Non-wood Plant Macro-Remains

EAI/IAI Continuing Professional Development (CPD)

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IAI Institute of Archaeologists of Ireland

The Discovery Programme
Centre for Archaeology and Innovation Ireland
An Clár Fionnachtana
Ionad Seandálaíochta agus Nuálaíochta Éire

Non-wood Plant Macro-Remains

-Non-wood plant material:
-Seeds, seed-like structures, fruits, tubers.

-Macro – Can be seen with naked eye but requiring low powered microscopy.

-Common in the archaeological record

-Types of preservation:
-Carbonised/Charred.
-Waterlogging/Anoxic environments.
-Mineralisation (Cess/Phosphates).
-Desiccated/Dried.

Cooking Activities

Refuse/debris

Animal Dung

Crop processing

Local environment

Archaeological Site

Crop harvesting

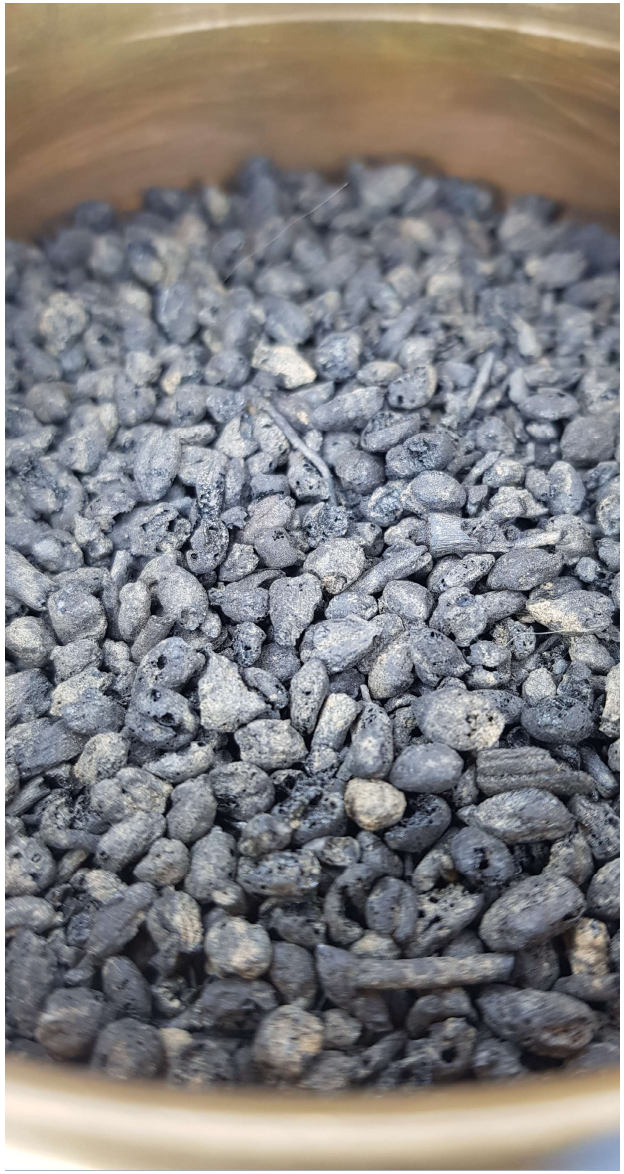
Local environment

Adjusted: Minnis (1981).

Carbonisation of plant macro-remains:

Carbonisation-method of preservation.

- Plant material burned under reducing conditions.
- Carbon-based compound -> skeleton of pure carbon.
- Once charred, the remains are resistant to chemical damage & microbial decay.
-Ubiquitous: commonly found on most archaeological sites.
-Dry-well drained sites, waterlogged samples.



Sampling Strategies:

Aim: To retrieve sufficient archaeobotanical material that's representative of the archaeological record.

