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SURVEY AND EXCAVATION
MONS CLAUDIANUS

1987-1993

VOLUME II

EXCAVATIONS : PART 1

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CHAPTER 8

THE BOTANICAL EVIDENCE

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8.1 INTRODUCTION

Most of our knowledge concerning food, diet and agriculture in Roman Egypt is based on documentary evidence (*e.g.* Schnebel 1925; Crawford 1979) and, to a lesser extent, on art historical evidence (Keimer 1924; Germer 1985; Manniche 1989). There are almost no detailed publications on archaeobotanical evidence from the period, even though the conditions for the preservation of botanical remains are very good in Egypt. There are only four published archaeobotanical reports (Barakat and Baum 1992; Cappers 1996; Newberry 1889; Wetterstrom 1982), and two of these concern grave goods rather than domestic evidence. When the excavations at Mons Claudianus revealed a profusion of botanical remains in the midden deposits, it was recognised that the analysis of these remains could provide information regarding the diet of the inhabitants of the site, the nature of the food supply, the use of plants for fuel and building materials, as well as the nature of the natural vegetation in the vicinity of the site during the Roman period. The writer joined the project in 1990. In this chapter the archaeobotanical data collected over four seasons (1990-1993) is presented. Most of the evidence comes from the deposits in and around the fort of Mons Claudianus itself, but samples were also collected from the nearby Hydreuma and from Barud. The report is organised in the following sections: the methodological issues regarding data collection and sampling are discussed in section 8.2, the results are presented in section 8.3, the formation processes of the archaeobotanical assemblage and the inter- and intra-site variability of the assemblage are discussed in section 8.4. The final section (section 8.5) summarizes the results of the archaeobotanical analysis and offers a reconstruction of the food supply to the fort on the basis of the available evidence.

8.2 METHODS

8.2.1 DATA COLLECTION AND SAMPLING

The principal aim of the analysis of the botanical data is to identify the range of plant foods present in the deposits and to reconstruct the food supply to the fort. The sampling strategy was, therefore, aimed at collecting samples from as many deposits as was possible within the usual constraints of time and money. During 1990 and 1992, when excavations took place on a large scale, a random sampling strategy was implemented by the writer, aimed at collecting at least five samples from each specific area of excavation. During 1991 and 1993 (when the writer was unable to come out to Egypt) excavation took place on a much smaller scale, but samples were collected from the main excavated deposits. Almost all the deposits sampled are so-called "sebakh" deposits, *i.e.* midden deposits: accumulations of domestic refuse, often redeposited and without a clearly defined stratigraphy. Three large middens lying immediately outside the fort were sampled: the South Sebakh, the South-West Sebakh and the Well Sebakh. Most of the South Sebakh had been excavated by 1990 and its finds removed to store. It has, unfortunately, not yet

South Sebakh	
1	K7 NE 1
2	L7 W 2
3	C7 3
5	C7 5
G1	Str1 SW (=A8)
G2a	West Section 1st (upper layer)
G2b	West Section 2nd (middle layer)
G2c	West Section 3rd (bottom layer)
Well Sebakh	
3	C1 W (3)
5	S1 NW (5)
6	C1 SE (6)
8	S1 NW (8)
9	C1 W (9)
Fort SE Corner = S13-14 and Area R	
6	S1 SW (6)
10	R1 S (10)
13	S1 E (13)
26	R2 SW (26)
32	S1 SW (32)
14	Room 4 (14) S1W (=S13)
24	Room 4 (24) S1W (=S13)
38	Room 4 (38) R'1W (=S13)
39	II (39) T'1NW
Fort NE = Area X	
5	(5)
8	(8)
9	(9)
14	(14)
24	(24)=(28)
Fort West I = Area M5-7	
5	Room 1 NW (5) (=M5)
6	Room 1 NW (6) (=M5)
14	Room 1 SW (14) (=M5)
1	Room 3 S (1) (=M7)
2	Room 3 SE (2) (=M7)
4	Room 3 SW (4) (=M7)
1+2	Corridor between 1+2 (=M5-M6)
Fort West II = L1 (east)	
2	SE (2)
4	SW (4)
8	SW (8)
9	SE (9)
Annexe SI = T18	
2	E (2)
3	E (3)
5	NW (5)
9	E (9)
10	E (10)
Annexe SE Corner = T27-T31	
3	(3)
9	(9)
18	(18)
23	(23)
28	(28)
37	(37)
Barud I	
2a	(2) 1st sample
2b	(2) 2nd sample
3a	(3) 1st sample
3b	(3) 2nd sample
3c	(3) 3rd sample
4	(4)
6	(6)
6NW	(6) NW corner
Hydreuma	
1	S Trench, upper half; 10-30 cm
2	S Trench, upper half, 1st stage; 30-60 cm
3	S Trench, lower half, 0.80m deep
4	East Slope IV (3b)
5	East Slope II (4)
6	NW Sebakh S (1), findspot Neronian ostracon
7	SW Sebakh (1) top burnt area
8	SW Sebakh (3a); 20-30cm
9	SW Sebakh 3C2
10	SW Sebakh NW Quarter; 20-30 cm
Wall plaster	
1	92 Room 4, Fort SE Corner (=S13)
2	92 Room, Fort SE Corner (=S14)
3	93 Room, Fort SE Corner (=S14)
4	92 Room 1, Fort West II (=L1)
5	93 Room 1, Fort West II (=L1)
Mud brick	
1	92 Building A, north wall
2	92 Building A, south wall
3	93 Building A, north wall
4	93 Building A, south wall
5	92 Gate (15)

TABLE 8.1. *List of contexts from which small samples were collected and sample abbreviations.*

been possible to study the botanical remains from the pre-1990 seasons, though they are not expected to add much new information to the data collected since 1990 and presented here. In addition to the three large external middens, samples were also collected from refuse dumps inside the fort and the fort annexe, from the mudbrick walls in central building A, and from the wall plaster still preserved in some of the rooms inside the fort (see Fig. 1.3 for the location of the areas sampled). A list of all the contexts sampled and the sample abbreviations used in the tables is given in Table 8.1.

Three different types of sample were collected:

a) *Small samples*

These are sediment samples of 2 litres in volume, collected from all areas of excavation. These samples were dry-sieved through an 0.5 mm mesh sieve. In most cases manual water-flotation was applied at a later stage, again using an 0.5 mm mesh sieve. Both the flots and the residues were dried and sorted under a microscope, using x10-15 magnification. The number of seeds present in the residues was normally very small indeed, indicating that the flotation had been very successful. The flots were in most cases very rich in plant remains (up to 1000 seeds) and were in many cases only partly analysed (see section 8.2.3 below). The quantitative analysis of the seed assemblage is based on the results from these samples only.

b) *Large samples*

These are sediment samples of c. 20 litres in volume (one basket full), which were dry-sieved through a 2 mm mesh sieve. These samples were sorted "by eye" by the writer, extracting the larger seeds and fruits; no attempt was made to pick-out the smaller botanical remains. This category of sample was collected during 1992 only, with the aim of checking to what extent the rarer plant species were being recovered in the small samples. The small samples are so small (two litres in volume) that plant species occurring only sporadically in the deposits might be missed all together. These samples were also sorted for small bones (see section 9.1). The number of identifications in these samples are used only to plot the presence and approximate abundance of the species, they are not used in any quantitative analysis. They are, therefore, not listed by context number, but by area only in the table.

c) *Hand-picked material*

This material represents plant remains that were recognised during excavation by the local workers and site supervisors and were picked-out by them. They typically represent date stones and other large fruit stones and nuts. This material is not representative of the botanical remains in the deposits, but, like the large samples, may contain rare species not recovered in the small samples.

In total, 71 large samples and 102 small samples were collected. Of the large samples, 63 came from deposits at Mons Claudianus and eight from Barud. Of the 102 small samples, 77 were analysed (Table 8.2): 49 from Mons Claudianus, ten from the Hydreuma, eight from Barud, five from mudbricks and five from wallplaster. In addition to these

Area	No. of samples collected	No. of samples analysed	No. of litres analysed	No. of seeds desiccated	No. of seeds charred	Density per 1 litre desiccated	Density per 1 litre charred	Total number of seeds
Mons Claudianus								
South Sebakh	12	8	6.5	1,819	32	280	5	1,851
Well Sebakh	5	5	6.5	16	781	2	120	797
Fort SE Corner	12	9	7.5	1,811	242	241	32	2,053
Fort NE	5	5	4.5	757	102	168	23	859
Fort West I	7	7	4.3	1,035	56	244	13	1,091
Fort West II	4	4	2.0	980	92	490	46	1,072
Annexe SI	5	5	3.5	1,026	55	293	16	1,081
Annexe SE Corner	12	6	2.0	624	965	312	483	1,589
Fort NI	4	0	.	.	.	.	.	.
NE Building	2	0	.	.	.	.	.	.
SW Sebakh	6	0	.	.	.	.	.	.
Wall plaster	5	5	3.5	1,348	3	385	1	1,351
Mudbrick	5	5	6.0	1,903	7	317	1	1,910
Barud I	8	8	10.0	3,071	271	307	27	3,342
Hydreuma	10	10	18.0	1,761	615	98	34	2,376
Total	102	77	74.3	16,151	3,221	.	.	19,372

Area	MC/B/H	Overall	MC/B/H	Overall
	Des	Des	Car	Car
Mean density per 1 litre	259	277	86	75
standard deviation	222	227	230	219

8.2. *Details of small samples and seed densities.*

"bulk" samples a small number of animal droppings and charcoal pieces was also collected (see sections 8.3.3.2 and 8.3.5 below).

8.2.2 IDENTIFICATIONS

The identification of the plant remains is based on comparison with modern seeds and fruits in the writer's own reference collection, as well as the Herbarium collections at the Royal Botanic Gardens at Kew, London, and in consultation with a great many colleagues (see acknowledgements). The nomenclature follows Täckholm 1974 for the wild plants, and Zohary and Hopf 1994 for the economic plants. For the cereals the traditional binomial classification is used (Zohary and Hopf 1994, Tables 3 and 5). Where appropriate the identification criteria used are discussed in section 8.3. The word seed is used throughout without consideration for the correct botanical terminology, and is used here to refer to seeds, fruits and false fruits. Fig. 8.1 provides an explanation of the technical terms used in the description of the cereals and pulses.

8.2.3 QUANTIFICATION AND DATA PRESENTATION

The numbers in the tables refer to the numbers of seeds identified in the samples. In all cases these numbers represent the minimum number of individuals present, not the number of fragments. All quantitative analyses are based on the data from the small samples only, but the total list of species recovered from the site is made up of the data from all three categories of samples (small, large and hand-picked). In order to analyse as many small samples as possible within the available time, it was decided to reduce the number of seeds counted in each sample from the ideal of 500 (needed for detailed statistical analyses; Van der Veen and Fieller 1982) to approximately 150-200. While this meant a loss of detail per sample, it reduced the sorting time per sample by almost 50 per cent and thus increased the number of samples that could be analysed by 100 per cent. The flots were divided into random subsamples using a riffle-box or sample splitter (Van der Veen and Fieller 1982).

The data are presented in a series of tables: the full data sets of the small samples are given in Appendix 1 and 2 at the back of this report. Tables 8.3 and 8.4 present the identifications of the large samples and the hand-picked material, and Table 8.5 provides an overall summary of the food species identified in the three different categories of sample, at the three sites, and by mode of preservation. The data from the large samples and the hand-picked material are presented as total counts per area and no differentiation between desiccated and carbonized seeds is made (these data are only used to record species' presence). The data from the small samples are presented sample by sample for the desiccated seeds (Appendix 1), but as only 17 out of the 77 samples contained more than 50 carbonized seeds, the carbonized remains are given for these 17 samples only (Appendix 2; presenting the carbonized data for all 77 samples would have resulted in many more pages of tables, but the extra information gained does not justify this). In the tables and some of the figures the plant species have been divided up into nine categories: cereal grain, cereal chaff (including straw), pulses, fruits, nuts, oil plants, condiments,

	Well Sebakh	SW Sebakh	Fort NE	Fort West I	Fort West II	Annexe SI	Barud I	Total
No. of samples (c. 20 litres each)	11	6	12	18	7	9	8	71
Cereals								
Hordeum vulgare L.	128	14	95	273	60	81	35	686
Triticum aestivum/durum	2	2	2	13	15	5	4	43
Triticum sp.	9	.	3	9	4	5	.	30
Cerealia indet	2	.	.	4	.	8	2	16
Chaff								
Triticum durum Desf., rachis nodes	.	45	36	195	313	95	10	694
Hordeum vulgare L., rachis nodes	.	23	19	59	21	103	1	226
Culm nodes	2	10	9	91	226	26	3	367
Pulses								
Lens culinaris Medick.	199	2	22	62	14	23	11	333
Vicia faba L.	6	.	.	.	.	.	.	6
Pisum sativum L.	27	.	4	2	.	1	.	34
Lupinus albus L.	11	.	2	1	.	5	1	20
Cicer arietinum L.	8	.	.	1	.	.	.	9
Pulses indet., large	17	.	1	10	4	3	5	40
Fruits								
Phoenix dactylifera L., stones	33	8	30	228	58	39	30	426
Phoenix dactylifera, perianth	1	.	.	11	1	3	.	16
Phoenix dactylifera, male flower	.	.	.	1	.	.	.	1
Hyphaene thebaica (L.) Mart.	.	.	.	1	.	1	.	2
Vitis vinifera L.	12	11	16	51	5	6	10	111
Olea europea L.	28	14	22	42	3	10	9	128
Cordia myxa L.	27	15	26	97	17	25	5	212
Citrus cf. medica L., seeds	1	3	1	1	.	1	.	7
Punica granatum L.	.	.	.	1	.	3	.	4
Capparis spinosa L.	.	.	.	.	.	1	.	1
Citrullus lanatus (Thunb.) Mats. & Nakai	1	2	2	3		19	6	33
Citrullus colocynthis (L.) Schrad.	1	9	7	70	5	46	5	143
Citrullus colocynthis, rind	.	.	.	+	.	+	.	0
Citrullus sp.	1	3	2	1	.	.	1	8
Cucumis melo/sativus	.	1	1	3	1	7	.	13
Lagenaria siceraria (Mol.) Standl.	.	.	.	2	.	.	1	3
Zizyphus spina-christi (L.) Schrad.	2	1	1	1	.	3	.	8
Nuts								
Pinus pinea L., seed case	4	1	1	2	1	2	.	11
Juglans regia L.	5	1	2	1	1	3	1	14
Corylus avellana L.	.	2	.	1	.	1	.	4
Amygdalus communis L	.	2	.	.	.	.	.	2
Oil plants								
Linum usitatissimum L.seed	2	.	.	.	.	2	.	4
Linum usitatissimum, capsule	.	.	.	.	.	1	.	1
Carthamus tinctorius L.	3	6	7	29	10	15	1	71
Moringa peregrina (Forssk.) Fiori	.	2	.	1	.	2	.	5
Vegetables								
Allium sativum L., base plate	.	.	.	13	5	.	1	19
Allium sativum, skin fragments	.	.	.	+++	+	+	.	0
Allium cepa L., base plate	.	.	.	6	1	2	.	9
Allium cepa, skin fragments	.	+	+	+	+	+++	.	0
Beta vulgaris L.	.	1	4	71	.	3	.	79
Brassica spp.	1	.	1	1	.	1	.	4
Lepidium sativum L.	2	.	.	.	.	.	.	2
Condiments								
Coriandrum sativum L.	3	1	2	17	1	12	.	36
Cuminum cyminum L.	.	.	.	.	.	2	.	2
Foeniculum vulgare Mill.	.	.	.	2	.	2	.	4
Umbelliferae indet.	.	.	.	1	.	.	.	1
Trigonella foenum-graecum L.	3	.	.	1	.	.	.	4
Wild plants								
Acacia sp.	.	.	.	.	.	2	.	2
Leptadenia pyrotechnica (Forskk.)Decne	.	.	.	.	.	2	.	2
Zilla spinosa (Turra) Prantl	2	53	202	223	22	165	297	964
Rhus tripartita (Ucria) Grande (sumach)	.	.	1	.	.	.	.	1
Total								4,861

TABLE 8.3. *Plant species identified in the large samples.*

vegetables and wild plants. This grouping is for ease of reference only and the categories are slightly arbitrary: *e.g.* onion could be regarded as both a vegetable and a condiment, olive as both a fruit and an oil plant, and bottle gourd and cucumber as both a fruit and a vegetable. Furthermore, many of the plants found will have had more than one use: several condiments and vegetables and some of the fruits may have been used for medicinal, as well as culinary purposes. This will be brought out in the discussion of the results.

8.3 RESULTS

8.3.1 GENERAL OBSERVATIONS

The most striking aspect of the Mons Claudianus seed assemblage is its extraordinary richness, both in the number of species present and in the density of seeds in the deposits (Tables 8.2 and 8.5). In total 57 species of food plants, two possible food plants and 64 taxa of wild plants have been identified, and the average density of seeds in one litre of deposit (excluding the wall plaster and mudbrick samples) was 259 (stdev 222) for desiccated and 86 (stdev 230) for carbonized seeds (see also section 8.4.1). The overall assemblage consists of 27,646 seeds: 16,111 in the small samples, 4,861 in the large samples, 3,413 in the hand-picked material and 3,261 in the wall plaster and mudbrick samples. Some 80 per cent of the seeds are preserved in desiccated form, the rest in carbonized form, though the relative proportions of desiccated and carbonized seeds vary considerably in the deposits. While most of the sampled deposits are dominated by desiccated remains, carbonized seeds are abundant in the midden deposits at the well and in the ovens and associated deposits in the south-east corner of the annexe. Fig. 8.2 displays the distribution of the two modes of preservation over the different parts of the site. In Figures 8.3 and 8.4 the plant species have been grouped into eight broad categories to facilitate the presentation of the overall characteristics of the assemblage.[1] These groupings or categories are not, of course, mutually exclusive (see section 8.2.3). Fig. 8.3 displays the number of seeds identified for each of these eight plant categories by mode of preservation, while Fig. 8.4 displays their relative proportions. Both the desiccated and the carbonized seed assemblages are dominated by remains of cereal chaff and seeds of wild plants, with these two categories taking up 85 per cent of the desiccated and 73 per cent of the carbonized assemblage. The two assemblages do, however, vary in the relative proportions of pulses and fruits. The differences between the two modes of preservation and the differences in the remains from the various areas of the site will be discussed in more detail in section 8.4 below.

The total list of food plants recovered from the site is presented in Table 8.5, in which it is also indicated which species were recovered from which type of sample. The small

[1] These figures are based on the data from the small samples only. As nuts were only found in the large samples and hand-picked material these figures illustrate eight out of the nine plant categories only.

	South Sebakh	Well Sebakh	SW Sebakh	Fort SE Corner	Fort NE	Fort NI	Fort West I	Fort West II	Annexe SI	Annexe SE	Animal Lines	Gate	Barud I	Total
ereals														
ɔrdeum vulgare L.	.	.	.	8	2	.	2	.	13	.	.	5	.	30
iticum sp.	.	.	.	20	.	.	.	.	.	.	.	1	.	21
ılses														
ens culinaris Medick.	.	.	.	3	.	.	68	.	.	.	.	.	1	72
sum sativum L.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
cia faba L.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
ıpinus albus L.	.	.	.	60	.	.	.	.	10	.	2	.	.	72
uits														
ıoenix dactylifera L.	125	.	9	1525	112	.	.	114	112	3	5	93	9	2107
yphaene thebaica (L.) Mart.	5	1	1	59	2	.	.	.	9	1	.	.	.	78
tis vinifera L.	.	.	.	2	.	.	.	.	.	.	.	.	.	2
lea europea L.	4	20	.	105	12	.	1	4	22	.	7	19	5	199
ɔrdia myxa L.	5	.	.	87	13	.	.	.	14	.	3	10	1	133
trus cf. medica L., fruit	.	.	1	.	.	.	.	.	.	.	.	.	.	1
trus cf. medica L., seeds	.	.	14	.	.	.	.	.	.	.	.	.	.	14
ınica granatum L.	.	1	.	4	.	.	.	.	.	.	.	.	.	5
trullus lanatus (Thunb.) Mats. & Nakai	1	.	.	2	.	.	.	.	3	.	1	.	1	8
trullus colocynthis (L.) Schrad.	.	.	.	1	.	.	.	.	298	.	.	.	.	299
trullus sp.	.	.	.	23	.	.	.	.	.	.	.	.	.	23
ıgenaria siceraria (Mol.) Standl.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
zyphus spina-christi (L.) Desf.	.	.	.	6	.	.	.	.	.	.	.	1	.	7
imusops schimperi A. Rich	.	.	1	1	.	.	.	.	3	.	.	.	.	5
elumbo nucifera Gaertn.	.	.	.	2	.	.	.	.	1	.	.	.	.	3
uts														
nus pinea L., scales	.	5	.	10	.	.	.	.	.	.	.	.	.	15
nus pinea L., seed case	1	10	.	59	3	.	1	.	.	.	.	.	.	74
ıglans regia L.	.	1	1	23	3	.	.	.	6	.	1	1	.	36
ɔrylus avellana L.	1	.	1	4	.	.	.	.	2	.	.	.	.	8
nygdalus communis L.	.	.	.	2	.	.	.	.	2	.	.	.	.	4
il plants														
oringa peregrina (Forssk.) Fiori	.	.	.	2	1	.	.	1	3	.	.	.	.	7
egetables														
ynara cf. scolymus L.	.	.	.	9	.	4	.	.	.	.	.	.	.	13
lium sativum L., base plate	.	.	.	1	.	.	.	.	.	.	.	.	.	1
lium cf. cepa L., base plate	.	.	.	.	.	.	3	.	1	.	.	.	.	4
lium cepa L., skin fragments	+	+	.	+	.	.	.	.	+	.	.	.	.	+
ild plants														
ɔlostemma argel (Del.) Hayne	.	.	.	7	1	11	1	.	1	.	.	.	.	21
eptadenia pyrotechnica (Forssk.) Decne	.	.	.	35	.	3	.	.	7	.	.	.	.	45
lla spinosa (Turra) Prantl	.	.	.	87	1	.	.	.	11	.	.	1	3	103
ɔtal														3,413

8.4. *Plant species identified in hand-picked material.*

	< Type of sample		>	< Site		>	< Preservation >	
	Small samples	Large samples	Hand-picked	Claudianus	Hydreuma	Barud	Des.	Car.
Cereals								
Hordeum vulgare L. (barley) grain	√	√	√	√	√	√	√	√
Hordeum vulgare L. (barley) chaff	√	√	.	√	√	√	√	√
Triticum durum (hard wheat) grain	√	√	√	√	√	.	√	√
Triticum durum (hard wheat) chaff	√	√	.	√	√	√	√	√
Pulses								
Lens culinaris Medick. (lentil)	√	√	√	√	√	√	√	√
Pisum sativum L. (pea)	√	√	√	√	.	.	√	√
Vicia faba L. (fava bean)	√	√	.	√	.	.	√	√
Lathyrus cf. sativus L. (grass pea)	√	.	.	√	√	.	.	.
Lupinus albus L. (termis bean)	√	√	√	√	.	.	√	.
Cicer arietinum L. (chickpea)	√	√	.	√	.	.	√	√
Fruits								
Phoenix dactylifera L. (date)	√	√	√	√	√	√	√	√
Hyphaene thebaica (L.) Mart. (dom fruit)	.	√	√	√	√	√	√	.
Vitis vinifera L. (grape)	√	√	.	√	√	√	√	√
Ficus carica L. (fig)	√	.	.	√	√	√	√	√
Ficus sycomorus L. (sycamore fig)	√	.	.	√	.	.	√	.
Olea europea L. (olive)	√	√	√	√	√	√	√	.
Cordia myxa L. (sebesten)	√	√	√	√	√	√	√	√
Citrus cf. medica L. (citron)	√	√	√	√	.	.	√	.
Morus cf. nigra L. (mulberry)	√	.	.	√	√	.	√	.
Punica granatum L. (pomegranate)	√	√	√	√	√	.	√	.
Capparis spinosa L. (caper)	√	√	.	√	√	.	√	.
Citrullus lanatus (Thunb.) Mats. & Nakai (watermelon)	√	√	√	√	√	.	√	.
Citrullus colocynthis (L.) Schrad. (bitter apple)	√	√	√	√	√	.	√	√
Cucumis cf. sativus L. (cucumber)	√	√	.	√	.	.	√	.
Cucumis cf. melo L. (melon)	√	√	.	√	.	√	√	.
Lagenaria siceraria (Mol.) Standl. (bottle gourd)	√	√	.	√	.	√	√	.
Zizyphus spina-christi (L.) Desf. (Christ's thorn)	.	√	√	√	.	.	√	.
Mimusops schimperi A. Rich (persea)	.	.	√	√	.	.	√	.
Nelumbo nucifera Gaertn. (Indian lotus)	.	.	√	√	.	.	√	.
Nuts								
Pinus pinea L. (pine kernel and cone)	.	√	√	√	.	.	√	.
Juglans regia L. (walnut)	.	√	√	√	.	.	√	.
Corylus avellana L. (hazelnut)	.	√	√	√	.	.	√	.
Amygdalus communis L. (almond)	.	√	√	√	.	.	√	.
Oil plants								
Carthamus tinctorius L. (safflower)	√	√	√	√	√	√	√	√
Linum usitatissimum L. (linseed)	√	√	√	√	.	√	√	√
Moringa peregrina (Forssk.) Fiori (behen nut)	.	√	√	√	.	.	√	.
Sesamum indicum L. (sesame)	√	.	.	√	.	.	.	√
Condiments								
Coriandrum sativum L. (coriander)	√	√	.	√	√	√	√	√
Foeniculum vulgare Mill. (fennel)	√	√	.	√	√	√	√	√
Anethum graveolens L. (dill)	√	.	.	√	√	.	√	.
Apium graveolens L. (celery)	√	.	.	√	√	.	√	√
Cuminum cyminum L. (cumin)	√	√	.	√	√	√	√	.
Trachyspermum copticum (L.) Link (ammi)	√	.	.	√	√	√	√	√
Pimpinella anisum L. (anise)	√	.	.	√	.	√	√	√
Nigella sativa L. (black cumin)	√	.	.	√	.	√	√	√
Ocimum basilicum L. (basil)	√	.	.	√	.	.	√	.
Mentha sp. (mint)	√	.	.	.	√	√	√	.
Trigonella foenum-graecum L. (fenugreek)	.	√	.	√	.	.	.	√
cf. Sinapis alba L. (white mustard)	√	.	.	√	.	.	√	.
Ruta cf. chalepensis L. (common rue)	√	.	.	√	.	√	√	.
Piper nigrum L. (pepper)	√	.	.	√	.	.	√	.
Vegetables								
Allium cf. cepa L. (onion)	√	√	√	√	√	√	√	.
Allium sativum L. (garlic)	√	√	√	√	√	√	√	.
Brassicas (cabbage, turnip)	√	√	.	√	√	√	√	√
Beta vulgaris L. (beet)	√	√	.	√	√	√	√	.
Lepidium sativum L. (cress)	√	√	.	√	√	√	√	√
Lactuca sativa L. (lettuce)	√	.	.	√	.	.	√	.
Cichorium endivia L./intybus L. (endive/chicory)	√	.	.	√	.	.	√	.
Cynara cf. scolymus L. (artichoke)	.	.	√	√	.	.	√	.
Possible food plants								
Portulaca oleracea L. (purslane)	√	.	.	√	√	.	√	.
Brassica nigra (L.) Koch in Rohling (black mustard)	√	.	.	√	√	√	√	√

E 8.5. *List of foodplants found by type of sample, site, and mode of preservation (midden and refuse deposits only).*

samples produce the best results in terms of number of species recovered (46 out of a total of 57 food plants) and in terms of quantitative detail. The large samples and hand-picked material recovered 37 and 26 species respectively. This pattern is not surprising in that the last two categories of samples are biased towards the larger seeds and fruits. The small-seeded species such as the herbs and spices are only recovered when sieving with a small mesh is implemented and when the samples are sorted under a microscope, rather than by eye. It is important to note, however, that 11 species were not recovered in the small samples: four fruits (dom, Christ's thorn, persea and Indian lotus), four species of nut (pine kernel, walnut, hazelnut and almond), one oil plant (behen nut), one condiment (fenugreek) and one vegetable (artichoke). Three of these were, in fact, only recovered in the hand-picked material: persea, Indian lotus and artichoke. These 11 species clearly represent taxa that only occur rarely in the deposits. The small samples are too small to be fully representative of the deposits, while the large samples and hand-picked material are biased towards the larger seeds and fruits, missing the smaller seeds such as the herbs and spices (*and* most seeds of wild plants). An increase in the sample volume of the small samples was not regarded to be a viable option, as the sorting of these samples is already extremely time-consuming. The strategy of collecting the plant remains at three levels of recovery and accuracy has proved to be very worthwhile and the extra investment of time needed to collect and analyse the large samples and hand-picked material has been justifiable. The different species found in the samples will be discussed below: the food plants in section 8.3.2, the wild plants in section 8.3.3, those found in the wall plaster and mudbrick in section 8.3.4 and those found in the animal droppings in section 8.3.5.

