Social change at the Harappan settlement of Gola Dhoro: a reading from animal bones

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Detailed analysis of the animal bone assemblage at Gola Dhoro here throws light on the expansion of the Indus civilisation into Gujarat. A square fort, imposed on a settlement of livestock herders in the later third millennium BC, was shown to have contained people who introduced a broader diet of meat and seafood, and new ways of preparing it. These social and dietary changes were coincident with a surge in craft and trade.

Keywords: South Asia, Harappan, Indus, Bronze Age, faunal analysis, animal bones, livestock, diet, pastoral economy, social practice, inter-regional interaction

Introduction

The Indus civilisation (*c*. 2600-1900 BC) integrated several distinct regions into one of the world's first state-level societies. As Harappa, Mohenjodaro, and several other population centres in the alluvial plains of the Indus and Ghaggar-Hakra river systems emerged as large walled cities, many of the distinctive styles of material culture developed there came to be widely distributed in adjoining regions, such as Gujarat, where they had no local antecedents (Figure 1). While this is clear evidence that the residents of Gujarat during this period came to participate in inter-regional interaction networks to a greater extent than had previously been the case, the social processes by which they came to be incorporated into South Asia's first urban society remain the subject of considerable debate.

Gola Dhoro, a small (~2ha) settlement situated on the northern coast of the peninsula of Saurashtra, is an ideal site at which to investigate these issues. Analyses of faunal remains

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Received: 10 June 2008; Revised: 5 June 2009; Accepted: 18 August 2009

ANTIQUITY 84 (2010): 528–543 http://antiquity.ac.uk/ant/84/ant840528.htm

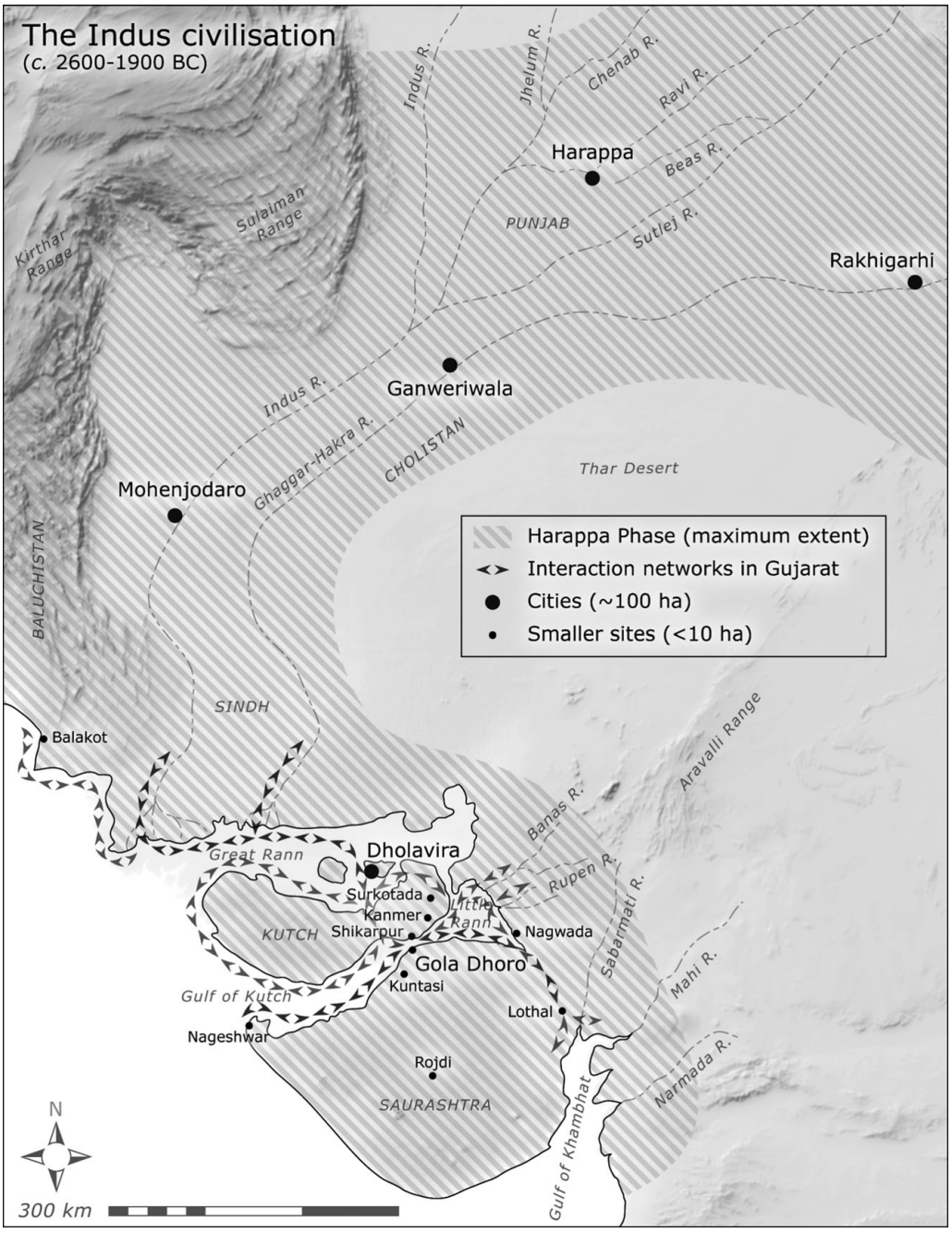


Figure 1. Map of the Indus civilisation showing sites mentioned in the text. Gujarat is the coastal area to the south. (Based on SRTM data and Landsat imagery publically available from NASA.)

from the site show how increased participation in inter-regional interaction networks is associated, firstly, with changes in the pastoral economies that provided the residents of the site with an important category of subsistence goods and, secondly, with changes in residents' domestic practices, specifically those relating to the consumption and preparation of meat.

