

PLUM (*PRUNUS DOMESTICA* L.) VARIETIES IN LATE- AND POST-MEDIEVAL GRONINGEN:
THE ARCHAEOBOTANICAL EVIDENCE

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ABSTRACT: Among the plum-stones recovered from late- and post-medieval cesspits in Groningen, thirteen different types have been distinguished. In the present paper these types are discussed and illustrated. Some of the Groningen plum-stone types match stones of traditional plum varieties from the north of the Netherlands and France.

KEYWORDS: Archaeological plum-stones, traditional plum varieties.

1. INTRODUCTION

One of the long-term research projects of the Groninger Instituut voor Archeologie of the University of Groningen is the archaeobotanical examination of late- and post-medieval occupation deposits in the town centre of Groningen. Some of the results of this study have already been published (Van Zeist, 1988; 1992) and a comprehensive, fully documented report is in preparation. In addition to the remains of a great number of other wild and cultivated plants, pips and stones of native and imported fruit are also commonly found in the town-centre deposits. Mention may be made here of apple, pear, plum, sloe, grape, red currant, strawberry and fig. The present article deals with a discussion of plums consumed in (early-)historical Groningen. The term 'plum' (*Prunus domestica*) is used here in its widest sense, to include true plums in the modern sense, as well as damsons, gages, bullaces and Mirabelles.

The contents of a number of cesspits yielded, in addition to the remains of other fruits, substantial quantities of plum-stones. Most of the rather large fruitstones of plum and some other fruit species may not have been excreted with the faeces, but may have ended up in cesspits as kitchen refuse. The rich and varied plum-stone material invited, as it were, more detailed examination. It has repeatedly been established that fruitstones of plum recovered from archaeological contexts show quite a variety in shape and size, indicating the presence of diverse kinds of plum at the sites concerned (for example, Baas, 1971; 1974; Behre, 1978; Knörzer, 1971; Kroll, 1980; Lange, 1988). Among the Groningen material a remarkably large number of plum-stone types could be distinguished.

In examining archaeological plum-stones one naturally wishes to know which plum varieties were cultivated in the past. This raises the question as to what extent it is possible to identify the kind of plum from the stones. In this respect the evidence from modern plum cultivars is encouraging in that Röder (1940) has demonstrated that the shape of the stones, which finds

expression in the so-called index values (see section 2), is characteristic of a particular variety.

It is self-evident that identification of subfossil stone types is possible only by comparison with stones of plum varieties which still exist. In principle, for a comparison with archaeological plum-stones, traditional ('old-fashioned') varieties are of prime interest as these are the kinds of plum cultivated in the past. Unfortunately, many of these old sorts have virtually disappeared. In addition, stones of modern cultivars may provide indications as to the identity of subfossil stones. This is because modern cultivars are derived from traditional varieties and the shape of the stones may not have changed markedly in the selection process. It should be borne in mind that for various archaeological plum-stone types a modern equivalent may never be found. A few examples of the identification of subfossil plum-stones beyond the more general indications 'Rundpflaume' and 'Ovalpflaume' (round plums, oval plums, in the German literature) are given below. For a discussion of the relationships between present-day and ancient plum varieties, the reader is referred to Körber-Grohne's (1996) book on plums, cherry plums and sloes.

Knörzer (1971) compares one of the plum-stone types identified from the medieval 'Niederungsburg' near Buderich (lower Rhineland) with stones of primitive plums (*Haferpflaume*) escaped from cultivation in the northern Eifel. Körber-Grohne (1996: pp. 149-151) indicates the close resemblance of plum-stones from Roman and medieval sites in Germany to those of the traditional variety 'Kleine Damascener'. Behre (1978) found a fair correspondence of stone types (*Formenkreise*) A and B established for Haithabu and Alt-Schleswig with those of plum cultivars illustrated in Röder (1940: figs 78 and 94, respectively).

With respect to the Groningen plum-stones, we are very fortunate that a large reference collection is available. For many years, H. Woldring has been in search of specimens of traditional plum varieties which still exist, in the Netherlands as well as in England,

France, Italy, Greece and Turkey. On the basis of the plum-stone material collected by him, a modern equivalent could be established for more than half of the stone types determined from Groningen. A publication on traditional plum varieties by Woldring, with descriptions of the trees, the fruits and the fruitstones, is in preparation.

2. METHODOLOGICAL ASPECTS

In distinguishing between different types of plum-stones, in the first place the shape of the stones, the dimensions and the index values (the ratios between measurements) are of importance. The position of the measurements (length, breadth and thickness) is indicated in figure 2. Plum-stones are laterally compressed, as a result of which the breadth is smaller than the thickness. The relatively broad lateral sides are domed to a greater or less degree. Where the term 'sides' is used below, the lateral sides are meant (this in contrast to the narrow ventral and dorsal sides). The base of the stone is at the end (the attachment) of the fruit-stalk. The following index values are usually defined in plum-stones: 100B:L (100 x breadth/length), 100T:L and 100T:B. The 100T:L index value is a measure of the relative slenderness; the more slender the stone, the lower this index value is. Roundness finds expression in the 100T:B value: stones with strongly domed sides show a relatively low 100T:B value, whereas in rather flat stones this value is relatively high (in plum-stones the 100T:B value is always more than 100).

In addition to shape and dimensions, the following features play a part in characterizing stone types. The surface of the stones usually shows a network pattern of pits of varying size and depth. If this surface pattern is only weakly developed, the wall looks rather smooth. In addition, the surface may show one or more longitudinal

creases which start from the base. The ventral side is made up of a thickened ridge or rim (*Wulst* in German) which may be more or less strongly developed. The ventral ridge is usually bordered by a distinct groove on both sides.

The numbers of stones of some of the plum-stone types established for Groningen are quite small, so these types are not supported by satisfactorily large numbers of measurements. However, we are of the opinion that each of the stone types defined by us is justified, because it is characterized by a combination of features and clearly differs from the other types. Moreover, for most of our types either a matching modern equivalent is present, or they correspond with subfossil stone types described and illustrated in the literature. To emphasize their local significance, the type numbers are given the prefix 'Gro' (Gro-1, Gro-2, etc.).

Opinions on the subdivision of *Prunus domestica* L. into subspecies differ. For practical reasons, and in conformity with, among others, Behre (1978) and Körber-Grohne (1996), the subdivision into two subspecies is adopted here: subsp. *insititia* and subsp. *domestica* (syn. *oconomica*). With respect to the term 'variety' as used in this paper, we follow the practice of (British) fruit breeders in which different forms and races are indicated as variety (Roach, 1985; Simmons, 1978). In this sense 'variety' largely corresponds with 'Sorte' in German, but differs from the term variety (var.) as defined in plant nomenclature, for example, *Prunus domestica* subsp. *insititia* var. *subrotunda*.

3. SAMPLES AND PRESENTATION OF THE RESULTS

The samples which yielded a fair number of plum-stones, with numbers of stones per type are presented in

Table 1. Plum (*Prunus domestica*). Numbers of fruitstone types recovered from the contents of cesspits in Groningen. For explanation, see text. KL Klooster/Rode Weeshuis, WNC Wolters-Noordhoff-Complex, MKH Martinikerkhof, KAT Gedempte Kattendiep, C century.

