Netherlands Journal of Geosciences — Geologie en Mijnbouw |**96 – 2 | 165–173 | 2017** doi:10.1017/njg.2016.21

Medieval impacts on the vegetation around the confluence of the river Meuse and its tributary the Swalm, the Netherlands

Corrie Bakels

Faculty of Archaeology, Leiden University, The Netherlands
Corresponding author. Email: c.c.bakels@arch.leidenuniv.nl

Manuscript received: 7 January 2016, accepted: 30 May 2016

Abstract

The vegetation history of the area around the confluence of the rivers Meuse and Swalm (the Netherlands) during the Middle Ages is covered by two pollen diagrams. The diagram Swalmen reveals a large-scale deforestation as a result of the foundation of a nobleman's homestead around 950. The diagram Syperhof shows a period during which the forest partly returns after a long history of unremitting anthropogenic stress. This temporary phenomenon is ascribed to the onslaught of the Black Death in 1349. Both diagrams provide evidence of the start of buckwheat growing.

Keywords: Black Death, buckwheat, deforestation, Middle Ages, pollen diagram

Introduction

While prospecting for likely places to sample Late Subatlantic sediments in the lower part of the Swalm river, Frans Bunnik discovered several good candidates. His search was part of an archaeological project on an Early Medieval settlement that would disappear under the future motorway A73 and its aim was to provide a reconstruction of the settlement's surroundings through pollen analysis. Due to budget restrictions true diagrams were never made. However, his results were so interesting that I decided to take over. In cooperation with Frans Bunnik, two locations for further research were chosen. These cores also served to train two students of the Faculty of Archaeology, Leiden University, i.e. Marijke Langeveld and Iris van Tulder.

The results were earlier presented to an archaeological public (Bakels et al., 2015), but as they are considered to be of interest as part of a special issue on the history of the Meuse valley, they are presented here as well.

The river Swalm is a relatively small tributary of the much larger Meuse river. It flows from a source in Germany and meanders towards its confluence with the Meuse between the Dutch towns of Venlo and Roermond (Fig. 1). An abandoned meander not far from its end provided the material for one of the pollen diagrams discussed below. The place was named Swalmen after a nearby village. The valley of the Meuse has many filled-in oxbows and one of these, just south of the confluence with the Swalm, was chosen for the second core, named Syperhof after a nearby farm.

The rescue excavation in the plotted route of the future motorway revealed Early Medieval occupation dated to the seventh century, but the most important find was a complex of structures belonging to an important Medieval homestead that was occupied between 950 and 1225. The homestead was interpreted as a *curtis*, a nobleman's estate (Vreenegoor & Van Doesburg, 2013).

Material and methods

Both sites were sampled with a side-filling corer. The sediment encountered was loam, except for the upper 18 cm of the Swalmen core, which consisted of peat. Coring ended when the sampler struck gravel. The cores were taken to the Leiden laboratory and cut into subsamples 1 cm thick. Subsamples chosen for further analysis were treated with KOH, HCl, gravity separation sg 2.0 and acetolysis. The pollen retrieved was embedded in glycerine. Before treatment, tablets with *Lycopodium* spores were added following Stockmarr (1971).

Identification of taxa was achieved by consulting the works of Faegri et al. (1989), Moore et al. (1991) and for cereals Grohne (1957). All identifications made by students were affirmed by me and I counted half of the slides myself.

Diagrams were drawn using TILIA and TILIAView (Grimm, 2011). The pollen sum chosen was an upland (dryland) sum,

Fig. 1. The location of the cores (black dots) discussed in this paper (drawing J. Porck).

excluding the wetland trees *Alnus* (alder) and *Salix* (willow), and possible wetland taxa like Poaceae (grasses) and Cyperaceae (sedges). The aim was to count until 300 pollen sum taxa had been recorded.

A chronology of the sites was obtained by accelerator mass spectrometry (AMS) dating based on terrestrial material (Table 1).

