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Phytoliths in the Predynastic: a Microbotanical analysis of Plant Use at HG, in the Hu Semaineh region, Egypt

Arlene Miller Rosen

This brief note is intended as an example of the kinds of information that can be obtained from phytolith analysis at Predynastic sites in the Nile Valley. Phytoliths are microscopic bodies of silica which form in the epidermal tissue of plants. The phytoliths which occur in monocotyledons (grasses, sedges and palms) take on the shape of the cells within the epidermal tissue and are often represented by large sections of fossilized epidermal tissue known as silica skeletons or multi-celled phytoliths. These multi-celled forms are identifiable to subfamily, genus, and sometimes species, whereas the single-celled types are typically identifiable at the subfamily level (Piperno, 1988; Rosen, 1992).

Egyptian Predynastic sites yield an abundance of the multi-celled phytolith forms. Although much basic research is still needed in order to distinguish many of the plant types, some of the more economically important plants are clearly identifiable including wheat, barley, rushes (including Cyperus papyrus and Cyperus alopecuroides), and reed grasses (Phragmites sp. and Arundo donax), and palms.

Multi-celled phytoliths are also indicative of the part of the plant in which they formed. This allows phytolith researchers to distinguish plant parts that were economically important to the occupants of a site, and also to determine what activities were taking place in a given archaeological context based on the part of the plant represented at that location. For example, a silo would contain an abundance of phytoliths form the glumes of the cereals stored, an animal pen would yield remains of cereal straw, and a sleeping area might be indicated by the remains of the stems of matting rushes.

HG

The site of HG is located near the village of Halfa Gibli in the Hu-Semeinah region of Egypt (see map, p. 2), in the vicinity of Nag Hamadi (Bard, 1989, 1994). It is situated on a ridge of alluvial fan deposits at the edge of the low desert abutting the Nile floodplain. The site was excavated by Kathryn Bard in 1991, but no permanent architectural features were preserved due to disturbance from recent cultivation. Some shallow in situ deposits were located on one spur of a ridge where a number of samples were collected for macro-botanical analysis, along with one sample for a trial investigation of the phytolith remains.

Methods

The sample was selected from a lens of ashy sediment within a section through in situ material. About 50 g of sediment were collected. This was subsampled in the laboratory an 10 g were treated with HCl to eliminate the pedogenic carbonates. A Sodium pyrophosphate solu-
tion was added to disperse clay particles which were then removed after gravity sedimentation of the silt and fine-sand fractions. Organic matter was oxidized by burning at 500° C in a high temperature muffle furnace. The remaining sediment was floated in a high density liquid (Sodium polytungstate) adjusted to a specific gravity of 2.3 in order to separate the opaline phytoliths from the quartz silt and fine sand. The phytoliths were mounted in Permount and counted at 400 x magnification. Separate counts were made for single-celled and multi-celled phytoliths.

**Results**

The results of the counts are presented in Table 1. The phytoliths formed in long cells were divided into the smooth-walled forms occurring in the leaves and stems of grasses versus the waxy-walled dendritic forms that occur in the glumes of cereals and weed grasses. These are counted separately from the other single-celled phytoliths in order to obtain information on the relative importance of these two categories of plant parts. Since long-cells from the leaves and stems are usually much more common than those of the inflorescences, the high relative percentage of 47% dendritic forms indicates a significantly large number of glumes of other floral parts in this sample.

The relative percentages of shorts cells (Figure 1) indicate that the «saddle» form dominates the assemblage (see Figure 2). This type of saddle is typically found in common reed (*Phragmites* sp.). The second largest category is that of the «rondels», a type commonly found in C3 (temperate) grasses including wheat, barley, and weed grasses. The C4 (tropical) grasses (represented by «crossed», «polybates», «bilobates» and «crenates») are much less common. The sedges (Cyperaceae) form about 10% of the sample of single-cell forms (Figure 3).

The multi-celled phytoliths are dominated by the leaves and stems of unidentifiable grasses and sedges (Figure 4). There are also a significantly large number of forms from the stems of the genus *Cyperus* sp. which includes papyrus (*C. papyrus*) and mat rush (*C. alopecuroides*). Multi-celled phytoliths from *Phragmites* sp., (common reed) a plant used for building temporary enclosures, are also present (see Figure 5). Although wheat and barley glumes do occur in the sample, they
are by no means dominant (see Figures 6 and 7). This sample seems to contain a variety of different plant types and plant parts, including some cereal straw (Figure 8) and is probably indicative of a midden deposit.

