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Water quality — Guidance on the estimation of phytoplankton biovolume

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National foreword

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European foreword

This document (EN 16695:2015) has been prepared by Technical Committee CEN/TC 230 “Water analysis”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2016 and conflicting national standards shall be withdrawn at the latest by March 2016.

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Introduction

The abundance or number of counting units of individual phytoplankton taxa does not necessarily reflect the real ratio of single taxa to the complete biomass of a phytoplankton community. Few big cells/counting units can contribute far more biomass to the system than many small ones. Hence, abundance data alone is often not an ideal measurement of population size. Biomass estimations give very important information for ecological studies, classification schemes and ecosystem modelling. Therefore, it is necessary to determine the biomass of phytoplankton taxa, particularly because phytoplankton delivers energy in the form of carbon, to other trophic levels of food webs. It is not possible to directly analyse the carbon content on the taxonomic level in natural phytoplankton samples, therefore the biovolume of the phytoplankton taxa is a suitable measure to determine the biomass of an ecosystem according to the taxonomic composition. Neither particle size analysis using laser analysis, nor flow cytometry, nor Coulter Counters, nor chemical analyses of chlorophyll-a concentration as well as total carbon allow statements on the taxon level. An estimation of the carbon content is possible using conversion factors (see Annex C).

Further, the biovolume is a quantitative basis for assessing hazards from those algae and cyanobacteria, which (can) contain noxious or toxic metabolites, and is used in combination with cell numbers or chlorophyll-a concentration within WHO guidelines and national regulations for risk assessments.

Up to now, various guidelines for estimating the biovolume of microalgae have been used in different national and international monitoring programs (e.g. [1], [2], [3], [4]). The main objective of this document is the standardization of the procedure for determining the phytoplankton biovolume in order to achieve comparability of data. For this reason, the estimation of the biovolume in phytoplankton samples in sedimentation chambers (according to Utermöhl) using an inverted microscope will be described in detail.

This European Standard is also applicable for image analysis of pictures derived from microscope and flow cytometry cameras. The use of a standard catalogue containing basic and some composed geometrical shapes is recommended. Of course, such a standard list will not reflect the variety of all naturally existing shapes and will not match the exact biovolume values of each taxon. It will always be a compromise between accuracy and efficiency. However, the usage of agreed geometrical shapes and the application of the relevant formulae will improve the comparability of phytoplankton data and will be an important step forward for the implementation of quality assurance measures in phytoplankton analysis.

1 Scope

This European Standard specifies a procedure for the estimation of biovolume of marine and freshwater phytoplankton taxa using inverted microscopy (Utermöhl technique according to EN 15204), in consideration of some heterotrophic protists (< 100 µm) that are not considered in routine zooplankton analysis and benthic microalgae, which can be found in pelagic water samples.

This European Standard describes the necessary methods for measuring cell dimensions and for the calculation of cell or counting unit volumes to estimate the biovolume in phytoplankton samples. This shall be done using harmonized assignments of geometrical shapes to avoid errors.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15204, *Water quality - Guidance standard on the enumeration of phytoplankton using inverted microscopy (Utermöhl technique)*

EN 15972, *Water quality - Guidance on quantitative and qualitative investigations of marine phytoplankton*

EN 16698, *Water quality - Guidance on quantitative and qualitative sampling of phytoplankton from inland waters*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
biomass
total mass of living organic matter within a system or taxon

3.2
biovolume
total volume of (living) organisms within a system or taxon

Note 1 to entry: The biovolume is usually expressed in cubic millimetres per litre (mm^3/l).

3.3
cell volume
counting unit volume
total volume of a single cell or one counting unit

Note 1 to entry: The cell volume or counting unit volume includes the cell wall (if existing) but excludes lorica and/or mucilaginous envelopes and cell surface structures such as spines, bristles and scales.

Note 2 to entry: The cell volume or counting unit volume is usually expressed in cubic micrometres (μm^3).

4 Principle

Generally, the estimation of the total or taxon specific biovolume in phytoplankton samples of natural communities or cultures is based on measurements of a representative number of individuals. By multiplying the average or median cell or counting unit volume with the abundance, the total biovolume of each taxon in the sample is determined.

Three approaches are feasible:

1) **Estimation by representative measurement:** A representative number of individuals (in most cases single cells) or counting units of all recorded or dominating taxa is measured in each sample or a specified number of samples within a comparable series. These data are used to calculate the average or median cell or counting unit volume of each taxon using the applied geometrical formulae.

2) **Estimation using size classes based on representative measurements:** For taxa with a high variability in cell size (e.g. several diatoms, different stages in life cycle) reasonable size classes can be determined first, and then the individuals are assigned to both the relevant taxon and size class. Basis for the definition of the size classes are measurements in the same manner as described in (1).

3) **Estimation using standard volumes based on representative measurements:** A reasonable general standard cell or counting unit volume is defined for each taxon once. These standard values are determined by representative measurements and calculated by the formula of the assigned geometrical shapes as described in (1).

A geometrical shape shall be assigned to each taxon in all approaches to calculate the cell or counting unit volume. Thus, to harmonize these approaches the geometrical shapes are pre-assigned to all taxa (see Annex D). These shapes have been chosen to reflect the corresponding taxa shapes as accurately as possible, and to allow effective taxa measurement with little effort (i.e. with as few dimensions as possible; usually only two are necessary). Seventeen different geometrical shapes are utilized (for the catalogue of geometrical shapes see Annex A). If it is impossible to describe the actual shape of a taxon with a simple basic geometrical shape, composite shapes (e.g. cone with half sphere) are used. If the actual geometry of taxa does not fit exactly to the assigned shape, a “geometry correction factor” is used for the final cell or counting unit volume calculation.

Taxon lists describing the preferred geometrical shapes have been published before (see e.g. [1], [3], [4]), based on specific taxonomical levels or for particular areas. This guidance document provides harmonized geometrical shapes for phytoplankton organisms spread across European marine, brackish, and freshwater systems. Annex D contains an alphabetical list of genera with the assigned geometrical shapes. If there are divergent forms on species, subspecies, form, or variety level within a genus they are listed as well.

5 Equipment and preservatives

The following equipment is required for biovolume analysis of phytoplankton samples.

5.1 Inverted microscope equipped with a condenser featuring a numeric aperture (NA) of at least 0,5 and plan objectives with a NA of 0,9 or more allowing for total magnification between 63× and 400× at a minimum. The microscope should have binocular, bright field (additional phase contrast is useful), 10× or 12,5× eyepieces.

Though inverted microscopy is the recommended method for analysing of phytoplankton, conventional (non-inverted) compound light microscopes may also be used for measuring phytoplankton under some conditions.

5.2 Calibrated object micrometre.

5.3 Eyepiece (ocular) micrometre.

5.4 Counting-graticule.

5.5 Sedimentation chambers according to EN 15204.

5.6 Image analysis software, if available.

5.7 Sampling bottles according to EN 15204.

5.8 Preservatives, acidic Lugol's iodine and/or alkaline Lugol's iodine according to EN 15204.

6 Procedure

6.1 Sampling and sample preparation

The sampling and determination of phytoplankton abundance and composition is a precondition for the calculation of the biovolume of a phytoplankton sample. Sampling shall be carried out according to EN 16698 for freshwater samples and EN 15972 for marine samples. For counting and species determination, see EN 15204.

The dimensions needed for the biovolume estimation of the relevant phytoplankton taxa are analysed in sedimentation chambers, which are prepared in the same manner as for counting and species determination (see EN 15204), using an inverted microscope and an eyepiece micrometre or image analysis software.

For specific scientific purposes, measurements can be carried out also with a conventional (non-inverted) compound light microscope.

6.2 Calibration of the eyepiece micrometre, counting-graticule and image analysis software

The required dimensions for estimation of the cell or counting unit volume shall be measured using an eyepiece (ocular) micrometre or an image analysis software. For the application of size classes a calibrated counting-graticule can also be used.