8.3.2 FOOD PLANTS

The information regarding the history and use of the various plants discussed here is drawn largely from Hepper (1990), Manniche (1989), Harrison *et al.* (1969), Simmonds (1976), Zohary and Hopf (1994), and Zohary (1982).

8.3.2.1 CEREAL GRAIN AND CHAFF

Two species of cereal grain are present: hard or durum wheat, *Triticum durum*, and six-row, hulled-barley, *Hordeum vulgare*. Both are represented by grains and chaff. Hard or durum wheat is a free-threshing wheat, unlike emmer wheat, *Triticum dicoccum*, the main wheat of the Pharaonic period, which is a glume wheat.[2] Durum wheat replaced emmer wheat as the dominant wheat crop sometime during the Ptolemaic period (Crawford 1979). The identification is based on the morphology of the rachis segments (see Fig. 8.1 for an explanation of the technical terms used): the segments are more or less trapezoidal in shape, longitudinal lines along the outer edges of the convex face are absent, and the

[2] The difference between glume wheats such as emmer, *Triticum dicoccum*, and free-threshing wheats such as durum wheat, *Triticum durum*, and bread wheat, *Triticum aestivum*, lies in the ease with which the glumes, which surround the grain in the ear, are removed during threshing.

nodes contain distinct bulges at the point of glume insertion (Hillman *et al.* 1996; Jacomet 1987). The wheat grains could not be identified to species level; they are generally poorly preserved, often rather shrivelled, with the endosperm largely decayed. The well-preserved specimens did, however, clearly belong to a free-threshing species. There is, in fact, another free-threshing wheat species present in the samples: bread wheat, *Triticum aestivum*. It is present in the form of a few rachis segments, which, unlike those of hard wheat, are more shield-like in shape and lack the distinct bulges and, instead, have just a thin inconspicuous ridge at the point of glume insertion. The overall number of bread wheat rachis nodes is small: only 28 as against 2704 of durum wheat. The remains of bread wheat are here interpreted as a contaminant of the durum wheat crop, not as a crop in its own right. As there is so little archaeobotanical evidence from the Roman period, it is, at this stage, difficult to say whether bread wheat was grown as a separate crop in Egypt. At both Quseir al-Qadim (Wetterstrom 1982) and Berenike (Cappers 1996) durum wheat was found, at Qasr Ibrim both durum wheat and bread wheat are present (Rowley-Conwy 1989), and there is some evidence that bread wheat may have been an important crop in the Dakhla oasis (Tanheise pers. comm.). Bread wheat is, as its name already indicates, the main wheat used for bread making, that is for the production of leavened bread. Durum wheat has a lower gluten content and is primarily used for flat breads (*e.g.* pitta bread), biscuits and pasta, hence its other name: macaroni wheat. Up until recently it was assumed that the distribution of bread and durum wheat was related to climatic conditions, with bread wheat attributed to temperate regions of Europe and durum wheat to the mediterranean countries (Van Zeist 1976; Zohary and Hopf 1994). While this certainly reflects the modern day situation, the pattern may have been different in the past (*e.g.* Van der Veen 1995; Van der Veen, Grant and Barker 1996). It was not until the mid-1980s that identification criteria for distinguishing between these two species were developed (Hillman *et al.* 1996; Jacomet 1987), so that identifications of either of these species before that date must be regarded as unreliable.

In addition to large numbers of rachis segments of durum wheat, the samples also contained other light chaff components: glumes, paleas, lemmas and awns, all very fragmented. Counting these fragments into minimum number of individuals is a time-consuming process, and these counts add little information to that already provided by the counts of the rachis segments (*i.e.* all these fragments demonstrate the presence of the winnowing by-product, see below). Here their presence is indicated by a "+" symbol in the data tables (with more than one "+" indicating their relative abundance).

There is a third species of wheat present in the samples: emmer wheat, *Triticum cf. dicoccum*. In total 72 glume bases of this species were found, though the identification is tentative only. It is possible that some of these remains represent immature durum spikelets or a primitive durum variety. Like bread wheat, the remains of emmer wheat are regarded as a contaminant of the durum crop, not a crop in its own right. Farmers are likely to have tolerated the occurrence of emmer or bread wheat in their durum crops as they did no harm to the crops and would have been difficult to remove.

Only one species of barley is present in the samples: six-row, hulled barley, *Hordeum vulgare*, a species widely cultivated in Egypt from the pre-dynastic period onwards.

The identification is based on the grains and rachis segments. The grains, like those of bread wheat, are generally poorly preserved. In many cases all that is left are the empty hulls (palea and lemma), the endosperm having decomposed. The endosperm or starch of cereal grains does not appear to preserve well in dry conditions; a similar observation was made by Wetterstrom (1984). The grains are identified by the presence of the hulls and, in the case of well-preserved specimens, by the fact that the hulls are adhering to the grains. The grains have an angular cross-section, and a considerable number of the grains represent lateral or asymmetrical grains characteristic of 6-row varieties. The rachis segments taper out towards the top and clearly display three approximately equal-sized pedicels and six glumes. In quite a number of rachis nodes the two lateral pedicels are raised above the median one, forming "stalks". This would cause the lateral grains to be slightly raised above the median ones and in lax-eared varieties may make the lateral florets overlap. This has given rise to the misleading term "four-rowed" or *tetrastichum* forms (Briggs 1978, 68 and 72). Rachis nodes with "stalked" lateral pedicels have been found at two other Egyptian sites: at New Kingdom el-Amarna (Samuel 1989, 284-285, who uses the term *Hordeum vulgare*, var. *tetrastichum* or four-row barley) and at Byzantine Kom el-Nana (Smith 1997). They are also known from prehistoric Europe (Buurman 1987; Jacomet 1987; Piening 1981; Villaret-von Rochow 1967). Piening (1981) distinguishes between real stalks ("echte Stielchen") and fake stalks ("unechte Stielchen") and associates these with naked and hulled varieties of *Hordeum vulgare* respectively. The Mons Claudianus stalks match her description of false stalks. Villaret-von Rochow (1967) regards the presence of raised pedicels as a primitive feature. Certainly the progenitor of cultivated barley, *Hordeum spontaneum* Koch, does possess raised lateral pedicels (as do several varieties of two-row barley), though in this case the lateral florets are sterile and the stalks or pedicels are much longer and thinner than those in six-row barley. While more research into the presence or absence of raised pedicels is clearly needed, the rachis segments in the assemblage from Mons Claudianus possessing this feature are regarded as belonging to six-row barley, as they clearly carry three fertile florets at each internode (and not two as the term "four-row" implies).

The samples also contain a large number of small fragments or shreds of barley hulls (lemma and palea). As they are so fragmented it is impossible to count how many grains they represent. To give some indication of their abundance the symbol "+" has been used in the tables, with one "+" indicating their presence and three "+"s their considerable abundance in a sample. *Hordeum vulgare* is a hulled barley, which means that the hulls are fused to the outer surface of the grain (unlike so-called "naked" varieties). The hulls [3] of barley cannot be digested easily by humans and need to be removed before the barley is prepared for human consumption. The hulls are normally removed by pounding the grain in a mortar, after which the hull fragments can be removed by winnowing or sieving (Hillman 1985). Pearl barley, used in Britain in soups and stews, is the modern-day

[3] Not to be confused with the bran layer of the grains. Bran is the pericarp or outer layer of the grain itself (the original ovary wall). The hulls (or husks, lemma and palea) are part of the floret. They surround the grain and, in the case of hulled barley, are fused with it.

equivalent of de-hulled barley. Today the hulls are removed using both heat and friction. The presence of barley hulls can be taken as definite evidence that barley was used for human consumption. Barley grain used as animal fodder does not need to be de-hulled. Archaeobotanical evidence for the de-hulling of barley is very rare, as the small shreds of hulls do not preserve well, especially not in carbonized seed assemblages.[4] Evidence for the de-hulling of barley has, to my knowledge, been found at only two other sites: at both Gordion and Sardis in Turkey (both mid-first millennium BC) pots filled with barley hulls were found (Hillman 1985 and Nesbitt 1995).

Barley is not often considered as a human food and the rarity of definitive evidence for past human consumption of barley grain may have, partly, contributed to this. It is today largely used as a fodder crop and in the production of beer and whisky. Barley grain is rich in starch and sugar, but is low in protein and fat. Baking bread with barley flour produces "heavy" loaves, as barley has a low gluten content. It can, however, be mixed with wheat flour to a maximum of 30 per cent with good result (Briggs 1978). More often it is used for flat breads, as well as for porridge, and in soups and stews. Wheat grains have a higher gluten content than barley grains and, therefore, make better leavened bread, though this varies according to the type of wheat. Bread wheat, *Triticum aestivum*, produces by far the best flour for bread making (Renfrew 1973). Barley is an easier crop to grow than wheat: it has a shorter growing season, is less demanding on soil conditions and is more drought tolerant. Barley was an important staple food in ancient Greece, but had a poor image in Roman Italy, at least in Pliny's time, where barley was seen primarily as animal fodder and famine food, and where soldiers were put on barley rations as a punishment (Braun 1991). In both countries barley was the food of the lower classes of the population.

For both species there is more chaff than grain present in the samples. After the harvest the crop is processed (threshing, winnowing, sieving) to separate the grain (the product) from the straw, chaff and weeds (the by-products). The product will consist of nearly one hundred per cent grain, while the by-products of winnowing and coarse sieving consist predominantly of chaff, and that of fine sieving largely of weed seeds. In order to assess whether the cereal remains in the samples represent the product or one of the by-products of the cereal harvest, the ratio of chaff to grain was calculated for each sample and each species separately (no calculation was performed if less than 25 fragments were present; the proportions are given at the bottom of each data table (Appendices 1 and 2). In both durum wheat and six-row barley the proportion of rachis to grain-and-rachis in the complete ear is approximately 25 per cent (*i.e.* 1 rachis segment per 3 grains). Thus, samples containing considerably less than 25 per cent rachis represent the final product (*i.e.* cleaned grain), while samples containing considerably more than 25 per cent rachis represent one of the early by-products of the cereal harvest (*i.e.* winnowing or coarse

[4] With the exception of parts of North Africa and the Near East desiccated plant assemblages are rare and most archaeobotanical evidence for cereal cultivation and consumption in the Old World comes from carbonized assemblages, where the seeds and chaff have been in contact with fire, became charred and have, thus, become chemically inert and capable of surviving for thousands of years.

sieving). In all but two of the samples the proportion of wheat chaff is 95 per cent or above (the two exceptions have proportions of 84 and 89 per cent). This indicates that all wheat remains in the samples represent the by-product of winnowing, and not the final product. The figures for barley are slightly different, though the proportion could only be calculated for 10 samples. There are six samples with proportions of 60 or above (probably representing coarse sieving and winnowing by-products); one sample represents the product (*i.e.* clean grain: Hydreuma 2), while the remaining three samples appear to represent mixtures (proportions of 37, 40 and 59). As mentioned above, many samples contain the hulls of barley in addition to complete barley grains, though the exact number of grains that they represent cannot be calculated. Taking this into account the proportions of rachis in each sample are in reality somewhat lower than those calculated. These figures suggest that in the case of barley both the product (clean grain) and the early by-products (chaff: coarse sieving and winnowing) have been imported to the site, while in the case of wheat the evidence points towards the import of chaff (winnowing by-product) only, but see section 8.4.5 below.

The presence of the chaff of wheat and barley is here interpreted as representing imports from the Nile valley, even though in other situations it is interpreted as evidence for local arable production (Hillman 1981, 1984a and b; G. Jones 1984, 1987; Van der Veen 1992; 1999). The environmental conditions at Mons Claudianus are not at all favourable to agriculture and there is no evidence to suggest that the climate has changed drastically since the 2nd century AD. Annual precipitation is *c.* 5 mm and the vegetation near the site consists of typical desert species such as *Zilla spinosa* (Turra) Prantl, *Artemisia judaica* L. and rare occurrences of *Leptadenia pyrotechnica* (Forssk.) Decne. In the heads of the wadis occasional trees of *Acacia raddiana* Savi and *Moringa peregrina* (Forssk.) Fiori are found. The wild plants found in the archaeobotanical samples consist of the same desert species as those found growing around the site today (see section 8.3.3.1 below). There is no botanical evidence to indicate that the vegetation in the Roman period was markedly different from that of today. With the exception of two long catchment walls running along a wadi linking the Wadis Umm Hussein and Umm Diqal, some 1.5 km south-west of Mons Claudianus (Peacock and Maxfield 1997, 165-173), no evidence has been found for the management of rainwater. Most drinking water (and the water for the bath house) must have come from the large well associated with the settlement. Furthermore, the ostraca mention frequent requests for water to be delivered, probably in water sacks made of animal hides, from nearby wells. All the archaeological and documentary evidence indicates that the site was a specialised quarry settlement not involved in agricultural activities (but see section 8.3.2.7 for evidence of gardens). The very large quantities of chaff found in every sample must have been imported to the site from the Nile valley. Chaff (and straw) is an important commodity in arid regions (Van der Veen 1999) and will have been used at Mons Claudianus for a range of different purposes: fuel, fodder and building material. Evidence for all of these is present in the samples (see sections 8.3.4, 8.3.5 and 8.4.3).

The ratio of wheat to barley grains in the small samples is 38 to 293 (and 73 to 686 in the large samples), which means that there are almost 8 times more barley grains than wheat grains in the assemblage (or even more if the barley hulls are taken into account). The chaff ratios are the reverse: 3551 rachis segments of wheat to 615 of barley, or *c.* six times more wheat than barley chaff. The wheat grains may simply represent the grains that are found mixed within the winnowing by-product (the separation of grain and chaff is never one hundred per cent). Thus, there is no conclusive evidence in the archaeobotanical samples that wheat grains were imported. This does not mean that no wheat was eaten; wheat could have been brought in as bread and/or flour. There is documentary evidence for the import of bread (see section 8.4.5 below) and there is some entomological evidence for the import of flour (Panagiotakopulu and Van der Veen 1997). If wheat grain was imported, in addition to bread and flour, it was used carefully and none was spilled or thrown away onto the middens. In contrast, there is clear archaeobotanical evidence that barley grain was imported and the evidence for the de-hulling of barley demonstrates that barley was used for human consumption (see section 8.3.5 for evidence of barley as animal fodder). The excavations have recovered 19 small and one large mortar, one rotary quern and 10 stone pestles (wooden pestles may have been more common). Usually grain is first pounded in a mortar to break it into small fragments and it is then milled into fine flour using a quernstone or rotary quern (for a detailed description of the processes involved, see Samuel 1989; 1993). Both durum wheat and barley are best suited for making flat breads, such as our "pitta" bread. Ovens to make such flat breads have been found in the Annexe SE Corner; see Chapter 4 and 8.4.3 below. Barley cakes or coarse dry breads and porridge could be made from coarsely ground or pounded grain. Flat breads would have been made with flour, while leavened bread is made with fine flour.

Barley and wheat are also used in the production of alcoholic beverages such as beer, and there is evidence for the production of malt in one of the samples. Sample "Hydreuma 2" contained 64 grains of barley and most of these were germinated. Germination of grain occurs in a number of different situations: if the grain is harvested late and/or if the weather is wet immediately before harvesting, grain may germinate in the ear, though this is not likely to happen in Egypt. Secondly, grain may germinate when it is stored in unsuitable conditions, that is when it is stored in slightly damp and warm conditions, again conditions rarely encountered in Egypt (Samuel 1996). Thirdly, grain may be germinated deliberately in the process of making beer. Grain is "steeped" by immersion in water, drained and allowed to germinate. Once the grain has germinated it is dried or roasted, coarsely ground (grist) and then mixed with water, left to stand and finally sieved. The resulting liquid, *i.e.* the beer, is rich in sugars and starch (D. Samuel pers. comm.; Briggs 1978; Samuel 1995, 1996 for a more detailed description of the process). Beer can be made with both barley and wheat, though barley grains have the advantage of containing more sugar (Briggs 1978). The germinated grains in the sample from the Hydreuma were carbonized, which suggests that they became accidentally charred during the drying or roasting process, and that malt was made at the Hydreuma, and by implication beer.

8.3.2.2 PULSES

Six species of pulses are present in the samples: lentil, *Lens culinaris*, pea, *Pisum sativum*, fava or broad bean, *Vicia faba*, var. *minor*, grass pea, *Lathyrus* cf. *sativus*, termis bean or white lupin, *Lupinus albus*, and chickpea, *Cicer arietinum*. In addition to whole seeds and separate cotelydons, the samples also contain many detached hila, especially of lentils, peas, fava beans and chickpeas. These detached hila, preserved both in desiccated and carbonized form, consist of the hilum and the cushion of tissue underneath the hilum (= parenchyma). In most cases part of the seed coat, or testa, was still attached, though there was no evidence of the radicle. This suggests that the remains represent the de-hulling of pulses, *i.e.* the by-product of the removal of the testa (A. Butler pers. comm.). Alternatively, the hila may have become detached when the pulses were soaked. Dry pulses are usually soaked in water to reduce the cooking time. If the seeds were very dry this could have resulted in the testa and hila lifting off. Many samples also contained fragments of the testa. No attempt was made to identify these to genus or to quantify the remains, but their presence is indicated in the data tables with the "+" symbol. The de-hulling of pulses is still carried out today; for example both lentils and yellow split peas are de-hulled before being used in the preparation of "dahl", an Indian stew of lentils and/or peas. This phenomenon of finding detached hila of pulses has never been recorded from Europe, but several instances are now known from North Africa and the Near East: at Romano-Libyan sites in Libya (Van der Veen, Grant and Barker 1996), at Bronze Age Tell Brak, Iraq (Butler 1988), at Neolithic Çatal Hüyük, Turkey (unpublished; A. Butler pers. comm.) and at Byzantine Kom el-Nana, Egypt (Smith 1997).

Lentils are numerically the most common pulse in the samples: 729 out of the 773 seeds of pulses, though a large number of these come from one site (the Hydreuma). The lentil is generally regarded as the most tasty and nutritious of pulses. Its protein content is high (25 %), it does not contain bitter alkaloids, and it is, consequently, often used as an important meat substitute in poor societies (Zohary and Hopf 1994). Lentils probably formed one of the main staple foods at Mons Claudianus. The fava bean, today an important staple in the Egyptian diet, is rare in the deposits, only 9 specimens were found. The earliest reliably-dated archaeological specimens come from sites of the Graeco-Roman period (Wetterstrom 1982). Fava beans are not common at Quseir al-Qadim (Wetterstrom 1982) and absent at Berenike (Cappers 1996), which, combined with the scarcity of this species at Mons Claudianus, suggests that fava beans did not acquire their present popularity in Egypt until after the Roman period.

Pea is the second most common pulse in the samples. Most of the remains consist of detached hila with fragments of testa. The patterning of the seed coat indicates that two varieties are present: *Pisum sativum*, var. *elatius* (the wild pea) and *Pisum sativum*, var. *sativum* (the cultivated pea). The wild variety has a rugose surface pattern and a relatively wide hilum, the cultivated variety has a smooth seed coat and a narrower hilum (Chernoff *et al.* 1992; A. Butler pers. comm.). The differences in seed coat patterning are just visible under standard magnification (x25 - x50), and very clearly visible at higher magnification (SEM). Interestingly, both are present in similar amounts.

Peas and chickpeas belong, like lentils, to the early neolithic crop assemblage of the Near East. Both have high protein contents (22 and 20 per cent respectively) and, like lentils, are often used as meat substitutes in peasant communities (Zohary and Hopf 1994). Peas are found in Egypt from the predynastic period onwards, chickpeas from the New Kingdom onwards. Both were found at Roman Quseir al-Qadim (Wetterstrom 1982). The *termis* bean or white lupin has been recorded in Egypt from the Roman period onwards. It contains bitter alkaloids which are toxic, but boiling in water does remove these. They are today often eaten as a snack food, like seeds of melon and pumpkin (discarded testa and hila can be found in the streets of towns and villages in Egypt). Grass pea or chickling vetch, *Lathyrus* cf. *sativus*, is one of the most drought resistant of the pulses. The seeds cannot be distinguished from those of the wild *Lathyrus cicera* on the basis of the seed morphology alone, but as the latter is not native to Egypt, we are most likely dealing with the cultivated grass pea here (Kislev 1989). Today grass pea is largely grown for animal feed, but in semi-arid regions it is also an important component of the human diet. When consumed in large quantities (typically when providing more than one third of the diet) it can cause lathyrism or paralysis in both humans and animals (Townsend 1974; A. Butler pers. comm.).

8.3.2.3 Fruits

The assemblage is characterized by a wide range of different fruits: 19 species in total. Date stones, *Phoenix dactylifera*, are the most common species encountered, though most of them were recovered in the hand-picked material, with concentrations of 20 or more stones in many of the deposits. Most of the remains consist of desiccated stones, but some whole fruits and perianths were also found. The fruits are rich in sugar and vitamin A, B1 and B2 (Renfrew 1973). In dried form they can be kept for long periods of time. They can be eaten fresh (often as a dessert) or dried, and are also used to produce an alcoholic drink. Poor quality varieties are used as animal fodder. The stones show great variability in shape and size. As at Quseir al-Qadim (Wetterstrom 1982) they range from short, squat stones with rounded ends to long thin ones with pointed ends. This variation is suggestive of the presence of different varieties or different areas of origin. To test this hypothesis 300 date stones were measured, but the scatter plot of the measurements does not identify the presence of different populations (Fig. 8.5). Similar results were obtained at Berenike (Cappers 1996). Date fruits do, in fact, vary widely in size on individual trees (and branches; Brown and Boligot 1938 quoted by Wetterstrom 1982), making it unlikely that varieties can be identified solely on the basis of measurements of the stones.

The fruits of another palm, the dom palm, *Hyphaene thebaica*, were absent in the small samples, rare in the large samples, but common in the hand-picked material, especially in the deposits at Fort SE Corner (Tables 8.4 and 8.5). No complete fruits were found: in all cases the edible mesocarp had been removed. This fibrous mesocarp (fruit flesh) is sweet, with a ginger-like flavour and is eaten raw after having been soaked in water, or prepared as a syrup. The remains found consist of the hard stone inside the mesocarp, which is used as a vegetable ivory for buttons etc (Täckholm 1961). There is no evidence that the stones were used for this purpose at Mons Claudianus: none of the stones were cut.

The fruits must have been used for their edible fruit flesh. The dom palm is common in the Nile valley south of Qena and occurs very sporadically in the Eastern Desert (Täckholm 1974). The fruits found on site probably came from the Nile valley.

Four of the fruit species are classic mediterranean species, though all were grown in Egypt in the Roman period: olive, *Olea europaea*, grape, *Vitis vinifera*, fig, *Ficus carica*, and pomegranate, *Punica granatum*. Of these, the seeds or pips of fig and grape are the most common, occurring in most of the samples, though in very small numbers only. The olive stones represent the import of whole fruits (olive oil would have been imported separately as witnessed by the large number of amphorae: see Tomber forthcoming). Like the date stones, the olive stones display a lot of variability in shape and size, and they were measured (N = 80) to assess whether different varieties could be recognized, but no evidence for distinct populations could be identified (Fig. 8.6). While different varieties were undoubtedly being imported, these cannot be recognized in measurements of the stones, possibly for the same reason as date varieties could not be identified. The pomegranate is rare in the deposits: one pip and five fragments of the leathery rind, including the characteristic crown-like calyx. They are eaten as a fresh fruit and made into a syrup, but were also considered a symbol of fertility (Zohary and Hopf 1994). The olives were almost certainly imported as pickled fruits; the figs could have been transported as dry fruits; pomegranates can be transported quite easily. The presence of grapes is more problematic; they do not travel quite so well as the other fruits and may, therefore, represent dried grapes or raisins, rather than fresh fruits.

A second species of fig, the sycamore fig, *Ficus sycomorus*, is present in the samples. The fruits of this species are generally regarded as inferior to those of the true fig (both in size and taste), but the sycamore fig has been cultivated in Egypt for a very long time and the fruits and timber have been found in pharaonic tombs (Zohary and Hopf 1994). The wild sycamore fig occurs from Sudan southwards and is not native to Egypt: in Egypt only the cultivated form exists. The pollination and seed setting of the wild tree is dependent on a symbiotic wasp, *Ceratosolen arabicus*, which does not occur in Egypt. Cultivation is, therefore, based on clonal propagation. Dry sycamore figs found in Egyptian tombs do not contain seeds (Galil 1968) and the identification of *Ficus sycomorus* has always been based on the presence of whole fruits (and timber), not on the basis of seeds (W. Smith, pers. comm.). In cultivated trees, fruit setting can take place without fertilization, either by the production of parthenocarpic clones or by the gashing of the young fruits to induce maturation, a practice well known in ancient Egypt (Galil 1968; Galil and Eisikowitch 1968; Zohary and Hopf 1994). The gashing produces a circular hole inside the fruit wall and is carried out when the fruit is still young. The gashing causes increased ethylene gas production which in turn accelerates the ripening process (Galil 1968; Galil and Eisikowitch1968); fruits produced in this way are sweet and suitable for human consumption. The second form of fruit setting is caused by a wasp, *Sycophaga sycomori* L., which by entering the fruit induces a similar fruit ripening process. The female wasp lays eggs inside the fruit and new wasps develop in the ovaries which become galls. The presence of the galls and dead wasps make the fruits unsuitable for human consumption, but they are used as animal fodder. The remains of the sycamore fig in the samples consist of 14 "seeds". These are not, in fact, true seeds, but the galls produced when the wasp laid its eggs in the ovaries of the fruit. The galls look like seeds in overall morphology, but they are broken, to let the young wasps out. I am grateful to Wendy Smith for the identification of the "seeds" as galls (for further detail see Smith forthcoming). The presence of the galls suggests that they came from fruits full of galls and dead wasps, *i.e.* fruits only suitable for animal fodder.

