GEOLOGIE EN MIJNBOUW VOLUME 49 (5), p. 381-390 1970

POLLEN ANALYSES OF THE HELVOIRT RIVER VALLEY

P. BUURMAN[1])

ABSTRACT

Four pollen diagrams from the Helvoirt river valley (Noordbrabant, The Netherlands) are presented and discussed. Several conclusions concerning the formation of the valley and its deposits are drawn.

INTRODUCTION

In 1963 Polak published two diagrams of the subsoil of an Allerød pine forest from the northern border of the Helvoirt valley (Noordbrabant, The Netherlands). This valley is a Pleistocene river valley that was poorly supplied with sediments during the Late Weichselian and the Holocene and is still clearly distinguishable in the landscape (fig. 1).

In the summer of 1967 the author paid some attention to the filling sediments in order to obtain more exact information about the age of the valley. Samples were taken from three profiles; from profile I with a Dachnowski auger, from profiles II and III in sample pits. Soil peels of profiles I and III are shown in fig. 2, but the sediment columns given with the diagrams may not agree with the data of these peels because of sharp fluctuations of sediments.

The Holocene deposits are composed of *Phragmites* and *Carex* peat; the Pleistocene of lime gyttja, hypnaceae peat, algae gyttja and sand and loam layers. These lime gyttja deposits are rich in oöspores of *Chara* and in *Equisetum* stems. The hypnaceae peats are composed exclusively of *Bryum* species.

[1]) Department of Soil Science Agricultural University, Wageningen.

Methods

Samples were treated with KOH, HF, Na-perborate and stained with safranine. Counting was done by Mrs. G. Janssen-Koolhaas and by the author.

Tree pollen was used for pollen sum in the Holocene part of the diagrams. The sum of tree pollen, grasses, cyper grasses, *Artemisia, Juniperus, Ericaceae* and *Myrica* was used for the Pleistocene part.

DESCRIPTION OF THE DIAGRAMS

Eemian

Diagram I, Ia

The sediment columns show a presence of sand, humic sand and loam. The high values for *Alnus* and *Betula* will be due to the prevailing wet conditions.

The column 2.00-2.80 m. represents a podzol profile in diagram I. This can be regarded as autochthoneous, containing little secondary pollen. According to Havinga (1963, 1964) severe corrosion of e.g. *Quercus* must be taken into account. This part of the diagram probably represents zone E5.

The lower part of profile I and profile Ia have a pollen content that indicates their origin in an Eemian age, although the loam deposits suggest "Brabant loam" from the Saalian. The spectra in these lower parts show contamination features with e.g. *Pterocarya*. The very constant spectra throughout these parts of the profile may indicate a considerable secondary pollen content.

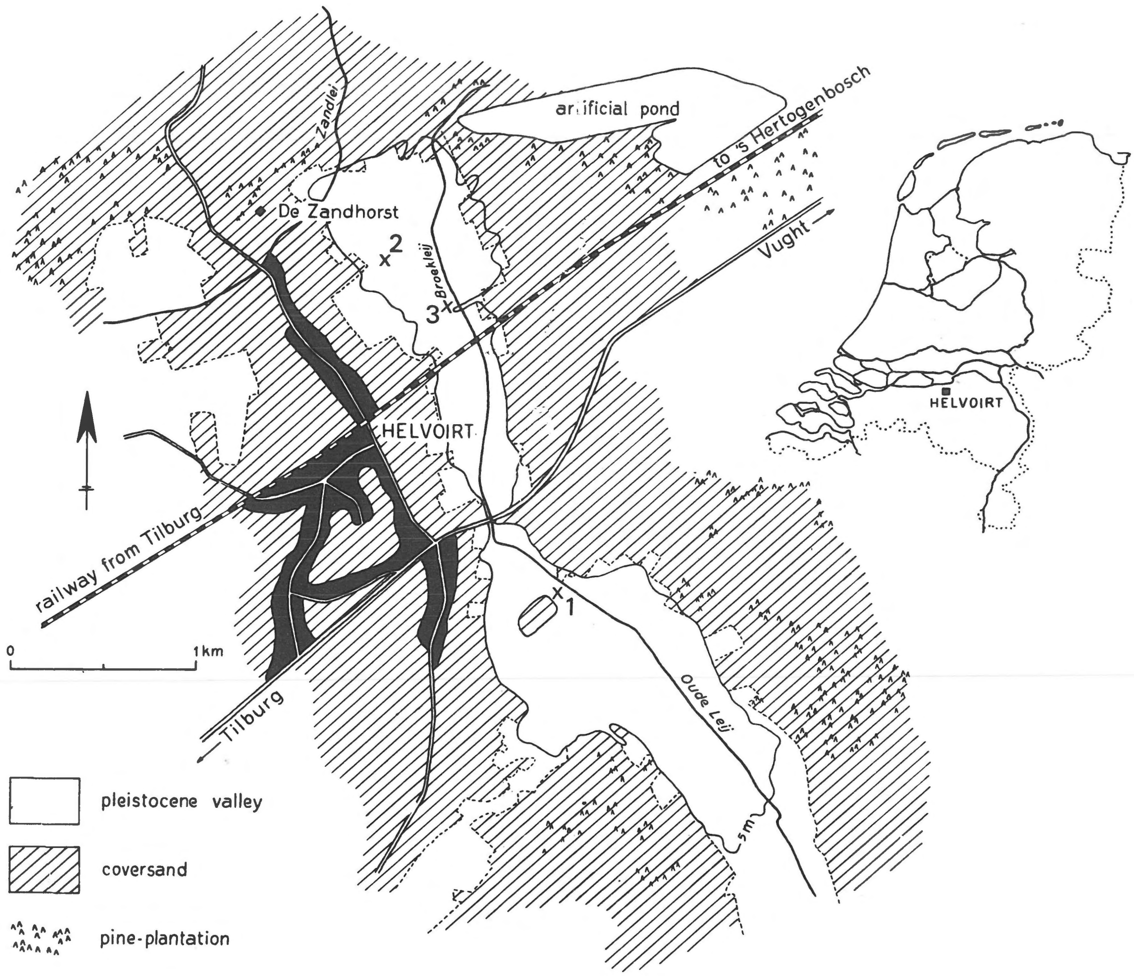


Fig. 1
The Helvoirt river valley.
Sample points for diagrams I, II and III given as 1, 2, 3.