Prior to measurement, all systems shall be calibrated with a calibrated object micrometre for every microscope and all objectives and eyepieces used.

The scale of commercially available calibrated object micrometres has a length of 1 mm (or 2 mm) where the millimetre is divided into 100 equal parts. The distance between the graduation lines is 10 µm. By aligning the scale of the eyepiece micrometre with the scale of the object micrometre or the grid boxes of the counting-graticule, the scale value (S) or conversion factor of the eyepiece micrometre can be determined for each magnification as follows:

$$S = \frac{n_{\mathrm{obj}} \times 10}{n_{\mathrm{eye}}} \qquad (1)$$

where

S is the scale value (conversion factor) for the eyepiece micrometre in micrometres (µm);

n_{obj} is the number of graduation lines of the object micrometre;

n_{eye} is the number of graduation lines of the eyepiece micrometre or the number of grid boxes of the counting-graticule.

The conversion factor should be specified with up to two decimal places. The intervals between the graduation lines of the scale shall be separately determined with the calibrated object micrometre for every objective used.

If image analysis software is used, this equipment shall be calibrated with the calibrated object micrometre separately for every level of magnification, following the instructions in the operating manual of the software.

6.3 Statistical requirements for determination

The required dimensions of the relevant geometrical shape shall be measured for each taxon of interest. At least 20 individuals per taxon should be measured to ensure that the standard error of cell or counting unit volume will be generally < 10 %.

For taxa, which are very variable in size, the number of measured cells/counting units should be increased until the standard error is < 10 %, to a maximum of 50 individuals ([3], [5]).

Where the size variability of a taxon is small, the number of measured cells may be minimized to only 5 to 10 individuals. In all cases, it is advisable to check that the standard error of cell or counting unit volume is low. The standard deviation and standard error can be calculated according to Formulae (2) and (3) as follows:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}} \quad (2)$$

where

- s is the taxon volume standard deviation;
- x_i is the volume of a single cell/counting unit of the taxon;
- $\overline{x}$ is the mean volume of all measurements of the taxon;
- n is the number of the respective measured cells of the taxon.

From the standard deviation s, the standard error of the mean $\sigma_{\overline{x}}$ can be calculated using Formula (3):

$$\sigma_{\overline{x}} = \frac{s}{\sqrt{n}} \quad (3)$$

To obtain the percentage range σ_{rel} of the standard error, divide the standard error of the mean $\sigma_{\overline{x}}$ by the mean value $\overline{x}$ of the samples using Formula (4):

$$\sigma_{rel} = \frac{\sigma_{\overline{x}}}{\overline{x}} \times 100 \quad (4)$$

From the results, the 95 % confidence limits can be determined using Formulae (5) and (6):

$$\overline{x}_u = \overline{x} + (\sigma_{\overline{x}} \times 1{,}96) \quad (5)$$

$$\overline{x}_l = \overline{x} - (\sigma_{\overline{x}} \times 1{,}96) \quad (6)$$

where

$\overline{x}_u$ is the upper 95 % confidence limit;

$\overline{x}_l$ is the lower 95 % confidence limit.

Since the required number of individuals to be measured for any taxon is dependent upon the size variability of that taxon, it is helpful to calculate the cell or counting unit volume after each measurement. This will allow continuous statistical analysis and check of precision, thus minimizing the number of measurements required. Ideally, the confidence limits should be set at 95 % as a measure for precision. By ensuring that only as many cells as necessary for achieving this limit will be counted, the amount of laboratory work will be minimized.

If not enough cells/counting units of a taxon are present in the sample in order to achieve the minimum statistical requirements described, all of the (few) cells of this taxon shall be measured or a mean standard biovolume may be used (see below).

Measuring a high number of cells for every taxon in every sample is a time consuming procedure. For routine monitoring programmes mean cell or counting unit volumes calculated from own measurements, for a particular project and area, may be used. These mean volumes shall be checked regularly by measuring actual cell dimensions (see 6.4) and calculating actual cell and counting unit volume (see 6.5). For taxa with a high variability in cell size and representing more than 50 % of the total biovolume, these checks are strongly advised.

6.4 Measurement

6.4.1 General

Measurement of the cells/counting units can be carried out in a separate step or parallel to the counting process. Depending on the cell size of the taxa, the determination of the required dimensions (e.g. diameter, height, length, width, etc.) should be carried out at magnifications between 63× and 1 000×, in order to obtain corresponding precision.

The so-called empty magnification, which does not reveal any new detail, should be avoided. Therefore, the total magnification of the microscope should preferably be higher than 500× but smaller than 1 000× of the NA of the used objectives to work in the area of useful magnification.

It is important that the cells to be measured are chosen randomly to avoid a discrimination of special size classes. This can be achieved by selecting the cells from randomly distributed visual boxes all over the sedimentation chamber.

If single cells can clearly be distinguished in chain-building or filamentous species or other colony forming taxa, only one cell per chain, filament or colony should be measured. Filamentous algae often form lumps and are distributed very unevenly in the chamber. Also in these cases, it shall be ensured that cells from different lumps are measured.

By rotating the eyepiece micrometre and moving the sedimentation chamber with the microscope stage, the scale of the eyepiece micrometre is placed over the required dimension of the cell/counting unit to be measured. The number of covered graduation lines is read, and with the application of the conversion factor (see 6.2), the length of the dimension is calculated by multiplication.

The measurement results should be reported in micrometres, with up to two decimal places. If the end of the cell dimension to be measured is between two graduation lines of the ocular scale, the share is to be estimated to a maximum of one decimal place.

When using the size classes approach based on representative measurements, the calibrated counting-graticule may also be used for the assignment of the individuals to the corresponding size classes.

When image analysis software is used, the corresponding details of the operating manual shall be followed.

6.4.2 Using size classes based on representative measurements

The appropriate number of size classes depends on the size variation of each taxon. The size classes, for example, can be derived from cluster analyses applied to a representative dataset of measured cells of the taxon (see 6.4.1).

For each size class the average cell or counting unit volume is calculated using the formula of the taxon specific geometrical shape with mean dimension lengths. By multiplication with the respective abundance and addition of all size classes of a taxon, the total taxon specific biovolume in the sample is determined. In routine monitoring programmes, standard size classes should be used (e.g. [4]). If regional lists of size classes are available, they should be used instead [4]. It is recommended to create a new size class, when the biovolume of individuals significantly exceeds the biovolume of existing size classes.

6.4.3 How to deal with hidden dimensions

For some particular taxa, it is often not possible to measure all dimensions needed to calculate the cell volume ("hidden dimensions", e.g. height of prismatic cells of different shapes or small diameter of elliptical cells) during routine analysis. Then it is necessary to estimate the length of missing dimensions as a proportion of one of the visible dimensions using a calculated species-specific factor. The visible to hidden size relationship can be obtained from measurements of other samples from the same sample series or from the same area if the position of the cells allows this. Measurements should be used preferentially over estimates. The taxon list in Annex D gives suggestions for the dimension relations for most of the taxa, which usually have a "hidden dimension". For those taxa, where no suggestion for the "hidden dimension" is given, corresponding nominal values shall be taken from the literature if available. If the "hidden dimension" shall be determined exactly for a special problem, the cells can be turned around in paraffin oil. With special microscopes, it is also possible to measure the distance between focus of the upper and lower end of the "hidden dimension".

6.4.4 Measurement of filamentous taxa

With some filamentous taxa (e.g. cyanobacteria), it is often difficult to distinguish individual cells within a filament, especially when the cells are directly connected without any gaps. In such cases, filament pieces of a fixed length, e.g. 100 µm or 10 µm, can be counted and measured (100 µm or 10 µm length and diameter), and multiplied by the total enumeration of this counting unit in the sample.

Alternatively, mean dimensions of filaments can be measured to calculate the volume of one filament, a value that is then multiplied by the number of filaments in the sample.

