Harappa Excavations 1986-1990

A Multidisciplinary Approach to Third Millennium Urbanism

Edited by Richard H. Meadow

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Cover art: Bowl on Stand H88-1002/192-17 associated with Burial 194a in Harappan Phase Cemetery (see Figure 13.18).

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Faunal Remains and Urbanism at Harappa

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Excavations at the third millennium BC urban site of Harappa (Punjab, Pakistan) have produced a large quantity of mammal bone remains. Two features of this material—bone measurements and density of bone in excavation units—are considered from the point of view of using aspects of assemblage variability to document faunal exploitation and site formation processes. Measurements of cattle, sheep, and goat bones from Area C on the south side of Mound E are compared with those documented from earlier levels at the site of Mehrgarh and contemporary levels at Nausharo (Baluchistan, Pakistan). The results suggest that different breeds of sheep and cattle may have been kept in the two regions during the Harappan phase. The density of bone deposited in Street NS2355, when considered in combination with the nature of the street deposits and adjoining architecture, permits one to monitor the cycle of urban life in that part of Harappa. It appears that only during Period 2 (or early Period 3A) and late in Period 3B was the street actively maintained or reconstructed. At other times it served as an open sewer, acted as a dump for debris from nearby households, or fell out of active use as a thoroughfare.

During the Indus Valley Tradition fluctuating tensions created by pressures for both uniformity and diversity drove the cultures of the region into and out of phases of integration and regionalization, urbanization and deurbanization (Shaffer 1991). The underlying forces and resulting patterns are usually most clearly manifest in aspects of technology, sociopolitical organization, and ideology as these are reflected in the material culture. Nevertheless, some of the most profound changes during the second half of the third millennium in the Greater Indus Valley took place in subsistence practices (Costantini 1981; Jarrige 1985; Meadow 1989a; Weber 1990, 1992).

A common feature of the Harappan phase (ca. 2600–2000 BC) in the Indus valley alluvial zone appears to have been an agricultural foundation of winter crops—including principally barley and wheat—and domesticated bovids—including cattle, sheep, and goats (Costantini 1981, 1984, 1990; Meadow 1987, 1989a). Yet the details of subsistence practice as revealed by the plant and animal remains at individual sites vary considerably depending upon resource availability as dictated by geographical and cultural factors. While topography, soils, climate, water, and natural vegetation provided possibilities for or placed physical constraints on plant and animal husbandry, it was the knowledge of individual farmers and herders that dictated how such resources were used.

In a like manner, birds, fish, and terrestrial game might have been available to a population but not used to any great extent. A specific example is provided by the coastal site of Balakot. In the late fourth and early third millennium Balakotian levels, fish bones and mollusc shells are rare. Clearly the population had access to and perhaps some knowledge of coastal habitats, but did not exploit them as a major source of food. In contrast, during the Harappan phase at the same site, both fish and mollusc remains are plentiful suggesting that those faunas were heavily harvested (Dales 1979, 1986; Meadow 1979; Belcher, Chapter 8 in this volume).[1]

Defining variability in subsistence activities between sites and even between phases at the same site is not a straightforward task (Meadow 1978a,

1989b). Techniques of food preparation, disposal practices, and depositional events influence the character of the floral and faunal records (flora: e.g., Dennell 1976; Hillman 1984; fauna: e.g., Gilbert 1979; Meadow 1980). In addition, the indiosyncrasies of specific events as well as day-to-day, season-to-season, and year-to-year variability are reflected in the plant and animal remains (Wright, Miller, and Redding 1980). Some might argue that our understanding of past plant and animal exploitation practices is directly related to our ability to identify and control for such biasing factors. Another approach is to actively examine the variability in the archaeological record and frame questions to identify both general trends and specific variations that can provide insight into the constraints lying behind individual activities. In this way, floral and faunal remains can provide information both on subsistence practices and on phenomena beyond the strictly subsistence sphere.

With respect to faunal remains, I provide two examples here. The first uses the dimensions of sheep, goat, and cattle bones from the neolithic and chalcolithic levels at Mehrgarh (District Kachi, Baluchistan, Pakistan), from the Harappan periods at the nearby site of Nausharo, and from the Harappan phase at Harappa (District Sahiwal, Punjab, Pakistan) to investigate differences in animal husbandry practices through time and between different regions of what is now Pakistan. The second example employs data on the abundance of bones in street deposits at Harappa to monitor the cycle of urban life.

Materials and Methods

The site of Mehrgarh is located in the northern part of the Kachi Plain at the foot of the Bolan Pass in eastern Baluchistan. Excavated between 1974 and 1985, it has a more or less continuous series of deposits that run from the 6000+ BC "aceramic neolithic" (Mehrgarh Period IA) through the "coarse ware neolithic" (MR.IB-IIA) and "fine ware neolithic" (MR.IIB) into the "chalcolithic" (MR.III, IV, V, and VI) and "early bronze age" (MR.VIIA-C) (Jarrige and Lechevallier 1979; Jarrige 1981, 1985; Lechevallier and Quivron 1981, 1985).

Deposits at the nearby site of Nausharo overlap in time those of Mehrgarh Period VII and continue through the Harappan phase. Thus Mehrgarh Periods VIIA-C are approximately contemporary with Nausharo Periods IA-C. Nausharo Period ID (ca. 2500 BC) follows and is overlain by the Harappan phase Periods NS.II and NS.III (Jarrige 1986, 1988, 1989), which in turn are approximately contemporary with Periods 3A and 3B at Harappa (Chapters 4 and 13 in this volume). While the faunal material from Mehrgarh discussed here has previously been published (Meadow 1981, 1984a, 1984b, 1989b, and specifically Meadow 1992), information on the fauna from Nausharo is presented for the first time. It comprises bones and teeth from Harappan phase deposits of Periods II and III on the southern mound that were excavated during the 1986 and 1987 seasons.[3]

The site of Harappa is located near near the town of Sahiwal south of the river Ravi about halfway between Lahore and Multan. The mammal bones considered here were excavated during the 1990 season and come from street and trash deposits excavated in Area C on the southern slope of Mound E that can be assigned principally to Periods 3A and 3B (see Chapters 4 and 13 in this volume, Figure 7.7, and the discussion below). The 5,554 specimens that form the basis of Figure 7.8 come from the street deposits alone and were identified at least to size of animal. These deposits were dry-sieved through wire screens (ca. 1/4 inch or 64 mm mesh). All materials from the street levels were analyzed with the exception of some of the bones from Lot 3151 that remain to be studied.[4]

Identifications for the Mehrgarh, Nausharo, and Harappa materials were made on the basis of accumulated experience of the analysts, notes compiled over the years on osteological differences, and modern comparative collections some of which were made at Mehrgarh and Harappa and are stored at those sites. Data was computer coded following the protocol defined in Meadow (1978b) and manipulated on Macintosh® computers using Microsoft® Excel©. Bone weights were taken to the nearest half-gram on a metric postal scale. Measurements were made with dial or digital calipers to the nearest 0.1 mm with an estimated accuracy of ±1%. Measurement definitions generally follow those of von den Driesch (1976) with the exception of the ones for carpals that are defined by Stampfli (1963).

Bone measurements are taken to document the size and build of the animals exploited (Boessneck and von den Driesch 1978). Size in animals has two components: weight and height. Breadth and depth measurements of appendicular bones reflect the weight supported by each limb of the animal, while lengths especially of the long bones and phalanges are correlated with the height of the animal (von den Driesch and Boessneck 1974). Some zooarchaeological studies of animal size change and variability have not dealt with these two types of dimensions separately, primarily because of the small numbers of the measurable bones in any given assemblage. For this study, however, lengths were graphed separately from breadths and depths (Figures 7.1–7.6 as well as Meadow 1992).

