Palynological Research: a Useful/Unavoidable Key for Environmental Archaeology (Abstract)

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The use of pollen diagrams to detect and define anthropogenic impact has a long history in temperate northern Europe. Two main approaches are noted for identifying human impacts in pollen studies; the first is to evaluate the changes in forest composition (Amman 1988) and the second to study indicator species (Behre 1981). These techniques purport to show changes in time and space initiated by humans and are principally linked to demonstrating farming activities in the Prehistoric. Most models infer that land clearance is a key feature in detecting human impact (cf. Emanuelson 1988), therefore they rely on the presence of greater abundances of herbaceous and ruderal taxa in pollen diagrams.

Several palynological studies have resulted in the detection of human impact that either predates known archeological settlement in their study areas (Edwards 1985; Lowe et al. 1994) or post-dates archeological evidence (cf. Willis & Bennett 1994). This has created uncertainty about the compatibility of the palynological record with the archeological record and underlines the complex nature of fitting the two records together. Notable models have examined the effect of humans on the environment in terms of pollen dispersal and spatial representation of settlement (Edwards 1979; 1982), but ultimately, the detection of anthropogenic change is problematic. Many of these problems may result from the over-dependence on the indicator species approach which is highly problematic in e.g. south-east Europe (Bottema 1982). Birks et al. (1988) note the followings shortcomings as problems in pollen taxonomy from pollen-morphological limitations; representational bias due to differential pollen production and dispersal; differences in human exploitation of certain crops and environments and the problems of finding modern analogues for past floral assemblages – fundamental point also raised by Berglund (1985) Birks (1993).

The basis of much anthropogenic work emanated from northern Europe (Edwards 1982; Amman 1988) which continues to have a different flora from the Balkans; the lack of research in this latter area means that few taxa are known as useful for palaecological reconstructions. The Cerealia, for example, are wild in the Balkans (Tutin et al. 1964–1980; Zohary and Hopf 1988; Huttunen et al. 1992) thus any attempt to scan specifically for them as agricultural indicators is without merit and contrary to the arguments advocated by Edwards et al. (1986) and other authors. The presence of cereals would imply a mixed economy at best; they would not necessarily indicate the initiation of agriculture (sensu Bottema 1982) nor the dominant landuse on the cultural landscape. Birks et al. (1988) have shown the benefits of considering the whole assemblage in defining human impact from pollen diagrams which the later presented environmental archaeological case studies do.

The underlying problem therefore lies in fitting archeological statements to vegetational change questions. Willis & Bennett (1994) also discuss the fundamental difference between the archeological records and the palaecological records. The knowledge that humans became active farmers in the past 10,000 years has altered the interpretation of some taxa present in pollen diagrams. The cultural assemblage, as an anthropogenic indicator, is based on a temporal relationship to any noted postglacial vegetational effect. In defining impacts, therefore, the basis is solely on the coincidence of change and the perceived belief that humans must have affected the vegetation because humans had the ability to do so. Questions of settlement pattern (i.e. nucleated, riverine, dispersed), function, population density and the area influenced by prehistoric settlements would clarify some of these issues when combined with palaecological interpretations. Whilst direct integrated studies with archeological sites are desirable (Berglund 1985; Edwards 1985), the detection of anthropogenic impacts would seem more complex then a casual relationship between humans and effect. The ability therefore to ask the right questions and apply appropriate hypotheses is paramount and dispels loose interpretations that may have generated the apparent incompatibility between the archeological record and the palaecological record.

Several environmental records from Hungary possess certain features that make interpretation difficult. One factor is that the diagrams produced from the middle of the Carpathian Basin are at variance with others from the surrounding regions e.g. northern Balkans (Willis et al. 1994), the Carpathian mountainous region (Rybniček & Rybníčková, 1989) or the Alps (Drescher-Schneider 2000). For example, the rise in beech and hornbeam is considerably later than the northern Balkan sites (Willis 1994). The difference in terms of forest composition and species turnover together with lack of compatibility from sites suggest that the different climatic influences have significantly influenced the local vegetation in Hungary. A further related difficulty is that in most of the cases no established trend is noted in determining anthropogenic change. Often pollen data show a continual presence of traditional northern European anthropogenic indicator species (Behre 1981) from the beginning of the Holocene upwards or the anthropogenic interpretation of these taxa does not fit with the archaeological evidence for indicating agricultural activities.

