# After the deluge, a palaeogeographical reconstruction of bronze age West-Frisia (2000-800 BC)

Zijverden, W.K. van

**Author**: Zijverden, W.K. van
**Title**: After the deluge, a palaeogeographical reconstruction of bronze age West-Frisia (2000-800 BC)
**Issue Date**: 2017-02-15

# 5 Site location: local variation or uniformity?

## 5.1. Introduction

In chapter 3 and 4 palaeogeographical reconstructions were presented at different map scales. The maps presented in chapter 3 are useful to understand the general geography of West-Frisia and changes in its appearance over time. It also explains changes in exploitability in general terms and main routes of transportation. The maps presented in chapter 4 show information about the exploitability of the environment surrounding settlement sites and changes over time. In this chapter the focus lies on the local variation in the subsurface of the site locations, in order to understand which parts of the landscape were favoured for settlement sites.

In 1991 IJzereef and Van Regteren Altena suggested a close relationship between relief and settlement layout for the Middle Bronze Age of West-Frisia. In their publication, the authors suggest that all settlement sites were situated at creek ridges or at least in close proximity to these ridges (IJzereef and Van Regteren Altena 1991, 67). In their opinion, the first houses were built on the higher parts of the flanks of the creek ridges. During the habitation in the Middle Bronze Age, the houses were displaced to the lower parts of the flanks of the creek ridges. In the Late Bronze Age, the houses moved to small terp mounds situated at the higher parts of the ridges (figure 5.1). Since the excavation of *Enkhuizen-Kadijken* it is clear this is not true for all sites (Roessingh and Lohof 2011, 299).

In order to get a grip on the relation between the nature of the subsurface and site location, the key sites of the *"Farmers of the Coast"* research project, are evaluated for information on the subsoil. This evaluation should result in a general idea on site location. These ideas about site location will be tested in the case-study of *De Rikkert*.

*Figure 5.1: Habitation model according to IJzereef and Van Regteren Altena (1991). From left to right the situation at the start of the Middle Bronze Age, the end of the Middle Bronze Age and the Late Bronze Age. Legend: a marsh area, b flanks of creekridge, c creek ridge, d house, e house situated on a terp mound bordered by a terp ditch.*


*Figure 5.2: Ditches of the site Hoogkarspel-Watertoren plotted on the map of Ente (1963) (After: Bakker et al. 1977, 194, figure 7). Legend: a ditches, b loamy sand to sandy loam, c sandy loam to loam, d sandy loam to loam overlying (silty) clay loam, e deeply humose soils induced by man.*

## 5.2. The model

As early as 1959 a relation between the nature of the subsoil and the location of a burial mound was attested by Bakker (1959, 173). Bakker used the then unpublished soil map of Ente (1963) to understand the location of *Tumulus I* of the site *Hoogkarspel* (Bakker 1959, 183). In a later publication he plotted all excavated features uncovered during the subsequent excavations of the *Hoogkarspel* sites on this soil map (Bakker *et al.* 1977, 192). He observed: "*The ditch density displays a striking relation to Ente's soil map.*" and "*In the North, one can see a compromise between the current*[71] *rectangular ditch system and the desire to include a loam ridge running diagonal to this system: the enclosures thus have a diamond shape*" (Bakker *et al.* 1977, 192; figure 5.2). In other words, it is thought that relief and soil types were meaningful to the inhabitants in relation to the settlement location and layout. Not only at the *Hoogkarspel* site was this relationship presumed. IJzereef and Van Regteren Altena (1991, 67) suggest for the site *Bovenkarspel-Het Valkje* that the orientation of the individual houses was determined by the orientation of the "sandy" creek ridge during the entire period of habitation. Just like Bakker *et al.* (1977), IJzereef and Van Regteren Altena (1991, 66) depict the soil map of Ente (1963) underneath the maps with the layout of the excavation to emphasize their argument.

Two critical remarks can be made about these observations, interpretations and use of Ente's soil map. First of all, the map of Ente (1963) is a soil map with a complex section type legend. The soil map describes the successive lithological units to a depth of 125 cm below the surface. The successive lithological units are described in four classes: *deeply humose soils*, *"kiek" clay*, *"knik" or "pik" layer* and *westfrisian marine clay soils*. The first class, *deeply humose soils,* is the result of drainage and tillage by man of former peat lands. In general this layer is dated to the Middle Ages and later. The second layer, *"kiek" clay*, is related to the enlargement of the lakes in the Flevomeer area. The third layer, *"knik" or "pik" layer*, refers to the (cultivated) Bronze Age top soil. The last layer refers to, as the name suggests, the marine deposits in the Bergen tidal basin. All layers are subdivided based on organic matter content and grain size distribution. The map definitely does not reflect geomorphological elements like levees, creek ridges or relief classes. Although Ente (1963, 67) mentions that creek ridges often consist of relatively sandy soils, he specifically mentions that this is not always the case. Therefore the simple translation of sandy soils into creek ridges and clayey soils into tidal marshes or floodbasins, used in many archaeological publications, is incorrect.

Secondly the map is published on a scale of 1:20.000 and based on an average of 6 corings per hectare. Ente (1963, 4) specifically states that the map units cannot **and** do not reflect the actual detail

71 Middle Bronze Age.

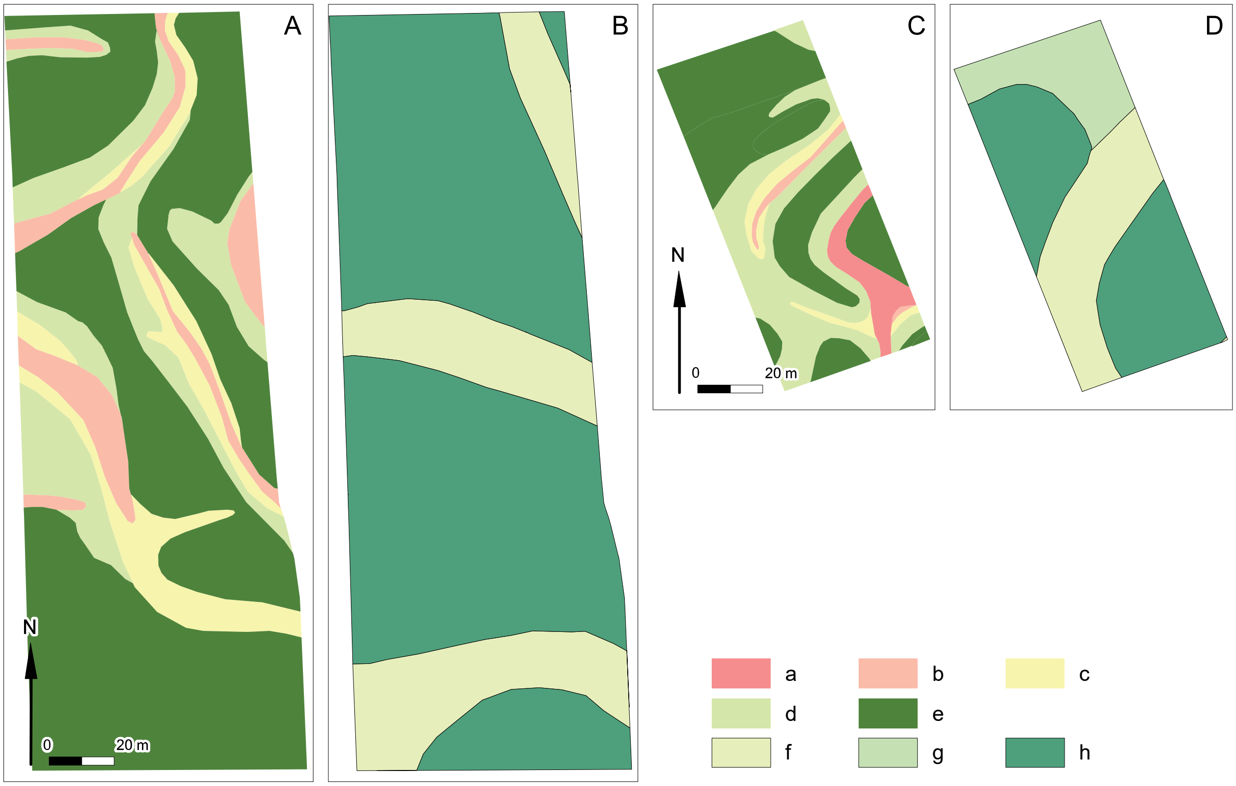



*Figure 5.3: A Detailed soil map of a parcel in Andijk presenting the 'westfrisian marine clay soils' based on c. 100 corings/hectare (After: Ente 1963, 4, figure 3A). B The same parcel and soil units at the soil map of Ente (1963) based on c. 6 corings/hectare. C Detailed map of a parcel in Hout presenting the 'westfrisian marine clay soils' based on c. 100 corings/hectare (simplified after: Ente 1963, 14, figure 5A) D The same parcel and soil units at the soil map of Ente (1963) based on c. 6 corings/hectare. Legend: a loamy sand to sandy loam over (sandy) loam b sandy loam, c (sandy) loam over (silty) clay loam, d (silty) clay loam over (sandy) loam, e (silty) clay loam, f sandy loam to loam, g sandy loam to loam overlying (silty) clay loam, h (silty) clay loam.*

present in the landscape. He illustrates this problem with two detailed maps of a parcel in Andijk (Ente 1963, 4; figure 5.3A) and a parcel in Hout (Ente 1963, 14; figure 5.3C) with a density up to an average of 100 corings per hectare (Ente 1963, 14). Obviously there is only a slight resemblance between both maps. For archaeological purposes the detail of figure 5.3A and 5.3C is needed. In the absence of such detailed maps, the map of Ente is often magnified ten times or more (for example Bakker *et al.* 1977 or Hakvoort and Jansen 2012). One should bear in mind that the map is not designed for such uncritical use.

## 5.3. An uniform description

In every archaeological project at least one or more soil sections are described. In the field of archaeology there is consensus on the necessity of the documentation of the local stratigraphy by analysis of one or more soil sections. The description method of these soil sections is always subject to debate. In general several elements are included: colour, lithology, archaeological features, soil formation, lithostratigraphy, lithogenesis and sedimentary characteristics. Only for the description of the lithology is the use of a standard common practice. In the Netherlands different standards for the description of the lithology (grain size distribution, organic matter content and $CaCO^3$-content) have been in use. These standards are known as "Stiboka", "Verbraeck" and "NEN5104" (resp.: De Bakker and Schelling 1966; Verbraeck 1984; Nederlands Normalistatie Instituut 1989). In 1997 a committee of archaeologists and earth scientists developed a standardized method for the documentation of soil sections and corings in which NEN5104 was chosen as the standard for the description of the lithology (Projectgroep Archeologie HSL 2001). Despite the consensus on the necessity of standardisation, standardisation of the description method of soil sections is not an issue in the Dutch Archaeology Quality Standard (CCvD

2013). Depending on education and experience, archaeologists describe sections in more or less detail and quality and certainly not in a standardized way, with the exception of the grain size distribution, organic matter content and $CaCO^3$-content.

In order to compare the information on the subsoil of the different sites (§ 5.4), the original documentation on sections has been consulted, including photographs and technical reports. The lithological units have been transposed into USDA soil taxonomy terminology following the example of Van der Veer (2006, Appendix I). For each excavation a representative cross-section is selected and described. Furthermore, information retrieved from soil samples is summarized.

## 5.4. A selection of sites

In West-Frisia over 90 excavations revealed features dating to the Bronze Age (Roessingh in prep.). Many of these sites have not or only partly been published. Within the *"Farmers of the Coast"* research project, the excavation results of the sites *Hoogkarspel*, *Andijk*, *Bovenkarspel-Het Valkje*, *Medemblik-Schepenwijk* and *Enkhuizen-Kadijken* are selected for an analysis of settlement sites. These five sites have been chosen, because they cover relatively large areas and are thought to be representative for Bronze Age settlement sites in West-Frisia. The first three sites were excavated in advance of or during the period of land consolidation projects. These sites have not been published in full. The documentation of these sites was available in an analogue format and had to be digitized. The last two sites were excavated more recently in advance of housing development projects. These sites have been published in full and all documents are digitally available.

