



**Revue Archéologique de Picardie**

N° spécial 28 -2011

# **Le Néolithique du nord de la France dans son contexte européen**

**Habitat et économie aux 4<sup>e</sup> et 3<sup>e</sup>  
millénaires avant notre ère**

**Actes du 29<sup>e</sup> Colloque interrégional  
sur le Néolithique  
Villeneuve d'Ascq, 2 - 3 octobre 2009**

*Sous la direction de  
Françoise Bostyn, Emmanuelle Martial & Ivan Praud*

## AN OUTLINE OF THE SUBSISTENCE OF THE VLAARDINGEN CULTURE FROM THE NETHERLANDS

Otto BRINKKEMPER, Erik DRENTH & Jørn T. ZEILER

### INTRODUCTION

Today dozens of settlements of the Vlaardingen culture or group (further abbreviated as VL) are known from the Netherlands. Due to good preservation conditions the excavation of several of these sites has yielded numerous animal bones and botanical remains. The present article discusses what can be inferred from these archaeo-biological remains about the VL subsistence. It considers not only primary products, such as meat, but also includes a brief discussion of the extent to which animals were bred or hunted for secondary products, such as milk, traction and raw materials. Another point at issue is what the archaeobotanical and -zoological data tell us about the nature of the habitation. Are they, in other words, indicative of seasonal or permanent occupation, i.e. occupation by a social group of some kind through part or all of the year?

The sources used in this article are either borrowed from the literature or based upon our own research. The references to them can be found in tables I-IV. Not included in our investigations is a recently investigated VL site at Hazerswoude-Rijndijk, which has produced thousands of animal bones and botanical remains. At the time when this article was written, the reports on these ecofacts had not yet been concluded.

The present paper is a revised English version of a recent publication in Dutch (BRINKKEMPER *et al.* 2010). Of its kind it is not the first overview, as several researchers have given outlines of the VL before (*e.g.* BAKELS & ZEILER 2005), whilst Louwe Kooijmans, in particular (*e.g.* 1993), has made an attempt to interpret the archaeobotanical and -zoological remains in terms of settlement differentiation.

### THE VL: ITS DISTRIBUTION IN TIME AND SPACE

The VL is considered here as a separate archaeological culture, whose distribution within the Netherlands covers both the Western Coastal region

and the Central River district (fig. 1). Both areas have, generally speaking, depositional conditions (a relatively high rate of sedimentation and high ground water tables) that favour the survival of archaeobotanical and -zoological remains. To the North of the VL the « territory » of the more or less contemporary West group of the Funnel Beaker Culture (usually abbreviated as TRB, as the Dutch and German terms are *Trechterbekercultuur* and *Trichterbecherkultur*, respectively) is found, while in the South the Stein group borders the VL (fig. 2). Though LOUWE KOOIJMANS (1983) has rightly pointed out the close resemblances in material culture of the VL and the Stein group, there are nonetheless differences between the two. In our opinion these dissimilarities are reason enough to distinguish the VL and Stein group as two separate archaeological entities (VAN GIJN & BAKKER 2005 ; DRENTH *et al.* 2007, p. 121-122; BRINKKEMPER *et al.* 2010, p. 27-29). Whatever stance is held, it does not affect the present article, since the sites of the Stein group as depicted on fig. 1 have produced practically no archaeobotanical and -zoological remains.

With regard to figure 1, it should be noted that the sites have been plotted on a palaeogeographical map compiled by VOS & KIDEN (2005) for the Netherlands around 2750 BC. Needless to say that such a reconstruction is coarse-meshed due to its scale and because it displays only one moment in time. Nevertheless it gives a general idea of the situation at the beginning of the third millennium BC and supposedly the end of the fourth millennium BC, showing how the environment differed from the present-day one.

There is not only disagreement about the demarcation of the VL in space but also in time. It is beyond doubt that, in the course of time, the VL was totally absorbed by the Beaker cultures. But various views are held as to when this process was completed. One opinion is that the completion had already taken place during the Single Grave culture (SGC), that is in the second quarter of the third millennium BC, most probably around 2650/2550 BC (DRENTH *et al.* 2008). This idea of incorporation

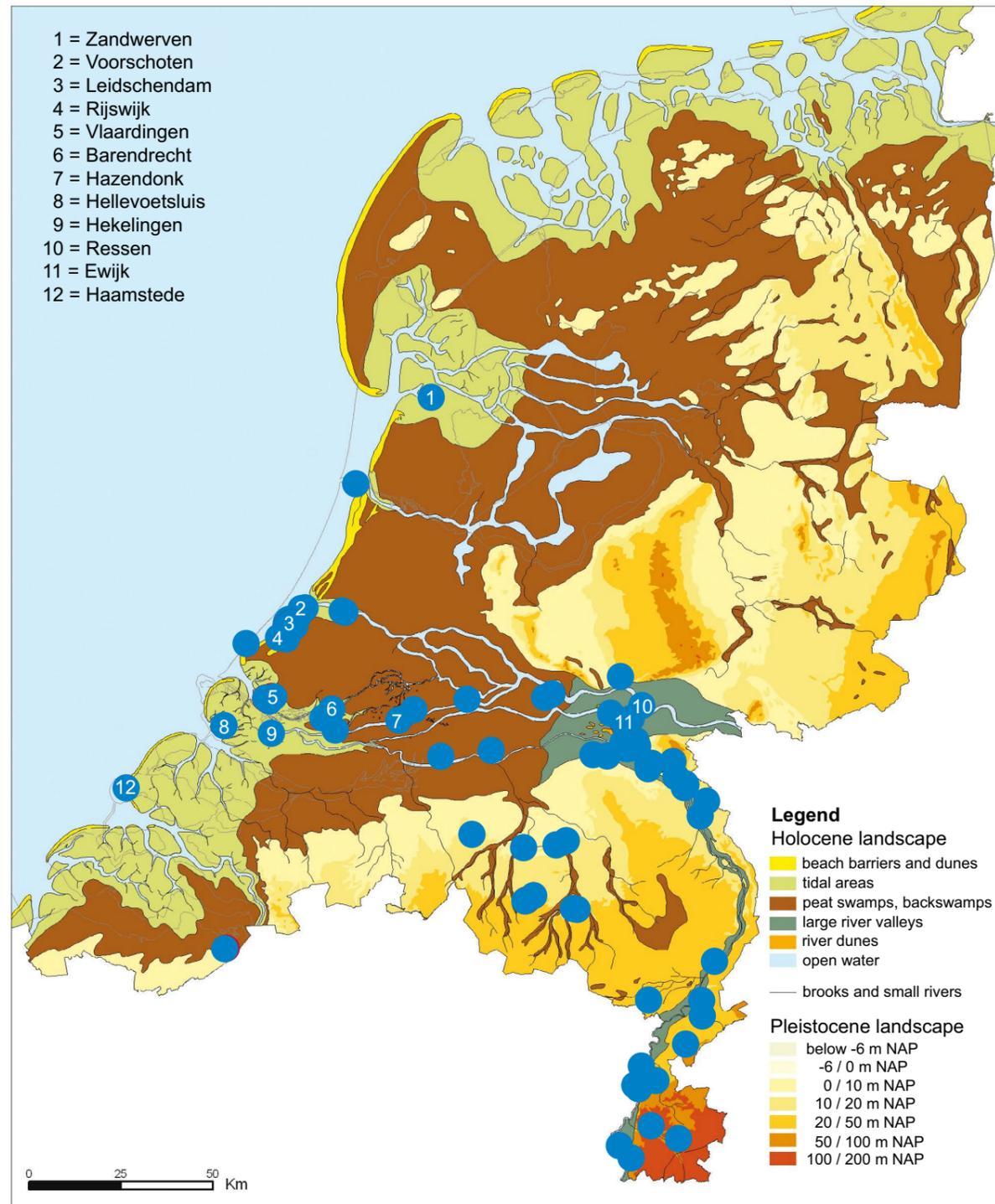


Fig. 1 - Distribution of (possible) settlements of the Vlaardingeng culture and Stein group, plotted on a palaeographical map by Vos & Kiden (2005), showing the situation around c. 2750 BC. For the sake of clarity, a dot can represent more than one site. Sources : Archis, the national archaeological database, and literature. NAP = Dutch Ordnance Datum. Locations mentioned in the text are indicated by numbers.