Questions are therefore raised on the ways of deciphering the influence of various effects on the woodland; how can human impact be separated from climatic change effects? Can autogenic succession be identified in woods interfered with by humans? And what distinguishes human impact from natural forest succession?

The absence of known archeological settlements can make further difficulties in interpreting pollen, geochemical, sedimentological, and charcoal results. In most of the cases there are some hypotheses being tested that can help us to answer the above questions.

1) Periods of anthropogenic activity are associated with periods of higher palynological richness and periods of soil erosion:

This hypothesis assumes that human activity will extend and increase the number of vegetational mosaics in the pollen source area thereby allowing a change in vegetational composition of the catchment area. A further assumption is that soil erosion will result from anthropogenic interactions with the landscape on a local scale allowing the transport of detritus into the basin.

In that case an important consideration is the degree of stratigraphic resolution. It can happen that the diagram shows varying palynological richness values and sediments indicate active erosion in the basin, but the resolution is too poor (e.g. 150–200 years/level) to lay any certainty on the results. Periods of slash and burn would therefore be undetectable unless there was substantial vegetational disturbance in the local area around the basin and sustained permanent clearances over many generations of Prehistoric people.

2) Charcoal concentrations are a function of the intensity of human impact:

This hypothesis is difficult to implement due to the acknowledged multitude of origins for charcoal e.g. in lake profiles (Clark 1988; Clark et al. 1989). It assumes that humans used fire to control the environment and that charcoal detected here is interpretable as sign of human activity such as domestic fires. Whilst past studies have shown the difficulty of correlating historical fires to charcoal profiles, they have shown that charcoal variations have been consistent with observed vegetational responses to fires.

3) The charcoal, pollen and geochemical records highlight anthropogenic activity by recording fire and erosion events and the changing and diversifying flora:

This hypothesis presents an integration and expansion of the previous two hypotheses. Whereas hypothesis one focused on palynological richness compared with soil affects and hypothesis two regarded charcoal on its own, the third hypothesis tests each affect against the other. It therefore assumes that humans will affect the environment in such a way that soil erosion is initiated, vegetational mosaics increase in abundance, that floristic changes equate to palynological changes and that fire will be directly associated with vegetational change or indicate local habitation.

One distinct problem with this hypothesis is that whilst the provenance of the pollen can be confidently assumed as local and can be spatially modeled (cf. Jacobson & Bradshaw 1981), no work has been done on defining the chemical source area for lake basins. It may result that the detrital component to the sediment is purely derived from a very local area (within a few meters of the lake edge) whilst the pollen records events from up to 30–100–1000 m away from the basin edge depending on the size of the lake (Bradshaw 1981). The apparent delay with which anthropogenic disturbance may be picked up in the pollen record compared to the archaeological record suggests that certain thresholds are exceeded; thresholds, for example in the intensity of impact and the resultant effect. In densely wooded environments subtle effects may not be noticed but in a stressed environment similar actions may not be in proportion to the palynological result. The drawback of the argument therefore is that the subtlety of anthropogenic impact may be detected in one environmental signature before it is visible in any of the others.

In several sites it is difficult to distinguish phases of anthropogenic activity if clearance is regarded as standard for signifying human activity (cf. Edwards 1979; 1988). Part of the answer therefore lies in discerning what constitutes anthropogenic impact and defining alternative ways of detecting it, such as considering the whole assemblage (Birks et al. 1988; Birks and Line 1992) and not just focusing on small facets of pollen data. Palynological response would be a better index of change than pure presence/absence of taxa. The ability to ask appropriate questions of the data is essential. Questions that address for example the relationship between humans, settlements, their land-use practices and the environment they inhabited.

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