

# The gradual transition to farming in the Lower Rhine Basin

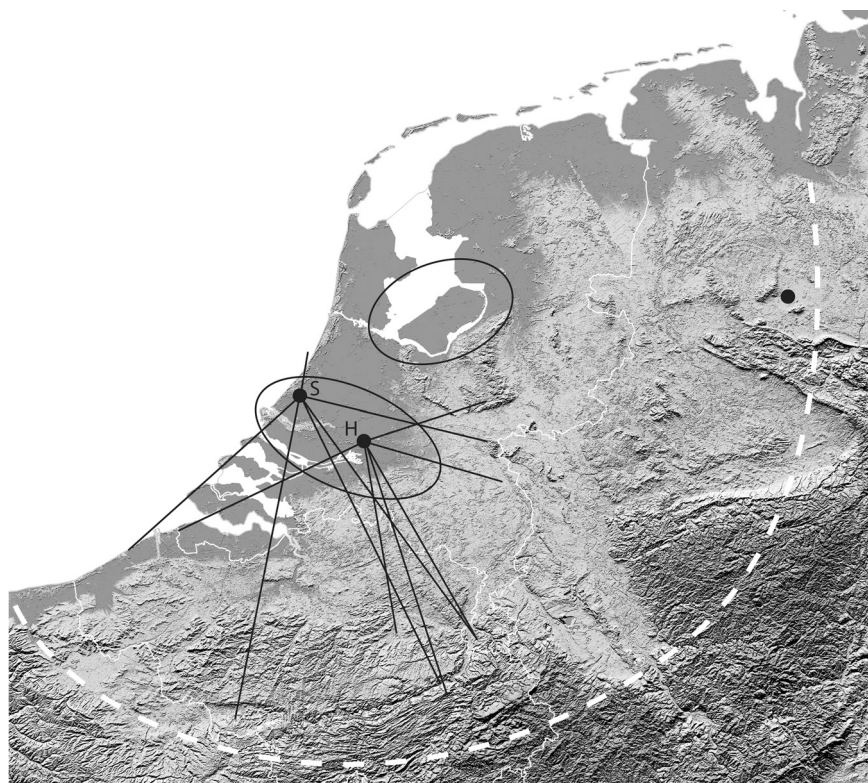
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THE NETHERLANDS ORGANISATION FOR SCIENTIFIC RESEARCH finances a research programme directed to a new synthesis of the transition to farming in the Netherlands, viewed in its wider geographical context, profiting from the new wealth of data made available by modern large-scale field research. The programme encompasses various projects: a critical approach to the site-bound evidence by Luc Amkreutz, a regional approach by Bart Vanmontfort (Leuven), the first physical anthropological and isotopic study of the area by Liesbeth Smits, the acquisition and distribution of raw materials and prestigious items by Leo Verhart, and a re-evaluation of the various sources of palaeobotanical evidence from the delta district by Welmoed Out. This paper is meant as a short interim report, anticipating the synthetic volume planned for the year 2008. Comments are made especially on the seemingly parallel developments at the other end of the North German Plain in the Baltic coastal area.

## THE LOWER RHINE BASIN

The Lower Rhine Basin embraces all of the Netherlands and Belgium together with the adjacent parts of the Rhineland, Westfalia and Lower Saxony (Fig. 1). We have chosen this arena for our research, since the present-day Netherlands are too restricted to give a sufficient overview of the cultural phenomena in question and so to allow us to understand the processes of interaction properly. It is even argued below that communities as far as the German Baltic coast experienced similar developments.

The Lower Rhine Basin is the southern part of a wider long-term geological subsidence area, which centres in the southern North Sea, into which a series of rivers discharge: the Rhine, the Meuse and the Scheldt being the most prominent. The Basin shows a distinct zoning. It consists mainly of a flat sandy plain with Late Glacial coversands at the surface, sandy and



**Figure 1.** The Lower Rhine Basin with the two major concentrations of sites, in the IJsselmeer Basin and the Rhine/Meuse estuary. Hardinxveld (H) and Schipluiden (S) are two examples of the exchange relations of the gradually transforming communities in the north with the farming communities in the southern loess zone. Location of the Húde I site indicated in Lower Saxony.

gravely river deposits and occasional Saalian boulder clays in the subsoil. These deposits have been pushed up to hilly ranges by the Saalian ice sheets in some regions like the Veluwe district in the central Netherlands. The Basin has hilly ranges along its southern margins with a zone of loess deposition to the north of it, separating the hills from the sands. Essential for our research is the extensive complex of Holocene deposits at the confluence of the lower courses of the rivers mentioned, a complex consisting of clastic and organic deposits of widely different facies, ranging from coastal marine sediments to sphagnum bogs. It has been named the ‘Rhine-Meuse Delta’, although it extends far beyond the sedimentation area of the rivers. This must have been a region rich in natural resources, plant as well as animal, which were exploited by people, who settled on dry outcrops or sediments, like river levees. The remains have been preserved below several metres of sediments that

