The Merovingian settlement at Oegstgeest: the vegetation in its vicinity and the plants used by its inhabitants

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A riverine settlement in the early medieval world system

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Corrie Bakels

Introduction

The Merovingian settlement at Oegstgeest was situated on the right bank of what was then the main course of the river Rhine, not far from its entry to the North Sea. It was built on a wide levee that was interrupted by several crevasse gullies. Beyond the levee stretched extensive estuarine floodplains. Other elements in the landscape were the sandy remains of former beach barriers. In the lower areas, between these strips, peat formation took place. West of the river a vast dune area lay between the lower land and the sea. The inhabitants lived in an environment dominated by the estuary of a large river (fig. 23.1).

The Oegstgeest settlement was not the only one in this region. On the same side of the river one settlement (Rijnsburg) was detected 2 km downstream and another 5.5 km upstream (Leiderdorp). On the left side of the river other settlements were found. Traces of occupation were noted in the hinterland as well. All settlements were occupied at the same time.

It is assumed that the inhabitants of these settlements exploited an exclusive territory; if the wide river is interpreted as a natural boundary, then the dryland environment of immediate interest to the inhabitants of Oegstgeest consisted of the levee on the west bank of the river, the floodplain beyond, and some sandy strips at a distance. The river was the fourth valuable environment in their lives.

The excavations provided four sources of botanical material which might give clues to the former vegetation. Because these materials are not independent from the functioning of the settlement, the activities of its inhabitants cannot be disregarded when studying and interpreting them. The first of these sources is a deposit located between two rows of posts shoring up the riverside. The second is the original surface of sods used to construct dams in the settlement. The third is waste from the settlement, and the fourth consists of wood and wooden objects found during excavation. This contribution deals with the first three mentioned. Wood is discussed in other chapters.

The riverside deposit

During the 2004 excavation a deposit was encountered that contained a band of peaty material intercalated between layers of river clay.[1] Six samples from this deposit were taken for pollen analysis: two from the clay below the peat, two from the peat, and two from the clay on top.[2] The result is presented in figure 23.2. The pollen content of the peaty material is entirely different from the clay. It is dominated by sea plantain (*Plantago maritima*) pollen. Sea plantain thrives in salt marshes. On closer inspection the 'peat' consisted of leaves and stems of several herbs including grasses, which were not further identified, but the whole is reminiscent of cut plants, a kind of hay. The find suggests that a lot of hay may have fallen in the water from the bank or flooded in from a downstream location during a high tide and got stuck between the rows of posts. Oegstgeest is situated in the tidal, brackish, zone of the Rhine estuary. The backswamps behind the levees must have been brackish. Such terrain is suited to hay-making and pasturing animals. Pastures with sea plantain are included today among the vegetational units belonging to the Asteretea tripolii.[3] Most of these units are not quite natural, but owe their existence to extensive grazing by cattle, sheep, and hares. In figure 23.2 all pollen

(1) Bakels/Van Tulder 2006. (2) The samples were treated with KOH, HCl, specific gravity separation (s.g. 2.0) and acetolysis. Before treatment a tablet with a known number of Lycopodium spores were added. The pollen sum is a Total Pollen sum. The diagram was drawn with the software Tilia and TiliaGraph (Grimm 2015).

types that may have been produced by this kind of vegetation are grouped under the heading 'brackish pasture'.

The pollen content of the clay is not well suited to giving hints as to the vegetation of the environment. The river Rhine carries pollen from a large area, and it is impossible to distinguish which pollen is more or less local and which comes from far away. Some oak (*Quercus*), hazel (*Corylus*), and alder (*Alnus*) may represent regional stands because their pollen percentages are higher than those of other trees, but this cannot be proven based on the contents of a river clay (but see below). Pollen from a brackish environment and Foraminiferae reflect the estuarine location.

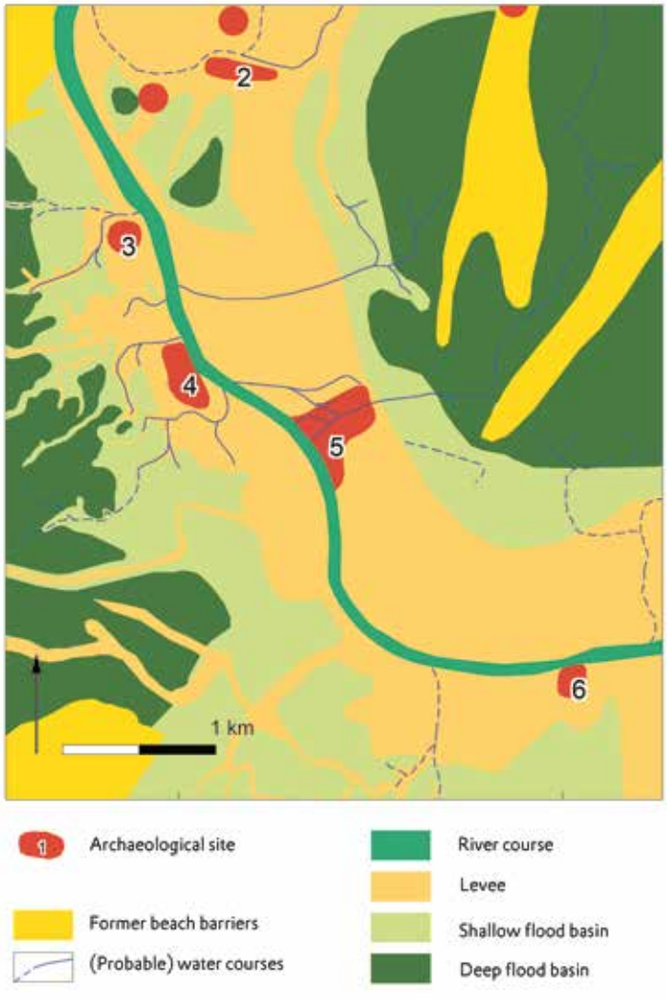
The sods

The inhabitants constructed small dykes and dams with sods as building material. Stacking results in burial of the original surface of the sods, sealing this from the air. The result is that pollen lying on this surface has a chance of being preserved. The pollen grains reflect the vegetation growing on the place of sod-cutting and the vegetation in the surroundings. This principle is used to reconstruct the environment of barrows built with sods[4], but can also be applied to other structures.

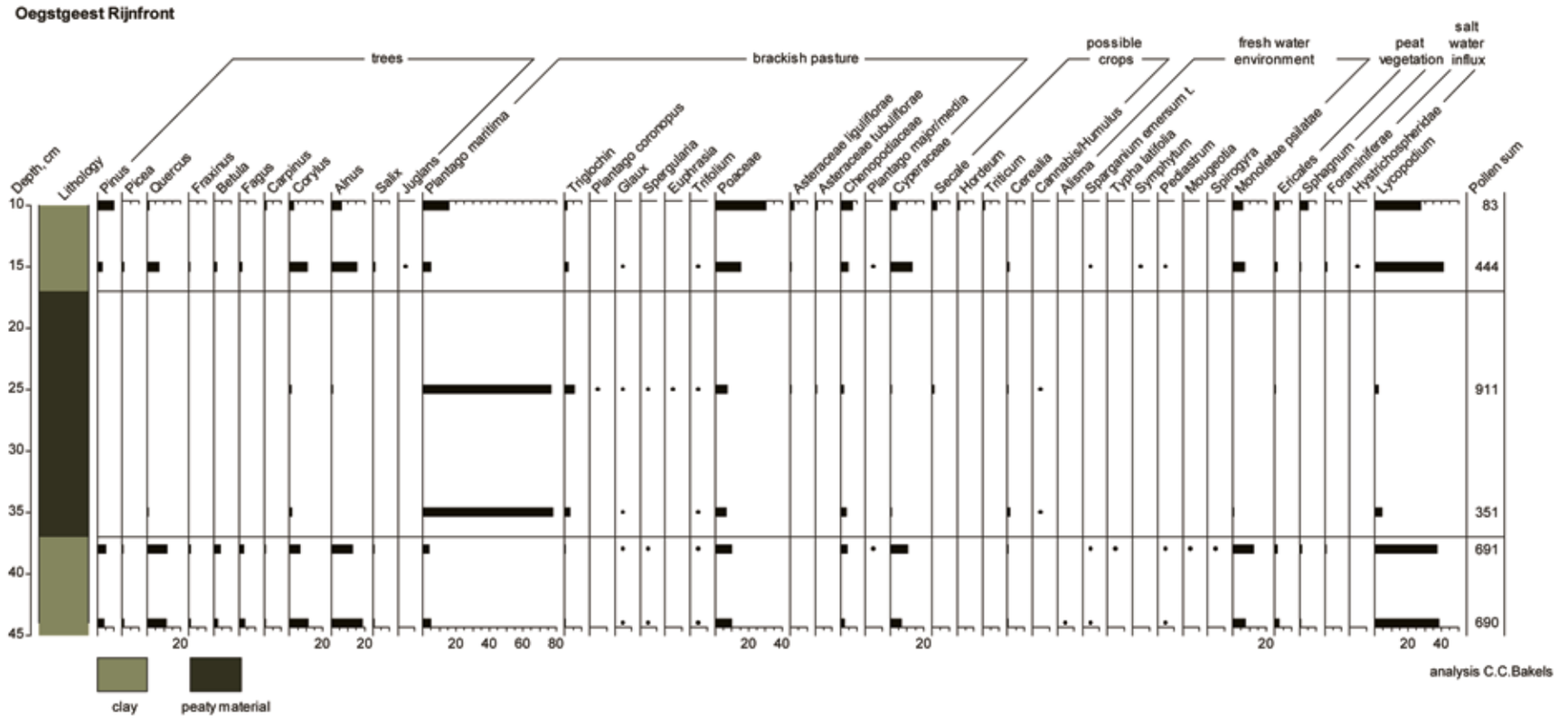
Two dams, and two sods from each of them, were sampled and analysed by Doorenbosch.[5] The result is presented in figure 23.3. For clarity the separate values of a range of single finds of dryland herbs are omitted, but they are included in the category 'all dryland herbs'. All the other values are presented in a single graph. Pollen shed by salt marsh plants is scarce, which implies that the place where the sods were cut was rarely flooded. Most herb pollen originates from ruderal, way-side vegetation and trodden places. Some pollen is from plants that can grow up to decimetres high but other pollen is from low-growing plants. It is likely that they belong to the vegetation on the levee. Possibly patches with higher vegetation had to be mowed before the sods were cut.