is adhered to in the present article. Accordingly, we refrain from distinguishing a late VL phase, which is characterised by late SGC pottery, as inter alii Louwe Kooijmans (1976) and Lanting & Van der Plicht (1999/2000, p. 32-34) have done, labelling this phase VL 2b. The discord about when the VL ended is part

of an ongoing debate about the internal chronology of the VL, which first and foremost rests on pottery. Originally, a two-fold division was made : VL 1 and VL 2 (Glasbergen *et al.* 1967a; 1967b). A refinement was subsequently made by Louwe Kooijmans (1976, p. 279-289). Both VL 1 and 2 were divided into two

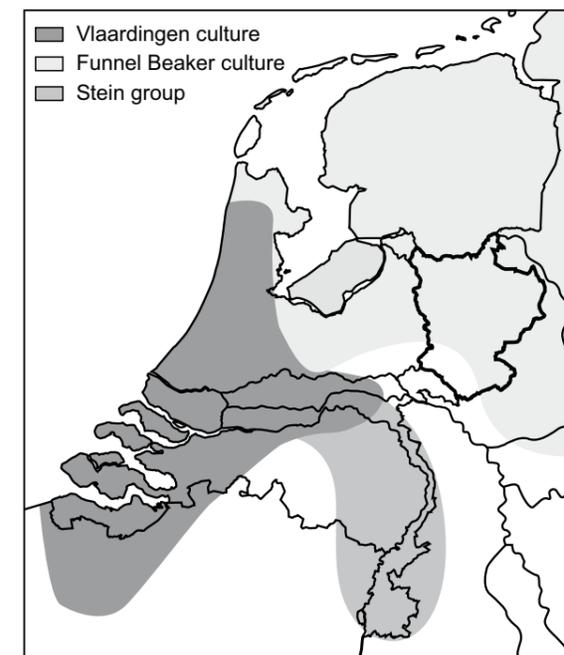


Fig. 2 - Distribution of the VL, Stein group and the TRB in the Netherlands and the adjacent regions (after Van Gijn & Bakker 2005).

subphases. Lanting & Van der Plicht (1999/2000, esp. 32-34) have postulated a somewhat different chronological scheme in which VL 1 has three subphases (1a-c), since Louwe Kooijmans' phase 1b has been split. Very recently Beckerman & Raemaekers (2009) have proposed a chronological subdivision into an early, middle and late phase.

In view of the disagreement about the VL chronology we use here a simple subdivision of an early and a late phase. The early phase includes the phases VL 1a, 1b and 1c, as distinguished by Louwe Kooijmans and Lanting & Van der Plicht whereas our late phase equals VL 2a according to the definition of the aforementioned scholars. It remains to be seen when exactly the VL started. In any case this must have been at some time in the second half of the fourth millennium BC (for example Lanting & Van der Plicht 1999/2000, 28, p. 32-33). Although the final date of the early VL, as used here, is also unknown, it must be after 2800 BC. The late VL, as we define it, falls within the second quarter of the third millennium BC, although a start 50 years earlier cannot be completely ruled out. Around 2650/2550 BC the incorporation of the VL into SGC was completed, thereby marking the end of the former culture.

In conclusion, the present article sees the VL as an archaeological culture, whose onset must be sought some time in the second half of the fourth millennium BC and its end in the second quarter of the third millennium BC (most probably around 2650/2550 BC). Within the Netherlands its distribution encompasses in essence the Western

Coastal district and the Central River district. The next section will briefly elucidate the main environmental settings that the VL inhabited within these two regions.

LANDSCAPE

Physical geographical explorations into the abiotic environment of VL settlements have demonstrated a varying site location. A considerable number of settlements are situated on levees of creeks and rivers, such as those at Vlaardingen, Hekelingen and Barendrecht-Zuidpolder (Vlaardingen : Van Regteren Altena *et al.* 1962, p. 23-28; Hekelingen I : Bennema 1953 ; Hekelingen III : Louwe Kooijmans 1986, p. 13, 15; Barendrecht-Zuidpolder : Houkes *et al.* in press). River dunes were also inhabited, e.g. the Hazendonk (donk = river dune) at Molenaarsgraaf (Louwe Kooijmans 1974). In all these cases, elevated locations in an extended fresh-water swamp behind the coastal dunes were chosen. True coastal sites are those at Haamstede-Brabers, Leidschendam-Prinsenhof, Rijswijk and Voorschoten. These are situated on dunes that were deposited upon beach barriers (Haamstede-Brabers : Verhart 1992, p. 75 ; Leidschendam-Prinsenhof : Glasbergen *et al.* 1967b, p. 98-99 ; Voorschoten-Boschgeest : Glasbergen *et al.* 1967a, 7; Rijswijk : Kootker & Van Dijk in press). Apart from these, a VL settlement on a ridge in a salt marsh has been excavated at Hellevoetsluis-Ossenhoek (Goossens 2009). An example of a VL site in a salt- to brackish-water environment has been investigated at Zandwerven (Drenth & Lanting 1997, p. 56). This settlement was probably located on a sand dune. Finally, the settlement site in Ewijk-Ewijkse Veld occurs in the Central Dutch River area, on a levee (Janssen 1989, p. 135).

Information related to the biotic landscape of VL sites is mainly derived from palynological studies. Next to pollen, botanical macroremains, wood and faunal remains provide information about the environment. Palynological data is available from the Hazendonk, Hekelingen, Leidschendam-Prinsenhof, Vlaardingen and Voorschoten sites (Van der Woude 1983 ; Florschütz 1953 ; Groenman-van Waateringe *et al.* 1968 ; Van Regteren Altena *et al.* 1963 ; Groenman-van Waateringe *et al.* 1968). In all instances, alder dominates the tree pollen spectra. The sites must have been situated in a generally wet environment. On the higher parts of the landscape, oak occurred as the dominant tree. During habitation phases, these drier forests seem especially to have been affected by deforestation, most possibly by man. Anthropogenic indicators (cereal-type, crop weeds, and others) often increase during phases of habitation recorded in the different pollen diagrams.

Waterlogged botanical macroremains provide the most reliable information on the near surroundings

of the settlements. Where such remains are available in adequate numbers (Hazendonk and Hekelingen), they substantiate the picture of the wet environment that showed up in the palynological studies. Most of the excavated VL sites are situated in a landscape dominated by alder carr and eutrophic, fresh-water marshes. BAKELS (1986, 1) summarised this environment as follows : « ... punctiform river dunes to ribbon-shaped levees and stream ridges constituted drier elements in an otherwise swampy landscape ».

**THE SUBSISTENCE FROM AN ARCHAEOBOTANICAL PERSPECTIVE**

In order to gain insight into the subsistence, and thereby possibly into the VL settlement system information from settlements excavated so far has been gathered together (tab. I). Data for eleven different sites are available (for references, see tab. I). From several other sites only a few samples have been analysed. For example, both from Ressen-Zuiderveld West (VAN HAASTER in VAN DEN BROEKE 2002) and Rijswijk-de Schilp (KOOISTRA 2006), two samples from VL context were assessed, but not selected for full analysis on the basis of the poor preservation. From the three sites excavated in Rijswijk, only from Schaapweg were (two) samples analysed.

The small dataset only allows us sketch a broad picture of the plant part of the subsistence. This is among others things due to the fact that, even in the sites that are investigated, usually per site only a limited number of samples have been analysed and published. Relatively positive exceptions are the Hazendonk and Barendrecht-Zuidpolder sites with twelve and ten investigated samples, respectively; we can speak of a reasonable amount of information here. In the case of Hekelingen III, the settlements were intensively sampled and analysed, but the analyses of only a few samples have been published in a preliminary publication (BAKELS 1988).

Not only is the archaeobotanical knowledge about the VL determined by the state of publication, but also by research tradition. To give an example, the dwelling sites at Vlaarding and Zandwerven were excavated in the 1960s, when it was not yet customary to collect and analyse larger number of samples. Moreover, not all publications present the same level of information. Botanical material from Voorschoten- de Donk and Ewijk-Ewijkse Veld have been briefly mentioned in the archaeological publications in question, but it can be questioned whether all available data are published.