Weichselian

Diagram I, I′, II, III

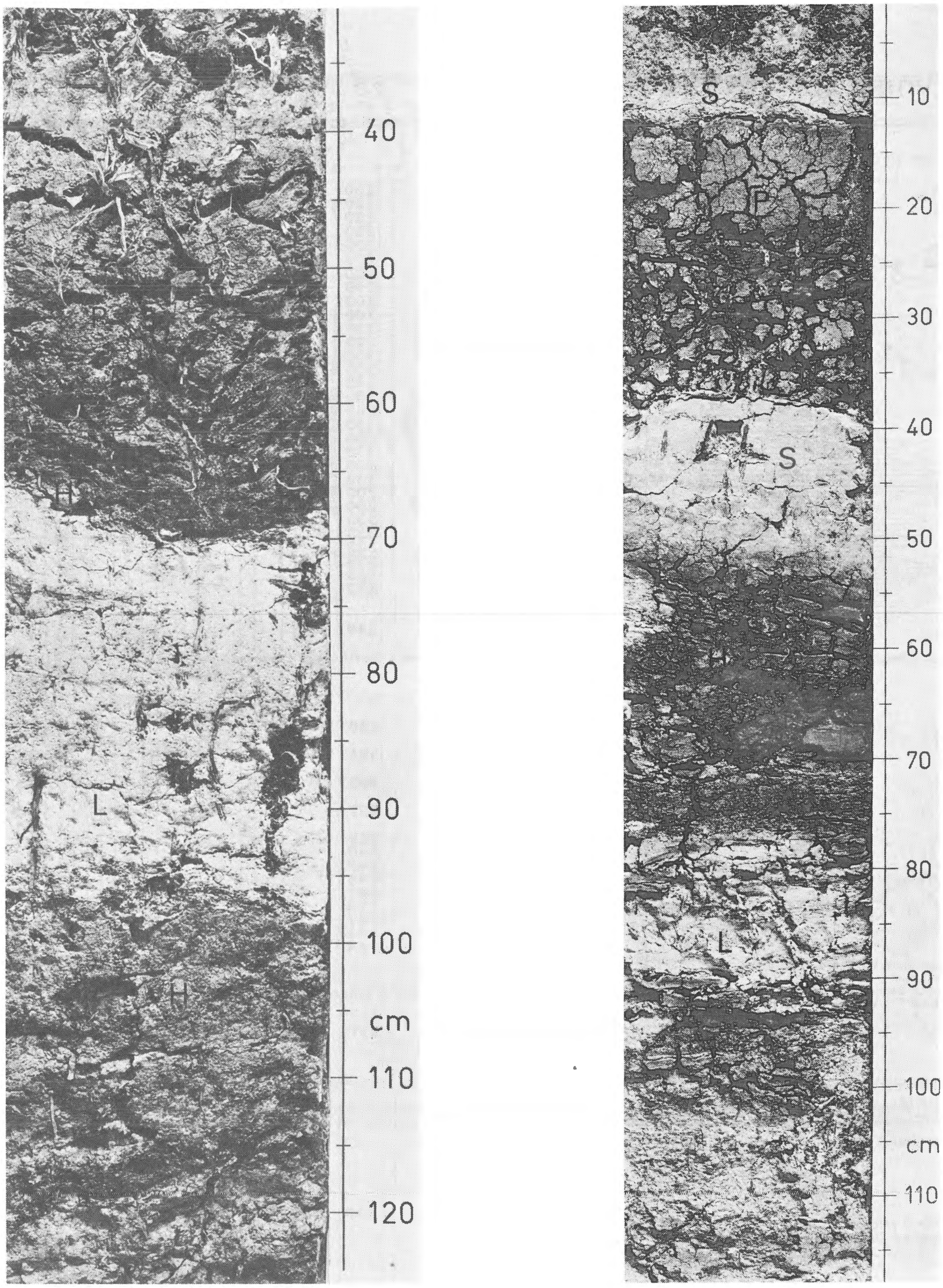
In these diagrams a hiatus begins at the top of E5 that covers the top of the Eemian and the greater part of the Weichselian deposits. The spectra from 1.65 up to 1.20 m in diagram I and the lowest spectra of diagrams II and III are severely contaminated with secondary pollen.

The spectra from 1.50 m up to 1.10 m of diagram I are also given in diagram I′.

