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Soils and The Archeologist

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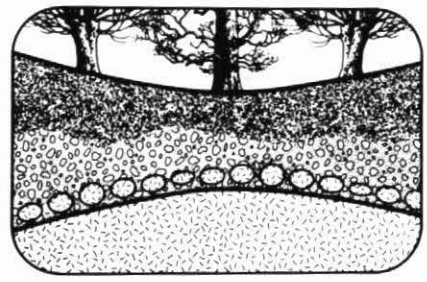

Soil Column

Soils and The Archeologist

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The archeologist, in common with the geologist and the pedologist, is largely concerned with subsurface features. In his work the archeologist has benefitted considerably from the fact that when man abandons a habituation site it is frequently buried by one or more natural processes. Consequently, when an archeologist wishes to obtain information about a past civilization he invariably has to dig for it (Fig. 1.) One would therefore expect that a very profitable tool at the archeologist's disposal would be the physical and chemical composition of the soil, the preserving medium. Instead, we find that, with relatively few exceptions, surprisingly little use has been made by archeologists of the techniques of soil analysis. Furthermore, few attempts have been made to study such soils with a view to using them as indicators of environmental impact by previous civilizations.

Artifacts and Disturbed Soils

In Canada, and especially within those areas that have been used for agricultural purposes, features of man's earlier settlements are rarely recognizeable at the surface. Frequently, the first sign that a site has been previously inhabited is the presence of various human artifacts within the plough layer. At sites where the vegetation has subsequently reverted to a semi-natural state the morphology of soil profiles will often indicate the depth of physical disturbance caused by previous human activity and resulting in the disruption of the soil's A and B horizons. Additional evidence of soil modification by early man is often provided by the effects of accelerated soil erosion causing the truncation of contemporary soil profiles and the burial of other soils downslope under slope deposits.

Of course, an essential prerequisite to the evaluation of such soil disturbance is a detailed knowledge of the natural and undisturbed soils in such areas. Studies of certain soils developed from sandy parent material of fluvio-glacial origin in parts of southern Ontario, that have been preserved as a result of being buried either beneath middens (refuse dumps) or beneath slope deposits downslope from an abandoned Indian village, suggest that the natural soils prior to the Indian occupancy approximately 350 years ago were well developed Podzols. In contrast, the present day undisturbed soils in the same area are only weakly developed Podzols which have perhaps formed as a result of further soil development subsequent to forest clearance by early Europeans.

Chemical Relicts

The preservation of the remains of physical structure in the ground such as post holes, pits, and hearths, together with the artifactual material within soils, undoubtedly facilitates archeological interpretation, but perhaps even more important is the fact that the soils presently covering archeological sites also contain a chemical record of past human activities.

Figure 1
Soil sampling at an archeological site

Not only did the Indian village dwellers, such as the Iroquoian peoples in Ontario, disturb the soils within and around their settlement sites to a degree which is still discernible some three hundred years later, but they also significantly modified the chemical composition of these soils. Soil reaction (pH), organic carbon, organic and inorganic phosphorus, together with elemental calcium, magnesium and iron levels in the present day soils can all be used to study the extent of previous settlement areas as well as to delimit individual house patterns. Not only is it possible to determine where such peoples lived by means of soil chemical properties, but through the investigation of the chemical composition of their refuse it is even possible to reconstruct the diets of the village inhabitants.

The study of soil reaction at archeological sites is important, not only because it may reflect previous human activity, but because it markedly influences the rate and type of soil development. One feature of former Indian villages in southern Ontario, for example, is that the soil pH is invariably higher within the village perimeter than without it. To some extent this may be due to the removal of the soil organic layers which would otherwise have contributed to soil acidity, but the accumulation of fire ash and refuse may also be contributing factors since they serve as neutralizing agents in the soil.

The measurement of soil organic carbon may also serve as a valuable archeological tool. Anomalously high concentrations of organic carbon in the subsoil sometimes indicate the positions of former building posts when the more usual patterns of post moulds in the soil are either absent or incomplete. In this way the full extent of previous buildings can often be determined. Differences in the chemical composition of soil organic matter; variations between organic and inorganic compounds and the degree of organic matter decomposition and mineralization can all be used as indicators of the environmental impact of previous human activities.

Phosphorus, which exists in the soils in both organic and inorganic forms, is particularly suitable for use in archeological interpretation on account of the fact that it readily combines with other elements to form insoluble compounds. Under alkaline soil conditions phosphorus combines with calcium and magnesium, whereas under acid conditions it tends to combine with iron and aluminum. Man, when he inhabits a site, produces amounts of phosphorus-rich waste in the form of urine, excretia, and waste food products. Phosphorus, when released from these various products upon decay, will in most cases become rapidly fixed in the soil and rendered immobile. The detection of anomalously high phosphorus levels in soils can therefore be used as evidence of human habitation and phosphorus determinations can aid considerably in the location of settlement patterns and middens. In some instances phosphorus levels in soils can also be used to determine the length of occupancy for a site, assuming of course that the population of the site is known approximately and that the site, when it was inhabited, was occupied more or less continuously. Studies on Iroquoian villages in southern Ontario, for example, using residual phosphorus accumulations in the soils, suggest that village sites were occupied for periods of between 10 and 25 years before the local soils became nutritionally depleted, crop yields declined and the village site was eventually abandoned and fired.

Thus, pedological investigations undertaken in conjunction with archeological excavations can be of considerable use in the interpretation of the nature and effects of previous human occupancy in an area. As our understanding of the residual physical and chemical features in soils improves, the next few years may very well see the much more extensive use of pedological techniques in archeological work.

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Pyroclasts

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The first of these columns (v. 2, no. 4) was supposed to inspire and provoke readers to send in all sorts of bright ideas, contentious suggestions and vicious comments which would form the grist for subsequent columns. However, I'm afraid the deadline for the third column has arrived before the first one has been delivered by the mails so this pyroclastic eruption still lacks input from our great underground reservoir, the readers. Once again I shall have to tread water and rely on wire taps.

More on the Renaissance in Canadian Geoscience

Signs that geoscience is on the move include the winning of the coveted 1975 Steacie Award by Fab Aumento of Dalhousie U. for his pioneering studies on the Mid-Atlantic Ridge. The award this year was shared with Jules Carbotte, a McMaster physicist. It is only the second time that the Steacie Award has been won by a geoscientist. Much more important is the fact that this is the second time in a row that an earth scientist has won it. We're finally putting some people into that exalted orbit dominated for so long by physicists, chemists and the odd Suzuki!

NRC deserves a great deal of credit for inaugurating the Steacie Award. It serves as a spur to achievement and a reward for individual excellence. It is virtually a national Nobel Prize for young scientists.