

A PALYNOLOGICAL INVESTIGATION OF SOME ARCHAEOLOGICALLY INTERESTING SECTIONS IN NORTHWESTERN SURINAM

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SUMMARY

The present article deals with a palynological investigation of an archaeological site in northern Surinam. We succeeded in reconstructing the history of the occupation of this area by means of palynological correlation in connection with radiocarbon dating. An attempt was also made to discover what kind of crops was grown by the early inhabitants.

INTRODUCTION

The collaboration of archaeologists and palynologists has often been very useful for both sciences. In the tropical lowlands, however, little palynological investigation has been done in reference to archaeology. I went to Surinam from July 17 to August 2, 1962, to sample sections for this purpose. Dr. D. C. Geyskes, director of the Museum of Surinam, accompanied me to the neighbourhood of Wageningen where Dr. Geyskes is studying the archaeology of the Hertenerits (fig. 1 and 2).

It wish to express my gratitude to him and to the Netherlands Foundation For The Advancement Of Research In Surinam And The Netherlands Antilles (WOSUNA), which paid for the expenses during my stay in Surinam.

To the Stichting Machinale Landbouw I am very grateful for their assistance. The research has been carried out in Leiden under the supervision of Dr. T. van der Hammen, to whom the author is indebted for his stimulating enthusiasm and help.

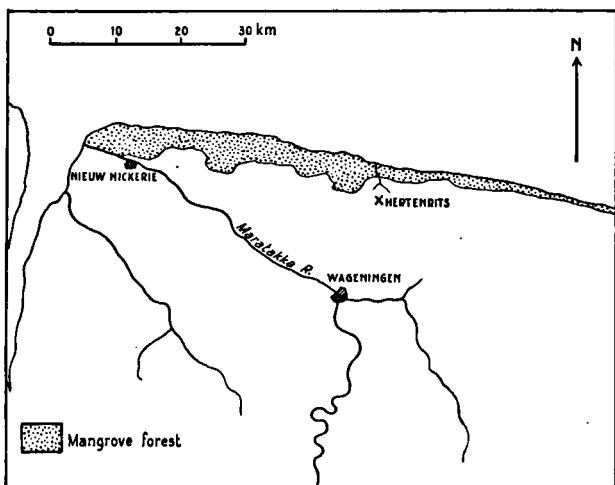


Fig. 1. Sketch map of northern Surinam showing Mangrove-forest zone and location of the Hertenerits area.

In the swamps northeast of Wageningen, about six km from the coast, a number of earthworks, apparently artificially made, are to be found. Most prominent is the "Hertenerits", an artificial mound with a diameter of about 250 m, which rises about 2 m above the level of the surrounding swamp. A number of "paths" (probably for canoeing) lead to this mound from all directions; along these "paths" are found smaller mounds. According to Dr. Geyskes these smaller mounds were used for cultivating purposes during the inhabitation of the "Hertenerits". We sampled sections from the mound the "Hertenerits", the swamp and a ditch beside one of the raised fields.

Geologically this part of Surinam belongs to the young coastal plain. Lithologically it consists of heavy grey marine to brackish clays from the Demerara clay formation.

THE PRESENT VEGETATION

The young coastal plain of northwestern Surinam may be subdivided into inundated areas, the swamps on the one hand, and rather dry areas, the levees and ridges on the other hand. In the swamps we find a great variety of associations of herbaceous elements, locally with plots of forest. On the levees and ridges generally only forest associations are to be found. The dominance of species alternates along with the changes in environment. The salinity of the soil and of the water as well as the level of the ground-water are factors which determine this environment.

In this part of Surinam the following vegetation types can be noticed.

A. Mangrove-forest

It occurs along the coast as far as spring and storm tides flood the shore and in brackish swamps behind the coastal barrier, furthermore along the estuaries and riverbanks upstream beyond the salt limit, approximately up to the point reached by tidal counter-currents.

There are two distinct types.