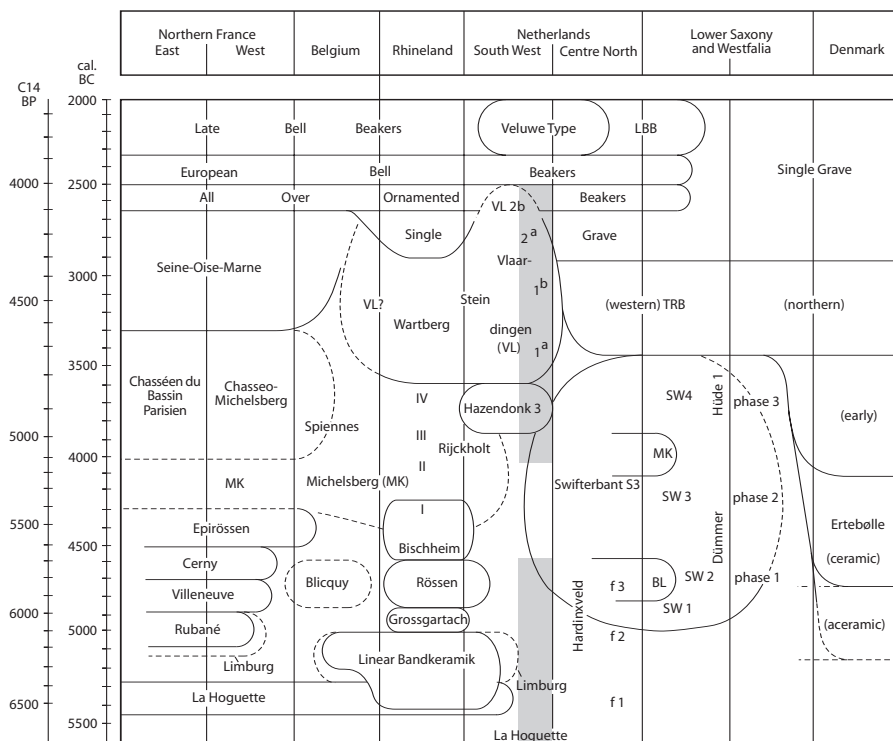
were formed during the continuous rise of sea level and of the ground water table. As such they became waterlogged but also not so easy to prospect.

We are generally inclined to stress the contrast between these wetlands and the upland sands, but are nowadays more and more aware as well that the low and gently undulating coversand landscape, intersected by numerous wide and shallow brook valleys, also offered very diverse ecological conditions, comprising a considerable wetland component as well. The main distinction, as compared to the 'delta', is the presence of the stretches of light and sandy soils on the coversand ridges, which will have been suited for crop cultivation.

### THE STUDY OF NEOLITHISATION

The study of neolithisation in this basin is the study of the extension of a subsistence-based food production from the loess belt into the North European Plain, into a landscape that will not have differed so much in climatic terms (although more so in more northern latitudes), but will have differed in other aspects, especially in soil conditions, vegetation and fauna. It was a landscape with a high rate of ecological diversity, with a mosaic of dry and wet microregions, and so was presumably an attractive ground for hunting, fishing and gathering, while the loess zone offered a much less differentiated and more densely wooded landscape, but well suited as it appears to the early hoe cultivation of the Bandkeramik farmers and their successors.

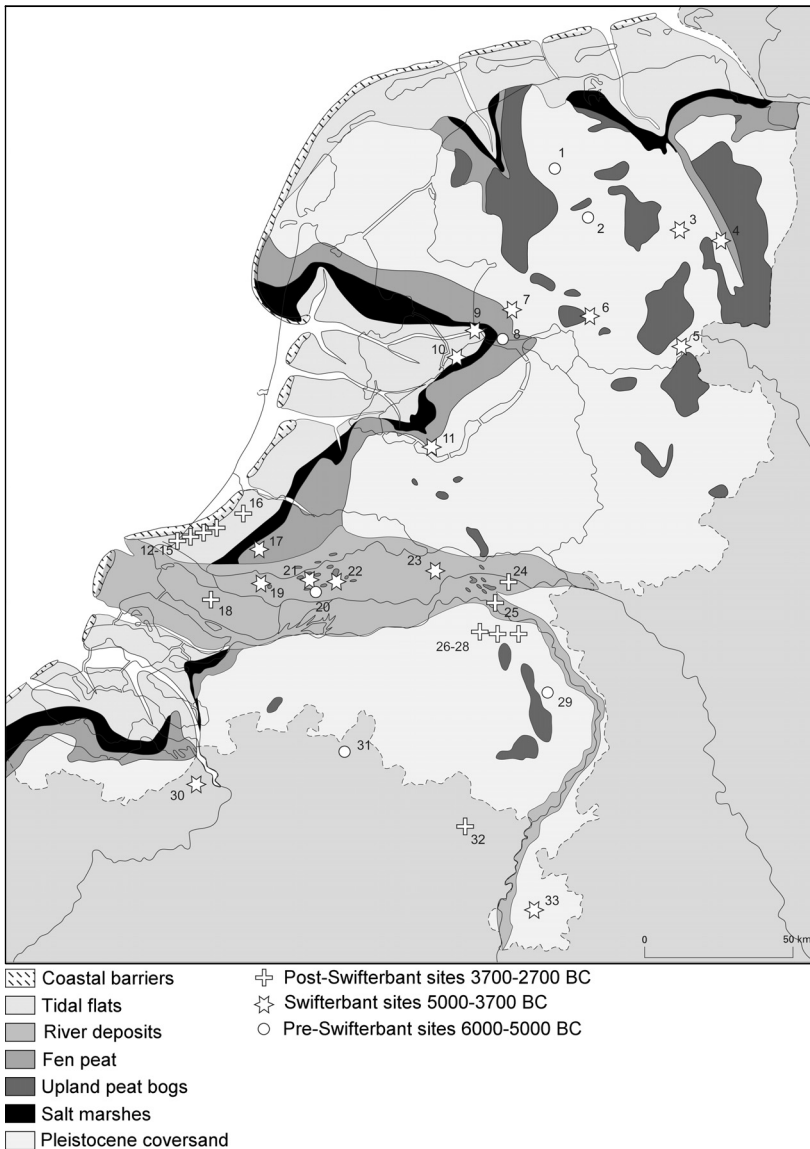
While one party in the process (the early farmers) have become known in detail from an early stage of research on the basis of their well preserved settlements, the other party (the foragers and their successors) have not, as a result of the bad preservation of their upland sites and the invisibility of their wetland locations. The upland flint scatters often have a palimpsest character and hardly any organic remains have been preserved. This was a serious drawback for the development of an appropriate model of the transformations that took place as a result of the interaction of both communities. It was mainly the isolated items that found their way into the 'hunters' land' in the north that demonstrated communication, but what went back in return still completely escapes us. For some time the Hude I site in Lower Saxony (Deichmüller 1965; Raemaekers 1999, 72f) stood alone, but in the last decades a series of stratified settlement sites have been discovered in the delta wetlands, where organic remains have been preserved in large quantities, with artefacts as well as discarded animal remains and plant food. These are the basis for the definition of the Swifterbant culture (Figs 2 and 3). The sites cover now the full trajectory in which the transition took place with the exception of the relatively short phase of 4450–4100 cal BC. We profited



**Figure 2.** Chrono-geographical scheme for the Neolithic in the Lower Rhine basin and adjacent areas. Update of a scheme originally presented in 1976. Stages covered by the Hardinxveld and Hazendonk sites indicated with bars.

especially from the more recent discovery of new, highly informative wetland sites during survey in advance of public works, while the funds to excavate and analyse these sites properly are available as a result of the implementation of the Malta Convention in the Netherlands. There is, however, one major problem in the use of these wetland data for our view of the neolithisation process, which is the extent to which these essentially wetland sites can be viewed as representative of developments in a wider region, including the uplands as well, or whether the new evidence should be seen as documenting specific wet environment aspects of the former societies.