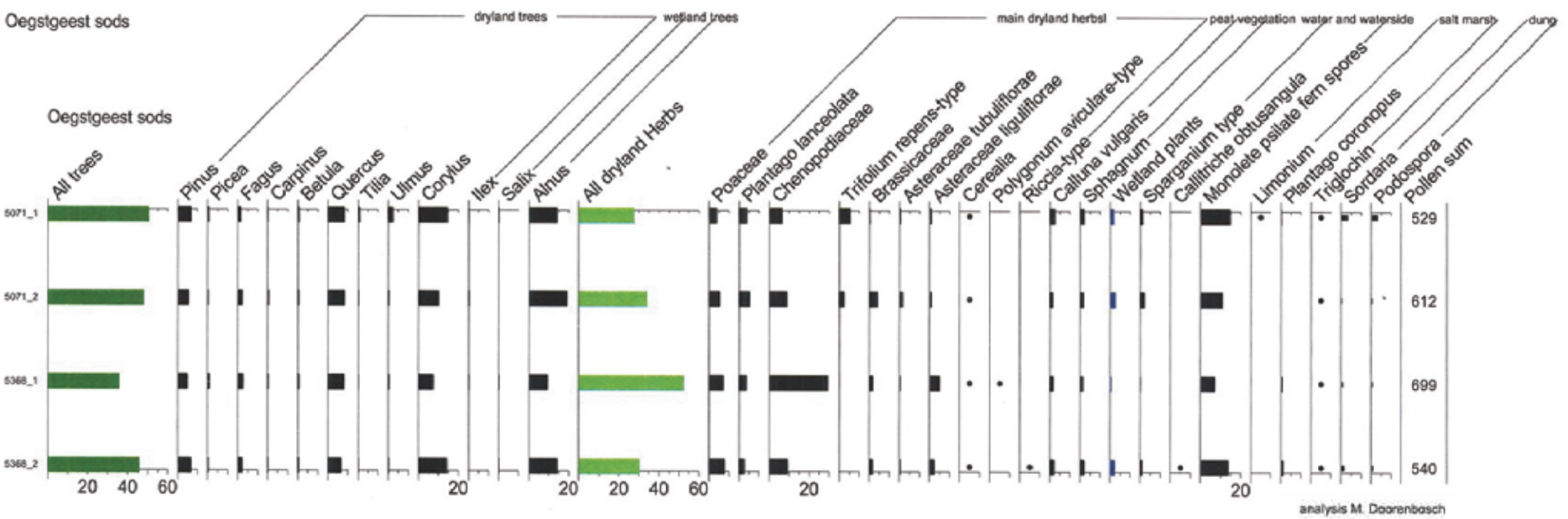
Tree pollen percentages are as important as dryland herbs. Oak (*Quercus*), hazel (*Corylus*), and alder (*Alnus*) show the highest values. In the river clay discussed above, precisely these three trees were considered as possibly growing in the surroundings of the settlement. It might be that the levee with its dense population was too intensively exploited to allow for remnants of true forest. Oak and hazel might have been present as copses. The sandy former beach barriers offer another possible location, but, at a greater distance, the vast dune area close to the sea mentioned above may have been clad in true broadleaved forest. This forest even provided an environment suitable for brown bears, witness the part of a skeleton found there and ^{14}C dated between 880 and 970.[6] Though this date is post-Merovingian it may be assumed that bears were also present in an earlier period. The location of alder stands poses the greatest problem. Alder is a wetland tree and is slightly to not at all salt tolerant. It is not expected to grow in estuarine floodplains.[7] The tree might have grown on the far ends of the flood plain where freshwater conditions possibly prevailed, and the fringes of the peaty areas between the old beach barriers. This might also have been the place where the ferns (Monoletae psilatae, possibly *Thelypteris palustris*) grew. The two wetland herbs, bur-reed or lesser reedmace (*Sparganium* type) and starwort (*Callitriche obtusangifolia*), can stand brackish conditions, but their pollen percentages are low, and the waterside vegetation was clearly not very luxuriant. Traces of crop plants are restricted to a few cereal type pollen (Cerealia), but it is impossible to ascribe these to cultivated cereals. In coastal areas wild grasses occur that shed the same kind of pollen.

Fig. 23.1
Merovingian Oegstgeest and contemporaneous sites plotted on the relevant paleographical map, based on fig. 2 in chapter 1. The sites nos 1 and 7 are situated outside this cut-out; 2. Rijnsburg, 3. Valkenburg-Dorp, 4. Valkenburg-De Woerd, 5. Oegstgeest, 6. Leiden-Boshuizerkade; red dots indicate stray finds.
Map by Wilko van Zijverden based on Van Dinter 2017.



(3) Westhoff *et al.* 1998. (4) See for instance Doorenbosch 1980. (5) The samples were treated in the same way as the peaty material described above. (6) Kuijper *et al.* 2016. (7) Hill *et al.* 1999; Thiem *et al.* 2018; Van Dinter 2017.


Oegstgeest Rijnfront
trees
brackish pasture
possible crops
fresh water environment
peat vegetation
salt water influx
Depth, cm
Lithology
Pinus
Picea
Quercus
Fraxinus
Betula
Fagus
Carpinus
Corylus
Alnus
Salix
Juglans
Plantago maritima
Triglochin
Plantago coronopus
Glaux
Spergularia
Euphrasia
Trifolium
Poaceae
Asteraceae liguliflorae
Asteraceae tubuliflorae
Chenopodiaceae
Plantago major/media
Cyperaceae
Secale
Hordeum
Triticum
Cerealia
Cannabis/Humulus
Alisma
Sparganium emersum L
Typha latifolia
Symphytum
Pediastrum
Mougeotia
Spirogyra
Monoletae psilatae
Ericales
Sphagnum
Foraminiferae
Hystrichosphaeridae
Lycopodium
Pollen sum
10
15
20
25
30
35
40
45
83
444
911
351
691
690
clay
peaty material
analysis C.C.Bakels


Oegstgeest sods
dryland trees
wetland trees
main dryland herbs
peat vegetation
water and waterside
salt marsh
dung
Oegstgeest sods
All trees
Pinus
Picea
Fagus
Carpinus
Betula
Quercus
Tilia
Ulmus
Corylus
Ilex
Salix
Alnus
All dryland Herbs
Poaceae
Plantago lanceolata
Chenopodiaceae
Trifolium repens-type
Brassicaceae
Asteraceae tubuliflorae
Asteraceae liguliflorae
Cerealia
Polygonum aviculare-type
Riccia-type
Calluna vulgaris
Sphagnum
Wetland plants
Sparganium type
Callitriche obtusangula
Monolete psilate fern spores
Limonium
Plantago coronopus
Triglochin
Sordaria
Podospora
Pollen sum
5071_1
5071_2
5368_1
5368_2
529
612
699
540
analysis M. Doorenbosch

<< Fig. 23. 2
The pollen content of the riverside deposit.

< Fig. 23.3
The pollen content of the original surface of the sods.

In addition to pollen and spores from vascular plants, spores from fungi were counted, especially those that indicate the presence of dung, *Sordaria* and *Podospora*. All four sods show these fungi. Obviously, the levee was trodden by livestock, dropping dung on the way.

It must be remarked here that on two locations within the settlement an ancient vegetation horizon was sampled which might have provided additional data, but unfortunately no pollen was preserved in this material.

Settlement waste

The inhabitants left waste including plant remains. Most of this material will have decayed, but some charred matter survived in places where it was not trampled beyond recognition, and non-charred matter survived in a waterlogged condition in wells and gullies.

A very large number of samples was taken during all the years of excavation. 34 samples from waterlogged and 37 from dry sediments were fully analysed, whereas 140 samples were only examined to assess the presence of identifiable plants.[8] Several persons handled the material, among whom Denise de Haan, Boen Tji Go, Erica van Hees, Wim Kuijper, Said Najaf Koshear, and Iris van Tulder should be mentioned. Out of this vast and unequally studied set of data three cut-outs or 'windows' were chosen to represent what was found. The aim was to present three houses with their presumed yards, one from each cluster, but that aim was found to be unrealistic. The fourth cluster, C, had not provided a sufficient number of samples. Of course, it is far from certain that the structures were indeed part of a single yard and were functioning at the same time. To be sure of that, every structure would need to have been dated with great accuracy and that is impossible. The samples were handled in an identical way and fully analysed with equal care.

Cluster A

The cut-out chosen for cluster A consists of house AH 06, two outhouses AO 13 and AO 14, a pit filled with waste, and well AW 21 (fig. 23.4 A). The house-ditch of the main house was sampled in several places and from each of the two outhouses two postholes were analysed. The sample from the well was obtained from its bottom. Appendix 23.1 presents the results. The outcome is meagre. The number of fruits and seeds is so low that the remains must reflect waste which was lying around and landed accidentally in the structures. This includes hulled barley (*Hordeum vulgare*), two ruderal plants, orach (*Atriplex* sp.) and dead-nettle (*Lamium* sp.), and rushes (*Juncus* sp.). The ruderals may have grown in the yard. The rushes may have thrived there as well. Rushes grow in damp places and this would imply that the surface of the yard was not very dry. Another possibility is that rushes were used to cover the floor of the house or outhouses, either strewn around or woven into mats. The custom of strewing earthen floors with rushes is known to have been common in medieval times, even in royal households.[9]

Cluster B

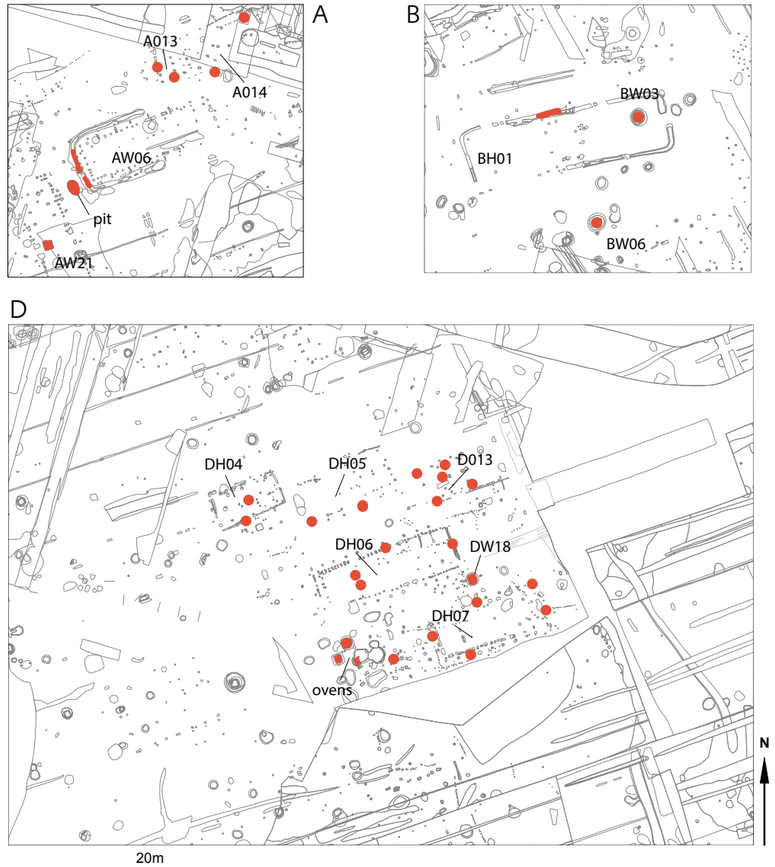
The cut-out from cluster B comprises a house partially surrounded by a house-ditch, BHS 01, and the wells BW 03 and BW 06 (fig. 23.4 B). The results are presented in appendix 23.2. The house-ditch provided few remains: two charred cereal grains, one fragment of a hazelnut shell, and rushes. The wells were more prolific. Remains of crops are scarce, and the category 'weeds and ruderals' is the best represented both in species and numbers if rushes are disregarded; these bear so many seeds per plant that they tend to outnumber other species. At first sight the presence of plants growing under saline or brackish conditions is remarkable, but they show that the brackish part of the site's environment played a role in the activities of its inhabitants. Plants from disturbed soil and pioneers in humid places may be expected in the yards. Plants from freshwater environments are likely to be plants from the waterside and may have arrived in the settlement together with reeds[10], sedges, and rushes gathered for use in, on, and around the house.