Late Weichselian

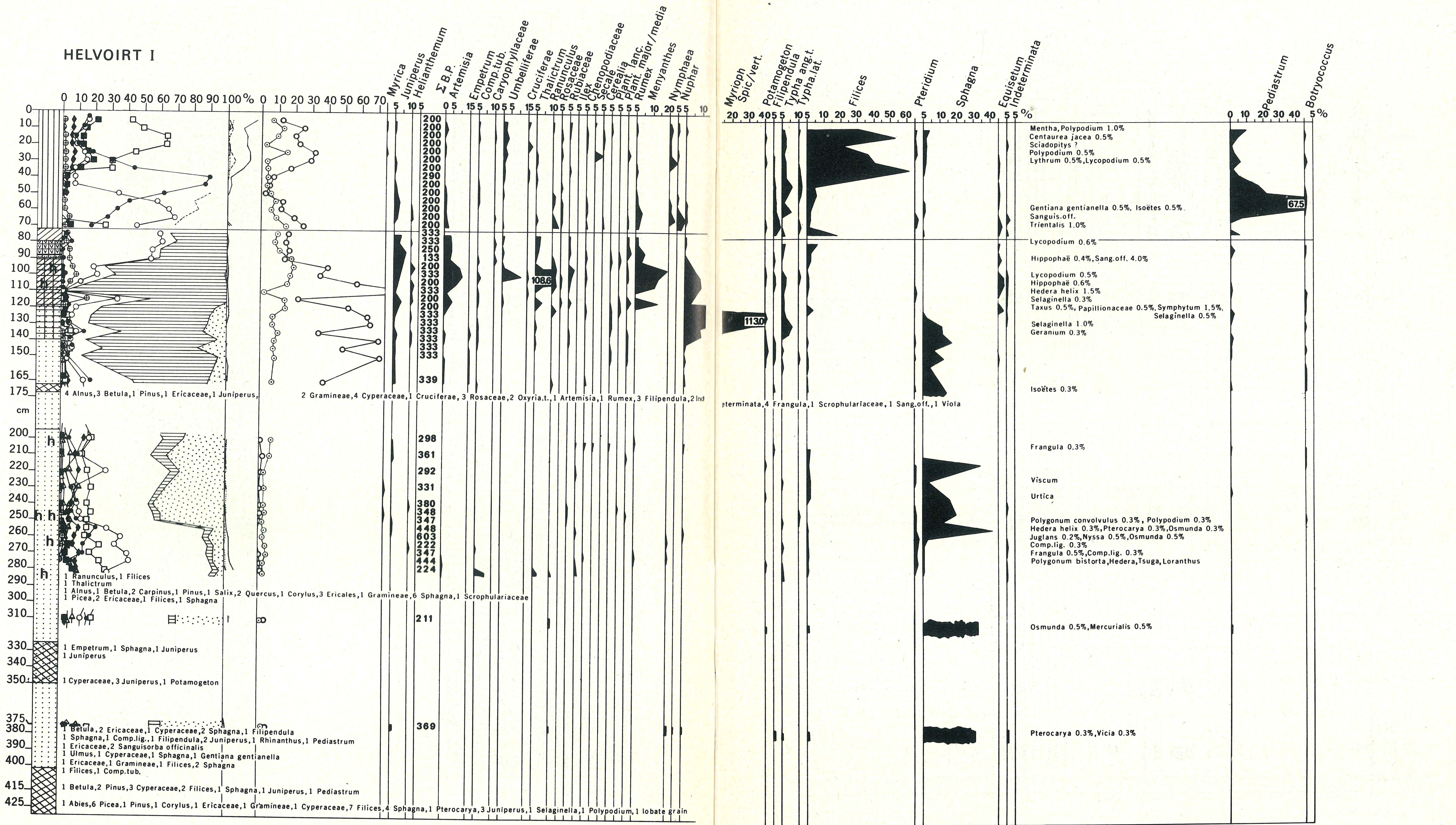
Diagrams I, II, III

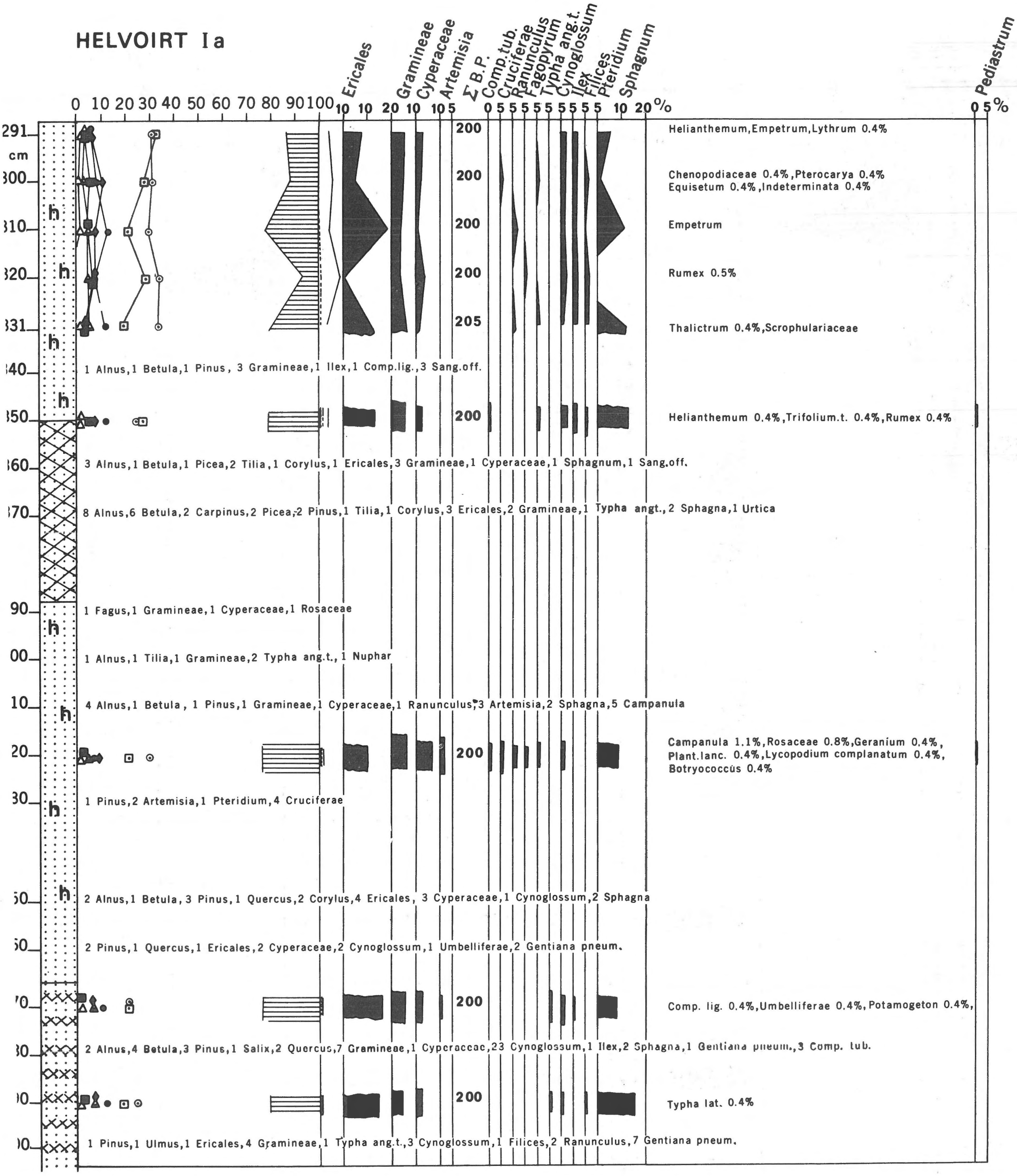
The Late Weichselian deposit in diagram I is supposed to start with the sandy gyttja deposit at 1.40 m. This is synchronous with a sharp rise in *Myriophyllum*, indicating wet circumstances. The spectra from 1.40-1.10 m represent the LW Ia and Ib. The Bølling oscillation is followed by a drier phase, characterised by the growth of *Hypnaceae* peat and a rise in *Betula, Salix, Artemisia, Thalictrum* and