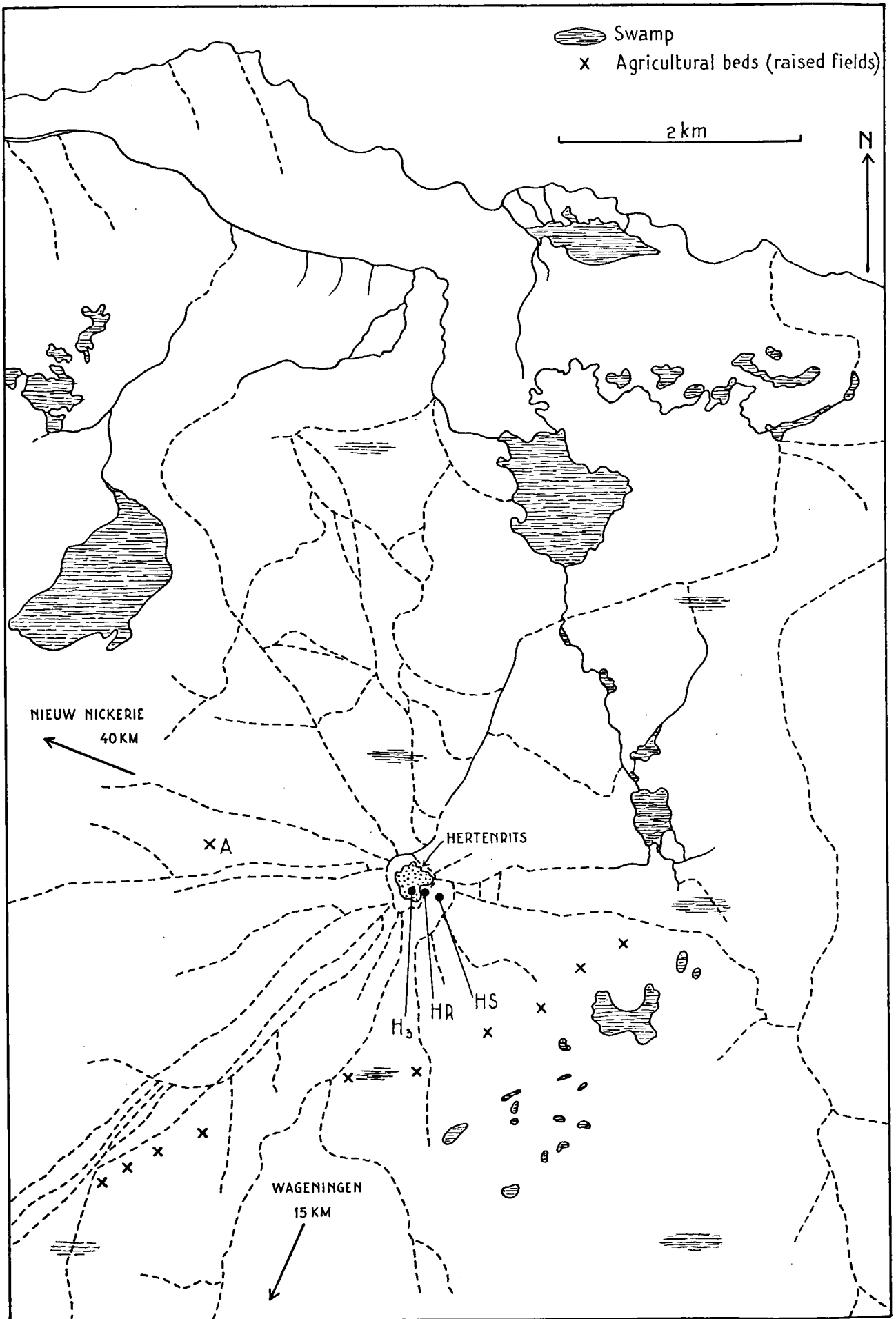


Fig. 2. Sketch map of the Hertenrits area.

- a. The *Avicennia*-forest, along the coast and on the levees of the lower rivers.
- b. The *Rhizophora*-forest, growing in soft mud along the riverbanks and near the mouths of rivers and creeks.

The species of the mangrove-forest are *Avicennia nitida*, *Rhizophora mangle*, *Rhizophora harrisonii*, *Rhizophora racemosa* and *Laguncularia racemosa*.

B. Open swamps

Open water occurs almost exclusively in the salt and brackish swamp in and directly behind the *Avicennia*-forest along the coast. In general, open water is readily invaded by pioneer communities, which in turn are followed by an apparently rather stable vegetation of tall herbs.

In slightly brackish and fresh water we find a pioneer association of floating aquatics (*Nymphaea* and *Nymphoides*), which can be succeeded in still rather deep water by an association of grasses and *Polygonum* species, forming together a floating mat.