Cluster D

The complex of cluster D comprises two houses (DH 06 and DH 07), three outhouses (DH 04, DH 05 and DH 13), one well (DW 18), and several red-burned patches of soil that are tentatively interpreted as traces of ovens (fig. 23.4 D). The results are presented in appendix 23.3. The samples from the postholes revealed almost nothing: only a rachis-fragment (chaff) of barley, a fragment of a hazelnut shell, a ruderal, and club-rush (*Schoenoplectus* sp.). The contents of the well are dominated by weeds and ruderals. Remains of crops are absent in the well. Again, species from brackish environments are present.

(8) Samples were sieved in the laboratory with gently running tap-water. The finest mesh used was 0.5mm. In general sample size was 1 litre. (9) George 1996.
(10) Reed (*Phragmites*) seeds are difficult to detect in archaeobotanical material and their absence in the records does not imply absence of the plant.

Fig. 23.4
The three cut-outs with the points of sampling. A. cluster A, B. cluster B and D. cluster D.



The representativeness of the results offered by the three examples

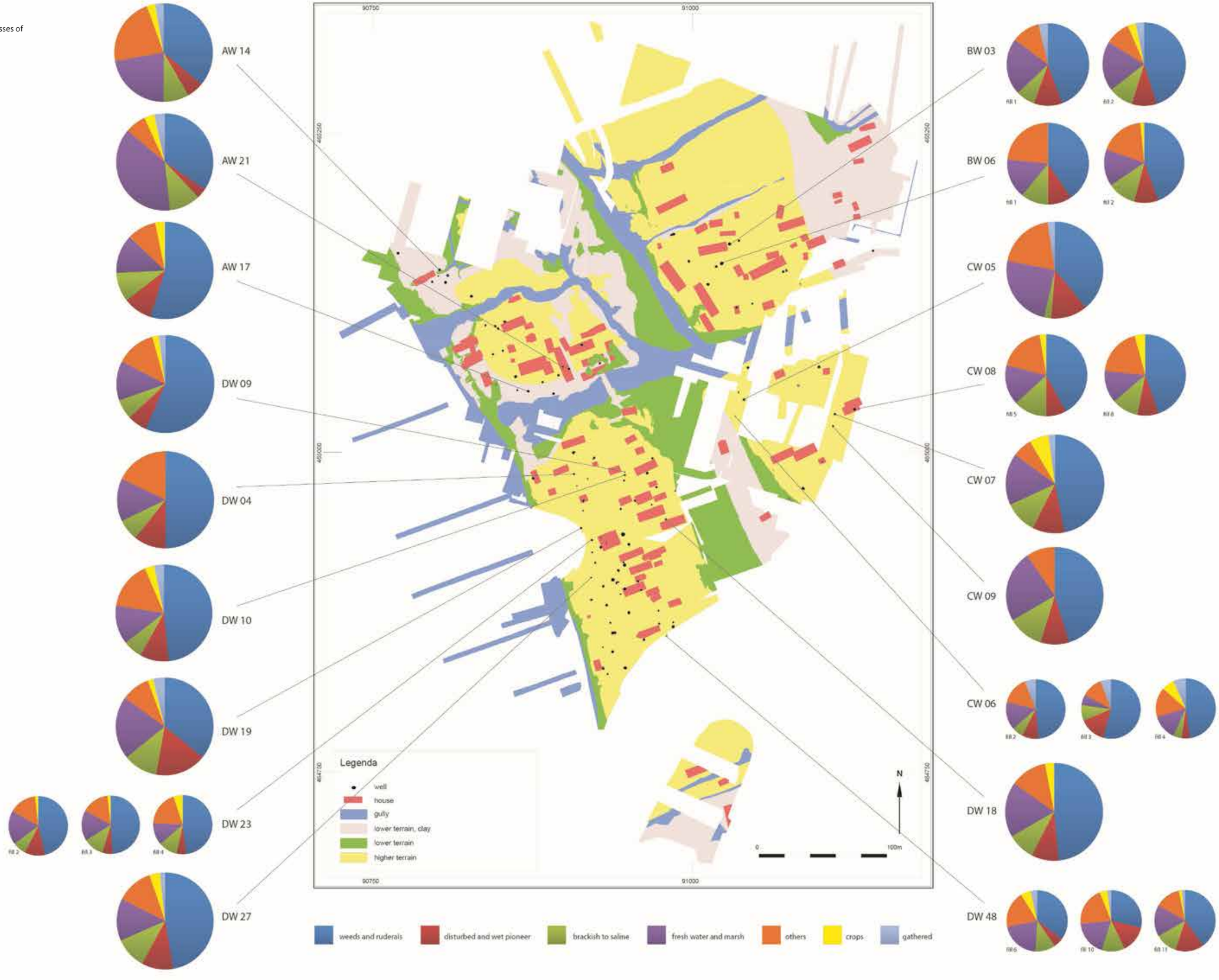
The question arises whether the three cut-outs are representative for the settlement as a whole. To answer this question the remains found in them should be compared with results obtained from the same kind of samples. In this sub-section the results from the structures with the best-preserved remains, i.e. the wells, will be compared with the results from other wells.

The list of wild plant taxa (plant species, genus, or family) is long (appendix 23.4). To reduce the set of data to something manageable the taxa are arranged in five classes according their natural environment. The classes are: (1) weeds and ruderals; (2) plants from disturbed soils and pioneers in damp places; (3) plants growing in brackish to saline environments; (4) plants from fresh water and watersides; and (5) taxa that could not be contributed to a class.

Comparison of the numbers of the fruits and seeds found will distort the picture, because some taxa produce far more seeds than others. Therefore, comparison is executed at the level of presence/absence. For each sample the number of taxa per class is noted. The outcome is presented in appendix 23.5, where two classes are added: crops, and gathered plants (see below for the taxa). Moreover, figure 23.5 displays the proportion of wild plants once more. From several wells more than one layer of fill has been analysed. The surprising result is that the fill of all these wells and layers is quite similar. The wells from the clusters are mainstream. The 'weeds and ruderals' class predominates, the other three classes that have an environmental meaning are secondary and almost equal in size.

The representativeness of the remains found in other kinds of structure such as postholes and house-ditches were as meagre as those found in the three cut-outs. Nowhere was a concentration of fruits and seeds observed. Some ruderals and a few charred remains of cereals and other food plants will be commented on below.

Fig. 23.5
Wells and the share of the five classes of wild plants in their fill.



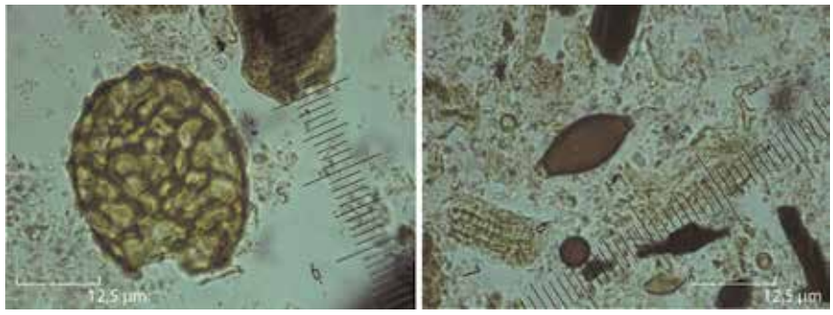


Fig. 23.6
Ascaris egg (left) and *Trichuris* egg (right), photo D. de Haan.

Gullies

Another kind of feature are the watercourses that dissected the settlement. They got their share of waste as well. The gullies had a sandy-clayey fill, but one sample obtained from gully 1 was taken from a different kind of deposit which was described as dung. The result of the analysis is presented in appendix 23.6. The dung does not differ much from the other fills and the whole is quite similar to the general picture provided by wells, though samples from wells are richer in fruits and seeds per sample volume, which may be the reason that the number of taxa detected in them is larger. True aquatics are almost absent and those found can thrive under slightly brackish conditions (*Hydrocharis morsus-ranae*, *Lemna*, *Ranunculus aquatilis*-type). Most plants found belong to the waterside or were flushed by the movement of water in and out of the gullies from marshy locations elsewhere.

The silver bowl was found in gully 3 and material found directly in contact with this object was analysed in an additional study. The aim was to investigate whether something interesting could be detected in connection with this bowl. The table shows that nothing special was found, though two taxa occur only in this context, *Chara* and *Salvinia* natans spores. It is questionable whether those two derived from plants growing locally. *Chara* spores may have been part of the older sediment. Floating fern (*Salvinia natans*) is not considered as native, at least not since the Middle Holocene.[11] In the more recent past this fern was an occasional immigrant which escaped from aquaria or, more interestingly in the case of the Oegstgeest find, arrived with wood rafted from upstream Germany.[12] The Dutch name vlotvaren refers to this origin (vlot = raft, varen = fern).

Discussion

The content of the wells, food plants excepted

Most weeds and ruderals may have been growing in the settlement, in gardens (if present), in locations out of reach of general traffic, etc. For some weeds, for instance corncockle (*Agrostemma githago*) and white lace flower (*Orlaya grandiflora*), this is, however, unlikely (see below). The plants from disturbed environments and pioneers may also originate from the site. Plants from brackish to saline environments are considered to have arrived from the floodplain pastures. The growing place of the water and waterside plants cannot have been the wells themselves, because their construction, in most cases with a definite lining, will not have offered pond-like conditions.

The seeds and fruits of the plants growing in the settlement may have landed in the wells spontaneously or been dumped there after the weeding of gardens and yards. The presence of the others requires more explanation.

One hypothesis is that the class 'brackish to saline' came in as part of animal dung. Another source may be hay from brackish pastures. Cut plants, for animal feed or bedding, are put forward as the source of the waterside plants. Remains of alder (*Alnus*) and willow (*Salix*) may have arrived with wood. A means of checking the 'dung' hypothesis may be provided by the content of the gully described above. This 'dung' does not stand out as having a special composition. Nevertheless, an indication that excrements did land in wells is provided by the find of the eggs of two kinds of internal parasites in well DW 27: *Ascaris* and *Trichuris* (fig. 23.6). *Ascaris* species live in pigs and humans and *Trichuris* in many other animals, but due to the form and size of the eggs the host can be determined.[13] Denise de Haan identified them as *Ascaris lumbricoides* and *Trichuris trichuria* , both parasites living in human intestines.[14]

To conclude, notwithstanding the lack of information as to the exact source of all waste, it seems safe to conclude that it reflects the economic activities of the inhabitants.

Pasture and livestock

Both the analysis of the riverside deposit and the content of the wells point towards the presence of pastureland. Given the geographical setting this must have been brackish as is also indicated by the plant species found. The vegetation is presumed to

(11) Out 2010. (12) Atlas Nederlandse Flora 1980-1989. (13) Thienpont *et al.* 1986. (14) De Haan 2010.