Another fruit indigenous to Egypt is sebesten, *Cordia myxa*. This fruit is not known in western Europe and is very rare in Egypt today. Its wild relative, *Cordia sinensis* Lam. grows in the oases of the western desert and near the border with Sudan, but is rare (Täckholm 1974). The sebesten tree was cultivated in Egypt in the past and the fruit stones have been found on many archaeological sites. The fruits are the size of a cherry, round and pointed at the base, with a cup-shaped persistent calyx. At Mons Claudianus the stones, some whole dried fruits and the calyx have been found, though mostly in the large samples and hand-picked material. The fruits were eaten fresh and used to make wine. Theophrastus (*Hist. Plant.* IV.2.10) describes the tree and says that the fruits were dried, the stones removed and a cake made from the pulp. The fruits were probably also used in medicine, as a laxative and to treat coughs. In the 16th century the fruits were boiled into a paste and this was applied to swellings (Manniche 1989). Both *Cordia myxa* and *Cordia sebestena* (found in the Caribbean) are today used to treat coughs (Lötschert and Beese 1983). The fruits are probably best known, however, for the production of bird-lime. The fruits, when ripe, contain a very slimy fruit flesh and this is boiled and made into a glue. The glue is smeared onto twigs and thus used to trap small birds, a practice widespread in the Near East and Mediterranean, even today (M. Kislev, pers. comm.). There is no evidence that the fruits were used for this purpose at Mons Claudianus.

A surprising find was the near complete fruit of citron, *Citrus medica*, and several seeds of this same species (this species should not be confused with our "lemon" or "lime"). The citron was the first of the citrus species (all native to south-east Asia) to arrive in the Mediterranean. Citron probably arrived from India, via the Persian Empire, and was known to the classical writers. Theophrastus (*Hist. Plant.* IV.4.2-3) describes its cultivation and propagation, which suggests that the fruit was well known by the late 4th century BC. There is one rather early archaeobotanical find of citron: at Hala Sultan Tepe in Cyprus, dated to 1200 BC (Zohary and Hopf 1994; Hjelmqvist 1979b), but its significance is not clear. The widespread cultivation of citrus fruits in the Mediterranean as we know it today, dates from after the Arab conquest. The fruits of the citron are elongated in shape, with a rough, wrinkled, thick rind enclosing a small sour pulp. The rind is highly aromatic, rich in ethereal oils, the fruit flesh is very acid. Today the citron is used in the preparation of candied peel, but it also plays an important rôle in the Jewish religious ceremony of the Feast of the Tabernacle. The citron, or ertrog, has been identified as the "fruit of a goodly tree" mentioned in the Bible in association with the Feast of the Tabernacle (*Leviticus* 23:40). There is, however, no actual mention of ertrog anywhere in the Bible and it is not until the 2nd century BC that there is some documentary evidence that the citron is equated with the "fruit of a goodly tree". By the first century AD the use of the citron in this festival is, however, firmly established: Josephus (*Antiquities* XIII.13.5)

describes an incident in which a high priest named Yanai deviated from the normal ritual of the ceremony and was "stoned" with ertrog fruits by angry worshippers (Isaac 1959a). The fruits used in the ceremony were subject to rigid specifications: the fruit must be fresh; its skin must be undamaged; the stigma and style which are carried on its protuberant nipple must be in place; and at least the base of the stalk must be attached to the fruit (Isaac 1959a, 183). The cultivation of the citron became specialised in the production of fruits for the ceremony, and the cultivation of the fruit in the Peleponnese and Mauretania at the beginning of the first millennium AD has been linked to the presence of Jewish settlers in those regions (Isaac 1959b). The fruit soon became associated with Jewish symbolism: the citron is one of the most common motifs in Jewish inscriptions, tombs, mosaics and ritual objects (Isaac 1959b). We know from historical sources that the citron was cultivated in Egypt in Graeco-Roman times (Schnebel 1925) and was used primarily in medicine and perfumery, although André (1981) recounts the use of the fruit as a condiment in meat dishes by Apicius (*de Re Coquinaria* IV.3.5). The fruit and seeds of the citron found at Mons Claudianus may well represent the use of this species in culinary and/or medicinal purposes, though it may also identify the presence of Jewish people on the site. Among the names of people listed on the ostraca there are two that have been identified as Jewish names (Cuvigny 1992, 80). The names indicate that there were Jewish people living at the site, and the citron seeds suggest that they may have been able to hold their religious ceremonies there. Although the Jewish community in Egypt was greatly reduced after the Jewish Revolt of AD 115-7, some Jewish people remained and they did manage to preserve their traditions (Bowman 1990, 122ff).

Two fruits that occur only very rarely in the deposits are mulberry, *Morus* cf. *nigra*, and caper, *Capparis spinosa*. It has not yet been possible to distinguish between the seeds of *Morus alba* and *Morus nigra*, but the two seeds found at Mons Claudianus probably belong to the black mulberry. The black mulberry, originally from Persia, was cultivated in the Mediterranean region in the classical period and was known to the classical authors. The white mulberry is native to China and is grown mainly for its leaves which are eaten by the silk worm. The fruits of the black mulberry have little commercial value: the fruits do not have a high nutritional value and they do not travel well. Braun (1991) mentions that in classical times the unripe fruits were used in medicine (to expel intestinal worms) and that the juice mixed with oil of roses was used to treat fever. The fruits can, of course, also be eaten dried, and made into jam and wine. The caper is a low shrub common in all deserts of Egypt. The fruits are like small figs and when ripe burst open to expose red fruit flesh and seeds (Renfrew 1973). Although the fruits are eaten, today the part of the plant used most is the immature flower bud which is pickled and used in sauces. The presence of the seeds at Mons Claudianus suggests that whole mature fruits, not the unopened flower buds were brought to the site.

There are five species of the cucurbit family present in the samples: watermelon, *Citrullus lanatus*, bitter apple or colocynth, *Citrullus colocynthis*, sweet melon, *Cucumis melo*, cucumber, *Cucumis sativus*, and bottle gourd, *Lagenaria siceraria*. There is no agreement over the origin of the cultivated watermelon. According to Jeffrey (1980) the watermelon is derived from the wild *Citrullus lanatus* native to southern Africa, especially the Kalahari desert. He has suggested that the species was domesticated there and subsequently spread over much of Africa and beyond. Zohary (1982), on the other hand, claims that the watermelon is derived from the colocynth, *Citrullus colocynthis*, a plant found widely in desert and semi-desert areas of northern Africa and the Near East, including Egypt. He argues that, as agriculture developed very late in southern Africa (this millennium) and as seeds of watermelon have been found in Egyptian tombs dated to *c.* 2000 BC, the watermelon must have been domesticated elsewhere, with *C. colocynthis* as the progenitor (the wild *C. lanatus* does not occur north of the equator). Both the wild *C. lanatus* and *C. colocynthis* are fully interfertile with the cultivated watermelon. His arguement appears convincing, but the records of water melon seeds from Egyptian tombs may not be entirely reliable. In the past seeds of the colocynth were misidentified as watermelon. Both Germer (1985) and Wetterstrom (1982) identify the early records of watermelon seeds in Egypt as belonging to *Citrullus vulgaris, var. colocynthoides* Schwf. Wetterstrom (1982) describes this species as a small inedible melon, cultivated in Egypt, as well as imported from Sudan, for its seeds, which were roasted and eaten as a snack food, though she speculates about the possibility that this variety may, in fact, be the same as *C. colocynthis*.[5] At Mons Claudianus both *C. lanatus* and *C. colocynthis* are found. The seeds of the colocynth are very uniform in size and morphology. The seeds are small (*c.* 8 × 4.5 mm), have a shiny seed coat and are a pale brown in colour. The seeds of watermelon are much larger (*c.* 11 × 6 mm), have the characteristic bulges on either side of the grooves at the base of the seed, have a non-shiny seed coat and are tan in colour. The watermelon is largely grown for its sweet, juicy flesh, but the seeds are also eaten, roasted, as a snack food. Many of the watermelon seeds in the samples were broken, suggesting that the endosperm, the "inside seed", has been eaten by cracking open the seeds. The colocynth does grow wild in the wadis around Mons Claudianus. It has small round fruits, the size of tennis balls, which are initially green, but when ripe yellow in colour. They contain a large number of seeds each. The fruit pulp of the colocynth is extremely bitter and poisonous in large quantities, but is used for medicinal purposes, mainly as a purgative. The seeds are edible and are sometimes ground into flour and used as a famine food by Bedouin (Zohary 1982). The seeds of colocynth in the Mons Claudianus samples were mostly complete, though some had clear rodent damage (gnaw marks).

The seeds of the sweet melon, *Cucumis melo*, and the cucumber, *Cucumis sativus*, are very similar and distinguishing between them is difficult. Identification criteria described by Vermeeren (forthcoming) were used to separate the two species: the location of the hilum and the overall shape of the seed being the most diagnostic criteria. While many seeds could not be identified beyond genus level, both species were present, with *C. sativus* slightly more common. The cucumber is indigenous to India; the date for its introduction into the Old World is not known, but the plant was known by the Greeks and Romans, and was probably cultivated in Roman Egypt. Melon, a native of tropical Africa, is a variable

[5] This has subsequently proved to be the case. The reference material used was not correctly identified (R. Cappers pers. comm.).

species, producing both sweet varieties (sweet or musk melon) and unsweet, green forms (chate melon, eaten like cucumber). Illustrations in Egyptian tombs (Old Kingdom onwards) have been identified as representing the curved fruits of the green, chate melons (Germer 1985; Zohary and Hopf 1994). It is not possible to determine whether the Mons Claudianus specimens represent the sweet melon or green chate variety. The bottle gourd, *Lagenaria siceraria*, is a species native to Africa south of the equator. It appears to have been cultivated in Egypt from the pharaonic period onwards: it has been identified in tombs dating to 3500 BC (Simmonds 1976). The young fruits can be eaten as a vegetable; the mature fruits are mostly used as a container for liquid, after the flesh has been scooped out (Zohary 1982), hence the name bottle gourd. The bottle gourd is here listed under the fruits, but could also have been grouped under the category of vegetables.

The Christ's thorn, *Zizyphus spina-christi*, is a small tree commonly found in eastern Africa, south Arabia and the Levant. The tree is common in Egypt, though mainly as a cultivated variety, and occurs, albeit rarely, in the Eastern Desert (Zahran and Willis 1992; Täckholm 1974). In the Nile valley it is widely cultivated for its edible berries, which are the size of cherries, initially green and later yellow in colour. They contain a round central stone. The fruit flesh is in taste and texture not dissimilar to that of apples. The wild form has spines and the name of the tree indicates that it is thought to have been the plant from which Jesus' crown of thorns was made, although there is no actual evidence for this (Zohary 1982). The stones have been found in Egyptian tombs and Roman sites such as Quseir al-Qadim and Berenike (Wetterstron 1982; Cappers 1996). The fruit flesh is eaten fresh, but also dried, ground into a flour and incorporated in bread, and all parts of the plant are used in medicine (Manniche 1989). In the Mons Claudianus deposits the stones of this tree are rare (they are only found in the large samples and hand-picked material), in contrast to Mons Porphyrites where many stones were found during the 1996 excavations of the 2nd century AD South Sebakh (Van der Veen 1996). The tree is rare in the Eastern Desert today, but there are four trees planted in a square formation next to the Roman station at Umm Sidri at the junction of the Wadi Abu Ma'amal and Wadi Umm Sidri, exactly halfway between the Mons Porphyrites fort and the loading ramp at the mouth of the Wadi Umm Sidri, the starting point of the Roman road to the Nile. The local Bedouin treat the trees as a protected species, regarding those at Umm Sidri as dating back to the Roman period (Hobbs 1989, 106).

The last two fruits that need to be discussed are persea, *Mimusops schimperi* (syn. *Mimusops laurifolia*) and Indian lotus, *Nelumbo nucifera*. Neither of these two plants grows in Egypt today. Persea is native to Ethiopia, but was cultivated in Egypt during pharaonic and Roman times (Hepper 1990). The yellow fruits, *c.* 4 cm long, contain two shiny hard seeds. The fruits were eaten fresh: Theophrastus claimed that they were sweet and luscious (*Hist. Plant.* IV.2.5). The seeds and fruits have been found in pharaonic tombs, and the leaves of this tree have been found made into garlands (Hepper 1990; Manniche 1989). In Roman times the tree had become quite rare and cutting it had become prohibited (Manniche 1989). A papyrus from Oxyrhynchus (*P.Oxy.* XXXVI, 2767) indicates that the Roman administration continued the Ptolemaic practice of regulating the planting and care of persea trees. They were planted especially in city streets and citizens were ordered to irrigate and look after them. At Mons Claudianus this species is rare; only five specimens have been found, all in the hand-picked material.

The Indian lotus, *Nelumbo nucifera*, was introduced into Egypt during the Persian period. It is a water plant and, unlike the other lotus plants, carries its flowers and leaves well above the water surface on long stalks. The common lotus motifs in Egyptian art are not modelled on this species, but on two waterlillies, *Nymphaea lotus* and *Nymphaea caerula*, whose leaves float on the water (Hepper 1990; Harrison *et al.* 1969). Both the rhizomes and the seeds of the Indian lotus were eaten. In Mons Claudianus only three seeds were found. The seeds were usually roasted, but were also eaten raw. The receptical or seed head has the shape of an inverted cone and these are today used in flower arrangements. This plant is the sacred lotus of India (the symbol of the Ganges) and it is thought to have been sacred in Egypt as well.

8.3.2.4 Nuts

Four species of nuts were found in the samples: pine kernels, *Pinus pinea*, walnut, *Juglans regia*, hazelnut, *Corylus avellana*, and almond, *Amygdalus communis*. All of these species are rare, none were found in the small samples. Most came from the hand-picked material of the Fort SE Corner area. All the nuts were preserved in desiccated form. Pine cones and kernels are the fruits and seeds of the stone pine, a tall, parasol-shaped tree, native to the eastern and northern Mediterranean. It does not grow in Egypt. The scales of the cones bear one or two seeds which are encased in a hard shell. There can be as many as 100 seeds in one cone (Kislev 1988). The cones are normally harvested in the winter and stored till June when they are spread out in the sun. This makes the cones open and they are then beaten to knock out the seeds. The empty cones are removed and any broken scales and empty (sterile) seed cases are separated from the others by water. The seeds are subsequently dried and then opened (using fire) to extract the kernels (Kislev 1988). The finds at Mons Claudianus consist of the hard seed cases as well as several scales. This suggests that whole pine cones and not just the seeds were imported. Scales and seed cases were also found at Quseir al-Qadim and Berenike (Wetterstrom 1982; Cappers 1996). Pine kernels are, of course, commonly used in cooking, in both savoury and sweet dishes and pastries, but the pine cone also appears to have religious connotations. They have often been found in association with Roman temples and may have been used in certain ceremonies (Kislev 1988).

Neither the walnut, hazelnut nor almond are native to Egypt and they probably represent imports from the Mediterranean region, although they may have been cultivated on a small scale in the Fayum during the Graeco-Roman period (Schnebel 1925). All four species of nut can be stored for long periods of time and would, therefore, have been easy to transport to the site. They are all rare in the deposits and probably represent luxury items.

8.3.2.5 Oil plants

Four species have been grouped under this category: safflower, *Carthamus tinctorius*, linseed, *Linum usitatissimum*, behen nuts, *Moringa peregrina* (syn. *M. aptera*), and sesame, *Sesamum indicum*. A fifth species could be olive, *Olea europaea*, which has been listed under the fruits. Olive oil was imported to the site as witnessed by the amphorae

(see Tomber forthcoming). The seeds of the safflower produce a bland oil which was used in cooking, and the flower is used as a dye plant (yellow and red). The seeds of safflower have been found in Egypt as early as the New Kingdom: the flowers were used in garlands, and mummy wrappings were often dyed red with safflower (Hepper 1990; Manniche 1989). The plant was widely cultivated in Graeco-Roman times (Schnebel 1925). The seeds are common in the Mons Claudianus deposits, although they occur in very small numbers only (usually just one or two per sample). Most of the remains are very tiny fragments of the achene, although a few complete inside seeds were also found. Sesame, *Sesamum indicum*, is thought to be native to Tropical Africa. It is not clear whether sesame was already known in pharaonic Egypt: no undisputed archaeobotanical records exist (Hepper 1990). The seeds and, more importantly, the oil were known to classical authors and Columella describes the cultivation of the plant (*De Re Rustica* II.10.18; Gallant 1985). Most of the references to sesame oil in the ancient sources derive from Egyptian papyri, suggesting that the cultivation of sesame was well known in Egypt by the Roman period. Archaeobotanical records of sesame are extremely rare, and at Mons Claudianus only one seed was found (in the Well Sebakh).

Flax or linseed, *Linum usitatissimum*, is represented by a few seeds and some capsule fragments. Flax has been cultivated in Egypt since early dynastic times and was the common raw material for clothing. Linen is much cooler than wool and cotton was not yet available. The seeds contain an edible oil and the residues of the oil pressing (seed cake) as well as the crushed capsule fragments were, and still are, used as animal fodder, while roasted linseeds were eaten and added to bread and barley porridge. The behen nuts are the seeds of the ben tree, *Moringa peregrina*, which is native to Egypt and still grows in the Eastern Desert today. The trees are normally found in the narrower wadis, on the lower flanks of the high mountain ranges where there is more water run-off then in the wider wadis (Hobbs 1989 and personal observation). Today local Bedouin collect the seeds which are enclosed in long thin pods. The seeds are sold in the Nile Valley where they are valued for their oil. The oil is sweet and odourless and is, therefore, used in cooking as well as cosmetics and medicine (Hepper 1990; Manniche 1989).

8.3.2.6 Condiments

Fourteen species have been grouped under this category, seven of which belong to the umbellifer or carrot family: coriander, *Coriandrum sativum*, fennel, *Foeniculum vulgare*, dill, *Anethum graveolens*, celery, *Apium graveolens*, cumin, *Cuminum cyminum*, ammi, *Trachispermum copticum*, and anise, *Pimpinella anisum*. Most of these plants are native to the Mediterranean and the Near East, though dill comes from temperate Europe and ammi from India. The seeds of all these species are used as flavourings in a range of different dishes, while the leaves are in some cases also eaten. The seeds of several of them, especially coriander, dill, fennel and celery, are also widely used as anti-flatulents and are combined with cabbage dishes and pulses for this purpose. The presence of a large number of seeds (94) of ammi, *Trachyspermum copticum*, is noteworthy. This species is native to India where it is today widely cultivated and used in cooking and as a household remedy for indigestion (Samuel 1995b). It is today grown in many Near Eastern countries, including Egypt, but is unknown in Europe. The only archaeobotanical record of ammi, prior to this one from Mons Claudianus, is from the Workmen's Village at El-Amarna, dated to 1350 BC, where 13 seeds were found in a small linen bag (Samuel 1995b). The seeds from Mons Claudianus suggest that the species is quite common by the Roman period, but it is not known whether the seeds represent an import from the Nile Valley or from India.

Black cumin, *Nigella sativa*, is not in any way related to the cumin species mentioned above (it belongs to the family of the Ranunculaceae, not the Umbelliferae). The small, angular black seeds have an aroma similar to cumin and they are commonly found on the markets of countries in the Near East and India. They are used primarily sprinkled on breads and cakes (Zohary 1982). The plant is thought to be native to West Africa, but the seeds were already present in Egypt in pharaonic times: a small pot with seeds of black cumin was found in Tutankhamun's tomb (Hepper 1990). Mint, *Mentha* sp., and basil, *Ocimum basilicum*, are used for their aromatic leaves. The fact that the seeds were found at Mons Claudianus suggests that they were grown on site, possibly as pot herbs (see also section 8.3.2.7). Mint is nowadays used in tea and to flavour yoghurt, as well as to treat indigestion and flatulence. Basil is today best known as one of the main ingredients in pesto sauce, but the leaves are used in many other dishes. Rue, *Ruta* cf. *chalepensis*, is a condiment, but the oil distilled from its leaves is used in herbal medicine, while the leaves themselves are also used in salads (Manniche 1989; Zohary 1982). The seeds of fenugreek, *Trigonella foenum-graecum*, are rare: they were only found in the large samples of the Well Sebakh and Fort West I. This plant is, in fact, a pulse, *i.e.* a cultivated species of the family of the Leguminosae. It is here listed under the condiments as the seeds are commonly used as a flavouring in sauces and breads, though the leaves are also eaten in several countries (*e.g.* India, Iran), highlighting the arbitrary nature of the division of these food plants into separate categories.

Pepper, *Piper nigrum*, is a plant native to India. Two pepper corns were found at Mons Claudianus, both in deposits in the South Sebakh. Pepper corns were imported by the Romans from India via the Red Sea ports of Berenike and Myos Hormos (now thought to be the same as Quseir al-Qadim; Peacock 1993). At both these sites pepper corns have been found: at Quseir al-Qadim they are very rare in the Roman period (Wetterstrom 1982), but at Berenike they are found in large numbers (Cappers 1996). Pepper was an expensive luxury in Roman Egypt (R. Bagnall pers. comm.).

One seed has been tentatively identified as white mustard, cf. *Sinapis alba*. The seeds of this species and of the Brassicas (listed under the category vegetables), are very difficult to identify to species level. The seeds of this species are pale yellow in colour, more or less spherical in shape and have a thick sculptured surface or reticulum, surrounding small hollows (interspaces; Renfrew 1973; Berggren 1981). The seeds are used, together with those of black mustard, *Brassica nigra*, to make mustard. But today the species is more commonly used as a salad plant (using the seedlings). The seeds of black mustard, *Brassica nigra* (*syn. Sinapis nigra*), are common in the samples, 654 desiccated and 75 carbonized seeds were found. It is not certain that these seeds represent a condiment, as the plant is

a common arable weed in the Nile Valley, the oases and in the Eastern Desert north of the Qena-Quseir road (Täckholm 1974). Boulos and Hadidi (1984) describe the plant as a characteristic weed in winter crops. The seeds could have come to Mons Claudianus as a contaminant of the wheat or barley grain, or with the chaff (see also section 8.3.3.1). In the data tables (Appendices 1 and 2) this species is listed under the wild plants, but in Table 8.5 under "possible food plants".

8.3.2.7 Vegetables

At least eight plant species have been identified as vegetables. Onion, *Allium cepa*, and garlic, *Allium sativum*, are vegetables, but are also used to flavour other foods. Garlic was found primarily in the large samples and the remains consist of the characteristic base plates to which the cloves are attached. Some fragments of the outer skin of the bulb and of the skin surrounding the individual cloves were also present. There are also some other base plates, which belong to onion, *Allium cepa* (or possibly leek, *Allium porrum*). Furthermore, many samples contained tiny fragments of the tunic or outer skin of onion, suggesting that onion was quite common on site. Vegetables are usually underrepresented in the archaeobotanical record and it is only the exceptionally good preservation conditions at the site that have ensured the survival of tissue such as onion skin. The fragments cannot be quantified in any way, but their presence is indicated in the data tables with the "+" symbol. Onion, garlic and leek have a long history of cultivation in Egypt (Zohary and Hopf 1994). They can be stored for long periods of time and are easily transported.

The Brassicas contain a number of related species which are difficult to separate on the basis of seed morphology alone. They include the cabbages, *Brassica oleracea*, turnip, *Brassica rapa* and swede, *Brassica napus*. The seeds of a common arable weed, charlock, *Sinapis arvensis*, are very similar in shape, size and morphology to the cultivated Brassicas, and to those of white mustard, *Sinapis alba*. The identification of the different *Brassica* and *Sinapis* species is based on the prominence of the reticulum (Berggren 1981), but only one species could definitely be identified to species level: black mustard, *Brassica nigra*. Several seeds resemble *Brassica* cf. *oleracea*, the species that gave rise to the various cabbage varieties (cabbage, kale, savoy, brussels sprouts, cauliflower, broccoli and kohlrabi), one may represent turnip, *Brassica* cf. *rapa*, while several others were intermediate forms between *B. rapa* and *B. napus*. Many seeds could not be identified to species level, and all have been subsumed under *Brassica* spp. in the tables.

The presence of the Brassica seeds is particularly noteworthy, as there can be no other reason for their presence than local cultivation. Cabbage species are always eaten before they set seed (before they have "bolted"), so that it is not possible for the seeds to have arrived accidentally, attached to the cabbage leaves. They must have been imported as seeds, which implies that they were grown at Mons Claudianus. There is a large well immediately adjacent to the fort, and there may have been some small garden plots nearby. The growing of fresh green vegetables on site would have meant access to a very important and otherwise rare source of vitamin C. Cabbages are a particularly rich source of vitamin C. There are four other species which represent fresh greens: spinach beet, *Beta vulgaris*, cress, *Lepidium sativum*, lettuce, *Lactuca sativa* and endive/chicory, *Cichorium endivia/intybus*. Of these, the seeds of spinach beet and cress are relatively common in the samples. Spinach beet is closely related to beet root and sugar beet, but this variety is grown solely for its green leaves, which are a good source of vitamin C. *Beta vulgaris* is, however, also a weed growing throughout Egypt (Täckholm 1974), and it cannot be ruled out that some of these seeds came to Mons Claudianus as a contaminant of the cereal crops, rather than as seed for green vegetables. Cress, *Lepidium sativum*, is eaten in the seedling stage and often combined with white mustard, *Sinapis alba* (the "mustard and cress" punnets found in British supermarkets). Lettuce and endive/chicory are present with just 1 and 2 seeds respectively. Again the seed suggests that these plants were grown on site, where they would represent a valuable source of fresh salad plants.

Globe artichoke, *Cynara* cf. *scolymus*, is also quite rare in the deposits. Thirteen involucral bracts were found in the hand-picked material from the Fort SE Corner and Fort NI areas. The artichoke originates in the Mediterranean region and was known to the Greeks and Romans. There is some confusion, however, as to whether they knew just the cardoon, *Cynara cardunculus*, which is cultivated for its edible leaf stalks, or also the globe artichoke, *Cynara scolymus*, which is grown for the tender fleshy bases of the bracts and the fleshy recepticle of the flower heads. According to André (1981) the Romans only knew the cardoon, and he implies the globe artechoke was not cultivated before AD 1466. Zohary and Hopf (1994), however, suggest that the globe artichoke was cultivated by the end of the first millennium BC (though no evidence is provided). The bracts of the cardoon are less fleshy than those of the artichoke and they have long spines; those of the artichoke are usually blunt or notched at the apex, although cultivars with acute and spiny bracts also exist (de Rougemont 1989, 271; Wiklund 1992, 16). The bracts found at Mons Claudianus do have spines, but they also resemble bracts from which the fleshy base has been removed. On balance, the remains from Mons Claudianus are thought to represent globe artichoke, *Cynara scolymus*, as it is the bracts, not the leaf stalks that were found. Wiklund (1992, 118) has, in fact, suggested that both cultivars should be placed in a single species, *C. cardunculus L.*, because of the existence of a more or less continuous range of morphological variation between the typical wild *C. cardunculus* and the cultivars of cardoon and artichoke.