Sample Date	KL271 1800- 1840	KL328 c.1800	WNC750A c.1800	MKH345 1600- 1650	MKH195 16th C	KAT62 1550- 1575	MKH639 1525- 1550	MKH178 c.1500	MKH356 14th C
Type Gro-1	7	6	2	78	15	3770	-	58	27
Type Gro-2	-	2	1	-	5	35	11	5	8
Type Gro-3	-	-	-	83	2	20	-	36	-
Type Gro-4	4	32	51	86	-	-	-	27	1
Sub-type Gro-5a	83	119	12	13	7	2030	-	63	6
Sub-type Gro-5b	6	40	9	14	1	177	3	17	3
Type Gro-6	-	-	-	6	-	-	-	2	-
Type Gro-7	-	16	6	3	-	-	-	-	-
Type Gro-8	-	9	1	-	-	-	-	-	-
Type Gro-9	21	20	4	-	-	5	-	-	-
Type Gro-10	5	3	-	-	-	-	-	-	-
Type Gro-11	17	20	2	-	-	-	-	-	-
Type Gro-12	-	-	-	-	8	12	440	-	4
Type Gro-13	42	145	3	6	5	17	-	9	1
Unidentified	21	31	13	20	4	44	12	25	3



Fig. 1. Town centre of Groningen. Location of cesspit sites discussed in this paper. 1. Martinikerkhof; 2. Wolters-Noordhoff-Complex; 3. Klooster/Rode Weeshuis; 4. Gedempte Kattendiep.

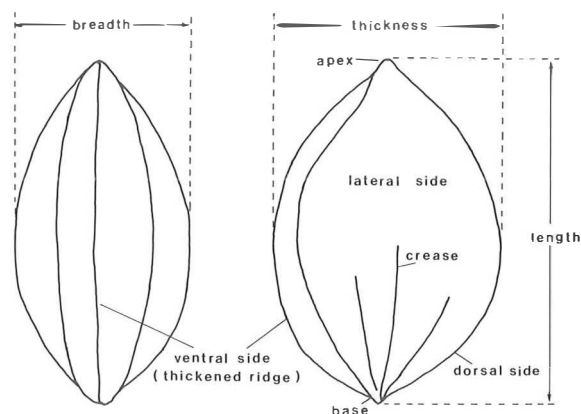


Fig. 2. Key to the terminology used for the description of plum-stones and position of the measurements (adopted from Behre, 1978: fig. 1).

table 1. The find sites from which the samples originate are indicated on the map of the Groningen town centre (fig. 1). With respect to these sites the following may be mentioned.

In the area on the west side of the Martinikerkhof (MKH) excavated in 1987 and 1989 a large number of cesspits came to light (Schoneveld, 1990). Various cesspits were also excavated at the Wolters-Noordhoff site (WNC) (Kortekaas & Waterbolk, 1992), but here the contents of cesspits had not been washed over a

screen to recover small objects (see below). The large cesspool uncovered at the Kattendiep site (KAT) in all probability belonged to a building (the so-called 'Langhuis') which formed part of the Peper- or Sint Geertruids hospital (Carmiggelt & Van Gangelen, 1988). A report on the excavations at the site indicated as Klooster/Rode Weeshuis (KL), carried out by the Stichting Monument en Materiaal, is in preparation. The fill of the cesspit at this site consisted of a lower and upper part separated by a brick floor.

With one exception (WNC 750A), the contents of the cesspits included in the present paper were washed over a screen of 4 mm mesh, after which the residue that stayed on the sieve was dried. The dried residue was subsequently sorted for artifacts, animal bones and plant remains, in particular fruitstones.

The numbers of plum-stones listed for Wolters-Noordhoff (WNC) 750A are the totals of stones recovered from a relatively small sediment sample (c. 10 litres in volume), which had been washed over a sieve of 2 mm mesh in the laboratory, and stones hand-picked in the field by the excavators.

As for the Kattendiep (KAT 62) sample, the results presented in table 1 differ considerably from those published earlier (Van Zeist, 1988: table 6). In re-examining the Kattendiepplum-stones it turned out that the 'Mirabelle type' of the earlier publication comprises two different types: our present types Gro-1 and Gro-5. In addition, the stone type listed in the Kattendiep

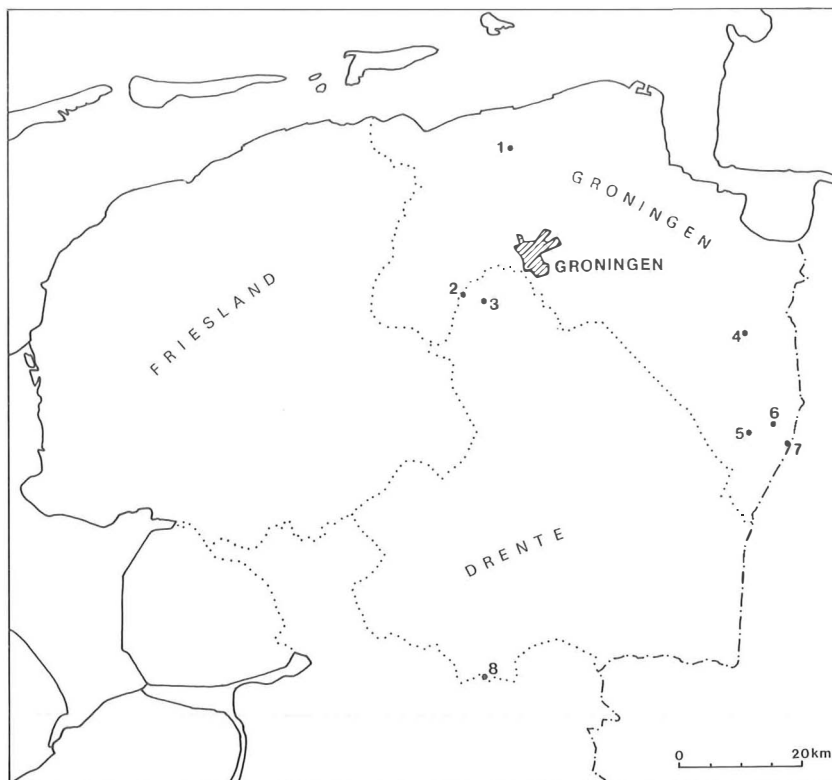


Fig. 3. Find-spots of traditional plum varieties in the north of the Netherlands mentioned in this paper. 1. Rasquert; 2. Nietap; 3. Foxwolde; 4. Blijham; 5. Sellingerbeetse; 6. Jipsinghuizen; 7. Hasseberg; 8. Schrapsvveen.

publication as 'Behre type B' is definitely not of this type. Stones which match those of Behre's (1978) *Formenkreis B* have not been found in Groningen.

The category 'Unidentified' includes stones which could not (satisfactorily) be attributed to one of the types distinguished here. This is only in part due to poor preservation or serious deformations. Some stones look more or less intermediate between types and/or may be aberrant forms of one of the types distinguished. In addition, some stones listed as unidentified may represent a specific type. However, as only one or a few stones of such a type were present and no matching modern equivalent was available, no separate type has been defined.

4. STONE TYPES DISTINGUISHED AND COMPARISON WITH LIVING PLUM VARIETIES

4.1. Type Gro-1 (fig. 4)

The stones of this type are slightly asymmetric in outline; near the base they are somewhat curved inward on the dorsal side. The stones are fairly flat and pointed at the base. The apex is blunt, sometimes slightly pointed. The stone is fairly smooth; a surface pattern is only weakly developed. The stones of this type are small, mostly not larger than 15 mm.

The Gro-1 stones correspond with those of an old plum variety, relict specimens of which are still found in Rasquert and Jipsinghuizen (for the location of these places, see fig. 3). The plums, 2 to 2.5 cm large, are suboval to globular in shape, with a yellow-red skin. The fruit flesh has a good flavour and is free from the stone. For dimensions and index values of subfossil and modern stones, see table 2:1.

