Guidelines for Collection of Botanical Samples from Kenan Tepe
Cathryn M. Meegan, Archaeobotanist, UTARP

WHY STUDY BOTANICAL REMAINS?

Botanical samples are collected from archaeological sites in order to provide data for understanding site use and human behavior. Botanical remains can be interpreted to determine such behaviors as plant selection and use, processing, cooking, storage, consumption, and discard, as well as changes in local environments related to human occupation and climate change. Like any archaeological material, botanical remains must be analyzed relative to their temporal and spatial context within a site. These guidelines are designed to help excavators collect flotation and pollen samples that will provide useful information for the archaeobotanist. Samples or seeds taken out of context do not provide meaningful information about human plant use. These guidelines will direct you in collection procedures, sample size, and sample selection.

At Kenan Tepe, we are currently using a selective sampling strategy. Examination of previously collected samples indicated that selective sampling would maximize the chances of recovering meaningful botanical remains. Hearths, pits, ovens, and floors are most likely to contain preserved botanical remains. Plant material found in open archaeological sites is most often found carbonized. Seeds, wood, and other plant parts that were not burned, either purposefully or by accident, are usually not preserved because of either physical or chemical degradation. Carbonization protects botanical remains from chemical degradation and discourages animals from moving or using plant parts.

TAPHOMONY:

There are several factors that influence the chances of recovering macrobotanical remains. Deposition processes and subsequent conditions for preservation are the most important determinants of what types of remains will be found in the archaeological record. The primary sources of macrobotanical remains for this study are charred areas, such as hearths, pits, and burned floors. In archaeological sites, carbonized plant remains are most likely to be preserved because they are more resistant to organic decay than unburned remains.

Seeds and other plant parts may be charred by accidental spillage into a fire, intentional sweeping into a fire, purposeful use as fuel, and burning of a structure lists three sources of seeds in the archaeological record. Direct sources bring seeds that are brought to a site to be used. Indirect sources introduce seeds as a consequence of the use of larger portions of the plant, not just its seed. Seed rain contributes seeds as they are blown in from the surrounding locality. Seed rain consists primarily of wild or field weed seeds. A variety of paleoethnobotanical studies of plant processing, use, and archaeological deposition show that charred cultivated seeds are deposited in archaeological deposits from direct and indirect sources as a result of accidental or intentional burning.

Good preservation of plant remains is fostered by minimal exposure to cycles of wetting and drying or freezing and thawing, as well as limited availability of oxygen. Rock shelters, caves, frozen contexts, bogs, deep strata, and less permeable soils provide the best conditions for preservation. Open, shallow surface deposits are most likely to result in decomposition or destruction of plant remains.
WHAT ARE BOTANICAL REMAINS?

Macrobotanical remains are defined as those plant remains that can be seen by the naked eye, but usually require the use of a microscope for identification. These remains include wood charcoal, seeds, straw, fibers, nuts, and plant parts that result from processing. Microbotanical remains are those that can only be seen under a microscope. These include pollen, starch grains, and phytoliths.

At Kenan Tepe, we are concentrating on macrobotanical remains. Pollen and phytoliths are less likely to be preserved within an arid site and, at this time, I do not have the equipment, time, or money to process for these microremains. Macrobotanical remains are collected from bulk sediment samples collected during excavation and processed using water flotation. The process of water flotation is based on the principle that carbonized material is less dense than water and will, therefore, float and can be skimmed off the surface. Instructions on how to use the water flotation machine constructed for the project are included in this handout. The following are instructions for obtaining flotation samples; an easy reference page (Table 1) is also included and should remain in your trench notebook.

FLOTATION SAMPLES:

1. **Definition:** A flotation sample is a sediment sample collected during excavation that is expected to contain culturally and environmentally informative botanical remains.

2. **Purpose:** Flotation samples are collected to efficiently recover charred or desiccated botanical remains from cultural contexts that are expected to provide information about subsistence and cultivation by the human occupants. Plant remains can help identify site or feature function, agricultural production practices, plant utilization, and environmental impact of human occupation.

