

soils to be reduced to a level being too low from an agricultural point of view. The consequence is that they are exposed to irreversible desiccation.

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## 28. UPPER HOLOCENE TRANSGRESSIONS IN THE NEIGHBOURHOOD OF THE MOUTH OF THE MEUSE

door/by Dr Ir W. J. van Liere

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### 1. THE CONCEPTION: "MOUTH OF THE MEUSE" DURING THE DEVELOPMENT OF THE LARGE PEAT FORMATION IN WESTERN HOLLAND

During the whole holocene period the large rivers Meuse and Rhine had a joint debouchment in the area between the island of Voorne and the village of Monster. It is, however not possible to reconstruct the oldest shapes of the river-mouth in any detail.

In the South, for instance on Voorne, (submerged) *bog peat* occurs in the subsoil, so that here at any rate during the formation of peat behind the protecting Old Dune belt, the river-water must have had a very slight influence, as it is a matter of common knowledge that the formation of bog peat is only possible at a great distance from the river-water which is rich in nutrients. The subsoil of the Westland consists of *low moor peat* (principally reed-sedge peat), which is often washed out and mixed with silt finding its origin in river-water. In the North the formation of bog peat begins to the South of Wateringen and to the East of the line Delft-Rotterdam (fig. 1).

Considering the comparative narrowness of the passage between bog peat deposits, it is not probable that during the forming of the peat the mouth of the rivers had the aspect of an estuary of any considerable extent in this area. It is probable, however, that the river-water attacked the peat shores locally. That is why clay tracks sometimes occur in the peat (in the subsoil) having wholly the appearance of silted up flood-channels, such as were formed during the later estuary stage. This is, for instance, the case near Ter Bregge in the Prince Alexander Polder and some localities in the islands. Recent finds of flint implements at Hekelingen on Putten prove that the clay banks of such channels were