4.2. Type Gro-2 (fig. 4)

The stones of this type fit into Behre's (1978) *Formenkreis A*. The Gro-2 stones are oblique-oval in outline, somewhat pointed at the base and with strongly domed sides. The ventral ridge is strongly developed. Fairly short creases on the surface of the stone radiate from its base. According to Behre, the stones of *Formenkreis A* correspond with those of modern '*Rundpflaumen*' (*P. domestica* subsp. *insititia* var. *subrotunda*). He compares them with stones of the variety 'Gute aus Bry' shown in Röder (1940: p. 91, fig. 78). So far, H. Woldring has not found modern plum-stones which match the subfossil Gro-2 specimens.

The Gro-2 stones show a considerable variation in size as is evident from the minimum and maximum values for the length (table 2:2). A similar variation has also been determined for *Formenkreis A* stones from Haithabu, Alt-Schleswig and Lübeck in Germany (cf. table 2:2).

Table 2. *Prunus domestica*. Mean, minimum and maximum dimensions in mm and index values of subfossil and modern plum-stone types. An asterisk indicates a modern provenance. L length, B breadth T thickness, N number of stones measured, KL Klooster/Rode Weeshuis, MKH Martinikerkhof, KAT Gedempte Kattendiep.

	L	B	T	100B:L	100T:L	100T:B	N
<i>1. Type Gro-1</i>							
MKH 345	14.13 (12.7-15.2)	5.84 (5.3-6.8)	10.14 (9.4-11.1)	41 (37-47)	72 (65-78)	174 (160-192)	50
KAT 62	13.85 (13.0-15.3)	6.11 (5.4-7.1)	9.84 (9.1-11.3)	44 (40-49)	71 (62-79)	161 (149-175)	50
*Jipsinghuizen	15.01 (13.2-16.4)	6.45 (5.7-8.0)	9.83 (8.5-10.8)	43 (37-51)	66 (59-74)	153 (130-177)	22
*Rasquert	14.36 (12.1-16.0)	6.27 (5.1-7.4)	9.71 (8.4-10.5)	44 (37-51)	68 (62-72)	156 (135-176)	29
<i>2. Type Gro-2</i>							
MKH (various samples)	14.20 (11.4-17.3)	8.41 (7.4-10.7)	10.99 (9.4-13.5)	59 (49-68)	78 (71-84)	131 (115-159)	32
KAT 62	14.62 (12.1-16.5)	9.01 (8.1-10.0)	11.51 (10.0-12.8)	62 (53-75)	79 (68-87)	128 (110-137)	30
Haithabu (Behre, 1978)	14.42 (10.2-17.6)	8.23 (4.4-10.4)	11.02 (7.6-13.7)	57 (43-73)	76 (57-97)	134 (108-166)	797
Alt-Schleswig (Behre, 1978)	14.31 (10.3-17.8)	8.26 (6.1-10.9)	10.91 (8.3-13.5)	58 (44-80)	76 (61-94)	132 (105-156)	581
Lübeck (Kroll, 1980)	14.34 (10.6-17.4)	8.11 (6.0-10.4)	11.18 (8.5-14.5)	57 (46-81)	79 (65-100)	139 (112-172)	258
<i>3. Type Gro-3</i>							
MKH 178	14.53 (12.7-16.3)	6.98 (6.1-8.4)	10.33 (9.2-11.2)	48 (43-55)	71 (65-79)	148 (129-163)	26
MKH 345	15.11 (12.8-17.0)	7.25 (6.3-8.0)	10.59 (9.4-11.8)	48 (43-53)	70 (63-77)	146 (134-160)	60
*Mont-les-Etrelles	14.93 (13.8-16.1)	7.27 (6.7-7.8)	10.38 (9.5-11.0)	49 (44-55)	70 (66-76)	143 (132-151)	40
*Betaille	15.14 (13.3-16.4)	6.86 (6.4-7.9)	10.30 (9.3-11.4)	45 (42-50)	68 (62-73)	150 (140-164)	22
*Blaubeuren (Körber-Grohne, 1996)	13.7 (12.2-14.8)	6.7 (5.2-7.7)	9.5 (8.7-10.2)	49 (43-58)	69 (65-73)	144 (125-157)	20
<i>4. Type Gro-4</i>							
MKH 178	17.97 (16.6-19.6)	7.36 (6.6-7.9)	11.98 (11.0-13.1)	41 (36-46)	67 (61-75)	163 (148-176)	25
MKH 345	18.79 (17.4-20.4)	7.29 (6.3-8.3)	12.32 (11.2-13.8)	39 (32-43)	66 (61-73)	169 (155-192)	60
KL 328	18.39 (16.6-20.8)	7.48 (6.5-8.3)	12.26 (10.7-13.8)	41 (36-46)	67 (58-71)	164 (148-182)	28
*L'Emprunt	18.96 (17.4-20.4)	7.77 (7.0-8.3)	11.89 (10.9-12.8)	41 (38-46)	63 (57-66)	153 (144-161)	20
*Bassignac-le-Bas	16.54 (15.5-17.5)	7.29 (6.6-7.9)	11.38 (10.2-12.2)	44 (40-50)	69 (61-74)	156 (145-165)	20
<i>5. Type Gro-5</i>							
MKH 178	13.42 (11.6-14.8)	6.78 (6.0-7.7)	9.76 (8.1-11.3)	51 (41-60)	73 (67-81)	144 (122-170)	45
sub-type 5a							
KAT 62	13.46 (11.0-14.9)	6.92 (6.0-8.5)	9.72 (8.1-11.2)	52 (44-61)	72 (65-81)	141 (118-158)	50
sub-type 5a							
MKH 178	15.88 (15.0-17.2)	7.52 (6.9-8.3)	10.99 (9.7-12.2)	47 (42-53)	69 (64-77)	147 (129-164)	13
sub-type 5b							
MKH 345	15.92 (15.0-17.8)	7.43 (6.9-8.0)	10.94 (10.0-12.2)	47 (43-53)	69 (65-75)	147 (138-160)	14
sub-type 5b							
KAT 62	16.39 (15.1-17.7)	7.49 (6.6-9.0)	10.96 (10.1-12.0)	46 (42-52)	67 (60-75)	147 (121-166)	50
sub-type 5b							
*Nietap (Dubbele Boerewitte)	16.74 (14.4-17.8)	7.95 (7.0-8.5)	11.94 (11.1-12.8)	48 (44-53)	71 (65-81)	150 (140-167)	35
<i>6. Type Gro-6</i>							
MKH 178/345	17.13 (16.1-18.3)	7.06 (6.3-7.6)	10.98 (10.0-11.7)	41 (38-45)	64 (59-70)	156 (141-168)	8
*Blijham	16.81 (15.2-18.4)	7.36 (6.4-8.9)	10.57 (9.6-11.7)	44 (39-50)	63 (57-70)	145 (125-163)	25

Table 2. (continued)