The tall herbaceous swamp vegetation can be subdivided into several types according to the dominance of one or a few species, amongst others of *Typha angustifolia*, *Acnida cuspidata* (Amaranthaceae), *Cyperus* (Cyperaceae), *Montrichardia arborescens*, Gramineae, *Leersia hexandra* and *Rhynchospora corymbosa*.

Some of the swamps are covered by a floating peat-layer of several meters thickness, with a vegetation of mainly Cyperaceae.

C. Swamp-wood

It varies widely in appearance from an open scrub to a low, closed one storey forest, 10–15 m high, and passes very gradually into the swamp-forest, which is more than 20 m high. A transitional type is the *Triplaris surinamensis* forest. A layer of herbs is only present where enough light is available; sometimes it is completely absent. In general palms are infrequent. The swamp-wood is found mainly in the young coastal plain. In the brackish swamps near the coast we find *Machaerium lunatum* shrubs and *Erythrina glauca*. In slightly brackish and fresh water extensive stands occur of *Pterocarpus officinalis* and *Tabebuia insignis*. In other localities a more mixed swamp-wood grows, with besides *Tabebuia* and *Pterocarpus*, *Triplaris surinamensis*, *Annona glabra*, *Genipa americana*, *Simaba multiflora*, etc.

D. Swamp-forest

It is at least 20 m high and consists of two storeys; the soil is inundated most of the year, which leads to an accumulation of a thick layer of pegasse. A herb stratum is always present.

Characteristic trees of the formation are *Virola surinamensis*, *Symphonia globulifera*, *Triplaris surinamensis*, *Pterocarpus officinalis*, *Tabebuia insignis*, etc.

E. Marsh-forest or seasonal swamp-forest

Under this heading forests occur with two storeys in periodically inundated areas. Palms are well re-

presented, but their numbers vary greatly with the locality.

Maximiliana maripa, *Euterpe oleracea*, *Ocneocarpus baccata* and *Mauritia flexuosa* reach the canopy, whereas *Bactris* spp., *Geonoma* sp. and *Astrocaryum sclerophyllum* belong to the undergrowth.

Amongst the trees we may mention *Carapa procera*, *Eschweilera subglandulosa* and *Hura crepitans*.

For further details on the vegetation types and their botanical contents to be found in this area, we refer the reader to the article of J. C. Lindeman (1953).

THE COURSE OF THE INVESTIGATION (SAMPLE TREATMENT AND PALYNOLOGICAL PRINCIPLES)

From each section samples have been taken every 10 cm, beginning at the surface; the sampling was done with the Dachnovsky Sonde, except (partly) H₃. All the samples were treated in the same way, first boiling them for five minutes in a KOH solution (10 percent); thereafter followed gravitative separation in a bromoform-alcohol mixture; furthermore an ultrasonic equipment was used.

In general 200 pollen grains have been counted from each sample. In the pollen sum used for construction of the diagrams, all the trees and herbaceous elements were included; spores have been excluded from this sum.

In order to get a clear insight into the principal changes of environment, general diagrams were constructed, as proposed and used by van der Hammen (van der Hammen, 1963 and van der Hammen & Wymstra, 1964).

The diagrams are composed of the following three groups.

- a. Mangrove elements
- b. Herbaceous swamp elements
- c. Forest elements (other than mangrove)

Mangrove elements

In these general diagrams a high percentage of mangrove elements means an increase of marine influence. A relatively high percentage of *Avicennia* always indicates that the species was abundant at or very near to the sampling location (the pollen grains are not easily transported by water; van der Hammen, 1963).

Rhizophora pollen is more easily transported.

A high percentage of it may also indicate that the species was growing on the spot, but it is also possible that the material was deposited far off the shore (Muller, 1959).

Herbaceous swamp elements

The pollen types of this group, which occur in important percentages through all the diagrams, are: Cyperaceae, *Typha*, Amaranthaceae-Chenopodiaceae type, Gramineae and Compositae (Tubuliflorae). *Typha angustifolia*, Cyperaceae (*Cyperus articulatus*) and Amaranthaceae (*Acnida cuspidata*) seem to occur as a group. The occurrence of this group in the diagrams may represent brackish conditions (Lindeman 1953).

Compositae occur rather indifferently. Occasionally found or showing very low percentages through the diagrams are: *Polygonum persicaria* type, *Sagittaria*, Malvaceae, Convolvulaceae. Amaranthaceae-*Alternanthera* type and Solanaceae occur in the diagrams only in the zones dominated by herbaceous swamp elements.

Forest elements (other than mangrove)

The percentages for these elements in the diagrams are in general very low. It is difficult to conclude anything more detailed about their behaviour.