Collection Strategies:

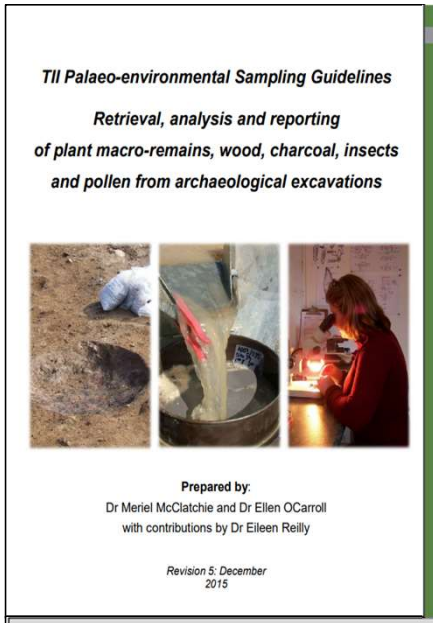
-Blanket, **systematic**, random, **judgement**, scatter, hand picked.
-Pros/cons
-Mix of systematic & judgement is best.
-Systematic:
    -Samples are taken according to a clear strategy.
    -Includes a variety of approaches.
    -Considers the types of contexts encountered.
-Judgement:
    -Focuses on deposits that appear to be potentially rich.

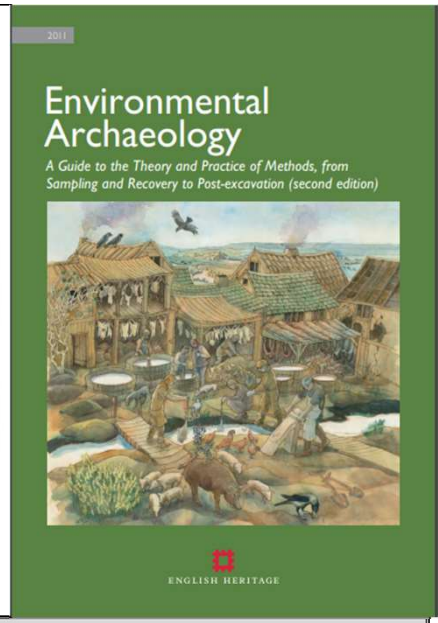
Key to remember:

-Not always visible with naked eye!
    -*'I'll take samples when I see charred remains'*….may not work!

Sample Size:

-Varies by preservation type.
-20l of soil sediment.
-Bags/Bucket.
-Stored for processing.





Recommended sample volumes	
Charred and/or mineral-replaced remains	20 litres of sediment
Waterlogged remains	10 litres of sediment
Waterlogged AND charred/mineral-replaced remains in single deposit	10 litres of sediment
Deposit that is too small to achieve the above volumes (e.g. stake-hole or small pit)	All available sediment

Processing of Samples: The Flotation Method

-The flotation technique combines water with soil sample to separate charred plant material from their enclosing matrix.

-The aim of the flotation method:

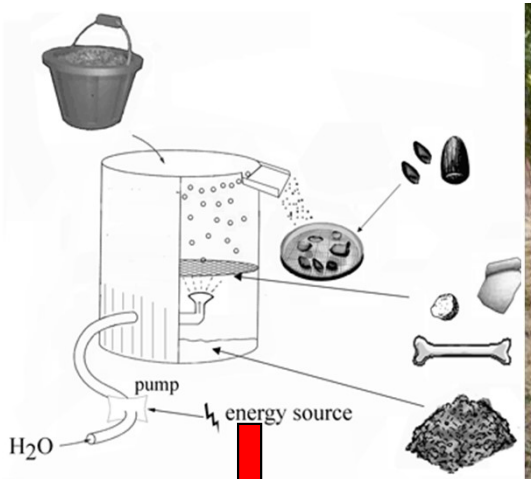
- -Recovery of botanical remains.
- -Small zoological remains.
- -Other small cultural remains.

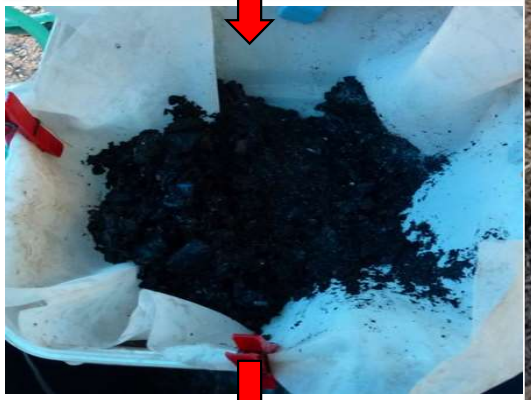
-It is a simple, inexpensive, easily implemented & modified to suit specific excavation requirements.