8.3.2.8 Possible food plants

The final plant to be discussed here is purslane, *Portulaca oleracea*. It is listed under the "possible food plants" category as this species occurs commonly in Egypt as a weed in the Nile Valley, oases and along the Mediterranean. It is, however, also cultivated in Egypt. Young leaves are used in salads and the older leaves are used in stews. The leaves are rich in vitamin C, and in the past it was used to prevent scurvy (Manniche 1989). Like several other species, the seeds of this species could have come in as a crop contaminant or as seed for growing green vegetables.

8.3.3 WILD PLANTS

8.3.3.1 Seeds

A large proportion of the plant remains found (45 per cent in the desiccated assemblage and 29 per cent in the carbonized assemblage) consists of seeds of wild plants. Some 64 different species have been identified. Many of these are typical desert species: *Zilla spinosa, Cornulaca monacantha, Cleome droserifolia, Cleome paradoxa, Leptadenia pyrotechnica, Forsskalea tenacissima, Francoeria crispa, Arnebia hispidissima, Aizoon canariense, Ochradenus baccata, Asphodelus fistulosus*, and *Trichodesma africanum*, and all of them are still found growing near the site today. While the seeds of many of these species may have blown into the deposits accidentally, there is clear evidence that the wood and twigs of *Zilla spinosa* and *Cornulaca monacantha* were deliberately collected as firewood. Both species were common components of the ash deposits in the Annexe SE Corner, the communal kitchen area (see section 8.4.3 below). The fruits of both *Leptadenia pyrotechnica* and *Solenostemma arghel* may have been collected as the seeds each have tufts of long silky hairs which may have been used in cushion stuffings. Both plants are still used today for medicinal purposes; the leaves of *Solenostemma* are used to make a tea (to settle the stomach), and the wood of *Leptadenia* is used as firewood (Hobbs 1989). The Bedouin living in the Eastern Desert use many of the wild plants growing there for medicinal purposes (Hobbs 1990; Osborne 1968), and some of the occupants of the Roman settlement may have been familiar with the beneficial properties of many of these desert plants.

Another group of wild plants encountered in the samples are plants which today grow in the Nile valley, often as weeds in the arable fields or as ruderals growing on the canal banks. Common weeds are *Coronopus niloticus, Brassica nigra, Raphanus raphanistrum, Lolium* cf. *temulentum, Avena fatua/sterilis, Phalaris paradoxa*, Vicieae, Leguminosae indet., *Sorghum* cf. *virgatum, Crypsis* cf. *schoenoides, Scirpus, Cyperus* and *Carex* species. These plants are likely to have grown in arable fields in the past and may have been harvested accidentally together with the cereal or pulse crops. Depending on their aero-dynamic properties (G. Jones 1984, 1987) some of them (those with large and heavy seeds) will have been imported together with the cereal grain (*e.g. Lolium* cf. *temulentum, Avena fatua/sterilis, Phalaris paradoxa, Sorghum* cf. *virgatum*, Vicieae) while others (those with small and light seeds) are likely to have arrived at the site together with the cereal chaff (*e.g. Coronopus niloticus, Brassica nigra, Crypsis* cf. *schoenoides*). Several of these species (*Scirpus, Eleocharis palustre, Cyperus*, and *Carex*) are indicators of wet or marshy conditions, and are today found in the Delta, in Nile mud, on canal banks and, more generally, in areas with a high water table such as irrigated fields (Täckholm 1974). *Cyperus laevigatus* is also found in depressions in the desert (it can tolerate salty land). Two species, *Alisma* sp. and *Ruppia maritima*, are aquatics. *Alisma* was in the past found in basin land, while *Ruppia* is found in salt and brackish water (Täckholm 1974). Both are today found in the Nile Delta, and in swampy habitats in the oases and parts of the Nile valley. All these damp habitat indicators probably reflect the conditions prevalent in the arable fields from which the crops were harvested.

A third group of species, such as *Frankcoeuria crispa, Chenopodium murale, Heliotropium* sp., *Solanum* sp., and *Saccharum spontaneum* are today found both in the Nile valley and in the Eastern Desert. They may, therefore, have arrived into the refuse deposits via both routes. Of these, *Frankoeuria crispa* and *Saccharum spontaneum* are the most common in the samples. A more detailed study of the associations between the various wild species and between these and the crop plants, using multivariate statistics, may help identify their actual route of entry (Van der Veen forthcoming). The seeds of one other wild species were sporadically found in the samples: those of the ben tree, *Moringa peregrina*. The seeds are collected for their oil content, see section 8.3.2.5 above.

Most of the Eastern Desert, including the area of Mons Claudianus, is today classified as hyper-arid. Mean annual rainfall is 5 mm, though this figure does not reflect recurrent annual rainfall, but "accidental" cloudbursts (Zahran and Willis 1992): there can be several years without any rainfall. The present arid conditions, part of the arid zone of the Sahara, have prevailed since c. 3000 BC (Butzer 1961, 1976; Zahran and Willis 1992). The wild plants found at Mons Claudianus reflect a vegetation similar to that of today. Species commonly found in the immediate vicinity of the site are *Zilla spinosa, Artemisia judaica, Leptadenia pyrotechnica, Cleome droserifolia, Zygophyllum coccineum* and *Asphodelus fistulosus*. Most of these species are also found in the samples, with the exception of *Artemisia judaica*. The seeds of this species are very small (< 0.5 mm) and may have been lost during sieving. There is also some historical evidence that rainfall figures during the Roman period were similar to those of today. Hobbs (1989, 98) quotes Theophrastus (372-287 BC) as saying: « A little north of Koptos there grows on the land no tree except that called the thirsty Acacia, and even this is scarce by reason of the heat and the lack of water, for it never rains except at intervals of four or five years, and then the rain comes down heavily and is soon over» (*Hist. Plant.* IV.7.1). There is a similar quote from Pliny the Elder (c. AD 50): « But, in the East, it is a remarkable fact that, as soon as we leave Koptos, passing through the desert, we find nothing growing except the thorn called "dry thorn" » (*Nat. Hist.* XIII.139).

8.3.3.2 Charcoal

While there is no evidence for climatic change between the Roman period and today, the degree of vegetation cover is likely to have been dramatically altered over this period of time. The present population density in the eastern Desert is approximately one Bedouin per 90 sq. km (Hobbs 1989, 2). There are no reliable figures for the Roman period, but at Mons Claudianus alone there were at one point in time nearly one thousand people involved in the quarrying and the administration of the site (MC Inv. O.1538 and 2921). The collection of firewood must have been a daily activity and will have had a serious impact on the woody vegetation stands in the immediate vicinity of the settlement. Firewood will have been needed to fuel the ovens in the kitchen, to heat the water in the bath house, and to sharpen the tools in the tempering workshops and the quarries. It has not been possible to implement a systematic and representative sampling strategy for wood and charcoal, but a small number of samples of charcoal have been analysed, primarily

Area	Annexe SE	Annexe SE	Annexe SE	Annexe SE	Well Sebakh	Well Sebakh	Well Sebakh	Fort West II	Barud I	Barud I	Hydreuma	Hydreuma	TOTAL
Context	7	25	29	31	4	5	8	2	2	6	8	2	
Acacia nilotica (L.) Willd. ex Del.	2	1	1	.	2	4	2	5	.	3	.	3	23
Acacia albida Del.	.	.	.	.	.	.	.	.	1	.	.	.	1
Acacia raddiana type	.	.	1	.	.	.	.	.	.	.	3	.	4
Acacia sp.	.	.	2	.	.	.	.	.	.	.	.	.	2
Leptadenia pyrotechnica (Forssk.) Decne	.	1	.	.	.	.	.	.	.	.	.	.	1
cf. Calotropis procera (Ait.) Ait.	1	.	.	.	.	.	.	.	.	.	.	.	1
cf. Capparis decidua (Forssk.) Edgew.	.	.	.	.	.	.	.	.	.	.	.	1	1
Leguminosae Indet.	1	.	.	3	.	.	.	.	.	.	.	.	4
twig indet.	.	1	.	.	.	.	.	.	.	.	.	.	1
indeterminate	2	.	.	.	.	.	2	.	.	.	.	.	4
Total	6	3	4	3	2	4	4	5	1	3	3	4	42

'ABLE 8.6. *Charcoal identifications.*

Sample no.	Sample type and area	Total count	No. Poaceae	% Poaceae
	CAMEL			
1	MC92 NE Building, N Trench (2)	204	72	35
2	MC90 Fort Annexe SE Corner (31)	208	78	38
8	MC92 Fort Annexe SI (3)	200	29	15
15	MC90 Fort SE Corner (16)	202	10	5
	DONKEY			
3	MC92 Fort Annexe SI (11)	200	75	38
12	MC91 Fort NI	200	32 (+9 broken)	16
13	MC92 Fort Annexe SI (2) SE/SW	200	100 (+23 broken)	50
	SHEEP/GOAT			
4	MC92 Fort Annexe SI (2)	200	0	0
5	MC92 Fort West I, Rm3 (4)	200	0	0
6	MC90 Fort SE Corner (19) b	200	5	3
7	MC90 Fort SE Corner (19) a	200	6	3
9	MC92 Fort NE, handpicked	200	1	1
10	MC92 Fort West I, Rm1 (6) SE	200	3	2
11	MC90 Fort SE Corner (23)	200	0	0
14	MC92 Fort Annexe SI (3) LS	200	1	1

TABLE 8.7. *The relative proportion of pollen of the Poaceae family in samples of animal droppings.*

from the areas of the site where there was ample evidence of fire: the Annexe SE, the Well Sebakh, the Hydreuma, as well as from one context of Fort West II and the midden at Barud. The results are given in Table 8.6.

Seven taxa have been identified, four desert species (*Acacia raddiana* type, *Leptadenia pyrotechnica*, cf. *Calotropis procera* and cf. *Capparis decidua*), two species from the Nile valley (*Acacia nilotica* and *A. albida*) and one (Leguminosae indet.) of unknown habitat. The four desert species can be found in the Eastern Desert and in the vicinity of Mons Claudianus, while *Acacia nilotica* and *A. albida* both occur in the Nile valley, though *A. albida* is rare today. Even with so few samples identified it is clear that the inhabitants of the site used species of the local woody vegetation for firewood, *and* imported charcoal from the Nile valley. It is interesting to note that the desert species come primarily from the deposits of the Annexe SE Corner, that is from the ashy deposits in and around the ovens in the kitchen, while charcoal from the other areas is more or less restricted to the imported species. This suggests that the use of charcoal was specialised, with desert species more commonly used for domestic purposes, and imported charcoal possibly used for more specialised fires, such as in the smithies. (The lower deposits in the Well Sebakh were heavily burnt, and it has been suggested that there might have been a smithy nearby; W. Cockle pers. comm.). This would fit with the fact that the charcoal fragments of *Acacia nilotica* and *A. albida* were all quite large and very hard, suggesting that they may be the product of intentional charcoal making; K. Neumann pers. comm.). The fragments of the desert taxa were generally smaller, including fragments of twigs. While it is very difficult to use charcoal fragments to assess the relative importance of different taxa, it is noticeable that the imported species, *Acacia nilotica*, is by far the most common species present in this small sample, which suggests that local firewood was in short supply. Both these hypotheses, obviously, need testing and further work on the charcoal is planned within the framework of the Mons Porphyrites project.

The present evidence is not sufficient to assess the exact extent of the Roman impact on the vegetation stands in the wadis. Hobbs (1989, 98 ff.) has identified three major phases of environmental degradation: the Roman period, the late 19th and especially the early 20th century, and more recently. The Bedouin themselves blame the Romans for the depletion of the tree stands in the wadis and point to the considerable quantities of charcoal which can be found at the Roman quarries and mines in the desert. There is, however, plenty of evidence that there were still substantial stands or "forests" of trees by the late 19th century. E. A. Floyer who travelled through the Eastern Desert in the 1880s describes wadis full of Acacia trees "hacked and chopped about" by Bedouin for charcoal (Floyer 1887, 670: quoted by Hobbs 1989, 99-100). And the Bedouin themselves identify the early 20th century as their heyday of tree cutting, to produce charcoal for the Nile valley (Hobbs 1989, 100). The drought of the 1950s and the recent use of the desert as a military training ground have completed the onslaught on the woody vegetation of the area. While the Eastern Desert has been arid for some 5000 years, its present barrenness is a relatively recent phenomenon, with the Romans representing the first in a long line of culprits.

8.3.4 WALL PLASTER AND MUDBRICK

In addition to the samples from the middens and refuse deposits five samples of wall plaster and five samples of mudbrick were collected in order to analyse what type of organic material was used as a tempering agent in the clay. Though most of the plaster had fallen off the already exposed walls, intact wall plaster was found in two of the rooms excavated in area Fort SE Corner (S13 and S14), in one room in Fort West II (L1) and in one room in area Fort West I (M7). The plaster in the last room was decorated with paintings, and several layers of wall decoration were identified: one geometric design combined with a rural scene of a shepherd with his sheep or goat and one with floral designs. A niche inside one wall was decorated with a woman's face. Mudbrick was only found in the central building (A, north and south wall) and near the gate. Samples were collected from these building materials (all two litres in volume each) and they were treated in the same way as the small samples from the middens and refuse deposits (see section 8.2 above). The results are listed in Appendix 1, and the broad characteristics of the two assemblages are displayed in Fig. 8.7.

The plaster samples contain considerable quantities of desiccated plant remains: the average seed density is 385 seeds per litre (the amount of carbonized plant remains is negligible). The samples are dominated by cereal chaff, which takes up c. 80 per cent of the total. Most of the chaff consists of the rachis segments of hard or durum wheat, *Triticum durum*, though small amounts of barley rachis and grain are also present. Straw, in the form of culm nodes, is present in small quantities. Seeds of wild species take up 13 per cent of the total. The most common species are *Brassica nigra*, *Coronopus niloticus*, Leguminosae indet., *Crypsis* cf. *schoenoides*, *Francoeuria crispa*, *Raphanus raphanistrum* and Amaranthaceae/Chenopodiaceae, *i.e.* mostly arable weed species with small, light seeds which may have been incorporated within the cereal chaff. In addition to the cereal chaff and associated arable weeds the plaster samples also contain pulses (especially lentils; 2 per cent), fruits (date stones, grape pips, fig seeds, olive stones, and melon seeds; 2 per cent), as well as coriander, *Brassica* seeds and cress. This suggests that while the main component of the tempering used in the plaster was cereal chaff with its associated weed seeds, some kitchen waste or midden material was also used. The presence of small fragments of Mons Claudianus granite within the plaster indicates that the plaster was made on site. If all the walls inside the fort were covered with plaster, which seems likely considering that fragments of plaster were found still adhering to many walls, the amount of tempering material required would be considerable. Furthermore, there is evidence that the outside wall of the site was also covered with plaster, which means that the amount of cereal chaff (the main ingredient of the tempering agent) needed, must have been absolutely enormous.

The mudbrick samples also contain a lot of desiccated plant remains: the average density of desiccated seeds is 317 seeds per litre (again the amount of carbonized remains is negligible). The dominant components in these samples are the seeds of wild plants (54 per cent) and cereal chaff (43 per cent). In contrast to the plaster samples, the mudbrick not only contains many more seeds of wild plants, but most of these are seeds of desert plants, rather than just arable weeds. The five most common species are *Forsskalea* *tenacissima, Zilla spinosa, Frankoeuria crispa, Trichodesma africanum*, and *Cleome droserifolia*. All five are common plants in the Eastern Desert, although *Frankoeuria* also grows in the Nile valley and may have come in as an arable weed. *Trichodesma africanum* occurs in the mudbrick samples only; it is not present in either the plaster or the midden samples. It is a plant commonly found in the Eastern Desert. Apart from these desert plants the samples also contain small numbers of arable weeds, such as *Coronopus niloticus*, Leguminosae indet., and Amaranthaceae/Chenopodiaceae. The cereal chaff consists of rachis segments of hard or durum wheat, *Triticum durum*, rachis segments of barley, *Hordeum vulgare*, as well as culm nodes (straw). The culm nodes are clearly prepared to be used in the brick: they are all chopped to a length of *c.* 2 cm. All the cereal grains belong to barley; they may have been grains still adhering to the rachis segments. Small amounts of pulses, fruits, oil plants, condiments and vegetables were also found, but in much lower densities than in the plaster samples. The samples also contained small fragments of pottery, as well as fragments of Mons Claudianus granite, indicating that the mudbrick, like the plaster, was made on site, not imported from the Nile valley.

To conclude, the most important ingredient of the tempering used in the wall plaster is cereal chaff, which must have been imported from the Nile valley in huge quantities for this purpose, but kitchen waste or midden material was also used. The tempering of the mudbricks was different in composition: the clay used for the mudbricks was tempered with approximately equal quantities of desert plants (seeds as well as leaves and stems) and cereal chaff, including straw, carefully chopped to size for the purpose, as well as some kitchen waste or midden material.

8.3.5 ANIMAL FODDER

Many of the midden deposits contained animal droppings, especially droppings of sheep or goat, as well as a small number of camel and donkey droppings. The number of camel and donkey droppings may have been much higher; these droppings tend to break up easily and are then difficult to recognize. In order to assess whether the animals were left to graze on the local vegetation or were given fodder in the form of cereal chaff or grain, 15 droppings were selected for analysis. Each individual dropping is small, especially in the case of sheep/goat droppings, and the number of macro plant remains is, therefore, likely to be low. For this reason it was decided to carry out an analysis of the pollen content of the droppings in the first instance. Four camel droppings, three donkey droppings and eight sheep/goat droppings were sampled (Table 8.7). A total of 200 pollen was counted in each sample and the number of pollen of the Poaceae family recorded. The pollen of the Poaceae or grass family (which includes both wild grasses and cultivated cereals) were measured at x1000 under oil immersion. The results indicate that in the case of the work animals, the camel and donkey, between 5 and 50 per cent of the pollen belong to the Poaceae family, while the sheep/goat droppings show negligible amounts of Poaceae pollen. Cereal pollen are similar in morphology, but larger in size than those of wild grasses and measurements are used to separate them: while there is a considerable overlap in size

between them, pollen with a maximum grain diameter of ≥38 micron and annulus width of ≥8 micron are usually regarded as belonging to cultivated cereals, while those smaller than these may belong to either cereals or wild grasses. The measurements are given in Figs 8.11, 8.12 and 8.13 and these indicate that a considerable proportion of the Poaceae pollen belong to cereals rather than grasses. The analysis of the macro remains is not yet complete, but it is clear from a preliminary scan of the samples that both camel and donkey dropping contain macro remains of cereals (chaff and grain), while no such remains appear to be present in the sheep/goat droppings. One camel dropping (sample 2) contains 16 grains of barley, all very well preserved and mostly complete, as well as a few fragments of wheat rachis. One donkey dropping (sample 3) contains 11 barley grains and some 40 fragments of rachis (mainly of wheat) and straw. All were very fragmented and poorly preserved: in the case of the barley grains the hulls had become separated, the endosperm had gone and only the pericarp (bran) layer remained, fragmented.

Thus, both donkeys and camels were given fodder in the form of cereal straw, chaff (mostly wheat) and barley grain, but there is no evidence that the sheep/goat were given such fodder. It is important to stress here there is no one-to-one relationship between the percentage of cereal pollen in each dropping and the percentage of cereal-based fodder in the diet of the animal, and they will, of course, have eaten other plants. What this research has demonstrated, however, is that the work animals (camels and donkeys) were given cereal-based fodder as part of their diet. This research is still in its preliminary stage and more samples need to be analysed, which is planned within the framework of the Mons Porphyrites project, but what can be concluded already is that, considering the large number of animals needed at the site, vast quantities of cereal chaff and straw, as well as barley grain, must have been brought to the site for fodder. Some of this will have been blown around the site and accidentally become incorporated in the refuse and midden deposits, and some of it will have entered the deposits after it had passed through the digestive system of the animal and after the dropping has crumbled into unrecognisable fragments. Thus, a considerable proportion of the cereal straw, chaff, some arable weed seeds and barley grains found in the middens and refuse deposits must originate from animal fodder and dung.

8.4. DISCUSSION

The analysis of desiccated seed assemblages, unlike that of carbonized and waterlogged assemblages, is still in its infancy and methodological aspects, such as the formation processes of these assemblages, are poorly understood. In this section some of these aspects will be briefly discussed, although a fuller analysis will be prepared for a more specialist publication (Van der Veen forthcoming). Any differences in the seed assemblage existing between the various parts of the settlement and between Mons Claudianus, the Hydreuma and Barud will also be discussed in this section, as is a comparison between the documentary evidence and the seeds.

8.4.1 MODES OF PRESERVATION

While the seed assemblage is dominated by desiccated remains, approximately 20 per cent of the assemblage is preserved in carbonized or charred form. The mean seed density of the desiccated remains (in the small samples excluding the wall plaster and mudbrick) is 259 seeds per litre of deposit (min = 0; max = 1072, stdev = 222); and for the carbonized remains 86 seeds per litre (min = 0; max = 1664; stdev = 230). Most samples contain a few carbonized seeds; only 5 samples (or eight per cent) consisted of 100 per cent desiccated seeds, but 42 samples (or 63 per cent of the samples) contain more than 90 per cent desiccated remains. Nine samples (or 13 per cent) contain more than 80 per cent carbonised remains, all of them from the Well Sebakh and the Annexe SE Corner (the figures for each sample are listed at the bottom of the data tables in Appendices 1 and 2; Table 8.2 and Fig. 8.2 give the average seed densities for each area by mode of preservation). The density of seeds in archaeological deposits is a reflection of the rate of deposition: a high seed density suggests that the material was deposited all at once and a low density that the remains were deposited piecemeal, mixed in with other refuse over a period of time (G. Jones 1991, 66). The density figures for the desiccated and carbonized seeds suggest that most desiccated remains represent deliberate deposition, but that the carbonized plant remains were only deliberately deposited in two very specific areas (Well Sebakh and Annexe SE Corner), *and* that the carbonized remains in the other samples may represent no more than some "background noise", *i.e.* carbonised remains blowing around the settlement and getting accidentally incorporated within the midden deposits. The activities which will have given rise to carbonized seed assemblages in these two areas will be described in section 8.4.3 below.

The range of species preserved in carbonized form is much smaller than that of the desiccated remains. Of the 56 food plants only 23 were recovered in the carbonized assemblage, which highlights the unique value of desiccated remains, in that they provide a far more complete picture of human diet than carbonized remains can provide. Table 8.8 gives the predominant mode of preservation for each species (excluding those taxa occuring with less than 25 seeds). The plant remains most commonly represented in the carbonized assemblage are cereal grain, cereal chaff, lentils, two wild desert shrubs (*Cornulaca monacantha* and *Zilla spinosa*), two arable weeds (Vicieae and Leguminosae indet.), and three other food plants: fennel (*Foeniculum vulgare*), cress (*Lepidium sativum*) and cabbages (*Brassica* spp.). The large proportion of burnt cereal chaff, together with *Zilla spinosa* and *Cornulaca monacantha*, relates to the fact that these remains were utilized as fuel or tinder in the ovens (see also section 8.4.3 below). The arable weeds were probably mixed with the cereal chaff and got burnt in the same way. The burnt remains of cereal grain and pulses (especially lentils) probably relates to the way in which these foods were processed (see section 8.4.2 below); the reason why the fennel, cress and cabbage seeds got burnt is not clear, but they originate largely from the deposits in the Well Sebakh where there is some evidence that the midden deposits were burnt in situ, so that this is the most likely explanation (see also section 8.4.3 below).

	No. Des	No. Car	% des	% car
Cereal grain				
Hordeum vulgare L.	126	167	43	57
Triticum sp.	19	19	50	50
Cerealia indet.	33	50	40	60
Cereal chaff				
Triticum durum Desf., rachis nodes	2132	572	79	21
Triticum aestivum L., rachis nodes	16	12	57	43
Triticum sp. (tough rachis) rachis nodes	493	211	70	30
Triticum (tough rachis) basal nodes	70	45	61	39
Triticum durum/aestivum, rachilla	608	20	97	3
Triticum cf. dicoccum Schübl., glume bases	64	8	89	11
Hordeum vulgare, rachis nodes	488	116	81	19
Cerealia indet., rachis internodes	743	201	79	21
Cerealia indet., culm nodes	57	43	57	43
Pulses				
Lens culinaris Medick., seeds	86	412	17	83
Lens culinaris, detached hila	231	0	100	0
Fruits				
Phoenix dactylifera L., stones	93	10	90	10
Vitis vinifera L., pips	108	10	92	8
Ficus carica L.	299	20	94	6
Cordia myxa L., stone	23	3	88	12
Citrullus lanatus (Thunb.) Mats. & Nakai	61	0	100	0
Oil plants				
Carthamus tinctorius L.	101	1	99	1
Condiments				
Coriandrum sativum L.	49	5	91	9
Foeniculum vulgare Mill.	57	17	77	23
Apium graveolens L.	31	3	91	9
Trachyspermum copticum (L.) Link	94	2	98	2
Nigella sativa L.	62	2	97	3
Vegetables				
Brassica spp.	61	19	76	24
Beta vulgaris L.	33	0	100	0
Lepidium sativum L.	65	34	66	34
Wild plants				
Forsskalea cf. tenacissima L.	68	7	91	9
Portulaca oleracea L.	113	0	100	0
Chenopodium murale L.	46	1	98	2
Cornulaca monacantha Del., seed	55	114	33	67
cf. Amaranthaceae indet.	42	9	02	10
Cleome droserifolia (Forssk.) Del.	2121	39	98	2
Brassica nigra (L.) Koch in Rohling	654	75	90	10
Zilla spinosa (Turra) Prantl	191	257	43	57
Coronopus niloticus (Del.) Spreng.	226	11	95	5
Vicieae indet.	11	15	42	58
Leguminosae, small-seeded legume	490	224	69	31
Heliotropium sp.	74	8	90	10
Francoeuria crispa (Forssk.) Cass.	463	8	98	2
Crypsis cf. schoenoides (L.) Lam.	37	3	93	8
Phalaris sp., seed	61	5	92	8
Saccharum spontanaeum L.	208	0	100	0
Imperata/Themeda	27	0	100	0
TOTAL ASSEMBLAGE	12,900	3,211	80	20

N.B. These figures are based on the seeds in the small samples from Mons Claudianus, Barud and the Hydreuma only, but excluding those in the wall plaster and mudbrick samples.

