Some General Remarks on Human Impact in Pollen Diagrams

Abstract

Human impact in pollen diagrams is reflected by so-called anthropogenic indicators. These represent species that are directly connected with human activity or at least show a marked increase in the pollen diagrams in phases of human interference in the vegetation. Two groups of anthropogenic indicators can be distinguished (Behre, 1990) : primary ones, which comprise the various cultivated plants that are planted or sown intentionally, and secondary anthropogenic indicators, which also show human activities and are favoured by man and his economy in various ways, for instance the species of meadows and pastures or the weeds and ruderals.

With regard to the origin of the anthropogenic indicators, two groups can be distinguished : apophytes and anthropochores, both for the first time described in detail by Linkola (1916). The apophytes comprise species that are native in the area and were able to spread when new biotopes were created by man, while the anthropochores come from outside the area and were introduced with agriculture, with trade or in another way.

The interpretation of pollen diagrams with respect to human impact, its form and intensity has to be done very carefully. It is relatively easy in the case of cultivated plants or anthropochores, if their pollen can be identified down to species level. Major difficulties arise, however, with the apophytes as these species may represent natural stands as well as anthropogenically formed or induced biotopes.

There have been several approaches to the grouping of anthropogenic indicators in pollen diagrams and their interpretation. When pollen diagrams from different authors and different landscapes are compared, it is evident that the occurrence of the same species has been treated in different ways. This is due to the fact that many species occur in several different biotopes and plant communities. As mentioned above with respect to the apophytes, these have at least two biotopes in which they occur : their original natural habitat (often the open and frequently in undated mud zone along rivers) and a secondary habitat (fields, ruderal stands etc.). In some cases these anthropogenic indicators occur in five or six different primary and secondary biotopes. Behre (1981) has made an attempt to illustrate how the main species that are taken as anthropogenic indicators in Central European pollen diagrams spread over different forms of

field weed communities, meadows, pastures, grazed forests, and natural sites. A similar attempt, adapted to the situation in North Scandinavia, was published by Vorren (1986) (see figure 1). Here the problems of agriculture at the northern forest limit are also included. A comparison of both graphs shows that the species that can be used as anthropogenic indicators differ in different regions and that also the indicator value or direction of certain species (in this comparison *Juniperus communis, Calluna vulgaris* or the Compositae groups) change.

From this it follows that most of the species that are used as indicators of human impact cannot be attributed to only one form of agricultural economy. For each pollen diagram careful consideration is necessary to decide the meaning of the oscillations in the curves of the species serving as anthropogenic indicators. This consideration has to take such factors as climate and soil into account in addition to possible former occurrences of certain natural stands and former methods of agriculture. Even the designation of species into groups indicating arable or pastoral farming has to be done with great care and may vary between different areas and at different times. In former times with different agricultural implements and systems even *Plantago lanceolata*, now the main indicator of grassland communities, may have represented fields.

Though it is tempting to attribute each species to only one plant community according to its main occurrence for instance, this leads to incorrect interpretations. Particularly in this respect, the use of computer evaluation with its sharp classification involves a great danger of misinterpretation, if it is not done properly.

It has always to be kept in mind that many anthropogenic indicators are not represented in pollen diagrams mainly because they cannot be separated from other species on the basis of their pollen morphology or because they do not appear in the pollen precipitation because they are insect pollinated or because they are autogamous. Therefore macrofossil analyses should be included wherever possible, especially in archaeological contexts. Such analyses show which species are involved and provide important help in the interpretation of the pollen spectra. Furthermore the macro remains may provide evidence of different aspects of the former economy, for instance the cultivation of summer crops or winter cereals, or may indicate different ways of harvesting : close to the ground or ear collection.

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REFERENCES

BEHRE, K.-E., 1981, *The Interpretation of Anthropogenic Indicators in Pollen Diagrams*, in *Pollen et Spores*, 23, p. 225-245.

BEHRE, K.-E., 1990, *Some Reflections on Anthropogenic Indicators and the Record of Prehistoric Occupation Phases in Pollen Diagrams of the Near East*, in *The Impact of Ancient Man on the Landscape of the Eastern Mediterranean Region and the Near East* (BOTTEMA, S. and VAN ZEIST, W., eds.), Balkema, Rotterdam. (In print).