-No need to over-engineer the flotation tank:

- -Simple design.
- -Easy to clean.
- -1mm strong mesh to collect heavy residue/hold sample.
- -0.5mm mesh to collect the carbonised flot.

-Collect flot and hang to dry, dry in trays.





Examining Flots:

- Once dried flots are scanned and sorted.
  - -Magnification is necessary

- Assessment (TII Stage 3)
  - -Samples are graded.
  - -Scale of abundance (+, ++, +++)

- Full archaeobotanical analysis (TII Stage 4)
  - -Identifications.
  - -Quantifications.
  - -Interpretations.

Species Identification and Quantification:

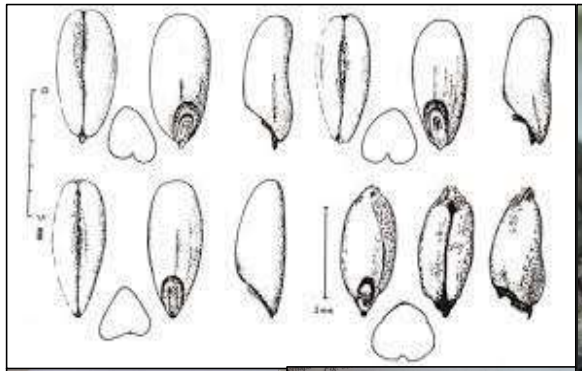
Identifications are based on:

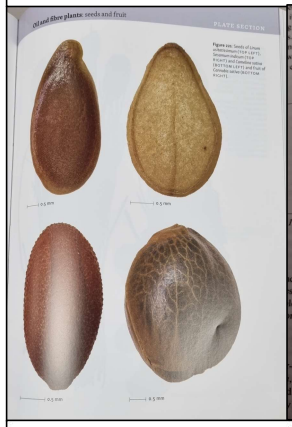
- -Gross morphology (Shape & Size).
- -Identification criteria (taught).
- -Experience (time on microscope).
- -Comparisons with reference materials.
- -Reference to identification manuals.

Identifications should be verifiable

Appendix 1: Taxonomic Table

Context		4	6	10	21	21	23	28	31	34	41	43	44	58	52	58	50
Sample no.		**1**	**2**	**4**	**5**	**6**	**7**	**11**	**12**	**13**	**14**	**15**	**18**	**19**	**20**	**21**	**23**
Cereal Grains																	
Avena sativa L.	Oat	0	0	0	0	0	0	0	0	0	0	**5**	0	0	**8**	0	0
cf. *Avena* L.	Oat	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0
Hordeum vulgare L.	Barley	0	0	0	0	0	0	0	0	0	0	**1**	**231**	0	**63**	0	**191**
Triticum aestivum/durum/turgidum	Naked wheat	0	0	0	0	0	0	0	0	0	0	**3**	**170**	**1**	**179**	0	**0**
Secale cereale L.	Rye	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**	0	0
Cerealia	Indet. cereal	0	**2**	0	0	0	0	**2**	0	0	**10**	**39**	**573**	0	**562**	**5**	**309**
Cereal Chaff																	
Hordeum vulgare L.	Barley	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**	0	0
Triticum aestivum L.	Bread wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**	0	0
Fabaceae (Pea Family)																	
Vicia/lathyrus sp.	Vetches	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0
Rosaceae (Rose Family)																	
Rubus sp.	Bramble	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0
Polygonaceae																	