Results and discussion of the diagrams

Swalmen

The infill of the Swalmen deposit is the older (Fig. 2). Its silting-up with loam started sometime before 725–967. One AMS date, GrA 29855 from a depth of 48–50 cm, is rejected as being obviously too old. It is the only date based on a piece of charcoal; the others are based on terrestrial seeds.

As mentioned above, most of the infill concerns loam, but this loam is not uniform in aspect as it shows three distinct layers: a lower loam separated by a 2 cm thick layer of compact loam from an upper loam that is slightly coarser in texture. AMS ^{14}C dates from near the top of the lower loam and the bottom of the upper loam reveal that the presence of a hiatus is unlikely (Table 1). Sedimentation seems to have been a continuous process.

Upland vegetation

Pollen retrieved from the lower loam deposit reflects an environment covered with deciduous forest. Percentages of non-arboreal pollen (NAP) are low. The main tree is *Quercus* (oak),

Table 1. The ^{14}C dates. Calibration Oxcal 4.2.

	GrA	^{14}C years BP	calAD 95.4%
Swalmen			
40 cm	59,688	670 ± 35	1270–1394
48–50 cm	29,855	1495 ± 40	430–645
67–69 cm	29,857	985 ± 45	981–1161
75–76 cm	29,718	1125 ± 35	777–993
125 cm	59,690	1180 ± 35	725–967
Syperhof			
30–32 cm	29,721	265 ± 35	1681–1930
60 cm	59,691	295 ± 35	1485–1663
80–82 cm	29,722	134.2 ± 0.5%	recent
180 cm	59,692	570 ± 35	1300–1427
450 cm	59,760	895 ± 45	1029–1221

but *Tilia* (lime) and, to a lesser extent, *Ulmus* (elm) are also part of the local forest. The presence of the light-demanding *Fraxinus* (ash) shows that the forest was not very dense. Moreover, the relatively high percentages of *Corylus* (hazel) and *Betula* (birch) show that forest edges and therefore clearings were present as well (local pollen zone 1).

In the course of time, around 725–967, *Quercus* percentages gain in importance whilst the others, except for *Corylus*, fall (local pollen zone 2). This is best explained by an increasing human influence, most likely the effect of the Early Medieval population detected during the excavation. Some of their activities involved cereal growing, as witnessed by low percentages of Cerealia (cereal) pollen.

Whether *Pinus* (pine) and *Fagus* (beech) also formed part of the local forest is questionable. Nevertheless *Pinus* reacts in very much the same way as the other trees, and some stands may have been present on sandy-gravelly soils on, for instance, the terraces in the nearby valley of the Meuse. *Fagus* behaves slightly differently and this tree may not have grown in the immediate surroundings. The same applies to *Carpinus* (hornbeam).

At the time of deposition of the thin layer of compact loam the percentages of arboreal pollen (AP) suddenly drop. At this level an important rise in herb percentages, first and foremost the cereals *Triticum* (wheat), *Hordeum* (barley), *Avena* (oats) and *Secale* (rye), accompanied by the notorious field weed *Centaurea cyanus* (corn flower), spurrey (*Spergula*) and the hepatic *Riccia*, is visible instead (local pollen zone 3; for *Riccia* as indicator of agriculture see e.g. Koelbloed & Kroeze, 1965). The most plausible explanation is that the already thinning forest was cut down to make way for arable fields. The AMS dates suggest that this large-scale clearing is connected with the founding of the large homestead, the *curtis*. The excavation revealed huge barns (Vreenegoor & Van Doesburg, 2013). Still more important, it was discovered that the parcelling of the land south of the

