1957

THE IMPORT OF NEW PALYNOLOGICAL TECHNIQUES

Today, after recent publications by the Wenner-Gren Foundation on geochronological techniques, coupled with a modern interest in European Prehistory, American anthropologists are hearing more about the application of "hard science" to archeological material. At the last meeting of this society in Lincoln, the application of pollen analysis to archeology was discussed. It is my purpose to elaborate on this theme, mention some new discoveries in the field, and make some statements about collection and preservation of pollen samples.

Though the study and interpretation of pollen grains, (or to give it it's proper name, palynology) has been lauded as particularly useful to the archaeologist, and though it has been utilized with great success in Europe, extremely little work has been done with it in connection with archaeology in the New World. Technical drawbacks seem to have been the major factor for this lack of research, for the method of extraction of the fossil pollen from the soil was clumsy, and the yield in information was low relative to the amount of labor necessary. Also, a botanical consultant who can identify and interpret the results is often unobtainable.

Before going into detail, however, let me take a few moments to briefly recapitulate the present status of pollen work as it applies to archaeology. Some time ago, it was discovered that the pollen of flowering plants was taxonomically distinctive. The structure of the pollen granule differs in shape, size, and external character from family to family, genus to genus. Thus different trees, for instance, are distinguishable on the basis of their pollen much as they are on the basis of leaf shape and flower structure. It is also known that pollen is nearly indestructible under anaerobic conditions. Thus the pollen from plants that falls upon a water surface or falls upon the ground and gets buried is preserved indefinitely to all practical purposes. It is assumed by palynologists that the majority of pollen grains which a plant produces fall to the ground in the general area of their production. Acting upon this assumption, we realize that the stratigraphic record of a soil deposit may contain the vegetation record during it's deposition. Major changes in vegetation will be clearly seen by analysis of the deposit.

Now changes in vegetation are recognized to have two major causes: the influence of man upon the land by such action as cultivation, selective gathering, or fire; and climatic change. Both of these causes are of great interest to the archaeologist. Until recently, however, the application of pollen analysis to archaeology was limited because it was difficult to separate the pollen from the soil. Certain types of soils were more difficult to work with than others and most pollen analyists relied on organic soils such as peat beds as these soils relinquish their pollens most easily. While there are many such deposits in Northern Europe, their distribution in the New World is limited to areas which are mostly outside the field of archaeological interest. Thus palynology has had a hard time establishing itself as a prominent feature in New World archaeology.

But the picture has changed. Today, utilizing a new method of pollen extraction, the soil problem has been overcome. All types of soil tested by this method have contained fossil pollen grains in statistically revelant numbers. Besides, it is now possible to work with larger soil samples and thus increase the yield of grains. Under the old method we were able to work with perhaps 20 grams of sample with a yield of about 15-20 grains per microscope slide. Under the new method we can use about 100 grams of sample with a yield of about 350 grains per slide. Since 150-200 grains is considered a statistical sample, the improvement is obvious.

In addition, the new technique is relatively simple. It consists primarily of a flotation process wherein oil is added to a suspension of soil and water. When the suspension settles, the heavier oil particles fall to the bottom and the light pollen grains, trapped by the soil, stay at the top where they are pipetted off into a filter paper. The method has been set forth, step by step, by Drs. Kurtz and Turner in an article entitled An Oil Flotation Method for the Recovery of Pollen from Inorganic Sediments, which appears in Micropaleontology, (in press), an American Museum of Natural History publication. Any graduate student with a little background in chemistry should be able to follow the directions given by the authors and reduce the soil samples to microscope slides.

Once the sample has been reduced to slides, of course, the job of identification and interpretation of the grains is still one for a botanist. Also, pollen analysis is still a specialization in botany, so the number of truly competent botanical consultants is limited. If the demand grows, however, and if the archaeologist is willing to reduce the sample to the microscopic level before sending it in for analysis, much may be accomplished within a short time.

North American archeologists realize that a knowledge of the climatic picture from the end of the last glaciation to the present would be a great aid in the interpretation of material culture and its change. Also, it is realized that modern techniques of relative dating are playing an important role in our knowledge of the prehistory of the continent. Modern pollen analysis can i give information relative to both factors. Interpretation of the pollen record will enable us to know concretely the fluctuation of the climate of the past. An archaeological horizon which may be identified with one or more of these climatic periods may be given a relative date, and once the climatic periods have been dated by Carbon-14 and other absolute dating methods, we will have succeeded in placing that archaeological content in it's proper place in time. Also, certain very important questions as to the nature of cultural change may be forthcoming from data based on palynological research. We know, for example, that a great drought profoundly affected the course of the prehistory of the Puebloan culture of the Southwest. The data on climatic change which are associated with human occupations of the past will give us evidence upon which to base assumptions about the qualitative effects of environmental change on culture, and perhaps allow us some quantitative results as well.

But none of this can be accomplished without samples. The archaeologist must realize that the sites he works on are founts of information to more people than himself. He must realize that his pieces of pottery, tools of stone and bone, and burials are not all that is there. Buried in the back dirt is the climatic record. A thousand grams of soil may contain not only pollen but minute vegetal remains, shells of tiny land and water mollusca, beetle carapaces and other entomological materials, the bones of rodents and other small fauna, and perhaps more that we have not yet imagined. There may come a time when the archaeologist will wish he was able to bring his whole site back to the lab in order that nothing be overlooked.

For the present, however, soil samples will do. Even if these samples are not analyzed at present, they should be collected and mention of them be made in the site report. In this way, the data will be preserved for later investigation if analysis is not practical at the time.

You have been given a short article entitled Sampling for Micro-Archaeological Research wherein one procedure of sampling is included as well as the basic problems involved. Other, more competent, techniques may be devised as more people become familiar with the problem. The important thing, however, is that the samples be taken. The article is fairly self-explanatory, and I do not wish to go over it here for reasons of time. Other copies may be obtained by writing to the Department of Botany, University of Arizona, and any questions, suggestions, or criticisms will be greatly appreciated.

James Schoenwetter
Department of Botany
University of Arizona
Tucson, Arizona
March, 1957.