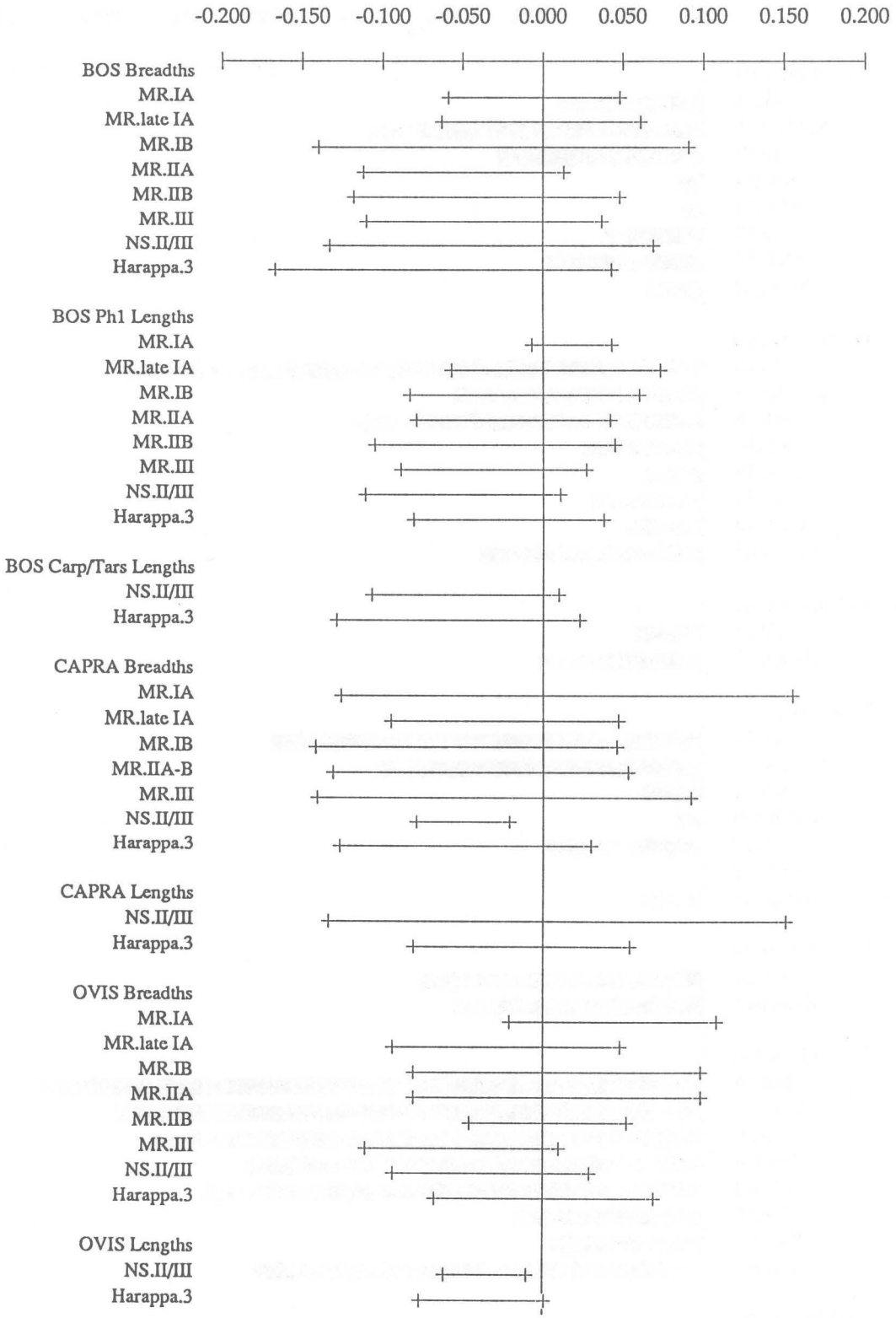

Figure 7.1: Difference of Logarithms diagram showing ranges of dimensions for bone lengths and breadths from Mehrgarh (MR), Nausharo (NS), and Harappa. Assemblages are arrayed from earliest (at top) to latest, but with Nausharo Periods II/III and Harappa Period 3 being approximately contemporary. The standard dimensions (represented as 0.000) with which the archaeological specimens were compared are listed in Table 7.1. Values for the plotted data along with sample sizes are listed in Table 7.2.

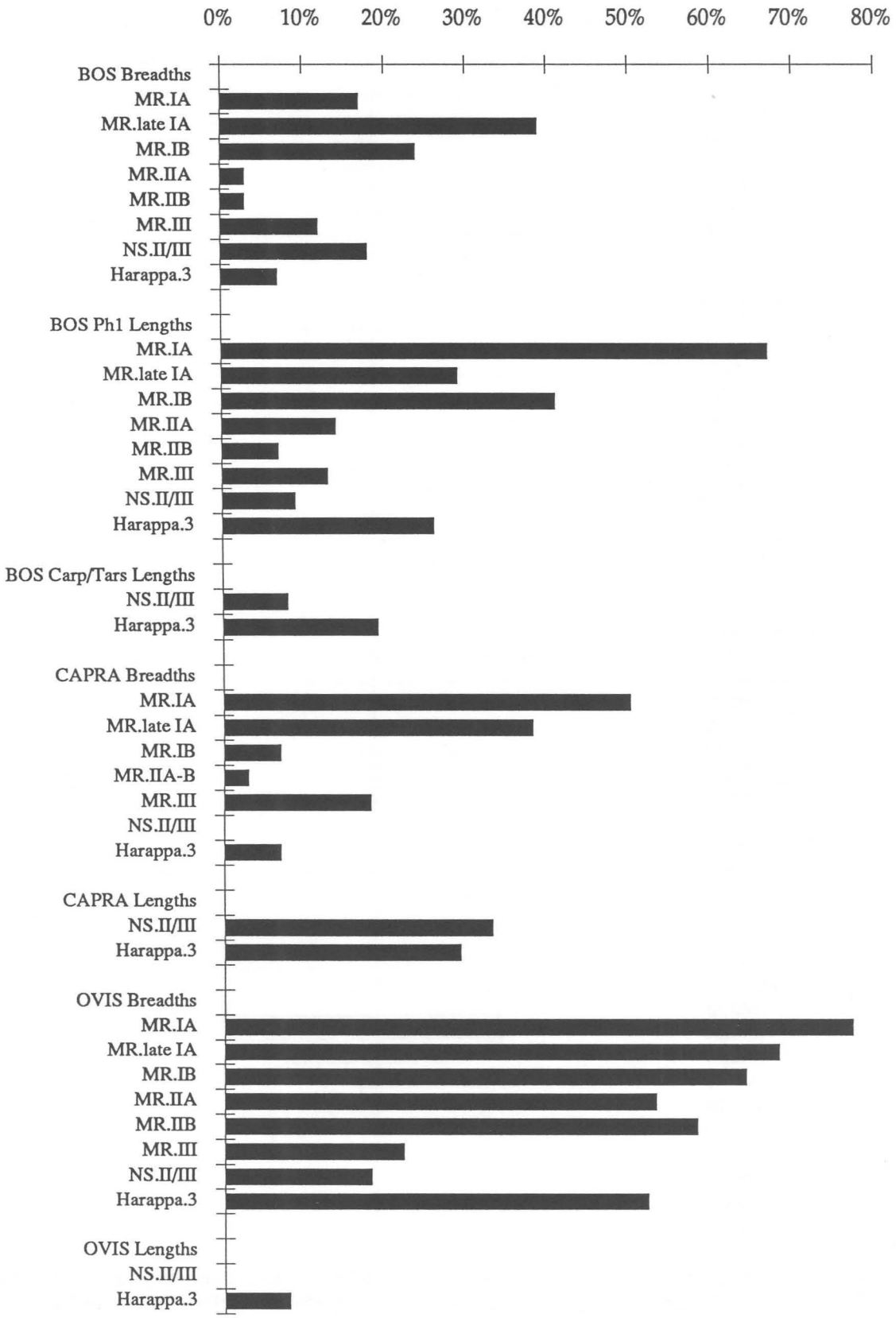

Figure 7.2: Diagram showing the percentage of measured specimens that are larger than the standard. See caption to Figure 7.1 for further details.

