EARLY DYNASTIC III ANIMAL UTILIZATION IN LAGASH: A REPORT ON THE FAUNA OF TELL AL-HIBA

KAREN MUDAR, University of Michigan

ESSENTIAL for a more complete understanding of the prehistoric and early historic societies is an analysis of the economy. The archaeologically visible remains of a subsistence economy consist of preserved animal and vegetal materials, tools, and architectural features. When analyzed and interpreted in a suitable framework, the study of these remains can elucidate the natural resources utlilized, the pattern of animal husbandry, and the movement of animal and vegetal products within and between communities. Faunal analyses from southern Mesopotamia have been few, and none have utilized adequate samples from large urban centers. The material discussed in this paper is of particular interest, for it is the first available sample of adequate size from such a center.

The paper presented here is a report on the faunal material excavated by Dr. Donald Hansen in 1970-71 from two areas of Tell al-Hiba, ancient Lagash, an urban center in southern Iraq. These samples date from the Early Dynastic III phase (ca. 2600-2350 B.C.). Area 'A' consists of a temple precinct, while Area 'C' was an area of interconnected small rooms, either an administrative sector[1] or a residential district. The consistent presence of only two successive floors in the structures in Area 'C' indicates that the associated sample derives from a fairly brief interval during the Early Dynastic III period. The sample from Area 'A' covers a longer time span; four distinct architectural phases were recognized.

When the faunal material arrived at the University of Michigan Museum of Anthropology, it was sorted into the Classes Mammalia, Aves, Pisces, and Mollusca. The material was then identified to genus and, when possible, to species. After this information was obtained, the collection was examined a second time to correct errors and note further characteristics needed for coding and recording on data cards and

* I would like to thank Dr. Donald P. Hansen for making this faunal collection available to the University of Michigan Museum of Anthropology. Without his cooperation this analysis would not have been possible. Abdullah Masry, anthropologist for the expedition in the 1970-71 season, was responsible for the conservation and labeling of the bones. Also, my thanks go to Robert Biggs and Abdullah Masry for bringing the bones safely to Ann Arbor. I would like to thank Dr. Kent Flannery, Dr. Henry Wright, Richard Redding, and Melinda Zeder for their assistance in identification and for suggestions. My thanks also go to my colleagues Kathy Ataman, Steve Borkan, Mary Kay Riccardo, and Linda Paalsgard for their hours of sorting and identifying. Assistance in the identification of the fish material was given by Dr. Gerald Smith; assistance in the identification of the avifauna was given by Dr. Robert Storer. Dr. Henry van der Schalie arranged for a sample of the molluscs to be identified by Dr. Richard Houbrick at the Smithsonian Oceanographic Sorting Center. All are gratefully acknowledged.

[*JNES* 41 no. 1 (1982)]

0022-2968/82/4101-0003/$1.00.

[1] D. Hansen, "Al-Hiba, 1968-1969, A Preliminary Report," *Artibus Asiae* 32 (1970): 243-50; idem, "Al-Hiba, 1970-1971, A Preliminary Report," *Artibus Asiae* 35 (1973): 62-78.

sorting with a program developed at the University of Michigan.[2] This computer program provides an efficient method of storing and retrieving faunal data.[3]

The results of this analysis should be treated with caution because there are three problems with the data. First, the excavation units were not screened; hence, a size bias is present in the species or elements in the faunal material. Second, the samples were presorted before shipment, eliminating bones which were not considered identifiable. This removed a potentially useful source of information about meat preparation. Third, the analysis was conducted without the benefit of detailed excavation records, which would have allowed an analysis of bones per unit of volume.

FAUNAL REMAINS FROM AREA 'C'

OVI-CAPRIDS

Ovi-caprids, *Capra hircus* (the domestic goat), or *Ovis ariea* (the domestic sheep), were the most commonly represented mammals in the sample, comprising 667 of the total 1,086 identifiable bones. At Tell al-Hiba, as elsewhere,[4] sheep and goats were the most important economic resource in the traditional local economy. These animals could have been utilized for fiber and milk products as well as meat.

