

## 3.2 THE BELGIAN POLDERS, FLANDERS: A TEST CASE 2002-2006

M Pieters, L Schietecatte, I Zeebroek, C Baeteman, J Bastiaens, K Deforce, I Jansen, E Meylemans & J van Laecke

### Introduction

From 2002 to 2006 about 400ha of the Belgian Polders reclaimed wetlands, in the vicinity of Oostende and Middelkerke, have been surveyed archaeologically in order to establish a methodology to determine efficiently their archaeological value (fig. 3.2.1). The surveyed area, perpendicular to the present coastline and stretching from the beach to the sandy region, is 3 to 4km wide and about 7.5km long. The museum of Walraversijde is the logistical centre for public outreach for the project. The Belgian Polders are very poorly understood archaeologically and, as a result, also largely undervalued. This survey project set out to develop an efficient strategy for the proper archaeological evaluation of this area and to contribute to a better understanding of the potential for research and presentation.

### Methodology

Several techniques have been used to survey the area, including line walking, grid walking, geophysical techniques (electrical resistivity and magnetometry), boreholing and analysis of the Digital Terrain Model of Flanders. These techniques were applied in a well-defined order: from the general to the specific. The project started with rapid line walking of a 'statistically significant' area. The average individual plot of land had an area of a little more than 2 ha. Following this, detailed grid walking was applied to specific plots, highlighted as interesting by the line walking. Some of the plots walked in lines were also surveyed using adapted geophysical techniques. Geological research was also carried out, to compare the archaeological dataset with the geological one. This chain of activities allowed the elimination of some hypotheses which resulted from the line walking alone, but also gave support to others.

Line walking was carried out only on arable fields. The plot boundaries used by the farmers were used to define the survey units. Where arable fields were too big, they were divided into smaller survey units of about 2 ha. This was intended to increase the precision of the location of archaeological remains. Survey work in Flanders does not require the permission of the owner or tenant, but the project was publicised in a local newsletter to make people aware of the activities of the survey team. There were no problems with the team walking the arable fields, so long as this was not done after it had been sown. All the fields were walked under ideal conditions after a long period of rain, sufficient to wash the archaeological material free from the soil matrix so that it could be efficiently gathered.

About 13 % of the test survey area was surveyed. The survey team consisted of 4 to 5 people, one archaeologist and 3 to 4 technical assistants. The fields were surveyed in lines parallel to the direction of ploughing and with an interval of 3 to 5 metres. All the archaeological material was collected regardless of date or type. The objective was to survey fields with high densities of archaeological material, in a more detailed way. Survey unit 32 was surveyed in grids measuring 3 by 10 m. These more detailed surveys added useful information allowing more elaborate interpretations.

All the collected material was cleaned, numbered and analysed. Pottery formed the most common find, comprising about 54,000 fragments in total from the 174 survey units surveyed so far. Analysis consisted primarily in splitting the material into 46 different categories of which 32 refer to ceramics. The categories were based on technical characteristics identifiable on small and worn fragments. This detailed analysis of a very large dataset has allowed detailed research questions to be asked. Some artefact types, such as flint, remain absent in the study area.

Following the line and grid field walking, magnetic and electric resistivity surveys were applied in areas of concentrations of archaeological material. As a final stage boreholing was also carried out in order to add geological information.

## Results

### Line walking: results in chronological order

During the fieldwork no flint artefacts or any pre- or protohistoric pottery was found. This agrees with the present understanding that the sediment at the surface in the Belgian Polders is Post-Roman in date. Some Roman artefacts have, however, been found. The digging of peat in medieval and later times has been suggested as the major mechanism by which this material was brought to the surface. This peat digging, however, does not appear to have brought pre- or protohistoric remains to the surface. This could mean that the coastal plain didn't support human occupation during these periods, but this seems highly improbable when one considers data from similar wetlands in adjacent Zeeland (The Netherlands). It may be that the hypothesis of peat-digging activities, bringing objects to the surface, has not been as effective as first thought.

A total of 31 survey units presented Roman pottery fragments at the surface (fig. 3.2.2), in other words, nearly one in six. Half of these only produced one fragment, with the other half producing 2 or more fragments per unit, with densities up to 31 fragments per ha. These concentrations can probably be considered as zones of increased activity in the Roman period. One problem is to determine the stratigraphic position of the source of the material: on top of the clay, below the clay or in the clay lying at the surface. In addition, a zone without Roman remains at the surface has been defined and interpreted as the area of a former tidal creek, the so-called Testerep-creek. Recent geological work shows the late Holocene creeks to be in the same position as their early and middle Holocene forerunners. This means that in the creeks no settlement remains are expected but remains of boats and fishing gear could be present in these areas.

In concluding the remarks about the Roman period, the study area could be divided into 3 separate areas. The survey work detected two concentrations of Roman period material, a zone with dispersed Roman artefacts and a zone without Roman remains at the surface. This should result in different management regimes: preventive excavations for the identified concentrations and watching briefs for both the upper part of the soil stratigraphy in the second zone and deeper layers of the stratigraphy in the third zone.

There are a number of ceramic groups that are useful for evaluating archaeology in the early and high Middle Ages (5<sup>th</sup>-12<sup>th</sup> century). Chaff-tempered wares (fig. 3.2.3), wares with calcium carbonate temper (shelly wares: fig. 3.2.4), wares with a dark core (fig. 3.2.5), Badorf ware (fig. 3.2.6), red-painted Rhineland wares (figs 3.2.8 & 9), Ardennes wares (fig. 3.2.10), Hamwih class 13 wares (fig. 3.2.11) and Paffrath wares (fig. 3.2.12). Some of the early medieval wares (chaff tempered and Badorf) were found in the vicinity of an early medieval place name (*Eiergem*). This suggests that early and high medieval place names are useful indicators that can be used in archaeological management. The red painted pottery from the Rhineland is a very useful tool for evaluating the period from the 10<sup>th</sup> to the 12<sup>th</sup>/13<sup>th</sup> century. It occurs in statistically meaningful quantities and allows identification of scatters which can be interpreted as former settlements, zones with less finds which can be interpreted as former agricultural land and zones without such material, which we assume were not used as arable land. It has been concluded from the survey work, that plots with more than 5 such fragments per ha (fig. 3.2.7, about 10 % of the area) should be incorporated into areas where an increased level of archaeological follow-up for all infrastructure works is required. Areas with densities above 40 fragments per ha (fig. 3.2.7) are interpreted as defining former settlements and in these areas, a minimum of trial-trenching is recommended before any activity takes place that penetrates the soil below the plough depth. The zones without red painted fragments at the surface correspond approximately with the area of the Testerep tidal creek though interestingly the areas immediately adjacent had no fragments of ceramic material either.

