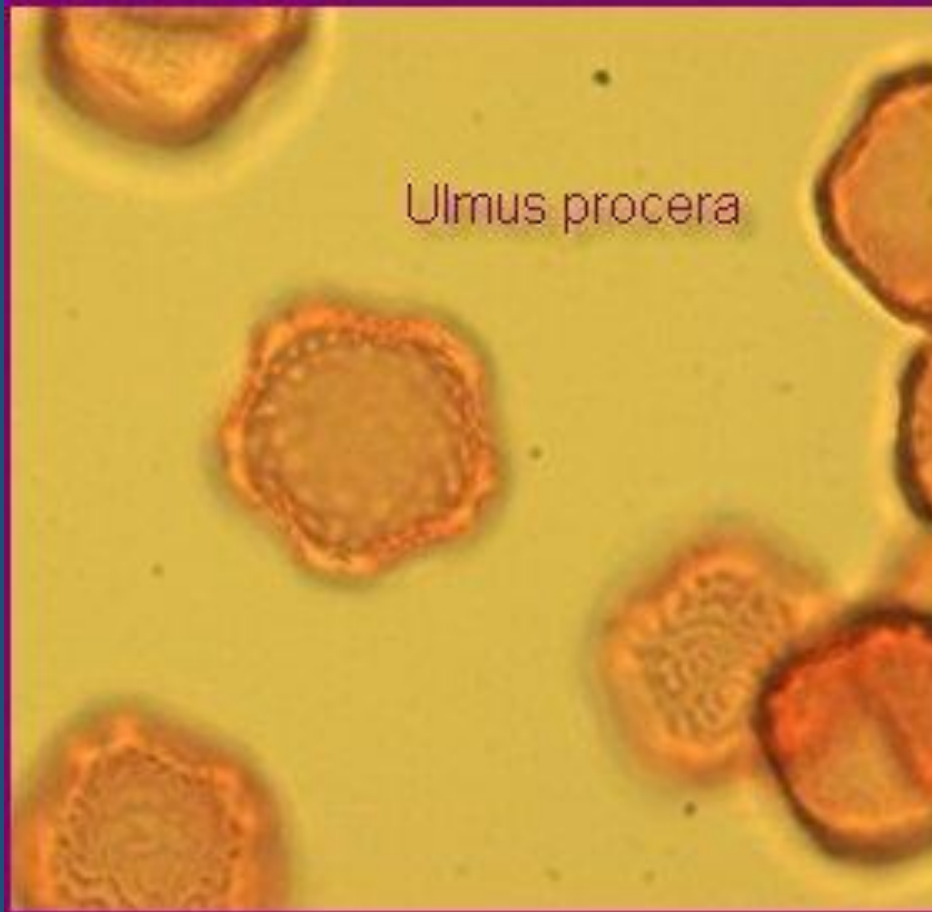


Bio-Archaeology and Forensics Pollen

Ulmus pollen Elm



PALAEOBOTANY

MICROFOSSILS - POLLEN

MACROFOSSILS - SEEDS

VEGETATIVE REMAINS
WOOD

PALYNOLOGY = POLLEN ANALYSIS

POLLEN - HIGHER PLANTS (ANGIOSPERMS AND GYMNOSPERMS), i.e. TREES, SHRUBS AND HERBS

SPORES - FERNS AND MOSSES (PTERIDOPHYTA AND BRYOPHYTA)

MALE GAMETES - SPERM CELLS

Basic principles of pollen analysis

1. Resistant to decay. For palaeoenvironmental studies survives in a range of environments, particularly anaerobic and acidic
2. Identifiable to family, generic or species level
3. Easily transported
4. Produced in abundance
5. Most fall to the ground rather than fulfilling their reproductive function.

6. Pollen rain, i.e. pollen in the atmosphere, is a function of the composition of the vegetation.

7. The pollen spectrum in a given sample indicates the vegetation surrounding that place at a point in time in the past or, in forensic studies, the present.