The goats from Lagash are domesticated, as indicated by the helical twisting of the horn cores. Little work has been published on the changing osteological patterns of domestic sheep, but the absence of horns in females is considered characteristic of domestic populations.[5] The absence of sheep horn cores in a sample of this size, and the late time-period of the site, suggests that a hornless, domestic population was present.

Figure 1 presents the survivorship curve for the ovi-caprid population at Lagash. Rather than calculating survivorship rates in the traditional manner, a method developed by Richard Redding was used.[6] Different ovi-caprid elements fuse at known times, and survivorship curves may be determined by examining elements fusing at different times.[7] For each diagnostic element (e.g., distal femur, proximal tibia, etc.), fused elements were given an arbitrary score of '1.0', unfused elements were given a score of '0.0', and articular ends in the process of fusing were rated at '0.5'. The individual scores were then added together and divided by the number of representatives of that element. This provided an average score for each element. This score is an estimate of the percentage of animals in the sample remaining alive after the age at which the element fuses. The element scores were next arranged in the order in which

2 R. Redding, M. Zeder, and J. McArdle, "Bonesort II—A System for the Computer Processing of Identifiable Faunal Material" in M. Zeder and R. Meadow, eds., *Approaches to Faunal Analysis in the Middle East*, Peabody Bulletin no. 2 (Cambridge, Mass., 1978).

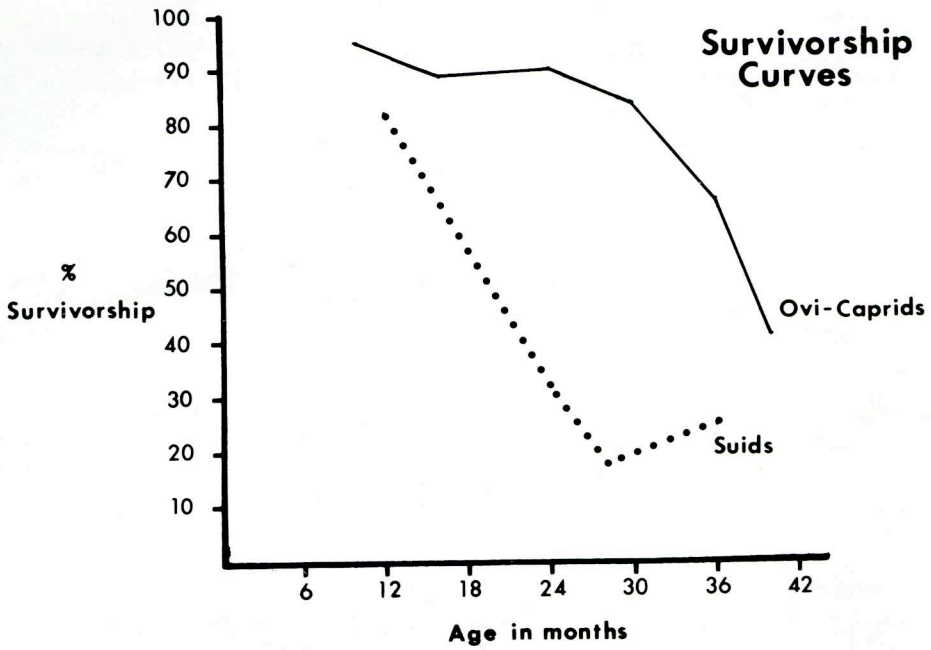
3 A copy of the data cards and program can be obtained from H. T. Wright, University of Michigan Museum of Anthropology, Ann Arbor, Michigan 48109.

4 F. Hole, K. Flannery, and J. Neeley, *Prehistory and Human Ecology of the Deh Luran Plain*, Memoirs of the Museum of Anthropology, University of Michigan, no. 1 (Ann Arbor, 1969), p. 262.

5 Ibid., p. 280.

6 Redding, "The Faunal Remains" in Wright, *An Early Town on the Deh Luran Plain: Excavations at Tepe Farukhabad*, Memoirs of the Museum of Anthropology, University of Michigan, no. 13 (Ann Arbor, 1980).