Grey ware (figs. 3.2.13 & 14) is useful for evaluating the Middle Ages (9<sup>th</sup>-15<sup>th</sup> century). The distribution pattern of grey ware is very similar to the distribution of red painted ware and in combination an appreciation of chronology becomes possible, as late medieval (13<sup>th</sup>-15<sup>th</sup> century) concentrations can be separated from one another. Ceramics from Siegburg and highly decorated red wares are very suitable for evaluating the late medieval period (figs. 15-16). They occur

throughout the study area and demonstrate that the reclaimed tidal creeks were definitely used as agricultural land in late medieval times. Scatters of red wares (fig. 17) systematically occur in the vicinity of existing farms and this suggests that many of these farm-sites date back to the high Middle Ages. During their evolution, these sites have repeatedly seen slight changes in location and this is detected by the field survey. Archaeological management has to take into account the existing farm sites and their surroundings as areas of considerable potential. Three specific scatters were identified during the field walking.

The material remains from the second half of the 16<sup>th</sup> century to the present-day have yet to be analysed in detail, but no significant concentrations from this period have been located. There is, however, considerable research potential related to distribution of certain types of ceramics and much of this type of data is thought unlikely to exist elsewhere in the same quantities.

In summary, this quick method of line walking identified 13 units, in which two scatters of Roman date were defined, four units identified as former settlements dating from the early and/or high Middle Ages and sixteen others which could potentially be identified as such. Three artefact scatters dating from the late Middle Ages and thirteen others could also be potentially identified. A total of 45 survey-units require detailed archaeological follow-up. This represents about 25% of the area and is a good expression of the archaeological potential of these reclaimed wetlands, which at present are undervalued.

### **Detailed grid walking**

In survey unit 32, a concentration of material that could not be precisely defined by quick line walking, was surveyed in grids during the second stage. Seven grids of 30 by 30m, subdivided into individual units of 3 by 10m were used (fig. 3.2.18). The distribution patterns of red painted ware, red ware and grey ware were analysed in detail (figs 3.2.19-21). Red ware concentrations were identified in block 6 and the grey ware, though less concentrated, identified that blocks 5 and 7 also belonged to this concentration. The red painted ware had a distribution pattern situated outside the main area of the concentration. This detailed survey showed the potential of grid walking to refine distribution patterns. These are still visible and are not entirely obliterated by ploughing. The results also show that red painted ware had been spread out by other mechanisms. This method of grid walking is time consuming but provides more detailed information, which allows more thorough interpretation. The distribution of the red ware strongly suggests that the concentration is not older than the 13<sup>th</sup> century and the absence of material from the 16<sup>th</sup> century suggests an upper chronological limit. The combination of this dating evidence, of the remains themselves and their distribution pattern, allows a date range of the 13<sup>th</sup> – 16<sup>th</sup> century for the concentration in survey unit 32. The grid walking also provides important management information as it allows more precise areas to be defined. This method when repeated should allow a differentiation to be made between both scatter resulting from ploughed-out settlements and scatter resulting from intensive and long manuring of agricultural areas.

### **Results of the Magnetometer survey**

Survey-units 26, 27 and 28 were geomagnetically tested and revealed a set of plot boundaries related to a former trackway. Along this track way, concentrations of material dating from the high and late medieval period have been detected by the line walking. Survey unit 32 was tested in the zone of block 6 and 7 where detailed grid walking had been undertaken. In this zone numerous anomalies were detected including a possible oven. Ditches were not detected, which if correct, implies that the settlement was not a 'moated site'. In survey units 142-143 a number of rectilinear positive anomalies were revealed. This strongly suggests that the scatters dating to the early and/or high Middle Ages may be related to structures, remains of which lie below the plough soil. By contrast, survey unit 155, which had a very high concentration of pottery fragments of early and/or high Middle Age date, showed no sign of anomalies, which might suggest the presence of structural remains. Apparently the roughness of the surface of the plot resulted in less clear magnetic signals and it is suggested that in order to achieve the best results, areas in the Flemish Polders should be entirely level before applying magnetometry with success.

## Geophysical research at Walraversijde

The site of the former medieval fishermen's settlement at Walraversijde, has seen more than 10 years of archaeological work, in close collaboration with the province of West Flanders. About 2 ha of the site has been excavated so far. The area untouched by excavations, has been surveyed using magnetometry and electrical resistivity. Close to the excavated area, the magnetometry revealed the continuation of ditches recorded during excavation. In the area of the former chapel, the electrical resistivity provided evidence for the ditch and/or brick wall of the churchyard. These non-destructive techniques allow more detailed hypotheses to be elaborated and programs for future excavation work to be designed.

## The Digital Terrain Model of Flanders applied to archaeology in the coastal plain

The development of the DTM for Flanders in the period 2001-2004 was coordinated by the Support Centre GIS Flanders and commissioned by the Flemish water management institutes, primarily initiated by the floodings in the last decade. Two acquisition techniques were used: scanning airborne laser altimetry (LiDAR) in the non-urban areas and photogrammetrical techniques in the urban areas (about 5% of the total surface). LiDAR data is available at a mean density of 1 point/20m<sup>2</sup>, and the photogrammetrical data has a density of 1 point/100m<sup>2</sup>. On hard surfaces or surfaces with, for example, short grass, a mean precision of 7cm is guaranteed. In the polder area the data was collected in the period 2003-4. From the onset of the creation of this product the high potential of the DTM for archaeological and geomorphological applications was realized. Since the product became regularly available in 2005 it has been used more systematically in fashion in archaeological and landscape studies.

In this project the DTM is used on different scale levels and with different goals. During the first phase DTM was used to identify general structural elements of the landscape (anthropogenic and geomorphological features). For this the DTM was processed (with ArcGIS' *spatial analyst*, using Kriging analysis for creating the raster) for a large area: from *Bredene* to *Slijpe*, about 15 km along the coast and 5 km land inwards. It was striking that it was possible to identify and define fossil gully systems (for example in the historical polders of Ostend), creek ridges, relict parcel structures, dykes, moated sites and areas of former peat extraction. For these latter areas the DTM proved itself to be a better source for identification and demarcation than the soil map. During a second stage, archaeological information for the area, especially the fieldwalking results, have been compared with the DTM. For this a range of spatial analysis and imaging techniques were used (hillshade imaging, contouring etc.). A striking pattern for the two larger concentrations of Roman finds was noted: here the association with higher areas (fossil creek ridges?) amidst thoroughly peat extracted zones becomes apparent. Where the Medieval concentrations were noted several associations become immediately apparent. Firstly all large concentrations are situated in zones where the DTM shows no peat extraction, and in the zones with peat extraction very few finds have been recovered. Secondly these finds seem to be situated in zones where, using a combination of the soil map, aerial photographs and the DTM, one or more moated sites can be identified. A third possibility of association, but one which needs a lot more study, lies in relating the identified moated sites and surface findings with on the DTM visible relict parcel systems.

The DTM also proves to be a very interesting instrument with respect to the problem of the so called '*terpen*'. As a testcase the DTM was analysed for Leffinge and Bredene, two villages which are thought to be situated on *terpen*. In both cases a clear circular mound structure is visible as a central structure - in the case of Bredene about 150m. in diameter, in the case of Leffinge about 300m. in diameter.