The settlement of Hellevoetsluis-Ossenhoek, excavated in the present framework of "Malta-archaeology" shows that the state of affairs is also a matter of finances. Despite the availability of eight

samples for archaeobotanical analyses, only four have, in the end, been analysed. The allocation of finances can be questioned here, as not less than 185 sieved residues from excavated squares have been studied. The mesh width of these latter residues is not mentioned, but the remains found suggest a minimum of 2 x 2 mm. Chaff remains are generally smaller, and they could have passed the sieves unseen. Analysis of the four de-selected samples might have provided more information than just another sample with some carbonised naked barley grains.

With the exception of the hardly studied sites of Voorschoten and Ewijk-Ewijkse Veld, all sites have yielded cereal remains. It is remarkable that the relatively well-studied settlement at Barendrecht has only yielded one single cereal grain, which belonged to naked barley. The remaining sites steadily produced a combination of naked barley and emmer wheat. In an archaeobotanical overview for the Netherlands VAN ZEIST (1968, p. 58) has mentioned the presence of hulled barley for Vlaarding, noting the presence of two asymmetrical grains as being indicative of this form of barley. But asymmetrical grains occur both in hulled and in naked barley. In the same treatise Van Zeist draws attention to a considerable number of similarly asymmetrical grains coming from the VL settlement of Zandwerven, which he nota bene assigns to naked barley. It is obvious that Van Zeist's determination of the two asymmetrical grains from Vlaarding is highly questionable, all the more so since other Dutch Neolithic sites have yet to produce remains of hulled barley.

The proportion of naked barley and emmer wheat varies between the sites. In most cases, barley predominates, but emmer wheat is more common at Vlaarding and Hellevoetsluis-Ossenhoek. Of the two, emmer is much more demanding with respect to soil fertility. It is also much more sensitive to saline conditions (BOTTEMA *et al.* 1980; VAN ZEIST *et al.* 1976). Barley on the other hand is a more suitable crop for wet environments (KÖRBER-GROHNE 1987, p. 46 ; BRINKKEMPER 1993, p. 125). However, the environmental situation at Vlaarding and Hellevoetsluis, both located close to the Dutch coast, makes it unlikely that the circumstances were less saline than at e.g. Hazendonk and Hekelingen. At the moment, the dominance of emmer wheat in the two aforementioned sites is therefore a riddle. This is particularly curious since, in an archaeobotanical study of Early and Middle Neolithic wetland sites from the Netherlands, OUT (2009, p. 421) has observed a positive correlation between the dominance of barley and a large saline influence.

Apart from naked barley and emmer wheat, grains of unidentifiable cereals have been discovered here and there. These are supposedly derived from

	Ewijk-Ewijkse Veld: early VL	Hazendonk: early VL	Hekelingen III "phase 1": early VL	Hellevoetsluis-Ossenhoek: in any case early VL	Vlaarding (Louwe Kooijmans' phase 1a): early VL	Vlaarding (Louwe Kooijmans' phase 1b): early VL	Zandwerven: early VL	Barendrecht-Zuidpolder: late VL	Hekelingen III "phase 2": VL phase unknown	Rijswijk-Schaapweg: VL phase unknown	Voorschoten-de Donk: VL phase unknown
<b>Number of samples</b>	2	12	5	4+185	1	3	3	10	5	2	1
<b>Cereals</b>											
Naked barley ( <i>Hordeum vulgare</i> var. <i>nudum</i> )	-	22	1	8+18	-	4*	17	1	31	-	-
Barley rachis internode ( <i>Hordeum vulgare</i> )	-	2	-	3	-	-	-	-	6	-	-
Emmer wheat ( <i>Triticum dicoccon</i> )	-	4	1	55+48	-	21	95	-	3	-	-
Emmer wheat chaff ( <i>Triticum dicoccon</i> )	-	-	2	65+3	-	-	1	-	3	2	-
Einkorn type chaff ( <i>Triticum monococcum</i> type)	-	-	-	-	-	-	-	-	-	1	-
Bread wheat ( <i>Triticum aestivum</i> )	-	-	-	-	-	199	-	-	-	-	-
Wheat ( <i>Triticum spec.</i> )	-	1	-	-	-	65	-	-	-	-	-
Wheat chaff ( <i>Triticum spec.</i> )	-	2	-	-	-	-	-	-	-	-	-
Oats ( <i>Avena spec.</i> )	-	-	-	-	-	1	-	-	-	-	-
Cereals (Cerealia indet.) (weight in grams)	-	-	-	-	-	1,55	-	-	-	-	-
<b>Oil-rich seeds</b>											
Linseed ( <i>Linum usitatissimum</i> )	-	-	-	-	-	-	-	-	1	-	-
Opium poppy ( <i>Papaver somniferum</i> subsp. <i>setigerum</i> )	-	-	-	-	-	+	-	-	-	-	-
<b>Edible wild plants</b>											
Hazelnut ( <i>Corylus avellana</i> )	-	20	45	25+301	-	+	+	-	32	-	1
Hawthorn ( <i>Crataegus monogyna</i> )	+?	4	-	-	-	-	-	1?	-	-	-
Wild Apple ( <i>Malus sylvestris</i> )	-	-	-	-	-	-	-	-	1	-	-
Sloe ( <i>Prunus spinosa</i> )	-	12	4	15+248	-	-	-	-	3	-	-
Dogwood ( <i>Cornus sanguinea</i> )	+	11	-	1+5	-	-	-	-	1	-	-
Acorn ( <i>Quercus spec.</i> )	-	49	-	-	-	-	-	-	2	-	-
Lesser celandine tubers ( <i>Ficaria verna</i> )	-	-	-	-	-	-	-	-	2	-	-
Dog rose ( <i>Rosa canina</i> )	-	-	-	-	-	+	-	-	-	-	-
Dewberry ( <i>Rubus caesius</i> )	-	-	-	-	-	-	2	-	-	-	-
Blackberry ( <i>Rubus fruticosus</i> s.l.)	+	21	-	-	-	-	-	-	-	1	-
Elder ( <i>Sambucus nigra</i> )	+?	2	1	-	-	-	-	-	2	-	-
Water chestnut ( <i>Trapa natans</i> )	-	-	-	-	-	-	-	-	2	-	-

**Tab. I** - Crops and edible wild plants from VL settlements, with a further chronological indication. For Hellevoetsluis-Ossenhoek, numbers from samples and from 2 x 2 mm hand-sorted sieve residues are reported. All the remains were charred fruits or seeds unless otherwise indicated ; \* : see text. References : Barendrecht-Zuidpolder : BAKELS, in press ; Ewijk-Ewijkse Veld : JANSSEN 1989 ; Hazendonk : OUT 2009 ; Hekelingen III : BAKELS 1988 ; Hellevoetsluis-Ossenhoek : KOOISTRA 2009 ; Rijswijk-Schaapweg : KOOISTRA 2006 ; Vlaarding : VAN ZEIST 1968 and OUT 2009 ; Voorschoten-de Donk : VAN VEEN 1989 ; Zandwerven : VAN ZEIST 1968.

one of the two species. One carbonised grain of oats has been attested for the Vlaarding site. Owing to the absence of chaff remains, it cannot be ascertained whether this grain is from cultivated or wild oats. Since cultivated oats has not been demonstrated in the Netherlands with certainty before the Iron Age, it presumably is the wild crop weed here. With regard to the crop plants, mention should moreover be made of a single seed of linseed/flax that was recovered at Hekelingen III. Finally, one seed of opium poppy comes from Vlaarding.

An extensive analysis of (potential) crop weeds may shed some further light on the question whether crops were imported or cultivated locally. In the relatively well-studied site at Hazendonk, some wild plant species that are considered today as crop weeds occur commonly. These are redshank, pale persicaria, fat hen and fig-leaved goosefoot. Less frequent are black bindweed, chickweed and black nightshade. These species are ecologically rather unspecific, so information about the location of arable fields cannot be inferred and besides,



Fig. 3 - Ard marks dated to the VL from Hellevoetsluis-Ossenhoek (after GOOSSENS 2009).

some might well have grown in and around the settlement.

On the basis of only a single carbonised cereal grain found in ten samples from Barendrecht-Zuidpolder, Bakels (in press) assumes that this was not an « agricultural settlement ». However, since hardly any carbonised botanical macroremains have been found here at all (but lots of waterlogged ones), it remains in our opinion to be seen whether this far reaching conclusion can be drawn.