7 I. A. Silver, "The Aging of Domestic Animals" in D. Brothwell and E. Higgs, eds., *Science in Archaeology* (New York, 1970), pp. 283-302.



fusion takes place. If two bones fuse at the same age, two separate percentage estimates were made. A survivorship curve was then drawn, representing the proportions of the sample surviving past any given age.

As suggested by Payne, survivorship data will vary with the economic strategy employed.[8] He has developed four models of survivorship curves, characteristic of herding strategies for meat production, milk production, wool, and meat-milk production. Texts from Lagash refer to both wool production and distribution of sheep and goats for food and offerings.[9]

The survivorship curve of the sheep/goat sample from Area 'C' at Tell al-Hiba in figure 1 does not correspond exactly with any of Payne's curves, but, as will be discussed below, the curve corresponds most closely with the meat production curve. When ovi-caprids are utilized for meat, animals of both sexes are allowed to live until the growth curve begins to level out, at which time most of the males are slaughtered, leaving only a few for breeding purposes. The females surviving to 6 or 8 years of age are slaughtered as their reproductive powers decrease. This strategy results in a low mortality curve the first 1½ to 2 years of age, at which point the herd is abruptly halved in size. The resulting survivorship curve is generally concave with respect to the origin, or step-like.

[8] S. Payne, "Kill-off Patterns in Sheep and Goats: The Mandibles from Asvan Kale," *Anatolian Studies* 28 (1973): 281-303.

[9] A. Deimel, *Sumerische Tempelwertschaft zur Zeit Urukaginas und seiner Vorgänger* (Rome, 1931), pp. 40-70.

The survivorship curve of the sample discussed here is representative of the animals transported to Lagash, and it may not be representative of the herds servicing the city. This difference may explain the lack of fit between Payne's curve for meat production and that of Area 'C'. Animals less than 1 year old are missing from the Al-Hiba sample; mortality at this age is probably due mainly to accident and disease, and it is not expected that this age group would be present in an urban sample. The fairly steep drop of the age curve may be due to young females being culled from the herd after one or two seasons of barrenness. It should be noted that the drop in the Area 'C' survivorship curve occurs six months to a year after the growth curve levels off.

If sheep/goats are utilized for fiber production, Payne suggests, the survivorship curves will differ significantly from that of herds utilized for food production. Both sexes are retained longer than expected for meat or milk production and are removed from the herd only after infirmity is attained. The survivorship curve is convex with respect to the origin. The survivorship curve of the sample from Area 'C' suggests that the herds servicing Lagash were utilized primarily for meat. However, it is possible that the herds were maintained primarily for fiber production in the rural areas, and only a portion of the herds were diverted to the urban area for consumption purposes. While the survivorship curve of the urban sample would indicate utilization for meat, the survivorship curve of the whole herd might indicate utilization for fiber.

A comparison of the survivorship curves of the sample taken from the urban environment and one from a satellite village might solve this problem. If the rural survivorship curves were similar to that representing meat production, it may be suggested that the production of meat is the goal of herding activities of the herds servicing Lagash. If this proves to be the case, it might be suggested that the published texts place an inordinate amount of emphasis on the textile industry and fiber production activities did not affect the survivorship curves and, hence, must have been a minor consideration in managing flocks.

If the survivorship curves derived from the rural and urban areas differed significantly, and the curve from the rural sample more closely resembled a population exploited for fiber, this might indicate that groups of young adults were being diverted to the urban environment for consumption purpose. This may suggest a centralized decision-making authority manipulating herd management, perhaps through impositions of tax or tribute. This is also implied by the abruptness of the change in slope, suggesting a uniform cropping pattern for all the herds servicing Lagash.

Although there is no evidence for an open market system operating in Lagash at this time period,[10] it must be noted that active market competition may produce a similarly uniform cropping-pattern. It is also possible that, with extensive agriculture, limitations of pasturage may necessitate scheduling of activities such that autonomous herds are reduced at identical times.