I concentrate in this paper mainly on the excavated evidence. This survey is, however, just one in a long series of syntheses, like those by Keeley (1992), Thomas (1996) and myself (Louwe Kooijmans 1993b; 1998; 2004). The latest overview is given in the recent handbook on Dutch prehistory (Louwe Kooijmans *et al.* 2005). Raemaekers (1999) made a thorough analysis of the Swifterbant ceramics, as the basis for the proper definition of this relatively



**Figure 3.** Palaeogeography of the Dutch Holocene sedimentation area around 4200 cal BC with sites mentioned in the texts and other selected locations outside the loess zone. 1. Bergumermeer; 2. Jardinga; 3. Gietsenveentje; 4. Bronneger; 5. Heemse; 6. De Gaste; 7. Northeastpolder; 8. Schokkerhaven; 9. Urk; 10. Swifterbant cluster; 11. Hoge Vaart; 12. Voorschoten; 13. Wateringen; 14. Schipluiden; 15. Rijswijk; 16. Ypenburg; 17. Bergschenhoek; 18. Hekelingen; 19. Rhoon; 20. Hardinxveld; 21. Hazendonk; 22. Brandwijk; 23. Zoelen; 24. Ewijk; 25. Wijchen-het Vormer; 26. Grave; 27. Gassel; 28. Kraaienberg; 29. Merselo; 30. Doel-Deurgancksdok; 31. Weelde-Paardsdrank; 32. Meeuwen-Donderslagheide; 33. Geleen-Janskamperveld.

new cultural entity, and developed the argument of 'primitive communism' to describe and explain Swifterbant subsistence. Verhart (2000) followed the process in the Limburg Meuse Valley on the basis of a systematic analysis of the thousands of flint assemblages in that region. He stressed the attraction which artefacts of the dominant farming group will have had for the hunters, in explaining the wide spread of such items outside the farmers' territories. The extension of the Swifterbant complex in the Scheldt Basin has been documented by the excavations at Doel in the new Antwerp harbour (Crombé 2005; Crombé *et al.* 2002; see also Crombé & Vanmontfort, this volume).

### THE LATE MESOLITHIC

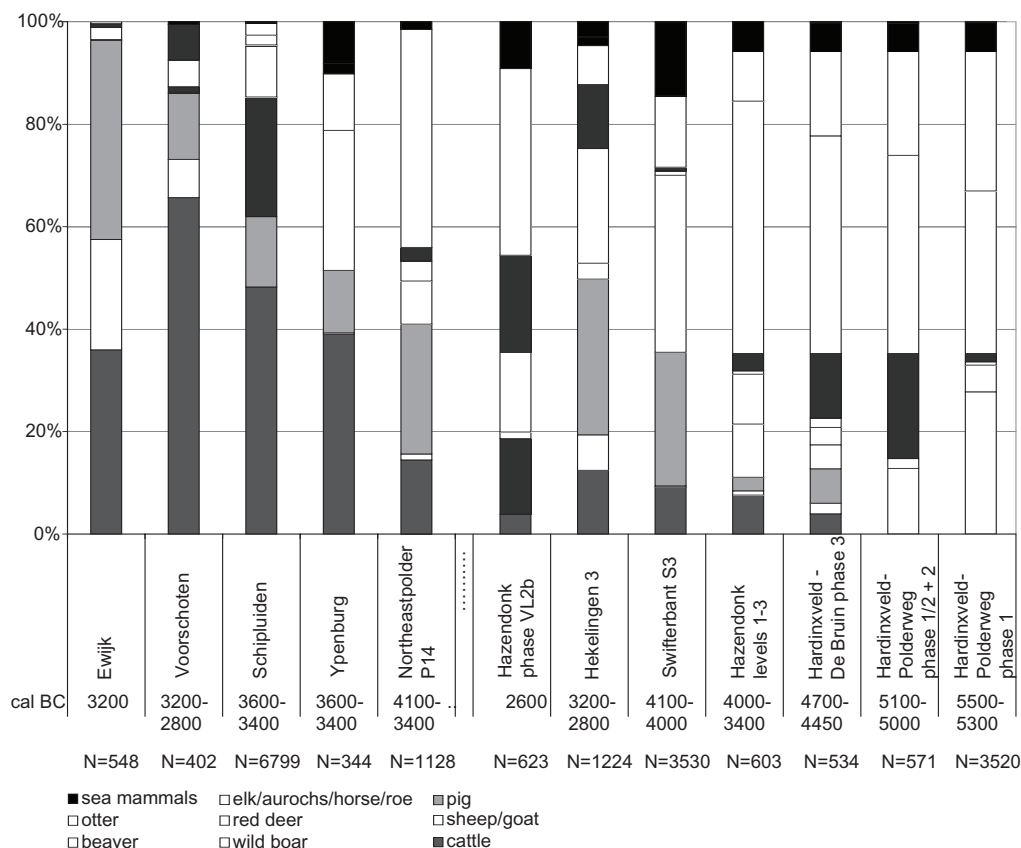
Until a few years ago and for want of something better, similar developments for the transition of hunter-gatherers to farmers to those supposed in Denmark were presumed for the Lower Rhine Basin Late Mesolithic, i.e. a shift to a more sedentary society with a strong seasonal exploitation system, although archaeological evidence was almost non-existent and rather different from that in Scandinavia. Shell middens for instance were completely absent.

