

## **Introduction to environmental archaeology: What do plant remains tell us?**

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### 1 ) Pollen analysis

Although pollen analysis allows the researcher to take an extensive view of the whole flora, the only kinds of pollen detected are those from plants which depend on the wind for pollination (anemophily). The pollen production of plants which pollinate through insects (entomophily) is less than 1/10,000 that of their anemophilic counterparts. In almost all cases pollen is identifiable at the genus level, some at the family level, and plants which have only 1 genus in a species are identifiable up to the species level. There are a large number of taxonomic groups which can be identified. Many of the main constituents of forests, as well as the Gramineae, Cyperaceae, and Compositae plants which make up the grassy plains, are anemophilic. Samples are taken from the sediment in lacustrine or marshland environments and are analyzed by the zoning method based on biostratigraphic zones. Vegetation and environment are estimated through the comparison of pollen and vegetation zones. In science, the pollen analysis method is not used for the detailed reconstruction of vegetation but has a large resolution given the sediment used as samples. Also, pollen is the best preserved out of all organic remains, albeit influenced by the environment in which it is preserved. However, some types of pollen, such as those of camphor trees, are destroyed by chemical processing.

In archaeological sites, samples of sediments are often taken from closed environments such as the area within an excavation site. Therefore, through comparison, it is sometimes possible to distinguish between strongly local indigenous and allogenic assemblages and artificial assemblages accumulated through the work of humans. A relatively detailed reconstruction is sometimes possible through the detection of entomophilic plants. Depending on the speed and condition of the sedimentation, it is sometimes possible to analyze seasonality.

### 2 ) Identification of seeds and fruits

The development of seeds and fruits differ according to the type of plant. In some plants, the seed (seed coat) is the only thing that hardens, while other plants may bear nuts, which have hard pericarp (outer shell), or stone fruit, where the endocarp (inner shell) is the only thing that hardens. In sediment, hard and durable objects remain without decomposing. Graminae are prone to decomposition and in many cases do not remain. The major characteristic of the analysis of seeds and fruits is that it allows the identification of up to the species level. Seeds and fruits are not preserved as well as pollen, and tend to be found in collections. In many cases they are difficult to detect according to the strata, and are usually quantified. The analysis

methods are the same as those for pollen.

In archaeological sites, they are strongly indigenous or artificial assemblages. Because they allow the investigator to identify up to the species level, it provides insight into the seed structure and allows for the detection of cultivated plants. Graminae grains (carbonized rice), which do not usually remain in natural settings, and beans, remain in carbonized form, which can be said to be characteristic of archaeological sites.

### 3 ) Identification of tree species

Being large, as in the case of seeds and fruits, tree remains are not detected universally and are therefore amenable to identification, unlike microscopic remains. Wooden remains consist of natural wood and wood products, the latter assemblages being artificial. Due to their size they have low mobility and in many cases are strongly classifiable as indigenous assemblages. Identification is at the genus level. Data consist of trees only. In many cases, a comprehensive analysis of microscopic pollen and large seeds, fruits, and tree species makes possible a more detailed reconstruction of autochthony and allochthony.

### 4 ) Analysis of plant opal and plant silicate

Plant silicate is produced in relatively few plants and is therefore used to investigate specific plants instead of the general vegetation. Because plant opal is produced by many Graminae plants (i.e. rice) and enables the classification of different strains of rice, the silicate body originating from motor cells of Graminae is identified and the quantitative density used for the analysis of rice paddy strata estimation. This is called plant opal analysis. The silicate bodies originating from trees and single-celled organisms are analyzed in biostratigraphic plant silicate analysis. Not many classifications of plant silicates are identifiable, and those which are, are mostly Graminae. Therefore, this method does not allow as sweeping a look at the entire flora as pollen analysis. Although estimated as highly autochthonous due to having been deposited as a part of large plant remains, such as leaves, they must nevertheless be considered to move with the sedimentary particles because they are microscopic as single units. The quartzose nature of the material allow it to remain even in environments which lead to the breakdown of organic remains such as pollen, seeds, and fruits, thereby making possible the reconstruction of forests in geographic regions where tephra and loam are developed.

### 5 ) Diatom analysis

Diatoms are a type of aquatic, single-celled algae which produce a silicate shell and are preserved within sediment. There are several different types, each with certain ecological preferences: saline concentration; running or standing water; acidic or alkaline; floating or

bottom-dwelling; terrestrial diatoms which can grow in moist environments on land; and environmental index groups which suggest more specific environments such as inner bays, mud flats, rivers, or lakes. As with indigenous and allogenic assemblages in aquatic systems, and plant silica bodies, derived fossils are sometimes found due to the excellent preservative qualities of diatoms. However, for the most part they can be considered to be indigenous assemblages.

In archaeological sites, the environment of the water area can be reconstructed, such as marine transgression, sedimentary environment, and the circumstances of the site.