	L	B	T	100B:L	100T:L	100T:B	N
<i>7. Type Gro-7</i>							
KL 328	19.60 (17.5-22.9)	6.37 (5.7-7.4)	11.35 (10.4-12.7)	33 (29-36)	58 (53-62)	179 (167-190)	15
Alt-Schleswig (Behre, 1978)	19.66 (14.6-22.2)	6.36 (4.9-7.5)	11.26 (9.7-12.4)	32 (27-37)	57 (53-65)	177 (157-206)	14
*Belvoir	20.84 (18.6-22.0)	6.38 (5.9-6.8)	11.52 (10.8-12.3)	31 (28-37)	55 (51-59)	181 (162-192)	11
<i>8. Type Gro-8</i>							
KL 328	24.11 (22.3-26.8)	6.14 (5.6-7.2)	10.23 (9.8-10.7)	26 (23-32)	43 (38-48)	167 (149-178)	8
*Stromberg (Körber-Grohne, 1996)	20.0 (17.3-24.2)	5.6 (4.5-6.8)	8.7 (7.4-10.0)	28 (23-33)	43 (38-50)	155 (129-188)	50
<i>9. Type Gro-9</i>							
KL 328	20.01 (18.2-22.9)	6.74 (6.0-7.7)	11.18 (10.0-12.6)	34 (30-39)	56 (48-62)	166 (146-184)	18
KL 271	20.46 (18.0-23.9)	6.58 (5.8-7.5)	11.11 (9.3-12.4)	32 (29-38)	54 (50-62)	169 (151-188)	21
*L a Croisille	20.45 (19.3-22.1)	7.09 (6.1-8.8)	11.52 (10.4-12.4)	35 (31-42)	56 (54-61)	164 (132-194)	17
*Prune d'Agen	24.89 (22.1-27.4)	7.48 (6.6-8.3)	13.53 (12.0-15.0)	30 (26-35)	54 (49-60)	181 (166-201)	19
<i>10. Type Gro-10</i>							
KL 328/271	16.87 (16.1-18.0)	7.35 (7.0-8.3)	13.18 (12.2-14.5)	44 (41-46)	78 (71-81)	180 (172-192)	6
*Nietap	17.12 (15.0-18.9)	7.48 (6.1-8.5)	13.07 (11.4-14.6)	44 (38-49)	76 (70-80)	175 (160-192)	15
<i>11. Type Gro-11</i>							
KL 328	14.45 (12.9-15.6)	7.53 (7.0-8.3)	11.54 (11.0-12.5)	52 (47-58)	80 (74-86)	154 (143-171)	19
KL 271	14.53 (13.0-15.8)	7.46 (7.0-8.3)	11.85 (10.8-12.7)	52 (46-57)	82 (77-84)	159 (147-173)	16
<i>12. Type Gro-12</i>							
MKH 639	15.24 (13.2-16.6)	6.85 (5.6-8.1)	9.79 (8.6-11.0)	45 (39-52)	64 (58-72)	143 (124-168)	80
<i>13. Type Gro-13</i>							
KL 328	14.35 (12.1-15.7)	6.19 (5.6-7.5)	9.03 (8.3-10.0)	43 (37-50)	63 (58-70)	146 (125-171)	50
*Sellingbeetse	14.52 (13.1-16.2)	6.22 (5.6-7.2)	8.75 (7.6-9.9)	43 (38-49)	60 (54-65)	141 (123-157)	19

4.3. Type Gro-3 (fig. 4)

The Gro-3 stones are clearly asymmetric in outline. The greatest thickness is in the lower half of the stone. The (lateral) sides are moderately domed. The apex is sharply pointed and the base is somewhat truncated. The stone surface is fairly smooth. One or more creases run from the base in a longitudinal direction. The groove on both sides of the ventral ridge is very narrow.

There are modern equivalents of this type of plum-stone; stones of a bullace-type plum (*Kriecher*) from Blaubeuren in southern Germany, described by Körber-Grohne (1996: pp. 65-66), closely resemble the Gro-3 specimens. This appears not only from a comparison with the photographs of one of the Blaubeuren stones

(Körber-Grohne, 1996: Plate If), but also from the fair correspondence of the index values (table 2:3). The Groningen stones are, on average, somewhat larger. The *Kriecher* from Blaubeuren is a sucker of a rootstock on which another plum had been grafted. The round, dark-blue fruits are 22 to 27 mm large.

The Gro-3 stones exactly match those of bullace-type plums collected by H. Woldring in southern France. The index values of the stones from two French sources do not differ significantly from those of the subfossil specimens (table 2:3). The French plum-trees belong, just as the Blaubeuren specimen, to the group of St Julien plums. It is not unlikely that the Groningen plum-trees in question were of French origin, that is to say,

they had originally been imported from France. It should be pointed out that not nearly all St Julien type plums have stones of our Gro-3 type. This appears from the findings of Körber-Grohne (1996: Plate I) and from other St Julien plum-stones collected by H. Woldring in France (see also our Gro-10 type, section 4.10).

At present St Julien type plum-trees are used only as rootstocks for grafting modern plum cultivars. In view of the fairly large numbers of Gro-3 stones it may be assumed that at the time this variety was cultivated here for its fruits.

4.4. Type Gro-4 (fig. 4)

The stones of this type are (slightly) asymmetric in outline; near the base they are somewhat curved inward at the dorsal side. The stones are rather flat (slightly domed sides) and distinctly extended at the base. The groove on both sides of the ventral ridge is absent or at most rudimentarily developed. On the other hand, the ventral ridge is flanked by a longitudinal depression on the lateral sides. The surface sculpture is made up of a narrow-meshed network of shallow pits.

The Gro-4 stones closely resemble those of plums collected by H. Woldring in the Dordogne (France). These plums are rounded-obovate, 30 to 35 mm large, with a violet-reddish skin and firm sweet flesh. In table 2:4 the dimensions and index values of subfossil and modern stones from two provenances are presented.

4.5. Type Gro-5: sub-types 5a and 5b (fig. 5)

The stones of this type are oval in outline, with a rather broad base. The sides are clearly domed and the surface is pitted. The thickened ventral ridge is comparatively broad.

Among the Gro-5 stones two sub-types are distinguished: a small sub-type Gro-5a and a larger sub-type Gro-5b. At first these sub-types were regarded as separate types and, in fact, they may represent two different varieties. The Kattendiep sample yielded a very large number of Gro-5a stones, which in the Kattendiep publication are included in the 'Mirabelle type' (see section 3). In addition, a much smaller number of larger-sized stones of the same shape as those of sub-type 5a were recovered from the Kattendiep sample. These stones, the present sub-type Gro-5b, closely resemble those of the 'Dubbele Boerewitte' (Double Farmers' White), a plum variety which is still common in the north of the Netherlands. The fruits of this variety are suboval to round, 30 to 35 mm large and yellow-skinned.

The question arose whether the stones of sub-type 5a were perhaps small specimens of the 'Dubbele Boerewitte'. However, the minimum length of modern stones of the 'Dubbele Boerewitte' from Nietap is 14.4 mm (see table 2:5), whereas most of the subfossil stones are smaller than 14.4 mm. This has led to the conclusion

that the small type Gro-5 stones are not of the 'Dubbele Boerewitte'. The dividing line between sub-types 5a and 5b has arbitrarily been drawn at 15 mm (15.0 mm and more is sub-type 5b). Admittedly, this is not quite satisfactory as some of the stones listed as sub-type 5a may in fact be of the 'Dubbele Boerewitte', whereas small specimens of sub-type 5b may be of the as yet unknown variety represented by sub-type 5a.

With respect to the possible identity of the Gro-5a stones, the following should be remarked. As there is a continuous size range from the smallest Gro-5a stones to the largest Gro-5b specimens, one wonders whether the variety represented by sub-type 5a was the predecessor of the 'Dubbele Boerewitte', and whether this was the form from which the latter has developed. In this connection, the extinct variety called 'Enkele Boerewitte' (Single Farmers' White) should be mentioned, which according to Knoop (c. 1750: p. 19) differed from the 'Dubbele Boerewitte' by the smaller size of the plums and a slightly different skin colour. According to the same author the 'Enkele Boerewitte' was widely cultivated in the Netherlands and its fruits were much appreciated because of their rich flavour. For that reason one wonders whether sub-type 5a may correspond with the 'Enkele Boerewitte'.

Dimensions and index values of stones of both sub-types and of the 'Dubbele Boerewitte' from Nietap (for location, see fig. 3) are presented in table 2:5. From this table it is clear that the index values of the Gro-5b stones correspond well with those of modern 'Dubbele Boerewitte'. The index values of stones of sub-type 5a differ somewhat, but not significantly, from those of sub-type 5b. The fair correspondence in index values between the two sub-types supports the hypothesis that the 'Dubbele Boerewitte' has developed from the variety represented by sub-type Gro-5a.