A third method, which is more precise for filamentous forms, particularly those, which have no distinct boundaries between cells, is as follows: Instead of counting individual filaments, the total length of the fraction of each filament that is within the boundaries of a counting grid shall be measured, ignoring the fraction outside of the grid boundaries (see Figure 1). The sum of the total length of all fractions of filaments within the grid shall be calculated after counting of the transect is completed. Afterwards, the diameter of at least 20 filaments shall be measured and the mean filament diameter is calculated. To obtain the biovolume of the respective taxon, the sum of total filament lengths (h) shall be multiplied with the square of the median filament diameter and the factor of $\pi/4$, because the filament is a cylinder with the volume:

$$V = \frac{1}{4} \times \pi \times d^2 \times h \qquad (7)$$

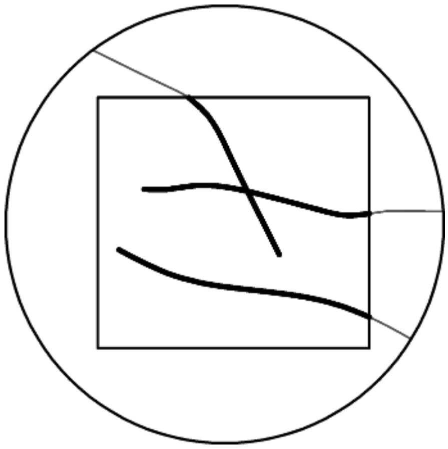


Figure 1 — Determining biovolume for filaments without distinct cell boundaries using a counting grid

NOTE The lengths of all fractions within the counting grid (black rectangle) are measured, excluding fractions outside of the counting grid boundaries [6].

6.4.5 Measurement and counting of colony- and coenobium-forming taxa

In most cases, the assignment of a geometrical shape should be based on the shape of an individual cell. For some colony- and coenobium-forming species where individual cells are difficult to distinguish or have very complex contours, it can be expedient to assign a geometrical shape based on the shape of the whole colony or coenobium or to use ultrasonic treated samples (where the association of cells have become disintegrated into individual cells) for counting and measuring the cells.

For example in some species, small individual cells are aggregated into compact spatial colonies. The individual cells are usually indistinguishable, and the number may be very difficult to assess in these colonies or coenobia. In such cases, the estimation of the volume can be based on the geometry of the entire colony or coenobium, in particular during the analysis of routine monitoring samples. For some taxa an additional geometrical shape correction factor shall be taken into account for the volume calculation. The same applies for colony- or coenobium-forming taxa with very complex contours of individual cells. Table 1 lists examples. In Annex D, it is specified for the respective taxa if the entire colony or coenobium with its geometry should be measured.

Table 1 — Geometrical shapes and correction factors for some colony- and coenobium-forming taxa.

Taxon name	Geometry based on colony	Geometrical shape correction factor	Hidden dimension factor
Woronichinia	sphere	0,2	-
Coelosphaerium	sphere	0,2	-
Snowella	sphere	0,75	-
Botryococcus	spheroid	-	-
Eudorina	sphere	0,25	-
Pandorina	sphere	-	-
Coelastrum	sphere	-	-
Pediastrum	cylinder	species dependend	height of colony = height of single cell (factor see Annex D)
Crucigenia	cuboid	species dependend	third edge length (height) = 0,5×second edge length (width)

A more precise method to achieve the biovolume of such colonial forms, especially the cyanobacterial genera *Microcystis, Aphanothece, Aphanocapsa*, and the *Dolichospermum* species forming “ball of yarn” colonies, is to measure cell dimensions and the greatest axial linear dimension of the colony in the sedimented sample, and then separate the colonies by ultrasonic treatment, and count the individual cells in the treated sample [7].

6.4.6 Measurement of complex geometrical shapes

Some taxa show very complex cell outlines requiring a composition of multiple geometrical shapes and thus, the application of complicated formulae for biovolume calculations. In order to ease that work, some simplified combined forms have been assigned to these taxa that can be easily measured and will require only minimum effort for the estimation. However, depending on the required precision, more complex and thus more precise geometrical subdivisions shall be applied to those taxa. Another possibility is to resort to pre-determined cell volumes from literature (mean standard cell or counting unit volume), bearing in mind that the size of the cells depends on a number of environmental factors and thus, may vary widely. On the other hand, cell volume estimation for some species is easier on half-cell basis (for example in some desmid genera like *Cosmarium* and *Staurastrum*).

In any case, everything shall be documented in the protocol. As an example, Annex E shows how to measure the needed dimensions for four taxa from the conducted interlaboratory comparison as well as for two additional taxa, which are not easy to measure.

6.5 Calculation of biovolume

The cell or counting unit volume is calculated on the basis of the taxon-specific geometrical shape and the linear dimensions determined for the individual cell or counting unit (e.g. diameter, height, length, width, etc.; see Annex A). For some taxa, the associated geometrical form will not fit exactly to the actual cell shape, for example, if a cuboid is assigned to a pennate diatom with rounded apical cell ends. For such cases, the cell volume shall be multiplied by a correction factor, which is given in Annex D for relevant taxa.

The average cell or counting unit volumes of the various taxa shall be generally calculated as the median of all individual cell or counting unit volumes.

NOTE If the individual volumes per taxon are normally distributed (according to Chi-squared test or Kolmogorov-Smirnov test), the arithmetic mean can be used for the calculation of the average volume instead of the median. For answering specific questions in ecology, it can be necessary to use also the arithmetic mean for non-normally distributed values.

These calculations shall be carried out for every phytoplankton taxon recorded in all or selected samples using the “representative measurement” approach (see Clause 4) or basically once for characteristic samples using the “standard factor” approach (see Clause 4). If applying the “size class” approach (see Clause 4 and 6.4.2) the average cell or counting unit volume for each size class is calculated using the mean of the upper and lower dimensions of size class borders.

The biovolume per taxon in a sample is calculated by multiplying the number of cells/l (or cells/ml) or counting units (e.g. number of 100 µm filament pieces per liter) with the median (or mean) of the determined taxon-specific cell or counting unit volumes (µm³) as measured by one of the three methods listed above:

$$V_{\mathrm{bio},\,i} = \frac{n_i \times \tilde{V}_i}{10^9} \quad (8)$$

where

$V_{\mathrm{bio},i}$ is the biovolume of taxon or size class i in cubic millimetres per litre (mm^3/l);

n_i is the number of cells (or number of counting units) of taxon or size class i per litre (l^{-1});

$\tilde{V}_i$ is the median (or mean) of the cell or counting unit volumes of taxon or size class i in cubic micrometres (µm³).

The total biovolume to be determined for each sample results from the sum of the biovolume determined for each phytoplankton taxon or size class.

Statistical performance data from the conducted European wide interlaboratory comparison for validation are listed in Annex B.

6.6 Biovolume biomass relations

In phytoplankton ecology, the biomass is usually expressed as chlorophyll-a concentration (µg/l), biovolume (mm^3/l) or carbon content (µg/l). Assuming the density of organisms being equal to the density of water (1,0 g/cm^3, [8]), the biomass as wet weight may be estimated as follows:

1 mm^3/l (biovolume) = 1 cm^3/m^3 (biovolume) = 1 mg/l (wet weight);

1 mm^3/m^3 (biovolume) = 10^6 $µm^3$/l (biovolume) = 1 µg/l (wet weight).

NOTE For the estimation of the carbon content, see Annex C.

6.7 Reporting

The specific cell or counting unit volumes are expressed in cubic micrometres ($µm^3$) without decimal places or for picoplankton with two significant places (e.g. 4,2 $µm^3$). The biovolume of a single taxon and the complete sample is given in cubic millimetres per litre (mm^3/l or mm^3/ml) with three significant digits or places (e.g. 12,5 mm^3/l, 3,75 mm^3/l, 0,138 mm^3/l, 0,004 mm^3/l).

As an example, the taxon specific part of a sample report can contain information as shown in Table 2.

Table 2 — Example report for taxon specific sample part.