The new sites and reflection on the older evidence tell us now that the Late Mesolithic settlement system is characterised by site diversity as well as the systematic and long-term use of specific locations in the landscape. This holds for the wide artefact spread of Weelde-Paardsdrank, of which just one small cluster was excavated (Huyge & Vermeersch 1982); it is the case with the well-known Bergumermeer site, for which a time depth of roughly a millennium has been documented by radiocarbon dates (Lanting & van der Plicht 1997–8, 136; Newell 1980); and Hoge Vaart, the first location excavated in the modern 'capital intensive' style, is also interpreted as an accumulation of multiple use over an extensive period of time (Hogestijn & Peeters 2001). All can be seen as 'normal' base camps possibly of seasonal use. Another type of site is formed by concentrations of hundreds of 'hearth pits', like Mariëberg (Verlinde in Louwe Kooijmans *et al.* 2005; Verlinde & Newell in press), conceived as locations where specific processes were carried out, possibly related to food conservation. Similar sites are known from the earlier, Boreal, Mesolithic as well. A third type is the butchering location of Jardinga (Prummel *et al.* 2002), where game was dismembered. Since different animals are documented and since the excavation is just a cutting of restricted dimensions in a valley floor, which has produced bones at other locations as well, we feel permitted to consider the valley stretch as a micro-region with a special function in the settlement system. Verhart (2000, 55) could demonstrate that communities along the Middle Limburg Meuse Valley shifted their activ-

ities between two micro-regions of different potential, the one along the river valley floor, the other at a distance of 10 km, along smaller brooks.

The most detailed information, however, is given by two sites, close to the village of Hardinxveld-Giessendam, excavated in 1998–9 in advance of the construction of a new railway (Louwe Kooijmans 2001a; 2001b; 2003). They appeared—on the basis of a wide spectrum of palaeoecological indicators—to have been distinct winter base camp locations, the one used for five centuries, the other for a millennium. They are pure Mesolithic in their lower levels and reflect increasing Neolithic elements upwards through the stratigraphy. These are two Late Glacial river dunes with tops at *c.* -5 m below Dutch OD, which were used as settlement locations in the extensive delta swamps at a time when the water level was several metres lower than these dune tops. The two sites are within 1 km of each other and in the main we consider one to succeed the other, the Polderweg site being occupied mainly in the earlier stages from 5500 to 5000 cal BC, and the De Bruin site continuing down till 4450 cal BC. The natural Holocene stratigraphy of the aquatic deposits alongside the dune allowed the distinction of three main phases of occupation and offered a wealth of ecological, economic and artefactual information, since the occupants had used this zone as a rubbish dump. Main subsistence activities in all phases had been hunting wild boar, trapping beaver and otter (Fig. 4), fishing for pike, and fowling. There are several clear winter indicators and negative scores on summer correlates, leading to the conclusion of exclusive or dominant winter use of the site. The presence of burials of people and dogs, the presence of women and children among the human skeletal material (Fig. 5a), the extent of the site, and the broad flint, bone and antler artefact spectra, are the basis for assuming a base camp function for a number of households, at least in the first phase (5500–5300 cal BC). So the option of a settlement system with seasonal base camps of very long term use has been substantiated at least for this single case of high quality evidence. The model could be extended with the suggestion of summer residences in the upland margin zone, at a distance of 10–20 km, which brings the Dutch territorial pattern close to the Ringkloster-Norsminde model of eastern Jutland (Andersen 1994–5, 50–3).

The communities were, in contrast, rather different as regards their material culture, as far as can be assessed from the preserved artefacts. This holds at any rate for the antler industry with its unperforated T-axes and sleeves with and without shaft holes. The slender wooden paddle blades are different in design from those in the north as are important details of the dugout canoe, found at the De Bruin site. The links were distinctly in a southern direction as illustrated by the *pointillé* design on one of the antler sleeves. That is also documented by the sources of several classes of flint from the southern chalk belt, by the most likely sources of large pieces of quartzitic



**Figure 4.** Faunal spectra from selected Late Mesolithic and Neolithic sites, 5500–3500 cal BC, in the Holocene sedimentation area in two groups: wetland sites to the right and agricultural locations at the left. In both groups spectra are arranged in chronological order. Excluded are antler, dog and all fur animals except otter. Indeterminate pig/wildboar bones are spread over pig and wild boar according to the ratio of these positive identifications. The same holds for cattle/aurochs. Four factors arise in the interpretation of these data: the stage in the process of neolithisation, the ecozone in which the site was situated, the possible differences in function of the site in the former settlement system, and seasonality. The left group is considered possibly to reflect the upland processes.

coastal	Schipluiden, Ypenburg, Voorschoten
river district	Ewijk
upland margin	Northeastpolder P14
estuarine, marshes	Hardinxveld, Hazendonk, Swifterbant, Hekelingen

Data from: Clason 1990; Gehasse 1995; Groenman-van Waateringe *et al.* 1968; Oversteegen *et al.* in Louwe Kooijmans 2001b; de Vries 2004; Van Wijngaarden-Bakker *et al.* 2001 in Louwe Kooijmans 2001a; Zeiler 1997 and in Louwe Kooijmans & Jongste 2006.



rock and small pieces of pyrite in the Ardennes and by the presence of unmistakable bone-tempered Blicquy type of pottery. We conclude—since material culture must be seen as fully independent of wet environmental conditions—that the Hardinxveld community, being embedded in a southern interaction sphere, can be viewed as representative of the communities north of the loess zone and north of the later agricultural frontier along its margins.

### FIRST FARMERS IN THE LOESS ZONE, 5500–4300 CAL BC

Traditionally the beginning of the Neolithic is marked by the extension of the Bandkeramik culture from the early nucleus in Hessen, through the Rhine corridor to the north.

There are a series of arguments to view this expansion first and foremost as a colonisation. First, there are no microliths found in the rich material of any of the large-scale excavations: neither in the Rhineland, nor in Dutch southern Limburg, nor in its earliest stage, like the Geleen-Janskamperveld settlement. Secondly, no transitional complexes between Mesolithic and Bandkeramik are known, and thirdly, the whole Bandkeramik cultural complex contrasts to everything we know of the late Mesolithic.