### *5.4.1. Hoogkarspel*

During the soil survey, Ente and his co-workers mapped several barrows close to the water tower in the village of Hoogkarspel. In 1958 one of those barrows was partly levelled by the owner of the parcel. A rescue excavation was undertaken by the archaeological institute of the University of Amsterdam (Bakker 1959). This excavation is the first of a series of excavations in the municipality of Hoogkarspel. In successive years between 1965 and 1979 large parts were excavated with test trenches and trenches. Three excavated units can be distinguished, *Hoogkarspel-Watertoren*, *Hoogkarspel-Tumuli* and *Hoogkarspel-Tolhuis* (figure 5.4). The last unit, *Hoogkarspel-Tolhuis*, is also referred to collectively as *Hoogkarspel-Tolhek*, *Medemblikker-Tolhuis*, *Medemblikker-Tolhek* or simply *Tolhek*, *Tolhuis* or *Tolweg* in the literature. The unit *Hoogkarspel-Tolhuis* is further subdivided into smaller units A to F. The barrows have been excavated separately and are referred to as *Tumulus,* followed by a number and a letter. All excavations have been carried out by the archaeological institute of the University of Amsterdam with the exception of *Tumulus I A*, which was excavated by the archaeological institute of Leiden University (Modderman 1974). In this chapter this complex of excavations is referred to by the name *Hoogkarspel.*

The first use of the *Hoogkarspel* site is dated to the Early Bronze Age, based on the presence of a pit with Barbed Wire pottery. The location of this pit is unclear. Brandt (1988, 217) places this pit in the western part of the *Watertoren* excavation. Bakker (2004, 98) places this pit in the north-eastern part of the excavation. Based on an analysis of the excavation data Roessingh suggests for the entire complex a date in the Middle and Late Bronze Age between 1500 and 800 BC with an emphasis on the periods 1400-1200 and 900-800 BC for the use as settlement site (Roessingh in prep.). According to Roessingh (in prep.) the tumuli have to be dated in the Middle Bronze Age. All dates have to be used with some reservation due to the lack of a solid dated framework for this site (Roessingh in prep.).

During the excavations many sections have been documented by archaeologists. In their descriptions of the sections they focus on the stratigraphy of features. Therefore, most of the sections have been described with great detail to features. The sampling for pollen, macrobotanical remains and molluscs was also mainly focused on the features. In contrast to these often detailed descriptions of archaeological stratigraphy and sampling, the nature of the subsoil is described in a very general way. In the technical report it is mentioned that the subsoil in some areas is more clayey compared to other areas within the excavation. Very little information on sedimentary characteristics is available. In the technical reports sampling of the subsoil for diatoms, pollen and molluscs is mentioned.[72] These analyses are briefly

72 The molluscs have been analyzed by W.J. Kuijper, the diatoms by M.J. Jansma and the pollen and spores by B. van Geel and C.C. Bakels.

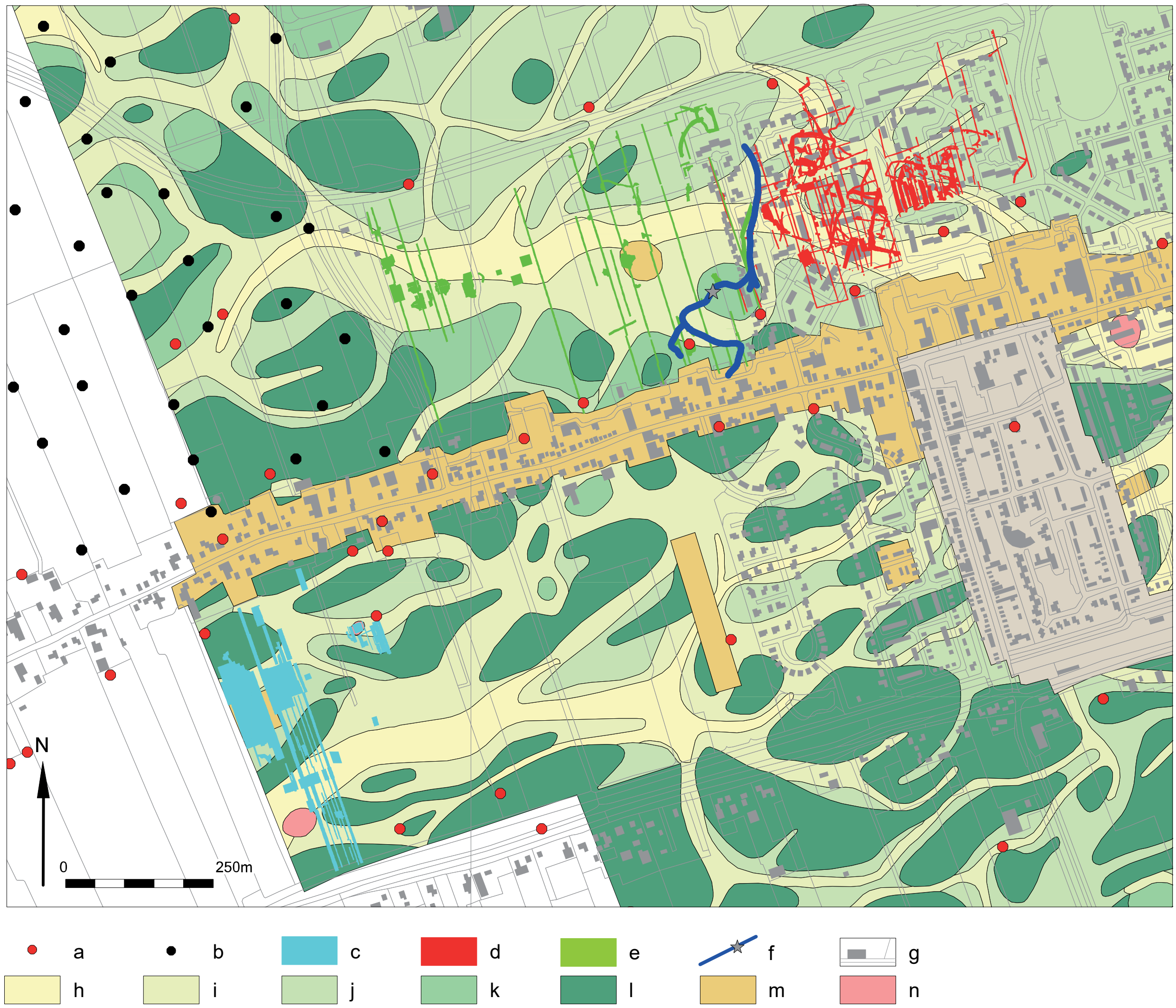



*Figure 5.4: Overview of archaeological research of Hoogkarspel plotted on the soil map of Ente (1963). Legend: a coring (DINO-Loket), b coring Stiboka, c trenches excavation Hoogkarspel-Tolhuis, d trenches excavation Hoogkarspel-Watertoren, e trenches excavation Hoogkarspel-Tumuli, f "breakthrough" gully and location section figure 5.5, g modern topography, h loamy sand to sandy loam, i sandy loam to loam, j sandy loam to loam overlying (silty) clay loam, k thick (25-60 cm) (silty) clay loam soils overlying (20-30 cm) sandy loam to loam, sometimes underlain by (silty) clay loam, l (silty) clay loam, m deeply humose soils induced by man, n ancient settlement soils.*

reported by Bakker *et al.* (1977, 197-204). In the technical reports several visits of Ente (Stiboka), De Jong (Geological Survey) and a visit of Zagwijn (Geological Survey) are reported. In two sentences the visit of these soil scientists are summarized: *"… het profiel…en het horizontale vlak … met zoden zijn typisch voor kwelderzoden. Zijn (Ente) indruk is dat het kwelderstadium zeer snel verlopen is."*[73] Any arguments for this interpretation are absent.

Detailed information on the landscape is mainly provided by Bakker in Bakker *et al.* (1977, 192-196). In this publication he gives a lot of thought on the relief in relation to the subsoil. During the *Hoogkarspel* excavations, a relief difference of 100 cm was attested between the highest and the lowest part of the settlement sites. The higher parts are characterized by a sandy subsoil, whereas the lower parts are characterized by a clayey subsoil. According to Bakker the *Hoogkarspel* site is situated at two parallel oriented sandy stretches which probably represent tidal gullies (figure 5.4). Bakker discusses the nature of the sediment flanking these gullies.

73 "The soil in the section and excavation floor are typical for a tidal marsh environment with a high sedimentation rate." Technical report 17-08-1965.

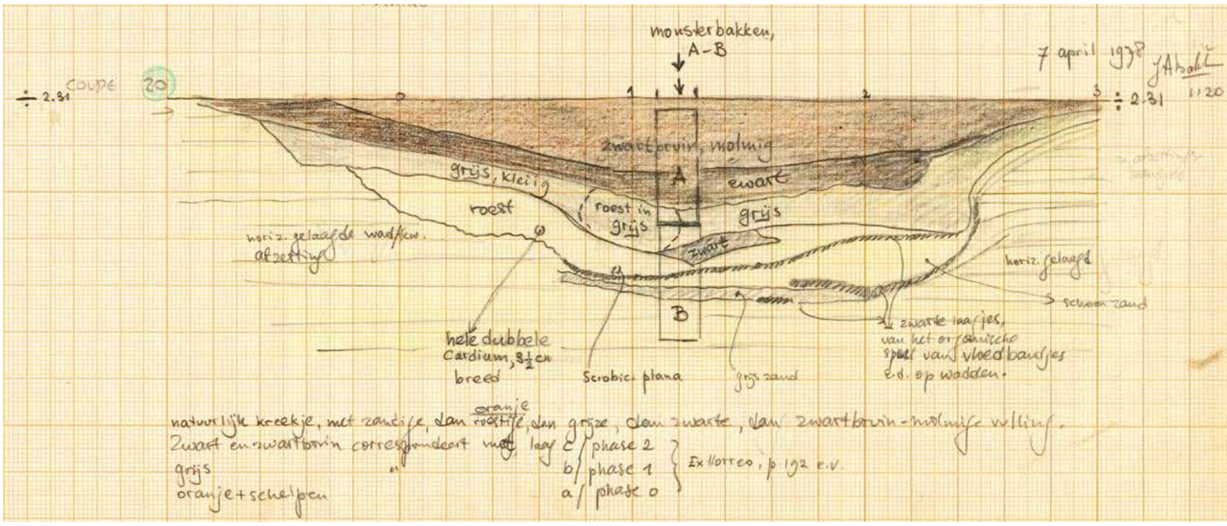



*Figure 5.5: Cross-section of the breakthrough gully drawn by Bakker. The position of the section is indicated in figure 5.4 (Source: Digital Production Centre University of Amsterdam).*

Two contradicting interpretations are presented, salt marshes and tidal flats. Bakker refers to personal communication with Ente over an interpretation as tidal flat. Bakker is aware that this interpretation needs an explanation for the drying of these tidal flats and relief inversion accounting for the current differences in the relief. Bakker refers to "other specialists" for the interpretation as a high salt marsh. He concludes the discussion with the observation that: "*a generally accepted geomorphological model is not yet available*" (Bakker *et al.* 1977, 196).

Interesting in the publication of the site *Hoogkarspel-Watertoren* by Bakker is the description of a gully that cuts through the northern sand stretch at a right angle (figure 5.4). This gully is described by Bakker as a breakthrough gully in analogy to the breakthrough gullies described by Louwe Kooijmans in the central river area (Louwe Kooijmans 1974, 102). This type of gully is caused by different surface water levels in the basins on either side of a ridge. The water breaches the ridge causing a small channel and levelling the surface water in both basins. Characteristic for these channels are the fan shaped splays in the basins on either side of the ridge at the mouth of the gully. In figure 5.5 one of the scarce well-documented cross-sections of the gully is depicted. The drawing clearly shows the lack of lateral displacement of the gully. The channel deposits consist of fine sand and contain doublets of molluscs like *Scrobicularia plana* and *Cerastoderma* (in figure 5.5 noted as: *Cardium*). The subsoil shows a distinct horizontal bedding which is thinning upwards. The note "*wad/kw. afzettingen*" illustrates the questioning of the nature of the subsoil. The diatom samples taken from the subsoil indicate a marine to marine-brackish environment (Bakker *et al.* 1977, 197) The mollusc samples taken from the channel deposits of the gully indicate a shallow brackish environment by the high numbers of *Peringia ulvae*, *Littorina saxatilis saxatilis*, *Hydrobia stagnorum* and *Cerastoderma glaucum*. The other species present are *Ovatella myosotis*, *Mytilus edulis*, *Cerastoderma edule edule* and *Macoma balthica* (Bakker *et al.* 1977, 198-199). This population is representative for a shallow, vegetated brackish environment intersected by creeks. Probably there were higher grounds or salt marshes in the immediate vicinity. Pollen in the subsoil was severely corroded and therefore not informative (Bakker *et al.* 1977, 197-198).