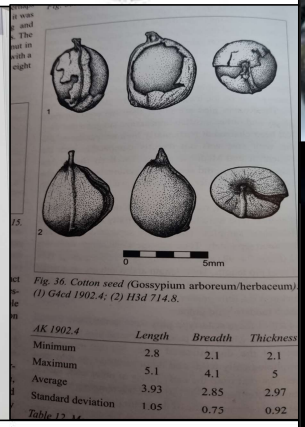


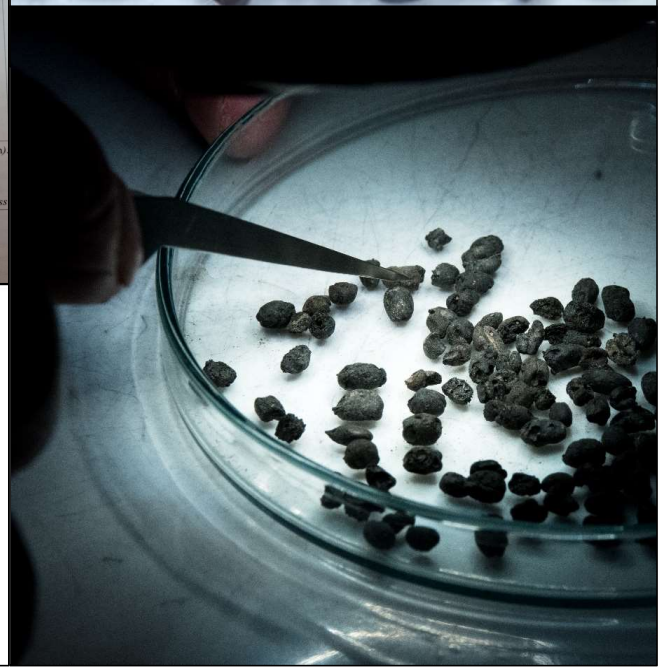
Fig. 36. Cotton seed (Gossypium arboreum/herbaceum). (1) G4cd 1902.4; (2) H3d 714.8.

AK 1902.4	Length	Breadth	Thickness
Minimum	2.8	2.1	2.1
Maximum	5.1	4.1	5
Average	3.93	2.85	2.97
Standard deviation	1.05	0.75	0.92

Family: Poaceae (Grass Family).
Common name: Hulled Barley.
Binomial: *Hordeum vulgare* L.
AEB Category: Cereals.

Description: Barley grains are identified by examination of the side and end profile of the grains. Barley identification can be refined further to two-rowed barley (*Hordeum vulgare* subsp. *distichum*) or six-rowed barley (*Hordeum vulgare* subsp. *vulgare*). While both are rounded in cross-section, generally rounded in appearance, with horizontal lines visible on the dorsal and ventral sides, six-rowed barley has a a-symmetrical (twisted) grain, while two-rowed barley is symmetrical.

AEB Recovery: 1182 specimens recovered.
Dimensions: 4.4 mm (L) 2.67 mm (W) 2.27 mm (Th).
Photograph: AEB01_Trench1_s131_c313



Taphonomy of charred remains:

-How plant material gets carbonised/ Formation Processes.
-Differs greatly from those of waterlogged/mineralized assemblages.
-Carbonised material only becomes preserved through fire contact.

Formation Processes:

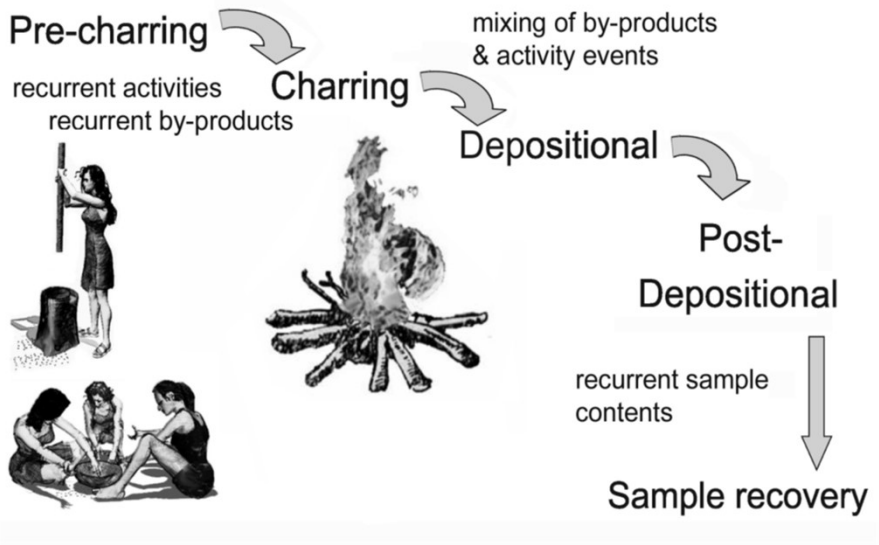
-Remains charred within the context from which they were recovered (Primary).

-Deposits where assemblages from a single burning event have been moved to the context from which they were excavated (single discrete event). (Secondary)

-Assemblages formed from the deposition of many successive charring events, possible representing several different activities (multiple different events). (Tertiary)

-Context of the assemblage important!!!

