SOME REMARKS ON THE INTERPRETATION OF A POLLEN DIAGRAM OF A PODSOL PROFILE

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SUMMARY

Two different interpretations of a pollen diagram of a podsol profile described by HEIM (1966) are compared, viz. the latter's interpretation and that preferred by the present author. Unlike Heim, the present author attaches, among other things, great significance to the effect of biological activities on the pollen distribution in a sandy soil.

The interpretation of a pollen diagram of a podsol profile necessitates close consideration of each of the various processes contributing to the development of a pollen profile in a sandy soil. These are: mixing of pollen in the soil as a result of biological activities, downwash of pollen into the soil, simultaneous eolic sedimentation of pollen and sand, (differential) destruction of pollen, and arbitrary overrepresentation (HAVINGA 1962, 1963).

By overlooking the effect of one or more of these factors we may easily obtain a distorted or completely wrong interpretation. I will try to demonstrate this by discussing J. HEIM's article "Analyse pollinique d'un podsol à Hergenrath". I will give both the author's and my own preferred interpretation, thereby enabling the reader to make a comparison and form his own opinion, which might in turn be brought up for discussion.

The description of the profile is as follows: 0–6 cm, recent sand deposit; 6–23 cm, drift sand; 23 cm, top of the buried podsol profile; 23–31 cm, brown A_1-horizon; 31–76 cm, grey A_2-horizon, enclosing between 37.5 and 45 cm mesolithic artefacts dating from c. 7000 B.C. (Preboreal-Boreal); 76–81 cm, black humic B-horizon; 81–83 cm, dark reddish brown ferric B-horizon; 83–86 cm, transitional B-C-horizon.

The pollen diagram given in the article, which goes as far as 57.5 cm below the sand surface, shows among other things the following essential features. All spectra are of Subatlantic age; *Fagus* generally dominates in the covering drift-sand layer and the podsol profile, *Tilia* is only slightly represented in the drift-sand layer and the uppermost 5 cm of the podsol profile, 6 cm beneath the top of the latter *Tilia* makes a sudden advance and below fluctuates between 6 and 15%.

Between 60 and 87.5 cm, 12 samples were analysed in which the pollen concentration was so slight that the author was unable to calculate any further spectra from the data obtained; in the article they are shown as absolute numbers.

Heim's conclusions are as follows: The mesolithic artefacts in the soil occur on top of a former brown forest profile, the top and pedological characteristics of this profile being invisible in the present podsolized soil. The brown forest profile and the artefacts were covered by sand of probably eolic origin. The complex brown forest profile + drift-sand layer then podsolized as a whole, resulting in the podsol profile now found under the more recent 23 cm drift-sand layer. The A_2-horizon of the podsol profile developed unhampered by the presence of the original soil surface or cultural remains. After the podsolization was complete pollen infiltrated into the soil, resulting in a pollen profile represented by the pollen diagram.

Heim also poses the following questions: Why are no spectra found corresponding to a mesolithic age? Why did pollen infiltrate to below the archeological horizon? Why did the former soil surface, corresponding to the top of the brown forest profile, disappear altogether?

My own observations are as follows. The data of the 12 samples below 57.5 cm, excluded from the pollen diagram because of the very slight pollen totals, may be profitably added, giving a pollen total permitting the construction of a reliable spectrum. Even if we exclude the data of the samples between 60–72.5 cm and 75–87.5 cm occurring in the A_2 and B-horizon respectively, the pollen totals afford some insight into the pollen floras at the respective depths, as is shown in table 1.

Table 1. The pollen spectra at 55, 60–72.5 and 75–87.5 cm.

Depth	Percentages of Σ AP							Σ AP	Perc. of PT
	Alnus	Betula	Corylus	Fagus	Pinus	Quercus	Tilia		Σ NAP
55 cm	8	18	19	38	–	5	12	168	20
60–72.5 cm	8	12	34	8	–	4	34	24	72
75–87.5 cm	7	6	14	–	3	1	69	83	27

The lowest spectrum of this table with a very high *Tilia* percentage and no *Fagus*, apparently dates from the Atlantic period. It resembles spectra of the same age in the A_2 or B-horizon of several podsol profiles (Peel I-IV) in the Dutch province of Noord-Brabant, not far from the Belgian border, which I analysed myself. In two of the profiles these spectra link up below with typical Boreal spectra. Atlantic spectra with very high *Tilia* percentages were also encountered by DRICOT (1961) when analysing a podsolized sandy soil in the Campine in Belgium.

Before going on to interpret the now more complete pollen diagram, a few remarks may be appropriate on the theoretical development of a pollen profile in a sandy soil. In a soil with intense biological activity, such as a brown forest soil, pollen will be mixed in the soil to a depth equal the active depth of the soil fauna. As intense biological activity will also cause severe pollen corrosion and destruction, pollen infiltrating the soil during a certain period of the Holocene will gradually replace that which entered the soil during the previous period. If the biological activity declines, as in a brown forest soil gradually degrading to a podsolized soil, the depth to which pollen is mixed in the soil decreases and there is no further "rejuvenation" of the deeper spectra. In fact, being out of reach of the zone of severe pollen corrosion they are to some extent preserved. At the same time downwash of pollen will become a relatively more important process.

Bearing in mind these theoretical considerations, we arrive at the following interpretation of the pollen diagram. It can be seen from the lowest (75–87.5 cm) spectrum in table I that a forest substantially consisting of *Tilia* originally existed on the site of the profile investigated probably as early as the Atlantic period. It probably succeeded a Boreal forest of a different composition of which no pollen is left in the soil. A brown forest profile developed in the forest floor. Before the immigration of *Fagus* during the Subboreal, the depth of the zone of biological activity declined somewhat. "Rejuvenation" of pollen spectra during the periods when *Fagus* became or was a main constituent of the forest left the lowest spectrum unchanged. The severe soil degradation resulting in the development of the present podsol profile did not occur before the Subatlantic period. During this period the biological activity declined more rapidly, whereas its depth of occurrence in the soil declined proportionally, leaving behind ever younger spectra which were preserved. In addition to the latter process there was a downwash of (younger) spectra in the upper part of the soil profile. In this way the changes in vegetation during the Subatlantic were recorded; these can be read from Heim's diagram. The diagram clearly shows a gradual replacement of forest by an open heath vegetation, a change related to the podsolization process.

The intense biological activity during the phase of the brown forest profile had a further effect, viz. vertical transport of sand particles. They were brought by the soil fauna onto the soil surface and the archeological remains. In this way the latter gradually sank into the soil (SCHEFFER & SCHACHTSCHABEL 1966, p. 109). During the podsolization of the soil this process declined, leaving the remains at the depth at which they are now found, among the Subatlantic pollen spectra.

After the soil had podsolized and before the drift-sand layer was deposited above 23 cm, pollen infiltrated as a result of downwash only. Consequently the composition of the spectra in the upper part of the A_1-horizon is much the same as that of the spectra in the covering drift-sand layer (little *Tilia*, much NAP).

The abnormally high NAP percentage (72%) in the spectrum at 60–72.5 cm *(table 1)* is due to an intense accumulation of spores at 60 cm, viz. 43 spores to 5 tree and 4 *Calluna* pollen grains. It must be attributed to arbitrary over-representation.

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