Covered with Clay

Man and Landscape during the Late Neolithic up to the Middle Bronze Age of the Dutch central river area

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M.A. Thesis
Faculty of Archaeology
Universiteit Leiden
September 2000

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Preface

“Unless you tell me what your objectives are, I cannot tell you what I think of your work…”
-Lewis Binford, Leiden, 8-6-2000

On learning…

The MA thesis lying here before you is the product of many hours of learning. Contrary to what you might perhaps suspect, this does not exclusively refer to the four and a half years that the regular study program took. Rather, it refers to the final seven months that the writing of this study took me.

This is not to deny the fact that I have picked up many valuable facts and arguments at numerous interesting lectures during those four and a half years. But the last seven months, the most challenging months, have painfully made clear to me how little I knew.

Perhaps my enthusiasm and my curiosity to explore all possible facets of archaeology, have somewhat strayed me from ‘the’ (if any exists) path to more ‘profound’ scientific knowledge on specific subjects. I never had, or never thought I had, or never simply took the time to specialise in a specific period, region, methodology or theory in prehistoric archaeology. Rather, fascinated by everything, I tried to do as many things as possible, and preferably all at the same time. In that sense, my curiosity perhaps has turned against me, and left me in the end with minimal knowledge on a multitude of subjects.

To realise this was one thing, but to alter it, proved even more complicated. One eye-opener was a visit I made last year with a group of archaeology students to ‘RAAP’. Martin Verbruggen, who once taught geology at our faculty but had become the manager of this archaeological consultancy company, asked the students what they wanted him to talk about. His suggestion to start with a more or less epistemological or theoretical reflection on archaeology was (as was to be expected?) not met with too much excitement. Then, he provoked the crowd with a question: He, the implicit personification of commercial (“non-scientific” ?) archaeology, asked who of the students (the “scientists proper”) had so much as even used the word ‘hypothesis’ once in one of their papers. In the uncomfortable silence, I reflected on the implications this had for what I feared to be my Augean stable: this study.

In the process of writing I had to learn, above all, that mere collection of data alone is not going to bring you closer to your objectives.

On the contrary, it turned out that my former style of writing was in fact mere enumeration of little facts and (comments on) opinions read, blurring instead of clarifying my vision. Initially the visit to RAAP, but later on the efforts by Joanne Mol, Zita van der Beek and Harry Fokkens have been very helpful in trying to alter this.

Secondly, I came to realise the second aspect I had done wrong during the four and a half years: I had not read enough books. More and more I got the feeling that the most interesting problems in archaeology could only be addressed from both a profound general background, as well as detailed knowledge on sites, finds and dates. I can only say that I sincerely hope to read more in the future…

On this study…

The genesis of this study started with my doubts on what subject to pick for my Master thesis after four years of study. Re-reading notes from nearly all taught courses, I (finally) decided to pick the period that made the least sense to me; the Late Neolithic.

During my first conversation with Harry Fokkens, we discussed the possibilities. My desire to work on some archaeological material and place that within a wider theoretical frame of reference turned out to be somewhat too optimistic, or less flattering; somewhat naive. In the first place nearly all Late Neolithic material had already been described. Secondly, ‘placing Late Neolithic material in a wider theoretical framework’ was too vague and too all-embracing to be manageable.

The obvious solution was to find out were ‘new’ Late Neolithic material was being unearthed. Harry pointed out that at several locations in the prospective track of a new freight railway, the ‘Betuwelijn’, Late Neolithic material had come to light. As this railroad was to connect the harbour of Rotterdam with the German Rhineland, it passed through nearly the entire Dutch central river delta, providing an incredibly (archaeologically) well-known (yet narrow) strip.

We discussed the fact that it might be interesting to combine the detailed data from this narrow strip with a more general picture, which was to be constructed based on a regional analysis of the surrounding area. For the sake of manageability, we selected a quite restricted study-area in the central Dutch river delta, surrounded at all sides by rivers or canals. It soon turned out that by looking at the Late Neolithic and Early Bronze Age we would not get much further.
Therefore, the decision to add the Middle Bronze Age data was made. It has been this decision, that has allowed the maximal ‘exploitation’ of the data discovered during the ‘Betuweroute’ excavations. However, there also was considerable set-back: The time remaining did not allow me to investigate and discuss the Middle Bronze Age data to the same extent as had been done for the other periods.

Furthermore, my quest to present my data with enough criticism and references has perhaps caused this MA thesis to be somewhat bulky. This, like the fact that I wrote it in English, can be seen as a reflection of my personal opinion on how to write a ‘scientific’ M.A. thesis. It was one of my aims that this study was to be understandable and of interest to as many readers as possible, without condemning them to the entirety of this study.

It was my aim that a reader who is potentially, or only marginally, interested in this work could look at table of contents, choose its pick and for further reading be sent elsewhere by the references therein.

I am not in favour of ‘cover-to-back’ reading of any study, although I have tried to present my arguments in a fashion that would allow for both selective, as well as continuous reading.

Finally, to comment on the motto: What I have ‘achieved’ in this study is for the reader to decide. My personal objective, above all, was to learn.

Leiden, 06-09-2000

Stijn Arnoldussen
Acknowledgements

The writing of this MA thesis could not have been done without the support of various people. Firstly, I want to thank my parents for their continuous support and interest. Their encouragement to study archaeology (as well as their tolerant attitude towards the never-ending piles of rubbish from nearby ploughed field which I brought into the house as a child) I have appreciated tremendously.

The kind help and directions given to me by various local archaeologists is very much appreciated. Furthermore, I want to express my gratitude to Eric Verhelst who kindly permitted me to take part of the BATO collection to Leiden for study. Zita van der Beek, Simone Bloo, Liesbeth Theunissen, Yvonne Keizers, Andre Ramcharan, Leo Verhart, W.J. Kuijper and Leendert-Pieter Louwe Kooijmans have been a great help in the identification and interpretation of the archaeological materials of the BATO collection.

I am very grateful to Peter Jongste, Bernard Meijlink and others at the ‘ADC’ for providing me with the preliminary results of the Betuweroute excavations ‘De Bogen’ and ‘Eigenblok’ respectively, as well as for their critical remarks on some of my drafts. Without their co-operation, the writing of this study would have been impossible.

I am particularly grateful for the proof-reading, comments and directions given at the time of writing by Harry Fokkens, Joanne Mol, Zita van der Beek, Eugene Ball and Claartje Schamp. Their remarks have considerably improved various parts of the text.

On a more personal level, I want apologize to my friends for my absence on nearly every ‘social occasion’ the last few months. We’ll catch up! Furthermore thanks to Milco Wansleeben, who not only had to endure my -illegal- presence in his office, but who also saw it gradually being transformed into a pigsty by me. Much thanks to my friends at the Turfmartk 10 for their support, especially Thijs Houben for letting me use his hardware (keep on buying ‘goodies’!) and my hijacking of his dictionary.

Lastly, I want to thank again my friends, the folks at ‘Turf 10’ (hey!…why are those separated ?!) and - above all- my girlfriend Claartje Schamp for preventing me from becoming mental during the last six months…. ;-)
1. Introduction

In this chapter, the aims, backgrounds and structure of this study will be introduced. First a general introduction will be given. Secondly, the (problems with) specific research questions will be dealt with. Thereafter, the methodology used in this study to try to answer these questions is explained.

1.1 Introduction

This study is an attempt to gain more insight into the dynamic relationships between man and landscape in the Dutch central river area during the Late Neolithic period up to the Middle Bronze Age. The Dutch river area as a whole forms, and has formed in prehistory, an area that has provided man with constantly shifting geological settings to exploit or endure. Contrasting to the Pleistocene landscape of the Netherlands, which is cross-cut in east-west direction by the river deltas, the river area proper has nearly always represented a landscape that was very much ‘alive’. Processes of fluvial erosion and sedimentation have, although with varying intensity and extent, created a stage for human behaviour that through its diversity and variability must have provided both advantages as well as disadvantages for human presence.

Therefore, to make any substantiated comments on prehistoric life in the Dutch river delta, various viewpoints need to be combined. To answer specific research questions, the complex intertwining of geological, archaeological and theoretical concepts needs to be unravelled and the role of each of them in explaining past behaviour within a distinct setting of place and time should be assessed.

1.2 Research objectives

1.2.1 Philosophical aspects

The quote by Lewis Binford that I used as a motto in the preface expresses the desire to state clear and specific research objectives. Desirable as this is, it is often quite hard to achieve on a practical level. Archaeology as a science can be approached from both deductive as well as inductive lines of reasoning. This has considerable implications for the establishment of ‘appropriate’ research questions.

Research questions following an inductive pattern seem to have problems with surpassing the descriptive level. From this point of view, a perfectly valid hypothesis like ‘Is there evidence for human presence in the landscape of the Dutch central river area during the late Neolithic?’ could be validated with the discovery of one single Late Neolithic sherd. It is clear that research questions restrained to this level will tell us little, if anything, about past human behaviour. The deductive approach also has its setbacks. Whereas in maths or Aristotelian logic a deductive approach can lead to valuable derivatives of the existing factual knowledge, I think this is less the case in archaeology.

The validity of archaeological premises is subject to endless discussions and ultimately unverifiable in its strictest sense. As even the most primary research questions and observations are theory-based, who is to judge on the truth of derived premises?

This is ‘the catch’ of archaeology. How do we interpret facts from the past in the present? How do we formulate hypotheses that, if verified or refuted, leave us with meaningful knowledge of the past? This, perhaps, is the grail all archaeologists are said to be looking for.

Now let us return to the implications for the research objectives in this study.

1.2.2 Archaeological aspects: The Late Neolithic to Middle Bronze Age

It is not a problem at all to postulate a magnificent archaeological research question, yet its manageability diminishes with its increasing domain. If I was to formulate the question I would really like to answer in this study, it would be something like this: ‘To investigate, understand and predict the complex dynamic relationships between man and landscape, in both synchronic as well as diachronic perspective during the Late Neolithic, Early- and Middle Bronze Age in the Dutch central river area, with a focus on the relevance of sociological, ideological, economical, geological and ecological factors and their complex intertwining.’.

Clearly, such questions cannot be answered within the scope of an M.A. thesis.

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1 For dates of archaeological periods used in this study see: Appendix I.
2 “Unless you tell me what your objectives are, I cannot tell you what I think of your work…” - Lewis Binford, Leiden, 8-6-2000
3 This contrast between inductive (the logic of scientific discovery) and deductive (the logic of argumentation) was studied by Sir Francis Bacon (1561-1626). See Bacon 1620. For archaeological implications see: Salmon 1976 and Salmon 1982.

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4 This reflects Kant and Popper their denial of the existence of theory-free observations (or ‘Dinge an sich’). See: Koningsveld 1987, p. 101, 103 or Kant 1781 and Popper 1934.
5 An example is, for instance, Lewis Binford his quest for ‘Middle Range’ theories or the ever ambivalent role of ethnological data in archaeology.
6 However, one should in my opinion always keep such ‘higher’ objectives in mind.
Thus, we try to split up these large-scale questions into more manageable research questions. However, in one way or another, these do all relate to my initial interest that I had upon starting this study: To try to understand what Late Neolithic and Bronze Age life was like in the Dutch central river area, with a particular focus on settlement archaeology.

1.2.2.1 Transitions

The archaeological periods involved, the Late Neolithic and the Early- to Middle Bronze Age in my opinion represent some of the most interesting periods in north-west European prehistory. Important transitions take place within the spheres of settlement systems, funerary rituals, subsistence strategies, social practises and material culture. Some of these will be introduced below.

But first, I should stress the fact that I by no means agree to a notion that separation of aspects like ‘economy’, ‘ideology’ or ‘technology’ etcetera has any archaeological -let alone historical- validity. Their interrelation and interaction will have made them inseparable and profoundly rooted in prehistoric everyday life. Their separation in archaeological studies is for the sake of clarity and manageability, and if one wishes, can be seen as an archaeological confession to our lack of knowledge in understanding these relations. Their individual discussion perhaps correlates stronger to the level of ‘archaeological observation or perceptibility’, being part the ‘object’ of archaeological science, than to the level of ‘archaeological interpretation’.

Although I agree to the notion that more holistic histories of prehistory need to be written, I will argue in this study that not all currently available data is suitable to do so. Furthermore, the creation of such synthesised accounts, unfortunately, cannot be undertaken within the scope of a M.A. thesis.

1.2.2.1.1 Settlements

The elusive settlement pattern of the Late Neolithic and the Early Bronze Age period is seemingly transformed to the almost rigid farmstead system that we known of for the Middle Bronze Age.

The ill-defined farm(stead) structure and dynamics assumed for the Late Neolithic and Early Bronze Age becomes substantially more visible during the Middle Bronze Age.

The longer, three-aisled farms replace the former two-aisled building tradition. The entirety of the settlement complex also becomes more clear. Instead of the reconstruction of ‘a single possible farm’ amidst numerous un-identifiable posts, the Middle Bronze Age a stereo-typed picture of a farmstead with several outbuildings and perhaps a well -all confined within a fenced-off area- emerges.

Also, the settlement system dynamics are seen as transitional: It is suspected that predominantly the inverted channel deposits of fossil stream belts have been occupied in both periods, although the semi-permanent settlement system reconstructed for the Late Neolithic and Early Bronze Age is supposedly transformed into the less ‘mobile’ settlement system of the Middle Bronze Age. Despite their acknowledged low visibility, the role of smaller extraction sites is often assumed to decrease during the time-span of this study, although substantiating arguments are often lacking.

1.2.2.1.2 Funerary rituals

Changes in funerary ritual are evident throughout the entire time span involved. As I will try to focus on the settlements in this study, they will only marginally be dealt with. Reconstructed general trends are the increasing number of visible burials throughout time, the decrease in burial mound dimensions and the increasing importance of cremation as an accepted funerary rite. Also, throughout time the social restrictions on appropriate behaviour concerning interment seem to be less strict, or less strictly adhered to.

1.2.2.1.3 Economy

Studies of prehistoric economy often break down into two components: One is the study of subsistence strategies, the other is the study of exchange relations and contacts.

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7 Although, this does not represent a clear-cut dichotomy. For instance, the discussion of prehistoric ‘economy’ is in my opinion directed more by current theoretical viewpoints than the underlying archaeological observations.
8 See Chapter 6: Synthesis.
9 Furthermore, their separate introduction below is a deliberate simplification to increase comprehensibility and comparability with other studies.
14 See Chapter 5: (a.o.) paragraph 5.2.1 and 5.3.4.3.
Subsistence strategies are seen as displaying a decrease in the importance of hunting, the emerge of a system of true mixed farming towards the Middle Bronze Age and shifts in the range of domesticated species (both vegetal as well as faunal) with time. It will become clear that there is considerable attention being paid to the (role of) exchange-systems in both Late Neolithic and Bronze Age archaeological conceptualisation.

### 1.2.2.1.4 Technology

As with all other aspects of life, technology was in a constant state of change. Most typically, copper and bronze artefacts, and presumably somewhat later the necessary metallurgical knowledge, were introduced to the north-western parts of Europe. Studies of ceramics have demonstrated variations in both the relative occurrence of decorated pottery, as well as in decorative techniques and patterns throughout time. The flint 'industry' does display changes in the shapes of flint arrowheads and the assumed decrease in the use of flint toward the Middle Bronze Age. From all periods worked stones (grinding stones, hammer stones and cooking stones) are known, although stone (hammer) axes are typical for the Late Neolithic.

### 1.2.2.1.5 Social implications

Undoubtedly, the transitions referred to above have had their impact on the social conditions. These, however, are hard to retrace in the archaeological record. For instance, what are we to think of the social implications resulting from adopting an intensified system of mixed farming? Has the emphasis on cattle breeding anything to do with tribal warfare? What does it mean that instead of acting as grave goods in the Late Neolithic and Early Bronze Age, ceramic vessels come to be used as containers for cremated remains in the Middle Bronze Age?

Why is it that the elaborately decorated ceramics of the Late Neolithic and Early Bronze seem to be less frequently present in Middle Bronze Age ceramic spectra? Can we establish any correlation between the life-cycles of people and those of farmsteads? In this study I will predominantly concentrate on the - archaeological visibility of - the (dynamic) perception of the landscape by prehistoric man.

These paragraphs above describing the various transitions are to be taken merely as a frame of reference. Consequently, these represent fiction or facts and will not all be dealt with in this study to the same extent. However, they are able to provide the (unfamiliar) reader with a conceptual framework, as if it be the stage of play wherein more specific research question act.

### 1.2.3 Specific research questions

I could have transcribed all statements from the previous paragraphs into questions, as I have done with the last paragraph. However, in my opinion, this can be done by any critical reader. Instead of presenting an enumeration of questions, the most obvious research question is perhaps the best:

'To what extend does this study, with its current methodology, offer arguments to substantiate, defy, alter or enhance the views on the processes of culture change that have been referred to above?'.

In this form, the main research question combines both an archaeological analysis with the (in my opinion) equally valuable methodological self-criticism that is needed to evaluate and substantiate data, viewpoints and conclusions.

### 1.3 Methodology

This paragraph deals with the methodology applied in this study. Although throughout the entire body of the text smaller methodological remarks are made, more general issues are presented here. The reader is thus offered an insight into 'how' I have tried to tackle various problems. I deem this important, because the 'solutions' used have structured this study both conceptually as well as textually.

#### 1.3.1 The idea

Initially, I wanted to focus upon the Late Neolithic and Early Bronze Age periods. However, during the evolving of the study it became clear that, with the methodology applied, these periods alone would not offer sufficient data for a M.A. thesis.

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16 But see: Drenth & Hogestijn 1999, p. 132.
17 See: (a.o.) Gehasse 1995, Louwe Kooijmans 1993, Zeiler 1997 and Chapter 5, paragraph 5.2.5.1.3.
18 See Chapter 5, paragraph 5.2.4.1 and 5.3.4.3.
22 No overview is currently available. For examples see: Bauche 1988, Drenth & Kars 1990, Fokkens & Schinkel 1990, Kars in prep., and references therein.
23 See: Fokkens 1986 and Chapter 5, paragraphs 5.2.4.2, 5.2.5.1.3 and 5.3.4.1.
24 See: Fokkens 1999 and Chapter 5, paragraph 5.3.4.1.
27 The ‘idea’ is less formally discussed in the preface.
Therefore, the Middle Bronze Age was added to the chronological scope. The archaeological work accompanying the construction of a freight railway (the ‘Betuweroute’) across the Dutch river area had recently yielded new material dating to these periods. These new excavations, as well as the archaeological data they supplied, differed considerably in both scale and nature from the already known archaeological record. Thus, two distinctive sets of archaeological data emerged.

One the one hand there is what I will call, although admittedly inappropriate, the ‘low-resolution data’. These predominantly comprise find-spots known from the archaeological journals, the Dutch automated national archaeological database (ARCHIS) and through the collections of local archaeologists. On the other hand, there is the ‘high-resolution’ data originating from (among others the ‘Betuweroute’) investigations.

A regional approach, combining both low- as well as high-resolution data, was considered the most valuable line of investigation. In doing so, both old as well as new data could be used, and their differences outlined. For the sake of manageability, a small study area housing both ‘resolution-types’ of data was selected.

1.3.2 The study area

The Rhine-Meuse delta has proven to be an attractive study area for a wide range of scientists, including geologists, soil-scientists and archaeologists. The fluvial dynamics and its influence on the landscape and its occupants during the Holocene have been extensively studied during the past three decades.

In this study I will focus upon a small area within the Rhine-Meuse delta; a part of the stream belt of the river ‘Linge’ west of the ‘Amsterdam-Rijn’ canal. The Linge is more or less the central dividing river of an area limited by the rivers ‘Lek’ in the north, and the river ‘Waal’ to the south. Both rivers are relatively recent distributaries of the river Rhine. The most westward boundary of the study area is formed by the ‘Merwede’ canal, which from 1895 onward connected the waterways of the city of Amsterdam with the Waal near Gorinchem. The approximately 11 kilometre long lower part of the Amsterdam-Rijn canal that connects the Waal near Tiel with the Lek just south-east of Wijk bij Duurstede is used to limit the study area to the east.

The map printed below shows the study area and various cities mentioned in this study.

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28 As the Middle Bronze Age data has not been investigated to the same extend, this has serious implications for the representativeness and comparability of the different periods. For the inventory of Middle Bronze Age sites I have used the ARCHIS database exclusively. No additional literature or local collections were studied. See also Chapter 3, paragraph 3.5.

29 These are discussed in Chapter 3. To group the entirety of the data as ‘low-resolution’ of course belies the varying quality of the data therein. This is particularly the case with the ‘publications’; these can be both extensive and excogitated excavation reports, as well as single sentences listing stray finds.

30 See Chapter 4 on the Betuweroute project and data.

31 See Chapter 2, paragraph 2.1.2 History of the geological enquiry.

The area between the river Linge and the river Waal is topographically indicated as the ‘Tielerwaard’ and is part of the provinces ‘Zuid-Holland’ and ‘Gelderland’.

The ‘low resolution’ data from archaeological journals, the ARCHIS database and local collections will be presented in chapter three. There, for each type of data, specific source criticism will be given. The ‘Betuweroute’ data presented in chapter four, naturally do not reflect the totality of data known. Rather, a selection of potentially interesting sites is made, and these are described in somewhat more detail. The sites ‘Eigenblok’ and ‘De Bogen’ were selected for a somewhat more extensive discussion in this study.

The theoretical backgrounds are explored in chapter five. As the totality of archaeological data and/or interpretations used in this study has been formed over a span of time that has seen many changes in conceptual frameworks, a historical approach has been adopted. This offers the readers a background that will enable them to evaluate former publications. Beside this, through its chronological structure, current themes and discussions are listed in the final paragraphs. It will become clear that the concepts used in Late Neolithic archaeological interpretation have not always been the same as those used in Bronze Age archaeological conceptualisation. Thus, a bi-partite structure (Late Neolithic versus Early- and Middle Bronze Age history of archaeological theories) has been adopted to discuss these differences.

1.3.4 The backgrounds

Contrary to what is commonly assumed by the general public, archaeological finds themselves tell few tales of the past. Archaeologists combine the information derived from the specific context from which an object originated, with (if one wishes; personal) conceptual framework. It is this combination, rather than ‘things being unearthed’ that underlies archaeological ‘storytelling’.

Therefore, to provide the finds with context, information on their geological and conceptual backgrounds is eminent. In chapter two an introduction to the complex fluvial architecture of the Dutch river area will be presented. This is concluded by a palaeo-geographical reconstruction of the study area. The geological context of the archaeological data will be analysed through combination with soil survey maps, geological maps, sand-depth maps and detailed maps of smaller areas derived from other studies.

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1.3.5 The evaluation

In the synthesis (Chapter 6) all threads are recombined to assess to what extent this study can contribute to the problems outlined above. In this chapter all types of data, as well as the methodology applied, will be evaluated.
Methodological comments on the different types of data, the different backgrounds and the methodology applied to them, as well as the specific archaeological implications and results will be presented.

1.4 Summary

In this study an attempt is made to shed some light on the cultural dynamics that took place during the Late Neolithic, the Early- and the Middle Bronze age. In particular, the relationships between man and landscape, in synchronic, diachronic and regional perspective will be investigated.

To do this, a regional approach that combines both ‘low resolution’ as well as ‘high resolution’ archaeological data within a confined geographical study area in the Dutch central river area is adopted. The total of archaeological data is placed within both a geological as well as a conceptual context. Thus, an archaeological analysis can be combined with an inter-source (high versus low resolution) data evaluation.

In the first chapter the research objectives, methodology, the study area, different types of data used and the various backgrounds are briefly introduced. In chapter two the geological background is extensively discussed. The ‘low-resolution’ data is introduced in chapter 3, whereas the ‘high-resolution’ data is discussed in chapter 4. The theoretical concepts underlying their interpretation are outlined in chapter 5. In the final chapter an assessment is made to what extend the different types of data used in this study can be used to clarify the relation between man and landscape during the Late Neolithic, Early- and Middle Bronze age. Thereafter, specific results and their archaeological implications are presented.
2. Geology and paleogeography

2.1 Introduction

The Dutch central river area has been a focus of fluvial activity throughout the entire Holocene period. This chapter aims to provide the reader with sufficiently detailed knowledge of (the problems in establishing) the geological backgrounds to the present state of the archaeological record. The relations between the fluvial landscape and the archaeological data are two-fold. First of all, landscape morphology and hydrology might have prevented, or favoured, human presence in some parts of the landscape over others. Secondly, fluvial processes like sedimentation and erosion might have both preserved, as well as destroyed significant parts of the remains of prehistoric activities. Thorough understanding of these fluvial dynamics in the Dutch central river area is needed to investigate and evaluate the relationships between man and landscape in prehistory.

2.1.1 Structure

This chapter starts with a brief summary on the history of the geological enquiry. Thereafter, in paragraph 2.2, the reader will be made familiar with the Dutch system of geological classification used in this study. In paragraph 2.3 an introduction to the specific -distribution of- fluvial facies units will be presented. In paragraph 2.4 the paleogeography and paleoecology of the study area will be discussed. After some brief comments on the methods used in paleogeographical and paleoecological reconstructions, the main fluvial systems and general trends in vegetation succession during the Late Pleistocene and Holocene geological periods will be examined.

2.1.2 History of the geological enquiry

One of the first scientists to publish on the geology of the Dutch central river area was T. Vink. His 1926 publication dealt with the Lek river system and in 1954 he published his ‘De rivierstreek’ (‘The river area’). Geological maps of the area had already been made by W.C.H. Staring (1858-1867) and Tesch (1925-1951).

In the thirties and forties of the 20th century emphasis was laid on the mapping of fossil river channels in the Rhine/Meuse delta and the reconstruction of past environments. The first large-scale soil-analyses of the wider region were published by Edelman et al. and Egberts in 1950. Results of soil survey in the Vijfheerenlanden were published in 1960 by Th. A. de Boer and L.J. Pons.

Research intensity increased dramatically from 1959 onward when C.J.H van Rossum initiated a field course in the Holocene fluvial district of the central Netherlands for undergraduate students of physical geography at the University of Utrecht. This field course basically consisted of soil mapping, following the approach developed at the Soil Survey Institute (Wageningen). B.P. Hageman had been supervising the Tielerwaard coring project of the Geological Survey of the Netherlands from 1957 to 1964. This campaign resulted in the publication of the geological map of the eastern part of the study area by Verbraeck in 1970. In 1969 B. P. Hageman published his influential article ‘Development of the western part of the Netherlands during the Holocene’.

Louwe Kooijmans’ 1974 thesis on the archaeology and the Holocene geology of the Rhine-Meuse delta examined the ‘Vijfheerenlanden’ and an area to the west of the study area. The publication became very influential through its thorough discussion and integration of archaeological and geological studies. The genesis and structure of the Tielerwaard river-clay area was discussed by A.J. Havinga and A. op ’t Hof in 1975.

Under the supervision of H.J.A. Berendsen - successor to C.J.H van Rossum- more geological research took place in the Rhine/Meuse delta south of the city of Utrecht, resulting in several publications. These tended to concentrate less on soil-survey and more on geomorphological and geological mapping. Instead of coring to a depth of 1.5 metres typical of soil-survey, depths of boreholes

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1 A river delta is defined as ‘(…) a deposit, partially subaerial, built by a river into or against a permanent body of water’ (Miall 1984).
2 See for botanical research: Florschutz & Jonker 1939. J.J. Pannekoek van Rheden conducted research on the mapping of fossil river systems (Pannekoek van Rheden 1942).
5 Törnqvist 1993, p.7.
6 See Verbraeck 1970 and associated maps.
7 Louwe Kooijmans 1974.
were often increased to penetrate the entire Holocene sequence\textsuperscript{12}. 

\textsuperscript{12} Törnqvist 1993, p. 7.
J. D. van der Woude investigated not only the paleoecology of the ‘Molenaarsgraaf’ site excavated by L.P. Louwe Kooijmans\textsuperscript{13}, but also conducted a case-study on an area near the city of Leerdam. The aim of his 1981 publication was to create a ‘coherent picture of the paleoenvironments and their evolution during the Holocene’\textsuperscript{14}. The data gathered between 1964 and 1973 by the Geological Survey of the Netherlands for the eastern part of the study area were published as a geological map in 1984 by Verbraeck\textsuperscript{15}.

Based mainly on the extensive data set-up to 200,000 borings in the Rhine-Meuse delta as a whole- gathered by the department of physical geography at the University of Utrecht, recent publications by Törnqvist (1993), Weerts (1996) and Makaske (1998) focussed on the architecture and dynamics of river systems and their changes during the Late Weichselian and Holocene of the Rhine/Meuse delta. Although they do not all concern the study area proper, understanding of the processes that took place within the larger basin of the Rhine-Meuse delta is imperative to understanding the local paleogeography.

Detailed information on the fluvial architecture of - among other regions- the Betuwe and Tielerwaard was published on 1:25,000 scale maps based on 70 corings per square kilometre\textsuperscript{16}. Due to the increasing awareness of -and proposed solutions for solving- the problems in radiocarbon dating of fluvial systems, several articles on dating the sedimentation phases of fossil rivers in the Rhine-Meuse delta were published\textsuperscript{17}. H.J.A. Berendsen and E. Stouthamer are currently preparing the publication of a scale 1 : 100,000 paleogeographical map of the Rhine-Meuse delta\textsuperscript{18}. Based on over 1000 radiocarbon dates they will depict the fluvial history of the entire Rhine-Meuse delta at 500 year intervals\textsuperscript{19}.

2.2 Classification

The objective of this paragraph is to give a short introduction to the Dutch system of geological classification. During geological survey, ‘lithostratigraphical units’ are mapped. Berendsen defines these as ‘rock strata that can be classified through their distinct nature and composition (lithology) of the material’.\textsuperscript{20} Nature and composition of rock strata are largely determined by their specific genesis. Therefore, genesis is sometimes (directly or indirectly) implied if classifying sediments according to the system of the Geological Survey of the Netherlands\textsuperscript{21}.

The fundamental unit of the Dutch lithostratigraphical classification is the Formation. Formations can be joined into Groups or can be divided into Members and divided further into Beds. Last year (July 1999), the system of classification has undergone considerable changes\textsuperscript{22}. To maintain compatibility with older literature, the changes to the previous system of classification\textsuperscript{23} will be briefly discussed below.

2.2.1 Formations of the Late Pleistocene

The Formations dating to the Late Pleistocene and Holocene that can be found in the study area will be explored below. The different lithological characteristics of the various geological elements will be discussed in paragraph 2.3\textsuperscript{24}.

2.2.1.1 Kreftenheye Formation

The Kreftenheye Formation consists of river deposits of the rivers Rhine and Meuse, dating to the Saalian and Weichselian period. Lithologically they consist of a relatively uniform package of gravel (up to 40 %) and medium to coarse sand (210-600μm), occasionally with lenses of fine sand\textsuperscript{25}. Mineral analysis of sediments deposited by the river Rhine yield a relative high level of augite minerals\textsuperscript{26}. The braided river deposits in the upper part of the formation are finer (150-300μm) and contain less gravel (maximum of 10%)\textsuperscript{27}. Fining upward sequences and lateral accretion surfaces are rare. The gradient of the top of the Kreftenheye Formation is approximately 25 cm/km towards the west\textsuperscript{28}. Maximum thickness of the package is around 15 meters. In the western part of the study area, the top of the Kreftenheye Formation can be found between four and twelve metres below sea-level.

\textsuperscript{13} Published in his 1974 thesis. Louwe Kooijmans 1974, p. 169-339.
\textsuperscript{14} Van der Woude 1981. See also : Van der Woude 1984 and Van der Woude 1985.
\textsuperscript{15} See Verbraeck 1984 and associated geological maps.
\textsuperscript{16} Berendsen et al. 1994 and Weerts 1996, p. 28.
\textsuperscript{18} Berendsen & Stouthamer, in press.
\textsuperscript{19} Weerts 1996, p. 174, Berendsen & Stouthamer, in press. For project information and preliminary results see: http://www.geog.uu.nl/fg/paleogeography/ and the paleogeographical maps in the digital data.
\textsuperscript{20} Freely adapted from: Berendsen 1997, p. 221.
\textsuperscript{21} See Zagwijn & van Staalden 1975.
\textsuperscript{22} Ebbing et al. 1999.
\textsuperscript{23} Defined by Zagwijn en Van Staalden (1975).
\textsuperscript{24} Weerts 1996, p 32. (modified and extended after Törnqvist et al. 1993).
\textsuperscript{26} Verbraeck 1984, p. 94.
\textsuperscript{27} Verbraeck 1990.
\textsuperscript{28} Pons 1957.
In the eastern part of the study area the Kreftenheye Formation can generally be found at shallower depths of about 4 to 6 metres\(^{29}\).

In some parts of the study area a thin layer of loam can be found on top of the Kreftenheye deposits, which is classified as the ‘Wijchen’ Member\(^{30}\). Older literature often refers to it as ‘\textit{Hochflutlehm}’. Deposits consist of massive sandy-silty clay to clayey sand. Thickness of the deposits varies between 0.5 and 1.0 metre. Sand admixtures are usually in the fraction 210-300 µm. A paleo-sol is frequently present and clay may be more or less organic\(^{31}\). This layer might represent flood-basin deposits of meandering rivers dating to the Bølling-Allerød interstadial\(^{32}\).

### 2.2.1.2 Twente Formation

Deposits of the Twente Formation are predominantly siliciclastic aeolian and fluvio-periglacial in nature. This coversand deposit contains fine to sometimes loamy sand and was deposited outside the paleo-valley of the braided Kreftenheye river\(^{33}\). Therefore it is scarcely found within the study area. Only near the inner bend of the river Lek north-east west between the towns of Vianen and Hagestein - at depths from 6 to 8 metres below datum - coversand deposits can be traced\(^{34}\). Here the thickness is minimal, but it increases to 2.5 m towards the north-east.

Based on their lithology, river dunes were sometimes classified as being part of the Kreftenheye Formation -consisting of moderately coarse (circa 300 µm) grained sand- and elsewhere (for instance near brook gullies) as part of the Twente Formation\(^{35}\). To solve this problem a new Member, the ‘Delwijnen’ member, was added to the Twente Formation. Now all river dunes, albeit sometimes of different mineralogical composition, are classified as the Delwijnen Member\(^{36}\).

Typically, these river dune deposits consist of fine to coarse sand, occasionally silt and sometimes displays a horizontal lamination.

#### 2.2.2 Holocene Formations

##### 2.2.2.1 Echteld Formation

The Echteld Formation was introduced in 1999 to replace the ‘Betuwe Formation’\(^{37}\). All Holocene deposits of meandering and anastomosing rivers upstream of the perimarine area were formerly classified as Betuwe Formation\(^{38}\). However, the definition of the ‘perimarine area’ is problematic. The former definition of the ‘perimarine area’ by B.P. Hageman in 1969 ‘With the term “Perimarine area” is meant the area where the sedimentation or seditation took place under the direct influence of the relative sealevel movements but where marine or brackish sediments themselves are absent.’ had provoked much discussion\(^{39-40}\). The fact that lithologically identical sediments were classified differently on both sides of this arbitrary border has caused Berendsen to incorporate the fluvial deposits in the (peri)marine area into the Betuwe Formation\(^{40}\).

Traditionally, the Betuwe Formation incorporated deposits from the Rhine and Meuse (and their branches) as long as their sedimentation did not proceed into the peat-dominated (‘Westland Formation’) downstream area\(^{41}\). According to this definition, flood-basin peat and residual channel peat were also classified as being part of the Betuwe Formation. Nowadays, all peat is being classified as belonging to the ‘Nieuwkoop’ Formation\(^{42}\).

The ‘Gorkum’ and ‘Tiel’ Members were formerly classified as being part of the Westland Formation but now belong to the Echteld Formation in the new classification system. They comprise all Holocene clastic fluvial sediments of the ‘perimarine area’ that were formerly classified as Gorkum or Tiel Member\(^{43}\). Although the chronostratigraphical subdivision into these two Members mentioned has been heavily criticised, I deem knowledge of former notions inevitable to assess older literature.

\(^{29}\) This can be deduced by combining the ‘Top of Sand’ map with the ‘Age of Holocene Stream Belts’ map for sheet 39 West (see Chapter 2), and the ‘Top of the Twente and Kreftenheye Formation’ map for sheet 38 East of the Geological Survey of the Netherlands. Cf. Verbraeck 1984, p. 104, Fig. 35 and Verbraeck 1970, p. 49.


\(^{31}\) Weerts 1996, p. 32.


\(^{34}\) See: Subsidiary Maps belonging to the Geological Map of the Netherlands, Top of the Twente and Kreftenheye Formation, Gorichem (Gorkum) 38 Oost, Haarlem: Rijks Geologische Dienst.


\(^{36}\) See Ebbing et al. 1999, p. 25.29. It consists of all deposits belonging to the recent river Rhine, as well as the deposits of the recent Rhine that are mixed with deposits belonging to the recent river Meuse, which based on their lithology and stratigraphy can easily be distinguished from underlying sediments. Freely after: Ebbing et al. 1999, p. 25.

\(^{37}\) Cf. Ebbing et al. 1999, p. 18,14,25.

\(^{38}\) For a short explanation of the terms ‘meandering’ and ‘anastomosing’ see paragraph 2.3.1.

\(^{39}\) Berendsen 1982, p. 67-69; Törnqvist 1993, p. 17 and Verbraeck 1984, p. 149-154,179. Van Dijk et al. (1991) argue that all of the study area east of the city of Leerdam was void of direct marine influence during the Holocene, with the city of Leerdam thus forming the boundary of the perimarine area.

\(^{40}\) Berendsen 1982; Berendsen 1984a/b and Berendsen 1997.

\(^{41}\) Verbraeck 1984, p. 175, Zagwijn & van Staalduinen 1975.

\(^{42}\) The ‘Nieuwkoop’ Formation and the ‘Broek’ Formation advocated by Berendsen (1982, 1997), overlap to a certain extent. The Nieuwkoop Formation, however, is the official nomenclature. Ebbing et al. 1999, p. 25,30.

Gorkum Member

Gorkum sediments were thought to have been deposited by meandering rivers during the Atlantic and the Subboreal periods until ± 3800 B.P. 1999, p. 25,30. Deposition took place during a period of relatively rapid sea-level rise. Gorkum deposits are usually covered by Tiel deposits or ‘Holland Peat’, which is now classified as part of the ‘Nieuwkoop Formation’. Four kilometres south-east of the town of Culemborg a relict of the Schoonrewoerd channel belt -classified as Gorkum Member- surfaces. Channel deposits are usually 50-350 meters wide and rise 2-8 metres from the bottom of the surrounding floodbasin. Smaller channels will have existed but are ill known because of the large grids often used in coring 45. Levee deposits belonging to the Gorkum Member are generally 0.5 to 2.5 metres thick and occur at different (overlying) depths. Thickness of the total Gorkum Member deposits varies between four (east) and seven metres (west).

Tiel Member

Fluvial deposits in the perimarine area that were supposedly deposited during the same period as the Dunkirk Member in the coastal area were classified as Tiel Deposits. Although Holland Peat is incidentally found underneath Gorkum deposits and Holland Peat is very infrequently found in Subatlantic Tiel deposits, the fact that Tiel beds dominate the sediments on top of the Holland Peat was used to distinguish it from Gorkum deposits 46. Sedimentation took place during the Subboreal period after ± 3500 B.P. and during the Subatlantic period 47. Only a thin -often less than 2.0 metres- package of sediments, in which peat intercalations were rare or absent, was thought to have formed. Total thickness of the Tiel beds is modest (0.5-3.0 metres) and some channel deposits have carved into the Pleistocene subsoil. The channel beds have widths from 50 to 2000 (river Waal) metres.

Lithologically these sediments are comparable to those of the Echteld Formation and Gorkum Member described above. Therefore attention will be drawn to specific differences. In general borders between lithological components are more pronounced; channel bed sediments tend to be coarser and edges of natural levee deposits can be defined more clearly. Peat is evidently less frequently present in the floodbasin deposits, although vegetation horizons occur often.

Sometimes these layers of greyish to black humic clay change laterally into a brown-grey humic clay, possibly representing a wetter area 48.

2.2.2.2 Nieuwkoop Formation

The Nieuwkoop Formation was introduced in July 1999 and consists of all Holocene peat deposits. This encompasses the peat in the coastal area (formerly classified as the ‘Basal Peat’ and ‘Holland Peat’ Members of the Westland Formation), the peat found in the fluvial district (formerly classified as the being part of the ‘Betuwe Formation’ as well as the oligotrophic peat found on the Pleistocene sands classified as ‘Griendtsveen’ 49. Griendtsveen and Holland Peat are classified as Members, while Basal peat is classified as a Bed. The Basal peat bed is distinguished by the fact that it immediately overlays the Pleistocene subsoil. The direct influence of sea-level rise and indirectly through groundwater level rise- is seen as the primary cause of the emergence of the Basal peat. Therefore, Basal peat in the western part of the Netherlands lays much deeper and is older than Basal peat in the eastern part of the Netherlands 50. The Holland Peat Member is briefly outlined below.

Holland Peat

All Holocene peat found in the coastal and perimarine regions -except the peat underlying the Calais Deposits (‘Basal Peat’) - were classified as Holland Peat. It supposedly was deposited synchronously with deposits of the Gorkum Member and is often covered by Tiel deposits. Only seldom can Holland Peat be found that is deposited directly upon Pleistocene sediments. North of the river Linge and west of Culemborg a thick -up to 5 metres- package of peat can be found. West of Culemborg and in the Tielerwaard the Holland Peat seems to concentrate in three layers with an average thickness of about 0.1-2.0 metres, although this probably represents an over-simplification. Apart from the often clayey peat, small lenses of peaty clay, gyttja 51 and humic clay are regularly found. Different peat types do not show a clear stratigraphical sequence. Alnus (alder) peat and Phragmites (reeds) peat dominate 52.

45 Verbraeck 1984, p. 149,157-164.
46 See chapter 6, paragraph 6.4.2.
47 The Holland Peat Member does not exist anymore, all peat is classified as belonging to the Nieuwkoop Formation. Ebbing et al. 1999, p. 25,30.
48 Verbraeck 1984, p. 166.
49 Verbraeck 1984, p. 168. See also Steenbeek 1990 on paleo-sols in the Dutch central river area.
Although Holland Peat growth was thought to have started from the Early-Atlantic period, according to Verbraeck most of the peat was formed during the transition from the Atlantic to the Subboreal period lasting till the end of the Subboreal (± 6000-2800 B.P.)\(^{53}\). The three major -certainly asynchronous-peat layers most probably date to the Atlantic Period, the Atlantic/Subboreal transition and the Subboreal/Subatlantic transition.

### 2.3 Lithology and facies units

#### 2.3.1 Introduction

Facies distribution in both vertical and horizontal dimension in the Rhine-Meuse delta is largely determined by the specific character (style) of the fluvial deposition\(^{54}\).

Traditionally, three types of fluvial styles are used in classification of (fossil) river systems\(^{55}\). Braided rivers are defined as multiple channel systems characterised by migrating channels divided by sandy to gravelly bars. Although also defined as a multiple channel system, the anastomosing river style is characterised by highly stable channels encased in fine grained floodbasin deposits\(^{56}\). Meandering rivers are single channel systems with a more or less sinuous shape which shifts laterally through erosion and accretion. During the last 15,000 years the Rhine/Meuse delta has seen several changes of fluvial regime. Fluvial style changed from braided to meandering and in some parts of the delta to anastomosing\(^{57}\).

The diagrams below show the differences in fluvial style and a time-space model of the occurrence of these different styles in the Rhine/Meuse delta.

The specific interaction of factors controlling changes of fluvial style are still under much debate, but sea-level rise, river gradient and aggradation rate, (peak) discharge and thickness and cohesiveness of the subsoil are seen as important parameters\(^{58}\).

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\(^{53}\) Verbraeck 1984, p. 166.

\(^{54}\) For this study Reading’s definition of ‘facies’ is best applicable: ‘a distinctive rock unit that forms under certain conditions of sedimentation, reflecting a particular process or environment’. Cf. Reading 1986. For more extensive discussion see Weerts 1996, p. 25.


\(^{56}\) Makaske 1998.

\(^{57}\) Weerts 1996, p. 29.50. See also: Berendsen 1982; Bosch & Kok 1994; Pons 1957 and Törnqvist 1993. Straight river systems are rare and seem not to have occurred in the study area: Cf. Walker & Cant 1984.

2.3.2.2 Vertical accretion channel deposits

According to Berendsen, vertical accretion channel deposits (channel-lag deposits, coarse channel-fill deposits) usually contain very fine to coarse sand and occasionally sandy-silty clay. This is partly due to the low gradient (0.1 m/km) of most Holocene rivers. Weerts, however, describes the vertical accretion channel deposits as very homogeneous (fine to medium fine sand; 150-420 μm) and flat-topped. Fining upward sequences and lateral accretion surfaces are rare. The fine gravel is characterised by a relatively high amount of green-grey sandstone (12-15%) and -if compared to Pleistocene channel deposits- a relatively low amount of quartz (50-55%). Most vertical accretion channel deposits show a gradational transition to overlying overbank deposits. Thickness of the deposits in the Rhine-Meuse delta ranges from five to fifteen metres, with widths of 40 up to 100 metres.

2.3.2.3 Residual channel deposits

Residual channel deposits comprise minerotrophic peat, (humic) clay, sandy-silty clay and (less frequent) clayey and fine sand. If a river channel is abandoned because of an upstream avulsion, the sediment is coarser near the point of avulsion and becomes more fine grained towards the end of the residual channel. Peat is commonly found in residual channels in the central and western part of the Rhine/Meuse delta, while in the eastern part mostly clay and sand dominate the channel fills. Residual channels formerly belonging to meandering rivers are usually one to three metres thick and 10 up to 80 metres wide. Residual channel deposits in former anastomosing river sand bodies tend to be smaller (5-15 metres wide) and much less thick (0.5-1.5 metres).

2.3.2.4 Natural levee deposits

During periods of flooding, the high water level overtops the channel banks. The fall-off in the level of turbulence causes the suspended material to be deposited. Therefore, natural levee deposits tend to develop a horizontally laminated structure of sandy-silty clay, sometimes alternating with layers of fine sand. Usually within 100 metres from the active channel they smoothly merge into the floodplain deposits. In this narrow strip they cover lateral accretion deposits and vertical accretion channel deposits of the river near the convex bank and cover older floodbasin deposits near the concave bank.

According to Collison, levee deposits are especially well developed on the concave banks of meanders, although this can not be proven for the Rhine-Meuse delta. The average grain size of the levee deposits is plotted in the diagram below.

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61 Berendsen 1997, p.182.
63 Berendsen 1997, p. 182.
64 Entire subsection after Weerts 1996, p. 44-45.
66 Collison 1986.
67 Possibly due to the small amount of transported sediment and the effects of erosion, natural levee deposits are usually only 0.5-1.5 m thick and poorly developed in the Rhine-Meuse delta (Berendsen 1982, p. 103).
68 Entire subsection after Weerts 1996, p. 43-44.
69 Weerts 1996, p.44. Joanne Mol argues that crevasse channel width in the Dutch fluvial district seldom exceeds 20 metres (personal communication, 21-02-2000).
2.3.2.6 Dike breach deposits

Due to its comparable lithological components, dike breach deposits are sometimes classified as being part of the crevasse facies. Lithologically these sediments consist of silty- to sandy clay, part of the crevasse facies. Lithologically these sediments consist of silty- to sandy clay. Specific to dike breaches is the addition of coarse sand and even gravel originally belonging to the Pleistocene subsoil. Dike breaches predominantly occur where a dike overlays -fossil- channel belt deposits.

2.3.2.7 Floodbasin deposits

Floodbasin deposits consist of very thin laminated clay to massive and humic clay. Clay thickness varies between 4-6 metres in the eastern river area to up to 12 metres in the western part of the Vijfheerenlanden. Dark coloured vegetation horizons are often present within the grey clay and represent periods of limited sedimentation which enabled the development of these paleosols. Deposits usually consist of intercalated layers floodbasin deposits, organic deposits (Alnus and Phragmites fragments are frequently found) and to a lesser extent crevasse deposits and natural levee deposits.

2.3.2.8 Fluvio-lagoonal deposits

Although Weerts classifies ‘gyttja’ as main constituent of a separate facies unit, the ‘Fluvio-lagoonal deposits’, it no longer encompasses all deposits present in a fluvio-lagoonal environment as had been done by Van der Woude. Fresh water gyttja is made up of fine grained organic sediments, sometimes with fine clastic intercalations. A dark brown colour and macro remains of Potamogeton (pondweed) and Nyphaea (waterlilies) may indicate a transition to the coarser detritusgyttja. These are mostly deposited in shallow (yet at least two metres in depth) and permanent lakes and their thickness rarely exceeds one metre. Outside of the study area the lateral extent can be several kilometres.

2.3.3 Facies distribution

Because of the fact that almost the entire Holocene genesis of the study area can be attributed to fluvial sedimentation and due to the high correlation between fluvial style and specific architectural facies, the distribution of several fluvial styles is discussed below.

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This should be noted that when geological mapping of the study area took place, river systems in the study area were thought to have been meandering and the complex fluvial architecture of the overbank deposits is often inadequately investigated to trace the patterns mentioned below. Beside this difference in theoretical background it should be pointed out that the used mapping grid (9-10 corings/km²) is barely usable for detecting small-scaled lithological differences in facies distribution. The patterns explored below offer only a rough guideline to fluvial facies distribution. Additional geological survey will provide a more stable basis for the analysis of fluvial facies distribution and its implications.

In a braided fluvial system as shown below (Fig. 2.4), sandy to gravelly deposits prevail. Although most likely an oversimplification, two Pleistocene river terraces in the Rhine-Meuse delta are thought to have been formed by braiding rivers. Indirect 14C dating indicates a pre-Allerød age. The lower terrace is dated to the Younger Dryas interstadial and is viewed upon by Weerts (1996) as being the last period of occurrence of a braided river system in the Rhine-Meuse delta.

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77 This can be illustrated by the analysing the detection rate of crevasse deposits plotted against sampling interval as done by Weerts (1996). Increasing sampling interval from 20 to 100 metres decreases encountering rate from 57% to 45 %. Cf. Weerts 1996, p. 69, Table 3.3.
78 Verbraeck reconstructs at least six phases of Kreftenheye river sedimentation: Verbraeck 1984, p. 94-107.
The occurrence of river dunes—often overlaying a ‘hochflutlehmb’ loam bed deposit dating between the Weichselian Pleniglacial and Allerød period—is common in the eastern part of the Rhine-Meuse delta. In the study area, however, few river dunes are found. Braided river deposits nearly everywhere underlie the Holocene sequence in the study area.

Anastomosing rivers have dominated the central and western parts of the Rhine-Meuse valley during the period of rapid base-level rise that ended around 4000 B.P. In the study area, typical characteristics like abundant crevasse deposits, laterally interconnected channel sand bodies with a low width/thickness ratio and a complicated pattern of overbank, peat and lacustrine facies units in the floodbasins can be found.

Törnqvist argues that sediments of the ‘Schaik’ channel system that represent a fully developed anastomosing river system are only found downstream of the study area. Anastomosing river sediments within the study area are looked upon as being transitional to meandering. Therefore, unambiguous regions of both meandering and anastomosing fluvial style can hardly be defined. These transitional river systems have moderate width/thickness ratios (circa 25, whereas truly meandering rivers have values higher than 50) and show less crevasse deposits.

Channel deposits showing patterns of lateral accretion, which is typical of meandering river systems, can be found in the eastern part of the study area. In various publications a hypothetical north-south frontier running through the city of Geldermalsen is seen as the ‘border’ between deposits of the anastomosing and meandering fluvial style. To me, the exact location of this boundary seems of little value.

Törnqvist 1993, p. 105; Weerts 1996, p. 140, Fig. 7.1.

These were observed in several profiles east of the study area: Törnqvist et al. 1993, p.98-99 Fig. 1 & 4; Weerts 1996, p.63-65,71.

2.4 Paleogeography and paleoecology

2.4.1 Introduction

Acquiring knowledge of past landscapes involves the challenging task of combining geological data with palynological and paleobotanical research. In this paragraph I will try to create a general overview of the late Pleistocene and Holocene paleogeography of the study area. This will be largely based upon the results of the extensive geological data set gathered within the Rhine-Meuse delta by H.J.A. Berendsen and the paleo-environmental studies carried out by J.D. van der Woude. A short description of the applied methods will be given in the next paragraph. Hereafter paleogeographical descriptions for several phases of the late Pleistocene and Holocene will be presented. River systems active during the chronological period of interest (roughly outlined as between 4300 B.P. and 3000 B.P.) will be discussed in somewhat more detail than fluvial systems that were active during preceding and following phases.

2.4.2 Methods

2.4.2.1 Geological research

Between 1957 and 1964 the Geological Survey of the Netherlands carried out circa 2800 corings in the central Rhine-Meuse delta. These -predominantly manual- borings penetrated the Holocene sequence to a depth of circa 6 to 10 metres. An ‘Edelman’ auger was used for the upper metre of topsoil and the sandy to sandy-clayey sediments. For corings below the groundwater table (depths approaching ten metres) a ‘Van-der-Staay’ suction corer was used. Peat and clayey deposits were explored using an extendable auger. Sediments were described according to the (former) classification system of the Dutch Normalization Institute, which is published in Verbraeck 1970. Palynological samples were obtained from several cores and published by De Jong and Zagwijn. Methods had not changed much during the 1964-1967 campaign, apart from the fact that a supplementary system of classification was used in describing the sediments.

The number of auger borings carried out by students of Physical Geography at Utrecht University during campaigns since 1973 exceeds 200,000 of which an estimated 15% penetrates into the Late Weichselian subsoil. Coring density varies from 60 to 350 corings per km². Beside the set of augers described above, a mechanical pulsating corer was used for a very few number of deep (up to 15 metres) subsoil explorations. Samples to be used for ¹⁴C-dating or palynological investigation were obtained using a 6cm diameter ‘Dachnowski’ probe. Classification of sediments followed the classification of H. de Bakker & J. Schelling (1966). All cores were described at 10 cm intervals: Texture, organic material content, plant remains, colour, oxidation/reduction indications, grain size, gravel content, lime content, iron content, groundwater level, stratigraphy and other remarks (shell/archaeological remains, etc.) were documented. A small number of samples was further analysed for grain size, percentage of organic particles, heavy minerals and gravel analysis. The methods used are summarised by Berendsen and were also applied and described by Augustinus.

The Leerdam study area investigated by J.D. van der Woude (1981) comprises circa 2 km² in which 500 hand borings were executed, resulting in a 80 m square grid with increased coring density near areas of subsoil irregularity. Ideally borings were gouged down to the sandy and loamy subsoil that forms the basement of overlying Holocene sediments. As no laboratory analysis was carried out, all classification was done in the field. The properties used in classification were (among others): Colour, calcium carbonate content, charcoal remains, organic components, faunal (e.g. snail shell) remains and the ‘degree of gradualness’ of vertical lithological changes.

