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A BURIED ALLERØD PINE-FOREST

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In the month of May 1960 we received a message that a fossil pine forest had been uncovered at the bottom of a sand-pit on the farm "Zandhorst" near Helvoirt in the province of North-Brabant. Unfortunately bulldozers were got in readiness to level the excavation with the utmost speed, so that only a few hours were left for observation and sampling.

As may be seen from Fig. 1, the farm is situated on coversand at

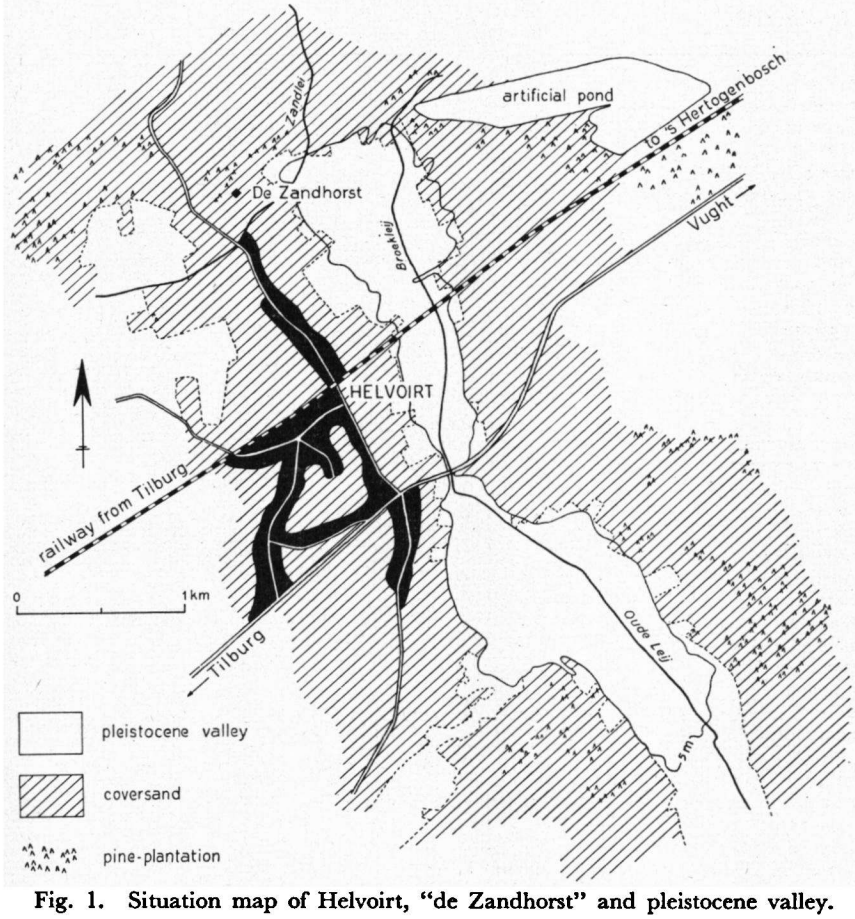

Fig. 1. Situation map of Helvoirt, "de Zandhorst" and pleistocene valley.

the border of an ancient pleistocene river valley, the course of which could be seen as a slight depression in the landscape.

A layer of 3 meters of coversand had been removed, thus exposing the filling-up of the valley with peat. Embedded in this peat, mainly consisting of *Hypnaceae*, were a great quantity of pine stems together with masses of cones. The latter looked whole and fresh as if they were recently grown (Plates 1 and 2, see opposite page 536). Wood and bark of birch and *Phragmites*-leaves and stalks occurred too.

Many of the stems showed signs of burning and scorching; lumps of charcoal could be gathered easily (Plate 2). It seemed very likely that the Allerød forest, so frequently represented in Late-Glacial diagrams, was lying under our feet in situ. No other wood than pine and birch was to be seen, thus showing the source of the pine-birch dominance in the Allerød pollen diagrams.

