R. De Ceunynck and H. Thoen

THE IRON AGE SETTLEMENT AT DE PANNE-WESTHOEK. ECOLOGICAL AND GEOLOGICAL CONTEXT

RÉSUMÉ. *Dans le cadre d'une étude géologique des dunes de La Panne-Westhoek par R. De Ceunynck* [1], *une analyse palynologique d'une couche humeuse a pu être réalisée. Une datation au carbone-14 place celle-ci de 2660 ± 100 B.P. (à la base) et 1965 ± 110 B.P. (au sommet). Cette datation concorde avec le peu de matériel archéologique de l'Age du Fer qui fut récupérée dans ce contexte. H. Thoen* [2] *entreprit l'étude de ce matériel.*

Une occasion unique se présentait d'approfondir ainsi notre connaissance de l'écologie de l'habitat préhistorique à La Panne, site connu dans les milieux archéologiques, mais à propos duquel on ne sait en fait que peu de choses.

INTRODUCTION (H.T.) [3]

The archaeological site in the dunes of De Panne has been discovered in 1886 by G. Donny, a Public Works engineer (Donny, 1886). The initial finds were mainly Roman, but soon older objects came to light. The discovery of coins – Celtic, Roman and even *sceattas* – gave the site a wide publicity. At the turn of the century the dunes were systematically combed by amateurs and gradually attracted the attention of professional circles (de Loë, 1901-2).

The first general survey of the finds from De Panne was published in 1902 by Baron A. de Loë, curator of the *Musées Royaux du Cinquantenaire* at Brussels (de Loë, 1901-2). From this publication it transpires that the finds were always made in one and the same area, situated *c.* 2,800 m. N.W. of the church of Adinkerke, some 200 m. from the Belgian-French border and approximately 300 m. from the high tide mark. This site was later to be indicated as "Panne I" by E. Rahir. In the years 1902-4 the dunes were further explored by J. Maertens de Noordhout, M. de Maere d'Aertycke and G. Cumont. This led to the discovery of a new find-place – "Panne II" – situated in the Rietpanne, better known as "camp romain" or "Romeins kamp". This site lay to the S. of Panne I, at approximately 500 m. from the coast (Maertens de Noordhout, 1903, 157 ; de Maere d'Aertrycke, 1905, 36). A systematic prospection in 1905-6 by the *Musées royaux du Cinquantenaire*, directed by A. de Loë, resulted in the discovery of a third find-place, some 350 m. to the S. of Panne II. This site – "Panne III" – stretches across the border and is

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3 For the geomorphological terminology see Depuydt 1966 and 1972. For the chronology of the La Tène period we use the amended Déchelette system (*cfr.* De Laet, 1979, 550-551) :

La Tène I : 500/450-200 B.C.
La Tène II : 200-100 B.C.
La Tène III : 100 B.C.-early Roman period.

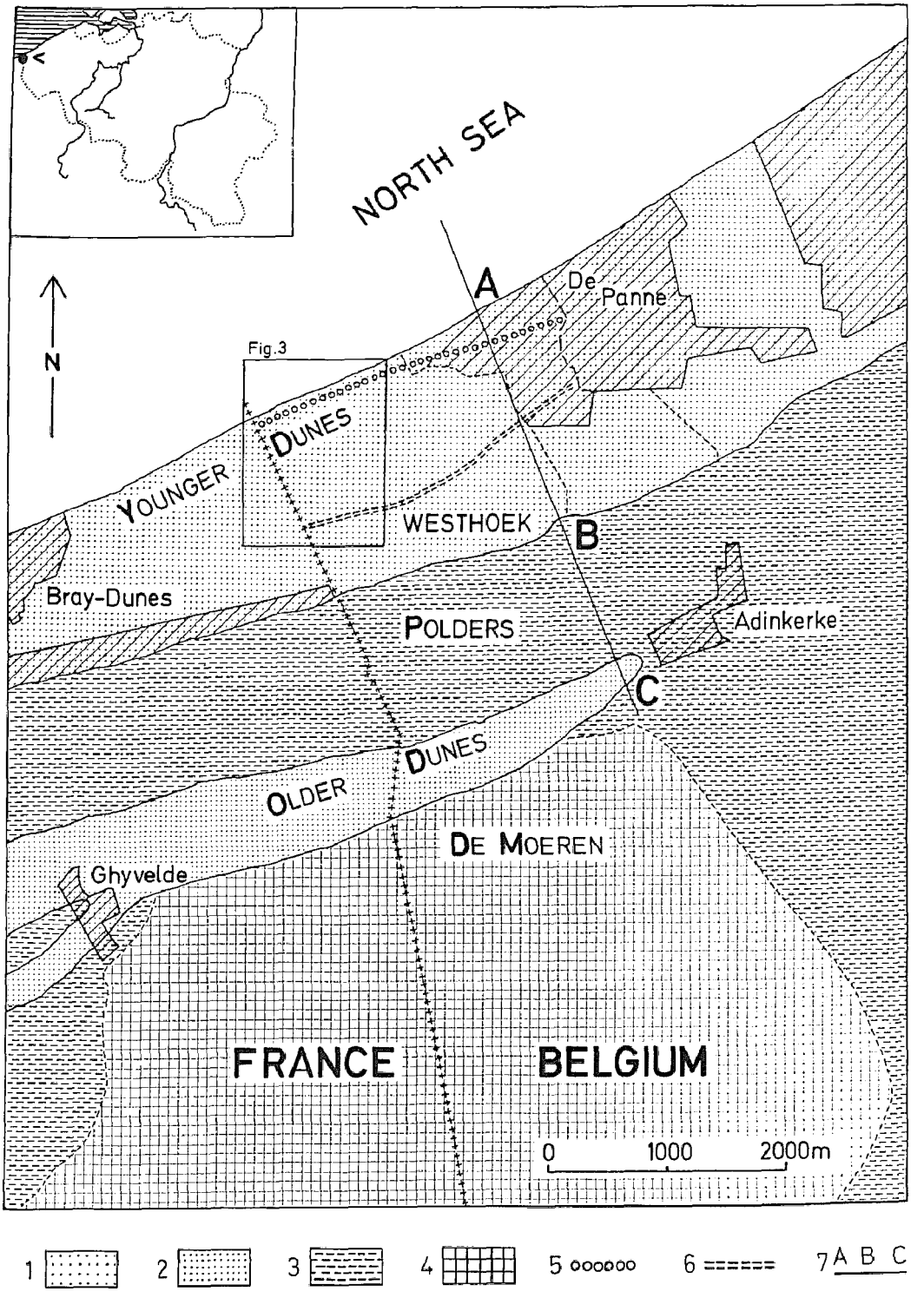

FIG. 1. – General outline map with location of the map of fig. 3 and the section-line of fig. 6, 7 and 8 (after Herbauts, 1971 ; Lebbe and De Ceunynck, 1980).

1. Younger Dunes.
2. Older Dunes.
3. Polders (marine deposits of Dunkerque-2 age).
4. De Moeren.
5. Northern border of the older dune sediments.
6. Southern border of the older dune sediments.
7. Section-line of fig. 6, 7 and 8.

partly situated on the territory of Bray-Dunes (Dép. du Nord, France). In 1907, G. Cumont published the coins (Cumont, 1907). This study marked the end of a first period of active archaeological research.

After World War I De Panne attracted once more the attention under the impulse of some amateurs, amongst whom K. Loppens deserves most of the credit (Loppens, 1928 ; 1932, 95-98). The interest of the Musées Royaux was again aroused in 1926 by the discovery of an urn burial in Panne I. This resulted in quite an extensive excavation by E. Rahir in 1927 on this site, soon to be extended to Panne II and III and lasting well into 1929 (Rahir, 1927, 1928 and 1930). With this large campaign, the official research in De Panne came to an end. Although quite a few amateurs and societies remained active, a co-ordinated scientific research was never achieved. Only part of the finds from the excavations by A. de Loë and E. Rahir has been published. The majority of the objects have been put in the reserves of the Musées Royaux in Brussels and have never seen daylight again.