8. Pollen spectra from several levels provide a picture of the vegetation and its development through the length of time represented by the sediments.

9. Pollen spectra obtained from several sites enable comparison of changes in vegetation through time at different places or, in forensic studies, allows comparison between crime scene/victim and suspect.

POLLEN PRESERVATION: DEPOSITIONAL ENVIRONMENTS

PEAT DEPOSITS - BOG AND FEN
LAKE DEPOSITS

DEVELOP IN A STRATIFIED SEQUENCE



BURIED SOILS BENEATH ARCHAEOLOGICAL MONUMENTS



GUT CONTENTS OF PREHISTORIC BODIES
FAECAL DEPOSITS
ORGANIC RESIDUES IN POTS

SAMPLING
MONOLITH TINS IF SECTION
AVAILABLE
CORING - E.G. RUSSIAN
CORER



Forensic sampling

Grave: sample different soil layers, spoil (mix of layers), underneath body or directly beside, where suspect likely to have stood when digging out deepest layer. Only sample top few millimetres of soil - want only recent pollen.

Similar sampling procedure to that on an archaeological site.

Vehicle: wheels, wheel arches, foot pedals, foot-wells and car boot if relevant. Visibly different soil types should be sampled individually.

Other surfaces: leaf litter, lawn, plants which could have touched clothing, surface with algae on, dust from ledge, windowsill, seat, etc.

Wash surface with distilled water and 3% detergent and scrub with toothbrush or nylon swabs if gentle action required.

Suspect, living victim or body: footwear, clothing (especially lower parts of trousers and areas that have come into contact with soil), hair, nails, nasal cavities – if body covered since last breath, and other body areas.

Laboratory Sampling

Samples removed from monolith tin or core in laboratory after recording the sediment stratigraphy of the column. Frequently use a 16cm sampling interval which can be reduced to 8cm, 4cm, 2cm and contiguous samples, as required.

In certain circumstances may have spot samples from an archaeological site rather than a column.

Forensic Laboratory Sampling

Samples or exhibits examined, notes taken then processed

Soil samples or item washed, swabbed or taped. Washing or swabbing best but taping or vacuuming with a filter may be only way to proceed.

AFTER SAMPLES ARE SUB-SAMPLED IN
LABORATORY

LABORATORY PREPARATION TO EXTRACT
POLLEN AND SPORES.

PROCEDURE DESIGNED TO REMOVE MATRIX
THEREBY CONCENTRATING POLLEN AND SPORES
THAT ARE PRESENT

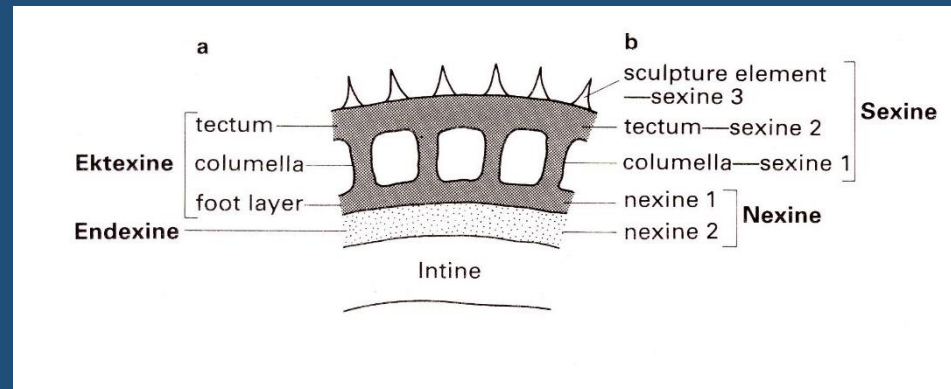
INCLUDES ACETOLYSIS AND HYDROFLUORIC
ACID OR HEAVY LIQUID SEPARATION

A SUB-SAMPLE OF THE RESIDUE CONTAINING
POLLEN IS MOUNTED ON SLIDES FOR LIGHT
MICROSCOPY OR ONTO STUB FOR ELECTRON
MICROSCOPY

POLLEN WALL - 2 LAYERS

INNER LAYER - INTINE (CELLULOSE)

OUTER LAYER - EXINE (SPOROPOLLENIN)



From: Moore, P.D., Webb, J.A. and
Collinson, M.E. 1991 Pollen Analysis.
Oxford, Blackwell Scientific Publications.