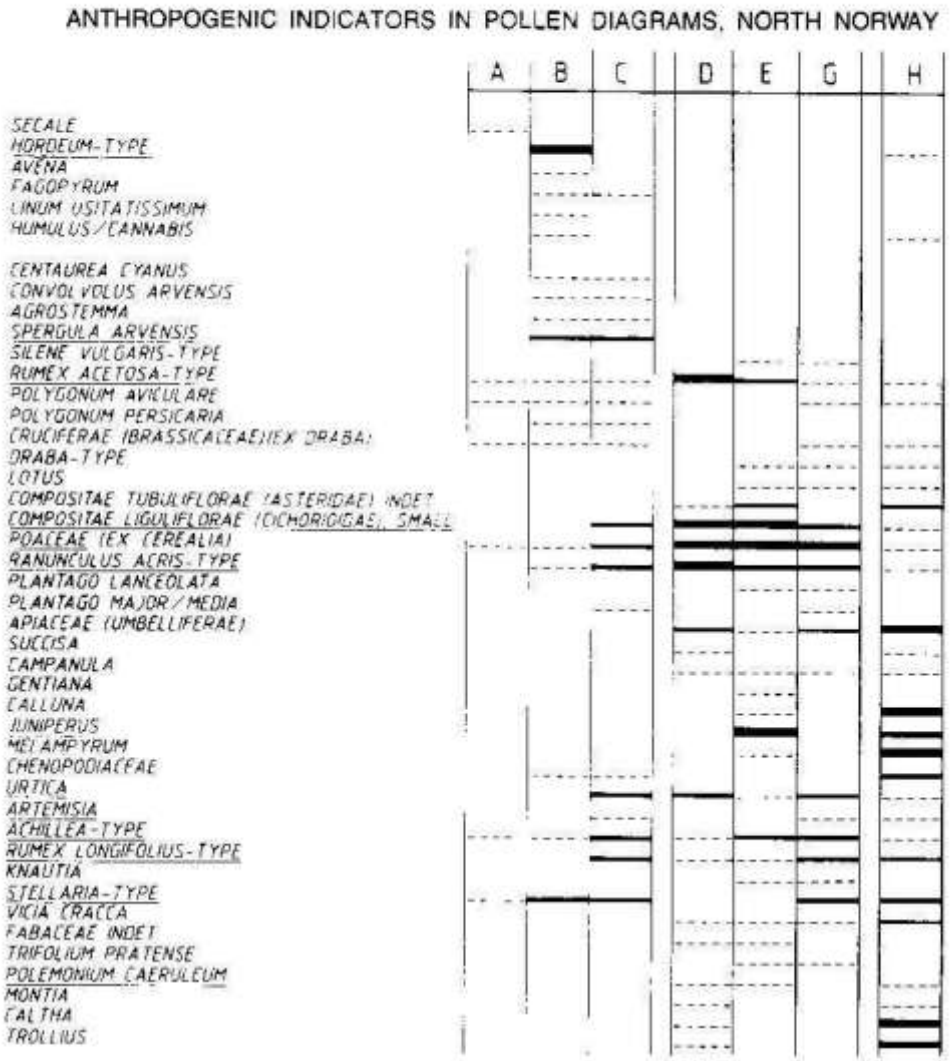

Fig. 1. Pollen taxa indicating anthropogenic activity in Northern Norway, representing areas around the northern limit in Norway and Europe. The list is tentatively arranged according to the scheme in Behre (1981). Taxa occuring most frequently have been underlined. (From Vorren, 1986).

LINKOLA, K., 1916, *Studien über den Einfluss der Kultur auf die Flora in den Gegenden nördlich vom Ladogasee. 1. Allgemeiner Teil*, in *Acta Soc. Fauna Flora Fennica*, Helsinki, 45, 1, 432 p.

VORREN, K.-D., 1986, *The impact of Early Agriculture on the Vegetation of Northern Norway - A Discussion of Anthropogenic Indicators in Biostratigraphical Data*, in *Anthropogenic Indicators in Pollen Diagrams* (BEHRE, K.-E., ed.), Balkema, Rotterdam, p. 1-18.