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MOSCOW

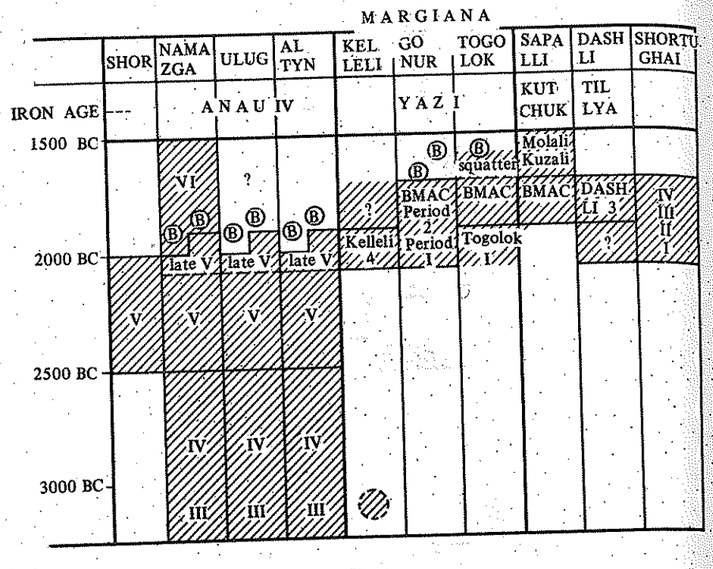

Fig. 6.

PRELIMINARY ARCHAEOBOTANICAL RESULTS FROM THE 1989 EXCAVATION AT THE CENTRAL ASIAN SITE OF GONUR DEPE, TURKMENISTAN

Naomi F.Miller

Fredrick Hiebert of the Peabody Museum, Harvard University submitted various archaeobotanical samples excavated as part of the joint Soviet-American excavation of Gonur depe led by Victor I.Sarianidi. Reported here are a series of dry-sieved samples dating to the beginning of the second millennium calib. B.C. cut from the baulk of the deep sounding ("shurf") in the center of the north mound at Gonur depe. The sounding was 6 m x 6 m square, 3.5 m deep; no architecture was found (figs. 1, 2). Shurf samples ds 1 to ds 8 date to Namazga V, and shurf samples ds 9 to ds 10 date to Namazga VI (F.Hiebert, personal communication). One flotation sample from a hearth in a Bronze Age domestic structure in the north mound was also examined (Locus 43, hearth 2 in room 2; Table 1). For details about the site and recent excavations, see Hiebert (in press).

Gonur depe is located in the Kara Kum desert near Bayram-Ali. Annual precipitation at Bayram-Ali is about 125 mm, well below the minimum necessary for rainfall agriculture. Today the region is an extremely dry sand desert. Photographs show a virtual absence of trees, except for scrubby saxaul (Haloxylon). There seems to have been a settlement shift after the Bronze Age to the south and east (that is, upstream), as conditions in the low-lying areas deteriorated.

During the Middle/Late Bronze Age, the delta of the Murgab river was at Gonur depe. Irrigation would therefore have been practiced, enabling cultivation of all the food plants reported below (see Suslov 1961 for general environmental description). Models of the ancient vegetation are based partly on the plant life of nearby irrigated areas and seeps, which are characterized by tamarisk, camel thorn and poplar. The deep canals are lined with dense thickets (F.Hiebert, personal communication). Gonur depe would have been located close to such habitats. Ultimately, archaeological information should enable us to refine our understanding of the ancient vegetation and changes in the landscape through time.

Methodology

Although Hiebert had planned a flotation program, strong winds limited the use of this technique. Consequently, most of the soil samples were dry-sieved through 2 mm mesh, and visible charred botanical materials were removed by K.Moore and F.Hiebert without the help of a mi-

croscope; the remainder of each soil sample was not kept. In the field camp, the materials were further sorted into three categories: charcoal, seeds, and dung. For this report, the materials from each soil sample were examined under low magnification (7x-30x).

The shurf samples represent a series of comparable trash deposits, but seeds smaller than the 2 mm mesh are not represented (table 1). A flotation sample was therefore examined, to see how including small seeds in the analysis could alter the interpretations based purely on the larger fragments.

Deciding how to record, compare, and interpret archaeobotanical items can be difficult because different plant parts represent different usages; for example, a charred plum pit is a waste product, but a charred barley or wheat grain would seem to represent burned food. Table 2 attempts to standardize some of the quantities reported; for that reason, estimated numbers of seeds are listed. In particular, due to extensive puffing of the grains, average weight of both barley and bread wheat were about 0.005 g/grain; grain counts reported in Table 2 are estimates based on the weight of identifiable fragments added to the number of whole grains.