POLLEN IDENTIFICATION

1. Presence or absence of apertures

- i. Apertures a) pores (pori)
 b) furrows (colpi)
- ii. Apertures vary in a) number
 b) position
 c) character

2. Surface sculpturing

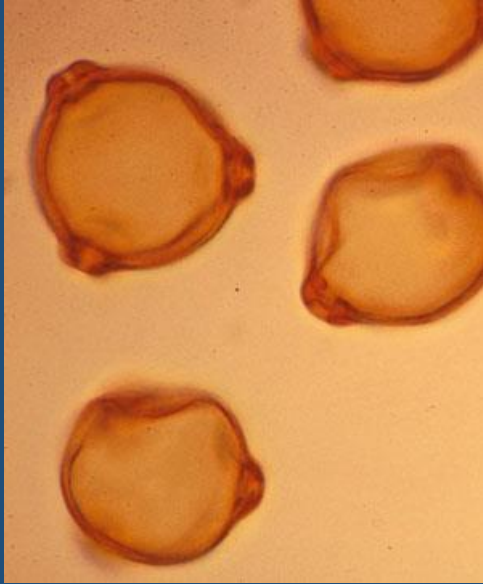
3. Size

4. Shape

	Di-		Tri-		Tetra-		Penta-		Hexa-		Poly-	
	polar	eq.	polar	eq.	polar	eq.	polar	eq.	polar	eq.	polar	eq.
Zonoporate	 e.g. <i>Colchicum</i>	 e.g. <i>Betula</i>	 e.g. <i>Betula</i>	 e.g. <i>Betula</i>	 e.g. <i>Alnus, Ulmus</i>	 e.g. <i>Alnus, Ulmus</i>	 e.g. <i>Alnus, Ulmus</i>	 e.g. <i>Alnus, Ulmus</i>	 e.g. <i>Alnus, Ulmus</i>	 e.g. <i>Alnus, Ulmus</i>		
Zonocolpate	 e.g. <i>Tofieldia</i>	 e.g. <i>Tofieldia</i>	 e.g. <i>Acer</i>	 e.g. <i>Acer</i>	 e.g. <i>Hippuris</i>	 e.g. <i>Hippuris</i>	 e.g. <i>Labiatae, Rubiaceae</i>	 e.g. <i>Labiatae, Rubiaceae</i>	 e.g. <i>Labiatae, Rubiaceae</i>	 e.g. <i>Labiatae, Rubiaceae</i>		
Zonocolporate			 e.g. <i>Parnassia</i>	 e.g. <i>Parnassia</i>	 e.g. <i>Rumex</i>	 e.g. <i>Rumex</i>	 e.g. <i>Viola</i>	 e.g. <i>Viola</i>	 e.g. <i>Sanguisorba officinalis</i>	 e.g. <i>Sanguisorba officinalis</i>	 e.g. <i>Utricularia</i>	 e.g. <i>Utricularia</i>
Pantoporate			 e.g. <i>Urtica</i>	 e.g. <i>Urtica</i>	 e.g. <i>Urtica</i>	 e.g. <i>Urtica</i>	 e.g. <i>Plantago</i>	 e.g. <i>Plantago</i>	 e.g. <i>Plantago</i>	 e.g. <i>Plantago</i>	 Chenopodiaceae	 Chenopodiaceae
Pantocolpate					 e.g. <i>Ranunculaceae</i>	 e.g. <i>Ranunculaceae</i>			 e.g. <i>Spergula</i>	 e.g. <i>Spergula</i>	 e.g. <i>Polygonum amphibium</i>	 e.g. <i>Polygonum amphibium</i>
Pantocolporate					 e.g. <i>Rumex</i>	 e.g. <i>Rumex</i>			 e.g. <i>Polygonum oxyspermum</i>	 e.g. <i>Polygonum oxyspermum</i>		

