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| --- | --- | --- |
| **Phytolith Morphologies**  (single-cell unless described as **multi-cell**) | **ICPN alternative** | **References to identification criteria/comments** |
| Psilate long-cell**G~** | Elongate psilate margin | Most frequently found in grass stems ([Metcalf, 1960](#_ENREF_10); [Twiss, 1992](#_ENREF_19)). |
| Echinate long-cell**M** | Elongate echinate | General of monocots. Of particular importance as a morphology that is found in *Phragmites* (reed) culms. |
| Dendritic long-cell**G** | Elongate dendritic | Found primarily in pooid grass husks and are characterized by finely branched processes ([Novello and Barboni, 2015](#_ENREF_12); [Rosen, 1992](#_ENREF_15)). See the ICPN schematic drawings ([Madella et al., 2005](#_ENREF_9)). |
| Bilobe short-cell**G** |  | Generally panicoid grasses ([Twiss et al., 1969](#_ENREF_20))­­. |
| Polylobate short-cell**G** |  | Generally panicoid grasses ([Twiss et al., 1969](#_ENREF_20)). |
| Cross short-cell**G** | Quadralobate | Generally panicoid grasses ([Twiss et al., 1969](#_ENREF_20)). |
| Saddle short-cell**G** |  | Generally chloridoid grasses ([Twiss et al., 1969](#_ENREF_20)), but also appears in *Phragmites*. |
| Rondel short-cell**G** |  | Generally pooid grasses ([Twiss et al., 1969](#_ENREF_20)). |
| Wild grass husk **G** **(multi-cell)** |  | Generally pooid grass. Dendritic long cells, with papillae and short cells (mainly rondel). Cork cells are sometimes silicified ([for a more detailed discussion of husk identification methods please refer to Rosen, 1992](#_ENREF_15)). |
| cf. Wild wheat husk **G (multi-cell)** |  | Dendritic long cells with high rounded wave with irregular amplitude. Variable papillae size range from 21-43 µm, with 16 to 18 pits, and a domed stippled surface. Cork cell’s tend to be D-shaped ([for a more detailed discussion of husk identification methods please refer to Rosen, 1992](#_ENREF_15)). |
| Bulliform**G** |  | Found in the leaves of grasses, also known as motor-cells ([Metcalf, 1960](#_ENREF_10)). |
| Stacked Bulliforms**G**  **(multi-cell)** |  | Found in the leaves of grasses. Higher silicification may indicate a wet or submerged growing environment ([Andrejko and Cohen, 1984](#_ENREF_2); [Bremond et al., 2005](#_ENREF_5); [Sangster and Parry, 1969](#_ENREF_18)). |
| Keystone Bulliform (‘Fan-shaped’) (cf. reeds)**G** | Cuneiform bulliform cell | Commonly occur in reed-grass species that favor watery habitats ([Sangster and Parry, 1969](#_ENREF_18)). Cf. to fan-shaped reed ([Liu et al., 2013](#_ENREF_8)). With higher silicification may also become a ‘stacked’ multi-cell form. |
| *Phragmites* (reed) culm**G (multi-cell)** |  | Echiniate long cells connected by narrow ‘pinched’ short-cells (mainly rondel to saddle). The short-cells are narrower than the echinate long-cells that connect them ([Ryan, 2011](#_ENREF_17); [Ryan, 2009](#_ENREF_16)). |
| *Phragmites* (reed) leaf**G (multi-cell)** |  | Characterized by small frequent stomata ([Ryan, 2011](#_ENREF_17); [Ryan, 2009](#_ENREF_16)), with a central lacuna that pinches out beyond the more silicified top and bottom (‘hamburger’ shape) ([Greiss, 1957](#_ENREF_6)). |
| Sedge cones**M** |  | See ([Ollendorf et al., 1987](#_ENREF_14); [Ollendorf, 1992](#_ENREF_13); [Metcalf, 1971](#_ENREF_11); [Le Cohu, 1973](#_ENREF_7)). Single and multi-cell forms. |
| Juncus-type**M (multi-cell)** |  | See ([Fig. 108 and 114A in Greiss, 1957](#_ENREF_6)). Characterized by small, linear stacks of uniform oval to cube shaped cells. |
| Platelets (sheet)**DM** |  | See ([Bozarth, 1993](#_ENREF_4)). Found in dicot leaves and wood, cf. to platelet ([Albert et al., 2003](#_ENREF_1)). |
| Polyhedron**D** |  | Found mainly in dicot leaves, single and multi-cell forms ([Albert et al., 2003](#_ENREF_1); [Bozarth, 1992](#_ENREF_3)) (Fig. 5d). |
| Honeycomb**DM** | Favose | Found mainly in dicot leaves ([Bozarth, 1993](#_ENREF_4); [Albert et al., 2003](#_ENREF_1)). |
| Smooth spheroid **D** |  | Found mainly in dicot wood, cf. to spheroid psilate ([Albert et al., 2003](#_ENREF_1)). |
| Blocks**DM** |  | Found mainly in dicot wood, cf. to parallelepiped block forms ([Albert et al., 2003](#_ENREF_1)). |
|  | | |

Key: **G** grasses, **G~** mainly grasses, **M** monocot, **D** dicot.