Fig. 23.7
Wild celery (*Apium graveolens*) in its natural habitat; Kwade Hoek, Goeree, the Netherlands, photo C.C. Bakels.

resemble a kind that owes its existence to light to medium grazing. The domestic animals responsible for this were presumably cattle and/or sheep. Recent practice shows that keeping horses on such pastures is not advisable, because their lively movements tend to damage the vegetation on clayey and often muddy soils to an undesirable degree.[15] This is especially so in a still active system. Pigs are never kept in comparable environments.

Recent practice also shows that medium grazing involves keeping 0.5-2.0 GVE/ha/year and light grazing <0.5 GVE/ha/year. GVE stands for livestock unit. At present one cow represents 1 GVE, but as Merovingian cattle were much smaller[16] , its value might have been in the range of a heifer, 0.5 GVE. Sheep, lambs included, are valued at 0.15 GVE.[17]

With a neighbouring settlement at ± 2 km distance on the same side of the river, and another at 5.5 km, the pasture land available to the inhabitants of the Oegstgeest settlement may have been limited, assuming the existence of 'territories' and rights of grazing. Possibly this land extended 1 km north and east, a kind of minimum estimate, also taking into account that land on the other side of the river Rhine, where other contemporaneous settlements existed, was out of bounds. In that case the area amounts to ± 230 ha, excluding the wide levee but including the sandy strips of former beach barriers, which might also have provided pastures (and served as a refuge in times of flooding). The levee is omitted because its primary use may have been the raising of crops and terrestrial traffic. Application of GVE values provides an estimate of the number of livestock that could be held year-round on a sustainable basis. The result is a maximum of 115 head of cattle or 765 sheep when lightly grazed, and a maximum of 460 head of cattle or 3060 sheep when medium grazed. Combinations of both kinds of animals are possible, of course.

Food plants and fibre plants

The fruits and seeds which were likely of direct importance to the inhabitants of Oegstgeest are listed in table 23.1a and b.[18] It is more than probable that many herbs not listed there were used as well. The tables present only the most obvious ones.

The remains were found charred and waterlogged. As remarked above, concentrations have not been found. All remains are considered to belong to the scattered waste lying around in the

(15) Infoblad veldwerkplaatsen: beweiding van kwelders, handreikingen voor het beheer 2013. (16) Cavallo 2006. (17) Data from management nature reserve Het Zwin, an environment more or less resembling the Rhine estuary. www.inbo.be (18) The list of raw data mentions one instance of buckwheat (*Fagopyrum esculentum*), but on inspection of the location of the sample it could not be ruled out that it represents a much later period.

Table 23.1a
The number of waterlogged samples in which a certain food and/or fibre plant was found.

N total samples = 34		
	charred	waterlogged
Hordeum vulgare	6	-
Hordeum vulgare, internodium	4	-
Hordeum distichum? naked	1	-
Secale cereale	2	1
Secale cereale, internodium	2	3
Triticum aestivum rachis	1	-
Triticum sp.	1	-
Hordeum/Triticum/Secale	2	1
Cannabis sativa	-	3
Linum usitatissimum	-	5
Linum usitatissimum, capsule fragment	-	1
Ficus carica	-	2
Juglans regia	-	1
Vitis vinifera	1	5
Brassica rapa, zaad	-	5
Foeniculum vulgare	-	2
Apium graveolens	-	1
Corylus avellana	1	7
Rubus caesius	-	2
Rubus fruticosus	-	7
Sambucus nigra	-	6
Humulus lupulus	-	2

Table 23.1b
The frequency in which the food and/or fibre plants were found.

N samples = 34	freq. %
charred	
Hordeum vulgare	17.6
Secale cereale	5.9
Triticum aestivum	2.9
Vitis vinifera	2.9
Corylus avellana	2.9
waterlogged	
Secale cereale	8.8
Cannabis sativa	8.8
Ficus carica	5.9
Linum usitatissimum	14.7
Vitis vinifera	14.7
Juglans regia	2.9
Brassica rapa	14.7
Foeniculum vulgare	5.9
Apium graveolens	2.9
Corylus avellana	20.6
Rubus caesius	5.9
Rubus fruticosus	20.6
Sambucus nigra	17.6
Humulus lupulus	5.9

settlement. This kind of waste offers information on the importance of each plant.[19] The more often a plant is found, the more common it was.

It turns out that only cereal remains, a grape pip and hazelnut shells are charred. They are found in both dry and waterlogged settings. As stray charred matter can as easily fall into, for instance, a well as another feature, a study of the contents of wells and gullies can serve to assess the importance of all kinds of plants. In table 23.1a the number of specimens found in the 34 fully analysed samples is mentioned. In table 23.1b only species are listed. Numbers in table 23.1b are not the same as in table 23.1a because if, for instance an internodium of rye (*Secale cereale*) was found in the same sample as the kernel, it counts in 23.1b as one. Table 23.1b presents the finds as percentages of all samples. Because of the different way in which they are preserved charred and waterlogged remnants are not lumped.

Three cereals were found, barley (*Hordeum vulgare*), rye, and bread wheat (*Triticum aestivum*). Perhaps there were four, because oats (*Avena*) is not listed as none of the few remains could be identified as cultivated oats. Barley seems to have been the most common. Other crop plants are hemp (*Cannabis sativa*), flax/linseed (*Linum usitatissimum*), walnut (*Juglans regia*), fig (*Ficus carica*), grape (*Vitis vinifera*), and fennel (*Foeniculum vulgare*).[20] The remaining species may have been gathered from wild stands, even celery (*Apium graveolens*) and beet (*Beta vulgaris*).[21] Wild celery grows profusely in brackish environments, its natural habitat, and is an indigenous species in Dutch brackish estuarine locations (fig. 23.7). Wild beet favours estuarine floodplains. The question is whether the crop plants were cultivated by the inhabitants of the settlement. The presence of cereal chaff (internodia, rachis) would suggest a local crop. Two of the cereals, rye and bread wheat, are free-threshing and commonly transported as naked grain. Nevertheless, it may be wondered whether a site thus close to the sea, unprotected from wind by stands of trees, and open to occasional flooding, was suited to winter crops such as rye and especially bread wheat. Barley, commonly a summer crop, is less questionable.

In this respect some weeds from cereal fields, i.e. corncockle (*Agrostemma githago*) and white lace flower (*Orlaya grandiflora*), provide food for thought. In the Roman period *Agrostemma* came with imported wheat.[22] Orlaya has a southern distribution.[23] The occurrence of these species, both weeds of winter crops, suggests

(19) Bakels 2005 (20) In the vast number of samples which were only scanned for the presence of plant remains one additional plant was detected: dill (*Anethum graveolens*). (21) *Beta vulgaris* was found during the scanning of samples. (22) Bakels 2010. (23) Van den Bos *et al.* 2014.

that the rye and bread wheat may have been imports. The presence of their chaff may be explained by the import of some straw as well.

Other imported goods are noted, i. e. grape and fig. Although both grape and fig can grow and bear fruit in the Oegstgeest region, if tended with the utmost care, it is far more probable that they were imported dried. Presumably walnut was also imported. The single pollen grain found in the river clay (see fig. 23.2) may have arrived with the water of the river Rhine from distant regions.

Local crops may have been barley and flax, both of which can stand occasionally brackish conditions. In the case of hemp and fennel this is not certain, because these crops are reported to be sensitive to salt, not only on the ground but also carried through the air by westerly winds.

Imported luxury products: fig, raisin, walnut

The presence of fig, grape, and walnut in Oegstgeest deserves special attention. Table 23.2 presents all Dutch Merovingian contexts published up to and including 2012. A distinction is made between waterlogged and dry conditions because of the different preservation conditions they offer. The chance of identifying these products is optimal in a wet environment. Moreover, only contexts which were subject to handling with fine-meshed sieves are included, to avoid cases in which the tiny fig seeds are likely to have been missed. It is clear that the nut and two fruits are far from common in Merovingian contexts (fig. 23.8).

As mentioned above, the grape pips are presumed to have been remnants of raisins (or currants). At present raisins are sold seedless, but in a not too distant past these sun-dried grapes contained seeds. Raisins are sweet, as are dried figs. Sugar from sugar-cane was not yet known in Merovingian Europe, although the Romans knew this sugar and Pliny described it as a kind of honey that collects in reeds, to be used as medicine[24], its introduction in central and western Europe dates from after the arrival of the Moors in Spain during the eighth century.[25] Sugar is held to have remained a medicine long after this. That sugar could also be extracted from beets was not discovered until the second half of the eighteenth century.[26] Honey was the main sweetener, but raisins and dried figs (and dates) came next. Written sources are rare for the Merovingian period, but figs (mentioned as 'krigas') are listed in a charter from Chilperic II dated to 716, which in its turn was a confirmation of a charter from Chlotarius III dated to the third quarter of the seventh century. The charter is about freedom from taxes of imported goods unloaded at Fos (near Marseille, France) and destined for the monastery of Corbie near Amiens in northern France.[27]

Remains of figs and raisins are rare to absent in the archaeological records of regions upstream on the river Rhine. Knörzer did not detect them during his intensive archaeobotanical investigations in the German Rhineland.[28] Rösch found one seed of fig in early medieval sites in southwestern Germany, but its date is fourth century at the latest and it might be Roman. He also detected one pollen grain of grape in a sixth century grave, but that grain is explained as a trace of grape cultivation for wine.[29] An overview of three sites in northwestern Switzerland does not mention them.[30] Nor were they found during studies in northern France.[31] It must be admitted that archaeobotanical studies of Merovingian sites are relatively rare in comparison with the earlier Roman and following Carolingian periods, a fact that may distort the picture to some extent. Nevertheless, the appearance of fig and raisin in Oegstgeest seems to be something special.

The same may be true for walnut, although the nuts may not have been imported from the Mediterranean regions that presumably provided the figs and raisins. The tree was introduced by the Romans in central and northwestern Europe and its presence in the German Rhineland is proven from the Late Roman period onwards.[32] A remarkable find of walnut is reported from Krefeld-Gellep, a site in the German Rhineland. A grave (grave no 2466) dated to the sixth century revealed a bronze basin containing two wooden dishes. One of the dishes offered three walnuts and one chestnut (*Castanea sativa*).[33] The author suggests the possibility that the nuts represent a special, luxury, grave gift, but she warns that they might have been the only products available during an interment in autumn. But one may wonder why the more common, indigenous, hazelnut was not added if that was the reason. In any case, walnut may have been an imported product in Oegstgeest, just as figs and raisins were.

Conclusion

According to the botanical evidence the inhabitants of Merovingian Oegstgeest lived in an environment with an important share of brackish estuarine floodplain that was mainly suited to keeping livestock, especially cattle and sheep. Barley, flax, and possibly some hemp may have been cultivated on drier parts of the landscape, but wheat and presumably also rye were imported from elsewhere. Agricultural weeds suggest more southern, loess-covered areas, such as are found in the German Rhineland, Belgium, and northern France as possible sources.