All the ancient botanical materials recovered were preserved by charring. The density of material is high, but most of it, especially the wheat and barley, is greatly distorted and puffed. For that reason, seeds of only a few types have been measured to give a rough idea of dimension and shape. Material with smallest dimension of less than 2 mm is, of course, not represented in Tables 3, 4 and 5.

Cultigens

Barley (Hordeum vulgare subsp. hexastichum, both hulled and naked forms).

The predominant cultigen in all samples, 6-row barley (including both hulled and naked forms), is also the most numerous. Many of the grains are twisted, a characteristic of 6-row barley. In some cases hull fragments still adhere to the grain. Less commonly, a well-preserved grain has the characteristics of naked barley as described by van Zeist and Bakker-Heeres (1982), that is a rounded cross-section and transverse wrinkling. The numerous rachis internodes are clearly of the 6-row type. One sample (ds 4) has 12 measurable grains, though these tend to be somewhat shorter than many of the puffed barley grains (Table 3). With an average length: breadth index of 148, the grains are slightly rounder than those reported from Altyn depe (L:B=151, Janushevich 1977).

Wheat (Triticum sp.)

Several wheats were recognized in the samples. Free-threshing hexaploid wheat (Triticum aestivum s.l.) is most common find, and many of the grains are fairly short and broad; their form is reminiscent of club wheat (Triticum compactum) as illustrated by Costantini and Biasini (1984) and Costantini and Costantini-Biasini (1986). A few grains that might be either T. compactum or Indian dwarf wheat (T. sphaerococcum) were also seen. Only two of these particularly small seeds were measurable (Table 4). Although caryopses of Triticum aestivum cannot be distinguished from those of T. durum on purely morphological grounds (van Zeist and Bakker-Heeres 1982:198), these grains are most likely bread wheat. Several probable grains of emmer wheat (T. dicoccum) were also seen. Most of the wheat rachis fragments are T. aestivum internodes, and a few spikelet forks of emmer were also recovered.

Pulses

Lentil (Lens culinaris) is the most common pulse. Grass pea (Lathyrus sp.), pea (Pisum sp.) and chickpea (Cicer arietinum) were also recovered in small numbers.

Fruits

The most common fruit seed is grape (Vitis vinifera), and a few grape peduncles (stems) were also recovered. Several of the seeds have an elongated stalk, said to be characteristic of the cultivated type, though the breadth: length index is not distinctive (Table 5). Although only two whole Prunus sp. pits were found, several samples had pit fragments. Though small, the pits are most likely from a variety of plum. Their shape is similar to uncharred modern plum pits from the region provided by K.Moore (Table 6). Finally, a tentatively identified apple seed (Malus sp.) occurs in one sample.

Wild and weedy plants

Many of the plants in this group cannot yet be identified to genus, and members of the families from which they come can grow in a fairly wide range of conditions. Special mention can be made of some.

The most ubiquitous and numerous type in the shurf samples is camel thorn (Alhagi sp.). Individual seeds, pod segments, and pod fragments are present. The number of seeds noted for each sample includes loose seeds as well as the number of intact segments (Table 2). Townsend (1974:496) describes it as "a deep-rooted, thorny xerophyte which ... provides valuable forage for camels". Other animals, however, generally avoid it. Camel thorn usually grows on uncultivated wasteland, and is common today on the edge of irrigated fields 6 to 10 km from the site.

The next most numerous type of weed seed is an as yet unidentified member of the mustard family (Cruciferae), listed on Table 2 as "Cruciferae 1". Individual seeds and whole and partial siliques ("seed pods") are present. The seed count is calculated from loose seeds, whole siliques (two seeds each) and halves. The Cruciferae family includes many weedy types that grow in fields with and without irrigation, as well as types which grow on fairly barren terrain. On Table 2, the categories "Cruciferae 2" and "Cruciferae 4" refer to seeds which are attached to their siliques. "Cruciferae 3" consists of intact siliques.

Some of the Gonur seeds are from sedges (Cyperaceae), plants that typically grow in moist ground. Others, like Rumex, are from field weeds that, at least based on my observations in southern Iran and central Anatolia, tend to grow in fairly moist irrigated fields. Adonis, a member of the Ranunculaceae, is also a small herbaceous plant. Members of the goosefoot family (Chenopodiaceae, including Salsola and Suaeda) are drought and salt-tolerant, and are common in the deserts of Central Asia (Suslov 1961). In fact, saxaul (Haloxylon), a member of the Chenopodiaceae, is one of the woody types growing in the region today. In addition to a few unidentifed grasses, a wild Setaria and Phalaris have been tentatively identified.