In general the DTM offers a number of possibilities in recognizing patterns and identifying features in the polder area, which can be used to formulate new hypotheses for a number of problems, for example the interpretation of the Roman surface material, or the *terpen* issue.

For this a larger sample is needed, and the DTM needs to be compared with other surface collections or archaeological data. In general, also because of the relative scarcity of data for, for

example, the Roman period, it seems necessary to analyse the total Flemish polder area with the DTM.

## **Geology in support of the archaeological survey**

Following the archaeological prospection, a geological reconnaissance survey has been undertaken in the study area. The aim was to detect whether there is a correlation between the concentration of archaeological finds of the Roman period and the geological setting. Therefore, a series of undisturbed hand borings has been carried out at those localities with a high concentration of pottery fragments. In order to integrate the results in a larger context, all the existing borehole descriptions of the study area have been re-examined with special attention to the deposits covering the surface peat (*i.e.* the last 2000 years).

The results show that the locations with a high concentration of ceramics from the Roman period coincide with peat extraction zones. Since the geological history of the post-peat period is rather well known (Baeteman *et al.*, 2002; Baeteman, 2005), it could be assumed that the peat extractions are from medieval or later periods. The excavation pits show a complex stratigraphy which can change from place to place. In many places, the bottom of the pit is filled with a thin layer of sand with a concentration of *Hydrobia* overlain by a 2m thick heterogeneous mud characterised by reduction spots and containing a lot of peat detritus and occasionally a few small sherds and freshwater gastropods. Sometimes thin organic horizons are present. From a certain level, the heterogeneous layer is covered by thinly laminated tidal flat deposits. This stratigraphy shows that the abandoned excavation pits were initially flooded by coastal waters with little sedimentation. The water-filled pits became fresh and were progressively filled with material from the direct surroundings. This implies that for a quite long time this area was deprived of natural sedimentation. This is in accordance with the geological history of the last 2000 years, showing that tidal flat deposition was again occurring after 1400-1200 cal BP.

The boreholes carried out in the southern area with a high concentration of archaeological remains have been correlated in five cross-sections. They show that the peat excavations are located in an area where the Pleistocene subsoil (well-drained and relatively consolidated sand) is at a relatively high level. The area is also located between two major 'young' Holocene sand-filled tidal channels. The geological setting of the area with a high concentration of archaeological finds in the northern area shows a similar situation with a high position of the Pleistocene subsoil and the presence of a major tidal channel.

In order to find out whether the peat excavations were planned systematically according to environmental conditions, two maps have been made indicating all the new and existing boreholes with peat excavations and where the peat has not been excavated. The map of the southern area shows that many places have been excavated including areas where no archaeological remains have been found so far. However, the maps do not show any particular pattern. It appears that peat extraction occurs randomly and there is no apparent relation with a particular geological setting.

As a tentative conclusion of the geological survey, it can be suggested that peat extraction was undertaken randomly in the entire area. However, it seems that the settlements were selected according to the most favorable locations in the plain.

## **Testing a mechanical drilling set in the Flemish wetlands**

In order to facilitate stratigraphical and palaeobotanical survey and research, a mechanical coring set has been used within the framework of the Planarch 2 project. A percussion drilling set for heterogeneous soils, powered by a gasoline driven percussion hammer was used. In comparison with the classical hand augers and hand soil core samplers the percussion drilling set offers better possibilities for inspection, description and sampling, thanks to its wide, open gouges and closed liner sampler (Canti & Meddens 1998). With the percussion drilling set specific problems can be tackled better, such as the environmental setting of archaeological sites, the evolution of the landscape, the identification of inhabitable places.

In the Planarch 2 project percussion drillings have been carried out in the marine wetlands, in completion of archaeological and palaeobotanical research carried out earlier (Deforce & Bastiaens, in prep.). The earlier palaeobotanical research had been conducted on a sequence exposed in an archaeological excavation pit and focused on the presence of peat layers, the so-called surface peat. The aim of the percussion drilling was to describe and sample the underlying stratigraphy and to locate the so-called basal peat in order to allow a better deposit modelling.

As a way of evaluating the percussion drilling performed in the Flemish wetlands, hand auguring was also carried out. The two sets of results were compared and clearly they offer an insight into the pros and cons of both methods.

## **Conclusions**

So far pre-Roman remains have not been detected in the survey area. As a result, the possible material record of those periods cannot yet be properly managed. Other methods are needed either to detect material remains from these periods or to explain their absence.

For the Roman period, three distinct areas were identified: zones without scatter, zones with dispersed scatter and zones with concentrated scatter at the surface. The zones without scatter correspond to visible former tidal creeks. The nature and the exact stratigraphical position of the concentrations have still to be analysed. Analysis of the Digital Terrain Model suggests a relationship with higher areas, probably fossil tidal gullies mainly with sandy sediments in the subsoil.

The data relating to the early and/or high Middle Ages allows a number of conclusions to be drawn. Areas with place names from this period are important archaeological zones that can be deduced from the distribution of pottery from the early medieval period. Red painted ceramics are a very useful tool for evaluating the archaeological potential related to the high Middle Ages. This results from the fairly large amounts of red painted ware and the dating evidence it provides. Based on the densities of this material, distinctions can be made between ploughed out former settlements and zones interpreted as former agricultural land. Five fragments per hectare is considered as defining a limit between agricultural land and former settlements. Areas with densities higher than five per need to be watched carefully. That does not mean that every hectare plot with more than five fragments of red painted pottery should automatically be interpreted as a former settlement but the possibility cannot be excluded.

The distribution of imports of early and/or high medieval date, has been compared with the distribution of grey and red ware. This comparison allows the dating of the duration of occupation and land use to be made.

For the late medieval and early modern period red wares are very important. Zones with high densities of such material systematically occur near existing farms. The area around these farms frequently contains material remains from earlier periods and these farms constitute zones of high archaeological potential.

For the last five centuries the survey work mainly provides information about the distribution of certain ceramic groups and less about former settlements and the landscape seems to have attained more or less its present day structure. The distribution of certain ceramic products is probably only present in the plough layer but nonetheless should be considered as an important archaeological resource.

The line surveys revealed 45 units, which deserve appropriate archaeological management. This is about 25% of the total survey area: an extremely high percentage.

Using the detailed grid surveys, scatters can be efficiently and precisely located and this type of information allows more detailed interpretation of chronology and site evolution.

Geophysical analysis has allowed scatters to be connected to structures present below the plough soil, providing important information for the development of management strategies.

The Digital Terrain Model of Flanders with a mean guaranteed precision of 7cm seems to be a very powerful tool in archaeology. This Model should be thoroughly confronted with existing SMR's.