Besides the staple crops true luxury products were detected i.e. fig, raisin, and walnut. It turns out that the inhabitants of Oegstgeest were not just rural people living off their own territory. They were part of a wider network that reached far beyond the nearest neighbours.

(24) Plinius Secundus Maior, Naturalis Historia XII, 17. (25) Rosenberger 1996; Abbott 2009, 16. (26) Marggraf 1747. (27) Levillain 1902, 236-237. (28) Knörzer 2007. (29) Rösch 2008. (30) Brombacher/Hecker 2015. (31) Bakels unpublished reports. (32) Bunnik 1999, 101. (33) Hopf 1963.

Table 23.2
The occurrence of *Juglans*, *Vitis*, and *Ficus* in Merovingian sites in the Netherlands. Only sites with archaeobotanical sampling methods using fine-meshed sieves are entered.

Site	Ficus	Vitis	Juglans	N samples	N samples	Source
				wet	dry	
Oegstgeest	+	+	+	34	37	This volume
Alphen-Chaam	-	-	-	2	9	Van Haaster 2005
Cuijk Route 1Accent	-	-	-	-	4	Bakels 2005
Dommelen Kerkakkers	-	-	-	-	70	Pals 1988
Geldrop	+	-	-	10	-	Van Beurden 2002
Houten Tiellandt I	-	-	-	11	-	Kooistra 1996
Katwijk Zanderij	-	-	-	6	5	Bakels 2008
Leiderdorp-Plantage middle merovingian	-	+	-	3	-	Kuijper unpublished
Leiderdorp-Plantage late merovingian	-	-	+	5	-	Fischer 2014
Maastricht Amby	-	-	-	4	-	Bakels and Dijkman 2000
Maastricht MarktMaas	-	-	+	-	6	Bakels unpublished
Maastricht Wolfstraat	-	-	-	-	5	Kooistra 1996
Odoorn	-	-	-	-	30	Van Zeist 1986
Pesse phase 1	-	-	-	-	6	Van Zeist 1968
s-Gravenhage J. van Oldenbarneveltlaan	-	-	-	-	14	Magendans and Waasdorp 1989
Someren Waterdael	-	-	-	3	-	Van der Meer and Van Haaster 2010
Wijk bij Duurstede Voorwijn	-	-	-	1	-	Brinkkemper and De Man 2002
Wijnaldum Tjitsma 5th-6th c.	-	-	-	2	4	Pals 1999
Wijnaldum Tjitsma phase 6th-7th c.	-	-	-	4	17	Pals 1999
Zutphen Ooijerhoek	-	-	-	-	3	Van Beurden 2001

Fig. 23.8
Grape pip found in well DW 27, actual size 5.6 x 4.0 mm, photo D. de Haan.

Appendix 23.1
Cut-out cluster A, plant remains.

Oegstgeest cluster A	
House AH 06 house ditch	
sample 124	
Cerealia fragm., charred	2
Juncus sp.	x
sample 126	
stalk fragm., charred	1
samples 127, 128 en 129	no remains
sample 130	
Juncus sp.	2
cf Atriplex sp	2
cf Lamium sp.	1
sample 131	
stalk fragm., charred	1
Juncus sp.	4
indet.	2
Outhouse AO 13	
postholes 68 and 83	no remains
Outhouse AO 14	
postholes 11 and 124	no remains
Pit	
Juncus sp.	xx
Hordeum vulgare, charred	1
Atriplex sp.	1

Oegstgeest cluster A	
Well AW 21 (2 liter sample)	
Alisma sp.	1
Anthemis cotula	1
Atriplex patula/prostrata	xx
Bolboschoenus maritimus	1
Brassica sp.	x
Cannabis sativa	1
Carex pseudocyperus	1
Carex sp., div. species	x
Chenopodium album	xx
Chenopodium polyspermum	xx
Corylus avellana	1
Eleocharis palustris	1
Glaux maritima	x
Hyocyamus niger	x
Juncus sp.	xxx
Malva cf sylvestris	x
Menyanthes trifoliata	1
cf Oenanthe sp.	1
Poaceae	x
Polygonum aviculare	xx
Ranunculus sceleratus	1
Sagittaria sagittifolia	x
Schoenoplectus tabernaemontani	xx
Solanum dulcamara	x
Sphagnum, leaf	xx
Stellaria media	1
Triglochin maritima	x
Urtica urens	xx
Zannichellia palustris	x

Legend: cf=resembles, x=some, xx=tens, xxx=hundreds

Appendix 23.2
Cut-out cluster B, plant remains.

Oegstgeest cluster B			
House BHS 01 house ditch			
Cerealia, charred	2		
Corylus avellana, charred	1		
Juncus sp.	1		
Well BW 03 and 06	BW 03 fill 1	BW 03 fill 2	BW 06
Aethusa cynapium	-	2	-
Alisma sp.	-	-	1
Anagallis arvensis	1	4	1
Anthemis cotula	2	1	730
Apiaceae	-	-	1
Atriplex littoralis	-	-	1

Oegstgeest cluster B			
Atriplex prostrata/patula	100-200	500-1000	167
Atriplex sp.	-	-	1
Avena sp. charred	-	1	-
Bolboschoenus maritimus	5-20	2	2
Brassica cf rapa	-	-	7
Brassica sp.	1	-	2
Brassicaceae sp. 1 indet	-	-	6
Brassicaceae sp. 2 indet	-	-	1
Capsella bursa-pastoris	5-20	1	17
Carex triangular nutlets	-	100-200	2
Carex flat nutlets	-	4	1
Carex sp. div.	5-20	-	-
Cerastium sp.	-	-	1
Chenopodium album	100-200	200-500	39
Chenopodium ficifolium	100-200	100-200	13
Chenopodium glaucum/rubrum	1	-	1
Chenopodium murale	-	-	1
Cirsium cf arvense	1	1	1
Conium maculatum	-	-	1
Coronopus squamatus	-	-	2
Corylus avellana	-	1	-
Eleocharis palustris	1	5	2
Erica tetralix	-	-	256
Euphorbia helioscopia	1	-	1
Fallopia convolvulus	-	-	1
Galeopsis sp.	-	-	2
Glaux maritima	1	2	24
Hordeum sp. internodium charred	-	1	-
Hyoscyamus niger	100-200	100-200	6
Juncus effusus-type	-	-	11785
Juncus sp.	500-1000	500-1000	-
Lamium amplexicaule/purpureum	-	-	2
Lamium sp.	1	-	1
Leontodon autumnalis	-	-	1
Lychnis flos-cuculi	-	1	-
Malva sp.	-	-	2
Mentha aquatica/arvensis	-	-	1
Persicaria lapathifolia	-	-	8
Plantago major	-	-	25
Plantago sp.	-	-	1
Poa sp.	-	-	80
Poaceae	-	-	8
Polygonum aviculare	-	7	116
Potamogeton sp.	1		4
Potentilla anserina	1	3	2
Ranunculus flammula	1	-	-
Ranunculus repens	-	1	-
Ranunculus sardous	100-200	100-200	18
Ranunculus sceleratus	-	-	2
Rubus fruticosus	1	-	-
Rumex crispus/obtusifolius	-	-	1
Rumex sp.	200-500	200-500	115

Oegstgeest cluster B			
Salicornia europaea	-	-	1
Salix sp. scale or bud	-	-	1
Schoenoplectus lacustris	-	-	1
Schoenoplectus sp.	5-20	1	1
Schoenoplectus tabernaemontani	-	-	1
Sisymbrium officinale	-	-	15
Solanum nigrum	-	-	86
Sonchus asper	-	1	7
Spergula arvensis	1	1	1
Spergularia cf salina	-	-	2
Sphagnum sp.	-	-	xxx
Stellaria media	100-200	2	15
Suaeda maritima	-	1	1
Thlaspi arvense	-	-	3
Triglochin maritima	1	1	109
Urtica dioica	-	-	65
Urtica urens	-	4	83
Zannichellia palustris	-	-	1

Legend: xxx= hundreds

Appendix 23.3
Cut-out cluster D, plant remains.

Oegstgeest cluster D	
House DH 06	
Chenopodium album	1
House DH 07	
No remains out of 5 postholes	
Outhouses DH 04 and 05	
no remains out of 4 postholes	
Outhouse DO 13	
Hordeum vulgare, internodium	1
5 other postholes no remains	
Ovens	
Corylus avellana	1
Schoenoplectus sp.	4
Three other 'ovens' no remains	
Well DW 18	
Anagallis arvensis	1
Anthemis cotula	1
Apium graveolens	2
Aster tripolium	4
Atriplex patula/prostrata	60
Bolboschoenus maritimus	5
Carex sp.	34
Chenopodium album	92

Oegstgeest cluster D	
Chenopodium ficifolium	8
Chenopodium murale	6
Eleocharis palustris	88
Glaux maritima	8
Juncus sp.	xxxx
Leontodon autumnalis	3
Mentha arvensis/aquatica	2
Oenanthe fistulosa	4
Persicaria lapathifolia	3
Plantago major	9
Poa annua/Phleum sp.	2
Polygonum aviculare	10
Potamogeton sp.	1
Potentilla anserina	8
Potentilla sp.	2
Rumex acetosella	2
Rumex sp.	10
Schoenoplectus tabernaemontani	8
Solanum nigrum	14
Sonchus arvensis/oleraceus	1
Sonchus asper	4
Stellaria media	28
Trifolium repens	2
Triglochin maritima	58
Urtica urens	20

Legend: xxxx=thousands

Appendix 23.4
The wild taxa found in wells arranged according their occurrence in the natural environment.