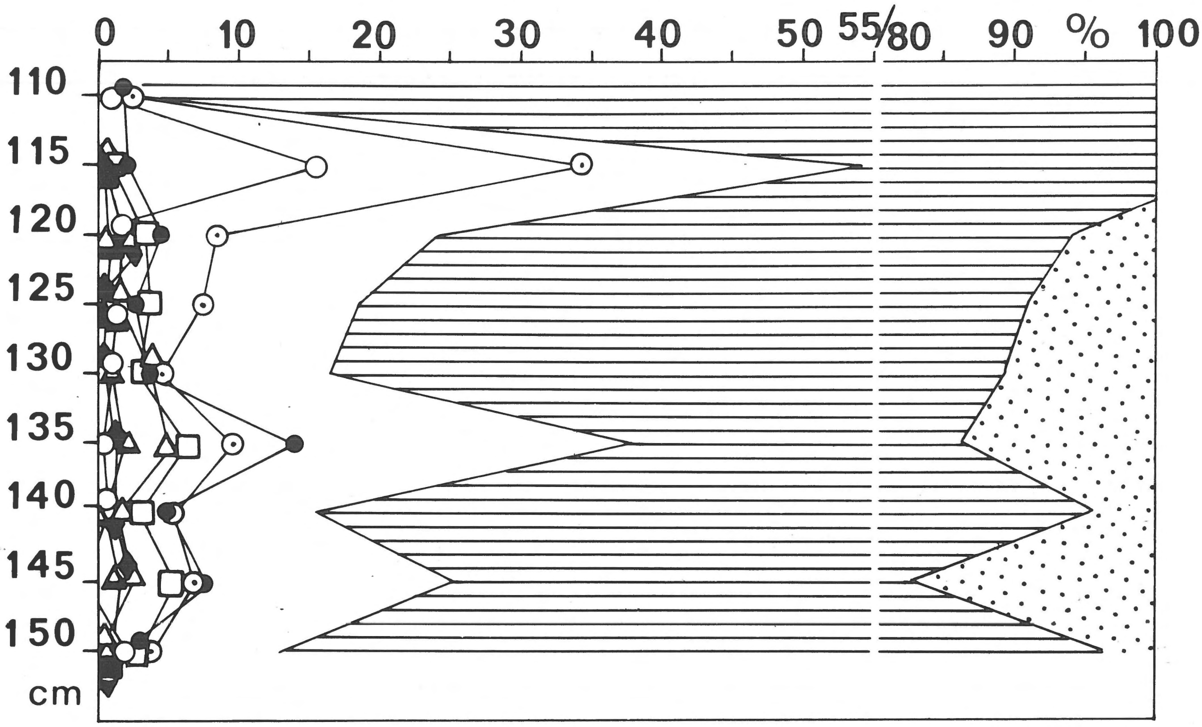


ig. 2
eels of profiles I and III.

