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Summaries of papers, supplied by authors

The following is an extended summary of Richard Macphail's paper presented at Birmingham.

The soil micromorphology of tree subsoil hollows

Introduction

Most excavators and environmentalists are familiar with subsoil hollows on their sites, and frequently these are ascribed to the earlier presence of trees, on the basis of their field morphology (Limbrey 1975) and the land snails which they may contain (Evans 1972).

Such hollows are of interest to soil scientists because, on shallow soil sites on limestones particularly, they represent the deepest soil profile available for study. For example, at Hazleton long cairn, Gloucestershire, on oolitic limestone, the Neolithic palaeosol averaged some 13 cm in thickness, whereas subsoil hollows provided soil up to 46 cm in depth (Macphail 1986a). Similarly, these subsoil hollows may provide the deepest soil sequence for snail or soil pollen investigations if conditions are suitable for their survival.

Soil micromorphology has now been applied to a number of subsoil hollow features, and although complementary physical, chemical and geophysical analyses have been carried out (Macphail 1985; Allen and Macphail in press), this paper will concentrate upon the results of the microfabric studies. The latter may also suggest why data from standard laboratory analyses of bulk samples can sometimes be difficult to interpret.

Forest soils and development of subsoil hollows

Soils formed under broadleaved forest are typically Argillic Brown Earths (Avery 1980), known elsewhere as Udalfs, Luvisols or Sols Lessivés (Duchaufour 1982). When formed on thin drift or residual weathering debris of limestone, the generalised profile, from the surface down, has: a Moder (L,F) organic surface layer; a dark brown humic, biologically worked, finely structured A1 or Ah horizon; a yellowish-brown Eb or A2 horizon which my be moderately depleted of clay and iron; a brown, moderately clay-enriched Bt horizon showing clay coatings; and a reddish-brown ferruginous Beta B horizon at the weathering junction between the soil and underlying limestone (or chalk) or parent material C horizon. Initially trees tend to take root and grow in the deeper patches of the drift mantle where it overlies the irregular surface of the limestone. Enlarged tree hollows are gradually formed by the concentration of water containing reactive organic leachates which concentrate at the base of the tree and its root bole, and enhance the activity of the roots probing into the limestone.

Modern examples of the wind-throw of trees show that a hollow is formed in the soil, and that pale weathered subsoil/parent material clings to the root plate, remaining until frost and rain loosen it, or the tree decays. The hollow in the direction of the 'throw' contains disrupted brown soil, whereas the edges of the hollow as a whole slowly infill with topsoil. A discrete pattern of weathered parent material and soil is thus produced which, seen in plan, has a banana or horse-shoe shape, with brown soil infilling one side of the hollow and describing the outside circle of the feature. Brown soil also intercalates, at depth, with the wedge of pale disrupted subsoil/parent material fallen from the root plate (Lutz and Griswold 1939; Courty et al. in prep.). The slow infilling of a hollow can of course be disturbed by fauna burrowing through accumulations of soil and leaf litter. In thin sections of infilled tree hollows this faunal activity can be seen to produce a homogenised and very porous fabric as at Balksbury Camp, Hampshire (Macphail 1985). By contrast, at Hazleton long cairn and Ashcoombe Bottom, Sussex, the infills remained very heterogeneous, and fragments of the Beta B clay, the Bt and the Eb horizons were readily distinguishable (Macphail 1986b; Macphail in Allen in prep.). Soil micromorphology can thus demonstrate the physical mixing of the original horizons of the forest profile, the surviving ped fragments of which may provide the only available indications of the nature of the original forest soil cover. Obviously, bulk analyses of such heterogeneous soil material found in tree hollows will only give average measurements of clay or organic matter content.

In addition to the physical mixing of previously horizontal soil horizons, soil from the broken edges of soil fragments is readily slaked and washed down into the coarse soil fissures after rainfall. This mobilised soil is often relatively unsorted and forms coatings and infills (Bullock et al. 1985) of coarse clay, silt and fine sand.

To summarise, the post tree-throw fabric may show:

a) juxtaposed fragments of various soil horizons;
b) fragments of Bt horizons which often have clay coatings in their porosity which are not orientated to the present-day vertical and therefore relate to their forest soil ancestry; and
c) infills of poorly sorted soil in between the soil fragments.

Application

Many forest soils, especially the deeper ones, do not have obvious tree hollows, but have fabrics similar to those just described within their subsoils. For instance, a soil formed on impure (silty) limestone in the Italian Appenines, known to have been deforested in the 1940s, had such a microfabric, which can be clearly related to this phase of deforestation (Macphail in press; Courty et al. in prep.). Using examples like this and the previously described tree-throw microfabrics as a model, it should therefore be possible to look at archaeological palaeosols to see if there is similar evidence of tree disturbance that can be directly linked to human activity. For example, at Ashcoombe Bottom the presence of flint artefacts within the heterogeneous subsoil hollow may link this disturbance microfabric with Beaker Age forest clearance (Macphail in Allen in prep.). Other sites, such as the Bronze Age cairn at Chysauster (Macphail 1987) and the Neolithic rampart at Carn Brae (Macphail in prep.) in Cornwall, have similar fabrics relating to soil disruption and infills. These are quite close to the surface (20-40 cm), sometimes associated with wood charcoal, and apparently just pre-date sharply contrasting soil microfabrics associated with cultivation which occur at the soil surface. From previous studies (Romans and Robertson 1983; Macphail et al. in press) it has become evident that cultivation can produce its own specific microfabric, and at Chysauster and Carn Brae this is in the form of a homogeneous fine fabric containing phytoliths and 'Gramineae'-type (grass-derived) charcoal, within which are rounded voids (vughs) coated by very dusty clay. In these instances, the microfabric may be interpreted as suggesting that forest clearance was succeeded by cultivation, rapid archaeological burial preserving this sequence before any biological reworking could take place.