The dunes of De Panne have been classified as a nature reserve ("De Westhoek") by law on 29.8.1957 and this put an end to all archaeological activity there. In 1961, P. Favorel has published a very thorough *status quaestionis* of the archaeological research in De Panne (Favorel, 1961-2).

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Our present knowledge of the De Panne find-place is thus based on the activities of A. de Loë in 1905-6 and E. Rahir in 1927-9. The poor state of the soil science, already repeatedly criticised contemporary (e.g. Loppens, 1932, 97-8), resulted in wrong interpretation and registration of the archaeological layers and traces, which were all determined as "*foyers d'habitat*" and "*foyers industriels*". The data concerning the house types and even the grave types based on the observations of de Loë and Rahir (e.g. Mariën, 1952, 410 ; 1980, 32-34 ; De Laet, 1974, 466 ; 1979, 573-574) should consequently be treated with the utmost care.

The two main problems which have been the subject of discussion during the excavations as well as today concern the *dating* and the *character* of the archaeological site.

Chronologically, two main periods of settlement can be ascertained, namely during the Iron Age and in the Roman period. The Gallo-Roman remains can be dated from the Flavian period onwards till in the third quarter of the third century, i.e. approximately between 70 and 270 A.D. (Thoen, 1978, 194-202).

On the Iron Age phase of the settlement the archaeologists disagree. Taking the motifs of pottery decorations as a criterion, A. de Loë and E. Rahir made a differentiation between "*types de premier âge du fer*" (Hallstatt) and "*types de deuxième âge du fer*" (La Tène) (Rahir, 1927, 33-50 and Fig. 8-15 ; 1928, 252-255 and Fig. 117-120 ; 1930, 23-30 and Fig. 8-13). The slightly angular forms, mainly finger-indented ("*décoration au doigt*") and pinched ("*décoration à la pincée*") were dated as Hallstatt, the sharply angular pots and bowls, usually combed or furrowed (so called cardium-decoration) ("*décoration au peigne et linéaire*"), as La Tène.

M. E. Mariën excludes an Early Iron Age (Hallstatt) phase. He dates all pre-Roman earthenware in the Late Iron Age (La Tène), thereby making a distinction between Early La Tène ware (sharply angular forms), due to their relation with the carinated Marne ware (Mariën, 1952, 377-380 and Fig. 352-353), and Late La Tène ware, comprising the more rounded forms, which would have superseded the angular forms (Mariën, 1952, 410-412 and Fig. 369-370). As regards the decoration, Mariën suggests that the earliest types would have been sparingly decorated, whereas the later ones would have been abundantly finger-indented, pinched, combed, etc. ; especially the latter decoration would have been typical of the La Tène III period. Like A. de Loë and E. Rahir, Mariën also stresses the *continuity* between the Iron Age settlement and the Roman period (Mariën, 1952, 410 ; 1971, 220 and 223-224). In his 1971 study Mariën clearly looks for a relation between the different archaeological groups in Belgium and the location of the different tribes known from literary sources (Mariën, 1971).

However, during our research into the Gallo-Roman settlement in the Belgian coastal plain, we ascertained that combing was precisely the characteristic mode of decoration of the local Gallo-Roman pottery, and that the combed ware dated by Mariën as Late La Tène were in fact Gallo-Roman pottery products from the 2nd.-3rd. century A.D. (Thoen, 1978, 97 and 179-188). Subscribing to this view, S. J. De Laet rejects the continuity between the settlement in the Late La Tène period and the Roman period, a theory that formerly had been generally accepted (De Laet, 1974, 465 ; 1979, 573). Hereby he relies on the fact that the Gallo-Roman inhabitation in De Panne starts only around 70 A.D. (research Thoen, 1978, 194-202) and on the presence of a sterile layer of drift-sand between the Iron Age and the Roman strata (research de Loë, 1908, 37 and Fig. 3). In contrast to Mariën, De Laet stresses an Early La Tène settlement at De Panne, belonging to La Tène I and II (De Laet, *o.c.*).

The *character* of the site has been interpreted from the beginning in the light of the *briquetage* finds. These comprise the earthenware cylinders or "nails", tripods, perforated plaques, etc. They were determined by A. de Loë and E. Rahir as technical implements of a potter, hence the interpretation of their find-places as "*foyers industriels*" or "*foyers de fabrication (de poteries)*" in contrast to the "*foyers d'habitat*" or hut complexes. E. Rahir even went as far as publishing a substantial study, entitled "*L'Age du Fer à La Panne. Une fabrique de Poteries*" (Rahir, 1927), wherein he treated all aspects of the production and which he lavishly illustrated with reconstruction drawings, chemical analyses, etc. This nice theory collapsed like a house of cards when K. Loppens indicated the discrepancy between the finished products (Iron Age earthenware) and the raw material (post-Roman Dunkerque-2 clay) (Loppens, 1932, 96) and when it became known that *briquetage* was not related to potting but to salt-making. However, it was not before 1961 that De Panne *briquetage* was determined as such by J. Nenquin and K. Riehm (Nenquin, 1961, 93-95 ; Riehm, 1961, 189). The former author suggested that salt-making took place both during the Iron Age and the Roman period, since *briquetage* had been found in layers from those periods. From the

numerous publications and from the excavation reports by A. de Loë and E. Rahir it appears however that *briquetage* has been found predominantly in Iron Age contexts. The few times it was present in Roman pits, the *briquetage* has always been found in association with Iron Age pottery sherds. We think that these finds are rather to be explained as having been disturbed by Roman activities and that no proof has yet been proffered for the use of *briquetage* – and therefore of salt-making – in the Roman period at De Panne (Thoen, 1978, 50).

As to the *physical-geographical aspect* of the settlement, we have also put forward the view that the Iron Age habitation developed on a beach flat protected by dunes (Thoen, 1978, 57-59) (Fig. 7). Thereby we have rejected the theory on the evolution of the dunes advocated by the geomorphologist F. Depuydt (1966 and 1972) (Fig. 6). As determining factors for the implantation and the development of the Iron Age settlement at De Panne we have cited the safe location behind the old range of dunes, the proximity of the sea (important for salt-making and fishing) and the presence of an old river-mouth to the E. of the site.

With respect to the dating problem we have also pointed out a possible relation between the development of the settlement and the active phase of the Dunkerque-1 transgression. Since De Panne was one of the few sites in the old dune area which were not flooded, its advantageous geographical position must have been attractive to prospective settlers, especially during the active phase of D-1. The latter we have dated from *c.* the 5th. to the 2nd. century B.C., relying on information from the Netherlands, and archaeologically this coincides with the La Tène I and II periods. For the same reasons the salt-making community, which was closely linked to the proximity of the sea, would have been on the decline or even been completely absent at the end of this transgression. Hence the few remains or even the complete absence of La Tène III remains (Thoen, 1978, 58-59). Following this line of thinking, the dating of the Iron Age settlement proposed by De Laet would be correct, in contrast to the one suggested by Mariën.

It is against the background of these latest opinions on the character and date of the De Panne Iron Age settlement that a study has been made of a humic layer, discovered in 1978 by R. De Ceunynck during a geological survey of the dunes.

The Site (R.D.C.)

The humic layer which contains archaeological remains was found some 20 cm beneath the surface of a little dune depression deprived of vegetation (Y on Fig. 3). The elevation of this depression is approximately + 5 m (Zero H Oostende).

