

**DEGRADATION OF BOTANICAL REMAINS IN ARCHAEOLOGY:  
OPTIMIZING FOR PRESERVATION *IN SITU***

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Concerns about the degradation of the archaeological record with subsequent loss of information have led to initiation of research to establish guidelines for the optimal preservation of common materials found at archaeological sites, because this record is neither regenerable nor replaceable. Hitherto, research has focused on metal, bone and wood, but the research on botanical remains, such as plant seeds, has so far been scarce and is in need of further development. The results of this study should lead to a recommendation on the optimal approach to preserve our archaeological heritage *in situ*.

Botanical remains are an important component of many archaeological sites. The information contained within this type of material provides important information about human activities and environmental conditions in the past. The preservation of this material is henceforth an important issue, especially at sites where, in accordance with modern international concepts of archaeological heritage management, such preservation is done *in situ*.

The objective of the presented study is to develop an assessment system for the preservation potential of sites in wetland areas. To obtain an insight into the natural variation of the chemical composition of botanical remains, seeds from a wide variety of plant species commonly encountered at archaeological excavations were analyzed using Pyrolysis-GC/MS. Currently a library has been built up covering a selection of over 60 species (see Table 1). Additionally TMAH thermochemolysis has been applied to a large subset for additional information on the chemical composition of these plant species.

The application of factor analysis on the Py-GC/MS results allows for identification and observation of changes in the chemical composition reflecting degradation. By referencing soil parameters such as the presence or absence of water and oxygen, pH and the

buffer capacity of the soil from the corresponding excavation sites it can be determined which parameters cause the largest changes in the chemical composition, and therefore preservation state of botanical remains. With this information, guidelines can be established to develop long-term strategies for the *in situ* preservation of sites; and to develop techniques and methods to monitor protected sites; as well as to contribute to a theoretical basis for the sustainable management of our archaeological heritage.

<i>Atriplex patula/prostrata</i>	Common Orache / Spear-leaved Orache	<i>Persicaria maculosa</i>	Persicaria / Red Shank
<i>Avena</i>	Oat	<i>Phragmites australis</i>	Common Reed
<i>Bidens tripartita</i>	Trifid Bur-marigold	<i>Polygonum aviculare</i>	Knotgrass
<i>Bolboschoenus maritimus</i>	Sea Club-rush	<i>Potentilla anserina</i>	Silverweed
<i>Brassica rapa</i>	Turnip	<i>Prunus avium</i>	Gean / Wild Cherry
<i>Calluna vulgaris</i>	Heather / Ling	<i>Prunus domestica</i>	Bullace
<i>Cannabis sativa</i>	Hemp	<i>Prunus persica</i>	Peach
<i>Centaurea cyanus</i>	Cornflower	<i>Ranunculus acris/repens</i>	Meadow Buttercup / Creeping Buttercup
<i>Ceratophyllum demersum</i>	Rigid Hornwort	<i>Ranunculus sardous</i>	Hairy Buttercup
<i>Chenopodium album</i>	Fat-hen	<i>Raphanus raphanistrum</i>	Wild Radish
<i>Cirsium arvense/palustre</i>	Creeping Thistle / Marsh Thistle	<i>Rosa</i>	Rose
<i>Cladium mariscus</i>	Great Sedge / Saw-sedge	<i>Rubus idaeus</i>	Raspberry
<i>Corylus avellana</i>	Hazel	<i>Rumex acetosella</i>	Sheep's Sorrel
<i>Fagopyrum esculentum</i>	Buckwheat	<i>Rumex crispus</i>	Curled Dock
<i>Fallopia convolvulus</i>	Black Bindweed	<i>Rumex maritimus/ palustris</i>	Golden Dock/Marsh Dock
<i>Fragaria vesca</i>	Wild Strawberry	<i>Sambucus nigra</i>	Elder
<i>Galeopsis speciosa/ tetrahit</i>	Large-flowered- / Common Hemp-nettle	<i>Scleranthus annuus</i>	Annual Knawel
<i>Hordeum vulgare</i>	Six-row Barley	<i>Secale cereale</i>	Rye
<i>Juglans regia</i>	Walnut	<i>Solanum nigrum</i>	Black Nightshade
<i>Lamium album/ maculatum</i>	White Dead-nettle / Spotted Dead-nettle	<i>Sonchus arvensis</i>	Corn Sow-thistle/ Per. Sow-thistle
<i>Leontodon autumnalis</i>	Autumnal Hawkbit	<i>Stellaria media</i>	Chickweed
<i>Linum usitatissimum</i>	Cultivated Flax	<i>Suaeda maritima</i>	Annual-seablite
<i>Mentha aquatica/arvensis</i>	Water Mint/Corn Mint	<i>Thlaspi arvense</i>	Field Pennycress
<i>Myrica gale</i>	Bog-myrtle / Sweet Gale	<i>Triglochin maritima</i>	Sea Arrowgrass
<i>Nuphar lutea</i>	Yellow Water-lily	<i>Triticum aestivum</i>	Bread Wheat
<i>Oenanthe aquatica</i>	Fine-leaved Waterdropwort	<i>Urtica dioica</i>	Stinging Nettle
<i>Persicaria hydropiper</i>	Water-pepper	<i>Urtica urens</i>	Annual Nettle
<i>Persicaria lapathifolia</i>	Pale Persicaria	<i>Vitis vinifera</i>	Grape-vine

Table 1. Overview of the plant species for which Py-GC/MS traces were obtained of their seeds found during archaeological excavations.