= lime gyttja	p = reed and sedge peat
= hypnaceae peat	s = sand


HELVOIRT I
Myrica
Juniperus
Helianthemum
Σ B.P.
Artemisia
Empetrum
Comp.tub.
Caryophyllaceae
Umbelliferae
Cruciferae
Thalictrum
Ranunculus
Rosaceae
Rubiaceae
Ilex
Chenopodiaceae
Secale
Cerealia
Plant. lanc.
Plant. major/media
Rumex
Menyanthes
Nymphaea
Nuphar
Myrioph. Spic/vert.
Potamogeton
Filipendula
Typha ang.t.
Typha lat.
Filices
Pteridium
Sphagna
Equisetum
Indeterminata
Pediastrum
Botryococcus
cm
108.6
113.0
67.5
4 Alnus,3 Betula,1 Pinus,1 Ericaceae,1 Juniperus, 2 Gramineae,4 Cyperaceae,1 Cruciferae, 3 Rosaceae,2 Oxyria.t.,1 Artemisia,1 Rumex,3 Filipendula,2 Indeterminata,4 Frangula,1 Scrophulariaceae, 1 Sang.off.,1 Viola
1 Ranunculus,1 Filices
1 Thalictrum
1 Alnus,1 Betula,2 Carpinus,1 Pinus,1 Salix,2 Quercus,1 Corylus,3 Ericales,1 Gramineae,6 Sphagna,1 Scrophulariaceae
1 Picea,2 Ericaceae,1 Filices,1 Sphagna
1 Empetrum,1 Sphagna,1 Juniperus
1 Juniperus
1 Cyperaceae, 3 Juniperus,1 Potamogeton
1 Betula,2 Ericaceae,1 Cyperaceae,2 Sphagna,1 Filipendula
1 Sphagna,1 Comp.lig.,1 Filipendula,2 Juniperus,1 Rhinanthus,1 Pediastrum
1 Ericaceae,2 Sanguisorba officinalis
1 Ulmus,1 Cyperaceae,1 Sphagna,1 Gentiana gentianella
1 Ericaceae,1 Gramineae,1 Filices,2 Sphagna
1 Filices,1 Comp.tub.
1 Betula,2 Pinus,3 Cyperaceae,2 Filices,1 Sphagna,1 Juniperus, 1 Pediastrum
1 Abies,6 Picea,1 Pinus,1 Corylus,1 Ericaceae,1 Gramineae,1 Cyperaceae,7 Filices,4 Sphagna,1 Pterocarya,3 Juniperus,1 Selaginella,1 Polypodium,1 lobate grain
Mentha,Polypodium 1.0%
Centaurea jacea 0.5%
Sciadopitys ?
Polypodium 0.5%
Lythrum 0.5%,Lycopodium 0.5%
Gentiana gentianella 0.5%, Isoëtes 0.5%
Sanguis.off.
Trientalis 1.0%
Lycopodium 0.6%
Hippophaë 0.4%,Sang.off. 4.0%
Lycopodium 0.5%
Hippophaë 0.6%
Hedera helix 1.5%
Selaginella 0.3%
Taxus 0.5%, Papillionaceae 0.5%, Symphytum 1.5%,
Selaginella 0.5%
Selaginella 1.0%
Geranium 0.3%
Isoëtes 0.3%
Frangula 0.3%
Viscum
Urtica
Polygonum convolvulus 0.3%, Polypodium 0.3%
Hedera helix 0.3%,Pterocarya 0.3%,Osmunda 0.3%
Juglans 0.2%,Nyssa 0.5%,Osmunda 0.5%
Comp.lig. 0.3%
Frangula 0.5%,Comp.lig. 0.3%
Polygonum bistorta,Hedera,Tsuga,Loranthus
Osmunda 0.5%,Mercurialis 0.5%
Pterocarya 0.3%,Vicia 0.3%


HELVOIRT Ia
Ericales
Gramineae
Cyperaceae
Artemisia
Σ B.P.
Comp.tub.
Cruciferae
Ranunculus
Fagopyrum
Typha ang.t.
Cynoglossum
Ilex
Filices
Pteridium
Sphagnum
Pediastrum
Helianthemum,Empetrum,Lythrum 0.4%
Chenopodiaceae 0.4%,Pterocarya 0.4%
Equisetum 0.4%,Indeterminata 0.4%
Empetrum
Rumex 0.5%
Thalictrum 0.4%,Scrophulariaceae
1 Alnus,1 Betula,1 Pinus, 3 Gramineae,1 Ilex,1 Comp.lig.,3 Sang.off.
Helianthemum 0.4%,Trifolium.t. 0.4%,Rumex 0.4%
3 Alnus,1 Betula,1 Picea,2 Tilia,1 Corylus,1 Ericales,3 Gramineae,1 Cyperaceae,1 Sphagnum,1 Sang.off.
8 Alnus,6 Betula,2 Carpinus,2 Picea,2 Pinus,1 Tilia,1 Corylus,3 Ericales,2 Gramineae,1 Typha angt.,2 Sphagna,1 Urtica
1 Fagus,1 Gramineae,1 Cyperaceae,1 Rosaceae
1 Alnus,1 Tilia,1 Gramineae,2 Typha ang.t., 1 Nuphar
4 Alnus,1 Betula, 1 Pinus,1 Gramineae,1 Cyperaceae,1 Ranunculus,3 Artemisia,2 Sphagna,5 Campanula
Campanula 1.1%,Rosaceae 0.8%,Geranium 0.4%,
Plant.lanc. 0.4%,Lycopodium complanatum 0.4%,
Botryococcus 0.4%
1 Pinus,2 Artemisia,1 Pteridium,4 Cruciferae
2 Alnus,1 Betula, 3 Pinus, 1 Quercus,2 Corylus,4 Ericales, 3 Cyperaceae,1 Cynoglossum,2 Sphagna
2 Pinus,1 Quercus,1 Ericales,2 Cyperaceae,2 Cynoglossum,1 Umbelliferae,2 Gentiana pneum.
Comp. lig. 0.4%,Umbelliferae 0.4%, Potamogeton 0.4%,
2 Alnus,4 Betula,3 Pinus,1 Salix,2 Quercus,7 Gramineae,1 Cyperaceae,23 Cynoglossum,1 Ilex,2 Sphagna,1 Gentiana pneum.,3 Comp. tub.
Typha lat. 0.4%
1 Pinus,1 Ulmus,1 Ericales,4 Gramineae,1 Typha ang.t.,3 Cynoglossum,1 Filices,2 Ranunculus,7 Gentiana pneum.



Menyanthes. This is phase LW Ic, the Older Dryas stadial. The Allerød oscillation, LW II, starts with a lime gyttja and is characterised by an increase in *Betula* and *Juniperus* and a decrease in herb pollen. The toplayer of the Allerød sediments is formed by *Hypnaceae* peat. Younger Dryas (LW III) is not represented. The spectrum at 0.70 m is probably contaminated with younger pollen.