One notable feature is in the phytoliths from the wheat glumes. These consist of silicified micro fossils of the cells of glume epidermis including long cells, short cells, cork cells and papillae. It has been noted by Tubb et al. (1993) that the papillae ornamentation of Emmer (*Triticum dicoccum*) differs from that of bread wheat (*T. aestivum*). The emmer typically displays an average of 9 pits around each papillae whereas bread wheat has an average of 11-13 (depending upon the variety). The wheat phytoliths from HG contain a number of examples of papillae which 13+ pits (Figure 9). This suggests that bread wheat might have been at HG site in addition to the emmer. In an earlier analysis of macrobotanical remains from HG site G. Hillman identified the remains of an advanced emmer (*T. paleaeocolchicum*) (W. Wetterstrom, personal communication). This wheat also displays a larger papilla diameter and greater number of pits 10 ± 13 that of *T. dicoccum* (Tubb Hodson, personal communication), and may be the type of wheat represented by these phytoliths.

Emmer wheat phytoliths are also indicative of wet-land farming in arid environments. Rosen and Weiner (1994) showed that in the southern Levant, emmer wheat grown with irrigation produced a significantly higher number of phytoliths with over 10 joined cells than wheat grown by dry farming. Phytoliths with large numbers of joined cells were also observed on the wheat glume phytoliths from HG (see Figure 10). Some of these contained up to 80 attached cells. This type of signal is of course predictable in the Nile Valley where there is no rainfall agriculture.
**Fig. 10** Percentages of the number of silicified cells per wheat phytoliths, a pattern typical of irrigated wheat

<table>
<thead>
<tr>
<th>Site</th>
<th>HG</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>EHG 91-1</td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>Predynastic</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1 Phytolith counts and percentage from HG**

<table>
<thead>
<tr>
<th>Cell Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Long-cells (Leaf/Stem)</td>
<td>93</td>
<td>52.54</td>
</tr>
<tr>
<td>Dendritic Long-cells (Floral)</td>
<td>84</td>
<td>47.46</td>
</tr>
<tr>
<td>Total Long-cells</td>
<td>177</td>
<td></td>
</tr>
<tr>
<td>Papillae</td>
<td>10</td>
<td>3.91</td>
</tr>
<tr>
<td>Hairs</td>
<td>3</td>
<td>1.17</td>
</tr>
<tr>
<td>Bulbiforms</td>
<td>4</td>
<td>1.36</td>
</tr>
<tr>
<td>Crenates</td>
<td>1</td>
<td>0.39</td>
</tr>
<tr>
<td>Bilobes</td>
<td>7</td>
<td>2.33</td>
</tr>
<tr>
<td>Polylobates</td>
<td>3</td>
<td>0.99</td>
</tr>
<tr>
<td>Crosses</td>
<td>7</td>
<td>2.33</td>
</tr>
<tr>
<td>Hairs</td>
<td>3</td>
<td>1.17</td>
</tr>
<tr>
<td>Rondels</td>
<td>75</td>
<td>29.30</td>
</tr>
<tr>
<td>Saddles</td>
<td>101</td>
<td>39.45</td>
</tr>
<tr>
<td>Cones</td>
<td>27</td>
<td>10.35</td>
</tr>
<tr>
<td>Spool</td>
<td>8</td>
<td>3.13</td>
</tr>
<tr>
<td>Flat Tower</td>
<td>5</td>
<td>1.77</td>
</tr>
<tr>
<td>Horned Tower</td>
<td>4</td>
<td>1.56</td>
</tr>
<tr>
<td>Total Shot-cells</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Total Panicoid</td>
<td>6.25</td>
<td></td>
</tr>
<tr>
<td>Total Festucoid</td>
<td>31.25</td>
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</tr>
</tbody>
</table>

**Conclusions**

The analysis of this one sample from Hu serves as an example of some of the types of problems that phytolith analyses can address at Predynastic sites. Phytoliths can not only supplement macrobotanical remains by adding to the lists of identified plants, they can also supply information unattainable by more traditional methods of paleoethnobotany.

**Acknowledgements**

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**References**