Bos

Another ungulate important to the inhabitants of Lagash were cattle of the genus *Bos*. The 41 bones recovered represent at least two individuals. Present in this sample

[10] R. McC. Adams, *Evolution of Urban Society* (Chicago, 1966), p. 55.

were four measurable phalanges, whose length range from 59 to 68mm. Flannery notes a decrease in phalanx length corresponding to a general decrease in body size due to domestication in southwestern Iran.[11] The wild bovid population from Ali Kosh measured 70-77mm in first phalanx length, while the domestic population at Tepe Sabz and Ras al-Amiya measured 59-69mm for the same element. The measurements from the Lagash sample correspond well to those of the latter, and from this it may be concluded that the bovids at Lagash were from a domestic population of *Bos taurus*.

Domestic cows probably served as draft animals, and could have been utilized for milk products and hides. The one butchering mark, on a tibia, suggests that cows were also used as a source of meat.

EQUIDS

A minimum of 2 individuals are represented by 53 equid bones. These bones may represent any number of species, including the domestic horse, *Equus caballus*; onager, *Equus hemionus*; or the domestic ass, *Equus asinus*. As extensive criteria for species identification of equids from post-cranial osteological material have not been published, it is impossible to assign any of the elements to the species level.[12] Textual evidence indicates that domestic populations were maintained for draft purposes, suggesting that some domestic animals may have been present in the sample.[13] There were no butchering marks observed on any of the recovered material.

SUIDS

One hundred eighty-one identifiable bones of *Sus scrofa*, the pig, are present in the sample from Tell al-Hiba. These elements represent a minimum of 6 individuals. Suid domestication may be determined by two methods; an examination of the survivorship curves and through osteometric analysis. Both methods are applied below.

As with cattle, a decrease in body size is generally associated with suid domestication. One element which reflects this size decrease is the third molar, three of which were recovered from Area 'C' of Tell al-Hiba. The measurements of these three teeth can be compared to measurements of teeth of recent wild pigs from southwest Asia which were measured by Flannery.[14] The crown length of the third molar of the modern wild sample range from 38.8 to 41.3mm. The measurements of those recovered from al-Hiba are 28.0, 22.4, and 33.1mm, falling outside the range for wild pigs. However, the al-Hiba measurements are comparable in size to a sample recovered from Banahilk, a Halaf site of about 5000 B.C.[15] The Banahilk third molars, representing a domestic population, varies from 28.0 to 33.0mm. The Banahilk measurements compare well to those from al-Hiba, and indicate that at least some of the suids at al-Hiba were drawn from a domestic population.

[11] Hole, Flannery, and Neeley, *Deh Luran Plain*, p. 307.

[12] M. Hilzheimer, *Animal Remains from Tell Asmar*, Studies in Ancient Oriental Civilization, no. 20 (Chicago, 1941), has established criteria for metatarsals. The complete metatarsal is needed, and none were recovered from Tell al-Hiba.

[13] M. Lambert, "La Période présargonique, la vie économique à Shuruppak," *Sumer* 9 (1953): 202-5.

[14] Hole, Flannery, and Neeley, *Deh Luran Plain*, p. 309.

[15] Ibid.

A computation of the survivorship curve for the suids at Lagash, based on the recovered bones and constructed in the same manner as the ovi-caprids, failed to exhibit a pattern characteristic of any herding strategy. Mortality was low the first year of life, gradually increasing until it reached almost 90% at the age of 28 months (see fig. 1). Two of the elements known to fuse after 3-3½ years of age indicate that no animals survived past this age; however, two other elements also known to fuse after the age of 3-3½ years of age indicate that 50% of the population survived at least until the age of 3-3½ years. The pattern of the suid survivorship curve may be due to several factors. One possible explanation for this contradiction is that suids were not managed. Their primary source of food, refuse or midden areas, is not subject to seasonal fluctuations in the same way as is that of ovi-caprids. A fairly steady food supply would not necessitate scheduling of suid herding activities. Pigs may have been butchered as the occasion required, rather than to satisfy scheduling pressures. A possible explanation of the contradiction in the survivorship curve may be that the curve of the al-Hiba population has been skewed by the introduction of bones from a wild population, as some pig hunting may have also occurred. Another possibility for the appearance of this mortality curve is that error has resulted from inadequate sample size. Distinguishing among these three possible explanations for the contradictory nature of the data for the suid material will require larger samples.