"Unknown 1" seems to be a small lumpy round fruit, about 4 mm in diameter, with many narrow seeds ca. 1 mm long within. "Unknown 2" seems to be a 4-carpel fruit. "Unknown 3" may be Centaurea, a member of the Compositae family.

Charred dung

Most of the samples include dung. In some cases there are recognizable sheep/goat pellets and fragments; the identification is based on shape, outer surface texture, and to a lesser degree, internal texture. Other pieces are likely to have originated from larger animals, perhaps cow, other bovid, or even camel; the identification is based on straw impressions oriented haphazardly and the absence of a smooth outer surface. Seeds have been found embedded in some of the dung (Table 7).

Charcoal

In the absence of suitable comparative material, the Gonur charcoal has not been examined. Many of the pieces recovered by sieving should, however, be large enough to identify. In the arid environment of the Murgab delta, one might expect to find the common trees of the Near East that grow next to surface streams or in areas of high water table, such as poplar (Populus) and tamarisk (Tamarix); these were the most common fuels at Shahr-i Sokhta, for example (Costantini 1977a, 1977b). In sites in southern Turkmenistan between the Tedzhen and Murgab rivers, elm, poplar, maple, willow and tamarisk have been found

(Lisitsina 1968). Given its prominence in the woody vegetation of today, as well as its occasional occurrence on archaeological sites in Turkmenistan, saxaul is another expected wood type (ibid). Although people do not usually use orchard trees as a major fuel source, trimmings from the vine, plum, and other fruit trees might be expected as occasional constituents of the charcoal assemblage. Juniper has been identified in archaeobotanical samples from the piedmont zone of southern Turkmenistan (ibid.); if it were found at Gonur, it would probably represent transport of that wood over some distance, rather than local collection. Since charcoal analysis is a destructive procedure (the pieces are broken so that a clean surface may be examined), it is best to wait until a chunk of saxaul can be obtained for comparison before attempting it.

The samples

Despite differences in the proportions of seed, charcoal and dung, the samples with the most material are rather uniform. Six-row barley, camel thorn, and the unknown mustard "Cruciferae 1" consistently dominate. The shurf samples are listed in chronological order in Table 2.

A comparison between the flotation sample of Locus 43 and the drysieved samples shows that the larger seeds and plant parts may be adequately represented by simple sieving. Smaller types, especially Trigonella, weedy grasses and the chenopods, are best retrieved through flotation.

Interpretation

The bulk of the material reported here seems to be fuel residue. Both wood and dung seem to have been plentiful, despite the fact that natural stands of trees would have been restricted to water sources. It is likely that some of the seeds, wild and cultivated, originated in dung fuel (Miller and Smart 1984). Some of the wild plants may have been burned in fires fueled by brush. This is most likely the case for the camel thorn and "Cruciferae 1". The former is avoided by most animals (personal observation), and it is used as fuel in arid regions (cf. Townsend 1974). The seeds and pods seem to be intact, as though they had been burned directly. Of course, a few of the seeds were found embedded in dung (Table 7), which strongly suggests at least those specimens had been eaten by an animal. Until it is identified, we will not know the palatability of "Cruciferae 1", but the fact that so many of the siliques are found intact may mean that the plant was simply burned, never having passed through an animal's digestive tract. The quality of preservation contrasts strongly with that of the cereal grains, but I am not yet willing to infer that the puffed grains had passed through animals before becoming charred.

Janushevich (1984) briefly mentions finds of naked barley and Triticum compactum - like wheat from sites in Turkmenistan. Sites from desert oases and arid continental regions outside Turkmenistan also have remains that may be compared with those of Gonur. These areas are ecologically similar and share many of the food plants found in the Gonur assemblage. The comparisons below are based primarily on Costantini and Costantini-Biasini's research on sites in desert and semi-arid areas of Iran and south Asia. Shahr-i Sokhta (1977a, 1977b), Hissar (forthcoming), Gijlar (1984), and Yahya (in 1985) in Iran are all located in arid internal drainage basins. Harappan civilization, represented by sites such as Mehrgarh (1984), Pirak (1977, 1979), and Nausharo (1986) in Pakistan, and Shortughai (Willcox 1990) in Afghanistan, was in contact with the Near East. Like Gonur depe, these sites have plants which originated in both the Near East and South Asia (Table 8).