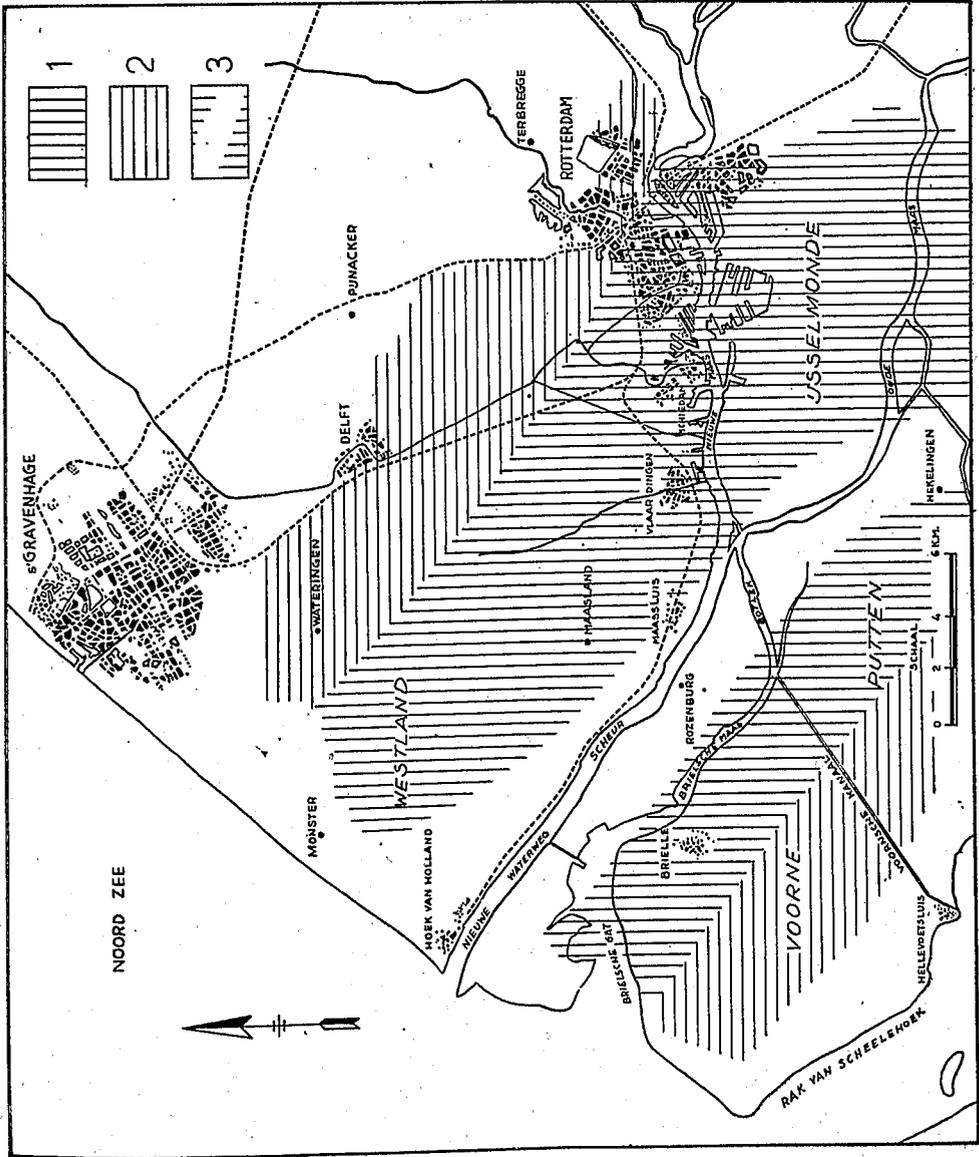


Fig. 1. Probable position of the mouth of the Meuse river during the formation of the peat (Atlanticum).  
 1. Low moor peat — 2. Bog peat — 3. Probable position of the river-mouth

already habitable in the Bronze period (approx. 1000 years B.C.). In a later stage these clay tracks often became overgrown with peat again.

## 2. THE LARGEST EXPANSION OF THE MEUSE ESTUARY IN THE FORM OF A FLOOD-CHANNEL SYSTEM

Great changes were effected during the centuries preceding the beginning of our era. The protecting belt of the rows of Old Dunes was then apparently no longer able to withstand the attacks of the sea. Ebb and flow gained access to the interior, the sea-water killed the plants, causing peat formation, and on a large scale the tides scoured out flood-channels in the peat. The breach made at the time in the Old Dunes to the South of Monster, must have been fairly large. Yet the flood soon lost its force on the vast peat plain. The largest flood-channel penetrated from Monster to Pijnacker. Numerous channels came into being in the neighbourhood of Maasland and in the old nuclei of Putten and IJsselmonde these channel systems may also be traced (see fig. 2).

It is improbable that the new Meuse river existed at that time, because its present course is crossed by a flood-channel going straight on from Delft to the isle of IJsselmonde.

In the neighbourhood of the channels a layer of clay was deposited on the peat, while in course of time the channels themselves were silted up too.

In its largest extension this channel landscape comprised the area taken up at present by the islands of Rozenburg, Putten and IJsselmonde, and the area to the West of a line drawn from Rotterdam through Pijnacker to The Hague. Voorne remained a peat landscape which was not flooded, or only in a minor degree. Already during the Iron Age (the last centuries before our era) the banks of the flood-channels were inhabitable. At the time of the erosion-stage or shortly after, the clay was deposited in salt water, according to the enclosed shells, during the subsequent silting up the environment became more brackish under the influence of river-water and possibly also rain-water. It cannot be stated with certainty how much time elapsed between the formation of the flood-channel estuary and the complete silting up. It is probable, however, that this silting up took place rapidly, in some 200 or 300 years.

## 3. RELATIVELY DENSE POPULATION ON THE SILTED UP FLOOD-CHANNELS DURING ROMAN TIMES (50 to 250 years A.D.)

Since the first century the channels had been silted up to such an extent that the clay tracks were habitable. The population became relatively dense as some ten settlements have been found in the Westland outside the Old Dunes. The settlements are characterised by black soil and potsherds of native and Roman earthenware.