Taxon name	**Abundance** n/l	**Geometry**	**Average cell volume** $µm^3$	**Total biovolume** mm^3/l	**Carbon content (according to ...)** µg/l
Thalassiosira nordenskioeldii	12 109	cylinder	9 817	0,119	6,53
Odontella aurita	265 725	elliptic cylinder	14 091	3,74	188,5
….					
Sum of sample 5	**765 180**			**4,43**	**231,2**

Some taxa (e.g. flagellates without solid cell wall) are inclined to shrink during the fixation process. Shrinkage depends on many influencing factors (preservative, life stage, physiological status, species, etc., even diatoms can shrink). Often it is difficult to find good correction factors for this process in the literature. As a consequence, applying a general correction factor to preserved material can lead either to overestimation or to underestimation of the biovolume. For monitoring activities with the objective of detecting trends, the exact compensation by preservation correction factors is not of the highest priority. In other cases where it might be mandatory to determine the exact biomass, correction factors for influence of fixation should be derived from comparisons between fixated and living organisms. This shall be noted in the protocol.

7 Quality Assurance

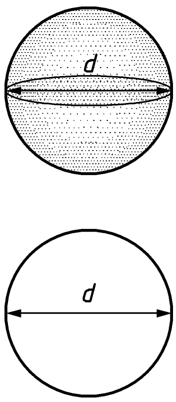
The quality assurance associated with this European Standard should be in accordance with EN 14996.

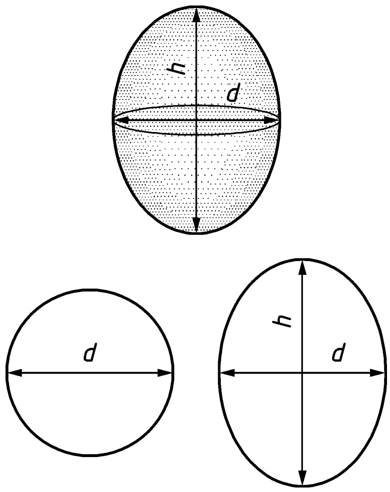
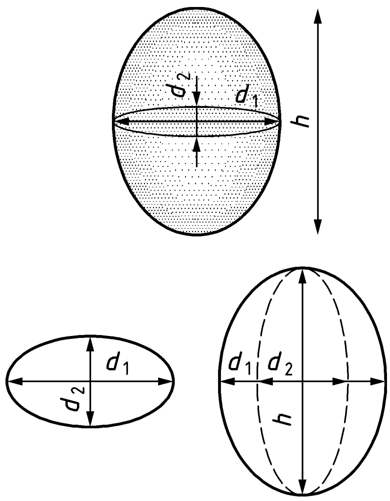
Annex A
(informative)

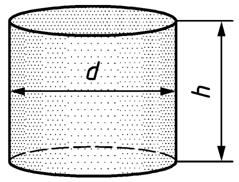
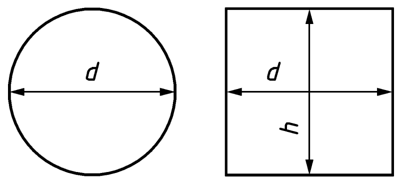
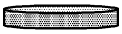
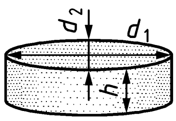
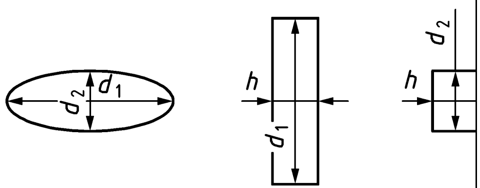
List of geometrical shapes

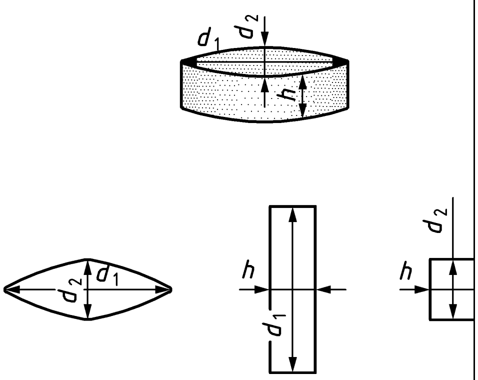
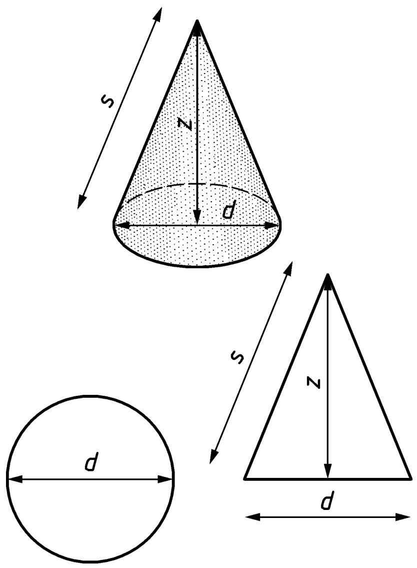
Table A.1 provides information about 17 different geometrical shapes used for the biovolume estimation of phytoplankton. The first column simply contains a consecutive number (ID-number) for each shape. Listed in the second column is the official geometrical name of the form alongside any other synonymous names. The images of each shape show a 3D-view, a cross-section, and a longitudinal-section in which the dimensions are designated to be used for biovolume calculation. The third column shows some general information about each shape, a description about the needed dimensions as well as some taxon examples. Firstly, it is listed if it is a basic shape or a composed form. If the latter is the case it is also indicated from which basic shapes the form is composed. The volume calculation precision distinguishes between exact calculation, if there is a clearly defined formula for volume, and approximate calculation, if the formula is derived by approximate integration. The dimensions necessary for calculation of biovolume are listed with full name and abbreviation as well as with information about measurability of these dimensions in phytoplankton organisms using an inverted microscope. “m” means that this dimension is measurable, “hd” means that this is a hidden dimension that cannot be measured in a sedimentation chamber. If both specifications are listed (m; hd), this indicates that cells can have different positions, the orientation of which can affect if the dimension is measurable or not. Finally, some typical taxon examples for each shape are listed. In the last column, the formulae needed for biovolume calculation are specified, with the deduced form based on diameter that can clearly be measured in the cells, and with the original geometrical form based on radius.

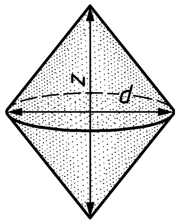
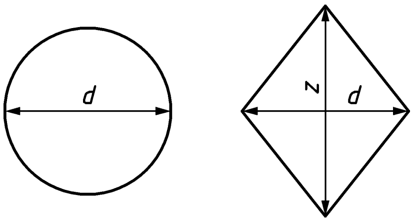
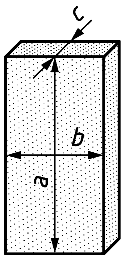
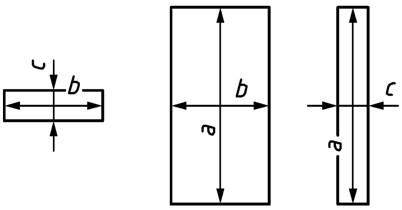
Table A.1 — Geometrical shapes

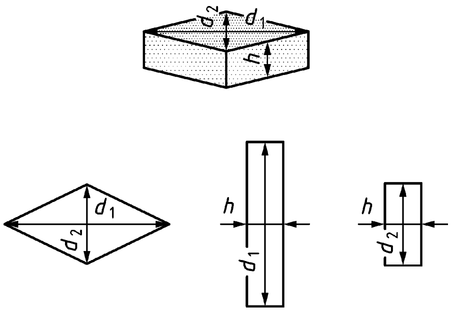
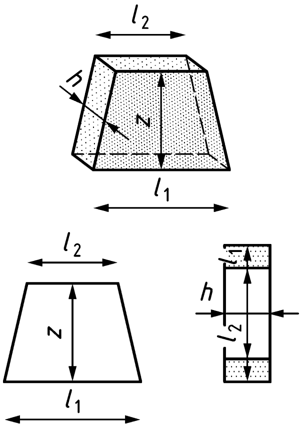
ID	Geometrical shape *(Synonyms)*	Information	Volume formula
1	**Sphere**  cross section	*basic shape* *Volume calculation precision: exact* **Dimensions:** *diameter (d)* - m **Examples:** *Chroococcus, Coelastrum, Gloeocapsa, Microcystis, Oblea, Pterosperma*	$V = \frac{1}{6} \times \pi \times d^3$ For radius $r = \frac{d}{2}$: $V = \frac{4}{3} \times \pi \times r^3$