TABLE 8.8. *Relative proportions of desiccated versus carbonized preservation for each species where N = ≥25 (midden and refuse deposits only)*

8.4.2 ROUTES OF ENTRY

The processes at play in the formation of carbonized seed assemblages are reasonably well understood. In Europe, the composition of these assemblages has been found to be remarkably similar through space and time, and they are invariably interpreted as representing the harvested cereal crop and its associated impurities (M. Jones 1988, 44; Knörzer 1971). The assemblages consist of cereal grain, cereal chaff and arable weeds, with other plant remains occurring only rarely and in small quantities. This is explained by the fact that it is only the cereal crops that, through their processing sequence, are likely to get into contact with fire. Most other food remains will not have any contact with fire and, consequently, do not preserve, but decompose in middens, compost heaps or arable fields. The formation processes of desiccated seed assemblages have not been studied in any detail to date, but it is clear that many different processes and routes of entry need to be considered, especially as the preservation of the remains is due primarily to natural processes, rather than due to cultural processes as in the case of carbonized remains. At Mons Claudianus the desiccated remains derive from middens outside the fort and from refuse deposits which have accumulated inside several rooms within the fort. Evidence from the pottery and the ostraca indicates that the accumulation of debris in these deposits does not represent a simple linear process through time. Ostraca with late dates are found below those with early dates and sherds which can be joined together are found in widely different parts of the midden (Bingen 1996). This indicates that the middens consist of redeposited material, in some cases forming an "inverted" stratigraphy. A similar process is thought to be in operation in the refuse deposits within the rooms and material accumulated within the fort may, at a later date, have been redeposited onto one of the external middens. Some of the midden material may have been removed at intervals to be used as fuel, as tempering for the plaster and mudbrick or as manure in the gardens. The context or exact location of the plant remains within the midden is, consequently, of little value in the process of interpreting its origin. Instead, this interpretation will have to be based on the internal composition of each of the samples. Even though the samples derive from very small quantities of deposit (2 litres maximum in volume) it is clear from the tables that most of them contain material from a number of different activities. Here the various routes of entry that have been identified are briefly discussed; a detailed statistical analysis of the samples, which may identify the formation processed of the remains more clearly, is in preparation (Van der Veen forthcoming).

Food processing and kitchen waste

There are a number of different remains in the samples which clearly represent the processing and preparation of food: the hulls of barley, the detached hila and testa of the pulses (especially lentils), the germinated barley grains, the fragments of onion and garlic skins and the base plates of these species, the seeds of various herbs and spices (*e.g.* coriander, fennel, cumin, pepper, sesame), and the shells of the nuts etc. All of these remains will have accumulated in areas where food processing and preparation took place, and at regular intervals (? daily) this waste will have been dumped onto one of the middens or refuse deposits.

Snack foods and table waste

Many of the date stones and other large fruit stones, as well as the water melon seeds, the nut shells and maybe the termis beans, will have been thrown onto the middens (or in fact anywhere around the site) once the fruit was eaten. Most of these remains are found in very small quantities dispersed in the deposits, pointing to the casual nature of their deposition. The date and olive stones, however, often occur in groups, suggesting that they may represent table waste.

Faecal material

It is difficult to imagine how individual pips of figs enter the midden deposits. Fig pips are usually swallowed when eaten and not spat out. One theory is that they represent the presence of faecal material in the deposits (R. Cappers, pers. comm.). The seeds of mulberry, pomegranate and grape could have entered the deposits in the same way. The grape pips are frequently broken into small fragments which does suggest they have gone through the digestive tract (although some may have been spat out onto the midden like the snack foods, or represent table waste). Some samples also contain tiny fragments of bran, which also points towards the presence of faecal material.

Seeds accidentally blown in

The samples contain a large number of seeds from plants still growing around the settlement today. Many of these may have been blown in accidentally and have gradually accumulated, dispersed within the domestic refuse.

Decaying plaster and mudbrick

In several of the rooms inside the fort the walls were covered with plaster. Analysis of this plaster identified cereal chaff (mainly wheat chaff) and seeds of some wild plants to be the main materials used in the tempering of the clay. The presence of small quantities of pulses (esp. detached hila of lentils), fruit stones (dates, grapes, figs, melon), safflower achenes and herbs such as coriander, suggests that other plant remains were also used as temper. The assemblage is, in fact, not that dissimilar to that from the South Sebakh. While the temper consisted largely of cereal chaff, it may have been mixed with some midden material. Once the room fell out of use the plaster decayed and fell inside the room where, in some cases, it became mixed with refuse deposited inside the room. Some of this material may, at a later stage, have been redeposited onto the midden, adding to the complexity of the formation of the refuse deposits. A similar process is likely to have been at play with the mudbrick.

Animal droppings and fodder

Most of the samples contain small quantities of sheep/goat droppings, and, more rarely, camel and donkey droppings. While sheep/goat droppings are relatively firm and generally stay intact, those of camel and donkey are more fragile and crumbly in texture. It is, therefore, conceivable that the deposits contain many more donkey droppings than were identified, as they disintegrate readily. Many samples did, in fact, contain small fragments of what appears to be dung, with plant fragments incorporated within their matrix. As the donkey and camel droppings analysed so far contain both cereal chaff and barley grain (section 8.3.5 above) a proportion of cereal chaff in the samples is likely to originate from decaying animal dung and unused fodder. Three other species may point to the presence of animal dung in the deposits: sycamore fig, safflower and flax. Sycamore fig is represented in the samples by individual galls, which like fig seeds, suggests that they may have come through the digestive tract. As sycamore figs containing galls are not eaten by humans, but are used as fodder, they are suggestive of the presence of animal dung. Both the achenes of safflower, *Carthamus tinctorius*, and the capsules of flax, *Linum usitatissimum*, are very fragmented. Both represent the by-product of the extraction of the seeds which are used for their oil content. These by-products are often used as fodder (Beech 1969; Langer and Hill 1993). Both these species may have been imported to Mons Claudianus for their seeds (either to extract the oil or to eat the seeds, roasted or added to stews). It is also possible that these by-products of oil production were imported as fodder, or, were minor admixtures within the imported animal fodder.

Hearth sweepings (fuel/tinder)

The remains from the Annexe SE Corner consist to a large extent of charred cereal chaff, straw, some arable weeds and seeds and twigs of two desert shrubs, *Zilla spinosa* and *Cornulaca monacantha*, and have been interpreted as the remains of fuel and tinder used in the ovens in this area (see also sections 8.3.3.2 and 8.4.3). While the ashes from the ovens clearly accumulated in the immediate vicinity of the ovens, they may also have been deposited elsewhere in and around the fort. Another area where the accumulation of ash and incompletely burnt fuel might be expected is at the bath house. Unfortunately, no excavations took place here, but during the survey of the buildings no ash deposits were recorded, and there is indeed no evidence for heat or burning on the pilae, suggesting perhaps that it was never used (Peacock and Maxfield 1997, 132). A proportion of the chaff found in the midden and refuse deposits may, therefore, represent used and unused fuel.

8.4.3 INTRA-SITE VARIABILITY

Within Mons Claudianus the small samples originate from eight separate areas. In this section differences between these areas are briefly discussed. The overall characteristics of these assemblages are presented in Figs 8.8, 8.9 and 8.10 (see also Fig.8.2 and Table 8.2). Only assemblages of 500+ identifications are illustrated. It is clear from these figures that the assemblages are very similar to one another: all areas are characterized by large quantities of cereal chaff and wild plants. All areas, except Annexe SE Corner, contain a range of other food plants, though the proportions vary. The main difference lies in the near absence of food plants in the Annexe SE Corner (see below), and in the fact that only the Well Sebakh and the Annexe SE Corner have substantial carbonized assemblages.

South Sebakh

This is the large midden lying immediately south of the south wall of the fort (above Chapter 5). It was excavated between 1987 and 1990 and is dated by ostraca to the earlier second century AD (mainly Trajanic). By 1990, when I joined the project, most of the midden had been excavated, but the far eastern side was still available for sampling. The deposits were shallow and not very organic; consequently, the preservation of the plant remains was poor, especially so for the cereal remains. Four samples were taken from the section on the western side, where the midden underlies the granary or store building. The preservation was only marginally better here, possibly because the section had been exposed for a number of years before the samples were taken. The assemblage consists primarily of desiccated plant remains: the average seed density of desiccated remains is 200 seeds per litre and that of carbonized remains 5 seeds per litre. The assemblage is characterized by a higher than average proportion of cereal chaff, a lower than average proportion of wild seeds and a higher than average proportion of fruits (45 seeds per litre). The midden contains kitchen waste (onion skin, condiments including pepper, vegetables), snack food and table waste (fruits) and some evidence of possible faecal material (human and animal: fig seeds, safflower achenes). During 1987 a layer of burnt bread was found in the western section of the midden, mostly small round loaves or buns. (Samples taken in 1989 from the main body of the mound are housed in the EAO store at Denderah.)

Well Sebakh

During 1992 a trench was excavated through the substantial midden deposits lying immediately north-west of the well. The ostraca from this area are dated to the early second century (Trajanic) and include many water receipts. Much of the midden material, including the pottery and animal bone, was charred, and the deposits appeared to have been burnt *in situ*. The seed assemblage consists primarily of carbonized (charred) remains: the average seed density of the desiccated remains is 2 seeds per litre, that of the carbonized remains 120 seeds per litre. The assemblage is dominated by cereal chaff and wild seeds, but cereal grains, pulses, condiments and vegetables are also present. The seeds of fennel, ammi, cabbage and cress are particularly common, and the only seed of sesame came from this area. Some of the charred remains are only partially charred, *i.e.* the seeds and chaff are discoloured, but not carbonized inside, again suggesting burning *in situ*. Refuse deposits are sometimes set alight in order to reduce the smell of the decaying organic matter and to reduce fly infestations. There is, however, no evidence that this was common practice at Mons Claudianus (the other midden and refuse deposits do not show any evidence of burning episodes), and the deposits may have become charred in situ due to the heat of smouldering ash and charcoal thrown onto the midden.

Fort SE Corner

The south-east corner of the fort was excavated between 1990 and 1991. The ostraca from this area are predominantly mid-second century in date, though documents from the later second and perhaps early third century were also present. (Two coins dated to the later third century were also found, but not in the area of rubbish dumping.) Part of this area may have been a kitchen: two hearths, each defined by a ring of amphora spikes, were found. This area also contained a latrine, though no samples associated with its use have been analysed. The whole area was filled with midden material which probably originated from elsewhere in and around the fort, and two of the rooms still had plaster adhering to the walls (see section 8.3.4 above). The assemblage consists primarily of desiccated remains: the average seed density of the desiccated remains is 241 seeds per litre, that of the carbonized remains 32 seeds per litre. Apart from the cereal chaff and wild seeds, the category of fruits is reasonably well represented. The assemblage is characterized by the presence of large quantities of food processing waste (the hulls of barley and the testa of pulses) and kitchen waste (onion skin, onion and garlic base plates, artichoke scales), herbs and spices (coriander, fennel, ammi and black cumin), as well as the presence of luxury food items such as artichoke, pine kernels, almond, hazelnut, and walnut shells. There is also some evidence of possible faecal material (fig seeds, sycamore galls, safflower achenes).

Fort NE

This area adjoins the Annexe SE kitchen area, and had, in the Antonine period, been connected with it through a gap in the wall (Chapter 3.4.2). The area was subsequently filled with sebakh. The assemblage consists primarily of desiccated remains: the average seed density of the desiccated remains is 168 seeds per litre, that of the carbonized remains 23 seeds per litre. Like all other assemblages, the samples are dominated by cereal grain and wild seeds. All the categories of food plants are represented, though in low proportions only. All the samples contain food processing waste in the form of barley hulls, and some of them also contain testa fragments of pulses.

Fort West I

This area consists of several rooms at the south-west corner of block M, on the road leading from the main street to the cistern room. The walls of one room were plastered and decorated with wall paintings (see section 8.3.4 above). The rooms were filled with refuse deposits, dated to the mid- to later second century. The assemblage consists primarily of desiccated remains: the average seed density of the desiccated remains is 244 seeds per litre, that of the carbonized remains 13 seeds per litre. Like all other assemblages the samples are dominated by cereal grain and wild seeds, and all the categories of food plants are present.

Fort West II

This represents a room immediately inside the gate. The walls of the room were plastered (see section 8.4.3 above), and the room was filled with sebakh dated to the mid-second century AD. The assemblage from this room has the highest seed density of desiccated remains: 490 seeds per litre (the seed density of the carbonized remains is 46 seeds per litre). Like every other assemblage, it is dominated by cereal chaff and wild plants. Food processing waste (barley hulls and pulse testa) is common in all samples.

Annexe SI

This represents a pair of rooms abutting the southern wall of the Annexe. Room 1 (the more southerly of the pair) was filled to the top with sebakh material, including a lot of straw and woody (roofing?) material. The ostraca from this area are dated to the second century AD (Hadrianic and early Antonine). The assemblage is dominated by desiccated plant remains: the average density of desiccated seeds per litre is 293, that of carbonized seeds is 16 seeds per litre. Again cereal chaff and wild seeds are the main components, but pulses (especially lentils) are very common (taking up 15 per cent of the overall assemblage). The samples contain a lot of food processing waste (barley hulls and pulse testa fragments), but also fruit stones and luxuries such as nuts.

Annexe SE Corner

The SE Corner of the Annexe has been identified as the communal kitchen area (see Chapter 4). It was found to contain nine cylindrical ovens, no more than five in contemporary use, and dated to the second century. They were open at the top, and were probably used for the baking of bread (see also section 8.3.2.1 and Chapter 4.2). All the deposits in this area contained ash, often in huge quantities. The assemblage contains a large proportion of carbonized plant remains: the density of desiccated seeds is 312 seeds per litre, that of carbonized seeds is 483 per litre, and in this respect the assemblage is very different from the preceding ones. Furthermore, the samples do not contain food plants, with the exception of cereal grain (especially barley). The assemblage is dominated by cereal chaff (especially of wheat), straw (culm nodes) and the seeds and twigs of two wild plants: *Zilla spinosa* and *Cornulaca monacantha*. Both are small desert shrubs, still growing in the vicinity of the site. *Zilla spinosa* is, in fact, the most common species found in the wadi today. Other common wild plants are Leguminosae indet. and *Heliotropium* sp., both probably arable weeds which arrived at the site mixed in with the cereal chaff. There is no difference in composition between the desiccated and charred assemblages. In several samples some of the seeds and chaff fragments were only partially charred, while context (28) was clearly different in being much more "organic" than the other deposits. It did, in fact, contain primarily desiccated plant remains, identical in composition to the carbonized remains in the other samples. The assemblage from this area is not only very different from all the ones discussed above, it is also the only assemblage for which there is a direct association between the plant remains found in the deposits and the function of the area from which the deposits were recovered. The samples are interpreted as representing the fuel used in the ovens (or not yet used in the case of the desiccated remains). Firewood is (and almost certainly was) very rare in the vicinity of the site (see section 8.3.3 above and 8.5.4 below), so that its occupants were forced to use twigs of two common desert shrubs, as well as to import what must have been vast quantities of cereal chaff from the Nile valley. The ovens are similar in shape and size to the New Kingdom ones found at the Workmen's Village at El-Amarna (Samuel 1995a) and, by analogy with round ovens found in the Near East today, they are interpreted as having been used to bake flat breads against the oven wall (Samuel 1989, 255). They may, of course, also have been used to bake other types of bread or food. As the only opening is at the top, food would have to have been put on trays or in containers and lowered inside the oven and placed directly on the fire, which must have been awkward considering the heat. One ceramic tray was found, but it has no evidence of burning at its base (R. Tomber pers. comm.), and was, therefore, probably not used inside the oven. Most of the cereal grain found on site is barley, and barley is suited for flat breads rather than leavened bread. The ovens may have been used largely for the production of these flat breads. One large round mortar was found outside room U29 (Fig. 4.23). This may have been used to pound the barley grain to remove the tough hulls (see also section 8.3.2.1 above), and to produce a coarse flour. Cereal grains were only found in one sample: context (18) contains 41 charred barley grains; this is a sooty deposit inside oven (10). Context (28) contains a considerable number of barley hulls, suggesting that the dehulling of barley grains was carried out in the kitchen area (probably using the large stone mortar mentioned above). The shreds of barley hulls would not survive contact with fire, hence their absence in the other samples from this area. The very low number of cereal grains found in this area suggests that great care was taken not to spill the grain accidentally.

8.4.4 INTER-SITE VARIABILITY

The plant remains discussed here originate from three separate sites: Mons Claudianus, the Hydreuma and Barud. The Hydreuma is a watering station just over 1 km south-west of Mons Claudianus. Trial excavations in 1993 suggest that the midden deposits are largely later first to early second century in date (Flavian/Trajanic, although some Neronian material was also found; see Chapter 7). The site contains some substantial cisterns, but the buildings are scattered against the hill slope and, unlike most of the stations on the Qena to Mons Claudianus road, not enclosed by a perimeter wall. Barud is a Roman fort and quarry located *c.* 10 km south-east of Mons Claudianus. During 1992 a small trial trench was excavated in the midden outside the north gate of the fort and the deposit dated to the mid-second century (Antonine) (Peacock and Maxfield 1997, 275-279). The dating evidence suggests that all three sites saw contemporary occupation, though the Hydreuma started earlier and Mons Claudianus probably continued later. The food plants found at the three different sites are listed in Table 8.5 and the general characteristics of the assemblages are displayed in Figs 8.8, 8.9 and 8.10. Of the 56 food plants recovered in total, 55 are present at Mons Claudianus, 28 at the Hydreuma and 25 at Barud. Both the Hydreuma and Barud have a smaller range of pulses (though the Hydreuma samples contain a large number of lentils), no persea or Indian lotus, no nuts, peper, sesame or artichoke. All of these food plants are, however, very rare in the deposits of Mons Claudianus. Considering the fact that the number of samples analysed from the Hydreuma and Barud is considerably smaller than that from Mons Claudianus (Table 8.2 and section 8.2.1), it is very likely that the full range of foods would have been present on all three sites, and that the absence of certain species is largely due to differences in the amount of excavation and sampling at the three sites. Thus, the evidence suggests that the food supply to all three sites must have been broadly similar.

The preservation of the seeds was not as good at Barud and the Hydreuma as at Mons Claudianus. The midden at Barud was not very organic in content. It is very shallow and may, consequently, have suffered more decomposition of organics than the deep deposits at Mons Claudianus. Most of the assemblage from Barud does, in fact, consist of seeds of wild plants (in particular of *Cleome droserifolia*) which must have grown near the midden and been blown into the midden while it accumulated. The amount of human deposition in this midden is low. The preservation at the Hydreuma is also poor, but here a substantial part of the assemblage is burnt, especially the cereal grain and the lentils. The barley grain is germinated, probably for the production of malt for the brewing of beer (see also section 8.3.2.1). Both the Hydreuma and Barud have much smaller amounts of cereal chaff than Mons Claudianus: the average density at these two sites is 28 and 36 rachis nodes per litre respectively, as against 155 per litre at Mons Claudianus. If the suggestion made above (section 8.3.2.1) that the abundant presence of cereal chaff is, at least partly, connected with the import of this material as animal fodder, than the lower quantities of chaff at the Hydreuma and Barud would suggest that there were fewer animals at these two sites. This is consistent with the presence of substantial animal lines at Mons Claudianus and the absence of animal lines at the Hydreuma and Barud. Chaff is still present at the latter two sites, because, in addition to fodder, it is used as a fuel and tempering agent.

8.4.5 DOCUMENTARY EVIDENCE

One of the many remarkable aspects of the excavations was the recovery of large numbers of ostraca (over 9000 in total), all concerned with the organisation of the complex, including the organisation of the food supply (Bingen *et al.* 1992, 1997). This information is of particular interest here as it allows comparisons to be drawn between the documentary and archaeobotanical evidence. Although much of the evidence remains as yet unpublished, there is already a wealth of information available and here three examples of how the two lines of evidence both corroborate and complement one another are discussed (a more detailed discussion of the methodological aspects of comparing different lines of evidence is in preparation).

Two types of document, the *entolai* and the private letters, are particularly informative about the food supply (Bingen 1997; Bülow-Jacobsen 1992, 1997; Cuvigny 1992, 1996). The *entolai* are documents written by the skilled civilian workers (*pagani*), and contain instructions to the quartermaster. The ostraca document that their pay consisted of a monthly allocation of wheat (one artaba = *c.* 40 litres), a wine ration and a salary of (usually) 47 drachmae (Cuvigny 1996). The evidence suggests that they wrote down monthly instructions to the quartermaster specifying which foods they wanted and how they wanted their wages spent. From these we learn that they usually arranged for their wheat allocation to be given to their female relatives in the Nile valley to be turned into bread before being brought to the site, and that part of their salary was used to buy oil, lentils, onions and dates (Cuvigny 1992; 1996). Furthermore, we learn from the ostraca that the other, unskilled, category of workmen, the *familia*, were also paid a salary (amount unknown), and received one artaba of wheat, lentils and oil each month, and, once a year, a set of clothes (Cuvigny 1996). The scarcity of wheat grains compared to barley grains in the archaeological deposits suggests that wheat grains were imported in much smaller quantities than barley, if at all (section 8.3.2.1). This is confirmed by the evidence from the *entolai* which document the import of wheat in the form of bread, not grain. In contrast, barley is hardly mentioned in the ostraca, but the archaeobotanical evidence demonstrates that it must have been a major food for human consumption.

The private letters, written to or by the families and friends of the occupants of the site, often included requests for or acknowledgement of receipt of food items (Bingen 1997; Bülow-Jacobsen 1992, 1997). The foods most frequently mentioned in these letters are meat, fish and vegetables. The fact that these foods are requested from or supplied by family and friends suggests that they did not form part of the official, organised food supply, but were obtained through private enterprise. Of the plant foods mentioned, the vegetables are the most common, especially cabbage, "lachanon" (= "greens") and beet (probably spinach beet). Interestingly, there are three ostraca which suggest that the vegetables may have been grown in the desert. *O.Claud.* 227 contains the phrase: « I shall send you the vegetables when there are any »; *O.Claud.* 332 mentions the word seeds, though sadly the rest of the sentence is not preserved, and *O.Claud.* 280 refers to the sending of water and dung and to the fact that the vegetables have not grown yet. This confirms the conclusion drawn on the basis of the archaeobotanical evidence that at least some of the vegetables were grown in the desert (section 8.3.2.7 above).

A final example is that concerning the import of plant remains for purposes other than food. The archaeobotanical evidence indicates that plant remains were imported to the site in enormous quantities for the purpose of animal fodder (chaff, straw and barley grain; section 8.3.5), temper in wallplaster and mudbrick (chaff and straw; section 8.3.4) and fuel (chaff, straw and wood charcoal; section 8.3.3.2). There are several references in the ostraca to the delivery of loads of chaff (*e.g.* *O.Claud.* 124 and 125), though it is not clear from the documents whether these loads refer to a donkey or a camel load, nor is it clear what the chaff was meant for (Bülow-Jacobsen 1992, 11). There is one reference to the delivery of charcoal (MC Inv. O.1745; Bülow-Jacobsen pers. comm.), and two references to fodder, one associated with a reference to date stones (MC Inv. O.1417 and 7831; H. Cuvigny pers. comm.). Of relevance also is *P.Giss.* I 69 requesting all the barley in the Heptakomia Apollonipolites nome to be brought to Qena, as a great number of animals had been assembled for the purpose of bringing down a fifty-foot column, thought to be coming from Mons Claudianus (Peña 1989). In view of the quantities of fodder, fuel and tempering material required and the importance of this material for the functioning of the complex, the ostraca are remarkable quiet on the matter. What they do say is consistent with the findings of the archaeobotanical analysis, but it is the latter which provides the necessary detail and identifies the importance of these imports for the functioning of the complex.

8.5 SUMMARY AND CONCLUSIONS

8.5.1 SUMMARY OF THE ARCHAEOBOTANICAL EVIDENCE

To conclude, the archaeobotanical assemblage has provided a wealth of information regarding the diet of the inhabitants, as well as the way in which they used plants for purposes other than food. In terms of the food plants a remarkably wide range of foods has been recovered from the midden and refuse deposits at the site: two types of cereal, six species of pulses, 19 fruits, four oil plants, four nuts, eight vegetables and 14 herbs and spices. Even without the availability of meat and fish (on which see Chapter 9) these plant foods would have provided a healthy, well-balanced diet. The cereals and pulses, together with the dates, would have provided most of the necessary carbohydrates; the cereals and pulses are a good source of vegetable protein, which, combined, will approach the quality of that of meat (Fidenza 1991). The nuts and oil plants would have contributed protein and important fats, a more concentrated form of carbohydrates, while the fruits provided vitamins and sugars; the vegetables must have played a vital role in contributing essential vitamin C, iron and minerals to the diet (especially the onions, cabbages and spinach beet), while the condiments provided the all important flavouring, being able to make the duller staple foods appetizing. Several plants will have been used to make beverages, both cordials (*e.g.* made from the dom fruits and the Christ thorn berries), and alcoholic ones: beer (made from barley) and wine (imported, as attested by the ceramic evidence; see Tomber forthcoming).

There is clear evidence that while some processed foods were brought in (cf. the evidence from the ostraca for the import of bread, wine and oil, and the ceramic evidence for wine, oil and fish sauce), processing of foods was also done on site. Barley was de-hulled before being used for human consumption (bread and/or porridge), barley was turned into malt for the brewing of beer, and the testa of the pulses were removed before eating. Several plants will have been used for more than just food: the colocynth, citron, sebesten and many of the herbs may have been used for medicinal purposes, while the citron, pomegranate and pine cones may have played a role in religious ceremonies.

One of the more striking aspects of the assemblage is the evidence for luxury foods. The remote location of the site and the indication in classical texts that some quarries were run using forced labour (*e.g.* Josephus, *Bell. iud.* 6.418; Aristides, *Aegyptios* 67, 5-12), had made us believe, at the start of the project, that the diet might have been restricted to a small range of staple foods. Staple foods are foods that form the main component of the diet and are fundamental to human nutrition. In contrast, luxury foods are choice foods, expensive and desirable for enjoyment, but not indispensable in terms of human nutrition. Obvious staples at Mons Claudianus are wheat (as evidenced by the ostraca), barley, lentils, dates, grapes, olives, onions, wine and olive oil (as evidenced by amphorae) as well as donkey meat and fish (see 9.2.1 and 9.6.3). Obvious luxury foods are the nuts and pepper (both expensive), artichoke, pomegranate, citron, and persea (rare), and the herbs (indispensable in terms of human nutrition), to which we can add the meat of game, oysters and snails from the faunal evidence (see 9.2.4 and 9.7). The presence of these luxuries is important, as it highlights the quality of life available to some at least of the inhabitants of the site: they had access to foods for special occasions, treats and religious ceremonies.

Another important aspect of the assemblage is the evidence for the import of plants for purposes other than food. The composition of the assemblage points to the importation of vast quantities of chaff and straw, as well as wood charcoal and barley for the purpose of animal fodder, fuel and building material (temper for the wall plaster and mudbrick). The quantities brought in, as suggested by the archaeological remains, indicate the importance of this material for the functioning of the site, and also indicate that these by-products of the cereal harvest, often wrongly regarded as "waste" products, formed an important economic resource, traded over long distances (see also Van der Veen 1999).

