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The Reconstruction of a Buried Maas River Landscape near Lomm, (Limburg, The Netherlands) Using a Multi-Disciplinary Approach; Human Adaption to Landscape Changes

Fluvial sediments; palynology; archaeology; Younger Dryas; Holocene; Maas valley; The Netherlands.

1 Introduction

In the southeast Netherlands large water basins are being constructed near Lomm as a passage for the Maas river during high-water levels. The research area is located on a terrace formed during the Younger Dryas close to the Maas river (Fig. 1). Since 1999, the area has been the object of archaeological research. First a reconnaissance study was carried out during which 18 potential archaeological sites were discovered.[1] In 2003 the sites were evaluated by digging 23 trenches, followed by three digging campaigns.[2]

In order to investigate human-environmental relationships through time a combination of natural science methods were applied including geomorphological (i.e. LOI, grain-size), micromorphological and botanical (i.e. pollen- and macrofossil) analyses. AMS ^{14}C and OSL dating provided an accurate chronology for the sediments.

1.1 Palaeoenvironmental Reconstruction in Relation to Human Occupation

Our research shows that the Maas terraces were more or less continuously inhabited since the Mesolithic. Most archaeological remains however, date from the Iron Age, Roman period and Medieval times. The distribution of the archaeological remains shows that there was a strong interaction between people and their physical environment. Humans adapted to the changing landscape (Fig. 2), as most remains were found on the higher river terraces or their slopes, at a short distance from the Maas river. Because of the higher setting of the terraces they were seldom flooded and formed an excellent location for habitation.

1.2 Younger Dryas (Palaeolithic)

During the Younger Dryas the river Maas was a braided river with minor overbank deposition and very sandy and gravelly channel deposits. During the second part of