4.6. Type Gro-6 (fig. 5)

Only a few stones of this type were found. As they form a rather uniform group which differs from the other types determined from Groningen, they are distinguished as a separate type. The oval stones are symmetric in outline, minutely pointed at the apex and blunt at the base. The stone surface is pitted.

The distinction as a separate type is supported by the fact that we believe that we know a modern equivalent. The Gro-6 stones match those of blue plums from Blijham (fig. 3). The dimensions and index values of the subfossil stones also correspond reasonably well with those of the modern ones (table 2:6).

4.7. Type Gro-7 (fig. 6)

The Gro-7 stones are fairly flat (only slightly domed sides), strongly asymmetrical in outline, with an almost straight dorsal side. They are blunt to pointed at the apex, with an extended, more or less pointed base and

a rough, pitted surface. A prominent crest is present on the ventral ridge. The features of this type of stone are characteristic of the true or European plum, *Prunus domestica* subsp. *domestica* (*Zwetsche* in German). The Gro-7 stones closely resemble those of subsp. *domestica* from Alt-Schleswig in northern Germany, illustrated in Behre (1978: fig. 9). There is also a markedly good correspondence between the Groningen and the Alt-Schleswig stones with respect to dimensions and index values (table 2:7).

The stones from Groningen and Alt-Schleswig are distinctly smaller than those of modern subsp. *domestica* cultivars, which are about 30 mm long as against c. 20 mm for the subfossil ones. However, stones of traditional subsp. *domestica* varieties are of about the same size as the archaeological ones, as is demonstrated by the example from Belvoir in eastern France (table 2:7).

4.8. Type Gro-8 (fig. 6)

A small number of stones from sample KL 328 bear a slight resemblance to the Gro-7 stones from the same sample (section 4.7), but there are clear differences in shape. The Gro-8 stones are very slender, pointed at the top and with a narrow base terminating in a point; they are more or less sickle-shaped. The greater slenderness as compared with type Gro-7 finds expression in the lower 100B:L index values: a mean value of 43 as against 58 in Gro-7; there is even no overlap in the 100B:L values (table 2:7,8).

The Gro-8 stones correspond reasonably well with those of yellow/yellow-red/red *Spilling* described and illustrated by Körber-Grohne (1996: p. 170, Plate IVd). The index values of the Gro-8 stones do not differ significantly from those of modern *Spilling* stones from southwestern Germany (table 2:8). Yellow/yellow-red/red *Spilling* belongs to subsp. *domestica* and is distinguished by Körber-Grohne as a separate variety: *Prunus domestica* subsp. *oeconomica* (syn. *domestica*) var. *odorata*.

4.9. Type Gro-9 (fig. 6)

The Gro-9 stones are elliptic in outline, with a blunt to rounded apex and a fairly broad base. The sides are slightly domed, with a median crease which usually does not reach the apex. The stone surface is fairly smooth. As in the Gro-4 stones, the ventral ridge is flanked by a depression on the lateral sides, but in contrast to the Gro-4 stones, the groove on both sides of the ventral ridge is present as well.

The Gro-9 stones match those of plums collected by H. Woldring in southern France (La Croisille) very well, a likeness which also finds expression in the close

similarity of the dimensions and index values of the subfossil and modern stones (table 2:9). The La Croisille plums are obovate to oval in shape, and 30 to 35 mm large (the taste of the flesh and the colour of the skin could not be determined as the fruits were not yet ripe). In addition, the shape of the Gro-9 stones fairly closely resembles that of modern, commercially sold dried plums (prunes) of the variety Prune d'Agen. The latter are larger, c. 25 mm on average, and comparatively flatter than the subfossil stones, which finds expression in a higher mean 100T:B index value (table 2:9).

4.10. Type Gro-10 (fig. 5)

A small number of stones from the two cesspit samples from the Klooster/Rode Weeshuis site are distinguished as a separate type (Gro-10). These stones perfectly match those of a St Julien type plum collected by H. Woldring at several localities in the north of the Netherlands (this is a different kind of St Julien plum from the one mentioned in section 4.3). The stones of this type are ovate in outline, blunt at the apex and rounded at the base. The greatest thickness and also the greatest breadth are below the middle of the stone. A striking feature of the subfossil as well as of the modern stones is the corrosion of the stone surface. Near the apex, a remnant of the original, fairly smooth stone surface is usually still preserved. For dimensions and index values, see table 2:10.

4.11. Type Gro-11 (fig. 7)

The stones of this type are oval to sub-oval in outline, with clearly domed sides. They are blunt to minutely pointed at the apex and blunt to slightly extended at the base. The surface is pitted. The thickened ventral ridge is relatively broad. For dimensions and index values, see table 2:11.

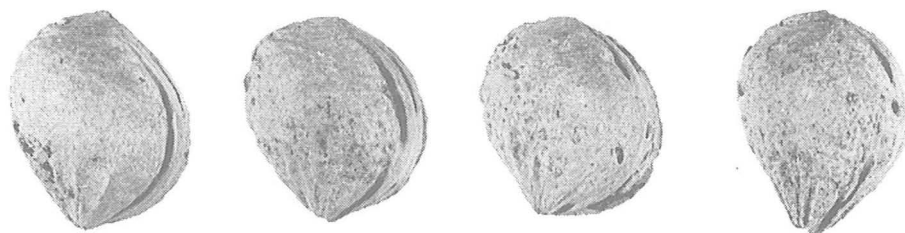
No modern equivalent of this stone type is known to us, nor have we found descriptions of plum-stones which satisfactorily match the Gro-11 stones in the literature either.

4.12. Type Gro-12 (fig. 7)

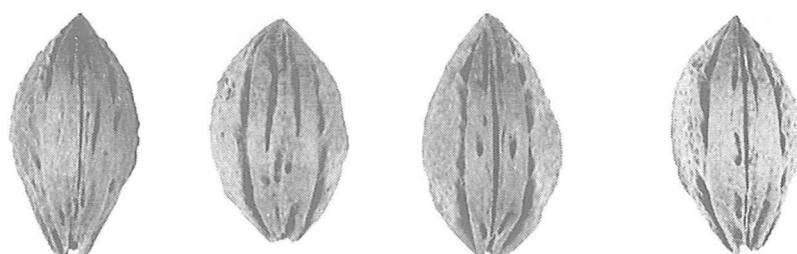
Almost 95% of the plum-stones of sample MKH 639 belong to a separate type labelled Gro-12. Only small numbers of this type were found in other samples. The Gro-12 stones are almost symmetrical in outline with the greatest thickness in the middle. They are pointed at the apex and tapering towards a narrow base. The sides are moderately domed. The surface shows a narrow-meshed pattern of shallow pits. A longitudinal crease, which may extend up to the apex, is observed in the



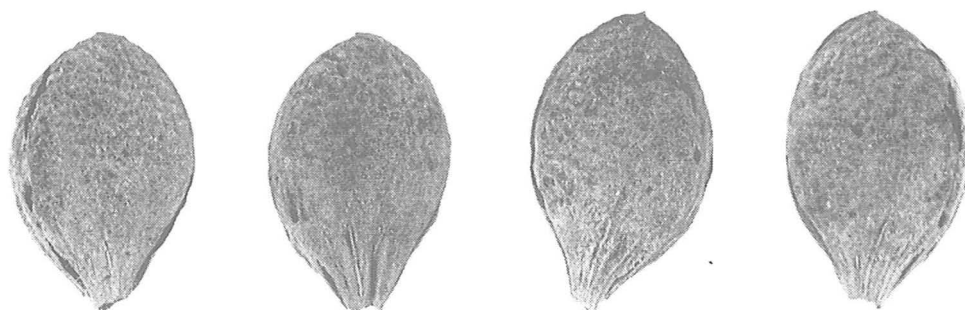
Gro - 1



Gro - 2



Gro - 3



Gro - 4



Fig. 4. Gro-1, MKH 345; Gro-2, KAT 62; Gro-3, MKH 345; Gro-4 MKH 345.