It is very possible that the VL inhabitants worked the soil of their arable fields by means of an ard, as ard marks have been found at Hellevoetsluis-Ossenhoek (fig. 3). Up to now, this is the only unequivocal example of ard marks for the VL. One should in this respect bear in mind that ard marks survive only occasionally and are difficult to date (DRENTH & LANTING 1997, p. 59).

The wild plant community may well have contributed to the provisioning of human food, too. Nuts from hazel and fruits from sloe appear to have provided the largest contribution, as evidenced by the number of retrieved remains. The large number of acorns found at the Hazendonk site most likely derived from trees in the direct surroundings, since immature, uncarbonised cupules have been discovered, sometimes with the acorns still attached. Since these remains are inedible for human beings, they must have dispersed naturally, and thus point to the local presence of oak trees (OUT 2009, p. 50 in appendix 3). In contrast, mature acorns are edible, but they need to be roasted to remove the poisonous tannin. Carbonised acorns are therefore most probably related to consumption, but for waterlogged acorns this needs not to be the case. Because the acorns and cupules at Hazendonk are mainly waterlogged and some of them are immature, they need not necessarily have been collected as food.

Dogwood and hawthorn, which both have edible fruits, wild apple, berries of (dog) rose, blackberries and dewberries, will all undoubtedly have been eaten as well. But in view of their scarce occurrences, they cannot be considered as staple food plants. OUT (2009, 363) argues that all collected fruits in Middle and Late Neolithic are from local provenances. Nowhere have species been found that cannot have grown locally.

In comparison to Late Mesolithic and Early Neolithic sites in the Netherlands, the remains of water chestnut and lesser celandine (both suitable for consumption) occur rarely in VL settlements (cf. OUT 2010, p. 442). The absence of water chestnut will have a natural cause. This thermophilous species will hardly have been available after the end of the warmer Atlantic period, i.e. around 3800 BC, having therefore largely disappeared before the start of the VL.

The amount of archaeobotanical information from VL sites is so limited that it is impossible to discern diachronous trends. Yet, seen from a long-term perspective a trend emerges. In the course of the Neolithic the proportion of wild plants decreased (OUT 2009, p. 361-363). Accordingly, the share of edible wild plants within the assemblage of carbonised botanical remains is smaller at VL times than during the preceding Swifterbant culture and Hazendonk group. Out argued that this difference is not caused by the number of samples investigated, the dimensions of the find layers and/or the function of sites. Out's explanation is a shift within the subsistence, although she admits that environmental changes in the landscape due to intensifying use might have affected availability adversely.

#### THE SUBSISTENCE FROM AN ARCHAEOZOOLOGICAL PERSPECTIVE

There is archaeozoological data from about a dozen settlements (tab. II-IV with references) which can be used to reconstruct the VL subsistence. However, such a reconstruction is hampered in several respects. Firstly, the sites under consideration have not been excavated in the same way. This implies that a simple one-to-one comparison of data is out of the question. In particular, in the case of the early investigations no sieving was carried out; instead bones were only collected manually. Small mammals, birds and fish are therefore absent or strongly underrepresented. Needless to say the consequences of this may be significant; the absence of fish remains on a site does not mean that fishing played no role in subsistence.

A second obstacle in the comparison of data is that in several studies, once again in particular the ones of early date, only the number of bones is given. In other words, their weight is not mentioned,

whereas this is a better indicator of the meat a species yields than the number of bones, since weight is a variable which is not affected by the degree of bone fragmentation.

Apart from shedding light on meat consumption, faunal remains can be informative about secondary products, that are animal products other than meat, such as bone for tools, hides and furs, milk and traction. The representation of the different skeletal elements may be indicative in this respect, as shown by the remains of brown bear. In most cases only lower limb bones and skulls have been discovered at VL settlements, indicating that as a rule brown bears were skinned outside the dwelling places (ZEILER 2010). It further transpires that these animals were hunted for their fur rather than for their meat. As far as bone and antler tools are concerned, it is a well-known fact that a broad spectrum of implements was manufactured from these raw materials. Illustrative of this are awls, spatulae and axes (VAN GIJN & BAKKER 2005, p. 294-296). The frequencies of worked bones from wild and domestic mammals seem to correspond to the overall bone frequencies. At Hekelingen III, where hunting played an important role in the subsistence, the majority of the bone tools come from wild animals, especially red deer and roe deer. At Hellevoetsluis-Ossenhoek, where hunting was less important, most tools are made of domestic animal bones.

The state of affairs is such that at least at one VL site ard marks have come to light, namely at Hellevoetsluis-Ossenhoek (fig. 3). Presumably cattle was used for traction (see in this connection PÉTREQUIN *et al.* 2006). To what extent cattle were bred by the VL for milk production remains to be seen. The age profiles give no indications in this respect. At all sites, the numbers of remains of young calves are quite low; the majority was slaughtered at a later age, from their second-third year onwards. This points rather to meat production and the use for traction than to milk production. However, recent (chemical) research shows that milk was already produced in Neolithic societies in Great Britain and France (BALASSE & TRESSET 2002; COPLEY *et al.* 2003). So far such investigations have not been carried out for the VL-sites. Noteworthy in this context is the lack of evidence for substantial wool production, as remains of sheep/goats are practically absent in the VL fauna assemblages.

Hunting and fishing seem to have been important in the fresh-water marshes. In terms of weight the mammal bones from the various settlements at Hekelingen III mainly (49-65 %) derive from wild mammals, especially red deer. A similar observation has been made for Vlaarding. About two-thirds of the identified mammal bones are from wild species, with red deer and wild boar dominating. In the faunal remains from the Hazendonk, again,

wild mammals clearly preponderate (ZEILER 1997). Next to beaver and wild boar, red deer dominates in the early VL (Louwe Kooijmans' phase VL 1b). Cut marks indicate that beavers, otter and wildcat were hunted not only for their furs but also for their meat. The picture emerging for Barendrecht-Zuidpolder is slightly different (ZEILER 2000). The larger part of the bones, in terms of weight, stems from domestic animals, with cattle especially important. It should be borne in mind, however, that the small number of faunal remains may distort the picture. Be this as it may, there can be no doubt that also in this instance the hunting of wild mammals was of importance. By contrast, fowling seems to have no significant economic meaning. Even where the bones were retrieved by sieving, the number of bird bones is low. It should be mentioned, though, that among the bird remains are those of species that strike the eye. At Vlaarding the bones of the Dalmatian pelican were recovered. This bird does not live wild any more in the Netherlands. Bones of the eagle owl come from Hazendonk. After a long period of absence this bird species nowadays breeds again on Dutch territory.

Another source of protein was provided by cattle breeding. The VL stock mainly encompassed cattle and pigs. As mentioned before, sheep and goats were bred only in small numbers. The wetlands in which VL inhabitants lived do not favour either species. Both are very susceptible to infection by the liver fluke. This parasite, living in fresh-water environments, can cause severe liver damage, often resulting in death.

Fishing procured a number of fresh-water and catadromous species (tab. III). True saltwater fishes, such as herring, are present as well. Bones of sturgeon are known from all the VL settlements discussed. Its popularity is also clear from the numbers of bones among the fish remains, with sturgeon, without exception, the species that is the best represented. But it may be overrepresented since its remains are easy to recognise, even if they are very fragmented. This holds true not only for Vlaarding and Hekelingen III, characterised by a high percentage of game remains, but also for Barendrecht-Zuidpolder, where the percentage of wild mammal bones is substantially lower (see above; BRINKHUIZEN 2001). From other archaeological remains the importance of fishing can also be inferred. At Vlaarding the remains of a wooden fish weir were discovered. A similar structure was perhaps found in a side creek at Hekelingen III, too, although, in contrast to the Vlaarding example, no distinct pattern can be deduced from the posts (BRINKHUIZEN 1983). In comparison with the fresh-water swamps, the conditions for stock breeding were more favourable in the coastal area consisting of coastal barriers and dunes. The brackish beach plains to the west of the settlements undoubtedly