The Indus civilisation in Gujarat

The developmental trajectory of the Indus civilisation in Gujarat during the formative Regionalisation Era (*c*. 3500-2600 BC) (Shaffer 1992) stands in stark contrast to that known from the alluvial valleys of the Indus and Ghaggar-Hakra rivers in Sindh and the Punjab. In these latter regions, studies of material culture (Mughal 1990) and excavations at sites such as Harappa (Meadow & Kenoyer 2008) demonstrate the clear and gradual development of what has come to be known as Harappan material culture and social practice. In contrast, the bulk of durable material culture from the relatively few excavated sites in Gujarat that date to this period is stylistically and technologically distinct from that known from Sindh and the Punjab (Ajithprasad 2002). While relatively little is yet known regarding the organisation of the pastoral economy practiced in Gujarat during this period, it is nevertheless clear that the residents of the region exploited domestic sheep, goat, cattle and water buffalo (Meadow & Patel 2003). The interpretation of many Regionalisation Era sites in Gujarat as pastoral encampments (Bhan 1994) and the occasional presence at these sites of pottery common in Sindh and the Punjab, has led to the hypothesis of a migration of pastoral peoples from Sindh during this period (Possehl 2007). These migrants would have encountered autochthonous populations who may have been responsible for the recently proposed indigenous domestication of several species of millet in this region (Fuller 2006).

The emergence of walled cities, the development of the as-yet-undeciphered Indus script, distinctive ceramic forms and decorative motifs, urban architectural technologies, and the production of a wide variety of distinctive personal ornaments signal the beginning of the Integration Era (*c*. 2600-1900 BC) (Kenoyer 1998; Possehl 2002). Urban growth in the alluvial floodplains of the Indus Valley was concomitant with the widespread distribution of Harappan material culture in adjoining regions, such as Gujarat, that were source areas for the semi-precious stones and marine shells from which many of the most distinctive and highly valued Harappan ornaments were crafted. Although this set of inter-related processes is generally understood as the first emergence of state-level society in South Asia, considerable debate remains regarding Indus political organisation during this period (e.g. Kenoyer 1994; Possehl 1998).

In Gujarat, Harappan material culture is most conspicuous at the large (∼50ha) walled city of Dholavira (Bisht 2000) and at a network of about 25 small (<10ha) settlements (Sonawane 2005) including the excavated sites of Kanmer (Kharakwal *et al*. 2007), Lothal (Rao 1979), Nageshwar (Hegde *et al*. 1991), Shikarpur (Bhan & Ajithprasad 2008) and Surkotada (Joshi 1990). These settlements often incorporated massive walled enclosures with gateways, and several were centres for the manufacture of distinctively Harappan-style personal ornaments from locally available raw materials. In addition to these so-called Harappan settlements, a series of radiocarbon dates from the site of Rojdi (Possehl &

Raval 1989) demonstrates that at least a portion of nearly 200 additional settlements in Gujarat, which are largely devoid of classically Harappan material culture and therefore generally have been considered to post-date Harappan sites, are in fact contemporaneous. Possehl (Possehl & Raval 1989) has suggested that these 'Sorath Harappan' settlements were established by the local inhabitants of the region, while those settlements characterised by the production and use of classically Harappan material culture were the outposts of a more recent migration of 'Sindhi Harappan' merchants and traders during the Integration Era. Although considerable culture-historical research remains to be undertaken in the region, it is nevertheless clear that during the Integration Era, Gujarat was, like other frontier regions (Lightfoot & Martinez 1995; Stein 2002; Parker 2006), a space where individuals and communities with diverse backgrounds and interests interacted and where social networks and identities were subject to continual negotiation.

Gola Dhoro: a Harappan manufacturing centre in Gujarat

It was within this complex social landscape that Gola Dhoro, a small (~2ha) settlement located on the northern coast of the peninsula of Saurashtra at the convergence of water-based trade and communication corridors, was established (Figure 2). Excavations undertaken between 1996 and 2005, by archaeologists from the Department of Archaeology and Ancient History, Maharaja Sayajirao University at Baroda (MSU) (Sonawane *et al.* 2003), have demonstrated that the site was established on fire-cleared sterile soil. Although local Gujarati ceramic forms with antecedents in the Regionalisation Era predominate, the presence of classically Harappan-style material culture and a single radiocarbon date from a secure context (Beta 217982) with 2σ calibrations of 2550-2540 and 2490-2300 (MSU Dept. of Archaeology n.d.) demonstrate that the site was established towards the beginning of the Integration Era.

After approximately 1m of deposition in most areas of the site, Phase II at Gola Dhoro is defined by the construction of a near perfect square, walled enclosure with sides of approximately 100m (~1ha). The walls of the enclosure are 7m thick and constructed of mud-bricks with dimensions following the typically Harappan ratio of 1:2:4. Construction of this massive walled enclosure is dated by a single radiocarbon date from a secure context with a 2σ calibration of 2480-2280 BC (MSU Dept. of Archaeology n.d.). In the half of the settlement that remained outside of this new walled enclosure, residential structures continued to be used and renovated. During this period there was a dramatic increase in the volume of classically Harappan material culture recovered from the site, including a series of five steatite seals and several associated sealings featuring the famous unicorn motif alongside the Indus script. Manufacturing debris and installations indicate that the residents within the walls were heavily involved with the stone bead, faience and marine shell bangle industries (Bhan *et al.* 2005). Most prominently, the shell bangle workshop excavated within the walls at Gola Dhoro is the largest and most significant ever discovered (Bhan & Gowda 2003). Bangles of this type are known from all major Indus cities and were one of the few ornament types to have been buried with the (mostly female) deceased in the cemetery at Harappa, highlighting their high economic value and ideological significance throughout the Indus civilisation (Kenoyer 1992, 2000).