Gazelle

The genus *Gazella* is a small wild ungulate which could have been hunted on the nearby plains. A minimum of 6 individuals was represented by 35 recovered bones. There was no attempt to identify these bones to species level; they may represent one of three species, *G. gazella*, *G. dorcas*, or *G. subquttarosa*.

There is a relatively large proportion of horn-cores present. This may be due to the utilization of gazelle horn-cores for purposes other than food consumption, such as handles for tools. However, it is possible that some *Gazella* bones were misidentified and placed in the ovi-caprid category. The skeletons, except for the cranial elements, are quite similar.

OTHER MAMMALS

Several other mammalian species were represented by miscellaneous elements, and these species will be briefly discussed. Their scarcity in the faunal sample may indicate that these species were of small importance in the subsistence economy of the residents of Lagash.

Several elements representing canids (dogs, wolves, and jackals) were recovered, but were not identified to species level and will be referred to as *Canis* spp. A fragment of antler identified as the fallow deer, *Dama mesopotamica*, was recovered. The identification is based on the distinctive brow tine at the base of the antler. The Mesopotamian fallow deer is native to the region, but the lack of material suggests that it was not heavily exploited for meat. A small felid pelvis was also recovered but was not identified to species level. The remaining 109 bones were too fragmentary to identify even to genus level.

EVIDENCE FOR PROCESSING

Butchering marks were rare in the al-Hiba sample. There was one mark on an ovicaprid humerus, and another on a *Bos* tibia. Bone burning is common, but burning patterns were of little assistance in delineating butchering and cooking techniques. A general overview failed to reveal any pattern in the burning of bone; it is suspected that another activity, such as use for fuel, rather than food preparation, is responsible for the resulting configuration.

FISH

The fish remains from Tell al-Hiba, all from Area 'C', totaled 57 fragments. Of these, 12 were unidentifiable. The remaining elements were classified into 4 families, Pomadasyidae, Sparidae, Siluridae, and Cyprinidae.

The family Pomadasyidae, the grunters, are represented by 3 spines, all of which were burned. Although it is impossible to identify them to species level, at least 2 different species are represented. The grunters are a marine fish, inhabiting the coastal waters of the Persian Gulf.[16]

Another marine family represented is Sparidae, also inhabiting the coastal waters of the Persian Gulf.[17] Twelve elements were recovered, consisting of 1 right maxille, 5 spines, and 6 opercular fragments. The opercular fragments are quite massive and are from a large fish. The maxilla was tentatively identified as belonging to the genus *Acanthopagrus*.

The family Siluridae, the catfish, are represented by 4 elements: a spine, a pharyngeal arch, a cleithrum, and a Webberian apparatus. They have been identified as belonging to the freshwater genus *Mystus*.

A basiocipital fragment representing the species *Barbus luteus*, in the family Cyprinidae, was also identified. *Barbus luteus* is a freshwater species.

All of the fish discussed above could have been obtained within the region. The marine families Pomadasyidae and Sparidae inhabited the shallow coastal waters of the Persian Gulf which could have been within a few days journey by boat from Lagash. The method of procurement could have been either netting or spearing. Cyprinidae and Siluridae probably inhabited the freshwater canals and streams around the city.

It is fruitless here to discuss the significance of the proportion of fish bones in the total sample. Although 16% of the fish bone recovered was burned, possibly confirming the use of fish as a food resource, it is impossible to estimate the relative importance of fish in the diet of the people at Lagash without more specialized recovery techniques. Excavation practices such as screening and flotation would greatly aid in the recovery of small faunal material.[18]

[16] H. Blegvad, "Fishes of the Iranian Gulf," *Danish Scientific Investigations in Iran, Part III*, (Copenhagen, 1944), p. 122.