While plant macrofossils and charcoal fragments from midden and refuse deposits cannot be used directly in any quantitative reconstruction of the vegetation, they can provide an indication of the likelihood of vegetation change. Here both the charcoal identifications and the seed assemblage contain the same species as those that are still growing around the site today, suggesting little change. The evidence for the import of wood charcoal and chaff points to the fact that there was insufficient local firewood, but the clear evidence for the use of desert species as fuel suggests that the present barrenness of the area may be partly due to excessive exploitation of the woody vegetation stands during the Roman period.

The archaeobotanical assemblage has also raised a number of important methodological issues. Most of the assemblage (*c.* 80 per cent) was preserved in desiccated form. The carbonized remains were largely concentrated in three areas: in the ash deposits around the ovens in the kitchen area (Annexe SE Corner), the Well Sebakh and in the midden at the Hydreuma. In the first case we are dealing with plant remains used as fuel, in the case of the Well Sebakh the plant remains appear to have been burnt in situ (*i.e.* the midden was burnt), while in the last case the barley grains and lentils probably became charred accidentally during processing. The formation processes of the desiccated remains are far more complex: some seven different routes of entry have been identified, but in most cases these did not result in discrete depositions: the internal composition of all the samples suggests that a lot of mixing took place. In addition to a number of human activities, the desiccated remains also contain evidence from other sources (unused fodder, decaying dung, used and unused fuel, unused organic temper, as well as decaying mudbrick and plaster), and unravelling these and separating them from human food refuse is difficult. The application of multivariate statistics to this data set is planned and may identify and separate more clearly the routes of entry of individual species and the different formation processes for the desiccated and carbonized plant remains (Van der Veen forthcoming).

8.5.2 THE FOOD AND FODDER SUPPLY TO THE FORT

The archaeobotanical evidence has identified three different sources of food supply: the Nile valley, local cultivation, and collection of local, desert species. Most of the human foods and most of the animal fodder came from the Nile valley, but there is clear evidence, corroborated by the ostraca, that vegetables were cultivated locally by the inhabitants of

the site, and that a few plants were collected from the local desert vegetation. Most of the fuel and the organic temper for the wall plaster and mudbrick also came from the Nile valley, but here desert species played a more important role: several taxa were used as fuel, especially in the kitchen ovens; and several more were used in the organic temper, especially in that for the mudbricks.

Finally, the evidence clearly demonstrates that Mons Claudianus was no malnourished, nor undersupplied desert station, but a settlement that had access to most foods that were available in the Nile valley or the Mediterranean. The results highlight the organised nature of the food economy in Roman Egypt, and the role it played in underpinning the existence and functioning of sites engaged in specialised, non-agricultural activities.

Appendix 1	Number of desiccated seeds for each sample.
Appendix 2	Number of carbonized seeds for samples which contain ≥50 carbonized seeds.

Area:	<			South Sebakh				> <		Well Sebakh			> <				Fort SE Corner			
Context:	1	2	3	5	G1	G2a	G2b	G2c	3	5	6	8	9	6	10	13	26	32	14	24	38
No. of litres:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
% sorted:	25	50	50	25	100	25	25	25	100	50	25	50	100	25	25	25	50	50	25	25	50
Cereal grain																					
Hordeum vulgare L.	.	14	1	3	18	3	1	1	.	.	.	.	.	8	5	3	.	.	2	3	7
Triticum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	1	1	.	3	.	1
Cerealia indet.	.	.	.	5	.	1	.	.	.	.	.	.	.	.	.	2	.	.	4	1	5
Cereal chaff																					
Triticum durum Desf., rachis nodes	1	76	36	197	103	29	26	39	2	.	.	.	.	49	40	49	41	80	14	41	17
Triticum aestivum L., rachis nodes	.	.	.	.	2	.	1	3	.	.	.	.	.	.	.	.	1	.	.	.	.
Triticum sp. (tough rachis) rachis nodes	3	.	9	46	11	14	10	14	.	.	.	.	.	8	9	11	12	20	1	.	3
Triticum (tough rachis) basal nodes	.	6	4	.	8	.	1	.	.	.	.	.	.	4	4	2	2	6	1	.	.
Triticum durum/aestivum, rachilla	.	.	9	3	18	8	1	12	.	.	.	.	.	11	17	26	10	6	11	20	2
Triticum dur/aest, glumes, lemma and palea	+	.	+	+	+	.	.	+	+	.	.	.	.	+	++	+	+	+	+	++	+
Triticum sp., awns	+	.	.	+	.	.	.	.	.	.	.	.	.	+	+	+	.	+	+	+	+
Triticum cf. dicoccum Schübl., glume bases	.	2	2	.	.	1	2	.	.	.	.	.	.	10	6	.	.	29	.	.	1
Triticum cf. dicoccum, rachis segments	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	.	.	.	.	.	.
Hordeum vulgare, rachis nodes	3	10	8	40	31	8	4	6	1	.	.	.	.	37	10	22	5	3	7	10	7
Hordeum sp., basal nodes	.	.	.	.	2	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.
Hordeum sp., hulls	+		++	+	+	.	.	.	+	.	.	.	.	+++	+++	++	+	+	+++	++	+
Hordeum sp., awns	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	+	+	.
Cerealia indet., rachis internodes	1	33	24	46	40	16	8	14	.	.	.	.	.	21	12	30	26	22	7	14	3
Cerealia indet., culm nodes	.	.	2	5	3	1	2	8	.	.	.	.	.	5	3	1	1	1	1	1	.
Pulses																					
Lens culinaris Medick., seeds	.	.	1	2	30	.	.	.	.	.	.	.	.	2	.	3	3	.	3	2	.
Lens culinaris, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	3	2	.
Pisum sativum L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Pisum sativum, detached hila	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	2	1	.
Vicia faba L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia faba, detached hila	1	.	.	.	4	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
Lathyrus cf. sativus, seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lupinus albus L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Lupinus albus, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Cicer arietinum, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
pulses indet., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
pulses indet., testa fragments	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+++	+	.
Fruits																					
Phoenix dactylifera L., stones	.	4	9	2	9	1	2	6	.	.	.	.	.	2	.	1	2	2	1	1	1
Phoenix dactylifera, perianth	.	.	2	.	.	.	.	.	.	.	.	.	.	1	1	1	.	.	1	.	.
Vitis vinifera L., pips	.	7	2	1	27	4	2	1	.	.	.	.	.	1	2	2	2	4	2	1	1
Vitis vinifera, stalks	.	1	.	4	3	2	3	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Ficus carica L.	2	26	12	.	35	29	39	29	.	.	.	.	.	3	1	8	11	10	3	.	.
Ficus sycamorus L., galls	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	2	1	1	.

Area:	<			South Sebakh				> <		Well Sebakh			> <				Fort SE Corner			
Context:	1	2	3	5	G1	G2a	G2b	G2c	3	5	6	8	9	6	10	13	26	32	14	24	38
Olea europea L.	.	.	.	.	1	1	.	1	.	.	.	.	.	1	1	2	.	1	.	.	.
Cordia myxa L., stone	.	.	.	.	.	.	1	1	1	.	.	.	.	1	.	1	.	2	1	.	1
Cordia myxa, calyx	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Citrus cf. medica L., seeds	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Morus cf. nigra L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Punica granatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Capparis spinosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Citrullus lanatus (Thunb.) Mats. & Nakai	.	1	1	.	1	.	.	2	.	.	.	.	.	.	.	1	.	3	.	.	.
Citrullus colocynthis (L.) Schrad.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Citrullus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cucumis melo/sativus	.	1	.	.	4	2	1	2	.	.	.	.	.	1	.	.	1	5	.	.	.
Lagenaria siceraria (Mol.) Standl.	.	1	.	.	2	2	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.
Oil plants																					
Carthamus tinctorius L.	1	3	1	1	4	2	1	3	.	1	.	.	.	2	1	2	2	3	2	1	1
Linum usitatissimum L., capsule fragment	.	.	.	.	1	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.
Linum usitatissimum, seed	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sesamum indicum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Condiments																					
Coriandrum sativum L.	1	.	1	.	4	.	.	1	.	.	.	.	.	1	3	2	1	3	1	2	1
Foeniculum vulgare Mill.	.	.	.	1	8	.	.	1	.	.	.	.	.	3	.	6	2	.	1	4	1
Anethum graveolens L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Apium graveolens L.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	2	.	3	.	.	.
Cuminum cyminum L.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trachyspermum copticum (L.) Link	.	5	1	1	1	1	1	2	.	.	.	.	.	6	1	5	.	1	.	1	1
Pimpinella anisum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nigella sativa L.	.	7	1	.	23	.	1	5	.	.	.	.	.	1	1	4	3	.	.	.	.
Ocimum basilicum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Mentha sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Sinapis alba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ruta cf. chalepensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Piper nigrum L.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vegetables																					
Allium cf. cepa L., skin fragments	.	.	+	.	.	.	.	.	.	+	.	.	.	+	+	+	+	.	+	+	+
Allium cf. cepa, base plate	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium sativum L., skin fragments	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brassica spp.	.	.	.	.	12	.	.	.	.	.	.	.	.	.	3	2	2	4	.	.	.
Beta vulgaris L.	.	.	.	.	2	1	1	1	.	.	.	.	.	1		1	1	3	.	2	.
Lepidium sativum L.	.	2	2	1	13	.	1	.	.	.	.	.	.	.	2	1	3	.	.	.	.
Lactuca sativa L.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cichorium endivia L./intybus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Wild plants																					
Forsskalea cf. tenacissima L.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.

Appendix 1: Desiccated Seeds

Appendix 1 continued

Area:	<	South Sebakh						> <	Well Sebakh			> <		Fort SE Corner							
Context:	1	2	3	5	G1	G2a	G2b	G2c	3	5	6	8	9	6	10	13	26	32	14	24	38
Polygonum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex sp., seed	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex sp., perianth	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Aizoon canariense L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Portulaca oleracea L.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	5	11	1	3	2	5	.
Caryophyllaceae type 1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Caryophyllaceae type 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chenopodium murale L.	.	4	1	2	1	.	1	.	.	.	.	.	.	.	3	.	.	.	1	.	.
Chenopodium sp.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.
Salicornia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cornulaca monacantha Del., seed	.	.	.	.	.	.	.	.	.	.	.	.	.	3	7	.	.	.	.	.	.
Cornulaca monacantha, leaf/stem	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Amaranthaceae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	1	.
Amaranthaceae/Chenopodiaceae	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	.	.	.	1	2	.
Fumaria sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cleome droserifolia (Forssk.) Del.	.	5	2	10	.	2	3	1	1	.	.	.	.	2	2	2	5	12	.	2	.
Cleome cf. paradoxa R. Br. ex DC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Brassica nigra (L.) Koch in Rohling	.	8	12	4	13	1	2	2	.	.	.	.	.	6	22	10	15	27	5	23	3
Zilla spinosa (Turra) Prantl	1	2	1	1	3	.	2	2	.	.	.	.	.	2	5	2	2	9	2	1	.
Raphanus raphanistrum L., pod	.	1	.	2	1	.	.	.	.	.	.	.	.	1	.	.	.	2	.	.	1
Raphanus cf. raphanistrum L., seed	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Coronopus niloticus (Del.) Spreng.	.	1	9	2	.	.	1	.	1	.	.	.	.	6	1	10	3	7	.	1	.
Cruciferae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Ochradenus baccatus Del.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Vicieae indet.	.	.	.	.	1	.	.	.	.	.	.	.	.	3	.	4	1	.	.	.	.
Acacia sp. leaflet	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leguminosae, small-seeded legume	.	.	4	3	19	8	4	27	.	1	.	.	.	18	9	11	4	1	4	7	2
Lotus cf. corniculatus/desertii	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Trifolium sp.	.	.	.	1	.	.	.	.	.	.	.	.	.	2	4	1	.	.	.	.	.
Lotus cf. corniculatus/desertii, pods	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Leguminosae indet., pods	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.
Zygophyllaceae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Malva sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Torilis nodosa (L.) Gaertn.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Orlaya	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Umbelliferae indet.	.	.	.	.	.	.	.	1	.	.	.	.	.	3	.	.	.	1	.	.	.
cf. Anagallis arvensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leptadenia pyrotechnica (Forssk.) Decne	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Amebia hispidissima (Lehm.) DC	1	.	.	1	2	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	.
Echium cf. rauwolfii Del.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Heliotropium sp.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	1	.	.	.

Area:	<	South Sebakh						> <	Well Sebakh			> <		Fort SE Corner							
Context:	1	2	3	5	G1	G2a	G2b	G2c	3	5	6	8	9	6	10	13	26	32	14	24	38
Trichodesma cf. africanum (L.) R. Br.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ajuga/Teucrium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Verbena cf. officinalis L.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Labiatae type 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Solanum/Withania	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Hyoscyamus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Francoeuria crispa (Forssk.) Cass.	.	.	6	2	.	2	1	2	.	.	.	.	.	3	6	5	1	4	.	2	8
Compositae, flowerhead	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Compositae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alisma sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Ruppia maritima L.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asphodelus fistulosus L. v. tenuifolius Cav.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lolium cf. temulentum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	1	1	.	.	1	2	.
Avena sterilis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Avena fatua L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crypsis cf. schoenoides (L.) Lam.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	2	.	.	1	1	.
Phalaris paradoxa L., spikelet	.	.	.	.	1	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.
Phalaris sp., seed	.	.	2	.	.	.	1	.	.	.	.	.	.	6	3	3	.	.	.	1	.
Panicum turgidum Forssk.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Panicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Echinochloa	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
cf. Setaria	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Saccharum spontanaeum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	120	5	.	.	2	.	6	.
Sorghum cf. virgatum (Hack.) Stapf	.	.	1	.	1	.	.	1	.	.	.	.	.	.	1	1	1	.	3	1	.
Imperata/Themeda	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gramineae indet.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.
Scirpus spp.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.
Eleocharis palustre (L.) R. Br.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyperus cf. laevigatus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyperus type B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex/Cyperus	.	.	.	.	1	.	1	.	.	.	.	.	.	.	1	.	.	1	.	.	.
Cyperaceae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Indeterminate	7	2	4	15	8	20	13	21	2	4	.	2	.	9	13	18	6	28	12	17	12
Total	22	228	175	408	475	159	140	213	8	6	0	2	0	390	229	285	177	319	107	185	86
Proportion of des. to car. seeds	100	98	98	96	99	100	100	99	11	3	0	1	0	99	96	96	83	96	92	94	98
Proportion of barley rachis to grain	-	-	-	93	65	-	-	-	-	-	-	-	-	82	-	88	-	-	-	-	-
Proportion of wheat rachis to grain	-	100	100	100	100	100	100	100	-	-	-	-	-	97	98	98	98	100	84	100	-
Density of des. seeds per litre	44	228	175	816	237	318	280	426	4	6	0	2	0	782	458	570	177	319	214	370	86

Appendix 1 cont.

Area:	> <		Fort NE			> <			Fort West I				> <		Fort West II		> <		Annexe SI		
Context:	39	5	8	9	14	24	5	6	14	1	2	4	1+2	2	4	8	9	2	3	5	9
No. of litres:	2	2	2	2	2	2	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2
% sorted:	100	50	25	25	100	25	50	50	50	50	50	25	50	25	25	25	25	25	25	25	50
Cereal grain																					
Hordeum vulgare L.	.	3	.	1	2	11	1	2	.	.	2	1	.	.	4	4	7	1	1	.	2
Triticum sp.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	1	4	1
Cerealia indet.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	1	1	.	.	2	.	5
Cereal chaff																					
Triticum durum Desf., rachis nodes	5	17	25	28	25	18	13	28	35	9	58	23	30	32	37	30	93	26	26	23	27
Triticum aestivum L., rachis nodes	.	.	.	.	.	3	.	.	1	.	.	.	.	.	1	.	2	.	.	.	1
Triticum sp. (tough rachis) rachis nodes	1	6	.	.	15	7	6	.	7	2	.	4	5	.	9	3	12	2	17	6	4
Triticum (tough rachis) basal nodes	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	1	5	3	.	4	1
Triticum durum/aestivum, rachilla	.	11	13	19	18	15	7	6	9	5	11	14	9	20	50	19	52	5	13	20	29
Triticum dur/aest, glumes, lemma and palea	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	+	+	+	+
Triticum sp., awns	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+++	+++	+	.	.	+	+
Triticum cf. dicoccum Schübl., glume bases	.	.	.	.	4	2	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.
Triticum cf. dicoccum, rachis segments	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hordeum vulgare, rachis nodes	2	12	6	8	15	6	5	4	5	2	19	5	4	8	9	4	10	9	14	12	8
Hordeum sp., basal nodes	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Hordeum sp., hulls	+	++	++	+++	++	++	++	+	+	+	+	+	+	++	+++	++	++	+	+	+++	++
Hordeum sp., awns	.	+	+	+	.	.	+	.	.	.	.	.	.	+	+	+	.	.	.	+	+
Cerealia indet., rachis internodes	3	9	12	14	21	10	8	1	11	2	21	10	14	12	20	8	7	9	9	16	8
Cerealia indet., culm nodes	1	.	.	.	1	.	.	1	1	.	.	.	1	1	.	.	5	2	1	3	1
Pulses																					
Lens culinaris Medick., seeds	.	1	.	1	.	.	1	3	1	.	1	1	.	.	2	.	1	2	1	.	.
Lens culinaris, detached hila	.	3	1	4	1	.	6	.	.	.	.	4	1	2	59	5	.	2	1	88	17
Pisum sativum L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pisum sativum, detached hila	.	.	.	.	.	1	.	.	.	.	.	.	.	.	2	.	.	1	.	.	1
Vicia faba L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia faba, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Lathyrus cf. sativus, seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lupinus albus L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lupinus albus, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Cicer arietinum, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
pulses indet., seeds	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
pulses indet., testa fragments	.	+	.	+	+	.	+	.	.	.	.	.	.	+	+	+	+	+		+++	++
Fruits																					
Phoenix dactylifera L., stones	.	1	.	.	1	1	2	1	1	1	4	1	.	.	1	.	1	1	.	1	.
Phoenix dactylifera, perianth	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Vitis vinifera L., pips	1	2	.	1	1	1	4	1	1	1	1	1	1	.	3	1	2	.	1	.	2
Vitis vinifera, stalks	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ficus carica L.	3	2	1	3	4	1	2	1	.	.	.	2	7	1	1	1	1	3	2	1	3
Ficus sycamorus L., galls	.	.	.	1	.	.	.	3	.	.	1	.	.	.	.	.	.	.	.	.	.

Area:	> <		Fort NE			> <			Fort West I				> <		Fort West II		> <		Annexe SI		
Context:	39	5	8	9	14	24	5	6	14	1	2	4	1+2	2	4	8	9	2	3	5	9
Olea europea L.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Cordia myxa L., stone	.	.	1	.	1	1	.	.	.	.	.	.	1	1	.	.	.	.	1	.	.
Cordia myxa, calyx	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	1	.	.	.
Citrus cf. medica L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Morus cf. nigra L.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Punica granatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Capparis spinosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Citrullus lanatus (Thunb.) Mats. & Nakai	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	2	1	.	2
Citrullus colocynthis (L.) Schrad.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Citrullus sp.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	2	.	.	.	.	.
Cucumis melo/sativus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	1	.	.
Lagenaria siceraria (Mol.) Standl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oil plants																					
Carthamus tinctorius L.	1	1	1	2	1	.	1	2	1	.	2	1	2	1	1	.	1	.	1	1	1
Linum usitatissimum L., capsule fragment	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	1	.
Linum usitatissimum, seed	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Sesamum indicum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Condiments																					
Coriandrum sativum L.	.	.	.	1	.	.	1	.	1	1	1	1	.	.	1	.	.	1	2	2	1
Foeniculum vulgare Mill.	.	2	.	1	.	2	1	1	.	.	.	.	.	.	.	.	.	2	2	.	.
Anethum graveolens L.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Apium graveolens L.	1	.	1	1	1	.	1	.	.	.	1	1	.	.	.	.	.	2	1	.	1
Cuminum cyminum L.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2
Trachyspermum copticum (L.) Link	.	.	.	.	1	.	.	1	.	.	.	.	1	.	.	1	.	8	3	.	2
Pimpinella anisum L.	.	.	:	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nigella sativa L.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	1	2	.	.	.
Ocimum basilicum L.	.	.	.	1	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.
Mentha sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Sinapis alba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Ruta cf. chalepensis L.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Piper nigrum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vegetables																					
Allium cf. cepa L., skin fragments		+	.	.	.	.	+	+	.	.	.	.	.	.	.	+	+	.	+	.	+
Allium cf. cepa, base plate	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium sativum L., skin fragments	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brassica spp.	.	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	3	4	.
Beta vulgaris L.	.	.	.	.	3	.	2	4	.	.	1	1	.	.	2	.	.	.	1	.	.
Lepidium sativum L.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Lactuca sativa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cichorium endivia L./intybus L.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Wild plants																					
Forsskalea cf. tenacissima L.	.	.	1	.	4	.	3	.	12	.	.	.	.	1	.	2	1	10	5	.	.

Appendix 1 cont.

Area:	> <			Fort NE		> <				Fort West I			> <		Fort West II		> <		Annexe SI		
Context:	39	5	8	9	14	24	5	6	14	1	2	4	1+2	2	4	8	9	2	3	5	9
Polygonum sp.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Rumex sp., seed	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	1	.	.	.
Rumex sp., perianth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aizoon canariense L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Portulaca oleracea L.	.	.	2	2	4	1	7	43	1	.	4	6	2	.	2	.	.	.	.	1	.
Caryophyllaceae type 1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caryophyllaceae type 2	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Chenopodium murale L.	.	.	2	.	5	.	.	2	.	.	3	1	2	.	.	.	1	.	1	1	.
Chenopodium sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Salicornia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cornulaca monacantha Del., seed	.	1	2	.	.	.	1	.	.	.	2	.	.	.	6	6	1	.	.	.	.
Cornulaca monacantha, leaf/stem	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.
cf. Amaranthaceae indet.	.	.	2	3	.	1	.	1	.	.	1	1	.	.	.	.	.	3	13	1	.
Amaranthaceae/Chenopodiaceae	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Fumaria sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cleome droserifolia (Forssk.) Del.	1	.	9	2	1	5	1	.	8	.	3	2	4	2	10	1	1	2	2	3	4
Cleome cf. paradoxa R. Br. ex DC	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
Brassica nigra (L.) Koch in Rohling	1	5	5	5	3	1	20	18	1	5	20	16	8	.	8	4	.	6	2	3	1
Zilla spinosa (Turra) Prantl	2	2	3	2	7	10	3	5	.	1	2	1	4	.	1	2	3	1	4	.	5
Raphanus raphanistrum L., pod	.	.	.	.	1	.	.	1	1	.	.	.	1	1	.	.	2	.	.	.	.
Raphanus cf. raphanistrum L., seed	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Coronopus niloticus (Del.) Spreng.	1	1	2	4	4	1	6	3	.	7	18	9	5	.	9	5	.	1	10	8	2
Cruciferae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	.	.
Ochradenus baccatus Del.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago sp.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicieae indet.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Acacia sp. leaflet	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Leguminosae, small-seeded legume	.	1	4	8	11	31	6	8	1	6	5	7	2	4	47	10	4	21	23	2	6
Lotus cf. corniculatus/desertii	.	.	.	.	.	.	3	.	.	.	.	1	.	.	.	6	1	.	.	.	.
Trifolium sp.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	1	.
Lotus cf. corniculatus/desertii, pods	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	13	3	1	1	4	11
Leguminosae indet., pods	.	1	.	.	.	.	.	.	.	.	1	.	.	1	2	.	1	1	.	1	.
Zygophyllaceae indet.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Malva sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Torilis nodosa (L.) Gaertn.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
cf. Orlaya	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Umbelliferae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Anagallis arvensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leptadenia pyrotechnica (Forssk.) Decne	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Arnebia hispidissima (Lehm.) DC	.	1	.	1	1	3	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.
Echium cf. rauwolfii Del.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Heliotropium sp.	.	.	.	.	.	8	3	2	.	.	.	.	.	.	1	.	.	1	.	.	.

Area:	> <			Fort NE		> <				Fort West I			> <		Fort West II		> <		Annexe SI		
Context:	39	5	8	9	14	24	5	6	14	1	2	4	1+2	2	4	8	9	2	3	5	9
Trichodesma cf. africanum (L.) R. Br.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ajuga/Teucrium	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Verbena cf. officinalis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Labiatae type 2	.	.	.	1	.	1	.	.	.	.	3	.	.	1	1	.	.	1	.	.	.
Solanum/Withania	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Hyoscyamus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Francoeuria crispa (Forssk.) Cass.	1	.	6	11	14	.	46	10	.	1	4	11	1	6	35	48	10	1	4	2	7
Compositae, flowerhead	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Compositae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alisma sp.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ruppia maritima L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asphodelus fistulosus L. v. tenuifolius Cav.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lolium cf. temulentum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Avena sterilis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Avena fatua L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crypsis cf. schoenoides (L.) Lam.	.	1	2	2	1	1	.	.	.	.	2	.	.	2	3	1	2	.	1	1	.
Phalaris paradoxa L., spikelet	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Phalaris sp., seed	1	1	2	2	.	.	.	.	.	.	1	1	2	.	2	.	.	2	8	.	2
Panicum turgidum Forssk.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Panicum	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
cf. Echinochloa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Setaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	4
Saccharum spontanaeum L.	.	1	3	28	.	.	5	2	.	.	.	.	.	.	20	1	.	.	.	4	1
Sorghum cf. virgatum (Hack.) Stapf	.	1	1	.	.	2	.	1	.	.	1	2	.	.	.	.	2	1	.	.	.
Imperata/Themeda	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	20	.
Gramineae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Scirpus spp.	.	.	1	.	.	.	.	.	.	.	2	1	.	1	.	.	.	1	1	.	.
Eleocharis palustre (L.) R. Br.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyperus cf. laevigatus L.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Cyperus type B	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex/Cyperus	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Cyperaceae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Indeterminate	7	11	9	11	18	15	20	20	4	7	21	13	21	10	26	45	17	20	25	28	37
Total	32	101	126	172	193	165	194	177	102	54	228	149	131	111	388	230	251	164	210	268	204
Proportion of des. to car. seeds	18	78	82	97	84	99	97	92	98	83	97	97	95	95	97	77	99	95	98	100	99
Proportion of barley rachis to grain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proportion of wheat rachis to grain	-	-	96	100	100	100	-	100	100	-	100	100	100	97	100	100	100	97	98	89	97
Density of des. seeds per litre	16	101	252	344	97	330	388	354	204	54	456	596	131	222	778	460	502	328	420	536	204

Appendix 1 cont.