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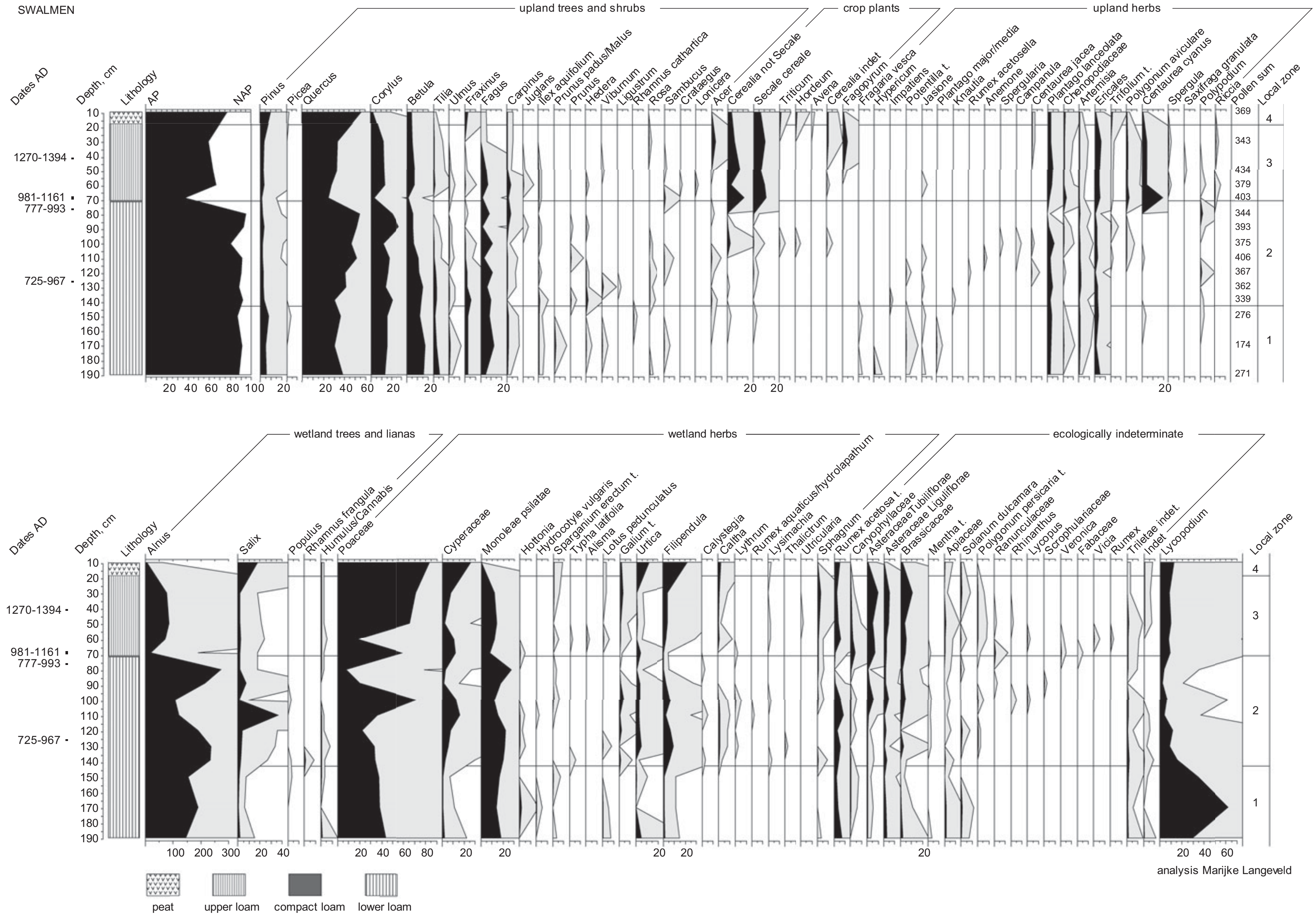

Fig. 2. The pollen diagram Swalmen, exaggeration of curves (10×) in grey.

mouth of the river Swalm and east of the river Meuse, as seen today, goes back to the time of the *curtis* (Fig. 3). The bottom layer of a track that is part of this system was dated (Vreenegoor & Van Doesburg, 2013). All cereal taxa represented by pollen were found as charred grain near the barns (Van Beurden & Hänninen, 2013).

Around 1225 the large farm was abandoned (Vreenegoor & Van Doesburg 2013), but farming did not cease, as is evident from the continuation of the deposition of loam, held to be derived from soils lying bare, and the still high percentages of cereal pollen and field weeds in the upper part of the diagram. Farmers even adopted a new crop, *Fagopyrum esculentum* (buckwheat).