TABLE TO DIAGRAM I

Helvoirt I	Depth in cm														
	2	11	20	30	40	50	60	70	80	90	100	109	117	125	131
Ephedra															0.3
Hippophaë									0.3						
Thalictrum			0.6	0.4	0.8		0.5	0.9	0.6	3.0			1.0	1.8	
Rumex													0.6	0.6	
Eurumex															0.2
Chenopodiaceae	0.3			0.2						0.3	0.3		0.6	0.3	
Littorella				0.6	0.2				0.3						
Juniperus	0.3			0.2	0.8		0.5		0.3	0.9	0.6	0.3	0.3	0.6	
Filipendula	0.6	0.3	0.3	1.4	1.2		0.5	0.3	0.6	0.3		0.3	0.3		
Compositae tubuliflorae							0.3	0.3			0.3		0.3	0.3	1.1
Compositae liguliflorae				0.2						0.3					0.4
Caryophyllaceae															0.2
Umbelliferae	0.6	0.3	0.3	0.2	2.6		0.8	0.3	2.1	0.9	0.6	0.6	0.3	0.6	
Jasione														0.3	
Ranunculaceae				0.2										0.3	
Potentilla-type		0.3			0.2							1.2		0.3	
Galium				0.6		0.2	0.8		0.3	0.6		1.2	0.3	0.3	0.2
Labiatae	0.3	0.3						0.3			0.3				
Valeriana							0.3								
Epilobium		*		0.2											
Sanguisorba officinalis					0.2										
Menyanthes	0.3	5.4	1.5	3.0	0.6	2.9	3.0	7.5	4.5		0.6	0.3		0.9	
Nymphaea	1.2	0.9	8.7	3.4	1.0	0.2								0.3	
Nuphar	0.3						0.3			8.1			0.8		
Potamogeton					0.4										
Typha augustifolia				0.2	0.4		0.3		0.3	1.2		0.3	0.3		0.2
Dryopteris thelypteris-type	0.6								0.3			0.3			
Equisetum				0.8	0.8	1.0	0.5	0.3	1.5	49.8	0.6	3.9	8	10.2	0.4
Selaginella selaginoïdes												0.6			
Sphagna		0.6		0.6	0.8			0.6	0.3				0.3	0.3	2.2
Indeterminata				0.2							0.9	0.3			

However the diagrams leave no doubt about the composition of the vegetation during the Allerød period, the forests themselves never have been encountered.

Another wide-spread phenomenon is the occurrence of a thin layer of fine charcoal particles in the younger coversand, the Usselo layer. VAN DER HAMMEN (1951) states that this charcoal originates from *Pinus*. He also mentions half-carbonized tree trunks in peat from the Allerød period.

Forest-fires occurring probably more than once must have caused this, but whether the fires were natural (lightning) or artifical (in-

TABLE TO DIAGRAM II

Helvoirt II	Depth in cm														
	6	16	26	36	46	56	66	76	86	96	106	115	124	133	142
Ephedra distachya														0.3	
Hippophaë	0.3								0.3						
Thalictrum		1.1	0.6			1.2	0.6	0.6		0.3		0.3	0.3	0.6	
Rumex												1.3			
Chenopodiaceae				0.3						0.3	0.6	0.3	0.3		0.3
Littorella		0.9	0.3									0.3			
Plantago species		0.6			0.3			0.3	0.3			0.3	0.3		0.6
Juniperus		2.3	0.3		0.6	1.2	0.6	2.7	0.6		0.6	1.3		1.3	0.3
Parnassia														0.3	
Filipendula		2.0			0.3	0.6	0.3								
Compositae tubuliflorae		1.1		0.3			0.6	0.3		0.3	11	0.3			1.2
Compositae liguliflorae				0.3									0.3	0.3	
Caryophyllaceae															0.3
Umbelliferae		0.6	0.3		0.6	0.9		0.6		0.6				0.6	
Cruciferae															0.3
Campanulaceae						0.3									
Ranunculaceae		0.6	0.3									1.3			
Potentilla-type		0.3				0.6	0.3	0.6	0.3	0.9					
Galium		0.6	0.6	0.3	0.6	0.6	0.9	0.6	0.3					0.3	
Boraginaceae															0.3
Valeriana		0.3													
Sanguisorba minor					0.3		0.3	0.3							
Sanguisorba officinalis												0.3			
Menyanthes	0.3	2.9	1.2	0.6	2.7			6.9				1.3	0.3	0.3	0.9
Nymphaea	3.3	4.0													
Nuphar	0.6	1.4	0.3		0.3	6.3						1.3			0.9
Potamogeton		1.4					0.3	0.6					0.7	1.0	
Typha augustifolia							0.3		0.3	0.6	1.8	0.7	0.7		
Dryopteris thelypteris-type				0.6		0.3	0.3		0.3		1.2			0.6	1.2
Equisetum	0.6	1.7	6.9	2.7	0.3	47.1	0.6	8.4	2.1	0.3		8.7	3.7	1.3	7.2
Selaginella selaginoïdes									0.3	1.2	37.0	21.7	2.7	0.6	
Sphagna	0.6			0.3					0.3	0.9	0.6	1.0	2.0	3.6	2.4
Lycopodiaceae					0.3									0.3	