A proper date of the gully is not provided. The absence of archaeological material in the channel deposits is striking. The gully has been excavated over a length of approximately 500 meters. One should expect some archaeological material like pottery and bone to be present as channel lag deposit in these channel deposits. Therefore an early date for this gully is suggested. Furthermore mollusc analysis of features represent an exclusively freshwater environment for the Middle and Late Bronze Age (Bakker *et al.* 1977, 198). This is supported by the analysis of spores and macrobotanical remains of features dating to the Middle Bronze Age and later (resp. Bakker *et al.* 1977, 197-198 and 200-204). The chronology of events at


*Figure 5.6: Gully cutting the creek ridge at the site Noorderboekert. The surface with ard marks dates to the Late Neolithic and Early Bronze Age (Photo: ArchOL BV).*

the *Hoogkarspel* site shows some resemblance to the *Noorderboekert* and *Rijweg* sites. These sites were exploited in the Late Neolithic and Early Bronze Age (§ 3.5.6). After the Early Bronze Age sedimentation took place and gullies, cutting the creekridge at a right angle, were formed (figure 5.6). These sediments represent comparable environments with the breakthrough gully of *Hoogkarspel* (§ 3.5.6). Based on the resemblance in environment, stratigraphy and morphology it is reasonable to place this breakthrough gully in this short sedimentation phase.

Based on the presented data, the lithology at the site of *Hoogkarspel* can be described as follows. The base of the sediments consists of a calcareous sandy loam to loam. This sandy loam to loam is, as far as it has been described, horizontally bedded and thinning upwards. In the north eastern part of the *Hoogkarspel* site, a small gully, the previously described "breakthroughgully", cuts through the top of this layer. The top of the sediment is decalcified and enriched with organic matter by soil formation. The archaeological features are visible underneath the A-horizon. This horizon is also visible underneath the tumuli. The A-horizon varies in colour. In the more sandy subsurface and underneath the tumuli the soil has a greyish colour. At other locations the horizon is almost black. Locally the A-horizon is covered with a thin layer of sandy loam or loam. In the top of this layer a second A-horizon has developed. Features are present under both A-horizons. Based on the distribution and appearance of this layer, an artificial origin is suggested.[74] The top of this Bronze Age landscape is covered by a brown layer, which is interpreted as dredging mud. The top of this mud is incorporated in the modern plough layer.

### 5.4.2. Andijk

The excavation of the well-preserved *Hoogkarspel* sites made archaeologists of the Dutch State Archaeological Service (ROB) aware of the upcoming destruction of this well-preserved prehistoric landscape by the planned land consolidation project. Based on a large scale field survey of the land consolidation area *De Streek*, north and south of the village of Andijk test trenches were dug. These excavations are known as *Andijk-Noord* and *Andijk-Zuid* (IJzereef and Van Regteren Altena 1991, 61). In this publication is referred to these two sites as *Andijk*. In figure 5.7 an overview of the trenches is presented. Based on an evaluation of the available data, amongst others the absence of Hoogkarspel Jong pottery, the site is dated to the Middle Bronze Age. A more exact date is not possible (Roessingh in prep.). Both sites will be published in full by Roessingh (in prep.).

74 Technical reports 13-03-1967, 21-04-1967 and 27-04-1967; drawing of soil section trench 12, November 1966.


*Figure 5.7: Overview of archaeological research of Andijk plotted on the soil map of Ente (1963). Legend: a coring (DINO-Loket), b trenches excavation Andijk-Noord, c trenches excavation Andijk-Zuid, d location section, e loamy sand to sandy loam, f sandy loam to loam, g sandy loam to loam overlying (silty) clay loam, h (silty) clay loam, i "kiek"clay, j deeply humose soils induced by man, k modern topography.*

Very little is known of the stratigraphy of these two sites. A sketch of the stratigraphy and a poorly documented soil section (figure 5.8) is all that is left on the stratigraphy in the documentation of this excavation. The technical reports of the excavations are lost. The soil map of *De Streek* (Ente 1963) suggests a relatively clayey subsoil. The few coring descriptions available in the DINO-database support this description. Remarkable is the absence of a sand body in all coring descriptions. Although every description presents a layer of sandy (clay) loam of 20 to 80 cm within the first 120 cm.

Based on the corings and the few notes on the drawings, the base of the section can be described as a calcareous sandy (clay) loam. The top is enriched with organic matter and is decalcified. Underneath the top features dating to the Middle Bronze Age are present including ard marks. The top is covered with an oxidized layer of peat. The nature of this peat is unknown. The peat is non erosive covered with clay. The top of this clay is incorporated in the modern plough zone.

### 5.4.3. Bovenkarspel-Het Valkje

Based on the previously mentioned survey and the experience during the excavation in Andijk, the Dutch State Archaeological Service (ROB) decided to excavate an area of approximately 18 hectares in Bovenkarspel. This excavation is known as *Bovenkarspel-Het Valkje*. Only the bone assemblage of this site has been published in full by IJzereef (1981). The botanical data has been published by Buurman (1996) and Van Amerongen (2016). An adjacent area of 61 hectares south of the excavated area has been preserved for future research (IJzereef and Van Regteren Altena 1991, 61-62). This area is known as *Bovenkarspel-Monument*. In this area three small-scale excavations have been conducted in the period of the land consolidation project. In 2002 a fourth excavation, known as *Bovenkarspel-De Geerling* was carried out. The four excavations were published in 2004 (Van Heeringen *et al.* 2004). In figure 5.9 an overview of the trenches is presented. The site is dated in the Middle and Late Bronze Age between 1600 and 800 BC according to Roessingh (in prep.).

From the Bovenkarspel sites a large number of soil sections has been documented in detail, amounting to a total of almost 4 km length. Little information

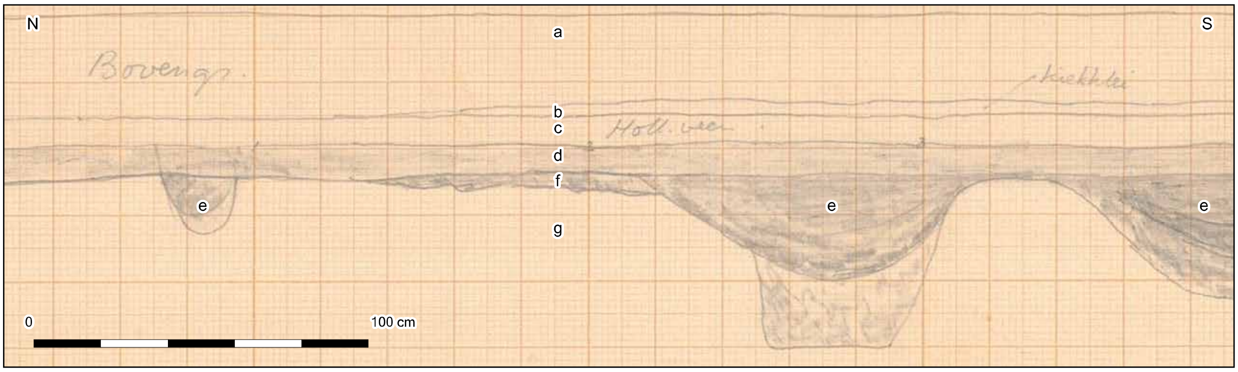



*Figure 5.8: Detail of soil section Andijk-Noord (Source: Provinciaal depot voor archeologie Noord-Holland). Legend: a modern plough zone, b "kiek" clay, c oxidized peat, d decalcified humic (clay) loam, e feature Middle Bronze Age, f feature ard marks, g calcareous sandy loam.*

has been written on the drawings of the sections. Although a large number of samples were taken during the excavation for a wide variety of research (mollusc analysis, macrobotanical analysis, pollen analysis, phosphate analysis and so on), little of this research has actually been realized. Interesting is the schematic drawing of the bedding in a large number of sections. Based on these sketches the impression of the environment is quite different to the environment of *Andijk*, *Hoogkarspel*, *Medemblik* and *Enkhuizen*. In these excavations the natural sediment is characterized by a planar lamination. At the site of Bovenkarspel the natural sediment is characterized by a cross stratification. The first is, amongst others, common in tidal marsh deposits, the second in channel deposits.

During the excavation several sections were discussed with Ente (Stiboka) and De Jong (Geological Survey). In the technical reports of the excavation the information from these earth scientists is shortly summarized. According to these notes, the base of the sections consists of tidal flat deposits gradually changing into tidal marsh deposits. Ente questions the interpretation as tidal marsh deposits, whereas De Jong has no doubts. The discussion focuses on the planar lamination of the top of the natural sediments, which is typical for a tidal marsh according to De Jong. Ente reasons that such stratification is also possible in mud flats. Due to the close proximity of a tidal channel he suggests that an interpretation as mudflat should be taken into account. In the top of the marsh deposits a soil has developed. Little attention is given to the nature and genesis of this horizon by both earth scientists. Based on the drawings, the nature of the A-horizon varies in the excavation in stratigraphy, lithology, organic matter content and colour. Locally the horizon is covered by a thin peat layer and/or "kiek" clay. Remarkable is the absence of peat in the drawings of the sections. In most sections a brown layer interpreted as "baggerdek" (dredging mud), covers the soil horizon. In figure 5.10 a detail of a section is depicted.

The researchers divided the soil horizon into two stratigraphical layers. The lower unit is dated to the Middle Bronze Age, the upper unit to the Late Bronze Age. In the excavation reports this is simply stated as a fact. No additional research has been carried out for a better understanding of this division. Not one section contains sediment between the supposed Middle and Late Bronze Age layer, contrary to the sections of *Hoogkarspel*. Therefore a sedimentation phase in between the Middle and Late Bronze Age can be excluded at this site. Two explanations can be given for this division. First, the soil formation conditions have been changed during the Bronze Age. For example, a substantial change in the groundwater depth and fluctuation can lead to a different breakdown process of organic matter, explaining the difference in colour and lithology of the upper layer, compared to the lower layer. Second, gradual sedimentation has taken place from the Late Bronze Age onwards for example during seasonal flooding. At the time of the excavation these kinds of ideas could have been tested with micromorphology. Since the project leader of the excavation was well acquainted with this kind of technique, this has apparently not been an issue.