-Highlights the importance of providing information from excavations, stratigraphic report etc. to specialists.



Pre-charring Taphonomy: Crop Cultivation & Harvesting

-Cereals are cultivated in stands/fields.
-Modified environment – ploughed fields, cleared, managed.
-Plants collected comprise of cereals, chaff & species that grow in the field
    -From one field or a mix of several fields or farms.
    -Harvest method employed:
        -By hand
        -Hand sickle (high up the stem)
        -Scythe (Low on the stem)

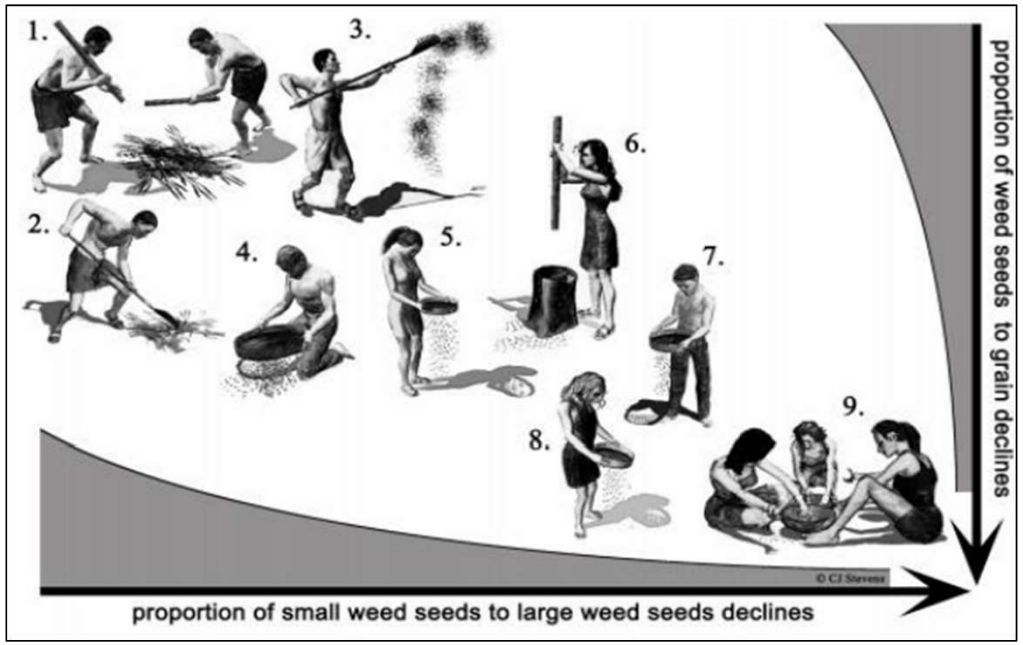
All influence the range of plants that will enter the site and potentially get preserved.




Pre-charring Taphonomy: Crop Processing

Cereals require processing before consumption/storage:

- -Multi-stage process.
- -Each step changes the assemblage.
  - -Removal of chaff and straw.
  - -Cereal: weed ratio.
  - -Removal of smaller, lighter seeds.
  - -Proportion of heavy, cereal mimics increase.



Depositional taphonomy

-Due to damp conditions in Ireland cereals required drying before storage/further processing.

-Corn drying kilns.

-One of the most common archeological features.

-Cereals (and weeds) enter the kiln.

-Large quantities of wood charcoal (Fire setting/chamber) used to heat and dry cereal.

-Large quantities of non-wood macro remains (Drying chamber) that fall from the drying floor and become carbonized.

-Sometimes chaff may have been used as fuel/tinder for (Flue/fire setting).

Secondary/tertiary deposits from kilns:

-Kilns are raked out after use.

-Deposited in pits, or nearby ditches.

-Accumulation of waste from life of drying kiln.