3. **When to collect:**

   A. When cultural features, surfaces, and deposits are first exposed during excavation. If you must wait to collect the sample, the feature or surface must be covered to avoid contamination by modern activities. If you waited to take the sample, you should scrape the top inch or so of sediment off the top of the area to be sampled before taking the sample.

   B. When potential for good preservation is observed and distinct context and stratigraphy are recognized. When the cultural context is disturbed by bioturbation, erosion, vandalism, and other human and natural disturbances, the stratigraphic integrity and cultural context are compromised. Interpretation of botanical remains is then unreliable.

4. **Where to collect:**

   A. Collect one or more surface control samples on-site prior to ground-breaking on a new trench to identify the modern seed assemblage. The sample may be collected as a surface
scrape or by grabbing sediment from various locations in and around the trench boundary.

B. Collect from cultural contexts as they relate to research questions (see Table 1), such as hearths, ovens, pits, and floors, intact ceramic vessels, and charcoal lenses.

C. Collect samples in contexts that appear to be burned and contain macrobotanical remains or when you believe the sample may provide useful information. Use your best judgment and if you are unsure, take a sample.

D. Do not take samples from obviously disturbed contexts such as animal burrows or areas that contain obviously modern intrusions. Unless asked, do not take samples from walls. Direct any questions about sampling to the archaeobotanist.

5. **Sample Size and Number:** The size of the sample will depend on the context (see Table 1). Some contexts require larger samples in order to obtain useful data and some contexts are more likely to provide valuable botanical remains. In general, hearths provide the most numerous and best preserved remains. Two samples of approximately 2 liters each (about _ a medium-size bag) should be collected from hearths. Two or more samples should also be taken from floors if sealed context. In all other cases, one 2 liter sample should be taken unless there is obvious burning. If you cannot obtain the full suggested size, take what you can. Flotation samples are measure before processing. Take two samples if you are in doubt. Suggested sample size and contexts may be changed as analysis proceeds.

6. **How to Collect:**

   A. Using a clean trowel, remove sediment from context and place in a CLEAN medium size bag. Double bag all samples and seal. The find tag should be placed between the two bags. Try to secure the bag without using a tight knot. The bags must be opened to process.
   
   B. Label bags completely and NEATLY. Use pen and not pencil and make sure the tag is filled out correctly and legibly.
   
   C. On the back of the tag, briefly indicate why you took the sample…e.g. "hearth" or "surface appeared burned".
   
   D. Do NOT remove individual seeds or plant remains from the sediment. We lose contextual and volumetric data when you do this.
   
   E. Samples should be returned to the dighouse each day and placed in the crates labeled for flotation samples. Do not mix flotation samples with other types of samples. If you need to start a new layer or column of crates, do so.

*These guidelines were adapted for Kenan Tepe and Near Eastern contexts from "Guidelines for Collection of Botanical Samples from Southwestern Archaeological Contexts" by the Southwest Paleoethnobotany Workshop, 2001 (compiled by Janet L. McVickar) and from Meegan (In Progress).*
**Flotation Machine Instructions**  
Cathryn M. Meegan, Archaeobotanist, UTARP

1. The flotation machine constructed for this project is located on the large porch in the back apartment. Flotation is best conducted during the morning hours, because the samples need to dry slowly. Afternoon sun will dry the samples too quickly and this can cause the carbonized seeds to burst. Supplies needed for flotation include:

   - Ziploc bags
   - Sharpie
   - Clothes pin
   - Clothes line
   - Measuring cup
   - Chiffon, cut into 12" squares
   - Rubber bands
   - Strainer (2 if possible)
   - Cardboard (soda boxes) with newspaper lining
   - Log book

2. Several samples should be processed at one time (at least 10). The flotation machine uses a lot of water, though it is recycled, and it is more efficient to do many samples in one work session. The flotation machine should be cleaned prior to its first use and after the sediment has been cleaned out once the tall barrel is full. Check that all areas where the barrel has been cut and metal fixtures connected are sufficiently caulked to prevent leaks.

