonable to conclude that the meat which was consumed was purchased in pre-cut sections rather than slaughtered and eaten in the same location. This inference is also borne out by the observations that in no instance was a complete skeleton found, and that the average number of bones from individual skeletons was estimated to be far smaller than would be expected were the bones those of complete skeletons.

[12] Øystein Sakala LaBianca, "The Diachronic Study of Animal Exploitation at Tell Ḥesbân," forthcoming paper.



A. A view of Tell Ḥesbân from down in the Wadi el-Majarr on the west. Photo: Paul J. Bergsma.

B. The staff of the 1974 Heshbon expedition. Photo: Paul H. Denton.