Geological research has been carried out in order to evaluate patterns observed via the systematic field survey. It looks as if the Roman pottery concentrations are to be correlated with peat extraction zones. Peat extraction seemed to have been a lot more intensive in the pre-medieval times than thought before and this factor should be taken into account in management plans.

A mechanical drilling set has been tested in the Flemish Wetlands. It provides a useful tool for deposit modelling.

Notwithstanding these survey techniques, trial trenching is still considered necessary to efficiently control the information obtained by the before mentioned techniques and methods.

As a general conclusion, it is recommended that a larger area of the Flemish Polders should be rapidly surveyed. This is a very efficient way of providing information for archaeological management of the existing landscape. The analysis of a statistically significant part of the Polders should allow a valid model for the whole of the Polders to be made. Using this method a great deal of information can be added to the existing SMRs and understanding of the important landscape of the polders can be improved.

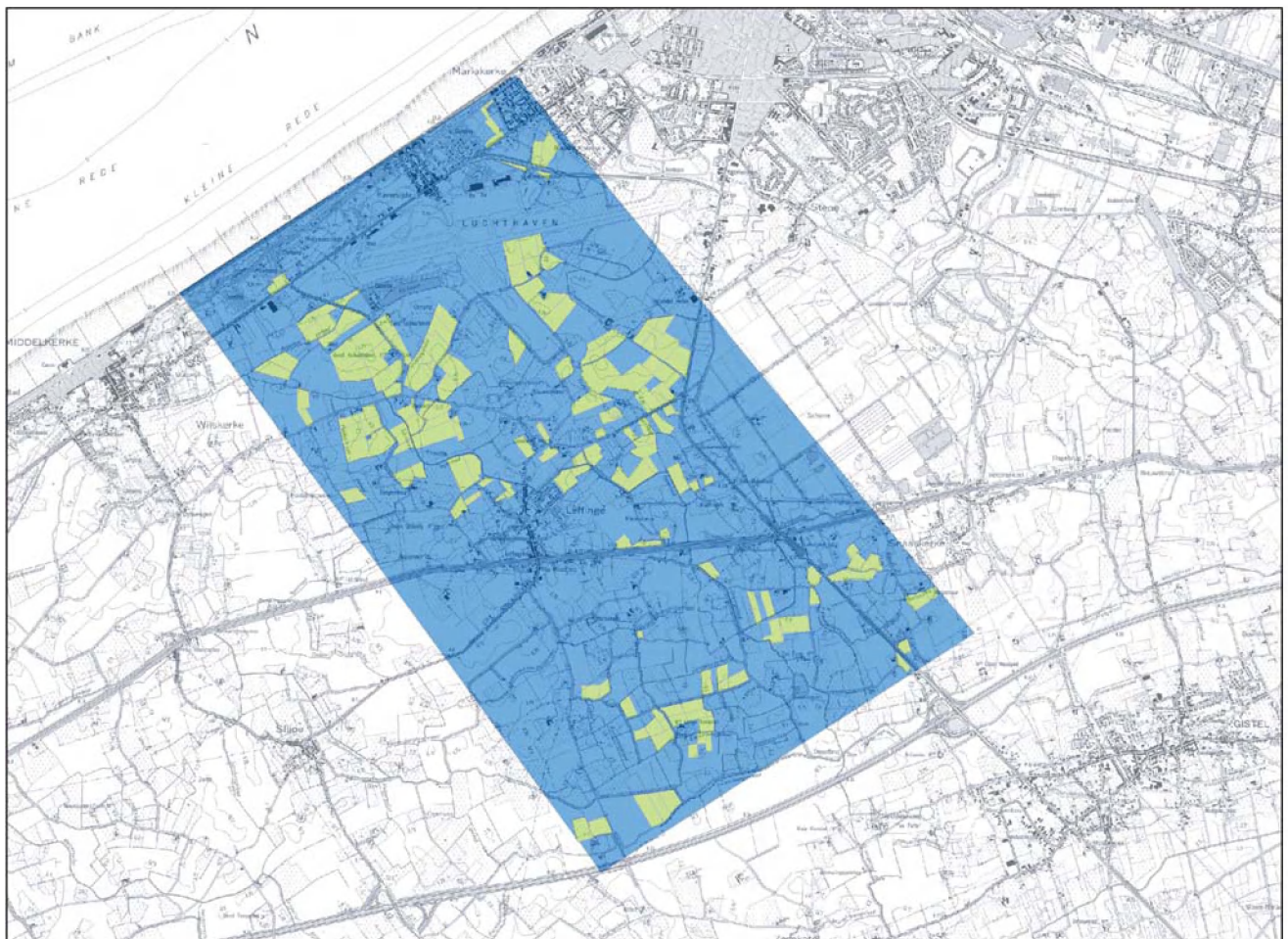


Fig 3.2.1 Location of the study area



Fig 3.2.2 Distribution of plots with Roman pottery at the surface. Units with 1 fragment per plot are compared to units with 2 or more fragments per plot.

Blue: 1 Fragment  
Red: 2 or more fragments



Fig 3.2.3 Distribution of chaff tempered wares.