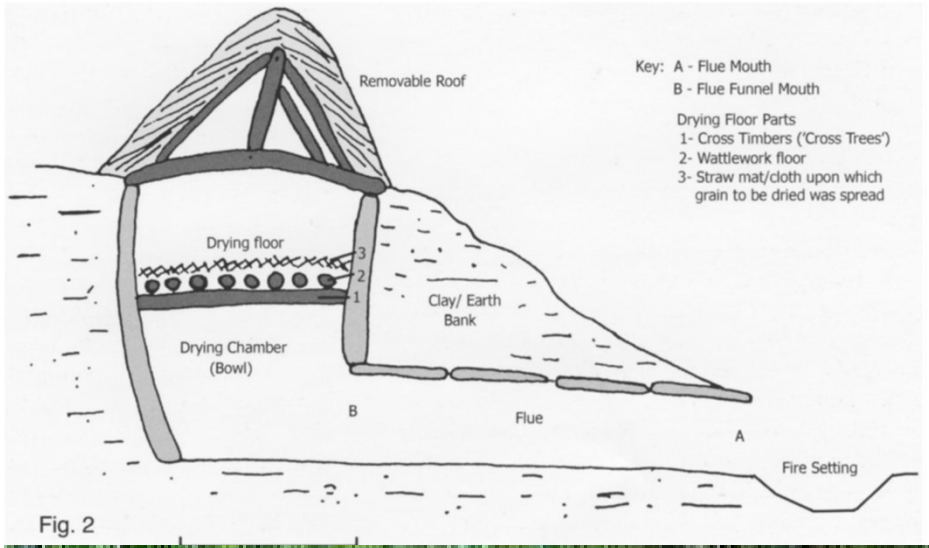


Fig. 2

Differential preservation of plant parts:

- Bias in the ability of plants to carbonise and withstand the thermal exposure.

-Charring experiments help archaeobotanists interpret their assemblages.

-Cereals overrepresented (Heavier, denser, more robust)
-Fiber crops, fruits, nuts, legumes, vegetables, herbs, spices, and medicinal plants all underrepresented.
-Fragile/oily plant parts burn away to ash first.
-Chaff which burns away to ash more quickly (hence grain is found more often in deposits).

- Approx. 35% of the range of edible plants found in waterlogged samples

-Experimental firings of hearths between 60%-80% of grains failed to survive the event.

Post-depositional taphonomy

-While resistant to chemical and microbial attack.
-Carbonised material is susceptible to:
    -Mechanical damage
    -Alternate wetting/drying

-**Mechanical damage**
    -Redeposits, Often, plant remains material from pit and ditch fills are found at 2-3 steps removed from their original depositional context.

    -Slumping, infilling, erosion and movement in water, can impact plant remains (surface preservation of the seeds and adhering mud and particles). Can happen many years after original deposition.

-**Alternate wetting/drying**
    -Can occur naturally.
    -But also, during sample processing…..
        -If its dried – keep it dry
        -If wet – keep it wet

Very encrusted and abraded seeds, Ballybane (Photos: J. Sunderland/ Penny Johnson

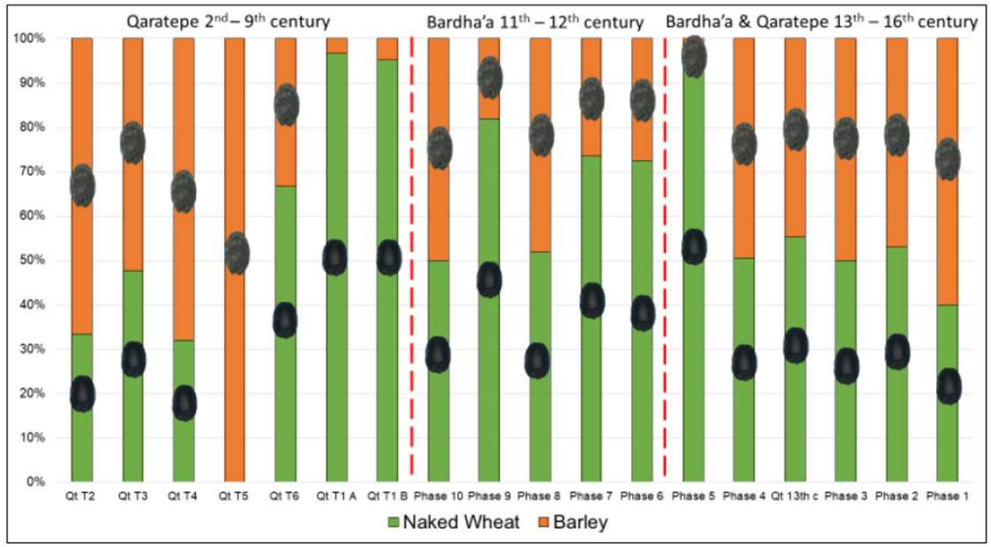
Carbonised Assemblages: Analysis and Interpretation:

Reveal insights into a range of activities:

-Arable economy.
-Agricultural management & practices.
- Innovations (Technological/crop biological).
-Aspects of socio-economic life

Analyses: Arable Economy

-What species were cultivated.
-Preference of cultivated species.
-Diachronic changes.