The corings in the research programs mentioned above offer the possibility of (relative) dating of fossil channels. Stratigraphical analysis can indicate superposition, and thus relative ages, although one must be aware that rejuvenation phases can seriously increase profile complexity. Preferably, a stratigraphical distinction between different channel sand bodies and their correlative overbank deposits can be made. Comparison of the depths to which decalcification took place and comparison of the state and nature of soil formation processes has been suggested as a (relative) dating solution for fluvial systems, but its methods and applicability are far from ambiguous.

1. The paleogeography of the entire Rhine-Meuse delta is extensively studied by Berendsen. See Berendsen 1982; Berendsen 1984a;b; Berendsen et al 1994 and Berendsen & Stouthamer, in press. Jan Doeije van der Woude’s study on the paleoenvironment of the Molenaarsgraaf and Leerdam areas is the most comprehensive (paleobotanical) study currently available (Van der Woude, 1981).


6. Van der Woude 1981, p. 7, 79 (Fig. 34).

7. Decalcification depths for several Rhine-Meuse delta rivers are depicted in Berendsen 1982, p. 120-122.
Establishment of gradient lines of fluvial systems is used by many authors to calculate paleo-discharge and phases of activity. In this approach sand body gradient lines are accepted as being representative for (fossil) river gradients. Gradient lines tend to be influenced not only by internal (fluvial) causes, but also by sea-level rise, channel body geometry and differential tectonic movement, which all can cause divergence. The best results are achieved with accurate height measurement on deposits that have eroded themselves into the Pleistocene subsoil and therefore are barely affected by subsidence.

2.4.2.2 Radiocarbon dating

Radiocarbon dating of residual channel deposits and organic beds underneath overbank deposits is used to determine phases of fluvial activity. Most of the radiocarbon dating was done at the Centre for Isotope Research of Groningen University (ClO, prefix GrN/GrA (AMS)) and the Robert J. van de Graaff-laboratory of Utrecht University (prefix: UtC). A table of all currently available (partly unpublished) $^{14}$C dates of interest for geological, archaeological and palaeobotanical research of the Rhine-Meuse delta is currently being compiled by H.J.A. Berendsen and E. Stouthamer. Both the techniques and accompanying methodological and chemical problems of radiocarbon dating in general have been thoroughly discussed by several authors. Specific problems concerning the dating of phases of fluvial activity are described below.

Törnqvist has argued that ‘Radiocarbon samples from the tops of lithostratigraphically correlative organic beds underneath overbank deposits (sample type 1, see Fig. 2.7 below (S.A.)) yield consistent ages, indicating a synchronous onset of overbank deposition over distances of at least up to 20 km along channel belts.11. Likewise, (AMS) radiocarbon dating of macrofossils from the base of organic residual channel deposits (sample type 3), has proven to be an accurate indication of the termination of in-channel sedimentation. As all these types of dating are in fact indirect, erroneous dating can result from the disturbing influence of non-depositional unconformities. Especially the dating of organic deposits overlying natural levee deposits (sample type 2) is considered problematic.

The slightly elevated natural levee sand body have, more often than was envisaged before, been subject to such unconformities. The paleosols found on natural levees are perhaps indicative of such hiatuses.

Therefore, processes like rejuvenation and erosion of overbank deposits have to be clearly understood in order to select a sound sample location. A combination of type 1 and type 3 samples is, in contrast to type 2 samples (which yield scatters ranging up to 1000 $^{14}$C years), considered reliably for dating fluvial systems. The fact that these are relatively recent notions, calls for attentiveness if analysing older geological reports and publications.

W. Roeleveld and R. Steenbeek have pointed out that a difference in radiocarbon age seems to exist between coarse ($>180 \mu m$) and fine ($<180 \mu m$) fraction samples.

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6 Although unpublished, the table is available upon request for study or education. Contact: H.J.A. Berendsen, Faculty of Geographical Sciences, Heidelberglaan 2, 3808 TC Utrecht, The Netherlands.
10 Törnqvist 1993, p. 34. Bulk samples of pure, rapidly accumulating ($<5cm/century$) peat are accurately datable, but gytijas and strongly clayey samples with low accumulation rates should be interpreted cautiously.
Dating by means of alkali-extract samples can provide an alternative source if the carbon percentage of samples is low (<2.5%), but the authors are reticent about its applicability on humic clays\(^\text{15}\) .

Calibration problems in \(^{14}\)C dating are well known and increasing research on the disturbing influence of atmospheric \(^{14}\)C variations combined with statistical analysis of smoothing parameters ensures acceptably precise calibration of radiocarbon samples. The first part of Törnqvist’s 1993 thesis deals extensively with the problems encountered and offers several possible solutions\(^\text{16}\). Application of new calibration software (the CALHIS program) is accompanied by a new statistical approach to highly smoothed calibration curves that can result in a more precise dating of organic deposits\(^\text{17}\).

2.4.2.3 Palynology and paleobotany

Both pollen analyses and studies of botanical macrofossils contribute to the reconstruction of former environments and can, in some cases, be used for dating\(^\text{18}\). Pollen studies can be used to determine vegetation evolution on a local and on a regional scale, which offers the possibility to correlate results from multiple pollen studies. Palynological studies of the Rhine/Meuse delta have been published by Florschütz & Jonker (1939), De Boer & Pons (1960) and numerous by De Jong & Zagwijn\(^\text{19}\). The vegetation successions of former riverbeds was described by J. Donselaar in 1961.

Chronostratigraphic subdivisions of pollen diagrams concerning the study area are usually made according to the system published by Zagwijn & Van Staaldruinen (1975). Specific methods used in pollen analysis are seldom described in the publications. The procedures followed in establishing the pollen diagram of Molenaarsgraaf, published by Louwe Kooijmans in 1974, are comparable to those described by Voorrips (1964)\(^\text{20}\).

Pollen analysis of fluviatile deposits is complicated by the fact that river clay beds contain pollen that have been transported by the river and originate from the upstream catchment area. This has especially been described for *Picea* (Spruce), *Abies* (Fir), *Fagus* (Beech) and *Pinus* (Pine), which are sometimes documented in the pollen record during periods in which these species (apart from *Pinus*) never existed in the Netherlands\(^\text{21}\). Correlation of the arboreal pollen content from clay beds with under- and overlying peat beds has been suggested by Van der Woude (1981) to diminish this influence. As certain taxa can be both river-borne and present in the local vegetation, one must be careful in deleting species from the pollen record\(^\text{22}\). Research if further hampered by the possibility of reworked material being present in clay beds overlying peat beds.

Traditionally groups of species are identified as representing a ‘local vegetation’\(^\text{23}\). *Betula* (Birch), *Fagus* (Beech), *Carpinus* (Hornbeam), *Quercus* (Oak), *Tilia* (Linden) and *Ulmus* (Elm) are seen as tree pollen reflecting a relatively dry environment.

A somewhat wetter context can perhaps be reconstructed if pollen of *Alnus* (Alder), *Fraxinus* (Ash), *Populus* (Poplar), *Frangula* (Buckthorn), *Cornus* (Dogwood) and *Salix* (Willow) trees are present. Aquatic localities can be indicated by the presence of species of *Nymphaea* (Lilies), *Nuphar* (Pond lilies), *Nymphaoides* (Banana lilies), *Sagittaria* (Arrowhead) and *Umbelliferae* (Parsley) plant families.

Dry vegetation conditions can be indicated through presence of genera like *Papilionaceae* (Pea family), *Compositae* (Aster family), *Chenopodiaceae* (Goosefoot/Beet family), *Artemisia* (Mugwort/wormwood), *Plantago* (Plantain family) and *Rumex* (Sorrel family).

Predominantly *Phragmites* (Reeds), but also *Glyceria* (Reed-Manna Grasses), *Rubiacaeae* (Madder family), *Cruciferaeae* (Mustard family) and many other species of plants can point towards a wetter environment.

Anthropogenic influences can be traced either through the presence of *Cerealia* (Cereals), *Plantago Lanceolata* (Ribwort), *Gramineae* (Grasses), *Rumex* or *Compositae* pollen or throughout fluctuations in the Aboreal / Non-aboreal curve.

\(^{15}\) They are somewhat more reserved towards its revenues than the Schoute (1984) publication they refer to.


\(^{17}\) See the example of calibration curves with different degrees of smoothing for 4500-5000 cal year B.P. in: Törnqvist 1993, p. 62, Fig. 1.

\(^{18}\) For a general introduction see: Bradley 1985.


\(^{20}\) In general, preparation for palynological research involves KOH (10%) pre-treatment, sieving, light Schüle reaction (removal of plant tissue fragments), KOH post-treatment, acetolysis followed by Bromoform (or ZnCl\(_2\)) separation. The last stage is post-treatment with light HF chemicals\(^\text{24}\). If the sediment under investigation consists of very solid clay, separation by Bromoform or ZnCl\(_2\) can also be executed as the first stage. Samples to be used in macro fossil analysis are simply boiled in 5% KOH solutions.


\(^{22}\) Van der Woude (1981, p. 26) illustrates this with the *Tilia* curve from boring Leerdam S332.\(^\text{25}\)

\(^{23}\) The list of species mentioned below is not to be considered exhaustive. Various other groupings of pollen taxa are possible. List adapted from Steenbeek 1990, p. 41.
The integration of geological, geophysical, paleobotanical and chemical (radiocarbon) data forms the basement of almost every paleogeographical investigation. Therefore, the above mentioned problems should always be kept in mind when establishing or combining paleogeographical reconstructions.

2.4.3 Paleogeography: Late Pleistocene

At the start of the Weichselian period (± 100-70 kA B.P. - 10 kA B.P.) the entire study area became covered with deposits of the active braided river systems. During this period the sea-level was probably 80 m below datum and periglacial influence was strong. The environment was dominated by tundra and arctic-desert vegetation, while large parts of the soil in the Netherlands were subject to permafrost. The lithological aspects of these sediments, classified as Kreftenheye Deposits, have been described above (paragraph 2.2.1.1). Due to the large lithological similarities between different phases of fluvial activity, establishing spatial aspects is complicated for the Kreftenheye deposits. Verbraeck (1984) traced six phases of activity starting from the Middle-Saalian period (Kreftenheye I), continuing up till the late Weichselian and (Holocene) Preboreal and Boreal periods (Kreftenheye VI), but this subdivision is nowadays no longer supported by geologists.

Geographical positioning of these phases of Kreftenheye activity is hazardous and can provide barely more than a general insight. The map reprinted below give an indication of the geographical position of the Kreftenheye V and VI phases, but until more detailed (local) research is carried out on this subject, its value should be considered limited.

Due to the problems described above, all of the Late Weichselian fluvial deposits are grouped into two river terraces. The genesis of these two terraces is seen as correlative to climatic changes during the Late-Weichselian period. The higher terrace has yielded indirect $^{14}$C dates that without exception revealed a pre-Allerød age.

24 Berendsen 1982, p. 49. This indicates a mean year temperature of –6° and –8° Celsius during the coldest (stadial) periods.
25 The lithology of six Kreftenheye phases is summarised in: Verbraeck 1984, p. 102-103.
26 See Verbraeck 1984, p. 97, Fig. 31.
27 Verbraeck 1984, p. 97, Fig. 31. For the eastern western part of the study area see Verbraeck 1970, p. 49 Fig. 20. See also Berendsen 1997, p. 89, Fig. 7.4.
28 These were first recognised by Pons & Schelling (1951). This interpretation is still confirmed by most authors: Cf. Berendsen 1988; Berendsen et al. 1995 and Teunissen 1990.
29 Weerts 1996, p. 27. A peat layer within the Wijchen member was dated 10,800 ± 60 B.P. (GrN 18105). See also: Bennema & Pons 1952.
30 See Weerts 1996, p. 78 (especially Fig. 4.4)
For the eastern part of the study area Berendsen & Stouthamer have reconstructed a Late Glacial fluvial system that remained active until the Younger Dryas period\textsuperscript{31}. It is unclear, however, to what extent it continued into the western part of the study area. The map (Fig. 2.9, above) has been adopted from Berendsen & Stouthamer (\textit{in press}) and depicts the spatial distribution of the still unnamed fluvial system\textsuperscript{42}.

In many parts of the study area a light-grey loamy sandy-silty clay can be found directly overlying the Kreftenheye deposits; this has been described in paragraph 2.2.1.1 as the Wijchen Member, or ‘\textit{hochflutlehm}’. Verbraeck’s reconstruction (see Fig 2.8) of the Kreftenheye VI phase offers a rough guideline to its spatial distribution. Average thickness of the layer is circa 30cm, but locally can ad up to one metre. Pollen analysis of this sediment near Benschop indicates a Boreal age. \textit{Corylus} (Hazel) dominates the lower part of the pollen section, but is gradually replaced by mainly \textit{Pinus} and \textit{Quercus}\textsuperscript{33}. Van der Woude has suggested that the diamicton of clay and sand (combined with a large lateral uniformity) might indicate that aeolian processes have played a large part in constructing both the loam deposits as well as the river dunes discussed below. He acknowledges, however, that this hypothesis has still to be adequately tested\textsuperscript{34}.

During the second phase of the Younger Dryas interstadial most of the river dunes in the Rhine-Meuse delta came into being. These consist of blown out sediments of the active braid plain that were deposited onto the higher inactive Pleniglacial river terrace\textsuperscript{35}. Although some are found within the study area, they are more frequently found in the ‘\textit{Alblasserwaard}’ region to the west\textsuperscript{36}. Although research intensity varies between different regions of the Rhine-Meuse delta it is, considering the current state and scale of investigations, not likely that this pattern will be altered dramatically in the near future. River courses that ran at right angles with the prevailing (south)western wind orientation during this period are suggested by Berendsen as having the best chance of developing lasting river dunes\textsuperscript{37}.

Within the region of interest only the ‘Leerdam’ and the ‘Zandberg’ river dunes have been more closely investigated\textsuperscript{38}.

2.4.4 Pleistocene-Holocene transition

It is clear that since their original formation, river dune morphology has constantly been altered by aeolian influences during the (early) Holocene. Their typical ‘horned’ shape and irregular topography, alignment to prevailing wind orientation, but especially the occurrence of interlining layers of redeposited river dune sand in Early-Holocene overbank deposits does account for this. Vanderberghe stated that climatic conditions during the later part of the Younger Dryas (cold, dry and showing strong aeolian activity) were favourable to these processes\textsuperscript{39}. The presence of bare interfluvies, in other words, the absence of erosion resistant vegetation in the braided river system is regarded by Mol as a vital precondition\textsuperscript{40}.

The Pleistocene-Holocene transition is seen by Verbraeck (1970) as reflecting two changes in fluvial style. Although his assumptions are largely based on research in the ‘\textit{Land van Maas en Waal}’ area published by Pons in 1957, he considers this data relevant to the eastern part of the study area. Verbraeck states that during the Allerød period the fluvial style first changes from braided to meandering, but that a decreasing temperature during the last stage of the Allerød brings this process to a stand\textsuperscript{41}. Fluvial style once more becomes braided, before finally changing into meandering at the end of the Late Glacial period. Verbraeck regards the decreasing (peak) discharge of the rivers as the predominant cause for this. A diminishing discharge is more gradually distributed because of increasing vegetation, disappearing permafrost and overall decreasing physical erosion, all stimulating the change to meandering fluvial style\textsuperscript{42}. In recent publications the role of vegetation is increasingly considered the principle factor\textsuperscript{43}.

The start of Holocene fluvial deposition is recently looked upon by several authors as illustrating an incisive meandering system caused by an increase in the discharge/sediment load ratio\textsuperscript{44}.

\textsuperscript{31} H.J.A Berendsen, personal communication. 22-02-2000.
\textsuperscript{32} All paleogeographical maps by Berendsen and Stouthamer \textit{in press}. used in this study are enclosed as Mapinfo (5) Tables, Mapinfo(5) workspace (paleogeographical maps.WOR) and Tagged Image Files (*.tif) in the digital data.
\textsuperscript{33} See pollen-diagram ‘Benschop’: Berendsen 1982, p.200-201, Fig.10.1.
\textsuperscript{34} Van der Woude 1981, p. 66-68.
\textsuperscript{35} Bohncke et al. 1993; Berendsen 1982 and Weerts 1996, p. 75-78.
\textsuperscript{36} See also Wijchen Member, or ‘\textit{hochflutlehm}’
\textsuperscript{37} For a distribution map see Van Dijk et al. 1991, p. 312, Fig. 1, Berendsen 1997, p. 174, Fig. 8.24. Cf. Louwe Kooijmans 1974, p. 84-90.
\textsuperscript{38} Sand being blown along the river course has a far greater chance of being eroded by the active river. Cf. Berendsen 1997, p. 126.
\textsuperscript{39} Van Dijk et al. 1991, p. 318-319 and Van der Woude 1981 (Leerdam river dune).
\textsuperscript{40} Vandenberghe 1987, p. 735. See also Weerts 1996, p. 78.
\textsuperscript{41} J. Mol, personal communication. 24-02-2000. See also Mol 1997.
\textsuperscript{42} Verbraeck 1970, p. 38.
\textsuperscript{43} Verbraeck 1970, p. 39) refers to Leopold & Wolman 1957 for factors stimulating meandering fluvial style.
\textsuperscript{44} See Mol 1997.
According to Törnqvist, environmental change at the Pleistocene/Holocene transition resulted in a period of incision, presumably by meandering rivers\(^45\). Although the depth of these incisions vary between different parts of the study area, in general they are relatively deep (7 metre in the east up to 17 metres in the west). Because of a frequently established stratigraphical gap between 11000 B.P. and 8500 B.P., De Jong & De Gans consider the dating of these incisions problematic. The fill often contains clay that palynologically can be dated to the Boreal period. They suspect a hiatus and suggest a Late Weichselian (Younger Dryas 11,000-10,000 B.P.) age for the formation of the entrenchments\(^46\).

In general it can be concluded that during the last phase of the Weichselian period river systems became predominantly meandering. It is suggested that this was accompanied by a (relative) drop of groundwater table\(^47\), thus facilitating aeolian activity on the dryer floodplains and perhaps the formation of river dunes. Deposition outside the floodplain was minimal at the Holocene/Pleistocene transition and perhaps even during the first phases of the Early-Holocene.

2.4.5 Preboreal-Boreal period

The period of reduced deposition on top of the Kreftenheye Formation lasted about 2000-3000 \(^{14}\)C years in the western part of the Rhine/Meuse Delta\(^48\). Although peat is the most common primary Holocene deposit, in some parts of the floodplain initially a clay has been deposited that seems to be of Boreal age. In the south-eastern corner of my study area, between the Linge and Waal rivers south-east of Leerdam, floodbasin deposits are directly overlaying the Kreftenheye Formation\(^49\).

(Pre)Boreal rivers in the Vrijheerenlanden and the rest of the study area most likely still followed (parts of) the Late Glacial braided channels. The calcareous peaty clays and gyttjas that were deposited in the floodbasins are more easily recognisable and datable than the sandy (pre)Boreal channel sands.

Climate conditions during the Early-Holocene are reconstructed through pollen analysis\(^50\).

In the Preboreal and Boreal period the curve for \textit{Pinus} shows an increase compared to the preceding Younger Dryas period. At the Preboreal/Boreal transition the \textit{Pinus} curve reaches its maximum dominance, before gradually (and somewhat irregularly) diminishing during the Boreal period. Also the \textit{Betula} curve displays a recovery from the Younger Dryas period, although not a strong as \textit{Pinus}, and the maximum value for \textit{Betula} fits well within the second half of the Preboreal period.

During the Boreal period \textit{Betula} values rapidly decline from 35% to 10%, the latter remaining the average \textit{Betula} percentage throughout the Holocene. Increasing average temperature is indicated by the occurrence of \textit{Corylus} from the Preboreal/Boreal transition onwards. The \textit{Corylus} curve reaches a maximum of almost 40% at (or sometimes slightly earlier than) the Boreal/Atlantic transition. During both the Preboreal and Boreal period a decrease in herb taxa is eminent.

An example of a (late) Early-Holocene vegetation reconstruction is offered for the ‘Het Broek’ peat area\(^51\).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{hetbroek.png}
\caption{Fig. 2.10 Location of the ‘De Broek’ Peat area.}
\end{figure}

Here, at the last stage of the Boreal period a \textit{Salix} and \textit{Corylus} vegetation was present with an undergrowth of ferns\(^52\). The higher levees were dominated by \textit{Pinus} and \textit{Corylus} vegetation, while wetter areas in the flood basins were bordered by reed or sedge (\textit{Poaceae} and \textit{Cyperaceae}) species. Vegetation succession in abandoned river branches may have followed patterns as described by Van Donselaar\(^53\).

Although the environmental outlines as sketched above certainly can contribute to an understanding of which plant species could occur in general, it is of little value in reconstructing the local vegetation succession and spatial distribution in our study area.

\(^{45}\) See Törnqvist 1993, p.97 and references therein to Pons 1957 and De Groot & Gans 1996.
\(^{47}\) Cleveringa et al. 1988.
\(^{48}\) Törnqvist 1993, p. 97. He calls this phase ‘non-depositional’, but I think this belies the complex fluvial facies distribution. See also Verbraeck 1984, p. 112.
\(^{49}\) See profile from Törnqvist 1993, p. 133, Fig. 1B, and enclosure.
\(^{50}\) This is a very general description of the entire Netherlands, with no local validity whatsoever. It, however, does create a general environmental background. Pollen values after: Jungerius, Koster & Kwaad 1973.
\(^{51}\) See Hofstede et al. 1989
\(^{52}\) Hofstede et al. 1989, p. 417. See also pollen diagram on page 416, Fig. 3.
\(^{53}\) Van Donselaar 1961.
Vegetation on stream ridges and in floodbasins tends to be far more directed by local water level (fluctuations)\(^54\).

2.4 Early-Atlantic Period

During the start of the Early Atlantic period the processes of environmental change differed little from those at the end of the Boreal period. Pollen curves for *Pinus* show that this species was only marginally present in the vegetation. *Corylus* species can only in the very beginning of the Atlantic retain their high (up to 50%) values, and within several centuries fall down to a constant 30% average\(^55\). Simultaneous with these trends is the rise of *Alnus* and *Quercus*, although the latter perhaps already (slowly) gained importance during the last centuries of the Boreal period. Genera like *Ulmus*, *Tilia* and *Fraxinus* are, although in very small quantities (seldom more than 5%), constantly present on the higher parts of the landscape\(^56\). In the marshes *Poaceae* (Grasses) and *Cyperaceae* (Sedges) were bordered by *Alnus* and *Salix* trees.

Gradually but steadily the emerge of a deciduous forest, which in the study area probably was concentrated on the higher levees, is traceable in the pollen record.

The absence of gyttja in the ‘Het Broek’ peat area (see paragraph 2.4.5, Fig. 2.10) is seen as an argument against the presence of a fluvio-lagoonal environment, which might perhaps be extrapolated to the eastern part of our study area\(^57\).

Fluvial sedimentation by relatively wide, meandering river channels dominates the study area\(^58\). The Early-Atlantic period can furthermore be characterised as a period of rapidly increasing onset. Relatively fast accumulation of mainly clay and organic materials took place throughout the entire study area between 7500 B.P. and 5000 B.P.\(^59\). This rapid aggradation was primarily caused by a rise in groundwater table, thus implying a complex relation with the general sea-level rise\(^60\).

Dating of Basal Peat near the city of Leerdam showed that around 6100 B.P. the (basin) water level was circa 4 metres below datum\(^61\).

2.4.6.1 The Middelkoop System

The Middelkoop systems consists of several stream ridges in the study area that are seen as the relicts of a fluvial system that was transitional from meandering to anastomosing. Because sample locality is known to influence dating results, several dates have been proposed for the start of the Middelkoop overbank onset.

The radiocarbon date by Törnqvist (6745 ± 45 B.P., GrN 18930) is thought to have been contaminated by an overlaying peat bed\(^62\). Therefore, the date obtained by Van der Woude (1983) of 7370 ± 100 B.P. (GrN 8383) is used.

The extensive water-dominated floodplains (the fluvio-lagoonal environment) that Van der Woude reconstructs at the end of this period for the downstream ‘Molenaarsgraat’ area, probably does not very accurately apply to the current upstream study area.


\(^{55}\) Based upon: Jungerius, Koster & Kwaad 1973.

\(^{56}\) Hofstede et al. 1989, p. 417.
This, however, by no means implies that all parts of the Middelkoop system emerged synchronously at this date.

The large and deep channel belts found in the northern part of the study area are thought to have functioned up to 6000 B.P., while several downstream branches ended their sedimentation phases as early as 6400-6300 B.P. Furthermore, it should be pointed out that the reconstruction of the fossil river courses of the Middelkoop system made by Törnqvist and Van Dijk incorporates stream ridges that are classified by Berendsen as belonging to the Benschop system discussed below. To what extent this division remains meaningful is subject to debate.

2.4.6.2 The Benschop System

During the Early Atlantic period a fluvial system consisting of several stream belts emerges. This system is known as the ‘Benschop’ fluvial system. Within our study area it comprises the ‘Tienhoven’, ‘Kortenhoven’ and (originally) ‘Achthoven’ stream ridges.

However, it is assumed that precursors of these ridges existed around 7000 B.P. The table below gives the most recent view towards the dating of the stream ridges as seen by H.J.A. Berendsen and E. Stouthamer. Their research shows that the Achthoven stream ridge dates to the Late Atlantic period.

<table>
<thead>
<tr>
<th>Name</th>
<th>Begin cal. B.P.</th>
<th>End cal. B.P.</th>
<th>Duration cal. years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kortenhoven</td>
<td>8368</td>
<td>7175</td>
<td>1193</td>
</tr>
<tr>
<td>Tienhoven</td>
<td>7788</td>
<td>7175</td>
<td>613</td>
</tr>
<tr>
<td>Achthoven</td>
<td>7077</td>
<td>6125</td>
<td>952</td>
</tr>
</tbody>
</table>

Table 2.1 Calibrated dates for Kortenhoven, Tienhoven and Achthoven active phases.

The Tienhoven channel could be equally old as the Kortenhoven ridge, and Makaske (1998) dates the period of activity between 7600 B.P. and 5200 B.P., almost a millennium longer than Berendsen and Stouthamer. According to Berendsen (1982) the last phase of activity of the Benschop fluvial system is recorded near Lopik in a thin clay layer that has been indirectly dated between 6000 ± 35 B.P. (GrN 7958) and 5350 ± 35 B.P. (GrN7957).

During the second part of the seventh millennium BP an extension of the Middelkoop system takes place.

Pollen analysis has shown that the main period of activity of the ‘Tienhoven’ ridge is Middle-Atlantic (and ended before 5350 ± 35 B.P.; GrN 7957).

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63 Törnqvist 1993, p. 50. GrN 2816/2828, GrN 10104, GrN 10113 and GrN 8922 in Fig. 9, p. 48.
64 This is true for the southern part of the ‘Achthoven’, ‘Kortenhoven’ and perhaps the ‘Tienhoven’ ridge. Cf. Törnqvist & Van Dijk 1993, p. 130-131, Fig. 2A-B and Berendsen 1982, p. 146, Fig 8.1.
66 Berendsen 1982, p. 145-148 and Berendsen & Stouthamer, in press. Its Atlantic age is correlative with the second available date of the main phase of activity: 5350 ± 40 BP (GrN 12461).
67 Berendsen & Stouthamer, in press, Appendix 4: Ages of channel belts (yr B.P.) in the Rhine-Meuse delta.
68 Makaske 1998, p. 181, Fig. 5.5b. He, however, states that this date is partially based on the Berendsen & Stouthamer data set. Both authors agree on the dating of the Achthoven ridge.
A system of channels was formed that joins the Kortenhoven and Tienhoven courses, bifurcates in the west-central part of the study area, and continues with several branches leading to the city of Gorinchem, in the south-west of the study area.

Just below the river Waal two stream ridges are present. These belong to the ‘Broek’ and ‘Brakel’ systems of the southern Rhine-Meuse delta. It is most likely that these continued into our research area, but that they have been inadequately investigated yet.

2.4.7 Middle and Late Atlantic Period

Vegetation history of the Middle- and Late Atlantic shows the consolidation of processes that started in the Early Atlantic period. Corylus and Quercus have reached a solid 20% percent dominance each, while Alnus is somewhat more present (circa 30%). These values, as well as those for Ulmus, Tilia and Fraxinus, show only minor alterations during this period. A small Fraxinus and Tilia peak (never exceeding 5%) in the Middle Atlantic period, is followed by an increase (from 5% to 8%) of Ulmus during the Late-Atlantic.

The groundwater level was still rising and reconstructed depths for this period range from –2.5 to –1.0 metres. Phases of increased clastic and organic sedimentation can be traced, although they show a less remarkable distinction than in more downstream areas. Van der Woude (1981) reconstructs a water-level fall around 6100 B.P. – 6000 B.P., indicated by the expansion of Salix and Phragmites. Whether or not the evapotranspiration of these vast Phragmites marshes has contributed to the inversion of the relief, as supposed by Van der Woude, in my opinion has too inadequately been investigated to draw conclusions upon. A local increase in Alnus can be the result of normal vegetation succession due to relative water level drop caused by the accumulation of peat. This process is usually called ‘autogenetic succession’.

It is clear that sedimentation by the Middelkoop system described in paragraph 2.4.6.1 ceased after 6200 B.P.

Peat growth in the floodbasins increased during the Atlantic period and a radiocarbon date of 6090 ± 70 B.P. (GrN 8923) for a piece of wood at the bottom of a peat layer near Leerdam might roughly indicate its starting point. Eventually, even the higher parts of the Middelkoop stream ridge were covered by peat, although this was not the case until 4800 ± 70 B.P. (GrN 8376). This indicates that the highest parts of the Middelkoop stream ridges remained relatively dry between 6100 B.P. and 4800 B.P.

Around 6500 B.P. two new systems can be found in the south-western part of the study area: The ‘Gorkum’ and the ‘Arkel’ systems.

2.4.7.1 The Gorkum System

Based on the channel architecture as examined by Törnqvist (1993), relics of the Gorkum system are seen as representing a fluvial style transitional from meandering to anastomosing. A radiocarbon date of basal peat that underlies flood basin deposits of the Gorkum system was dated conventionally at 6515 ± 50 B.P. (GrN-18927) and is used to determine the starting phase. The 14C age of the core ‘Dalem IV’ is younger (5590 ± 70 B.P.; UtC-1895) and indicates the end of overbank deposition by the Gorkum system.

2.4.7.2 The Arkel System

Little investigation has been carried out in locating the Arkel system. Törnqvist has already pointed out that probably due to its depth (~4.0 metres below datum) it has not been indicated on the geological map of the Netherlands.

He envisages that parts of the Arkel system might belong to a northern part of the Gorkum system. Only very locally phases of activity were established: Organic beds associated with its overbank deposits were dated and yielded ages of 6550 ± 60 B.P. (GrN-18918) for the beginning and 5400 ± 50 B.P. (GrN-18917) for the cease of fluvial activity.

2.4.7.3 The Maurik System

Although older literature refers to the Maurik stream ridge as belonging to the Linschoten system (paragraph 2.4.9.1), new radiocarbon dating suggests a Middle- to Late Atlantic age.
This is corroborated by the fact that the 750 metres wide Maurik stream ridge continues to the south-west and joins the Tienhoven stream ridge.\(^{81}\) Berendsen & Stouthamer date its phase of sedimentation between 6200 B.P. and 5350 B.P.\(^{32}\). This latter date (5350 ± 40 B.P. (GrN 12461)) was obtained by Hofstede from the base of a peat layer overlying fluvial sediments, but no radiocarbon dates confirming the start of Maurik channel sedimentation are known to me.\(^{83}\)

### 2.4 Paleogeography

#### 2.4.7.4 The Zijderveld system

The Zijderveld stream ridge is created by the most northern of two fluvial systems that almost simultaneously came into existence around 5300 B.P.: The Zijderveld\(^{84}\) and Schaik systems.\(^{85}\) The start of the sedimentation phase is radiocarbon dated at 5345 ± 40 B.P. (GrN-18922), based on the dating of overbank deposits.

#### 2.4.7.5 The Schaik System

The Schaik system is seen as a predominantly anastomosing river system, roughly active between 5300 B.P. – 3700 B.P. and running east-west through the western part of the study area. The part of the Schaik system west of the city of Leerdam has been extensively studied by Törnqvist, van Ree and Faessen.\(^{89}\) Their main objective was to investigate the (causes of) changes in longitudinal facies architecture of a river that is located in the zone where transitions of fluvial style are common. They reach the following conclusion: ‘The rate of (ground)water-level rise appears to be a principle factor determining longitudinal variability of channel pattern in the study area. (Ground)water-level rise of > 1.5 mm yr\(^{-1}\) is needed for the development of fully developed anastomosing fluvial style, forming ribbons with width/thickness ratios of < 15, whereas values of approximately 1.0-1.5 mm yr\(^{-1}\) lead to the formation of transitional anastomosing to meandering fluvial systems.’\(^{90}\). These parameters most likely also apply to comparable other fluvial systems.

Several samples from the top of the organic beds underneath the overbank deposits reveal relatively consistent dating results: 5395 ± 65 B.P. (GrN 6234), 5300 ± 80 B.P. (GrN 10113) and 5285 ± 50 B.P. (UtC 1396/1397).\(^{91}\) Dating its last phase of sedimentation is more complicated. Several samples dating the onset of organic accumulation on top of the overbank deposits of the Schaik system are far from synchronous and in a number of cases obviously too young to represent the end of activity: 3745 ± 60 B.P. (GrN 6235), 3630 ± 40 B.P. (UtC 1410) and 2860 ± 60 B.P. (GrN 10118). That this is caused by a hiatus at the clay-peat transition has been illustrated by several occurrences of well-developed vegetation horizons discovered in multiple corings.

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\(^{81}\) Hofstede et al. 1989, p. 411.
\(^{82}\) Berendsen & Stouthamer, in press, Appendix 4: Ages of channel belts (yr B.P.) in the Rhine-Meuse delta.
\(^{83}\) Hofstede et al. (1989) state that its sedimentation started during the second half of the Atlantic period. In their diagram (p. 412, Fig.1) the date 6200 B.P. can be obtained from the table. This, however, is based on palynological research, and might alter drastically if new radiocarbon dates become available.
\(^{84}\) Fig. 2.14 is incorporated in the digital data as Mapinfo(5) table ‘Makaske_zijderveld.TAB’.
\(^{85}\) Traditionally, the Schoonrewoord system is also thought to have emerged around 5300 B.P. (Cf. Törnqvist 1993, p. 151. Fig. 9). Makaske dates the beginning of the Schoonrewoord system around 4500 BP (Makaske 1998, p. 215-217). This is supported by Berendsen & Stouthamer, in press. This is backed up by a dating of Phragmites peat in coring ‘Noordeloos 6’: 4520 ± 60 B.P. (GrN 10886).

Un-‘founded’ channel deposits are more subject to subsidence, and therefore, might offer smaller accommodation space for human occupation.\(^{86}\)

The end of fluvial activity by the Zijderveld channel is confirmed by a ¹⁴C date from the residual channel of ‘Gully II/2’, revealing an age of 4620 ± 60 B.P. (GrN-5221).\(^{87}\) Hereafter some erosion still did take place in the residual gully, but sedimentation ceased.\(^{88}\)

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\(^{87}\) For location of sample see: De Jong 1970-1971, p. 67 (Fig.1) and p. 82.
\(^{89}\) Törnqvist 1993, p. 111-127.
\(^{90}\) Törnqvist 1993, p. 126.
\(^{91}\) For sample locations: Törnqvist 1993, p. 46 (Fig. 6) and p. 48 (Fig. 10).
Törnqvist estimates that this hiatus represents a time span in the order of 500 years. Apart from this, it is clear that radiocarbon dates of the last phase of activity yield a trend of increasing age downstream. In the western part of our study area the last phase is dated $4240 \pm 50$ B.P. (UtC 1409). In the western part of our study area the last phase is dated $4240 \pm 50$ B.P. (UtC 1409).  

2.4.7.6 The Eigenblok System  

The Eigenblok system is a anastomosing fluvial system that was active during at least two phases. The first phase, indicated as Eigenblok I, started in the Early Holocene and might have continued until 5586 cal. B.P. The location of channel deposits belonging to this first phase is not indicated on known geological maps. Rejuvenation of the eigenblok system took place between 3636 and 2487 cal. B.C. Channel deposits are generally found at depths between 1.5 to 2.5 metres below datum. A complex system of accompanying crevasse deposits has been reconstructed. A part of the channels belonging to the second phase is reprinted below.

Based on: Berendsen 1997; Jungerius, Koster & Kwaad 1973; Van Zijverden & Stouthamer in prep.(b), paragraph 2.2.3 and reference therein.

Fig. 2.15 Location of the Eigenblok system and Betuweroute sites.

2.4.8 Subboreal Period  

Throughout the Subboreal period, on a supra-regional level, no serious fluctuations in the pollen curves of *Alnus* and *Corylus* occur. *Quercus* curves show a slight increase, sometimes from 15% (in the Late Atlantic) to 20%, without ever exceeding this percentage.

The *Ulmus* curve shows some irregularities, but in general remains below 2%. The pollen curve for *Tilia* reveals a slow but steady decrease during the entire Subboreal, while *Fraxinus* remains constant. The first occurrence of *Fagus* is often used to define the start of the second phase of the Subboreal period, roughly after 3700 B.P. Here, again, attention must be drawn to the fact that pollen can be transported into the locality long before actual occurrence of the species takes place. Indicators of human presence (*Plantago Lanceolata* and *Cerealia*) are observed relatively more frequent. Establishing the Subboreal water-level for our study area is complicated, but generally varied between 1.50 and 0.50 metres below datum. This, however, pays little respect to its supposed local variability.

Van der Woude (1981) has reconstructed a ‘fluvio-lacustrine’ environment for the ‘Molenaarsgraaf’ area during the Early Subboreal. This environment became drier between 4600 B.P. and 4100 B.P. when shore vegetation (mainly *Umbelliferaeae* and *Cyperaceae*) decreased lake size and eventually overgrew lakes entirely, resulting in a marsh-herb vegetation. As I have argued before (see paragraph 2.4.6), it is doubtful whether this kind of environment actually existed in our study area.

2.4.8.1 The Schoonrewoerd System  

The Schoonrewoerd channel belt starts in the north-eastern corner of the study area near the city of Culemborg and penetrates deep into the adjacent ‘Bommelerwaard’ region to the west. The Schoonrewoerd channel deposits have an average width of about 100 metres, but in many places a system of multiple connected channel belts occur. The fluvial architecture consists of irregular bends, alternating with long straight reaches. Makaske (1998) has pointed out that ‘A spectacular downstream decrease of in channel sand width/thickness ratio from around 40 to 5, characterizes the Schoonrewoerd system’. Extensive crevasse splays are abundant while residual channel deposits are rarely found.

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97 This also has been argued by Steenbeek 1990. Cf. Törnqvist 1993, p. 49.
98 See Törnqvist 1993, p. 48, Fig. 9. for sample locations.
99 Van Zijverden in prep.(b), paragraph 2.4.5. For (partial) location see Mapinfo (5) Table ‘Eigenblok system TAB’, for possible continuation combine this table with Mapinfo (5) workspace ‘IND. Value with GEB_Code.WOR’ (sand-depth map).
100 Stouthamer in prep. and Van Zijverden in prep. (a), paragraph 2.2.3.
101 Van Zijverden in prep. (a), paragraph 2.2.3 and reference therein to Van der Sluys 1956.
Although the geological map reprinted below is only partially relevant to our study area, it offers an eye-opening insight into the complex fluvial architecture that can be reconstructed through detailed geological survey\textsuperscript{104}.

I think these dates can serve as a rough guideline, but that much more radiocarbon dating is necessary to determine phases of activity for several smaller branches, let alone the numerous crevasse splays.

The significance of the above mentioned dates for the Schoonrewoerd system therefore are most likely to yield a high local potential, but much more research needs to be done to understand the regional chronology of these extensive fluvial systems\textsuperscript{110}. The dates stated above leave little room for the former subdivision of the Schoonrewoerd system as had been proposed by various authors\textsuperscript{111}: According to Törnqvist the Schoonrewoerd system was active between 5350 B.P. and 3600 B.P., with a phase of reduced activity between 4700 B.P. and 4500 B.P.

Establishing the termination of the Schoonrewoerd system is also complicated. The date of 3570 ± 70 B.P. (GrN 10108) proposed by Törnqvist is considered by Makaske to be too young. Taking into account the fact that the Schoonrewoerd ridge is crosscut by the Hennisdijk system, which according to Makaske is unambiguously dated around 3850 B.P., the date of 3823 ± 40 B.P. (UtC 4647) presented by Makaske seems reasonable\textsuperscript{109}.

The dates stated above leave little room for the former subdivision of the Schoonrewoerd system as had been proposed by various authors\textsuperscript{111}: According to Törnqvist the Schoonrewoerd system was active between 5350 B.P. and 3600 B.P., with a phase of reduced activity between 4700 B.P. and 4500 B.P.

Louve Kooijmans supposed that during the second ‘wild’ phase the stream was connected to the sea, while in the first ‘quiet’ phase it ended up branching into numerous small crevasse channels in the swamps\textsuperscript{112}. The shorter life-span of the Schoonrewoerd system, however, coincides better with the average life span of fluvial systems in the Rhine-Meuse delta of around 1000 years\textsuperscript{113}. Van der Woude (following Louwe Kooijmans 1974) presumes on the base of presence of archaeological remains that the Schoonrewoerd channel had inverted to a stream ridge around 3800 B.P.\textsuperscript{114}. His thesis unfortunately does not state what archaeological remains were dated, nor their stratigraphical position.

\textsuperscript{104} Adapted from Makaske 1998, p. 186, Fig. 5.7.
\textsuperscript{105} Törnqvist 1993, p. 151 Fig. 9.
\textsuperscript{106} He uses radiocarbon dates of a peat bed underlying the assumed initial Schoonrewoerd sedimentation: 5290 ± 50 B.P. (GrN 10100, for location: Törnqvist 1993, p. 45 Fig.3), 5350 ± 50 B.P. (GrN 10105, for location: Törnqvist 1993, p. 48 Fig.9) and 5345 ± 45 B.P. (GrN 10852, for location: Törnqvist 1993, p. 45 Fig.4.).
\textsuperscript{107} Published by Törnqvist & Van Dijk 1993, p. 48, Fig. 9: Core ‘Noordeloos VI’.
\textsuperscript{109} Makaske 1998, p. 217. The dating of the Hennisdijk system is confirmed by Berendsen & Stoutamer, in press.
\textsuperscript{110} Van der Woude’s (1981) hypothesis that indirect sedimentation through branches and break-through channels of the Schoonrewoerd system continued after 3700 B.P. thus can be proven nor rejected.
\textsuperscript{113} Törnqvist 1993, p. 158.
\textsuperscript{114} Van der Woude 1981, p. 109. He refers to: Louwe Kooijmans 1974, p.93 (Table 6), 97.

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Fig. 2.16 Geological map of the Schoonrewoerd system.

The Schoonrewoerd stream ridge has usually been looked upon as being part of a Middle Holocene fluvial system comprising the Zijderveld, Schoonrewoerd and Schaik systems\textsuperscript{105}. Törnqvist (1993) proposed 5300 B.P. as the start for its fluvial activity, while Berendsen (1982) and Makaske (1998) both date its first sedimentation phase around 4500 B.P.\textsuperscript{106}. This age had already been suggested by De Boer & Pons (1961) based on pollen study, but Berendsen uses a radiocarbon date (4520 ± 60 B. P. (GrN 10886)) of a Phragmites peat underlying Schoonrewoerd fluvial deposits\textsuperscript{107}. The explanation of these difference has been undertaken by Makaske, who convincingly argues that this lower clay bed in fact belongs to the Zijderveld system\textsuperscript{108}. The dates stated above leave little room for the former subdivision of the Schoonrewoerd system as had been proposed by various authors\textsuperscript{111}: According to Törnqvist the Schoonrewoerd system was active between 5350 B.P. and 3600 B.P., with a phase of reduced activity between 4700 B.P. and 4500 B.P.
2. Geology and paleogeography

2.4 Paleogeography and paleoecology

A filling in of the residual channel around 3800 B.P. is in accordance with Törnqvist’s hypothesis that sedimentation in residual channels starts almost instantaneously after watercourse abandonment.\textsuperscript{115}

### 2.4.8.2 The Erichem / Zoelen system

In his study of anastomosing rivers, Makaske (1998) only marginally refers to the Erichem system. From the figures and maps the following data can be deduced: The Erichem system consist of a circa 600 m wide and 2.7 km long remnant of a stream once running from the city of Geldermalsen toward to north-east. Its assumed phase of activity was between 4400 B.P. and 2300 B.P.\textsuperscript{116}

The Zoelen stream ridge has been described by Havinga & Op ‘t Hof (1975) and Verbraeck (1984). The channel sand body is a subsidiary branch of the ‘Ommeren’ stream ridge and between 500 to 1000m wide. The channel deposits consist of fine to very coarse sands with gravel.\textsuperscript{117}

According to Verbraeck (1984) the main period of sedimentation of the Ommeren as well as the Zoelen streams was from 5530 ± 55 B.P. (GrN 6232) to 4935 ± 60 B.P. (GrN 6233). Pollen analysis of a coring of ‘Het Broek’ was thought to confirm these dates.\textsuperscript{118}

### 2.4.8.3 The Hennisdijk System

Thanks to research published by Makaske we posses a fairly detailed geological map of the Hennisdijk system.\textsuperscript{122} Lithologically it consists of a coarse sandy core, sometimes containing gravel lenses, encased by fine to medium sand. The channel body is 250-400 metres wide and circa 6 kilometres long. Crosscutting sediments of the Betuwe Formation and the Wijchen loam bed Deposit, it has carved itself deep into the Pleistocene subsoil.\textsuperscript{123} It has been indicated by Makaske that the Hennisdijk system, as geological maps suggest, has avulsed from the Erichem system.\textsuperscript{124}

Radiocarbon dates for the onset of overbank material were published by Verbraeck, who -according to Makaske- erroneously thought that a directly overlying sand body was the responsible fluvial system. According to Verbraeck, the Hennisdijk sand body belonged to the Schoonrewoerd system, thus being much older than the dates obtained: 3895 ± 40 B.P. (GrN 6229) and 3945 ± 35 B.P. (GrN 6230).\textsuperscript{125} Recently a new date for the peat bed underlying overbank onset has become available (3814 ± 42 B.P. (UtC 4643)) that perfectly agrees with the former. Also, for the first time for the Hennisdijk system, residual channel deposits were radiocarbon dated to 2975 ± 35 B.P. (UtC 4642) thus defining the cease of fluvial activity.\textsuperscript{126}

### 2.4.8.4 The Est System

According to Verbraeck the Est system was active between 5500 B.P. and 2000 B.P.\textsuperscript{127} Törnqvist has dated organic levels in the residual channel to 2190 ± 60 B.P. (GrN 12465) and 2310 ± 60 B.P. (GrN 12466).

H.J.A. Berendsen and E. Stouthamer will introduce a new perspective in their article ‘Late Weichselian and Holocene palaeogeography of the Rhine-Meuse delta (The Netherlands)’.\textsuperscript{120} Radiocarbon dating of macrofossils from coring ‘Zoelen 244’ yielded an age of 4376 ± 34 B.P. (UtC 6846) which is considered indicative for the start of sedimentation of both the Zoelen as well as the Erichem system. Combining these fluvial systems has also led to one termination age for both: 2420 ± 140 B.P. (UtC 04638), based on a coring near Erichem.\textsuperscript{121}

\textsuperscript{115} Törnqvist 1993, p. 51. This contrast with former notions. Cf. Verbraeck 1984, p. 194,199,209, who assumed that inactive channels can remain open for thousands of years.


\textsuperscript{118} See pollen diagram: Hofstede et al. 1989, p. 416, Fig. 2.

\textsuperscript{119} For a more detailed map of the Erichem system: Törnqvist 1993, p. 180 and Mapinfo (5) Table ‘Makaske_zijderveld.TAB’ in the digital data. For the Zoelen system combine Mapinfo (5) workspace ‘IND. Value with GEB_Code.WOR’ with Table ‘4000BP.tif.TAB’ in the digital data.

\textsuperscript{115} Berendsen & Stouthamer, \textit{in press}. See also: Appendix 4.


\textsuperscript{120} Verbraeck 1974, p. 170 (Fig. 57a), 173.
This indicates that the river system indeed was active until the Early Subatlantic period. A much younger date for the lowermost organic level of 1890 ± 60 B.P. (GRN 12467) is supposedly caused by a second phase of activity that around 2300 B.P. eroded older residual channel fills and started filling up around 1890 B.P. The hypothesis that perhaps the avulsion responsible for this process also played a part in the genesis of the Linge system is an interesting one, but needs to be confirmed by more radiocarbon dates. Recent dating of macrofossils at the top of a peat layer in coring ‘Esther II-246’ by Berendsen & Stouthamer has revealed that the start of sedimentation most likely occurred much later than the 5500 B.P. proposed by Verbraeck. This date (3124 ± 38 B.P. (UC 6848)) affirms the Late Subboreal start of the first phase of fluvial activity of the Est system.

2.4.8.5 The Hamel System

Channel deposits of the anastomosing Hamel System can be found at depths between 1.0 and 1.5 metres below surface level. The Hamel System presumably was active between 800 and 300 cal. B.C. The channel deposits are usually small in width and residual channels deposits in crevasse splays belonging to this system are frequently found.

During the second half of the Subatlantic period values for Carpinus reach up to 9%, while Fagus expands up to 23% at the expense of predominantly Tilia, Ulmus and Corylus. A drop from 22% to 10% in the Corylus curve is observable for the first six centuries of the Subatlantic. Another remarkable increase is noticeable in the herb curves. These, for the first time since the late glacial, show a significant increase. This time, however, not climate but man’s consecutive presence in the landscape was the cause for this. Genera like Artemisia, Plantago and Cerealia are seen as indicators of settlements in nearby areas.

Most of the rivers in the Rhine-Meuse delta are of meandering style during the Subatlantic period. Only around 1800 B.P. a few rivers show characteristics typical of anastomosing fluvial style, although they show lateral accretion and high width/thickness ratios. Around 1800 B.P. an increase in the total number of avulsions throughout the entire Rhine-Meuse delta is reconstructed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Begin cal. B.P.</th>
<th>End cal. B.P.</th>
<th>Duration cal. years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hagestein</td>
<td>2634</td>
<td>943</td>
<td>1691</td>
</tr>
<tr>
<td>Ravenswaay</td>
<td>2222</td>
<td>927</td>
<td>1295</td>
</tr>
<tr>
<td>Redichem</td>
<td>2222</td>
<td>927</td>
<td>1295</td>
</tr>
</tbody>
</table>

Table 2.2 Calibrated dates for Hagestein, Ravenswaay and Redichem active phases.

128 For a map of the Est System see Törnqvist 1990, p. 224, Fig. 1.
130 Berendsen & Stouthamer, in press.
131 For the location of part of the Hamel system see Mapinfo (5) Table ‘Hamel_system.TAB’ in the digital data.
132 Stouthamer in prep. and Van Zijverden in prep. (a), paragraph 2.2.3.
133 Van Zijverden in prep. (b), paragraph 2.5.1.
135 Weerts 1996, p. 73.
136 See Berendsen & Stouthamer, in press., Törnqvist 1993 and Weerts 1996, p. 73.
137 For a map displaying the ‘Linschoten System’ channels see Berendsen 1982, p. 146. Fig. 8.1.
138 See paragraph 2.4.7.3.
The start of the Hagestein stream is defined by a radiocarbon dated macrofossil in a peat layer underlying overbank deposits which yielded 2514 ± 38 B.P. (UIC 6713). It is not clear to me how the last stages of activity were dated. Due to the fact that datable residual channel deposits belonging to the Hagestein stream are rare, there are only minor opportunities for radiocarbon dating.

Descriptions of the Ravenswaay and Redichem systems thus far have only been published by T. Vink in 1926 and 1954. Here, again, I have found no further information concerning the dating of either start nor end of the Redichem and Ravenswaay channels.

2.4.9.2 The Spijk System

The Spijk system is a relatively small system of narrow channel belts consisting of clayey sand in the south-western part of the study area. The dating of the top of an underlying peat bed yielded 2510 ± 50 B.P. (UIC-1891), representing the start of overbank deposition. Termination of fluvial activity took place around 1885 ± 30 B.P., which is a weighted mean of samples UIC-1426 and UIC-1427. Considering the fact that the last two samples were taken above more than 2 metres of fine-grained channel deposits and the fact that the Spijk system is crossed by the Linge it is likely that sedimentation ended several centuries earlier, since the Linge system came into being around 2160 B.P.

2.4.9.3 The Linge System

The thick bed of *Alnus* peat that nearly everywhere underlies deposits of the Linge system offers ample opportunities for 14C dating the beginning of the activity. Radiocarbon dating normally result in ages around 2200 B.P.

The unrestricted onset of fluvial deposits ended around 1300 A.D. when the Linge stream was dammed near its upstream bifurcation at the city of Tiel. Since then only minor changes to its course have taken place and it is one of the few active fluvial systems in the study area.

2.4.9.4 The Lek System

Berendsen has published an informative summary of the discussions concerning the genesis of the Lek river. Two consistent dates could be established for the beginning of sedimentation (2220 ± 35 B.P. (GrN-8708) and 1950 ± 30 B.P. (GrN-8707)) at two sites relatively far apart. The first sample was obtained from a deposit of strongly clayey peat and is considered more liable to contamination. Therefore the age of 1950 ± 30 B.P. is generally taken to represent the beginning of activity of the Lek system. After a phase of increased sedimentation between 300 A.D. and 700 A.D. the river was dammed in the early Middle Ages around 1100 A.D.

2.4.9.5 The Waal system

Bordering our study area to the south is the river Waal, the most important present-day distributary of the river Rhine. Its vast sand body (widths of up to 1 km for the channel belt are far from rare) has almost everywhere eroded itself into the Pleistocene subsoil. Most accurate dates for the beginning of the Waal system are the alkali extract age (1655 ± 50 B.P. (GrN 13504-Alkali Extract)) obtained by Berendsen in the 'Bommelerwaard' area and the radiocarbon date (1600 ± 50 B.P. (UIC 1899)) of a piece of *Salix* wood in a thin peat layer published by Törnqvist. One needs to keep in mind that local variability between sample locations can reflect different stages of the fluvial development. Thus, upstream samples can (and have) yielded much older dates for the first phases of deposition. From circa 360 A.D. - 580 A.D. to the present the river Waal has proven itself indispensable for drainage of the Rhine-Meuse delta.

2.5 Summary

In this chapter the geological background of the study area has been presented. After short introductions to the history of the geological enquiry, the Dutch system of geological classification and sedimentary descriptions of specific fluvial facies units and their distribution, a paleogeography of the study area has been offered.