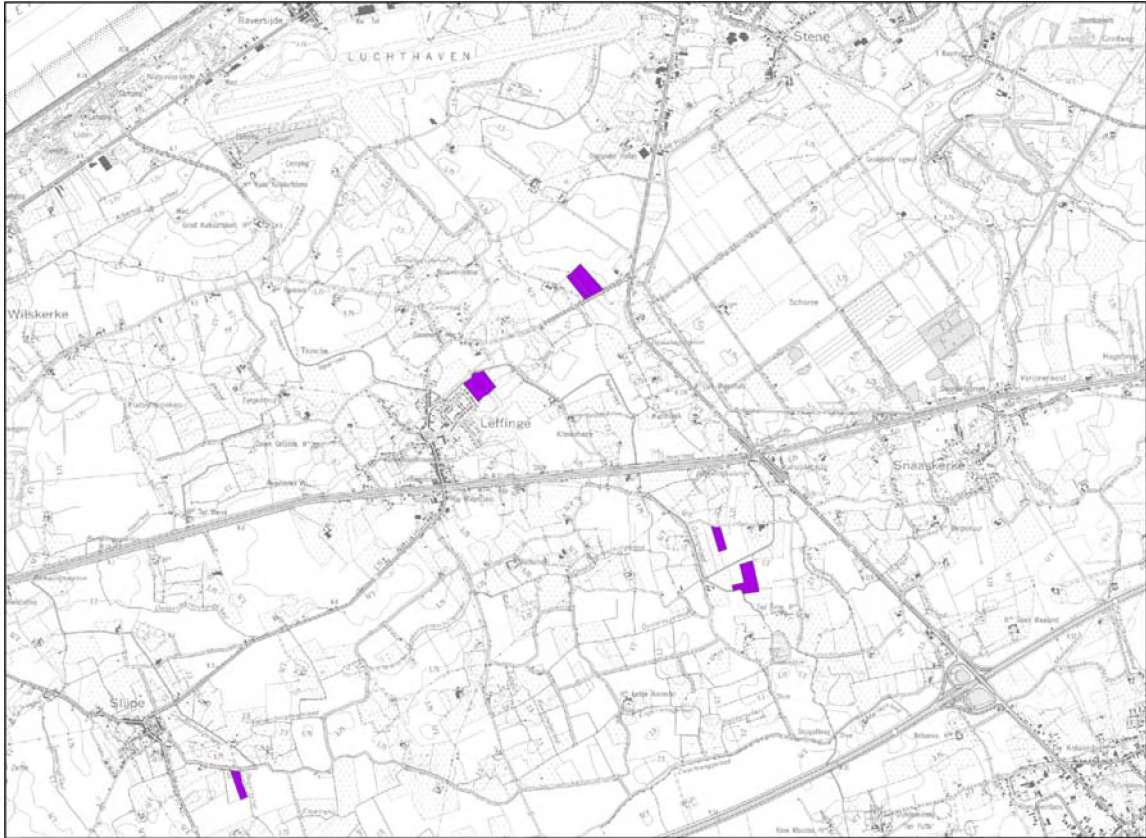


Fig 3.2.4 Distribution of shelly wares.



Fig 3.2.5 Distribution of wares with a dark core



Fig 3.2.6 Distribution of Bedorf

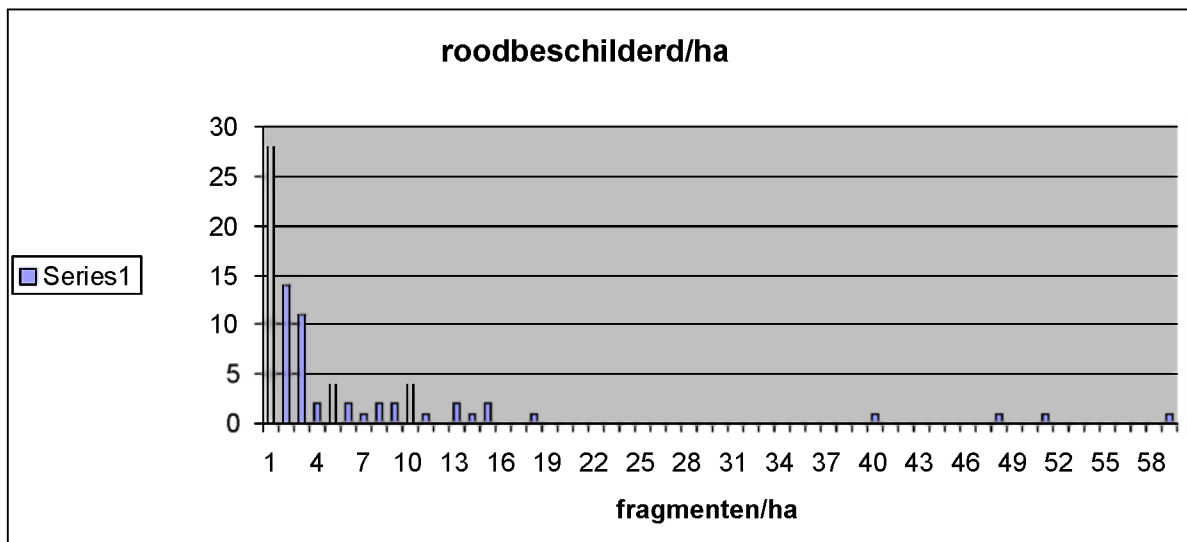


Fig 3.2.7 x-axis = number of fragments of red painted pottery per ha. & y-axis = number of survey units

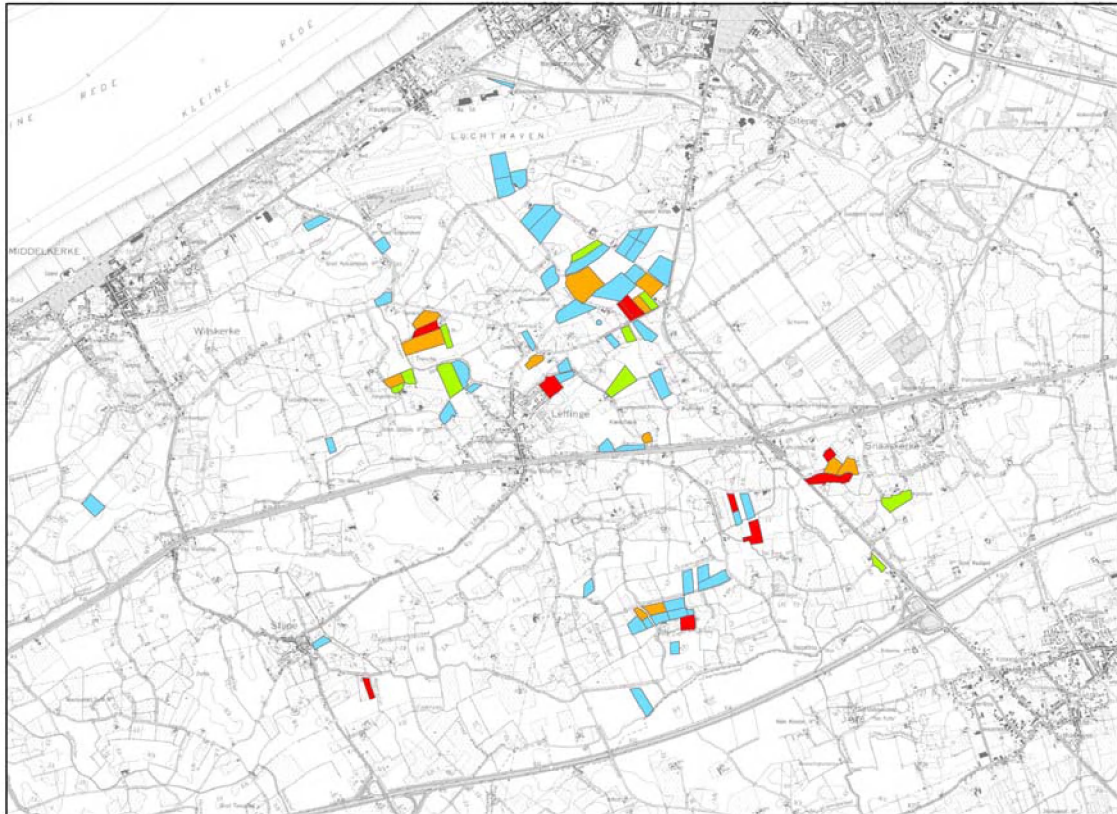


Fig 3.2.8 Distribution of red painted pottery in 4 classes (fragments per survey unit)

Red: 20 fragments or more  
 Orange: 10-19 fragments  
 Green: 5-9 fragments  
 Blue: 1-4 fragments