There are two arguments that this stage was preceded by a phase in which these northern regions had contacts with farmer communities further south. One is the use of 'grey western' flint—most probably from the South Limburg chalk region—in the earliest Bandkeramik settlements to south of the Rhineland Plateau. The second argument is the site of Sweikhuizen, where people had left some La Hoguette pottery, a pottery type present in the *Älteste Bandkeramik* (earliest LBK) assemblages to the south, but completely lacking in the slightly later *Ältere Bandkeramik* (early LBK) of the Rhineland and Limburg. The site shows that the La Hoguette interaction sphere extended to the southern fringe of the Lower Rhine Basin. Either these 'Hoguettiens' or the indigenous Mesolithic will have been the intermediary in the acquisition of western flint.

It might be superfluous to do so, but it should be stressed in view of some recent discussion that all evidence points to permanent settlements in the middle of clearances in the forests for fields for cereal cultivation. The labour input in the sturdy houses, the communal surrounding enclosing structures and the palaeobotanical evidence on weeds and crops are the main and convincing arguments.

These most north-western LBK communities extended into the Belgian Hesbaye, but not farther west, with the exception of the small Wange/Overhespen enclave and a second cluster in Hainaut, that might best be

viewed as a pioneer extension from the later LBK community in northern France. This pattern remained the same as material culture developed into Rössen in the east and Blicquy in the west. Most of the Belgian loess zone seems to have remained hunter-gatherer territory.

## CONTACTS AND INTRODUCTION, 5500–4450 CAL BC

The interference of the Bandkeramik with the northern hunters was restricted in extent and intensity. A zone of *c.* 30 km of the adjacent sand seems to have been used for herding and/or hunting from Late Bandkeramik times onward. Bandkeramik adzes found their way in small numbers farther north, supposedly in a form of exchange. The well known Rössen *Breitkeile* have a much denser and wider distribution all over the North European Plain and as such demonstrate more intensive contacts and—hidden behind these wedges—other Neolithic elements and ideas. They were, however, rarely deposited on settlement sites, Hüde I in Lower Saxony being the rare exception in the Lower Rhine Basin (Deichmüller 1965). The introductions can be followed in some detail in the Hardinxveld stratigraphy. The rich material allows us to believe that the lack of evidence in levels below the first occurrence of new elements really reflects a genuine absence of innovations at this stage.

Most intriguing is a distinct LBK type of arrowhead, made on a Rijckholt type of flint blade, from phase 1: so with a latest date synchronous with the earliest LBK occupation in southern Limburg. One might even think of the preceding phase for which a Hessen connection has been postulated above. The arrowhead at any rate reflects not only southern links at this stage but contacts with the agrarian communities there as well and so documents the start of an availability stage, *sensu* Zvelebil (1986). The first pottery in a local style is dated sharply at the Polderweg site around 5000 cal BC and marks the start of the Swifterbant culture, a ceramic Mesolithic stage, comparable to evolved Ertebølle, but three centuries earlier. The same stage has been documented in the extensive excavations at Hoge Vaart, in the IJsselmeer Basin (4900–4800 cal BC) and in the deposition at Bronneger, province of Drenthe (4800–4600 cal BC). It has a counterpart in the early pottery from Schlamersdorf in the German Baltic coastal area, *prima facie* dated to *c.* 5300 cal BC. A fresh water reservoir effect should, however, not be excluded in this case, but the pottery certainly precedes the earliest Ertebølle ware in Denmark dated around 4700 cal BC (Andersen 1994–5, 42; Hartz *et al.* 2002, 330; and see Hartz *et al.*, this volume). Pottery seems to be present at Hüde I from the beginning of its occupation, *c.* 4700 cal BC (Lanting & van der Plicht 1999–2000, 58; Raemaekers 1999, 89).

Bones of domestic animals do not occur before phase 3, i.e. between 4700 and 4450 cal BC and more probably late in this phase 3 rather than early (Fig. 4). All four domesticates—cattle, pig, sheep and goat—are represented in low numbers and document animal husbandry by this community. It must be doubted, however, whether the animals were kept on the site itself. The pattern of deposition can better be explained by depositional practices than by consumption, and so chunks of meat might have been brought to the site from the upland and not the animals themselves, which is also more in line with winter conditions in this marsh landscape. As far as crop cultivation is concerned, in spite of sampling and wet sieving directed to the recovery of cereals, no such remains were found. This simply means that cereals—if grown at all—apparently were not brought in, like the chunks of meat. Low percentages of domestic animal bones (2% and cattle only) have similar ages, around 4700 cal BC, again at the German Baltic coast, at the site of Rosenhof (Hartz *et al.* 2002, 327; and see Hartz *et al.*, this volume).

We must realise that the earliest occurrence of these agricultural indicators on isolated dune tops in the delta does not exclude an earlier introduction on the sandy uplands. The present archaeological evidence, however, makes us more surprised about the early dates for the domestic animals than about the absence of cereals, since the expansion of the Neolithic all over the Belgian loess zone and to the north is dated to the phase of the Michelsberg culture and not earlier, i.e. *c.* 4300 cal BC (and see Crombé & Vanmontfort, this volume).

### MICHELSBERG EXPANSION, 4300–3400 CAL BC

Turning again to the loess zone, remarkable changes—even disruptions—can be attested in the transition of the Rössen and Blicquy communities into those of the Michelsberg culture (Vanmontfort 2004). It seems that Neolithic society is restructured and that the basic unit shifts to a higher level, from the village in a segmentary society towards groups for which supra-local enclosures have a central function, a development seen over wider tracks of western and northern Europe. It is in this stage, to be dated from 4300 cal BC onward, that the wide spaces between the restricted Neolithic enclaves in Belgium are filled in. Apparently both the Blicquy farmers and all final Mesolithic groups transformed into Michelsberg and changed to a new way of life. The Michelsberg complex also demonstrates an expansion towards the north, beyond the loess zone, into the Limburg Meuse Valley and the Münster Basin. This means a northern shift of the old agricultural frontier which must have had its effect on the local communities beyond.