Wild taxa found in wells
Weeds and ruderals
Aegopodium podagraria
Aethusa cynapium
Agrostemma githago
Anagallis arvensis
Anthemis arvensis
Anthemis cotula
Arctium sp..
Arenaria serpyllifolia
Atriplex patula/prostrata
Brassica sp.
Bromus secalinus-type.
Capsella bursa-pastoris
Chenopodium album
Chenopodium ficifolium
Chenopodium hybridum
Chenopodium murale
Chenopodium polyspermum
Cirsium cf arvense
Cirsium vulgare/oleraceum
Cirsium sp.
Conium maculatum
Coronopus squamatus
Daucus carota
Dipsacus sp.
Elytrigia atherica/repens
Euphorbia helioscopia
Fallopia convolvulus
Festuca rubra
Galeopsis ladanum
Galium aparine
Glechoma hederacea
Hyoscyamus niger
Lamium amplexicaule/purpureum
Lapsana communis
Lepidium cf ruderale
Malva sylvestris
Onopordum acanthium
Orlaya grandiflora
Papaver argemone
Papaver dubium/rhoeas
Persicaria lapathifolia
Persicaria maculosa
Plantago lanceolata
Plantago major
Poa annua/Phleum spec.
Polygonum aviculare
Raphanus raphanistrum
Rumex acetosella
Rumex crispus/obtusifolius
Scleranthus annuus
Sinapis arvensis
Sisymbrium officinale
Solanum nigrum
Sonchus arvensis/oleraceus
Sonchus asper
Sonchus cf oleraceus
Spergula arvensis
Stellaria media
Taraxacum officinale
Thlaspi arvense
Torilis japonica
Urtica urens
Valerianella dentata
Xanthium strumarium
Plants from disturbed enviornments and wet pioneer vegetations
Alopecurus geniculatus
Anagallis minima/Samolus valerandi
Bidens sp.
Centaurium sp.
Chenopodium glaucum/rubrum
Isolepis cetacea
Leontodon autumnalis
Odontites sp.
Potentilla anserina
Ranunculus repens-type
Ranunculus sardous
Ranunculus sceleratus
Rumex conglomeratus
Rumex maritimus
Trifolium repens flower
Urtica dioica
Plants from brackish to saline environments
Armeria maritima
Aster tripolium
Atriplex littoralis
Chenopodium rubrum
Glaux maritima
Oenanthe lachenalii
Plantago maritima
Pucinellia distans
Ruppia maritima
Ruppia sp.
Salicornia europaea s.l.
Spergularia marina
Spergularia media
Spergularia salina
Spergularia sp.
Suaeda maritima
Triglochin maritima
Zannichellia palustris
Plants from fresh water environments
Alisma plantago-aquatica
Alisma sp.
Alnus glutinosa
Berula erecta
Bolboschoenus maritimus
Carex pseudocyperus
Carex sp., div. species
Eleocharis palustris s.l.
Eupatorium cannabinum
Euphorbia palustris
Filipendula ulmaria
Galium palustre
Glyceria maxima
Humulus lupulus
Hydrocharis morsus-ranae
Lemna sp.
Lychnis flos-cuculi
Lycopus europaeus
Lythrum salicaria
Menyanthes trifoliata
Nymphoides peltata
Oenanthe fistulosa
Persicaria hydropiper
Peucedanum palustre
Potamogeton sp..
Ranunculus aquatilis type
Ranunculus flammula
Sagittaria sagittifolia
Salix sp. scale or bud
Salvinia natans
Schoenoplectus lacustris
Schoenoplectus tabernaemontani
Solanum dulcamara
Sphagnum sp. leaf
Typha sp.
Others
Agrostis sp.
Apiaceae
Atriplex sp.
Betula spec.
Brassicaceae sp. 1 indet.
Brassicaceae sp. 2 indet.
Calluna vulgaris
Cerastium sp.
Epilobium sp.
Erica tetralix
Euphrasia sp./ Odontites sp.
Festuca ovina/rubra
Galeopsis sp.
Juncus bufonius
Juncus effusus-type
Juncus sp., div species
Lamium album-type
Lamium sp.
Malva sp.
Mentha aquatica/arvensis
Myrica gale leaf
Plantago sp.
Poa sp.
Poaceae
Potentilla erecta-type
Rhinanthus sp.
Rosa sp.
Rosaceae sp.
Rumex sp.
Sagina sp.
Silene sp.
Solanum dulcamara
Stellaria sp.
Trifolium sp.
Viola sp.

Appendix 23.5
The number of taxa per environmental class found in the fully analysed wells, supplemented with crops and gathered taxa.

N taxa per class

well	weeds and ruderals	disturbed and wet pioneer	brackish to saline	fresh water and marsh	others	crops	gathered
AW 14 fill 7	13	2	3	8	8	1	1
AW 17	17	3	3	4	3	1	0
AW 21	10	1	3	11	2	1	1
BW 03 fill 1	12	3	2	6	3	0	1
BW 03 fill 2	14	3	3	6	3	1	1
BW 06 fill 1	26	6	7	10	15	0	0
BW 06 fill 2	27	6	7	9	11	1	0
CW 05	16	5	1	10	8	0	1
CW 06 fill 2	16	3	2	5	5	0	2
CW 06 fill 3	19	5	3	2	4	0	2
CW 06 fill 4	21	2	2	6	7	3	3
CW 07	22	5	5	8	3	3	1
CW 08 fill 5	16	3	5	6	7	1	0
CW 08 fill 8	21	4	5	6	9	2	0
CW 09	19	4	5	10	4	0	0
DW 04	14	3	2	4	5	0	0
DW 09	26	3	3	6	6	1	1
DW 10	15	3	2	4	5	1	1
DW 18	16	3	3	6	4	1	0
DW 19	19	9	6	11	5	1	2
DW 23 fill 2	25	6	4	10	8	1	0
DW 23 fill 3	26	3	6	9	8	1	0
DW 23fill 4	28	3	6	7	11	3	0
DW 27	27	6	6	8	7	2	1
DW 48 fill 6	20	3	6	12	11	3	2
DW 48 fill 10	14	7	6	9	10	2	1
DW 48 fill 11	24	9	7	10	8	1	1

Appendix 23.6
Plant remains from gullies.

Gullies							
	gully 1	gully 1	gully 2	gully 2	gully 3	gully 3	gully 3
sample	118	378 dung	185	187	4333	4397	bowl
sample volume liters	1	0.25	1	1	2	2	1
Crops and gathered fruits/seeds							
Hordeum vulgare	-	-	-	-	2*	-	-
Secale cereale	-	-	-	1*	-	-	-
Brassica rapa	-	2	-	-	-	-	-
Vitis vinifera	-	1	-	-	-	-	-
Apium graveolens	-	8	-	-	-	-	-
Sambucus nigra	-	1	-	-	-	1	-
Rubus fruticosus	-	1	1	1	-	-	-
Total taxa	N=0	N=5	N=1	N=2	N=1	N=1	N=0
Weeds and ruderals							
Anagallis arvensis	-	-	-	1	-	2	-

Gullies							
	gully 1	gully 1	gully 2	gully 2	gully 3	gully 3	gully 3
sample	118	378 dung	185	187	4333	4397	bowl
sample volume liters	1	0.25	1	1	2	2	1
Atriplex patula/prostrata	xx	xx	-	xx	xx	xx	-
Bromus secalinus-type	-	11	-	-	-	-	-
Capsella bursa-pastoris	-	-	1	-	-	-	-
Chenopodium album	x	x	x	-	xx	xx	-
Chenopodium ficifolium	-	x		1	xx	1	-
Chenopodium polyspermum	xx	-	xx	-	-	-	-
Cirsium arvense/palustre	-	-	-	2	-	-	-
Coronopus squamatus	-	1	-	-	xx	-	-
Daucus carota	-	1	-	-	-	-	-
Euphorbia helioscopia	-	-	x	1	xx	xx	-
Hyoscyamus niger	-	-	3	3	-	1	-
Malva sylvestris	-	x	-	-	-	-	-
Onopordum acanthium	-	-	-		2	-	-
Persicaria lapathifolia	-	2	-	-	xx	-	-
Plantago major	-	xx	-	-	-	x	-
Polygonum aviculare	-	x	x	9	xx	xx	-
Solanum nigrum	-	x	x	-	-	-	-
Sonchus asper	-	x	2	-	xx	1	-
Stellaria media	-	-	xx	-	-	-	-
Urtica urens	-	x	x	xx	-	-	-
Total taxa	N=3	N=13	N=10	N=8	N=9	N=9	N=0
Plants from disturbed environments and wet pioneer vegetations							
Leontodon autumnalis	-	x	-	-	-	-	-
Odontites sp.	-	1	-	-	-	-	-
Potentilla anserina	-	1	1	1	x	-	-
Ranunculus repens type	-	1	-	1	-	-	-
Ranunculus sardous	-	1	-	-	-	-	-
Ranunculua sceleratus	-	-	-	-	1	-	-
Rumex conglomeratus	-	2	-	-	-	-	-
Rumex crispus/obtusifolia	-	-	xx	-	-	-	-
Trifolium repens flower	-	x	-	-	-	-	-
Urtica cf dioica	-	-	-	-	-	-	1
Total taxa	N=0	N=8	N=2	N=2	N=2	N=0	N=1
Plants from brackish to saline environments							
Armeria maritima	-	2	-	-	-	-	-
Aster tripolium	-	xx	-	-	1	1	-
Atriplex litoralis	-	-	-	-	x	-	-
Glaux maritima	-	-	-	1	1	-	-
Oenanthe lachenalii	-	x cf	-	-	-	-	-
Plantago maritima	-	3	-	-	-	-	-
Ruppia sp.	-	-	-	-	-	1	-
Suaeda maritima	-	-	-	-	-	2	-
Triglochin maritima	x	xx	-	1	-	-	-
Zannichellia palustris	-	-	2	-	xx	xx	-
Total taxa	N=1	N=5	N=1	N=2	N=4	N=4	N=0
Plants from (fresh) aquatic and wetland environments							
Alisma sp.	-	1	-	1	-	1	3
Alnus glutinosa	1	x	-	-	-	-	-
Ranunculus aquatilis-type.	-	-	-	-	-	xx	-

Gullies							
	gully 1	gully 1	gully 2	gully 2	gully 3	gully 3	gully 3
sample	118	378 dung	185	187	4333	4397	bowl
sample volume liters	1	0.25	1	1	2	2	1
Bolboschoenus maritimus	1	xx	-	-	x	2	-
Carex sp., div species	x	x	-	x	x	-	-
Chara sp.	-	-	-	-	-	-	2
Eleocharis palustris s.l.	x	xx	-	xx	xx	-	-
Eupatorium cannabinum	-	-	-	1	-	-	-
Hydrocharis morsus-ranae	-	-	-	-	-	1	-
Galium palustre	-	2	-	-	-	-	-
Lemna sp.	-	-	1	-	xx	-	-
Lychnis flos-cuculi	-	8	-	-	-	-	-
Lythrum salicaria	-	x	-	-	-	-	-
Salvinia natans	-	-	-	-	-	-	2
Schoenoplectus sp.	-	x	2	-	xx	xx	-
Schoenoplectus tabernaemontani	-	-	-	2	-	-	-
Sphagnum sp. leaf.	-	xx	-	-	-	-	-
Typha sp.	-	-	-	-	-	-	5
Total taxa	N=4	N=11	N=2	N=5	N=5	N=5	N=4
Others							
Agrostis sp.	-	x	-	-	-	-	-
Brassica sp.	-	-	-	-	x	xx	-
Juncus sp. div. species	xx	xxxxx	-	xxxxx	-	-	xxx
Lamium sp.	-	-	-	1	-	-	-
Mentha aquatica/arvensis	-	xx	-	-	-	1	-
Myrica gale leaf	-	1	-	-	-	-	-
Poaceae	-	xx	-	-	-	-	3
Rhinanthus sp.	-	2	-	-	-	-	-
Rumex sp.	-	1	-	1	x	-	-
Solanum dulcamara/nigrum	-	-	-	-	x	-	-
Viola sp.	-	-	-	1	-	-	-
Total taxa	N=1	N=7	N=0	N=4	N=3	N=2	N=2

Legend cf=resembles, x = some, xx = tens, xxx = hundreds, xxxx =thousands, xxxxx = ten thousands, * = charred

Abbreviations

AAC	Amsterdam Archeologisch Centrum
AAS	Amsterdam Archaeological Studies
Archis	Archaeological Information System
AWN	Archeologische Werkgemeenschap Nederland
BROB	Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek
DAR	Delftse Archeologische Rappoorten
FDI	Fédération Dentaire Internationale (World Dental Federation)
GAS	Groningen Archaeological Studies
HOP	Haagse Oudheidkundige Publicaties
JALC	Journal of Archaeology in the Low Countries
NAR	Nederlandse Archeologische Rapporten
NO	Nederlandse Oudheden
OBSP	Oegstgeest Bio Science Park
OMROL	Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden
ONRZ	Oegstgeest Nieuw Rhijngeest Zuid
OSLP	Oegstgeest SL Plaza
RA	Rheinische Ausgrabungen
RAD	Rapportages Archeologie Deventer
RAM	Rapportage Archeologische Monumentenzorg
RCE	Rijksdienst voor het Cultureel Erfgoed (Cultural Heritage Agency of the Netherlands)
v.	vondstnummer (find number)

Zohar, I./M. Belmaker, 2005: Size does matter: methodological comments on sieve size and species richness in fishbone assemblages, *Journal of Archaeological Science* 32, 635-641.