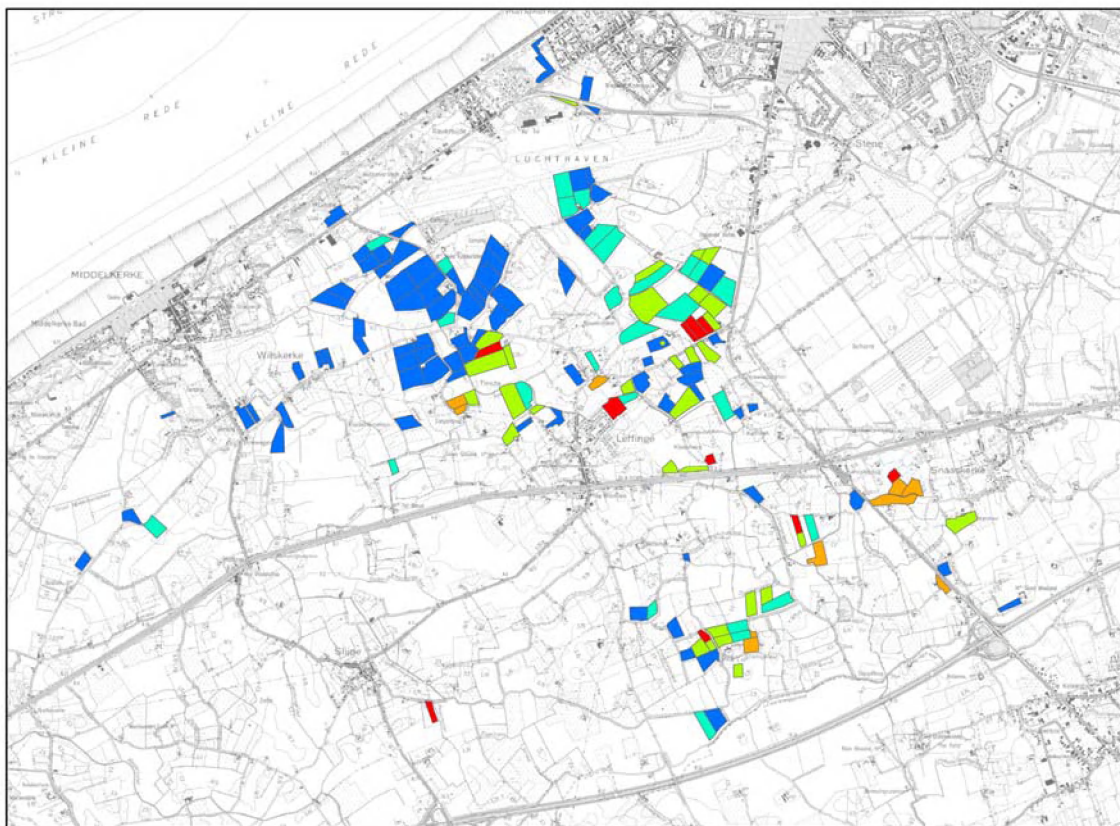


Fig 3.2.9 Distribution of red painted pottery in 5 classes (fragments per hectare)

Red: 11 fragments or more  
 Orange: 6-10 fragments  
 Light Green: 1-5 fragments  
 Dark Green: less than 1  
 Blue: None