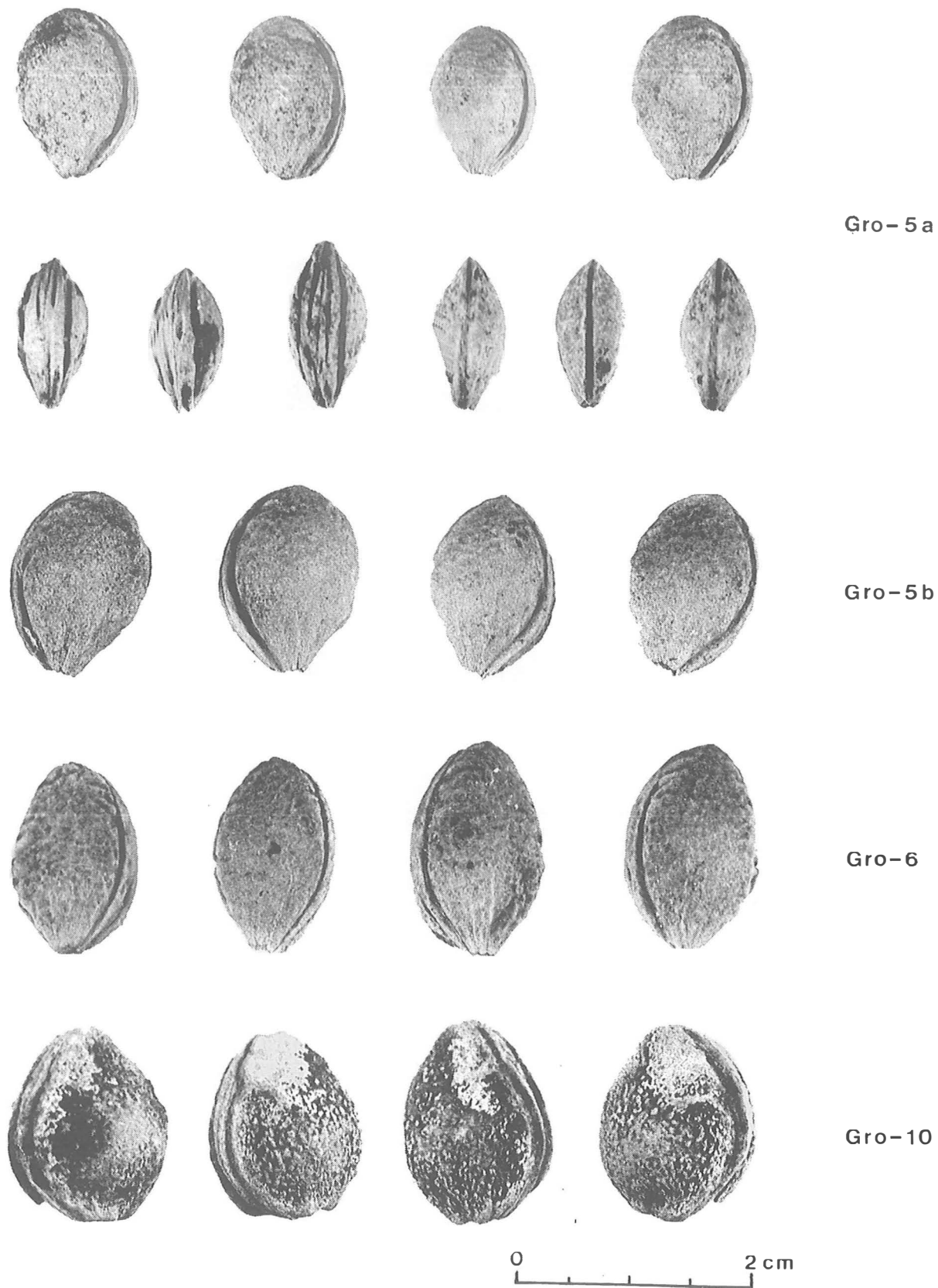
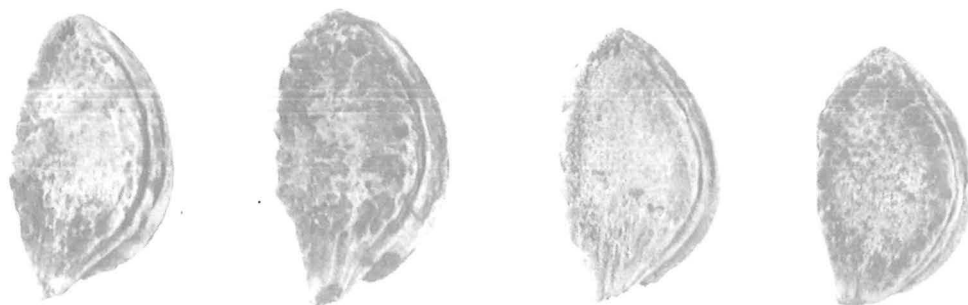
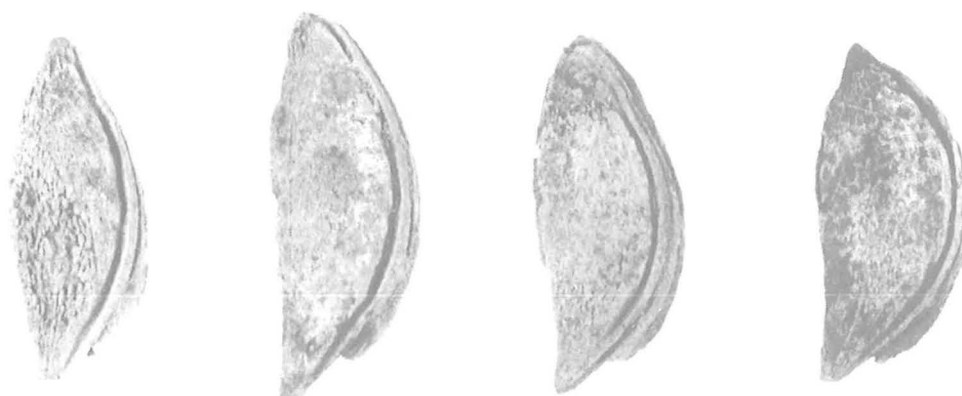
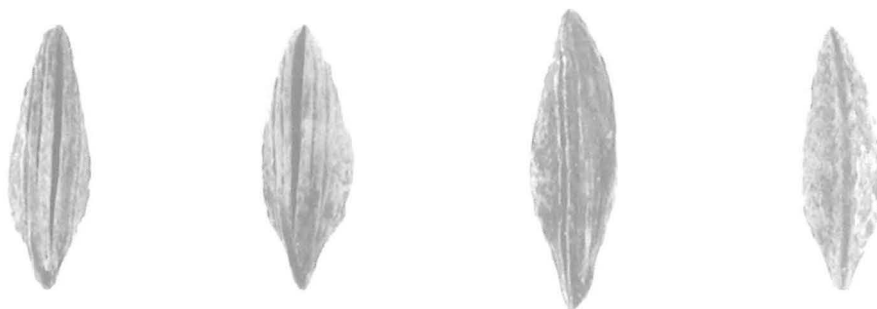


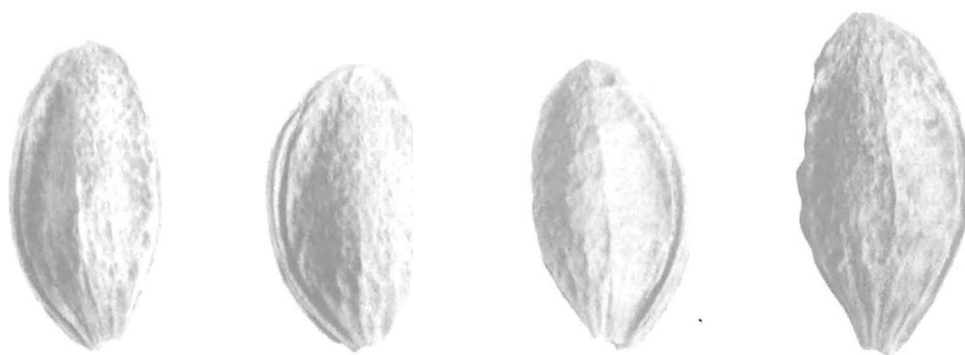
Fig. 5. Gro-5a, MKH 178; Gro-5b, KAT 62; Gro-6, MKH 345; Gro-10, KL 271.