FIG. 5.4. Diagram showing the range of aperture number, position and character. Some of the possible combinations have no example within the British flora. Classification of pollen types based upon the number and arrangement of apertures. Examples are shown in polar and equatorial views. Dotted lines indicate a different focal plane. Empty positions denote the lack of a North West European example.

Betula
Birch



Pinus sylvestris
Pine



Plantago lanceolata
Ribwort plantain



www.aqua.org.au/.../14plantago_lanceolata.jpg

Quercus
Oak



www.geographie.uni-freiburg.de/.../Quercus.jpg

POLLEN COUNTING

REGULAR TRAVERSES.

MAGNIFICATION USUALLY 400X-1000X

POLLEN COUNT OF 300-500 GRAINS - POLLEN SUM
MAY REQUIRE MORE TO IDENTIFY RARE TYPES

POLLEN/SPORE CONCENTRATIONS MAY BE
CALCULATED BY THE ADDITION OF A KNOWN
QUANTITY OF AN EXOTIC POLLEN TYPE
e.g. LYCOPODIUM

Data Presentation

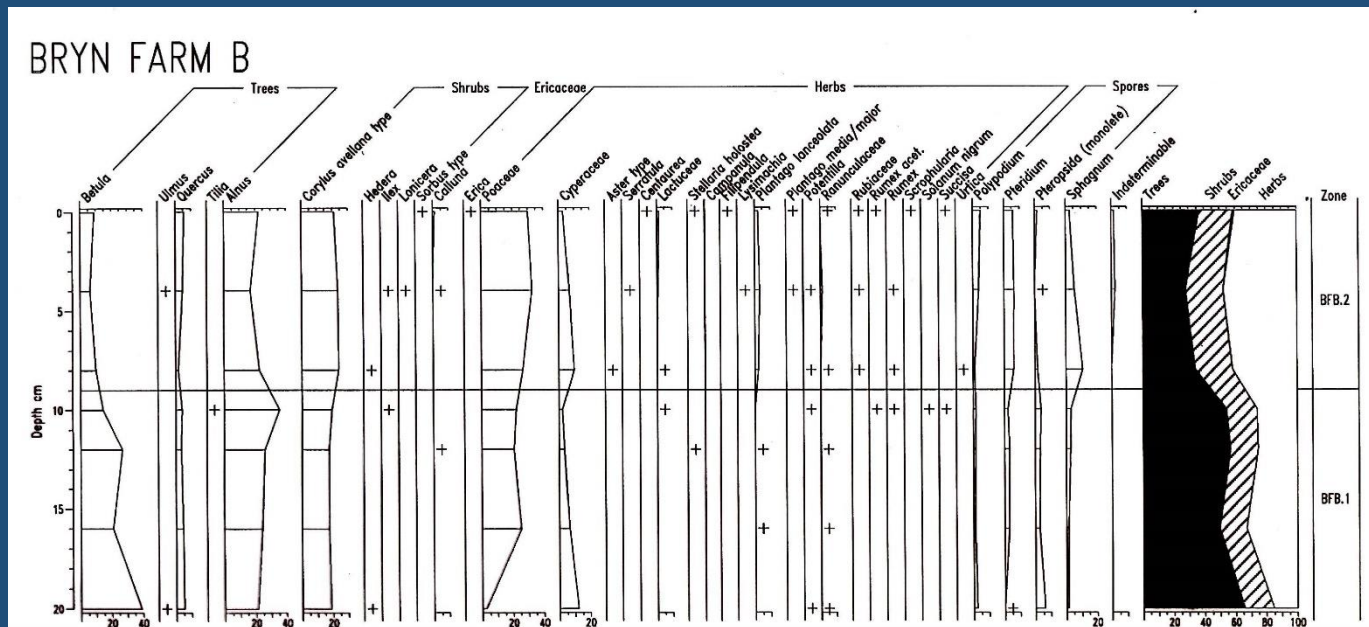
Data may be converted to percentages to compare relative frequencies.