1 Raemaekers and Heunks 2000.
2 Pransgma 2008; Gerrets and Williams 2011; Gerrets and Leeuwe 2001.

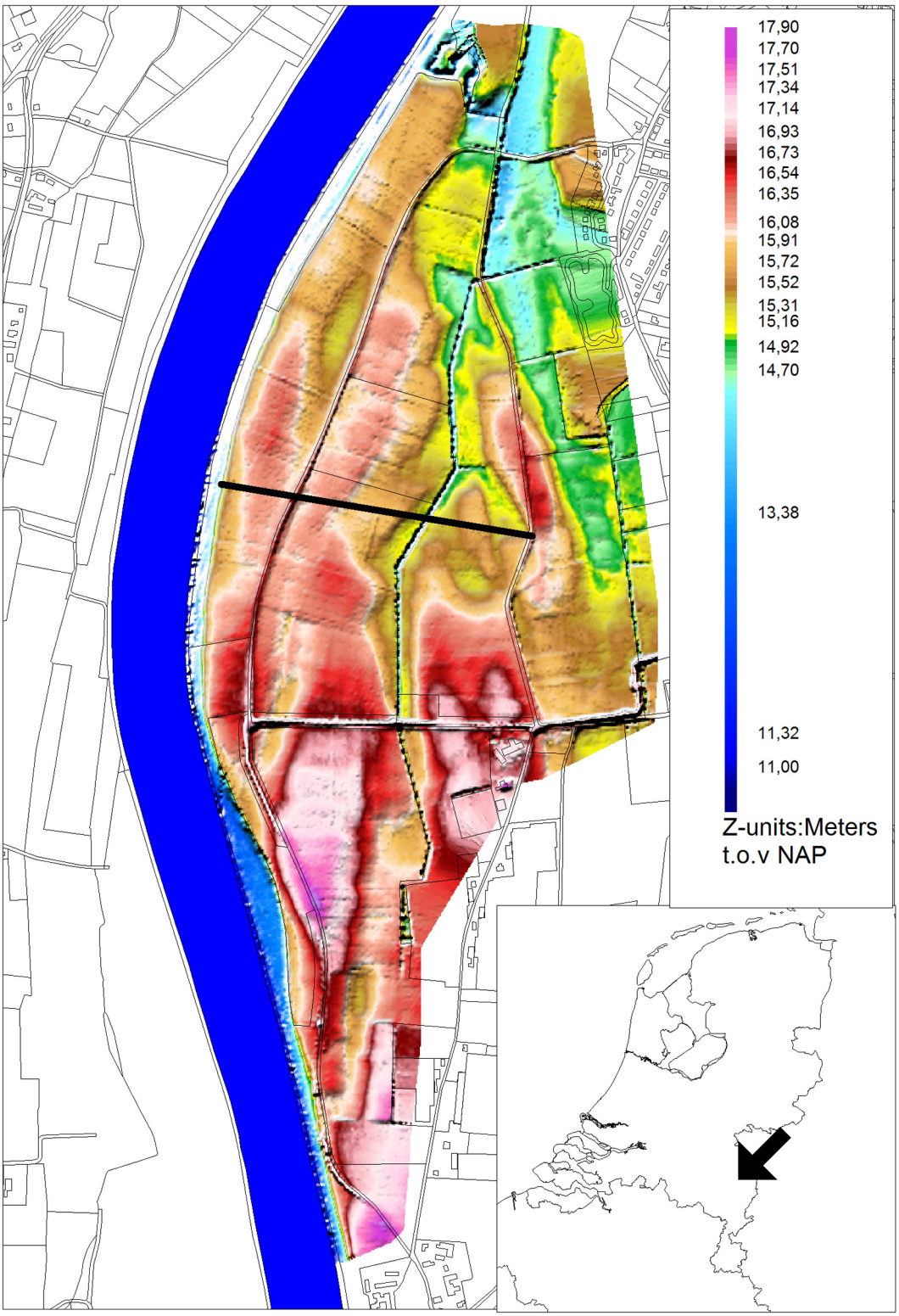
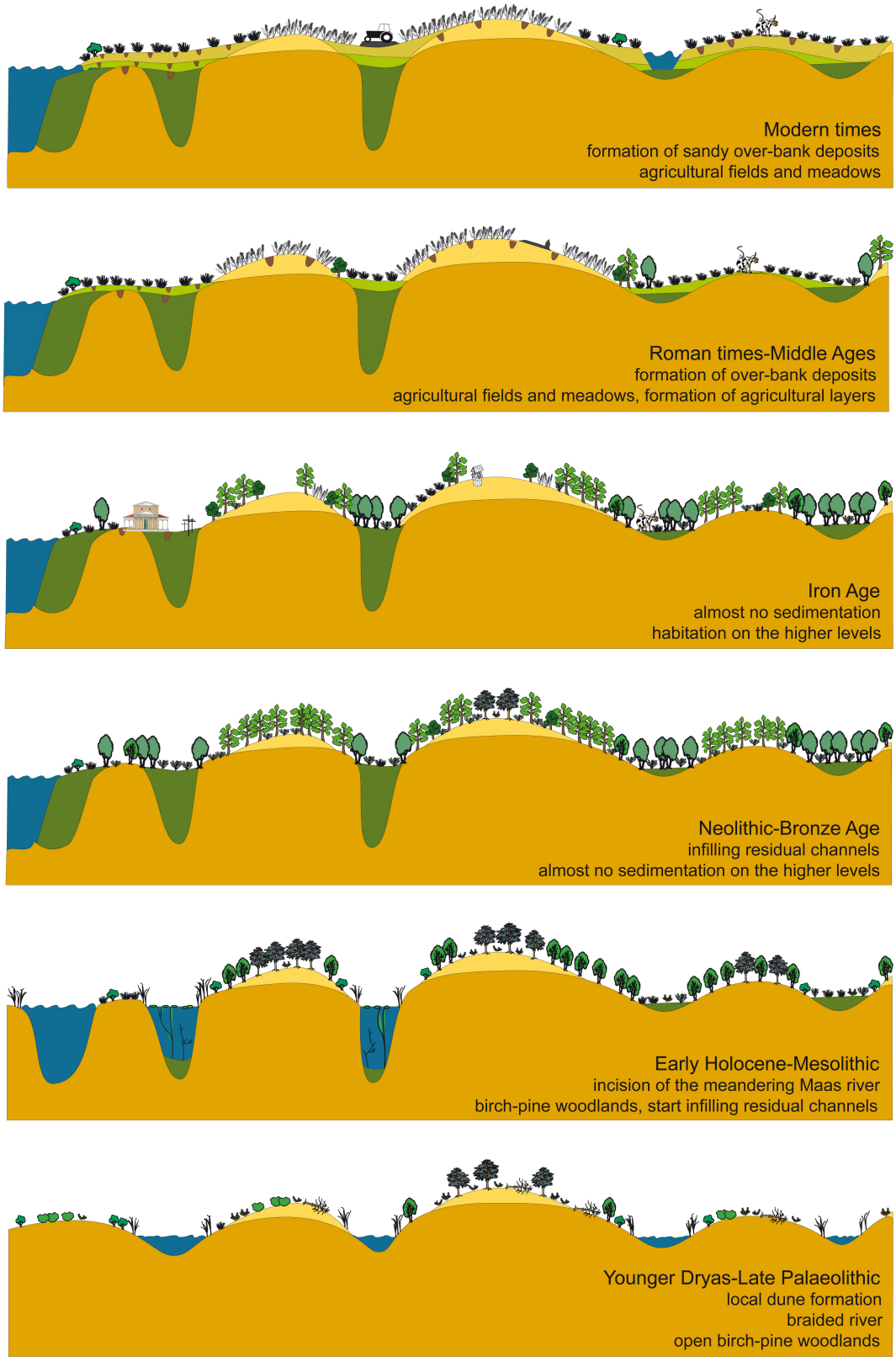