Two deep (up to 3 meters) sections have been documented at a right angle to the supposed tidal channel (cross-sections trench 200-201 and 250, figure 5.9-5.12). The cross-sections present a classic section of a silted up channel with distinct levees. A

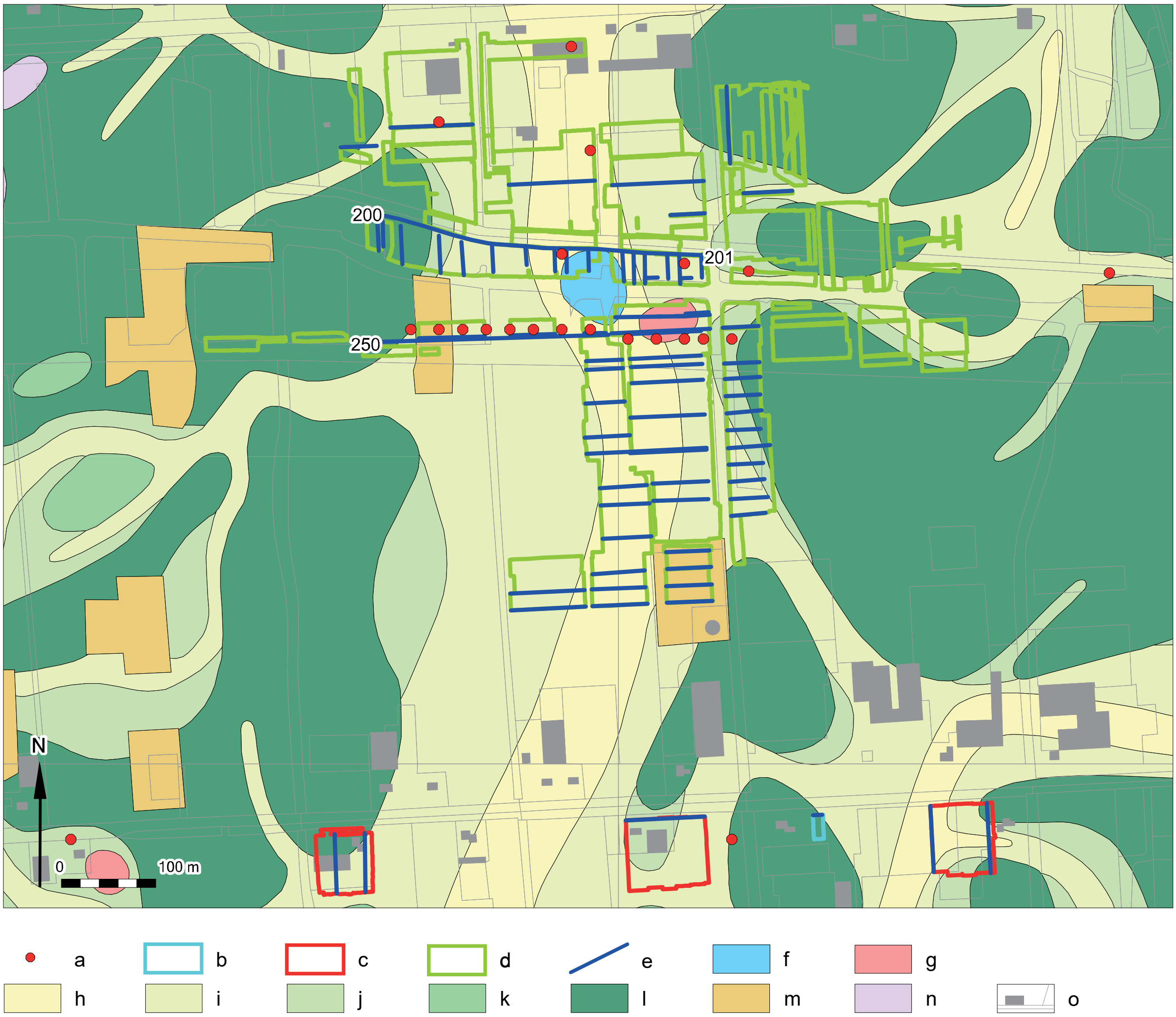



*Figure 5.9: Overview of archaeological research of Bovenkarspel plotted on the soil map of Ente (1963). Legend: a coring (DINO-Loket), b trenches excavation Bovenkarspel-De Geerling, c trenches excavation Bovenkarspel-Monument, d trenches excavation Bovenkarspel-Het Valkje, e location section, f, water, g ancient settlement soils, h loamy sand to sandy loam, i sandy loam to loam, j sandy loam to loam overlying (silty) clay loam, k thick (25-60 cm) (silty) clay loam soils overlying (20-30 cm) sandy loam to loam, sometimes underlain by (silty) clay loam, l (silty) clay loam, m deeply humose soils induced by man, n peat, o modern topography.*

clear residual gully was present in the centre of these sections (figure 5.11). This residual gully was silted up completely at the start of the habitation in the Middle Bronze Age. A sedimentological description of both cross-sections has been published by Roep and Van Regteren Altena (1988). One of the sections (250) has been completed with corings down to the Pleistocene subsoil. According to this description the sections contain two superimposed channel systems. Off-centre of the channel deposits, the systems are separated by a peaty clay representing a lagoonal phase. The youngest channel system contains thick layers with climbing ripples indicating a rapid accumulation. The changes in stratification from bottom to top indicate decreasing flow velocities over time. The levees present mostly sharp laminations of sand and clay. Only towards the top is the typical crinkly bedding indicative of vegetated levees present. The same is attested for the tidal marsh deposits accompanying the levees. At the base of the tidal marsh deposits a distinct layer of *Scrobicularia plana* is present. The top of the levees and tidal marshes is relatively sandy. In the top of the tidal marsh deposits small and shallow channel fills occur. These observations also indicate high sedimentation rates. Roep and Van Regteren Altena (1988) suggest the

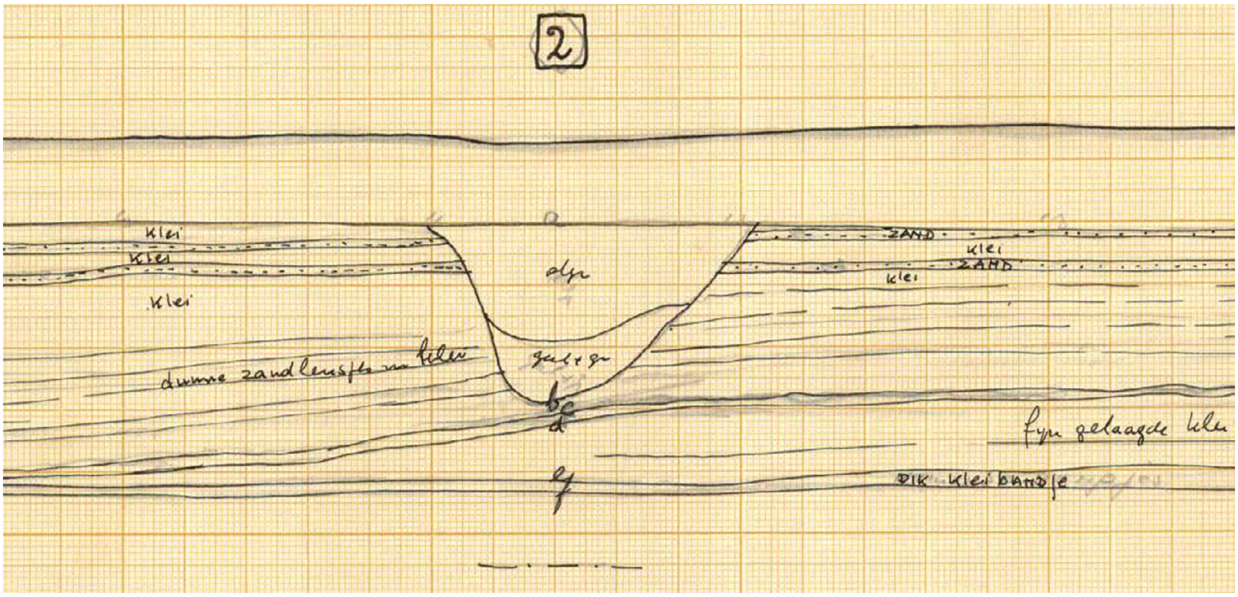



*Figure 5.10: Detail of a soil section Bovenkarspel-Monument (Source: Provinciaal depot voor archeologie Noord-Holland). Legend: a plough zone, b feature, c crinkled layering sand and clay, d Scrobicularia plana, e fine layers of clay, f massive clay.*

*Figure 5.11: Detail of a cross-section of the residual gully at Bovenkarspel-Het Valkje (Source: Provinciaal depot voor archeologie Noord-Holland).*

rapid sedimentation as a result of storm enhanced currents.

Roep and Van Regteren Altena (1988) suggest that compaction of the levees and tidal marsh deposits had already taken place at the start of the Middle Bronze Age. In their opinion the compaction led to inversion of the relief. However, in § 2.5.1. and 4.5 it is argued that the compaction only partly took place in the Middle Bronze Age and relief inversion did not occur. The largest part of the compaction occurred from the Middle Ages onwards as a result of an artificial lowering of the groundwater level, a process which still continues. Roessingh (in prep.) calculates a height difference of 120 cm in the Bronze Age top soil. He uses surface height measurements and height measurements of the top of the trench floors for his computation. This calculated height difference is not corrected for differential subsidence and reflects the present day height difference in the Bronze Age surface. Therefore it is reasonable to expect that the height difference in the Middle Bronze Age was smaller than the computed 120 cm

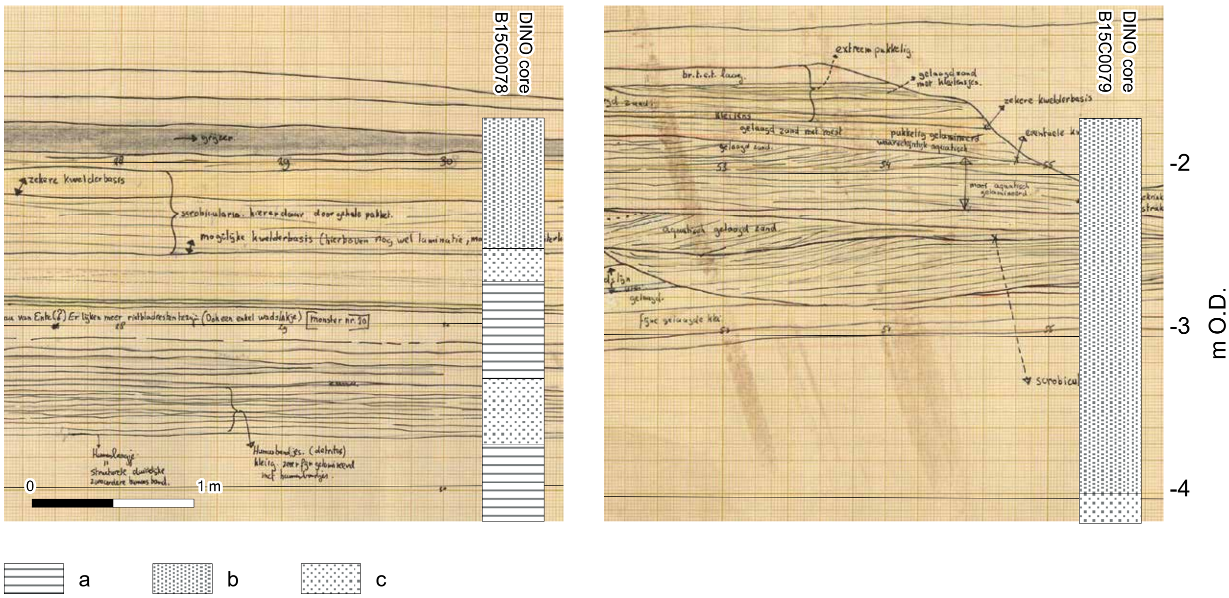



*Figure 5.12: Details of cross-section 250 and DINO-coring with tidal marsh deposits (left) and channel deposits (right) (Source: Provinciaal depot voor archeologie Noord-Holland). Legend: a clay loam, b loamy sand, c sand.*

and that the site of *Bovenkarspel* was situated at a slightly elevated ridge in the Bronze Age landscape. Probably the well-drained sandy top soil was more meaningful to the inhabitants than the slightly higher elevation. The distribution of the houses, orientation of the settlement site and the ditch system suggest the first over the latter (Roessingh in prep.), a situation which was also observed by Bakker *et al.* (1977, 192) for the *Hoogkarspel* site.

### 5.4.4. Medemblik-Schepenwijk and Schuitenvoerderslaan

Medemblik is a small town in West-Frisia. The first historical sources date to the 9th century AD (Besteman 1979, 210). The research into the early medieval history of Medemblik by the University of Amsterdam led coincidentally to the discovery of two Bronze Age settlement sites (Besteman 1977, 257; Besteman 1979, 217-218). Between 1967 and 1969 part of a settlement site was excavated at a construction plot (De Boer 2013). This site is known as *Medemblik-Schuitenvoerderslaan*. In 1996 in advance of the development of a residential area named *Schepenwijk*, in a plot next to the area excavated in the sixties, a desktop study combined with an assessment with manual corings was conducted (De Rooij and Soonius 1997). In 1997 test-trenching was conducted (De Rooij and Thanos 1997), during this assessment features dating to the Middle and Late Bronze Age were found. A follow-up with a full excavation was not achievable at that time. In 2006 the second part of the construction plot was once again subject to desk top study research and assessment with manual corings (Buitenhuis and Mulder 2006). An assessment with test-trenches was conducted in 2006 and followed by an excavation in 2007 (Van Benthem 2007; Schurmans 2010). Figure 5.13 presents an overview of the research and the location of documented soil sections. The site is dated to the Middle and Late Bronze Age between 1450 and 1100 BC and 900 and 800 BC (Schurmans 2010, 144-146).