Albert RM, Bar-Yosef O, Meignen L, et al. (2003) Quantitative phytolith study at hearths from the Natufian and Middle Paleolithic levels of Hayonim Cave (Galilee, Israel). *Journal of Archaeological Science* 30: 461-480.

Andrejko MJ and Cohen AD. (1984) Scanning electron microscopy of silicophytoliths from the Okefenokee swamp-marsh complex. In: Cohen AD, Casagrande DJ, Andrejko MJ, et al. (eds) *The Okefenokee swamp: its natural history, geology and geochemistry.* Wetland Surveys, Los Alamos, NM., 468-491.

Bozarth SR. (1992) Classification of Opal Phytoliths Forms in Selected Dicotyledons Natives to the Great Plains. In: Rapp GJ and Mulholland SC (eds) *Phytolith Systematics Emerging Issues.* New York: Plenum Press, 193-214.

Bozarth SR. (1993) Biosilicate assemblages of boreal forests and aspend parklands. In: Pearsall DM and Piperno DR (eds) *Current research in phytolith analysis: Applications in archaeology and paleoecology.* Pennsylvania: The University Museum of Archaeology and Anthropology, University of Pennsylvania, 95-101.

Bremond L, Alexandre A, Peyron O, et al. (2005) Grass water stress estimated from phytoliths in West Africa. *Journal of Biogeography* 32: 311-327.

Greiss EAM. (1957) *Anatomical Identification of some Ancient Egyptian Plant Materials* Le Claire, Impremerie Costa Tsoumas & Co. .

Le Cohu M-C. (1973) Examen au microscope électronique à balayage, des cônes de silice chez les Cypéracées. *C. R. Acad. Sc. Paris* 277: 1301-1303.

Liu L, Jie D, Liu H, et al. (2013) Response of phytoliths in *Phragmites communis* to humidity in NE China. *Quanternary International* 304: 193-199.

Madella M, Alexandre A and Ball T. (2005) International code for phytolith nomenclature. *Annals of Botany* 96: 253-260.

Metcalf C. (1960) *Anatomy of the monocotyledons I. Gramineae,* London: Oxford University Press.

Metcalf C. (1971) *Anatomy of the Monocotyledons V. Cyperaceae,* London: Oxford University Press.

Novello A and Barboni D. (2015) Grass inflorescence phytoliths of useful species and wild cereals from sub-Saharan Africa. *Journal of Archaeological Science* 59: 10-22.

Ollendorf A, L. (1992) Towards a Classification Scheme of Sedge (Cyperaceae) Phytoliths. In: Rapp GJ and Mulholland SC (eds) *Phytolith Systematics Emerging Issues.* New York Plenum Press, 91-112.

Ollendorf A, L., Mulholland SC and Rapp GJ. (1987) Phytoliths from some Israeli Sedges. *Israel Journal of Botany* 68: 125-132.

Rosen A. (1992) Preliminary identfication of silica skeletons from Near Eastern archaeological sites: an anatomical approach. In: Rapp GJ and Mulholland SC (eds) *Phytolith Systematics, Emerging Issues.* New York: Plenum Press, 129-147.

Ryan P. (2009) Diversity of Plant and Land Use During the Near Eastern Neolithic: Phytolith Perspectives from Çatalhöyük. *Institute of Archaeology.* University College London.

Ryan P. (2011) Plants as material culture in the Near Eastern Neolithic: Perspectives from the silica skeleton artifactual remains at Çatalhöyük. *Journal of Anthropological Archaeology* 30: 292-305.

Sangster AG and Parry DW. (1969) Some Factors in Relation to Bulliform Cell Silicification in the Grass Leaf. *Annals of Botany* 33: 315-323.

Twiss PC. (1992) Predicted World DIstribution of C3 and C4 Grass Phytoliths. In: Rapp GJ and Mulholland SC (eds) *Phytolith Systematics Emerging Issues.* New York: Plenum Press, 113-128.

Twiss PC, Suess E and Smoth RM. (1969) Morphological Classification of Grass Phytoliths. *Soil Science Society of America Proceedings* 33: 109-116.