Fig. 1 | Digital Elevation Model of the study area with the location of the cross-section displayed in Fig. 2.

Fig. 2 *(on the next page)* | Schematic cross-section through the study area showing the landscape evolution during the end of the Late Glacial and Holocene.


Modern times
formation of sandy over-bank deposits
agricultural fields and meadows
Roman times-Middle Ages
formation of over-bank deposits
agricultural fields and meadows, formation of agricultural layers
Iron Age
almost no sedimentation
habitation on the higher levels
Neolithic-Bronze Age
infilling residual channels
almost no sedimentation on the higher levels
Early Holocene-Mesolithic
incision of the meandering Maas river
birch-pine woodlands, start infilling residual channels
Younger Dryas-Late Palaeolithic
local dune formation
braided river
open birch-pine woodlands
Legend:
Pine forests
Alder carrs
Birch forests
Mixed oak forests
Willow shrubs
Juniper bushes
Hazel shrubs
Heather vegetation
Open water vegetation
Shore vegetation
Grasslands/Meadows
Agricultural fields

the Younger Dryas the climate became warmer and drier and river activity decreased.[3] Aeolian activity increased and dune formation occurred.[4] The sand was blown from the Younger Dryas terrace onto the eastern bank of the valley, where as a result large dune complexes were formed on older river terraces. On the braided river terrace itself small dunes developed. In this period the vegetation changed from open birch-pine forests to herbaceous vegetation with dwarf shrubs. No indications for human presence were found.

1.3 Preboreal – Boreal (Mesolithic)

Due to the warming at the start of the Holocene, vegetation became denser and the discharge of the river became more regular. As a result the river Maas changed towards a meandering pattern and discharge concentrated in one channel in the western part of the study area. Other channels were abandoned and filled-in with clay. Due to the warmer/wetter climate, birch expanded and forests formed, in which also poplar and pine re-appeared. During this period, pine was restricted to the drier sand dunes and higher terraces. From the Boreal onwards, dense woodlands with deciduous trees developed, initially with hazel but later also with oak, elm, and lime. At the higher terraces pine remained present.

The first signs for human occupation were found in the form of flint artefacts. However, since the remains were not *in situ* it is not certain which activities were carried out. Certainly the area was of interest for hunting activities as just to the north, near Well Aijen, several Mesolithic sites were recovered on the higher levels of the early Holocene meander belt.[5]

1.4 Atlantic (Mesolithic – Neolithic)

As the Atlantic accumulation continued, peat formation started in the residual channels. On the river terrace mixed deciduous woodlands with oak, elm and ash remained present. Oak was the dominant tree in these woodlands, with hazel, mistletoe, ivy and ferns as undergrowth. In residual channels alder dominated, while pine remained the dominant tree on the higher terraces.

In the northern part of the study area, some open places developed in the forests where heather and pioneer vegetation was present. These may be reflections of human interference in the landscape. However, no cereal pollen was found and despite the find of a pottery fragment from the early Neolithic, is it uncertain if these people lived in the area.

1.5 Subboreal (Neolithic – Bronze Age)

Infilling of the smaller residual channels continued until the Bronze Age. On the river terrace sedimentation ceased. In the mixed deciduous woodlands the role of lime and elm decreased. The decrease in elm may be ascribed to the use of twigs and branches as winter food for the cattle by Neolithic people.[6] The presence of the Neolithic farmers in the area was also confirmed by finds of cereal pollen.

3 Kasse, Vandenberghe, and Bohncke 1995; Isarin and Bohncke 1999.
4 Kasse 1999.
5 Tichelman 2005.
6 Bunnik 2005a; Bunnik 2005b.