During the excavations in the sixties almost every section was documented. The section depicted in figure 5.13 was published by Besteman (1977) for its completeness of the stratigraphy. Part of the original drawing is depicted in figure 5.14. During the excavation of 2007 only one section was documented. The location of this section is also depicted in figure 5.13. Although the description of both sections is detailed when it comes to archaeological phenomena, the information on the subsoil is poor. The lithological descriptions of the subsoil in the available corings from archaeological projects are not helpful at all for clarifying the stratigraphy, due to the poor quality of the descriptions and the shallow depth. Most corings end in fine sand within 120 cm below the surface level. The few corings which have been placed into deeper levels, present clay underneath the sand body of the supposed creek ridge.


*Figure 5.13: Overview of archaeological research of Medemblik-Schepenwijk and Schuitenvoerderslaan plotted on the soil map of Du Burck and Dekker (1975). Legend: a coring (DINO-Loket), b coring Stiboka, c coring (De Rooij and Soonius 1997), d coring (Buitenhuis and Mulder 2006), e coring with (loamy) sand, f trenches excavation Medemblik-Schuitenvoerderslaan (De Boer 2006), g test trenches (De Rooij and Thanos 1997), h test trenches (Van Benthem 2007), i excavated area (Schurmans 2010), j location of soil sections, k modern topography, l loamy sand to sand, m sandy loam to loamy sand, n loam to sandy loam, o kiekclay (20-40 cm) on loamy sand to sand, p soil with alternating lithology with or without (20-40 cm) kiekclay cover, q lake deposits (>80 cm).*

In the documented sections, the base is characterized by calcareous, sandy clay loam to very or extremely fine sand. All photographs and descriptions of the sections present a clear planar stratification in this sediment. The sediment is fining upwards. The top of the sand body is decalcified and enriched with organic matter and can be interpreted as an A-horizon. In this horizon pottery dating to the Middle and Late Bronze Age is incorporated. Underneath the horizon, features dating to the Middle and Late Bronze Age are present. The horizon is erosively covered with a thin layer of clayey peat to very humic clay or (clay) loam. In the descriptions of the depicted section in figure 5.14 it is suggested that this sediment originated as a gyttja (Besteman 1977, 255). The organic matter is strongly oxidized and was not investigated in the sixties or during the excavation of 2007. This peaty layer is covered with several layers of clay. The oldest layer consists of decalcified clay, contains charcoal and gradually develops into a second layer of clay, which is characterized by a large amount of burned clay, charcoal and some pottery dating to the Medieval period. Features dating to the Medieval period are present in and underneath this layer. The layer is covered with a third layer of decalcified clay. In this layer charcoal and small particles of burned clay are present. The entire section is covered with a very humic clay. In this layer medieval and prehistoric pottery appear, which suggests that these finds are in a secondary position. The top of this layer is incorporated in the modern plough layer.

Based on the excavations, it is thought that the sites *Schuitenvoerderslaan* and *Schepenwijk* were situated at a small creek ridge. This interpretation is based on the height differences in the Bronze Age surface level within the excavated area. The interpretation is understandable given the available data. For example Schurmans (2010, 17) noted a height difference in the top of the Bronze Age surface of almost one meter (-1.30 m O.D. to -2.20 m O.D.). Furthermore in the low southeast corner of the excavation the top of the Bronze Age surface is far more clayey compared to the higher parts. The available soil map also suggests a southwest-northeast oriented stretch with sandier sediments (figure 5.13). Although this interpretation is understandable given these observations and the available habitation model, two observations should have led to a critical evaluation of this interpretation:

- Where are the outer limits of the sites/cultivated landscape?
- How to explain the distribution of sand (figure 5.13) in relation to the "small creek ridge"?

As described in chapter 4, differential subsidence due to changes in hydrology and sedimentation are of great influence on height differences in the present day landscape. Therefore the present day height differences do not reflect the height differences of the landscape of the past. Therefore, the question arises whether the creek ridges, as they are observed in the present day landscape, were an equally recognizable geomorphological unit in the Bronze Age landscape. Apart from that the used soil map is a section type map, which reflects the successive lithological units of the first 120 cm below the present day surface in a generalized way. It does not reflect geomorphological or geomorphogenetic units and therefore cannot be used as such. A comparison of the soil map with the distribution of corings with a sandy subsoil (figure 5.13 unit e) presents, not surprisingly, a partially contradicting image. Apparently, outside the borders of the sandy stretch, sand bodies occur. An analysis of the sand depth of all the sand bodies shows that the highest sand elevations occur outside the excavated areas. Despite the presence of sand bodies outside the sandy stretch, during the coring campaigns no archaeological finds appeared to be present in this area. The soil section of *Schuitenvoerderslaan* explains partially why archaeological finds were absent in the coring campaigns (figure 5.14). When the top of the Bronze Age surface is incorporated in the modern plough zone, the chance of finding indications for settlement sites, like charcoal, pottery and burned clay in a core are very small.

The follow-up of the coring campaigns with small and widely distributed trenches is not suitable for tracing settlement sites, as is argued by Roessingh (in prep.). In addition, the large amount of modern disturbances in the test trenches of the 2007 excavation are grounds for questioning the validity of the conclusion that the area is no part of the settlement site (Van Benthem 2007). Although the conclusions of the survey are questionable due to the small trenches and large surface with disturbances, the design of the survey is way better compared to the design of the test trenches carried out in 1997. During this survey the trenches were focused on locations with a positive result in the coring campaign. Locations with absence of archaeological finds have not been trenched at all!

This "sloppy" research process makes the excavation results of the *Medemblik* sites less useful for a site location analysis. The usefulness of these sites is hampered by the lack of additional information on the genesis of the subsoil and a relation between characteristics of the subsoil and archaeological features. Based on the presented data, the interpretation as settlement sites situated at a small creek ridge is questionable. With the presented data, an interpretation as a former tidal marsh is a likely possibility. A proper geoarchaeological assessment in the early phase of the research process possibly could have improved the interpretation. In chapter 6 the topic of the need for proper geoarchaeological assessments is discussed in more detail.

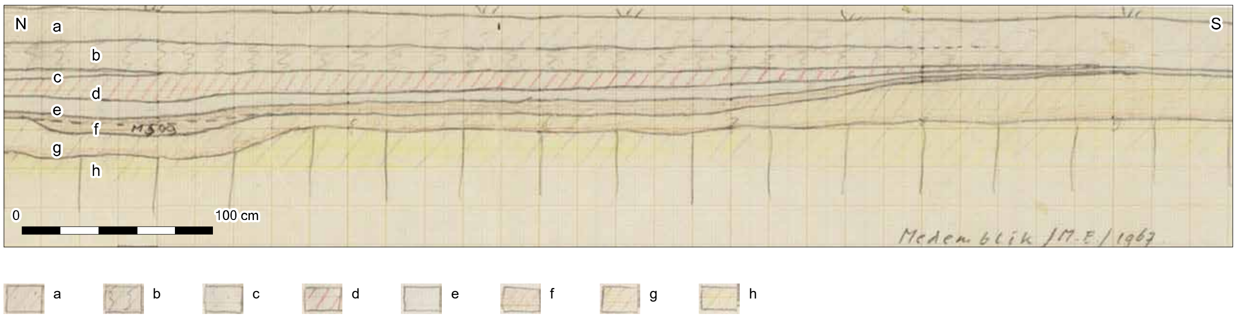



*Figure 5.14: Detail of soil section Medemblik-Schuitenvoerderslaan (Source: Digital Production Centre University of Amsterdam). Legend: a modern plough zone, b decalcified very humic clay, c decalcified clay with particles of charcoal and burned clay, d decalcified very humic clay with medieval pottery, large amounts of burned clay and charcoal, e decalcified clay with small particles of charcoal, f oxidized peaty clay, g very humic clay or (clay) loam, h calcareous sandy loam.*

### 5.4.5. Enkhuizen-Kadijken[75]

*Enkhuizen-Kadijken* is a construction plot northeast of the city of Enkhuizen. In 2006 a desktop study was published (Lohof 2006). Lohof (2006, 6) argues that the chances for a Bronze Age settlement site are high, due to a few finds of Bronze Age pottery during a field survey in 1954 at the plot. The presence of a burial mound just outside the perimeters of the plot strengthens his expectation (Lohof 2006, 6). During the land consolidation project the site was levelled. Therefore, Lohof advised an assessment of the completeness of the stratigraphy with hand coring equipment. This assessment was carried out shortly after the desktop study (Van Zijverden 2006). Large parts of the plot appeared to be intact and an assessment with test trenches was conducted (Roessingh and Van Zijverden 2007). It appeared to be a settlement site dating to the Middle and possibly Late Bronze Age. A small part of the plot (5A) was excavated due to the progress of the building activities (Roessingh and Lohof 2011). In 2009 the central part of the plot (5B) was excavated (Roessingh and Lohof 2011). In 2008 and 2010 an assessment with test trenches was conducted in the western part of the construction plot (Roessingh 2009; Roessingh 2010). Although the stratigraphy at this part of the plot was less well preserved, the features of a settlement site were well visible. A small stretch was excavated in 2011 (Roessingh and Vermue 2011). The last part of the construction plot was excavated in 2012 (Van der Linde and Hamburg 2014). Figure 5.15 presents an overview of the research and the location of documented soil sections. The site is dated to the Middle and Late Bronze Age between 1500 and 800 BC (Roessingh in prep.).

The base of the soil section consists of calcareous (silty) clay loam. In this clay some marine molluscs are present. The clay is only partially consolidated and any indications for soil formation are absent. The clay is abruptly covered with peat. The peat can be characterized as a *Carex* peat based on macrobotanical remains (figure 5.16). Towards the top the peat transforms gradually into a clayey peat or peaty clay. The top of the peat is eroded and covered by calcareous fining upwards sandy loam to (silty) clay loam. The sediment is characterized by a thinning upwards planar lamination. At the base of this unit many marine molluscs, like for example *Macoma balthica*, are present in a secondary context. The only molluscs in living position in this unit are exclusively *Scrobicularia plana*. In the top of this unit a soil horizon has developed, which is characterized by a slight decalcification and enrichment with organic matter. In this A-horizon, successive rows of small particles of charcoal (probably grasses) were observed in a thin section analysis (Roessingh and Lohof 2011, 391). Probably the grassy vegetation has been burned repeatedly. There are however, no additional indications for the presence of man. This unit is interpreted as a tidal marsh deposit.

The top of this unit is locally eroded and covered by a second unit of calcareous fining upwards sandy

75 The analysis of macrobotanical remains was carried out by C. Moolhuizen (ADC-ArcheoProjecten), the analysis of molluscs by W.J. Kuijper (Leiden University), the thin section analysis by R.P. Exaltus (ArcheoPro), K. van Kappel (ADC-ArcheoProjecten) and M. Pronk (VU University Amsterdam), the analysis of diatoms by H. de Wolf (WMC Kwartair Consultants). The physical geographical research and sampling was carried out by W.K. van Zijverden (ADC-ArcheoProjecten).