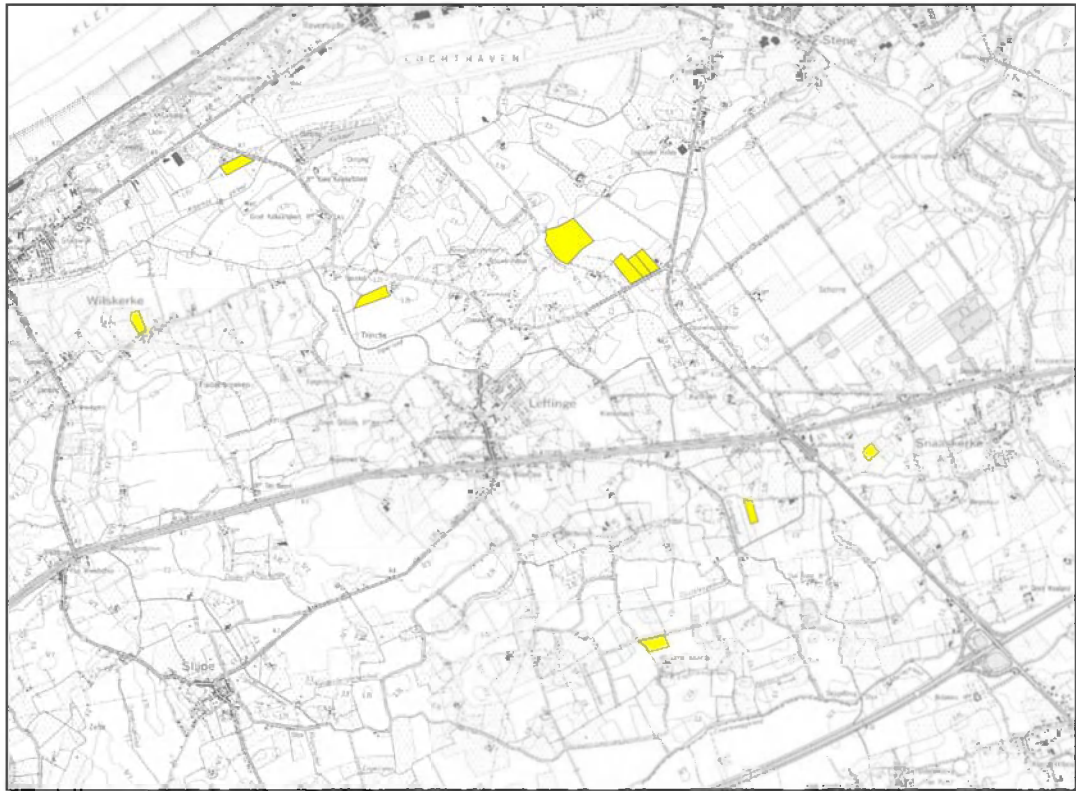


Fig 3.2.10 Distribution of Ardenne

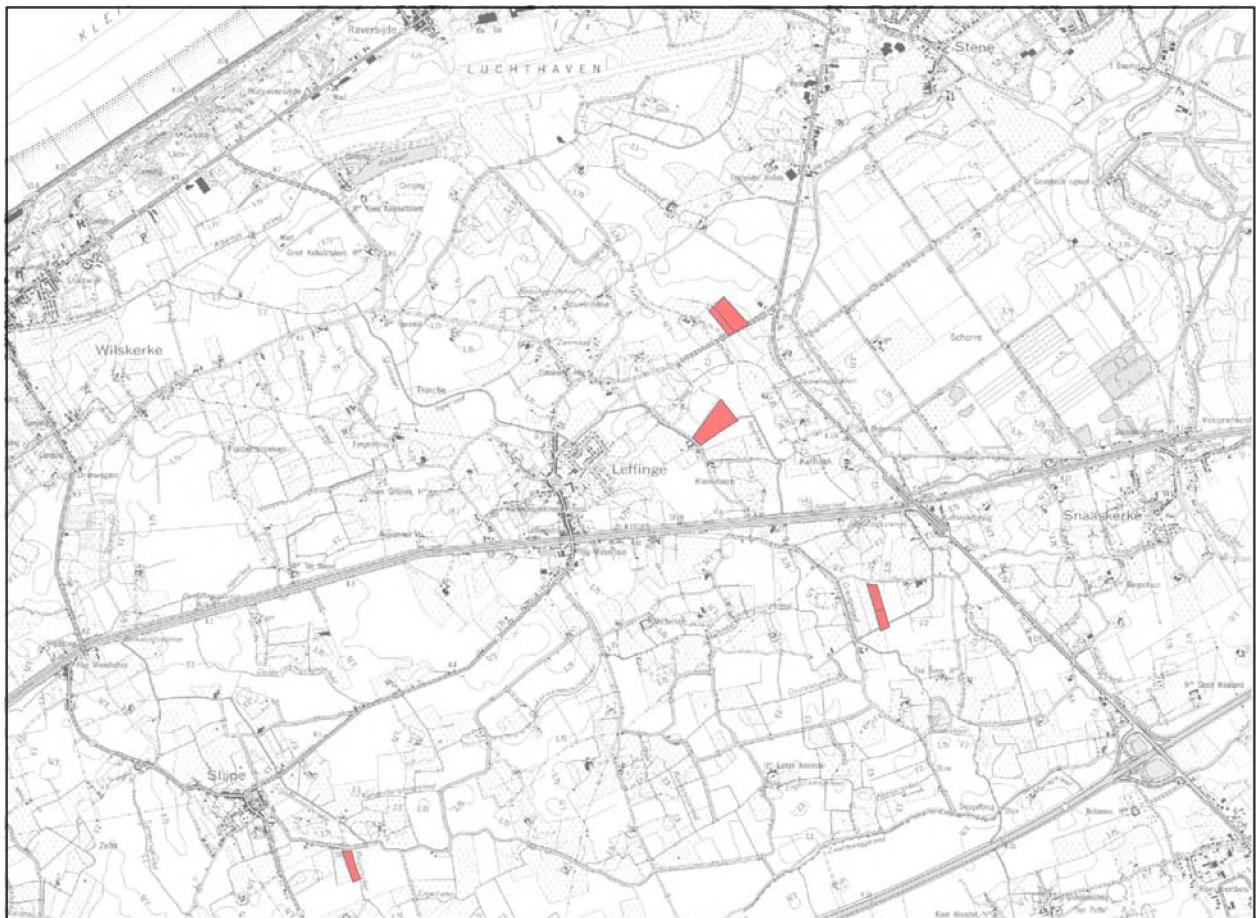


Fig 3.2.11 Distribution of Hamwih Class 11



Fig 3.2.12 Distribution of Paffrath pottery



Fig 3.2.13 Distribution of grey wares in 5 classes (per hectare)

Red: More than 150 fragments  
 Orange: 100-149 fragments  
 Brown: 10-99 fragments  
 Green: less than 10 fragments  
 Blue: None

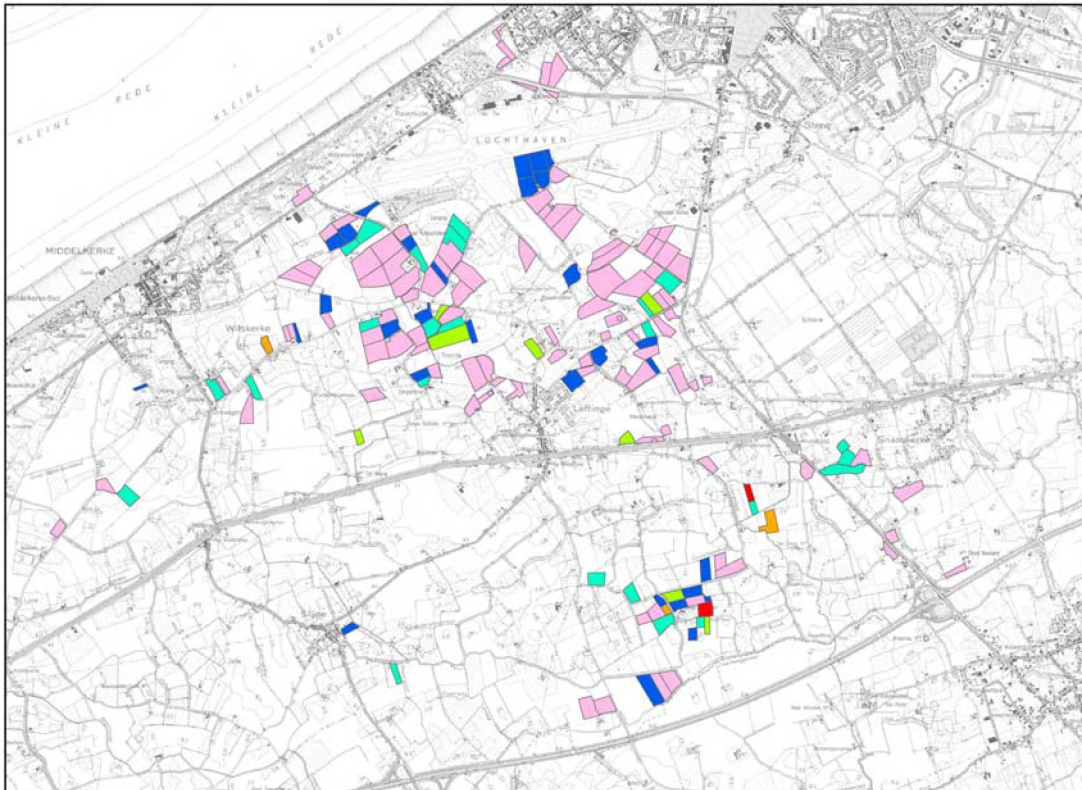


Fig 3.2.14 Ration of grey ware/red ware in 6 classes

Red: 4 or more  
 Orange: 3-3.9  
 Light Green: 2-2.9  
 Dark Green: 1-1.9  
 Blue: 0.5-0.9  
 Rose: less than 0.5