20 Fish remains
Franka Kerklaan

Beerenhout, B. 2009: *Visonderzoek Leidsche Rijn 51 en 54; een handelspost binnen het netwerk van Dorestad?* Amsterdam.
Beerenhout, B., 2010: *Ichthyo-archeologisch onderzoek aan visresten uit Oegstgeest, plangebied Nieuw Rhijngeest-Zuid; een Merovingische nederzetting aan de Rijnmonding (late 6e-7e eeuw).* Amsterdam.
Brinkhuizen, D.C., 1989: *Ichthyo-archeologisch onderzoek: methoden en toepassing aan de hand van Romeins vismateriaal uit Velsen (Nederland).* Groningen.
Gerstmeier, R./T. Romig, 2000: *Zoetwatervissen van Europa*, Baarn.
Lepiksaar, J./D. Heinrich, 1977: Untersuchungen an Fischresten aus der Frühmittelalterlichen Siedlung Haithabu, Neumünster (Berichte über die Ausgrabungen in Haithabu 10).
Lythgoe, J./G. Lythgoe, 1976: *Vissen van de Europese kustwateren en de Middellandse Zee.* Nederlandse bewerking: J.C. Niesthoven/Fr. de Graaf, Baarn.
Muus, B.J./J.G. Nielsen/P. Dahlstrøm/B.O. Nyström, 1999: *Zeevissen van Noord- en West-Europa*, Haarlem.
Nijssen, H./S.J. De Groot, 1987: *De vissen van Nederland*, Utrecht.
Redeke, H.C. 1941: *De visschen van Nederland*, Leiden.
Ruting, J., 1958: *Welke vis is dat? Nederland, Centraal en West Europa*, Zutphen.
Van Dam, P.J.E.M., 2003: Feestvissen en vastenvissen. Culturele, ecologische en economische aspecten van de visconsumptie in de Nederlanden in de Late Middeleeuwen, *Tijdschrift voor sociale geschiedenis* 3, 468–495.

21 Shell finds from a Merovingian settlement along the Rhine at Oegstgeest
Wim J. Kuijper

Bruyne, R.H./ S.J. van Leeuwen/ A.W. Gmelig Meyling/ R. Daan (eds), 2013: *Schelpdieren* van *het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca)*, Utrecht/ Lisse.
Gittenberger, E./A.W. Janssen/W.J. Kuijper/ J.G.J. Kuiper/T. Meijer/G. van der Velde/J.N. de Vries, 1998: De Nederlandse zoetwatermollusken. Recente en fossiele weekdieren uit zoet en brak water, Leiden (Nederlandse Fauna 2. Nationaal Natuurhistorisch Museum Naturalis).
Jansen, E.A., 2015: *Veldgids slakken en mossels – land en zoetwater*, Zeist.
Kuijper, W.J., 1990: *Schelpdieren in romeins Valkenburg (Z.-H.),* in E.J. Bulkt/D.P. Hallewas (eds), 1990: *Graven bij Valkenburg III, het archeologisch onderzoek in 1987 en 1988*, Delft, 134-141.
Kuijper, W./S. Lampe/J. Slopsma, 2014: *Schelpen. Deel II-13*, in: M. Driessen/ E. Besselsen (eds)., 2014: *Voorburg-Arentsburg. Een Romeinse havenstad tussen Rijn en Maas*, Amsterdam (Themata 7), 823-831.
Van der Jagt, I.M.M./F.J. Laarman, 2019: Het effect van zeven op de archeo(zoö)logische informatie. *De resultaten van een zeefexperiment bij de opgraving van een vroegmiddeleeuwse nederzetting in Oegstgeest*, Amersfoort (Intern rapport RCE).

22 The effect of sieving on archaeo(zoo)logical information
Inge M.M. van der Jagt and Frits J. Laarman

De Boer, A./F.J.G. van der Heijden, 2003: *Oegstgeest-Rijnfront, inventariserend archeologisch onderzoek: bureauonderzoek en IVO-fase 1 en 2* (ADC-rapport 184), Bunschoten.
Dijkstra, M.F.P., 2011: *Rondom de mondingen van Rijn & Maas. Landschap en bewoning tussen de 3e en 9e eeuw in Zuid-Holland, in het bijzonder de Oude Rijnstreek*, Leiden.
Esser, K., 2009: Archeozoölogie - zoogdieren en vogels, in: Nokkert, M./ A.C. Aarts/ H.L. Wynia (eds), *Vroegmiddeleeuwse bewoning langs de A2 Een nederzetting uit de zevende en achtste eeuw in Leidsche Rijn* (Basisrapportage archeologie 26), Utrecht.
Grant, A., 1982: *The use of tooth wear as a guide to the domestic ungulates*, in Wilson, B./ C. Grigson/ S. Payne (eds). *Ageing and sexing animal bones from archaeological sites*. Oxford: BAR British series 109, 91-108.
Habermehl, K.-H. 1975: *Die Altersbestimmung bei Haus- und Labortieren*, 2. Auflage, Berlin.
Hambleton, E., 1999: *Animal Husbandry Regimes in Iron Age Britain. A comparative study of faunal assemblages from British Iron Age sites*, BAR British Series 282, Oxford.
Hemminga, M./T. Hamburg, 2006: *Een Merovingische nederzetting op de oever van de Oude Rijn. Opgraving (DO) en Inventariserend Veldonderzoek (IVO) Oegstgeest-Rijnfront zuid 2004*, Archol rapport 69, Leiden.
Hemminga , M./T. Hamburg/M. Dijkstra/C. Cavallo/S. Knippenberg/S.M.E. van Lith/C.C. Bakels/C. Vermeeren, 2008: *Vroeg Middeleeuwse nederzettingssporen te Oegstgeest. Een inventariserend Veldonderzoek en Opgraving langs de Oude Rijn* (Archol rapport 102), Leiden.
Hilgen, S., 2015: Oegstgeest 2014. *Zeefexperiment* (stageverslag Universiteit Leiden).
Jezeer, W. (ed.), 2011: *Oegstgeest Nieuw Rhijngeest-Zuid, een Merovingische nederzetting aan de Rijnmonding. Een archeologische opgraving* (ADC-rapport 2054), Amersfoort.
Lauwerier , R.C.G.M., 1988: Animals in Roman times in the Dutch eastern river area, *Nederlandse Oudheden* 12, Amersfoort.
Lauwerier, R.C.G.M., 1997: Laboratorium protocol archeozoölogie, Amersfoort.
Levitan, B., 1982: *Excavations at West Hill, Uley, 1979: the sieving and sampling programme* (Western Archaeological Trust Occasional Papers No. 10), Bristol.
Lyman, R.L., 1994: *Vertebrate Taphonomy*, Cambridge.
Marinelli, M.G., 1998: Gemeente Oegstgeest : *Rhijnhofweg (CMA-terrein 30F-023) : een archeologische kartering en waardering* (RAAP-rapport 391), Amsterdam.
Payne, S., 1972: *Partial recovery and sample bias: the results of some sieving experiments*, in Higgs, E.S., (ed.), *Papers in economic Prehistory*. Studies by Members and Associates of the British Academy Major Research Project in the Early History of Agriculture, Cambridge, 49-64.
Prummel, W., 1983: Excavations at Dorestad 2. Early medieval Dorestad an archaeozoological study (Nederlandse Oudheden 11), Amersfoort.
Reidsma, F., 2011: *Fire in Prehistory. A practical and theoretical approach to the study of hearts*, bachelor thesis Universiteit Leiden.
Silver, I.A., 1969: *The Ageing of Domestic Animals*, in D. Brothwell/E.S. Higgs (eds.), *Science in Archaeology*, London, 283-302.

23 The Merovingian settlement at Oegstgeest: the vegetation in its vicinity and the plants used by its inhabitants
Corrie Bakels

Abbott, E., 2009: *Sugar, a bittersweet history*, Duckworth Overlook, London/New York.
Atlas Nederlandse Flora 1980-1989. Floron, Nijmegen.
Bakels, C.C., 2005: Crops produced in the southern Netherlands and northern France during the early medieval period: a comparison, *Vegetation History and Archaeobotany* 14, 394-399.
Bakels C.C./I.J.M. van Tulder, 2006: *Botanie*, in M. Hemminga/T. Hamburg (eds), 2006: *Een merovingische nederzetting op de oever van de oude Rijn,* Leiden (Archol rapport 69), 112-115.
Bakels C., 2010: De vroegste vondsten van bolderik (Agrostemma githago L.) in Nederland (The earliest finds of corncockle (Agrostemma githago L.) in the Netherlands), in C. Bakels/K. Fennema/W.A. Out/C. Vermeeren (eds), 2010: *Van planten en slakken (of plants and snails)*, Sidestone Press, Leiden, 13-20.
Brombacher, C./D. Hecker, 2015: Agriculture, food and environment during Merovingian times: plant remains from three early medieval sites in northwestern Switzerland, *Vegetation History and Archaeobotany* 20, 331-342.
Bunnik, F.P.M., 1999: *Vegetationsgeschichte der Lössbörden zwischen Rhein und Maas von der Bronzezeit bis in die frühe Neuzeit*, PhD thesis University Utrecht.
Cavallo, C., 2006: Dierlijke resten, in M. Hemminga/T. Hamburg (eds), 2006: *Een merovingische nederzetting op de oever van de oude Rijn*, Leiden (Archol rapport 69), 73-81.
De Haan, D., 2010: *A botanical reconstruction of the environment surrounding a Merovingian settlement at the Oude Rijn, Zuid-Holland, The Netherlands*, MA Thesis Leiden University.
Doorenbosch, M., 1980: *Ancestral heaths, reconstructing the barrow landscape in the central and southern Netherlands*. Sidestone Press, Leiden.
George, D., 1996: *Rushbearing: a forgotten British custom*, in A.F. Johnston/W. Husken (eds), 1996: *English parish drama*, Rodopi, Amsterdam-Atlanta, 17-29.
Grimm E.C., 2015: *Tilia and Tiliagraph 2.0.41*. https://www.tiliait.com/download/
Hill, M.O./J.O. Mountford/D.B. Roy/R.G.H. Bunce, 1999: *Ellenberg's indicator values for British plants. ECOFACT Volume 2 Technical Annex*. Huntingdon, Institute of Terrestrial Ecology (ECOFACT, 2a).
Hopf, M., 1963: Walnüsse und Esskastanie in Holzschalen als Beigraben im fränkischen Grab