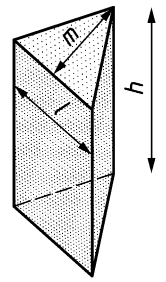
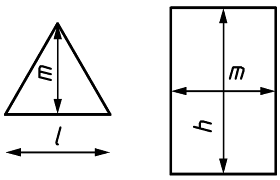
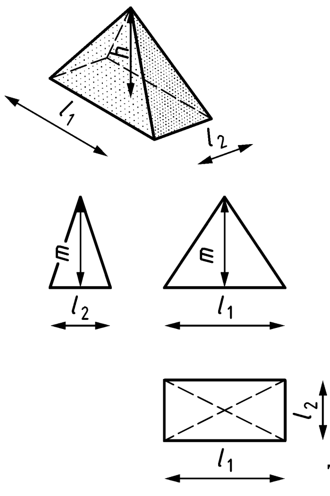
ID	Geometrical shape *(Synonyms)*	Information	Volume formula
2	**Spheroid** *rotational ellipsoid* *ellipsoid of revolution*  cross section longitudinal section	*basic shape* *Volume calculation precision: exact* **Dimensions:** *diameter (d)* - m *height (h)* - m **Examples:** *Aphanothece, Chlamydomonas, Desmodesmus, Trachelomonas, Woronichinia*	$V=\frac{1}{6}\times\pi\times d^2\times h$ For radius $r=\frac{d}{2}$: $V=\frac{4}{3}\times\pi\times r^2\times\frac{1}{2}\times h$
3	**Ellipsoid** *tri-axial ellipsoid,* *flattened ellipsoid*  cross section longitudinal section	*basic shape* *Volume calculation precision: exact* **Dimensions:** *large diameter (d_1)* - m *small diameter (d_2)* - hd *height (h)* - m **Examples:** *Amphidinium, Cosmarium, Dinophysis, Gymnodinium, Mallomonas*	$V=\frac{1}{6}\times\pi\times d_1\times d_2\times h$ For radius *r*: $V=\frac{4}{3}\times\pi\times r_1\times r_2\times r_3$ with $r_1=\frac{d_1}{2}$; $r_2=\frac{d_2}{2}$; $r_3=\frac{h}{2}$

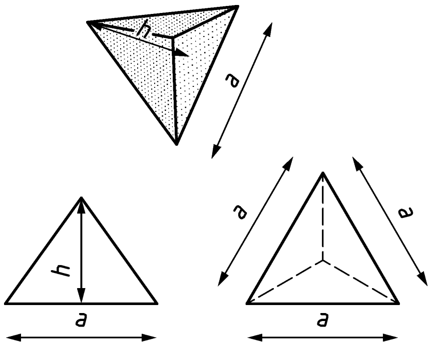
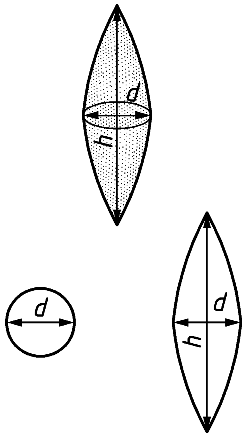
ID	**Geometrical shape** *(Synonyms)*	**Information**	**Volume formula**
4	**Cylinder** *circle based cylinder*   cross section longitudinal section  disk: *d* >>*h*  **thread:** *d* **<<** *h*	*basic shape* *Volume calculation precision: exact* **Dimensions:** *diameter (d)* - m *height (h)* - m; hd **Examples:** *Aphanizomenon, Aulacoseira, Coscinodiscus, Phormidium, Rhizosolenia, Thalassiosira*	$V = \frac{1}{4} \times \pi \times d^2 \times h$ For radius $r = \frac{d}{2}$: $V = \pi \times r^2 \times h$
5	**Elliptic cylinder** *prism on elliptic base* *oval cylinder*   cross section longitudinal sections	*basic shape* *Volume calculation precision: exact* **Dimensions:** *large diameter* (d_1) - m *small diameter* (d_2) - m; hd *height of cylinder (h)* - hd; m **Examples:** *Achnanthes, Chaetoceros, Fragilaria, Odontella, Surirella*	$V = \frac{1}{4} \times \pi \times d_1 \times d_2 \times h$ For radius *r*: $V = \pi \times r_1 \times r_2 \times h$ with $r_1 = \frac{d_1}{2}$; $r_2 = \frac{d_2}{2}$

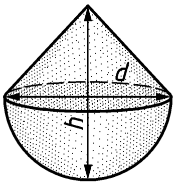
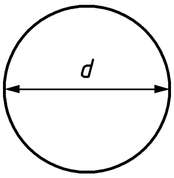
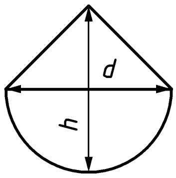
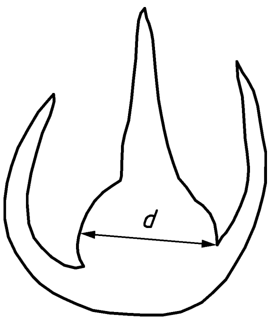
ID	Geometrical shape *(Synonyms)*	Information	Volume formula
6	**Lanceolate cylinder** *naviculoid*  cross section longitudinal sections	*basic shape* *Volume calculation precision: approximate* **Dimensions:** *large diameter (d_1)* - m *small diameter (d_2)* - m; hd *height of cylinder (h)* - hd; m **Examples:** *Haslea, Navicula*	$V = \frac{2}{\pi} \times d_1 \times d_2 \times h$ For radius *r*: $V = \frac{8}{\pi} \times r_1 \times r_2 \times h$ with $r_1 = \frac{d_1}{2}$; $r_2 = \frac{d_2}{2}$
7	**Cone**  cross section longitudinal section	*basic shape* *Volume calculation precision: exact* **Dimensions:** *diameter (d)* - m *slant height (s)* - m *height of cone (z)* - hd NOTE With an inverted microscope, the slant height can exactly be measured. The cone height is a hidden dimension because of the oblique projection. **Examples:** *Calciopappus, Minuscula, Pyramimonas longicauda*	$V = \frac{1}{12} \times \pi \times d^2 \times \sqrt{s^2 - \frac{1}{4} \times d^2}$ For radius $r = \frac{d}{2}$ and height $z = \sqrt{s^2 - r^2}$: $V = \frac{1}{3} \times \pi \times r^2 \times z$

ID	Geometrical shape *(Synonyms)*	Information	Volume formula
8	**Double cone** *two cones*   cross section longitudinal section	*composed shape* *basic shape: cone* *Volume calculation precision: exact* **Dimensions:** *diameter (d)* - m *height of double cone (z)* - m NOTE Due to the position in the sedimentation chamber, the total height can only be measured approximately because of the oblique projection. **Examples:** *Gyrodinium spirale, Heterocapsa triquetra, Protoperidinium crassipes*	$V = \frac{1}{12} \times \pi \times d^2 \times z$ For radius $r = \frac{d}{2}$: $V = 2 \times \frac{1}{3} \times \pi \times r^2 \times \frac{1}{2} \times z$
9	**Cuboid** *rectangular box* *rectangular parallelepiped*   cross section longitudinal sections	*basic shape* *Volume calculation precision: exact* **Dimensions:** *first edge length (a)* - m *second edge length (b)* - m; hd *third edge length (c)* - hd; m **Examples:** *Bacillaria, Hantzschia, Pinnularia, Tabellaria*	$V = a \times b \times c$