DISCUSSION OF THE DIAGRAMS AND INTERPRETATION OF THE POLLEN DATA

For the location of the sampling sites, see fig. 2 and 3.

Diagram HS (Hertenrits Swamp) (fig. 4)

A section 200 m northeast of the "Hertenrits" in the herbaceous swamp was sampled in order to obtain a reference pollen diagram.

The samples from this diagram represent a normal undisturbed section of swamp sediments. At the time of sampling, the level of the water was about 50 cm above the surface.

The lithological profile presents downwards:

0—10 cm a peaty layer (pegasse).

10—120 cm a brown-grey mottled clay.

120—... cm a lighter coloured heavy grey clay.

The lithological units seem to correspond with our zonation in the diagrams. The mottled horizon may be divided into two parts, the upper part being slightly darker.

In order to simplify the description of the diagrams, a sub-division into four zones has been made. In the diagram are represented:

- zone D more than 90 percent herbaceous elements.
- zone C the *Avicennia* maximum (dominance); upper limit the fall of the *Avicennia* curve.
- zone B more than 80 percent herbaceous elements and little mangrove elements; upper limit the beginning of the rise of the *Avicennia* curve.
- zone A an average of 40 percent for *Rhizophora*, between 10 and 20 percent of other trees and less herbaceous elements than in the other zones; upper limit the fall of the mangrove elements.

With these zones the following succession of events may be reconstructed.

Zone A. — The high percentages of *Rhizophora*, together with the relatively high percentages of other tree elements, may indicate sediments, probably deposited just offshore on mud flats, in a lagoon, or eventually in a river estuary (van der Hammen, 1963).

Zone B. — The sudden decrease of *Rhizophora* percentages and the prevalence of herbaceous swamp elements at the transition from zone A to zone B may be explained by a drier period or a regressional or

stationary phase. The lagoon might then have been closed from the sea by ridge formation, thus forming a swamp, with a brackish to fresh water environment. Looking at a recent topographical map for the actual situation, such a ridge and a creek is seen between the "Hertenrits" and the coast. So the concept of a lagoon in earlier time seems probable, sea water influence being cut off as the lagoon was closed by the ridge barrier.

Zone C. — This zone starts with the rise of the *Avicennia* curve; this may indicate that we are again in a more marine environment, possibly representing a minor transgression.

Zone D. — The upper part of the diagram is dominated by herbaceous swamp elements. The pollen picture may partly have been influenced by man.

Diagram H₃ ("Hertenrits") (fig. 5)

This section has been taken from the mound. The profile corresponds to section 3, taken by Dr. Geyskes.

In the summer of 1962 it was possible to study the upper part of the profile and to take samples down to 300 cm. In the spring of 1964 Dr. Geyskes again visited the digging site and took additional samples up to 420 cm.

After this last trip we were able to complete the diagram. It appears now that there is a close resemblance between this diagram and diagram HS, and it is easy to recognize the same zonation. The diagram consists of zones A and B and a part of zone C. Zone D is missing. The spectrum at 190 cm has not been incorporated in the diagram because of the fact that it does not give us the impression of belonging to an undisturbed succession. The decrease of Cyperaceae and the enormous increase of Gramineae may be ascribed to the influence of man.

Dr. Geyskes took a C14 sample in this section, a piece of wood at 250 cm depth, which gave the following result.

GRN-1897 — Hertenrits hole 3, woodsample — 1265 ± 60 B.P.

This date, AD 685 corresponds to a level in the upper part of zone B (*Avicennia* increase).

Diagram HR (beside the mound) (fig. 6)

In the swamp northeast of the "Hertenrits" this section has been sampled.

From the bottom to the top the diagram shows a transition from zone B, a zone in which herbaceous swamp elements dominate, to zone C, marked by the increase of *Avicennia* percentages; the upper parts of zone C and zone D are also present. A small difference with the zones in diagram HS is that in zone B of diagram HR, *Avicennia* does not occur at all. Notable are also the curves for Cyperaceae and Gramineae. In the lower part of the diagram these species occur in relatively high percentages. It is interesting to note that a horizon of potsherds occurs apparently at the base of zone C (see also fig. 3).

THE HISTORY OF THE "HERTENRITS"

From sections of Dr. Geyskes through the mound it appears that there is an interchange of clay and pegasse layers. The potsherds which have been found by Dr. Geyskes are concentrated just above and below the pegasse layers. The first occurrence of potsherds is noted at a depth of 260 cm, just below a pegasse layer and just below the boundary of zones B-C.

