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Environmental reconstruction: bioarchaeological evidence

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Faunal Remains **<u>Main Approaches to Reconstruction</u>**

- marker species reconstruction
  relies on ecological preferences of species present.
  To what extent does sample represent a single biotic community?
- relative abundance of different taxa
  especially useful for examining changes through time.
  To what extent might changes in representation represent changing cultural preferences instead of environmental availability?
- The Bergmann Effect: Body size as a reflection of climate change
  Requires detailed modern data. Must rule other sources of size change, such as island dwarfing or domestication.
- Stable isotopes extracted from bones or teeth
  These data should reflect the proportion of C-3 (normal, including temprate grasses and virtually bradleaf taxa, shrubs, etc.) and C-4 plants (prevalent in savanna grasses and sedges) in the animal's diet

Plant Macro-remains **<u>Types of remains and preservational modes:</u>**

- On-site (Archaeobotany)

NB: these sources of evidence have all been influenced by archaeological formation processes, including cultural factors and human selection. Therefore potentially highly biased, or even misleading, reflection of natural vegetation

- Seeds (charred)
- Wood charcoal
- Desiccated macros (including seeds, leaves, etc.)

- Off-site (Quaternary Palaeobotany)

- Water-logged sequences (including leaves, seeds, wood)
  Preserved in bogs, swamps. Can include *in situ* preservation (e.g. submerged forests) or sedimentary sequences (e.g. preserved in former oxbox ponds, peat bog sequences etc.).

Notes on taphonomy: <u>seeds</u> are resilient and can be transported long distance by water. They may therefore deposited at some distance from where they were produced, requiring consideration of sedimentary regimes. <u>Leaves</u>, on the other hand, are fragile and become increasingly fragmented with transport distance. Thus large, intact (and more readily identifiable) leaf fragments tend to reflect local deposition from the immediate flora.

Plant Micro-remains **<u>Types of remains and preservational modes:</u>**

Discrete, specific microfossils
NB: usually one form per species (although it may not be possible to distinguish related species, or even genera within the same familiy in some cases)

- **Pollen and spores** (Paylonology)
  Pollen from conifers and flowering plants (Gymnosperms and Angiosperms)
  Spores from ferns, mosses, fungi

  Some phytoplankton types provide information on aqautic environments, such as salinity or ocean depth, including
- **Diatoms** (taxonomic Class Bacillariophyceae)
  Unicellular, aquatic algae with silicaceous exoskeletons

- **Dinoflagellates** (taxonomic Division Pyrrhophyta)
  Unicellular 'red' algae, with cellulose armor plates.
  Certain dinoflagellates are an important component of corals

Disarticulated, non-specific morphotypes

NB: Numerous forms produced in a given plant and species, extensive sharing of forms between different species, including distantly related ones, occasional morphotypes are more taxonomically diagnostic, especially when still articulated (therefore reflecting epidermal cell patterns).

- **Phytoliths** (also called plant opals)
- **Articulated phtyoliths** (multiple silicified cells attached, sometimes called spodograms)

Sampling for Microremains
Processing is done in the laboratory with chemical extraction. Bulk sediment samples, either from on-site archaeological contexts/ strata, or Off-site from coring of natural sedimentary deposits, e.g. bogs, lake beds, etc. Sample sizes are small (e.g. 50mL), with only a fraction processes at one time. For non-sealed (e.g. core) samples, caution must be taken to avoid to minimise contamination by windborne particles, e.g. through immediate samples of freshly cleaned sections.

Further readings: Selected Bibliography
<u>Some archaeozoological case studes studies</u>
Avery, D. M. 1982. Micromammals as paleoenvironmental indicators and an interpretation of the late Quaternary in the Southern Cape Province, South Africa, *Annals of the South African Museum* 83: 183-374

Bocherens, H. and M. Fogel 1995. Trophic structure and climatic information from isotopic signatures in Pleistocene cave fauna from Southern England, Journal fo Archaeological Science *22: 327-340*

Davis, S. M. 1981. Effects of temperature change and domestication on the body size of late Pleistocene to Holocene mammals of Israel, *Paleobiology* 7: 101-114

Iregren, E. 1986. An example of how a mammalian species may vary biometrically during different climatic conditions, in P. Ducos (ed.) *Archaeozoologia.* La Pensee Sauvage Edition, Cedex, France, pp. 87-97

Klein, R. G. The Interpretation of Mammalian Faunas from Stone-age Archaeological Sites, with Special Reference to sites in the Southern Cape Province, South Africa, in A. K. Behrenmeyer and A. Hill (eds.) *Fossils in the Making: Vertebrate Taphonomy and Paleoecology.* University of Chicago Press.

Klein, R. 1986. Carnivore size and Quaternary Climate Change in Southern Africa, *Quaternary Research* 26: 153-170

Kurten, B. 1960 Chronology and faunal evolution of the earlier European glaciations, *Commentationes Biologicae* 21: 3-62

Payne, S> 1985. Zoo-archaeology in Greece: A Reader's Guide, in N. C. Wilkie and W. D. E. Coulson (eds.) *Contreobutions to Aegean Archaeology.* University of Minnesota Press.