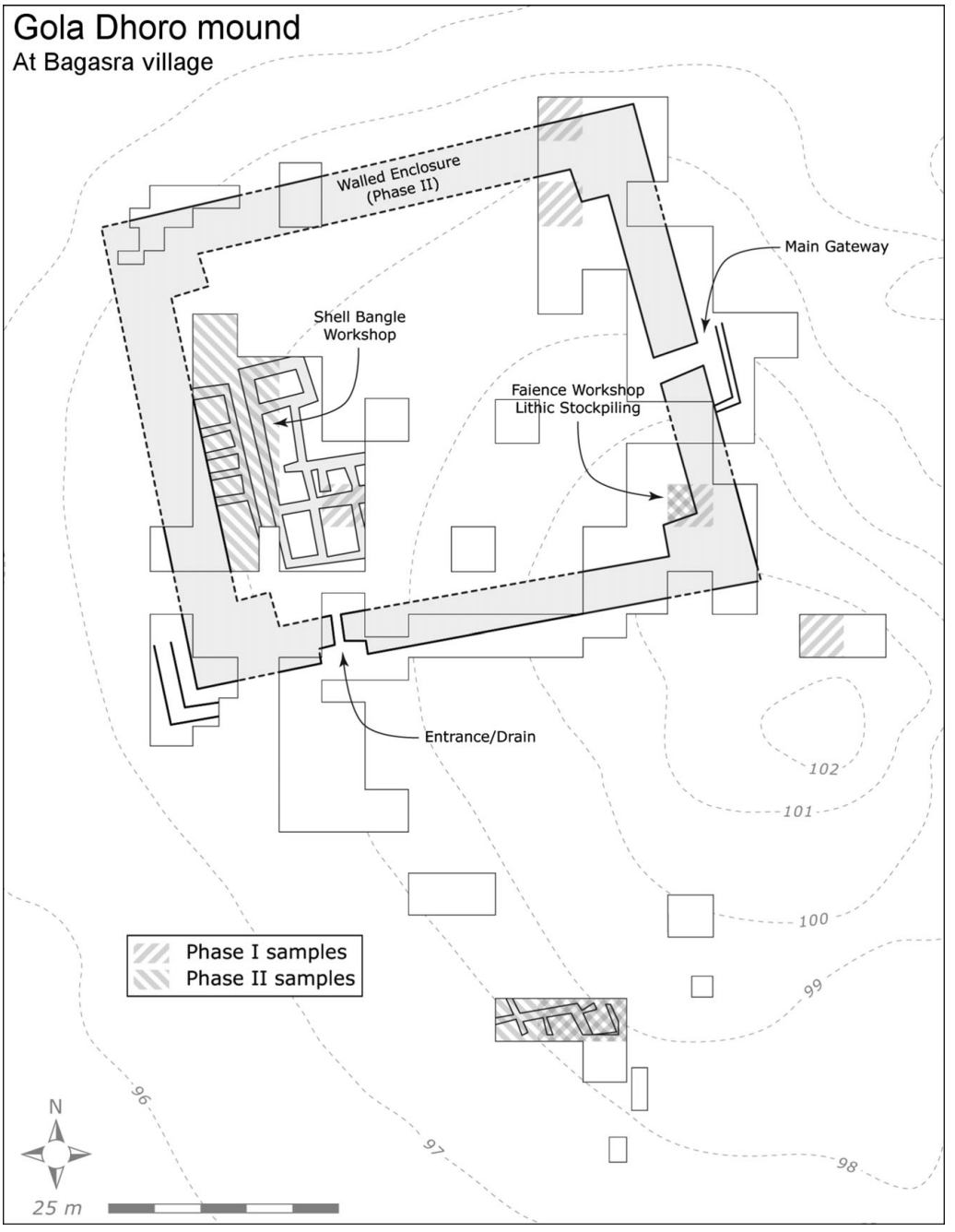


Figure 2. Map of Gola Dhoro (courtesy of the Department of Archaeology and Ancient History, Maharaja Sayajirao University at Baroda).

The construction and maintenance of the walled enclosure during Phase II at Gola Dhoro required the mobilisation and co-ordination of labour on a large scale and thus signify major reorganisation of political and economic life at this small settlement. Subsequently, while some residents continued to live outside the walls, others lived within them and were involved with the production and inter-regional trade of several of the most highly valued Harappan craft goods. Given the complex settlement history of the region and a material assemblage at the site that incorporates both classically Harappan as well as distinctively local forms, the extent to which either the founding of Gola Dhoro or the construction of the walled enclosure were the result of recent migrants to the region is not clear. Regardless of the identity of the settlement's residents, faunal analyses nevertheless shed considerable light on the ways in which this reorganisation and reorientation of the political economy was manifest in their everyday lives.

Meat provisioning at Gola Dhoro: pastoral economy and domestic practice

As is common at sites of this type in the region, the faunal remains from Gola Dhoro are second only to potsherds in count, weight and volume, demonstrating the centrality of meat in the diet of the site's residents. The following discussion is based on a study of over 20 000 bone fragments sampled from all spatial areas of the site during the first two occupational phases at Gola Dhoro (Chase 2007: 50-82). Following standard archaeological practice in the region, archaeologists from the Maharaja Sayajirao University excavated a series of 5 × 5m trenches separated by 1m baulks laid out in an orthogonal grid across the site (Sonawane *et al.* 2003). All cultural material, including faunal remains, was recorded in stratigraphic layers that were assigned to broader occupational phases. Layers deposited prior to the construction of the walled enclosure were attributed by the excavators to Phase I and mostly derive from the restricted areas at the bottom of several non-contiguous trenches distributed throughout the 2ha settlement area. Relatively small samples from restricted exposures at the bottom of widely separated trenches have precluded meaningful intra-site comparisons during this phase.