Six-row barley, both hulled and naked varieties, dominates these assemblages, representing up to 90% of the cereals. The wheat grains (and barley, too), sometimes have a short, "sphaerococcoid" shape. For example, Triticum sphaerococcum, a hexaploid wheat, seems to have been developed on the Indian sub-continent. It is present in Pakistan at the site of Mehrgarh; Costantini and Costantini-Biasini (1986:355) note that "agriculture was dominated by naked grains, the tendency being apparently to cultivate and select small-seeded plants". By the third millennium B.C., this grain had spread to other parts of south and central Asia. It is present at Sharh-i Sokhta in the Hilmand basin of Seistan province, Iran (Costantini 1977).

The grape pips reported from these sites are not always morphologically distinguishable from the wild type. It is, however, likely that they were cultivated. Not only is this entire area outside the presumed range of the wild type, but charcoal from the vine has been identified at Mehrgarh (period VII, mid-third millennium B.C.; Thiebault 1989). Grape had become an established crop throughout these arid and oasis areas certainly by the mid-third millennium B.C. (as is also the case in the Near East). Its occurrence at Gonur is thus a continuation of a long tradition of viticulture.

There is only a little information supporting comparisons between the non-cultivated seeds of the Gonur assemblage and those of other desert and desert edge sites. Like Gonur, Gijlar has seeds of both steppe (Alhagi) and field (Galium, Polygonum). Unlike the Chenopodium at Shahr-i Sokhta, which was found in pots as well as scattered in the deposits (Costantini 1977), the Chenopodiaceae at Gonur occur in the flotation sample, and are likely to have originated in dung fuel. More detailed comparisons await analysis of additional samples from Gonur and the continuing publication of other assemblages.

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Figure 1. Plan of Gonur depe (F.Hiebert)

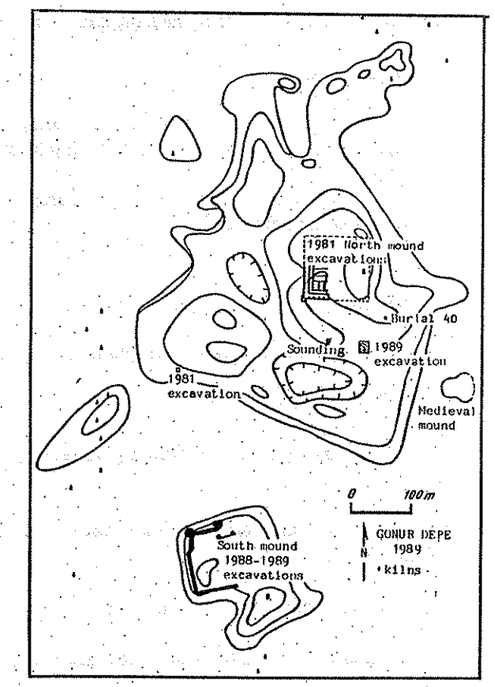

Figure 2. Section drawing of shurf (F.Hiebert)

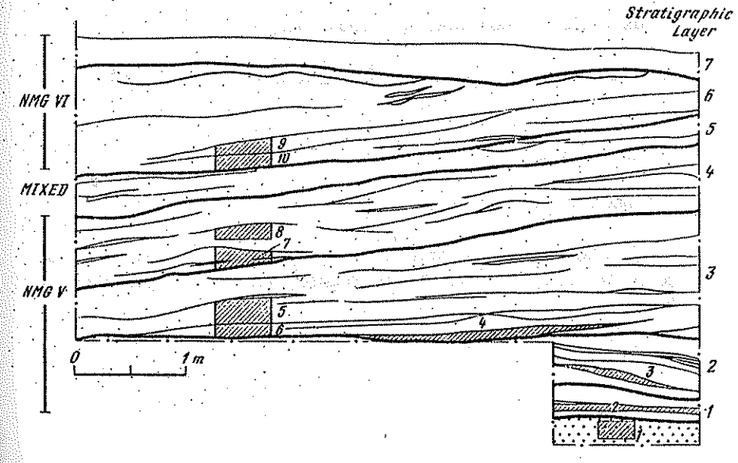

Table 1. Catalog of samples from shurf (fig.1) and Locus 43 (1)