The procedure employed to document animal size where relatively few bones are measurable was first described by Meadow (1981). Called the "difference of logarithms" or "log difference" technique, it permits the plotting of dimensions of different skeletal parts on the same set of axes. Thus in Figures 7.3–7.6, the "0-lines" represent selected dimensions of "standard animals" (see Table 7.1 for these values) which, together with the corresponding measurements from the archaeological specimens, are converted into logarithms and subtracted the first from the second. Each vertical line in these figures represents a single dimension, with log difference values that are larger than the standard plotted above the "0"-line and values that are smaller plotted below.

Use of the log difference technique is limited to revealing trends in the data. Because one must assume that skeletal part allometry in each archaeological animal is the same as in the standard animal to which it is compared, one cannot use the technique to identify the sex or other characteristics of individual specimens, something which can be done only on a skeletal part by skeletal part basis.

Animal Husbandry

For the Middle East and Europe, documentation of skeletal part dimensions has shown that there was a decrease in the overall size (height and weight) of sheep, goats, cattle, and pigs over the course of their first domestication (e.g., Boessneck et al. 1971; Clason 1979; Davis 1987; Grigson 1989; Helmer 1989; Uerpmann 1978, 1979). By the mid-third millennium BC, however, one can expect to see the development of special breeds of animals and special husbandry practices that should be reflected in the zooarchaeological record (see Boessneck et al. 1971; Crabtree 1990; Davis 1984, 1987; Zeder 1984, 1988, 1991). These developments would have resulted through conscious and unconscious selection stimulated by the widespread use of domestic animals in different environmental settings, the growth of urban centers requiring provisioning, an increasing focus on secondary products such as milk, wool, and traction, and the possible formation of specialist pastoral groups.

In Mesopotamia, the use of sheep, goats, and cattle for dairy products and the presence of wool-bearing and fat-tailed sheep are documented in the texts or iconography from the site of Uruk by the end of the fourth millennium BC (Green 1980; Zeuner 1963:173). At the same time, symbols in the form of plows occur on proto-elamite and archaic tablets (Damerow and Englund 1989:71, MDP31:4463; Sherratt 1981:Figure 10.4), and what appears to be a symbol in the form of a cart is incised on archaic tablets from Uruk (reproduced in Littauer and Crouwel 1979:Figure 1). Presumably, both plows and carts were drawn by cattle in the fourth millennium as they were in later periods (Littauer and Crouwel 1979; Sherratt 1981).

Unfortunately little use has been made of faunal remains from Mesopotamia to identify changes in animal exploitation patterns or morphologies that could have accompanied the development of the new husbandry practices and breeds. That such an

Table 7.1: Standard Dimensions used to compile Figures 7.1 through 7.6 and Table 7.2.

Dimension	*Bos* (zebu)	*Ovis* (sheep)	*Capra* (goat)
Scapula (BG)	58.7	22.0	24.7
Humerus (BT)	89.5	29.5	34.2
Radius (Bp)		33.5	35.5
Radius (BFp)	87.1		
Radius (Bd)	84.3	31.0	33.2
Ulna (BPC)	56.3	19.0	
Ulna (DPA)			29.5
Radial Carpal (L)	34.0		
Intermediate Carpal (L)	31.4		
Ulnar Carpal (L)	36.7		
Carpal II+III (GB)	38.6		
Carpal IV (B)	34.1		
Metacarpal (Bp)	65.7	25.0	27.3
Metacarpal (Bd)	68.9	26.5	30.5
Pelvis (LA)	80.5		
Femur (DC)	54.9	21.0	23.0
Tibia (Bd)	71.6	26.5	
Tibia (Dd)			21.7
Lateral malleolus (GD)	40.3		
Astragalus (GLl)	75.4		
Astragalus (Bd)	51.4	19.6	20.8
Central+IV Tarsal (GB)	66.7		
Tarsal II+III (D)	40.6		
Metatarsal (Bp)	54.4	22.5	23.0
Metatarsal (Bd)	64.3	26.0	28.5
Phalanx I ant. (GLpe)	68.7		
Phalanx II ant. (GL)	44.0		
Phalanx I post. (GLpe)	69.0		
Phalanx II post. (GL)	45.2		
Phalanx I mean (GLpe)	68.9		

All dimensions in mm. L = Length, B = Breadth, D = Depth. For measurement definitions, see von den Driesch (1976) and Stampfli (1963). *Bos indicus* (Museum of Comparative Zoology 51755) adult male, collected by S.J. Olsen, Ft. Meade, FL, USA, 1957, measured by R.H. Meadow (Meadow 1986); *Ovis orientalis* (Field Museum of Natural History 57-951), adult female from western Iran; *Capra aegagrus* (British Museum [Natural History] 653M and 653L2) average of adult male and adult female from the Taurus mountains; sheep and goats measured by H.-P. Uerpmann (Uerpmann 1979, Table A-3).

approach may be promising is demonstrated by a study of the measurements of sheep remains from the Early Dynastic III and Old Babylonian periods (Meadow, in preparation). Log difference diagrams show that there was an overall increase in animal size toward the end of the third millennium, a phenomenon that might have resulted from the introduction of new breeds to the region.

Moving east to the Greater Indus Valley, decreases in the size of cattle, goat, and sheep also appear to have taken place starting in the 6th or even 7th millennium BC (Meadow 1984b, 1992). Details of that phenomenon, which I have argued elsewhere was a local process at least for sheep and cattle (Meadow 1984b, 1992), can be reviewed in Figures 7.1 and 7.2 and in Table 7.2. In Figure 7.1, maximum and minimum log differences for cattle, goat, and sheep bones are plotted for different assemblages of the neolithic, early chalcolithic, and Harappan periods. In Figure 7.2, the percentage of specimens that are larger than the standard is shown for each of the same divisions. Length and breadth dimensions are treated separately, and some sample sizes are quite small as can be seen by examining Table 7.2.

For cattle (*Bos* sp.), bone breadths—reflecting animal weight—decrease during the ceramic neolithic (between MR.IB and IIA—Figure 7.1), and the percentage of large specimens also decreases (Figure 7.2). There is, however, considerable variability in MR.IB, suggesting a period of change in cattle exploitation practices. Great variability is also present during the Harappan phase (Figures 7.1–7.4). At Nausharo, very heavy as well as light animals are represented, and there is an increased percentage of bones from heavier individuals. In contrast at Harappa, the percentage of heavy animals remains low and extremely small breadth dimensions have been recorded.

The picture is rather different when a single length dimension such as that of the first phalanx is considered. Size (height) decrease is almost continuous from the aceramic neolithic at Mehrgarh into the Harappa phase at Nausharo (Figure 7.1), although the greatest change in percentage of large specimens still occurs in the ceramic neolithic between MR.IB and IIA (Figure 7.2). Of potential significance is the fact that the lengths and percentages of long specimens for both first phalanges and carpals/tarsals are considerably greater at Harappa than at Nausharo.

To judge from these data, the cattle of Harappa were lighter but taller than those at Nausharo during the Harappan phase, suggesting the presence of different breeds (just as there are today). As additional specimens are documented, this hypothesis needs to be tested on a skeletal part by skeletal part basis.