Wetland vegetation

In the lower part of the diagram the wetland taxa reveal fluctuations, in particular in local zone 2. The curve of *Alnus* (alder) pollen declines from a depth of 125 cm onwards, to rise again at a depth of 100 cm. As the decline is accompanied by a rise in *Salix* (willow) percentages followed by a rise in Poaceae (grasses, presumably wetland species) and Cyperaceae (sedges), the development may reflect a very local event connected with a temporary change in aquatic conditions. *Salix* replaced *Alnus*, after which local succession led to the return of *Alnus* in the immediate surroundings of the small oxbow. In view of the deposition of loam and the absence of peat formation, the water was never truly stagnant except for the uppermost centimetres, and the presence of plants as *Hottonia palustris* (water violet) corroborates this. *Hottonia palustris* thrives in places with some water movement (Weeda et al., 1988). Human influence is not detected in the lower loam.

The upper loam is characterized by much lower percentages of *Alnus* pollen. Alder seems to have been replaced by Poaceae (grasses). The most obvious source of this development is human interference. The occupants of the big farm seem not only to have cleared the upland but also the wetland. This wetland comprises not only the narrow valley of the Swalm but presumably includes parts of the adjacent valley of the Meuse as well. Besides arable fields, farmers may have felt the need for pastures and meadows. This is supported by the excavators of the farm, who found that the inhabitants also practised horse breeding (Vreenegoor & Van Doesburg, 2013). Pastures and meadows remained after the abandonment of the *curtis*. At present, the area is still meadowland.

Syperhof

The oxbow of the Meuse sampled for pollen analysis started to silt up in the period of upper loam deposition in the Swalmen oxbow (Fig. 4). Sedimentation of loam continued well into historical, even sub-recent, times. One of the AMS measurements, obtained from a depth of 80 cm below surface, gave a value contaminated with atomic bomb ^{14}C. This sample consisted of five tiny seeds which may have found their way from the surface to the deeper level. This date was rejected. The other dates are based on much larger material such as parts of alder cones.

Upland vegetation

Up to a depth of 310 cm the upland vegetation as expressed in the Syperhof diagram is similar to the vegetation as reflected in the Swalmen diagram (local zone a). The pollen content of the river loam seems to represent the same source or at least the same kind of source, though the sediment was deposited by a much larger river. The river Swalm discharges its water downstream of the Syperhof oxbow and it is not feasible that a substantial part of the loam had its origin in the watershed of this stream. Nevertheless the picture is the same. Obviously, transport by water was of minor importance. Both the Syperhof and Swalmen diagrams are considered to represent the same area, namely the area around or more precisely south of the confluence of the rivers Swalm and Meuse.

The lower part of the diagram reflects a deforested landscape. Some *Quercus* (oak) was spared, possibly as small remnants of forest. These stands were bordered by *Corylus* (hazel) and *Betula* (birch). As in the case of Swalmen it is not clear whether *Fagus* (beech) was growing in the area or farther away.

Most herb pollen is derived from cereals. As these were not further identified in some of the spectra, only a curve Cerealia is presented, but most of this is *Secale* (rye), though *Triticum* (wheat), *Hordeum* (barley) and *Avena* (oats) are present as well. Other crop plants are *Fagopyrum* (buckwheat) and possibly *Cannabis* (hemp) and *Humulus* (hops). It was not possible to separate *Cannabis* from *Humulus* in every single case, but *Cannabis* is certainly present. In the Swalmen diagram the pollen type is ranged as 'wetland' taxon because of the habitat of wild hop, but the regular, continuous curve in the Syperhof diagram suggests a crop plant. Although the dioecious hop is grown for its female plants, some male plants were always present in Medieval plantations as is witnessed by the presence of hop seeds in Medieval settlements (Behre, 1984). Therefore, hops should be considered next to hemp.