Layers attributed by the excavators to Phase II are from trenches located both inside and outside the walled enclosure. Intra-site comparisons on this basis are a primary focus of the analyses presented below. In each area, the faunal remains included in this study derive from domestic trash deposits that accumulated in rooms and adjoining narrow spaces that had fallen out of use and which were subsequently remodelled and re-used. A full range of skeletal elements is present in each area, most specimens are highly fragmented, and articulated bones are extremely rare. In conjunction with the archaeological context of deposits from which they derive, these observations suggest that the faunal assemblages under consideration are largely comprised of domestic food waste rather than the contents of more functionally specialised butchers' dumps (as documented in Chase 2005).

The results of the analyses can be summarised under three sub-headings: prelude, pastoral economy and domestic practice.

Prelude

During Phase I domestic animals were integral to the residents' cuisine. However quantified, the bones of cattle- and buffalo-sized animals are nearly twice as frequent as those of sheep- and goat-sized animals (Figure 3). Of those that could be identified to more specific taxonomic categories, pigs and wild artiodactyls (gazelle, antelope, nilgai, deer, etc.) are exceptionally rare, as are the remains of fish and crab despite the site's coastal setting. Given the greater frequency of their remains in conjunction with the larger body size of cattle and buffalo, as compared to sheep and goats, it is clear that beef was by far the most common meat consumed during Phase I. This pattern of heavy reliance on the meat of large domesticates is characteristic of archaeological sites in the region (Thomas *et al.* 1997) as well as throughout the Indus civilisation more generally (Meadow 1989).

The ages at which animals were slaughtered provide valuable information regarding the strategies by which domestic animals were exploited. Although the size of the sample of independent, age-able cattle and buffalo mandibles from Phase I contexts is small, more than half are from adult animals suggesting their exploitation for secondary products (milk and/or traction) prior to consumption as meat (Halstead 1998) (Figure 4). The profile of ages at which sheep and goats were slaughtered is similar to that modelled by Redding (1981) for subsistence herders who raise animals primarily for their meat. Overall, there is little in these analyses or from the archaeology of the site to suggest that Gola Dhoro was anything other than an agro-pastoral village during Phase I.

Pastoral economy: relations of production and consumption

The construction of the walled enclosure that defines Phase II at Gola Dhoro signifies a major reorganisation of the political economy at the site. During this phase, however, the ages at which domestic animals were slaughtered in both residential areas are generally similar to those from the initial occupation of the site and suggest that this event was not associated with major changes in the organisation of the pastoral economy (Figure 4). More detailed reconstructions of the pastoral economy, based on metric analyses of sexually dimorphic skeletal elements (e.g. Filean 2008), require regional datasets as well as a more complete understanding of the morphological and metric distinctions between closely related domestic species, e.g. cattle and buffalo (Patel & Meadow 1998), than is currently available.

These data suggest that the residents of the settlement were potentially self-sufficient in terms of the products of domestic animals. There is no positive evidence for a net import or export of animals, as would be expected if the residents of the site participated in a regionally organised *indirect* distribution system (following Zeder 1991), either as producers or consumers of livestock (Stein 1987; Chase 2005). Moreover, the lack of significant variation in the age profiles from inside and outside the walls suggests that the residents of each area obtained animals via *direct* distribution mechanisms. This implies either that both communities were involved in their production, or that if there was trade in livestock within the site, consuming households obtained animals via small-scale *ad hoc* exchanges with their producers. There is no evidence at Gola Dhoro for