tentional burning by Usselo men) cannot be decided. It seems likely, however, that the approaching cold of the Late Dryas-time killed a large number of pine-trees, so that the wood rich in resin became highly inflammable. The pine-birch forest at the "Zandhorst" had the appearance of having met with a rather sudden death. After one or more fires it was buried under the sand of the Younger Dryas-time.

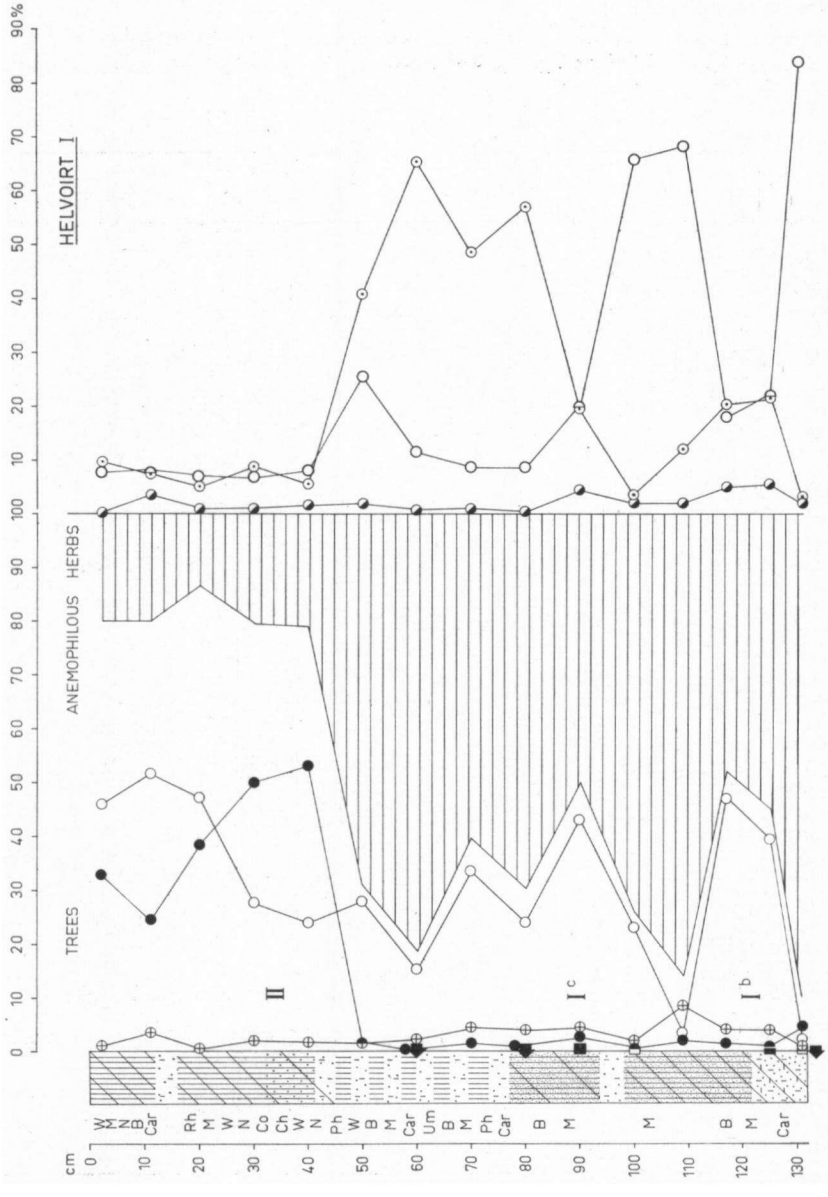

Plate 1. *Hypnaceae peat*, with pine-cones and *Phragmites*.