The record also mentions two cultivated trees, *Juglans* (walnut) and *Prunus avium/cerasus* (cherry and/or sour cherry). Cherry could have been wild but as this kind of pollen does not appear regularly in pollen diagrams, its appearance suggests orchard trees. Walnut is not indigenous but was introduced by the Romans (Bunnik, 1999).

From a depth of 310 cm onwards the balance between trees and herbs gradually shifts even more in the direction of herbs, mainly cereals (local zone b). The main sufferer is *Corylus* (hazel); the curve of *Quercus* (oak) remains the same or rises slightly. The reason may be that remnants of forest, including their edges, were cut down, but that oak was spared. A growing

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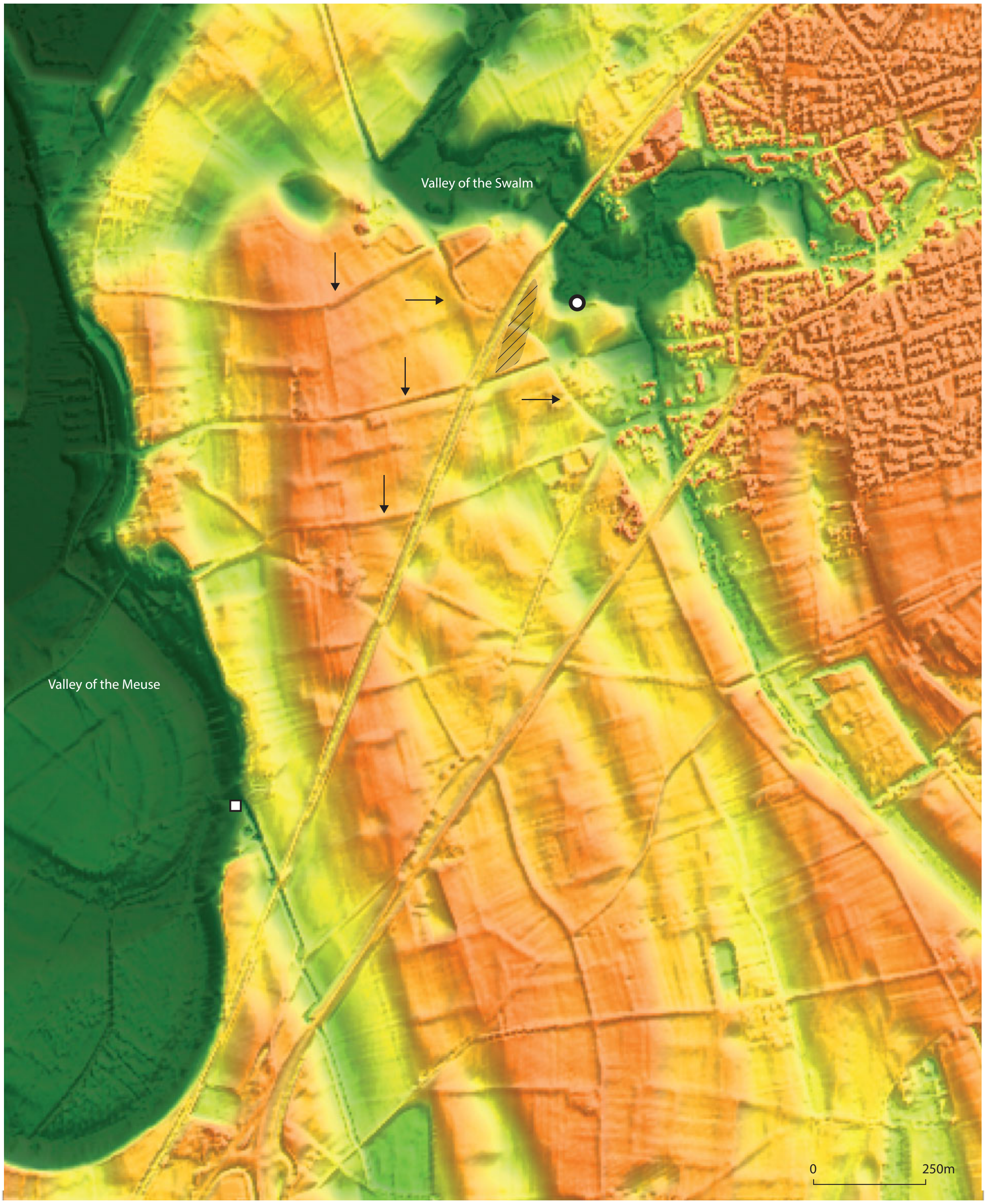