Table 7.2: Statistics Used to Compile Figures 7.1 and 7.2

	No.	Min. log dif.	Max. log dif.	%>0
Bos Breadths				
MR.IA	18	-0.059	0.048	17%
MR.late IA	18	-0.063	0.061	39%
MR.IB	55	-0.140	0.091	24%
MR.IIA	64	-0.112	0.013	3%
MR.IIB	68	-0.118	0.048	3%
MR.III	42	-0.110	0.037	12%
NS.II/III	38	-0.133	0.069	18%
Harappa.3	84	-0.167	0.043	7%
Bos Phalanx 1 Lengths				
MR.IA	6	-0.007	0.043	67%
MR.late IA	14	-0.057	0.073	29%
MR.IB	29	-0.083	0.060	41%
MR.IIA	29	-0.079	0.042	14%
MR.IIB	30	-0.105	0.045	7%
MR.III	16	-0.089	0.027	13%
NS.II/III	23	-0.111	0.011	9%
Harappa.3	34	-0.081	0.038	26%
Bos Carpal/Tarsal Lengths				
NS.II/III	12	-0.107	0.010	8%
Harappa.3	21	-0.129	0.023	19%
Capra Breadths				
MR.IA	52	-0.126	0.155	50%
MR.late IA	8	-0.095	0.047	38%
MR.IB	28	-0.142	0.046	7%
MR.IIA-B	33	-0.131	0.053	3%
MR.III	28	-0.141	0.092	18%
NS.II/III	7	-0.079	-0.021	0%
Harappa.3	14	-0.127	0.030	7%
Capra Lengths				
NS.II/III	9	-0.134	0.151	33%
Harappa.3	7	-0.081	0.054	29%
Ovis Breadths				
MR.IA	56	-0.021	0.108	77%
MR.late IA	22	-0.094	0.048	68%
MR.IB	75	-0.081	0.098	64%
MR.IIA	32	-0.081	0.098	53%
MR.IIB	19	-0.046	0.052	58%
MR.III	18	-0.111	0.010	22%
NS.II/III	28	-0.094	0.029	18%
Harappa.3	63	-0.068	0.069	52%
Ovis Lengths				
NS.II/III	7	-0.062	-0.010	0%
Harappa.3	12	-0.077	0.001	8%

MR=Mehrgarh (see Meadow, 1992);
NS=Nausharo; No.=number of specimens;
Min.log dif.=minimum log difference;
Max.log dif.=maximum log difference;
%>0=percentage of log differences greater than 0.000.

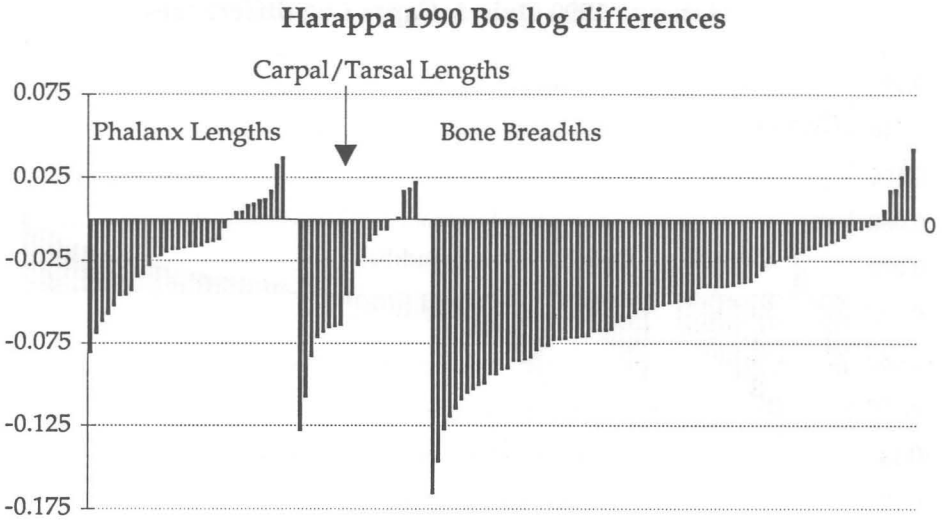

Figure 7.3: Difference of Logarithms diagram for cattle (*Bos*) bones from Harappa showing distribution of individual measurements in relation to the standard.

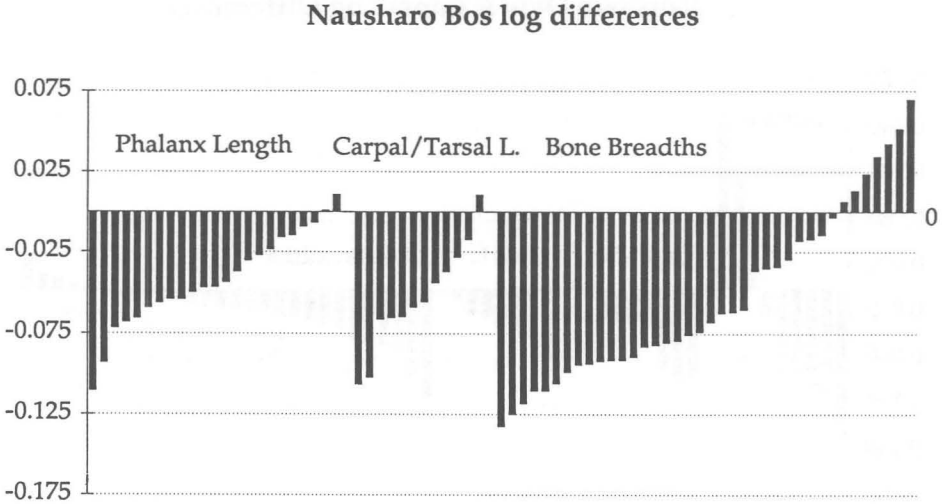

Figure 7.4: Difference of Logarithms diagram for cattle (*Bos*) bones from Nausharo showing distribution of individual measurements in relation to the standard.

Furthermore, whether these patterns developed only in the Harappan phase or had earlier roots is a question that remains to be answered.

For goats (*Capra* sp.), the picture is somewhat different than for cattle. In the earliest levels at Mehrgarh, small, light-weight, presumably domestic animals and heavy, presumably wild individuals are both represented (Figure 7.1), although a relatively high proportion of the specimens come from animals larger than the standard (Figure 7.2). By ceramic neolithic MR.IB, size decrease in goats appears to have ended, with relatively few heavy animals represented in any of the later periods. Unfortunately, bone lengths could be plotted only for the Harappan phase and then only for very few specimens (Table 7.2, and Figures 7.5–7.6). There is enormous variability represented at Nausharo and a considerable proportion of tall animals at both Nausharo and Harappa. Taken at face value, it appears that both long-legged animals and small, even dwarf, individuals are represented, although once again it is necessary to document a larger sample of material and to examine the bone

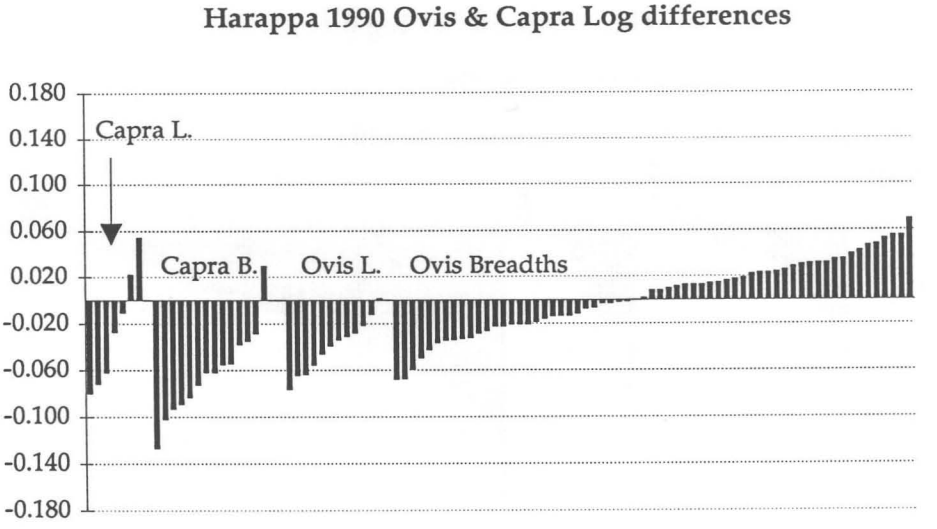

Figure 7.5: Difference of Logarithms diagram for goats (*Capra*) and sheep (*Ovis*) bones from Harappa showing distribution of individual measurements in relation to the standard.