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141 For location see Törnqvist 1993, p. 133, 141-142 and enclosure. See also Berendsen et al. 1994, Sheet 17-31.
142 Törnqvist 1993, p. 142.
143 Törnqvist 1993, p. 142. See also paragraph 2.4.9.3.
144 For location of the Linge channel belt see this study, Chapter 1, Fig. 1.1.
145 2160 ± 60 B.P. (UIC 1717, Coring ‘Linge I-1’) and 2235 ± 35 B.P. (UIC 1481/1482, Coring ‘Linge III’) in Törnqvist 1993, p. 48 (Fig. 9).
147 For location of the Linge, Lek and Waal active fluvial systems see Chapter 1, Fig 1.1, Paleogeographical maps ‘1000BP.tif’ and ‘present.tif’ and Mapinfo (5) workspace ‘IND. Value with GEB_Code.WOR’ in the digital data.
148 Berendsen 1982, p. 184 (Fig 8.8).
149 The increased activity is assumed by Berendsen because profiles (unspecified) show a vertical increase in sand percentages (Berendsen 1982, p. 185).
150 Berendsen 1986, Fig 3.15 and Törnqvist 1993, p. 140-141 (Fig. 3).
151 Berendsen & Stouthamer (*in press*) date the first phase of activity upstream from Tiel at 2160 ± 60 B.P. (UIC 1717, Coring ‘Linge I-1’).
The methods used to establish paleogeographical reconstructions have been briefly outlined. Although I will question the local validity of such paleogeographical reconstructions in archaeological analysis later in this study\textsuperscript{152}, at this point they have sufficiently provided a general introduction to the dynamic fluvial Holocene geomorphogenesis of the study area.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{holocene_systems.png}
\caption{Early- and Middle Holocene Fluvial systems.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{holocene_systems2.png}
\caption{Late Holocene fluvial systems.}
\end{figure}

\textsuperscript{152} See Chapter 6, paragraph 6.2.2.1.

\textsuperscript{153} These are incorporated in the digital data as Excel ('97) Worksheet '/Tables/dating_fluvial_systems.xls'.

\textsuperscript{154} These are based on the (unpublished) radiocarbon dates by Berendsen & Stouthamer in prep.\textsuperscript{153}. 
3. Archaeology

3.1 Introduction

The aim of this chapter is to present some of the archaeological data used in this study. The way this is done is indicative of the methodology applied, thus offering the reader an insight into the origin of my data, its capabilities and its limitations.

First, a short history of the archaeological enquiry will be presented. Hereafter, the three most important sources of data (literature, the ARCHIS database and local collections) will be presented. The significance of each of these three sources, their specific problems or advantages, will be discussed. Thereafter, the data from the inventory will be introduced. Again, the data related to the ‘Betuwelijn’ project will be dealt with in chapter four. The final paragraph comprises a summarising statement on the total of archaeological data included in the inventory.

3.2 The history of the archaeological enquiry

3.2.1 Introduction

The formulation of (in particular) archaeological bodies of theory tends to be directed by the inductive cycle of scientific reasoning. Dynamics in archaeological conceptualisation can, and have been triggered by newly unearthed finds. Therefore, there will evidently be some degree of overlap between this paragraph (3.2) and chapter five, where I will discuss the theoretical background. The possibility of excavations, publications and excavators being referred to in several chapters persists. Furthermore, influential progress made beyond the constricting geographical boundaries of the study area will not be omitted.

3.2.2 Archaeological investigations

The Dutch central river area was relatively late to receive archaeological attention. Although archaeological objects presumably have been found during reclamation as early as 1660, these were not yet recognised as such.

The archaeologist Willem Pleyte (1836-1903) is usually given credit for the initial recognition of Dutch prehistoric objects. The systematic search for archaeological monuments in the ‘Betuwe’ district started with the reports of the wanderings through the landscape by the Dutch Christian priest Otto G. Heldring in 1838.

The description of a perforated and decorated sherd is most likely the oldest available reference to Dutch Bronze Age pottery from the study area. In 1861 and 1865, Derk Buddingh -teacher by profession- published the results of his strolls through the Betuwe in search of ‘germanic-batavian and roman antiquities’. Stimulating as these first attempts were, they were also highly imaginative.

1 In chapter four the ‘high-resolution’ data from the Betuwelijn excavations will be presented.
3 This general remark is admittedly contestable. However, this is not the place for an epistemological or philosophical excursion on archaeological theory. Its purpose is merely to indicate the correlation between excavations (publications) and conceptualisation. For examples see: Chapter 5.
4 For early reclamation see: Blanken – Janszoon 1835, p. 15.
5 Dikes were presumably build as early as the ninth century. The first reference to a dike bordering the river ‘Linge’ dates to 1259 A.D. See: Hol 1957, p. 48.
6 It is assumed that a Barbed Wire Beaker sherd is described. Rim perforations are also commonly found with pottery of the Vlaardingen Culture. Heldring 1838, p.62-63: ‘Maar nauwelijks had ik eenige schreden op den zwartachtigen grond gezet, of ik vond onderscheidene scherven van blauwe aarde, waaronder zich er eenige bevonden met ruwe teekenen bezet, zoals men zich dezelve zoude voorstellen uit de hand van eenen onbedreven kunstenaar voortgekomen te zijn, die er, misschien met een fijn steentje, houtje of iets dergelijks, eenige strepen op maakte en eenige gaatjes er onregelmatig in boorde.’
Incidentally discovered stray finds of predominantly pottery, stone or flint objects contributed to the accumulation of the known archaeological record until shortly after world war two. At that time, the methodological advances and intensity of both geological and archaeological research had increased.

The systematic soil survey led by Edelman since 1943, and later the Soil Survey Institute ('Stiboka') conducted numerous investigations in the Dutch river clay area that yielded prehistoric sites. These soil surveys have already been discussed in somewhat more detail in chapter two. The increased knowledge of the geological background gave rise to ample publications on the possibilities for human occupation in the Netherlands. For the central river clay area, the publications of Pieter J. R. Modderman cannot be omitted. This general principle of discovering settlement sites during soil survey coring campaigns persists.

Local archaeologists too became more and more organised. In 1951 the 'Association of Amateur Archaeologists in the Western Netherlands' was founded. This dedicated group of local archaeologists became increasingly active outside the western Netherlands and the name was later changed to 'Archaeological Co-operative of the Netherlands' ('Archeologische Werkgemeenschap Nederland').

From 1962 onwards members organised many fieldwalks and small-scale test excavation in the western Dutch river clay area. The central and north-eastern part of the river delta became the field of activity of the 'Historical Society of Kesteren and surroundings' ('Historische Kring Kesteren en Omstreken'). The 21st of May 1968 the work-group 'Midden- en West-Betuwe' was founded. Although with an irregular intensity, this workgroup focussed on the archaeological investigation of the central and western Betuwe district. The area surrounding the city of Tiel has been investigated by the members of 'BATO'.

Meanwhile, professional archaeologists too started to experience and appreciate the archaeological potential of the central river area. Whereas Iron Age occupation debris had already been found during the extensive soil surveys, the first Bronze Age refuse layer in the Dutch river area was unearthed in 1954 near the town of Kesteren.

Although the excavation of the Bronze Age settlement at Zijderveld between 1965 and 1971 had a high potential to change archaeological thoughts about the central river area, this was never fully explored due to its incomplete publication until 1999. Very influential, however, was the thesis on the occupation history of the Rhine/Meuse river delta published by Leendert Pieter Louwe Kooijmans in 1974. This very detailed report on the 'Hazendonk' and 'Molenaarsgraaf' excavations, founded on an solid physical-geographical framework, placed the Middle and Late Neolithic of the Dutch river delta within broader context.

During the last decade the information acquired by (local) archaeologists originated from both small-scale fieldwalking, as well as from large-scale infrastructural projects. Anticipating the implementation of the 'Malta' legislation, recently various archaeological coring campaigns as well as test excavations have been conducted. For the central river area, the archaeological coring program conducted prior to the construction of the 'Betuwe railway' uncovered many new sites. Parts of this new data will be discussed in chapter four.

3. Data and source criticism

In this paragraph I will discuss the origins, flaws and capabilities of my inventory data. Lacking any archaeological significance, the data is grouped by origin. This, however, facilitates the critical discussion of the data for each type of source. First I will deal with publications, thereafter the ARCHIS database and finally local archaeological collections.

When preparing this study, I have benefited greatly from the fact that Zita van der Beek was writing a thesis on the Late Neolithic of the Meuse, Demer and Scheldt area. She had already gathered an extensive archaeological inventory of Late Neolithic sites, which I was grateful able to use. Therefore, a significant part of my inventory is derived from hers.

It has already been stated in the first chapter that Bronze Age sites are dealt with separately.

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15 Zijderveld was first discovered in 1954, by members of the ‘Lek en Merwe’ work-group. Extensive publication and discussion in: Theunissen 1999, p. 156-180.
16 See also chapter 2, paragraph 2.1.2 and chapter 5.
18 For the results of the coring program see: Asmussen & Exultus 1933 and Asmussen 1994.
19 Zita van der Beek, Universiteit Leiden, k. 014, Reuvenlaan 4, Postbus 9515, 2300 RA Leiden. See Van der Beek, in prep.
The Bronze Age inventory has been limited to usage of the ARCHIS database. The paragraphs concerning ‘publications’ and ‘local collections’ thus refer nearly exclusively to sites in the inventory dated before the Bronze Age\textsuperscript{20}.

3.3.1 Publications

3.3.1.1 Description of the data

I have already stated above that I was allowed to use the inventory of Late Neolithic period sites by Zita van der Beek. She had inventoried nearly all relevant publications up to 1995, and some until 1997\textsuperscript{21}. The ones relevant to my study were inventoried up to 1999 or 2000, depending on their rate of publication.

3.3.1.2 Problems and implications

It is important to keep in mind that although Dutch legislation does oblige finders of archaeological objects to report these to the local authorities, no analogue catalogue comprising all of these find reports is printed annually\textsuperscript{22}. Therefore, archaeological series do seldom offer an overview of archaeological finds. Whenever archaeological objects are listed, their discussion is frequently retained on a descriptive level. Additional information concerning the finder, date of discovery, geological context, extent of the archaeological site etceteras is only very infrequently listed\textsuperscript{23}. In this study, the fact that the geological contexts (let alone profiles) are hardly ever described in older literature, is of much relevance. It should be clear that this strongly hampers the establishment of more interpretative accounts about the past.

3.3.2 The ARCHIS system

3.3.2.1 Description of the data

ARCHIS is the Dutch archaeological information system. It consists of a computerised archaeological database which is maintained by the State Service for Archaeology (‘R.O.B.’). Usage of this database is limited to the ‘R.O.B.’, academic archaeological institutes and their students. The structure of this database can be divided into three segments: ‘observations’, ‘localities’ and ‘complexes’\textsuperscript{24}.

ARCHIS is designed to also function as a geographical information system (GIS), which enables the combined analysis of wide varieties of parameters concerning both archaeology as well as geography.

Contributions to the ARCHIS database stem from continuous addition of publications and museum collections, the data stored in the Dutch central archaeological archive (CAA), and reports by both professional archaeologists as well as observations from amateur archaeologists.

ARCHIS observations from within the study area have been selected based solely on start- and final archaeological dates of observations\textsuperscript{25}. All observations starting from the Neolithic period have been evaluated, as well as those starting from the Bronze Age\textsuperscript{26}. A selection of these has been taken into the inventory\textsuperscript{27}.

3.3.2.2 Problems and implications

Archaeologist using the ARCHIS database, particularly in regional analysis, should be aware of a number of considerations.

First, one should keep in mind that the ARCHIS project started relatively recent in 1989. The laborious task of entering data from older publications and museum collections has not yet been completed for many regions\textsuperscript{28}. Especially where data from local archaeological work-groups has not been entered into ARCHIS, the resulting outputs are significantly hampered\textsuperscript{29}.

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\textsuperscript{20} Stretching the archaeological period of interest to span the Middle Bronze Age has caused the database to reflect this. Inventory numbers 1-67 represent the ‘Late Neolithic’ ARCHIS query. Numbers 70-95 represent the ‘Bronze Age’ ARCHIS query.

\textsuperscript{21} A list of studied Dutch archaeological journals is included. See: Appendix II.

\textsuperscript{22} Instead, this is the domain of ARCHIS, the Dutch (digital) archaeological information system. See paragraph 3.3.2.

\textsuperscript{23} Personal communication: Zita van der Beek, 29-05-2000.

\textsuperscript{24} For a more extensive description of the ARCHIS structure see: Brandt et al. 1992.

\textsuperscript{25} The study area was defined as comprising sheet 38 Oost and 39 West of the Dutch Geological Survey maps. Dutch National Coordinate System (120.000, 425.000) – (160.000, 450.000).

\textsuperscript{26} See Archis query results ‘Sites_starting_LateNeolithic.html’ and Sites_starting_BronzeAge.html in the digital data (/ARCHIS).

\textsuperscript{27} ARCHIS assigns a general date ‘Neolithic-Recent’ to stray finds of bone, and a date ‘Neolithic-Bronze Age’ to stray finds of flint. Typologically undateable observations of stray finds have been omitted. Furthermore, sites which clearly date to the Early-Neolithic have sometimes been left out.

\textsuperscript{28} This has predominantly been the case for the provinces of Brabant and Zeeland. Cf. Leijnse 1999, p. 33. For my study area, ARCHIS is thought to be relatively complete. Personal communication: Edwin van Hagen, 19-06-2000.

\textsuperscript{29} Although many local archaeology work-groups do report their findings (which subsequently end up in ARCHIS), it should be kept in mind that this is not always the case. Some local archaeologists in my study area no longer reported.
Secondly, it should be stressed that ARCHIS can be characterised as an archive designed for the documentation of archaeological phenomena.

Although in the (tri-partite) structure an (separated) interpretation can be made, ARCHIS was not designed to put forward, or substantiate, the endless variety of specific and dynamic research questions originating from the minds of individual archaeologists. To put it another way: the structure of the ARCHIS database does not fit the requirements (involved in the testing) of various hypothesis to the same extent. Site location analyses, for instance, is difficult if based on ARCHIS alone. The most detailed report only offers a crude description of surface morphology and simplified lithostratigraphy. Needless to say that this belies the complex fluvial architecture of the river area, and the problematic interpretation of the archaeological remains found therein.

The argument stated above can also be reversed: As submitting data to ARCHIS has become an intrinsic part of recent archaeological fieldwork, ARCHIS is liable to reflect contemporary research interests among (local) archaeologists. This is, however, compensated for by data from non-archaeological discoveries and in my opinion does not pose a serious threat.

3.3.3 Local collections

The ARCHIS database listed several archaeological work-groups that maintained archaeological collections. The majority of these were contacted and some visited. The purpose of these visits was to acquire data possibly not (yet) added to ARCHIS, and to verify the dating.

3.3.3.1 Description of the data

The H.K.K.O. was visited, but only one Vlaardingen Culture sherd and severely damaged flint axe could be located.

Material nor descriptions for the two inventory sites (numbers 9 & 19) could be found. Erik Verhelst kindly gave permission to visit and study the B.A.T.O. collection at the ‘Streekmuseum De Groote Sociëteit’ in the city of Tiel. From an alphabetical list of sites, all sites within the study area dating to the Neolithic or Bronze Age were selected for inspection. The material belonging to inventory number 8 (‘Zoelen-Mauriksestraat onder Zoelen’), numbers 62 and 63 (‘Kerk-Avezaath Ambtsparker/II/III’), 15, 32, 61 and 60 (‘Zoelen Kerkenakkers I to IV’) could not be located. Materials from the sites ‘Maurik Meerboomweg’ (inventory number 17), ‘Zoelen-Zoelenput’ (inventory numbers 20, 102-107) and ‘Maurik-Hornixveld’ (inventory number 14) were taken to Leiden for study. No individual archaeologists were visited.

3.3.3.2 Problems and implications

Documentation accompanying the finds was marginal. Apart from excavation reports of several days at site ‘Maurik Meerboomweg’ (inventory number 17) and the publication concerning the H.K.K.O. Vlaardingen Culture finds described above, no further documentation was available. Coordinates were sometimes derived from toponyms on scale 1:10.000 topographical maps. Information concerning the physical-geography was only very infrequently available. The small number of active groups of local -amateur- archaeologists decreases both the chances of discovery as well as the scientific accessibility of the material. The overall picture that emerges for the study area is one of small numbers of local archaeologists, concentrating on the abundant Iron Age and Roman Age sites and recording little additional information.

3.4 The inventory: short descriptions

In this paragraph, almost all sites listed in the inventory will be introduced. The diversity in number and nature described above, will evidently cause these descriptions to vary considerably.
This paragraph is therefore perhaps to be characterised as an effort to inform the reader about how I interpret the data, instead of offering an 'unmodified' representation. Therefore, the inventory reports do always offer references to primary data in the field ‘Literature’.\(^{39}\)

Sites will be presented according to crude archaeological dating\(^{40}\). Sites which contained traces of multiple archaeological periods will be listed based on their oldest assumed date.

3.4.1 Early- and Middle Neolithic or Neolithic undefined

<table>
<thead>
<tr>
<th>Inv. Nr.</th>
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<th>Toponym</th>
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<tbody>
<tr>
<td>34</td>
<td>Vuren</td>
<td>Spijsche Veld</td>
</tr>
</tbody>
</table>

A stone (lydite) hammer-axe, type 'Breitkeil', measuring 9.5 by 5.3 by 3.8cm was found at approximately 14m depth at a sand-dredging site. The axe was perforated with a 2.7cm hole and traces of it being used as a hammer stone were visible. I adhere little interpretative value to these dredging finds.

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<th>Inv. Nr.</th>
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<th>Toponym</th>
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<tbody>
<tr>
<td>35</td>
<td>Gorinchem</td>
<td>Polder Spijk</td>
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</table>

A black coloured stone battle axe, which exhibits traces of being used as a hammer stone. Supposedly it also originates from a sand exploitation site. Again, I deem the value -due to lack of context- minimal.

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<th>Inv. Nr.</th>
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<th>Toponym</th>
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</thead>
<tbody>
<tr>
<td>28</td>
<td>Zoelen</td>
<td>De Hevel</td>
</tr>
</tbody>
</table>

One sherd, dating to the Middle- or Late Neolithic period, was supposedly found at ground level in an orchard. This sherd was not found during my personal study of the material\(^{41}\). Large quantities of Iron Age, Roman Age and Late Mediaeval ceramics were also found.

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<th>Inv. Nr.</th>
<th>Town</th>
<th>Toponym</th>
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<tbody>
<tr>
<td>29</td>
<td>Zoelen</td>
<td>Mauriksestraat</td>
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</tbody>
</table>

A complete antler axe, made from the lowest part of a deer antler, was found on the refuse heap at a sand dredging site. Void of context, relevance is confined to the level of 'presence-absence' indication.

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<tr>
<th>Inv. Nr.</th>
<th>Town</th>
<th>Toponym</th>
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<tbody>
<tr>
<td>38</td>
<td>Zoelen</td>
<td>De Beldert / Mauriksestraat</td>
</tr>
</tbody>
</table>

A rescue excavation revealed concentrations of flint, ceramics and bone, all dating to the Middle Neolithic period. An inhumation grave of Middle Neolithic age, containing both an inhumation of a older woman (±50-70y.) and a child (±7y.), and during a later phase the partial remains of yet another woman, were unearthed. These graves were found in clayey levee deposits, as were possible traces of woodwork lining of the creek bank. Traces of Iron Age and/or Roman settlement features -among which a possible house plan- were found.

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<th>Toponym</th>
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<tbody>
<tr>
<td>41</td>
<td>Zoelen</td>
<td>Lingeplas</td>
</tr>
</tbody>
</table>

The objects described below were found in layer of grey to black clay, 25m deep in a sand dredging pit. One complete deer antler axe, although incompletely pierced, and a fragment of another deer antler axe were found. Also, a bone axe (13.2cm) and a flint scraper were found. There is no contextual evidence to advocate a more precise dating\(^{42}\).

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<tr>
<th>Inv. Nr.</th>
<th>Town</th>
<th>Toponym</th>
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<tbody>
<tr>
<td>25</td>
<td>Maurik</td>
<td>Eiland van Maurik</td>
</tr>
</tbody>
</table>

Near the recent banks of the river Rhine, a polished flint axe (narrow at the top, oval cross section, type 'spitznackige Flintovalbeil'), was found.

Fig. 3.2 Flint axe from ‘Maurik-Eiland van Maurik’. (Not to scale: Length = 11,8cm)

\(^{39}\) The inventory reports are available as Microsoft Access ('97) database in the digital data (/Database/inventory.mdb).

\(^{40}\) See appendix II for dating of archaeological periods.

\(^{41}\) It might have been mislaid and be present in unstudied boxes.

\(^{42}\) Antler axes of this type are usually dated between the Mesolithic and Early Neolithic. Personal communication: Harry Fokkens, 22-06-2000. Antler implements (a.o. axes) have been used until the Middle Bronze Age.
3. Archaeology

3.4 The inventory: short descriptions

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<th>Town</th>
<th>Toponym</th>
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<tbody>
<tr>
<td>27</td>
<td>Beesd</td>
<td>-unknown-</td>
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</tbody>
</table>

The digging of a ditch for electrical wiring near a recent road uncovered a flint polished axe with a narrow top, type ‘dünnackige Flintovalbeil’. No further information concerning its dimensions or whereabouts are available.

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<tbody>
<tr>
<td>30</td>
<td>Lith</td>
<td>Uit de Maas</td>
</tr>
</tbody>
</table>

A jade or nephrite stone axe and polished flint axe with narrow top (‘dünnackige Flintovalbeil’) were found during digging at a site close to recent river Meuse between the towns of Dreumel and Lith. The flint axe measures 5.75 cm by 2.9 cm and has an overall length of 12.7 cm. The jade axe has a length of 23.7 cm and measures 7.6 cm by 2.26 cm in cross-section.

![Flint and jade axe from Lith](image)

Flint flakes were recovered from sand dredge pit deposits. The geological context is unknown. The flakes offer no (typological) opportunity for more precise dating.

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<tbody>
<tr>
<td>68</td>
<td>Beusichem</td>
<td>Hussen</td>
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</table>

Survey of ploughed land yielded a possible Middle Neolithic arrowhead with concave basis and -more or less- straight sides. On the same spot sherds dating to the Iron Age and Roman Age, as well as few Early Mediaeval sherds were found.

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<tr>
<th>Inv. Nr.</th>
<th>Town</th>
<th>Toponym</th>
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<tbody>
<tr>
<td>43</td>
<td>Hoogblokland – 1</td>
<td>Den Beemt – 1</td>
</tr>
</tbody>
</table>

In a test-trench excavated by members of the archaeological work-group ‘Lek and Merwestreek’ five dark postholes occurred in a darker coloured larger feature, possibly a hearth or a fire place. Herein Vlaardingen type sherds and pieces of burned bone were present. Beside six fragments of undecorated, Late Vlaardingen ceramics (tempered with crushed stone and slightly polished), 4 fragments were decorated in nearly horizontal bands of ‘v’ shaped impressions. This type of decoration is a-typical to Late Vlaardingen ceramics. Flint artefacts included three flakes and one scraper. The nature and diversity of archaeological remains favour an interpretation as activity area.

<table>
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<th>Inv. Nr.</th>
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<tbody>
<tr>
<td>11</td>
<td>Zoelen</td>
<td>Mauriksestraat</td>
</tr>
</tbody>
</table>

Two sherds, tempered with coarse quartzite, most likely Vlaardingen Culture. This is the same locality as inventory number 10, described below. They were found without context on refuse heaps.

3.4.2 Vlaardingen culture

<table>
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<tr>
<th>Inv. Nr.</th>
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<th>Toponym</th>
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<tr>
<td>43</td>
<td>Goudriaan</td>
<td>Donk Goudriaan</td>
</tr>
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</table>

Some flint and Neolithic pottery was found on this partially levelled- river dune. According to Louwe Kooijmans the pottery can be classified as belonging to the Vlaardingen (material) Culture Group 43. H.A. de Kok classified this (?) pottery as Bell Beaker 44. Some flint fragments show polished facets. These are most likely fragments of polished flint axes.

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<th>Inv. Nr.</th>
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<th>Toponym</th>
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<tbody>
<tr>
<td>44</td>
<td>Hoogblokland – 2</td>
<td>Den Beemt – 2</td>
</tr>
</tbody>
</table>

A test pit dug by A.W.N. members in 1963 in the Hoogblokland river dune yielded a bottom of a Vlaardingen ceramic vessel. Three flakes and a single scraper were also uncovered. The youngest finds were Mediaeval (11th-12th century) ceramics.

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<tr>
<td>45</td>
<td>Hoogblokland – 1</td>
<td>Den Beemt – 1</td>
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</table>

Another, yet more extensive, test pit dug by A.W.N. in which Late Vlaardingen Culture ceramics and sherds of a small beaker with impressions of a bone or a small stick were found.

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<th>Inv. Nr.</th>
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<th>Toponym</th>
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<tbody>
<tr>
<td>46</td>
<td>Hoogblokland – 1</td>
<td>Den Beemt – 1</td>
</tr>
</tbody>
</table>

In a test-trench excavated by members of the archaeological work-group ‘Lek and Merwestreek’ five dark postholes occurred in a darker coloured larger feature, possibly a hearth or a fire place. Herein Vlaardingen type sherds and pieces of burned bone were present. Beside six fragments of undecorated, Late Vlaardingen ceramics (tempered with crushed stone and slightly polished), 4 fragments were decorated in nearly horizontal bands of ‘v’ shaped impressions. This type of decoration is a-typical to Late Vlaardingen ceramics. Flint artefacts included three flakes and one scraper. The nature and diversity of archaeological remains favour an interpretation as activity area.

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<th>Toponym</th>
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</thead>
<tbody>
<tr>
<td>47</td>
<td>Hoogblokland – 1</td>
<td>Donk van Pelicaan</td>
</tr>
</tbody>
</table>

Two sherds, tempered with coarse quartzite, most likely Vlaardingen Culture. This is the same locality as inventory number 10, described below. They were found without context on refuse heaps.

43 See: Louwe Kooijmans 1974, p. 368 (nr. 59).
44 De Kok 1965, p. 122 (nr. 7).
45 The decoration was most likely applied with a broken bone of a bird or a twig. See Archis number 25092. E. Drenth.
Two fragments of Vlaardingen ceramics -tempered with coarse quartzite- were found on a spoil heap together with a fragment of an T-shaped antler axe. There are no indications concerning their contemporaneity. This is the same locality as inventory number 11, described above.

While working his garden Mr. T. van den Hof unearthed a flint axe, 17.3 cm long and with an oval facetted cross-section. This type of facetted axes are usually classified as being of the ‘Buren’ type. ‘Buren’ type axes are sometimes seen as type fossil for Vlaardingen Period sites.

3.4.3 Vlaardingen- and Beaker Culture Period

Construction of a new provincial road near the city of Geldermalsen unearthed a Roman Age find layer. At the same site, albeit in washed out sediments, Vlaardingen and Beaker Period sherds were found. Although these finds are ex-situ, they perhaps are to be seen as indicators of nearby presence during these periods.

Finds ranging in date from the Mesolithic (a flint trapeze arrowhead) to the Iron Age (handmade ceramics) were found on this river dune. Sand extraction pits dug by the local farmer, but also trenches dug by local archaeological work-groups yielded Vlaardingen type ceramics, Middle Bronze Age ‘Drakeslijn’ type ceramics and burned clay (loam). This river dune, which is known by the name ‘Schoonrewoordse Donk’, still rises about 80 centimetres above its surroundings.

Recent ground quarrying profiles revealed three large darker depressions between 0.9m and 1.2m below the recent surface. According to ARCHIS only Vlaardingen type ceramics, accompanied by fragments of indeterminable bone and fragments of stone that exhibited traces of being used as a grinding stone, were discovered. According to the literature also Early Bronze Age ceramics were found. These ceramics could not be found and their dating cannot be confirmed.

Survey by members of the H.K.K.O. resulted in the recovery of nine sherds of Vlaardingen type ceramics, coarsely tempered with stone. One sherd displayed incised decoration and perhaps represents a Beaker period example. Furthermore, a flint flake, 10 bone fragments and 4 stones were discovered.

Extensive soil disturbance was caused by the construction of several fish breeding ponds. In the profiles a clay layer (at approximately 0.5m below surface) was visible. According to ARCHIS, sherds of Bell Beaker ceramics together with a flint flake, arrowhead, and a possible flint ‘knife’ were found therein. Finds from this site were studied, and a quite different set of archaeological remains could be described.

---

**Inv. Nr.** | **Town** | **Toponym**
--- | --- | ---
10 | Zoelen | Mauriksestraat
8 | Zoelen | Mauriksestraat
26 | Noordeloos | Woonhuis T. van den Hof
2 | Geldermalsen | Provinciale weg
6-7 | Leerdam | Polder Hoogeind/Schoonrewoordse Donk
9 | Zoelen | Witte Stein
24 | Goudriaan | -unknown-
17 | Maurik | Meerboomweg

---

47 They have been found in association with Vlaardingen Culture ceramics. Personal communication: Zita van der Beeck, 22-4-2000.
48 These are separate numbers because their ARCHIS co-ordinates differ slightly. However, content and references to primary literature are the same.
49 For references on Dutch Bronze Age pottery classification see: Theunissen 1999, p. 202-206.
50 The ambiguous toponyms can cause confusion. A sand dredging site near the Mauriksestraat in town of Zoelen is known under the toponyms ‘Zoelenseput oost’, ‘Zoelenseput West’, ‘Mauriksestraat’, ‘Mauriksestraat onder Zoelen’, ‘De Beldert I/II/III/V’. In the local collections these all have separate co-ordinates. Therefore, these were added ‘as separate sites’ to the inventory later-on. The ARCHIS database seems to have grouped some of these under the co-ordinates 158.640/437.620 (ARCHIS 7820, Inventory number 8). These co-ordinates could not be found on any of the find-labels of studied finds. See also: Inventory numbers 10, 11, 19, 20, 29, 38, 80, 84, 102-107.
51 While visiting the H.K.K.O., these finds could not be retrieved. Therefore, the dating of the decorated sherd remains ambiguous.
52 See the report on the BATO collection: Appendix III.
The oldest ceramics included possible Vlaardingen Culture sherds, although this interpretation is not beyond doubt. Cord-impressed decoration, indicating a Late Neolithic date, was observed on six sherds. Bell Beaker sherds, some alleged Late Bell Beaker date, were also found.

All Late Neolithic material was very eroded, and most likely has been washed from its original location. Late Neolithic material from individual depressions was found ‘in association’ with Early Bronze Age, Middle Bronze Age and Roman Age ceramics.

Some sets of finds recovered from depressions (labelled as ‘features’) gave the impression that they contained material from one period (especially Late Neolithic and Middle Bronze Age, and in one case Iron Age) only.

The lithic assemblage consists of both stone as well as flint in considerable quantities. Numerous small (<3cm) and round flint scrapers were found, as well as three flint ‘knives’.

A thin-walled (6mm) sherd of cord-decorated pottery, a fragment of a (Middle ?) Bronze Age vessel bottom and two Iron Age sherds were found during fieldwalking. According to the label these were found in sandy sediments.

The dredging of a drainage ditch (the ‘Wetering’) revealed a dark layer of clayey sediments wherein several objects were discovered.

---

Fig. 3.4 Cord- (above) and dentated spatula impressed (below) ceramics from ‘Maurik-Meerboomweg’.

Fig. 3.5 Bell Beaker ceramics from ‘Maurik Meerboomweg’.

Fig. 3.6 Arrowheads, worked flake (knife) and scraper from ‘Maurik-Meerboomweg’.

Fig. 3.7 Cord-decorated sherd from ‘Kerk-Avezaath – Burensedijk’.

---

53 One cannot be sure, however, whether these represent All Over Corded Beakers or Protruding Foot Beakers.

54 These are generally indicated by the term ‘plano-convex knives’, and held typical for the Late Neolithic / Bell Beaker period. Personal communication: Zita van der Beek, 25-05-2000. One of these was submitted for trace-wear analysis, and turned out to bear (possible) traces of longitudinal friction (cutting) along its edge (personal communication: Yvonne Keizers, 03-07-2000). See appendix V.
The bottom of an vessel - most likely of the Vlaardingen type - was found together with a fragment of an (AOO-2) Beaker. The presence of the black layer of clay, imposed on sandy sediments between 1.9m and 2m below surface, could be affirmed by additional coring near the sides of the drainage ditch. At a small distance from this drainage ditch, on ground surface, ceramics and a triangle-shaped loom-weight dating to the Late Iron Age, as well as some Roman Age ceramics, were found. A Middle- to Late Neolithic refuse layer is to be expected.

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<th>Toponym</th>
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<tr>
<td>31</td>
<td>Buren</td>
<td>Korenbroeck</td>
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During survey a flint arrowhead was found at ground level. Imprecise dating to the Late Neolithic or Early Bronze Age is assumed.

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<tbody>
<tr>
<td>32</td>
<td>Zoelen</td>
<td>Kerkenakkers 2</td>
</tr>
</tbody>
</table>

Up to 80 sherds of moderately tempered Vlaardingen ceramics, a flint axe, a flint scraper and 40 undifferentiated flakes were found during a survey. Indeterminable fragments of bone, burned clay (Dutch: 'huttenleem') and a worked flint blade were found. A stone was perhaps used as cooking stone.

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<tr>
<td>36</td>
<td>Vianen</td>
<td>Donk van Autena</td>
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</table>

The first archaeological remains were found during soil survey in 1950. These were Iron Age and medieval (13th-14th century) ceramics. A test pit excavated by A.W.N. members in 1964 yielded more Iron Age pottery, but also few sherds tempered with both crushed stone as well as crushed pottery. These specific sherds perhaps date to the Neolithic, although a dating to the Middle Bronze Age cannot be excluded. All archaeological objects were found in a clayey layer of sand approximately 60cm below surface. Particles of charcoal were found throughout this entire layer.

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<td>53</td>
<td>Echteld</td>
<td>Scheele Hoek</td>
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</table>

At a construction site local archaeologists excavated a dark grey feature. It consisted of heavy silt and medium coarse sand and measured two by five metres. Three sherds that were strongly tempered with fine crushed quartzite were found, of which one was very thin walled (5-6mm).

Fragments of a stone battle axe were found near the city of Culemborg. No further information, nor the objects self could be retrieved.

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<th>Toponym</th>
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<tbody>
<tr>
<td>21</td>
<td>Culemborg</td>
<td>-unknown-</td>
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</tbody>
</table>

A battle axe made from black coarse grained stone (diabase). The axe can be classified as 'Jutse' battle axe type 'K'. At the findspot a test pit was dug, which yielded a fragment of a polished flint axe and a bone fragment.

![Fig. 3.8 Stone battle-axe from ‘Geldermalsen-Meteren’](image)

As early as 1885 this diabase battle axe, type 'P-2', was found. Its length measures 18cm and its maximum width is 6.2 cm. Where exactly it was found could not be retrieved.

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<tr>
<td>66</td>
<td>-unknown-</td>
<td>Neder-Betuwe</td>
</tr>
</tbody>
</table>

The profile of a newly dug drainage ditch uncovered sherds with parallel cord impressions, perhaps belonging to an AOO 2 battle beaker. A sherd with horizontal 'fishbone' impressions is usually classified as belonging to a Protruding Foot Beaker vessel. Furthermore, a triangle shaped flint arrowhead and two unworked flint flakes were found. More details on the profile would facilitate interpretation.

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<tr>
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<tbody>
<tr>
<td>13</td>
<td>Geldermalsen</td>
<td>Hangwaard 1</td>
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</tbody>
</table>

Excavation of a future construction site yielded traces of field systems presumably dating to the Late Neolithic.
Furthermore, Iron Age features and a Roman Age graveyard with 75 graves were unearthed. A large lump of clay (circa 70cm round) has been washed from its original location and had been preserved in sandy channel bed deposits. This dislocated clay lump had preserved a fragment of the Late Neolithic occupation layer and some Potbeaker ceramics. 

According to ARCHIS, survey in a forest revealed sherds that could have originated from Protruding Foot Beaker ceramics, some from All Over Ornamented and some from Bell Beaker ceramics. Lithics supposedly included two flint arrowheads (one triangular in shape), a scraper and a flint nodule.

When studying the original material, no Protruding Foot nor All Over Ornamented Beaker ceramics were found. Eleven fragments (17 grams) of thin-walled (5mm) Late Neolithic (Bell Beaker ?) pottery were found. On one of these dentated spatula impressions were observed. As these were all very rounded, I suspect these to have been washed from their original location. Four (less eroded) Roman Age sherds were also recovered. The lithics included 24 fragments of riverine flint, with only one (perhaps two) worked flake(s) and 290 grams of sandstone and quartzite fragments.

The most remarkable find from this locality was a jet bead, measuring 15 millimetres in diameter, 6–9 millimetres thick and with a conical perforation.

During fieldwalking one finely tempered sherd was discovered. Based mainly on its decorative pattern, a date to the All Over Ornamented Period or Early Bell Beaker period has been suggested.

In 1954 a soil survey of the channel deposits belonging to the fossil ‘Schaik’ river system was initiated. As occupation remains were suspected, a test pit was dug. Underneath a 35-50cm thick clay cover a darker coloured band was discernible. Herein, local archaeologists retrieved a chip of flint and a fragment of a Late Bell Beaker vessel.

### 3.4.5 Late Beaker and Early Bronze Age Period

Indications for Late Neolithic occupation in the vicinity of this locality consist of one (possible) Pot Beaker sherd and one sherd decorated with zig-zag impressions. Among the total of over 1800 grams of (predominantly Middle Bronze Age) ceramics, some indicators for the Early Bronze Age and Early-Middle Bronze Age were found.

The abundant stone material recovered contained two grinding/ rubbing stones and a hammer-stone. A Middle Neolithic flint blade most likely originates from a nearby Middle Neolithic settlement. One heavily eroded Iron Age sherd was found in the profile of a recent drainage ditch at the site. A nearby Early- or Middle Bronze Age settlement is to be expected.

### Table 3.4.5 Late Beaker and Early Bronze Age Period

<table>
<thead>
<tr>
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<tr>
<td>15</td>
<td>Zoelen</td>
<td>Kerkenakkers 1</td>
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<th>Town</th>
<th>Toponym</th>
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<tbody>
<tr>
<td>16</td>
<td>Hoogblokland</td>
<td>Den Beemd - 1</td>
</tr>
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</table>

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<tr>
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<th>Town</th>
<th>Toponym</th>
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<tbody>
<tr>
<td>102</td>
<td>Zoelen</td>
<td>Zoelenseput Oost</td>
</tr>
</tbody>
</table>

![Fig. 3.9 Jet bead from ‘Maurik-Hornixveld’.

The dating is unclear, but a Middle- to Late Neolithic Age is suspected.

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55 Personal communication: Erik Verhelst, 31-03-2000.
56 This, however, is not to deny their existence. Material from this site was retrieved from boxes that contained predominantly finds from other sites. Thus, the chance that one day a bag with these finds might turn up remains.
57 Zita van der Beek has informed me that jet bead have been found in association with Vlaardingen Culture materials. A Middle- to Late Neolithic date is suspected. Personal communication: Zita van der Beek, 25-05-2000 and Leo Verhart 07-06-2000.
58 An almost identically worked stone has been retrieved from a Middle Bronze Age level at the ‘Bogen’ excavation (See: paragraph 4.4.2.). Personal communication: Yvonne Keizers, 01-06-2000.
3. Archaeology

3.4 The inventory: short descriptions

Fig. 3.11 Worked stone from ‘Zoelen-Zoelenseput Oost’.

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<tr>
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<tbody>
<tr>
<td>103</td>
<td>Zoelen</td>
<td>De Beldert II</td>
</tr>
</tbody>
</table>

A sherd with several horizontal grooves under the rim and sherd with fingertip impressions could date to the Late Neolithic period. Furthermore, thick (12-15mm) Middle Bronze Age ceramics (tempered with coarse (1-7mm) crushed quartzite) were found at this part of the sand-dredging site known as ‘Mauriksestraat/ Zoelenseput/De Beldert’60. Flint flakes and an Early Bronze Age arrowhead, as well as stone and bone fragments were found.

Fig. 3.12 Flint arrowhead and ceramics from ‘Zoelen - De Beldert II’.

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<th>Toponym</th>
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<tr>
<td>20</td>
<td>Maurik</td>
<td>Mauriksestraat / Zoelenseput West</td>
</tr>
</tbody>
</table>

The relation of this site to all other sites with the toponym ‘Mauriksestraat’ is unclear. The context of the finds could not be retrieved. They represent both surface finds and materials collected from profiles at a sand dredging site. One sherd, that exhibits clear traces of the coiling technique, might possibly be dated to the Middle Neolithic.

Some material is indicative for the Late Neolithic period (e.g. three fragments of Pot Beakers), but both Early Bronze Age and Middle Bronze Age ceramics were found in considerable quantities61.

Fig. 3.13 Potbeaker-like ceramics, flint arrowhead and scraper from ‘Maurik Zoelenseput West’. Scalebar in centimetres.

Fragments of bone and stone (over 5 kilograms) could not be assigned to a specific period. Few Roman Age and (sub)recent sherds were found, presumably at ground level.

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<tr>
<td>18</td>
<td>Culemborg</td>
<td>Rietveldseweg</td>
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</table>

A break-through channel fill cross-cutting channel deposits of the Schoonrewoord system and its immediate surroundings were investigated in 1965. The channel fill yielded predominantly Iron Age ceramics, but bone and wood were also preserved. Few thick, stone tempered (most-likely Middle Bronze Age) sherds were found in the break-through fill. Louwe Kooijmans has his doubts whether these do represent occupation on the exact same spot62. Two Barbed Wire decorated sherds found in the immediate surroundings perhaps indicate Early Bronze Age activities. Three hectares of land bordering the gully were excavated and yielded ditches dating to the Iron Age and Medieval period. Three granaries were reconstructed based on the excavation plan, presumably all dating to the Iron Age. Also, part of a three-aisled farm (width 8m, central aisle 3m, length at least 20m) was discovered. No dating was suggested in the publication. A Bronze Age date, however, would best comply with the typology of known prehistoric house plans63.

61 Over 1 kilogram of Bronze Age ceramics (presumably both Early- as well as Middle Bronze Age) were recovered.
63 For an introduction: Roymans & Fokkens 1991, p. 1-19 (Especially p. 9, Fig. 5).
At the sand-dredging site near the ‘Mauriksestraat’, a dark-grey coloured paleo-sol had developed at 0.8m depth between layers of clay. From this layer Early Bronze Age ceramics were found, as well as five fragments of red deer (Cervus elaphus) tools. Based on the presence of perforation and use-wear traces on one fragment, it is interpreted as an axe-fragment. The reference in the ARCHIS database that human skeletal material had been found could not be verified in the publications.

At two locations hand-made ceramics were collected during fieldwalking. Although no decoration in Barbed Wire style was apparent, the moderately tempered sherds are dated to the Early Bronze Age. Five flint flakes and a stone, perhaps used as a cooking stone, were also reported.

Sixteen fragments of medium to coarse tempered ceramics were found during fieldwalking. Together with two worked flint flakes and two unworked flakes, they offer an insecure dating to the Early Bronze Age.

A single fragment of moderately tempered pottery and a stone, displaying signs of being used as a cooking-stone, were collected during a survey. The sherd is dated to the Early Bronze Age.

Survey yielded one fragment of pottery that was tempered with quartzite.

Two sherds found at this part of the sand-dredging site, known as ‘Mauriksestraat/ Zoelenseput/De Beldert’, were tempered with crushed pottery.

Together with three (8mm thick) sherds, a flake of grey flint and some stone, all are insecurely dated to the Bronze Age.

Four fragments of Middle Bronze Age pottery and a worked flint blade were found during survey at a sand dredging site. The sherds were tempered with coarsely broken quartzite. Large scale archaeological excavations have taken place in 1965, 1966 and 1971 in the centre of the Zijderveld river channel deposits. Although palynological studies advocate Late Neolithic or Early Bronze Age occupation in the vicinity, no objects excavated could be dated unambiguously to either one of these period.

Numerous finds and features were found in a dark 15-20cm thick paleo-sol, intercalated between layers of sandy clay. The features are interpreted as a Middle Bronze Age settlement site and, at a slightly higher level, an Iron Age settlement site. House plans, palisades and granaries datable to both periods were unearthed.

A small excavation has taken place on the site to determine the stratigraphy. At the lowest level, hand-made ceramics tempered with coarse quartzite were found. It is plausible that these correlate to Middle Bronze Age occupation activity nearby. This lowest layer was covered by an archaeologically sterile layer of clay.
Above this layer, a layer with both prehistoric and Late Mediaeval pottery was found. The small number of prehistoric sherds in this layer probably originate from the lowest layer, and accidentally got included through (biological) disturbances.

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<tr>
<td>85</td>
<td>Beusichem</td>
<td>Pietersteeg</td>
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Fragments of Middle Bronze Age 'Drakestein' type ceramics, four stones, one flint flake and bone fragments were found in a dark grey layer between 0.75-0.95m below ground surface at a construction site. This layer could represent a find-layer, but an interpretation as paleo-sol with stray finds cannot be excluded.

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<tr>
<td>79</td>
<td>Erichem</td>
<td>Lingen</td>
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Fragments of animal bones and coarsely tempered Middle Bronze Age ceramics were retrieved from a drainage ditch profile. No reference to the existence of a find-layer is made. This, however, is quite likely to have been the case.

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<tr>
<td>80</td>
<td>Zoelen</td>
<td>Mauriksestraat</td>
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</table>

During survey the bottom parts of two Middle Bronze Age vessels were found. Fragments of burned bone were found associated with the pottery fragments. These are interpreted as the remains of Middle Bronze Age cremations. It is unclear whether these remains are to be interpreted as a destroyed burial mound (complex) or an isolated funerary location.

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<tr>
<td>81</td>
<td>Drumpt</td>
<td>Het Achterveld</td>
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One fragment of Middle Bronze Age ceramic was found during the survey of a profile of a recent ditch. At the same location (according to ARCHIS) also Roman Age ceramics were found. Both these finds are interpreted as being washed out. However, it is not clear whether the indication of representing 'washed out finds' is based on (eroded appearance of) the finds, or their geological context.

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<tr>
<td>83</td>
<td>Culemborg</td>
<td>Voorkoop</td>
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</table>

One fragment of thick-walled Middle Bronze Age ceramic, tempered with coarse pebbles, was found during survey. The sherd was most likely retrieved from a profile, but this is not explicitly stated.

Fragments of MBA pottery (coarsely tempered), burned clay (Dutch: 'huttenleem'), stone and bone were found during survey. These finds can be both stray finds, as well as originating from an (undescribed) find-layer. A small number of corings could clarify this.

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<tr>
<td>82</td>
<td>Buren</td>
<td>Nieuwe Steeg</td>
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One fragment of Middle Bronze Age pottery was found during survey. Additional coring on the site could reveal if this represents a stray find or a ploughed-up find-layer.

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<td>Zoelen</td>
<td>Munnikskamp</td>
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Two flint flakes (of which one was worked), twenty-one fragments burned 'cooking' stones, three bone fragments and fifty-five Middle Bronze Age sherds were found during the survey of an orchard. No additional information was available.

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<tr>
<td>89</td>
<td>Zoelen</td>
<td>Munnikskamp 2</td>
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</table>

Fragments of coarsely tempered Middle Bronze Age ceramics, nine stones (interpreted as cooking stones) and 12 bone fragments were found during digging activities. According to ARCHIS, the entire site is disturbed. It remains unclear whether these are to be seen as a disturbed occupation layer, or (displaced) stray finds.

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<th>Toponym</th>
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<tr>
<td>87</td>
<td>Kerk-Avezaath</td>
<td>Korenbreek</td>
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</table>

Fragments of coarsely tempered Middle Bronze Age ceramics and fragments of bone were found during digging. No indication whatsoever regarding their geological context. Therefore, their interpretative value is very limited.

3.5 Inventory synthesis

The interpretation of stray finds and small find scatters (certainly concerning surface finds during surveys) remains problematic.

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67 Wilfried Hessing is preparing a study of the nearby Roman funerary site: Hessing, *in prep.*
Therefore, there is a realistic danger of this type of regional inventories being reduced to the level of ‘establishing or confirming presence’. Working uncritically with this data, or others similar in nature, is prone to devaluate the argument, or worse, to lead to erroneous interpretations.

For the Neolithic period it has become clear that 14 sites would not have been listed if use was made of the ARCHIS database alone. Furthermore, not all of the sites published in Louwe Kooijmans’ thesis (1974) seem to have been added to the ARCHIS information system. However, an equal number of sites, that were listed in ARCHIS have not been published yet. The study of archaeological journals resulted in the addition of some new sites, although these were predominantly stray axe finds. Various archaeological monographs were used not so much as to acquire more sites, but rather to develop an archaeological background. The degree of overlap between sources is perhaps to be seen as an indication of the degree of completeness of the ARCHIS system. However, the qualitative losses accompanying the use of a single source are unacceptable. For the Bronze Age inventory only ARCHIS has been used, so an inter-source evaluation cannot be made.

The importance of the local collections varies with the archaeological period of interest. I have a strong feeling -but lack substantiating statistical arguments- that the relatively rare occurrence of (Late) Neolithic material being unearthed in the river area will have caused it to being reported more often, and thus is more likely to end up in either publications and/or ARCHIS.

For the Bronze Age, I suspect that this is less the case. The various local archaeologists have, however, nearly all stated that material dating to (in particular the Early-) Bronze Age was rarely found.

Therefore, it is to be considered no more than an educated guess that I suspect that ARCHIS can be enriched with ample new sites through continuous addition of descriptions of local collections. For the later Iron- and Roman Ages this assumption is even more likely to be true, if the claimed numbers of sites discovered by local archaeologists to be taken as a guideline.

Summarising, I feel that the data from the inventory alone does not provide us with the means to resolve the problems outlined in chapter one. The inventory does provide us with a sufficiently reliable overview of presence of archaeological material from different periods. However, without more detailed research on the geological background and more detailed descriptions of the find locality, hypotheses surpassing the descriptive level are difficult to test. In particularly the ARCHIS system is not adequately equipped to house parameters involved in describing the complex fluvial architecture and its relation to archaeological phenomenon. This is compensated for by its spatial (GIS) component and abundant references to primary literature.
4. Current research: The ‘Betuweroute’

4.1 The Betuweroute project: Introduction

The ‘Betuweroute’ project can be summarised as the construction of a double-track freight railway of national importance, cross-sectioning the Dutch landscape in west-east direction. The project history will be shortly outlined below. In particular, the specific role of archaeology in this project will be dealt with. Some of the archaeological sites discovered (and investigated) within my study area, that are of relevance to this study will be introduced. The specific nature and implications of their relevance will be dealt with in the synthesis (chapter six).

4.1.1 Infrastructure of national relevance

During the second half of the 1980’s, the Dutch government became increasingly concerned with finding solutions that could reduce the expected pressure on Dutch logistic infrastructure. In two governmental reports, the possibilities to transform a less effective passenger railroad in the Betuwe district to a cargo railway, were explored. In 1989 a special advisory committee reported that the realisation of an east-west freight ‘corridor’ connecting the Rotterdam harbour with the European hinterland, was of national economic importance. In November 1996 nearly all necessary legislation had been invoked, and in May 1998 the Dutch highest legal court spoke its final words on legal procedures. The Betuwe railroad, 160 kilometres long, to be finished in 2005 and costing nine billion guilders, was an undeniable reality.

4.1.2 Archaeological research

Anticipating the implementation of the ‘Malta’ legislation, The Ministers of Transport, Public Works and Water Management and of Education, Culture and Sciences decided that archaeologists would be able to carry out research into the archaeological value of sites along the route before the line was laid. Therefore, the Archaeology Project Group Betuweroute was set up to organise archaeological efforts and to make sure the research was carried out within the planned time scale and the available budget. The Betuweroute Archaeology Project Group is a co-operative effort between the Betuweroute Project Organisation and the National Service for Archaeological Heritage. Their first task was to inventory whether any known archaeologically valuable locations were threatened by the envisaged location of the railroad track. Based on a standard archaeological (literature and ARCHIS) inventory (called a ‘SAI’), the state service for archaeology selected 260 potentially interesting locations.

This implied that, on a scale as never seen before, the Dutch government became involved in the process of infrastructural design and legislation. Several studies on the influence of the ‘Betuwelijn’ (as the railway came to be known) on economics, ecology and national implications of its prospected location, were undertaken. The extensive debates numbed only marginally with the assent given by the Dutch Lower House of Parliament in 1995.

1 Visit the project website at http://www.betuweroute.nl/.
3 See: http://www.betuweroute.nl/ (in Dutch) for further details.
4 See Anonymous 1996.
4. Current research: The ‘Betuweroute’

These usually consisted of the excavation of small test-pits and trenches to determine the archaeological quality of the locality. Although the dimensions of these trenches varied according to the specific research questions from locality to locality, in general sixteen square metres per location were excavated.

4.2 Sites within the study area

As the map reprinted below indicates, only a limited number of sites fall within my study area.

Site number six (‘Geldermalsen – De Laar-Eendekooi’), appeared to be no more than a diffuse dark charcoal coloration, that yielded some sherds dating to either the Iron- or the Roman Age. Sites 7 and 8 (‘Eigenblok Oost & West’) yielded traces of both Late Neolithic as well as extensive Middle Bronze Age occupation. The sites grouped as ‘Eigenblok’ will be discussed in paragraph 4.3. Site 9, ‘Geldermalsen – Lage Blok’, is a Middle Iron Age settlement site, that yielded only one single feature that might be datable to the Middle Bronze Age. Therefore, it will not be discussed in more detail. The sites 28, 29 and 31 represent the complex ‘Geldermalsen De Bogen’. Dates of archaeological remains within the ‘De Bogen’ complex range from the Late Neolithic to the Early- and Middle Bronze Age. Two additional locations (sites 45 ‘Spoorbrug Voorvliet’ and 49 ‘Voetakker- Vervolg’) were added to the ‘Bogen’ complex later on. The results of the ‘Bogen’ excavations will be presented in paragraph 4.4. Site 10, ‘Tiel- Prinkel’, is a levelled artificial mediaeval occupation mound (Dutch: ‘Terp’). The sites 11 (‘Buren - Malburg’), 12 (‘Buren- Stenen Kamer’) and 33 (‘Kerk-Avezaath - Linge’) all contained material datable to the (Early- and Later-) Mediaeval periods. Sites 11 (which also yielded few Roman sherds) 12 and 33 have all been excavated.

4.3 The ‘Eigenblok’ complex

4.3.1 History of the archaeological enquiry

Sites 7 and 8 (‘Eigenblok West & Oost’) were selected for additional archaeological inspection (‘AAI’). Based on a total of 186 corings, divided evenly over sites 7 and 8, RAAP reached the following conclusions: Anthropological indicators (e.g. charcoal, burned clay, ceramics) at Eigenblok-West all concentrated within a 40m by 20m rectangle. This supposedly represents one prehistoric farmstead. In the north-eastern part the remains of agricultural layer might have been preserved. Eigenblok-Oost might encompass the remains of one or several Middle Bronze Age farmsteads. Based on their proximity (site 7 and 8 are located 300 metres from each other), the assumed relationship between them contributed to the high qualification in the process of selection as described in paragraph 4.1.2.
The research objectives that were defined at the start of the additional archaeological research (‘AAO’) were quite similar for both locations: Have any features been preserved? If so, at what depth were these visible, to which period do these date, and do they enable geopaleoarchaeological reconstruction of the site? How well are macrobotanical remains (pollen, plants, wood and charcoal) preserved, and do they enable paleo-geographical reconstruction of the site? For Eigenblok-West, more specific research questions on the dating of the agricultural layer and its relation (both spatially as well as chronologically) to the settlement were added.