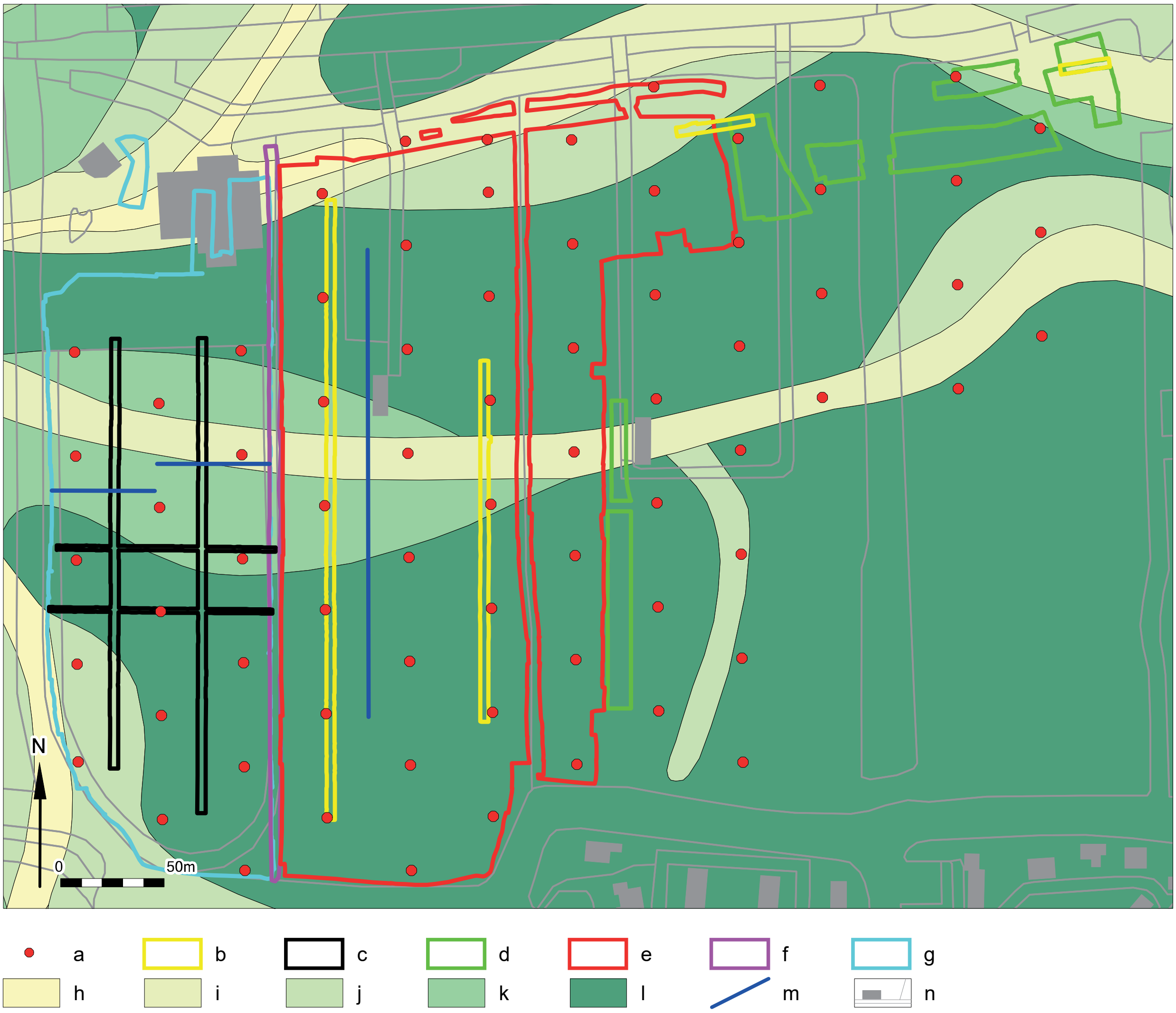



*Figure 5.15: Overview of archaeological research of Enkhuizen-Kadijken plotted on the soil map of Ente (1963). Legend: a coring (Van Zijverden 2006), b test trenches (Roessingh and Van Zijverden 2007), c test trenches (Roessingh 2009; Roessingh 2010) d excavated area 5A (Roessingh and Lohof 2011), e excavated area 5 b (Roessingh and Lohof 2011), f excavated area (Roessingh and Vermue 2011), g excavated area (Van der Linde and Hamburg 2014), h loamy sand to sandy loam, i sandy loam to loam, j sandy loam to loam overlying (silty) clay loam, k thick (25-60 cm) (silty) clay loam soils overlying (20-30 cm) sandy loam to loam, sometimes underlain by (silty) clay loam, l (silty) clay loam, m location of soil sections, n modern topography.*

loam to (silty) clay loam. The sediment is characterized by a thinning upwards planar stratification. In the center of the section the sediment is characterized by cross-stratification. The diatoms and molluscs indicate the presence of a small gully in a salt to brackish environment. The small gully has eroded the older underlying tidal marsh and peat deposits. The unit has been interpreted as a tidal marsh deposit. In the top of this unit a soil horizon has developed. This A-horizon consists of a very humic (silty) clay, which is decalcified. It is the top of this unit which represents the surface during the Bronze Age. In the northern part of the excavated area, a small area of this Bronze Age surface is covered with a thin (30 cm) layer of calcareous clay loam. Based on a diatom analysis and a thin section analysis this layer has probably originated within a very short time span, probably a single event (Lohof and Roessingh *et al.* 2011, 46). The diatoms indicate a brackish to freshwater environment. In the top of this unit an A-horizon has developed, which has been exploited in the Bronze Age. Therefore the event that caused this layer has to be placed in the Bronze Age. A more exact date could not be provided. Based on a thin section

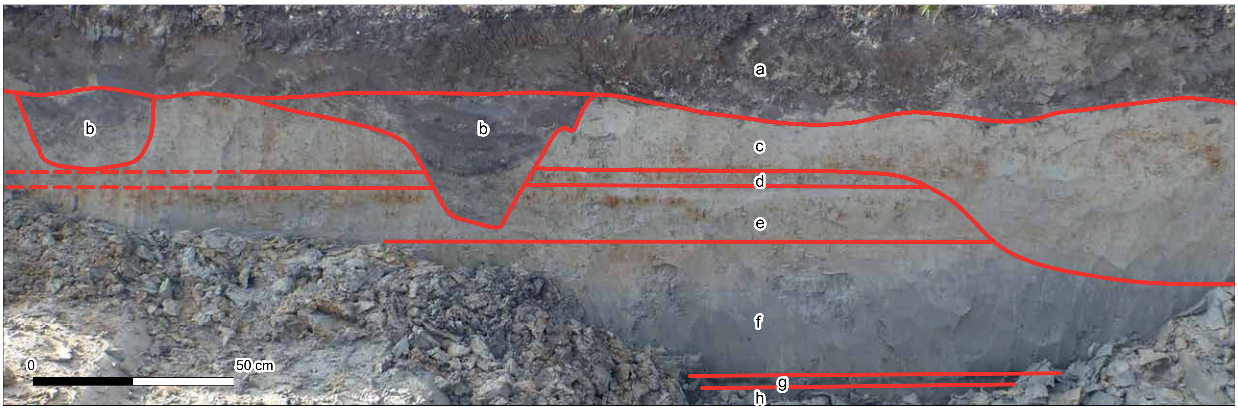



*Figure 5.16: Soil section Enkhuizen-Kadijken (Photo: ArchOL BV). Legend: a modern plough zone, b features, c channel deposits, d soil horizon, e tidal marsh deposits, f tidal flat deposits, g clayey peat, h Carex peat.*

analysis the soil became waterlogged over time and a diatomite clay developed, which represents a shallow freshwater lake (Pronk in prep.). The diatomite clay slowly developed into a regular non-calcareous clay. This unit is, based on the thin section analysis, interpreted as a back swamp environment. The top of this unit is incorporated in the present day plough zone.

### 5.4.6. A preliminary conclusion

After this evaluation of available information for the selected sites, which are supposed to be representative for Bronze Age settlement sites in West-Frisia, a generalized model can be drawn for each of the sites. In figure 5.17 a schematic sketch of the stratigraphy for each site location is presented (figure 5.17). The base of the section is formed by the fluvial sediments of the river Rhine and/or Vecht. These sediments are covered with a thin layer of cover sand. This landscape, dating to the Late Weichselian, is covered by a 10 to 13 meter thick cover of marine sands and clays alternating with peat layers. In the top of these sediments, channel deposits and levee deposits are present. These sediments have been formed before approximately 1800 BC. The silted up channels and their accompanying levee deposits formed larger or smaller creek ridges during the Late Neolithic and Early Bronze Age, depending on the compressibility of the subsoil, the age of the channel belt and the channel width. This landscape is covered by tidal flat and tidal marsh deposits. It is nearly impossible to distinguish tidal flat from tidal marsh deposits in the available dataset, due to the lack of information on the genesis of these deposits. In this layer channel deposits of former small creeks are present.

The tidal flat and marsh deposits have been draped over the previous landscape, leveling the former height differences in the Early Bronze Age landscape. For example at the *Noorderboekert* site, a cover of 250 cm in the lower parts of the previous landscape and less than 50 cm on the highest part of the previous landscape was present in the Middle Bronze Age. Therefore the former creek ridge of *Noorderboekert* was hardly visible in the landscape in the Middle Bronze Age. Contrary to the *Noorderboekert* site, the former creek ridge at the *Bovenkarspel* site has not been covered with tidal flat and/or tidal marsh deposits. In the Middle Bronze Age this former creek ridge was probably visible as a slight elevation in the landscape. The sites of *Andijk*, *Enkhuizen* and *Medemblik* are situated on top of tidal marsh deposits, distinct channel deposits are almost absent. At these sites probably little or no relief differences were present in the Middle Bronze Age. The same goes for a large part of the *Hoogkarspel* site. In the (probably) north-eastern part of the site, probably, a small channel belt dating to the Early Bronze Age is present. It would explain the presence of some Barbed Wire Pottery in this part of the site and channel deposits described by Bakker *et al.* 1977 as breakthrough gully.

Although any evidence is absent, it is likely that the large amount of Bronze Age ditches has contributed to differential subsidence of the top of the clayey and organic rich deposits to some extent. After all drainage of this type of sediments always results in subsidence.

This subsidence caused by man will have contributed to the natural subsidence. In the Late Bronze Age the relief difference will have been more pronounced compared to the Middle Bronze Age. The erection of small terp mounds at the sites of *Bovenkarspel* and *Hoogkarspel* in the Late Bronze Age points to recurring seasonal flooding (§ 3.6.2). Therefore small relief differences will have been of larger significance in the Late Bronze Age compared to the Middle Bronze Age. With this in mind, the present day height difference in the Bronze Age top soil of *Bovenkarspel* (110-240 cm -O.D.), *Andijk* (180-235 cm -O.D. ), *Hoogkarspel* (80-170 cm -O.D.), *Medemblik-Schepenwijk* (165-245 cm -O.D.) and *Enkhuizen-Kadijken* (175-205 cm -O.D.) should be several centimeters or at the most a few decimeters, but not over a meter as is the case. Therefore, the present day height variation of the Bronze Age top soil is not representative for the situation in the Bronze Age as was also argued in § 4.3.3.

These small height differences will also have influenced the development of the landscape in and after the Late Bronze Age. At locations where the original top soil is intact, the top of the Middle Bronze Age surface is covered with diatomite, very fine clay and/or peat. It is important to realize that this selection of locations is not an a-select sample. This is due to the simple fact that the upper clay layer protects the underlying sediments from mechanical erosion by historic and modern land use. This layer is only present in originally lower parts of the landscape, therefore originally low lying areas are overrepresented. Despite the small and hampered dataset, apparently very different environments were simultaneously present in eastern West-Frisia at the end of the Late Bronze Age or shortly after this period. The simple statement that West-Frisia was covered by oligotrophic peat (Pons 1992, 48) at the end of the Late Bronze Age or shortly after is certainly not defendable. Oligotrophic peat has been locally present in West-Frisia and dates to various periods in and after the Bronze Age (§ 3.5.4; 3.5.5, 3.5.7 and 3.5.8). Most peats in West-Frisia however, start as gyttja or other eutrophic peat and stay eutrophic long after the Late Bronze Age (§ 3.5.4-10).

Summarizing: in the Middle and Late Bronze Age slightly higher areas in the landscape appear at three locations (figure 5.17):

1. Locations with channel deposits of creeks in the tidal flat and marsh deposits.
2. Locations where Neolithic and or Early Bronze Age channel deposits occur at the surface.
3. Locations where Neolithic and or Early Bronze Age channel deposits are covered with a thin layer of tidal marsh deposits.