	Ewijk-Ewijkse Veld; early VL		Hazendonk Louwe Kooijmans' phase - 1b; early VL		Hekelingen I; in any case early VL		Hekelingen III, "phase 1"; early VL		Hellevoetsluis-Ossenhoek; in any case early VL		Leidschendam-Prinsenhorf; in any case early VL		Vlaardingen; early VL		Voorschoten-Boschgeest; early VL		Zandwerven; early VL		Barendrecht-Zuidpolder; late VL		Hekelingen III, "phase 3"; late VL		Voorschoten-Boschgeest; late VL		Hekelingen III, "phase 2"; late VL		Rijswijk-de Schilp; VL phase unknown					
	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW		
<b>Livestock</b>																																
Cattle ( <i>Bos taurus</i> )	197	6	286	113	93	3570	18967	1007	18967	208	334	196	44	21	842	8	133	57	51	1568	410	13110										
Sheep/goat ( <i>Ovis/Capra</i> )	118	7	27	9	62	435	230	869	33	19	22	2	14	120	4	15	4	19	150	44	238											
Pig ( <i>Sus domesticus</i> )	213	39	262	75	264	2690	127	765	180	315	43	1	18	130	23	287	6	85	719	57	456											
<b>Other domestic mammals</b>																																
Dog ( <i>Canis familiaris</i> )	6	8	29	2**	1	1	6	30			12	7																				
<b>Wild ungulates</b>																																
Aurochs ( <i>Bos primigenius</i> )									4	428																						
Red deer ( <i>Cervus elaphus</i> )	13	154	4133	162	176	3894	312	4764	28*	700	22*	3		2	43	20	513	18*	78	1301	4	234										
Roe deer ( <i>Capreolus capreolus</i> )	4	56	215	30	69	624	2	33	22	25	12			10	68	8	35	12	74	527												
Elk ( <i>Alces alces</i> )																																
Wild boar ( <i>Sus scrofa</i> )	1	39	276	55	20	535	637	3949				3		5	140	1	67	2	17	479	75	593										
Horse ( <i>Equus ferus caballus</i> )									2	1	10																					
<b>Fur animals</b>																																
Otter ( <i>Lutra lutra</i> )									4	10	22	5		2	2																	
Beaver ( <i>Castor fiber</i> )	2	110	292	40	39	122	8	46	1	218				2	3	18	69															
(Pine)marten ( <i>Martes sp./martes</i> )									7	7	16	2																				
Polecat ( <i>Mustela putorius</i> )																																
Brown bear ( <i>Ursus arctos</i> )																																
Fox ( <i>Vulpes vulpes</i> )									1	2	41																					
Badger ( <i>Meles meles</i> )																																
Wolf ( <i>Canis lupus</i> )																																
Wildcat ( <i>Felis silvestris</i> )																																
<b>Sea mammals</b>																																
Whale (Cetacea)									1	13	222																					
Sperm whale ( <i>Physeter macrocephalus</i> )																																
Bottle-nosed dolphin ( <i>Tursiops truncatus</i> )																																
Common porpoise ( <i>Phocoena phocoena</i> )																																
Common seal ( <i>Phoca vitulina</i> )																																
Grey seal ( <i>Halichoerus grypus</i> )																																

**Tab. II** - Identified mammal bones (numbers and - if available - weights) from VL settlements, with a further chronological indication ; N = number of remains ; BW = weight in g. Bones which cannot with certainty attributed to domesticated or wild animals are distributed according to the positive identifications. \* : As for red deer, antler is not included, with the exception of Leidschendam-Prinsenhorf and Voorschoten-Boschgeest ; \*\* : It is not certain if in this case the bones are from a wolf or from a large dog. With regard to Leidschendam-Prinsenhorf, there is possibly contamination with faunal remains belonging to the Single Grave culture. *References* for Tables II-IV : Barendrecht-Zuidpolder : BRINKHUIZEN 2001 and ZEILER 2000 ; Ewijk-Ewijkse Veld : CLASON 1990 ; Hazendonk : BRINKHUIZEN 1979 and ZEILER 1997 ; Hekelingen I : CLASON 1967 ; Hekelingen III : PRUMMEL 1987 ; Hellevoetsluis-Ossenhoek : BEERENHOUT 2009 and VAN DIJK 2009 ; Leidschendam-Prinsenhorf : GROENMAN-VAN WAATERINGE *et al.* 1968 and CAVALLO in HAMBURG 2006 ; Rijswijk-de Schilp : KOOTKER & VAN DIJK, in press ; Voorschoten-Boschgeest : GROENMAN-VAN WAATERINGE *et al.* 1968 ; Vlaardingen : CLASON 1967 ; Zandwerven : CLASON 1967.

	Ewijk-Ewijkse Veld		Hazendonk*		Hekelingen I		Hekelingen III, phase 1		Hellevoetsluis-Ossenhoek		Leidschendam-Prinsenhorf		Vlaardingen		Voorschoten-Boschgeest		Zandwerven		Barendrecht-Zuidpolder		Hekelingen III, phase 3		Voorschoten-Boschgeest; late phase		Hekelingen III, phase 2		Rijswijk-de Schilp					
	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW	N	BW				
<b>Freshwater fish</b>																																
Roach ( <i>Rutilus rutilus</i> )																																
Rudd ( <i>Rutilus erythrophthalmus</i> )																																
Bream ( <i>Abramis brama</i> )																																
Silver bream ( <i>Abramis bjoerkna</i> )																																
Idc ( <i>Leuciscus idus</i> )																																
Carp family (Cyprinidae)																																
Catfish ( <i>Silurus glanis</i> )																																
Pike ( <i>Esox lucius</i> )																																
Ruffe ( <i>Gymnocephalus cernuus</i> )																																
Perch ( <i>Perca fluviatilis</i> )																																
Tench ( <i>Tinca tinca</i> )																																
Burbot ( <i>Lota lota</i> )																																
<b>Anadromous/catadromous fish</b>																																
Sturgeon ( <i>Acipenser sturio</i> )																																
Eel ( <i>Anguilla anguilla</i> )																																
Allis shad/Twaite shad ( <i>Alosa alosa/A. fallax</i> )																																
Smelt ( <i>Osmerus eperlanus</i> )																																
Whitefishes ( <i>Coregonus</i> sp.)																																
Salmon/Sea trout ( <i>Salmo salar/S. trutta</i> )																																
(Three-spined) stickleback ( <i>Gasterosteus aculeatus</i> /Gasterosteidae)																																
Flounder ( <i>Platichthys flesus</i> )																																
<b>Marine fish</b>																																
Herring ( <i>Clupea harengus</i> )																																
(Thin-lipped) grey mullet/ ( <i>Liza ramada</i> /Mugilidae)																																
Cod family (Gadidae)																																
Plaice ( <i>Pleuronectes platessa</i> )																																
Plaice family, not specified (Pleuronectidae)																																

**Tab. III** - Identified bird bones (numbers) from VL settlements. For a further chronological indication and references see Table II. \* : The swan bones from Hazendonk could not be identified more specifically than as « mute swan or whooper swan ».