During the Bronze Age human activities in the area increased. On the higher parts of the terraces open places were created in the woodlands for fields and meadows. Despite signs for human occupation in the pollen data, only three graves were recovered near Lomm. Near Well Aijen, the location of the Bronze Age settlements shifted from the early Holocene meander belt to the higher Younger Dryas terrace. This suggests the occurrence of regular floods since the Bronze Age. At Lomm no indications for floods were found.

1.6 Subatlantic (Iron Age)

During the Iron Age peat formation in the main residual channel ceased. Sedimentation re-started at the end of the Iron Age when a gyttja layer formed in the peaty channel. The gyttja layer probably resulted from flooding due to a combination of increased human activities in the hinterland as well as higher groundwater levels caused by cooler and wetter climatic conditions.[7] On the higher parts of the river terrace however, no noticeable sedimentation occurred.

The river valley was still forested with deciduous woodlands with oak as the dominant tree. Although these forests were slightly more open than during the Bronze Age, they remained relatively dense in comparison to other Dutch river areas. Beech expanded on the loess plateaus and on the higher grounds of the Maas river valley. Open places were created in the woodlands for arable fields where cereals, such as emmer wheat and barley, were grown. Due to cattle grazing, woodlands became more open and meadows further extended.

During the Iron Age, occupation of the area further increased, as reflected in the construction of a large number of granaries. Despite their number, only one farmstead from the early Iron Age was found in the northern part of the area. In the mid-Iron Age a cemetery and impressive rectangular cult-place was built. Some of the smaller buildings were probably also connected to the cult-place and may have been used for ritual actions. The cult-place was built in the lower area remarkably close to the active Maas river channel. Apparently the proximity to the river was evidently more important than a high and dry location.

1.7 Subatlantic (Roman Period)

The Roman period is characterized by a change in habitation and land use. During this period the region was intensively occupied. Agricultural fields and meadows replaced the woodlands on the nearby loess plateau and in the river valley. The change in vegetation and use of the hinterland caused a higher flood frequency and induced regular flooding and overbank deposition of the study area. This resulted in an increase in the sedimentation rate at the end of the Roman period. This increase in sedimentation rate triggered by deforestation and human cultivation is also known from the Bronze Age onwards from large river systems such as the Rhine,[8] while at Lomm it occurred not earlier than the Roman period.

Also the vegetation change in the Maas valley during the Roman period differs from that at the nearby loess plateau. In the hinterland, the vegetation change occurs gradually from a forested landscape to a more open landscape. At Lomm, the vegetation change from the Iron to the Roman period seems more abrupt. In the northern part of the study area natural forests—which were still present during the Bronze and Iron Ages—were

7 Geel, Buurman, and Waterbolk 1996; Kalis, Merkt, and Wunderlich 2003.
8 Erkens et al. 2006; Bos et al. 2008.

largely replaced during the Roman period by large scaled meadows and cereal fields with rye. In the southern part open forests with oak and hazel and some lime and elm remained present.

In contrast to the large changes in vegetation, the occupation of the area seems to proceed more gradually. The cemetery that came into use during the Mid-Iron Age was still used in the Roman period. Moreover, from the Roman period only a few traces for human occupation were found (i.e. a water well, granary and farmstead). Roman settlements apparently concentrated further south of the study area.

1.8 Middle Ages

During the Middle Ages sedimentation on the river terraces continued. Beech increased in the forests during the early Middle Ages (450–1050 AD) and probably reflect a regeneration phase caused by a decline in population numbers.[9] Some fields and meadows remained present in the area. During the 7th–8th century human activities increased again on the higher terraces east of Lomm. In the study area there is only little evidence for human activities, i.e. 16 pits with large amounts of charcoal indicate iron production activities, dating between the 7th and 13th century.

During the second half of the Middle Ages, large-scale deforestations resumed in the northern part of the study area and meadows, arable fields and heathlands replaced most forests. On the fields, rye, buckwheat and broad beans were cultivated. In the southern part some forest patches with oak, hazel and birch remained present with, on the wetter soils, meadows and open fern-rich alder carrs. The village of Lomm (situated outside the study area) was established in the 13th century and became an important town in the 14th century.

1.9 Modern Times

Between the 14th and 18th century a strong increase in sediment supply resulted in a rapid amplification of the sedimentation rate. Sedimentation rates reduced after 1880, due to the change from crop cultivation to grasslands. After 1900 large scale pine plantations were established at the higher terraces. During the 20th century cultivation of rye and buckwheat occurred in the area and heathlands expanded. During the last years of WWII trenches were dug for the soldiers parallel to the Maas, when the river formed the front line.

9 Cf. Bunnik 1999.

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