-Agricultural management /practices:

-Extensification (increasing land under cultivation).
-Intensification (increasing inputs per unit area).
-Scale of production.
-Crop rotation.

-**Crop-biological Innovation**:

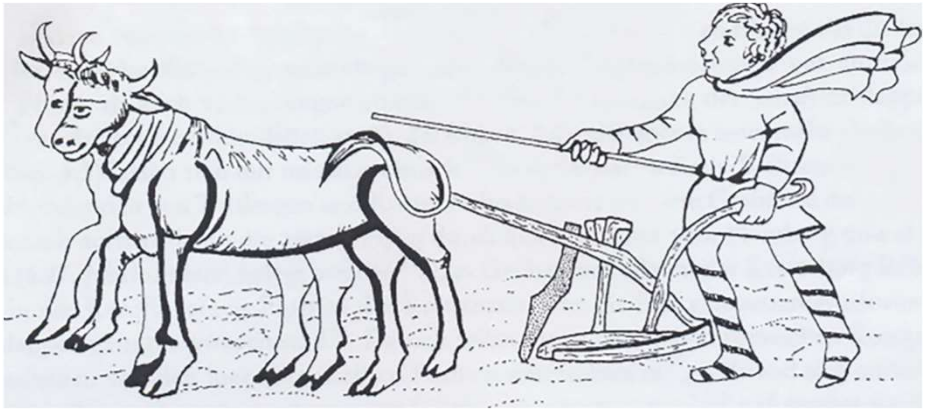
-Changing relative frequency of crops.
-Diversification (Addition of new crops).

-**Mechanical/ Technological innovations:**

-Addition of new crop/increased cultivation.
-Ploughing (Weeds that can tolerate disturbed ground).
-Storage.

-Socio-economic

-Urbanisation.
-Trade routes.



-Climate/Local environmental conditions:

-Inferred from changing frequency of crops species (i.e. Barley dominance may indicate wetter harsher conditions)

-Absence/Presence of wetland, forest, open meadow type weed species.

-Spatial analyses:

-Comparing the types of plants collected from different areas of an excavations

-What people were doing where?

-Identify activity areas ie. processing areas

-Clean/dirty areas.

-Stable Isotope analyses:

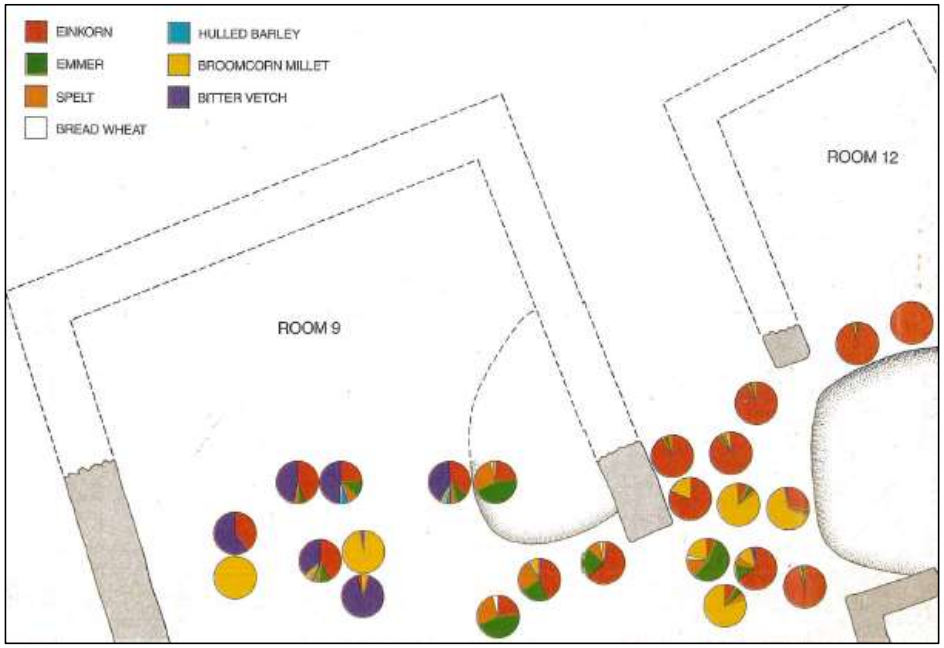
-Reconstruct agricultural practices.