When one wants to compare the position of the new find-spot with the excavations of A. de Loë and E. Rahir (*cfr. supra*), it must be recognized that the exact location of those excavations is unknown, because only a simple drawing has been made by them (Fig. 2). This drawing indicates only the most apparent geomorphological caracteristics of the area. The distances on the map are severely distorted. Nevertheless one can conclude that it is highly probable that the find-spot Panne II was then partially exposed to wind erosion in the deflation area of

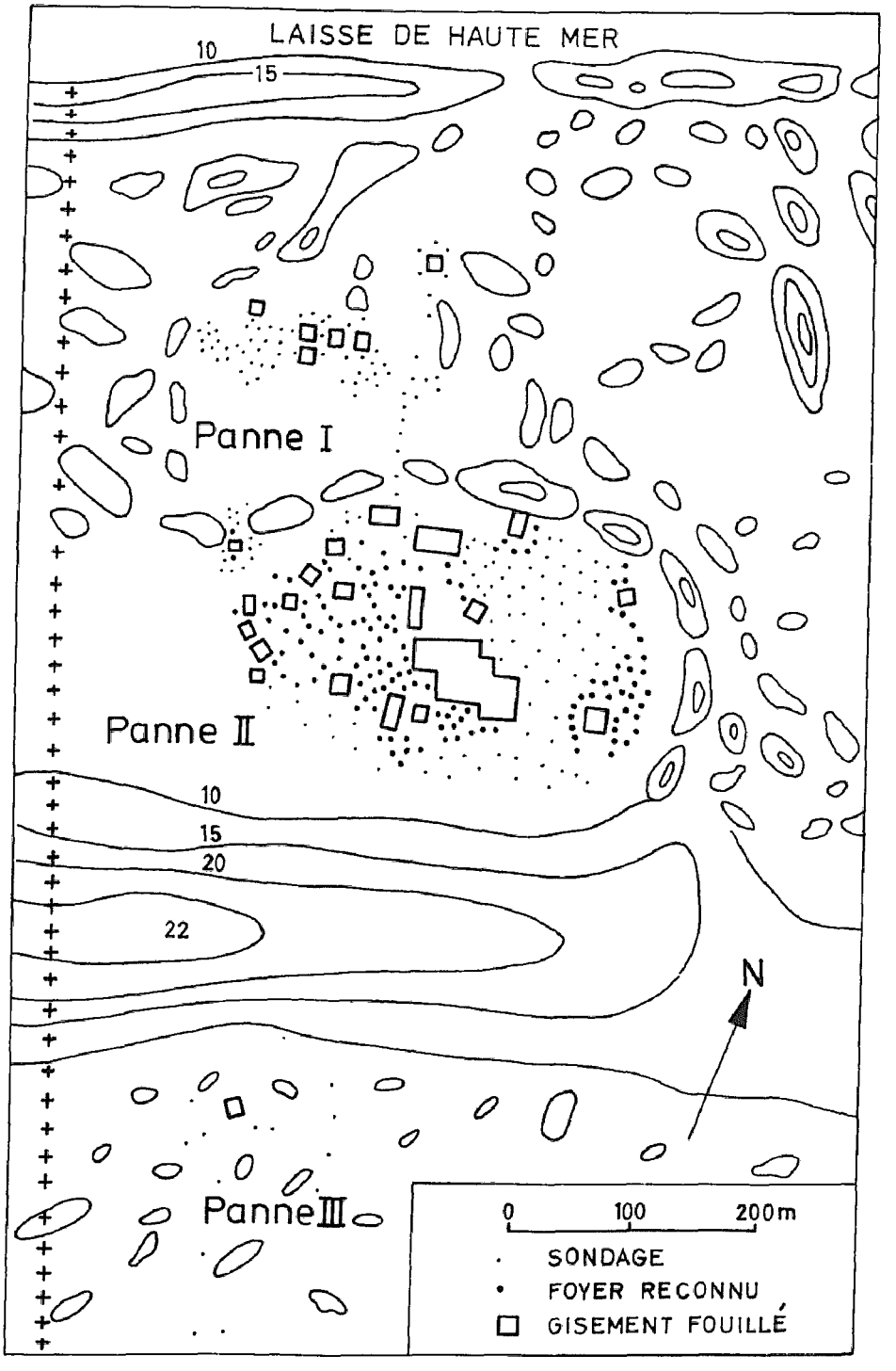


FIG. 2. – Scetch-map of the excavations by A. de Loë and E. Rahir (after Rahir, 1930).

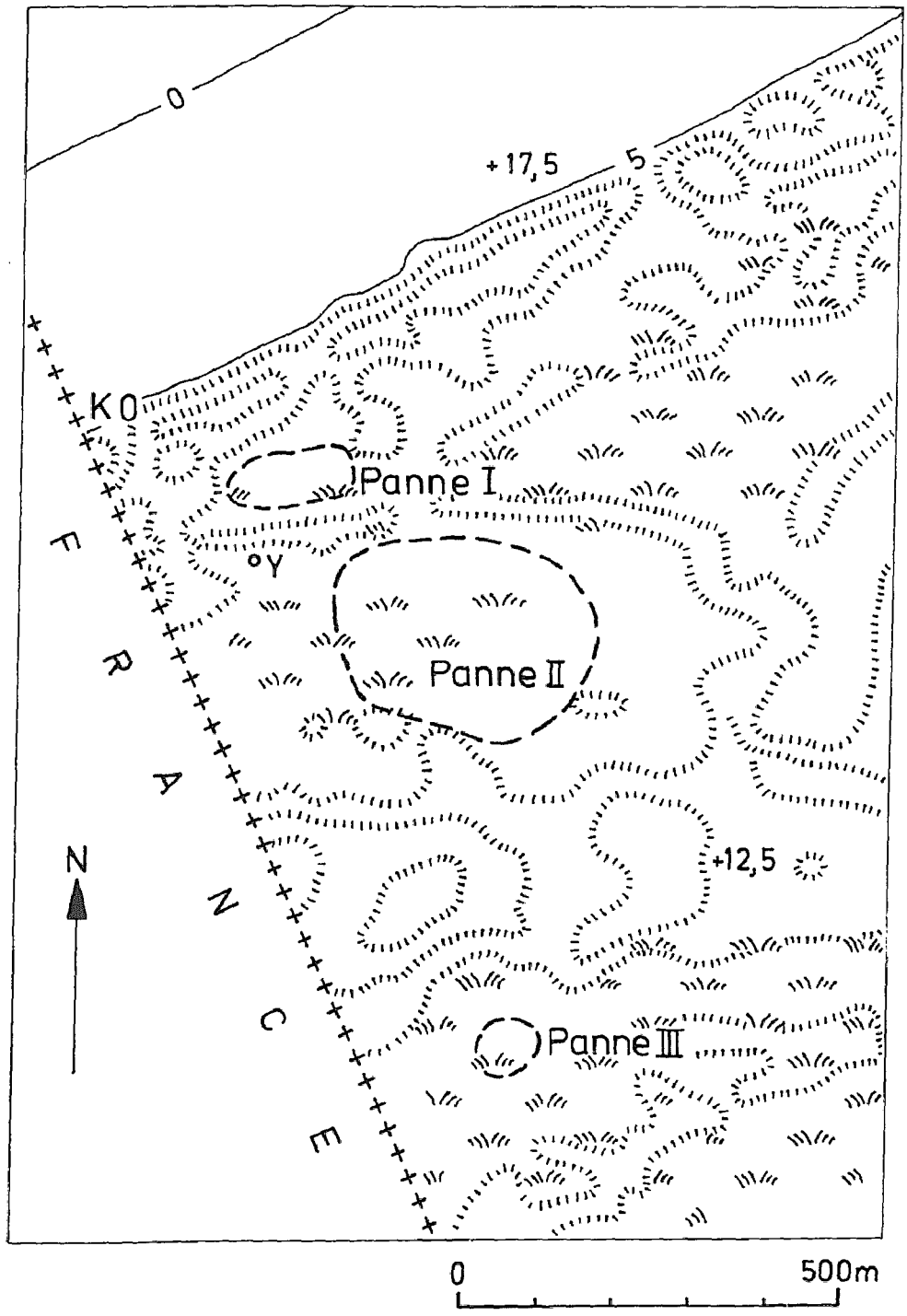


FIG. 3. – Location of the excavations by A. de Loë and E. Rahir (Panne I, II, III) and the present find-spot (Y) on a modern map.

the most westerly parabolic dune. In the mean time, the vegetation expanded in eastern direction, pursueing the shift in the same direction of the parabolic crest over 150 meters (Christiaens, 1976). Thus the site became covered with a dense dune scrub of *Hippophae* and *Salix*. The proclamation of the dune area as a natural reserve in 1957 also facilitated this natural process by prohibiting further archaeological excavations. Some remains of the excavations at Panne I are still visible at this time. Here the vegetation consists of low herbs (mainly grasses) preventing the total disappearance of indications of archaeological activity.