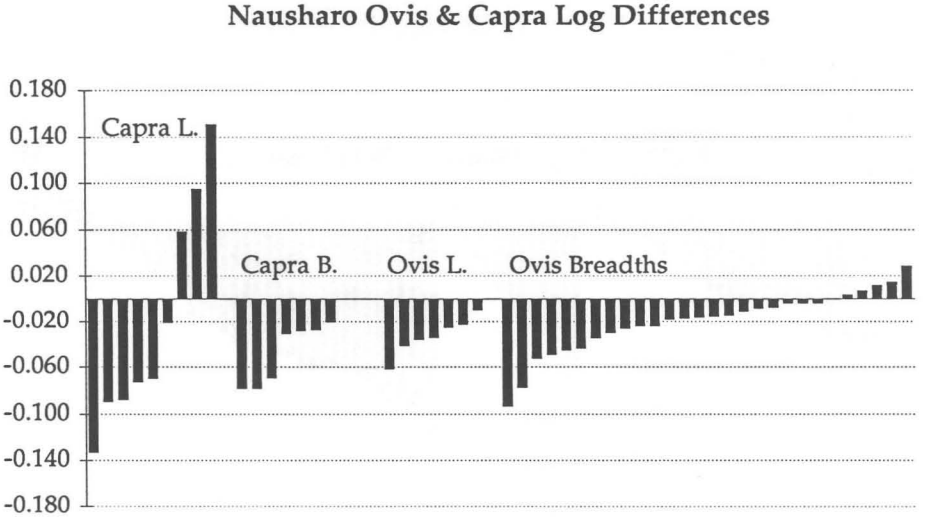

Figure 7.6: Difference of Logarithms diagram for goats (*Capra*) and sheep (*Ovis*) bones from Nausharo showing distribution of individual measurements in relation to the standard.

dimensions element by element. The possibility of wild goats being represented at Nausharo during the Harappan phase also must not be overlooked.

For sheep (*Ovis* sp.), the patterns are again different than for cattle and goats. Although relatively small (light) animals are represented in the late levels of the aceramic neolithic (MR.late IA), size diminution is not really complete until early chalcolithic MR.III. By that time, not only are the bones considerably smaller (Figure 7.1), but there are many fewer large specimens (Figure 7.2). Indeed in assemblages earlier than MR.III, more than 50 percent of all sheep bones measured are broader than the standard. Thus at Mehrgarh one can define two episodes of size diminution in sheep—one within aceramic neolithic MR.IA coinciding with sheep remains becoming much more frequent than those of goats and one between late neolithic MR.IIB and chalcolithic MR.III when goats become better represented than sheep (Meadow 1992).

During the Harappan phase at Nausharo, bone breadths and the proportion of large animals are about the same as for chalcolithic Mehrgarh. This contrasts

with the situation at Harappa, where more heavier (but not much taller) animals are represented for the same time period (Figures 7.1, 7.2, 7.5, 7.6). In addition, whereas sheep are better represented than goats at both sites, the ratio of sheep to goats at Harappa is 3.7 to 1 (n=220) as compared with 1.5 to 1 (n=207) at Nausharo. Thus it appears that sheep are markedly larger bodied and relatively more abundant at Harappa than at Nausharo. As with cattle, this may represent different breeds and different husbandry practices. Study of sheep demographics (kill-off patterns and sex ratios) will permit comparison of animal exploitation at the two sites and and may aid in identification of the effects of local environmental differences and socio-cultural choices.

The Cycle of Urban Life at Harappa

Beyond simply providing information on husbandry practices, faunal remains can be used to help monitor the cycle of urban life. Middle Eastern or South Asian towns often contain run-down areas that are temporarily used for dumping garbage and other debris. And even when an area is being actively occupied, streets are used for the disposal of trash including animal bones. Those streets of concern to the civic authorities may eventually be cleaned, while those streets that are ignored will literally fill up with debris between the walls of the structures on either side. Such build-up can occur even to the extent that new doorways have to be cut into existing buildings to provide access to dwelling units the ground floors of which are up to two meters below the street level.

Examples of such differences in elevation of contemporary living surfaces can be found in modern Harappa town today and provide a valuable model for interpreting the archaeological record. In particular, contemporary deposits inside of and outside of buildings need not be at the same absolute elevations, and it is often impossible to demonstrate stratigraphically the precise relationships between such deposits. We are thus compelled to draw together different lines of evidence—including plans of structures, locations of doorways, elevations of drains, and the nature of artifactual and ecofactual debris—to inform ourselves about the form of the settlement at any given time and how it changed over the decades.

Turning specifically to the south side of Mound E at Harappa, based on what is known to date of the architectural and artifactual remains, Kenoyer (this volume, Chapter 4) proposes that expansion into this part of the site took place during Period 2. This first settlement, debris from which is almost 1.5 m thick in places, was followed by a substantial initial Period 3A Harappan phase occupation, including habitation structures and a major town wall. Kenoyer proposes that, subsequently, this part of the city was ignored by the civic authorities, with the town wall and buildings falling into disrepair. With Period 3B, attention was once again focused on this quarter with new structures being built and the town wall repaired.

Portions of the north-south Street NS2355 were excavated on the south side of Mound E during the 1990 season. In Area C, this street was found to have been established during Period 2 (Early Harappan/ Harappan transitional phase) and to have continued through at least Period 3C (Chapters 4 and 13 in this volume). Possible ruts made by cart wheels were identified at two levels—in natural sediment (Period 2: Lot 3176 below lot 3172; Figures 4.12 and 13.41) and in street fill outside the walls of an Harappan phase house structure (Period 3B: Lot 3052 below lot 3048; Figures 4.16, 8.2, and 13.40). Between the "cart tracks on natural soil" and the "upper street levels" were multiple layers of fill deposited on well-defined street surfaces (Figure 7.7, right side) that range from a maintained horizontal surface to pitted, green-stained, garbage-filled muck.

The excavation units ("Lots") defined for Street NS2355 are listed in Table 7.3 along with the absolute elevations for the *top* of each lot (to assist the reader in finding their location in Figure 7.7). Also presented are comparisons of the approximate volume of sediment removed for each lot, the number of mammal bones in each lot and their total weight, measures of the density of bone (number of bones per cubic meter), and measures of bone size (average weight per specimen). These last two statistics are graphed on a base 10 log scale in Figure 7.8.

As far as the dating of the different levels are concerned, Early Harappan phase sherds occurred in the cart tracks in the lowest level and in the lowest 30 cm of street debris (Lots 3176 and 3172). A bit higher, a fragment of an engraved Indus seal (Figure 13.44e) turned up at the base of Lot 3166, nearly at the bottom of the street deposits (elevation of ca. 162.31m). The immediately preceding strata of Lot 3171 as well as those of 3166 and of all succeeding lots yielded Harappan phase pottery. Seven meters to the east, Early Harappan potsherds in association with hearths came from deposits nearly 1.5 m higher (from an elevation of 163.78m). Thus at the end of Period 2 some of the habitation levels were considerably higher than the street. Although no specific evidence of street fill removal was detected in the excavations, it is possible that some of the Period 2 street levels were eroded or removed during the course of Period 3A use.