**SWIFTERBANT AND HAZENDONK, c. 4200–3600 CAL BC**

The period 4500–4200 cal BC is as yet not covered by any excavation, with the exception of the Bergschenhoek fishing site, but the stage around 4100 cal BC is documented by the earlier work at Swifterbant and the Hazendonk. Detailed pottery analysis (de Roever 2004) demonstrates that the Swifterbant area was exploited before this stage, people using outcropping dune tops as temporary bases. Sites shifted to the levees of fresh tidal gulleys around 4100 cal BC when these became more or less fixed, only for people to leave these locations again as the water level rose and the levees became too wet and were silted over. In the main excavation, at the site S3, two synchronous hut locations could be traced on the basis of multiple renewed fireplaces and the distribution pattern of artefacts. These sites are, in spite of their setting, certainly no simple fishing camps like Bergschenhoek. The animal bones document a wide range of hunting activities, with wild boar, beaver, red deer and otter, in this order, being the most important game (Zeiler 1991; 1997). The inhabitants raised pigs and herded cattle as well and these must have been of roughly equal importance for the meat supply (Fig. 4; Zeiler 1997, table 3). The exact ratios are difficult to establish, however, in view of the difficulties in separating pig and wild boar and the discrepancies between the numbers of identifications and bone weights. The spread of cereal remains (chaff and grains) all over the place demonstrate that cereals were used as a food source as well. The local group can on this basis be characterised as semi-agrarian and be viewed as representing a next stage in the gradual process of neolithisation. It is, however, difficult to establish which function the site or sites had in the settlement system: year-round occupation or summer camps only? A few bones of swans and one bone of beaver are the scarce evidence for winter presence, but space does not allow a full discussion of this problem here.

The small and isolated dune top of the Hazendonk was intermittently used as a settlement location from c. 4000 cal BC onward up till late Beaker times. Domestic animals (cattle and pig) and cereals have been attested in most phases, especially in the lowest levels. Cattle has a score of 14% of the number of identifications in this phase, but later never more than a few per cent of all bones (Fig. 4). The main activity of the occupants appears to have been the hunting (or trapping) of beaver, red deer, roe deer, wild boar and otter in rather diverging ratios in the various Neolithic phases. Seasonal indicators do not point to use of the Hazendonk site in a specific season, but rather to its use at various times of the year (Zeiler 1991; 1997).

There are two competing interpretations for this site: a seasonal or permanent base camp versus a specialised hunting site. The first option would imply that there would have been communities, which relied for their living for the greater part on the exploitation of natural resources—with fur

animals like beaver and otter in a prominent position—even as late as the Late Neolithic, around 2600 cal BC, while groups in other parts of the delta were predominantly or fully agrarian. The second option would mean that the use of the dune tops for the exploitation of the marsh district would have shifted in due course from a seasonal base camp function (as at Hardinxveld) to that of a subordinate special activity site, linked to permanent settlement elsewhere. The author prefers the second option, mainly because the first supposition seems rather unlikely, but also in view of the difference in flint procurement between the various Vlaardingen group settlements in the different delta ecozones. The main problem, however, is the lack of evidence, especially of the supposed ‘permanent settlements elsewhere’ on the sandy uplands south of the wetland district. But both options would mean that a prominent exploitation of natural resources continued up till the end of the Neolithic.

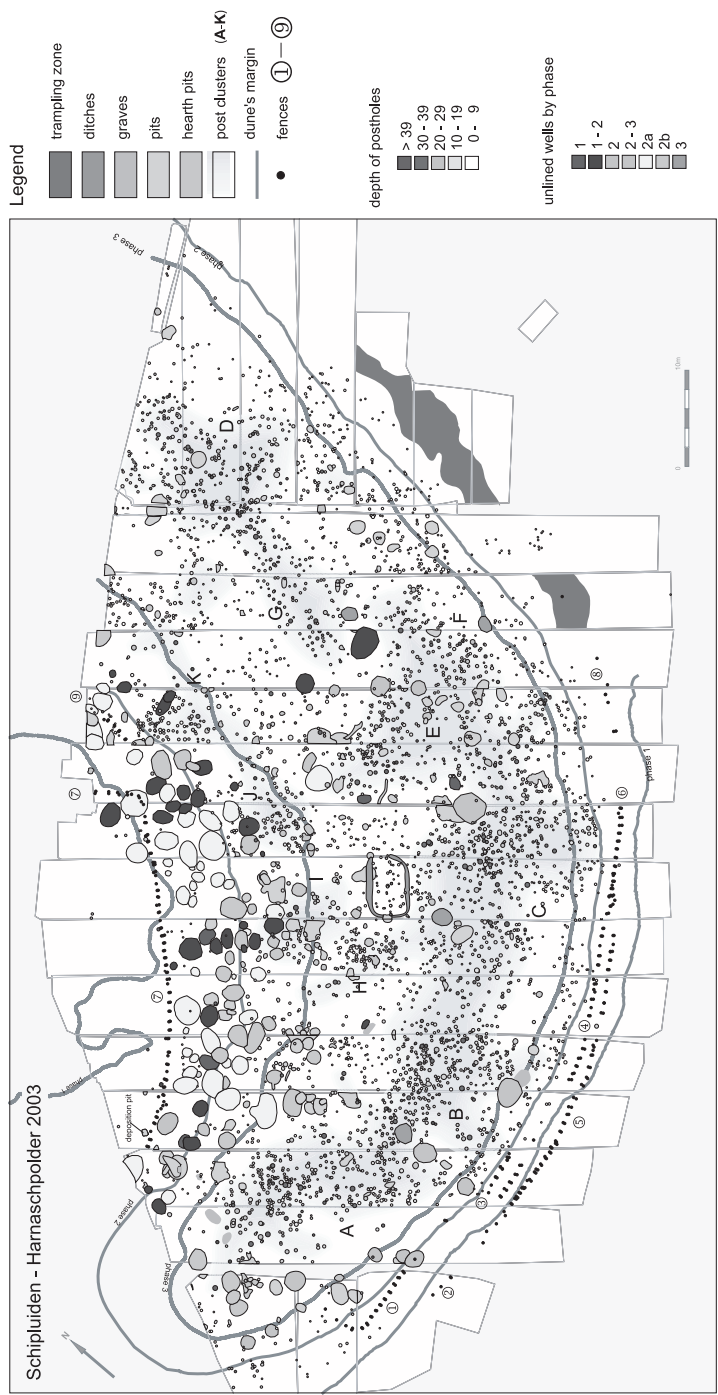
Another approach towards the start of crop cultivation has been the detailed pollen analytic investigation of a kettle moor called Gietsenveentje on the Drenthe Plateau (Bakker 2003). The earliest indications for arable weeds and disturbance of the natural vegetation were dated to 4050 cal BC.