Fig. 4.4 Location and numbers of sites in the ‘Eigenblok’ complex.

At Eigenblok-West additional coring took place and several test-pits and trenches were dug to answer these questions. Although the agricultural layer predicted by RAAP could not be confirmed, the interpretation of a Middle Bronze Age (‘Hilversum fase 2/3’, 1500-1100 cal. B.C.) farmstead was maintained. Various features were found, but no wood had been preserved. Ceramics from the Late Neolithic (one sherd) and Early Bronze Age (five sherds), but predominantly dating to the Middle Bronze Age were unearthed. Judging by that fact that even shallow features, such as cattle (Bos taurus) foot-prints, had been preserved, it was concluded that the site had not been subjected to much erosion.

At Eigenblok-Oost 0.8 hectares was excavated in test-pits (4 by 4 metres) and trenches (2 by 10 metres). Various features were found, that could represent a farm and some palisades or fences. One pit had cross-cut the findlayer (which was dated to the Middle Bronze Age based on analysis of the ceramics) and was dated to the Late bronze Age or Iron age. Although some worked wood had been preserved, the overall conservation of botanical remains was poor. Also, the site had been eroded by flooding after the main phase of occupation.

4.3.2 The excavations

It was decided that parts of Eigenblok West & Oost could only be preserved through final excavation. These excavations started at Eigenblok-West (August 1997-February 1998) and from February 1998 until July 1998 archaeologists concentrated on Eigenblok-Oost. During these campaigns it became clear that more remains were found as were expected. From September 1999 until mid December 1999 site 48 (‘Eigenblok-Vervolg’) was investigated. In the preliminary discussion below these sites will be numbered differently: Eigenblok-Vervolg has been divided into four separate ‘sites’ (numbers 1 to 4).

Site number 5 correlates to Eigenblok-West, whereas Eigenblok-Oost has been assigned number 6.

One should keep in mind that at the time of writing, these sites were not yet published. The information below is therefore based on preliminary reports and personal communication with the excavator.

4.3.2.1 Site 1

Various occupation remains were found on a sandy-silty heightening, and were perhaps -to a certain extent- guided by local landscape morphology. The largest density of features was found on the ‘summit’ of the heightening. Also, some fences seemed to follow the contours of the elevation. Finds stem predominantly from the eastern part of the farmyard. One farm and 19 ancillary buildings were reconstructed. These seem nearly all to be surrounded by a fenced area measuring 45 by 23 metres. Although multiple periods of use seem likely, the relative sequence of the house, fencing and some of the outbuildings -most likely some small huts for storage (Dutch: ‘spieker’) or barns- remains unclear.

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16 For AOO results see: Jongste 1996a, (p. 21-23).
17 See Van Zijverden in prep. (a).
18 Hielkema et al. in prep., paragraph 3.3.
Some grains of *Triticum aestivum* (Bread Wheat) radiocarbon dated to the Early Bronze Age presumably became incorporated in some Middle Bronze Age postholes.19

Two almost completely overlapping house plans were discernible in the southern concentration.23 Finds of ceramics and flint, as well as burned clay tend to concentrate near the centres of these house plans. Multiple fences and a water-well were reconstructed. In an area (measuring roughly two by three metres) near a fence, approaching the eastern floodbasin, numerous cattle imprints were found. North-west of the house, located in the floodbasin, a large feature of burned clay and charcoal -dated to the Middle Bronze Age-B- was discovered.24 Six ancillary buildings were reconstructed, one of which certainly dates to an other phase than house one.

House one measures 24 by nearly 6 metres and was (at least partially) three-aisled in construction. The walls stood 1.3-1.8 metres from the centre posts and were made of wattle and daub. The functional interpretation of the internal division remains unclear. The more open southern end, which also appears to have a more widened entrance, could have housed a cart or wagon.25

House two differs slightly in extent and orientation (NW-SE) from house 1 and therefore its reconstruction is problematic. A possible hearth in the western part might indicate the domestic partition.26 A sample of preserved wood retrieved from a feature that supposedly belonged to house 2 was radiocarbon dated to the start of the Middle Bronze Age-B.27

Site two is located on the northern fringe of a crevasse splay.28 Two separate concentrations of features were discernible. The southernmost was located on the highest part of the crevasse splay, which extended further towards the south. This concentration was separated, by what most likely used to be a wetter depression in the landscape, from a plateau of silty sediments located to the north. Fences cross this area and connect the southern and northern concentrations. The southern concentration is likely to extend even further to the south.

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Site three is located on the border of a larger crevasse splay.28 Trenches were dug to connect it laterally with sites two and four. The large numbers of - mostly smaller- postholes were hard to interpret functionally.29 A certain number of fences could be reconstructed, but certainly more have existed. The larger postholes were used to reconstruct three, of perhaps four ‘granaries’. Only limited numbers of ceramics, burned clay and bone were recovered from both the occupation layer as well as from the features. As with site 2, an area with burned clay and charcoal was found imposed upon the findlayer, suggesting that it originated during, or shortly after occupation.31

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19 Grains from one pit dated to the Early Bronze Age or Middle Bronze Age - A. For radiocarbon dates, location and interpretation of the *Triticum aestivum* grains see Jongste *in prep.*
20 The find density was highest in the eastern part, but possible remains of a floor extended from the central to the western part of the farm.
21 Radiocarbon dates will be published in Jongste *in prep.*
22 Entire subsection after Van Zijverden *in prep.* and Hielkema et al. *in prep.*, paragraph 3.4.
23 Entire subsection after Hielkema et al. *in prep.*, paragraph 3.4.
24 Dating based on personal communication with Peter Jongste (07-08-2000).
26 Hielkema et al. *in prep.*, paragraph 3.4.
27 For radiocarbon dates see: Jongste *in prep.*
28 See Van Zijverden *in prep.*(a), paragraph 2.5.
29 Hielkema et al. *in prep.*
30 Four to six post structure, usually square or rectangular in plan. However, no finds indicative of their function were unearthed.
31 See Hielkema et al. *in prep.*, paragraph 3.5 and Jongste *in prep.*
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### 4.3 The ‘Eigenblok’ complex

#### 4.3.2.4 Site 4

Site four is located on the middle of a body of crevasse-channel deposits that continues in northern direction. The dense clustering of features seems to follow the contours of these crevasse deposits. Both to the north as well as to the west small numbers of features occur outside the crevasse deposits. Several fences, a round structure, a four-post outbuilding and the north-western part of a three-aisled farm were reconstructed.

The house measured at least eleven metres, with a width of 6.7 metres. The south-eastern part of the house has been disturbed by a recent drainage ditch. The arrangement of the wall posts is similar to that of a farm discovered in Blerick. One of the posts belonging to the house was radiocarbon dated to the start of the Middle Bronze Age-B. The reconstructed ‘granary’ overlaps a fence, implicating multiple phases of use.

The reconstructed round structure has a diameter of approximately 3.2 metres, while its entrance is somewhat funnel-shaped and one metre long. A use as corral might be suggested, although similar round structures are usually larger in dimension. Pits of varying diameter and depth were found, both datable to earlier as well as later phases than the house.

Four areas (in general measuring 2 by 4 metres) with yellowish burned clay above a fine layer of charcoal were discovered near and in the floodbasin deposits at several meters from the house. These were formed during or shortly after the occupation at site 4.

#### 4.3.2.5 Site 5

Site 5 is located on the border between the channel deposits belonging to the large meander belt of the ‘Eigenblok’ system and the crevasse-channel deposits that also underlie the archaeological remains at sites 1 to 4. A total of 3850 m$^2$ has been excavated, of which an area measuring 60 by 60 metres was uncovered as a whole. Two separate archaeological levels could be distinguished: The lower one most likely dates to the Late Neolithic or Early Bronze Age, while the upper (separated by a archaeological sterile layer of clay) dates to the Middle Bronze Age. Unfortunately, this separating layer could not be found in all excavation trenches. The remains of a three-aisled farm, fences that (partially) surrounded it, a circular ditch (burial mound) and several ancillary buildings were found.

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**Footnotes:**

32 Hielkema et al. *in prep.*, paragraph 3.5.
33 Entire subsection based on Van Zijverden *in prep.*, paragraph 2.5 and Hielkema et al. *in prep.*, paragraph 3.6.
35 For radiocarbon dates see Jongste *in prep.*
37 Based on stratigraphical arguments (some of ? S.A.) these might be dated to the Late Bronze Age or Early Iron Age (P. Jongste: personal communication, 31-07-2000).
38 Van Zijverden *in prep. (a)*, paragraph 2.5 and Hielkema et al. *in prep.*, paragraph 3.7. On the ‘Eigenblok’ system see chapter 2, paragraph 2.4.7.6.
39 Hielkema et al. *in prep.*, paragraph 3.7 and Jongste *in prep.*
40 This was particularly difficult for the southern part of the site. See Hielkema et al. *in prep.*, paragraph 3.7.
The house measured 22 by 6.7 metres and was three-aisled in plan. In nearly all postholes the poles were present or identifiable. Radiocarbon dating of these timbers yielded dates from the first century of the Middle Bronze Age-B. An entrance at one third of the overall length of the western wall was reconstructed based on the occurrence of two larger postholes and the concentration of ceramics. The possibility of other entrances having existed at the short ends is likely. The northern part is interpreted as the living area, and the southern part as the byre.

Five outbuildings, among which three four-post and one nine-post structure have been reconstructed. Grains and chaff of *Triticum* (wheat) and *Hordeum vulgare* (barley) were retrieved from (second phase) postholes of another -rebuild- rectangular structure that might have served as a grain storage facility.

For the earlier (Late Neolithic and/or Early Bronze Age) phase one four-post structure and one five post outbuilding were reconstructed. Some of the numerous small features could be interpreted as fences of various types. These occur during both phases of occupation, but the fencing that seems to surround the farm most likely dates to the same period as the house.

To the south of the house a circular feature (diameter 7 metres, at the excavation surface 50cm wide and 30cm deep) was excavated. It could not be argued to which period this feature belonged to, but the paleo-sol accommodating the Middle Bronze Age debris seems to lay directly on top of it. The presence of a pit with charcoal and burned clay, as well as human skull fragments found to the east, might implicate a funerary function. If this was a burial mound, than it has to have been levelled before the accumulation of Middle Bronze Age settlement debris.

Various pits were found, dating to both periods, but only a small number could be interpreted functionally. Cattle footprints were found both within, as well as outside the reconstructed farmyard. Remarkably, also three human footprints were discovered among the cattle imprints.

Beside cattle herding, ard agriculture was also practised. The south-eastern corner of the site yielded several furrows, 30-40cm apart, that were orientated both north-west to south-east as well as perpendicular to that direction. These are interpreted as belonging to the Middle Bronze Age occupation phase. A pollen sample of these furrows yielded grains of wheat, barley and (wild) oats (*Avena fataea*). In the north-eastern part of the site ard-marks dating to the earlier period were observed. These were spaced more closely (< 20cm apart) and their prevailing orientation was south-east to north-west.

**4.3.2.6 Site 6**

Site 6 is located on the middle of the same channel deposits that border site 5. The area that yielded the highest density of features (roughly the size of 20 by 70 metres) was fully excavated, while the peripheral areas were investigated through trenches and smaller test-pits.

An intercalating layer of archaeologically sterile clay enables a crude differentiation between three main periods of use: The lowest level represents a phase of Late Neolithic or Early Bronze Age activity on the site. A possible corral, as well as two smaller structures and a burial mound are assigned to this earlier period. No occupation layer dating to this earlier period could be discerned, and it most likely has been eroded.

The paleo-sol located somewhat higher in the profile was identified as the Middle Bronze Age surface. Both features as well as finds were recovered from this layer. The find-distribution analysis shows a prominent concentration toward the area with the largest density of features. The features from this level are interpreted as representing two houses, ten ancillary buildings, several fences and an oval-shaped structure.

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42 See Jongste *in prep.* for the radiocarbon dates.
43 Hielkema *et al.* *in prep.*, paragraph 3.7.
44 The identification of the living area is based on the presence of a hearth and find-concentration analysis. No stable partitions were visible, and phosphor analysis could not identify stable areas. See Hielkema *et al.* *in prep.*, paragraph 3.7.
45 Their shallow depth (average depth 13.7 cm) is explained by the fact that the occupation layer belonging to this phase might have been eroded by later crevassae activity (Van Zijverden *in prep.*(a) and P. Jongste (personal communication, 07-06-2000)).
46 These were dated to the second half of the Middle Bronze Age-B.
47 There seem to be no relation between the position of the fence within the settlement and fence type (Hielkema *et al.* *in prep.*, paragraph 3.7). This contrasts to Liesbeth Theunissen her opinion on the Dodewaard and Zijderveld sites (Theunissen 1999, p. 168).
48 Hielkema *et al.* *in prep.*, paragraph 3.7.
50 Hielkema *et al.* *in prep.*, paragraph 3.7. Based on quantities of materials some pits were identified as refuse pits. One pit is interpreted as a possible drinking pond.
51 See Hielkema *et al.*, Van Dijk & Schelvis *in prep.*: Jongste *in prep.*(a)
52 Hielkema *et al.* *in prep.*, paragraph 3.7.
53 Hielkema *et al.* *in prep.*, paragraph 3.7. However, these seem to cross-cut the several north-west - south-east orientated fences, interpreted as dating to the Middle Bronze Age phase too.
54 Entire paragraph based on Hielkema *et al.* *in prep.*, paragraph 3.8 and Van Zijverden *in prep.*(a), paragraph 2.5.
55 Van Zijverden *in prep.*(a) and P. Jongste (personal communication, 07-08-2000).
A set of ard-marks signifies the third phase of human presence. These are drawn within the upper paleo-sol and sometimes cross-cut the Middle Bronze Age structures.

Fig. 4.10 Major structures at Eigenblok site 6.

In the field house one was visible as a north-west to south-east orientated, three-aisled, farm. Radiocarbon dates and pottery analysis favour a date to the start of the Middle Bronze Age-B\(^{56}\). Its complete length could not be measured because the south-eastern part had been disturbed by a recent ditch. The excavators have reconstructed a farm that measured 6 by 20 metres and that had entrances on both long sides.

The second Middle Bronze Age house, perhaps somewhat younger, differs in construction\(^{57}\). The roof-bearing posts are placed in pairs (with 0.8m between two posts) across the 3.3 metres wide house-centre. Its reconstructed dimensions are 18 metres in length and 6.8 metres in width. At the southern short end an extended entrance might have been present. A set of paired narrow gullies found within the house plan were interpreted as cart-tracks\(^{58}\).

The reconstruction of the outbuildings was problematic, and although postholes used in the reconstruction were often quite similar in depth, fill and diameter they resulted in seemingly irregular structures\(^{59}\). The reconstructed plan of an outbuilding overlaps with house two, and therefore they cannot be contemporaneous. For the oldest phase the interpretations are even more insecure. Some features are interpreted as a (very small: 0.8m by 0.5m) rectangular structure, others as an one metre wide triangular structure. An oval setting of stakes (circa one by two metres) was also discovered at this level, but no certain interpretation could be made.

The burial mound (15 metres in diameter) most have been constructed on the paleo-sol underlying the lower occupation level\(^{60}\). Some features were found underneath the mound, but these could not be interpreted functionally. The mound body consisted of a sandy light clay, that contained iron oxide particles and both unburned as well as burned animal bone fragments. A charcoal concentration found underneath the base of the mound was dated to the Early Bronze\(^{61}\). In the north-eastern quarter of the mound-body a cremation was interred. A rectangular depression (measuring roughly 2.7 by 0.8 metres), possibly representing an inhumation grave was preserved in the centre. Inhumation graves, as well as burial mounds lacking surrounding ditches or posts are known from the Late Neolithic period to the Middle Bronze Age period, but a dating to the Early Bronze Age or Middle Bronze Age-A might be suspected for the central grave and the mound body\(^{62}\).

The extensive ploughing that has occurred at the site after the Middle Bronze Age occupation hindered the recognition of smaller structures like fences\(^{63}\). Only to the north of the house one, a large part of the fencing could be traced. Another part of the fencing was located to the west of house one, and shared its orientation, whereas the fence referred to above was orientated at a perpendicular angle. These might represent the boundaries of the farmyard\(^{64}\).

Perhaps another farmstead, located somewhat more toward the south, is to be expected. The plough-marks referred to above, occur throughout the entire excavated surface. House two and several outbuildings have all yielded five to ten centimetres deep plough-marks right across their ground plans. The prevailing directions for the ard marks are south-east to north-west and south-west to north-east.

4.3.3 Summary

The sites from Eigenblok offer a stimulative picture of Middle Bronze Age occupation in the central Dutch river delta.

\(^{56}\) For radiocarbon dates see Jongste in prep. For pottery analysis see Schouten & Bloo in prep.

\(^{57}\) This type is well-known from other sites (Hielkema et al. in prep., paragraph 3.8): Oss, Nijnsel, Loon op Zand en Maldegem (see Theunissen 1999, p. 193) sites Emmerhout and Angelso (Huijts 1992, p. 37-53 and Harsem 1991, p. 21-29).

\(^{58}\) Hielkema et al. in prep., paragraph 3.8.

\(^{59}\) See plans in Jongste in prep. and descriptions in Hielkema et al. in prep., paragraph 3.8. Entire subsection based on Hielkema et al. in prep., paragraph 3.8.

\(^{60}\) Subsection on the burial mound based on Hielkema et al. in prep., paragraph 3.8.4.

\(^{61}\) See Jongste in prep. for radiocarbon dates.

\(^{62}\) Hielkema et al. in prep., paragraph 3.8 and P. Jongste (personal communication, 07-08-2000). For her study area, Theunissen sees the dominance of inhumation decreasing from 60% in the Early Bronze Age to 27.5% in the Middle Bronze Age – A and finally 18.2% in the Middle Bronze Age – B. This might favour a dating to the Late Neolithic or Early Bronze Age. Corollary, a later date of the cremated remains is likely. Cf. Theunissen 1999, p. 84.

\(^{63}\) Hielkema et al. in prep., paragraph 3.8 and P. Jongste (personal communication, 07-08-2000).

\(^{64}\) Hielkema et al. in prep., paragraph 3.8 and Theunissen 1999, p. 168.
Although the (geo-genetical) setting of these sites within the landscape varies\(^66\), they seem to offer a highly standardised set of archaeological phenomenon\(^66\).

At nearly all sites one (or more) farms dating to the Middle Bronze Age could be reconstructed, but their sequential chronology is unclear\(^67\). These are usually accompanied by several smaller and rectangular ancillary buildings as well as complexes of pits\(^68\). The interpretation of the pits found is problematic, but in a few cases they might represent refuse pits or water wells (or shallow ponds). These elements, or preferably their combination, are seen as a typical representation of a Middle Bronze Age farmyard. Fences sometimes seem to grid reconstructed farmyards. There are numerous (predominantly smaller) features found within these farmyards that could not be grouped into structural entities. These might have belonged to less recognisable (or less preserved) structures (fencing, racks, corrals, etceteras) from a wide range of archaeological periods.

In general, three phases of occupation could be discerned\(^69\). During the first phase (2300-1700 cal. B.C.), ceramics might indicate activities taking place at various sites. At site 5 and 6 nearby occupation might be suspected based on the presence settlement refuse. In the north-eastern part of site 5 ard-agriculture was practised. Burial mounds were erected on sites 6 and 5. During this phase the residual channel of the Eigenblok system would still have contained fresh water, while its levees would have housed lush vegetation, dominated by alder trees.

Hereafter, a crevasse belonging to the ‘Hamelse’ river system\(^70\), located to the north, had eroded parts of this older level. This took place before the Middle Bronze age occupation at various sites. During the second phase (1550-1250 cal. B.C.), occupation - presumably accompanied by ard-agriculture and cattle herding- took place at sites 1, 2, 4, 5 and 6. At site 2 and 3 unclear activities—resulting in large features of burned clay and charcoal- took place in the floodbasin near (within 25 metres) the houses. During this phase, some less destructive crevasse activity might still have occurred.

During the third phase (1000-500 cal. B.C.) evidence for activities are minimal. However, one should keep in mind that materials dating to this phase are more likely to have been disturbed (and become incorporated into the topsoil) by recent ploughing. Drowning of the lower parts of the landscape, might have caused habitation to end around 950 cal. B.C.\(^71\). Ploughing occurred at site 6, while occupation during this phase might have taken place north of site 6\(^72\). At site 2 a six post structure and a pit could be dated to this period. It was not until the Early- or Middle Iron age that this micro-region, once again, became a focal point for human activity.

The cattle imprints found at various sites, the ard-marks at site five and perhaps architectural aspects of house one at site 6, hint at the importance of cattle in subsistence strategies\(^73\). The availability of agricultural products can be illustrated with the presence of wheat, barley and (wild) oats. Remarkably, at site 5 the grains of bread wheat were discovered in the fills of several features\(^74\).

Although in general the conservation of bone was poor, archeo-zoological studies have shed some light on animal husbandry patterns. In general, and during both the earlier (Late Neolithic and/or Early Bronze Age) as well as later (Middle Bronze Age) period, cattle is (in number) the most frequently preserved domesticated animal. These were presumably kept predominantly for their meat\(^75\). However, if one looks to classes of mammal-size, at site 2 and 5 the medium-sized mammals -sheep/goat (Ovis aries and/or Capra hircus) and pig (Sus domesticus/scrofa)- obtain the first place. Pig nearly always is ranked secondly, followed by sheep/goat\(^6\). The most remarkable deviation from this general pattern stems from the Late Neolithic and/or Early Bronze Age phase at site 5. Here, the recovered bones predominantly originated from medium-sized animals, most likely sheep/goat\(^76\).

\(^66\) Van Zijverden in prep.(a) and Hielkema et al. in prep. Entire subsection based on Hielkema et al. in prep., paragraph 3.8.
\(^67\) Entire paragraph after Hielkema et al. in prep.
\(^68\) Hielkema et al. in prep.
\(^69\) This should not be taken as an archaeological interpretation about their contemporaneity. Rather, it is a technical remark stating that these were all reconstructed within the excavated surface.
\(^70\) See Jongste in prep. (Peter Jongste, personal communication, 07-08-2000). Information below on the paleogeography is all derived from Van Zijverden in prep.(a).
\(^71\) Van Zijverden in prep.(a). See also chapter 2, paragraph 2.4.8.5 on the Hamel system.

\(^71\) This was caused by a simultaneous rise of the ground water table combined with sediment subsidence (Van Zijverden, in prep.(a)).
\(^72\) This site was discovered during physical-geographical research, but was not excavated. Van Zijverden in prep.(a) and Peter Jongste (personal communication, 07-08-2000).
\(^73\) See Hielkema et al in prep. on the ‘Eigenblok’ features and Fokkens 1999 on the role of cattle. See also Chapter 5, paragraphs 5.2.4.2 and 5.2.3.1.
\(^74\) Bread wheat has been found at sites ‘Vlaardingen’ (Late Neolithic, Van Zeist 1970 (1986), p. 55-58), ‘Aartswoerd’ (Late Neolithic, Pals 1984), ‘Noordwijk’ (Early Bronze Age, Van Heeringen et al. 1998, p. 28-29), ‘Geldrop’ (Middle Bronze Age, Theunissen 1999, p. 195), ‘Texel-Beatrixlaan’ (Late Bronze Age, Van Heeringen et al., p. 28) and ‘Bovenkarspel-Het Valkje’ (Late Bronze Age, Van Heeringen et al., p. 28). The ard-marks and the physiological defects of a cattle bone fragment point towards their role as traction animal.
\(^75\) A dominance of pig has also been established for other sites (‘De Bogen’ (See paragraph 4.4), ‘Dodewaard’ and ‘Zijderveld’ (Clason 1999) in the Dutch river area.
\(^76\) This is based on the ratio of identified elements of pig/sheep/goat. Van Dijk & Schelvis in prep. p. 41.
Although marten-like species (polecat (*Mustela putorius*), badger (*Melis melis*), beaver (*Castor fiber*)) were recovered from phase 1 and 2 at site 5, and phase 2 at site 6, their importance was presumably the greatest during phase one. They were most likely hunted for their fur, although consumption of their meat is also probable. Fish bones have been too badly preserved to adhere much significance them. One can only say that fresh-water species like pike (*Esox lucius*), perch (*Perca fluviatilis*) and whitefish species (e.g. *Liza ramada*), were present. There are no strong indications, for any site or phase, that large game hunting placed a significant part in subsistence strategies. The assumed ‘drowning landscape’, consisting of swamps, alder bushes and inundated meadows, was confirmed by the archeo-zoological evidence.

### 4.4 The ‘De Bogen’ complex

#### 4.4.1 History of the archaeological enquiry

The ‘Bogen’ complex consists of a grouping of nine sites, that are located within short (500 metres) distances of each other. The sites were discovered during the systematic coring campaign (‘AAI’), which was set up to determine archaeological value of plots of land in the Betuweroute line. Whereas the sites 29-31 and 45 were already grouped during the phase of additional archaeological investigation (AAI), the settlements discovered at the nearby site 28 (‘Knooppunt B – Voetakker’) were added to the complex during the phase of final excavation. At all sites a dark grey layer of settlement debris was found, encompassed within a paleo-sol and superimposed upon sandy-clayey deposits.

To determine whether the suspected Late Neolithic to Middle Bronze Age activity (and for some sites; occupation) could be confirmed, additional archaeological investigation (‘AAO’) took place. The specific research questions aimed to determine the nature, extent and quality of the occupation layers. Specifically, they wanted to know what features and finds were to be expected in both the peripheries as well as the core areas, and whether or not the finds were in situ. In addition, the specific dating and number of the occupation layers, as well as their geological context were investigated.

To answer these questions, 218 additional corings were undertaken (some of which penetrated the entire Holocene sequence) and a total area of 447m² at the western side of the complex (sites 29-31,45) was unearthed in test pits and trenches.

Contrary to what had been postulated based on the AAI, the eastern sites turned out to be located on the westernmost fringes of a crevasse splay, and not on (inverted) channel bed deposits. Nearly all sites yielded features and numerous finds, thus strengthening the interpretation of prehistoric settlement locations. The southern concentration of site 29 yielded ceramics dating to the Late Neolithic and Early Bronze Age, but no features. It was interpreted as a special activity camp. The northern concentration of site 29 was interpreted as a settlement site ranging in date from the Late Neolithic to the Middle Bronze Age. A large number of features, among which postholes, a possible circular ditch and larger pits, were discovered at site 30. The ceramics suggest periods of activity between the Late Neolithic and Middle Bronze Age, perhaps staged at several farmsteads. Site 31 turned out to be a smaller concentration, which was possibly used exclusively as a special activity site during the Early Bronze Age. Site 45 was interpreted as a settlement dating between the Late Neolithic and Middle Bronze Age, although part of it had already been destroyed during the construction of a nearby highway.

At the western side of the complex (sites 28 and 49) six test-pits (covering a total of 58m²) were dug. The presence of features and finds of various artefact categories suggested that the eastern side might have housed one or more prehistoric farmsteads.

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78 Two burned vertebrae might point to their consumption. Van Dijk & Schelvis, in prep., p. 21, 43.
79 This was most remarkably indicated by the study of *Arthropoda* remains. See Schelvis in prep., in: Van Dijk & Schelvis in prep., p. 24-27. See also Van Zijverden in prep. (a).
81 At that time, also site 49 (‘Voetakker-Vervolg’) was added to site 28, and thus to the total of the ‘Bogen’ complex.
82 Van Zijverden in prep. (b) and Jongste & Smits 1998.
86 Jongste & Smits 1998, p. 31-33, 40.
89 Cf. Bulten & Smits 1998a. Again, site 49 was not added/investigated yet. This was to happen during the phase of final excavation.
As the Late Neolithic ceramics that were discovered were interpreted as stray finds, Middle Bronze Age (MBA-A) occupation seemed most likely\(^{90}\).

Based on the findings stated above, combined with the established fair conservation of (macro)botanical and faunal remains, all sites were declared worthy of preservation\(^{91}\). As preservation could not be ensured through changes in the planned railway location, excavation (‘DO’) was necessary.

4.4.2.1 Site 30

Site 30 is located on crevasse deposits and is the northernmost site of the larger sites at the ‘De Bogen’ complex. Features dating from the Late Neolithic to the end of the Middle Bronze Age were found, as well as (on a higher level) an Iron Age or Roman Age rectangular feature\(^{92}\). Based on the assumption that no houses were present simultaneously at site 30, a maximum of eight phases of occupation is reconstructed\(^{93}\). The fact that nearly all features were recovered from directly underneath the findlayer and showed little variation in depth, texture, dimensions and colour made it impossible to assign single posthole to separate phases. The find-layer has been selectively sampled in test-trenches (measuring two by two metres) and yielded material dating from the Late Neolithic-B to the Middle Bronze Age\(^{94}\).

4.4.2.2 Site 29

Site 29 consists of two large concentrations of features situated on a lobe-shaped sandy crevasse deposit\(^{95}\). Pottery collected in sample-pits and feature analysis has pointed out that three to eleven phases of occupation between the Bell Beaker period and the Middle Bronze Age-B might have been preserved.

In the north-western part of the site three overlapping house plans (one two-aisled and two three-aisled) have been discovered alongside a number of four and six-post outbuildings and fences\(^{101}\). In this part of the site cattle-imprints were also found. In the north-eastern part of the site two more two-aisled farms were found, one of which differed in orientation from other nearby structures.
Various rectangular structures found in the north-eastern part could not be assigned to a certain phase or farm. To the south of this area two nearly identical overlapping three-aisled house plans demonstrate the continuous exploitation of a particular plot for habitation. On the south-western fringe of the site a possible two-aisled farm was found, although the excavators are not certain about its interpretation. Several metres to the north of this possible two-aisled farm two overlapping three-aisled house plans were discovered. The central area between all these farmsteads was relatively 'empty', except for some fences and a cluster of wells. A very long palisade (nearly 175 metres) fenced-off the north-eastern part of site 29. Numerous smaller fences have been excavated in various other parts of the excavated surface.

4.4.2.3 Site 45

Site 45 is located on the highest part of the crevasse deposits. The fact that later crevasse activity has largely destroyed the upper part of the findlayer, and that no difference in stratigraphical position between features was discernible complicated the dating of features and structures. The typological study of house-plans and ceramics suggests phases of occupation during the Late Neolithic and the Middle Bronze Age. Several houses, outbuildings, ditches, pits and fences were reconstructed. A burial mound with three circular ditches and five interments is the most remarkable feature on this site. Feature density appears to be the largest on the higher parts of the crevasse deposits.

The burial mound has been used during at least four phases, starting in the Late Neolithic. Placed centrally under the mound, in crouched position and facing the south-east, a male had been interred during the Late Neolithic period. A baby had been buried - together with cup dating to the Bell Beaker period, at the Late Neolithic period. A young adult was buried in stretched position together with a bronze needle and a three-aisled farm has been excavated to the north-west of the burial mound, as well as a three-aisled farm with two 'granaries' located directly north of the burial mound. To the east of this farmstead a fourth farmstead, comprising of a farm and at least two outbuildings was discovered. The various fences are of both the single- as well as the double-post type but neither one does seem to clearly define farmstead areas.

4.4.2.4 Site 28

Site 28 consists of four concentrations of archaeological remains that have accumulated upon a narrow stretch of crevasse deposits bordering a floodbasin. For the sake of clarity these will be dealt with separately below. As the results from the excavations of these sites predominantly affirm the patterns discernible at sites 30, 29 and 45, they will not be discussed to the same extent.

At a later phase a secondary burial of an adolescent - in crouched position- took place. Based on their shared orientation, this individual was possibly interred during the same phase as a young child whose grave goods suggest a dating to the Late Bronze Age or Early Iron Age. During the excavation of the mound over 400 features were interpreted as post-holes, suggestive of a phase of occupation before the second mound period. It is tempting to interpret the large quantities of materials (of multiple artefact categories) that have been recovered from pits in -the direct vicinity of- the mound as the result of votive offerings. However, these 'odd' depositions are not confined to pits; large quantities of charred grain have been found in postholes within the mound body.

Various features to the east of the burial mound were interpreted as a three-aisled farm and some isolated pits. The area to the south and west of the mound is dominated by smaller features, presumably belonging to fences that sometimes extent to the north. Another Middle Bronze Age three-aisled farm has been excavated to the north-west of the burial mound, as well as a three-aisled farm with two 'granaries' located directly north of the burial mound. To the east of this farmstead a fourth farmstead, comprising of a farm and at least two outbuildings was discovered. The various fences are of both the single- as well as the double-post type but neither one does seem to clearly define farmstead areas.

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102 Hielkema, Brokke & Meijlink, in prep., paragraph 3.4.3.
103 Entire paragraph (4.4.2.2) based on: Hielkema, Brokke & Meijlink, in prep., paragraphs 3.4.1 to 3.4.6.
104 See Van Zijverden in prep(b) and Hielkema, Brokke & Meijlink, in prep., paragraphs 3.5.1 to 3.5.
105 Entire paragraph (4.4.2.3) based on: Hielkema, Brokke & Meijlink, in prep., paragraphs 3.5.1 to 3.5.7.
106 The Early Bronze Age seems to be underrepresented. See Ufkes & Bloo in prep paragraph 4.4 and Hielkema, Brokke & Meijlink, in prep., paragraph 3.5.1.
107 Hielkema, Brokke & Meijlink, in prep., paragraph 3.5.1 and Van Zijverden, in prep(b). This was also the case at 'Eigenblok'. See Chapter 4, paragraph 4.3.2.
108 Entire subsection on the burial mound based on Hielkema, Brokke & Meijlink, in prep., paragraph 3.5.7.
109 The finds suggest both a male sex for the individual as well as a dating to the Middle Bronze Age.
111 Hielkema, Brokke & Meijlink, in prep., paragraph 3.5.7.
112 See Hielkema, Brokke & Meijlink, in prep., paragraph 3.5.7 and Hänninen & Van Haaster in prep., paragraph 10.3.2.
113 One of these actually yielded grain samples that were radiocarbon dated to the Middle Bronze Age-A. Hielkema, Brokke & Meijlink, in prep., paragraph 3.5.3.
115 Entire paragraph (4.4.2.4) based on: Hielkema, Brokke & Meijlink, in prep., paragraphs 3.6 to 3.9.
Site 28-1

Occupation of the crevasse deposits took place during at least four phases spanning the Early- to Middle Bronze Age. As both the distribution of finds nor the litho-stratigraphy of features offered possibilities for more precisely defined dating, the interpretation of contemporaneous features and structures was problematic. However, the same stereo-typed picture of a Middle Bronze Age farmstead can be reconstructed. One very regular alongside (up to thirteen) outbuildings have been reconstructed. Some effort was made to reconstruct two-aisled (Early Bronze Age) houses from rows of centre-posts, but these could not be established beyond doubt. The farmstead is completed by the presence of numerous fragments of fences, clusters of pits and cattle-imprints.

Site 28-2

This site most likely represents a peripheral part of a prehistoric settlement. Ceramics retrieved from the findlayer ranged in date from the Late Neolithic period to the Middle Bronze Age. As features were only visible on the surface directly underneath the findlayer, their stratigraphy could not be used to assign features or structures to different phases of habitation. Apart from a residual crevasse gully that had most likely filled-up prior to human occupation, a four-post ‘granary-type’ outbuilding was the most prominent feature.

Site 28-3

Like 28-2, this site most likely represents a part of a settlement. As the find-density was low and the retrieved pottery was predominantly dated to the Middle Bronze Age, a single phase of occupation during this period is suspected. One ancillary building and a (part of a) fence, as well as five pits have been excavated.

Site 28-4

Site 28-4 has been somewhat more extensively investigated. Analysis of the ceramics showed that these predominantly consisted of Middle Bronze Age ceramics, supplemented by a much smaller Early Bronze Age component. As no stratigraphical differentiation of the features was possible, typological dating by house plan and ceramic evidence was applied. Based on the existing overlap between house plans, at least six phases of occupation must have taken place.

Two (Early Bronze Age) two-aisled houses were reconstructed, as well as four three-aisled farms. Both a six-post and a four-post outbuilding have been reconstructed, although it is not clear to what phase these belong. The same holds true for the fences and the well that were excavated in the southern part of the site 28-4.

4.4.3 Summary

The complex of sites known as ‘De Bogen’ comprised several prehistoric farmsteads. These range in date between the Late Neolithic period and the Middle Bronze Age. Especially for the Early (Late Neolithic and/or Early Bronze Age) phase the settlement structure remains unclear. Based on the occurrence of several two-aisled farms and the radiocarbon dates obtained from burned cereals, exploitation of the landscape for habitation and agriculture is assumed. However, to determine the exact role of agriculture remains dubious.

The cattle-imprints found at the ‘De Bogen’ sites might indicate the importance of cattle breeding, although some of these are thought to have been formed after the Middle Bronze Age. The ‘ard-marks’ found during excavation are too much under discussion to play any significant role.

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116 Van Zijverden in prep.(b) and Hielkema, Brokke & Meijlink, in prep., paragraph 3.6.
117 Hielkema, Brokke & Meijlink, in prep., paragraph 3.6.
118 It should be pointed out the orientation of the large house (40 by 6.5 metres) followed the (east-west) orientation of the crevasse deposits. Hielkema, Brokke & Meijlink, in prep., paragraph 3.6.4.
120 Hielkema, Brokke & Meijlink, in prep., paragraph 3.6.
121 Entire subsection on site 28-2 based on Hielkema, Brokke & Meijlink, in prep., paragraph 3.7.
122 For details on site 28-3 see Hielkema, Brokke & Meijlink, in prep., paragraph 3.8.
123 Some fragment of Early Bronze Age pottery were also found. Hielkema, Brokke & Meijlink in prep. paragraph 3.8.1 and Ufkes & Bloo in prep.
124 Entire subsection on 28-4 based on Hielkema, Brokke & Meijlink, in prep., paragraph 3.9, Van Zijverden in prep.(b) and Ufkes & Bloo in prep.
125 Hielkema, Brokke & Meijlink, in prep., paragraph 3.9.
126 Hielkema, Brokke & Meijlink, in prep., paragraph 3.9.
127 See Ufkes & Bloo in prep. and Hielkema, Brokke & Meijlink in prep.
128 It has already been introduced above that features could not be assigned stratigraphically to individual phases or farmsteads (Hielkema, Brokke & Meijlink in prep. and Chapter 4, paragraph 4.4.2). Furthermore, the features of the ‘De Bogen’ complex in general have preserved little datable material. Personal communication: B. Meijlink.
129 Hielkema, Brokke & Meijlink, paragraph 3.11 and Van Zijverden in prep. (b), paragraph 2.6.1.
Based on the physical-geographical research, agricultural fields might have been located on nearby crevasse deposits or channel bed deposits of the ‘Eigenblok’ system located at circa 4 kilometres from the settlements\(^{131}\).

The three-aisled farms typical to the Middle Bronze Age are generally well-known from other sites and easier to reconstruct because of their more regular lay-out. The larger number of three-aisled farms reconstructed at the ‘De Bogen’ complex perhaps underline this unequal visibility. Radiocarbon dates confirm the assumption that various farmsteads have been erected during the Middle Bronze Age-A and the first two centuries of the Middle Bronze Age-B\(^{132}\).

At various sites the plans of houses were found superimposed on more or less the same spot, as were those of the outbuildings. Pits too seem to cluster in specific parts of the farmyard during -subsequent ?-phases. Unlike at the ‘Eigenblok’ sites, the location of fences does not seem to be guided by landscape morphology\(^{133}\). I agree with the excavators that this might reflect a ‘Middle Bronze Age farmstead lay-out tradition’\(^{134}\). The high numbers (e.g. up to four at ‘De Bogen’ site 28-4) and shared orientation and lay-out of the superimposed three-aisled house-plans\(^{135}\), as well as the ceramic\(^{136}\), evidence point towards long, perhaps continuous, exploitation of this micro-region for habitation during the Middle Bronze Age.

If we focus more upon the relation between the settlements and the landscape, the general trend\(^{137}\) of settling on the higher sandy -crevasse- channels amidst the lower and wetter floodbasins seems to be confirmed\(^{138}\). All sites of the ‘De Bogen’ complex are located on the higher accumulations of crevasse and floodbasin deposits belonging to various phases of (renewed) activity of the ‘Eigenblok’ system\(^{139}\). The paleo-soil that had formed during the period of occupation testifies of a phase of decreased sedimentation, although in the floodbasin some sedimentation and gradual ‘drowning’ of the landscape did occur\(^{140}\). Presumably caused by a combination of sediment subsidence and continuous rise of the ground water table, the lower parts of the crevasse deposits gradually became uninhabitable\(^{141}\).

Both the inactive residual crevasse channels as well as the wells created by man would have provided fresh water to the occupants\(^{142}\). Wells were already constructed as early as the Late Neolithic period and hardly varied in construction from those dated to the Middle Bronze Age. Remarkably, they are all situated in depressions of the landscape and all penetrated the sediments to reach the level of the second aquiferous layer, most likely to avoid the chemical contamination by phosphates and nitrates (caused by presence of man and cattle) that might have polluted the first (less deep) aquifer.

Paleo-botanical investigations offer an insight into the vegetation of the landscape during occupation\(^{143}\). This largely corresponds to the vegetation one would expect in a fluvial setting\(^{144}\). Ponds of fresh water in the lowest parts of the floodbasin were bordered by reeds, alder, ash and willow while the higher parts of the crevasses housed an open vegetation of oak, hazel, birch, elm, linden and sloe (Prunus spinosa)\(^{145}\). The recovered grains of emmer-wheat and barley (Triticum dicoccon and Hordeum vulgare) might have been cultivated on the lower parts of nearby crevasse deposits\(^{146}\).

\(^{131}\) Van Zijverden in prep.(b) and Hielkema, Brokke & Meijlink in prep.
\(^{132}\) Radiocarbon dates will be published in Hielkema, Brokke & Meijlink in prep.
\(^{133}\) Hielkema et al. in prep., paragraph 3.3.2. In general, feature-density decreases with height towards the floodbasin. For the ‘Eigenblok’ complex sites see Hielkema et al. in prep. and this chapter, paragraph 4.3.
\(^{134}\) Hielkema, Brokke & Meijlink in prep., paragraph 3.6.5 and 3.9.5. However, I am very reluctant to confine this to the Middle Bronze Age exclusively. Although no coherent picture can be formed yet, examples of all ‘typical’ farmstead elements like fences, pits, ditches, wells and farms dating to the Early Bronze Age have been found (Hielkema, Brokke & Meijlink in prep.). The discovery and archaeological investigation of ‘single phase’ Early Bronze Age farmsteads in the future will help to unravel what is typical to farmsteads during what period and ‘short-term and long-term cultural biographies of farmsteads’ (see also Gerritsen 2000 on the cultural biography of farmsteads).
\(^{135}\) Hielkema, Brokke & Meijlink in prep.
\(^{136}\) Ulkes & Bloo in prep.
\(^{137}\) Examples from the Dutch river area are the sites ‘Molenbaarsgraaf’ (Louwe Kooijmans 1974), ‘Zijderveld’, ‘Dodevaard’ (Hulst 1991 and Theunissen 1999), ‘Kesteren’ (Sier in prep.), ‘Lienden’ (De Voogd in prep.) and the ‘Eigenblok’ complex. (Van Zijverden in prep.(a) and Hielkema et al. in prep).
\(^{138}\) Van Zijverden in prep.(b), paragraph 2.5.2.

\(^{139}\) On the ‘Eigenblok’ system see: Van Zijverden in prep.(a), paragraph 2.4.5, Van Zijverden in prep.(b), paragraph 2.5.2, Stouthamer in prep., and Chapter 2, paragraph 2.4.7.6.
\(^{140}\) Van Zijverden in prep., paragraph 2.5.2.
\(^{141}\) On the local situation see Van Zijverden in prep.(b), paragraph 2.5.2. On rise of the groundwater table see Van Dijk et al. 1991 and Van de Plassche 1980. On subsidence see: Van Zijverden in prep.(a) and Locher & De Bakker 1990.
\(^{142}\) These observations were made by Wilko van Zijverden (Van Zijverden in prep.(b), paragraph 2.5.3).
\(^{143}\) Hänninen & Van Haaster in prep., paragraph 10.5.
\(^{144}\) On the vegetation (successions) of former riverbeds see: Donselaar 1961.
\(^{145}\) Hänninen & Van Haaster in prep., paragraph 10.5.
\(^{146}\) Hielkema, Brokke & Meijlink in prep. and Hänninen & Van Haaster in prep., paragraphs 10.3.2 and 10.5.
The presence of a landscape housing both wetter areas and more open and forested drier grounds has also been attested by the study of the faunal remains. Some observations on the use of domesticated animals could be made. Cattle seem to have played the most prominent part and were most likely kept for their meat and to a lesser extent traction power. Most cattle was slaughtered at older age, which might point to a marginal importance of milking, as well as to a possible as traction animals. Live cattle provided traction, manure and some milk, while butchered they provided meat, hides and bone which has been used to manufacture implements.

There is some degree of variation between the various sites if we look to whether pig or sheep/goat were most important species second to cattle, but they are generally nearly equal in numbers and/or weight. The role of hunting of large mammals, (water)birds and fish appears to have been minimal in general. Some red deer (*Cervus elaphus*), aurochs (*Bos primigenius*), swine (*Sus scrofa*), beaver and otter (*Lutra lutra*) were hunted for hide and meat, although the antler indicative of red deer might have been gathered when shed. Most recovered species of fish thrive excellently in still or moderately flowing water.

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147 Entire subsection after Van Dijk, Esser & Zeiler *in prep.*

148 The reader should be aware that most of the bone material that was analysed originated from the find-layer, and therefore represents the (disturbed) accumulation of material dating to between the Late Neolithic and the Middle Bronze Age. Unlike at the ‘Eigenblok’ complex, no distinction between these phases was possible.

149 This, of course is a simplified remark. Deformations on two cattle bones might indicate intensive strain (during young age), but it is ill-advisable to draw serious conclusions upon such low numbers of bones. Van Dijk, Esser & Zeiler *in prep.*

150 For implements of both bone and antler see: Van Dijk, Esser & Zeiler *in prep.*

151 Van Dijk, Esser & Zeiler *in prep.*

152 Among the species identified: pike (*Esox lucius*), perch (*Perca fluviatilis*), bream (*Abramis brama*), tench (*Tinca Tinca*) and roach (*Rutilus erythrophthalmus*).
5. Theory

5.1 Introduction

The purpose of this chapter is to offer a general introduction to the theoretical evolution of Late Neolithic and Early- and Middle- Bronze Age settlement archaeology, with an emphasis on Beaker archaeology in north-western Europe in particular. Archaeological conceptualisation is imperative to the reconstructing and understanding past human behaviour, yet through its intrinsic inadequacy and variability through time, a factor of distortion in itself. Therefore, knowledge of the changing theoretical backgrounds in archaeology is vital to evaluate former publications and opinions.

It should be pointed out that this chapter does not aim to provide an all-comprising overview of models and theories concerning Late Neolithic or Bronze Age settlement archaeology. Only general highlights and trends, in somewhat more detail if concerning Dutch settlement archaeology, will be discussed. In this chapter I will try to illustrate the dichotomy that exists between research strategies applied in Late Neolithic and (Early- and Middle-) Bronze Age archaeology. A historical overview is created to expose and evaluate these differences. In my opinion, both general knowledge of models and theories in Late Neolithic and Bronze Age archaeology as well as my personal viewpoints towards these, is needed to comprehend and criticise the archaeological interpretations that will be presented in the synthesis (chapter 6).

First, the history of Late Neolithic archaeology will be discussed. Although a focus on settlement archaeology is attained, perspectives facilitating the understanding of Late Neolithic archaeology in general will not be omitted. Thereafter, the evolution of Early- and Middle Bronze Age archaeological concepts will be dealt with, albeit in less detail. For the sake of manageability, for this period an even stronger focus upon settlement archaeology will be maintained. Finally, a short summary is presented.

5.2 The history of Late Neolithic archaeological theory

5.2.1 Culture-historical approaches (1880-1940 A.D.)

The decades marking the change between the 19th and 20th century, can be characterised as a phase during which archaeologist sought to classify and preferably culturally ascribe material culture to peoples.

Since Cartailhac’s first description of ‘bell shaped’ vessels from Palmela in 1886, the study of pottery types was to become the predominant research topic in Late Neolithic archaeology for-at least-the next thirty years. The preoccupation with these typologically better classifiable -elaborately decorated- vessels undoubtedly caused the study of less eye-catching finds and cultures to lag behind.

Therefore, early twentieth century Late Neolithic archaeology is almost invariably ‘Beaker’ archaeology. The European ‘uniformity’ of the Beaker material called for an analysis of its dispersal throughout Europe.

Three types of approaches are discernible: Some authors reconstructed Beaker core areas based on type density, without paying much attention to the specific paths and timing of its ‘migration’ into Europe. The second option was to link Beaker dispersal to the spread of copper metallurgy, often resulting in the reconstruction of an Iberian origin. The third approach often resorted to, was the presumption of Beakers representing an ethnic entity or ‘Beaker Folk’. This last method of interpretation was by far the most long-lived, lying dormant perhaps even until today in the minds of some archaeologists, albeit far less explicit.

Furthermore, early twentieth century Late Neolithic archaeology was almost invariably burial mound archaeology. Due to the explorative policy of the curators of the Dutch National Museum of Antiquities, much research on burial mounds was undertaken in the Netherlands. During the first three decades of the previous century almost 120 mounds were recorded and partially excavated.

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1 For these first typological approaches see: Cartailhac 1886, Voss 1895, Reinecke 1900, Montelius 1898 and Götze 1900. For the Netherlands see: Åberg 1916.
2 The discussion about a division of Beaker ceramics into a "Neolithic" (‘cord decorated’ or ‘Jutland’) group and a "Copper Age" (‘Bell Beaker’) group lasted until the thirties and early forties of the last century.
3 Cf. Montelius 1898.
4 This was advocated by H. Schmidt between 1909 and 1915. See Schmidt 1909 and Schmidt 1913.
5 The first to adhere ethnic relevance to Beaker ceramics was the German A. Schliz. His works between 1906 and 1910 influenced (among others): H. Größler (1909), J. Abercromby (1912), J. Palliardi (1919) and H. Peake (1922).
6 For example see the Crémade-model put forward in 1995. The implications of ethnic ‘being’ of Bell Beaker groups is barely implicit: ‘The aspects described indicate that the Bell beaker population made their presence explicit and wanted to distance themselves from local populations.’ (Translation of: ‘Die beschriebenen Merkmale zeigen, daß sich die Gluckenbecherpopulation bewußt zu erkennen gab und sich gegen die einheimische Bevölkerung absetzen wollte.’). See Benz & Stadelbacher 1995, p. 392.
7 For an overview of results up to 1933: Bursch 1933, p. 114-123.
Crude as these excavations now may seem, the enormous quantities of materials unearthed by these early researchers stimulated Dutch Beaker research and resulted in -among others- the publications by J.H. Holwerda (1915) and A.E. Remouchamps (1923)

As is to be expected, the shape and structure of the graves and the interpretation of the therein discovered remains dominated both the research strategies as well as the publications. In no way acknowledging the biased nature of this data from burials, archaeologist developed theories in which the Beaker Folk was depicted as warriors, merchants or ‘...an internationally wandering horde, half armed with bows and half merchant nomads...’

Summarising it can be noted that Beaker archaeology before the second world war followed on both national as well as European scale a general pattern: After the process of identification and classification of forms, these forms were seen as representing an archaeological culture, which was thereafter directly equated to -the immigration of- an ethnic group. Little attention was paid to the cultures preceding the Beaker period in various regions. This was caused to a certain extent by the far smaller number of find spots, as a result of its far more problematic identification, and perhaps its less intriguing material culture.

5.2 Regional typologies (1940-1970)

The second phase of Beaker archaeology, roughly starting during and after the second world war, can be characterised by a return to increased research on describing, classifying and chronotyopological ordination of Beaker commodities. Although not always very successful, investigators tried to avoid the theoretical and methodological pitfalls which they inherited from the preceding decades. The rigid equation of material culture to -the movements of- ethnic groups was no longer adhered to without question.

Instead of discussing topics like ‘ethnicity’, much attention was given -often concentrated on a national level- to the establishment of regional chronotyopologies, resulting around 1960 in evolutionist typological diagrams for numerous European countries.

The typological scheme introduced by W. Glasbergen and J.D. van der Waals in their 1955 article 'Beaker types and their distribution in the Netherlands' was the most thorough typological study of Beaker pottery then known. Its content and implications will briefly be outlined below.

5.2.2 The Glasbergen – Van der Waals typology

In their introduction they characterise the problems of former studies as resulting from lack of uniform methodological nomenclature, determinations thus varying from archaeologist to archaeologist.

Three main categories of Beaker pottery were distinguished by them: The first are the 'rusticated' or all-over finger-tip ornamented Giant Beakers (dutch: 'Potbekers' / German: 'Riessenbecher' / Pot Beakers), which were not dealt with in that article. The second group comprised the 'Beakers with a small but distinct protruding foot, and ornamentation limited to the upper part' (Dutch: 'Staandvoetbekkers' / Protruding Foot Beakers). Absence of a protruding foot and a relatively flat bottom, combined with decoration not limited to the upper part defined the last category; the Bell Beakers (Dutch: 'Klokbekers' / German: 'Glockenbecher').

Their chrono-typological diagram for Protruding Foot Beakers in the Netherlands derived part of its authority by the fact that some radiocarbon dating was done on '1' type' Beakers. This, however, should not be overrated. Most of the diagram was founded on evolutionist presumptions about succession and derivation of decorative style.

Despite this, through careful analysis of the numerous finds they managed to establish a relatively certain typochronology.

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* In the Netherlands J.H. Holwerda and A.E. Remouchamps represent archaeologists regarding the Beaker phenomenon as the material remnants of a distinct 'culture', while the opposite was advocated by A. E. van Giffen. See Van Giffen 1930.

* Translation of: 'internationaler schweifender Horden, halb Händler und halb bogenbewaffnete Nomaden'. See Schütz 1906. According to Bursch, the ferocious nature of these immigration was 'clearly' indicated by grave good finds of arrowheads, wrist-guards and daggers, and its quick spread from Holland to Britain (Bursch 1933, p. 108).

* Sangmeister stated in 1951 that it was certain, that what had been classified as a "culture" did not always represent a specific ‘people’, or at least not a political entity (Sangmeister 1951, p. 74). This contrasted to V.G. Childe’s notion of the Beaker people, in both an ethnic and a political sense. See Childe 1957, p. 223.


* Sangmeister 1951, p. 74.

* See appendix IV.

* Some examples of the Beakers that we would now classify as belonging to the Single Grave Culture, were presented by them as the result of 'local evolution under the influence of the Bell Beaker culture', implicating their contemporaneity. See Glasbergen & Van der Waals 1955, p. 12.
In their analysis of the Bell Beaker group they identify a ‘true’ Bell Beaker series -mainly employing dentated spatula decoration, the 2³ type- and a subgroup of beakers borrowing the decorative techniques of the Beakers with protruding foot, the 2⁴ type. This diagram, again largely based on increasing complexity of the decoration, is reprinted in appendix IV.