ID	Geometrical shape *(Synonyms)*	Information	Volume formula
10	**Rhombic prism** *parallelepiped prism on parallelogram base*  cross section longitudinal sections	*basic shape* *Volume calculation precision: exact* **Dimensions:** *large diagonal (d_1)* - m *small diagonal (d_2)* - m; hd *height of prism (h)* - hd; m **Examples:** *Brachysira, Nitzschia, Pseudo-nitzschia*	$V = \frac{1}{2} \times d_1 \times d_2 \times h$
11	**Trapezoid prism**  cross section longitudinal section	*basic shape* *Volume calculation precision: exact* **Dimensions:** *length of large trapezoid side (l_1)* - m *length of small trapezoid side (l_2)* - m *height of trapezoid (z)* - m; hd *height of prism (h)* - hd; m **Examples:** *Crucigenia fenestrata*	$V = \frac{1}{2} \times (l_1 + l_2) \times z \times h$

ID	Geometrical shape *(Synonyms)*	Information	Volume formula
12	**Triangular prism** *prism on triangle base*   cross section longitudinal section	*basic shape* *Volume calculation precision: exact* **Dimensions:** *length of triangle side (l)* - m *height of triangle (m)* - m; hd *height of prism (h)* - hd; m NOTE For a prism on basis of an equilateral triangle, only the triangle side is needed. The triangle height can be expressed by this side. **Examples:** *Bellerochea, Ditylum, Goniochloris, Lithodesmium, Triceratium*	$V = \frac{1}{2} \times l \times m \times h$ or $V = \frac{1}{4} \times \sqrt{3} \times l^2 \times h$ for a prism on basis of an equilateral triangle with $m = \frac{1}{2} \times \sqrt{3} \times l$
13	**Pyramid** Cross sections  Top view	*basic shape* *Volume calculation precision: exact* **Dimensions:** *length of first basic side (l_1)* - m *length of second basic side (l_2)* - m; hd *height of pyramid (h)* - hd; m **Examples:** *Gomphonema, Licmophora*	$V = \frac{1}{3} \times l_1 \times l_2 \times h$

ID	Geometrical shape *(Synonyms)*	Information	Volume formula
14	**Tetrahedron**  lateral view top view	*basic shape* *Volume calculation precision: exact* **Dimensions:** *edge length (a)* - m *height of tetrahedron (h)* – hd **Examples:** *Staurastrum, Staurodesmus, Tetraedriella, Tetraedron*	$V=\frac{1}{12}\times\sqrt{3}\times a^2\times h$ or $V=\frac{1}{12}\times\sqrt{2}\times a^3$ for a regular tetrahedron with $h=\frac{1}{3}\times\sqrt{6}\times a$;
15	**Spindle**  cross section longitudinal section	*basic shape* *Volume calculation precision: approximate* **Dimensions:** *diameter (d)* - m *height (h)* - m **Examples:** *Ankistrodesmus, Closterium, Monoraphidium*	$V=\frac{2}{15}\times\pi\times d^2\times h$ For radius $r=\frac{d}{2}$: $V=\frac{8}{15}\times\pi\times r^2\times h$

ID	Geometrical shape *(Synonyms)*	Information	Volume formula
16	**Cone with half sphere** *cone with hemisphere*   cross section  longitudinal section	*composed shape* *basic shapes: cone, sphere* *Volume calculation precision: exact* **Dimensions:** *diameter (d)* - m *total height (h)* - m NOTE Due to the position in the sedimentation chamber, the total height can only be measured approximately because of the oblique projection. **Examples:** *Gonyaulax, Hemiselmis, Katodinium, Teleaulax*	$V = \frac{1}{12} \times \pi \times d^2 \times \left(h + \frac{1}{2} \times d \right)$ For radius $r = \frac{d}{2}$: $V = \frac{1}{3} \times \pi \times r^2 \times (h - r) + \frac{1}{2} \times \frac{4}{3} \times \pi \times r^3$
17	***Ceratium*-shape**  lateral view	*Complicated composed shape* *Volume calculation precision: approximate* **Dimensions:** *girdle diameter (d)* - m **Examples:** *Ceratium*	$V = x \times d^y$ x and y are factors derived from measurements [4], [9] *Ceratium* x: 0,32359 y: 2,9953 *C, furca* x: 2,3038 y: 2,532 *C, fusus* x: 35,198 y: 1,9156 *C, hirundinella* x: 2,3038 y: 2,532 *C, horridum* x: 0,32437 y: 3,0474 *C, lineatum* x: 1,2375 y: 2,5989 *C, longipes* x: 0,32437 y: 3,0474 *C, macroceros* x: 0,32437 y: 3,0474 *C, tripos* x: 0,32359 y: 2,9953

Annex B
(informative)

Performance data

The performance data given in Table B.1 to Table B.4 were determined in a European interlaboratory comparison for validation carried out in March 2014 on two mixed marine and two freshwater samples taken from the North Sea (Helgoland, Germany), the Baltic Sea (Stralsund, Germany) and different lakes around Oldenburg (Germany) and Bad Saarow (Germany). 52 participants from the following European countries have provided results: Denmark (4), Finland (3), France (1), Germany (20), Ireland (1), Italy (3), Lithuania (3), Norway (1), Poland (2), Portugal (3), Spain (2), Sweden (3) and United Kingdom (6).

All results have been calculated according to the German standard document DIN 38402-45:2014-06.

Table B.1 — Performance data for measurements of first dimension in biovolume analysis of phytoplankton species in natural samples - Abbreviations for dimensions according to Annex A.

Taxon name	l	n	X µm	x_{med} µm	x_{mean} µm	x_{HS} µm	s_R µm	$C_{V,R}$ %	s_r µm	$C_{V,r}$ %
Dactyliosolen fragilissimus (d)	45	1 225	11,74	11,93	12,06	12,04	2,01	16,7	1,80	14,9
Dinophysis acuminata (d_1)	42	961	33,48	33,90	34,07	34,07	4,24	12,5	3,23	9,5
Ceratium tripos (d_1)	44	998	66,79	65,93	66,74	66,66	6,12	9,2	4,56	6,8
Pseudo-nitzschia cf.pungens (d_1)	44	1 054	111,87	111,69	111,12	111,19	12,43	11,2	11,18	10,1
Thalassionema nitzschioides (d_1)	42	1 013	32,95	32,82	33,15	33,15	4,29	13,0	4,25	12,8
Rhizosolenia imbricata (d)	42	1 154	9,68	10,19	10,16	10,19	2,49	24,4	2,14	21,0
Ditylum brightwellii (l)	40	1 114	26,76	23,83	23,64	23,69	4,89	20,7	4,18	17,6
Stephanopyxis turris (d)	37	964	43,15	40,35	39,96	39,96	7,60	19,0	7,07	17,7
Odontella sinensis (d_1)	40	1 106	167,28	163,87	175,38	174,21	40,62	23,3	33,02	19,0
Chaetoceros debilis (d_1)	39	982	13,39	14,25	13,65	13,65	3,84	28,2	2,77	20,3
Fragilaria crotonensis (d_1)	53	1 391	76,94	76,58	78,15	77,47	12,51	16,2	14,27	18,4
Tabellaria fenestrata (a)	47	1 052	51,62	50,91	50,77	50,77	4,77	9,4	4,20	8,3
Aulacoseira granulata (d)	50	1 183	5,48	5,88	5,89	5,90	1,02	17,3	0,84	14,2
Cryptomonas erosa (d_1)	50	1 133	12,63	12,83	12,96	12,96	1,58	12,2	1,32	10,2
Rhodomonas lacustris (d)	49	1 249	5,20	5,27	5,28	5,28	0,66	12,5	0,71	13,5
Planktothrix agardhii (d)	47	1 260	3,32	3,34	3,44	3,42	0,72	21,0	0,15	4,3
Monoraphidium arcuatum (d)	42	1 085	1,73	1,69	1,83	1,78	0,54	30,3	0,32	17,8
Woronichinia naegeliana (d)	44	1 184	2,92	3,27	3,26	3,26	0,60	18,3	0,39	12,0
Cosmarium ocellatum (d_1)	43	977	28,60	26,21	26,44	26,46	2,54	9,6	1,85	7,0
Trachelomonas hispida (d)	45	1 068	21,15	20,96	20,86	20,87	2,08	10,0	1,75	8,4