[17] Ibid., pp. 138-45.

[18] S. Bökönyi and K. Flannery, in H. T. Wright, *The Administration of Rural Production of an Early Mesopotamian Town*, Museum of Anthropology, University of Michigan, Anthropological Papers, no. 38 (1968): 143.

BIRDS

A total of 25 elements from the Class Aves was excavated from al-Hiba. All but one were from Area 'C'. Fourteen bones were identified, representing 6 families. All 6 families could have inhabited the marshes around the city of Lagash.

The distal corocoid of a cormorant, *Phalacrocorax carbo*, was identified. This species is found near salt or fresh water and breeds in trees. It is found in the northern half of the Persian Gulf during the winter months only.[19] The flesh is edible, but has a fishy flavor.[20]

Platelea leucorodia, the spoonbill, also winters on the Persian Gulf. This species prefers open marshes, shallow lagoons, and mud flats in the estuaries of rivers. The spoonbill could have been hunted for meat and also for its brilliant white plumage. In the faunal sample from al-Hiba, it is represented by the proximal end of a tarso-metatarsus.

Phoenicopterus, the flamingo, has not been previously recorded from a Mesopotamian site. Two elements were recovered from al-Hiba. It is not surprising that this genus occurs in the sample, for the marshes around the city would have been excellent habitat. *Phoenicopterus* is found on the Gulf during the winter months only. Its flesh is quite edible, but the species may have also been valued for its plumage.[21]

The family to which most elements were assigned is Anatidae, the ducks. Although at least 3 species were represented in this group, specific identifications were not possible. One carpo-metacarpus and 3 ulnas were in a shoveler sized species range. The ulnas may have represented the shoveler, *Anas clypeata*. Three elements: a radius, an ulna, and a tarso-metatarsus were in the same size range as the wigeon, *Anas penelope*. The family Anatidae are primarily winter visitors and all species are edible.

A tarso-metatarsus from the family Laridae, the gulls, was recovered. This is a group of birds with a world wide distribution, found in salt and fresh water environments. The bone recovered was probably deposited non-culturally; it is unlikely that gulls played any part in the subsistence economy at Lagash.

The family Ralidae was represented by two proximal tibio-tarsal fragments, probably from a coot, *Fulica sp.* This bird is associated with a wide variety of habitats, and, while edible, probably was not important as a food source. The element may have been deposited non-culturally.

Although only 1 bird bone was burned and another showed any butchering marks, it is probable that birds were an important part of the aquatic resources of the inhabitants of Lagash. As most of the birds of economic importance recovered were winter visitors to the area, exploitation of avifauna must have occurred primarily during this season. This additional source of protein available prior to the lambing/kidding season when dairy products were scarce, may have been important.

FAUNAL REMAINS FROM AREA "A"

The excavations of Area 'A' uncovered a temple precinct. Four major levels were defined, corresponding to four major architectural stages.[22] Since the function of the

19 B. Allouse, *The Avifauna of Iraq*, Iraq Natural History Museum, publication no. 3 (Baghdad, 1953), p. 5.

20 Richard Redding, personal communication.

21 Dr. Robert Storer, personal communication.

22 Hansen, "Al-Hiba, 1970-1971," pp. 62-78.

area did not change through time, all the bones recovered from this area will be considered as one unit. The paucity of faunal material, only 141 bones identified, may be due to the non-residential function of the area.

Ovi-caprid material accounted for 80% of the material from Area 'A'. A minimum individual count of 6 ovi-caprids was established on the basis of 6 proximal metacarpals. The presence of at least 1 identifiable sheep and 1 identifiable goat were established, on the basis of 2 calcaneum. There were no butchering marks on any of the bones, and only 5 were burned. The sample is too small to attempt to construct a survivorship curve, and there were no horn cores recovered, but it may be assumed that these bones also represent individuals from a domestic population.

Sus scrofa elements were the second most numerous category of bones recovered from Area 'A'. Twelve bones comprised 8% of the total sample. They represented at least one individual. None of the bones were burned or showed any signs of butchering marks.