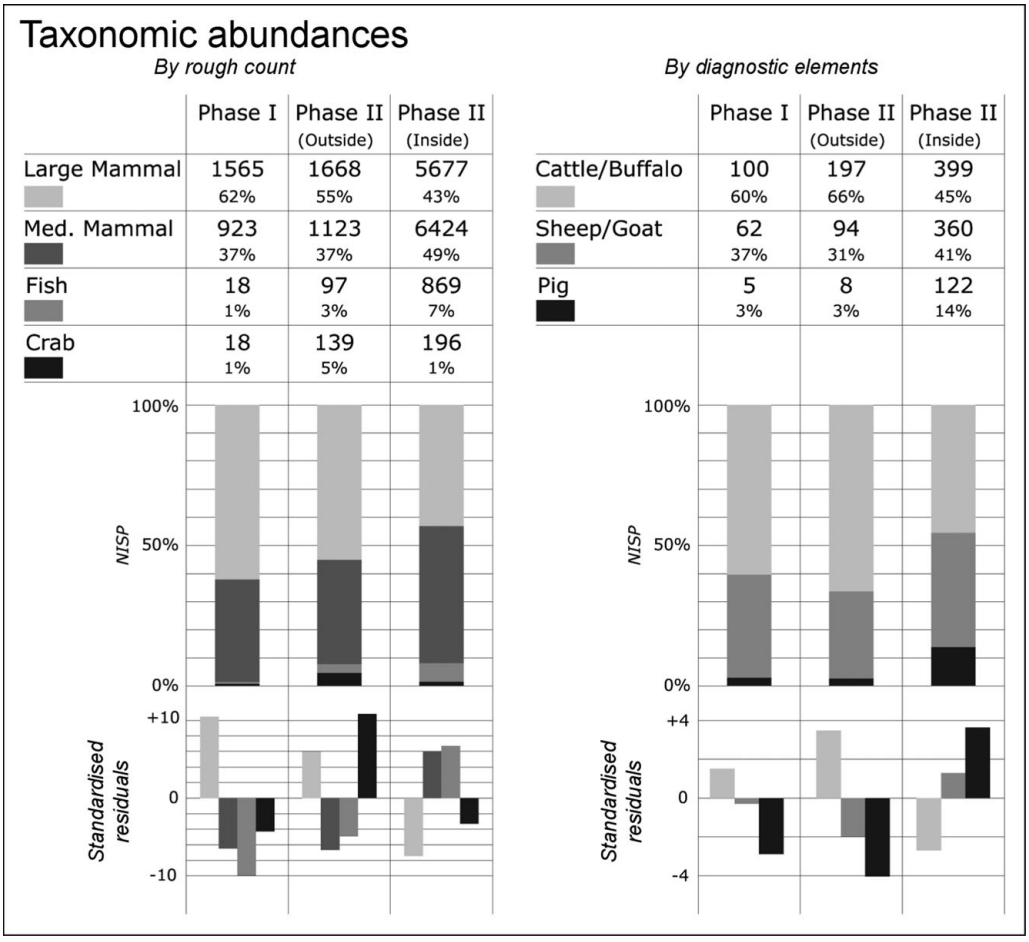
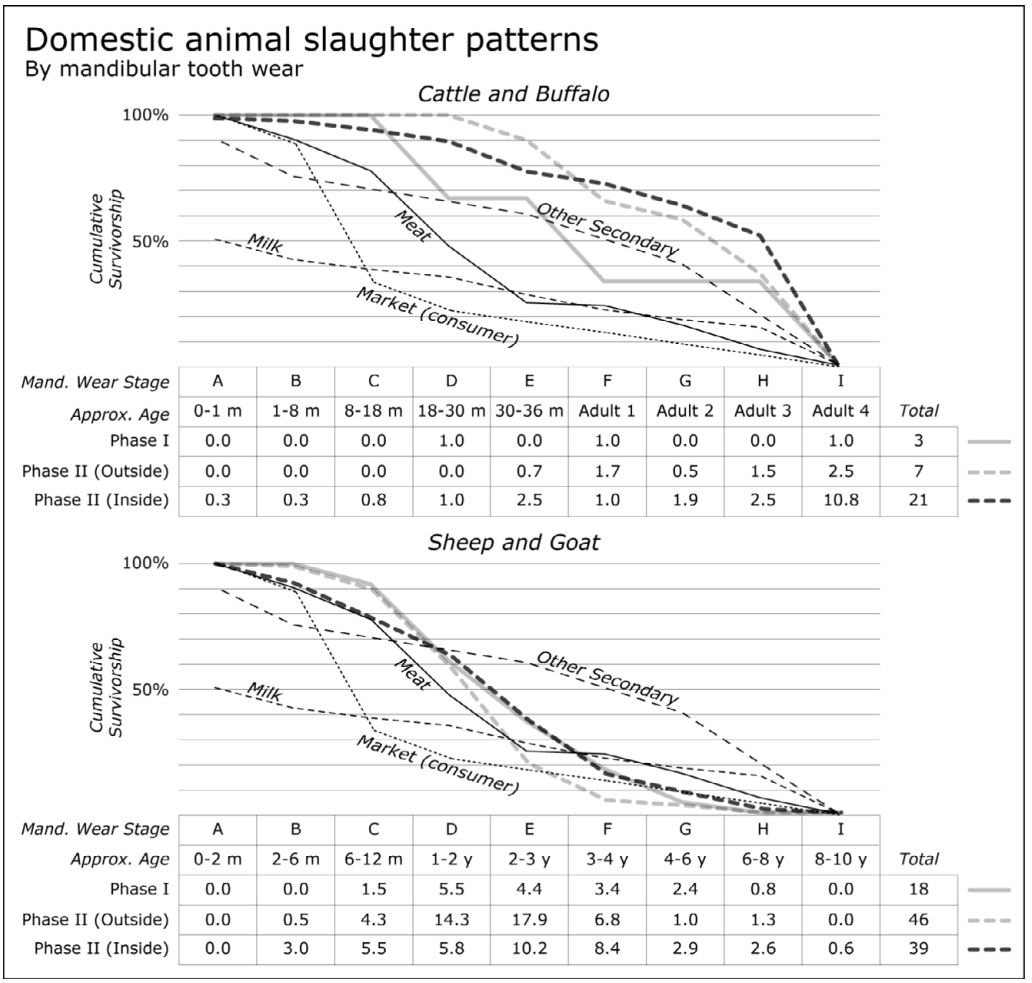


Figure 3. The relative abundance of taxa represented in the samples from Gola Dhoro. 'Rough count' data include all mammalian bone fragments; 'diagnostic elements' include only those pieces with an intact articular surface. Cattle/buffalo and sheep/goat categories may include some bone fragments from similarly-sized wild artiodactyls. Among the restricted set of diagnostic pieces for which reliable identifications are possible, most specimens have been identified as belonging to domestic species. Both measures of abundance show statistically significant (95% confidence) variation according to the chi-square (χ^2) statistic. For greater detail see Chase (2007).

the operation of an *indirect* distribution system institutionalised above the level of the household.

Analyses of the distribution of skeletal portions belonging to each taxonomic category of domestic animal provide insights into the manner in which the residents of each residential area obtained processed meat. There is no statistically significant intra-site variation in the relative abundance of skeletal elements from cattle- and buffalo-sized animals, i.e. they are distributed homogeneously throughout the site (Figure 5). This pattern is consistent with a *direct* distribution system for beef and suggests that consumers obtained whole animals on-the-hoof and processed them near the location where their meat was consumed and the resulting bones discarded.



