

International Code for Phytolith Nomenclature 1.0

ICPN Working Group: M. Madella^{1*}, A. Alexandre², T. Ball³

^{1*}Department of Archaeology and the McDonald Institute, Downing Street, Cambridge
CB2 3DZ, UK. mm10018@cam.ac.uk

²CNRS, CEREGE, Europôle de l'Arbois, BP80, 13 545 Aix en Provence Cedex 04,
France. alexandre@cerege.fr

³375 A Joseph Smith Building, Brigham Young University, Provo, UT 84602, USA.
Terry_Ball@byu.edu

Abstract

This paper presents the first International Code for Phytolith Nomenclature (ICPN) proposing an easy to follow, internationally accepted protocol to describe and name phytoliths (microscopic opal silica particles produced in and between the cells of many plants). Today, phytolith analysis is widely used in palaeoenvironmental studies, botany, geology and archaeology.

Key words: Phytoliths, nomenclature, systematic, description, code

Introduction to the International Code for Phytolith Nomenclature 1.0 (ICPN 1.0)

A discussion on phytolith nomenclature arose during the 3rd International Meeting on Phytolith Research (IMPR) in Bruxelles (August 2000). The majority of the delegates agreed that standardizing and harmonizing the naming and describing of phytoliths improve communication between researchers and facilitate the comparison of phytolith types and analyses. Presently, those studying phytoliths are faced with a considerable volume of names, including countless numbers of synonyms and homonyms. To further complicate the situation, there are often inconsistencies in the application of these names. The number of people working with phytoliths is growing fast as is the exchange of data and communication between research groups. Standardizing the nomenclature is therefore urgently needed to avoid further confusion and allow easy, uniform and correct usage of phytolith names. Such stability can only be achieved by the application of a generally accepted (international) nomenclature protocol and glossary.

For this purpose, during the 3rd IMPR and with the sponsorship of the Society for Phytolith Research (SPR), a working group in charge of developing an International Code for Phytolith Nomenclature (ICPN) was created. The International Working Group on Phytolith Nomenclature (IWGPN) was to develop:

- a) A **standard protocol** to be used during the process of naming and describing a new (or already known) phytolith type.

- b) A **glossary of descriptors** (nouns and adjectives) to be used in naming and describing a phytolith type.

It is anticipated that the work of the IWGPN will be refined and the protocol and glossary improved by an ongoing committee appointed by the SPR. The standard protocol and glossary of descriptors developed by the first Working Group are presented here as the International Code for Phytolith Nomenclature 1.0.

The protocol suggested below follows the example of many other protocols already in use in other scientific disciplines. The protocol supplies the researcher with clear, easy to follow guidelines to apply when describing and naming a new or already published phytolith type. In cases where a phytolith type has been described in earlier works using a different terminology, citations of the earlier works should be included.

The publication of a new phytolith type requires two elements: an accurate description and an appropriate name

DESCRIBING

1) Descriptive tools – The nouns and adjectives supplied in the Glossary at the end of this paper should be used. These are called descriptors. To insure the utility of the Glossary by the international community, terms with Latin or ancient Greek roots are used. The Glossary will be updated regularly by the current IWGPN and future committees, and new descriptors may be added when necessary.

2) Description procedure – When describing a phytolith type certain kinds of characteristic information need to be supplied:

SHAPE. A description of shape using terms from the Glossary or from geometrical forms should be supplied. The 3D phytolith form should be observed and described. Analysis in liquid mounting should be performed to facilitate the rotation of the phytoliths in this process and to ensure that all orientations are observed and described. Distinctive 2D characteristics should also be included in the description.

TEXTURE AND/OR ORNAMENTATION. A description of distinctive ornamentation should be given using the terms supplied in the Glossary. Weathering features should not be described as ornamentations or texture but can be noted if distinctive. Presence of inclusions may be described, though they are not generally considered diagnostic.

SYMMETRICAL FEATURES. Distinctive lines of symmetry should be included in the description.