Data may be presented in tables or as graphs, pie charts, etc.

Statistical analysis, e.g. to determine degree of similarity between samples

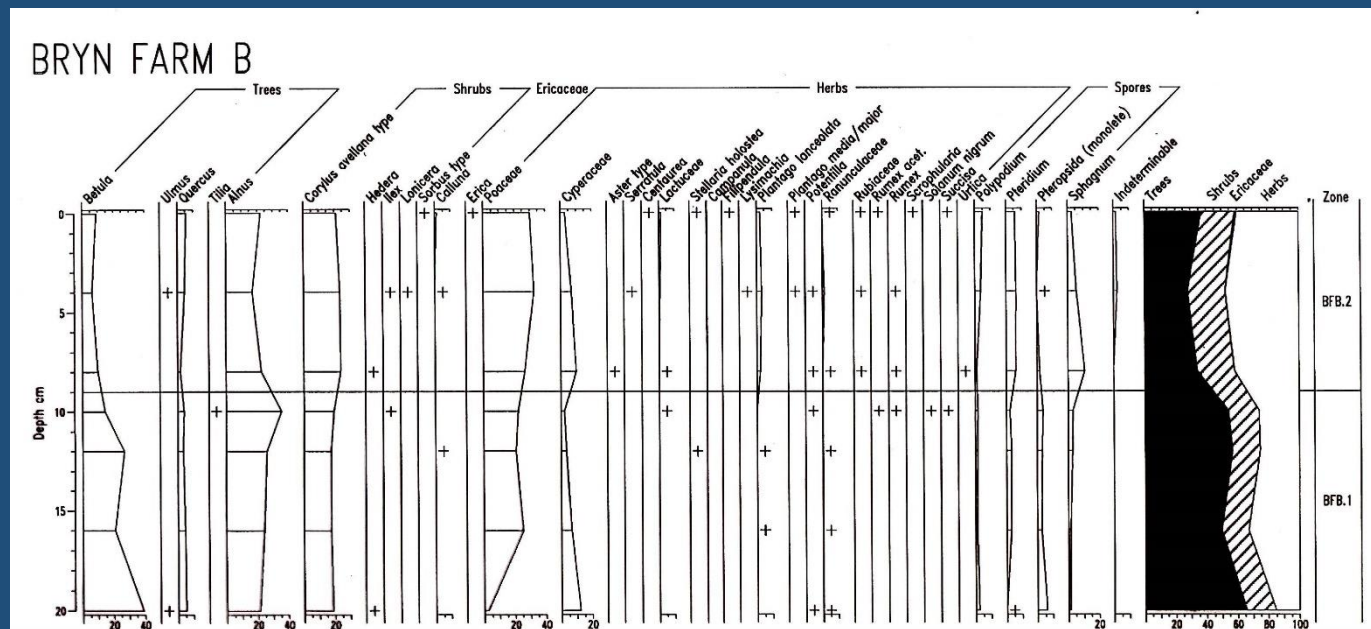
POLLEN DIAGRAM

SERIES OF GRAPHS OF THE VALUES FOR THE DIFFERENT TAXA PLOTTED AGAINST STRATIGRAPHIC DEPTH OR AGE.



POLLEN DIAGRAM ZONATION

SAMPLES WITHIN A ZONE SHOULD HAVE A BROADLY SIMILAR POLLEN COMPOSITION



INTERPRETATION

NEED TO KNOW ECOLOGY OF
PLANTS REPRESENTED

STRATIGRAPHIC INFORMATION

ADDITIONAL INFORMATION, *e.g.* PLANT
MACROFOSSILS

RADIOCARBON EVIDENCE