von Gellep (Krefeld), *Jahrbuch des Römisch-Germanischen Zentralmuseums* 10, 200-203.
Infoblad beweiding van kwelder: handreikingen voor het beheer 2013: Uitgave Bedrijfschap voor bos en natuur.
Knörzer, K.-H., 2007: Geschichte der synanthropen Flora im Niederrheingebiet, Pflanzenfunde aus archäologischen Ausgrabungen, Mainz (*Rheinische Ausgrabungen* 61).
Kuijper, W. J./I. K. A. Verheijen/A. Ramcharan/H. van der Plicht/T. van Kolfschoten, 2016: One of the last brown bears (*Ursus arctos*) in the Netherlands (Noordwijk), *Lutra* 59 (1-2), 49-64.
Levillain, L., 1902 : *Examen critique des chartes mérovingiennes et carolingiennes de l'abbaye de Corbie*, Paris.
Marggraf, A. S., 1747: Experiences chimiques faites dans le dessein de tirer un veritable sucre de diverses plantes, qui croissent dans nos contrées, *Histoire de l'académie royale des sciences et belles-lettres de Berlin*, 79-90.
Out, W., 2010: *The occurrence of* Salvinia natans *in the Netherlands during the Holocene*, in C. Bakels/K. Fennema/W. A. Out/C. Vermeeren (eds), 2010: *Van planten en slakken (of plants and snails)*, Sidestone Press, Leiden, 205-215.
Plinius Secundus Maior, *Naturalis Historia (natural history) XII*: Edited by H. Rackham for The Loeb classical library. Heinemann/Harvard University Press, London/Cambridge (Massachusetts).
Rösch, M., 2008: New aspects of agriculture and diet of the early medieval period in central Europe: waterlogged plant material from sites in south-western Germany, *Vegetation History* and *Archaeobotany* 17, 225-238.
Rosenberger, R., 1996: *La cuisine arabe et son apport à la cuisine européenne*, in J. L. Flandrin/M. Montanari (eds), 1996: *Histoire de l'alimentation*, Fayard, Paris, 345-365.
Thiem, D./A. Piernik/K. Hrunkiewicz, 2018: Ectomycorrhizal and endophytic fungi associated with Alnus glutinosa growing in a saline area of central Poland, *Symbiosis* 75, 17-28.
Thienpont, D./F. Rochette/O. F. J. Vanparijs, 1986: Diagnose van Verminosen door Coprologisch Onderzoek. Janssen research Foundation, Beerse, België.
Van den Bos, V./O. Brinkkemper/I. D. Bull/S. Engels/T. Hakbijl/M. Schepers/M. van Dinter/G. van Reenen/B. van Geel, 2014: Roman impact on the landscape near castellum Fectio,
The Netherlands, *Vegetation History and Archaeobotany* 23, 277-298.
Van Dinter, M., 2017: *Living along the* Limes, *landscape and settlement in the Lower Rhine Delta during Roman and Early Medieval times*, PhD thesis University Utrecht.
Westhoff, V./J. H. J. Schaminée/K. S. Dijkema, 1998: *Asteretea tripolii*, in J. H. J. Schaminée/E. J. Weeda/V. Westhoff (eds), 1998: *De vegetatie van Nederland* 4, Opulus Press, Uppsala-Leiden, 89-130.

References belonging to table 23.2

Bakels, C./W. Dijkman, 2000: Maastricht in the first millennium AD, the archaeobotanical evidence, *Archaeologica Mosana* 2.
Bakels, C. C., 2005: *Botanie*, in E. N. A. Heirbaut (ed.), 2005: *Bewoning van prehistorie tot middeleeuwen in het buitengebied van Cuijk*, Leiden (Archol Rapport 34), 140-145.
Bakels, C. C., 2008: Paleo-ecologische resten afkomstig van het Onderzoek uit 2005, in H. M. Van der Velde (ed.), 2008: *Cananefaten en Friezen aan de monding van de Rijn*, Amersfoort (ADC Monografie 5), 347-352.
Brinkkemper, O/R. de Man,2002: *Archeobotanisch onderzoek aan een Merovingische waterput te Wijk bij Duurstede*, Amersfoort (Interne rapporten Archeobotanie ROB 2002/4).
Fischer, A. D, 2014: *Botanische macroresten*, in M. F. P. Dijkstra/A. A. A. Verhoeven/K. J. C. van Straten (eds), 2014: Nieuw Licht op Leithon, Amsterdam (Themata 8), 541-554.
Kooistra, L. I.,1996: *Borderland Farming*. Assen, Van Gorcum and Comp., 277-289 and 291-357.
Magendans, J. R./J. A. Waasdorp, 1989: *Franken aan de Frankenslag, een vroeg-middeleeuwse nederzetting in 's-Gravenhage*, Den Haag (VOM-reeks 2).
Pals, J. P., 1988: *Akkerbouw in het middeleeuwse Dommelen*, *Phyto-archeologische studies*, PhD thesis Amsterdam University, 111-135.
Pals, J. P., 1999: *Preliminary notes on crop plants and the natural and anthropogenous vegetation*, in J. C. Besteman/J. M. Bos/D. A. Gerrets/H. A. Heidinga/J. de Koning (eds), 1999: *The excavations at Wijnaldum. Reports on Frisia in Roman and Medieval times*, Rotterdam, Balkema/Brookfield, 139-149.
Van Beurden, L., 2001: *Zaden en vruchten uit een Merovingische waterput in de Ooijerhoek bij Zutphen*, Zaandam (Biaxiaal 114).
Van Beurden, L., 2002: *Botanisch onderzoek in het Maas-Demer-Schelde gebied, de Romeinse en vroegmiddeleeuwse periode*, in H. Fokkens/R. Jansen (eds), 2002: *2000 jaar bewoningsdynamiek*, Leiden, 287-314.
Van der Meer, W./H. van Haaster, 2010: À la Merovingienne?, verslag van onderzoek aan archaeobotanisch materiaal van Someren-Waterdael III (IJzertijd-Middeleeuwen), Zaandam (Biaxiaal 461).
Van Haaster, H., 2005: Voedingsgewoonten en milieuomstandigheden op en rond een Frankische nederzetting in Alphen-Chaam (5e-6e eeuw), Zaandam (Biaxiaal 231).
Van Zeist, W. 1968: Prehistoric and early historic food plants in the Netherlands, *Palaeohistoria* 14, 42-173
Van Zeist, W./G. J. de Roller/R. M. Palfenier-Vegter/O. H. Harsema/H. During, 1986: Plant remains from medieval sites in Drenthe, the Netherlands, *Helinium* 26, 226-274.

24 Construction wood

Caroline Vermeeren, Kirsti Hänninen, Epko J. Bult, Erica van Hees and Marleen van Zon

Brandenburgh C. R., 2011: *Programma van Eisen*, *Gemeente Oegstgeest Nieuw Rhijngeest-Zuid*, Leiden.
Doeve, P., 2015: *The long journey of early medieval wood; establishing absolute dates and determining the provenance of timbers from the Oegstgeest-Rijnfront site*, Leiden (unpublished MA-thesis University of Leiden).
Fischer, A. D. 2016: Botanische macroresten, in M. P. F. Dijkstra/A. A. A. Verhoeven/K. C. J. van Straten (eds), 2016: *Nieuw licht op Leithon. Archeologisch onderzoek naar de vroegmiddeleeuwse bewoning in plangebied Leiderdorp-Plantage*, Amsterdam (Themata 8), 541-558.
Hemminga, M/T. Hamburg, 2006: *Een Merovingische opgraving op de oever van de Oude Rijn. Opgraving (DO) en Inventariserend Veldonderzoek (IVO) Oegstgeest-Rijnfront zuid 2004*. Leiden (Archol rapporten 69).
Jezeer, W., 2011: *Een Merovingische nederzetting aan de monding van de Rijn*, *Een archeologische opgraving te Oegstgeest Nieuw Rhijngeest-Zuid*, Amersfoort (ADC rapporten 2054).
Kilby, K., 1971: *The cooper and his trade*, Fresno.
Kooistra, L. I., 2009: *Hout van een vroegmiddeleeuwse vindplaats in Oegstgeest-Nieuw Rhijngeest-Zuid. Zaandam*, (BIAXiaal 423).
Kooistra, L. I., 2011: Hout, in W. Jezeer, *Een Merovingische nederzetting aan de monding van de Rijn*, Amersfoort (ADC rapporten 2054), 65-74.
Kooistra, L. I./C. Rieffe/T. van Venetië/C.Vermeeren, 2019: Van forten, schepen en barbeques: houtgebruik in de Romeinse tijd en de vroege middeleeuwen in de Haagse regio, in R. J. van Zoolingen (ed.), 2019: *AB HARENIS INCULTIS, Artikelen voor Ab Waasdorp*, Den Haag,46-59.
Kreuning, J. 2016: Pollen, in M. P. F. Dijkstra/A. A. A. Verhoeven/K. C. J. van Straten (eds), 2016: *Nieuw licht op Leithon. Archeologisch onderzoek naar de vroegmiddeleeuwse bewoning in plangebied Leiderdorp-Plantage*, Amsterdam (Themata 8), 523-540.
Kuijper, W. J., 2016: A late Holocene forest fauna with Spermodea lamellata, Merdigera obscura and Cochlodina laminata in the dunes of Noordwijk, the Netherlands, *Basteria* 80 (4-6), 195-200.
Kuijper, W. J./I. K. A. Verheijen/A. Ramcharan/H. van der Plicht/T. van Kolfschoten, 2016: One of the last wild brown bears (Ursus arctos) in the Netherlands (Noordwijk), *Lutra* 59, 49-64.
Lange, S., 2016: Bouwhout en houten voorwerpen, in M. P. F. Dijkstra/A. A. A. Verhoeven/K. C. J. van Straten (eds), 2016: *Nieuw licht op Leithon. Archeologisch onderzoek naar de vroegmiddeleeuwse bewoning in plangebied Leiderdorp-Plantage*, Amsterdam (Themata 8), 459-521.
Out, W. A/C. Vermeeren/K. Hänninen 2013: Branch Age and Diameter: Useful Criteria for Recognising Woodland Management in the Present and Past?, *Journal of Archaeological Science* 40, 4083–4097.
Out, W. A./K. Hänninen/C. Vermeeren, 2018: Using Branch Age and Diameter to Identify Woodland Management: New Developments, *Environmental Archaeology* 23 (3), 254-266.
Schweingruber, F. H., 1982: *Mikroskopische Holzanatomie*, Birmensdorf.
Vermeeren, C., 2019: De planten, in J. A. Waasdorp/A. C. van Weerelt (eds), 2019: *Vroegmiddeleeuwse pioniers in het Statenkwartier. Opgravingen rond het Frankenslag*, (Haagse Oudheidkundige Publicatie 21), 113-115.
Vermeeren, C./L. I. Kooistra, 2020: Botanisch materiaal uit de Midden-IJzertijd en de Merovingische periode van vindplaats Monster-Molenslag (gemeente Westland), in J. P. L. Bakx