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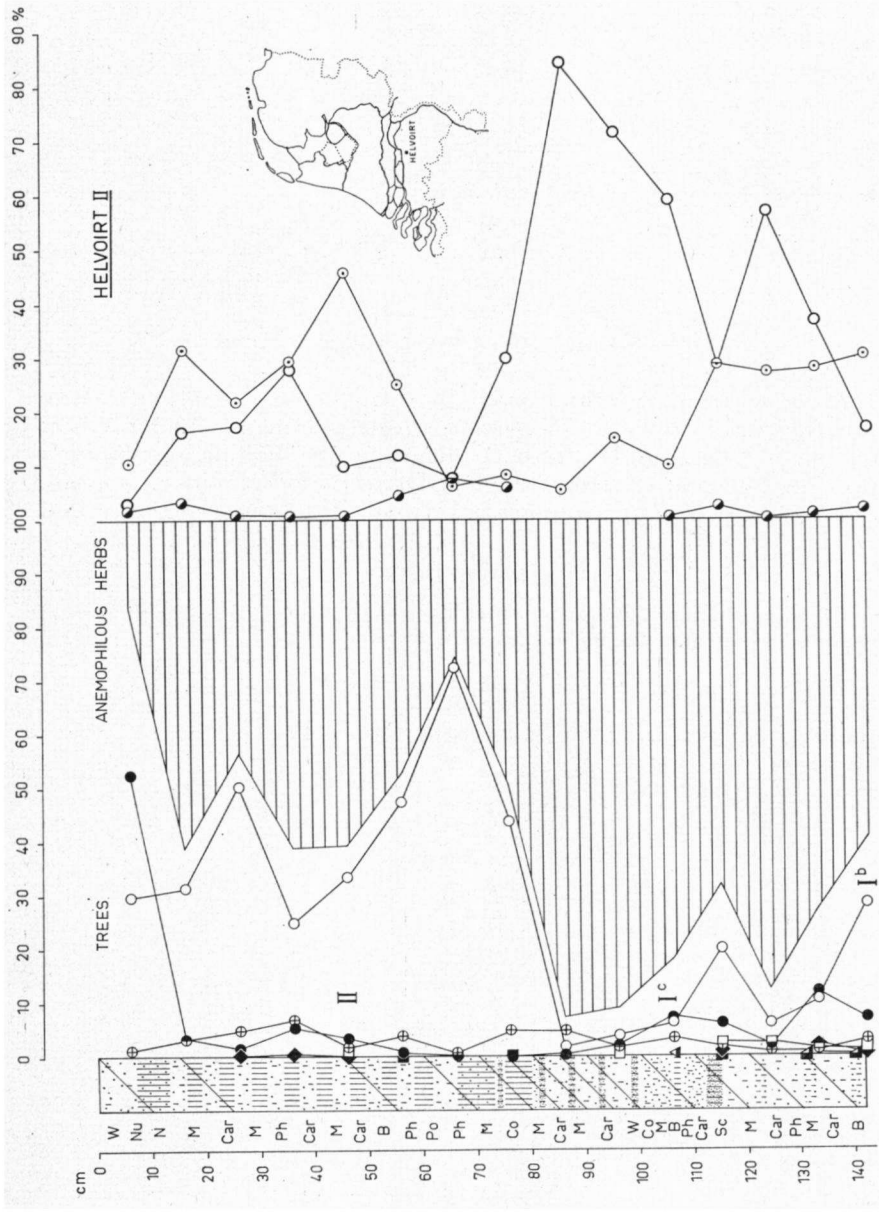
Plate 2. Pine-cones and lump of charcoal.

In order to date this forest, two borings were performed in the *Hypnaceae*-peat in which the stems were embedded. At a depth of 130–140 cm below the exposed surface the auger touched on sand.

Diagram II ends in the Allerød period at the dominance of *Pinus;* Diagram I even extends to the regression of *Pinus* and the following birch dominance.



The forests have grown on wet, marshy *Hypnaceae*-peat, in which *Phragmites*, hairs of *Nymphaceae* and *Botryococcus* occur. Pollen of *Menyanthes*, *Potamogeton* and *Typhaceae* are rather regular, *Menyanthes* often attaining high values.

Ericaceae are very scarce even in the Allerød. A special feature are the high values for *Selaginella selaginoïdes* in the Older Dryas-section of Diagram 11. In both diagrams the Bølling oscillation is present. The peat started at the first Dryas period on older coversand and was buried under younger coversand at the onset of the second.

ACKNOWLEDGEMENT

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REFERENCE

HAMMEN, TH. VAN DER. 1950. Leidse Geol. Meded. **17**: 1.