Mand. Wear Stage	A	B	C	D	E	F	G	H	I	
Approx. Age	0-1 m	1-8 m	8-18 m	18-30 m	30-36 m	Adult 1	Adult 2	Adult 3	Adult 4	Total
Phase I	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	1.0	3
Phase II (Outside)	0.0	0.0	0.0	0.0	0.7	1.7	0.5	1.5	2.5	7
Phase II (Inside)	0.3	0.3	0.8	1.0	2.5	1.0	1.9	2.5	10.8	21

Mand. Wear Stage	A	B	C	D	E	F	G	H	I	
Approx. Age	0-2 m	2-6 m	6-12 m	1-2 y	2-3 y	3-4 y	4-6 y	6-8 y	8-10 y	Total
Phase I	0.0	0.0	1.5	5.5	4.4	3.4	2.4	0.8	0.0	18
Phase II (Outside)	0.0	0.5	4.3	14.3	17.9	6.8	1.0	1.3	0.0	46
Phase II (Inside)	0.0	3.0	5.5	5.8	10.2	8.4	2.9	2.6	0.6	39

Figure 4. The ages at which domestic animals were slaughtered at Gola Dhoro. Mandibular wear stage definitions for sheep and goats are from Payne (1973) and those for cattle and buffalo are from Halstead (1985). Milk and secondary products profiles are taken from Payne (1973), meat from Redding (1981) and market from Chase (2005). Only independent specimens are included in these analyses. Mandibles or teeth not attributable to a single stage have been proportionately assigned to the appropriate stages evenly, following Zeder (1991), contra Payne (1973). Within each taxonomic category, the survivorship curves from Gola Dhoro are not significantly different from one another according to the Kalmogorov-Smirnov statistic. For greater detail see Chase (2007).

The bones of sheep- and goat-sized animals, however, are not homogenously distributed throughout the site. Rather, bone fragments from head (crania and mandibles) and axial portions (vertebrae and pelvis) are statistically more common in contexts outside the walled enclosure, while those from the limbs are more common on the inside (Figure 5). Although density-mediated taphonomic processes have structured the absolute distributions of documented skeletal portions in both areas, the effects of these processes are similar in each (Chase 2007: 194-213). The over-representation of limb portions inside the walls thus suggests that the residents of this area received cuts of mutton (e.g. legs of lamb) from animals

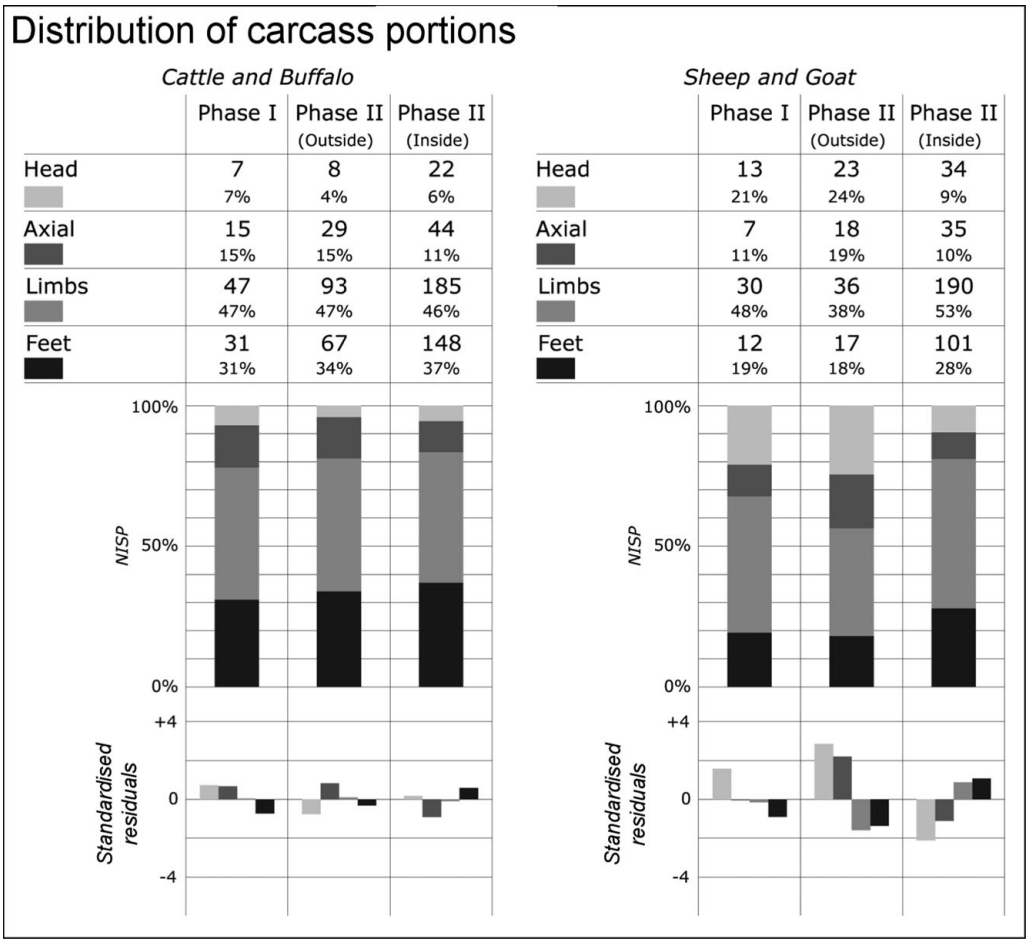


Figure 5. Distribution of carcass portions. The 'head' portion is counted by lower (d)P4 teeth and fragments of the mandibular condyle; the 'axial' portion is counted by fragments of the atlas, axis and actetabulum; the 'limb' portion is counted by fragments of the articular ends of the scapula, radius, ulna, femur and tibia, along with the carpals and tarsals; the 'feet' portion is counted by fragments of the articular ends of the metapodials and the phalanges. Cattle and buffalo carcass portions are homogenously distributed. Sheep and goat portions show statistically significant (95% confidence) variation according to the chi-square (χ^2) statistic. For greater detail see Chase (2007).

initially butchered outside the walls. The variation in the distribution of carcass portions between the two residential areas, while statistically significant, is small in magnitude, and all parts of sheep and goat carcasses are well represented in both areas, suggesting that the differential exchange of highly valued cuts of mutton was of relatively low volume (Figure 5).