Concluding: there is a relationship between landscape and settlement site location, as was previously suggested. Small height differences have been of influence as suggested by IJzereef and Van Regteren Altena (1991, 67), especially in the Late Bronze Age. These slightly higher locations cannot be characterized morphogenetically as creek ridges, with the exception of the *Bovenkarspel* site. There is definitely no relation between the units in the soil map of Ente (1963) or Du Burck and Dekker (1975) and the presence of settlement sites. This is clearly visible in the figures presented for each assessment of the local landscape (figure 5.3, 5.7, 5.9, 5.13 and 5.15). For each assessment features are present in all soil units, with the exception of the unit “peat”. This unit is absent in all assessments. Apparently there is a relationship between the occurrence of boundaries between soil units and the layout plan of the settlement sites, especially for boundaries between sandy and clayey soils. It appears that boundaries between sand and clay are of influence on the parceling (Bakker *et al.* 1977; Schurmans 2010; Roessingh in prep.). It is important to state that this boundary between map units is strictly lithological and does not necessarily coincide with morphological or morphogenetic units.

## 5.5. The test: De Rikkert

Large parts of the land consolidation areas *De Streek* and *Westwoud* were surveyed in advance of and during the land consolidation projects, resulting in numerous finds of Bronze Age pottery. The Bronze Age finds of these surveys have never been properly analysed. In order to put survey finds in perspective, fieldwork was conducted in four successive years (2012-2015) at several parcels situated north of De Rikkert in Oosterdijk (figure 5.18). This fieldwork also provided an opportunity to conduct a small geoarchaeological assessment.

The first archaeological features at *De Rikkert* were found in 1935 when the landowner levelled a burial mound and found parts of a skeleton (Lehman 1963). In 1960 a small excavation of another burial mound was conducted at an adjacent parcel (Lehman 1963). In the period 1972-1975 a large scale field survey was

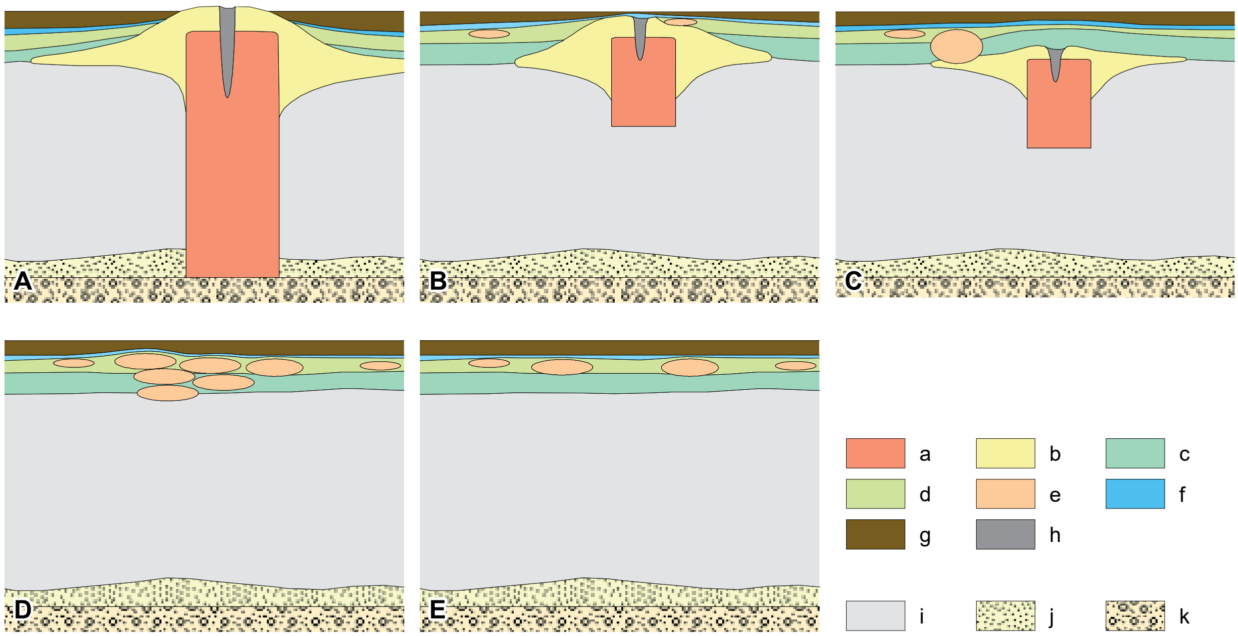



*Figure 5.17: Schematic sketch of the landscape of Bovenkarspel (A), Hoogkarspel (B), Noorderboekert (C), De Rikkert (D) and Enkhuizen-Kadijken (E). Legend: a channel deposits, b levee deposits, c tidal flat deposits, d tidal marsh deposits, e small channel deposits, f lake deposits, g peat and/or clay, h residual gully deposits, I older marine deposits and/or peat, j cover sand, k fluvial deposits.*

carried out in *De Streek* (Roessingh and Valentijn in prep.). During this survey several finds dating to the Bronze Age were found at *De Rikkert*. In addition to the survey, aerial photographs were analyzed revealing two possible burial mounds (De Vries-Metz 1993). This was the situation in 2012 when the Faculty of Archaeology of Leiden University organised a field survey for MA-students at *De Rikkert* (figure 5.18). During the survey, several corings were conducted in order to understand the lithogenesis. Based on the survey and a few additional corings, the stratigraphy was thought to be largely intact at one parcel. This parcel was selected for a small scale excavation, which was carried out by the *"Farmers of the Coast"* project group and students in 2013.

The excavation proved that a complete stratigraphy, including sediments dating after the Bronze Age was present. A sample of this complete stratigraphy was taken for micromorphologic, pollen, phytolith and macrobotanical research.[76] After the excavation a part of the parcel was investigated with geophysical methods (electric conductivity).[77] Later that year a second field survey and additional corings were carried out. In 2014 the adjacent parcel was investigated with small trenches and an additional geophysical research was conducted. In 2015 two series of small pits (1 m$^2$) were dug manually in order to test different field methods for prospection in West-Frisia. During this fieldwork, additional geophysical research was conducted (electrical conductivity and magnetometer).[78]

The base of the cross-section (figure 5.19) consists of a small peat layer, probably reed peat. This layer is covered by calcareous clay loam. In this sediment various small molluscs like *Scrobicularia plana* and juvenile *Cardium edule edule* are present. The sediment is slightly fining upwards and the lamination is thinning upwards. Based on these characteristics the layer is interpreted as tidal flat and tidal marsh deposits. A distinct division between these two lithogenetical units could not be made in the field. In the centre of the section a small body with channel deposits is present at the base of this layer. In the southern part

76 Micromorphology carried out by C. French (Cambridge University), pollen by M. Doorenbosch (Leiden University), Phytoliths by W. Out (Universität Kiel), Macrobotanical remains by E. van Hees (Leiden University).

77 Geophysical research carried out by W. Verschoof (RAAP BV).

78 Geophysical research carried out by W. Verschoof (RAAP BV) and a team of the Römisch-Germanische Kommission of the Deutschen Archäologischen Institut in Frankfurt.

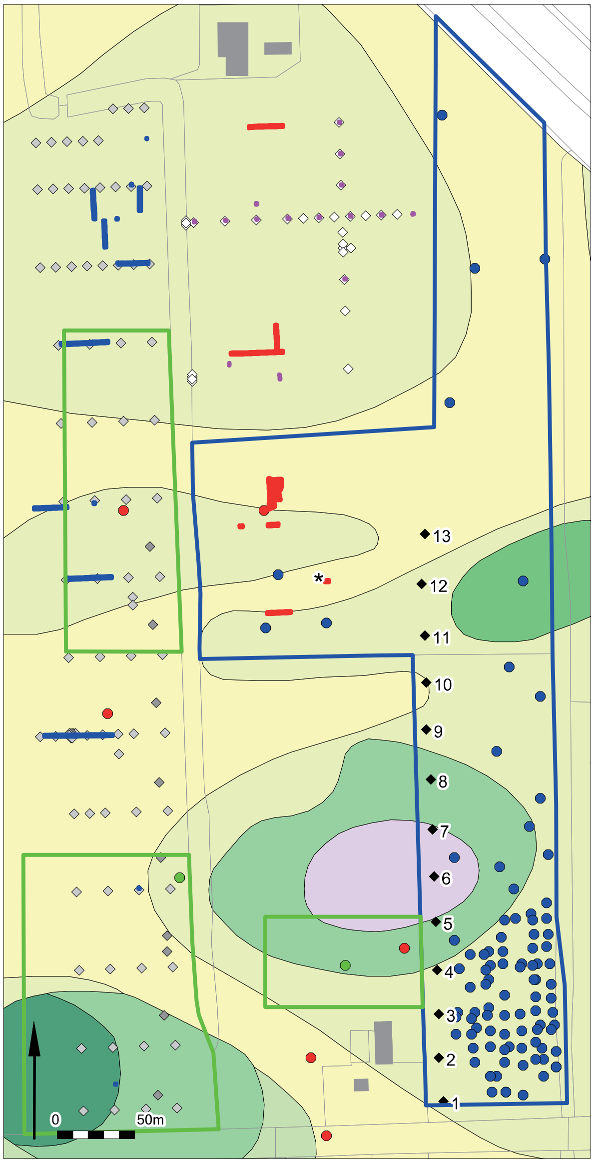
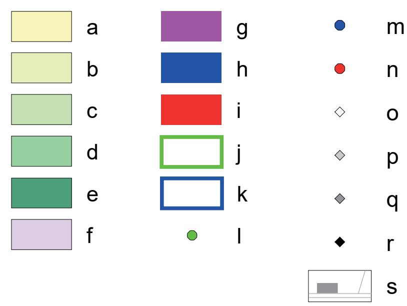



Figure 5.18: Overview of archaeological research De Rikkert plotted on the soil map of Ente (1963). Legend: a loamy sand to sandy loam, b sandy loam to loam, c sandy loam to loam overlying (silty) clay loam, d thick (25-60 cm) (silty) clay loam soils overlying (20-30 cm) sandy loam to loam, sometimes underlain by (silty) clay loam e (silty) clay loam, f peat, g trench 2015, h trench 2014, i trench 2013, j surveyed in 2013, k surveyed in 2012, l Bronze Age finds survey 2013, m Bronze Age finds survey 2012, n Bronze Age finds survey 1972-1975, o corings 2015, p corings 2014, q corings 2013, r corings 2012, s modern topography. The location of the soil sample depicted in figure 5.20 is indicated by an *.




a second body with channel deposits is present in the top of the layer. The top of the tidal marsh deposits and channel deposits is decalcified and enriched with organic matter. This zone represents a former top soil. The layer is covered with a layer of calcareous clay loam. The sediment is fining upwards and the lamination is thinning upwards. In the southern part of the section channel deposits are present which cut through the underlying layer. The top of this layer is decalcified, homogenized and enriched with organic matter due to soil formation. In the southern part this soil horizon is completely incorporated in the modern plough zone. In the northern half of the section only the top of the soil horizon is incorporated in the modern plough zone.

Two observations on this cross-section are of interest. First, in the top of coring 6 and 7 a peat layer was expected based on the soil map by Ente (1963). This peat layer is absent in these corings and finds are present in the top of this soil unit. Furthermore, peat is actually present more to the north in the area investigated by trenches in 2013. Second, the present day surface in the southern part is slightly higher compared to the central and northern part of the section. Due to levelling by modern land use, the height difference is nowadays 20 centimeters at the most, but probably was a little larger originally. The height differences are caused by the presence of the channel deposits in the subsurface. It is important to note that the relief differences are caused by stacked bodies of channel deposits (see coring 2, 3 and 4) and not single bodies of channel deposits. A comparable observation has been made in detailed cross-sections of a crevasse complex in the river area in the central part of The Netherlands (Van Zijverden 2002). This crevasse complex showed a complex morphology of superimposed crevasse channel deposits. The detailed cross-sections made clear that the elevations were not representing single crevasse channels but elevations caused by stacked bodies of channel deposits. This idea is apparently also applicable to some elevations in West-Frisia, which are traditionally interpreted as creek ridges.