Concluding it can be said that through its solid typological framework, Glasbergen & Van der Waals’ study structured Beaker archaeology for the better. Although still exclusively focussed on grave finds, they implemented meaningful subdivisions and were the first to suggest the synchrony of 2³ type Beakers and 1⁴ Beakers, heralding the later to be established Protruding Foot Beaker - All Over Ornamented - Bell Beaker sequence. Presumably as a side effect to the enthusiasm accompanying this publication, the results were all too often extrapolated to areas which lacked sufficient data to support its local implementation.

Indeed, there is some evidence to suggest that in some areas the typology of Glasbergen & Van der Waals recoiled on the archaeological research. The approach used by Hajek in his 1966 publication of ‘Die älteste Phase der Glockenbecherkultur in Böhmen und Mähren’ is notorious for its circular argumentation. Also, J. Guilaine’s (1967) essay on Bell Beaker finds from southern France in 1967 relied (perhaps too) heavily on Glasbergen & Van der Waals’ conclusions.

5.2.2.2 Subsistence, trade and settlements; the first attempts

On the other hand, the publication by Guilaine referred to above can be used equally well to illustrate the gradual emerge of a new viewpoint towards Late Neolithic research. Although far from explicit, J. Guilaine widened the scope of Beaker research to topics like ‘social dynamics’, ‘acculturation’, and more nuanced view towards trade. His goal was not (only) to date the artefact, but to unravel the cultural contexts.

To do this, perhaps for the first time, the data from graves was supplemented by data from settlement sites that had yielded beaker materials, as well as ecological and anthropological data. This holistic approach was needed to study social aspects like ‘trade’ and ‘subsistence’.

Guilaine’s model of Beaker people -representing small dynamic groups that gradually intermingled with local populations in which they sometimes came to represent a trading oligarchic class- received only minor attention. However, the system of classification and dating he excogitated, although admittedly hypothetical, without much criticism became the background for French Beaker archaeology.

In general, it can be concluded that during the fifties and sixties of the last century only a marginal number of authors effectively were able to shift the balance in Beaker research from (historical-descriptive) typological investigations to social-cultural related topics like ‘trade’, ‘subsistence’ or ‘group dynamics’. However, the first attempts to integrate settlement data had been made.

5.2.3 (Re)defining the ‘Beaker Folk’; practise and theory (1960-1980)

A number of general trends in Late Neolithic archaeological theory can be seen evolving side by side during the sixties and seventies. First of all there is a continuation of the more natural-scientific strategies investigating typology, technology, metallurgy and physical-anthropology. Secondly, increasing attention was paid to the several ‘subsystems’, which are nowadays seen as type fossils of processual archaeology. Thirdly, researchers concentrated on establishing a firm theoretical and methodological background.

It also should be noted that L. P. Louwe Kooijmans published his extensive thesis on the Rhine/Meuse delta in 1974. With scrupulous attention to details, the excavation data of the Late Beaker-Early Bronze Age settlement ‘Molenaarsgraat’ were published and placed in broader archaeological perspective.

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18 See: Hajek 1966, especially page 211 and 238.

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21 Guilaine 1967, p. 102, 111, 188.
24 Whereas the economic, social and ecological subsystems had already received considerable attention, the role of ideology in Late Neolithic change (again, exclusively in burial rite?) was first addressed by Ulrich Fischer in 1975. See also the discussion on the Corded Ware – Bell Beaker opposition based on Fischer (1956, 1975, 1976) and Häusler (1977, 1990) in Benz & Stadelbacher 1995, p. 393.
5. Theory

5.2 The history of Late Neolithic archaeological theory

Louwe Kooijmans’ depiction of the ribbon of farms on the former channel deposits near break-through channels, consisting of small local communities, who practised cattle breeding, agriculture and fishing - as opposed to little hunting - perhaps never left the minds of archaeologists since 25.

The efforts of E. Sangmeister in 1972 to reinstate the discussion about ‘Beaker culture’ versus ‘Beaker phenomenon’ and his objective to test the -increased- data for indication of social and economic structure, encompassed the first two trends described above 26. More examples can be found in the presentations held at the Bell Beaker symposium in Oberried between the 18th and 23rd of March 1974. The introduction of the ‘Dutch Model’ by Jan N. Lanting and Jan D. Van der Waals and more theoretical discussions will briefly be explored below.

5.2.3.1 The ‘Dutch Model’

In general, Lanting & Van der Waals their 1976 article on ‘Beaker Culture relations in the Lower Rhine Basin’ is seen as presenting the substantiating arguments for Glasbergen & Van der Waals (1955) study on Beaker pottery. Its influence, which was considerable, was for the better part derived from the vast data set of radiocarbon dates underlying their study, some of which had already been by J.N Lanting, W.G. Mook and J.D. van der Waals in 1973. Direct association of beaker types found in graves in the Dutch / German Rhine Basin were also presented.

Their aim was clearly stated in the introduction:

‘It is our intention to demonstrate that in the Lower Rhine Basin the burial practises of the PFB and BB, as evident from the archaeological remains of graves and grave-goods, form part of one, continuous development, and that it is in the course of this development and in this area that the earliest beakers of the AOO group and of the maritime type follow the beakers usually labelled PFB.’ 27.


Albeit perhaps reminiscent of the functionalist attention towards typology, one cannot but conclude that the model of continuity put forward by Lanting and Van der Waals became very influential. They warned their readers not to automatically adhere great significance to their, or other regional typochronologies, if applied to other regions. This, however, quite often was the case 29.

Data from settlements was merely presented as to verify that the same development in pottery could be traced, although the special status of the large, often rusticated, Pot Beaker ‘settlement’ ceramics was acknowledged 28. They concluded that the absence of deep pits and convincing postholes was typical to Beaker settlements in general, and that this low degree of details on settlement data held true for the PFB, AOO and the BB period.

Fig. 5.1 Typological scheme by Lanting & Van der Waals.

26 Sangmeister 1972, p. 189, 192.
29 Critical remarks were voiced by Strahm 1979 and, much later, Roussot-Larroque 1990. See also Van der Beek & Fokkens in prep.
Without discussing the possible causes for this, they state that great differences in pottery style can exist between core areas of ceramic distribution (typified by numerous finds, and well-established chronologies) and peripheral areas. In peripheral areas classifications are less sound and decoration is sometimes perceived as a ‘regional’ style, with a clear connotation of being retained on an lower evolutionary stage. In the Netherlands, the Dutch model was predominantly used as a touchstone for settlement finds.

5.2.3.2 Theoretical approaches: ‘Interaction spheres’ and ‘Beaker Networks’

In both the contributions of Case and Shennan it is stressed that the variations in the nature of the Beaker ‘phenomenon’ represent series of interaction spheres. H.J. Case suggested that (Beaker) material culture should not only be assessed through ‘the complete range of association of its component artifacts’ but ‘by placing these associations in a wide scale of contexts, regional, environmental, technical, economic and in correspondence to basic human need’ aiming towards contextual archaeology. From such holistic viewpoint courageous aims as to ‘understand the cumulative causes of the variability in beaker assemblages within particular contexts and varied ecologies, in both domestic sites and in graves, across limited spans of time and space.’ as had been put forward by Clarke were perhaps achievable.

David L. Clarke’s model was innovative in that it provided an interpretational background to the exchange of commodities in the Late Neolithic that was partially based on, or at least encompassed, settlement sites as a parameter. The key motivation for inter-site exchange in Clarke his model was uneven resource distribution, thus invoking a core-periphery model. Analogous to fine ceramics ware spreading from centres with fine pottery clays to areas lacking these, he reconstructed the exchange of metals, stone bracers and other artefacts as both a (low energy input) means to acquire scarce commodities as well as a process being driven by social reasons involving alliances, prestige, display behaviour and status symbolism.

From this point of view Beaker ceramics formed both the expression as well as the objective for socially-economical Beaker networks.

In conclusion it can be said the dissatisfaction with former typological and methodological approaches which had grown during the preceding decade was voiced during the Oberried symposium. Many argued for a more methodical and conscious use of archaeological interpretation, whilst admitting that much more raw data was needed to substantiate the theories put forward.

5.2.4 General models (1975-1990)

Dynamics in archaeological conceptualisation between -roughly- 1975 and 1990 can be divided into two phases. Although archaeologist during both phases concentrated on the establishment of general theories explaining the processes of change in Late Neolithic north-western Europe, a change in paradigm is discernible.

During the first phase these theories entailed much of the systemic approaches of processual archaeology. They relied heavily on ecological or technological arguments to explain causalities of the past. Also, the particular interest in exchange, grave ritual, communal centres and quantification of archaeological data are main topics for processual archaeologists.

Although far from clear-cut, there is a gradual change toward more contextual approaches during the second phase. Explanatory theories try to encompass as many ‘parameters’ of social change as possible. Furthermore, ‘Beaker artefacts’ are more often studied in relation to the synchronous native material culture. Some of these models put forward will be outlined below.

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30 They used the ‘epi-maritime’ Beakers from the northern Netherlands and Germany as a case-study (Lanting & Van der Waals 1976, p. 10).
33 Case 1976, p. 453. See also Case 1973 for a review on ‘contextual archaeology’.
35 Clarke 1976, p. 467.
36 Herein, a forerunner of the later ‘prestige-goods’ models is discernible. See also: Frankenstein & Rowlands 1978 and Friedman & Rowlands 1977.
37 The trend of regional characterisation continues into the late seventies (Cf. Harrison 1974, Barfield 1977 and Shennan 1977) and nineties (see paragraph 5.2.5.2).
40 For an example: Gallay 1979 and Shennan 1977, p. 54-55. Again, these were grave-good analyses. Archaeologists still tended to recede from more holistic approaches and studied isolated cultural elements instead of culture in its all-embracing complexity.
5.2.4.1 Elite exchange

The ‘elite-exchange’ or ‘prestige goods’ model became the predominant explanation for the occurrence of Beaker related cultural traits all over Europe during the late seventies and early eighties. Being often described, a short illustration with two quotes from Shennan and Harrison ought to suffice.

Based on cluster analysis of grave-goods Shennan argued that:

‘The nature of the objects included in the cluster suggested that it might have prestige significance, and that graves containing them might well be those of individuals of higher rank.’
- Shennan 1977, p. 53.

Likewise, Harrison stated:

‘The reason why beakers seem to have appeared so suddenly spread rapidly, and been so widely favoured surely lie in the increasing amount of status difference within Copper Age societies. (…) The Bell Beaker ‘expansion’ is therefore likely to have been the product of competition among neighbouring elites striving to keep abreast of the latest fashions in wealth, or its display, in order to control yet more of the resources that were available to them.’

Apart from presenting his theoretical stand, Shennan also discussed settlement dynamics in his study of central European Bell Beaker assemblages mentioned above. The Middle Neolithic -sometimes fortified- ‘central sites’, being regarded as focal points for habitation and exchange, are replaced by a more dispersed and less defensive settlement pattern during the Later Neolithic Corded Ware phase. Bonding factor between the two periods was the preoccupation to settle on the more fertile soils.

5.2.4.1.1 Cups that cheered: exchanged hospitality?

Whereas Shennan (1986) used the appearance of Bell Beaker ceramics to illustrate the timing and extent of contact networks, Andrew G. Sherratt’s 1987 article ‘Cups that cheered’ saw beaker ceramics -or preferably; their content- not so much as an expression of, but rather as the driving force behind the networks under investigation.

The content of the decorated beaker, perhaps combined with the implications derived from the social behaviour appropriate for consuming it, was the reason for its ‘intrinsic’ prestige status. Sherratt too constructed a pattern of cultural changes throughout the third millennium B.C. in Europe that gradually not only showed intensification of contacts, but also the increased expression of these contacts in the occurrences of ceramics types associated with ‘the manipulation of fluids’, which during later phases sometimes occurred combined into sets or ‘services’. A model of symposia, with elite or religious significance expressed through an alcoholic substance -beer or mead- consumed in elaborate Beakers -perhaps acting as a social lubricant- was presented.

In a very schematised view his line of argument is this: The increasing contacts in the Beaker networks posed a certain threat through possible hostile alliances, which had to be opposed by maintaining a warrior-class, that was being institutionalised through alcohol consumption during symposia, and perhaps through the exchange of rare commodities.

Concluding, it is clear that Sherratt his viewpoint towards to Beaker ceramics certainly was a stimulating one, but was in desperate need of more supporting arguments. Perhaps paradoxically, this was one of the first time that Beakers were ‘took from the grave’. Sherratt provided a social and behavioural, possibly even institutionalised setting for Beaker ‘consumption’ to function outside the grave and in the world of the living, thus perhaps shedding some light on its interpretation if found on settlement sites.

5.2.4.2 Agricultural intensification

Agricultural intensification had gained considerable acceptance as being the ‘prime mover’ in the emerge of stratified societies since E. Boserup’s 1965 publication of ‘The Conditions of Agricultural Growth’.

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42 A precursor to these is to be found in David Leonard Clarke his 1976 Oberried article.
43 This cluster seemed to occur more frequently with male than female interments, thereby giving rise to the model of the ‘Male Bell Beaker Elite’. Harrison 1980, p. 40: Due to the increasing importance of copper working during the Beaker periods, combined with a male monopoly of the trade secrets of this new technology, gave rise to the higher social status of men then in the periods before.
44 Shennan 1977, p. 55.66-69 (Fig. 3.4-3.5).
45 Whatever prestige attached to pottery is more likely to have been derived from the special nature of what was consumed from it rather than from any inherent value in the pots themselves: their elaboration was simply appropriate for the nature of what was provided in them’. Sherratt 1987, p. 83.
47 Anthropological and historical analogies for such feasts, particularly in hierarchical societies are ample. See also: Fried 1967, p. 178.
Research concentrated on establishing the scale, timing and extent of technological innovations, like plough agriculture, that made intensification possible. On the other hand, more general essays were also written with the purpose of creating a comprehensive overview, not only of the technological progress and its dispersion, but concentrating on its social and economical implications, with Andrew Sherratt his 1981 article on the ‘secondary products revolution’ as the best-known example.

Through its innovative focus upon the social implications of agricultural change, Harry Fokkens’ 1986 article ‘From shifting cultivation to short fallow cultivation’ belongs both chronologically as conceptually to the second phase as outlined in the introduction of paragraph 5.2.4. In a case-study on the TRB-PFB transition in the northern Netherlands Fokkens demonstrated that instead of strict demographic causes (although a population growth is implicitly assumed), the fact that the landscape had become ‘environmentally circumscribed’ probably was the main driving force behind agricultural intensification.

This is not the place to evaluate whether the assumed population growth indeed can be reconstructed for this period, nor whether such an functionalist-economic view towards the plough is still tenable. It should be stressed, however, that in this article Fokkens managed to pioneer a coherent model of agricultural innovations which paid special attention to the consequent social implications. Therefore, the main argument is reprinted below.

‘(...)the introduction of draught animals, considered a necessary pre-condition for the use of even a Neolithic plough (…), make many adjustments necessary within the household units. Time and people have to be freed to take care of them, some means of cattle stalling will become necessary, fodder for the winter-period may have to be collected and stored, pastures are needed, etc. In general, higher demands will be made from the local environment than before. Social repercussions will have resulted as well. For example the labor division between the sexes may have changed. (…)

Taking care of cattle, and ploughing may have been the new male tasks, but a time consuming activity like weeding is often part of the workload of women. The necessity of combining labor forces in order to handle these new tasks, may have induced the people to start living in extended families. Moreover a sense of private ownership of the means of production like land and draught animals, may have been introduced by the extra energy investment in working the land, ownership of and grazing rights for cattle etc.’


This increased sense of ownership was used by Fokkens as an explanation why the Middle Neolithic collective burial grounds (the megalithic monuments) were replaced by decentralised burial mounds. In stead of signifying a decrease in pressure on land, as had been thought before, this shift in burial rite might symbolise the new ‘private’ or personal connection of a much smaller social group with their land which they had so extensively worked during life. The social implications of raising and using cattle most likely intensified from the Late Neolithic period onward.

5.2.4.3 Information exchange and polity interaction

Trade and exchange, combined with processes of redistribution, have been regarded as essential to the emergence of stratified societies. Following Service (1962), many models have been established, some of which focus on ‘dominance’ and ‘thus’ consolidation of social positions, while other reconstruct exchange as an evident means to exploitation of non-local ecological resources. These models were further enriched with the expression that presence of exotic goods was perhaps not the most interesting aspect to explain, but that these goods were the mere material participants of a system of ‘information exchange’. However, most studies concentrated on the dispersal of a single artefact category (like amber beads or copper objects) in funerary context.

Although the establishment of these models referred to above proved of much value in continuing and increasing the development of a critical attitude towards archaeological conceptualisation, they were hard to make operational in explaining Late Neolithic change.

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49 Irrigation (Oates & Oates 1976), Plough agriculture (Fowler 1971) and Mediterranean polyculture (Halstead & O'Shea 1982) were studied.
50 See also: Bradley & Hodder 1979 and Renfrew 1981.
52 To put it exaggerated: ‘More mouths to feed with only limited land; Let’s plough!’.
54 See studies of Shennan 1982, Frankenestein & Rowlands 1978 and Flannery 1968 respectively.
56 Several studies in Renfrew & Shennan 1982.
57 These functionalist economic models perhaps indeed are to be considered as “an initiation ‘rite de passage’” into more sociological approaches as Martins (1974) has stated, but the pessimistic remarks by Whallon (1982, p.156-158) and Binford (1982a, p. 163) illustrate the still ‘long way from Beaker Folk’.

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Archaeological attention to politics, or ‘polity interaction’, was revived by Stephan Shennan in 1986. The ‘peer polity interaction’ model was tested for its capability to bridge the gap between the observed cultural uniformity and the fact that social-economic developments – ‘traceable’ through (stylistic) variation in material culture - occurred more or less simultaneously over wide areas, seemingly lacking a distinct priority or external cause. In general, Shennan his model explaining the Bell Beaker phenomenon was founded upon two main arguments. The first displays an ecological-deterministic view towards settlement preferences during the Beaker period. Shennan states - although offering no tangible evidence whatsoever- that the settlement unit became smaller than before and was located in environments that were less stable for long-term exploitation, thus leaving its vulnerable occupants little other choice but to engage in inter-community relations. The second line of reasoning was that the desire of communities lacking metal ores or objects to acquire these formed the main driving force behind the Beaker exchange networks. Continued long-distance exchange could be demonstrated for areas lacking these natural resources, while areas like Iberia - being in possession of ores and metallurgy - demonstrated a significant collapse of the exchange networks during the later Beaker period.

Summarising, the role of settlements and settlement analysis in Late Neolithic archaeology during the period between 1975 and 1990, was evidently still minimal. At the very best the data from settlement sites was used to illustrate or enhance the general models, which were still for the better part based on grave-good analyses.

5.2.5 New directions? (1990-2000)

The final decade of the last century gave rise to two trends in Late Neolithic archaeology. First of all, there had been a considerable increase in the numbers of sites excavated. This was partially the result of specific research programs, but certainly in the Netherlands- these were primarily boosted by large-scale expansion of infrastructure. This enlarged set of data gave rise to discussions on settlement dynamics, on settlement ecology and subsistence. As for the Netherlands, settlement interpretations tend to be structured largely by natural-scientific (e.g. archeo-zoological, palynological and botanical) studies.

The second trend consists of the writing of - sometimes clearly post-processual- essays on Late Neolithic change in general. Communication, gender, ideology, landscape perception and cosmology are themes being discussed for the Late Neolithic period. Perhaps even the presence of a third branch, the persisting regional descriptive approach, should be noted.

5.2.5.1 Perceptions of prehistoric settlement systems

5.2.5.1.1 Dutch Single Grave Culture archaeology

In 1989 the Dutch State Service for Archaeology ("ROB") commenced a research project on the Middle- and Late Neolithic occupation history of the north-western coastal area of the Netherlands. Several settlement remains from the Vlaardingen Culture, Funnel Beaker Culture (TRB) and Single Grave Culture (EGK) were partially unearthed. In his analysis of functional differences between Late Neolithic sites Jan W. Hogestijn distinguished two groups: The first comprises large (>3000m²) sites in the direct vicinity of open water and the second of smaller (<500m²) sites located at greater distance from open water.

A statistical approach combined with archaeological interpretation resulted in the model reprinted below. The small stars represent seasonal special purpose camps and the larger stars represent permanent or semi-permanent residential camps.

Fig. 5.2 Preliminary descriptive model of the EGK occupation.

The larger sites are interpreted as residential sites occupied by large groups in relatively dry areas. These were the focal points of organisation and storage, whereas the smaller sites were most likely used as ‘seasonal logistic settlements’. Small groups of people stayed there for short duration and specific purposes - most likely fishing, fowling and cattle grazing- only.

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60 Post-processual archaeology being defined as: ‘favouring non-generalising, some would say particularistic, approaches to prehistory and the role of prehistory in present day political and ideological concerns.’ (Hays 1993, p. 89). For examples: See Barrett 1994, Brodie 1997 and Thomas 1999.


Jan Willem Hogestijn justly stressed the fact that this preliminary model might need to be revised in the future to accommodate new data and variability caused by site-specific environmental variation. Although predominantly an ecological-descriptive model, it is to be considered courageous in its effort to focus upon regional settlement analysis.

5.2.5.1.2 Wetlands and uplands

In 1993 Leendert P. Louwe Kooijmans published an essay on the wetland and upland exploitation of the Dutch river delta. Thus far, the ecological setting of Late Neolithic settlements usually had received little attention, or was looked upon as merely presenting a stage for socio-economic behaviour. If, however, the environment was discussed in more detail, the investigations concentrated on aspects like ‘carrying capacity’, ‘critical land resources’ or ‘soil deterioration’ as a means to explain socio-economic adaptations from an ecological-deterministic point of view. Louwe Kooijmans his essay offered a systemic approach to settlement analysis which incorporated the variety of ecological resources that were available to prehistoric men in both a geographical and a chronological sense. His approach towards the complex relations between ‘ecological setting’, ‘subsistence strategy’ and ‘settlement system’ is reprinted below.

‘The diachronic changes of various elements (livestock, corps, houses, site functions) are far more prominent than the variability in relation to ecozone. Change and variation are not to be seen as adaptation but as the reflection of deliberative choices within the socially determined margins of freedom of behaviour.’

- Louwe Kooijmans 1993, p. 100.

Based on a variety of aspects like zoological evidence, husbandry, hunting (and their ratios), fowling, fishing, natural plant resources, cultivated crops and house plans, Louwe Kooijmans tried to establish the character of ‘site use parameters’ like ‘site function’, ‘duration’, ‘permanency’ and ‘seasonality’ for specific periods.

The Late Neolithic was divided into two periods: The ‘Late Neolithic (3300-2600 cal. B.C.)’ and the Late Beaker/Early Bronze Age (2600-1700 cal. B.C.). A short characterisation of these two periods as reconstructed by Louwe Kooijmans will be reproduced below.

The Late Neolithic (3300-2600 cal. B.C.)

The larger number of settlements sites recovered from all ecological zones of the prehistoric delta, enabled a more detailed view compared to preceding periods. Subsistence patterns are characterised by the tremendous decrease in exploitation of bio-resources and the consolidation of the use of new domesticates. Settlements vary between 10% up to 90% agrarian in character, indicating a diverse and landscape-bound subsistence economy. In freshwater tidal areas and peat zones the semi-agrarian strategy with summer-seasonal domestic sites (‘restricted residential mobility’) prevails. In the river clay area, as well as near and on the coastal dunes, animal husbandry combined with crop cultivation is predominantly practised. Available evidence for cattle-stalling or ploughing, however, is scant and the high proportions of domesticated pig might point to a relative importance of swine herding. This ‘quasi mixed farming’ most likely involved long fallow cultivation and is characterised as an ‘independent logistical mobile’ system. Based mainly on the distribution of different types of flint, Louwe Kooijmans reconstructs three large regions, thereby implicating both the discernability of regional aspects as well as the existence of wide geographical contacts. For all archaeological periods the role of small extraction camps is likely to be underestimated, but for the Late Neolithic a few examples are known.

The Late Beaker/ Early Bronze Age (2600-1700 cal. B.C.)

The Late Beaker period is seen as displaying a transitional form of agrarian subsistence strategies between the Late Neolithic period and the Middle Bronze Age. Semi-agrarian communities are no longer traceable and a system of short fallow agriculture combined with initial mixed farming seems to have appeared. Bone spectra analyses show that wild animals are virtually absent, while pig herding perhaps retained most of its former importance. Plough marks and the use of wheels demonstrate the use of draught animals (oxen).

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63 Most of these arguments, together with results from new excavations were published by Hogestijn in 1997. The two Single Grave Culture two-aisled houses of site ‘Zeevijk’ are published herein.
64 Entire paragraph after Louwe Kooijmans 1993.
67 This model was perhaps influenced by Binford (1982b) his notions of residential and logistical mobility.
68 See Louwe Kooijmans 1993, p. 71-91 for somewhat more detailed remarks.
Although these innovations might have been present in earlier periods, their more general use seems to start in this phase. Permanent settlements located in upland locations existed as before, but incidentally also selected wetland locations were occupied. Small extraction sites exploiting different ecological niches are well known for this period. However, he acknowledges the fact that predominantly the smaller, special activity or extraction camps, tend to escape our attention. Although several possible house plans dating to this period are known, no house has yet been unearthed that could be interpreted (through presence of a byre or three-aisled lay-out) as an intermediate type to the Middle Bronze Age types. The Late Neolithic houses known are all from fully agricultural sites and are in general small (4.5-9-15 metre) and two-aisled in structure.

Summarising it can be stated that Louwe Kooijmans’ model provided an useful perspective towards the interpretation of settlements and their functioning in local and supra-local subsistence systems, without restricting the chronological period to the Bell Beaker period. Particularly his efforts to demonstrate the fact that the archae(zoo)logical record represents human choices rather than availability or ecological setting should be stressed.

5.2.5.1.3 Discussions on subsistence

Since the publication of the essay by Louwe Kooijmans (1993) - outlined above - archaeologists in general have agreed to the relative underrepresentation of Late Neolithic settlements and the correlating inability in - or somewhat more positivist; problems in - making marks on settlement strategies for this period. Far less consensus, however, has been achieved in discussions on the role of agriculture in Late Neolithic subsistence. According to Leendert P. Louwe Kooijmans, the Bell Beaker Culture relied nearly exclusively on agriculture. This has been opposed by Jørn T. Zeiler and Elisabeth F. Gehasse, who have tried to demonstrate that hunting, gathering and fishing played significant parts in the prehistoric diet until the end of the Middle Bronze Age.

Drenth and Hogestijn have pointed out that there has been little archaeobotanical investigation carried out on later Beaker period sites in the Netherlands. According to them, the supposed continuity between Single Grave Culture and Bell Beaker Culture does not justify the denied relevance of hunting, fowling and gathering - of which ample evidence for the north-western coastal area of the Netherlands exists during the Bell Beaker Period.

5.2.5.2 Continuation of regional studies

Although during the nineties of the last century many post-processual archaeologists have criticised the notion that through careful analysis of the patterns in material culture alone archaeologists can unravel the past, it was still implicitly held common ‘that regional studies will ultimately contribute to understanding the synthesized totality of the ‘beaker network’. The proceedings of the conferences held in Nice (14 September 1984), Praha (1-6 October 1990) and Freiburg (1992, 1993-94) present clear evidence hereof. The Bell Beaker seminars in Freiburg were in essence a re-analysis of regional type association, that were deemed necessary because of the possible influences of new theoretical frameworks. However, the conclusions were not much different from ones originating from the two preceding decades.

5.2.5.3 Thematic approaches

Alongside these more regional approaches a number of other studies came to light that were more thematic and specifically focussed upon topics like ‘burial rites’ (Thomas 1991), ‘the role of wheels and ard in Late Neolithic change’ (Drenth & Lanting 1997, Fokkens 1998b) and ‘social practise and gender’ (Brodie 1997). This last study by Neil Brodie is a representative example of the increasing attention towards the ‘archaeology of communication’.

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72 These are found on the sites ‘Hekelingen 3’, ‘Vlaardingen’ (Van Beek 1990), and the Dutch province ‘Friesland’ (Woltering 1985) in general.
74 See Louwe Kooijmans 1985, p. 126, 154 and Louwe Kooijmans 1993, p.103.
5.2.5.3.1 A cattle ideology?

Especially in the Netherlands, perhaps due to its persistent focus on continuity, there is increasing attention toward the retracing of the roots of ideological aspects of Middle Bronze Age into the Late Neolithic. Somewhere in the shaded centuries before 1800 B.C., some archaeologists reconstruct the origins of the three-aisled long-house and some ideological aspects derived thereof.

Harry Fokkens (1999) has recently explored the possible social and ideological implications of cattle in Late Neolithic and Bronze age society. He justly stressed the fact that while many (economic) arguments would favour cattle stalling, none of these explain why byre and living area should be combined in one building. Therefore, the social implications of cattle should not be overlooked. Examples of Middle Bronze Age houses which could accommodate a large number of remarkably small-cows perhaps points to both the presence of a pastoral ideology as well as the special role cattle might have played in social (exchange) relations.

5.2.5.3.2 Ritual depositions

Another aspect of Late Neolithic archaeology that had thus far received only minor attention is the act of hoarding. In the Dutch province Drenthe the most archaeological finds from wet contexts are systematically investigated. This resulted in a publication by Prummel & Van der Sanden (1995) in which the continued deposition of cattle horns in peat from the Early Neolithic onward is documented. Incidental deposition of ceramics and skeletal material of both cattle and men into rivers and bogs during the Late Neolithic period seems likely. There is also evidence to suggest, although not from the Netherlands, that there might be a continuation of stone axe hoarding from the Neolithic Period to the Early Bronze age.

5.2.5.3.3 The future role of the ‘Dutch Model’

Very recently the 'Dutch (typological) Model' has been criticised by several authors. Laure Salanova stated in her 1998 paper on the Bell Beaker chronology in France that the radiocarbon dates underlying the model are far from numerous, and direct association is infrequent. Furthermore, on the basis of the few number -five or six- of Maritime Beakers, which show a remarkable break in shape (more rounded), decorative pattern (the alternation of decorated and undecorated zones) and decorative technique (the use of the comb) with the preceding All Over Ornamented phase, she sees the Maritime Style as an intrusive element in stead of representing a continuous development.

Ironically, the ‘Dutch Model’ is also currently under attack by Erik Drenth and Willem-Jan Hogestijn, who in their 1999 overview of Dutch Bell Beaker research advocate the non-existence of a ‘Maritime Bell Beaker Phase’. In their opinion a true ‘Maritime’ phase would imply a decrease in variety of decorative style during that period, while no ‘high status goods’ association with a Maritime Beaker has ever been found in funerary context, thus implying a change in funerary rites. Should a phase in the Bell Beaker Period have existed wherein all Beakers were of the Maritime type, than this would also be the only period lacking the possibility to trace regional groups according to Drenth and Hogestijn.

The ‘Maritime’ beakers are interpreted as being synchronous with the Later Single Grave Culture Period and the All Over Ornamented ‘phase’. A new model -the 'Dutch: Tweesporenmodel' (two-track model) - is presented by Drenth and Hogestijn, based on the assumption that decorative patterns in Beaker vessels from the Late Single Grave Culture Period to the Early Bronze age can be divided into two groups: The first group consists of Beakers decorated over the total length of their body, while the second group comprises Beakers bearing decoration exclusively on their upper half.

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82 The oldest date for a Dutch three-aisled houses comes from the site 'Dodewaard' (1782-1676 B.C. - 3430 ± 35 BP).
84 Fokkens 1999, p. 33-34. The role of cattle as contributing to raids and warfare is discussed (reference is made to Roymans 1996, p. 54). Warrior grave goods, depictions of weapons and ethnographic analogies (Thesinger 1998) are also discussed.
85 Perhaps the term ‘ritual’ is a misnomer. As religious activities most likely will have been inseparably linked with all other patterns of behaviour in people’s lives, the term ‘profane deposition’ is perhaps more applicable. ‘Ritual’ is perhaps still too often used as synonym for ‘odd’ or ‘non-functional’.
86 Prummel & Van der Sanden 1995. One particular horn was found in the ‘Bronnegerveen’, municipality Borger. Radiocarbon dating yielded 3920 ± 40 BP (GrN-20379).
88 This is based on Vankilde's (1996) paper on the Danish Neolithic-Bronze Age transition. See also Van der Beek, in prep. on stone axe depositions.
89 In essence, few of the determinations actually date Beakers(...). Of the 28 Bell Beaker results only 7 provide association: all are on charcoal and four of these are from the Vlaardingen house (Kinnies et al. 1991, p. 36). These are results published -with some critical reviews- by the British Museum dating program. Quoted in Salanova 1998, p. 2.
91 Drenth & Hogestijn 1999, p. 103-106. Personally I think that their approach towards the discernability of regional groups belies the methodological and theoretical problems in establishing these. The interpretation of variation in cultural traits as reflecting regional groups is strongly hampered by the low archaeological visibility.
92 Drenth & Hogestijn 1999, p. 104. Emphasis on ‘phase’ is mine and ought to remind the reader of the descriptive nature of this model.
A few remarks need to be made. First of all, their model is not substantiated by sound statistical analysis of the bipartite character of decoration length, nor is the correlation between other parameters like ‘shape’, ‘temper’, ‘use’ or ‘archaeological context’ investigated.93

Secondly, their ‘continuous development of Beaker ceramics along these two tracks’ sought after, is dangerously studied in relative isolation from other archaeological data, comprising -not in the least part- undecorated ceramics.94 Concluding it can be said that lacking both a detailed contextual archaeological analysis as well as substantiating radiocarbon dates, the value of their model is limited to a descriptive and heuristic level.

5.3 The history of Bronze Age Archaeological theory

5.3.1 Introduction

The -evolution of- (Early- and Middle-) Bronze Age archaeological theory, in particular if concerning settlements, forms the main topic of the following paragraphs. It will become clear that for the period roughly until the 1960’s there is a tremendous overlap between Late Neolithic and Bronze age theory. From that time onward a bipartite development in conceptualisation is discernible: Research concentrating on settlement data displayed an estrangement from Late Neolithic archaeological theory, while general theories explaining Late Neolithic change that arose during the 1980’s (see paragraph 5.2.4) described processes which outstripped narrow archaeological dating, and thus formed a body of cross-period archaeological theory. Therefore I will constrain myself as much as possible to relevant differences, whilst indicating areas of overlap. Furthermore, I will confine myself to the Early and Middle Bronze Age.95

5.3.2 Culture-historical approaches (1880-1950)

In discussing the early history of Bronze Age archaeological theory it should be noted that acceptance of the existence of a Bronze Age was gradual. The influential Dutch curator Jan H. Holwerda did not believe Christian Thomsen’s system to be significant for defining Dutch archaeological periods.96

The large scale investigations of burial mounds (see paragraph 5.2.1) in the northern Netherlands, however, changed this and by 1925 the existence of a Bronze Age was generally agreed upon.97

The interest in burial investigations persisted until the thirties and forties of the last century, and gave rise to speculative theories involving migrations.98 The decades surrounding the second world war saw the investigation of a new type of archaeological data; the bronzes.99 Bronze artefacts were studied as to reflect cultural connections, preferably with the central Wessex area. Although these cultural relations are now regarded quite differently, the notion of a hierarchical, even aristocratic, Bronze Age society has persisted for many decades.100

5.3.3 Features and farms; settlements discovered (1950-1986)

Thus far the Bronze Age had predominantly been depicted based solely on stray finds of bronzes and ceramics, a few features and excessive burial mound data. The first documented site yielding a house plan was ‘Margijnen Enk’, excavated in 1954, quickly followed by ‘Vogelenzang’.101 During the early sixties in the western Netherlands the sites ‘Den Haag-Kijkduin’ and ‘Monster-Het Geestje were unearthed.102 Meanwhile, the large-scale settlement excavations in the northern Netherlands concentrated on ‘Elp’ and ‘Angelsoo-Emmerhout’.103 These two sites for the first time yielded clear three-aisled Bronze Age house plans wherein stable partitions could be discerned. The reality of mixed farming as primary subsistence economy during the later Bronze Age seemed impossible to refute.

Fig. 5.3 Several Bronze Age sites and eponymous house types: ‘Emmerhout’ (left, top), ‘Elp’ (left, bottom) and ‘Zijderveld’ (right).

93 They acknowledge this lack of statistical arguments (Drenth & Hogestijn 1999, p. 110). To me, variation in decoration length represents more ‘a difference in degree’ than ‘a difference in kind’.
94 Drenth & Hogestijn 1999, p. 110.
95 For an discussion on Late Bronze Age theory see: Fokkens 1997.
96 Holwerda does not mention a Bronze Age in his 1907 and 1918 overviews. On the three-period system: Thomsen 1848.
97 See: Holwerda 1925 and Van Giffen 1924, p. 25.
103 Published by Waterbolk 1964, 1987 and Van der Waals & Butler 1974.
In 1965 and 1967 the sites ‘Zijderveld’ and ‘Dodewaard’ in the Dutch river clay area were discovered and the following excavation resulted in the recovery of many Bronze Age features, among which were fences, granaries and three-aisled Bronze Age houses. During the later seventies the West-Frisian clay area received considerable attention. The sites of ‘Hoogkarspel’, ‘Bovenkarspel’ and ‘Andijk’ were studied during various campaigns.

Rather than attaining a complete overview, I think it is elucidating to assess the importance of these excavations in reconstructions of the Bronze Age. Furthermore, the excavations referred to above did only seldom result in detailed publications.

5.3.3.1 Settlement structure

First of all, the fact that so many, and perhaps such apparently durable, houses could be reconstructed, sharply contrasted with the associations adhered to settlements dating to the (Late) Neolithic period. Being far from flimsy in construction or scanty in number, the Middle Bronze Age excavations yielded three-aisled farmsteads surrounded by ditches and fences that -through the large numbers of finds and evident rebuilding phases of farms- indicated a prolonged occupation as compared to estimates for Late Neolithic settlement sites.

5.3.3.2 Mixed Farming

This idea of permanency was furthermore reinforced by the assumption that three-aisled farms were long-houses in which both man and cattle were housed. The oldest Dutch examples of these were found in the river clay area and date to the start of the Dutch Middle Bronze Age. Since their initial discovery, the three-aisled houses have led to the construction of many theories. Traditionally, these studies usually confined themselves to (processual) thematic approaches toward agriculture or subsistence, and stated that the Bronze Age farmers practised mixed agriculture, although sometimes with a relative emphasis on cattle breeding. Hunting was no longer regarded as an essential subsistence activity. It is this confinement to mere functionalist statements on subsistence that forms the boundary between this phase of conceptualisation, and the phase described below in paragraph 5.3.4.

One can gain an insight into the extent to which Bronze Age archaeological conceptualisation was dictated by the relative richness of the archaeological record by comparing research interests between the Middle- and Early Bronze Age.

5.3.3.3 The Early Bronze Age

The eagerness of archaeologists to work with this rich Middle Bronze Age data perhaps caused one serious setback; the Early Bronze Age had received only minor attention. In the Netherlands the Early Bronze Age is characterised by the first occurrence of bronzes, by barbed wire decorated ceramics (Dutch: ‘Wikkeldraad’) and the supposed continuation of two-aisled house constructions.

Jan N. Lanting stressed the continuity between Dutch Late Neolithic and Early Bronze Age occupation in his extensive 1973 article. Due to the smaller number of excavated unambiguous farmsteads, the data from Early Bronze Age excavations played (if any) only a marginal role in the establishment -let alone testing- of new archaeological theories.

5.3.3.4 Social evolutionist substrate; emerging chiefdoms?

Whereas in the Netherlands archaeologists tended to concentrate on the excavation and interpretation - from an ecological or ‘subsistence’ stand- of settlement data, on European level models assuming increased complexity during the Bronze Age were being introduced. Assumptions concerning ‘prestige’, ‘power’ and ‘hierarchy’, reminiscent of Colin Renfrew his 1973 publication on the Wessex ‘chiefdoms’, were widely applied.


The house plans of ‘Emmerhout’ (Fig. 5.3) were the first farm with stable indications to be discovered. However, the oldest example yielding indisputable stable partitions (site ‘Loon op Zand’; Roymans & Hiddink 1991, p. 114) dates 1520-1418 cal B.C. (GrN 3185 ± 35 B.P.). The oldest date for a three-aisled farm originates from a post-hole at ‘Dodewaard’: 1870-1630 cal B.C. (GrN 5935: 3440 ± 35 B.P.).


Only ‘Ottoland-Kromme Elleboog’ (Louwe Kooijmans 1974) was considered to be of some importance. For an (1992) overview: Verhart 1992, for a recent example: Van Heeringen, Van der Velde & Van Amen 1998.

Many of these theories were founded upon well known social-evolutionist models, and were embraced by archaeologists working with Bronze Age sites, but those studying Late Neolithic processes of change as well. Therefore, the solid overview on social-evolutionist theories, social structure, social change and stratification published by Eric H. Lohof in 1991 applies to both.

5.3.4 Interpreting the changes (1986-2000)

The later part of the eighties forms the period in the history of archaeological theory where the diverging explanatory frameworks of Late Neolithic and Bronze Age archaeology reunite. Settlement data, predominantly the assumed complex intertwining of three-aisled farms, plough-marks, cattle and prestige were all studied in order to reconstruct processes of social change during the Late Neolithic and the Bronze Age.

5.3.4.1 Social implications

In paragraph 5.2.4.2 I have already mentioned the model put forward by Harry Fokkens, which in my opinion can be placed at the start of this development. Theories expressing the social consequences of both the raising of cattle as well as their application as draught animals became commonly accepted. The article ‘Cattle and Martiality: changing relations between man and landscape in the Late Neolithic and the Bronze Age’ published by Harry Fokkens in 1999 provided a stimulating overview. However, the number of studies concerned with this topic, even on an European scale, have thus far been quite limited. Interest in the (social) implications of man’s activities in the landscape received even less attention.

5.3.4.2 The Early Bronze Age

There is still only minor ‘interest’ in Early Bronze Age archaeology, although this is presumably for the larger part caused by the problematic typological dating of objects to the Early Bronze Age. Although the excavation of the Early Bronze Age two-aisled house at ‘Noordwijk’ in the Dutch coastal area was very informative on farm and farmstead layout, it offered little archeozoological data to be used in discussions on subsistence. Study of the excavated botanical macro remains showed an unusual absence of Triticum dicoccum (Emmer wheat) and a relative dominance of Triticum aestivum (Bread wheat).

Beyond the level of site-interpretation, new viewpoints toward dating of the Early Bronze Age also emerge. In their presentation held at the ‘Congrès national des sociétés historique et scientifiques’ conference at Lille, David Fontijn and Harry Fokkens have argued that there are objections against the Dutch phasing of the Bronze Age. As the Early Bronze Age in all aspects represents a continuation of the earlier Beaker traditions, they suggest that the Barbed Wire culture period (between 2000 and 1800 cal. B.C.) should be considered a final Late Neolithic phase.

5.3.4.3 Complexity

During the early nineties the complexity model, certainly for the Netherlands, gradually less adhered to. Liesbeth M. Theunissen (1993) and Eric Lohof (1991,1994) both have found no indications for the existence of chiefdoms in the Dutch Bronze Age in their extensive studies of the Dutch burial mound complexes. They reconstruct a society consisting of autonomous kin groups, presumably led by elder males. Studies of grave dimensions and attributes suggest that authority was based on sex, age, their position in the kinship hierarchy and personal qualities.

Concluding, it can be said that during the last couple of years Bronze Age research questions have altered only marginally.

First of all, the wish to generate widely applicable models of Late Neolithic and Bronze Age change has persisted.

117 Cf. Fokkens & Fontijn 2000. In Scandinavia and France this period is already classified as Late Neolithic, based on the ‘last’ occurrences of flint implements. Cf. Lomborg 1973 (Emphasis on ‘last’ is mine S.A.).
118 See also Theunissen 1996 and the studies by Erik Drenth (1992 and 1996).
121 See the studies by Brück 1999 and Gerritsen 2000.
Secondly, the relation between settlements and their environments as well as the role of agricultural change in the processes referred to above is assessed—predominantly—through paleo-ethnobotanical studies.\(^{123}\)

Unfortunately, the majority of Bronze Age settlement publications are brief reports of single excavations, lacking wider theoretical or contextual discussions. Yet, these are the best accessible tip of the iceberg consisting of the total of Bronze Age data unearthed.

### 5.4 Summary

Research objectives throughout the overall evolution of Late Neolithic archaeological theory tend to be dominated by a limited number of topics. The problems and solutions in Late Neolithic conceptualisation comprised themes like ‘typology’, ‘cradle of birth’, ‘style’ and ‘explanatory theory’. Although a constant shift in paradigms with time (culture-historical, processual, etcetera) is discernible, it has been argued above that they offered only few new research aims.

Instead, nearly all progress in the field of archaeological theory involved the establishment of new theoretical backgrounds or methodological strategies to resolve research questions that had been altered only marginally since their initial posting in the twenties of the former century. The development of Bronze Age archaeological theory, however, shows a remarkable contrast. This is largely caused by the better visibility, and therefore larger set of data available, of Bronze Age material culture.

Numerous Bronze Age barrows had been investigated in the Netherlands from the early thirties onward.\(^{124}\) These differed in both dimensions and number from the preceding period, facilitating their discovery.\(^{125}\) As more and more finds of bronze were unearthed, the study of bronze artefacts became increasingly important from the early fifties of the last century onward.\(^{126}\)

Apart from bronzes as a new artefact category, research topics varied only in minor aspects from those concerning the Late Neolithic period.

The schism between the two arose quite clearly between 1960 and 1970. This decade saw several excavations which yielded for the first time features suggestive of Bronze Age settlement remains.\(^{127}\)

In 1965 and 1967 the sites ‘Zijderiveld’ and ‘Dodewaard’ in the Dutch river clay area were discovered and the subsequent excavations resulted in the recovery of many Bronze Age features, some of which could be reconstructed as three-aisled Bronze Age houses.\(^{128}\)

Since the sixties and seventies of the last century large numbers of (Early-) and Middle Bronze Age settlements have been found. As a contrast, only a few sites with features indicative of Late Neolithic occupation had been discovered.\(^{129}\) Again, the visibility of Bronze Age settlement sites outwings the visibility Late Neolithic settlements, lacking such invasive density of deeper and more easily interpretable features.

Boosted by the processual focus on explaining the economic, ecological and technological subsystems, the context of finds in settlement sites offered Bronze Age archaeologist an environment stimulative to the construction and testing of wider ranges of hypotheses.\(^{130}\) These hypotheses covered themes like ‘subsistence economy’, ‘role of husbandry / agriculture’, ‘structure of houses and the settlements’. Late Neolithic archaeologists, lacking such a fine grained contextual matrix, retained their hypotheses on historical-descriptive levels of ‘questions of nature, origin, spread and typological classification’.

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\(^{125}\) Theunissen 1999, p. 57-58. Within her study area there are 14 Late Neolithic mound periods known, whereas from the Early- and Middle Bronze Age approximately 217 mound periods are known. This is not to be taken as a strict rule of correlation, but indicative of the discrepancies in mound research.


\(^{127}\) The first documented site is ‘Margijnen Enk’ (Modderman 1955b, p. 28), quickly followed by ‘Vogelenzang’ (Groenman-Van Waateringe 1961). The large-scale settlement excavations in the northern Netherlands concentrated on ‘Elp’ and ‘Angesto-Emmerhout’.


\(^{129}\) See paragraph 5.3.3.

\(^{130}\) See Clarke 1968 and Chapman 1979 on the role of processual archaeology.
Chapter 6. Synthesis: Man and landscape in regional perspective during the Late Neolithic to the Middle Bronze Age in the Dutch central river area

6.1 Introduction

In this chapter an attempt is made to evaluate the significance of the methodology, the geological and the archaeological data in altering or enhancing our viewpoints on the relations between man and landscape throughout the Late Neolithic up to the Middle Bronze Age in the Dutch central river area. This involves the critical re-twining of the known geological, theoretical and archaeological backgrounds to determine to what extent the data listed in chapters 3 and 4 actually can be converted to meaningful statements on the archaeological periods in question.

Once the representativeness and validity has been discussed, the implications derived from the data in this study for the various archaeological research problems listed in chapter 1 (paragraph 1.2.2.1) will be dealt with. Hereafter, a summary on the entirety of this study and its implications will be given.

6.2 Evaluation

In this paragraph, the capabilities and limitations of the data and methodology used in this study will be discussed.

6.2.1 Methods: regional analysis

It has been outlined in chapter 1 that the method adopted to combine ‘low’ resolution data with ‘high’ resolution data was the ‘regional analysis’. In this paragraph special attention will be given to evaluation of ‘regional analysis’ as an archaeological tool. Regional analyses, especially if combined with paleo-geographical reconstructions, can be a very powerful instrument in discussing the relationships between archaeological phenomena (such as settlement location patterning) and spatial parameters like the physical environment.

It must be stressed, however, that the selection of this method was based on a number of (implicit) assumptions. As these influence the effectiveness of a particular approach, they are of great importance. Therefore, some examples are reprinted below.

- All finds have been reported to the appropriate authorities and/or published
- A large number of finds dating to the period of interest have been discovered
- The representativeness of the total of archaeological data known has been established beyond discussion
- All finds are accompanied by descriptions of their geological and archaeological context
- Local archaeologists will have established well-documented inventories
- The scale of the study area is appropriate for the questions to be answered
- The geological background has been sufficiently investigated to support paleo-geographical reconstructions

In my opinion, it is eminent to question whether the data available is in fact ‘appropriate’ for the method selected. This way, implicit assumptions are made explicit, and their evaluation needs to be used by every critical scientist to reflect on, and if necessary alter or refute their methodology initially selected. It has been argued in chapter 3 (paragraph 3.3.3) that these assumption proved only partially valid for my study area: Various local archaeologists no longer reported archaeological finds to the State Service for Archaeological Research (R.O.B.), there is a considerable overrepresentation of post Bronze-Age materials and descriptions of find-spots was often minimal. On the assumed well-known geological background the reader is referred to chapter 2 and paragraph 6.2.3 below.

6.2.2 Methods: Formation processes

Archaeologists always need to take a critical stand towards the representativeness of their data. In other words: can we make an educated guess that enables us to judge to what extent or how well (or perhaps: how insufficiently) we know the archaeological record, as a contrast to how much of that record is (by whatever reason) obliterated from our view?

See Van der Beek *in prep.*, Fokkens 1998a, Slofstra et al. 1982 and the discussions in *Archaeological Dialogues* 1996, 3-2. For MA thesis examples see: Leijnse 1999 and Müller 1999. However, there is a clear danger of regional analysis being used in a paleo-geographical - deterministic way. Regional analysis is thus degraded to the level of ‘listing what type of dots are located within what types of geographical areas (or soil-types)’. This usage is clearly a mere geographical translation of the ‘absence-presence’ archaeology which I opposed in the first chapter. To once more use the ‘black-box’ metaphor; this will only display the (geographical or spatial) outcome of past behaviour, and will tell us little on the behavioural dynamics on the input side.

These assumptions are often considered trivial and of little relevance. I am inclined to think otherwise.
In regional archaeology—especially in studies using GIS (Global Information Systems) techniques—this has come to be known as the study of formation processes\(^3\), or if applied to map analysis; the study of map formation processes\(^4\). The parameters that might have distorted or rendered past behaviour imperceptible in this study(area), will be briefly discussed below.

6.2.2.1 Depositional processes

The most obvious precondition of relevance in the assessment of depositional processes is human presence. Based on analysis of the ARCHIS database\(^5\) it becomes clear that the evidence for Palaeolithic and Mesolithic human presence within the landscape of the study area is (currently) virtually absent\(^6\). For all following archaeological period the presence of man within the study area can be confirmed\(^7\). Archaeologically younger periods evidently display an increase in numbers of datable artefacts, but this will be illustrated below\(^8\).

Besides the physical presence of man, the material consequences of its wandering through the landscape should also briefly be considered. Although the exploitation of a landscape without altering its material dimensions, even in its most minimal sense (e.g. walking through it) is practically inconceivable, one should keep in mind that not all past behaviour needs to have effected its physical surroundings to the same extent.

Fundamental as this notion might appear, its implications are quite limited. Our knowledge of the stock of past or prehistoric material culture is filtered after its formation by the post-depositional processes described below, whereas the immaterial past can only be speculated about\(^9\).

6.2.2.2 Post-depositional processes

Whereas the study of depositional patterns is usually carried out at ‘excavation site’ level, the study of post-depositional processes is of particular relevance to archaeologists interested in regional analysis. Usually, they are divided into two groups; natural processes and anthropogenetic processes. Both will be briefly explored below.

6.2.2.2.1 Natural post-deposition processes: A fluvial setting

Natural factors that distort our view on the totality of the material record are divided into three categories: geological factors, geo-chemical factors and biotic factors. As the biotic factors largely influence the visibility on the ‘feature-‘ or ‘site-level’, they will not be dealt with here\(^10\). The role of geo-chemical factors on the preservation of archaeological remains has never been systematically studied\(^11\). Although the river area is generally described as providing ‘high quality’ preservation\(^12\), this is never back-up by a study on the preservative qualities of the different fluvial deposits and their (local) hydrology\(^13\). The scheme reprinted below therefore offers only a crude guideline\(^14\).

<table>
<thead>
<tr>
<th>Matrix</th>
<th>Archaeological material</th>
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<tr>
<td></td>
<td>pottery</td>
</tr>
<tr>
<td>clay</td>
<td>+</td>
</tr>
<tr>
<td>peat</td>
<td>-</td>
</tr>
<tr>
<td>sand</td>
<td>±</td>
</tr>
</tbody>
</table>

Table 6.1 Preservation conditions for various archaeological materials in different matrices.

\(^1\) Although attention to these processes had already started earlier (Cf. Ascher 1968, Clarke 1972 and Daniels 1972), M.B. Schiffer (1976) needs to be given credit for his formulation of a more coherent model and subsequent discussion of these processes.

\(^2\) These have been extensively discussed in: Fokkens 1998a, p. 56-80.

\(^3\) For comments on the ARCHIS database see: Chapter 3, paragraph 3.3.2.

\(^4\) See: ARCHIS maps (archis_palaeolithic_map.bmp, archis_mesolithic_map.bmp) and queries ‘archis_palaeolithic_query.html’ and ‘archis_mesolithic_query.html’ in the digital data (/ARCHIS/).

\(^5\) Most of these dots represent the wide range of dates entered for (stray) finds of flint and charcoal. No ‘true’ Palaeolithic finds are currently known to me from the study area. The single Mesolithic dot is listed in the inventory as number 6. The problem of the low archaeological visibility that will be described below for the younger periods evidently also has affected the visibility of older periods.

\(^6\) One should keep in mind that in this paragraph only binary ‘absence-presence’ is indicated. The archaeological implications will be discussed in paragraph 6.3.

\(^7\) See paragraph 6.2.2.2.3.