So the introduction of cereal cultivation seems for the time being to be fixed at *c.* 4100–4000 cal BC by the presence of charred cereal grains and chaff at Swifterbant S3 and in the lowest Hazendonk level, in combination with the pollen evidence of Gietse Veentje. Again this date matches the first occurrence in the Early TRB assemblage of Wangels on the German Baltic coast, in the form of charred grains and impressions in pottery, together with a faunal assemblage, consisting of about 50% of livestock bones, cattle as well as sheep (Hartz *et al.* 2002, 328; and see Hartz *et al.*, this volume).

### **SCHIJPLUIDEN, A PERMANENT SETTLEMENT IN THE COASTAL ZONE, 3600–3400 CAL BC**

An important new anchor site for our view of the neolithisation process was discovered in the subsoil of the former municipality of Schijpluiden, close to Delft at a depth of 3–5 m in the preparation of a new water purification plant, and excavated in 2003 preceding its construction (Fig. 5; Louwe Kooijmans & Jongste 2006). The results are complementary to and widen those of earlier investigations at Wateringen (Raemaekers *et al.* 1997) and Ypenburg (Koot in Louwe Kooijmans *et al.* 2005) in the same region.

Schijpluiden involves a rather low (1.5 m) coastal dune, located in a vast coastal plain, at *c.* 3 km behind the coastline of that time. The dune measured *c.* 40–120 m and was used as a settlement location in its full extent between *c.* 3630 and 3380 cal BC. Similar settlements are known from locations in the same Delfland district. This community is characterised by the so-called



**Figure 5.** Overall plan of the Schipluiden site. Notable are the complex of wells in the north-west, the stretches of surrounding fences and the post clusters all over the dune. Domestic refuse was found in a wide zone all along the south-eastern dune margin.

Hazendonk ware, a development in and beyond the southern zone of the Swifterbant culture. As in earlier times their links were predominantly to the south and east, as reflected in the sources of flint and stone. Material culture here thus combined a native pottery tradition with a flint tool kit, including flint axes, of strong southern (Michelsberg) affinities.

The Schipluiden settlement consisted of four or five households, each having its fixed yard on the crest of the dune. The community surrounded the entire dune with a fence halfway through the period of occupation, and subsequently maintained the fence by replacing stretches of it once or twice (Fig. 6). The construction of it is seen as a communal effort and as a purposeful structuring of the settlement, separating the wild natural land outside it from the domestic space, and possibly protecting gardens or fields that might have been kept between the houses. It has been calculated that *c.* 2000 m of straight wooden posts with diameters of *c.* 6 cm must have been brought to the site for the construction of the first fence in a basically open landscape, with only localised shrubs on the widely spread dunes—a considerable effort. This is the first time that the layout and character of a Neolithic settlement could be determined to the north of the loess zone. So we should not consider it as the beginning of permanent settlement, but merely as the earliest documentation of this.

Extensive palaeoecological investigation and modern parallels for the reconstructed landscapes show that the Delfland microregion must have been a rich grazing ground and attracted people for that reason, in spite of the risks of salt incursions from the nearby estuary now and then. People even grew cereals on the salt marshes, but collected a wide range of fruits, tubers and onions from the wild as well. Little can be stated about the relative importance of crop cultivation, but more can be said about the meat supply. In all phases domestic animals (cattle and pig only) account for *c.* 60% of the number of identified bones, the remaining 40% mainly consisting of wild boar and red deer (Fig. 4). The ratio is more favourable for domesticates in bone weight (70%), seemingly reflecting a rather conventional Neolithic subsistence. The faunal evidence for fowling—mainly waterfowl—is very rich and we should not underestimate the role of fish in this setting between the estuary to the south and the fresh water swamps to the east. That aquatic resources were indeed of great significance is strongly supported by the isotopic evidence of human skeletal remains, pointing towards a fresh water contribution of about half of all proteins (Figs 7a–7b and 8; Budd *et al.* in prep.). Carrying capacity calculations demonstrate clearly, moreover, that the hunting of large mammals could only contribute 10% of the daily food for the 100–50 people that supposedly inhabited the region. This implies a contribution by cattle and pigs of not more than 20% and makes us conclude that the subsistence of this community still had the character of what I once



**Figure 6.** Schipluiden fence traces in the field and an ethnographic reference in the Norsk Folkemuseum, Oslo 1976. Photo by the author.