The settlements were not situated on dwelling mounds, therefore

the country must have been perfectly secure against floods. We can only account for this by assuming that also during Roman times the mouth of the Meuse must again have been of slight significance. We should probably picture the mouth of the Meuse at that time as a kind of tidal flat area with many sand-bars and shallow channels, while the whole region must have been protected more or less from the sea by the remains of the Old Dunes.

In the channels between the sand-bars copious remains of wood and peat were washed together. We still strike these beds at a depth of from 1 to 1,50 m below the surface of the surrounding territory, in the shape of blue-coloured peaty sand, designated by the inhabitants "de blauwe", meaning "the blue".

#### 4. A SMALL ESTUARY BETWEEN THE YEARS 300 AND 900 A.D., ORIGIN OF THE CLAY COVER OVERLYING THE WESTLAND

About the second half of the third century habitation is suddenly interrupted, while to the West of the line Maassluis—The Hague a fresh bed of clay is deposited. Here the Roman remains lie from  $\frac{1}{2}$  to 1 m below the surface of the surrounding territory, whereas to the East of the line Maassluis—The Hague they are found nearly on the surface. It is probable that during that time the Western part of the Westland bore the character of a reed tidal marsh, merging into woodland towards the East. Pedologically traces thereof may be recognized in fertile black clay soils.

#### 5. DIKE BUILDING, EARLY MEDIAEVAL INHABITATION AND EXTENSIVE FLOODS

Since the tenth century this marshy area must have again been inhabited, partly on the sea tracks, partly on the "Westland" clay cover.

By the construction of the Meuse-dike from Rotterdam to Monster a large territory was safeguarded against floods. Before that time dwellings already arose, partly on small dwelling mounds, partly on minor local dikes.

The Meuse-dike was probably constructed on account of a renewed extension of the mouth of the Meuse which cut off the islands to the South. The clay found on Voorne was in all probability not deposited until early mediaeval times, while the adjoining islands are of recent date, also with the extension of more ancient nuclei.

In the hinterland of Delfland a strong inversion of the landscape came to pass under the influence of artificial drainage since the sixteenth century, in consequence of which the silted up flood-channels are now found lying as ridges in the landscape.

#### 6. REGRESSIONS AND TRANSGRESSIONS

Absolute figures with reference to the movements of sea-level during the last 3000 years are difficult to state for this area. As