Gro-7



Gro-8



Gro-9



Fig. 6. Gro-7, KL 328; Gro-8, KL 328; Gro-9, KL 271.

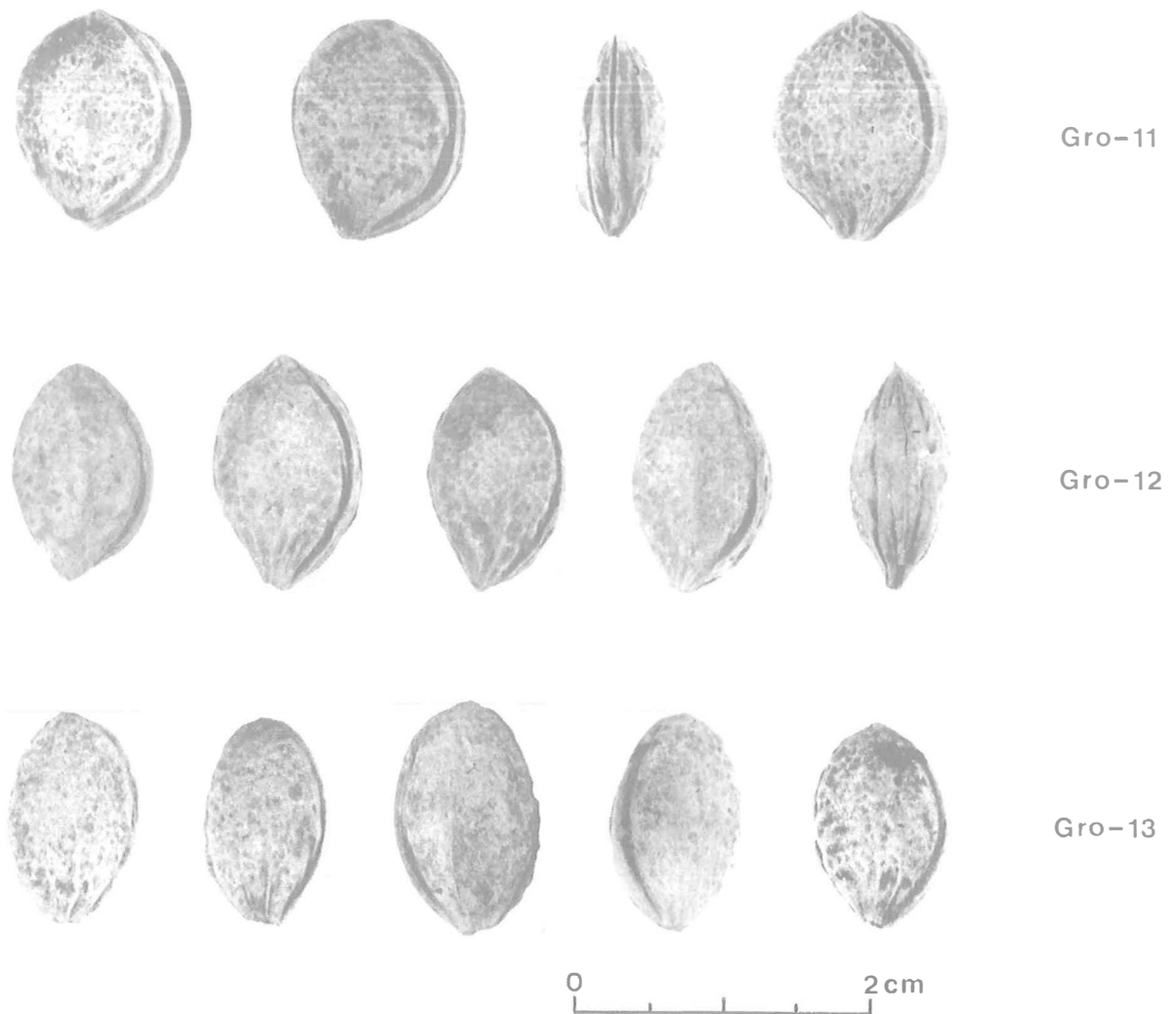


Fig. 7. Gro-11, KL 328; Gro-12, MKH 639; Gro-13, KL 271.

majority of the stones. For dimensions and index values, see table 2:12. No modern equivalent of this stone type is known to us.

4.13. Type Gro-13 (fig. 7)

Sample KL 328 yielded an appreciable number of plum-stones which are indicated here as type Gro-13. After this type had been distinguished as such, small numbers of Gro-13 stones were also recognized in other samples. The stones of this type are elliptic in outline and more or less blunt at the basal and apical ends. The surface shows a narrow-meshed network of shallow pits. The sides are only moderately domed, which finds expression in a relatively low mean 100T:B index value (table 2:13).

The Gro-13 stones match those of a traditional plum variety found in Sellingerbeetse (fig. 3). The fruits of

the latter are oval in shape, blue-skinned and of a reasonably good flavour. The visual resemblance between the modern and subfossil plum-stones is supported by the dimensions and index values (table 2:13). Trees of the same variety are also found in a few other places in the north of the Netherlands: Foxwolde, Schrapsvveen and Hasseberg (fig. 3). It is likely that this plum variety used to be widely cultivated in the north of the Netherlands.

There is a superficial resemblance between the Gro-12 and Gro-13 stones (fig. 7). Moreover, there is a markedly good correspondence with respect to index values (table 2:12,13). However, in comparing the stones of the two types with each other, some clear differences are evident, which justifies the distinction of two separate types.

5. CONCLUDING REMARKS

The results of the examination of plum-stones from Groningen give occasion to the following comments.

Most striking is the large number of different types that could be identified. So far, a similarly great diversity of plum-stone types has not been reported from any other site. This may in part be accounted for by the fact that the Groningen plum-stone material covers a period of about five centuries, which is much longer than at most other sites which yielded appreciable numbers of plum-stones. Only the plum-stones recovered from Alt-Schleswig cover a similarly long period, from the 11th to the 16th/17th century, but here only five different types were distinguished (Behre, 1978). The fact that, in contrast to the other sites, the 18th and early 19th centuries are represented in the Groningen material has also contributed to the total number of stone types identified from this town. However, most of the individual samples presented in table 1 have six and more different types, indicating that a fairly large variety of plums was always consumed in Groningen.

Only a few of the plum-stone types identified from Groningen have been reported from other sites. Our Gro-2 type, corresponding with Behre's (1978) *Formenkreis* A, appears to have been of a variety, or group of closely related sorts, which was cultivated over a large area, from north and central Germany for many hundreds of years (cf. Körber-Grohne, 1996: table 5) up to northern France (Douai: Van Zeist et al., 1994). The true or European plum (our type Gro-7) is represented in a great number of Roman, medieval and post-medieval sites in Germany (cf. Körber-Grohne, 1996: table 7). The occurrence of Gro-8 stones in Groningen is a rather isolated one as other subfossil finds of this stone type, which is attributed to yellow/yellow-red/red *Spilling*, are from southwestern Germany (Körber-Grohne, 1996: pp. 159-163).