In diagram HR it is remarkable that too just below this same boundary the first potsherds occur (fig. 3 and 6). This leads us to the conclusion that the site was for the first time inhabited towards the end of zone B. By C14 analysis this time was dated at 1265 BP (GRN-1897). Just after the beginning of zone C in diagram H₃, the normal deposition of pollen containing sediments ended, and we may conclude that this was the beginning of the building of the mound. In diagram HR (fig. 3 and 6) it appears that zone B is abnormally long. This may be explained as follows. At the beginning of zone B a creek was present at our site. In the course of zone B this creek was rapidly filled up by new sediments. Towards the boundary B-C it was so far filled up with sediments that only a slight depression remained. In this depression the potsherd-layer was built up, indicating the first time that the Hertenrits area was inhabited. From the fact that there is almost no difference in elevation between the potsherd-layers in sections HR and H₃, the conclusion may be drawn that there was not much difference in altitude between the occupation area and the general topography of the surrounding area. In other words there was no mound present; one may visualize the site in that time as an Indian village in the bend of a small creek. At the beginning of zone C a period started with much higher water-levels and more marine influence (for a discussion on the meaning of zone C see p. 34). In order to make it possible to stay in the Hertenrits area it was necessary to build up a mound. For further details on the history of the Hertenrits see Geyskes (in preparation).

Apparently we have to conclude from all the data now available, that a small and relatively low mound was built up during the last part of zone B, but that the bulk of the mound was thrown up during the time of zone C, apparently related to a growing marine influence.

AGRICULTURAL BEDS (RAISED FIELDS)

If one looks at the aerial photographs of the "Hertenrits" area, one gets the impression (fig. 2) of a giant cobweb. To the mound as a centre lead a number of small "paths". Between these "paths", series of fields are situated. Only the mound and these fields are raised above the water-level of the swamp.

According to Dr. Geyskes these fields were a kind of agricultural beds on which the people of the "Hertenrits" grew their crops.

From elsewhere in tropical America, raised fields and other earthworks like the mound the "Hertenrits" are

known. Mounds are found in dry areas as well as in areas subject to flooding. In the dry areas they probably served for burial and temple grounds.

William N. Denevan (1963) describes earthworks from the Llanos de Mojos in Bolivia. He found drained fields where ditches were dug to provide drainage, and raised fields where earth was piled up into artificial mounds, which resemble the fields in the "Hertenrits" area.

Diagram A (fig. 7)

Next to one of the fields in the "Hertenrits" area a section was sampled, section A. No pollen grains of ordinary cultivated food plants could be found in the samples. This may be explained by the fact that Cassava (*Manihot* sp.), known as the basic food for Indians, is a very poor pollen producer.

However, one pollen type that gives a curve of some importance and does not occur in any of the other diagrams is *Duroia* (Rubiaceae). Several species of this genus are shrubs that produce fruits which are edible. Vernacular names are e.g. Marmeldoos and Komaramara.

The diagram resembles the diagram HS, in fact the curves show almost the same course. We may easily apply the same zonation.

It is difficult to indicate the place of the hiatus (when the ditch and the raised field was made). In this respect it may be interesting to note that the *Avicennia*-maximum lies deeper in this section than in the other ones. High percentages for spores of Fungi occur where changes in the vegetation are marked in the diagram. Lithologically the sections HS and A may be correlated, the upper parts of the sections, which correspond to the zones B, C and D in the diagrams, being mottled.

THE AGE OF THE TRANSGRESSION AND ITS RELATION TO THE MOUND (fig. 3 and 5)

The C14 date of diagram H₃ corresponds to a level near the initial phase of zone C. Zone C apparently represents a transgressional phase. We may conclude from the C14 date that this last transgression took place in the years after about AD 700.

Other C14 dates from pegasse layers of the artificial mound date at AD 905 ± 60 (GRN-845) and AD 820 ± 45 (GRN-1898). The application of these dates to the profile may not be correct, because it is not certain that the pegasse layers are in situ. They may have been removed at the time of the building of the mound. The conclusion from these dates is, that the levels they represent are from after about AD 700.

As the mound was built after the year 700, at the beginning of the transgression, these dates may probably indicate inhabitation of the mound at least up to about AD 900 (and probably longer).

For further details on archaeology see Geyskes (in preparation).

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