Diagram II comes from the border part and diagram III from the basin part of the valley. Both diagrams show alternating sedimentation of lime gyttja and hypnaceae peat.

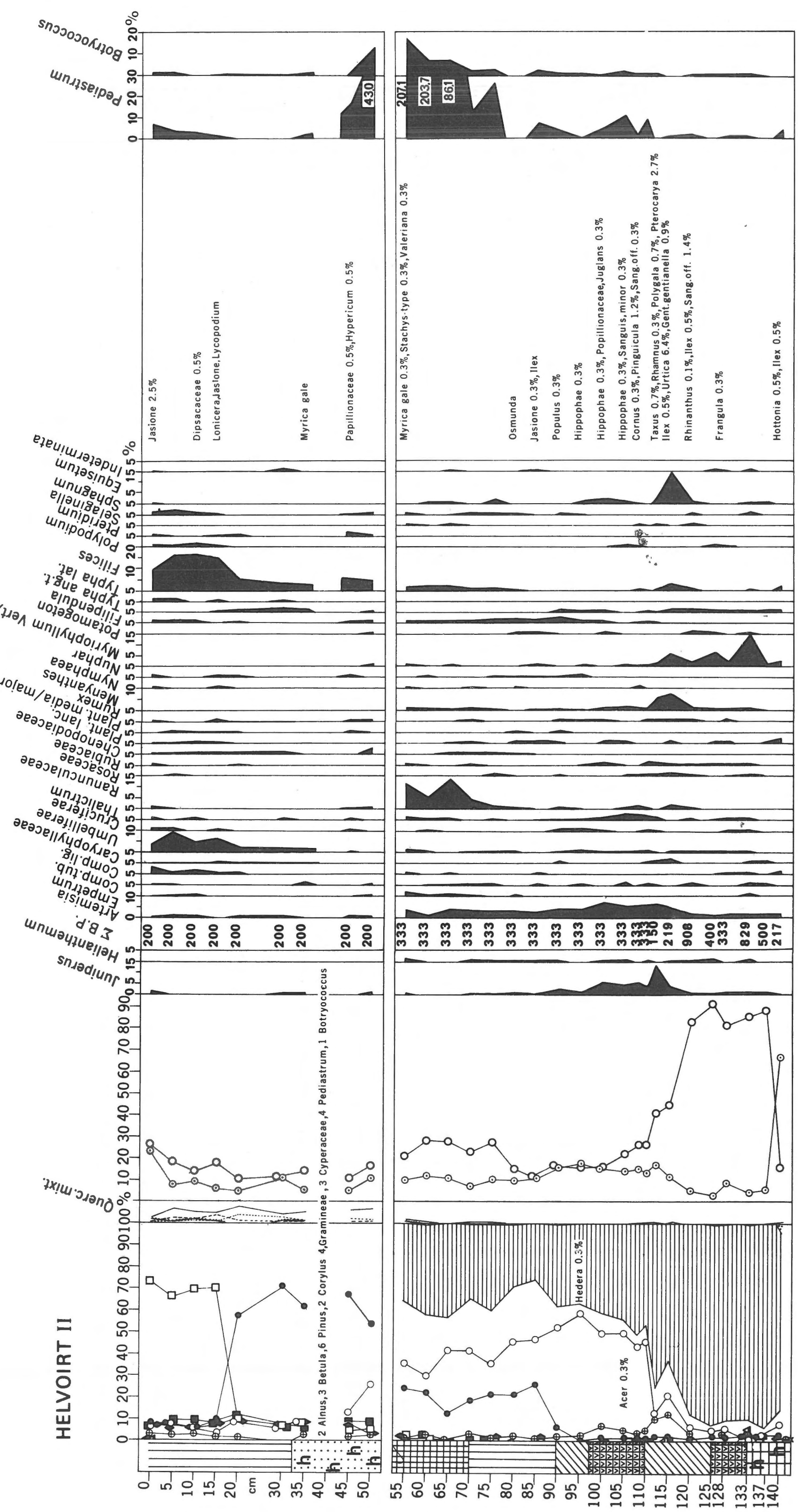
The spectra from 1.37 up to 1.10 m in diagram II and from 1.25 up to 0.80 m in diagram III cover the LW I. The Allerød oscillation (LW II) is present in diagram II at 1.10-0.70 m and in diagram III at 0.80-0.50 m. In both diagrams the Allerød starts with high values for *Artemisia* and *Juniperus* (in diagram III *Juniperus* even reaches 25% of the pollen sum). It is a remarkable feature that diagrams I and III, originating from the basin part of the valley, show very low *Pinus* values whereas the border diagram II shows a sharp increase of *Pinus* immediately above the hypnaceae peat at 0.90 m. Obviously local vegetation must have had an important influence on the spectra of the wet parts of the diagrams. The upper layer of the Late Weichselian deposit is an algae gyttja in diagram II and a hypnaceae peat in diagram III. Both parts may represent the Younger Dryas stadial. In both diagrams there is a hiatus between LW III and the following Holocene spectra.