During Period 3, over two meters of deposit accumulated in the street and can be related to three major

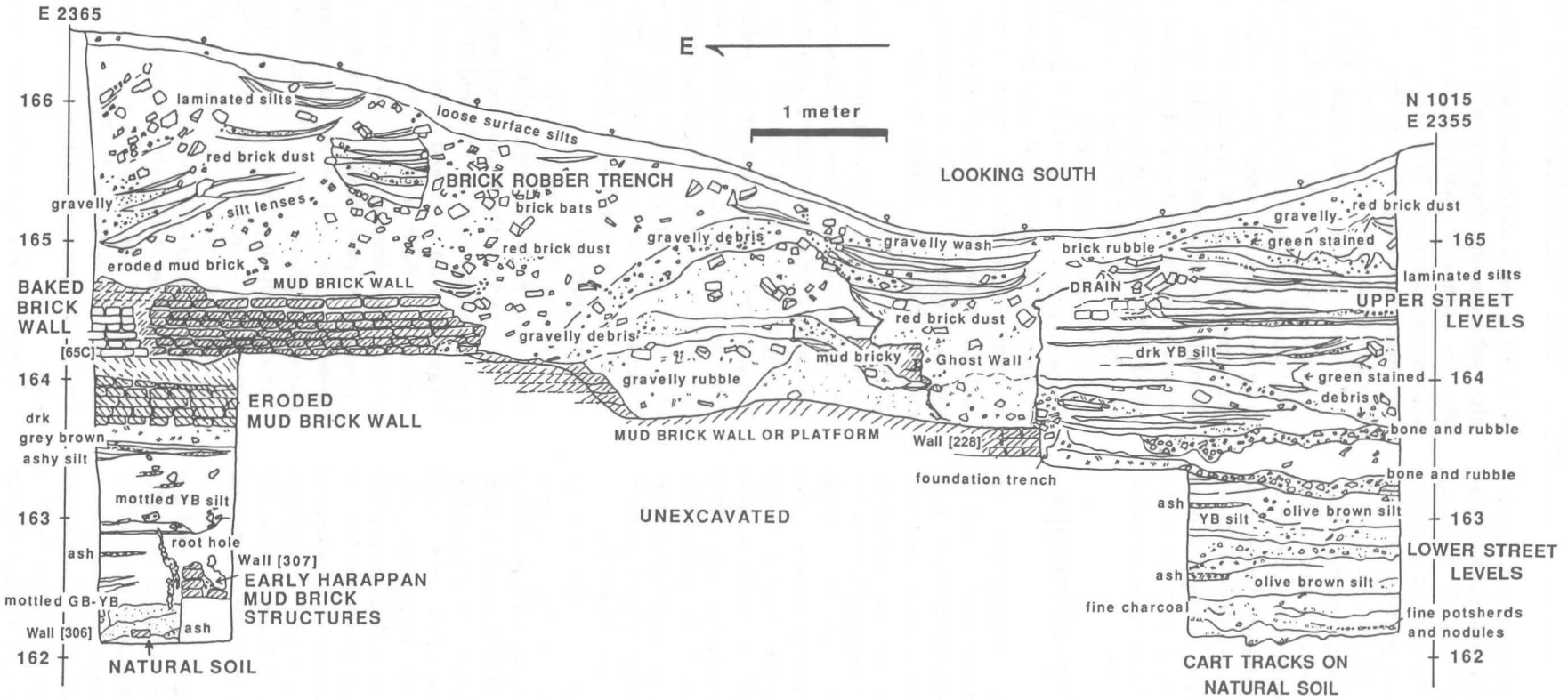

Figure 7.7: Harappa 1990: Section facing South of trench in Area C on the southern side of Mound E. Street NS2355 deposits are on the right (west) side of the section. Elevations are in meters.

Table 7.3: Harappa Mound E South, Area C, Street NS2355

Lot	meters	AMSL	m^3	#	wt	#/m^3	wt/#
3048	164.65	164.70	0.79	19	233.0	24.1	12.3
3052	164.63	164.52	0.45	0	0	0	
3055	164.43	164.51	1.11	168	1605.0	151.4	9.6
3056	164.32	164.31	4.53	551	5588.5	121.3	10.1
3062	164.01	163.93	2.23	326	2102.5	146.2	6.4
3065	163.78	163.69	0.65	122	1841.0	187.7	15.1
3066	163.66	163.57	1.07	204	1135.0	190.7	5.6
3151	163.43	163.42	1.63	1125	15564.0	690.2	13.8
3153	163.19	163.23	2.23	400	5439.0	179.4	13.6
3156*	163.30	163.40	1.01	186	2079.5	184.2	11.2
3161	163.00	162.76	0.38	150	1018.0	394.7	6.8
3162*	163.00	162.82	2.08	115	1010.0	55.3	8.8
3164	162.67	162.65	0.67	105	664.0	156.7	6.3
3165	162.60	162.55	0.24	91	635.0	379.2	7.0
3166*	162.62	162.60	2.10	454	2576.0	216.2	5.7
3171	162.35	162.31	0.74	1495	4743.5	2020.3	3.2
3172	162.26	162.19	1.04	43	86.5	41.3	2.0
3176	162.07	Natural Sediment					

*=Lot overlaps and is approximately contemporary with the one listed immediately above;
Lot 3151 has not been completely analyzed;
meters AMSL=greatest and least absolute elevations in meters of **top** of Lot;
m^3=approximate volume in cubic meters of sediment associated with the Lot;
#=number of specimens in the Lot;
wt=total weight in grams of specimens in the Lot;
#/m^3=number of bones per cubic meter in the Lot;
wt/#=average weight of specimens in the Lot.

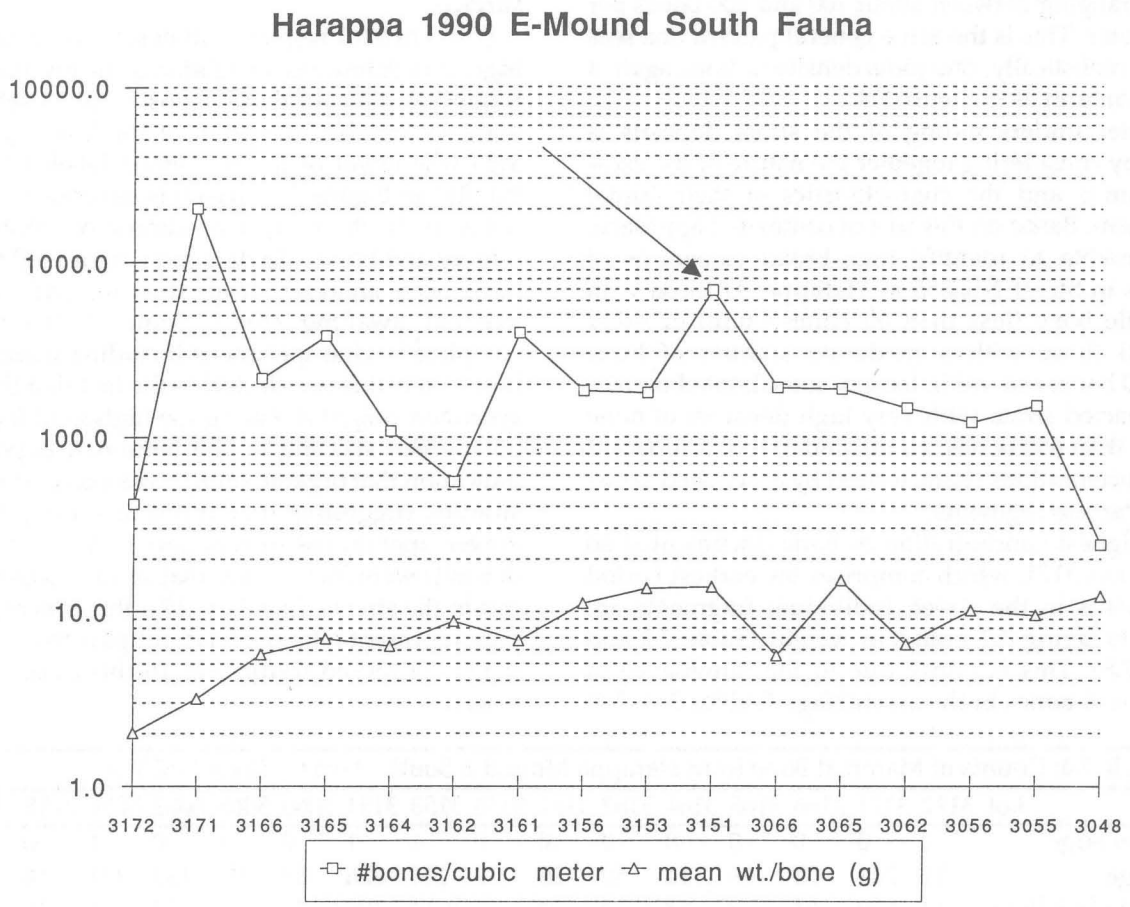

Figure 7.8: Log (base 10) plot of number of mammal bones per cubic meter and mean weight in grams of bone from Street NS2355 excavation units (Lots) arrayed from earliest (left) to latest (right). Values for the plotted data are listed in Table 7.3. The arrow points to the symbol for Lot 3151 to remind the reader that additional bones from that excavation unit remain to be analyzed.