3. The tall barrel should be filled to about 3 inches below where the spout empties the water into the first half-barrel. The first half-barrel should be filled to about 3 inches below where the spout empties the water into the second half-barrel. The second half-barrel should be filled to about halfway. The hose should have the open end in the second half-barrel and be attached to the water pump underneath the tall barrel. A rope should be tied at various places around the first half-barrel in order to prevent the sides from bowing out and dumping water out of the barrel and to provide a place for the strainer.

4. Turn on the water pump by plugging it in to an electrical outlet. Remember you are using water and electricity, so exercise caution. As soon as the pump is turned on, you must loosen the nut on the water pump. Make sure the water is cycling through the system. You may need to adjust the water levels. Check for leaks and re-caulk if necessary.

5. If the system is working properly, place the heavy screen over the top of the tall barrel, lining up the indentation with the pipe leading to the first half-barrel. Line the strainer with a piece of chiffon and secure with clothespins. The strainer should be balanced on the ropes on the first half-barrel so that the pipe from the tall barrel empties the water directly in to the strainer without splashing out or overflowing.

6. When you are certain the system is set up and operating properly, you may start processing. Make sure you have all your supplies handy. Write the information from the tag in to your logbook, including what is written on the back of the tag. Measure 2 liters of the sediment from
the sample bag and place it on the large screen on the tall barrel. The sediment will fall through the screen into the water, which is agitated by the water pump. Carefully mix the sediment in the screen with your hand to break up any clods of dirt and separate any botanical remains from the soil matrix.

6. The carbonized plant remains will float to the top of the water in the barrel and float out through the pipe leading to the first half-barrel. These remains should be caught in the chiffon lining the strainer. Any sediment or remains that go through the chiffon are too small for analysis. Continue watching the sample in the tall barrel and make sure the carbonized remains are exiting the tall barrel and are being caught in the chiffon. Continue processing until the carbonized remains are no longer visible on the surface of the water.

7. The strainer should then be removed and the chiffon taken off and tied with a rubber band. When you do this, make sure that no seeds or charcoal are lost in the process. You may have to use the sink in the apartment to gently coax the remains into the center of the chiffon so that it can be folded and tied. The chiffon bundle should be attached to the clothes line with a clothespin WITH THE TAG.

8. The heavy screen that lies on top of the tall barrel now contains what is called the heavy fraction: items larger than the screen and too heavy to float. These items must also be dried and examined. The heavy fraction should be placed on newspaper in the cardboard boxes, making certain to note which sample it contains. After the heavy fraction dries, it should be examined for large carbonized remains, pottery, lithics, and bones. The carbonized remains should be returned to the sample contained in the chiffon after it too has dried. Other remains should be placed in their own bag, labeled with information from the tag and the indication "From Flotation Sample". These bags will require a new find number, which will be given in consultation with the trench supervisor and database manager.

9. After the sample in the chiffon has completely dried on the clothesline, the botanical remains should be emptied into a Ziploc bag, which is labeled with information from the tag. The tag should be attached to the Ziploc bag by making a hole above the seal and tying the tag.

10. Each sample will be processed in the same manner. When processing several samples at a time, each sample will be in the machine individually. After the chiffon and heavy fraction are removed, a new sample can be placed in the machine with the screen replaced and a fresh piece of chiffon. Make sure you do not mix tags or samples. As you gain more experience, a personal system will develop that will improve your efficiency and prevent you from making a mistake. You can turn off the water pump between samples if you need to or during processing if you think something is going wrong. When the pump is turned off, the nut must be tightened.

11. If you make a mistake that contaminates the sample, make a note of that on the log book and start with a fresh sample. This happens to everyone, just be sure that it is noted.