-Carbon, nitrogen, sulphur isotopes.

-Watering regimes of plants.

-Manuring (intensification)

-Storage structures (FOODSEC)



Source: Penny Johnson

Radiocarbon dating

-Suitable for Radiocarbon dating.
-Short lived species.
-Single entity.
-Size of sample >10mg.
-Gold standard.

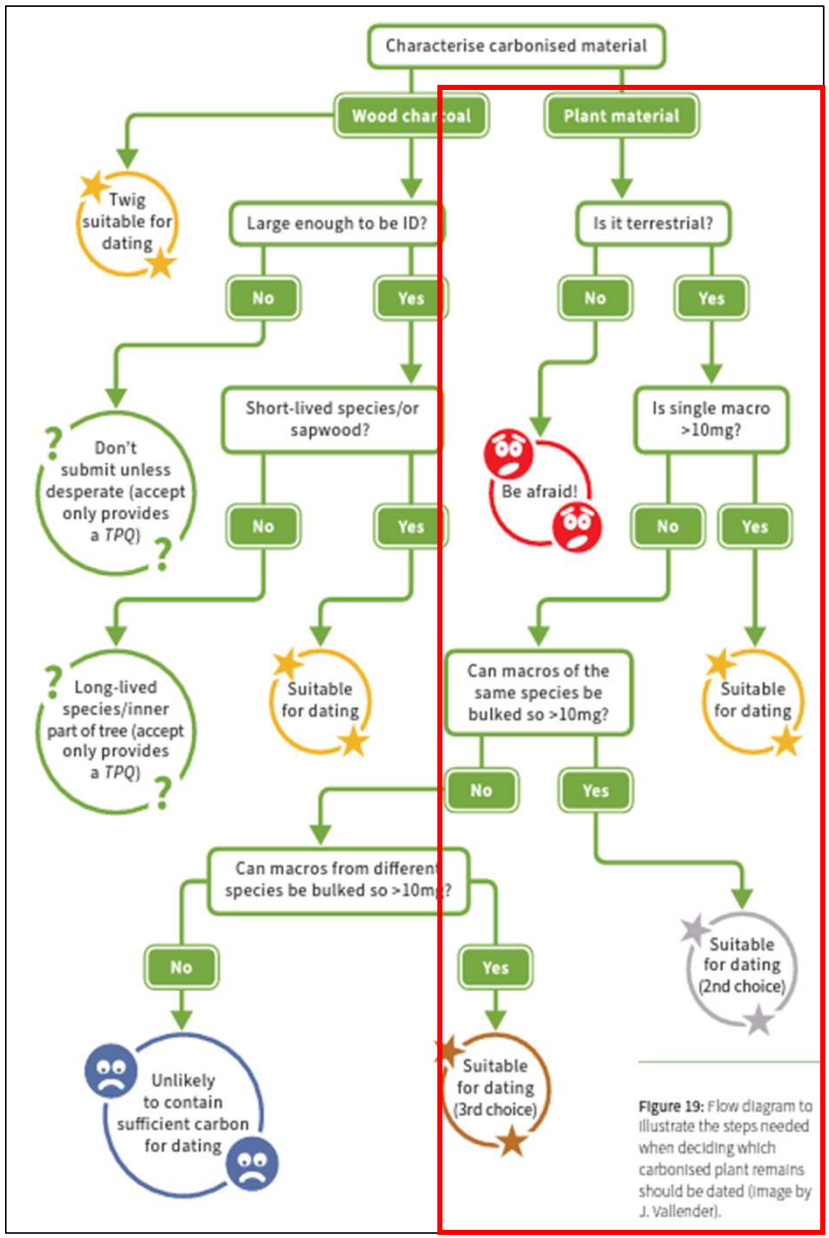


Figure 19: Flow diagram to illustrate the steps needed when deciding which carbonised plant remains should be dated (image by J. Vallender).

Thank you!

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