As a result of the previous findings the approximate location of Panne I, II and III could be defined on a modern map with the aid of aerial photographs (Fig. 3). The position of Panne III is still uncertain. When one considers the distribution of the find-spots it seems likely that these spots are part of one large site,extending underneath the local topography.

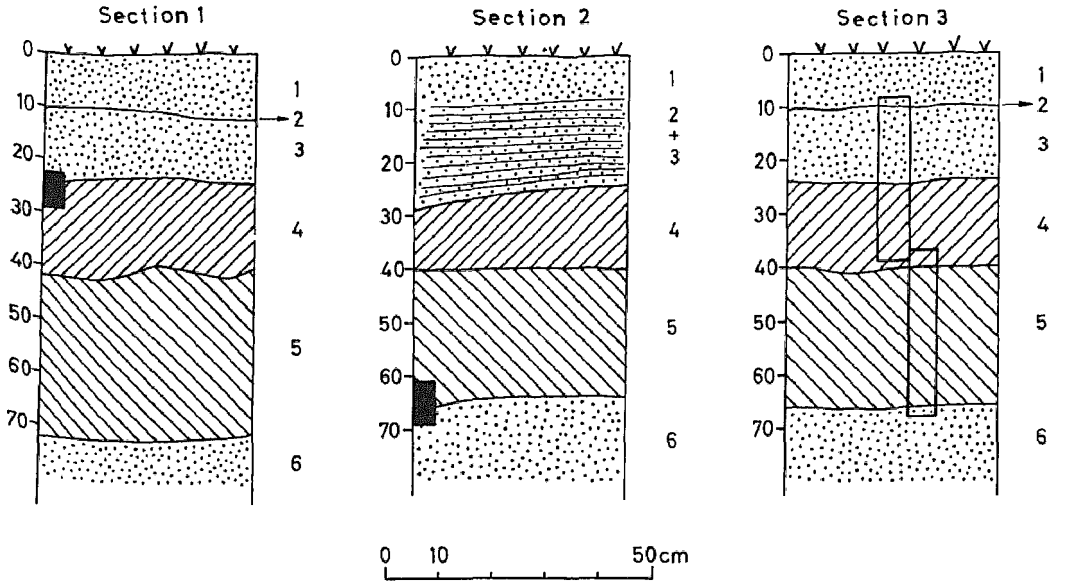


FIG. 4. – De Panne-Westhoek. Profiles, showing sampling-spots for C-14 (section 1 and 2) and pollen-analysis (section 3).

1. Yellow-grey dune sand.
2. Humic horizon, dark grey.
3. Yellow-grey dune sand.
4. Dark grey to black humus-rich sand ; small sherds.
5. Dark grey-brown humic sand ; numerous larger fragments of earthenware.
6. Yellow-brown dune sand.

DESCRIPTION OF THE PROFILES (R.D.C.)

The pottery fragments were found in a humic stratum which was about 40 cm thick (location : see fig. 3). The upper part of it (layer 4) contains much more humus than the lower one (layer 5). The greatest concentration of ceramics was observed in the latter, it was markedly less in layer 4, where the fragments were

also much smaller and fragile. The humic layer is covered with an overburden of 20 cm dune sand (layer 1 to 3) which shows a few humic horizons at the level – 0,10 m (layer 2). Dune sand also forms the substratum (layer 6).

Three sections were taken, each only a few meters apart. Section 1 was sampled for C-14 analysis at the level – 0.25 m, section 2 for C-14 analysis at the level – 0.65 m. Section 3 was continuously sampled for pollen analysis with the aid of small metal boxes.

The humic layer appears to be very sandy and rather homogenuous. Although we think that at the onset the layer originates from a soil-forming process, further growth of the layer must have been influenced by man. This is clearly indicated by the presence of the potsherds. In view of the fact that most sherds were found in the lower part of the layer, human influence was perhaps greater in the first period (represented by layer 5) than in the second period (layer 4).

Pollenanalytical Investigation (R.D.C.)

Introduction

All the levels studied pollen-analytically have come from undisturbed continuous samples. Preparation in the laboratory was executed according to the abbreviated acetolysis method, preceded by boiling in diluted fluoric acid.

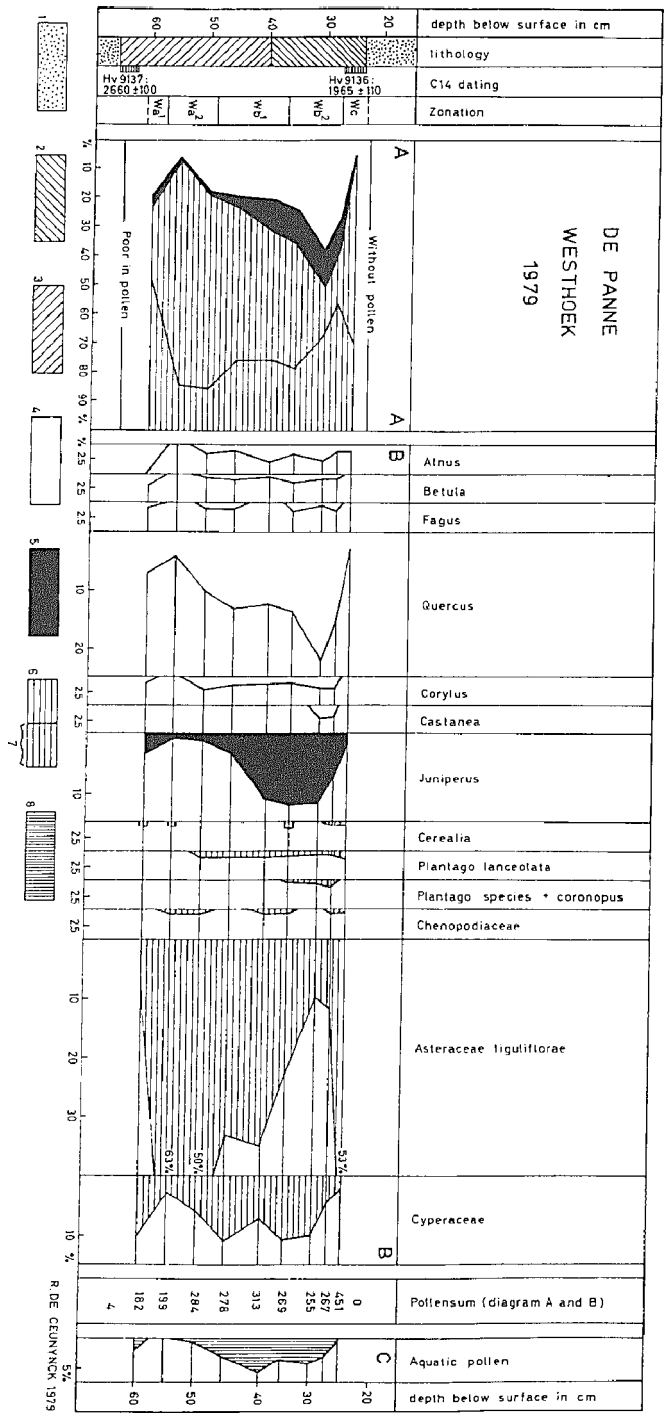
Since in a coastal dune area open vegetation plays an important role, a basic pollensum was chosen which gives an indication of the relationship between forest, shrub-vegetation and open vegetation. In consequence the basic pollensum includes trees, shrubs and terrestrial herbs. Spores and Aquatic pollen are not included (Fig. 5).