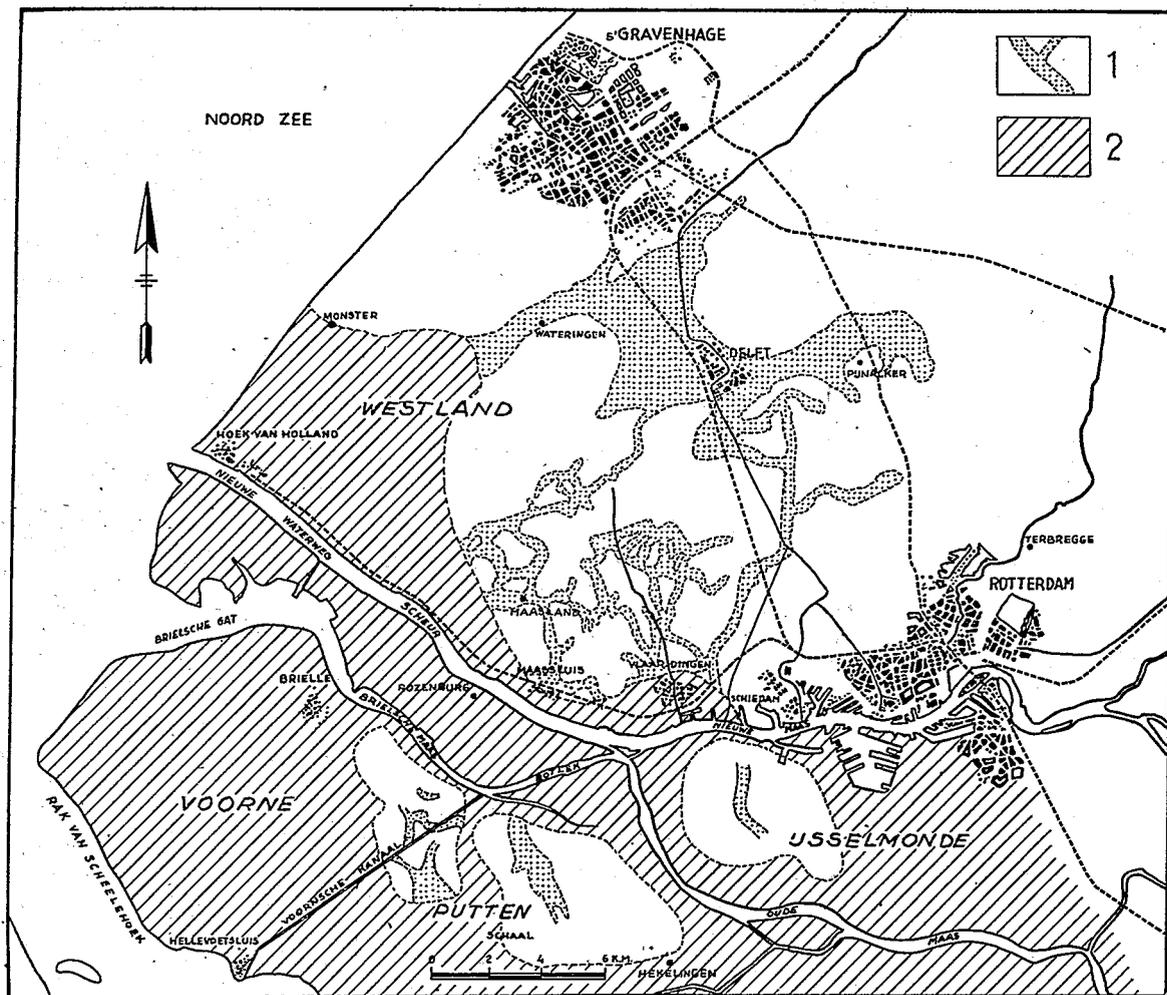


Fig. 2. Largest expansion of the channel system of the Meuse estuary in the original peat landscape. On the islands the system can be traced in only a few places owing to mediaeval inundations.

1. Channels in the peat as far as they can be recognized in the form of clay tracks in the old land (schematic) —
2. Clay deposits of more recent date

has been shown above, regressions and transgressions each with their own characteristics, may be established with certainty from the soil condition and may even be dated with the aid of archaeologica. This enables us to reconstruct the history of the estuary in some detail. But strata of peat and unconsolidated clay are ubiquitous in the subsoil (often to a thickness of many metres). Hence many phenomena of transgression may be attributed to compaction, while many phenomena of regression can be accounted for by the shifting of the mobile masses of sand on the coast, by which from time to time sea was more effectively barred off.

This is why the writer prefers to abstain from conjectures about the movement of the sea-level during the last millennia. For the same reason he refrained from indicating absolute heights with respect to New Amsterdam datum level when describing soil profiles in his recent publication „The Soil Condition of the Westland”, as these might easily lead to less correct conclusions.

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## 29. OPBOUW EN GEBRUIK VAN DE BODEM IN HET ZUIDWESTELIJK ZEEKLEIGEBIED (SPECIAAL VAN ZUID-BEVELAND EN WALCHEREN)

*Constitution and occupation of the soil in the south-western part of the marine clay area (especially in Zuid-Beveland and Walcheren)*

door/by **Ir K. van der Meer**

overgenomen uit: *Geografisch Tijdschr.* 2, 6, 1949

Dit artikeltje heeft een bijna gelijke inhoud als dat van hoofdstuk 30. Wij namen de volgende figuur er uit over:

*The content of this article is practically the same as of chapter 30. The following figure has been adopted from it:*