Area:	> <		Annexe SE Corner				> <				Barud I				> <				Hydreuma		
Context:	10	3	9	18	23	28	37	2a	2b	3a	3b	3c	4	6	6NW	1	2	3	4	5	6
No. of litres:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2	2	2.5	2	2
% sorted:	50	12	25	12	12	25	12	50	50	100	50	50	100	50	50	100	50	100	100	50	100
Cereal grain																					
Hordeum vulgare L.	2	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	6	4	.	.	.
Triticum sp.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerealia indet.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1
Cereal chaff																					
Triticum durum Desf., rachis nodes	33	7	4	6	6	129	.	19	14	15	20	22	62	10	8	14	24	11	87	36	3
Triticum aestivum L., rachis nodes	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Triticum sp. (tough rachis) rachis nodes	10	1	2	.	.	74	.	14	5	5	11	9	39	.	3	.	3	.	16	4	.
Triticum (tough rachis) basal nodes	.	.	.	.	.	10	.	.	2	.	.	.	.	.	.	.	.	.	2	1	.
Triticum durum/aestivum, rachilla	8	.	2	6	.	33	.	27	6	.	1	.	.	11	.	1	2	2	2	6	.
Triticum dur/aest, glumes, lemma and palea	+	+	+	+	+	++	.	+	+	+	+	+	+	+	+	+	.	+	+	+	.
Triticum sp., awns	+	.	+	+	+	++	.	+	+	+	.	.	+	.	+	+	.	+	+	.	.
Triticum cf. dicoccum Schübl., glume bases	.	.	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Triticum cf. dicoccum, rachis segments	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Hordeum vulgare, rachis nodes	6	.	.	.	.	26	.	6	1	.	2	.	7	.	.	4	12	4	14	4	.
Hordeum sp., basal nodes	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hordeum sp., hulls	++	+	.	.	+	++	+	+	+	+	+	+	.	+	.	.	+	+	.	+	.
Hordeum sp., awns	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerealia indet., rachis internodes	10	.	1	.	.	97	.	4	.	3	.	4	5	15	3	3	6	8	11	2	8
Cerealia indet., culm nodes	1	.	1	.	.	2	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Pulses																					
Lens culinaris Medick., seeds	.	.	.	.	.	.	.	.	1	.	4	3	1	3	1	3	5	3	.	.	.
Lens culinaris, detached hila	15	.	.	.	.	.	.	2	7	.	.	.	.	4	.	.	.	1	.	.	.
Pisum sativum L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pisum sativum, detached hila	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia faba L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia faba, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus cf. sativus, seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lupinus albus L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lupinus albus, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cicer arietinum, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
pulses indet., seeds	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
pulses indet., testa fragments	+	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	.
Fruits																					
Phoenix dactylifera L., stones	.	.	.	.	1	.	.	2	1	1	1	1	1	1	.	1	5	4	1	4	1
Phoenix dactylifera, perianth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Vitis vinifera L., pips	1	.	.	.	.	.	.	2	.	1	1	2	1	1	.	2	1	2	1	1	1
Vitis vinifera, stalks	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ficus carica L.	2	.	.	.	.	.	.	.	.	.	1	1	3	.	.	3	1	16	3	3	4
Ficus sycamorus L., galls	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Area:	> <		Annexe SE Corner				> <				Barud I				> <				Hydreuma		
Context:	10	3	9	18	23	28	37	2a	2b	3a	3b	3c	4	6	6NW	1	2	3	4	5	6
Olea europea L.	1	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	1	.	2	1	.
Cordia myxa L., stone	1	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	1	2	1	.	.
Cordia myxa, calyx	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Citrus cf. medica L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Morus cf. nigra L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Punica granatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Capparis spinosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.
Citrullus lanatus (Thunb.) Mats. & Nakai	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	2	3	2	1	.
Citrullus colocynthis (L.) Schrad.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.
Citrullus sp.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cucumis melo/sativus	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Lagenaria siceraria (Mol.) Standl.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Oil plants																					
Carthamus tinctorius L.	2	.	.	.	.	.	.	.	.	.	.	1	1	1	.	1	3	2	2	5	1
Linum usitatissimum L., capsule fragment	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum usitatissimum, seed	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.
Sesamum indicum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Condiments																					
Coriandrum sativum L.	.	.	.	.	.	.	.	1	1	.	1	.	1	1	.	2	1	1	1	1	.
Foeniculum vulgare Mill.	.	.	.	.	.	.	.	4	1	.	1	1	5	.	.	.	.	.	2	1	.
Anethum graveolens L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Apium graveolens L.	1	.	.	.	.	.	.	3	2	.	1	1	2	2	.	.	.	.	.	.	.
Cuminum cyminum L.	1	.	.	.	.	2	.	1	1	.	.	.	.	.	.	1	.	1	.	.	.
Trachyspermum copticum (L.) Link	.	.	.	.	.	.	.	2	11	.	4	1	4	5	1	.	.	6	.	.	2
Pimpinella anisum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Nigella sativa L.	1	.	.	.	.	.	.	.	.	.	1	.	3	2	.	.	.	.	.	.	.
Ocimum basilicum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mentha sp.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
cf. Sinapis alba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ruta cf. chalepensis L.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Piper nigrum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vegetables																					
Allium cf. cepa L., skin fragments	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Allium cf. cepa, base plate	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium sativum L., skin fragments	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brassica spp.	3	.	.	.	.	.	.	1	5	.	.	6	9	1	2	.	.	1	.	.	.
Beta vulgaris L.	.	.	.	.	.	.	.	.	1	.	1	.	1	.	.	.	.	.	1	.	.
Lepidium sativum L.	.	.	.	.	.	.	.	8	7	.	2	.	2	10	.	2	3	2	.	.	.
Lactuca sativa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cichorium endivia L./intybus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Wild plants																					
Forsskalea cf. tenacissima L.	1	.	.	.	.	.	.	2	7	3	4	3	2	1	3	.	.	.	.	.	.

Appendix I continued

Area:	> <		Annexe SE Corner				> <				Barud I				> <				Hydreuma		
Context:	10	3	9	18	23	28	37	2a	2b	3a	3b	3c	4	6	6NW	1	2	3	4	5	6
Polygonum sp.																					
Rumex sp., seed						2															
Rumex sp., perianth																			1		
Aizoon canariense L.																				1	
Portulaca oleracea L.						1															
Caryophyllaceae type 1																					
Caryophyllaceae type 2																					
Chenopodium murale L.								1	1												
Chenopodium sp.	1								1	1	1	2	4	1	1					2	1
Salicornia sp.															1	1					
Cornulaca monacantha Del., seed		1				25			1		2										
Cornulaca monacantha, leaf/stem					+	+															
cf. Amaranthaceae indet.																					
Amaranthaceae/Chenopodiaceae													1	6						4	
Fumaria sp.																		1	1		
Cleome droserifolia (Forssk.) Del.	2		1			4							1								
Cleome cf. paradoxa R. Br. ex DC								178	58	352	282	135	576	250	114	7	3	5	23	4	3
Brassica nigra (L.) Koch in Rohling	4					6							1				3				
Zilla spinosa (Turra) Prantl	4	7	8		13	29	2	10	11	1	14	7	15	4	3	41	9	53	15	22	
Raphanus raphanistrum L., pod									2		4		4		1	1	1	1	3	3	2
Raphanus cf. raphanistrum L., seed																		1			
Coronopus niloticus (Del.) Spreng.	4					9															
Cruciferae indet.								5	6	1	4	5	6	6	4	1	4	6	5	4	6
Ochradenus baccatus Del.																					
Medicago sp.																		1			
Vicieae indet.																				1	
Acacia sp. leaflet									1												
Leguminosae, small-seeded legume	11					2															
Lotus cf. corniculatus/desertii	1							3	2		19	22	35	20	6	2	2	7		13	2
Trifolium sp.																					
Lotus cf. corniculatus/desertii, pods																					
Leguminosae indet., pods																					
Zygophyllaceae indet.		1				1															
Malva sp.						1															
Torilis nodosa (L.) Gaertn.																					
cf. Orlaya																					
Umbelliferae indet.																					
cf. Anagallis arvensis L.												1	3								
Leptadenia pyrotechnica (Forssk.) Decne	1																				
Arnebia hispidissima (Lehm.) DC			1								3	5	1								
Echium cf. rauwolfii Del.						2		1	3			1						1			
Heliotropium sp.						53	1										1		1		
																			1		

Area:	> <		Annexe SE Corner				> <				Barud I				> <				Hydreuma		
Context:	10	3	9	18	23	28	37	2a	2b	3a	3b	3c	4	6	6NW	1	2	3	4	5	6
Trichodesma cf. africanum (L.) R. Br.																					
Ajuga/Teucrium																					
Verbena cf. officinalis L.																				1	
Labiatae type 2											1									1	
Solanum/Withania																5			2		
Hyoscyamus sp.																		1			
Francoeuria crispa (Forssk.) Cass.	10		2			6		19	10		1	1	2	5		8	4	21	5	6	
Compositae, flowerhead	1																				
Compositae indet.																					
Alisma sp.																					
Ruppia maritima L.																					
Asphodelus fistulosus L. v. tenuifolius Cav.																					
Lolium cf. temulentum L.								1													
Avena sterilis L.																					
Avena fatua L.	1								1												
Crypsis cf. schoenoides (L.) Lam.								2				1	2	1			1	1		1	
Phalaris paradoxa L., spikelet								1						1	1						
Phalaris sp., seed	1							3	13		1		1	1							
Panicum turgidum Forssk.																					
cf. Panicum																					
cf. Echinochloa																					
cf. Setaria	1															2					
Saccharum spontanaeum L.											1		2			4		2		1	
Sorghum cf. virgatum (Hack.) Stapf																					
Imperata/Themeda																2				3	
Gramineae indet.																					
Scirpus spp.								1	2				2	1				1			
Eleocharis palustre (L.) R. Br.									1												
Cyperus cf. laevigatus L.																			12		
Cyperus type B						1															
Carex/Cyperus													1				3	2	2		
Cyperaceae indet.													1								
Indeterminate	25	1	7		5	16		20	27	28	38	24	33	28	9	30	17	34	38	23	18
Total	180	18	29	12	26	536	3	348	217	411	433	260	849	392	161	145	128	212	261	161	53
Proportion of des. to car. seeds	82	15	26	3	13	84	3	96	96	100	88	92	95	95	63	54	24	99	89	98	80
Proportion of barley rachis to grain	-	-	-	-	-	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proportion of wheat rachis to grain	98	-	-	-	-	100	-	100	-	-	100	100	100	-	-	-	100	-	100	100	-
Density of des. seeds per litre	180	72	58	48	104	1072	12	348	217	206	433	260	425	392	161	58	128	106	104	161	27

Appendix 1 continued

Area:				> <		Wall plaster			> <		Mudbrick			>	TOTAL	TOTAL	TOTAL
Context:	7	8	9	10	1	2	3	4	5	1	2	3	4	5	MC	MC/B/H	Overall
No. of litres:	1	2	2	2	2	2	1	2	1	2	2	2	2	5			
% sorted:	100	100	100	100	25	25	50	50	100	50	50	50	50	100			
Cereal grain																	
Hordeum vulgare L.	.	.	.	.	1	7	15	.	5	4	17	15	7	1	116	126	198
Triticum sp.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	19	19	21
Cerealia indet.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	30	33	38
Cereal chaff																	
Triticum durum Desf., rachis nodes	75	26	22	31	29	91	53	86	185	121	74	58	61	53	1633	2132	2943
Triticum aestivum L., rachis nodes	.	.	.	.	.	3	1	.	3	.	1	2	.	1	15	16	27
Triticum sp. (tough rachis) rachis nodes	13	.	3	4	11	79	38	13	41	33	20	21	14	34	364	493	797
Triticum (tough rachis) basal nodes	.	.	.	.	2	10	3	4	8	2	3	2	4	.	65	70	108
Triticum durum/aestivum, rachilla	.	1	1	.	39	37	60	24	49	3	29	11	5	8	548	608	873
Triticum dur/aest, glumes, lemma and palea	+	.	.	+	++	++	++	+	+	+	+	+	+	+	++	++	++
Triticum sp., awns	+	.	.	.	++	+	+	.	.	.	+	.	.	.	+	+	+
Triticum cf. dicoccum Schübl., glume bases	.	.	.	.	.	.	2	1	.	.	.	.	.	.	62	64	67
Triticum cf. dicoccum, rachis segments	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	8	8
Hordeum vulgare, rachis nodes	6	6	4	7	5	6	9	5	11	10	24	25	5	3	411	488	591
Hordeum sp., basal nodes	.	.	.	.	.	.	1	.	.	.	.	.	.	.	10	10	11
Hordeum sp., hulls	.	.	.	.	+	+	+	+	+	.	.	.	.	.	++	++	++
Hordeum sp., awns	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
Cerealia indet., rachis internodes	4	11	2	4	8	.	54	19	.	19	34	22	13	.	650	743	912
Cerealia indet., culm nodes	.	.	.	.	.	10	3	2	9	14	20	8	9	4	56	57	136
Pulses																	
Lens culinaris Medick., seeds	.	1	.	.	7	5	4	.	.	.	.	.	.	.	61	86	102
Lens culinaris, detached hila	.	.	.	.	.	.	2	.	.	.	.	.	.	.	217	231	233
Pisum sativum L., seeds	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	1	2
Pisum sativum, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	1	1	16	16	18
Vicia faba L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
Vicia faba, detached hila	.	.	.	.	.	1	.	.	.	.	.	.	.	.	8	8	9
Lathyrus cf. sativus, seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0	0	1
Lupinus albus L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Lupinus albus, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2
Cicer arietinum, detached hila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3	3
pulses indet., seeds	.	.	.	1	.	.	.	.	.	.	.	.	.	1	3	5	6
pulses indet., testa fragments	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+	+	+
Fruits																	
Phoenix dactylifera L., stones	1	3	4	.	1	1	1	.	.	.	.	.	.	2	61	93	98
Phoenix dactylifera, perianth	.	.	.	1	.	.	.	.	.	.	.	.	.	.	7	9	9
Vitis vinifera L., pips	2	2	1	2	1	1	1	1	1	.	1	.	.	4	85	108	118
Vitis vinifera, stalks	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	15	15
Ficus carica L.	4	4	2	5	1	1	2	2	2	.	.	.	.	5	249	299	312
Ficus sycamorus L., galls	.	.	.	.	.	1	.	.	.	.	.	.	.	1	14	14	16

Area:				> <		Wall plaster			> <		Mudbrick			>	TOTAL	TOTAL	TOTAL
Context:	7	8	9	10	1	2	3	4	5	1	2	3	4	5	MC	MC/B/H	Overall
Olea europea L.	1	1	.	.	1	1	.	.	.	.	.	.	.	.	10	20	22
Cordia myxa L., stone	.	.	1	.	.	1	.	.	1	.	.	.	.	1	16	23	26
Cordia myxa, calyx	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4	4
Citrus cf. medica L., seeds	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2
Morus cf. nigra L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	2
Punica granatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	1	1
Capparis spinosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	2	2
Citrullus lanatus (Thunb.) Mats. & Nakai	2	8	17	6	1	1	.	.	.	.	.	.	.	.	16	61	63
Citrullus colocynthis (L.) Schrad	.	1	.	.	.	.	1	.	.	.	1	.	.	.	3	7	9
Citrullus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	11	11
Cucumis melo/sativus	.	.	.	.	.	1	1	.	.	.	.	.	.	.	20	21	23
Lagenaria siceraria (Mol.) Standl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	8	8
Oil plants																	
Carthamus tinctorius L.	4	8	8	10	1	.	1	1	1	.	.	.	.	2	54	101	107
Linum usitatissimum L., capsule fragment	.	.	.	.	1	.	.	.	.	.	.	.	.	.	6	6	7
Linum usitatissimum, seed	.	.	.	.	1	.	.	.	.	1	.	.	.	.	1	3	5
Sesamum indicum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
Condiments																	
Coriandrum sativum L.	.	2	1	1	.	1	2	.	1	.	.	.	.	2	34	49	55
Foeniculum vulgare Mill.	.	2	.	2	.	.	.	.	1	.	.	.	.	.	38	57	58
Anethum graveolens L.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	2	2
Apium graveolens L.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	20	31	33
Cuminum cyminum L.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	8	14	14
Trachyspermum copticum (L.) Link	.	8	2	4	1	.	.	.	.	.	.	.	.	.	44	94	95
Pimpinella anisum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	0	1	2
Nigella sativa L.	1	1	1	1	.	.	.	.	1	.	.	.	.	.	52	62	63
Ocimum basilicum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	5	5
Mentha sp.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	0	4	4
cf. Sinapis alba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Ruta cf. chalepensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	3	3
Piper nigrum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2
Vegetables																	
Allium cf. cepa L., skin fragments	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	+	+
Allium cf. cepa, base plate	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	3
Allium sativum L., skin fragments	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
Brassica spp.	.	.	.	.	2	.	2	.	.	.	.	.	.	3	36	61	68
Beta vulgaris L.	.	.	.	2	.	.	.	.	1	1	.	1	.	.	27	33	36
Lepidium sativum L.	.	.	2	.	.	2	.	2	.	.	.	.	.	.	27	65	69
Lactuca sativa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Cichorium endivia L./intybus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2
Wild plants																	
Forsskalea cf. tenacissima L.	1	.	.	.	.	.	.	.	1	400	59	62	39	2	42	68	631

Appendix 1 continued

Area:				><		Wall plaster			><	Mudbrick				>	TOTAL	TOTAL	TOTAL
Context:	7	8	9	10	1	2	3	4	5	1	2	3	4	5	MC	MC/B/H	Overall
Polygonum sp.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	1	2	3
Rumex sp., seed	2	.	.	.	.	.	.	.	.	.	.	1	.	.	8	11	12
Rumex sp., perianth	.	1	.	.	.	.	.	1	.	.	.	.	.	.	2	4	5
Aizoon canariense L.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	0	0	2
Portulaca oleracea L.	1	1	3	2	.	.	.	.	.	.	.	.	.	1	106	113	114
Caryophyllaceae type 1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Caryophyllaceae type 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	3
Chenopodium murale L.	.	1	.	.	1	1	1	.	.	.	2	.	.	2	31	46	53
Chenopodium sp.	.	.	.	.	.	1	.	1	1	.	.	.	2	.	4	6	11
Salicornia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	3	3
Cornulaca monacantha Del., seed	.	.	.	.	.	.	.	.	.	2	.	.	.	.	55	55	57
Cornulaca monacantha, leaf/stem	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
cf. Amaranthaceae indet.	.	.	.	2	20	.	.	.	.	11	5	2	.	6	29	42	86
Amaranthaceae/Chenopodiaceae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	13	13
Fumaria sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	1	1
Cleome droserifolia (Forssk.) Del.	1	2	4	7	1	.	1	.	1	6	5	2	2	11	117	2121	2150
Cleome cf. paradoxa R. Br. ex DC	.	.	.	.	.	.	.	.	.	.	.	.	1	1	5	9	11
Brassica nigra (L.) Koch in Rohling	6	61	40	47	4	9	5	2	1	1	.	.	.	2	295	654	678
Zilla spinosa (Turra) Prantl	3	2	5	3	2	.	.	.	1	55	16	6	17	19	156	191	307
Raphanus raphanistrum L., pod	.	1	.	.	1	.	2	1	.	1	.	1	1	.	15	17	24
Raphanus cf. raphanistrum L., seed	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	1	2
Coronopus niloticus (Del.) Spreng.	1	3	2	4	13	3	4	1	.	8	5	.	1	3	151	226	264
Cruciferae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	4	4
Ochradenus baccatus Del.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	0	2	2
Medicago sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4	4
Vicieae indet.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	10	11	12
Acacia sp. leaflet	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Leguminosae, small-seeded legume	5	5	.	5	5	7	15	.	.	3	4	.	1	13	342	490	538
Lotus cf. corniculatus/desertii	.	.	.	.	1	.	.	.	.	.	.	.	.	.	13	13	14
Trifolium sp.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	12	12	13
Lotus cf. corniculatus/desertii, pods	.	.	.	.	.	.	.	.	.	.	.	.	.	.	36	36	36
Leguminosae indet., pods	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	10	10
Zygophyllaceae indet.	.	.	.	.	.	.	.	.	.	4	4	.	1	.	4	4	13
Malva sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Torilis nodosa (L.) Gaertn.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2
cf. Orlaya	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Umbelliferae indet.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	5	10	12
cf. Anagallis arvensis L.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	0	1	1
Leptadenia pyrotechnica (Forssk.) Decne	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	11	11
Arnebia hispidissima (Lehm.) DC	1	.	.	.	.	.	.	.	.	.	.	.	.	1	16	23	24
Echium cf. rauwolfii Del.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	7	7
Heliotropium sp.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	72	74	74

Area:				><		Wall plaster			><	Mudbrick				>	TOTAL	TOTAL	TOTAL
Context:	7	8	9	10	1	2	3	4	5	1	2	3	4	5	MC	MC/B/H	Overall
Trichodesma cf. africanum (L.) R. Br.	.	.	.	.	.	.	.	.	.	20	1	3	3	.	0	0	27
Ajuga/Teucrium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Verbena cf. officinalis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	2
Labiatae type 2	1	.	1	1	.	.	.	.	.	1	.	.	.	.	9	14	15
Solanum/Withania	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	9	10
Hyoscyamus sp.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	0	2	2
Francoeuria crispa (Forssk.) Cass.	37	37	21	8	4	9	9	1	6	114	24	16	7	6	278	463	659
Compositae, flowerhead	.	.	.	.	1	.	.	.	.	.	.	.	.	.	2	2	3
Compositae indet.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	0	1	1
Alisma sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2
Ruppia maritima L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Asphodelus fistulosus L. v. tenuifolius Cav.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Lolium cf. temulentum L.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	10	11	13
Avena sterilis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
Avena fatua L.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	2	3
Crypsis cf. schoenoides (L.) Lam.	.	2	1	.	4	3	3	.	4	.	1	.	.	.	25	37	52
Phalaris paradoxa L., spikelet	.	.	.	.	.	.	.	.	.	.	.	.	.	1	7	10	11
Phalaris sp., seed	.	.	1	.	.	.	.	.	.	.	.	.	.	.	41	61	61
Panicum turgidum Forssk.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
cf. Panicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
cf. Echinochloa	.	.	1	1	.	.	.	.	.	.	.	.	.	.	3	5	5
cf. Setaria	.	1	1	.	.	.	.	.	1	.	.	.	.	.	8	12	13
Saccharum spontanaeum L.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	198	208	212
Sorghum cf. virgatum (Hack.) Stapf	.	.	.	.	.	.	.	.	.	.	.	.	.	1	21	21	22
Imperata/Themeda	.	.	.	.	.	1	2	.	.	.	.	.	.	.	22	27	30
Gramineae indet.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	5	5	6
Scirpus spp.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	10	17	19
Eleocharis palustre (L.) R. Br.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	5	5
Cyperus cf. laevigatus L.	.	1	3	4	.	.	.	.	.	.	.	.	.	.	1	21	21
Cyperus type B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	6	6
Carex/Cyperus	2	2	.	.	.	.	.	.	.	.	.	.	.	.	5	17	17
Cyperaceae indet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	1	1
Indeterminate	27	28	21	14	9	7	31	4	16	13	12	4	11	17	652	1109	1233
Total	201	238	178	184	184	306	330	171	357	847	369	263	207	217	8068	12900	16151
Proportion of des. to car. seeds	96	99	97	95	100	100	100	98	100	100	99	100	100	98			
Proportion of barley rachis to grain	-	-	-	-	-	-	40	-	-	-	59	63	-	-			
Proportion of wheat rachis to grain	100	100	100	100	100	100	99	100	100	100	100	100	100	100			
Density of des. seeds per litre	201	119	89	92	368	612	660	171	357	847	369	263	207	109			

Appendix 2 NUMBER OF CARBONIZED SEEDS FOR SAMPLES WHICH CONTAIN ≥50 CARBONIZED SEEDS

Appendix 2 No of carbonized seeds for samples with ≥50 car seeds

Area:	<	Well Sebakh			>	Fort SE	Fort WII <		Annexe SE Corner				> <	Barud I	>	<Hydreuma>		TOTAL	TOTAL	TOTAL
Context:	3	5	6	8	9	39	8	3	9	18	23	28	37	3b	6NW	1	2	MC	MC/B/H	Overall
No. of litres:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2			
% sorted:	100	50	25	50	100	100	25	12	25	12	12	25	12	50	50	100	50			
Cereal grain																				
Hordeum vulgare L.	2	3	1	1	2	3	4	3	1	41	2	.	3	4	5	6	64	76	167	167
Triticum sp.	1	1				1		1	1		1	1	1				7	10	19	19
Cerealia indet.			7	2	7	2		2	1		1	3	2	1	2			42	50	50
Cereal chaff																				
Triticum durum Desf., rachis nodes	4	29	8	75	14	13	22	24	18	104	67	30	8	19	30		1	492	572	572
Triticum aestivum L., rachis nodes					4				1	5				1				11	12	12
Triticum sp. (tough rachis) rachis nodes		11		21	15	2	12	17	9	28	10	37	7	7	10		1	179	211	211
Triticum (tough rachis) basal nodes		3		13	1		1	4	3	8	5	2		2	1			41	45	45
Triticum durum/aestivum, rachilla		9		1			6			3								20	20	20
Triticum dur/aest, glumes, lemma and palea		+		+				+	+	+	+							+	+	+
Triticum sp., awns				+	+			+		+	+				+	+	+	+	+	+
Triticum cf. dicoccum Schübl., glume bases				1				1		1	2			1				7	8	8
Triticum cf. dicoccum, rachis segments																		0	0	0
Hordeum vulgare, rachis nodes	3	21	7	11	2	3	5	3	3	23	3	4	2	2		1	2	104	116	116
Hordeum sp., basal nodes										1								1	1	1
Hordeum sp., hulls		++																+	+	+
Hordeum sp., awns																		0	0	0
Cerealia indet., rachis internodes	3	28	10	18	4	6	13	8	7	32	10	7	8		5		1	179	201	201
Cerealia indet., culm nodes		1					1	6	8	16	9		1					43	43	43
Pulses																				
Lens culinaris Medick., seeds	1	11			10	14										79	269	52	412	412
Lens culinaris, detached hila																		0	0	0
Pisum sativum L., seeds																		0	0	0
Pisum sativum, detached hila			2		3													5	5	5
Vicia faba L., seeds										1								1	1	1
Vicia faba, detached hila																		0	0	0
Lathyrus cf. sativus, seeds						2											2	2	5	5
Lupinus albus L., seeds																		0	0	0
Lupinus albus, detached hila																		0	0	0
Cicer arietinum, detached hila			1		1													2	2	2
pulses indet., seeds				1		6								1			1	7	12	13
pulses indet., testa fragments																		0	0	0
Fruits																				
Phoenix dactylifera L., stones	1	1			1	1										1	3	5	10	10
Phoenix dactylifera, perianth					1												1	1	2	2
Vitis vinifera L., pips				1	1	8												10	10	10
Vitis vinifera, stalks			1	1										1				2	3	3
Ficus carica L.			1			16												18	20	21
Ficus sycamorus L., galls																		0	0	0