Fig 3.2.15 Distribution of Seigburg pottery

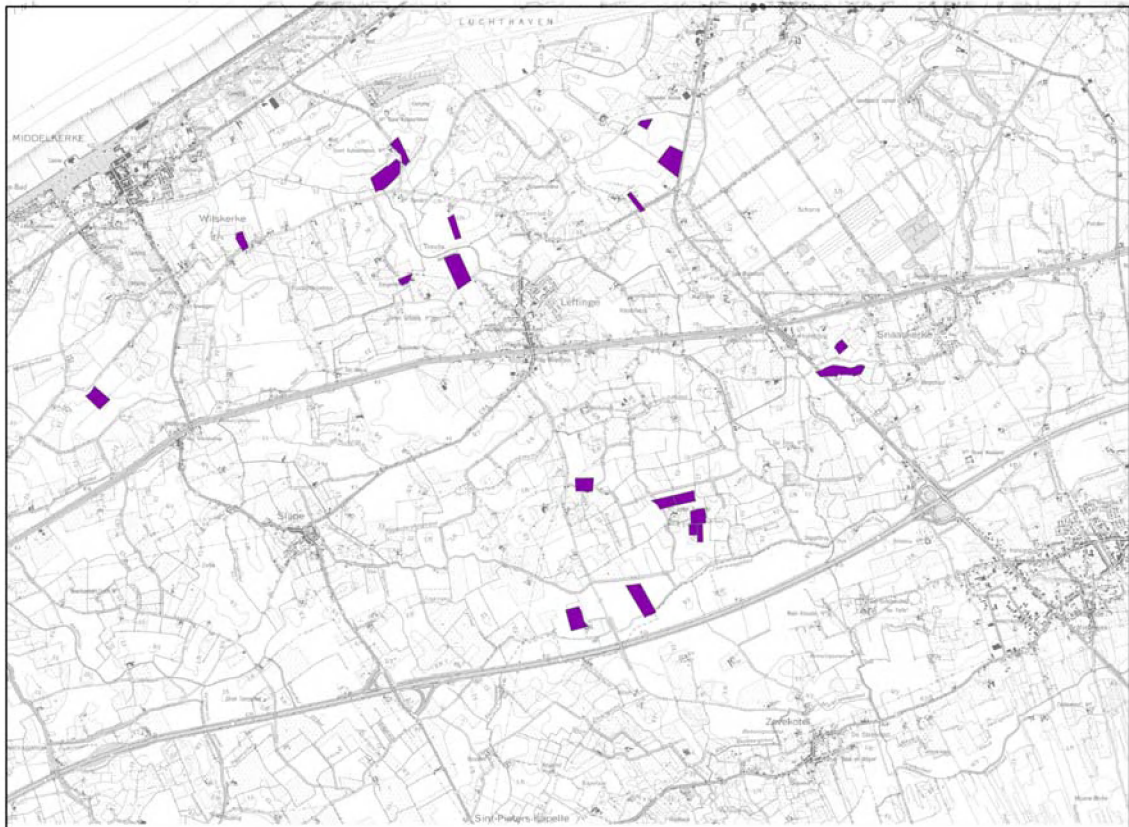


Fig 3.2.16 Distribution of highly decorated red ware



Fig 3.2.17 Distribution of survey units with high densities of red wares and two separately identified concentrations

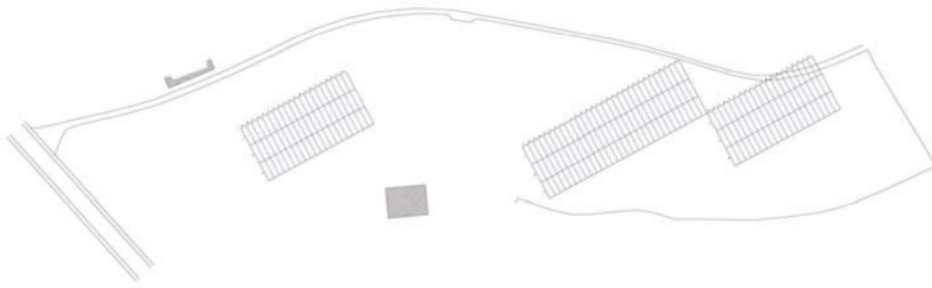


Fig 3.2.18 Location of 7 blocks for the grid survey at unit 32.

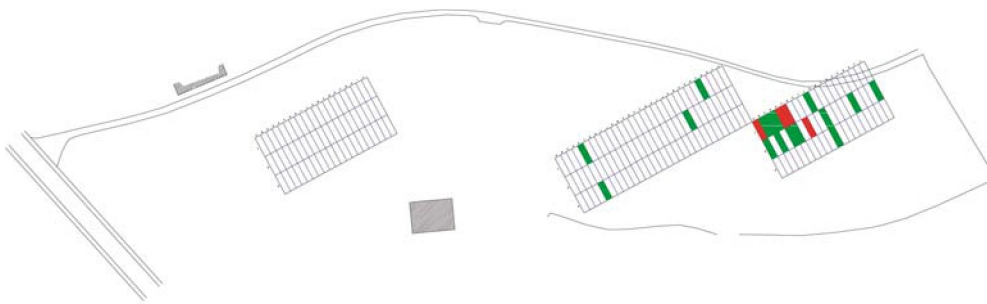


Fig 3.2.19 Distribution of red ware at unit 32

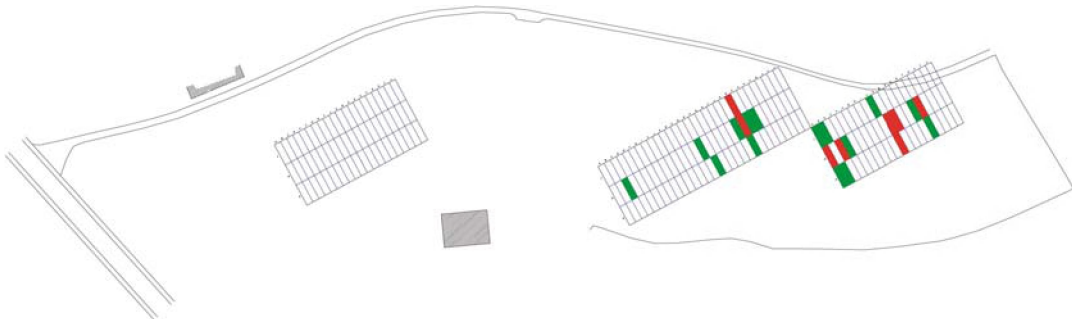


Fig 3.2.20 Distribution of grey ware at unit 32

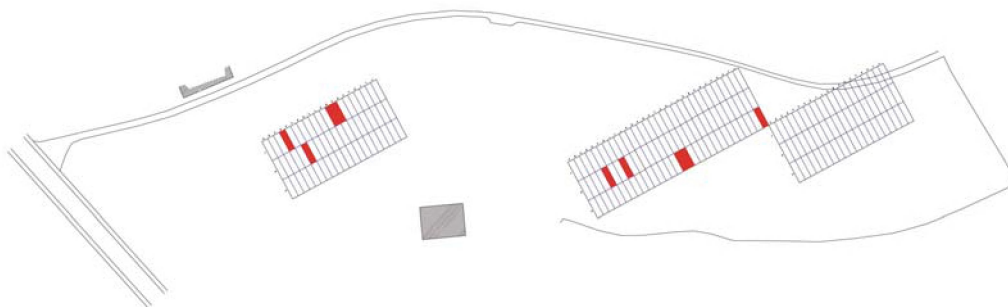


Fig 3.2.21 Distribution of red painted ware at unit 32