Namazga VI

ds 9 Black charcoal deposit; chunks of compressed, cow dung-like vegetal remains; sample ds 9.1 from this level also

ds 10 Gray ashy, with white flecks (probably salt). Chunks of mud brick visible; below ds 9

Namazga V

ds 8 Gray charcoal level; firm and fine texture

ds 7 Charcoal lens and ash

ds 5 Sandy light brown; thin layers faintly visible; very fine texture

ds 6 Gray salty or ashy level; firm texture, below ds 5; clear separation between ds 6 and ds 5

ds 4 Gray ashy; loose; fine texture

ds 3 Dark gray and black speckled lens; soft, fine texture

ds 2 Directly above lowest, sterile deposit

ds 1 Sandy yellow sterile soil (no material 2 mm recovered)

Bronze Age

Locus 43 "Raskop 2" sounding

(1) Plant remains were retrieved by dry sieving ("ds"), except for those from Locus 43, which were floated; information provided by F.Hiebert.

Table 2. Taxa from Locus 43 and shurf samples[1]

Samples:	loc 43 (>2 mm)	loc 43 (total)	ds 2	ds 3	ds 4	ds 6	ds 5	ds 7	ds 8	ds 10	ds 9	ds 9.1
Sediment volume (bags)	?	?	1	1	2	1	2	1	1	2	1	?
Charcoal (wt., g)	1.92	-	2.88	>4.23	5.76	7.05	5.76	4.58	3.73	7.06	9.57	?
Seed (wt., g)	0.84	1.82	0.37	0.22	2.03	0.06	0.07	0.86	0.11	0.23	1.74	2.29
Dung (wt., g)	1.15	-	1.18	+	2.48	0	0	3.90	0	+	6.89	0.07
Charcoal (ml)	10	-	12	>25	35	30	20	20	12	30	50	?
Seed (ml)	3	6	1	+	10	+	+	2	+	1	10	12
Dung (ml)	5	-	5	+	5	0	0	10	0	+	30	+
Sample volume (ml)	**18**	**-**	**18**	**>25**	**50**	**31**	**20**	**32**	**12**	**31**	**90**	**?**
Cereal												
Hordeum vulgare (est.)	105	139	30	14	112	4	5	25	4	16	116	139
Triticum aestivum/durum (est.)	2	2	3	1	27	.	1	11	.	2	23	21
Triticum cf. sphaerococcum (est.)	.	.	.	.	.	.	.	.	.	.	8	4
Triticum cf. dicoccum (est.)	.	1	.	.	2	.	.	.	1	2	.	8
Triticum sp. (est.)	.	.	.	.	.	.	.	.	.	2	.	21
Cereal (est. from fragments)	34	90	6	.	20	+	2	8	4	12	22	42
Pulses												
Cicer	.	.	.	.	1	.	.	.	.	.	.	.
cf. Lathyrus	.	.	.	1	.	.	.	4	1	.	.	.
Lens	5	5	.	.	12	.	.	11	2	1	18	15
cf. Pisum	.	.	.	.	2	.	.	.	1	.	.	.
other large legume	1	1	1	.	.	2	.	6	.	.	+	.
Fruit												
cf. Prunus	+	+	.	+	+	.	.	+	.	.	0.5	2
cf. Malus	.	.	.	.	.	.	.	.	.	.	.	1
Vitis	2	2	.	.	2	.	.	9	.	1	9	1

Table 2. *(continued)*

Samples:	loc 43 (>2 mm)	loc 43 (total)	ds 2	ds 3	ds 4	ds 6	ds 5	ds 7	ds 8	ds 10	ds 9	ds 9.1
Weed												
Centaurea	.	.	.	.	.	.	.	.	.	3	.	.
crucif 1	44	700	.	.	26	.	.	4	2	33	99	83
crucif 2	.	.	.	.	.	.	.	.	.	.	4	.
crucif 4	.	7	.	.	.	.	.	.	.	.	.	.
Salsola	.	2	.	.	.	.	.	.	.	.	.	.
Suaeda	.	3	.	.	.	.	.	.	.	.	.	.
Chenopodiaceae	.	1	.	.	.	.	.	.	.	.	.	.
Cyperaceae	.	4	.	.	.	.	.	.	.	.	.	.
cf. Alhagi	9	61	57	56	.	9	2	53	10	13	115	9
cf. Trigonella	.	116	.	.	.	.	.	.	.	.	.	.
other small legume	.	34	.	.	2	.	.	.	.	.	.	.
cf. Setaria	.	.	.	.	1	1	.	.	.	.	.	1
cf. Phalaris	.	.	1	.	.	.	.	.	.	.	.	.
Gramineae	1	33	2	.	1	.	.	1	.	1	6	.
Rumex	.	.	.	1	.	.	.	.	.	.	1	1
Gallium	.	.	.	.	.	.	.	1	.	.	.	2
Adonis	.	.	.	.	.	.	.	.	.	.	1	.
Unknown 2	.	.	2	.	.	.	.	.	.	.	.	.
Unknown 3 (Centaurea?)	.	.	1	.	.	.	.	.	.	.	.	.
seeds (identifiable?)	.	26	.	1	.	.	.	1	.	.	8	2
Weed seed sum	54	987	63	58	30	10	2	60	12	50	234	98