Fig. 3. Elevation Model of the Netherlands (AHN map) of the area south of the confluence of the rivers Swalm and Meuse. Elements of proven medieval origin are indicated by arrows, the excavation by hatching and the location of the Swalmen core by a dot. The location of the other core discussed in this paper is indicated by a square.

https://doi.org/10.1017/njg.2016.21 Published online by Cambridge University Press

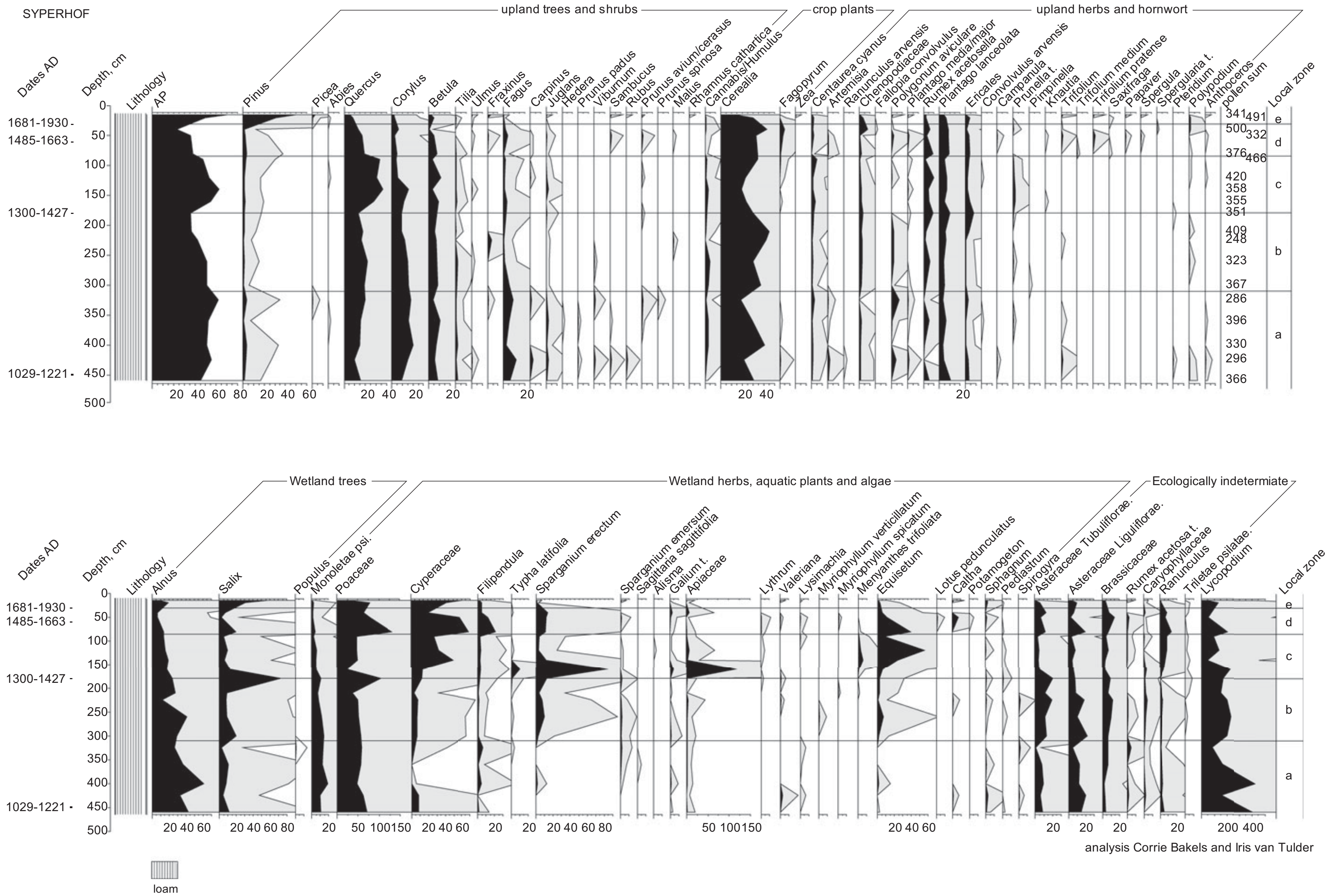

Fig. 4. The pollen diagram Syperhof, exaggeration of curves (10×) in grey; because the category ecologically indeterminate is rather long and does not contribute to the interpretation of the diagram, several taxa occurring sporadically and not tied to one pollen zone are omitted. These taxa are: Epilobium tetragonum, Hypericum t., Mentha t., Persicaria, Potentilla, Scrophularia, Solanum dulcamara, Urtica, Veronica and Vicia. In this diagram Cannabis/Humulus is ranged as a crop plant and Apiaceae as a wetland taxon (see text).

farming population is considered to be responsible. Indeed, historical sources support such a population growth (Slicher van Bath, 1963).

Around 1300–1427 the curves of trees (AP), especially *Quercus* (oak), start to rise again whilst that of Cerealia (cereals) falls (local zone c). Oak forest recovers at the expense of arable fields. A similar phenomenon was reported by Van Hoof et al. (2006) from a site near St Odiliënberg. Their pollen diagram concerns the infill of an oxbow in the valley of the river Roer, a tributary of the Meuse slightly further south (Fig. 1). The diagram is dated by 11 AMS dates. Van Hoof et al. (2006, pp. 406–407) write:

> the main feature of the analyzed pollen record is a long-term reduction of the arboreal component reflecting regional deforestation up to AD 1350, parallel to the population increase during this period ... Following the period with maximum values for non-arboreal pollen ... a period of prolonged and pronounced agricultural regression can be identified in the regional pollen record ... (ca AD 1360–1440).

This regression will be discussed below.