MORPHOMETRIC DATA. Measurements of size and shape with descriptive statistics such as ranges and means, may be included in the description if an adequately large sample has been analysed. To verify that a statistically sound

population has been sampled, a calculation such as the one below is recommended:

$$N_{\min} = Z^2_{\alpha/2} \times S^2 / (\text{ME})^2$$

Where:

N_{\min} = minimum adequate sample

$Z^2_{\alpha/2}$ = 1.64, which is the square of the two-tailed Z value at $\alpha = 0.10$

S^2 = variance

$(\text{ME})^2$ = square of the desired margin of error, usually 0.05 x the sample mean

ILLUSTRATIONS. Description of a phytolith type must be accompanied by illustrations. Illustrations need to be optical microscope photographs and/or 3D detailed line drawings portraying all possible orientations of the phytolith. While SEM photographs can also be used as a complement to the main illustrations. Because most of the routine work in phytolith identification is done at the optical microscope SEM photographs should not be used as a substitute for optical photographs. All illustrations must show a scale bar and a note with magnification and authorship.

ANATOMICAL ORIGIN. The description of a phytolith type needs to explicitly state the anatomical origin of the phytolith (at tissue structure or cell level) *only* if

the phytolith type has been directly observed in situ or if this origin has been already *clearly demonstrated* in a previous, fully-referenced publication(s).

3) Taxonomic significance – Researchers should use caution in assigning taxonomic significance to a phytolith type. A phytolith type may be observed in a given taxon but to be diagnostic it must be exclusively present in that taxon (e.g. if a phytolith type is considered diagnostic at family level, it must occur in all the genera of that particular family, and be absent in families belonging to the same order or group). Geographically observed types can also be identified when the flora of a specific geographic area has been investigated (e.g. Tropical Africa, New World Tropics, etc).

The Working Group is very aware that, because of multiplicity and redundancy (Piperno 1988), such a univocal production *often can be impossible* or very time-consuming to verify. When a phytolith type is observed in a plant and there is not sufficient information to corroborate any wider taxonomic significance, the researcher should avoid generalizations. For example, if a phytolith is observed in a species but no other comparative studies are available, then the phytolith should be published as *observed* in that species and *not as diagnostic* of that species or genus, family, etc.

- observed: found in a taxon but maybe present in other taxa.
- diagnostic: only present in that particular taxon.

Note I: When taxonomic significance can not be assigned to a single phytolith type, a group of phytolith types and their frequencies (phytolith assemblage) may have taxonomic significance and this should be considered.

Note II: Silica skeletons (articulated phytoliths) maintain the cell architecture of the original tissue. The single cells forming the silica skeleton can be described using the same procedure as per single cells. A description of the silica skeleton using anatomical terms for the articulated cells (e.g. stomata, hair, papillae, etc) may also be useful.

NAMING

1) Naming a phytolith type – The name given to a particular phytolith type should be formed by a maximum of up to three descriptors. Each descriptor can be a single word or a combination of words listed in the following order:

- The 1st descriptor should describe the SHAPE (this can be a 3D or a 2D descriptor whichever is more indicative and it can also include the symmetry, if indicative). The main orientation used when naming the phytolith type should be illustrated in the publication.

- The 2nd descriptor should describe the TEXTURE AND/OR ORNAMENTATION if characteristic or diagnostic and if not an artifact of weathering. Weathering features should not be described as surface

ornamentation and they should not be part of the name. However, distinctive weathering features may be noted in the description.

- The 3rd descriptor should be the ANATOMICAL ORIGIN *when this is clear and beyond doubt*. When the descriptor for anatomical origin also conveys a shape then an additional shape descriptor may not be needed. For example, “bulliform” is a word established in the botanical literature to describe a particular type of cell found in the epidermis of the grass leaf. For this particular case, the word conveys both an anatomical –that particular cell in the grass leaf- and a descriptive meaning –the cell is shaped like a bubble/drop.

A preliminary list of common phytolith types together with their names following the ICPN rules and coding is given in Table 1.

Nomina conservanda – Exceptionally, a name commonly used and made by descriptors not included in the Glossary can be preserved such as when a *name has become so meaningful* and internationally accepted that changing it might create confusion. The *nomina conservanda* rule will be applied in very exceptional cases at the discretion of the ICPN Working Group. The following is a list of *nomina conservanda* names accepted by the first ICPN Working Group:

Bulliform

Papillae

Dendritic

Cross

Saddle

Rondel

2) Publication of the name - A phytolith type named according to the International Code for Phytolith Nomenclature is considered the published name when the article has been distributed on printed matter to the general public (e.g. peer reviewed journals, books or proceedings). Publication is not fulfilled by communication at a public meeting (e.g. conference), by web publication, by naming reference collection material or by the issue of microfilms made from manuscripts, type-scripts or other unpublished material (e.g. university theses).

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