\(^8\) This is not to imply that I do not agree to the value of more ‘interpretative’ or ‘post-processual’ accounts of the past. However, theoretically, the immaterial past cannot be known. Very detailed analyses might facilitate the establishment of (hopefully quite probable) reconstructions of the immaterial past. From this viewpoint, the interpretative archaeologists’ task is to clarify and substantiate their probability.

\(^9\) Fokkens 1998a, p. 58. At the site 5 and 6 of the ‘Eigenblok’ complex, uprooted trees have played some part in decreasing the identification of features and structures (Hielkema et al. in prep. and chapter 4, paragraphs 4.3.2.5 and 4.3.2.6).


\(^12\) The preservation of botanical remains depends in particular on the mean lowest ground water level and current depth of the ground water. The preservation of zoological remains is predominantly influenced by the presence or absence of calcium-carbonates in the under- and overlying sediments (Van Zijverden in prep. (b), paragraph 2.2.4). The different types of the fluvial facies units found in the study area are described in chapter 2, paragraph 2.3.

\(^13\) See also Groenewoudt 1994, p. 54 (Fig. 7a/b) and reference therein to Darvill 1987.
A quick glance at the content of chapters 3 and 4 will have presented the reader with a general impression of the materials preserved.  

6.2.2.1.1 Fluvial processes: General dynamics  

Whereas the role of geo-chemical processes is of a certain, yet problematically definable relevance, the role of the geological factors is hard to overrate in the study area. From the start of the Holocene the study area has been located within a core area of nearly constant fluvial activity.

The table printed below lists the fluvial systems and their reconstructed phases of activity that have been active during the Holocene within the study area. Numbers according to the future publication by Berendsen & Stouthamer in prep.

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Name channel belt</th>
<th>Begin B.P. (Cal. years)</th>
<th>End B.P. (Cal. years)</th>
<th>Existence</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT</td>
<td>Lower terrace</td>
<td>52000</td>
<td>12918</td>
<td>39082</td>
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<td>Terrace X</td>
<td>12918</td>
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<td>2243</td>
</tr>
<tr>
<td>84</td>
<td>Kortenhoeven</td>
<td>8368</td>
<td>7175</td>
<td>1193</td>
</tr>
<tr>
<td>111</td>
<td>Middelkoop</td>
<td>8129</td>
<td>6125</td>
<td>2004</td>
</tr>
<tr>
<td>162</td>
<td>Tienhoven</td>
<td>7788</td>
<td>7175</td>
<td>613</td>
</tr>
<tr>
<td>52</td>
<td>Gorkum-Arkel</td>
<td>7387</td>
<td>6359</td>
<td>1028</td>
</tr>
<tr>
<td>104</td>
<td>Maurik</td>
<td>7077</td>
<td>6125</td>
<td>952</td>
</tr>
<tr>
<td>3</td>
<td>Achthoven</td>
<td>7077</td>
<td>6125</td>
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<td>6120</td>
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<tr>
<td>150</td>
<td>Schaik</td>
<td>6087</td>
<td>4830</td>
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<tr>
<td></td>
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<td>4437</td>
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</tr>
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<td>4958</td>
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<td>Est</td>
<td>3333</td>
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<td>1541</td>
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<tr>
<td>25</td>
<td>Hamel</td>
<td>2750</td>
<td>2250</td>
<td>500</td>
</tr>
</tbody>
</table>

Table 6.2 Start and end dates for fluvial systems within the study area.

However, the reconstructed picture presented above is in danger of presenting a situation that is belying its inherent dynamics.

First of all, the number of coexisting channels has varied considerably over time.

Secondly, their fluvial style has varied spatially (synchronic) as well as with time (diachronic).

The specific fluvial facies units that have been created by fluvial systems of different types have sufficiently been discussed in chapter 2, paragraph 2.3.2.

15 During the ‘Betuweroute’ investigations (especially during the ‘AAO’ phase, see chapter 4, paragraph 4.1.2) considerable efforts were made to determine the preservative qualities of the sites (Cf. Jongste & Smits 1998, p. 42, Jongste 1996a, p. 17-23, Bulten & Smits 1998a, p.17-31, Bulten 1997a, p. 28-31).


Although the number of river channels, their geographical location, the extent of their floodbasin coverage and their specific fluvial style has varied considerably during the Holocene, fluvial dynamics have always and nearly everywhere been responsible for the genesis of the Holocene landscape in the study area. Although this is not to deny the complexity and dynamics of the fluvial area, two fluvial processes, sedimentation and erosion, are of utmost relevance to this paragraph.

6.2.2.2.1.2 Fluvial processes: Sedimentation and erosion

Whereas erosion has supposedly washed away the archaeologically visible indicators of many prehistoric (settlement) sites, its counterpart sedimentation will have (perhaps already at the opposite bank) covered an equal number with (for instance floodbasin) deposits. To determine to what extent these processes have played a part in the archaeological visibility in the central Dutch river delta, and thus in establishing some background to the representativeness of my data, is difficult. However, if one examines more closely the results of the studies carried out during the Betuweroute project and some other archaeological studies in the river area, some trends become clear.

A survey of a large number of reports on the additional archaeological investigations (AAO) carried out in the Dutch river area has shown that in many cases an archaeological findlayer has been preserved. This preservation can often be attributed to the presence of an overlying layer of (floodbasin or levee) deposits. The thicker the load of sediments on top of an archaeological layer of debris, the smaller are the chances of it being disturbed by biological- or human disturbance, especially present-day ploughing. Apart from being covered by large quantities of sediment, the local lithology of a site is of relevance to its preservation. Layers of anthropogenetic origin which are founded upon clay, or clay-peat alternations, are suspected to be more susceptible to subsidence compared to those founded upon (a preferably continuous) sequence of more sandy-clayey or exclusively sandy sediments.

The filling-up of the hence created depressions does increase conservation, but simultaneously decreases chances of discovery.

Furthermore, I want to stress the fact that a dynamic fluvial setting not only decreases archaeological visibility through sedimentation (although sometimes compensated by increased preservation) but also selectively or partially destroys the archaeological remains. Through the process of avulsion an entire former settlement site might be washed out, and (after various periods of time and at various distances from its origin) be redeposited at another locality. However, this is not always the case. Crevasse channels are considerably smaller and their erosive effect on a former settlement site need not be as disastrous.

Although archaeologists should be very much aware that a fairly significant part of the archaeological record of the (Dutch) river delta might have been destroyed, it is hard to estimate or calculate the dimensions, extent and implications of these disturbances.

During archaeological fieldwork, two types of erosion indicators can be found. The first type consists of direct indicators (e.g. fluvial accretion deposits) such as crevasse channels which cross-cut other (archaeological) layers that are visible in geological profiles.

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19 It is assumed that maximum subsidence is reached after 30 years (Locher & De Bakker 1990). For older literature: see Hovinga & Op ’t Hof 1983, p. 40-41, Louwe Kooijmans 1974, p. 53 and Bennema 1954, p. 11.

20 Here it is implied that the fill consists of clay (see Table 6.1). The preservative qualities of sandier sediments are considerably poorer, but as sandy sediments in fluvial systems are generally deposited combined with processes of erosion justifies the above assumption.


22 See the profiles from site ‘Kesteren / Woonwagenkamp’ (Siemons & Sier 1999, p. 40).

23 This is clearly illustrated in the lithogenetic profile of site ‘Kesteren / Woonwagenkamp’ (Siemons & Sier, p. 39, Fig. 28). Crevasse channels of the ‘Hamel’ system have eroded several of the sites at the ‘De Bogen’ complex (Van Zijverden in prep. (b), paragraph 2.5.1).
The second type consists of indirect indicators. Archaeologists can suspect erosion if, for instance, the archaeological layer has a clear top boundary, retrieved pottery is small, weathered and rounded and predominantly found lying ‘flat’ on the ‘surface’. Furthermore, (micro-) morphological/geological studies of the facies units can be used to identify fluvial processes. The presence of stray, perhaps weathered finds in a deposited layer of sediment (e.g. a floodbasin deposit) is also an indirect indication of erosion.

Thus, it is in my opinion valid to conclude that the archaeological record of the Dutch river delta as a whole is severely biased by natural (fluvial) causes. However, to determine or predict the exact influences of factors like erosion and sedimentation is a hazardous task. Although I suspect this to be a very fruitful approach, I lacked the time in this study to quantify and spatially outline these factors.

6.2.2.2.2 Anthropogenetic post-deposition processes

The archaeological record has also been altered by human action, in both prehistoric as well as modern times. Intentionally, or unintentionally, prehistoric man might have dislocated materials from previous periods, dug up older finds, or have destroyed soil traces through digging or extensive ploughing.

As these processes have influenced the archaeological record on a level far more detailed than the regional analysis applied in this study, they will not be explored extensively.

The assessment of the influences of recent human activities is equally problematic. On the Pleistocene soils of the Netherlands the (heath) reclamation and agricultural exploitation of land has played a significant role in the discovery and destruction of archaeological materials. I am inclined to argue otherwise for the Dutch Holocene river delta.

Within the study area the thickness of the total of Holocene deposits ranges between 3.5 and 12 metres. Geological maps indicate that fluvial systems that were active between 5200 and 3700 cal. B.C. are to be found at two to three metres below current ground level. Furthermore, it is noteworthy that the ‘lower paleo-sol’ identified at circa 80-100 centimetres below ground level in almost the entire Betuwe district, has come to be known as the ‘Bronze Age paleo-sol’ through its attested correlation with Bronze Age remains. With the Bronze Age remains at a generalised depth of a metre below surface, we can safely assume that even recent agriculture (with average plough-depths of 70cm) does not necessarily need to have severely disturbed the archaeological record for the Bronze Age and older periods.

The possible effects that ‘favourable’ archaeological periods of interest or research questions might have had in the overrepresentation of a specific archaeological period, is in my opinion adequately compensated for by the archaeological investigations resulting from the Betuweroute project. Sites ranging in date from the (Late) Mesolithic to the Late Mediaeval periods were systematically investigated.

24 Particularly if this is backed up by a vertical find distribution analysis that does not display a normal Gauss curve (named after Friedrich Gauss (1777-†1855, see: http://home.wxs.nl/~wasse170/exponential/exponentialg.html). For archaeological examples see: Jongste 1998, p. 15 and Jongste 1997b, p. 20-21.

25 Many of the (predominantly Late Neolithic) ceramics from the BATO collection studied appeared to have been heavily eroded, most likely by being washed out during flooding or (crevasse) break-through. See Appendix III.

26 This was the case with some Middle Neolithic pottery at site ‘Valburg Zettensche Veld-West’ (Ten Asser & Van der Roest 1997) and the Neolithic finds at ‘Dodewaard-Hiënsche Veld’ (Jongste 1997b), ‘Valburg / Vergulde Bodem-Zuid (Bulten & Smits 1998b, p. 23), the earlier phase at ‘Eigenblok site 6’ (Van Zijverden in prep. (a)) and the bone and charcoal found at the lowest level of ‘Valburg-Zettense Veld-Oost’ (Jongste 1998, p. 23).

27 I have the strong feeling that this cannot be done without an extensive programme of additional geological coring and radiocarbon dating. But it still seems very attractive: If one knows both the phase(s) of sedimentation and their spatial extent, a spatially correlated factor indicating (for instance near the channel and overbank deposits, differentiated in inner- and outer bend) the preservative quality can perhaps be established.

28 There is some theoretical discussion on whether this should be considered a depositional process (See discussion in Fokkens 1998a, p. 56). In my opinion the boundary between depositional and post-depositional processes is formed by the period of interest (or implicit phasing) in the mind of the (excavating/interpreting) archaeologist. However, as I feel that these processes cannot be understood in separation from each other (archaeologists have to try to explain all factors that have contributed to the ‘current’ state of the archaeological record), this is a pointless debate.

29 This was the case in the centre of ‘Eigenblok site 6’ (Hielkema et al. in prep. and chapter 4, paragraph 4.3.2.6). Intersections of features are virtually absent at both the sites ‘Eigenblok’ as well as

30 This can be deduced by combining the ‘Top of Sand’ map with the ‘Age of Holocene Stream Belts’ map for sheet 39 West (see chapter 2), and the ‘Top of the Twente and Krefthenheye Formation’ map for sheet 38 East of the Geological Survey of the Netherlands (Verbraeck 1984, p. 104, Fig. 35 and Verbraeck 1979, p. 49).

31 See Map ‘Age of Holocene stream belts’; Late-Atlantic/Early-Subboreal to Middle Subboreal systems. These are located between two and three metres. One should be aware that the phasing/dating might be outdated.

32 Cf. Egberts 1950, Havinga & Op ‘t Hof 1975, p. 274 and Havinga & Op ‘t Hof 1983, p. 29, Bulten & Smits 1998a, p. 10. This is, of course, a generalisation. At the site ‘Elst-Ressen’ almost the entire Late Bronze Age – Early Iron Age find layer had been taken into the topsoil by ploughing (Jongste 1996c).

33 However, personal communication with local archaeologists has confirmed the relative absence of Bronze Age or older finds from ploughed fields in the study area (See chapter 3, paragraph 3.3.3).
6. Synthesis

6.2 Evaluation

Within the study area sites yielding Late Neolithic, Bronze Age, Roman Age and Early- and Late Mediaeval material were found during the Betuweroute investigations\(^{34}\).

Local archaeologists informed me that most of them concentrated on the survey of Iron Age, Roman Age and Mediaeval sites, but since some Late Neolithic and Bronze Age material had been recognised, I think that this reflects visibility rather than selective attention.

6.2.2.2.3 Excursion: Occupation history versus visibility

The effects of fluvial sedimentation on the chances of discovery of archaeological materials can be illustrated with the maps reprinted below. These are ARCHIS queries for localities interpreted as ‘settlements’ within a wider area surrounding my geographical study area\(^{35}\).

Fig. 6.3 ARCHIS maps of settlements during the Late Neolithic (top), Early Bronze Age, Middle Bronze Age, Late Bronze Age, Iron Age and Roman periods (bottom).

The increase in number of known localities is dramatic. Had these maps been published fifty years ago, their validity of representing the occupation history (an increasing number of people inhabiting the region through time, ‘preferably’ through migration and population growth) would have probably met little opposition\(^\text{36}\). Processual archaeology, however, has left current paradigms with sufficient awareness of the processes involved in hiding archaeology from our view, to ensure that present-day archaeologists keep well out of range of such interpretations. Ironically, from a methodological-theoretical point of view, this is an ostrich attitude. Ultimately, archaeologists will once again want to establish theories on the occupation history of particular regions, since these are the a prominent part of the synthesised accounts of man’s behaviour in its (more or less immediate) surrounding which forms the subject of archaeology as a science\(^{37}\).


\(^{35}\) The maps displaying the distribution of all finds (not necessarily interpreted as settlements) are available in the digital data: \'ARCHIS\textbackslash occupation\_history\_all\_finds\_<period>.jpg\'. These display the same general trend.


\(^{37}\) Again, these are generalising statements. Various archaeologists will declare different and equally valid goals as the subject of archaeological science. However, the (archaeological perceptibility of the) relation between man and landscape was central to this study.
The implications this has for the archaeological tale I want to tell below are tremendous. As I have mentioned earlier, I suspect the role of processes of sedimentation in the decreasing of chances of archaeological recovery of (pre-Iron Age) sites to be overwhelming. But how are we to take this factors into account without detailed knowledge on their geographical, synchronic and diachronic extent and intensity? How do we rate the representativeness of the information we have, if little is known on how much we do not know? This is a theoretical and methodological problem that must be dealt with in any archaeological account situated in the (Dutch) river area.

Without the appropriate methodology to overcome these problems, I have the feeling that we are still a long way from the ‘synthesised accounts’ referred to above. The paragraphs below (partially) assess the role of the data used in this study from this point of view.

6.2.3 Methods: Geological background

It has been stated earlier that the geological context of the archaeological data was to be formed based on the combination of soil survey maps, geological maps, sand-depth maps and detailed maps of smaller areas derived from other studies. In this paragraph some comments on their quality and applicability will be made.

The use of the soil-survey maps is especially limited for the older periods. It has already been stated above that soil-survey coring campaigns indeed have discovered many Bronze Age sites, but both the coring density as well as the coring depth are generally to low to offer an articulated overview of the fluvial setting and/or genesis. Clearly, soil survey maps are less suitable to answer geo-archaeological questions than geological maps that comprise information on the genesis of the entire Holocene litho-stratigraphical sequence.

However, these too should not be overrated. First of all, their scale (1:50,000) is often insufficient to be used on the ‘locality’ level. Furthermore, some physical-geographers have serious doubts on the accuracy of sheets 38 East and (although to a lesser extent) 39 West of the National Survey of the Netherlands. For the larger part of the study area a more detailed (1:25000) map of the depth of the sand below the surface is available. This more detailed scale is beneficial to archaeological analysis, although sand-depth maps are somewhat ‘two-dimensional’ from a geological point of view. They offer little to no information at all on the geomorphogenesis, thus presenting a palimpsest view on the presence, geographical extent and depth of the sandy substrate. However, through combination with the maps referred to above and the (radiocarbon dates substantiating the) paleo-geographical maps to be published by Berendsen they offer the best currently available geological background.

Only for a few small areas an even better resolution can be achieved. The various research programmes initiated by the faculty of geography at the university of Utrecht have resulted in the publications of several new and very detailed geological maps of (small parts of) the study area. However, these are based on higher coring densities, greater depths and accompanied by series of radiocarbon dates which all increase their applicability. If these detailed maps are compared to the less-detailed geological (1:50,000) and sand-depth (1:25000) maps the results are striking.

Fig. 6.4 Overlay of sand-depth map and detailed geological map.

6. Synthesis

6.2 Evaluation

38 See paragraph 6.3.
39 I want to stress the fact that I am aware that this remark can easily be mis-interpreted as a systemic approach towards regional archaeology wherein ‘depth below surface’ is directly correlated to ‘chance of discovery’. However, as a general rule this indeed seems to be the case, although the exceptions might be far more interesting that the general rule.
40 MapInfo (5.0) Tables bb-38Oost.tab and bb38-West.tab in the digital data.
41 See Verbraeck 1970 and Verbraeck 1984 and associated maps.
42 See Berendsen et al. 1994 and MapInfo (5.0) Table NL139e_poly.tab and associated thematic map ‘Ind. Value with GEB_CODE’ in the digital data.
43 See Törnqvist 1993, p. 40-41, Fig. 2., Makaske 1998, p. 186-187, Fig. 5.7 & 5.8 or MapInfo (5.0) Tables Törnqvist_tot_rot.tab, makaske1_rotated.tab and makaske2_rotated.tab in the digital data.
45 Usually to two metres below ground level.
46 Personal communication: Wilko van Zijverden, 06-06-2000. One should keep in mind that the coring needed for the construction of sheet 38 East was carried out between 1957 and 1964. The interest in large-scale detailed patterning of different fluvial styles is a relatively recent development (Weerts 1996, p. 69).
47 Detailed coring has revealed that these maps are not always reliable. See Van Zijverden in prep. (a) on the Eigenblok system.
The illustration above clearly indicates that a far more complex fluvial architecture, comprising of numerous smaller crevasse channels can be present where none might have been suspected based on analysis of the scale 1: 25,000 sand-depth map.

It will be clear that such lack of detail strongly hampers archaeological interpretation. Figure 6.5 (below) is a combination of the known geological and sand-depth maps (in yellow)[50], and a map based on detailed additional coring compiled by Bart Makaske. The flint-axe recovered from the site indicated on figure 6.5 could have been interpreted as ‘being located in the floodbasin’ -perhaps with associations of ‘deposition in wet context’- is use had been made of the ‘common’ geological maps only. However, the additional geological coring shows that the axe has been found near a crevasse channel, perhaps favouring an interpretations as ‘settlement find’ . Although the difference in detail between the two geological maps is striking, the suggested archaeological interpretations are to be considered mere speculation[51].

Where crevasse channels taper out into the floodbasin their widths decrease to only several metres, while at their starting point a general width of 20-30 metres is common[53].

As it has become clear that prehistoric (certainly early- and Middle Bronze Age) settlements were located on these crevasse channels, or on the relatively higher parts of the natural landscape caused by the presence of crevasse deposits at shallow depths[54], the facts that these are rarely pin-pointed in geological coring campaigns (because of the low auger density[55]) and thus remain ill-known, is a valuable observation.

6.2.4 Low resolution data: the inventory

At this point I will try to assess whether the data from the inventory is of sufficient quality to shed some light on the developments and dynamics presented in chapter 1, paragraph 1.2.2.1. This can be seen as a combination of both methodological as well as archaeological source criticism.

6.2.4.1 Applicability / quality assessment

A quality assessment of the low-resolution data used in this study will necessarily involve a certain degree of generalisation. As I have stated earlier, there is considerable danger of over-generalisation in archaeological regional analyses[56]. Therefore, the classification used below is only valid to illustrate possible methodological infirmities within this study.

The total of 107 sites listed in my inventory, have been evaluated for primary conditions to be used in regional analysis. These were quite trivial: Do we known the co-ordinates, or preferably; is there some information obtainable on its geological context[57]?

[50] This is a copy of Makaske’s geological map of the Schoonrewoord system. See Makaske 1998, p. 180, Fig. 5.5a. For legend see this study Fig. 2.16.
[51] This inventory number (26) was specifically selected for illustrative purposes. For secure archaeological interpretations more information on the context of the find is needed. One should keep in mind that this axe was found in the topsoil, which might have been redeposited.
[52] MapInfo (5.0) Tables makaske1_rotated.tab and makaske2_rotated.tab in the digital data: ‘MapInfo (5) Tables’.
[54] See chapter 4, paragraphs 4.3.2 and 4.4.2 and this chapter figures 6.12 and 6.13.
[55] See chapter 2, paragraph 2.3.2.
[56] Sites ranging in quality, nature and date being reduced to co-ordinates and generalised dates. See paragraph 6.2.1.
Can the finds be located for study to confirm or enhance their dating? Is their archaeological dating sufficiently precise? Are they otherwise irrelevant?

The pie chart below visualises the results of these questions.

![Pie chart]

Fig. 6.7 Diagram of low-resolution inventory evaluation (absolute numbers of occurrence).

The entries classified as ‘irrelevant’ have been singled out for more precise indication. They should not be misinterpreted as ‘without value’. These comprise auger descriptions of Betuweroute sites, and sites classified as being beyond the chronological or geographical scope of this study. Therefore, if another methodology is applied, their value needs to be re-evaluated.

As the pie chart above is an grouping of summed (absence of) conditions, their interrelation should also be examined. For the sake of clarity, the inventory numbers designated ‘irrelevant’ have been left out.

![Association diagram]

Fig. 6.8 Association diagram of low-resolution evaluation parameters.

Two aspects should be clarified: First, the relevance of finds which could not be retrieved for personal study appears overrated. Although this methodologically is a disadvantage, its archaeological implications need not be as severe. For instance, if a site has been thoroughly described in the ARCHIS system, the original material does not always have to be re-studied, to be used in regional analysis.

Secondly, the high correlation between an unknown geological context and insecure dating is the result of stray axe finds. Flint axes are resistant to fluvial erosion, generally well preserved and easily recognised. Furthermore, almost fifteen percent of the inventory sites is associated with sand dredging activities. The geo-stratigraphical context of most of these sites is unclear.

The five instances where dating was problematic despite some information on the geological context, involved undecorated ceramics, ill-described flint and a fragment of a polished flint axe recovered from a profile.

If we take into account the problem of the ‘ill-datable’ axes, the lack of detailed information on the geological backgrounds appears to be the primary flaw within this data-set. Although a considerable number of sites from the inventory have been labelled ‘void of (geo-stratigraphical) context’, more detailed analysis is needed. I have the strong impression that inadequate attention is being paid to the geomorphogenesis of the sediment in which archaeological remains have been discovered. There are sites where fluvial erosion might have played a considerable part, and this severely complicates their interpretation.

The point I want to make clear is that ‘finding a sherd in a darker layer of a profile’ does indeed provide it with context, but does not permit an ‘in situ’ -let alone ‘settlement’- interpretation without careful study to determine whether or not that layer is the result of sedimentation of material (natural and/or archaeological) originating from elsewhere.

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59 See the query ‘Evaluation Query: Dating Insecure’ in the digital data (inventory.mdb, queries).
60 See the queries ‘Evaluation Query: Not relevant’ and ‘Evaluation Query: Relevant?’ in the digital data (inventory.mdb, queries).
61 As I have pointed out earlier (paragraph 3.3.2), the lack of lithostratigraphical detail forms a far more influential problem in using ARCHIS in the river area than the dating. The dates entered in ARCHIS for archaeological sites are generally reliable.
62 Two antler and six flint (and one jade) axes. These are inventory numbers 21, 25, 26, 27, 29, 30, 41 and 48.
63 See the query ‘Evaluation Query: Dredging Finds’ in the digital data (inventory.mdb, queries).
64 These are inventory numbers 31, 53, 78, 104 and 107.
65 See the query ‘Evaluation Query: Context unclear’ in the digital data (inventory.mdb, queries).
66 Fluvial erosion might have affected inventory sites 2, 12, 13, 17, 37 and 102 (Late Neolithic) and 42, 73, 76, 77 and 85 (Bronze Age).
The sites classified as relevant are also in need of some explanation. In the process of evaluation, the archaeological sites in the inventory have been grouped into four ‘classes of relevance’. Although I have tried elsewhere to quantify more precisely ‘low-resolution’ archaeological data, I have the strong feeling that in case of doubtful representativeness, the data should be evaluated on a more profound individual basis. However, to create a (certainly questionable) degree of differentiation between the sites grouped as ‘relevant’, these were assigned to four classes. Again, this classification offers little to no potential at all to answer archaeological questions but serves merely to present some methodological considerations.

Sites classified as ‘relevance category 1’ comprise stray finds, often found during survey, or archaeological remains of which the geological context was unclear. Their interpretative value is mostly limited to indications of ‘absence or presence’. If more details on the litho-stratigraphical context are known, or a wide variety of material culture was retrieved from a confined locality, sites were classified as ‘relevance category 2’. These often represent archaeological observations at construction sites or during the construction of drainage systems, where information on the geological context was of a higher quality. Stray finds that through their exceptional nature were entitled to specific attention (such as the jet bead recovered from inventory number 14 ‘Maurik Meerboomweg’) were also added to class ‘2’.

This emphasis on availability and quality of background information is also noticeable in the criteria used for assignment to classes ‘3’ (predominantly test-pits and small-scale trenches (dug by local archaeologists)) and ‘4’ (large-scale excavations).

Two remarks need to be made. First, some confusion may arise towards the origin and ‘label’ of the sites in the inventory, often presented as ‘low-resolution’ data. The fact that these have been listed in the inventory does not define them as ‘low-resolution’. The sources that were used to establish the inventory (archaeological journals, ARCHIS and local collections) were expected to yield ‘low-resolution’ data. Although this has certainly proven to be the case, this is no strict law.

Thus, because it was entered into the ARCHIS database, the ‘Zijderveld’ excavation was taken into the inventory, notwithstanding the fact that this clearly represents an example of what has been labelled ‘high-resolution’ data. Inherent to my reluctance to adhere much value to (over)simplified or ‘bi-polar’ distinctions as ‘low’ versus ‘high’ resolution, I think that some inventory numbers classified as class ‘3’ could equally well be labelled ‘4’ or being of ‘moderate’ quality. Essentially, such classifications are of little value for they rely far to heavily on personal evaluation and specific research strategies.

Secondly, there is a danger that this classification will be interpreted as a methodological evaluation of archaeological data. Although I have already pointed out that I by no means wish to imply archaeological significance to it, my evaluation shows a strong correlation between ‘(methodological) origin’ (e.g. stray find, survey, observation of findlayer(s) in profile, test-trenches, extensive excavation) and assigned class/ascribed quality of the archaeological data. Although information on the (geological/ litho-stratigraphical) backgrounds is imperative to (nearly) all archaeological interpretation, I deem this dominance in the evaluation of the applied methodology (regional analysis) within this (fluvial) study area justified.

6.2.5 High resolution data: the excavations

The Betuweroute railway construction has offered archaeologists an unique chance to archaeologically investigate a cross-section of the Dutch river delta. In this paragraph I will try to assess to what extent this new data can be used to answer the questions asked in the first chapter of this study. This is predominantly a methodological evaluation, specific archaeological implications will be discussed in paragraph 6.3.

6.2.5.1 Applicability / quality assessment

The classification ‘high-resolution’ data is based on a number of properties that will be listed below.

The location of the excavations have been selected based on preliminary investigation of their quality. This encompasses aspects like site-preservation, integrity and extent in both horizontal and vertical plane, preservation of artefact categories, possibilities for paleo-geographical reconstructions and scientific infrequency of occurrence.

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67 This was done to establish a map indicating archaeologically valuable areas preceding prospective research. See: http://archweb.leidenuniv.nl/fa/student/bijvak/gap/puntensysteem.htm or home page http://archweb.leidenuniv.nl/fa/student/bijvak/gap/index.htm.

Therefore, as a contrast to the ‘low-resolution’ data whose discovery often depends on chance, the location of the excavations were deliberately selected to yield the best quality of information concerning both the archaeological sites, as well as the surrounding landscape.

The location of both large scale excavation surfaces as well as smaller test-trenches and the methodology used in the field were guided by various hypotheses that were established prior to the actual fieldwork. As preliminary investigations had identified various sites as prehistoric farmsteads, these hypotheses concentrated on the relations between man and landscape in their broadest sense. The location of both large scale excavation surfaces and landscape in their broadest sense might have led to a neglect of the considerable information on diachronic developments on both ‘site’ level as well as the level of ‘archaeological phasing’. In the Betuweroute excavations lithostratigraphical, palynological, (AMS) radiocarbon and dendrochronological dating could be combined with the observations on land-use, subsistence and material culture. This contrasts to the dating based on typology that is common to the ‘low-resolution’ data.

However, some critical remarks need to be made. First of all, the desire to concentrate on the relation between farmsteads and their immediate surroundings might have led to a neglect of the wider range of landscape exploitation. I have the feeling that this, once again, is the result of the higher archaeological ‘visibility’ of settlement sites as a contrast to other forms of human presence in a landscape. Consequently, the cyclic pattern of ‘site location expectation’ and ‘affirmation’ is maintained. It is beyond doubt that the scale and methodology used in the excavation of the farmsteads will yield new and stimulative insights on the subject of farmstead functionality, but is it fair to ultimately reduce the relation between man and landscape to the functionalist level of ‘occupation’?

Although the attention paid to ‘off-site’ archaeology during the Betuweroute investigations is considerable (and thus displays a noteworthy estrangement from the circular argument of ‘expectation-affirmation’ referred to above), it is still confined to the narrow strip of the prospective railway track. Prehistoric behaviour like herding, hoarding, gathering, farming, worshipping and maintaining in contact with nearby local populations will have encompassed a far larger geographical range.

Secondly, we should evaluate whether the archaeological data obtained from the Betuweroute excavations is equally representative for all periods of interest. To put it exaggerated; the find of a single Bell Beaker sherd near a Middle Bronze Age farm does not permit an interpretation as ‘Late Neolithic to Middle Bronze Age settlement site’. The outcome of this evaluation should be kept in mind when assessing any interpretation derived from that data.

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69 See Hielkema et al. in prep. and Hielkema, Brokke & Meijlink in prep., paragraph 3.1.2. and chapter 4, paragraphs 4.3.1 and 4.4.1.
70 It is explicitly stated that the primary objective was to excavate the entire farmsteads and their immediate surroundings. Cf. Hielkema et al. in prep., paragraph 3.1.1.

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71 Theunissen also has argued that the most detailed information applies to the level of farmstead-analysis and not to the wider scope of structuring and exploiting the landscape (Theunissen 1999, p. 191).
72 For instance, floodbasin deposits were investigated to a comparable extent as the (supposedly more interesting) inverted channel bed and levee deposits. This has resulted in remarkable observations on landscape exploitation (e.g. the burned layers of clay in the floodbasins of sites ‘Eigenblok’). See Hielkema et al. in prep., Van Zijverden in prep.(a), chapter 4, paragraph 4.3.2 and chapter 6, paragraph 6.3.1, especially 6.3.1.3.
73 On patterns of deposition see: Fontijn in prep. and Van der Beek in prep. On landscape usage see: Fokkens 1999, p. 37, Theunissen 1999, p. 185-198, Hielkema et al. in prep., Van Zijverden in prep(a,b). and chapter 4, paragraph 4.3.2. Note that while significant evidence is available to demonstrate that some of these activities (also) took place at close distances from the farmsteads (see chapter 4, paragraph 4.3.2), the far from ample investigations of the geographically more distant areas does not permit conclusions on their absence in regions located at greater distance.
6.2.5.2 The Eigenblok Complex

It has already been pointed out in chapter 4 that at Eigenblok sites 1 to 4 no differentiation between either the findlayer or the recognised features of the earlier (Late Neolithic or Early Bronze Age) or later (Middle Bronze Age) phase was possible, although indicators of both periods were present. At Eigenblok site 5 and 6 an intercalating layer of clay separated these, although this layer could not be found in all excavation trenches. The level of ‘data-quality’ for these two periods is hardly comparable. The small number of features that were recognisable on higher levels during excavation, that could be (radiocarbon) dated or that could be interpreted as ‘belonging to structures (typologically) datable to the Middle Bronze Age’ are supplemented by numerous features that could not be assigned to either the earlier (Late Neolithic or Early Bronze Age) or later (Middle Bronze Age) phase.

It appears to be the case that the ‘intrusion’ (palimpsest contamination) of some Late Neolithic or Early Bronze Age features into a Middle Bronze Age excavation surface is less problematic than the situation wherein only few features can be assigned to an earlier phase. This might imply that feature density of Late Neolithic and Early Bronze Age sites is considerably lower than that of Middle Bronze Age sites. One should keep in mind that the archaeological features for the earlier phase of the Eigenblok complex chiefly consists of single postholes, some fences and light structures and ard marks. Furthermore, crevasse activity has done considerable damage to the integrity of the lower occupation layer.

As far as methodology is concerned, two aspects in my opinion represents the scientifically most valuable properties of the Eigenblok complex excavations. The first is the fact that archaeological remains (especially bone and ceramics) have been recovered from two chrono-

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74 At Eigenblok sites 2 to 4 two separated archaeological layers were identified, but in those cases the Middle Bronze Age layer was the oldest. However, the significance of these ‘indicators’ of the earlier phase varies considerably. See Hielkema et al. in prep.
75 See Hielkema et al. in prep., paragraph 3.7.1.
76 As a general rule, this seems to be the case (but see plans in: Van Beek 1990). Furthermore, I think we should be aware of the fact that an earlier phase underlying a later settlement site should not necessarily be interpreted as a settlement site too. The remains of the earlier phase can (and sometimes clearly do) represent off-site peripheral patterns.
77 Hielkema et al. in prep., paragraphs 3.7.1 and 3.8.4.
78 Van Zijverden in prep.(a) and Hielkema et al. in prep.
79 However, one should always be aware of the methodology that was practised in the field. Where all features excavated? Were plans of the trench surface drawn for various depths? Are materials recovered from separate phases comparable in quantitative and qualitative aspects? These are all relevant considerations.
The second aspect is the fact that considerable attention has been paid to investigate the relation between the settlements and the landscape.  

6.2.5.3 The Bogen Complex

The methodology applied during the ‘Bogen’ complex excavations differed marginally from that of the ‘Eigenblok’ excavations. Based on the extensive preliminary fieldwork, the location of the excavation trenches was selected to offer the best opportunities to answer the (same) central hypotheses:

- What was the relation between man and environment during the phase(s) of occupation?
- How long were settlements occupied and are diachronic changes discernible?
- What factors were of significance in the choice of settlement location?
- What was the size and internal functionality of a prehistoric farmstead?
- Can we identify features, structures and areas for specific activities within the settlement?

Full-scale excavation of the sites suspected to represent prehistoric farmsteads was supplemented by less extensive excavation of more peripheral areas. The investigation of the dynamics relation between man and landscape was the primary objective of the conducted physical-geographical research.

Although the methodology displayed great similarities, the nature of the archaeological record of the ‘De Bogen’ complex differed in one important aspect from that of the ‘Eigenblok’ complex. Unlike at ‘Eigenblok’, no intercalating archaeologically sterile layer of sediment was discovered that could offer differentiation between the earlier (Late Neolithic and Early Bronze Age) phase(s) and the later (Middle- to Late Bronze Age, Early Iron Age) periods of use.

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80 The specific physical-geographical objectives were to determine what the immediate surroundings (500m) during occupation looked like, how the landscape was used during and after occupation, whether the physical properties of the landscape might have (partially) influenced settlement strategies, how large the settlements were and why they were abandoned (Van Zijverden in prep. (a), paragraph 2.1.2).
81 See chapter 4, paragraph 4.4.1.
82 Hielkema, Brokke & Meijlink in prep., paragraph 3.1.2.
83 These are ‘De Bogen’ sites 28-1, 28-4, 29, 30 and 45. See Hielkema, Brokke & Meijlink in prep., paragraph 3.2.1.
84 In particular ‘De Bogen’ sites 28-2 and 28-3. As the objective was to fully excavate the prehistoric farmsteads, the landscape exploitation approaching the limits of the excavations trenches can sometimes also be classified as ‘peripheral’ (Hielkema, Brokke & Meijlink in prep., paragraph 3.2.1).
85 Van Zijverden in prep. (b), paragraph 2.1.2.
As a consequence, it was decided to largely remove the findlayer without further collection of archaeological materials. Only in test-trenches measuring four by four metres the findlayer was sieved and sampled for detailed analysis. This will evidently complicate find (category) distribution analyses.

### 6.3 Transitions: An archaeological tale of the Dutch central river area

In this paragraph I will focus not so much on the flaws and methodological objections resulting from the methodology and data used in this study, but on the specific archaeological significance. This will be done according to the general themes introduced in chapter 1, (paragraph 1.2.2) that describe the various dynamics that archaeologists assume to have taken place between the Late Neolithic and the Middle Bronze Age. The reader should be aware that the paragraphs below are the result of my personal interpretation of the known data, and do not present an all-embracing final discussion of all known facts.

Rather, it is a narrative based on the selective discussion of all available data to answer thematically the question to what extent this study, with its applied methodology, can enhance our views on the processes of culture change that took place during the Late Neolithic and the Middle Bronze Age. Furthermore, as the relation between man and landscape was central to this study, the paragraph concerning ‘settlements’ will consequently be more extensive than the others.

#### 6.3.1 Settlements

##### 6.3.1.1 Vlaardingen and Beaker Culture period

Unfortunately, the settlement pattern and dynamics of the Late Neolithic remains illusive. Whereas to the west of the study area various localities have been investigated that with reasonable certainty might be labelled activity areas dating to the Vlaardingen Culture period, no unambiguous Vlaardingen Culture sites could be identified within the study area.

The geomorphology (river dune) of the locality ‘Schoonrewoerdse Donk’ near Leerdam where Vlaardingen sherds, flint flakes and a scraper were found does correlate to the general geomorphology of the Vlaardingen sites located more to the west. However, the ‘Schoonrewoerdse Donk’ also yielded materials dating to later periods so that we cannot be sure whether all artefact categories belong to the Vlaardingen Culture phase of activity. The Vlaardingen Culture sherds that were recovered near the provincial road at Geldermalsen were retrieved from washed sediment, but perhaps indicate nearby presence. If so, this would imply that Late Neolithic activity took place during, or very quickly (within two to three hundreds of years) after the phase of fluvial activity of a nearby stream.

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86 Hielkema, Brokke & MeiJink in prep., paragraph 3.1.1.

87 Although this has not been given sufficient attention in this study, I think that the term ‘culture change’ is a misnomer. It implies a static definition of culture, whereas the dynamics associated with the evolution, adaptation and changes within culture in my opinion would advocate a more ‘dynamic’ definition.

88 See inventory numbers 3, 5(4), 7(6) and 33. The fact that these are all located on fossil river dunes in my opinion tells us perhaps more about the research strategy adopted by the archaeological workgroup ‘Lek en Merwestedreek’ than on Vlaardingen Culture settlement preferences. Louwe Kooijmans 1974, p. XVII, 361-377.

89 The remains were found within 200 metres of a gully that supposedly was active between 5000 and 4000 B.P. However, both the origin of the materials as well as the location and phase of activity of the gully are uncertain.

90 The geomorphology (river dune) of the locality ‘Schoonrewoerdse Donk’ near Leerdam where Vlaardingen sherds, flint flakes and a scraper were found does correlate to the general geomorphology of the Vlaardingen sites located more to the west. However, the ‘Schoonrewoerdse Donk’ also yielded materials dating to later periods so that we cannot be sure whether all artefact categories belong to the Vlaardingen Culture phase of activity. The Vlaardingen Culture sherds that were recovered near the provincial road at Geldermalsen were retrieved from washed sediment, but perhaps indicate nearby presence. If so, this would imply that Late Neolithic activity took place during, or very quickly (within two to three hundreds of years) after the phase of fluvial activity of a nearby stream.

Fig. 6.9 Inventory sites located on channels of the Zoelen system.
As according to ARCHIS only Vlaardingen ceramics were found at this part (inventory number 8) of ‘Zoelen-Maurikse straat’ the presence of an (exclusively) Middle to Late Neolithic layer of debris might be expected, although other findspots at the same locality have yielded wide ranges of dates. Some of these might have been located on the levee deposits of a gully that was active between 4500 and 4000 B.P., although channel bed deposits and levee deposits of another gully belonging to the ‘Zoelen system’ are suspected to have been deposited between 4000 to 2000 B.P.

As no information on the lithogenesis of the sediments in which the Vlaardingen remains were found was obtainable, the ‘Mauriksestraat’ sites offer us little insight between landscape and settlements during the Vlaardingen Culture period.

The 80 Vlaardingen sherds found together with flint artefacts, bone, burned clay and stone at inventory number 32 (‘Zoelen-Kerkenakkers 2’) might point toward interpretation as a settlement site, although (again) the interpretation as ‘Vlaardingen’ is uncertain. The presence of channel bed deposits of Early-Holocene fluvial systems in the substrate might have prevented (or decreased) subsidence and favoured habitation.

The site ‘Erichem – Hoge Korne’ (inventory number 12) also yielded a darker layer with archaeological remains, although at this locality a Vlaardingen Culture vessel bottom was found together with an AOO2th Beaker. The interpretation remains unclear because lack of information on whether or not the darker layer represents redeposited material. The same line of reasoning can be followed for inventory number 17, ‘Maurik-Meerboomweg’, although here the identification of the pottery as ‘Vlaardigen-type’ also remains dubious.

At Echteld-Scheele Hoek (inventory number 53) supposed Late Neolithic ceramics were recovered from a feature at a construction site. As this site too is located near a branch of the Zoelen system, it would indicate Late Neolithic activity in a landscape with two active streams at less than 500 metres distance. The size of the feature, two by five metres, in my opinion complicates the interpretation. Perhaps the fill of a natural depression has been misinterpreted as a feature.

All sites listed above are located in the north-eastern part of the study area and show a strong correlation to the branches of the ‘Zoelen system’. The nature of this correlation, however, remains uncertain. If we interpret the finds from the sites as ‘washed out material’, the long phase of activity (between 4300 B.P. and 2400 B.P.) of the Zoelen system might be held responsible for this. However, the combination of Early-Holocene sandy deposits in the substrate combined with the sandy levee deposits of the active Zoelen system might equally well have provided the drier grounds favoured by prehistoric man. Without detailed information of the lithogenesis of the sediments this correlation cannot be fully explained. The obvious argument that sites generally appear to be located on top of suspected channel bed or levee deposits and that therefore the latter interpretation is most likely valid, is naïve. One should also take into account the unequal chances of discovery. As (continuous) sequences of sandy sediments are less susceptible to subsidence, they will often have remained relative higher parts of the surface and were covered by thinner layers of sediments, thus increasing their chances of discovery (e.g. through recent ploughing, see inventory number 32). Sites located in the floodbasins have considerably smaller chance of being discovered.

Inventory numbers 13 (‘Geldermalsen-Hangwaard I’) and 37 (‘Geldermalsen-Middengebied’) have preserved Late Neolithic ceramics that presumably originates from the same site. They are both located on channel bed deposits of a small creek that was active between 5500 and 5000 B.P. During the Late Neolithic some ditches were dug and ceramics left behind. At that time the nearest active gully was located 500 metres to the south-east. The site was largely destroyed by active branches of the Est system between 3100 and 2000 B.P., although a dislocated lump of clay had preserved a part of the Late Neolithic find layer.

These two findspots indicate that during the final Late Neolithic-B small (100 metres in width) strips of inverted channel bed deposits were structured or altered by man, most likely with the intention to define spaces for habitation and/or agriculture. Analysis of the wider geography has indicated that the nearby presence of active creeks, if not favouring, certainly did not prohibit human presence.
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The data available does not substantiate interpretations concerning site-functionality and seasonality. As stray finds (predominantly flint axes) and find-spots whose geological background is not properly understood dominate the archaeological record for this period, aspects like site function and settlement dynamics evade our grasp. However, this is not to suggest that these aspects cannot be studied in the future. The fluvial setting of the Dutch central river area has outstanding capabilities to preserve the organic evidence that will be of primary importance in answering such questions. Unfortunately, this kind of ‘high-resolution’ data is not yet available for the study area.

6.3.1.2 Late Beaker and Early Bronze Age period.

Various inventory numbers associated with the sanddredge site ‘Zoelen-Mauriksestraat’ have yielded indicators of Late Neolithic and Early Bronze Age activity. However, it has already been argued above (see paragraph 6.3.1.1), that there is insufficient information available on their exact former lithostratigraphical position to be used in interpretation. This is no different for the other inventory numbers assigned to these archaeological periods.

Although we are able to point out that during these periods activity occurred throughout the study area, one cannot but conclude that the ‘low resolution’ data is uninformative on settlement patterning and dynamics.

Let us now turn to the available ‘high-resolution’ data. At ‘Eigenblok’ sites 5 and 6 several outbuildings, some small stakes and a burial mound were assigned to a phase most likely Late Neolithic to Early Bronze Age in date. As no farmhouse dating to this phase could be reconstructed we can only assume that the identified features and structures represent the remainder of a settlement located nearby, that has been largely destroyed by later crevasse channel activity. The structures belonging to this phase were erected on the levee deposits and crevasse deposits of the ‘Eigenblok system’ which was active during the Middle Neolithic-B and the Late Neolithic-A. The paleo-sol that was found in various excavation trenches indicates that during a considerable period of time (50-100 years) processes of sedimentation and erosion came to a halt. The drier grounds of the levees will have housed lush vegetation, dominated by alder, some of which was presumably cleared for the construction of houses and fields. It is assumed that fresh water must have been obtainable from ponds in the floodbasin or from the residual gully of the meander belt. At the end of the Early Bronze Age renewed crevasse activity occurred that has eroded parts of this paleo-sol, but simultaneously provided new settlement opportunities for later phases.

Although material ranging in date from the Late Neolithic to the Late Bronze Age has been discovered at the ‘De Bogen’ complex sites, no single Late Neolithic and/or Early Bronze Age phase or site could be reconstructed. At all sites a palimpsest of material dating from the Late Neolithic to the Middle Bronze Age was discovered. The recovery of Late Neolithic ceramics from the find-layer is suggestive of activities during this period.

97 Hielkema et al. in prep. See chapter 4, paragraphs 4.3.2.5 and 4.3.2.6.
98 Hielkema et al. in prep and Van Zijverden in prep (a).
99 See Stouthamer in prep. and Van Zijverden in prep (a).
100 Van Zijverden in prep (a), Berendsen 1982 and Steenbeek 1990.
101 See Van Zijverden in prep (a) and Hänninen & Van Haaster in prep.
102 See Hielkema et al. in prep. and Van Zijverden in prep (a).
103 Hielkema, Brokke and Meijlink in prep.
104 In the preliminary report it is stated that the fact ‘people lived at this (29 S.A.) site is proven by the occurrence of pottery in the find-layer’ (Hielkema, Brokke & Meijlink in prep., p. 80). Certainly on a textual level, this is a disputable remark.
105 One post-hole of a two-aisled farm at ‘De Bogen’ site 28-4 yielded a Barbed Wire decorated sherd (Hielkema, Brokke & Meijlink in prep., paragraph 3.9).

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95 For Late Neolithic indicators see inventory numbers: 15,102 and 103. For Early Bronze Age indicators see inventory numbers: (8), 19, 20, 60, 61, 102, 103 and 105.
96 See inventory numbers 9, 12, 13, 14, 15, 17, 18, 53, 62, 63, 104, 106 and 107.
6. Synthesis

6.3 Transitions: An archaeological tale of the Dutch central river area

Although two-aisled Late Neolithic house plans are known\textsuperscript{106}, I am reluctant to date any of these typologically to the Late Neolithic. However, the existence of Late Neolithic occupation on ‘De Bogen’, is strongly suggested by the presence of a hearth, two wells and a burial mound which were all radiocarbon dated to the Late Neolithic period\textsuperscript{107}.

There are some indications that the appreciation and exploitation of the landscape during this period was not confined to ‘settling on the drier and higher grounds’. Both the location of the wells (near the lowest parts of the crevasse deposits or in the residual gullies) as that of the burial mound (situated on, or perhaps comprising) the highest tip of the natural crevasse landscape testify to the detailed knowledge of the qualities and capabilities of the landscape\textsuperscript{108}. The resolute and deliberate transformation of the surrounding landscape from ‘nature’ into ‘culture’ during the Late Neolithic period perhaps hints at an appreciation of the (dynamic relation between man and) landscape that might have manifested itself in various other aspects of everyday life.

As all sites at ‘De Bogen’ have been occupied during the Middle Bronze Age too, the reconstruction of the Early Bronze Age phases is strongly hampered\textsuperscript{109}. For the total of five relatively reliable two-aisled farms reconstructed, a \textit{terminus post-quem} date to the Early Bronze Age could be obtained for only one\textsuperscript{110}, although presumably all date to the Early Bronze Age and/or first centuries of the Middle Bronze Age. Some radiocarbon dates of wells that span the Early Bronze Age\textsuperscript{111}, as well as ceramics\textsuperscript{112} dating to the Early Bronze Age support the assumed occupation during this period. However, due to the palimpsest nature of the site no clear-cut reconstruction of how Early Bronze Age settlements were organised or interacted with their environment could be made.

In general, the interpretation of partially eroded findlayers and (small) postholes that cannot always be interpreted as structures ‘underneath’ a later phase of human (occupation) or fluvial activity remains problematic.

As not many other large-scale excavated settlements dating to either the Late Neolithic or the Early Bronze Age are known from the Dutch river area, interpretations based on site comparison are hazardous\textsuperscript{113}. However, I think it is better to explain why the interpretation is problematic, than to simply state that ‘Late Neolithic or early Bronze Age pottery has been found in the findlayer, or in this or that feature’ as has been done for the Dodewaard excavation\textsuperscript{114}. Likewise, I feel that archaeologists should be weary of over-interpreting spatial distributions of artefact categories.

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Fig. 6. 11 Example of a spatial distribution analysis.

Spatial absence-presence diagrams like the one reprinted above tell us little about past behaviour and suggest a geographical confinement that in my opinion belies past historical reality.

6.3.1.3 Middle Bronze Age

If the three-aisled farm excavated at ‘Culemborg-Rietveldseweg’ (inventory number 18) indeed dates to the Middle Bronze Age as is suggested by its layout and the Middle Bronze Age ceramics recovered from the nearby break-through channel fill, it was constructed on the sandy channel-bed and levee deposits of the Schoonrewoerd system that had been inactive for at least five centuries\textsuperscript{115}. Although no further information on settlement structure (outbuildings, fences, etcetera) is available, ‘Culemborg-Rietveldseweg’ is still the most informative ‘low-resolution’ inventory site\textsuperscript{116}.

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\textsuperscript{106} Chapter 5, paragraph 5.2.5.1.2, note 73 and Verhart 1992.
\textsuperscript{107} Radiocarbon dates will be published in: Hielkema, Brokke & Meijlink in prep.
\textsuperscript{108} Van Zijverden in prep.(b) and Hielkema, Brokke & Meijlink in prep.
\textsuperscript{109} Hielkema, Brokke & Meijlink in prep. and chapter 4, paragraph 4.4.
\textsuperscript{110} See this chapter, note 105.
\textsuperscript{111} For radiocarbon dates see: Hielkema, Brokke & Meijlink in prep
\textsuperscript{112} Ufkes & Bloo in prep.
\textsuperscript{113} Best-known are sites ‘Ottoland-Kromme Elleboog’ (Wassink 1981), ‘Molenlaarsgraaf’ (Louwe Kooijmans 1974) and ‘Dodewaard’ (Hulst 1991 and Theunissen 1999).
\textsuperscript{114} See Hulst 1991, p. 56 and Theunissen 1999, p.150 on Late Neolithic ceramics of the Dodewaard excavations. In my opinion archaeological finds are not self-evident but demand some degree of interpretation.
\textsuperscript{115} For dating of the Schoonrewoerd system see chapter 2, paragraph 2.4.8.1.
\textsuperscript{116} Inventory numbers 71,73,76,77 have all yielded pottery that was dated to the Bronze Age in general and are located to the west of the study area.
At the complex ‘Maurik Zoelensestraat’ considerable quantities of Middle Bronze Age ceramics have been uncovered, but it has already been discussed above that their interpretation is problematic. At ‘De Hoogt’ near the town of Zijderveld a test-pit near the flanks of the Zijderveld channel bed deposits yielded some Middle Bronze Age ceramics. According to ARCHIS the sherds were small and rounded, and interpreted as originating from washed or trampled sediments. However, as the Zijderveld system ceased, some Middle Bronze Age ceramics. According to ARCHIS the sherds were small and rounded, and interpreted as originating from washed or trampled sediments. However, as the Zijderveld system ceased around 3400 cal. B.C. and no active fluvial systems were locally present thereafter, these might very well correspond to Middle Bronze Age occupation nearby.

The presence of multiple artefact categories like bone, stone, ceramic and flint as have been recovered from a ‘darker layer’ at ‘Beusichem-Pietersteeg’ (inventory number 85), might represent settlement debris. This site seems to be located on top of the channel-bed and levee deposits of a river channel that was active between 6000 B.P. and 4500 B.P. During the Middle Bronze Age, an active branch of the Hennisdijk system was located within 1 kilometre distance. Unfortunately, during the Iron Age a gully belonging to the Buren system is located on the exact same position and might have eroded possible settlements and have dislocated finds.

The Middle Bronze Age pottery discovered in the profile of a ditch near Erichem (‘Erichem-Linge’, inventory number 79) has little value as long as it remains unclear whether it represent washed out material. Although the sandy sediments deposited by fluvial systems active from the Early-Holocene to the Iron Age will have provided a dry and preferable settlement locality in prehistoric times, the continuous fluvial activity is also very liable to have disturbed the various remains thereof.

The inventory numbers 86 (‘Buren-Nieuwe Tiend’), 88 (‘Zoelen-Munnikskamp’), 89 (‘Zoelen-Munnikskamp 2’) and 87 (‘Kerk Avezaath-Korenbroek’) are all located on the channel bed and levee deposits of the Zoelen system (for location see figure 6.9 above). Because these were nearly all found during survey, it is impossible to assess the role of the Zoelen system in preserving or having eroded the assumed Middle Bronze Age settlements.