The main diagram A shows the relationship between trees, shrubs and terrestrial herbs. Diagram B gives some specific curves of individual pollen-types included in the basic pollensum. Diagram C shows the curve of Aquatic pollen. The Spores are not represented in the diagram because of their very limited presence. Mainly spores of *Dryopteris*-, *Sphagnum*- and *Equisetum*-type were found.

When we look at the diagram there is no apparent indication of disturbance of the pollen containing layer. This agrees well with the fact that no sign of digging activity was found in the cuttings. Instead the main diagram A shows a typical transition from open herbaceous vegetation to dune scrub (*cfr. infra*) as witnessed in other diagrams of the coastal area.

Zonation

Zonation has been executed according to the "pollen assemblage zone concept" (Moore and Webb, 1978). The use of this system means that one zones each diagram upon its own features without reference to any other pollen diagram and without prior attempts at regional synthesis and correlation. Since some pollen-



Lithology

1. Dune sand.
2. Very humic sand.
3. Slightly humic sand.

Shading of the curves.

4. Trees.
5. Shrubs.
6. Herbs.
7. Gramineae.
8. Aquatic pollen.

Pollensum.

Diagram A : all pollen except Aquatic pollen and spores.
Diagram B : as for diagram A : some specific curves.
Diagram C : pollensum diagram A and Aquatic pollen equals one hundred percent.

FIG. 5. – Pollen diagram of layers 4 and 5 (section 3).

types are locally derived, it is possible that a pollen assemblage zone will then simply refer to the state of the vegetation in the immediate vicinity. This is of value when one is concerned with elucidating the local succession in vegetation (Moore and Webb, *o.c.*) as is the case here.

Zone characteristics :

Zone Wa : predominantly herbs ; the proportion of trees and shrubs is limited to a small amount (*Quercus* 4 to 11%, *Juniperus* 1 to 3%).
— Subzone Wa^1 : dominated by *Gramineae*, yet limited importance of the *Cyperaceae* and the Aquatic pollen.
— Subzone Wa^2 : dominated by *Asteraceae liguliflorae* (up to 65%), lower values of *Cyperaceae* and above all Aquatic pollen.
Zone Wb : at first a sharp incline of *Juniperus* then followed by an increase of *Quercus* ; higher values of *Cyperaceae* and Aquatic pollen.
— Subzone Wb^1 : increase of *Juniperus* while the proportion of *Quercus* roughly stays the same.
— Subzone Wb^2 : maximum of *Quercus* (22%) while the proportion of *Juniperus* stays the same.
Zone Wc : drastic decline of trees and shrubs, sharp increase of herbs mainly due to higher values of *Asteraceae liguliflorae* ; marked decline of *Cyperaceae* and especially Aquatic pollen.

Ecology

The diagram is dominated by the herbs, mainly due to the importance of *Gramineae* and *Asteraceae liguliflorae*. Other herbs that were found are *Chenopodiaceae, Asteraceae tubuliflorae, Plantaginaceae* and *Cruciferae*, also – yet sporadically – *Caryophyllaceae, Ranunculaceae, Rosaceae, Ericaceae* and *Papilionaceae* (up to 0.5%) (not represented in the diagram). Higher values of *Cyperaceae* probably point to wetter conditions, representing wet till semi-aquatic dune slacks overgrown with sedge. In this context it is worth noting that the similarity with the curve of the Aquatic pollen is quite conspicuous. On the other side, the *Asteraceae liguliflorae* reach their maxima when the values of the *Cyperaceae* and Aquatic pollen are minimal. This points to drier circumstances and probably even to higher aeolian activity.

Tree-pollen is characterised by high values of *Quercus*. Low and continuous values of *Alnus, Betula* and *Corylus* were also found. *Fagus* is rather scarce and has not been found continuously. For this reason a pollen-analytical dating is not possible. This was also the case in many diagrams in the Dutch coastal dune area (Boerboom and Zagwijn, 1966 ; Jelgersma *et al.*, 1970). The importance of the *Quercus*-curve points to woody patches of *Quercus* in the vicinity, possibly with a similar composition as the so called Dune Oakwood ("Duin Eikenbos") of The Netherlands (Kalkhoven *et al.*, 1976 ; Doing, 1974). The development of this vegetation depends on the climate and in the coastal region above all on the wind

intensity. As this intensity declines landwards such a woody vegetation develops mostly at some distance from the coast (Kalkhoven *et al.*, 1976).

During a certain period a dune scrub, dominated by *Juniperus*, was present. Sporadically *Salix* was found. *Hippophae rhamnoides*, the predominant species of contemporaneous dune scrub in Belgium, was not found.

The possible presence of woody patches of *Quercus*, the presence of *Juniperus* scrub and the absence of *Hippophae* points towards a less calcareous character of the dunes at that time. It is worth noting that the humic layer appeared to be decalcified and that the dune sand on top of it dit not.

Vegetation succession

Initially open herbaceous vegetation was dominant, marked by wetter conditions at first (Subzone Wa^1), than by drier circumstances (Subzone Wa^2), combined with greater aeolian activity. This is succeeded by the extension of dune scrub (*Juniperus*), immediately followed by the increase of influence of woody patches in the immediate vicinity (respectively Subzones Wb^1 and Wb^2). The expansion of woodland and dune scrub happened in wetter circumstances as indicated by the relative great proportion of the *Cyperaceae* and the Aquatic pollen. Finally open vegetation became dominant again (Zone Wc), what can be accredited to greater aeolian activity (severe drop of *Cyperaceae* and Aquatic pollen, a new peak in the curve of *Asteraceae liguliflorae*).

Human influence on vegetation

A possible indication of human influence is the presence – albeit in small quantities – of *Cerealia* and *Plantago lanceolata* pollen. *Cerealia* were found in the upper and lower levels. The probable presence of *Elymus arenarius*, a natural component of dune vegetation which produces also pollen of *Cerealia*-type, makes it impossible to determine whether or not there was cultivation of cereals. The curve of *Plantago lanceolata* is quite continuous. Here again this species is considered also as specific for natural dune pastures, but wether these have been affected by grazing is open to discussion (Jelgersma *et al.*, 1970). Furthermore, *Plantago* pollen was in many cases severely corroded, what made determination up to the species very difficult to achieve or even impossible (*Plantago species*).

Chenopodiaceae are considered to be indicators of saline conditons (salt marshes), especially when this pollen-type occurs together with remains of marine organisms such as cysts of *dinoflagellates* (Straka, 1970). This is not the case here. *Chenopodiaceae* pollen can also point to influence of man on vegetation when it occurs together with other indicators of such an influence (Munaut, 1967). In this way the combined occurrence of *Cerealia, Plantago lanceolata, Chenopodiaceae* and even *Cruciferae* could point towards influence of man.

The presence of *Castanea* pollen-type in the levels -0.27 and -0.30 m is problematic. If the pollen of this type belongs in fact to *Castanea*, then this could

indicate human influence, since *Castanea* was introduced by man in Roman times (Godwin, 1956). Roman influence in the upper levels is therefore not excluded. This interpretation is not contrary to absolute dating, when one reckons with absolute and relative errors in computing absolute dates. One could also consider possible infiltration of *Castanea* pollen (11/18 mu), although Munaut (1967) estimates differential infiltration of this pollen-type to be improbable.