episodes of building. The earliest episode is assigned to the beginning of Period 3A and the later ones to Period 3B. The Period 3A building was made of mud-bricks which came to be heavily eroded after abandonment, probably indicating the passage of a significant period of time. Before the second mud-brick building came to be built, the first had been filled and covered with debris including large articulated carcass portions of cattle (Lot 3255). The second mud-brick structure was probably occupied for some time and then used as a foundation for the third major architectural configuration—the Room 1/2/3 complex built of baked brick (Figures 4.16, 8.2, and 13.40).

If one were to examine the faunal data alone without considering other archaeological information, one might plot average density of bone against absolute elevation in 10 cm intervals. Such an exercise, which can be roughly accomplished by manipulating the data in Table 7.3, reveals two significant peaks corresponding with Lots 3171 and and 3151, two troughs matching the lowest and uppermost street surfaces (Lots 3172 and 3048), and otherwise an average density ranging between about 100 and 200 bones per cubic meter. This is the same general pattern one sees if, more realistically, one plots density of bone against excavation unit as in Figure 7.8.

A better understanding of the street deposits is gained by considering together the nature of the excavation units and the characteristics of their faunal component. Based on this sort of contextual approach, it is possible to identify four broad categories of deposits in Street NS2355 at Harappa: 1) those with very little bone (less than 60 bones/cu.m) or other trash; 2) those with a moderate amount of bone (100–250 bones/cu. m) in loosely consolidated matrix; 3) compacted strata with very high densities of bone (greater than 650 bones/cu.m); and 4) less compacted bone concentrations characterized by articulated skeletons or carcass segments.

The highest concentration of bone documented so far is in Lot 3171, which comprises the earliest Period 3A deposits in the street. Individual fragments are small, averaging 3.2 grams in weight (Table 7.3 and Figure 7.8). This is partly due to the dominance of small bovid bones in the assemblage (Tables 7. 4–7.5) and partly to the high degree of fragmentation of the material. The excavator noted that Lot 3171 was a fairly distinct compact layer ca. 10 cm thick made up of horizontally laid potsherds in hard packed silt. It may thus represent a street surface perhaps contemporary with the construction of the Period 3A buildings almost a meter higher in the east.

High proportions of small bovid and, more generally, medium mammal remains continue to characterize the immediately succeeding strata represented by Lots 3166, 3165, and 3164 (Tables 7.4–7.5). The sizes of fragments are larger, however, (Table 7.3 and Figure 7.8), and the sediment ashy and less compact, suggesting trash deposits from occupations in adjoining structures. Density of bone decreases considerably in Lots 3164 and 3162, although in Lot 3162 average weight per fragment is relatively high, reflecting both larger pieces and the presence of a higher proportion of bovine bone. This lot is described as having "packed nodule and terracotta cake fragments" together with ash and charcoal, and thus it again may have been just below an active street surface.

With Lot 3161 begins another series of deposits with high concentrations of relatively heavy (large) bone fragments. Most of these deposits are loosely packed, with the notable exception of the lower part of Lot 3151 (the lower of the two strata labeled "bone and rubble" in Figure 7.7), which is described in the field notes as "a thick layer of almost concreted rubble, pottery and bone." To date more than 1100 specimens have been analyzed from this lot, with additional material awaiting study. Some of the bones are complete bovine specimens including mandibles and horn cores; this is reflected in the fact that the average specimen weight is among the highest at the site. The olive-green staining of the bone-rich deposits is an indication that organic sludge was a component of this stratum, suggesting that drains or sump pits were no longer operational in this part of the site when the deposits were formed and that sewage was allowed to run in the streets. Like Lot 3171, this concreted rubble may represent a kind of natural pavement formed as the street served traffic and, in this case, as an open sewer.

Table 7.4: Counts of Mammal Bone from Harappa Mound E South, Area C, Street NS2355

Lot	3172	3171	3166	3165	3164	3162	3161	3156	3153	3151	3066	3065	3062	3056	3055	3048
very large	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0
large	11	244	72	16	14	50	35	37	200	626	88	90	133	321	84	14
large/medium	14	629	91	17	18	2	22	2	11	198	50	9	117	8	40	0
medium	18	622	291	58	73	63	93	147	188	300	66	22	76	221	44	5
Total	43	1495	454	91	105	115	150	186	400	1125	204	122	326	551	168	19

Material from Lot 3151 has not been completely analyzed.

The bone, sherd and rubble bed of Lot 3151 did not cover the whole of the street, pinching out toward the east against the earlier deposited strata of Lot 3156. This latter lot together with the intervening Lot 3153 yielded the partially articulated skeletons of four dogs—two young, two mature.[5] Bones from these skeletons were also excavated as part of Lot 3161, with an additional single articulating epiphysis from 3066, which like 3151 and 3153 abutted the slopping strata of 3156 in the east (Table 7.5). This distribution underlines the fact that the lots, as excavation units, may not be precisely congruent with single or even discrete multiple depositional units, and thus one can really only deal with them in terms of trends or tendencies and not as absolute measures of human activity. It also indicates, however, that a considerable quantity of debris was dumped into the street at one time, possibly when the Period 3A architecture was filled with trash prior to the construction of the mud-brick walls of Period 3B.

Lot 3066 (the upper "bone and rubble" stratum in Figure 7.7) or perhaps Lot 3065 with its high proportion of large bovine bones may represent the last of the fill deposited in the street before the construction of the Period 3B architectural complex. Lot 3062 comprises a series of street levels which may be contemporary with the earliest phase of Period 3B. Fragment sizes are relatively small (Table 7.3 and Figure 7.8) even though the proportion of bovine bone remains high (Table 7.5). Following these street levels, are a relatively thick series of deposits comprising Lot 3056 that are again stained green presumably with sewage. Unlike 3151, however, they are not tightly compacted. The same is true of the following "upper street levels" included in Lots 3055, 3052, and 3048 that are probably contemporary with the last occupation of the baked-brick Room 1/2/3 complex. The proportion of large mammal, specifically bovine, bone remains high in all of these upper levels, as does the average bone weight (fragment size).

To summarize, high densities of bone can result from packing due to the use of the street as an open sewer and/or by heavy traffic (e.g., Lots 3151 and 3171). Lower densities can be interpreted as reflecting periods of occupation during which trash was scattered in the streets and mixed with other debris and varying amounts of sediment resulting from housekeeping in nearby structures. Very low densities may reflect active maintenance or reconstruction of the street, while the presence of whole or significant portions of animal carcasses (e.g., Lot 3156) suggests that the street may have fallen out of active use as a thoroughfare for some time. Indeed, from this analysis it appears that only during Period 2 (or early Period 3A) and late in Period 3B (contemporary with the baked brick Room 1/2/3 complex) was the street actively maintained or reconstructed, although the fact that the excavation units do not always coincide with depositional units may obscure other episodes of street maintenance.