Around a depth of 140 cm the general tree pollen curve (AP) declines again, though *Quercus* (oak) remains stable for a longer period, and the cereal curve rises. *Fagopyrum* (buckwheat) gains steadily in importance. As deforestation continues, obviously trees have to make way for fields (local zone d). In the uppermost spectra AP rises again, but this time it is due to a rise in *Pinus* (pine) pollen percentages (local zone e). Written sources mention the planting of pine in the Swalmen area between 1920 and 1950 (J. Janssen, pers. comm., 2004). This is rather late for the southern Netherlands, where reforestation of soils not suitable for agriculture started already in the 19th century to grow props for coalmines. It is not suggested here that the pine pollen in the diagram provides a 20th-century date for the top of the Syperhof deposit, because *Pinus* pollen is known to be easily transported by air from distant sources (see e.g. Faegri et al., 1989). Nevertheless, the upper part is very recent. The find of *Zea* (maize) corroborates this.

The wetland vegetation

The wetland part of the record shows a constant decline of *Alnus* (alder) pollen percentages. *Alnus* does not recover during the phase in which the upland forest regains importance. A short episode with at first *Salix* (willow) followed by *Typha latifolia* (cat's-tail), *Sparganium erectum* (branched bur-reed) and some obvious wetland Apiaceae (parsley family) may reflect a strictly local change in water level. *Alnus* values remain low and declining, and Poaceae percentages remain more or less at the same level. This suggests that during the period of forest regrowth on the upland, the wetlands remained pasture and meadow land. This situation did not alter during the remaining time of deposition.

General discussion and conclusion

The pollen diagrams Swalmen and Syperhof together cover the entire Middle Ages. In the Syperhof diagram, some later periods are represented as well, but as this part of the record is 'compressed' into the upper part of the deposit the possibility of extracting information from these spectra is rather restricted. The majority of the pollen is considered to have been released by plants growing in the area south of the confluence of the rivers Swalm and Meuse, which implies only a few square kilometres. This is the kind of catchment area that would agree with the restricted surface of the oxbow lakes sampled (Sugita, 1994). A large part of this area is depicted in Figure 3.