Taking into account the previous consideration, man's influence on the vegetation was very insignificant as no distinct signs were found, unless major changes in vegetation would also be induced by man such as the variations of the content of *Asteraceae liguliflorae*. Possibly *Castanea* was introduced during Roman times, what eventually affirms Roman presence in the vicinity during a certain period.

GEOLOGICAL AND GEOMORPHOLOGICAL CONTEXT (R.D.C.)

F. Depuydt (1966 and 1972) was the first to put forward an elaborate hypothetic evolution of the dune area founded on geomorphological and sedimentological evidence. He assumes the presence of a fossil beach half-way underneath the present Younger Dunes. This statement is based on a division of the Westhoek area into two distinctive zones (Fig. 6) : a southern zone (II) formed in the period 800 till 1400 A.D. and built up from a fossil beach beneath the northern zone (III) ; zone III is formed after 1400 A.D. and built up from the present-day beach. The author however did not take into account the archaeological evidence. In fact extensive excavations proved the existence of a vast archaeological site of Iron and Roman Age (*cfr. supra*) *in situ* in the northern zone ! No beach deposits have been found on top of this site (Rahir, 1930, 76).

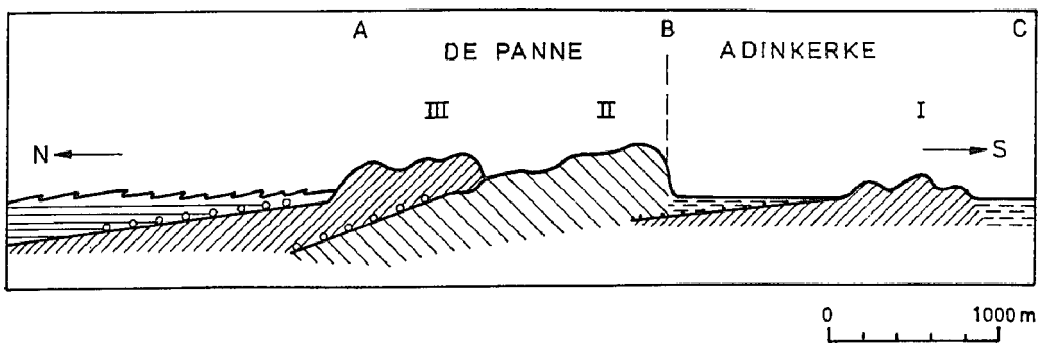


FIG. 6. – Evolution of the dune area, according to Depuydt, 1967 :

I. Dune zone with adjacent beach formed during the Subboreal age.
II. Dune zone with adjacent beach formed between 800 (post D-2) and 1400 A.D.
III. Dune zone with adjacent present-day beach formed between 1400 A.D. and present.

This contradiction between the archaeological evidence and the geomorphological interpretation was noticed by J. Herbauts (1971). This author tried to solve it by suggesting an older age for zones II and III : respectively pre-Dunkerque-2 age and post-Dunkerque-2 age. In this way he still accepted the presence of a fossil beach on top of the site, contrary to the description of Rahir (1930, 76). Independently of J. Herbauts, H. Thoen proposed another solution, in the context of a study of the Belgian Coastal area in the Roman period (Thoen, 1978). He supposes that the site was sheltered by Older Dune ridges, one landwards of the site (II) and one seawards of the site (III) (Fig. 7). He also assumes a similar development as determined in The Netherlands (Jelgersma *et al.*, 1970).

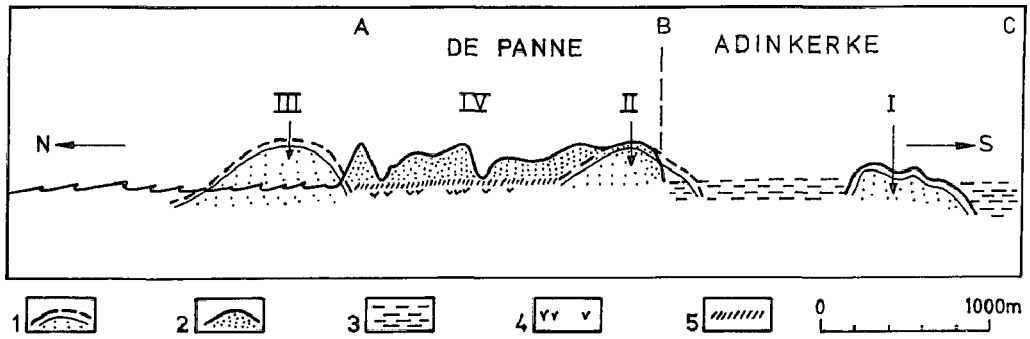


FIG. 7. – Section through the dune area, according to Thoen, 1978 :

1. Older Dune ridges (I, II, III).
2. Younger Dunes (IV).
3. Marine deposits of Dunkerque-2 age.
4. Peaty deposits.
5. Habitation layers.

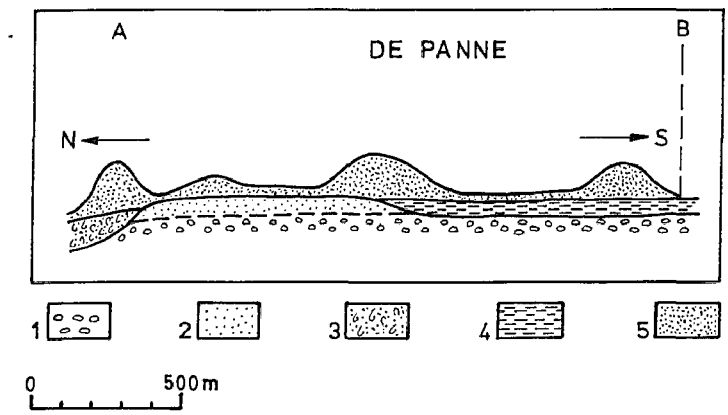


FIG. 8. – Geological section, after Lebbe and De Ceunynck, 1980 :

1. Older marine deposits.
2. Older dune sediments.
3. Subrecent beach deposits.
4. Marine clay deposits probably at least partially of Dunkerque-2 age.
5. Younger Dunes.

Meanwhile data from new borings are available (Lebbe and De Ceunynck, 1980). They give a better look on the spread of the older dune sediments beneath the Younger Dunes (Fig. 8). It appears that these sediments were eroded at their northern side by marine action. The southern boarder of these sediments runs approximately half-way the area (Fig. 1 and 8). No beach deposits were found on top of the older dune sediments except for their northern boarder. The Older Dunes were probably levelled at the beginning of the Younger Dune formation. Furthermore dune deposits of Roman age are included in the older dune sediments. The distribution of those different older dune sediments is not yet clearly known. This makes a reconstruction of Iron Age dune landscape impossible, although the Older Dunes were then most likely extended more seawards.

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The humic layer is one of the humic and peaty strata of the older dune sediments. At the find-spot the overburden consists of younger dune sediments. The upper level of the humic layer shows influence of aeolian activity at about 1965 ± 110 B.P. (*cfr. supra*). From this level on there is a total rupture in the deposits witnessed by the different sedimentary structures, a very drastic increase of the $CaCO_3$ content, the total absence of pollen and the presence of disturbed mainly Roman pottery fragments. This points definitely to later erosion at the top of the layer, in the course of which a certain amount of sediment was removed and replaced by a younger sediment with typical aeolian character. This aeolian activity has nothing to do with the formation of the older dune sediments and the aeolian activity witnessed by the pollen content at the top of the layer. As a consequence it is highly probable that a younger vegetation or occupation level (of Roman age) lay on top of the humic layer. It is as yet impossible to determine whether this layer and the presumed younger one were separated by a thin band of aeolian sand as was sometimes indicated (de Loë, 1908, 37-38 ; Loppens, 1932, 95), although the pollen content at the top however points in that direction.