The high numbers and diversity (burned clay, ceramics, cooking stones, flint and bone) of materials recovered certainly are suggestive of nearby Middle Bronze Age occupation. Corollary, I am reluctant to adhere too much value to the discoveries of single Middle Bronze Age sherds.

The ‘Zijderveld’ excavations took place between 1965 and 1971 and were situated on the top of the channel bed deposits belonging to the Zijderveld system. This was one of the first excavations in the river area to yield a relatively complete reflection of Middle Bronze Age farmsteads. Due to the high ground water table and the fact that no later fluvial erosion took place, the preservative quality was extraordinary. Beside the smaller features like fences, stake walls and cattle imprints in the deeper post-holes wood had been preserved. Some disturbance of the site resulted from habitation on the same location during the Early- and/or Middle Iron Age.

The central and presumably highest part of the inverted channel bed deposits displayed the highest density in features and structures (for major features see chapter 3, fig. 3.14). A three-aisled farm, numerous outbuildings (some of which dated to the Iron Age) and extensive fencing were discovered. Located towards the border of the channel bed deposits some outbuildings, but predominantly fences were unearthed.

This might implicate that the marginal parts of inverted channel deposits were used for purposes other than habitation. Unfortunately, the location of the excavation trenches does not allow such conclusions. If the density and number of rebuild fences is to be considered an indicator of nearby presence of a farmstead (as one might expect from looking to the western part of the excavation plan), the possibility of more farmsteads being located more to the east cannot be excluded. Perpendicular test-trenches located near the border of the levee deposits or detailed coring might have yielded valuable observations on this option. However, one should keep in mind that ‘Zijderveld’ was a rescue excavation. The rapid expansion of the nearby sand-dredge site left little time to answer such questions.

\[117\] Chapter 6, paragraph 6.3.1.1.

\[118\] See Theunissen 1999, p. 157 and chapter 2, paragraph 2.4.7.4.

\[119\] See the paleogeographical maps by H.J.A. Berendsen and E. Stouthamer in the digital data (MapInfo) tables.

\[120\] The Zoelen system was active between ± 4300 B.P. and 2400 B.P. (chapter 2, paragraph 2.4.8.2).

\[121\] According to ARCHIS, inventory number 89 has been completely disturbed. Because of their close proximity, this might also have some consequences for the other inventory numbers.

\[122\] Therefore, inventory numbers 81 (‘Drumpt-Het Achterveld’), 82 (‘Buren-Nieuwe Steeg’) and 83 (‘Culemborg-Voorkoop’) will not be dealt with here.

\[123\] On the Zijderveld excavations see: Huls 1991 and Theunissen 1999, p. 156-185. On the Zijderveld fluvial system see chapter 2, paragraph 2.4.7.4.

\[124\] Theunissen 1999, p. 159.

\[125\] Charcoal from two postholes was radiocarbon dated to the Middle Bronze Age: 1878-1452 cal. B.C. (Gn5376: 3370 ± 80 B.P.) and 1430-1140 cal. B.C. (Gn6406: 3065 ± 55 B.P.)

\[126\] Theunissen 1999, p. 156.
If we compare the evidence from Zijderveld with an idealised Middle Bronze Age farmstead\textsuperscript{127}, the relative absence of pits and wells, as well as the large quantities of fences is striking. Whereas the relative overrepresentation of fences at this site might be attributed to the better preservation, the absence of pits cannot\textsuperscript{128}. The prehistoric landscape morphology seems to have played an important part in structuring settlement layout. The lower and wetter parts (ponds?) near the location of the residual gully were not used for the construction of outbuildings nor farms but presumably for the watering of animals\textsuperscript{129}.

The role of landscape morphology and settlement lay-out (and perhaps functionality) is also visible at the sites of the ‘Eigenblok’ complex. For all sites it has become clear that the highest density of features has accumulated on the higher parts of the crevasse (sites 1 to 4) or channel bed/levee deposits (site 5 to 6)\textsuperscript{130}.

Although in some cases detailed radiocarbon dating might provide insight into ‘whether the granaries were there first and were later replaced or supplemented with a farm or conversely’, the main importance is the fact that this clearly demonstrates a dynamic prehistoric attitude toward site functionality\textsuperscript{132}.

The correlation between feature-density and elevation is affirmed by the excavations at site 2. The lower areas seemed to have housed fences exclusively, although clusters of cattle-imprints do occur near a wetter depression\textsuperscript{133}. The exact same orientation and location of the rebuild Middle Bronze Age farm perhaps indicates that little time elapsed between the building of the first and second farm. Presumably the remains of the first farm were still visible\textsuperscript{134}.

From this point of view it is perhaps remarkable that at site 4 only one farm seems to have been erected, although radiocarbon dating has illustrated that this might be the oldest house of the ‘Eigenblok’ complex\textsuperscript{135}. The fences that clearly cross-cut the house plan can either be younger as well as older and are hardly distinguishable from the hundreds of small stakes located to the south of the south.

127 A three-aisled farm, accompanied by several rectangular outbuildings and clusters of pits, (occasionally) a well and (rarely) a burial mound, encompassed in a fenced-off, more or less rectangular, area.

128 At the site ‘Dodewaard’ the number of pits was also low (Theunissen 1999, p. 148).

129 This is indicated by the presence of cattle imprints (Theunissen 1999, p.170). At the ‘Eigenblok’ and ‘De Bogen’ complex cattle-imprints did also cluster around (natural) depressions (Hielkema et al. in prep. and Hielkema, Brokke & Meijlink in prep.). However, possible pollution due to the presence of cattle as is suspected by Wilko van Zijverden to have occurred does not favour these as sources for potable water (Van Zijverden in prep. (b), paragraph 2.5.3).

130 Hielkema et al. in prep., paragraphs 3.3 to 3.9.

131 Hielkema et al. in prep., paragraph 3.3.2.

132 Although I for this site feel no need to relate the cultural biography of the farmsteads to that of people, the ideas put forward by Gerritsen (2000) do comply better with this dynamics than former more ‘static’ notions of farmsteads.

133 Hielkema et al. in prep., paragraph 4.3.3. We should be careful in interpreting these as drinking ponds. There is some risk of circular reasoning; as the depressions were wetter they could preserve imprints, whereas cattle walking (or even drinking) on all higher parts of the farmstead may have left no traces behind.

134 Three scenarios come to mind: 1. The farm was rebuild (extended, Hielkema et al. in prep. paragraph 3.3.4 and Theunissen 1999, p. 162) during a single generation. 2. The same preconditions that determined the location and orientation of the first house did also apply to the construction of the second. 3. Building on top of an older house was one of such (social/ideological) preconditions.

135 Radiocarbon dates will be published in Hielkema et al. in prep.
Some large features consisting of burned clay and charcoal could not be interpreted functionally, but their location in the lower floodbasin is noteworthy.\textsuperscript{136} The settlement location and layout of sites Eigenblok 5 and 6 is very similar to those of Dodewaard and Zijderveld.\textsuperscript{137} Located on the border of the crevasse splay and the levee deposits, or on the highest part of the inverted channel bed deposits, a typical Middle Bronze Age farmstead structure seems to have been preserved.\textsuperscript{138} As high concentrations of cattle imprints were discovered to the north-east of a fence which seems to limit the farmstead at site 5 to the north-east, it is suspected that the fence served to keep the cattle away from the farmyard.\textsuperscript{139} Site 5 and 6 were the only ones to yield ard-marks. Perhaps their location, more toward the (even drier?) levee- and channel bed deposits, favoured the lay-out of agricultural fields.\textsuperscript{140}

Site Eigenblok 6, and perhaps also Eigenblok 5, are also remarkable in their long periods of use. Although the evidence for Late Neolithic and/or Early Bronze Age occupation is scant, both sites seem to have been occupied regularly during these periods. The Late Neolithic or Early Bronze Age burial mound excavated at Eigenblok site 6, if not uninterrupted acting as a focal point, at least was respected and reinstated through new interments during the Middle Bronze Age.\textsuperscript{141}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig6_13}
\caption{Fig. 6.13 Location of the ‘De Bogen’ sites plotted on an relative elevation map of the underlying crevasse deposits (light-green is low, red is high).}
\end{figure}

Site 30 also testifies of a long period of use. As many as four three-aisled house plans have been found superimposed in the southern part of the excavated area.\textsuperscript{145} Again, this suggests some kind of preference of settling former inhabited areas.\textsuperscript{146}

\textsuperscript{136} Hielkema et al. in prep. A functionalist explanation could be that this was done to avoid large open fires near the houses.


\textsuperscript{138} Unlike at ‘Eigenblok’ sites 1,2 and 4, but similar to ‘Zijderveld’, no wells were identified. Perhaps wells were dug out of sheer necessity at sites further away from the crevasse deposits where no residual gully existed to provide fresh water.

\textsuperscript{139} At ‘Eigenblok’ sites 5 and 6 these occur both within as outside the assumed farmyards (Hielkema et al. in prep.). Cattle imprints were also found outside the assumed farmyard at ‘Eigenblok’ site 2 (Hielkema et al. in prep.) and ‘Zijderveld’ (Theunissen 1999, p. 171-172).

\textsuperscript{140} Hielkema et al. in prep., Van Zijverden in prep.(b), paragraph 2.5.3, Theunissen 1999, p. 133, Kooistra 1994 and Kooistra 1996. I think that we need to be rather reserved with the assumption that no agriculture at all took place in the floodbasin. However, even if these had existed their archaeological visibility is low. Floodbasin deposits usually consist of moderate clay only, which leaves no apparent soil-traces and is susceptible to fluvial erosion through (annual?) flooding. Furthermore, these have not yet been investigated to the same extent as the higher stream ridges.

\textsuperscript{141} This is quite common. Within her study area, Liesbeth Theunissen discovered that seven out of fourteen Late Neolithic mounds were re-used during the same or later periods. Cf. Theunissen 1999, p.57.

\textsuperscript{142} As the available space to construct new farmsteads on the relatively wide (over 110 metres) channel bed and levee deposits must have been considerable, the integration of the older burial mound within a new farmstead is suggestive of an appreciation -albeit most likely reinterpreted- or ascribed value of settling on plots of land that were conceptually and/or visibly associated with former (perhaps perceived as ancestral) activity.\textsuperscript{143}

In general, the typical picture of Middle Bronze Age farmsteads located on the higher parts of the crevasse landscape emerges for the sites of the ‘De Bogen’ complex too.\textsuperscript{144} The picture below illustrates the position of the site ‘core-areas’ (blue) on an elevation map of the crevasse underlying crevasse deposits.

I wish to avoid the confinement to merely funerary associations. In my opinion, burial mounds were not erected nor (re)-used solely to ‘bury the dead’. To examine their diverse implications, however, lies beyond the scope of this study. However, to serve as an example, the associations between ancestors, agriculture and fertility possibly expressed through the deposition of grain in the burial mound as at ‘De Bogen’ remains titillating (for an example see Hielkema, Brokke & Meijlink in prep.).

\textsuperscript{145} The presence of burial mounds within farmsteads has been claimed for West-Frisia in general (Jozsef & Van Regteren-Altena 1991) and sites ‘Elp’ (Waterbolk 1964/1987), ‘Emmerhoout’ (Van der Waals & Butler 1974) and ‘Hijken’ (Harsem 1974/1991). The suggestion that in West-Frisia these were erected by/for the initial colonists clearly does not apply to this incorporation of older mounds (Fokkens 1999, p. 34).

\textsuperscript{146} See this chapter note 134.
Rebuilding of farms on more or less the same location was also frequently encountered on site 29\textsuperscript{147}. Fencing did not seemed to define farmsteads at site 30, but concentrated toward the north and south of the concentration\textsuperscript{148}. Whereas at the ‘Eigenblok’ complex at some sites the fencing seems to follow the contours of the crevasse landscape, at the ‘de Bogen’ complex this was not as clear. On the contrary, the 172 metres long palisade at site 29 in some places is positioned at right angles to the landscape morphology\textsuperscript{149}. The large space approaching the floodbasin which it encompassed cannot (yet) be understood functionally, but does remarkably well indicate that social space (or the stage of human activity) by no means was confined to the higher sandy crevasse deposits.

At site 45 overlapping house-plans are absent. From this point of view, the four possible farms, centred around the burial mound, might even have coexisted\textsuperscript{150}. The available radiocarbon dates of two houses overlap, but their range by far exceeds the generally assumed life span (20-40 years) of wooden farms in the river area.

The role of the Late Neolithic burial mound at site 45 remains ambiguous. Although it was used for interment during the Late Neolithic and Middle Bronze Age-B, a phase of occupation directly aside (and presumably on top of) the low mound is suspected during the start of the Middle Bronze Age\textsuperscript{151}. This demonstrates the dynamic perception or ambiguous role of the burial mound within the Bronze Age settlement structure. Albeit unclear how it was perceived, or whether it perhaps even formed a stimulus in farmstead construction for that particular crevasse-height, the fact remains that it has been respected by three farmsteads, overbuild by one, and used once again for burial after its phase of ‘occupation’\textsuperscript{152}.

It has already been mentioned in chapter 4 that the results from excavation of the western part of the ‘De Bogen’ complex (sites 28-1 to 28-4) are considered to confirm the patterns established for the eastern sites (30, 29 and 45)\textsuperscript{153}. Therefore, only some general remarks will be made here.

First of all, the farmsteads (28-1 and 28-4) appear to be located on the higher parts of the crevasse deposits, whereas the site 28-2 and 28-3 that were located more toward the floodbasin can be interpreted as peripheral areas.

Secondly, as sites 28-1 to 28-4 are all located on a much smaller strip of crevasse deposits, it is tempting to interpret the high number of overlapping house plans at site 28-1 and 28-4 as a possible result of the small (and due to the rising water level\textsuperscript{154} increasingly getting smaller) available dry and higher located surface\textsuperscript{155}. However, I feel that more (extensively dated) large scale excavations of settlement complexes on crevasse as well as on channel bed and levee deposits are necessary to make any substantiated comments on this subject.

Summarising, a general picture of the relation between landscape and settlements for the Middle Bronze Age can be presented. Settlements, consisting of a three-aisled farm, accompanied by several rectangular outbuildings and clusters of pits, (occasionally) a well and (sometimes) a burial mound which encompassed in a fenced-off, more or less rectangular area were located in the central river area on higher sandy sediments. These could be either river dunes\textsuperscript{156}, wide stretches of inverted channel bed and levee deposits\textsuperscript{157} or the sometimes much smaller heights created by the presence of (sequences of) crevasse channels deposits in the subsoil\textsuperscript{158}.

The relationship between the settlements and the landscape is a highly dynamic and bilateral one. Sometimes locations where prior human activities had taken place were occupied\textsuperscript{159} and sometimes new, relatively ‘young’, crevasse channels appear to have been colonised. The vicinity of nearby (within a kilometre) active streams or channels perhaps favoured, but certainly did not prevent the erection of farmsteads. Although there is abundant evidence to suggest that man took an active role in transforming and exploiting his ‘immediate’ surroundings, the environment conversely preconditioned human activities to a certain extent: Levee breaches might have inundated former pasture lands, avulsions might have destroyed formerly occupied areas, whereas the gradual rise of the ground water table presumably has ended Middle Bronze Age occupation at various sites.

\textsuperscript{147} In at least two cases a two-aisled farm was partially overbuild by a later three-aisled farm (Hielkema, Brokke & Meijlink in prep., paragraph 3.4).
\textsuperscript{148} Hielkema, Brokke & Meijlink in prep., paragraph 3.3. The orientation of many fences corresponded better to the orientation (and the direction perpendicular to that) of the two-aisled than of the three-aisled farms.
\textsuperscript{149} Hielkema, Brokke & Meijlink in prep., paragraph 3.4.4. This was also indicated by the large features consisting of charcoal and burned clay near the floodbasin at the sites of the ‘Eigenblok’ complex.
\textsuperscript{150} Hielkema, Brokke & Meijlink in prep., paragraph 3.5.5.
\textsuperscript{151} Hielkema, Brokke & Meijlink in prep., paragraph 3.5.7.
\textsuperscript{152} This contrasts to the situation at ‘Eigenblok’ site 6. See Hielkema, Brokke & Meijlink in prep., paragraph 3.5.7.
\textsuperscript{153} See chapter 4, paragraph 4.4.2.4.
\textsuperscript{154} Van Zijverden in prep(b), paragraph 2.5.1.
\textsuperscript{155} See Hielkema, Brokke & Meijlink in prep., paragraph 3.6.5 and 3.9. Sites 30 and 29 perhaps also qualify.
\textsuperscript{156} See inventory numbers 6/7 and 37.
\textsuperscript{157} For example site ‘Zijderwaal’, Eigenblok site 5 and site 6 and inventory numbers 18, 85, 86-89.
\textsuperscript{158} See Eigenblok sites 1,2,4 and all sites belonging to the ‘Bogen’ complex.
\textsuperscript{159} See inventory number 6/7, 17, the sites of the ‘Mauriksestraat complex (inventory numbers 10, 11, 19, 20, 29, 38, 80, 84, 102-107), Eigenblok sites 5,6 and De Bogen site 29,30,28-land 28-4.
The internal structure of the settlements located on the crevasse channels was presumably guided more by landscape morphology than those located on the more vast channel bed- and levee deposits. Wells were dug in the lowest parts to provide the inhabitants with potable water and fences bordered the wetter zones near the floodbasin. It appears to be the case that the ‘crevasse settlements’ were inhabited as long as the ground water table was acceptable. At various sites superimposed house plans and ranges of radiocarbon dates hint at the long periods of use during the Middle Bronze Age. In general, the number of outbuildings (‘granaries’) is high, suggesting that they might have compensated for the lower numbers of (storage) pits.

Superimposed house plans occur less frequently at the settlements located on the extensive inverted channel deposits. The ‘exclusive’ presence of agricultural fields on channel bed and levee deposits indicated by ard-marks can be attributed to both ground-water level and soil-composition.

Perhaps, although this is a personal view-point rather than a proven fact, the high number of overlapping house-plans at the settlements located on the crevasse deposits might indicated that these were preferred settlement locations in the Dutch central river area and were only (after intensive use) abandoned if the ground water table caused unacceptable drowning of the landscape. It would be interesting to investigate with a larger data-set whether there indeed are less superimposed house plans on the lowest parts of the crevasse (which might have been first to ‘drown’) and channel bed/levee deposits (where enough land was available for wandering) farmsteads to avoid overbuilding than on the (preferred?) higher parts of the crevasse landscape. The latter housed farmsteads that were conveniently located centrally between the fields on the nearby stream ridges and the floodbasin favoured for cattle grazing.

The high diversity in vegetation and fauna within short distances typical of the crevasse landscape will certainly have contributed to this attractiveness.

One should keep in mind that the subsections above have focussed on the settlements, not on the total of prehistoric behaviour. It has become clear that a much vaster landscape was exploited. Uninhabited and forested higher areas will have been used to collect edible (e.g. fruits, plants) and/or functional (e.g. antler, timbers, pebbles) raw materials. Cattle imprint have been found in the floodbasin, as well as large features of burned clay and charcoal. In the floodbasin, amongst other activities, some fishing and presumably the collection of osier took place. In some cases, fences seem to have been erected that divide or encompass plots of the floodbasin plain. So far, these have been investigated near to (as to determine their relation with) the settlements. It seems appropriate to engage in supplementary research that concentrates on the nature, extent and phasing of the total of ‘floodbasin’ activities.

6.3.2 Funerary rituals

I have the impression that both the quantitative as well as the qualitative properties of the material culture associated with death and burial for all periods currently under investigation contribute to the low archaeological visibility. As fieldwalking is the most widely adopted method by local archaeologists, it should be pointed out that the associated features (circular ditches, postholes, grave-pits) can hardly (if at all) be recognised during survey. Furthermore, the inorganic grave goods interfere in most cases also known from other contexts (e.g. settlements or votive-depositions).

This low visibility can be illustrated with the ARCHIS query for burial mounds in the Netherlands reprinted overleaf. The Holocene fluvial delta appears to be void of burial mounds.

Therefore, the discovery during survey of the cremated remains at ‘Zoelen Mauriksestraat’ (inventory number 80) is quite remarkable. These were found in association with the bottoms of two ‘Drakestijn/Laren’ type ceramic vessels dating to the Middle Bronze Age. These might very well represent secondary burials originating from a burial mound disturbed by ploughing.

160 See (amongst others) sites ‘Zijderveld’ (Theunissen 1999), ‘Eigenblok 5 and 6’ (Jongste in prep.) and ‘De Horden’ (Hessing 1991).
161 See: Eigenblok sites 5 and 6. However, some disputable ard-marks were discovered at site 29. See Hielkema, Brokke & Meijlink in prep., paragraph 3.4. See also this chapter, note 160.
162 I have the feeling that we might be dealing with two ‘types’ of superimposed house plans that could have differed substantially in prehistoric perception. The first is the replacement (possibly caused by (a combination of ?) decomposition of timbers, household/livestock expansion or social motives) of farms within one or two generations, that can be characterised by the fact that inhabitants of the first house also inhabit the second. The second type might be the preferred allocation of a former farmstead as the location for a new farm, to house inhabitants which had not lived there during their last ‘wandering farmstead phase’. As these might be both (the descendants of) the people that had formerly occupied the farm to be overbuild) as well as a genetically/socially unrelated group, it is unclear whether the (constructed) social relation between the old farmstead and ‘new’ inhabitants was of significance in this process.

164 Again, there is more to material culture than just ‘function’.
165 The fluvial geomorphogenesis already discussed in paragraph 6.2.2.2.1 decrease chances of discovery even more.
166 Theunissen 1999, p. 84-86, (Fig. 3.29).
6. Synthesis

6.3 Transitions: An archaeological tale of the Dutch central river area

The ‘Betuweroute’ excavations have proven the existence of Late Neolithic and Bronze Age burial mounds in the Dutch central river area beyond doubt. As the analysis of their significance in the wider study of (changes in) funerary ritual lies beyond the scope of this MA thesis, it will suffice here to state that both burial mounds confirm in nearly all aspects (like dimensions, interments and grave goods) to the general patterns discernible in overall Late Neolithic to Middle Bronze Age burial tradition.

The fact that the Late Neolithic mound period at ‘De Bogen’ site 45 was located at the highest peak of the local crevasse topography perhaps indicates that the higher (highest?) sandy soils were assigned (social and/or ideological) meaning beyond the functionalist level of ‘dry land’. Their close spatial association with the later Middle Bronze Age farmsteads perhaps reflects a preference to settle in a landscape which exhibited the (mythical) remembrance of past (ancestral?) activities.

Besides the fact that such hypotheses are hard to substantiate and their representativeness for the entire Dutch river area cannot yet be known, the presence of features underneath and within the mound body testifies of the susceptibility to change of this assumed relation. Throughout time, occupied areas could be transformed into funerary spaces, just as well as an occupation phase partially extending on a former burial mound could be replaced by another mound period.

6.3.3 Economy

It has already been introduced in chapter 1 that the study of prehistoric ‘economy’ is a twentieth century misnomer used to study prehistoric subsistence strategies and exchange relations. This concern with ‘the physical evidence’ (e.g. paleo-zoology, paleobotany and raw material analyses) of past human activities in my opinion has made these types of investigation susceptible to ecological- and functionalist determinism. The investigation of artefacts that are considered to be of supra-local origin cannot be conducted properly if not guided by the implicit awareness that unsubstantiated use of equalisations like ‘distance means exotic’ and ‘exotic means status’ is more informative on the archaeologists in question than on prehistoric behaviour.

It is assumed that paleo-zoological, paleo-botanical and palynological studies offer the best possible ways to study prehistoric subsistence strategies. However, as these are all dependent on the preservation of organic materials, they seldom can be used to study ‘low-resolution’ data. The majority of the ‘low-resolution’ data has been discovered at the surface during survey, where decomposition of organic remains starts immediately.

Special attention was paid to the presence of grain-impressions on pottery, but none were discovered. One lump of burned clay from ‘Maurik Meerboomweg’ had preserved several imprints of an unidentified species of grass (Graminae) or sedge (Cyperaceae).

Fig. 6.14 ARCHIS map for burial mounds (all periods) in the Netherlands.

For ‘Eigenblok’ site 6 see Hielkema et al. in prep., paragraph 3.8.4 and chapter 4, paragraph 4.3.2.6. For ‘De Bogen’ site 45 see Hielkema, Brokke & Meijlink in prep., paragraph 3.7 and chapter 4, paragraph 4.4.2.3.

For an introduction to burial customs see: Theunissen 1999, p.35-110; Lohof 1994. It points out that cups have been endowed with a diversity of meanings as a contrast to being mere representations of ‘male warrior elite’ items (See also chapter 5, paragraph 5.2.4.1).

See Hielkema, Brokke & Meijlink in prep., paragraph 3.5.7 and Van Zijverden in prep.(b).

167 For ‘Eigenblok’ site 6 see Hielkema et al. in prep., paragraph 3.7.

168 This was the case at ‘Eigenblok’ site 6 (Hielkema et al. in prep., paragraph 3.7).

169 See Hielkema, Brokke & Meijlink in prep., paragraph 3.5.7 and chapter 4, paragraph 4.4.2.3.

170 See chapter 5, paragraphs 5.2.1, 5.2.3.1 and 5.2.4.1. I agree with Van der Beek and Fokkens that (the method of) endowing material culture with meaning is highly variable in both synchronic as well as diachronic sense (Van der Beek & Fokkens in prep., paragraph 1.4). For an introduction to the dynamics of material culture see Appadurai 1986. For some anthropological examples see Verhart 2000, p. 19-31.

171 For some anthropological examples see Verhart 2000, p. 19-31.

Fig. 6.15 Imprint of plant remains on a fragment of burned clay from site ‘Maurik Meerboonweg’.

Both burned as well as unburned bone, antler and dental remains have been preserved at various sites listed in the inventory\(^{175}\), but because they were either stray finds or originated from sites with multiple periods of use, could not be used to make specific inferences on prehistoric subsistence strategies\(^{176}\).

It has already been pointed out that the location of the ‘Betuweroute’ excavations were (partially) guided by the desire to gain insight into prehistoric subsistence strategies and therefore indirectly by the degree of preservation of organic material\(^{177}\). A summary of the results and discussion of the paleozoological and paleobotanical studies will be printed below\(^{178}\).

Due to the fact that discrimination between an earlier (Late Neolithic and/or Early Bronze Age) and a later (Middle Bronze Age) phase was possible at sites 5 and 6 of the ‘Eigenblok’ complex, the archaeozoological evidence might indicate diachronic patterns. During the Late Neolithic/Early Bronze Age phase at Eigenblok site 5 predominantly medium-sized animals were kept\(^{179}\).

Within this size-class (although overall only a very low number of bones could be assigned to species) sheep/goat dominated, supplemented by some pig/swine\(^{180}\). The number of identified cattle bones matches that of sheep/goat, but as the weight is seen as a better indicator, cattle is considered to be the most ‘important’ domesticated animal. Sheep/goat are just ranked second and pig undisputedly third\(^{181}\). The fact the undomesticated bone spectrum is dominated by marten-like species might suggest that the procurement of fur, rather than meat was essential in hunting\(^{182}\).

The number of bones recovered from phase 1 at ‘Eigenblok’ site 6 is even lower, but mammal-size distribution is comparable to that of ‘Eigenblok’ site 5\(^{183}\). Beside some bones of cattle and pig, no other (undomesticated) species could be identified.

If we compare these results with those from other Late Neolithic sites that have been compared by E. F. Gehasse, no identical pattern emerges\(^{184}\).

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Table 6.3 Ratios of W(ild), D(omesticated) animals, Pig(Sus), Bos (cattle), O/V (Sheep/goat) and ratios for mammals (MA), birds (AV) and fishes (PI). For dates of archaeological periods see Gehasse 1995 and Ten Anscher in prep.

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\(^{175}\) See the query ‘Preservation Bone’ in the ‘inventory.mdb’ database in the digital data. Unfortunately, all faunal remains investigated during the study of the ‘BATO’ collection (See chapter 3, paragraph 3.3.3.1 and Appendix III) originated from multi-period sites.

\(^{176}\) As organic remains of settlements exclusively dated to the Late Neolithic-A are absent in both ‘high-resolution’ as well as ‘low-resolution’ data, this study does not inform the reader on specific subsistence strategies for this period. For a discussion of other sites dating to this period see: Zeiler 1997 and Gehasse 1995.

\(^{177}\) See chapter 6, paragraph 6.2.5.1.

\(^{178}\) At the time of writing for the Eigenblok excavations only the preliminary chapter ‘zoology’ (Van Dijk & Schelvis in prep.) was available. For the ‘De Bogen’ complex both the preliminary ‘zoology’ chapter (Van Dijk, Esser & Zeiler in prep.) as well as the preliminary ‘archaeobotany’ chapter (Hänninen & Van Haaster in prep.) were studied. I want to thank both excavators and authors for letting me study these preliminary reports.

\(^{179}\) Van Dijk & Schelvis in prep., paragraph 8.4.

\(^{180}\) Van Dijk & Schelvis in prep., paragraph 8.4. This contrasts the continued importance of pig/swine as assumed by Louwe Kooijmans (1993a). For the problems associated with differentiation between domesticated and wild pig see: Gehasse 1995, p. 4-5 and Bogucki 1989.

\(^{181}\) Van Dijk & Schelvis in prep., paragraph 8.4.1.

\(^{182}\) However, it seems quite likely that these were consumed after skinning. Van Dijk & Schelvis in prep., paragraph 8.4.1.

\(^{183}\) Insufficient number could be assigned to species to comment on the ratio pig: sheep/goat (Van Dijk & Schelvis in prep., paragraph 8.4.1).

\(^{184}\) See Gehasse 1995, p. 226 (Table 9.12).
6.3 Transitions: An archaeological tale of the Dutch central river area

The relatively minimal ‘importance’ of wild species appears similar to that of sites ‘Molenarsgraaf’ and ‘Ottoland-Kromme Elleboog’, but the percentage of cattle at those sites was much higher than at ‘Eigenblok’. The distribution in size-classes seems to correspond better to site ‘P14’ (and to a lesser extent ‘J 78’)\footnote{See Gehasse 1995, p. 227, Bakels 1994, p. 108.}, although here the role of undomesticated species (hunting) hampers comparability. Gehasse argues that in comparison to the other sites listed in the table reprinted above, the environment surrounding the site ‘P14’ would have favoured the hunting of red deer and beaver\footnote{See Gehasse 1995, p. 100 and chapter 5, paragraph 5.2.5.1.2.}.

These variations in my opinion present no problem. Rather, I think that the study of such (micro-local?) adaptation of subsistence strategy to the surrounding landscape will help ‘solving’ the ‘problem’ of these differences. It suffices to state that the total range of choice that were open to man were selectively exploited\footnote{This remark is to stress (once again) the fact that the environment undoubtedly will have influenced man in its choices, but did not necessarily force man into making any of them (ecological-determinism).See Louwe Kooijmans 1993(a), p 100 and chapter 5, paragraph 5.2.5.1.2.} and these could vary considerable within distances as little as several kilometres. To establish the degree to which these choices indeed were influenced by local landscape morphology and vegetation, more detailed excavations (and paleogeographical reconstructions) of sites are needed.

For this earlier period the role of crop-cultivation remains hard to evaluate. The plough-marks dating to the Late Neolithic / Early Bronze Age phase that have been found\footnote{See Gehasse 1995, p. 226.} inform us on the presence, yet not on the relative importance of crop-cultivation in the total of available subsistence strategies. For sites ‘Molenarsgraaf’, ‘P14’ and ‘Zwollesumerbroek’ some cereal cultivation is suggested\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}

The absence of an intercalating layer between the remains of earlier (late Neolithic to Early Bronze Age) and later (Early-Middle Bronze Age) phases\footnote{Evidence for the presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.} at the complex ‘De Bogen’ excludes all possibilities for diachronic analysis.

Therefore, the summarised results from the zoological and botanical studies will only marginally be referred to.

For the later (Middle Bronze Age) phase more information on subsistence strategies is available from the ‘Zijderveld’, ‘Eigenblok’ and (albeit less applicable) ‘De Bogen’ excavations.

The evidence for animal breeding at ‘Zijderveld’ stems predominantly from archaeo-zoological study of the faunal remains\footnote{Evidence for the presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}. The three-aisled house has yielded no stable and the cattle imprints discovered could not be dated with certainty to the Middle Bronze Age\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}. In both number and weight cattle accounts for over 85% of the bone assemblage. Pig is ranked second (between 4.5% in weight and 10% in number), followed by sheep/goat (less than 3% in both number and weight\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}. Less than two percent (three fragments) could be identified as wild species\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}. As these observations have been made on a very limited (30) number of bones, their significance should not be overrated. The primary indicator for crop cultivation is the peak (20-30%) in *Cerealia* in the pollen diagram corresponding with the Middle Bronze Age occupation\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}. Charred grains of barley (*Hordeum vulgare vulgare*) and some husked emmer (*Triticum dicoccum*) were retrieved from the fills of postholes\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}.

For the Middle Bronze Age occupation at ‘Eigenblok’ site 5 and 6 ‘paleo-zoological study has demonstrated that in both number and weight cattle was by far the most frequently recovered domesticated animal, followed -at a significant distance- by equal values for sheep/goat and pig\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}. Although the low numbers of fish bones recovered might (partially) be the result of unequal preservation or methodology\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}, it is clear that the low number of undomesticated mammal species reflects a deliberate (choice of) prehistoric subsistence strategy\footnote{The evidence for presence of horse (Equus cabbalus/ferus) is next to absent. See Van Dijk & Schelvis in prep., paragraph 8.4.2/8.5.2 and chapter 4, paragraph 4.3.3.}.
Various cereals were presumably cultivated locally, as the grains of wheat (genus *Triticum*), barley (*Hordeum vulgare*) and (wild) oats (*Avena fatua*) were retrieved from plough-marks. The high values for cattle and the much lower, yet nearly equal values for sheep/goat and pig at the ‘De Bogen’ complex mimics the species distribution at the ‘Eigenblok’ complex. The undomesticated species that have been recognised cannot be assigned to a specific phase, although the comparison with other sites (see Table 6.3 above) might favour a dating to the Late Neolithic and/or Early Bronze Age. Study of the domesticated plant species from the ‘De Bogen’ complex revealed that barley (*Hordeum vulgare*) and emmer wheat (*Triticum dicoccum*) formed the most prominent species. The vegetable diet will have been supplemented by the gathering of other wild plants and fruits located nearby. The paleobotanical study affirmed the interpretation of a divers landscape with moderately open forested higher areas and wetter areas near the floodbasin.

All species recovered from the ‘Zijderveld’, ‘Eigenblok’ and ‘De Bogen’ excavations are in accordance with the landscape and vegetation archaeologists suspect to have existed near the farmsteads. Therefore, it is clear that the archaeologically visible organic materials are by no means indicative of (the existence of) supra-local exchange relations.

This is not to suggest that organic (raw) materials were not used in exchange relations. On the contrary, livestock may have very well been used as a social ‘unit of value(s)’.

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201 Some barley was also recovered from post-holes (Hielkema et al. *in prep.*, paragraph 3.7.4).

202 Van Dijk, Esser & Zeiler *in prep.*, p. 30 (Discussion ‘De Bogen’).

203 Van Dijk, Esser & Zeiler *in prep.*, p. 38. Fragments of wild goat (*Sus scrofa*), aurochs (*Bos primigenius*), red deer (*Cervus elaphus*) and perhaps beaver (*Castor fiber*) and otter (*Lutra vulgaris*) can indicate hunting for both meat as well as hide.

204 For detailed results see: Hänninen & Van Haaster *in prep.*, paragraph 10.3.2.

205 Burned remains of the genus *Prunus* and unburned *Rubus* seeds were found (Hänninen & Van Haaster *in prep.*, paragraph 10.3.2).

206 Theunissen 1999, p. 192-197, Hielkema et al. *in prep.*, Hielkema, Brokke & Meiink *in prep.*, Van Zijverden *in prep.a/b* and chapter 2, paragraph 2.4. I am hesitant to assume a correlation between the decrease of ‘importance’ of sheep between the earlier and later phases at ‘Eigenblok site 5’ and the ‘drowning’ of the landscape (Van Dijk & Schelvis *in prep.* and Van Zijverden *in prep.a*), although the risk of infection with *Menetus dilatatus* must have increased. On *Menetus dilatatus* infection see: http://www.gd-dieren.nl/pages/herkauwe/rundvee/ziektten/parasiet/hrzlev.htm#top (Dutch), Theunissen 1999, p. 190 and Schippers 1988.


208 For an ethnographic example of the different social settings and associated values of both organic and inorganic goods among the local population of the Mount Hagen area (new Guinea) see: Strathern 1971, p. 93-114 (esp. Table 10, p. 102). For an ‘material cultures study’ approach see: Appadurai 1986.


210 Examples have been found at ‘Voorschoten’, ‘Leiden’, ‘Kolhorn’ and ‘Swifterband S3’ (Louwe Kooijmans 1985, p. 53, 68, 92).


Archaeologically invisible (organic) artefacts, perhaps textiles or basketry, might also have been incorporated in exchange relations. Furthermore, one should keep in mind that there were no such things as ‘trade goods’. Objects were (and are) re-interpreted and endowed with associations and meaning based on their desired function in social activities.

As no specialist reports on the inorganic artefact categories from either the ‘Eigenblok’ nor the ‘De Bogen’ complex were studied during this study, an inter-source evaluation (‘low’ versus ‘high’ resolution data) of possible exchange relations cannot be made. However, some remarks on the ‘low-resolution’ data will be made. On the ‘high-resolution’ data is concerned the reader is referred to Jongste *in prep.* and Meiink *in prep.*

The jade axe that has been recovered from the river Meuse near the town of Lith indicates that during the Neolithic period some exchange of objects took place. Although no exact raw material origin is known for jade(ite) and nephrite axes, it is assumed that they originate from the south-western part of the Alpine region and date to the Middle- and Late Neolithic period.

One of the most beautiful indicators of (gradual?) long-distance displacement of commodities is the jet bead discovered at ‘Maurik-Hornixveld’.

Jet beads are infrequently found and presumably date to the Middle and Late Neolithic period. The northern coast of France near Boulounge-sur-Mer is the most likely raw material source of jet during these periods.

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212 For an ethnographic example of the different social settings and associated values of both organic and inorganic goods among the local population of the Mount Hagen area (new Guinea) see: Strathern 1971, p. 93-114 (esp. Table 10, p. 102). For an ‘material cultures study’ approach see: Appadurai 1986.


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214 Louwe Kooijmans 1985, p. 92.
6. Synthesis

6.3 Transitions: An archaeological tale of the Dutch central river area

During the study of the material of the B.A.T.O. collection (see chapter 3, paragraphs 3.3.3.1 and 3.4) two fragments of so-called ‘northern flint’ were discovered\textsuperscript{214}. One was a small (85 grams) nodule of light grey flint that had been rounded through rolling in a river and that had thereafter been intensively used as a hammer-stone\textsuperscript{215}. The other was a small (15 grams) flake of grey flint that showed (macroscopic) traces of being used as a cutting tool\textsuperscript{216}. The ‘northern’ flint is characterised by the presence of \textit{Bryozoa} (also known as \textit{Ectoprocta}) inclusions and originates from the regions covered by ice during the ‘Saale’ glaciation\textsuperscript{217}. The nearest location (perhaps within 10 kilometres) are the ice-pushed ridges of the Utrecht hills\textsuperscript{218}. Unfortunately, the dating of the material from ‘Maurik Meerboomweg’ ranges from Late Neolithic(-B) to the Middle Bronze Age, so we cannot be sure from which period these objects date.

6.3.4 Technology

The study of prehistoric ‘technology’, or the use of material culture, for the periods in question based on the available data in this study is problematic. It has already been discussed above that no specialists reports on artefacts of wood, metal, stone or flint recovered from the selected Betuweroute excavations have been studied\textsuperscript{219}, so that an inter-source comparison between ‘high’ and ‘low’ resolution data cannot be made.

Furthermore, the study of the diverse role of material culture in prehistoric behaviour in general would demand a methodology and scale that are incompatible with the nature of this MA thesis. Therefore, only smaller remarks that might illustrate the relation between occupants, material culture and landscape will be presented below.

In general, all stone (including flint) that has been studied from the B.A.T.O. collection\textsuperscript{220} might have been collected from the channel bed deposits of nearby fluvial systems.

Fig. 6.17 Flint ‘knife’ of ‘northern flint’ from site ‘Maurik-Meerboomweg’.

The other was a small (15 grams) flake of grey flint that showed (macroscopic) traces of being used as a cutting tool\textsuperscript{216}. In particular the flint and (quartzite) sandstone were frequently rounded and polished, which might be taken as an indication of its fluvial origin. Recognised artefact-types made from this type of flint were predominantly scrapers, ‘knife’ flakes and some (Early Bronze Age ?) arrowheads\textsuperscript{221}. The flint from site ‘Maurik-Meerboomweg’ is predominantly unworked, although the presence of small chips of flint and some core fragments suggest flint processing on the site\textsuperscript{222}. Among the selection of rocks identified sand-stone, quartzite sandstone and quartz were encountered most frequently.

Three grinding stones and a hammer stone (chapter 3, fig. 3.11) were made of quartzite sandstone\textsuperscript{223}. Only infrequently fragments of (weathered) granite and some diorite were discovered\textsuperscript{224}.

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\textsuperscript{214} These were identified by H. Fokkens and Liesbeth Theunissen, 06-06-2000.
\textsuperscript{216} Site ‘Maurik Meerboomweg’, box 117, bag 4, labelled ‘Maurik Meerboomweg S101C, 11-04-1991; 157.980-440.680. A similar blade was selected for microscopic use-wear analysis and was possibly used in longitudinal direction to cut unknown substances (see appendix V).
\textsuperscript{217} Van Gijn, Lammers & Houkes \textit{in prep.}, paragraph 6.3 and Beuker 1983, p. 7.
\textsuperscript{218} See: Louise Koosjmans 1974, p. 229 and Van Gijn, Lammers & Houkes \textit{in prep.}, paragraph 6.3.
\textsuperscript{219} For these the reader is referred to Jongste \textit{in prep.} and Meijlink \textit{in prep.}
\textsuperscript{220} Chapter 3, paragraphs 3.3.3.1 and 3.4.
\textsuperscript{221} Here, the flint recovered from site ‘Maurik Meerboomweg’ (inventory number 17) is discussed as being representative for the total of lithics studied. Chapter 3, paragraph 3.4, number 17.
\textsuperscript{222} However, both the interpretation as a (settlement) site as well as the dating is contestable.
\textsuperscript{223} These originated from site ‘Zoelen-Zaolenseput Oost’, Collection BATO, box 203 and ‘Maurik Meerboomweg’ box ‘Maurik Meerboomweg 1989’.
Although no mineral analysis on any of these rocks has been done, the dominance of quartzite and sandstone does comply to the (generalised) composition of Rhine/Meuse distributaries.

The ‘low-resolution’ ceramic evidence is even less informative on the relation between man and landscape. As no mineralogical or chemical analysis of studied pottery and possible clay sources has been undertaken, it is impossible to determine whether or not (all) ceramics were potted of local clays. However, I have the impression that the floodbasin deposits of the Dutch river area must have provided man with abundant excellent pottery clays. Due to the high degree of fragmentation and (fluvial) erosion man with abundant excellent pottery clays. Due to the high degree of fragmentation and (fluvial) erosion the ceramics from the B.A.T.O. collection studied the high degree of fragmentation and (fluvial) erosion of the ceramics from the B.A.T.O. collection studied (see the roundness of the pottery on figure 3.5), no remarks on the validity or value of the models often used to describe Late Neolithic pottery can be made.

Furthermore, I have the feeling that both decorative techniques as well as patterns might have been in use during periods much longer than is suggested by conventional typological schemes. For instance, had only a smaller part of the upper half of the sherd recovered at the site ‘Zwolle-Ittersumerbroek’ depicted below been preserved it could have erroneously dated to the Late Neolithic-A.

A remarkable observation has been made by Wilko van Zijverden on the relation between landscape and ceramic tempering. Middle Bronze Age ceramics retrieved from sites that were located at a considerable (more than 4 kilometres) from an active fluvial system show a relatively higher frequency of fine gravel tempering. Middle Bronze Age ceramics recovered from sites located nearer to (less than 3 kilometres) an active fluvial system tend to be predominantly tempered with crushed quartz. As this hypothesis was not known to me during the study of the ceramics, no special attention was paid to this distinction in tempering. However, as the majority of ceramics studied were tempered with crushed quartz and that most sites were located near to an active fluvial system (even within 500metres) the ‘low-resolution’ data might be assumed to confirm this pattern.

Summarising, it is clear that the lack of available ‘high-resolution’ data on the various aspects of material culture during the writing of this study has strongly hampered the discussion of its implications. Furthermore, the low archaeological resolution (litho-stratigraphical context, exact dating, site interpretation) of the ‘low-resolution’ data from the inventory prohibits far-reaching inferences. For the Early and Middle Bronze Age, based on the low-resolution data, we can assume that local ‘riverine’ flint was used (predominantly) for the manufacture of flint implements. The use of animal bone and antler can be illustrated with examples from both the ‘low-resolution’ as well as the ‘high-resolution’ data. As far as the procurement of (construction) wood and plants is concerned we can -based on the current data set- only assume that they must have (all or by and large) been available within hundreds of metres from the reconstructed settlements.

Fig. 6.19 Sherd from site ‘Zwolle-Ittersumerbroek’ with ‘Barbed Wire’ and ‘Herringbone’ decoration.

225 See Verbraeck 1984, p. 100 and Van Zijverden in prep., paragraph 2.5.3. However, according to Schouten & Bloo (in prep., paragraph 4.3) large (diameter > 15cm) stone to be used either to temper ceramics (quartz) or as rubbing-, hammer- or grinding stones (quartz and (quartzite) sandstones) cannot be found within the river area and therefore need to have been ‘imported’ (emphasis mine S.A.).


227 For example the ‘Dutch’ model by Glasbergen & Van der Waals 1976 (see chapter 5, paragraph 5.2.3.1), the ‘Two-track’ model by Drenth & Hogestijn 1999 (see chapter 5, paragraph 5.2.5.3.3).

228 If dealing with such fragmented pottery a descriptive approach as adopted by Sier 1993, p. 15-18 seems more appropriate.

229 Van Beek & Wevers 1993, p. 51 and Theunissen 1999, p. 150 Fig. 4.22. Naturally, any dating based on (the decorative pattern of) a single sherd is not advisable and likely to be erroneous.

230 Van Zijverden in prep (a/b), paragraph 2.5.3.

231 This is based on personal observations by the author.

232 See paragraph 6.3.1.3 above on the paleogeographical setting of sites. Interactive study of the sites and paleogeographical maps in the workspace ‘inventory.WOR’ in the digital data ‘MapInfo (5) Workspaces’ is also recommended.

233 However, more detailed analysis of both the ceramic temper as well as on the dating and location of active channels, can very well prove this assumption for the low-resolution data to be false.

234 The ‘high-resolution’ data on material culture will be extensively dealt with in the final publications of the sites ‘Eigenblok’ (Jongste in prep.) and ‘De Bogen’ (Meijlink in prep.).

235 See query ‘Antler Query’ in the digital data ‘Database\Inventory.mdb’.

236 See Van Dijk & Schelvis in prep., paragraphs 8.3.1, 8.3.3., 8.4.2, 8.5.2. and Van Dijk, Esser & Zeiler in prep., paragraph ‘synthese’.

In general, a picture of intensive exploitation of the micro-region emerges, that is occasionally supplemented by artefacts -of which often only the inorganic component can be analysed- made from raw materials not present locally. It should be stressed, however, that the social ‘meaning’ of such artefacts cannot mathematically be equated to terms like ‘exotic’ or ‘prestige’, and that the (perhaps socially utmost significant) movement of material culture which might have been both ‘manufactured local’ as well as ‘being imported’ cannot easily be reconstructed.

6.3.5 Social implications

It this paragraph I will try to assess to what extend this study has provided us with insight into ‘how the landscape was used, perceived and interpreted by man’.

6.3.5.1 Late Neolithic period

It has become clear that for the Late Neolithic the quality of the archaeological data in this study is insufficient to make substantiated comments about this. Although the transformation of the ‘natural landscape’ into man-made plots for fields, housing and burial must have had considerable impact on both prehistoric man as well as the landscape, archaeologists cannot yet grasp the spatial extent nor the possible diachronic variation of the specific ‘meaning’ associated with it.

Only occasionally can we suspect that special significance was adhered to aspects of the landscape.

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238 Exact figures or dimensions are pointless. In general this encompasses (for the current study-area) the higher stream ridges, the crevasse splays and the floodbasin deposits around the farmsteads and presumably any other area accessible to man. These can sometimes be found all within one to five square kilometres in the Dutch central river area.

239 For example see the jadeite axe and jet bead discussed in chapter 6, paragraph 6.3.3. This pattern of landscape exploitation has also been proposed for site ‘Molenarsgraaf’ (Louwe Kooijmans 1974, p. 278).

240 To analyse the role of these artefacts, interesting as it is, lies beyond the scope of this MA thesis. However, it should be clear to the observant reader that I certainly oppose the unsubstantiated beyond the scope of this MA thesis. However, it should be clear to the observant reader that I certainly oppose the unsubstantiated beyond the scope of this MA thesis.

241 The ‘high-resolution’ data from the ‘De Bogen’ excavation has provided us with a stimulative example of ‘endowing the natural landscape with meaning’.

The burial mound at site 45 appears to have been nothing more than a small natural heightening in the crevasse landscape prior to its use for interment during the Late Neolithic. Although one might argue that we do not know ‘why’ that particular location has been selected (and whether or not this was in accordance with a possible landscape-guided cosmology), the fact that the exact spot retained its funerary associations until the Late bronze Age or Early Iron Age is provocative.

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242 See: Fokkens & Fontijn, in prep., Van der Beek, in prep.

243 This, of course, is cyclic reasoning and possibly the result of archaeological research strategies. See also Louwe Kooijmans 1993(a), p. 94 on the low visibility of non-domestic (Late Neolithic) sites.

244 Chapter 3, paragraphs 3.4.2 to 3.4.5.

245 For instance, if one is willing to agree to the assumption of ‘axes’ representing ‘transformation-tools’ proper, their deposition in ‘wetter’ parts of the landscape might be significant. It is imaginable, yet totally speculative, that some axes which where used (technically or conceptually) to clear a particular plot, construct a pathway or to create timber, were deposited (with a timing that might have varied between ‘the same day’ and ‘upon the death of the (constructed) possessor’) in wetter areas (causing the gods wrath to being avoided and/or fertility and safety being ensured for man, cattle and the fields, and thus maintaining a reciprocal relation with the gods?).

Unfortunately, the geo-morphogenesis of the river area has favoured the discovery of sites located on the higher and drier parts (inverted channel bed and levee deposits, river dunes) of the landscape. Although the functionalist assumption ‘they will have lived and cultivated crops on the higher parts of the landscape’ is likely to be valid, its true relevance and meaning cannot reasonably be assessed without further study on the wider range of landscape exploitation like hunting, gathering, herding, worshipping, offering and the execution of craft activities.

The ‘low-resolution’ data for the Late Neolithic period in this study is hard to interpret functionally, let alone beyond that level, but seems to confirm the pattern of settling on the higher, sandy, grounds. The ‘high-resolution’ data from the ‘De Bogen’ excavation has provided us with a stimulative example of ‘endowing the natural landscape with meaning’.

The burial mound at site 45 appears to have been nothing more than a small natural heightening in the crevasse landscape prior to its use for interment during the Late Neolithic. Although one might argue that we do not know ‘why’ that particular location has been selected (and whether or not this was in accordance with a possible landscape-guided cosmology), the fact that the exact spot retained its funerary associations until the Late bronze Age or Early Iron Age is provocative.

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246 See: Hielkema, Brokke & Meijlink, in prep., paragraph 3.5.7 and chapter 4, paragraph 4.4.2.3.
Unfortunately, due to the palimpsest nature of the archaeological record at the ‘De Bogen’ complex, the relation between the burial mound and possible preceding and/or contemporaneous other activities is unclear\textsuperscript{250}. However, a pit that contained large quantities of bone and (Bell Beaker) ceramics was dug into the ‘mound’ body, as well as two postholes with (votive offerings of ?) large quantities of grain belong to the initial phase of (late Neolithic) use\textsuperscript{251}. If this tells us anything about Late Neolithic cosmology, it is the importance and close (inseparable ?) intertwining of materials (concepts ?) from domestic (pottery), husbandry-related (animal bones) and agricultural spheres (cereals) that are deposited in a context closely associated with (circles of life and ?) death and constructed notions of ancestry (perhaps to ensure to well-being and fertility of the family and entire ‘farmstead’ as a concept).

The data from the Dutch central river area in general, but especially within the study area, on activities occurring within the wider range of settings available to man in the landscape has yet inadequately been investigated. Although in the material culture retrieved for the Late Neolithic period indicators of long-distance material procurement (direct or indirect ?), hunting in (nearby ?) wood- and marshlands and perhaps of votive offerings (in bogs, residual gullies, rivers ?) can be found, the social implications of their correlation to the landscape (morphology) remains ill-known.

6.3.5.2 Early Bronze Age

The same pessimistic viewpoint holds true for the Early Bronze Age. For this period too we are much better informed on the landscape usage of the higher parts of the crevasse splay during the Early Bronze Age could be identified. However, if activities during the Early Bronze Age had taken place, the material indicators thereof are very likely to have been washed out by later crevasse activity\textsuperscript{259}.

Whereas small, triangular flint arrowheads with a concave base are usually interpreted as type-fossils for the Early Bronze Age\textsuperscript{252}, the identification of (undecorated) Early Bronze Age ceramics\textsuperscript{253}, stone and flint assemblages remains problematic. Needless to say that this complicates their functional interpretation and the study of their relation to the landscape even further.

The ( lithogenetical) context of all inventory numbers yielding possible Early Bronze Age remains is unknown, because they originated from either sand-dredge sites\textsuperscript{254} or field surveys\textsuperscript{255}. The interpretation of the ‘high-resolution’ data for the Early Bronze Age period is equally problematic. It has already sufficiently been discussed above that the materials and features possibly dating to this phase at the ‘De Bogen’ complex were hard to identify\textsuperscript{256}. The two-aisled house plans discovered at sites 28-4, 29 and 30 testify of occupation of the higher parts of the crevasse splay during the Early Bronze Age\textsuperscript{257}. The two overlapping house plans of two-aisled farms at ‘De Bogen’ site 30 and 28-4 might indicate that there was some degree of ( socially or ideologically ?) determined rigidity in the selection of new farmhouse locations\textsuperscript{258}. At ‘De Bogen’ site 45, no structures dating to the Early Bronze Age could be identified. However, if activities during the Early Bronze Age had taken place, the material indicators thereof are very likely to have been washed out by later crevasse activity\textsuperscript{259}.