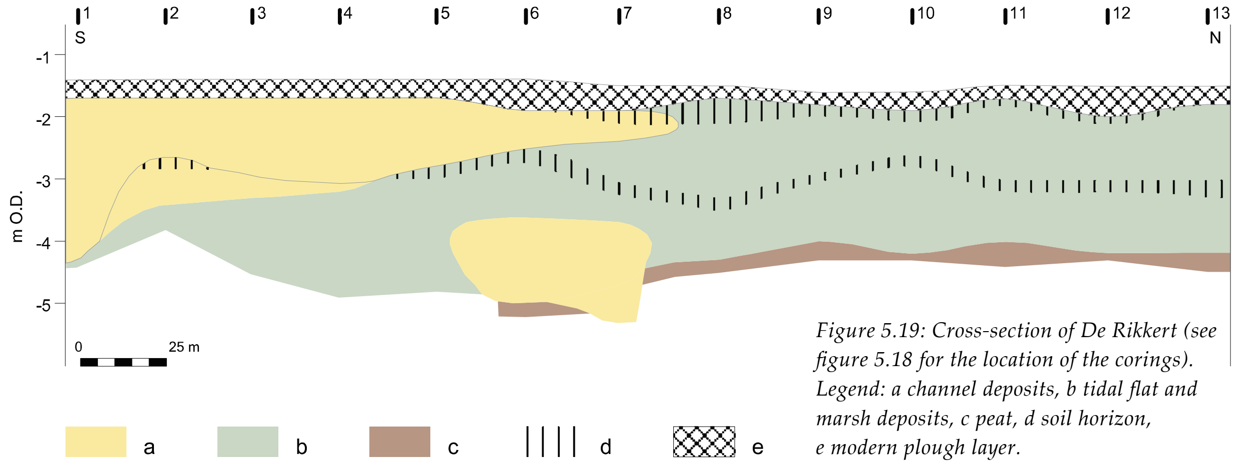



*Figure 5.19: Cross-section of De Rikkert (see figure 5.18 for the location of the corings). Legend: a channel deposits, b tidal flat and marsh deposits, c peat, d soil horizon, e modern plough layer.*

In 2013 several small trenches revealed a complete stratigraphy of the Bronze Age soil and later sediments (figure 5.20). The soil horizon was homogenized due to ploughing in the Bronze Age. Clear ard marks were present under the A-horizon. The micromorphological research by French (Roessingh and Valentijn in prep.) confirmed that the layer has been ploughed. Macrobotanical remains were not preserved at all and pollen was poorly preserved in this layer. The pollen grains that could be identified by Doorenbosch (Roessingh and Valentijn in prep.) represented pollen which are to be expected in arable land, like *Triticum*, *Hordeum*, Chenopodiaceae and *Plantago lanceolata*. The high numbers of pollen of *Alnus* and *Corylus* point to the presence of alder carr and hazel shrubs in the surroundings. These pollen types are also present in almost identical percentages in the lowest part of the overlying peat. Based on the almost identical pollen content of the base of the peat and the top of the A-horizon, it is suggested by Doorenbosch (Roessingh and Valentijn in prep.) that the pollen probably represent the base of the peat. The horizon contained phytolits, which are considerably weathered according to Out (Roessingh and Valentijn in prep.). The assemblage indicates the presence, in particular, of grasses and further some sedges and a modest presence of dicots (herbs and woody plants). Grasses of the *Pooideae* grass subfamily were present in the sample. This subfamily includes wild grasses but also wheat (*Triticum* sp.) and barley (*Hordeum* sp.). Part of the assemblage has a black discoloration, which may well have resulted from the burning of vegetation.

The overlying peat contained large particles of charcoal. Based on the micromorphological analysis and micro charcoal particles content in the pollen slides, it is suggested that the charcoal is only present at the base of the peat. Several particles were selected for an AMS-date, which resulted in a date in the Late Roman or Early Medieval period.[79] In the micromorphological research the presence of small layers of very fine sand and silt crusts were observed. These indicate that the peat has been flooded irregularly and fell dry. Based on the pollen analysis the peat can be characterized as a eutrophic peat, probably an alder carr. Pollen of cereals are present all through the peat layer, indicating that farming continued in this area.

The peat layer is covered by clay. According to the micromorphological analysis by French (Roessingh and Valentijn in prep.) this clay represents an environment with a variable stream velocity. Probably the landscape fell dry irregularly. This layer has not been investigated by other means.

## 5.6. Concluding remarks

At the start of the *"Farmers of the Coast"* research project, it was known that settlement sites were not only limited to the creek ridges, as was previously thought. Based on the excavation results of *Enkhuizen-Kadijken* it was clear that this type of site also occurred at tidal marsh deposits outside the perimeters of creek ridges. Based on the available publications on Bronze Age settlement sites in West-Frisia, the location of this site was thought to be an exception. The analysis of several large scale excavations presented in this chapter, shows that this situation is by no means an exception and far more complex.

79 Appendix 1, date 199: Suerc-51347 1608 ± 32 BP.


*Figure 5.20: Soil section and position of the investigated sample at De Rikkert (Photo: "Farmers of the Coast").*

In chapter 3 it was argued that the landscape of the Late Neolithic and Early Bronze Age was characterized by the presence of tidal creeks and basins, a landscape with considerable height differences and pronounced creek ridges. Between 1800 and 1700 BC a tidal marsh deposit was draped almost completely over the top of this landscape, levelling the distinct height differences of the former landscape (figure 5.21). Former creek ridges were sometimes present in this newly formed landscape as slightly elevated areas at locations like *Bovenkarspel* or the northeastern part of *Hoogkarspel*. At other locations like *Noorderboekert*, these creek ridges were buried beneath tidal marsh deposits, or simply absent at locations like *Enkhuizen-Kadijken* and *De Rikkert*. But these (partly) covered and uncovered former creek ridges were not the only elevated areas in the newly formed landscape. In a tidal marsh small creeks can be present resulting in small zones with channel deposits. Due to differential subsidence, these zones result in slightly elevated areas, like the small sandy stretch of *Enkhuizen-Kadijken*. To complete this more complex image, the case-study of *De Rikkert* shows that elevations also occur at locations with stacked bodies of channel deposits. Elevations in the landscape of the Middle Bronze Age are therefore not always the result of one single channel belt nor have a comparable genesis. The concept of either tidal marsh or creek ridge oversimplifies the complex reality.

The presence of settlement sites on top of tidal marsh deposits like *Enkhuizen-Kadijken* and parts of *De Rikkert* and *Hoogkarspel*, implies that the inhabitable area in the Bronze Age is far larger than previously expected. During the "*Farmers of the Coast*" research project the vastness of the Bronze Age cultural landscape was often questioned. If the creek ridges, or better, natural elevations, are not the structuring element of settlement sites, what else is? The results of the excavations at *Hoogkarspel*, *Medemblik* and *Bovenkarspel* suggest that changes in lithology (sand to clay) of the subsurface played a role in the structuring of the settlement sites. Apparently these changes in lithology were meaningful to the Bronze Age inhabitants (Bakker *et al.* 1977; Schurmans 2010; Roessingh in prep.). Although a structuring element, these lithological boundaries still do not explain the outer boundaries of the inhabited area.

This analysis of the local sites also demonstrates the difficulties in using detailed soil maps like the map of Ente (1963). For instance, the analysis implies that in the landscape of the Middle Bronze Age palimpsests of the previous periods were present. The detailed soil maps of West-Frisia only represent the clay, loam, sand and organic matter content of the subsoil in a strongly generalized way. One should bear in mind that the drawing is based on an oversimplified development model. Neither the genesis nor morphology is taken into account.

These maps cannot and should not be translated into geomorphological, geomorphogenetical or lithogenetical terms as is common use for predictive modelling (for example De Boer and Molenaar 2006; Molenaar and Van Berkel 2013). These soil maps should be used for what they are designed for, the distribution of clay, loam, sand and organic matter. If the soil maps cannot be used in this way a different approach is needed for predictive modelling in West-Frisia. This will be the topic of chapter 6.

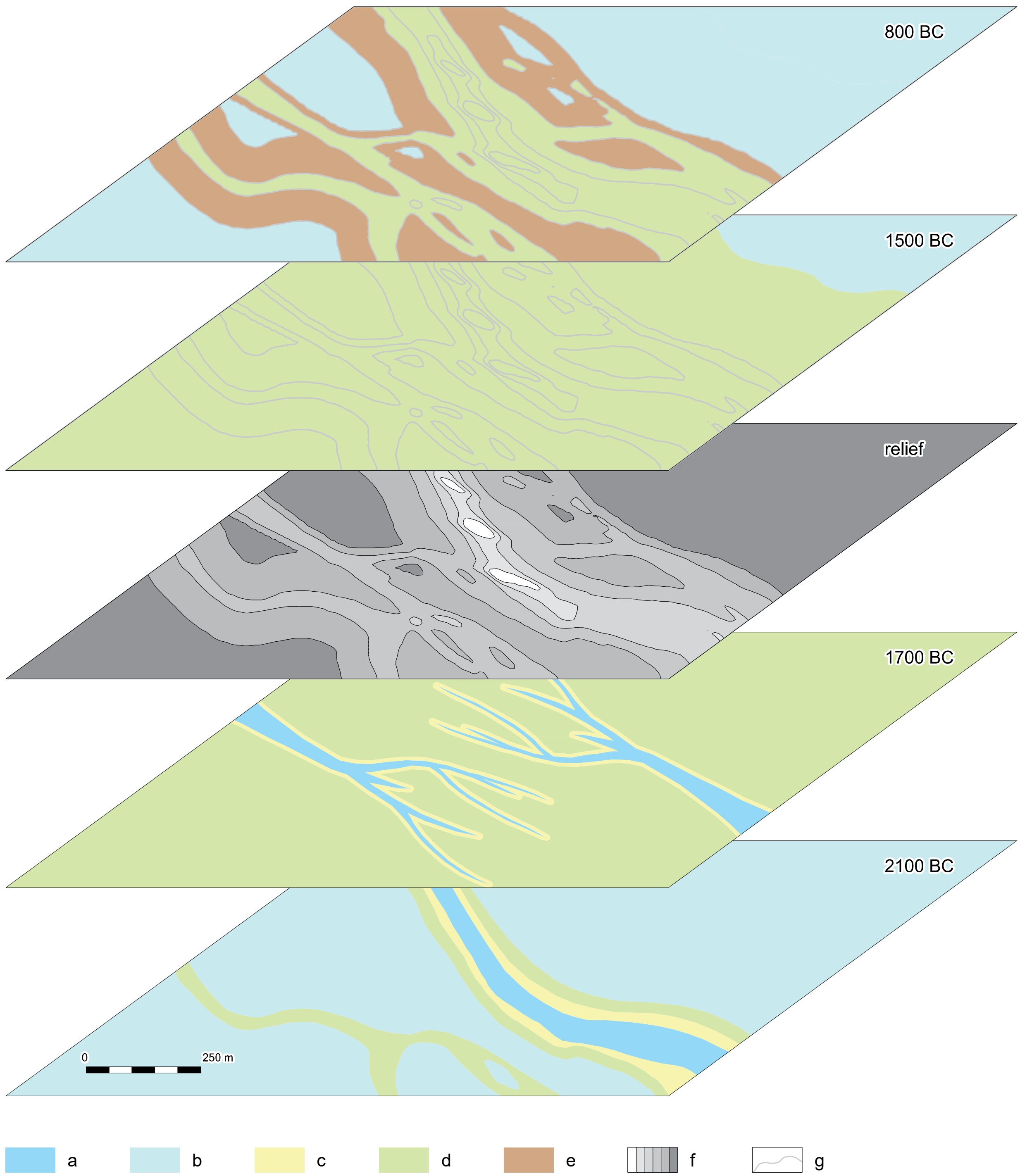



*Figure 5.21: Successive stages in the development of the landscape of West-Frisia. Legend: a salt-brackish water, b light-brackish to freshwater, c regular flooded, d vegetated area, e peat area, f relief classes from high (left) to low (right), g isohypse.*