The other stone types defined from Groningen have not been recorded from any of the many German sites which yielded appreciable numbers of plum-stones. Some of them may have been of regional significance only. Thus, modern equivalents of the Groningen stone-types Gro-1, Gro-5b, Gro-6 and Gro-13 are still present in the provinces of Groningen and Drenthe, but have not been found elsewhere by H. Woldring. This could indicate that the plum varieties concerned were cultivated in a rather limited area and that perhaps they were locally developed cultivars. Some of the plum varieties found at Groningen probably originated from France. At least, this is suggested by the fact that of our types Gro-3, Gro-4 and Gro-8, modern equivalents are found in France, but not in the north of the Netherlands. It is evident that the virtual absence of subfossil plum-stone finds from France and Belgium makes any suggestion about the spread of plum varieties from southern France in a northward direction highly speculative.

Conclusions on changes in the plum assemblage in

the course of time should be drawn with some reserve. The evidence is largely of incidental nature in that the contents of cesspits may comprise a short period only (one or a few years) and, moreover, may reflect the consumption pattern of one individual family. Table 1 suggests that some sorts of plum were consumed or otherwise used throughout the centuries, for example types Gro-1, Gro-5a and Gro-5b. Others, such as type Gro-3, are absent from the more recent periods, whereas types Gro-8, Gro-10 and Gro-11 were apparently latecomers. Small-fruited plums, with fruits 20 to 25 mm large, appear to have played a prominent role all the time. We do not know to what extent certain sorts of plum were preferred for being eaten fresh or stewed, for being made into jam or jelly, or for the preparation of alcoholic drinks.

It is likely that most of the plums and other sorts of native fruits consumed in Groningen were locally cultivated. A variety of fruit-bearing trees and shrubs would have been grown in (former) monastic gardens and in gardens of well-to-do citizens. In addition fruit was cultivated on a commercial basis, in orchards, which were found inside as well as outside the town wall as is shown on the town maps of Braun and Hogenberg from 1575 and Haubois (c. 1635). Some fruit may have been brought to the market from a greater distance, for instance from the sandy soils south of Groningen extending to the province of Drenthe and/or from relatively high-lying areas in the clay district to the north of the town.

It is tempting to hypothesize that rather small-scale fruit-growing and in particular fruit cultivation in private gardens have contributed to the remarkably large number of plum varieties identified from Groningen.

6. ACKNOWLEDGEMENTS

Rita M. Palfenier-Vegter assisted in the preparation of the publication. The co-operation of J. Buist and F. Vrede (Stichting Monument en Materiaal, Groningen) is gratefully acknowledged. G. Delger prepared the illustrations. The authors are much indebted to J.R.A. Greig (Birmingham) for correcting the English text and for his comments on the manuscript.

7. REFERENCES

- BAAS, J., 1971. Pflanzenreste aus römischen Siedlungen von Mainz-Weisenau und Mainz-Innenstadt und ihr Zusammenhang mit Pflanzen-Funden aus der vor- und frühgeschichtlichen Stationen Mitteleuropas. *Saalburg-Jahrbuch* 28, pp. 61-87.
- BAAS, J., 1974. Kultur- und Wildpflanzenreste aus einem römischen Brunnen von Rottweil-Alstadt. *Fundberichte aus Baden-Württemberg* 1, pp. 373-416.
- BEHRE, K.-E., 1978. Formenkreise von *Prunus domestica* L. von der Wikingerzeit bis in die frühe Neuzeit nach Fruchtsteinen aus Haithabu und Alt-Schleswig. *Berichte der Deutschen Botanischen Gesellschaft* 91, pp. 161-179.

- CARMIGGELT, A. & H. VANGANGELEN, 1988. De beerkuil. In: P.H. Broekhuizen, A. Carmiggelt, H. van Gangelen & G.L.G.A. Kortekaas (eds), *Kattendiep Deurgraven. Historisch-archeologisch onderzoek aan de noordzijde van het Gedempte Kattendiep te Groningen*. Stichting Monument en Materiaal, Groningen, pp. 123-143.
- KNOOP, J.H., c. 1750. *Fructologia, of Beschryving der Vrughtbomen en Vruchten die men in de hoven plant en onderhout*. A. Ferwerda & G. Tresling, Leeuwarden.
- KNÖRZER, K.-H., 1971. Die bisherigen Obstfunde aus der frühmittelalterlichen Niederungsburg bei Haus Meer. *Schriftenreihe des Kreises Grevenbroich* 8, pp. 131-186.
- KÖRBER-GROHNE, U., 1996. *Pflaumen, Kirschpflaumen, Schlehen. Heutige Pflanzen und ihre Geschichte seit der Frühzeit*. Konrad Theiss Verlag, Stuttgart.
- KORTEKAAS, G.L.G.A. & H.T. Waterbolk, 1992. De opgraving. In: P.H. Broekhuizen, H. van Gangelen, K. Helfrich, G.L.G.A. Kortekaas, R.H. Alma & H.T. Waterbolk (eds), *Van boerenerf tot bibliotheek. Historisch, bouwhistorisch en archeologisch onderzoek van het voormalig Wolters-Noordhoff-Complex te Groningen*. Stichting Monument en Materiaal, Groningen, pp. 181-234.
- KROLL, H., 1980. Mittelalterlich/frühneuzeitliches Steinobst aus Lübeck. *Lübecker Schriften zur Archäologie und Kulturgeschichte* 3, pp. 167-173.
- LANGE, E., 1988. Obstreste aus dem Zisterzienserkloster Seehausen, Kreis Prenzlau. *Gleditschia* 16, pp. 3-24.
- ROACH, F.A. 1985. *Cultivated fruits in Britain, their origin and history*. Blackwell, Oxford.
- RÖDER, K., 1940. Sortenkundliche Untersuchungen an *Prunus domestica*. *Kühn-Archiv* 54, pp. 1-132.
- SCHONEVELD, J., 1990. De opgravingen aan het Martiniekerkhof. In: J.W. Boersma, J.F.J. van den Broek & G.J.D. Offerman (eds), *Groningen 1040. Archeologie en oudste geschiedenis van de stad Groningen*. Uitgeverij Profiel, Bedum, pp. 237-274.
- SIMMONS, A.F. 1978. *Simmons' manual of fruit; tree, bush, cane and other varieties*. David & Charles, Newton Abbot.
- ZEIST, W. VAN, 1988. Zaden en vruchten uit een zestiende-eeuwse beerkuil. In: P.H. Broekhuizen, A. Carmiggelt, H. van Gangelen & G.L.G.A. Kortekaas (eds), *Kattendiep Deurgraven. Historisch-archeologisch onderzoek aan de noordzijde van het Gedempte Kattendiep te Groningen*. Stichting Monument en Materiaal, Groningen, pp. 144-160.
- ZEIST, W. VAN, 1992. Cultuurgewassen en wilde planten. In: P.H. Broekhuizen, H. van Gangelen, K. Helfrich, G.L.G.A. Kortekaas, R.H. Alma & H.T. Waterbolk (eds), *Van boerenerf tot bibliotheek. Historisch, bouwhistorisch en archeologisch onderzoek van het voormalig Wolters-Noordhoff-Complex te Groningen*. Stichting Monument en Materiaal, Groningen, pp. 525-535.
- ZEIST, W. VAN, H. WOLDRING & R. NEEF, 1994. Plant husbandry and vegetation of early medieval Douai, northern France. *Vegetation History and Archaeology* 3, pp. 191-218.