Bos was represented in approximately the same proportions as *Sus*. Eleven bones comprised 7% of the samples from Area 'A'. All were unburned, but 3 of the bones bore butchering marks. These were on 2 distal sesmoids and a phalanx. The presence of these marks indicates a utilization of this large bovid for purposes other than transportation. Since meat below the tibia-radius joint is minimal, the most plausible explanation for the presence of these scars is that they were inflicted during an attempt to recover a more complete skin. At least one individual was represented by the *Bos* material.

The last identifiable genus represented in this collection is that of *Equus*. Three distal elements were recovered, representing approximately 1% of the sample. The elements were not identified to species, nor were they burned or scarred.

CONCLUSIONS

A comparison of the faunal assemblages from Areas 'A' and 'C' revealed significant differences. As Area 'A' was a temple precinct, and Area 'C' was either administrative or possibly residential buildings, one might expect differential access to animal resources. People associated with the temple might have better access to more stable resources, or select species. This may be reflected in a comparison of the faunal assemblages from both areas.

Although it may be due to sampling error, all but one of the bones recovered from Area 'A' were mammalian. No fish, and only one bird bone were recovered from this section of the site. The lack of wild animal bones in the sample from Area 'A' may be related to the function of the precinct. One exception to this is the fish. Textual evidence indicates that fishing was controlled by the central decision-making apparatus.[23]

The proposition that individuals in the temple precinct had greater access to domestic food sources than other portions of the population is tentatively supported by a comparison of the mammalian species.

1. Eighty percent of the mammalian material from Area 'A' is composed of ovi-caprid

23 Deimel, *Sumerische Tempelwertschaft*, pp. 98-100.

TABLE 1

COMPARISON OF AL-HIBA AND SAKHERI SUGHIR FAUNAL ASSEMBLAGES

Animal	AL-HIBA			SAKHERI SUGHIR	
	Bone count	Minimum individuals	% of count	Bone count	% of count
Ovis/ Capra	599	20	61	136	74
Ovis	43	6	4	4	2
Capra	25	4	3	1	1
Bos	41	2	4	30	17
Equus	53	2	5	2	1
Sus	181	6	19	6	3
Gazella	35	6	4	4	2
Total	977	46	100	183	100

bones, as opposed to 68% of the material from Area 'C'.

2. *Bos* utilization was only slightly higher in the temple precinct than in the other area, 7% as oppsed to 4% respectively. There were also minimal differences in the percentages of equid present, one percent as opposed to two percent.

3. Gazelle elements, which comprised 2% of the faunal material from Area 'C', were completely absent from the Area 'A' sample. This is to be expected if gazelle was a wild resource and difficult to regulate.

4. The most striking difference in the percentages of the compositions of the faunal assemblages from Areas 'A' and 'C' is in the amount of suid present. Swine comprised 8% of the Area 'A' sample, while representing 18% of the Area 'C' assemblage, more than twice that of the temple precinct. To refer to an earlier discussion, it may have been unimportant or difficult to closely regulate a scavenging population with a steady food supply. This may account for the lack of swine in the assemblage from Area 'A'.

The differences in the faunal assemblages from Areas 'A' and 'C' support the proposition, based on architectural evidence, that these areas had different functions. If Area 'C' was bureaucratic in nature, its function would have been similar in nature to that of the temple precinct, and one would expect similarity in the composition in the faunal assemblages. The differences in the assemblages, discussed above, argue for a different function for Area 'C', suggested here to be residential.

The economic complexity of the city-state of Lagash is difficult to understand without examining the relationship of the urban area proper to its hinterland, through a comparison of the faunal assemblages. Although it would be of greater utility to use a faunal sample from a satellite community of Lagash inhabited during the same time period for comparison, a suitable sample was not available. The site used for comparison is Sakheri Sughir, an Early Dynastic I community near Ur.[24]

[24] Bökönyi and Flannery, in Wright, *The Administration of Rural Production*, p. 143.