\textsuperscript{250} Cornelissen 1988, Fokkens 1998a, p. 110-111. However, the barbed and tanged arrowheads held typical for the Late Neolithic-B (Bell Beaker) cultures do also occur in Early Bronze Age settlements (Van Heeringen et al. 1998, p. 34, 52 (see also the arrowhead from the ‘Wassenaa’ Early Bronze Age mass grave; Louwe Kooijmans 1993b)) as well as triangular arrowheads with concave basis and no bars are found in Late Neolithic (Beaker) settlement context (Othenin-Girard 1998, p. 58, 69; Boas 1997, p. 19).

\textsuperscript{251} On the recognition of the Early Bronze Age material culture see: Chapter 5, paragraph 5.3.3.3 and 5.3.4.2, Lanting 1973. The difficult recognition of (in particularly undecorated) Early Bronze Age ceramics has been confirmed by Simone Bloo (Personal communication, 06-06-2000).

\textsuperscript{252} Inventory numbers: 19, 20, 102 and 103.

\textsuperscript{253} Inventory numbers: 38, 60, 61, 62 and 63.

\textsuperscript{254} See: Hielkema, Brokke & Meijlink in prep., Van Zijverden in prep.(b), chapter 4, paragraph 4.4 and chapter 6, paragraph 6.4.2.5.3.

\textsuperscript{255} See also chapter 6, paragraph 6.3.1.2. These were all dated based on typology and find analysis. No radiocarbon dates for two-aisled structures from the ‘De Bogen’ complex were available.

\textsuperscript{256} Overlapping two-aisled house-plans were also found at ‘De Bogen’ site 29, although a third two-aisled farm was located at a considerable distance. It is unclear whether any of these farms co-existed. See: Hielkema, Brokke & Meijlink in prep., paragraph 3.4.4. See also this chapter, note 162.

\textsuperscript{257} Furthermore, the radiocarbon date obtained from charcoal from the pit with relatively large fragments of bone described above (paragraph 6.3.5.1) overlaps with the start of the Early Bronze Age (Hielkema, Brokke & Meijlink in prep., paragraph 3.5.7).
There is insufficient evidence to advocate that the presence of the burial mound played any decisive role in (avoiding ?) the location of possible later two-aisled farms.

At complex 'Eigenblok', little differentiation of features, structures or activities between the Late Neolithic period and the Early Bronze Age was possible. The construction of the burial mound at 'Eigenblok' site 6 took place during the Early Bronze Age. As two-aisled house plans were also absent, the 'barbed wire' decorated pottery retrieved from various sites, seems the most reliable other indicator of Early Bronze Age activities. It is perhaps remarkable, although the representativeness is subject to discussion, that both the Late Neolithic burial mound at 'De Bogen' site 45 and the Early Bronze Age burial mound were not spatially associated with nearby farmsteads. They both seem to have been erected in a part of the landscape which at that time served (a set of) purposes other than habitation.

6.3.5.3 Middle Bronze Age

The visibility, internal structure and location within the landscape of Middle Bronze Age farmsteads and activities has been extensively discussed elsewhere in this study, so that at this point I will restrict myself to some more interpretative remarks.

First of all, it appears to be the case that during the Middle Bronze Age (although this presumably started much earlier) in the Dutch central river area - as well as in general- the orientation, internal structure and function of farmsteads was highly standardised. A three-aisled farm, accompanied by several ancillary buildings, numerous smaller and ill-recognisable structures, some pits and sometimes a well or a burial mound were all located in a more or less fenced-off area. At some sites of the Betuweroute excavations fences 'surrounding' farmsteads seem to follow the contours of the crevasse landscape and the orientation of some houses corresponds to the direction of the underlying crevasse deposits.

The thus defined farmstead formed a centre of closely intertwined domestic, agricultural, social and (probably) ideological activities.

At this point I in particularly want to stress the fact that most of the activities involve an utilisation of the surrounding landscape to a certain, yet variable, extent. Man walked (and perhaps drove charts) through the diverse landscape on an (if not daily) very regular basis, to execute a wide spectrum of tasks and exploit various opportunities.

The figures (figure 6.21-6.24) that are reprinted overleaf (based on figure 6.20) serve merely to give an (far from all-encompassing) illustration of some of the activities taking place within and surrounding an occupied Middle Bronze Age farmstead.

The structuring principles concerning the (Middle Bronze Age and most likely also earlier) farmsteads can only properly be understood through their complex relation with the wider surrounding landscape. However, the spatial dimensions of these ‘standardised’ farmstead seems to have been influenced by properties of the local landscape.

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260 See: Hielkema et al. in prep., van Zijverden in prep. (a), chapter 4, paragraph 4.3 and chapter 6, paragraphs 6.2.5.2 and 6.3.1.3.
261 Hielkema et al. in prep. and Peter Jongste (personal communication, 31-07-2000).
262 See: Schouten & Bloo in prep., paragraph 4.2.4. Barbed Wire decorated sherds were retrieved from site 1, 2, 5 and 6.
263 See: Chapter 3, paragraph 3.4.7, chapter 4, paragraphs 4.3.2, 4.4.2 and chapter 6, paragraph 6.3 in general and particularly paragraph 6.3.1.3.
266 See: Hielkema et al. in prep. and Hielkema, Brokke & Meijlink in prep. See also chapter 4, paragraphs 4.3. and 4.4.
267 See: Hielkema et al. in prep. and chapter 4, paragraphs 2.3.2.2 and 2.3.2.6 on cart-tracks at the 'Eigenblok' complex.
268 The large features of charcoal and burned clay found near the floodbasin at the 'Eigenblok' complex vividly testify of this wider (geographic) range of activities (Personal communication: P. Jongste, 7-8-2000).
269 The model on which figures 6.20-6.24 are based can be studied interactively as Mapinfo (5) Workspace ‘MBA_Model.WOR’in the digital data.
270 A functionalist ‘snap-shot type’ analysis of the layout and functionality of a Middle Bronze Age farmstead, in my opinion belies the far more complex cultural biography of the farmstead as both a landscape-feature and as a concept. Therefore, the term ‘occupied’ is used to indicate that this at best can hint at the activities taking place during on-site occupation.
Although Middle Bronze Age archaeological research in general\textsuperscript{271}, and the ‘high-resolution’ data excavations in study in particularly have concentrated on the ‘farmstead-and-immediate-surroundings’\textsuperscript{272}, this is not the scale appropriate for regional analysis. However, a highly detailed set of data concerning this level is eminent in the investigation of both the dynamic relation between man and landscape during a ‘single occupation phase at a farmstead’ as well as for the writing of the (intrinsically diachronic) ‘cultural biography’ of farmsteads\textsuperscript{273}. In particular the availability of detailed dates that can unravel ‘farmstead-phases of use’ is crucial in this respect. At the most detailed level, that of a farmstead, house-plans, fences and ancillary building are found overlapping on the excavation surface. Detailed dating can provide us with insight into the relative constructional sequences, and thus perhaps offer clues to (more widely applicable?) patterns of change in farmstead functionality. It will be clear that according to this line of reasoning, I do not adopt a ‘functionalist’ approach towards farmstead functionality. A ‘functional’ farmstead is both an occupied farmstead, as well as a former occupied farmstead that is -for instance- thereafter being used for storage, ritual or agriculture\textsuperscript{274}.

For ‘Eigenblok’ site 6 and ‘De Bogen’ site 45 the presence of the burial mounds\textsuperscript{275} will have provided Middle Bronze Age man with a sense of ‘history’ of the land. Although the timing, responsible social group or specific rituals executed at that location may have been beyond the capacities of (communal) memory, the landscape will have been perceived as ‘man-made’ or ‘already transformed by man’.

At both locations the burial mound is likely to have been encompassed (perhaps literally through fences and conceptually through rituals) within a new (and at ‘De Bogen site 45 perhaps several) Middle Bronze Age farmsteads.

\textsuperscript{271} See: Theunissen 1999, p. 191 and chapter 5, paragraph 5.3.
\textsuperscript{272} Hielkema et al. \textit{in prep.}, paragraph 3.1.1. and Hielkema, Brokke & Meijlink \textit{in prep.}, paragraph 3.2.1.
\textsuperscript{273} On the concept of ‘cultural biography’ see: Kopyttoff 1986, for its introduction to farmstead analysis see: Gerritsen 2000 and Brück 1999.
\textsuperscript{274} This indicates the ambiguous role of the term ‘farmstead’ as a concept. Literally and archaeologically, landscape usage of a particular plot relates only to the cultural biography of a farmstead after the initial erection of a farm(stead). However, I think that prehistoric interpretation of the landscape occurred on a level surpassing such clear-cut distinctions. The possible structuring role of the (earlier) burial mounds in determining the location of farmsteads at ‘De Bogen’ site 45 and ‘Eigenblok’ site 6 might serve as an illustration.
\textsuperscript{275} See: Hielkema et al., \textit{in prep.}, Hielkema, Brokke & Meijlink \textit{in prep.}, chapter 4, paragraphs 4.3 and 4.4. and chapter 6, paragraph 6.3.1.3.
Similar notions of landscape perceptions are likely to have taken place at ‘De Bogen’ sites 28-4, 29 and 30\(^{276}\), where we can speculate on the role (and perceptibility) of the earlier two-aisled farm(steads?) during the Middle Bronze Age.

The fact that none of the six Middle Bronze Age farms reconstructed at ‘De Bogen’ site 30 intersect the location of the two-aisled farms might be significant\(^{277}\). However, in the north-western part of ‘De Bogen’ site 29 a two-aisled house has been overbuilt twice during the Middle Bronze Age so we must be aware of the dynamic nature of the interpretation of earlier (farmstead) activity by Middle Bronze Age man\(^{278}\).

The importance of detailed dating is also evident if we increment our scale of analysis one step. Instead of looking at layout, dimensions, geo-morphogenetical setting and function of isolated farmsteads, let us focus now upon the phenomenon of multiple farmsteads that are located at short distances from each other. Only through a scrupulous combination of stratigraphic analysis, feature interpretation and additional dating at all farmsteads can we determine whether or not these do represent synchronous, or successively build farmsteads.

This has considerable implications for our reconstructions of group size, social dynamics and (the backgrounds to changing) relations between the landscape and preferred farmstead locations.

Although it is generally accepted that Middle Bronze Age farmsteads seem to wander in a micro-region of the landscape\(^{279}\), this does not apply to all areas\(^{280}\). It is most likely not coincidental that at the site ‘Hoogkarspel – Het Valkje’, where several overbuild and some presumably synchronous farmsteads have been excavated\(^{281}\), the lithological/lithogenetical setting of the farmsteads mirrors that of the ‘De Bogen’ and parts of the ‘Eigenblok’ complex sites\(^{282}\).

It has already been introduced above\(^{283}\) that the diverse ecological and lithological setting of smaller inverted channel-bed and levee deposits among a wider, lower located floodbasin might have favoured occupation yet through its limited amount of inhabitable surface might have caused a deviation from the pattern of ‘wandering farmsteads’.

Concentrating on the scale of regional analysis, detailed dating will help clarifying the interpretation of long-term settlement dynamics within a larger region. Questions like ‘can settlement preferences surpassing the (geo-morphogenetical diversity of the) micro-(settlement)region be detected?’ ‘are there shifts in preferred settlement location discernible through time?’ ‘and what was the nature and degree of social, economical and ideological interaction between various settlements?’ come into play.

However, I think that combining all currently available ‘low-resolution’ and ‘high-resolution’ archaeological data with the geological background as has been done in this study illustrates that even for the (significantly better known) Middle Bronze Age period we are still a long way from answering those (and related) questions in a coherent and sufficiently substantiated manner.

6.4 Conclusions and implications

In this paragraph the results of this study will be summarised. Therefore, it will evidently display a degree of overlap with the paragraphs above and previous chapters. Hereafter some brief considerations on the implications of this study for prospective-, predictive- and heritage management archaeology will be presented.

6.4.1 Conclusions: Man and landscape in regional perspective during the Late Neolithic to the Middle Bronze Age in the Dutch central river area.

The paragraphs above have tried to present the reader with an archaeological tale of the relationship between man and landscape during the Late Neolithic and Early- to Middle Bronze Age. Beside efforts in increasing our comprehension of this relationship, it was also introduced in the first chapter that part of this study would be devoted to analysing whether or not the different types of data used in this study were suitable to do so.

It has become clear that the data used in this study for both the Late Neolithic period as well as the Early Bronze Age was in both quantitative as well as qualitative aspects unsuitable to investigate the relationship in question.

276 See: Hielkema, Brokke & Meijlink in prep. and chapter 4, paragraph 4.4.
277 Remarkably, four of the Middle Bronze Age farms do overlap in construction plan. See: Hielkema, Brokke & Meijlink in prep., paragraph 3.3. At the southern concentration of ‘De Bogen’ site 29 the two-aisled farm also had not been overbuilt, although two Middle Bronze Age farm(steads?) have been erected nearby.
278 At ‘De Bogen’ site 28-4 a two-aisled farm was overbuilt by another two aisled farm and three-aisled farm respectively. See: Hielkema, Brokke & Meijlink in prep., paragraphs 3.4 and 3.9.
280 If fencing can be proven to reasonably indicate the location of farmsteads, two synchronous farmsteads might be reconstructed at ‘Zijderveld’ (Theunissen 1999, p. 169 Fig. 4.41 and chapter 6, paragraph 6.3.1.3).
282 On the geo-morphogenetical setting of the ‘De Bogen’ and ‘Eigenblok’ complex see: Van Zijverden in prep.(a/b).

283 Chapter 6, paragraph 6.3.1.3.
6. Synthesis

6.4 Conclusions and implications

The quantitative setback (the low numbers of find spots known) is the result of the nearly constant Holocene sedimentation and erosion by fluvial systems -which significantly decreases chances of discovery and increases chances of destruction- and the problematic identification of undecorated Late Neolithic ceramics.

The qualitative disadvantages are the result of the methods of procurement of the archaeological materials. The majority of the data has been collected from (refuse heaps) at sand-dredge sites or collected during survey. Although the preservation of organic artefacts from sand-dredge pits might be fair, their lack of context complicates their interpretation. Whenever sites are disturbed by ploughing, exposure to air leads to dramatic deterioration of faunal, plant- and pollen remains, which causes the inorganic component to dominate the archaeological record uncovered during fieldwalking.

Only in a very small number of cases did archaeological data originate from small or large scale excavations and could be studied in contextual (the combination of various types of data from one site), geographical ('where in the landscape did activities took place?'), inter-site analysis) and diachronic ('are chances in the relation between man and landscape discernible through time?') perspective.

For the Late Neolithic period the archaeological data usually consisted of stray finds, predominantly flint, originating from finds spots whose geological setting is improperly investigated. Although functional interpretation of (combinations of few) artefact categories is problematic, it has become clear that activities clustered on the higher and sandy deposits of fossil river dunes, channel-bed and levee deposits. It is suspected that at various places transformation of the natural landscape, most likely for habitation and agriculture, took place on the levees of a former active fluvial channel within centuries after the cease of the fluvial activity. A burial mound was erected on the highest tip of a crevasse splay, while presumably other (relatively higher) parts of the crevasse landscape were used for occupation.

A higher degree of information is available for the Early Bronze Age. The 'Betuweroute' excavations have proven that during the Early Bronze Age also the higher parts of crevasse splays were centres of activity. The discovery of several two-aisled farms, some smaller structures and study of the faunal remains indicates that at various locations (although assessing their possible contemporaneity remains problematic) domestic and agricultural activities took place. Due to the problematic dating of features and structures we cannot define more precisely the dimensions and lay-out of the assumed Early Bronze Age farmsteads. Predominantly fences and cattle imprints testify of activities in the floodbasin, whereas a burial mound has been erected on the top of channel bed deposits.

Everyday life activities were by no means confined to the higher parts of the (crevasse splay) landscapes. The execution of craft activities, gathering of plants and fruits, (opportunistic hunting ?), herding, worshipping, raw material procurement and the maintaining of social relations with other groups will have involved a close (ideological ?) connection to, a thorough understanding of, and extensive exploitation of a geographically wide and environmentally varied landscape. However, this remarks is serves merely to maintain a proper perspective on the issue, for the majority of the aspects of landscape exploitation listed above do also apply to both the Late Neolithic period as well as to the Middle Bronze Age, and are more typical of 'later prehistoric man' than of any arbitrarily defined archaeological phase like the 'Early Bronze Age'.

Unfortunately, it was not possible to differentiate all archaeological remains at the 'Betuweroute' excavations between the Late Neolithic period and the Early Bronze Age. Therefore, and because of the low numbers of bones assigned to mammal species in general, the assumed decrease of the importance of hunting during the Early Bronze Age can only cautiously be confirmed. Cattle breeding, supplemented by (although presumably smaller, yet equal) numbers by of pig and sheep/goat formed a major subsistence strategy.

284 See chapter 6, paragraph 6.2.2.
286 See Chapter 3, paragraph 3.4.1-3.4.5 and chapter 6, paragraph 6.2.4.
287 Chapter 6, paragraph 6.3.1.1, 6.3.1.2, 6.3.3, 6.3.4 and 6.3.5.1.
288 See chapter 6, paragraph 6.3.1.1 and 6.3.1.2.
289 See Hielkema, Brokke & Meijlink in prep., Van Zijverden in prep.(b) and chapter 4, paragraph 4.4.
290 Jongste in prep., Meijlink in prep., chapter 4, paragraphs 4.3-4.4 and chapter 6, paragraphs 6.2.5, 6.3.1.2, 6.3.2, 6.3.3, 6.3.5.2.
291 See Hielkema, Brokke & Meijlink in prep. and chapter 4, paragraphs 4.3-4.4.
292 Hielkema, Brokke & Meijlink in prep., Hielkema et al. in prep. and chapter 4, paragraphs 4.3-4.4.
293 In prep., chapter 4, paragraphs 4.3-4.4 and chapter 6, paragraphs 6.3.1.2 and 6.3.2.
294 Jongste in prep., Meijlink in prep., chapter 4, paragraphs 4.3-4.4 and chapter 6, paragraph 6.3.3.
295 See: Van Dijk & Schelvis in prep., Van Dijk, Esser & Zeiler in prep., and chapter 6, paragraph 6.3.3.
As no radiocarbon dates of two-aisled farms within the study area are available, the social (and perhaps ideological) implications of the shift from the two-aisled to a three-aisled building tradition and its relation to husbandry cannot be studied properly. For the Middle Bronze Age we are, again, somewhat better informed on the relationship(s) between man and landscape. As far as the ‘low-resolution’ data is concerned, it has been argued that archaeological remains dating to the Middle Bronze Age are generally covered by less sediment and therefore more easily (disturbed and) discovered. Furthermore, as far more sites have been investigated, a more detailed frame of reference facilitates recognition. Although the disadvantages of the ‘low-resolution’ data already discussed above for older periods (lack of information on the litho-genetical background, overrepresentation of the inorganic component caused by fieldwalking being the prime source of archaeological data collection, problematic interpretation of site function) do also apply to the Middle Bronze Age data set, the larger number of findspots known can offer a better insight into the different geo-morphogenetical settings of Middle Bronze Age settlements within a (micro)region.

River dunes, inverted channel-bed and levee deposits, crevasse splays and floodbasin deposits were all used for habitation and a range of other activities.

The ‘high-resolution’ data used for the Middle Bronze Age has in this study, through its focus on the farmstead and immediate surroundings, proven that in the Dutch central river area the standardised concept of a Middle Bronze Age farmstead (consisting of a three-aisled farm, accompanied by several ancillary buildings, numerous smaller and ill-recognisable structures, some pits and sometimes a well or a burial mound, all located in a more or less fenced-off area) has considerable validity.

There is evidence to suggest that in the Dutch central river area deviations from this ‘standard’ farmstead lay-out and dimension are (to a certain extent) guided by landscape morphology. Fences sometimes seem to follow the contours of the landscape, wells were dug at specific locations and (less vast, yet possibly favoured) higher parts of the crevasse deposits frequently display sequences of overbuild farmsteads instead of a system of ‘wandering’ farmsteads, whereas others were presumably abandoned after (gradual) ‘drowning’ of the local landscape.

Unfortunately, dating and phasing of these Middle Bronze Age farmsteads is often to imprecise to make any substantiated comments on their succession or contemporaneity. However, it is quite likely that both ‘isolated’ single farmsteads, as well as small (two, perhaps three) clusters of farmsteads coexisted. The data for the Middle Bronze Age in this study on other archaeological themes like ‘subsistence strategies’, ‘funerary ritual’ and ‘technology’ are all relatively well comparable to what we know from other Middle Bronze Age sites in the Netherlands that are located both within, as well as outside the Dutch river area.

296 See: Fokkens 1999 and chapter 5, paragraphs 5.2.4.2 and 5.4.2.5.3.1.
297 Hielkema, Brokke & Meijlink in prep. See also chapter 4, paragraph 4.4.
298 Chapter 6, paragraph 6.2.2.1.
299 Although this holds true for most artefact categories and structures, I have the feeling that flint, stone and undecorated ceramics are more liable to be (erroneously) dated to the Middle Bronze Age while an earlier date cannot be excluded. However, we need to be aware of the risk of circular arguments. We should take the fact that higher parts of the current landscape coexisted and always question representativeness.
300 See inventory number 6 and 7 (chapter 3).
301 E.g. ‘Zijzerveld’ (inventory number 1, Theunissen 1999), ‘Eigenblok’ site 6 (Jongste in prep., chapter 4, paragraph 4.3).
302 For instance, on the burned layers of clay at Eigenblok sites 2 and 3 (Hielkema et al. in prep. and chapter 4, paragraph 4.3.2.2 and 4.3.2.3). On floodbasin habitation see: Theunissen 1999, p. 137 (and references therein to Havinga & Op ‘t Hof 1975/1983.).
303 ‘Eigenblok’ site 1-4 (Jongste in prep., chapter 4, paragraphs 4.3.2.1-4.3.2.4). ‘De Bogen’ (Meijlink in prep., chapter 4, paragraph 4.4).
304 Van Zijverden in prep. (b) and Hielkema, Brokke & Meijlink in prep.
305 Chapter 6, paragraph 6.3.1.3, Theunissen 1999, p. 185-191, Hielkema et al. in prep., Hielkema, Brokke & Meijlink in prep. and personal communication Harry Fokkens (7-08-2000).
306 This was the case at the ‘Eigenblok’ complex. See: Hielkema et al. in prep. and chapter 4, paragraph 4.3.
307 See chapter 4, paragraph 4.3 and 4.4.
309 See chapter 4, paragraph 4.3 and 4.4.
310 See chapter 6, paragraph 6.3.1.3, Theunissen 1999, p. 188. This was confirmed by the excavator of the ‘Eigenblok’ complex (Peter Jongste, personal communication: 06-06-2000).
311 On my disagreement with nomenclature like prehistoric ‘economy’ and ‘ideology’ see chapter 1. For a brief contextual analysis of the topics referred to see: Chapter 6, paragraph 6.3.
This dynamic relationship between man and landscape was not confined to the first ‘phase of contact’. From both ‘low’ as well as the ‘high-resolution’ data it has become clear that some sites were foci of activity during multiple, presumably sometimes successive archaeological periods. The ‘high-resolution’ Betuweroute data has presented some remarkable examples thereof. Sometimes older (Late Neolithic or Early Bronze Age) burial mounds and house plans appear to have been ‘respected’ in the sense of ‘not being overbuild’, whereas Middle Bronze Age features sometimes do cross-cut earlier mound periods and overbuild two-aisled farms have been found at the same site\textsuperscript{312}. However, I feel that we lack sufficient backgrounds for the Dutch central river area to determine whether or not, or to what extent, these dynamics correspond to ‘traditions’ confined to time or place.

Furthermore, it should be stressed that archaeologists ultimately will be concerned with the totality of past behaviour. Current archaeology’s focus on settlements (certainly if analysed solely by processual themes like ‘economy’ ‘technology’ and ‘ideology’ etcetera) belies the complexity and interwoven nature of prehistoric everyday life I assume to have existed for the periods in question. I suspect that additional valuable information on the dynamic relation between man and landscape can be retrieved from analysis of the location, nature, and shifts in prehistoric usage of the landscape for purposes other than habitation, although the detailed level of contextual analysis which is consequently needed is hard to combine with that of a regional analysis. Again, this general remark does also apply to periods (and regions) other than the Middle Bronze Age (in the Dutch central river area).

The problems in dating (sequences) of Middle Bronze Age activity also complicates analyses on a regional scale. Thus, because of the small numbers of settlements known and their problematic dating, it is not yet possible (based on the data in this study) to indicate whether or not shifts in landscape exploitation, settlement location preferences or (patterns) in settlement density can be discerned within the study area.

6.4.2 Implications

Now let us deal briefly with the various implications of these conclusions. It has been argued above that the ‘low-resolution’ data displayed both quantitative as well as qualitative shortcomings that hampered its interpretation.

Extensive and continuous inventorying of local collections, supplemented by consequent monitoring of soil disturbing activities is likely to gradually compensate for the small numbers -especially for pre-Iron Age sites- of find spots currently known.

In many areas an extensive network of local archaeologists can be used to record these valuable observations. I have the feeling that the Dutch State Service for Archaeology (R.O.B.) has not currently exploited the mutual benefits of close interaction with local archaeologists to a full extent. Through active participation -like the founding of new archaeological workgroups, scientific, executive and perhaps financial support of currently active archaeological workgroups- the State Service for Archaeology can acquire (in a controllable manner) up-to-date detailed information on the destruction of the archaeological record and new primary data which is crucial to both the establishment of (predictive) archaeological heritage management tools and to specific scientific problems in archaeology.

The nature of such primary data, or the qualitative aspects of the ‘low-resolution’ data, will be commented on below. Especially if (amateur) archaeological observations are made at construction sites as opposed to during fieldwalking, the possibility to investigate the geological context (which I consider eminent in discussions on site-interpretation, setting in the landscape and archaeological quality assessments (e.g. integrity, erosion, preservation) of sites in the Dutch river area) should be seized whenever possible.

In my opinion, here too lies an important task for the State Service for Archaeology. To educate local archaeologists on the scientific importance of establishing the litho-stratigraphical and lithogenetical context of archaeological data, preferably supplemented by training in (prospective) methods of obtaining such data (local geology, brief courses in coring techniques and interpretation), can result in a larger data set of higher quality. Furthermore, (experiments with) such intensive co-operation between local and professional archaeologists can be used to replace the feeling of distrust -felt by some local archaeologists- with appreciation and act as a catalyst for improvement of the overall relation between local and professional archaeologists.

This improvement of quality on the ‘input’ side naturally should be related to improvement of quality on the ‘output’ side.

\textsuperscript{312} Hielkema et al. \textit{in prep.}, Hielkema, Brokke & Meijlink \textit{in prep.}, chapter 4, paragraphs 4.3-4.4 and chapter 6, paragraph 6.3.1.3.
If we want to break away from ‘presence-absence’ types of regional analysis, the Dutch central archaeological information system (ARCHIS) should be used for the accommodation and consulting of detailed geological parameters. Beside this, ARCHIS entries should always be thoroughly and individually analysed to determine whether or not they do comply with the methodology and nature of the hypotheses involved. It is a misconception that (qualitatively undifferentiated) larger numbers of ‘dots’ plotted on maps will facilitate map interpretation or corroborate deduced conclusions.

The result of the ‘high-resolution’ data analysis has implications for various fields in archaeology too. First of all, it has been argued that archaeological observations on (and interpretations of) the relationship(s) between man and landscape takes place at multiple levels.

For the Late Neolithic and Early Bronze Age, remains of funerary activities (through their better archaeological visibility) traditionally formed the focus of archaeological research. The recent Betuweroute investigations have vividly illustrated that burial traditions in the Dutch river area during these periods correspond to those of the sandy Pleistocene regions of the Netherlands. More important, however, is the fact that their position in the micro-landscape (on -sequences of- crevasse deposits as well as on channel-bed and levee deposits), has been attested. Although various activities during the Late Neolithic and the Early Bronze Age are suspected at the Betuweroute sites ‘Eigenblok’ and ‘De Bogen’, the relation between the burial mounds and assumed settlement(s?) at the time of the erection of the funerary monument remains unclear.

Future investigations within the (wider) study area concentrating on these periods should try -through extensive dating and explicit attention to phasing- to define more precisely the (various implications) of the relationships between settlements, burial sites and other areas of activity in the landscape at various scales (e.g. at farmstead-, settlement-, micro-region and regional level).

The same point of view holds true for Middle Bronze Age archaeology. It has been suggested in this study that there appears to be a relative over-interpretation (perhaps rather than an over-representation) of Middle Bronze Age archaeological remains. Relatively scarce radio-carbon dates, combined with a far better investigated and larger frame of reference for the Middle Bronze Age facilitates -for instance- the ‘identification’ of (nearly all ?) ‘relatively thick walled, quartzite tempered and undecorated’ sherds as Middle Bronze Age ceramics and presumably has caused many Late Neolithic and Early Bronze Age structures to be unidentified, whereas the regular three-aisled Middle Bronze Age house plans seem to occur in abundance. However, for the Middle Bronze Age as a separate phase, the problems of synchronicity certainly outweigh the problems in identification of features, structures, materials or activities.

Thus far, the farmstead and its immediate surrounding have received considerable attention. During the recent Betuweroute excavations, significantly more attention than during preceding decades has been paid to the (reconstruction of the) immediate surroundings and the relationship between landscape, vegetation, animal life and its occupants. However, I have the feeling that an implicit focus on settlement/domestic activities is still lying dormant. It has been argued in this study that a holistic approach encompassing the totality of activities taking place in the landscape, with attention towards the regional and diachronic variation, will yield utmost valuable information on past behaviour. Future lines of investigation should therefore concentrate on the unravelling of dynamics of land-use at a micro- (farmstead) level, a meso- (settlement) level and macro-level (settlements in (micro)regional perspective).

The better chances of discovery of archaeological remains located on the higher sandier deposits in the river area, have in the recent past led to a circular pattern of archaeological reasoning wherein new excavations (or disturbances) of -predominantly settlement- sites located on the higher sandy deposits affirmed the common assumption of inverted channel-bed and levee deposits as ‘the’ preferred settlement location (especially for the Middle Bronze Age). The new data currently available must be used to define more precisely this and similar assumptions. Although the settlement location model of ‘settling on the higher sandy soils’ is not to be totally refuted, it at least must be refined with the conscience that a wider range of activities took place in the landscape beside occupation and the notion of the crevasse deposits as additional preferential settlement locations.

313 For instance, the single sherd from inventory number 71, ‘Maurik-Het Haagje’, is listed in ARCHIS as a settlement.
In particularly the latter remarks have serious implications for both prospective and predicting archaeology. Crevasse deposits can lithologically be hard to distinguish from levee-deposits, and if found near channel-bed deposits, be misinterpreted as levee deposits. However, as the latter are traditionally interpreted as a ‘preferred prehistoric settlement locations’, archaeological consequences are minimal. The Betuweroute excavations have proven that (sequences of) crevasse deposits proper were foci of activity (too) during the Late Neolithic to the Middle Bronze Age, so that some remarks on the visibility thereof during (prospective archaeological) coring campaigns need to be made. Although crevasse splays can measure up to 100 metres in width at their start near the active meander, their width decreases to several metres where they taper out into the floodbasin deposits.

For initial prospective archaeological coring, aiming to acquire a general understanding of the geological background and the (likelihood of) discovery of larger settlement sites, a coring interval of 30 to 50 metres within a triangular grid seems appropriate. To determine the presence, exact dimensions and allow archaeological ‘core-peripheral’ interpretation of a site, triangular grids at 22.5 metres or 15 metres. Clearly, the chances of encountering- and recognition- of smaller crevasse deposits with grids exceeding 20 metres are slim. This can be illustrated by plotting the detection rate of crevasse deposits against sampling interval as has been done by Weerts. Increasing sampling interval from 20 to 100 metres decreases encountering rate from 57% to 45%.

Predictive models in archaeology are also to benefit from the recent observations on prehistoric activity on crevasse deposits during the Late Neolithic up to the Middle Bronze Age. Although I by no means wish to imply that inductive approaches are the sole or primary key to predicting spatial patterns in the archaeological record, its clear that the crevasse splays -and adjacent floodbasin deposits- have thus far not been given sufficient recognition as centres of prehistoric activity.

However, parameters like paleo-relief, paleopedological features, the situation of dried-out watercourses, distance to former open water and detailed knowledge of long-term paleogeography, that are all considered vital to predictive modelling in a fluvial setting, are hard to establish in areas of constantly dynamic Holocene genesis.

Although it is commonly accepted that detailed paleogeographical reconstructions are vital to understanding -let alone predicting- the archaeological record in the Dutch central river area, it is remarkable that some of this available detailed data has not (yet) been incorporated into the ‘Indicative Map of Archaeological Values’ (‘IKAW’) of the Netherlands.

If we compare the result of the detailed geological map published by Makaske with (a cut-out from) the indicative map, its shows a confinement of the high rate of discovery to the channel-bed and levee deposits (see figure 6.25 overleaf). Furthermore, it is remarkable that while the map is labelled an ‘Indicative Map of Archaeological Values’ (‘IKAW’), the legend displays chances of discovery.

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515 Perhaps symptomatic is the confinement to ‘settlements’ - instead of the total range of landscape bound activities- and to the natural levees and fossil channel belts as centres of activity in a 1997 article on archaeological predictive modelling (Deeben et al. 1997, p. 95).
516 Habitation on crevasse deposits has already been confirmed by Havinga 1969, p. 29; Havinga & Op ‘t Hof 1975, p. 265; Havinga & Op ‘t Hof 1983, p.55.67. The archaeological implications (especially in predictive archaeological models; Deeben et al., 1997, p. 96) were usually limited, and did not result into the addition of ‘crevasse deposits’ to the set of generally assumed (Middle Bronze Age) settlement locations.
517 Weerts 1996, p. 44 and chapter 2, paragraph 2.3.2.5.
519 Groenewoudt 1994, p. 173. Justly, he stresses the fact that fine-mesh sieving of the core residue will also be required.
520 Van Zijverden 1997, p. 60 and Van Zijverden in prep (b), paragraph 2.3.1.
521 Weerts 1996, p. 69,Table 3.3.
522 On inductive versus deductive predictive modelling see: Deeben et al. 1997, p. 78.
523 Deeben et al. 1997, p. 83. In this study the association between such parameters and ‘archaeological relict areas/ ARA’ (arbitrary territories of high archaeological expectancy) was used to establish more deductive models. However, as the location of the ARA’s was based on an ARCHIS query for settlements, distorted by map formation processes (see chapter 6, paragraph 6.2.2), this correlation is subject to discussion.
524 I want to express my gratitude to R. Wiemer, Edwin van Hagen and Jan van Dalen (all from the State Service for Archaeological Investigations (ROB)) for providing me with an ‘IKAW’ of the study area. See MapInfo (5) Table ‘IKAW.TAB’ in the digital data.
525 Makaske 1998, p. 187, Fig. 5.8 and MapInfo (5) Table ‘Makaske2_rotated.tab’ in the digital data.
Based on the underlying assumptions (e.g. the focus on settlements and channel bed and levee deposits) and lack of any substantiated comments on the (scientific) quality of a site, the IMAV/IKAW must perhaps be interpreted literally as indicating chances of discovery.

In the (second generation) IKAW fossil channel-bed deposits are assigned a high value, the crevasse and levee deposits are assigned a moderate value, whereas the channel-, levee- and floodbasin deposits of present-day active fluvial systems are assigned a low value. However, as the IKAW for the Dutch central river area is based predominantly on the digital (sand-depth) maps by Esther Stouthamer and Henk J.A. Berendsen -which I consider (see figures 6.4, and 6.5 above) uninformative on the location of the less extensive crevasse deposits-, the role of (sequences of) crevasse deposits as centres of activity remains underestimated.

Furthermore, it should be stressed that while we might suspect problems of representativeness due to the low numbers of find spots dated pre-Iron Age and in the combining of inductive and deductive predictive modelling strategies, it will be evident that testing will be difficult. Using fieldwalking and phosphate mapping as testing methods seems inadequate for the periods involved. Phosphate mapping is usually carried out during soil survey, and the small coring depths used might in some cases not reach Late Neolithic deposits. For the (Early- ? and) Middle Bronze Age, this appears to be less the case.

In conclusion, it will be clear to the reader that what is needed to study the dynamic relationships between man and landscape during the Late Neolithic to the Middle Bronze Age in the Dutch central river area, is the critical evaluation and combination of (well-dated) ‘low-resolution’ and ‘high-resolution’ data. These should be analysed from a holistic (theoretical) point of view, at various scales, in correlation with highly detailed paleo-geographical reconstructions and with attention to geological processes like subsidence, fluvial sedimentation and erosion.

Although this will be a painstaking task, the river area proper provides the stratigraphic and preservative preconditions that -perhaps more than the Pleistocene cover sand regions elsewhere in the Netherlands- eventually will enable to answer many current and future archaeological questions.

Fig. 6.25 Comparison of detailed geological maps and IKAW. Dark orange means ‘high chance of discovery’, light orange ‘moderate change of discovery’, areas with ‘low chances of discovery’ (of archaeological remains) have been left transparent.


From this point of view the term ‘IMAV’ is a misnomer and might be replaced by ‘Indicative Map of Archaeological Chances of Discovery’.

Similar comparisons can be made through overlay of the ‘IKAW’ (appendix VI, MapInfo (5) Table IKAW.TAB in the digital data) and the maps used in this study: Verbraeck 1970/1984, Berendsen et al. 1994, Törnqvist 1993, p. 40-41, Fig. 2., Makaske 1998, p. 186-187. These can all be studied interactively as MapInfo (5) tables in the digital data (See chapter 1, paragraph 1.3.4).

For deposits belonging to fluvial systems dated older than 5000 B.P. are also assigned a moderate value. See Deeben, Hallewas & Maarleveld in prep. for IKAW methodology.

Personal communication D.P. Hallewas, 21-08-2000.

These were suggested for testing a model for the ‘Kromme Rijn’ area (Deeben et al. 1997, p. 98).

It has already been stated above (paragraph 6.2.2.2.2) that the ‘Middle Bronze Age paleo-sol’ is generally found at 0,8-1metre below the surface.
Appendix I  Dates for archaeological periods
(After Fokkens 1998a and Theunissen 1999)

<table>
<thead>
<tr>
<th>Name of archaeological period</th>
<th>Dating calibrated years B.C.</th>
<th>Dating Radiocarbon years B.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Neolithic B</td>
<td>4900-4200</td>
<td>6000-5300</td>
</tr>
<tr>
<td>Middle Neolithic A</td>
<td>4200-3400</td>
<td>5300-4700</td>
</tr>
<tr>
<td>Middle Neolithic B</td>
<td>3400-2900</td>
<td>4700-4300</td>
</tr>
<tr>
<td>Late Neolithic A</td>
<td>2900-2500</td>
<td>4300-3950</td>
</tr>
<tr>
<td>Late Neolithic B and Early Bronze Age</td>
<td>2500-1800</td>
<td>3950-3450</td>
</tr>
<tr>
<td>Early Bronze Age</td>
<td>2000-1800</td>
<td>3650-3450</td>
</tr>
<tr>
<td>Middle Bronze Age A</td>
<td>1800-1500</td>
<td>3450-3100</td>
</tr>
<tr>
<td>Middle Bronze Age B</td>
<td>1500-1050</td>
<td>3100-2900</td>
</tr>
<tr>
<td>Late Bronze Age and Early Iron Age</td>
<td>1050-500</td>
<td>2900-2450</td>
</tr>
</tbody>
</table>

Common geological and archaeological subdivisions
(Berendsen 1997b, p. 165, Fig. 8.1)
## List of studied archaeological series

<table>
<thead>
<tr>
<th>Common name of publication / series</th>
<th>Inventoried years</th>
<th>Not yet studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archeologische Kroniek van Gelderland</td>
<td>1966-1991</td>
<td></td>
</tr>
<tr>
<td>Analecta Praehistorica Leidensia</td>
<td>1964-1998</td>
<td></td>
</tr>
<tr>
<td>Berichten van de Koninklijke Nederlandse Oudheidkundige Bond</td>
<td>1959-1976</td>
<td></td>
</tr>
<tr>
<td>Westerheem</td>
<td>1955-2000</td>
<td></td>
</tr>
</tbody>
</table>

1 For more extensive references contact the author: S. Arnoldussen, Turfmarkt 10, 2312 CE, Leiden, The Netherlands, +0031-715148358, sarnold@stad.dsl.nl.
**Report on the BATO collection**

**Collection:** BATO  
**Contact:** Eric Verhelst

**Abbreviations**

- FLI = Flint  
- BON = Bone  
- STO = Stone  
- CER = Ceramics

**Materials**

- MNEO/NEOM = Middle Neolithic  
- VLAA(RDINGEN) = Vlaardingen Period  
- NEOL/LNEO = Late Neolithic  
- SGC = Single Grave Culture  
- NEOLA = Late Neolithic A  
- NEOLB = Late Neolithic B  
- BB/KB = Bell Beaker Period  
- EBA/VBRONS/BRONSV = Early Bronze Age  
- BRONS/BA = Bronze Age (undefined)  
- BRONSM/MBA = Middle Bronze Age  
- MBA-A = Middle Bronze Age A  
- MBA-B = Middle Bronze Age B  
- BRONSL/LBA = Late Bronze Age  
- IA/ YT = Iron Age  
- ROM = Roman Period  
- ROMM = Middle Roman Period  
- ME = Mediaeval Period  
- MEL/LME = Late Mediaeval period  
- NT/ (SUB)RECENT = (SUB) Recent

**Periods (see appendix I)**

- MNEO/NEOM = Middle Neolithic  
- VLAA(RDINGEN) = Vlaardingen Period  
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- SGC = Single Grave Culture  
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- IA/ YT = Iron Age  
- ROM = Roman Period  
- ROMM = Middle Roman Period  
- ME = Mediaeval Period  
- MEL/LME = Late Mediaeval period  
- NT/ (SUB)RECENT = (SUB) Recent

**Site: Kerk-Avezaath – Burensedijk**

**Town:** Kerk-Avezaath  
**Toponym:** Burensedijk  
**Coords.:** 153.880/ 435.770  
**Precision:** 0, co-ordinates of proximity town ‘Kerk-Avezaath’  
**Date find:** 10-05-1986 (amongst other)  
**Finder:** BATO (E. Verhelst, Tiel)  
**Period:** NEOL(A?), IA, YT,  

**Description Locality:**  
‘recovered from the sand’

**Description material:**

- CER:  
  One ceramic bottom, 16mm thick, tempered with coarse crushed quartzite, 20gram. According to label Vlaardingen culture, most likely Middle Bronze Age. (S.Arnoldussen/E.B.M Theunissen)

Two fragments (35gram) of Iron Age ceramics, curved wall profile with rim, reddish surface, backed at high temperature.

One fragment, 20gram, sherd decorated with cord impressions. Six rows of cord impressions, circa 4 mm apart. Fired with reduced conditions. Drawing and scan available (Fig. 3.7)

**Site: Maurik Meerboomweg**

**Town:** Maurik  
**Toponym:** Meerboomweg  
**Coords.:** 157.980/ 440.680  
**Precision:** 2, derived from 1:10.000 topographical map  
**Date find:** 1989-1990  
**Finder:** BATO (E. Verhelst, Tiel)  
**Period:** NEOL(-A?), NEOLB, KB, (BB),VLAARDINGEN,ME(L?)

**Interpretation:**

Possible Vlaardingen culture period ceramics from crevasse (fill?). Sherds found dating to the Late Neolithic period. Possibly SGC period, and certainly Bell Beaker period. All late neolithic material is very eroded, and most likely washed out. Found in ‘association’ with roman sherds (MM1-5) and Early and Middle Bronze age (MM1-16, MM1-28) sherds. Often hard to distinguish between EBA and LNEO. Only in few instances one might suspect that the depression contained Late Neolithic ceramics only (e.g. MM1-23, MM1-24 and MM1-29) The undecorated ceramics associated in those instances are generally 3-9mm thick, and moderately tempered with crushed pottery.

Possible MBA-A concentration at northern part of the site (MM1-13). Sometimes MBA found without other periods (MM1-27). Also possible Mediaeval ditch found, although no mentioning of finds. (Sub)-recent finds without label (MM1-15).

**Description Locality:**

Several darker ‘features’ were found in the profiles of a construction site of newly dug fish breeding ponds. From a day report it can be assumed that most of these were depressions, in which archaeological remains were found. The interpretation in the report of these representing an agricultural field system is unsubstantiated. Also a sub-recent (late mediaeval?) ditch was found.

**Physical Geography:**

The top layer consists of disturbed and ploughed topsoil, with a paleosol dated to the Roman Age directly underneath.
Finds are described as all originating from below a Gorkum IV (sub)paleosol (‘sublaklaag’), that was found at a (?) lower level. The finds that were recovered from the darker depressions most likely represent washed out material, from a (unknown) nearby settlement location, that has been preserved in residual crevasse-channel fills (E.Verhelst/L.P.LouweKooijmans). The finds recovered in (more or less dense) concentrations on the surface might (according to E. Verhelst) represent actual (on-site) traces of habitation.

Description material:

Box 117

CER:
S17 yielded considerable quantities (1950 gram) of Iron Age ceramics, as well as some (30 gr) bone. Sherd with dentated spatula impression (Bell Beaker period) from 117-3 (might belong to S101B). Sherd with cord impression from 117-1, dating to the Beaker period. One sherd with round impression: Late Neolithic, Early Bronze- or (Early-) Middle Bronze Age.

FLI:
Seven fragments, two flint (Late (?) Neolithic) ‘knives’ and one scraper. A flint nodule (of ‘northern’ flint) has been used as hammer stone.

BON:
± 100 fragments, teeth and phalange young Bos Taurus identifiable.

STO:
1 granite (30 gr), weathered.

BOX MM1 and 202 (MM1-18-MM1-29)
Thus: codes MM1-18 until MM1-29 are stored in BOX 202, and not Box MM1 !!!

CER:
Vlaardingen Culture: MM1-14, ceramics very crumbled, according to label taken from Vlaardingen Crevasse. Cord-decorated sherd (MM1-5,MM1-24) Bell Beaker ceramics: (MM1-17, MM1-23 (?),MM1-28) Possible Late Neolithic (undecorated) ceramics (MM1-3,MM1-9). Early Bronze Age ceramics (MM1-1, MM1-8, MM1-9, MM1-17), Middle Bronze Age ceramics (MM1-13) and several Roman Age sherds (MM1-5, MM1-10, MM1-13).

FLI:
Several scrapers (MM1-12), mostly small and round. Made from flakes that are ventrally retouched. Flint mostly of low quality (riverine-flint).

Circa 1500 gram unworked flint, with some worked flakes (10-20).

BON:
Usually indet. (MM1-1, MM1-5, MM1-13, MM1-16, MM1-23, MM1-24, MM1-25, MM1-27, MM1-28, MM1-29)
Sometimes molars determinable (MM1-9 and MM1-24: ovis/capra, MM1-16 and MM1-23:BOS(young),MM1-24 and MM1-29 Bos(adult))
Pelvis young pig: MM1-27
Incise Canis: MM1-28

STO:
Circa 6 kilograms: sandstone, flint pebbles from rivers, sandstone, quartzite-sandstone and quarts Pseudo-axe; MM1-6

Site: Zoelenseput - West

Town: Zoelen
Toponym: Zoelenseput West
Coords.: 158.180/437.63
Precision: 2, derived from 1:10.000 topographical map
Date find: 25-08-1986
Finder: BATO (E. Verhelst, Tiel)
Period: EBA, BRONSV, MBA, BRONSM, NEOM, ROM, NT

Interpretation:
Undecorated ceramics remain hard to date, only indication for early use are three (possible) Potbeaker sherds. Several indicators for EBA found. Most likely the material (although parts might be washed from original location) belonged to a settlement dating to EBA and MBA. However, it might equally well represent a palimpsest of these periods. One middle neolithic sherd, possibly originating from nearby middle neolithic site. Few roman and sub-recent sherds found (at surface ?).

Description Locality:
Several darker ‘features’ were found in the profiles, as well as surface finds, recovered from a sand-dredging site.

Physical Geography:
<unknown>

Description Material:
Box 355
CER:
Roman age ceramics, Early- or Middle Bronze Age ceramics, undecorated.
Pierced sherd with barbed wire decoration, sherd with shallow groove on rim (Early- MBA). Three possible sherds of Potbeaker ceramics (LNEO-EBA).

FLI:
Flint arrowhead with concave basis (Early Bronze Age ?), various flint scrapers.

BON:
Various fragments, some burned, teeth and lower jaw young Bos Taurus identifiable.

STN:
500 gram, sandstone, flint pebbles from rivers, sandstone, quartzite-sandstone and quarts.

Box 354

CER:
\(\pm 1000\) gram Middle Bronze Age ceramics. One Middle Neolithic sherd., Few roman sherd and (sub)recent ceramics.

FLI:
\(\pm 300\)gr. Most unworked flint from rivers.

BON:
630gr (80fragments), bones of cattle and pig.

STN:
5000 gram, sandstone, flint pebbles from rivers, sandstone, quartzite-sandstone, some granite, diorite and quarts.

Site: Zoelenseput Oost

Town: Zoelen
Toponym: Zoelenseput Oost
Coords.: 158.400/442.100
Precision: 2
Date find: 02-07-1989 / 21-10-1989
Finder: BATO (E. Verhelst, Tiel)
Period: LNEO (?), NEOL-MBA, (EBA), MBA, IA?, YT?

Exploration:

Settlement debris: not so rounded: perhaps indication of more nearby settlement or less disturbance by aquatic erosion. A possible Iron Age sherd (tempered with crushed pottery, very eroded) recovered from near recent drainage ditch (ZPO-4)

Description material:
BOX203

STN: Three rubbing/grinding stones, 1 large (1450gr) and 1 small (used in ribbon along surface: 286gr, almost identical found in De Bogen excavation !) and 1 hammerstone used on 1 side 256gram (Drawings ZOEBEL008 and ZOEBEL 021, Fig. 3.11), 3kg of diverse stone (mainly broken quartz and sandstones).

CER: 1800 gram, predominantly Middle Bronze Age pottery (ZPO-1, ZPO-3), one decorated sherd perhaps LNEO (drawing ZOEBEL016). One possible sherd of Potbeaker (LNEO-MBA), ZPO-3. Also group of thin-walled (<8mm), that might comprise some LNEO ceramics. One sherd with small stick/reed-impressions (drawing ZOEBEL015) perhaps EBA or MBA-A. Some burned clay found. (2 fragments, 1> 1cm), very rounded.

FLI: NEOM worked blade (‘Spitskling’), probably belongs to nearby Hazendonk 2 site. (ZPO-2)

Site: Maurik Hornixveld

Town: Maurik
Toponym: Hornixveld
Coords.: 158.400/442.100
Precision: 2?
Date find: 02-07-1989 / 21-10-1989
Finder: BATO (E. Verhelst, Tiel)
Period: Bell Beaker, NEOLB, ROM

Interpretation:

Washed Bell beaker finds, ex-situ. Stray roman finds? Unclear.

Description material:

BOX 202

Surface finds from ploughed field.

STN: 260gram, 3 broken quartzite, 6 sandstone
FLI: 6fragm. 1 flake (maasvuursteen)
CER: 3fragments (7gr) eroded, redu core, oxi walls, 5mm thick, one with dentated spatula impress, 4 roman sherds.

BOX 354

BON: 10fragm, 15gr indet
STN: 8 fragm. Sandstone (30gr)
FLI: 16 fragm (14gr), one possible retouched flake.
CER: 8fragm (10gr), moderately tempered with fine crushed stone and sand, 3gr burned clay.

BOX Maurik Meerboom (océ)

STO: Bead (git), 15mm diameter, 6-9mm in crosssection, conical perforation. M-LNEO age. (L. Verhart).
Appendix III  Report on the BATO collection

Site: Zoelen De Beldert (II)
Town: Zoelen
Toponym: De Beldert
Coords.: 159.850/437.800
Precision: 2
Date find: 6-9-1991
Finder: BATO (E. Verhelst, Tiel)
Period: LNEO, LNEO-EBA, EBA, MBA,

Interpretation:
Unclear, stray finds from surface or from profiles?, on the surface both Roman as well as Iron Age sherds were found. Labels sometimes state ‘Zoelen de Beldert II – Zoelense put Oost’ so the data from these two sites perhaps can be grouped.

Box 88

CER: Sherd with rows of finger-top impressions or grooves underneath the rim, potbeaker (LNEO-EBA) (ZB88-1, ZB88-5). Thick (12-15mm) ceramics tempered with coarse (1-7mm) crushed quartzite (MBA). (ZB88-2, ZB88-3).

FLI: Irregular flakes (ZB88-8, ) Arrowhead with hollow base (ZB88-2)

STO: pebbles and sandstone , all unworked (ZB88-2, ZB88-6,ZB88-8)

BON: Fragmented bone, a phalange Bos t. ZB88-6 , mostly indet (Zb88-4,ZB88-6,ZB88-7)

Site: Zoelen De Beldert (III)
Town: Zoelen
Toponym: Zoelense Put Oost -De Beldert III
Coords.: 158.830/437.830
Precision: 2
Date find: 27-1-1991
Finder: BATO (E. Verhelst, Tiel)
Period: BA (LNEO?)

Interpretation:
Most likely Bronze age, perhaps LNEO, found 95-105cm below surface.

Box88 (ZB88-9)

CER: 2 fragments, tempered with crushed pottery, 3 fragments (8mm thick), temper indet.
FLI: Flake 2 by 3cm, grey flint.
STO: 6 pebbles of quartz, 1 fragment of sandstone.

Site: Zoelen De Beldert (X20)
Town: Zoelen
Toponym: De Beldert X20 ‘Vlaardingen niveau’
Coords.: ?

Site: Zoelen De Beldert I
Town: Zoelen
Toponym: De Beldert I ‘Romeinse Tijd’
Coords.: ?
Precision: 2
Date find: 6-9-1991
Finder: BATO (E. Verhelst, Tiel)
Period: Rom

Interpretation:
Roman Age sherds and fragments of Bone (molar of Bos T.)

Site: Zoelen De Beldert V
Town: Zoelen
Toponym: De Beldert V ‘middelste laag profielwand ’
Coords.: 158.850/437.990
Precision: 2
Date find: 4-5-1991
Finder: BATO (E. Verhelst, Tiel)
Period: NEOM

Interpretation: Part of polished flint axe. Recovered from profile.

Site: Zoelen De Hevel
Town: Zoelen
Toponym: De Hevel
Coords.: 159.300/437.520
Precision: 2?
Date find: August 1986
Finder: BATO (E. Verhelst, Tiel)
Period: IA, YT, ROM, LME, NT

Interpretation: Material collected during survey of ploughed field.
Appendix IV  Beaker typology by Glasbergen and Van der Waals

Glasbergen & Van der Waals, 1955, p. 8. Fig. 3

Glasbergen & Van der Waals, 1955, p. 18. Fig. 9.
Use-wear analysis by Yvonne Keizers, 03-07-2000, Faculty of Archaeology, Universiteit Leiden.

Flint knife (left) possibly used to cut unknown substance in longitudinal direction.

Flint scraper (right) possibly used for hide processing.

Scalebar in centimetres.
(Second generation) IKAW map of the study area.
© State Service for Archeology, Amersfoort
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