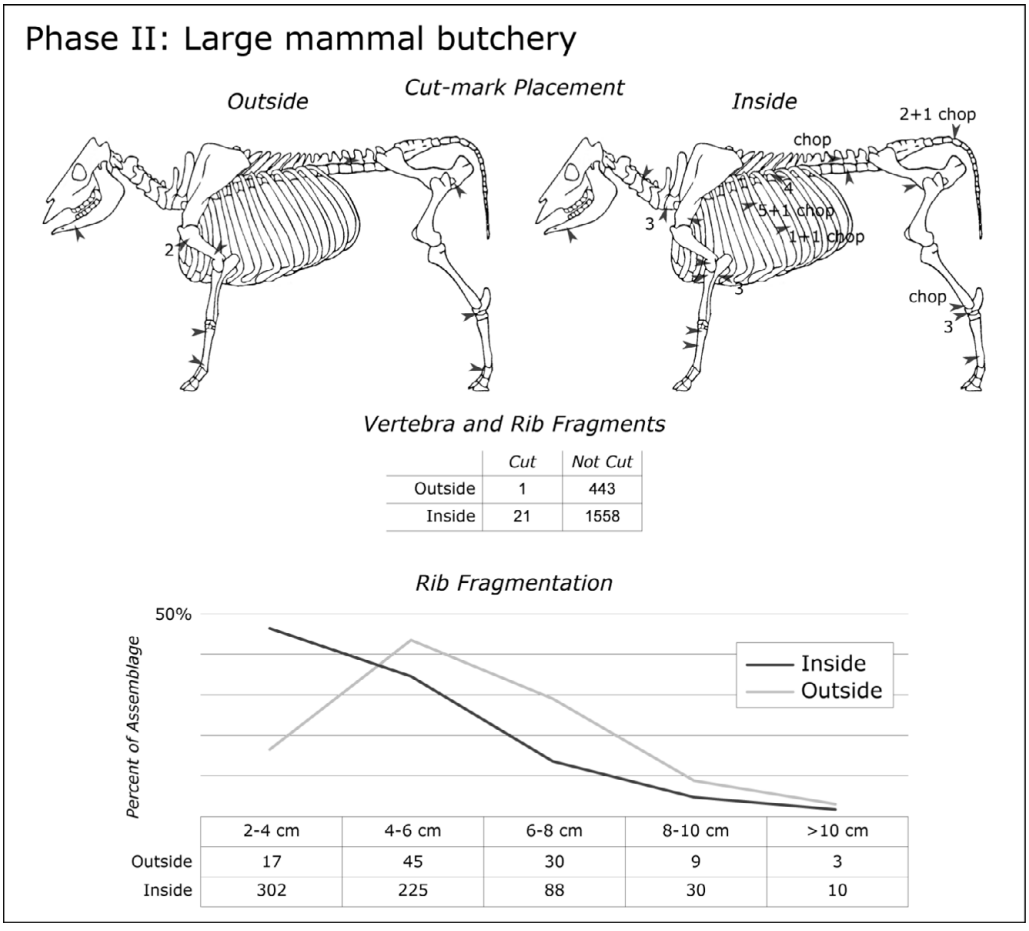
Domestic practice: cuisine and community

With the construction of the walled enclosure that defines Phase II at the site, some of the site's residents lived within the walls and were involved with the production and trade of highly valued craft goods while others continued to live outside. Analyses of taxonomic

abundances from the residential areas located inside and outside of the walled enclosure during Phase II demonstrate that the residents of each area were distinguished by the food, specifically the types and quantities of meat, that they ate. As compared to Phase I, there is a minor but significant increase in the consumption of marine resources both inside and outside of the walls during Phase II (Figure 3) comparable to that documented by Belcher (2003) at the similarly small and contemporaneously occupied settlement of Balakot. While the study of fish and crustacean remains was largely outside the scope of this study, the observation that the residents of the walled enclosure consumed significantly more fish than their neighbours on the outside, who consumed more crab, suggests that the residents of these two areas were distinguished by their food preferences, economic organisation, or both. In terms of the meat of domestic animals, the residents outside of the walls continued to maintain a diet similar to that of the site's first residents. The occupants of the walled enclosure, however, ate more mutton and pork than did their neighbours outside.