The Medieval landscape starts with light forest. Some human activity connected with agriculture is already present, but the main impact arrives with the foundation of a nobleman's farm, a *curtis*. Its founders cut down the forest, leaving some copses with oak standing. The remainder of the dry part of the landscape is converted into fields, according to a pattern still visible in the landscape today (Fig. 3). Rye, wheat, barley and oats are grown. The wetland part of the landscape is turned into pasture and meadow. This situation does not alter after the abandonment of the *curtis* around 1225. Pressure on the remnants of the natural vegetation continues and farmers add new crops: buckwheat and possibly hops and hemp.

The early appearance of buckwheat in the Syperhof diagram is rather exceptional. In this location the plant is present since the record began, i.e. 1029–1221. This is very early for the Netherlands and earlier than the earliest written sources allow (Leenders, 1996). The dates of the start of buckwheat growing provided by the Swalmen and Roer diagrams are in better agreement with the historical data, that is an introduction around 1389–1390. Either the ^{14}C date of Syperhof is faulty, or the oldest pollen grains arrived as an intrusion from a higher level, or came with river water from elsewhere, or an incipient cultivation is not recorded in written sources.

A downward transport is not very likely because the deposits above the early finds and below the distinct rise of the *Fagopyrum* curve are void of this pollen. A search in extra slides did not reveal any of these grains. Water transport by the Meuse can be discarded as well, because up to today no earlier buckwheat is reported from regions upstream, either in Southern Limburg or Belgium or France (Slicher van Bath, 1963; Sigaut, 2014). This only leaves the possibility of a wrong date or an early cultivation not recorded so far. Both can be considered, but it must be noted that Bunnik (1999) detected buckwheat in deposits in the adjacent German Rhineland dating to the second half of the 13th century. Moreover, a recent publication by De Klerk et al. (2015) draws attention to the fact that there are far more finds

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hidden in the literature than hitherto suspected. Therefore, an early cultivation is surely not out of the question.

From 1300–1427 onwards, the agricultural landscape undergoes a change. In the upland, forest reappears and cereal cultivation loses importance. This phenomenon is not only recorded in the Swalm–Meuse–Roer area, but is also known from elsewhere in Western Europe (Yeloff & Van Geel, 2007; Lagerås, 2013). Written sources mention it as well, and one of its aspects is the abandonment of farms or even complete rural settlements, called *Wüstungen* in German (Bieleman, 1992). The crisis is placed in the 14th–15th century.

A common explanation is a change in climate towards wetter conditions, but as stated by Lamb (1977) and Buisman (1995), this change is already felt by the end of the 12th century. More plausible is the effect of the plague, or Black Death, upon society. The Black Death reached the Swalm area in 1349 (Benedictow, 2004). Its toll is not recorded in local chronicles, but it is known that in cities not too far away, i.e. Cologne and Aachen in Germany, one-third of the population died (Creutz, 1933; Schmitz-Cliever, 1954). Such a decline, if also felt at rural sites, must have affected the number of hands able to till the land and bring in the harvest. It is feasible that the thinned-out population switched to other activities such as tending proportionally more livestock. This would explain the fact that the wetlands remained unaltered.

In the Roer area the regression ends around 1440 (Van Hoof et al., 2006). In the Syperhof diagram such an accurate date could not be obtained, but it ends before 1495–1663. Rural life recovers and the arable fields are tilled again. This situation remains until the present day.

Acknowledgements

I would like to thank Frans Bunnik for triggering this study, and my former students Marijke Langeveld and Iris van Tulder for their part in making and interpreting the diagrams. I am also grateful to Wilko van Zijverden who provided me with the AHN map and, last but not least, to Kelly Fennema for correcting the English. One of the reviewers, Otto Brinkkemper, drew my attention to a recent and very relevant paper concerning buckwheat.

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