	Ewijk-Ewijkse Veld	Hazendonk*	Hekelingen I	Hekelingen III, phase 1	Hellevoetsluis-Ossenhoek	Leidschendam-Prinsen	Vlaardingen	Voorst-Boschgeest, early phase	Zandwerven	Barendrecht-Zuidpolder	Hekelingen III, phase 3	Voorst-Boschgeest, late phase	Hekelingen III, phase 2	Rijswijk-de Schilp
<b>Freshwater fish</b>														
Roach ( <i>Rutilus rutilus</i> )	-	+	-	2	1	-	-	-	-	-	-	-	-	-
Rudd ( <i>Rutilus erythrophthalmus</i> )	-	+	-	1	6	-	-	-	-	-	-	-	-	-
Bream ( <i>Abramis brama</i> )	-	-	-	-	6	-	-	-	-	-	-	-	-	-
Silver bream ( <i>Abramis bjoerkna</i> )	-	-	-	2	1	-	-	-	-	-	-	-	-	-
Idle ( <i>Leuciscus idus</i> )	-	+	-	-	8	-	-	-	-	-	-	-	-	-
Carp family (Cyprinidae)	-	+	-	6	121	-	-	-	-	60	-	-	1	-
Catfish ( <i>Silurus glanis</i> )	-	+	-	3	-	-	-	-	-	3	-	-	5	-
Pike ( <i>Esox lucius</i> )	-	+	+	102	25	-	+	-	-	19	1	-	12	1
Ruffe ( <i>Gymnocephalus cernuus</i> )	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perch ( <i>Perca fluviatilis</i> )	-	+	-	2	30	-	-	-	-	25	-	-	-	2
Tench ( <i>Tinca tinca</i> )	-	(+)	-	1	-	-	-	-	-	-	-	-	-	-
Burbot ( <i>Lota lota</i> )	-	+	-	-	-	-	-	-	-	-	-	-	-	-
<b>Anadromous/catadromous fish</b>														
Sturgeon ( <i>Acipenser sturio</i> )	-	+	+	230	1920	2	2000	197	-	748	22	3	180	10
Eel ( <i>Anguilla anguilla</i> )	-	+	-	1	760	-	-	-	-	34	-	-	1	-
Allis shad/Twaite shad ( <i>Alosa alosa/A. fallax</i> )	-	+	-	-	11	-	-	-	-	1	-	-	-	-
Smelt ( <i>Osmerus eperlanus</i> )	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Whitefishes ( <i>Coregonus</i> sp.)	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Salmon/Sea trout ( <i>Salmo salar/S. trutta</i> )	-	-	-	-	-	-	-	-	-	7	-	-	-	-
(Three-spined) stickleback ( <i>Gasterosteus aculeatus</i> /Gasterosteidae)	-	-	-	-	739	-	-	-	-	-	-	-	-	-
Flounder ( <i>Platichthys flesus</i> )	-	-	-	-	4	-	-	-	-	2	-	-	-	-
<b>Marine fish</b>														
Herring ( <i>Clupea harengus</i> )	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Thin-lipped) grey mullet ( <i>Liza ramada/Mugilidae</i> )	-	-	-	1	68	-	-	-	-	-	-	-	2	-
Cod family (Gadidae)	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Plaice ( <i>Pleuronectes platessa</i> )	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Plaice family, not specified (Pleuronectidae)	-	-	-	-	133	-	-	-	-	-	-	-	-	-

Tab. IV - Identified fish bones (numbers) from VL settlements. For a further chronological indication and references see Table II. + : Species present, not counted ; \* : The fish data from Hazendonk (BRINKHUIZEN 1979) were not specified to habitation period.

provided excellent grazing areas (see above). It is therefore not surprising that the faunal assemblages from Voorst-Boschgeest, Leidschendam-Prinsen and Rijswijk-de-Schilp indicate that cattle breeding provided the main source of animal protein. The finds from Hellevoetsluis-Ossenhoek point to a closely related subsistence : cattle breeding had a leading part and there was a minor, though not unimportant role for hunting, fishing and fowling (especially ducks). Eel outnumbers all other fish species except sturgeon, indicating that for fishing mainly fykes (long, bag-shaped fishing nets held open by hoops) were used. Fishing was consequently first and foremost done passively (VAN DIJK 2009 ; BEERENHOUT 2009).

The situation at Ewijk-Ewijkse Veld seems to have been different, certainly in comparison to the settlements in the fresh-water swamps. The (near) absence of fish and bird remains may result from the fact that the bones were not collected by sieving. However, this would not explain the low percentage of wild mammals. The fauna spectrum is dominated by pigs and cattle, followed by sheep/goat. Apparently meat was first and foremost provided by stock breeding, in particular of cattle. A similar picture emerges for Zandwerven, although it should be borne in mind that only c. 50 bones were collected during the investigations; there was no sieving done. With the exception of a handful of bird remains and a bone from a bottle-nosed dolphin, the finds all derive from domesticated mammals. Among them, those of cattle prevail, and the remainder includes bones from pigs and sheep/goats.

**CONCLUSION AND FINAL REMARKS**

To summarise the archaeobotanical evidence, the emphasis lay, as far as cultivated crops are concerned, on emmer and naked barley. There is evidence that the ard was used for cereal cultivation. The array of species hitherto discovered hints further at the local gathering of wild edible plants. In contrast to other Neolithic periods, information from VL sites concerning consumption of roots and tubers is still lacking.

The archaeozoological data indicates that the focus was on cattle in the regions with extensive grazing areas, whereas the settlements on levees and small river dunes in the fresh-water swamps attest more to hunting on wild mammals. Presumably fishing also played a more important role in the wetlands, but since sieving on 'dry' sites has yet to be done, this remains to be seen.

From the above emerges the picture of a close correlation between subsistence and the local environment during VL times, but other inferences cannot (yet) be made, e.g. about diachronic

developments within the VL subsistence. The large majority of the data must be attributed to the early VL. Furthermore, given the fact that the VL inhabited various milieus, a diachronous comparison should start from a regional perspective. But a severe drawback is that the environmental settings of at most a handful of settlements are known. From both the Central Dutch river area and the salt water to brackish-water environment in the province of Noord-Holland there is only one settlement with faunal remains. Another obstacle is the current lack of consensus about the VL chronology. It goes without saying that this hampers not only a diachronous study but also prohibits far-reaching statements about possible relations between the regions in question. In this connection, a systematic archaeozoological analysis of skeletal element representation, with respect to the richness in meat, in relation to site differentiation could be very useful. Until now, such an analysis has not been carried out for the VL.

Given these constraints, it will come as no surprise that we furthermore refrain from any statements about seasonal or permanent occupation. What is more, it is equally problematic to decide this matter on the basis of archaeological evidence other than botanical and zoological (BRINKKEMPER *et al.* 2010, p. 42-47).

One of the crucial issues in a study on VL subsistence is of course to what extent the diet consisted of plant and animal products. Due to the scarcity of data we do not dare to make statements about this. Models which are often used for younger periods (e.g. BAKELS 1986) offer no solution. They are based upon the number of cattle stalls and granaries, structures of which there is at present no respectively hardly any evidence for the VL. Apart from that, the significance of wild plant food cannot be deduced from the excavated structures. The best perspective to reconstruct the VL diet is therefore isotope analyses of human bones. This may tell the share animals and plants had in subsistence. But up to now such human bones are a rarity for the VL.

**Acknowledgements**

The authors are grateful to dr. Allan Hall (York, UK) for correcting the English text and to Dr. Welmoed Out (Leiden, NL), Prof. Dr. Marie Besse (Geneva, CH) and Dr. Laure Salanova (Nanterre, FR) for their comments on previous versions of this article.

**REFERENCES**

BAKELS Corrie C (1986) - « Akkerbouw in het moeras ? » in TRIERUM Marco C van & HENKES Harold E - *Landschap en bewoning rond de mondingen van Rijn, Maas en Schelde* (Rotterdam Papers, V), Rotterdam, p. 1-6.

BAKELS, Corrie C (1988) - « Hekelingen, a Neolithic site in the swamps of the Maas estuary » in KÜSTER Hansjörg - *Der prähistorische Mensch und seine Umwelt, Festschrift U. Körber-Grohne zum 65. Geburtstag* (Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg, 31), Stuttgart, p. 155-161.

BAKELS Corrie C & ZEILER Jørn T (2005) - « The fruits of the land. Neolithic subsistence » in LOUWE KOOIJMANS Leendert P, GIJN Annelou van, FOKKENS Harry & BROEKE Peter van den - *The prehistory of the Netherlands*, Amsterdam, volume 1, p. 311-335.

BAKELS Corrie C (in press) - *Barendrecht-Zuidpolder, bewoning op een oeverwal ten tijde van de Vlaardingen-cultuur, de Potbeker periode, de Vroege en de Midden-Bronstijd : zaden en vruchten*, Intern rapport in opdracht van Bureau Oudheidkundig Bodemonderzoek Rotterdam (BOOR), Leiden.

BALASSE Marie & TRESSET Anne (2002) - « Early weaning of Neolithic domestic cattle (Bercy, France), revealed by intra-tooth variation in nitrogen isotope ratios », *Journal of Archaeological Science*, 29(8), 853-859.

BECKERMAN Sandra M & RAEMAEKERS Daan C M (2009) - « Vormvariatie van Vlaardingen-aardewerk. Een nieuwe typochronologie van het aardewerk van de Vlaardingen-groep (ca. 3400-2500 v.Chr. » - *Archeologie*, 13, p. 63-82.

BEERENHOUT Bob (2009) - « Vissen » in GOOSSENS Tiziano A - *Opgraving Hellevoetsluis-Ossenhoek. Een nederzetting van de Vlaardingen-groep op een kwelderrug in de gemeente Hellevoetsluis* (= Archol-rapport, 87), Leiden, p. 145-170.