The bones of pigs, while common inside the walled enclosure, were exceptionally rare prior to its construction and continued to be rare in contexts outside of the walls, suggesting that the residents of this structure were distinguished by their pork consumption. Pigs can be raised on human refuse in tight quarters. They have thus provided urban communities with some degree of independence from rural pastoral producers in cultural milieux as diverse as the ancient Near East (Hesse 1991; Zeder 1998), Egypt (Redding 1991), Roman Britain (Maltby 1994) and modern India (Chase 2005). It is tempting to imagine that the pigs consumed within the walled enclosure at Gola Dhoro afforded a similar independence to its inhabitants. Unfortunately, the important issue of pig domestication in South Asia has yet to be systematically addressed, and at present the osteometric data from Gola Dhoro are not sufficient to properly evaluate whether the pigs consumed at the site derive from managed or hunted herds. Nearly all of the age-able pig mandibles from Gola Dhoro, however, appear to be from animals younger than about two years of age (Chase 2007: 122-5), consistent with the ages at which domestic animals raised for meat are typically slaughtered. Alternatively, if the pig bones from Gola Dhoro derive from hunted wild animals, it is no less significant that the residents of the walled enclosure chose to utilise them while their neighbours did not. In contemporary India, as well as cross-culturally, the food preferences most often associated with communal (religious, ethnic, etc.) identity often involve the active *avoidance* of the flesh of particular animals (Simoons 1994), while differences relating to the relative amounts of different types of meat consumed are more likely to relate to more prosaic economic distinctions (e.g. Schultz & Gust 1983).

Analyses of the patterning and frequencies of cut-marks demonstrate that, in addition to differences in their food preferences, the occupants of the two residential sectors of the site during Phase II were also distinguished from one another by minor differences in their food preparation practices (Figure 6). This interpretation is based on the observation that cut-marks on the ribs and vertebrae of the larger (cattle- and buffalo-sized) animals occur more frequently in the samples from inside the walled enclosure than in those from outside. This is despite the fact that the samples from inside the enclosure appear to have been fragmented into pieces that are smaller on average than those from the outside of the walls, a process that has been associated with artificially *decreased* cut-mark frequencies rather than the *increased* frequency documented in this case (Bartram 1993: 209-18). Cut-marks in



	Cut	Not Cut
Outside	1	443
Inside	21	1558

	2-4 cm	4-6 cm	6-8 cm	8-10 cm	>10 cm
Outside	17	45	30	9	3
Inside	302	225	88	30	10

Figure 6. Cut-mark patterning and relevant taphonomic evidence for large mammals during Phase II at Gola Dhoro. Fragments of ribs and vertebrae were only identified to size-class. The number of cut-marked rib and vertebra fragments from contexts inside the walls is significantly greater (95% confidence) than outside according to the chi-square (χ^2) statistic. For greater detail see Chase (2007).

these locations are not produced during the initial carcass dismemberment process, which appears to have been undertaken in a similar manner for animals consumed in both areas. Rather, they are produced during food preparation activities such as the filleting of meat off larger cuts either prior to stewing or subsequent to roasting (e.g. Crader 1990; Landon 1996) suggesting that the residents of the walled enclosure at least occasionally prepared beef for consumption in different ways than did their neighbours outside. Although these differences in cut-mark patterning are relatively subtle, they are similar in magnitude to the observed differences in cut-mark patterning between bone assemblages processed by ethnically Chinese- and Anglo-American butchers in the nineteenth-century United States (Gust 1993).

Conclusions

These analyses demonstrate that the construction of the walled enclosure and the inauguration of intensive crafting and trading activities at the site of Gola Dhoro were not associated with a major reorganisation of the pastoral economy that provided its residents with the animal products that were central to their cuisine. With its construction, however, the residents of the walled enclosure maintained food preferences and preparation practices that distinguished them from both the earlier occupants of the site as well as their neighbours outside the walls. These findings can be taken to support the idea that the construction of the walled enclosure and the inauguration of crafting and trading activities at the site were the products of socially distinct craftspeople and traders who had recently migrated to the region (Joshi 1972; Bisht 1989; Possehl & Raval 1989; Dhavalikar 1994; Chakrabarti 1995). If this were the case, however, their activities did not lead to a major change in local productive economies, and they may have been closely involved with pastoral production as might be expected of settler-colonists (c.f. Steffen 1980). Alternatively, the construction of the walled enclosure may have been the product of members of local communities who, as they profited from increased participation in inter-regional trade and exchange networks, came to be socially distinguished from their neighbours by their domestic economies and practices.

The further exploration of these hypotheses requires the integration of other lines of material data from the site, the analyses of which are currently ongoing by colleagues in India and abroad. It also requires the comparison of the data presented here with those collected from other nearby settlements with similar, as well as contrasting, material assemblages. The taxonomic abundances reported here, for example, are roughly similar to both larger and smaller settlements with Harappan material culture, such as Dholavira (Patel 1997) and Nagwada (Patel 1989) respectively, as well as considerably different from several other nearby sites such as Kanmer (Joglekar 2007), Kuntasi (Thomas 1996) and Shikarpur (Thomas *et al.* 1997). Mandibular mortality profiles, intra-site distributions of skeletal portions and cut-mark patterns, however, have not been reported from these sites. Thus, while preliminary, the research presented here provides a new perspective on the Indus civilisation in Gujarat as well as an analytical baseline and replicable methodology for the further work necessary for a more complete understanding of South Asia's first urban civilisation.

Acknowledgements

I would like to thank the Archaeological Survey of India for allowing me to conduct the research upon which this paper is based as well as the American Institute of Indian Studies and the Fulbright Foundation who supported various stages of my research. The study of the faunal remains from Gola Dhoro would not have been possible were it not for support and encouragement of archaeologists from the Department of Archaeology and Ancient History at the Maharaja Sayajirao University at Baroda, especially P. Ajithprasad, Kuldeep Bhan, K.K. Krishnan, and V.H. Sonawane. I would like to especially thank J. Mark Kenoyer for his guidance and William Aylward, Richard Meadow, Ajita Patel, Travis Pickering, Sissel Schroeder and Jason Yaeger for their critical insights as this work has progressed. Nicole Boivin's and Carla Sinopoli's comments on an earlier draft of this paper have improved it considerably. The views expressed here, however, do not necessarily reflect those of any of the above, and all errors in fact or interpretation remain my own.

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