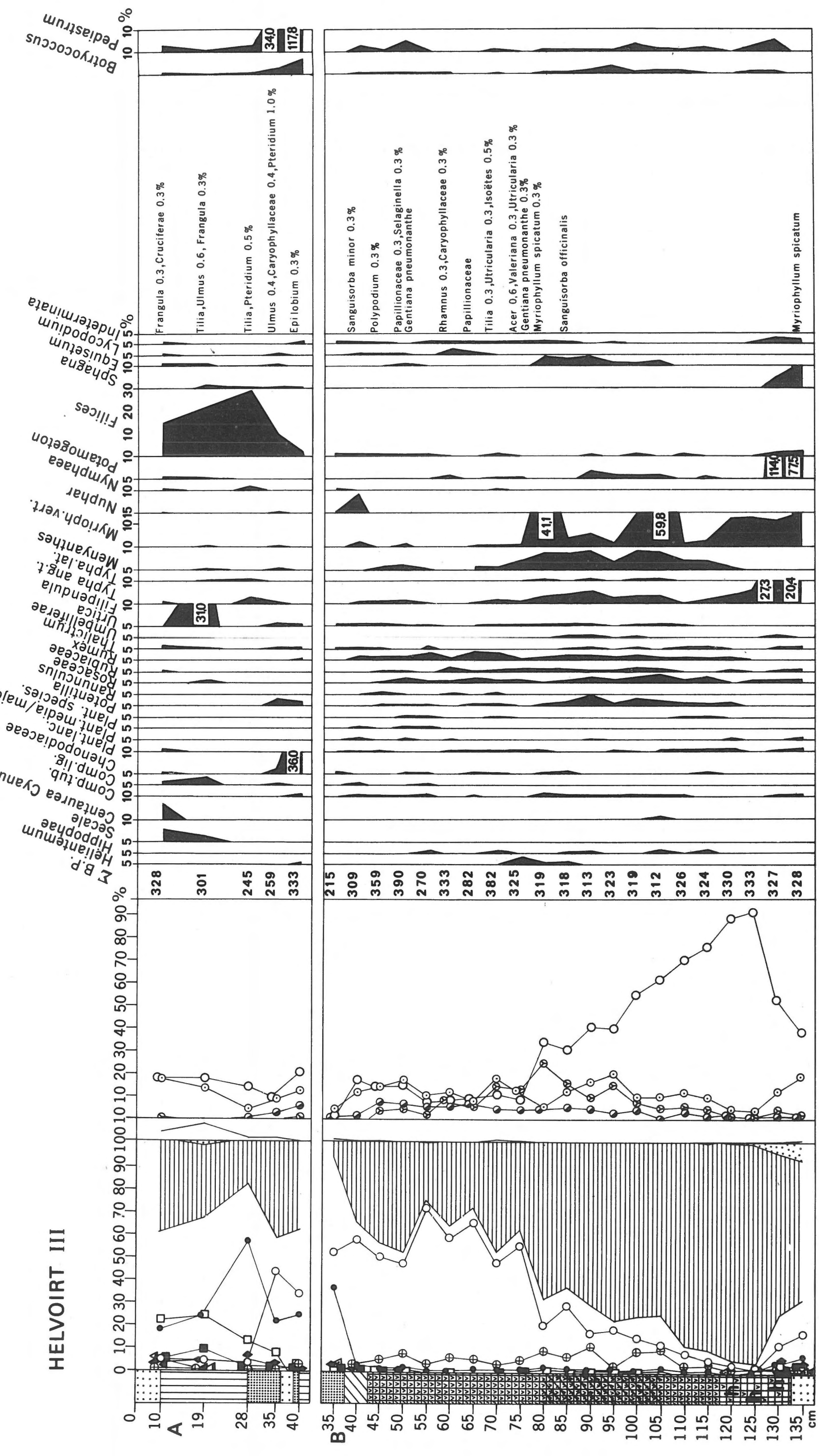
Holocene

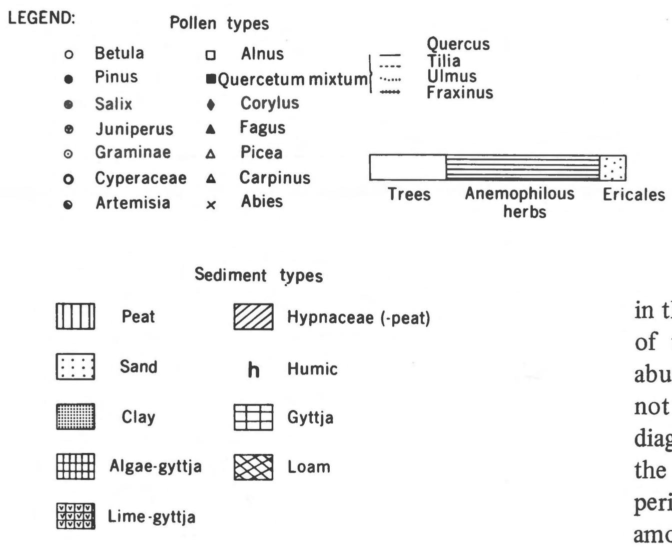
The Holocene starts with sedimentation of sand and clay and with a *Pinus* dominance. It will not be discussed.

CONCLUSIONS

The following suppositions can be made about the Helvoirt river valley. The undisturbed podzol profile under what is nowadays the middle of the valley indicates that the valley had not yet been formed in the Eemian period. The valley will probably have its


HELVOIRT II
2 Alnus, 3 Betula, 6 Pinus, 2 Corylus 4, Gramineae, 3 Cyperaceae, 4 Pediastrum, 1 Botryococcus
Hedera 0.3%
Acer 0.3%
Querc.mixt.
Juniperus
Helianthemum
Σ B.P.
Artemisia
Empetrum
Comp.tub.
Comp.lig.
Caryophyllaceae
Umbelliferae
Cruciferae
Thalictrum
Ranunculaceae
Rosaceae
Rubiaceae
Chenopodiaceae
Plant. lanc.
Plant. media/major
Rumex
Menyanthes
Nymphaea
Nuphar
Myriophyllum Vert./spic.
Potamogeton
Filipendula
Typha ang.t.
Typha lat.
Filices
Polypodium
Pteridium
Selaginella
Sphagnum
Equisetum
Indeterminata
Pediastrum
Botryococcus
Jasione 2.5%
Dipsacaceae 0.5%
Lonicera, Jasione, Lycopodium
Myrica gale
Papilionaceae 0.5%, Hypericum 0.5%
Myrica gale 0.3%, Stachys-type 0.3%, Valeriana 0.3%
Osmunda
Jasione 0.3%, Ilex
Populus 0.3%
Hippophae 0.3%
Hippophae 0.3%, Papilionaceae, Juglans 0.3%
Hippophae 0.3%, Sanguis. minor 0.3%
Cornus 0.3%, Pinguicula 1.2%, Sang.off. 0.3%
Taxus 0.7%, Rhamnus 0.3%, Polygala 0.7%, Pterocarya 2.7%
Ilex 0.5%, Urtica 6.4%, Gent. gentianella 0.9%
Rhinanthus 0.1%, Ilex 0.5%, Sang.off. 1.4%
Frangula 0.3%
Hottonia 0.5%, Ilex 0.5%
430
207.1
203.7
86.1
cm