For Wood Identification/ Wood charcoal studies:

Barefoot, A. C. and Hawkins 1982. *Identification of Modern and Tertiary Wood.* Calrendon Press, Oxford

Core, H. A., W. A. Cote and A. C. Day 1979. *Wood strcture and identification*, second edition. Syracuse Wood Science series 6. Syracuse University Press, Syracuse, New York.

Fahn, A., E. Werker and P. Baas 1986. *Wood Anatomy and Identification of Trees and Shrubs from Israel and Adjacent Regions.* Jerusalem: Israel Academy of Sciences and Humanities

Schweingruber, F. H. 1990. *Microscopic Wood Anatomy.* Swiss Federal Institute for Forest, Snow and Landscape Research

Smart, T. L. and E. S. Hoffman 1988. Environmental interpretation of archaeological charcoal, in *Current Paleoethnobotany* (C. A. Hastorf and V. S. Popper eds.). University of Chicago Press. Pp. 165-205

Thompson, G. B. 1994. Wood charcoals from tropical sites: a contribution to methodology and interpretation, in *Tropcial Archaeobotany. Applications and new developments* (J. G. Hather ed.), pp. 9-33. London: Routledge.

Thiebault, S. 1988. Palaeoenvironment and ancient vegetation of Baluchistan based on charcoal analysis of archaeological sites, *Proceedings of the Indian National Science Aacademy* 54A: 501-509

Willcox, G. 1974. A history of deforestation as indicated by charcoal analysis of four sites in Eastern Anatolia, *Anatolian Studies* 24: 117-133

For leaf remains, the basic approach is leaf architecture, which is discussed in the references below. Detailed identification guides have not yet been published although there are scattered descriptions of particular families botanical and palaeobotanical literature. Hickey is meant to be producing a detailed book covering all flowering plant families in the near future. Similarly, the use of venation patterns to systematically identify leafy material in archaeobotany has only been employed sporadically. For an example of the use of this and related approaches (epidermal cell patterns), see Tomlinson.

Hickey, L. J. 1979. A revised classification of the architecture of dicotyledonous leaves, in *Anatomy of the dicotyledons, second edition, Volume I* (C. R/ Metcalfe and L. Chalk eds.), pp. 25-39. Oxford: Clarendon Press.

Hickey, L. J. and J. A. Wolfe 1975. The bases of angiosperm phylogeny: Vegetative morphology, *Annals of the Missouri Botanical Garden* 62: 538-589

Tomlinson, P. R. 1991. Vegetative plant remains from waterlogged deposits identified at York, in Jane Renfew (ed.) *New Light on Early Farming - Recent Developments in Palaeoethnobotany.* Edinburgh University Press. Pp. 109-119

Pollen

Moore, P. D., J. A. Webb, and M. E. Collinson 1991. *Pollen Analysis*, second edition. Balckwell Scientific, Oxford.

Traverse, Alfred. 1988. *Paleopalynology*. London : Unwin Hyman

Dimbleby, G. 1985. *The Palynology of Archaeological Sites.* London: Academic Press

Godwin, Harry 1975. *History of the Flora of the British Isles,* second edition. Cambridge: Cambridge University Press

Faegri, K and J. Iversen 1975. *A Textbook of Pollen Analysis,* third edition. Blackwell Scientific, Oxford.

For some images of pollen on the Web:
Pollen catalogue of the British isles (University of Uppsala):
http://www.kv.geo.uu.se/pc-intro.html
http://scrl.usda.gov/scrl/apmru/imms/pollen/Light_Micrographs/LMicro.htm
http://www.geo.arizona.edu/palynology/sit_mnt0.html

Diatoms Battarbee, R. W. 1988. The use of diatoms analysis in archaeology: A review, *Journal of Archaeological Science* 15: 621-644

Juggins, S. and N. Cameron 1999. Diatoms and Archaeology, in *The Diatoms. Applicationms for the Environmental and Earth Sciences* (E. F. Stroermer and J. P. Smol eds.), pp. 389-401. Cambridge University Press

For images of selected diatoms, see these web sites:
http://www.calacademy.org/research/diatoms/
http://www.bgsu.edu/departments/biology/algae/index.html
http://www.indiana.edu/~diatom/diatom.html

Phytoliths
Rovner, I. 1983. Plant opal phytolith analysis: Major Advances in Archaeobotanical Research, *Advances in Archaeological Method and Theory* 6: 225-266

Piperno, D. 1988. *Phytolith Analysis: An Archaeological and Geological Perspectives.* New York: Academic Press

D. Pearsall and D. Piperno (eds.) 1993. *Current Research in Phytolith Analysis: Applications in Archaeology and Paleoecology,* MASCA Research Papers in Science and Archaeology 10. Philadelphia.

For images of phytoliths, try these websites
http://reled.byu.edu/ascript/tball/index2.html
http://www.southalabama.edu/geography/fearn/phyto.htm