Explanation of symbols

l number of laboratories with $|z_u\text{-score}| < 3$

n number of total individual test results of all laboratories with $|z_u\text{-score}| < 3$

X assigned reference value based on 7 replicates with each having a minimum of 30 single measurements

x_{med} interlaboratory[a] median value

x_{mean} interlaboratory[a] arithmetic mean value

x_{HS} interlaboratory[a] robust mean value (Hampel Schaetzer)

s_R reproducibility standard deviation

$C_{V,R}$ relative reproducibility standard deviation

s_r repeatability standard deviation

$C_{V,r}$ relative repeatability standard deviation

[a] Based on arithmetic means of individual laboratory measurements; only laboratories with $|z_u\text{-score}| < 3$ included.

Table B.2 — Performance data for measurements of second dimension in biovolume analysis of phytoplankton species in natural samples - Abbreviations for dimensions according to Annex A.

Taxon name	l	n	X µm	x_{med} µm	x_{mean} µm	x_{HS} µm	s_R µm	$C_{V,R}$ %	s_r µm	$C_{V,r}$ %
Dactyliosolen fragilissimus (h)	45	1 225	60,61	59,69	59,32	59,32	12,01	20,3	11,86	20,0
Dinophysis acuminata (d_2)	43	994	20,09	19,45	20,58	20,32	5,58	27,5	1,90	9,4
Ceratium tripos (d_2)	45	1 018	43,41	38,00	38,53	38,09	11,82	31,0	2,12	5,6
Pseudo-nitzschia cf.pungens (d_2)	43	1 024	4,81	4,51	4,59	4,58	1,01	22,0	0,84	18,4
Thalassionema nitzschioides (d_2)	42	1 013	3,99	4,35	4,26	4,23	0,99	23,4	0,77	18,2
Rhizosolenia imbricata (h)	42	1 154	188,20	201,34	200,16	200,46	45,13	22,5	41,59	20,7
Ditylum brightwellii (m)	40	1 114	23,17	22,99	22,87	22,96	4,47	19,5	4,51	19,7
Stephanopyxis turris (h)	37	964	66,83	59,20	58,30	58,30	10,36	17,8	9,62	16,5
Odontella sinensis (d_2)	40	1 106	66,91	64,27	64,17	63,63	20,62	32,4	11,50	18,1
Chaetoceros debilis (d_2)	38	959	10,04	9,31	9,53	9,40	2,59	27,6	1,59	16,9
Fragilaria crotonensis (d_2)	47	1 171	4,40	3,96	3,99	3,98	0,96	24,2	0,23	5,9
Tabellaria fenestrata (b)	47	1 052	5,16	7,57	7,39	7,41	2,33	31,4	1,07	14,4
Aulacoseira granulata (h)	43	966	27,33	26,04	26,11	26,11	3,16	12,1	2,68	10,3
Cryptomonas erosa (d_2)	49	1 113	10,73	10,13	9,95	9,99	2,10	21,1	0,95	9,5
Rhodomonas lacustris (h)	49	1 249	11,43	10,53	10,61	10,61	1,85	17,4	1,67	15,7
Planktothrix agardhii	-	-	-	-	-	-	-	-	-	-
Monoraphidium arcuatum (h)	41	1 065	49,31	42,00	41,25	41,25	7,92	19,2	4,98	12,1
Woronichinia naegeliana (h)	43	1 077	5,35	5,38	5,33	5,36	0,69	12,9	0,49	9,2
Cosmarium ocellatum (d_2)	43	956	14,30	13,39	13,52	12,19	2,52	20,7	0,87	7,2
Trachelomonas hispida (h)	45	1 068	27,12	27,13	26,83	26,80	3,01	11,2	2,35	8,8
For explanation of symbols, see Table B.1.										

Table B.3 — Performance data for measurements of third dimension in biovolume analysis of phytoplankton species in natural samples - Abbreviations for dimensions according to Annex A

Taxon name	l	n	X µm	x_{med} µm	x_{mean} µm	x_{HS} µm	s_R µm	$C_{V,R}$ %	s_r µm	$C_{V,r}$ %
Dactyliosolen fragilissimus	-	-	-	-	-	-	-	-	-	-
Dinophysis acuminata (h)	42	961	46,69	48,71	48,88	48,77	5,38	11,0	4,58	9,4
Ceratium tripos (h_1)	42	938	40,33	42,67	41,39	41,44	6,27	15,1	3,34	8,1
Pseudo-nitzschia cf.pungens (h)	44	1 054	4,81	4,06	4,14	4,12	1,51	36,7	0,66	16,1
Thalassionema nitzschioides (h)	42	1 013	4,59	4,69	4,77	4,76	1,00	21,0	0,78	16,4
Rhizosolenia imbricata	-	-	-	-	-	-	-	-	-	-
Ditylum brightwellii (h)	40	1 114	74,17	70,10	71,00	70,88	17,30	24,4	17,01	24,0
Stephanopyxis turris	-	-	-	-	-	-	-	-	-	-
Odontella sinensis (h)	40	1 106	195,30	180,70	175,04	175,34	47,20	26,9	42,85	24,4
Chaetoceros debilis (h)	38	954	9,14	8,83	8,99	8,91	2,10	23,6	1,57	17,6
Fragilaria crotonensis (h)	49	1 291	4,40	3,76	3,48	3,48	0,98	28,2	0,30	8,6
Tabellaria fenestrata (c)	41	929	7,82	4,88	5,47	5,40	2,06	38,2	0,70	13,0
Aulacoseira granulata	-	-	-	-	-	-	-	-	-	-
Cryptomonas erosa (h)	49	1 113	25,85	25,75	25,91	25,91	3,64	14,1	3,53	13,6
Rhodomonas lacustris	-	-	-	-	-	-	-	-	-	-
Planktothrix agardhii	-	-	-	-	-	-	-	-	-	-
Monoraphidium arcuatum	-	-	-	-	-	-	-	-	-	-
Woronichinia naegeliana	-	-	-	-	-	-	-	-	-	-
Cosmarium ocellatum (h)	46	1 014	26,82	26,86	27,04	27,04	2,32	8,6	2,12	7,8
Trachelomonas hispida	-	-	-	-	-	-	-	-	-	-
For explanation of symbols, see Table B.1.										