HELVOIRT III
A
B
cm
Σ B.P.
Helianthemum
Hippophae
Secale
Centaurea Cyanus
Comp.tub.
Comp.lig.
Chenopodiaceae
Plant.lanc.
Plant.media/major
Plant. species.
Potentilla
Ranunculus
Rosaceae
Rubiaceae
Rumex
Thalictrum
Umbelliferae
Urtica
Filipendula
Typha ang.t.
Typha.lat.
Menyanthes
Myrioph.vert.
Nuphar
Nymphaea
Potamogeton
Filices
Sphagna
Equisetum
Lycopodium
Indeterminata
Botryococcus
Pediastrum
Frangula 0.3, Cruciferae 0.3%
Tilia, Ulmus 0.6, Frangula 0.3%
Tilia, Pteridium 0.5%
Ulmus 0.4, Caryophyllaceae 0.4, Pteridium 1.0%
Epilobium 0.3%
Sanguisorba minor 0.3%
Polypodium 0.3%
Papillionaceae 0.3, Selaginella 0.3%
Gentiana pneumonanthe
Rhamnus 0.3, Caryophyllaceae 0.3%
Papillionaceae
Tilia 0.3, Utricularia 0.3, Isoëtes 0.5%
Acer 0.6, Valeriana 0.3, Utricularia 0.3%
Gentiana pneumonanthe 0.3%
Myriophyllum spicatum 0.3%
Sanguisorba officinalis
Myriophyllum spicatum
328 301 245 259 333
215 309 359 390 270 333 282 382 325 319 318 313 323 319 312 326 324 330 333 327 328
31,0
36,0
34,0
117,8
41,1
59,8
27,3
20,4
114,0
77,5



origin in the late Eemian and in the early Weichselian periods. These periods are represented by no more than 60 cms of sediments, so erosion had taken place. With the Late Weichselian flora definite wet conditions and an almost lacustrine milieu occurred, which points to the closure of the northern part of the valley by a W-E coversand ridge, probably originating from LW Ia or a bit earlier. The valley maintains its lacustrine milieu until the LW III. Between LW III and the following Holocene deposits is a hiatus that indicates an erosion phase. The sand and clay sediments at the base of the Holocene deposits also point to increased valley-forming activity in this period. In the younger part of the Holocene the wet milieu of the valley was suitable for peat formation.

It is clear that the sedimentation of lime gyttja in this river valley is not restricted to a special phase of the Late Weichselian. Alternating sedimentation of lime gyttja and hypnaceae peat depends on the moisture regime. It is striking that in the diagrams a warmer (wetter) oscillation frequently starts with the deposition of lime gyttja and that the formation of hypnaceae peats occurs in the drier Dryas stadials. Such phenomena are to be expected especially on the borders of basins.

A parallel can be drawn in this regard with two diagrams of old Meuse valleys near Meerlo (Limburg) (unpublished).

In the first diagram (Gunhof) the Allerød starts with a lime gyttja deposit, changing into a hypnaceae peat (in this case only composed of *Hypnum* species) in the Younger Dryas. The spectrum from the bottom of the *Hypnum* peat represents a pine forest with abundant *Filices.* In the lime gyttja aquatic plants do not exceed 15% of the pollen sum. In the second diagram (Legert) the growth of *Hypnum* peat starts in the Bølling and continues throughout the Boreal periods. Wet periods are characterised by fair amounts of aquatic plants (over 50%). While *Hypnum* here is the undergrowth of a pine forest, the *Bryum* from Helvoirt is a lacustrine border vegetation. The author wishes to suggest that in future *Hypnaceae* in sediment columns be always split up into the genus.

ACKNOWLEDGEMENT

The author is indebted to Dr. W.H. Zagwijn for checking the division of the diagrams. The diagrams were drawn by mr. G. Buurman and mr. H.T.H. Jansen. Photographs were made by mr. Z. van Druuten. Mr. A. op 't Hof and mr. R.H. de Bock helped in collecting the soil peels. The english text was corrected by mrs. D.A. Koop.

BIBLIOGRAPHY

Havinga, A.J. (1963) – A palynological investigation of soil profiles developed in cover sand. Med. Landb. Hogesch. Wageningen. 63-1.
(1964) – Investigation of the differential corrosion susceptibility of pollen and spores. Pollen et Spores 6, 2, p. 621-635.

Oosten, M.F. van (1967) – Bijdrage tot de kwartairgeologie van westelijk Noord Brabant. Geologie en Mijnb. 46, p. 131-146.

Polak, B. (1963) – A buried Allerød pine forest. Acta. Bot. Neerl. 12, p. 533-538.

Teunissen, D. and H.G.C.M. van Oorschot (1967) – De laatglaciale geschiedenis van het verwilderde riviersysteem ten zuidwesten van Nijmegen. Geol.Mijnb. 46, p. 463-470.

Zagwijn, W.H. (1961) – Vegetation, climate and radiocarbon datings in the late Pleistocene of the Netherlands. Med. Geol. St. N.S. 14, p. 15-45.