THE ELM DECLINE AND THE FIRST APPEARANCE OF PLANTAGO MAIOR [1])

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The relative decline of elm in the pollen diagrams at about 3000 B.C., which occurs throughout Western and Northern Europe and which has therefore been accepted as the boundary between the Atlantic and the Subboreal, has been the object of study by many researchers in the last quarter century. First a natural climatic cause was proposed (IVERSEN, 1941); subsequently (FAEGRI, 1944), and especially in the work of TROELS-SMITH (1953, 1955, 1960) one was increasingly inclined to attribute it to the activity of Neolithic man. In the *landnam* theory of TROELS-SMITH it was postulated that the Neolithic population kept its livestock permanently within enclosures and fed it on young elm branches, with the result that much of the elm was prevented from blossoming, and its pollen production accordingly reduced. Another noteworthy feature of the pollen diagrams, the sudden appearance of large quantities of pollen of pasture plants, including *Plantago lanceolata*, has been explained (IVERSEN, 1941) as the consequence of the so-called Plantago-*landnam*, in which forest was burnt off, grain cultivated for a number of years on the plots thus cleared, and subsequently livestock grazed on the same fields. This interpretation of the phenomena observed in the pollen diagram, originally put forwards as a purely theoretical explanation, was later tested by experiments in the Draved Skov in South Jutland (IVERSEN, 1956).

Although the landnam theory of IVERSEN was generally accepted, this did not happen with that of TROELS-SMITH. The elm decline remained the object of study and explanations were sought for example in the direction of a disastrous plant disease (SMITH, 1961; opposed by HEYBROEK, 1963). Difficult to explain in terms of human activity was the decline of the elm all over Western and Northern Europe at the same time, about 3000 B.C. The elm decline has been observed even in areas where no Neolithic occupation is known at the time; and in Ireland, which was rather sparsely populated during the Mesolithic, the elm falls from 20 % to only 1 %, which would seem to imply an absurdly large immigration or increase of population (WATTS, 1961). Although the C14 dates for the elm

[1]) Translated by Dr. J. J. BUTLER.

decline tended to vary to a considerable degree around the figure 3000 B.C. (GODWIN, 1960; VAN ZEIST, 1964) this was not considered serious enough to abandon the concept of the elm decline as a phenomenon which was more or less contemporary over large areas; and thus it was not abandoned as the criterion for the Atlantic-Subboreal boundary.

The studies of TAUBER (1965) and FRENZEL (1966) have, however, placed the elm decline in a different perspective in returning to a climatological explanation. FRENZEL postulates a cold phase of short duration between 3400 and 3000 B.C., but does not, however, answer the objections previously put forward against a decline in temperature as the cause of the elm decline (i.a. VAN ZEIST, 1959; TROELS-SMITH, 1960). TAUBER postulates the sudden appearance of a dry period at about 3000 B.C. and is able to explain practically all the phenomena associated with the elm decline, such as the rise in the curves for alder, birch, willow, hasel and oak and a slight decline of lime. TAUBER does not, however, explain the simultaneous appearance of the elm decline and the first appearance of *Plantago maior* and *Plantago lanceolata*.

Phytocenological research by WESTHOFF & VAN LEEUWEN (1966; see also VAN LEEUWEN, 1966a) has shown that in unstable boundary zones – that is to say, areas at the transition between freshwater and salt milieu, wet and dry, and poor and rich in nutrients – a vegetation appears which is not intermediate, but has its own plant community, quite different from those of the meeting extremes. The plant community that occurs in these contact zones – the Agropyro-Rumicion crispi alliance – is closely related to the tread communities of the Polygonion avicularis alliance. Both alliances are grouped in the order Plantaginetalia maioris, class Plantaginetea maioris. The Agropyro-Rumicion crispi alliance occurs in each of the above-named contact zones in geographically widely scattered parts of Western Europe. It is characterized as TÜXEN (1950) had already noted, by the unstability of the evironment.

It may be presumed, according to WESTHOFF & VAN LEEUWEN (l.c.), that these contact zones were the natural pastures of wild grazing animals. Natural pastures would have been available only along the seacoast and in river valleys, where the development of forest was hindered by unstable milieu factors.