Area:	<	Well Sebakh			>	Fort SE	Fort WII <		Annexe SE Corner				> <	Barud I	>	<Hydreuma>		TOTAL	TOTAL	TOTAL
Context:	3	5	6	8	9	39	8	3	9	18	23	28	37	3b	6NW	1	2	MC	MC/B/H	Overall
Olea europea L.																		0	0	0
Cordia myxa L., stone	1				1												1	2	3	3
Cordia myxa, calyx																		0	0	0
Citrus cf. medica L., seeds																		0	0	0
Morus cf. nigra L.																		0	0	0
Punica granatum L.																		0	0	0
Capparis spinosa L.																		0	0	0
Citrullus lanatus (Thunb.) Mats. & Nakai																		0	0	0
Citrullus colocynthis (L.) Schrad.																		0	1	1
Citrullus sp.																		0	0	0
Cucumis melo/sativus																		0	0	0
Lagenaria siceraria (Mol.) Standl.																		0	0	0
Oil plants																				
Carthamus tinctorius L.																		1	1	1
Linum usitatissimum L., capsule fragment											1							1	1	1
Linum usitatissimum, seed																		0	0	0
Sesamum indicum L.					1													1	1	1
Condiments																				
Coriandrum sativum L.		1	1	1		1												5	5	5
Foeniculum vulgare Mill.	1	1	8	4	2													16	17	17
Anethum graveolens L.																		0	0	0
Apium graveolens L.		1		2														3	3	3
Cuminum cyminum L.																		0	0	0
Trachyspermum copticum (L.) Link			1															2	2	2
Pimpinella anisum L.			9	2														11	11	11
Nigella sativa L.		1								1								2	2	2
Ocimum basilicum L.																		0	0	0
Mentha sp.																		0	0	0
cf. Sinapis alba L.																		0	0	0
Ruta cf. chalepensis L.																		0	0	0
Piper nigrum L.																		0	0	0
Vegetables																				
Allium cf. cepa L., skin fragments																		0	0	0
Allium cf. cepa, base plate																		0	0	0
Allium sativum L., skin fragments																		0	0	0
Brassica spp.	1	10	2	5														19	19	19
Beta vulgaris L.																		0	0	0
Lepidium sativum L.	1	14	7	4	4	1										1	2	31	34	34
Lactuca sativa L.																		0	0	0
Cichorium endivia L./intybus L.																		0	0	0
Wild plants																				
Forsskalea cf. tenacissima L.					2								2					6	7	7

Appendix 2 (continued)

Appendix 2 continued

Area:	<	Well Sebakh			>	Fort SE	Fort WII <	Annexe SE Corner					> <	Barud I	>	<Hydreuma>		TOTAL	TOTAL	TOTAL
Context:	3	5	6	8	9	39	8	3	9	18	23	28	37	3b	6NW	1	2	MC	MC/B/H	Overall
Polygonum sp.																		0	0	0
Rumex sp., seed		1									1							2	2	2
Rumex sp., perianth																		0	0	0
Aizoon canariense L.																		0	0	0
Portulaca oleracea L.																		0	0	0
Caryophyllaceae type 1																		0	0	0
Caryophyllaceae type 2																		0	0	0
Chenopodium murale L.		1																1	1	1
Chenopodium sp.														1				0	1	1
Salicornia sp.																		0	0	0
Cornulaca monacantha Del., seed								3		111								114	114	114
Cornulaca monacantha, leaf/stem										+++								+	+	+
cf. Amaranthaceae Indet.			2	7														9	9	9
Amaranthaceae/Chenopodiaceae																		0	0	0
Fumaria sp.																		0	0	0
Cleome droserifolia (Forssk.) Del.						1					1		1		2			8	39	39
Cleome cf. paradoxa R. Br. ex DC									1								1	1	2	2
Brassica nigra (L.) Koch in Rohling		3	22	14	30	1		1			1							75	75	75
Zilla spinosa (Turra) Prantl						13		24	11	11	15	16	38	16	28			189	257	261
Raphanus raphanistrum L., pod									1		1							2	2	2
Raphanus cf. raphanistrum L., seed																		0	0	0
Coronopus niloticus (Del.) Spreng.		3								3		1				1	1	9	11	11
Cruciferae indet.																		0	0	0
Ochradenus baccatus Del.																		0	0	0
Medicago sp.																		0	0	0
Vicieae indet.		2			1	2										1	4	10	15	15
Acacia sp. leaflet																		0	0	0
Leguminosae, small-seeded legume	33	9	29	2	21	15	3	2	2	12	12	1	3			22	41	156	224	224
Lotus cf. corniculatus/desertii																		4	4	4
Trifolium sp.																		0	0	0
Lotus cf. corniculatus/desertii, pods																		30	30	30
Leguminosae indet., pods																		0	0	0
Zygophyllaceae indet.																		0	0	0
Malva sp.																		0	0	0
Torilis nodosa (L.) Gaertn.																		0	0	0
cf. Orlaya																		0	0	0
Umbelliferae indet.					2													2	2	2
cf. Anagallis arvensis L.																		0	0	0
Leptadenia pyrotechnica (Forssk.) Decne																		0	0	0
Amebia hispidissima (Lehm.) DC			1															1	1	1
Echium cf. rauwolfii Del.								2										2	2	2
Heliotropium sp.								1		2	1	1	3					8	8	8

Area:	<	Well Sebakh			>	Fort SE	Fort WII <	Annexe SE Corner					> <	Barud I	>	<Hydreuma>		TOTAL	TOTAL	TOTAL
Context:	3	5	6	8	9	39	8	3	9	18	23	28	37	3b	6NW	1	2	MC	MC/B/H	Overall
Trichodesma cf. africanum (L.) R. Br.																		0	0	0
Ajuga/Teucrium																		0	0	0
Verbena cf. officinalis L.																		0	0	0
Labiatae type 2																		0	0	0
Solanum/Withania		1							1									2	2	2
Hyoscyamus sp.																		0	0	0
Francoeuria crispa (Forssk.) Cass.						1	1											5	8	8
Compositae, flowerhead																		0	0	0
Compositae indet.																		0	0	0
Alisma sp.																		0	0	0
Ruppia maritima L.																		0	0	0
Asphodelus fistulosus L. v. tenuifolius Cav.																		0	0	0
Lolium cf. temulentum L.																		0	0	1
Avena sterilis L.																		0	0	0
Avena fatua L.																		0	0	0
Crypsis cf. schoenoides (L.) Lam.										1	1							2	3	3
Phalaris paradoxa L., spikelet															1			0	1	1
Phalaris sp., seed	1	1			1	1							1					5	5	5
Panicum turgidum Forssk.																		0	0	0
cf. Panicum																		0	0	0
cf. Echinochloa																		0	0	0
cf. Setaria		1																1	1	1
Saccharum spontanaeum L.																		0	0	0
Sorghum cf. virgatum (Hack.) Stapf																		0	0	0
Imperata/Themeda																		0	0	0
Gramineae indet.		1					1			1								4	4	4
Scirpus spp.																		0	0	0
Eleocharis palustris (L.) R. Br.																		0	0	0
Cyperus cf. laevigatus L.																		0	0	0
Cyperus type B																		0	0	0
Carex/Cyperus																		0	0	0
Cyperaceae indet.											1							1	1	1
Indeterminate	11	19	20	31	40	34	.	2	14	11	24	.	11	3	10	11	11	272	333	336
Total	64	188	140	218	171	147	69	104	82	416	169	103	91	59	94	123	413	2325	3211	3221
Proportion of car. to des. seeds	89	97	100	99	100	82	23	85	74	97	87	16	97	12	37	46	76			
Proportion of barley rachis to grain	-	-	-	-	-	-	-	-	-	37	-	-	-	-	-	-	3			
Proportion of wheat rachis to grain	-	98	-	100	100	-	100	98	97	100	99	99	-	100	100	-	-			

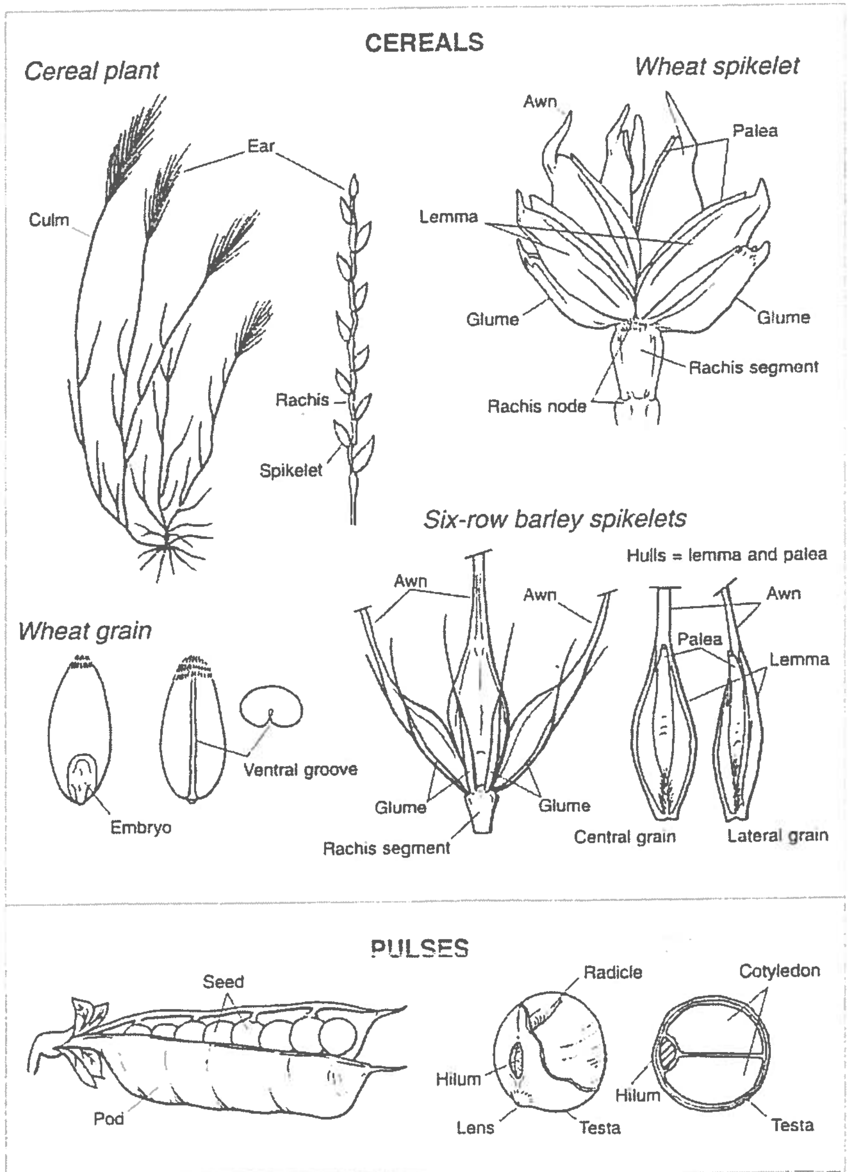


FIG. 8.1. *Technical terms for cereals and pulses as used in the text (after Renfrew 1973, Figs 5, 7, 9, 10, and 67 and Hillman et al. 1996).*

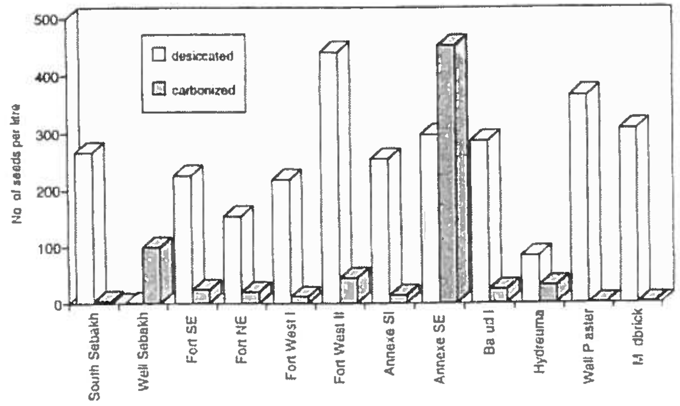


FIG. 8.2. *Seed density per litre of deposit by area and mode of preservation*

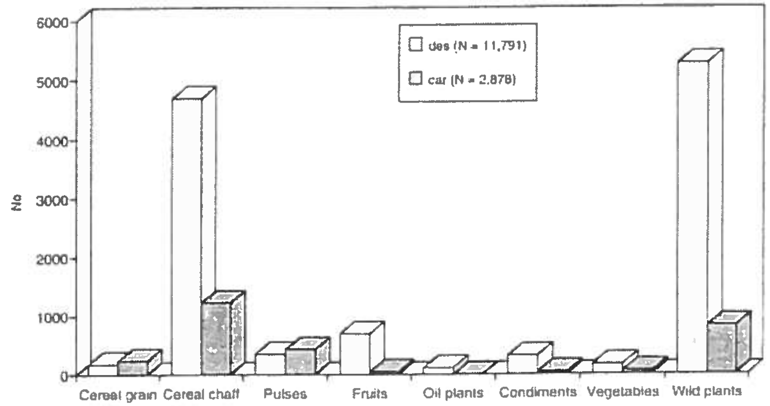


FIG 8.3 *Numerical abundance of each plant group by mode of preservation (midden and refuse deposits only).*

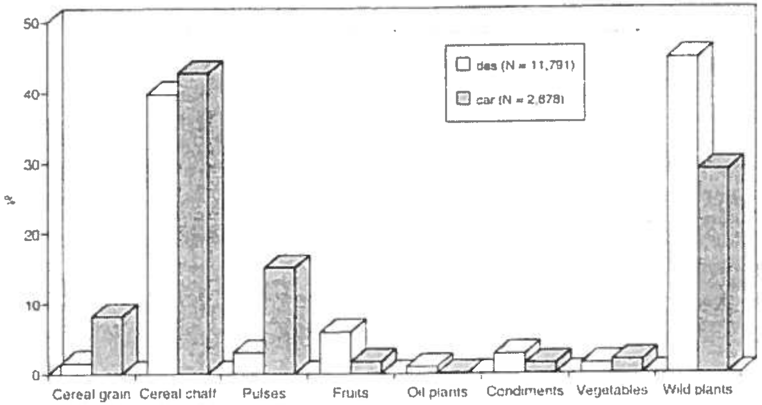


FIG. 8.4. *Relative proportions of each plant group by mode of preservation (midden and refuse deposits only).*

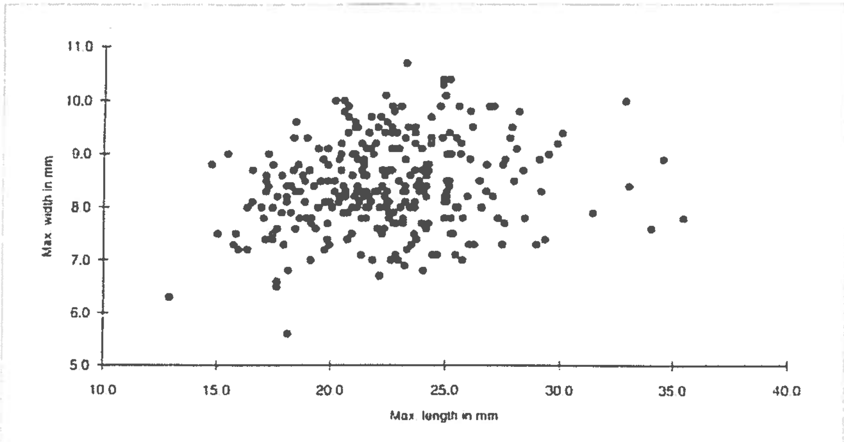


FIG. 8.5. *Scatter plot of measurements of desiccated date stones, N = 300.*

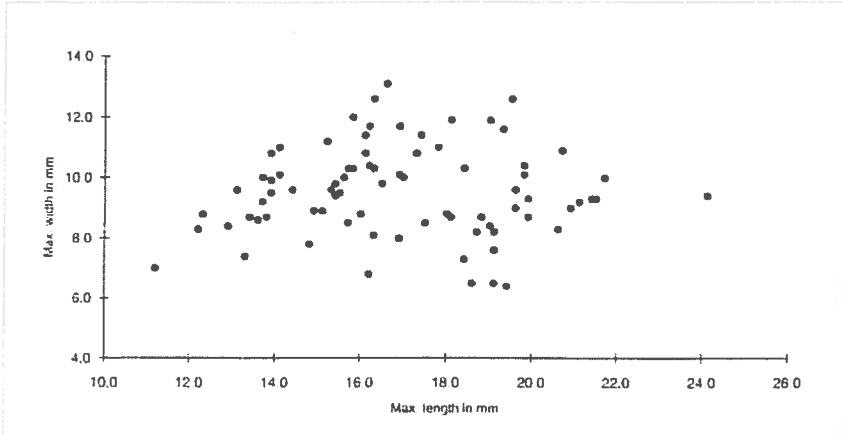


FIG. 8.6. *Scatter plot of measurements of desiccated olive stones, N = 80.*

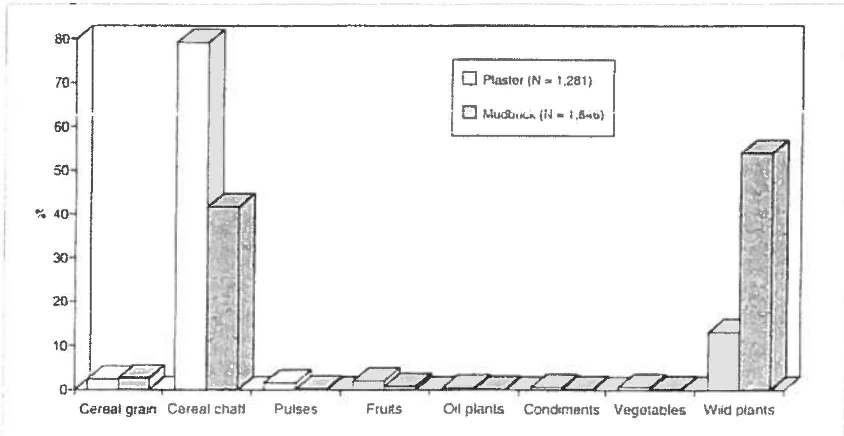
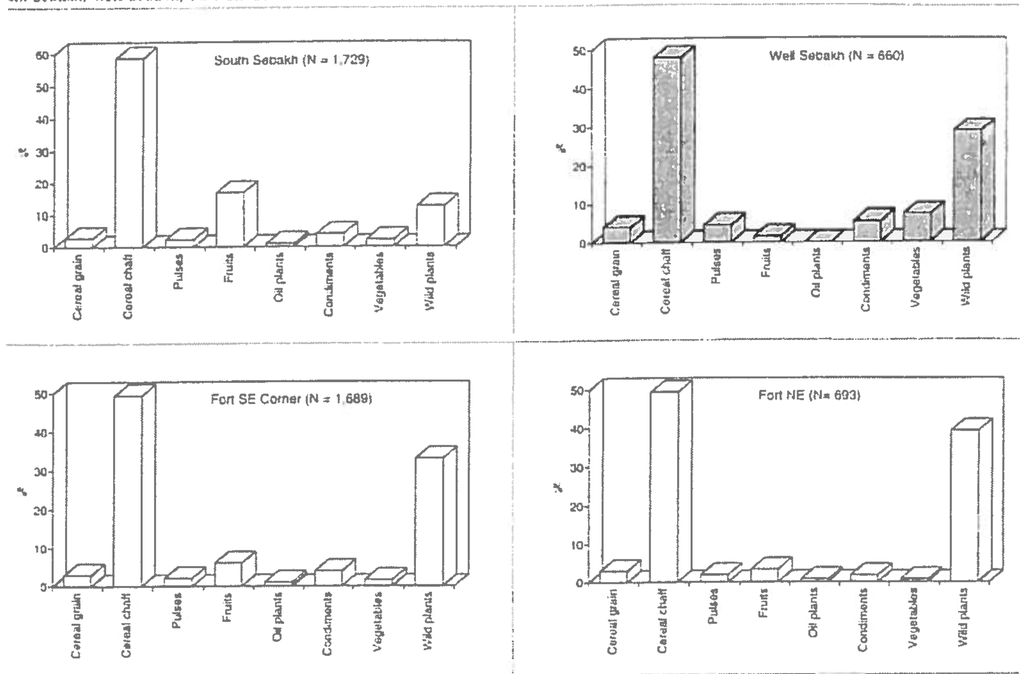
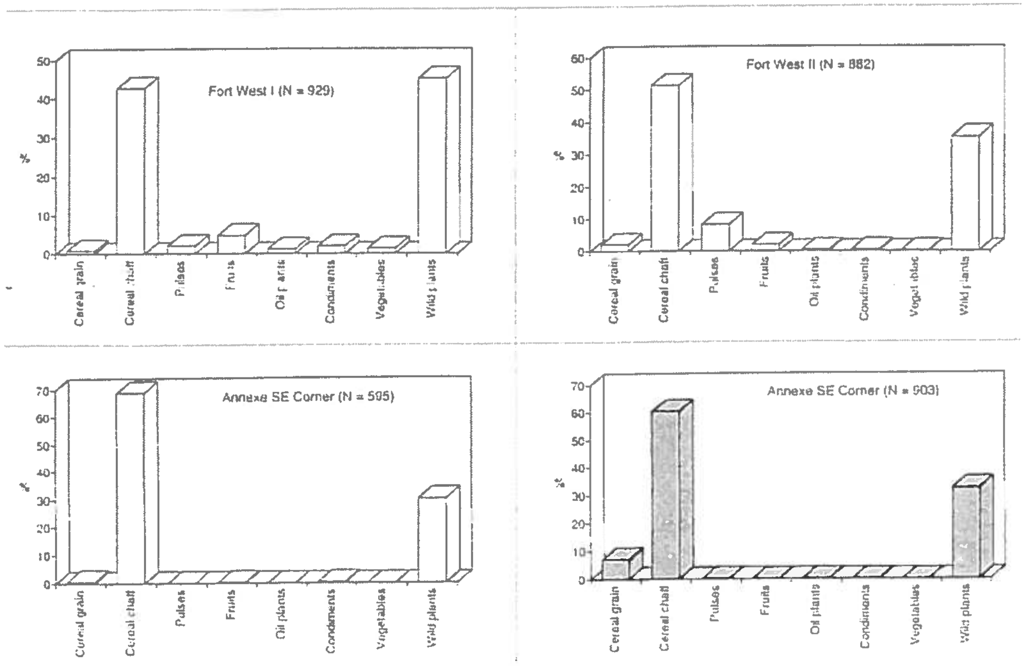


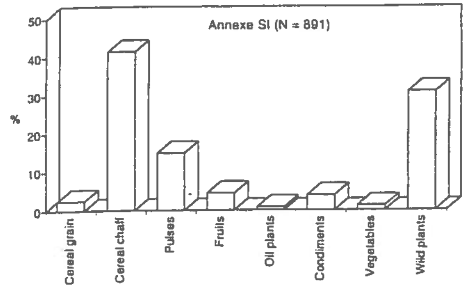
FIG. 8.7. *Relative proportions of each plant group for the wallplaster and mudbrick samples (desiccated seeds only).*

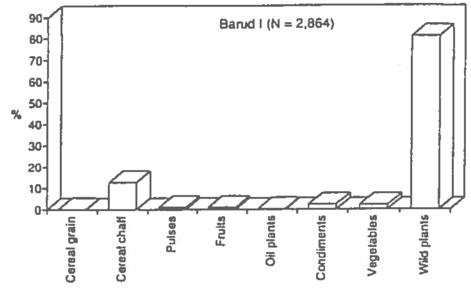
…8.8. *Relative proportions of each plant group by area (white bars represent desiccated seeds, shaded bars represent carbonized seeds): …th Sebakh, Well Sebakh, Fort SE Corner and Fort NE.*

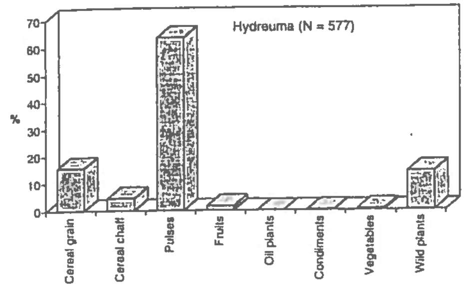


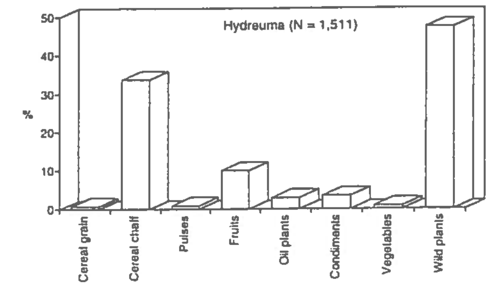


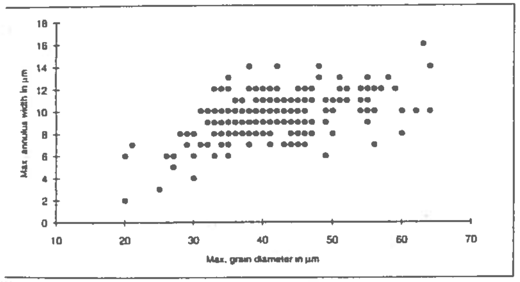
…G. 8.9. *Relative proportions of each plant group by area (white bars represent desiccated seeds, shaded bars represent carbonized seeds): Fo…*











ɪɢ. 8.11. *Scatter plot of measurements of Poaceae pollen (N = 207) rom samples of three donkey droppings. Pollen with a maximum grain liameter of ≥ 38 micron and an annulus width of ≥ 8 micron represent ereal pollen; those smaller [illegible] cereal or grass pollen.*

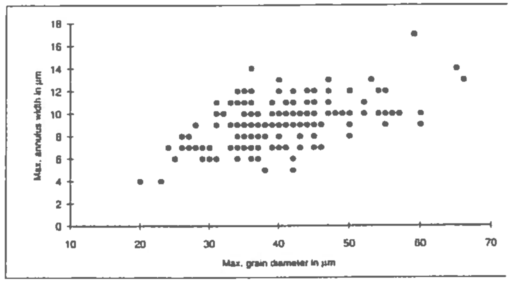
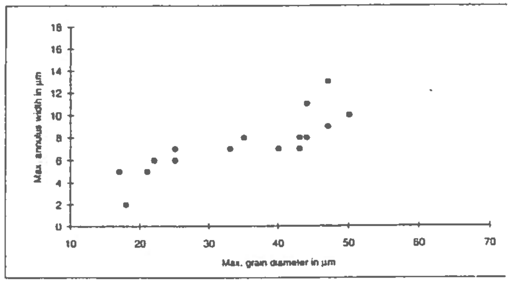


FIG. 8.12. *Scatter plot of measurements of Poaceae pollen (N = 189) from samples of four camel droppings. Pollen with a maximum grain diameter of ≥ 38 micron and an annulus width of ≥ 8 micron represe cereal pollen; those smaller than this represent cereal or grass polle*



ɪɢ. 8.13. *Scatter plot of measurements of Poaceae pollen (N = 16) rom samples of eight sheep/goat droppings. Pollen with a maximum rain diameter of ≥ 38 micron and an annulus width of ≥ 8 micron epresent cereal pollen; those smaller than this represent cereal or rass pollen.*

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