Conclusions

The study of subsoil hollows provides useful information on the early soil history, even if the original horizons only occur as fragments. Microfabrics resulting from tree-throw are not confined to subsoil hollows but may be present in all soils on which trees grew. Sometimes these fabrics, which have been equated with deforestation in modern soils, have been found in archaeological soils where supporting evidence may suggest forest clearance. Occasionally microfabrics indicative of cultivation may be superimposed on those of forest clearance.

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Dr R. I. Macphail, Institute of Archaeology, 31-4 Gordon Square, London WC1H OPY.

The Newcastle Quayside Project:

Environmental Archaeology in a Rescue Context

The Newcastle Quayside Project was set up by the Archaeological Unit for North East England to study the changing face of the river-front of the Tyne below Newcastle. Two major sites were excavated behind the present-day quayside, the first in 1984-5 and the second in 1985-6.

From the start a strict time limit had been imposed both on the excavation and on the post-excavation work, which meant that as much as possible of the environmental work had to take place during the period of excavation. The paper presented at Birmingham first discussed the advantages and problems of on-site sieving and sorting, but concluded that the advantages of getting the raw sediment processed and the residues sorted during the excavation, with the help of labour from a Manpower Services Commission Job Creation Scheme, far outweighed the disadvantages.

The results of the environmental work from the first site, Queen Street, were then summarised in terms first of the environment of the riverside prior to the extensive land-reclamation which took place from the early-mid 13th century, and second of the composition of the dumped material. This comprised both deposits which remained waterlogged and which formed a stable surface for building on, and non-waterlogged material which accumulated in the streets above, from the early 14th century onwards. The evidence suggests that the site was originally on the exposed foreshore of the Tyne, and subject to flooding. Analysis of the sediments and diatoms suggests that the site was possibly situated near the mouth of a freshwater tributary. Dumping seems to have taken place rapidly and to have involved domestic rather than industrial rubbish, with plant remains representing the sort of weeds likely to have been growing on disturbed and waste ground nearby, with a small component of food plants, including grape and fig, some possible cornfield and hay meadow weeds and possibly a few garden plants. The seed component was diluted by mineral matter, possibly from redeposited soil of floor sweepings, and abundant wood chips. No plant taxon was dominant in any of the samples. A wide variety of fish was represented, though gadids and herring predominated. Sand eel and small herring bones may have been present in the guts of other fish, but the evidence is inconclusive with regard to whether the remains originated in the documented fish-markets nearby. The problems of taphonomic processes were discussed in the context of both the mammal and fish bones.

The results of this work will be published in a monograph volume of Archaeologia Aeliana in 1988.

Rebecca Nicholson, Archaeological Unit for North East England, Department of Archaeology, The University, Newcastle-upon-Tyne NR1 7RU.

Snails by numbers

How do you interpret large amounts of bio-archaeological material - in this case snails? We used the following methods:

1. Plotting the distribution of species through the samples;
2. Looking at each assemblage as a whole using diversity and multivariate analysis.

Diversity

Rank order curves (Evans, J. G. pers. comm; Kenward 1978) were plotted to show species:number ratio of individuals relationship. These proved to be useful in extreme cases. Underlying distributions have been sought to define this relationship: we used the logarithmic series, described by alpha, the index of diversity (Fisher, Corbet and Williams 1943; Kenward 1978; Southwood 1966; Taylor *et al.* 1976). To avoid assumptions based on an underlying model, non-parametric indices were used: Shannon-Wiener, Brillouin, Berger-Parker and Simpson-Yule (Southwood 1966). All showed similar trends.

Multivariate Analysis

We used Genstat (Alvey *et al.* 1977) to carry out the various steps of the Principal Components Analysis. From the arrangement of the variables along the principal component axes, we can identify which species of snail were associated with which others then see how these associations behave, and how constant they are, by relating the principal component information back to the original data.

We used Clustan (Wishart 1972) to identify and quantify the similarity between the different samples with a variety of different clustering techniques.

The results have been very promising, but we know this is only the beginning. We now realise that other approaches may be equally appropriate. We would welcome feedback and advice.

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Diane Williams & Annie Milles, Department of Archaeology, University College, PO Box 78, Cardiff CF1 1XL, Wales, U.K.

The Spice of Life?

For some time, now, Philippa Tomlinson, Barrie McKenna and I have been recording assemblages of plant macrofossils from urban archaeological deposits, primarily in York and Beverley, that have yielded a range of seeds or fruits that seem likely to have been used whole (or in the case of the larger ones, also crushed or milled) as food flavourings. The list currently comprises opium poppy (*Papaver somniferum*), linseed (*Linum usitatissimum*), coriander (*Coriandrum sativum*), celery-seed (*Apium graveolens*), dill (*Anethum graveolens*), fennel (*Foeniculum vulgare*), and summer savory (*Satureja hortensis* - though I wonder whether the 'seeds' of this plant were actually used, or whether it has simply arrived in the deposits from dried plants being stored or used as a leaf herb). They are often found together with large concentrations of the 'bran' (in this case, the spermoderm layer) of wheat/rye (cf. Camilla Dickson's paper in the last issue of *Circaea*), and it is tempting to conclude that some, at least, were used to flavour and/or decorate some kind of bread or biscuit. It is, of course, impossible to distinguish the precise way such plant foods were used from the fossil remains - the contents of cess pits which provide most of this information obviously represent many different meals.