12. Once the sediment that sinks to the bottom of the tall barrel reaches the height of the showerhead in the barrel, the sediment must be emptied. This is accomplished by emptying the water and the sediment into 5 gallon buckets with the measuring cup and dumping it outside the apartment. This is usually done by hired workers.
13. All chiffon and heavy fraction samples will be dry by the end of the day (usually by after lunch) and should be brought inside and placed in bags. Changes in temperature and air conditions overnight can cause damage to the samples. At the end of each flotation session, the porch should be cleaned and all supplies put away. The porch has other uses, such as for sleeping, and all water should be swept out and soil cleaned from the porch.

14. Logbook entries should be entered in to the computer database at the end of each day of flotation. All data should be transferred so that a record of the number of flotation samples and volume of soil is readily available and the find numbers are available for the shipping manifest. Samples will be shipped to the US for processing after approval by the Turkish authorities.

Works Cited:


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Hillman, Gordon 1981

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Tracking early crops and early farmers: the potential of biomolecular archaeology. In The Origins and Spread of Agriculture and Pastoralism in Eurasia, edited by David R. Harris, pp. 93-100. Smithsonian Institute, Washington, DC.


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Miller, Naomi F. 1982

Minnis, Paul E. 1981

Pearsall, Deborah M. 2000
<table>
<thead>
<tr>
<th>Sample Context</th>
<th>Sample (approx. 2 liters each)</th>
<th>No. of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity/use surface (exterior of</td>
<td>Grab sample from across surface</td>
<td>1 (2 if burned)</td>
</tr>
<tr>
<td>structure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artifact (inside of intact ceramic</td>
<td>Retain contents; sediment under artifact if in situ</td>
<td>1</td>
</tr>
<tr>
<td>vessel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artifact (groundstone)</td>
<td>Sediment under and around if in situ</td>
<td>1</td>
</tr>
<tr>
<td>Ash/charcoal lens</td>
<td>Darkest concentration</td>
<td>1 (or 2 if obvious charcoal present)</td>
</tr>
<tr>
<td>Burial: skeletal remains</td>
<td>Adjacent to remains</td>
<td>1</td>
</tr>
<tr>
<td>Control sample; modern surface</td>
<td>Grab or surface scrape</td>
<td>1</td>
</tr>
<tr>
<td>prior to start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td>At least one sample; multiple samples if sealed or obvious burning; separate sample from corners, edges, near features (such as hearths) or doorways if able to discern; if surface uniform with no features or discernable doorway, one sample grab from across surface; indicate on tag where on floor sample taken (i.e. near pit, in corner, near door)</td>
<td>1 or more</td>
</tr>
<tr>
<td>Hearth/thermal feature</td>
<td>Interior fill, bases, sides, floor surface surrounding hearth</td>
<td>At least 2</td>
</tr>
<tr>
<td>Midden</td>
<td>If stratigraphic layers present, one sample from each strata</td>
<td>At least 1</td>
</tr>
<tr>
<td>Oven</td>
<td>Interior fill, base, sides, floor surface surrounding</td>
<td>At least 2</td>
</tr>
<tr>
<td>Pit, thermal (burned context)</td>
<td>Interior fill, base, sides, floor surface surrounding</td>
<td>At least 2</td>
</tr>
<tr>
<td>Pit, storage, non-thermal</td>
<td>Interior fill, base, sides</td>
<td>1</td>
</tr>
</tbody>
</table>
SPECIAL INSTRUCTIONS FOR THE 2002 FIELD SEASON

Take a sample of mudbrick (around the size of a modern brick) from each phase of construction. You can usually tell that you have reached a new phase of construction when the wall is on a different orientation. Check with your section supervisor if you have questions or take a sample if you are unsure. The sample should be a solid piece of mudbrick. Do not be overly concerned about the size, I will be sampling from the interior. Each mudbrick chunk should be placed in its own bag and labeled with a find number. Be sure to label the tag with the locus and try to estimate the orientation of the wall (e.g. runs approximately NE to SW).

Example of how two separate wall construction phases may appear in top plan.