The humic layer was at the onset possibly formed as a soil in a dune depression, which subsequently became occupied by man, without however changing severely the natural vegetation in the immediate vicinity (*cfr. supra*). This vegetation is reflected in the diagram. Following Jelgersma *et al.* (1970) the phases of soil formation represent wet conditions, those of dune formation drier ones. In our case too, conditions seemed to be relatively wet. The same authors also observed a cyclicity in dune formation almost synchronuous with the alternation of transgressive and regressive phases in the coastal area : the wet phases coincided with the transgressive, the dry phases with the regressive phases. The dating of the humic layer (top : 1965 ± 110 B.P., Hv-9136 ; bottom : 2660 ± 100 B.P., Hv-9137) corresponds very closely with the archaeological material and with the Dunkerque-1 transgressive phase.

Two conclusions can be drawn : first a dense vegetation apparently developped in the nearby dunes during relatively wet conditions and secondly this

development coincides with the Dunkerque-1 transgressive phase. It therefore appears that the same cyclicity applies at least partly for the dune formation in Belgium.

The Archaeological Finds (H.T.)

We shall discuss only the archaeological finds recovered *in situ*, i.e. found *within* the humic layer. They consist exclusively of pieces of earthenware, some 50 in total, which is rather a high number taking into account the limited cuttings. The distribution amongst the three cuttings is uneven. Most of the finds come from section n° 1, the remainder from sections n° 2 and 3. In sections 1 and 2 most of the finds were deposited in the lower part of the humic layer, the upper horizons containing few or no material at all. Section n° 3 contained only some very small fragments in the upper part. It should be noted that the ceramic material in the upper part consisted exclusively of fragments of *briquetage*. Most of these were too friable to be recovered.

The ceramic material can be divided in potsherds and *briquetage*.

I. *The Pottery* (Fig. 9 and 11)

Nine sherds belonging to dark-coloured, thick-walled hand-made earthenwere pots. The past is greyish-black to black and fairly coarsely tempered, mainly with

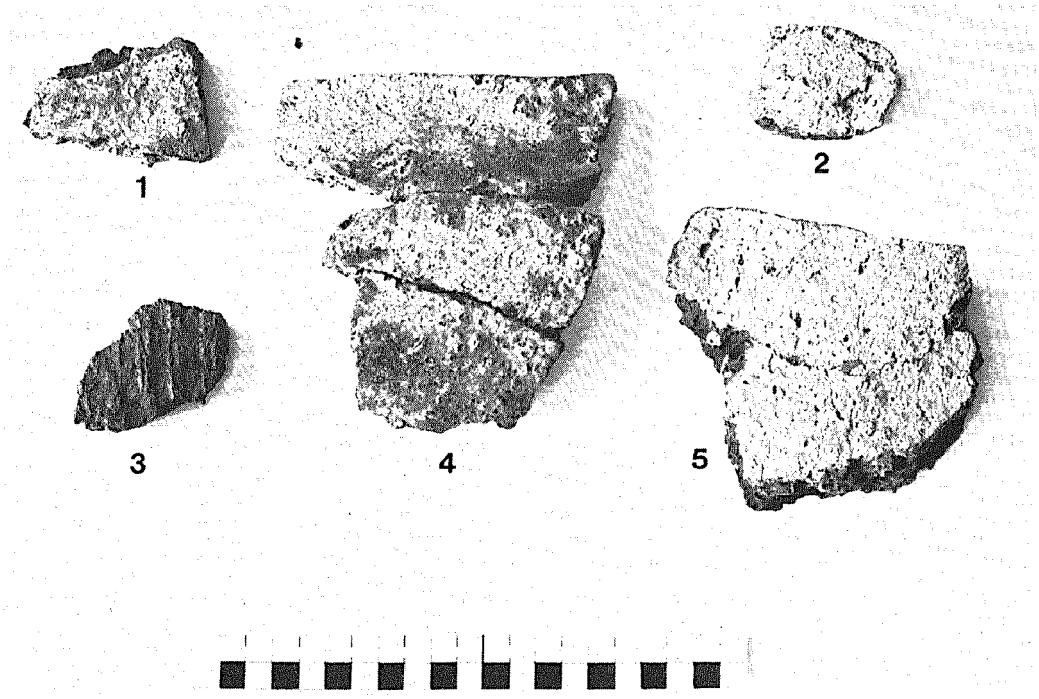

Fig. 9. – De Panne-Westhoek. Pottery from humic layer.
(*Photo H. Thoen, S.A.G.*).

grog and small lumps of baked clay ; traces of organic material are often visible. The walls are roughly smoothened. The outer surface is baked beige-brown, the inner beige-brown for the thinner sherds and greyish-black for the thicker ones (max. wall thickness is 11 mm.). One sherd has on the outside a rather crude groove decoration (fig. 9,3). Three matching sherds form part of a rim of a beige-brown bowl with a slightly carinated profile and a thickened rim-lip (fig. 9,4 ; 11,1).

As to the dating of this pottery one can only notice the characteristics of the pre-Roman Iron Age earthenware ; further chronological data cannot be obtained from so scarce a material.

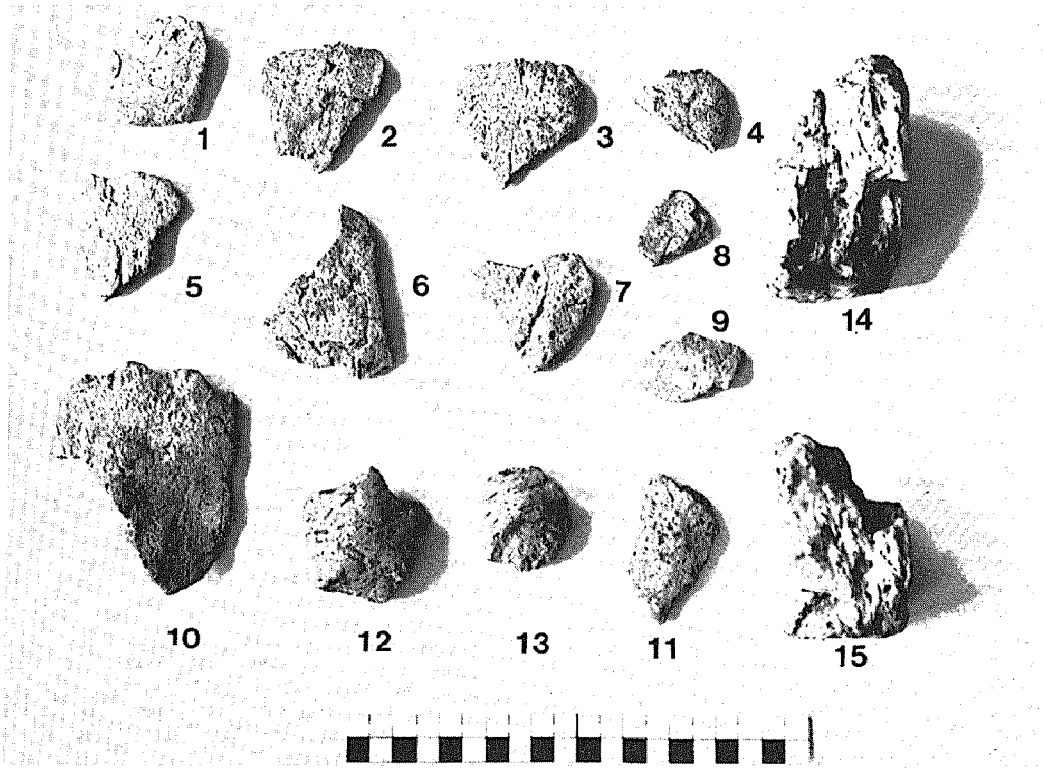

FIG. 10. – De Panne-Westhoek. *Briquetage*. (*Photo H. Thoen, S.A.G.*).