Grazing causes compaction of the soil through the constant trampling of the surface, superficial enrichment of the soil through manuring from the dung, and the disturbane of the vegetation cover by the feeding activities of the animals. Another consequence of intensive grazing is the reduction in the variety of species and the increasing appearance of a certain number of species. Soil com-

paction, superficial soil enrichment and disturbance of the vegetation are the common characteristics of unstable contact zones (see WESTHOFF & VAN LEEUWEN, l.c.). Thus the same sort of milieu and a closely related vegetation can appear from natural causes as from trampling and grazing by man and his livestock. IVERSEN's statement that *Plantago maior* is so closely related to the appearance of man that this plant would disappear if human cultivation ceased, is untrue in view of its occurrence in naturally unstable milieus.

With this in mind we can return to the elm decline and the first appearance of *Plantago*. It is clear that even prior to the appearance of Neolithic man a vegetation occurred in naturally unstable areas in which certain Plantaginaceae and other so-called weeds of cultivation occurred. If one speaks of the first appearance of *Plantago maior* and *Plantago lanceolata* at about 3000 B.C., one is actually referring to their first appearance in the pollen diagram subsequent to the Late Glacial. GODWIN (1956, pp. 167—168) even reports a number of finds of both *Plantago maior* and *Plantago lanceolata* dated prior to the elm decline and the Neolithic invasion of the British Isles (see also DONNER, 1963; VAN ZEIST, 1964, who interpreted the occurrence of *Plantago lanceolata* in Breton pollen diagrams before the elm decline either as glacial relicts or as indicators of the presence of Neolithic man already before the elm decline).

The occurrence of Plantaginaceae in the pollen diagram often contemporaneously with the elm decline can have two different causes – which may, however, also appear simultaneously.

a. Neolithic man was indeed present; and since according to TAUBER (1965), the pastures and fields would in a dry period have lain closer to the margin of open water, the possibility that the pollen grains of weeds of cultivation would come to rest there would have been greater.

b. Since, at least in the Northern temperate zone, a dry climate is usually also an unstable climate [1]) (wet periods concentrated in a few months of the year or in particular years), it is possible for the Agropyro-Rumicion crispi alliance which is characteristic for an unstable milieu to spread during a short-time alternation of dry and wet periods.

Thus, the appearance of pollen grains of *Plantago maior* and *Plantago lanceolata* in the pollen diagrams contemporary with the elm decline is, unless accompanied by pollen of Cerealia and archaeological material, not necessarily an indication of the presence of Neolithic man in the immediate vicinity.

For the elm decline in the Netherlands there is, at any rate in

[1]) As suggested verbally by Professor Dr. V. WESTHOFF.

our present state of knowledge, no need to invoke an anthropogenic cause. It has not in fact been possible so far to find a Neolithic culture in the Netherlands which was present at the time and could therefore be held responsible for the decline of the elm curve. The Bandkeramik Culture, with C14 dates about 4200 B. C., had already long disappeared, and in any case was only present in the extreme South of the country. Remains of the Rössener Culture, although present just beyond the Dutch border, were surely not present in such great quantity that the elm decline could have been caused by this culture. VAN ZEIST (1955) postulated a Neolithic occupation about 3000 B.C. in the Emmen region, which has subsequently been eagerly looked for. But the undecorated pots with round bottoms found in a flat grave under *hunebed* D20 and typologically earlier than two funnel beakers of the Drouwen [1]) phase of the Funnel Beaker Culture (TRB) from a flat grave under *hunebed* D32, which are C14 dated to 2640±80 B.C. (GrN 2226) (VAN GIFFEN, 1961) [2]) are too feeble an indication of a premegalithic phase of TRB in the Netherlands as early as 3000 B.C. (VAN GIFFEN & GLASBERGEN, 1964), or of the presence of a population which could be held responsible for the occurrence of the elm decline in the pollen diagrams from the Emmen area (VAN ZEIST, 1955; 1959).

SUMMARY

The appearance of pollen grains of *Plantago maior* and *Plantago lanceolata* in the pollen diagrams before and contemporary with the elm decline is, unless accompanied by pollen of Cerealia and archaeological material, not necessarily an indication of the presence of Neolithic man in the immediate vicinity, because of the occurrence of the Agropyro-Rumicion crispi alliance, order Plantaginetalia maioris in naturally unstable contact zones.

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[1]) The earliest certainly megalithic phase of the TRB in the Netherlands.

[2]) For correction of the C14 dating see VOGEL & WATERBOLK, 1963.

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