A comparison of the faunal material from the urban and rural center reveal striking differences in composition. This is to be expected, considering the differential access each site had to animal resources.

1. Both communities were found to utilize ovi-caprids as their chief source of meat, with sheep slightly predominant over goat. Ovi-caprid material comprised over half of the recovered bone: al-Hiba had 61% and Sakheri Sughir 74% of the total bone counts (see table 1). Unfortunately, the small sample did not permit construction of a survivorship curve for the Sakheri Sughir sample. This would be useful in determining whether herds were individually or collectively controlled, and in assessing the amount of centralized authority over rural settlements.
2. *Bos* bones were more common at Sakheri Sughir than at al-Hiba, the former having 17% and the latter having 4% *Bos* in the total bone count. The villagers' greater access to beef may have been due to one or a combination of several factors: the villagers may have been eating old draft or milch cows, or male calves from the herds may have been locally culled from a herd maintained for dairy products, slaughtered and eaten. Samples adequate for the construction of a survivorship curve from the sample from the rural settlement would help us to evaluate these two alternatives.
3. Proportionally, more bones of *Sus scrofa* occurred at al-Hiba than at Sakheri Sughir, the former having 19% and the latter having 3%. This may result from the larger site having more refuse to support pigs.

For a more useful comparison between the two types of sites a large sample from an Early Dynastic III village near al-Hiba is needed.

In conclusion, an analysis of the faunal material at Tell al-Hiba has provided insights into the organization of subsistence practices in an Early Dynastic urban center. The pattern of distribution of species and the configuration of the ovi-caprid survivorship curve indicate regulation for optimal meat production, and differential access to animal resources. Studies of this sort are essential to a fuller understanding of any society, and it is hoped that similar studies of other Mesopotamian sites will be encouraged in the future.

APPENDIX 1

MOLLUSCS

Class Mollusca contained 121 shells representing both salt and fresh water species. All the material in this sample was identified.

The only freshwater representative recovered was *Unio sp.*, of which there were 17 shells. This bivalve would have been common in the canals and streams around the city of Lagash.

Trachycardium rugosum, a bivalve, was the most common marine species in the molluscan assemblage. Fifty-six shells were recovered. While the flesh was probably eaten, these shells form a relatively deep cup and may have been utilized as containers. Five shells had traces of a black pigment and one had traces of green adhering to the inner surface.

One representative of *Dosinia erythraea* and two of *Pectunculus pectiformis* were recovered. Little is known of the habitat of these bivalves. One example of *Arca*

ehrenbergi was also recovered. This genus is found in backwaters and estuaries.[25] The flesh is edible but tough.

The most common gastropod represented was *Strombus decorus*, an edible member of the conch shell family. The species occurs in colonies on coral, sand, sponge, and weed bottoms from the low water mark to about 18 fathoms. It is usually common wherever it occurs.[26] Twenty-one individuals were recovered.

Seventeen individuals of *Thais carnifera* were also recovered. *Thais* is a member of the Muricadae family, which also contains *Murex*. These gastropods produce a purple dye, which may be used to color textiles. The dye producing fluid is exuded from a gland situated on the inner wall of the mantle.[27] It is not known whether *Thais* is edible. This species is found in shallow water in rocky areas.[28]

Eight individuals of *Xancus sp.*, probably *X. pyrum* were present in the sample. The outer shell of all the recovered specimens had been knocked away, leaving only the spiraling core. It is possible that the outer shell was used as a raw material for inlay or jewelry. It is not known whether this species is edible.

One nerita shell, *Nerita albiculla*, was recovered as well as one member of the Olividae family. Little is known about the uses of either of these species.

25 J. Hornell, "The Common Molluscs of South India," *Madras Fisheries Department* 14/6 (1922): 155.

26 R. T. Abbott, "The genus *Strombus* in the Indo-Pacific," *Indo-Pacific Mollusca* 1/2 (1960): 137.

27 Abbott, *American Sea Shells* (New York, 1954), p. 12.

28 S. Tinker, *Pacific Sea Shells* (Rutland, Vermont, 1958), p. 108.