II. *The Briquetage* (Fig. 10-11)

Some forty fragments of earthenware show an even pale orange-brown coulour (Munsell 7.5 YR 7.5/5) and are tempered mainly with organic material. They are very friable and show numerous cracks, clearly due to exposure from high temperature. This material is known in the archaeological literature as *briquetage* (*cfr.* introduction). This term denotes the technical implements used in a salt-making process, whereby a concentrated saline solution (brine) was evaporated in earthenware recipients. For the different systems we refer to the general studies by

Nenquin (1961), Riehm (1961), Gouletquer (1970), de Brisay and Evans (1975), etc., which treat these various systems in detail. Suffice it to say here that the *briquetage* technique is an universal process of salt-making which was in use in pre-historic Japan (Kondo, 1975) as well as nowadays in some parts of Africa (Gouletquer, 1975). In Europe, *briquetage* as a salt-making technique was in use from the Neolithic period till in the Middel Ages. Well-known centres existed in Central Europe (Poland, Salzkammergut, Saale Valley), in France (Lorraine and Brittany) and in England (Red Hills) (Gouletquer, 1971 and 1974).

In 1975 we published a short survey of the ancient salt-making sites in Belgium. Apart from the two Iron Age *briquetage* sites at De Panne and Brugge, we mentioned also the wooden constructions at Zeebrugge and Raversijde (near Oostende) which were used as "marais salants" and date from the Roman Period. Since then we have been able to examine a Roman "Red Hill"-site at Leffinge, also in the vicinity of Oostende. Here too, *briquetage* was in use (excavations by V.O.B.o.W., publication forthcoming).

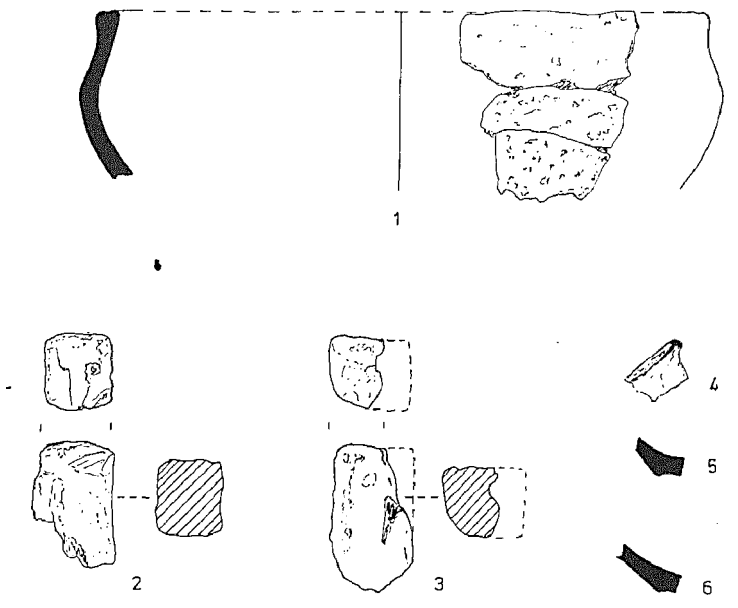

FIG. 11. – De Panne-Westhoek. Ceramic material from humic layer : 1 pottery ; 2-6 *briquetage*. Scale 1/3.

Despite the fragmentary nature of the *briquetage* finds from the humic layer at De Panne, there are various elements recognizable. Two fragments doubtlessly belong to "clay nails" (de Loë and Rahir) (Fig. 10,14-15 ; 11,2-3). Both are square in section, one having a side of 2.8 cm and a length of 4.5 cm, the other a side of 3 cm and a length of 5.4 cm. The function of these objects is not clear (pedestals ? grate ?). Another fragment is a pinched clay prop (Fig. 11,4). These objects are not uncommon amongst the *briquetage* material and were used to prop up or connect

parts of a grate or clay moulds. In the latter case Gouletquer (1970, 84, fig. 15.4) speaks of "*boulettes de calage*". The majority of the *briquetage* finds are thin sherds (3.5-5 mm), which come from the clay moulds which were destroyed on recovery of the salt-cakes. Two base fragments suggests that these moulds had a round shape, the diameter of the base being around 3 cm (Fig. 10,12-13 ; 11,5-6).

The importance of these finds is mainly the attestation of the use of the *briquetage* technique in the Iron Age site at De Panne-Westhoek. The fact that this small amount of fragmentary material enables us to gain new and important data on the salt-making technique in use at this site pleads for a total revision of the finds from De Panne, which are still present in the reserves of the *Musées Royaux* in Brussels.

Conclusion (R.D.C. & H. T.)

According to the radiocarbon measurements the humic layer discovered at De Panne-Westhoek was formed between 2660 ± 100 B.P. (710 b.c.) and 1965 ± 110 B.P. (15 b.c.) (conventional C-14 years). This concurs with the archaeological data and coincides in geological terms with the Dunkerque-1 transgression.

The formation of the humic layer is the result of the combination of soil-forming processes – mostly at the onset – and of human activity. The palynological examination pointed out that at the outset an open herbaceous vegetation was predominant, initially in humid, thereafter in drier conditions probably associated with a greater aeolian activity. The main expansion of the vegetation started with the development of a dune scrub (*Juniperus*) and was followed by an increased influence of strips of dune-oak forest in the immediate vicinity, probably under humid circumstances. The top of the humic layer shows a strong decline of scrub and forest vegetation, but a sudden rise of herbaceous vegetation, probably as the result of renewed aeolian activity in drier circumstances.

The archaeological finds recovered during the sampling of the soil profiles consist of some Iron Age pottery sherds and some fragments of *briquetage*, i.e. technical implements used in salt-making. Judging from the latest archaeological literature, the pre-Roman site at De Panne-Westhoek should be dated back to the Late Iron Age, i.e. the La Tène period. On the spot where the samples were taken, the majority of the archaeological remains were found in the lower part of the layer, the upper part yielding only a few scattered fragments. This suggests a vivid human activity during the initial formation of the humic layer and a much lesser human influence during the final phase. Although the radiocarbon date 2660 ± 100 B.P. is related to the initial formation of the humic layer, rather than to the start of the human activity, we do not exclude that the earliest human presence in the dunes of De Panne might be older than hitherto accepted, and therefore might date back to the Early Iron Age (Late Hallstatt).

The pollen diagram does not provide us with clear indications of the human influence on the vegetation. Apart from possible hints at dune pastures, specific

culture-pollen are few or non-existent. Human presence has thus clearly been of negligible effect on the dune vegetation. The main activity of the community will have been salt-making, as attested by the archaeological evidence.

Contrary to earlier conceptions, the settlement did not come into being on an old beach flat but in the old dunes, which protected the site in the N. against the sea. On the other hand nothing points to a similar protective barrier in the S. : the younger dunes here rest directly on marine sediments. It should be noted however that no such sediments have been found on the site itself. The geological data and the archaeological remains indicate that all archaeological find-places (Panne I, II and III) are in fact modern clearings of one large archaeological site which extends below the present topographical features.

As to the final phase of the pre-Roman settlement and the continuity thereof into the Gallo-Roman period, we may point out that – at least on the sampling spot – the boundery layer between the humic layer and the covering dune sand shows clear signs of erosion. It is therefore possible that the upper part of the humic layer has been eroded in later aeolian phases. However, it should be noted that the upper zone of the humic layer shows a sudden change from scrub and forest to herbaceous vegetation. Most probably this indicates aeolian activity which would have been responsible, around 1965 B.P., for stopping further growth of the humic layer. Judging from the very sporadic presence of archaeological material in the upper horizon of this layer, human activity in this period must have been very low. Some *Castanea*-pollen in this horizon might indicate the first – if still sporadic – Gallo-Roman presence in the vicinity.

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