One question that remains unresolved is whether the bones (and artifacts) in the street were the result of primary, secondary, or even tertiary deposition (Meadow 1980). In other words, were they thrown into the street immediately after consumption, were they swept up from their primary loci and dumped into the street, or were they transferred to the street as a component of fill intentionally deposited there. The second and third possibilities are more likely than the first which means that ravaging of the assemblages by dogs would have taken place before deposition in the street. The facts that whole segments of carcasses were

Table 7.5: Standardized Counts of Fauna from Harappa Mound E South, Area C, Street NS2355

Lot	3172	3171	3166	3165	3164	3162	3161	3156	3153	3151	3066	3065	3062	3056	3055	3048
bovine	1	42	15	5	2	10	5	7	49	124	5	13	20	36	8	3
large cervid	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sus scrofa	0	1	2	0	0	1	0	1	4	5	0	0	0	1	0	0
small cervid	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
small bovid	0	5	3	0	0	1	0	0	1	0	1	1	2	6	0	0
Gaz./Antil.	0	1	0	0	0	1	0	0	0	0	0	0	0	4	0	0
Ovis/Capra	1	82	55	9	7	9	11	6	38	69	5	3	10	35	4	2
large canid	0	2	0	0	0	0	8	47	22	1	1	0	0	1	0	0
Total	2	135	75	14	9	22	24	61	114	199	12	17	32	83	12	5

Standardized counts include only the following skeletal parts: occipital, zygomatic, mandibles and maxilla with teeth, loose dP4 and M3, atlas, axis, sacrum, articular ends of long bones, phalanges, distal scapula, acetabulum area of pelvis, carpals and tarsals; not included are horn core and other skull fragments, mandibles and maxilla fragments without teeth, other loose teeth, other vertebrae, other parts of the scapula and pelvis, ribs, sternum, shaft fragments, unidentified fragments; material from Lot 3151 has not been completely analyzed.

found both in the street and within an adjoining architectural complex and that none of these showed signs of carnivore chewing are evidence that, at least during that (those) depositional episode(s), dogs did not have access to the bones.

A more detailed understanding of the source for and formation of street deposits could be achieved through microstratigraphic stripping of depositional units (working back from an existing section) and piece plotting of uncovered materials. This kind of excavation might also be combined with micromorphological studies of site formation processes (Courty, Goldberg, and Macphail 1989) and determination of the season of death of animals the remains of which came to be included in the deposits (e.g., Wright, Miller and Redding 1980; Lieberman, Deacon, and Meadow 1990). Although time consuming and therefore expensive, such a combination of approaches, if employed in a carefully thought out and strategic fashion, could help unravel the intricacies of occupations that appear discontinuous when one considers only the configurations revealed by the large scale horizontal excavations so necessary for understanding structural complexes from an architectural point of view. Thus, the real value of street excavations lies in their potential for documenting continuity of occupation in the context of fluctuating civic attention to particular quarters where otherwise one might get the impression of episodic change due to the presence of successive and apparently discontinuous architectural configurations.

Conclusion

Although the faunal record is affected by a host of taphonomic factors, it is worth posing questions of that record in an attempt to investigate the processes and behaviors that produced it. To the extent that consistency of pattern characterizes the data, one can have some confidence in the trends revealed, bearing in mind, however, that equifinality is always a possibility.

Overall decrease in body size is a characteristic phenomenon of each of the domestic bovid taxa represented in northwestern South Asia during the neolithic period, although the pattern of size diminution differs in detail for each taxon. Unfortunately, data revealing this decrease is so far limited to one site. With the Harappan phase, bone measurements from a number of sites become available. Comparison of these indicates differences in animal build that could reflect different breeds or different husbandry practices or both.

At Harappa, sheep remains greatly outnumber those of goat, and many of the sheep bones come from animals as heavy, although probably not as tall, as those characteristic of neolithic levels at Mehrgarh. In contrast at Nausharo, sheep appear to be nearly as small as the size reached during chalcolithic Mehrgarh and to a lesser extent outnumber goats. These two strands of evidence are consistent with an interpretation that sheep were a particular focus of animal husbandry at Harappa perhaps for secondary products (wool) as well as for meat and fat.

With cattle a pattern opposite to that for sheep seems to occur. Thus on an overall basis, Harappa boasts taller lighter animals and Nausharo shorter heavier ones. This again may indicate the development of specific breeds in the two areas, although such an hypothesis requires testing through analysis of material from other sites and time periods particularly in the Punjab. For goats the situation is less clear because of small sample sizes, although there is marked diversity in animal height reflected in the few length measurements available from Nausharo. For all taxa, examination of kill-off patterns is the necessary next step in investigating potential differences in animal husbandry practices.

Given the fact that numbers of measurable bones are small absolutely as well as in relation to the size of the assemblages analyzed, it has been necessary to group data from all strata of the different phases in order to investigate questions relating to animal size and proportions. This requirement has reduced the resolution of the results and perhaps created an impression of punctuated change where in fact there may have been continuity. Other types of analyses that use a greater proportion of the analyzed fauna provide the opportunity to use the excavation unit as the minimal analytical unit. This has been the case with the analysis of the street deposits at Harappa.

Based on calculations of the number of bones per cubic meter of deposit, variability in the concentration of bone excavated from Street NS2355 could be monitored. Although resolution was not as good as it could have been if individual strata had been carefully stripped back from an existing section, it was possible to define different episodes in the life of the street and relate them to the sequence of architectural change in the area. A principal conclusion must be that units with the greatest bone density need not correlate specifically with major dumping episodes but merely with processes that tend to concentrate bone (and other artifactual material) by removing the sediment from the deposit. Packed bone and rubble can form a kind of natural pavement particularly if the street as a whole is used as a drain for the surrounding area. Episodes of dumping are better reflected by the presence of articulated skeletons or carcass segments. This situation, particularly if the bones lack any signs of gnawing, indicates the absence of scavenging carnivores from the area or the rapid covering of the remains by sediment.

In addition to bone density, mean fragment size was also calculated for each excavation unit in the street. The plot of the resulting statistics in Figure 7.8 shows a general trend toward larger (i.e., heavier) pieces in the later levels. This could be due to decreasing fragmentation, increasing numbers of bones from larger animals, or both. An examination of the bone count statistics reported in Tables 7.4 and 7.5 shows that larger mammal (i.e., bovine) remains are increasingly frequent in the later levels. Whether this, in fact, reflects an increasing focus on cattle (*Bos* and *Bubalus*) through the course of the Harappan phase remains to be tested by comparison with sequences of faunal remains from other areas of Harappa.

Notes

[1] One explanation for this pattern may be that in the earlier period the villagers of Balakot obtained marine resources such as unbroken mollusc shells and the occasional fish through trade with distinct fishing and gathering communities the existence of which is not otherwise attested in the settlements so far excavated. With the Integration Era of the Indus Tradition (Shaffer 1991), these fisher folk (ichthyofagoi) became fully incorporated into Harappan society and served as major sources of fish and molluscs for food and for ornaments (Kenoyer 1983). A test of this hypothesis would involve locating and excavating a sequence of coastal shell middens to document the course of marine adaptations along the Makran coast through late prehistoric period (Tosi 1986).

[2] The terminology used is basically that of Jarrige, but see also Kenoyer (1991) and Shaffer (1991).

[3] The faunal materials from Mehrgarh and Nausharo were studied at the field camp of the French Archaeological Mission where they are currently stored. Of 120 *Bos*, 75 *Ovis*, and 51 *Capra* specimens measured from Nausharo, 73, 35, and 16 measurements, respectively, were used to compile Figures 7.1–7.4.

[4] The faunal materials from Harappa were studied in part at the site and in part in the Zooarchaeology Laboratory of the Peabody Museum where they are now stored. Some 227 *Bos*, 126 *Ovis*, and 35 *Capra* specimens were measured to provide the 139, 75, and 25 dimensions, respectively, employed to make up Figures 7.1, 7.2, 7.5, and 7.6.

[5] The dogs of Harappa also probably ravaged faunal assemblages available to them, although only about 20 specimens of the 5,554 analyzed from the street deposits show clear signs of carnivore gnawing.

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