1 Plant remains were retrieved by dry-sieving, except for those from Locus 43, which were floated; one "bag" is about 1 liter

2 Not all charcoal was picked out of sample

3 6 charred mouse droppings were found also

4 *Rumex* achene from ds 9 is winged, and looks like *Rumex crispus*

Table 2. *(continued)*

Samples:	loc 43 (>2 mm)	loc 43 (total)	ds 2	ds 3	ds 4	ds 6	ds 5	ds 7	ds 8	ds 10	ds 9	ds 9.1
Plant parts												
Hordeum vulgare internode	1	592	14	.	6	.	.	34	.	1	28	.
Triticum aestivum/durum internode	2	60	11	.	8	.	.	5	.	1	30	16
other Triticum internode	.	67	.	.	.	.	.	7	.	1	.	.
Vitis peduncle	10	10	.	.	.	.	.	3	.	.	1	1
Triticum dicoccum spikelet fork	.	.	.	.	.	.	.	.	.	.	0.5	5
Cruciferae 1 silique	+	++	.	.	+	.	.	+	+	+	++	++
Cruciferae 2 silique	.	.	.	.	.	.	.	.	.	.	+	.
Cruciferae 3 (silique sections)	.	.	.	.	.	.	.	1	.	.	2	5
Cruciferae 4 silique	+	+	.	.	.	.	.	.	.	.	.	.
Alhagi pods & frags	+	++	++	++	++	+	+	++	+	+	++	.
straw culm nodes	60	.	.	.	.	.	.	.	.	.	.	.
leaf	3	3	.	1	.	.	.	.	.	.	.	.
Unknown 1	.	.	.	.	.	.	.	.	.	.	.	1
Unknown 2	.	.	+	.	.	.	.	.	.	.	.	.

Table 3. Barley dimensions (sample ds 4)

		Length mm	Breadth mm	Thickness mm	L:B
N=12	min.	3.9	2.7	1.7	118
	aver.	4.6	3.1	2.3	148
	max.	5.2	3.8	2.8	193

Table 4. Club wheat/Indian dwarf wheat dimensions (sample ds 9.1)

Length mm	Breadth mm	Thickness mm	L:B	T:B
3.6	3.3	2.7	109	82
3.5	3.0	2.4	117	80

Table 5. Grape dimensions (sample ds 9)

		Length mm	Breadth mm	B:L
N=9	min.	5.0	3.0	59
	aver.	5.8	3.7	65
	max.	6.8	4.3	74

Table 6. *Prunus* stones

	Length (mm)	Breadth (mm)
Modern, uncharred	1.3	1.4
	1.5	1.7
Sample 9.1, charred	0.8	0.8
	1.0	1.0

Table 7. Samples containing dung and embedded seeds

Sample no.	Seeds	Sheep/goat	"Cow" dung
ds 2	7 cf. Alhagi	1 pellet	
ds 4	3 unidentifed	16 pellets and fragments	
ds 7		fragments	
ds 9	1 Triticum	1 pellet and fragments	+++
ds 9.1	1 Rumex 1 cf. Setaria 2 unidentified	fragments	+++

Table 8. Some food plants from other sites*

	Mehrgarh III	Hissar II	Shahr-i sokhta	Pirak I	Shortu-ghaï	Naus-hauro
approx. date B.C.	5000?	3000	2500	2000	2000	2000?
Hordeum vulgare	++	++	++	++	++	++
Triticum aestivum s.l.	+	+	+	+	+	+
T. sphaerococcum			+	+		+
Vitis vinifera	+	+	++	(rare)	+	+
Prunus sp. (wild?)	+	+			(almond)	

*NOTE: Many other types occur on these sites.

(Source: Costantini and Dyson forthcoming, Costantini n.d., 1979; Willcox 1989; Costantini and Biasini 1986)