BENNEMA Jacob (1953) - « De bodemkundige onderzoekingen in de Vrieslandpolder bij Hekelingen, naar aanleiding van een oudheidkundige opgraving aldaar », *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek*, IV(issue II), p. 10-19.

BOTTEMA Sytze, van HOORN TC, WOLDRING Henk & GREMMEN Wim HE (1980) - « An agricultural experiment in the unprotected salt marsh, part II », *Palaeohistoria*, 22, Groningen, p. 127-140.

BRINKHUIZEN Dick C (1979) - « Preliminary notes on fish remains from archaeological sites in the Netherlands », *Palaeohistoria*, XXI, Groningen, p. 83-90.

BRINKHUIZEN Dick C (1983) - « Some notes on recent and pre- and protohistoric fishing gear from northwestern Europe », *Palaeohistoria*, 25, p. 7-53.

BRINKHUIZEN Dick C (2001) - *Vissers op een oeverwal. Archeozoologisch onderzoek van de visresten van twee prehistorische vindplaatsen (Laat-Neolithicum en Vroege Bronstijd) te Barendrecht* (= internal report Bureau Oudheidkundig Onderzoek Rotterdam (BOOR)).

BRINKKEMPER Otto (1993) - *Wetland farming in the area to the south of the Meuse estuary during the Iron Age and Roman Period. An environmental and palaeo-economic reconstruction*. Leiden (= Analecta Praehistorica Leidensia 24)

BRINKKEMPER Otto, DRENTH Erik & ZEILER Jørn T (2010) - « De voedsleconomie van de Vlaardingen-cultuur in Nederland. Een algemeen overzicht », *Westerheem*, special no. 2 - April 2010, AWN, Veghel, p. 26-51.

BROEKE Peter van den, with contributions by van HAASTER Henk, KOOISTRA Maja J, MAKASKE Bart, VERHART Leo BM & ZEILER Jørn T (2002) - *Van Mesolithicum tot Romeinse tijd in Nijmegen-Ressen. Archeologisch onderzoek in een persleidingstracé door het monument Zuiderveld-West* (= Archeologische Berichten Nijmegen, Rapport 2), Nijmegen.

CLASON Anneke T (1967) - *Animal and man in Holland's past. An investigation of the animal world surrounding man in prehistoric and early historical times in the provinces of North and South Holland* (also published as *Palaeohistoria*, XIII), Groningen.

CLASON Anneke T (1990) - « Ewijk, an inland Vlaardingen settlement. Archaeozoology and the amateur archaeologist » in SCHIBLER Jörg, SEDLMEIER Jürg & SPYCHER Hanspeter - *Beiträge zur Archäozoologie, Archäologie, Anthropologie, Geologie und Paläontologie* (= Festschrift H.R. Stampfli), Basel, p. 63-75.

COPLEY Mark S, BERSTAN Robert, DUDD Stephanie N, DOCHERTY Gordon, MUKHERJEE Anne J, STRAKER Vanessa, PAYNE Sebastian & EVERSLED Richard P (2003) - « Direct chemical evidence for widespread dairying in prehistoric Britain », *Proceedings of the National Academy of Sciences of the United States of America*, 100, p. 1524-1529.

DIJK Joyce van (2009) - « Zoogdieren, vogels en reptielen » in GOOSSENS Tiziano A - *Opgraving Hellevoetsluis-Ossenhoek. Een nederzetting van de Vlaardingen-groep op een kwelderrug in de gemeente Hellevoetsluis* (= Archol-rapport, 87), Leiden, p. 113-145.

DRENTH Erik, BRINKKEMPER Otto & LAUWERIER Roel GCM (2008) - « Single Grave Culture Settlements in the Netherlands: the state of affairs anno 2006 » in DÖRFLER Walter & MÜLLER Johannes - *Umwelt - Wirtschaft - Siedlungen im dritten vorchristlichen Jahrtausend Mitteleuropas und Südkandinavien*, Kiel (= Offa Bücher, 84), p. 149-181.

DRENTH Erik, HEIJMANS Har & KEIJERS Danny (2007) - « Van Mesolithicum tot en met IJzertijd. Sporen uit de prehistorie te Ittervoort-industrieterrein Santfort, fase 3, gem. Leudal (Li.) » in: HEIJMANS Har, DRENTH Erik, KEIJERS Danny & SCHREURS José - *Archeologisch onderzoek te Ittervoort. Oude bedrijvigheid op het industrieterrein Santfort ontsloten*, Hunsel, p. 97-237.

DRENTH Erik & LANTING Albert E (1997) - « On the importance of the ard and the wheeled vehicle for the transition of the TRB West Group to the Single Grave culture in the Netherlands » in SIEMEN Halle - *Early Corded Ware Culture. The A-Horizon - fiction or fact ?* (= Arkæologiske Rapporter Esbjerg Museum, 2), Esbjerg, p. 53-73.

FLORSCHÜTZ Frans (1953) - « Palaeobotanisch onderzoek in verband met de opgravingen in de polder Vriesland bij Hekelingen », *Berichten van de Rijksdienst voor het Oudheidkundig Bodemkundig Onderzoek*, IV (issue II), p. 19-24.

GLASBERGEN Willem, GROENMAN-VAN WAATERINGE Willy & HARDENBERG GM (1967a) - « Settlements of the Vlaardingen Culture at Voorschoten and Leidschendam (I) », *Helinium*, VII, p. 3-31.

GLASBERGEN Willem, GROENMAN-VAN WAATERINGE Willy & HARDENBERG GM (1967b) - « Settlements of the Vlaardingen Culture at Voorschoten and Leidschendam (II) », *Helinium*, VII, p. 97-120

GOOSSENS Tiziano A (red.) with contributions of HOOF Leon GL van, GOOSSENS Tiziano A, BEERENHOUT Bob, DIJK, Joyce van, GIJN, Annelou L van, KOOISTRA Laura, METAXAS O & VERBAAS A (2009) - *Opgraving Hellevoetsluis-Ossenhoek. Een nederzetting van de Vlaardingen-groep op een kwelderrug in de gemeente Hellevoetsluis* (Archol-rapport, 87), Leiden.

GROENMAN-VAN WAATERINGE Willy, VOORRIPS (A) Bert & WIJNGAARDEN-BAKKER Loes H van (1968) - « Settlements of the Vlaardingen Culture at Voorschoten and Leidschendam (Ecology) », *Helinium*, VIII, p. 105-130.

HAMBURG Tom met bijdragen van KNIPPENBERG Sebastiaan, HOOF Leon van & CAVALLO Chiara (2006) - *Neolithische bewoningsresten te Leidschendam. Begeleiding, Inventariserend Veldonderzoek (IVO) en Opgraving (DO) Leidschendam-Prinsen Hof* (= Archol Rapport, 59), Leiden.

HOUKES, Rob A, JONGSTE Peter FB & MOREE Jurrien M (in press) - *Boeren en Jagers in een dynamisch landschap. Het leven in IJsselmonde gedurende de Jonge Steentijd en de Bronstijd* (= BOORbalans, 7), Rotterdam.

JANSSEN AJ (1989) - « Een neolithische nederzetting in het Ewijkse veld », *Westerheem*, XXXVIII, p. 133-145.

KÖRBER-GROHNE Udelgard (1987) - *Nutzpflanzen in Deutschland* - Stuttgart.

KOOISTRA Laura I (2006) - « Paleogeografie » in BULTEN Everhard EB & BOONSTRA Yvonne M - *Archeologisch onderzoek in- en effluentleidingen Afwatwaterzuivering Haagse Regio* (= AHR-Rapport, 0619), Den Haag, p. 104-108.

KOOISTRA Laura I (2009) - « Botanische resten » in GOOSSENS Tiziano A - *Opgraving Hellevoetsluis-Ossenhoek. Een nederzetting van de Vlaardingen-groep op een kwelderrug in de gemeente Hellevoetsluis* (= Archol-rapport, 87), Leiden, 99-113.

KOOTKER Lisette M & DIJK Joyce van (in press) - *Archeozoologische analyse faunamateriaal uit Rijswijk De Schilp*

LANTING Jan N & PLICHT Hans [J] van der (1999/2000) - « De 14C-chronologie van de Nederlandse pre- en protohistorie. III : Neolithicum », *Palaeohistoria*, 41/42, p. 1-110.