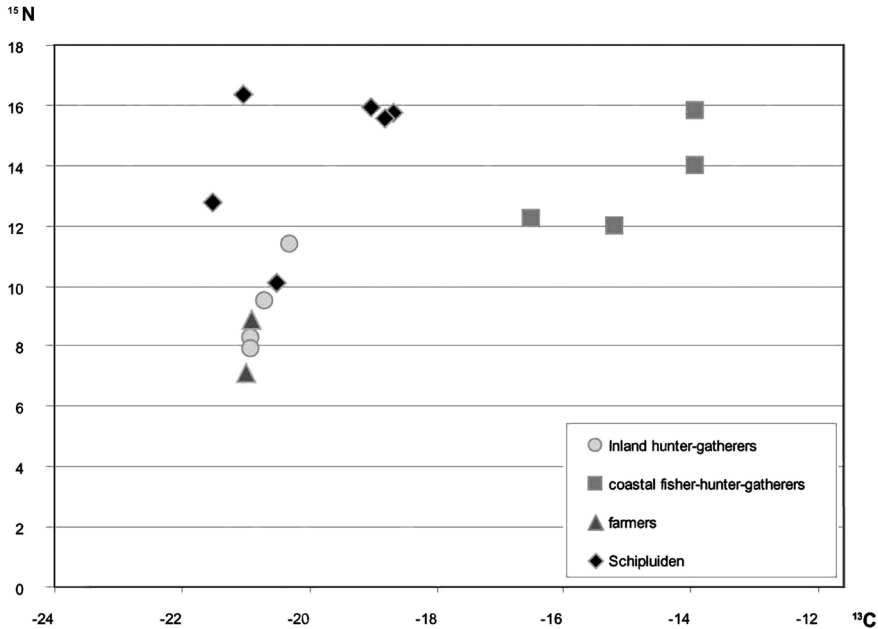


**Figure 7a.** Hardinxveld, burial of an elderly woman in a Late Mesolithic tradition, *c.* 5500 cal BC.



**Figure 7b.** Schipluiden, tightly flexed burial of an adult man in a Middle Neolithic tradition, *c.* 3500 cal BC. Photos Faculty of Archaeology, Leiden.

called an ‘extended broad spectrum economy’ (Louwe Kooijmans 1993a). We conclude that the change in material culture preceded changes in settlement system and the transformation of subsistence, at least in this coastal region. The fact that these people settled in this region by free will, and that they must have considered it attractive for their preferred way of life, implies that



**Figure 8.**  $^{13}\text{C}$  and  $^{15}\text{N}$  values of human skeletal material from Schipluiden, compared to the values of farmers, inland and coastal fishers. After Smits in Louwe Kooijmans & Jongste 2006.

we should not consider this economy ‘an adaptation to specific conditions’ but rather see it as representative for the period involved.

## CONCLUSION

We have given priority in this contribution first and foremost to the presentation of the factual evidence and its interpretation, since we fully agree with Peter Rowley-Conwy (2004) that some explanations of the Mesolithic-Neolithic transition have moved far away from this basis and can even be contradicted by the data.

Our main conclusions from the foregoing accounts are:

1 There has been a long-lasting, static, frontier between the agricultural world in the south and the hunter-gatherers in the north: a long ‘availability phase’ of about seven centuries between 5300 and 4600 cal BC.

2 The Neolithic was not adopted as a package, but piecemeal: the main Neolithic cultural elements preceding the subsistence shift. So the adoption of food production took place within societies of local origin and within the point-based pot tradition of the Swifterbant culture (Table 1).

**Table 1.** The neolithisation sequence in the Lower Rhine Basin represented by the first occurrences of Neolithic elements in the Dutch and North German Plain.

cal BC	aspect	site, location
c. 3200	first fully agrarian faunal assemblages (cattle >50%), Vlaardingen group	Ewijk, Voorschoten
3400	end of Swifterbant-Hazendonk pottery traditions	Schipluiden; Hazendonk
3600	permanent settlement, extended broad spectrum economy	Schipluiden
4100–4000	cereals (cattle <50%), crop cultivation	Swifterbant S3, Gietse Veentje
4500	livestock (cattle, pig, sheep, goat <5%)	Hardinxveld-De Bruin phase 3 (end?)
4800	Neolithic flint blades	Hardinxveld-De Bruin phase 2
4900–4800	adzes ( <i>Breitkeile</i> )	Hüde I, Dümmer
5000	first local (point-based) pottery	Hardinxveld-Polderweg phase 2
5500–5300	first contacts	Hardinxveld-Polderweg phase 1

3 There are striking parallels in this sequence of adoption between the Lower Rhine Basin and the German Baltic Zone, where new research documents a similar and synchronous sequence. Both regions might be viewed as just two areas where processes occurring all over the (intermediate) North German plain have been documented by their favourable conditions for preservation.

4 This sequence contrasts with the more abrupt changes in Britain on the one hand and Denmark on the other, around 4000 cal BC.

5 The transition, finally, viewed in a wider geographical context, can be seen as one piece in a mosaic of micro-regional transformations, being the results of region-specific choices of hunter-gatherers in their contacts with early farming communities.

Apart from the interpretational problems of the wetland sites, mentioned above, there is another problem in establishing the ‘domestic:wild ratio’ and the application of the 50% criterion of Zvelebil (1986). The questions are:

1 Do we measure in numbers of identified bones or in bone weight, or perhaps the isotope evidence for protein intake?

2 What species do we include in the ‘100% bone sum’? Are dog, antler, small rodents, birds included or excluded?

3 To what extent and on which criteria are pig and wild boar separated?

These matters play an important role when we compare faunal assemblages identified by different zoologists at widely different times, as Raemaekers (2003) did. He argued that neolithisation did not take that long, and that the ‘substitution phase’ must have ended around 3600 cal BC and not much later. The ‘50% domestic boundary’ was passed for the first time in his Wateringen 4 site and the same is the case in the later Vlaardingen sites in agriculture-friendly ecozones. This still leaves us, however, with the existence of locations devoted

for the greater part to the exploitation of natural resources in both phases. The question of whether neolithisation ended 3600 cal BC or continued till the Late Neolithic seems to be above all a matter of definition and choices.

The last question to be answered is why the communities in the Lower Rhine Basin and perhaps the whole North German-Dutch Plain reacted so cautiously to the new life style, in contrast to what happened earlier in the loess zone and later in Britain, for example. I have earlier (Louwe Kooijmans 1998) suggested that there will have been a fundamental difference in attitude to the natural environment between the fully 'domestic' Bandkeramik and the foragers of the North German-Dutch Plain. They just 'made other choices' because of this differences in attitude, but that never can be the sole explanation. The agricultural system which the Bandkeramik offered most probably was not attractive enough to adopt. The transformation into Michelsberg culture meant a new settlement system and possibly also a less rigorous agricultural system. It was at any rate eagerly adopted all over Britain and Denmark, but still piecemeal and without any cultural disruption in the Lower Rhine Basin, where the exploitation of the rich natural resources remained the more attractive alternative.

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