LOUWE KOOIJMANS Leendert P (1974) - *The Rhine/Meuse delta; Four studies on its occupation and Holocene geology* (also published as *Analecta Praehistorica Leidensia VII* [1974] and *Oudheidkundige Mededelingen van het Rijksmuseum van Oudheden te Leiden 53-54* [1972-1973]), Leiden.

LOUWE KOOIJMANS Leendert P (1976) - « Local developments in a borderland. A survey of the Neolithic at the Lower Rhine », *Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden*, LVII, p. 227-297.

LOUWE KOOIJMANS Leendert P (1983) - « Tussen SOM en TRB, enige gedachten over het laat-neolithicum in Nederland en België », *Bulletin des Musées Royaux d'Art et d'Histoire*, 54, p. 55-67.

LOUWE KOOIJMANS Leendert P (1985) - *Sporen in het land. De Nederlandse delta in de prehistorie*, Amsterdam.

LOUWE KOOIJMANS Leendert P (1986) - « Het loze vissertje of boerke Naas? » in TRIERUM Marco C van & HENKES HE - *Landschap en bewoning rond de mondingen van Rijn, Maas en Schelde* (Rotterdam Papers, V), Rotterdam, p. 7-25.

LOUWE KOOIJMANS Leendert P (1993) - « Wetland exploitation and upland relations of prehistoric communities in the Netherlands » in GARDINER Julie - *Flatlands and Wetlands ; Current themes in East Anglian Archaeology* (East Anglian Archaeology, 50), Norwich, p. 71-116.

OUT Welmoed A (2009) - *Sowing the seed ? Human impact and plant subsistence in Dutch wetlands during the Late Mesolithic and Early and Middle Neolithic (5500-3400 cal BC)* (= Academic Studies Leiden University, 18), Leiden.

PÉTREQUIN Pierre, ARBOGAST Rose-Marie, PÉTREQUIN Anne-Marie, WILLIGEN Samuel van & BAILLY Maxence (2006) - *Premiers chariots, premiers araires. La diffusion de la traction animale en Europe pendant les IV<sup>e</sup> et III<sup>e</sup> millénaires avant notre ère* (CRA-Monographies 29), Paris.

PRUMMEL Wietske (1987) - « The faunal remains from the Neolithic site of Hekelingen III », *Helinium*, XXVII, p. 190-258.

REGTEREN ALTENA, Jean Francois van, BAKKER Jan Albert, CLASON Anneke T, GLASBERGEN Willem, GROENMAN-van WAATERINGE Willy & PONS LJ (1962) - « The Vlaardingen Culture (I) », *Helinium*, II, p. 3-35.

REGTEREN ALTENA, Jean Francois van, BAKKER Jan Albert, CLASON Anneke T, GLASBERGEN Willem, GROENMAN-van WAATERINGE Willy & PONS LJ (1963) - « The Vlaardingen Culture (IV) », *Helinium*, III, p. 39-54.

Van GIJN Annelou & BAKKER Jan-Albert (2005) - « Megalith builders and sturgeon fishers. Middle Neolithic B : Funnel Beaker culture and the Vlaardingen Group » in LOUWE KOOIJMANS Leendert P, GIJN Annelou van, FOKKENS Harry & BROEKE Peter van den - *The prehistory of the Netherlands*, Amsterdam, volume 1, p. 281-306.

VEEN Monique A van (1989) - *Voorschoten-"De Donk", bewoning op de Oude Duinen, vanaf het late neolithicum tot in de Romeinse tijd* (= unpublished thesis I.P.L., Rijksuniversiteit Leiden), s.l.

VERHART Leo BM (1992) - « Settling or trekking? The Late Neolithic house plans of Haamstede-Brabers and their counterparts », *Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden*, 72, p. 73-99.

VOS Peter & KIDEN Patrick (2005) (2e druk) - « De landschapsvorming tijdens de steentijd » in DEEBEN Jos, DRENTH Erik, OORSOUW Marie-France van & VERHART Leo - *De steentijd van Nederland* (= Archeologie, 11/12), Meppel, p. 7-37.

WOUDE John D vander (1983) - *Holocenepaleoenvironmental evolution of a perimarine fluvial area. Geology and paleobotany of the area surrounding the archeological excavation at the Hazendonk river dune (Western Netherlands)* (= *Analecta Praehistorica Leidensia*, XVI), Leiden.

ZEILER Jørn T (1997) - *Hunting, fowling and stock-breeding at Neolithic sites in the western and central Netherlands*, Groningen.

ZEILER Jørn T (2000) - *Jagers en boeren op een oeverwal. Archeozoologisch onderzoek van zes vindplaatsen uit het Laat-Neolithicum en de Vroege en Midden-Bronstijd te Barendrecht Zuidpolder* (ArchaeoBone rapport, 19 = unpublished report for Bureau Oudheidkundig Bodem onderzoek Rotterdam (BOOR)), Leeuwarden.

ZEILER Jørn T (2010) - « Sometimes you eat the bear... Bruine beren en mensen in het Neolithicum », *Westerheem*, special no. 2, - April 2010, AWN, Veghel, p. 52-56.

ZEIST Willem van (1968) - « Prehistoric and early historic food plants in the Netherlands », *Palaeohistoria*, XIV, p. 41-173.

ZEIST Willem van, HOORN TC van, BOTTEMA Sytze & WOLDRING Henk (1976) - « An agricultural experiment in the unprotected salt marsh », *Palaeohistoria*, XVIII, p. 111-153.

### Les auteurs

Otto BRINKKEMPER, Cultural Heritage Agency  
P.O. Box 1600  
3800 BP Amersfoort  
Netherlands  
o.brinkkemper@cultureelerfgoed.nl

Erik DRENTH  
Torenstraat 4  
3811 DJ Amersfoort  
Netherlands  
drenth.erik@gmail.com

Jørn T. ZEILER  
ArchaeoBone  
Blekenweg 61  
9753 JN Haren  
Netherlands  
abone@planet.nl

### Résumé

Les fouilles sur plusieurs lieux d'habitation de Group de Vlaarding dans les Pays-Bas ont livré *inter alii* des restes botaniques et d'animaux. Ces reliques donnent de l'information sur la subsistance, quant aux produits primaires et secondaires. Ils sont indicatifs pour l'élevage, la chasse, l'agriculture et le recueil de plantes mangeables. Il semble que les sources exploitées sont notablement d'origine locale ou régionale. Malheureusement les données archéobotaniques et -zoologiques actuelles ne permettent pas des conclusions sur la durée de l'habitation (pendant toute l'année ou une saison).

**Mots-clefs** : culture Vlaarding, subsistance, paysage, Pays-Bas.

### Abstract

Excavations of several settlements belonging to the Vlaarding culture in the Netherlands have yielded amongst other things animal bones and botanical remains. These remains yield information about the subsistence of the Vlaarding people, in terms of both primary and secondary products. They provide evidence of husbandry, hunting, agriculture and the gathering of edible plants. It seems that first and foremost sources were exploited that were locally or regionally available. Unfortunately from the present dataset the question of permanent/seasonal occupation, that is habitation during the whole year or not, cannot be answered.

**Keywords** : Vlaarding culture, subsistence, landscape, the Netherlands

### Zusammenfassung

Bei den Grabungen mehrerer Siedlungsplätze der Vlaarding-Kultur in den Niederlanden kamen u.a. Pflanzenreste und Tierknochen zutage. Diese Spuren geben uns Auskunft über die Art und Weise, wie diese Bevölkerungen ihren Lebensunterhalt bestritten, sowohl was die Hauptnahrungsquellen angeht als auch die zweitrangigen Nahrungsquellen. Bezeugt sind Viehzucht, Jagd, Landwirtschaft und das Sammeln essbarer Pflanzen. Es ist erkennbar, dass zunächst die lokalen und regionalen Nahrungsquellen intensiv ausgebeutet wurden. Die aktuellen Daten erlauben es leider nicht, die Frage nach der Siedlungsdauer zu beantworten (saisonal oder ganzjährig).

**Schlagwörter** : Vlaarding-Gruppe, Lebensunterhalt, Landschaft, die Niederlande.

*Traduction* : Isa ODENHARDT-DONVEZ ([donvezservit@wanadoo.fr](mailto:donvezservit@wanadoo.fr)).