Table B.4 — Performance data for biovolume analysis of phytoplankton species in natural samples

Taxon name	l	n	X µm³	x_{med} µm³	x_{mean} µm³	x_{HS} µm³	s_R µm³	$C_{V,R}$ %	s_r µm³	$C_{V,r}$ %
Dactyliosolen fragilissimus	45	1 225	6 824	6 911	7 045	7 033	2 566	36,5	2 497	35,5
Dinophysis acuminata	43	992	16 718	16 334	17 241	17 190	6 906	40,2	3 940	22,9
Ceratium tripos	44	998	109 160	85 983	95 007	88 516	37 516	42,4	13 216	14,9
Pseudo-nitzschia cf,pungens	44	1 054	1 355	1 058	1 167	1 135	541	47,7	348	30,7
Thalassionema nitzschioides	41	1 006	490	555	536	535	218	40,7	161	30,0
Rhizosolenia imbricata	42	1 154	13 980	16 089	17 031	16 988	8 001	47,1	6 982	41,1
Ditylum brightwellii	40	1 114	24 055	18 753	20 080	20 080	8 571	42,7	7 689	38,3
Stephanopyxis turris	37	964	99 642	80 331	77 611	77 611	34 081	43,9	27 694	35,7
Odontella sinensis	40	1 106	1 785 462	1 560 584	1 624 194	1 586 715	785 689	49,5	723 632	45,6
Chaetoceros debilis	39	982	1 022	854	938	937	468	49,9	328	35,0
Fragilaria crotonensis	50	1 311	688	526	503	498	247	49,7	85	17,1
Tabellaria fenestrata	45	1 009	2 111	1 648	1 863	1 758	880	50,1	463	26,3
Aulacoseira granulata	45	1 032	680	753	761	760	272	35,9	216	28,4
Cryptomonas erosa	50	1 133	1 914	1 725	1 809	1 809	655	36,2	545	30,2
Rhodomonas lacustris	49	1 249	102	100	103	102	33	32,4	31	30,8
Planktothrix agardhii	47	1 260	866	884	969	941	362	38,4	68	7,2
Monoraphidium arcuatum	47	1 246	64	51	57	55	27	49,5	19	35,1
Woronichinia naegeliana	45	1 151	24	30	31	31	12	39,7	8	25,3
Cosmarium ocellatum	47	1 057	5 820	5 083	5 071	5 070	1 624	32,0	987	19,5
Trachelomonas hispida	45	1 068	6 410	6 414	6 302	6 287	1 716	27,3	1 309	20,8
For explanation of symbols, see Table B.1.										

Annex C
(informative)

Carbon content calculation

Organic carbon is a main constituent of organisms. It represents the energy source transported within food webs and therefore is an important basis for ecological modelling. The carbon content of phytoplankton in natural samples cannot be determined directly (e.g. with a CN-Analyser), because chemical methods are not suitable to discriminate between the C-contents of different organism groups such as phytoplankton, zooplankton, bacteria, detritus, etc. Additionally, it will be impossible to distinguish phytoplankton groups on the taxonomic level. Therefore, a common method for estimating carbon biomass is the calculation from the microscopically determined biovolume using conversion factors. Mainly due to the correlation between total cell volume and vacuole size as mentioned before, the estimation of the carbon content with an exponential function applied on the cell volume should be preferred to the use of fixed conversion factors per volume:

$$c(\mathrm{C})_i = a \cdot (V_{\mathrm{cell},i})^b \qquad \text{(C.1)}$$

where

$c(\mathrm{C})_i$ is the carbon content of taxon i in picograms per cell (pg/cell);

a and b are constant factors, see Table C.1;

$V_{\mathrm{cell},i}$ is the average cell volume of taxon i in cubic micrometres per cell (μm^3/cell).

Because the carbon content of phytoplankton cells varies depending on different physiological and environmental factors, there are no universal values for the factors a and b. Some values used in the literature are shown in Table B.1. Due to the fact that the ratio of total cell volume to vacuole size may significantly differ from one species to another, especially for diatoms and other taxonomic groups under the same conditions, different conversion factors are used.

Table C.1 — Conversion factors for converting cell volume to carbon content from different sources

Group	Function $c(\mathrm{C})_i = a \cdot (V_{\mathrm{cell},i})^b$		Source
	a	b	
pelagic diatoms	0,485	0,712	Strathmann (1967) [10]
	0,263	0,740	Tagushi (1976) [11]
	0,357	0,814	Vidal (1978) [12]
	0,513	0,757	Eppley et al. (1970) [13]
	0,131	0,890	Pavlovskaya & Kondratyeva (1981) [14]
	1,094	0,859	Blasco et al. (1982) [15]
	0,288	0,811	Menden-Deuer & Lessard (2000) [16]
marine dinoflagellates	0,387	0,900	Pavlovskaya & Kondratyeva (1981) [14]
phytoplankton without diatoms	0,347	0,866	Strathmann (1967) [10]
	0,251	0,940	Eppley et al. (1970) [13]
	0,216	0,939	Menden-Deuer & Lessard (2000) [16]
total phytoplankton	0,436	0,829	Moal et al. (1987) [17]
	0,109	0,991	Montagnes et al. (1994) [18]

The calculation of the carbon content is not mandatory, but if this procedure is carried out, then it is recommended to use the factors by Menden-Deuer & Lessard (2000) [16] or Eppley et al. (1970) [13]. Reference to what carbon factors have been used should always be included in the data report. Nevertheless, more extensive studies for different environmental conditions are needed to standardize the estimation of the carbon content of phytoplankton organisms via the biovolume.

Sometimes colony forming taxa shall be counted in cell aggregates. In these cases, it is necessary to distinguish between counting of cell packages (e.g. 100 cells of *Microcystis* sp.) and filaments (e.g. 100 µm pieces of *Nodularia* sp.). For these two special cases, the carbon content shall be calculated by using the following formulae (see also [2]):

For multi-cell colonies as

$$c(\mathrm{C})_i = a \cdot CPU \cdot \left(\frac{VCU}{CPU}\right)^b \tag{C.2}$$

and for filaments as

$$c(\mathrm{C})_i = a \cdot \frac{LCU}{CL} \cdot \left(\frac{VCU \cdot CL}{LCU}\right)^b \tag{C.3}$$

where

VCU	is the volume of the counting unit in cubic micrometres (µm^3);
CPU	is the number of cells per counting unit;
CL	is the cell length;
LCU	is the length of the counting unit in micrometres (µm), mostly 100 µm.

Especially for small cells (e.g. cyanobacterial picoplankton) the carbon content can be calculated by multiplying the average cell volume with a fixed factor using a simple linear dependency (e.g. [19]):

$$c(\mathrm{C})_i = x \cdot V_{\mathrm{cell},i} \tag{C.4}$$

where

$c(\mathrm{C})_i$	is the carbon content of taxon *i* in picograms per cell (pg/cell);
x	is a constant factor (pg/µm^3);
$V_{\mathrm{cell},i}$	is the average cell volume of taxon *i* in cubic micrometres per cell (µm^3/cell).

Annex D
(informative)

Alphabetical list of recommended geometrical shapes and hidden dimension factors

Table D.1 contains recommended geometrical shapes and additional information, which should be used for biovolume estimation. This information is generally assigned on genus level. If some species, subspecies, forms, or varieties within a genus are different, they are listed additionally. The taxon list also contains genera of typical benthic microalgae as well as some heterotrophic flagellates or other protists. Both groups often are determined in the routine monitoring in parallel to the real phytoplankton organisms (in the strict ecological sense), either because they are stirred up from the sediment into the pelagial or because they belong to taxonomical groups also containing autotrophic species (e.g. Euglenophyceae, Dinophyceae or Cryptophyceae).

Basis for the used taxonomical names is the current valid status provided by the international databases “World Register of Marine Species” (WoRMS) [20] and AlgaeBase [21]. These taxa list can not be a complete list of all phytoplankton taxa occurring in European waters but is intended as a recommendation for the most important taxa. If some taxa seem to be missing, possibly due to using synonyms, the validity of the used name has to be checked in the above mentioned databases to find the assigned geometrical shape.

For the listed taxa the geometrical shape relating to Annex A is given. Additionally it is listed to which unit (cell, filament, coenobium, etc.) the geometry has been assigned. Sometimes the allocated geometrical shape does not correctly cover the effective volume. In these cases, the result has to be multiplied by a “geometrical shape correction factor” to estimate the effective volume more precisely. Some of these factors have been taken from the Helsinki Commission (HELCOM) monitoring program [4]. All others are estimated suggestions based on the results of the mandated CEN project.

For some particular taxa, it is often not possible to measure all dimensions needed for the calculation of the cell volume during routine analysis. In the last column of Table D.1 recommendations are given for relations to measurable dimensions for most of the taxa, which usually have such a “hidden dimension” depending on the position in the microscopic view. Some of these indicated factors have also been taken from the HELCOM monitoring program [4] or derived from their size class dimensions. Others have been calculated from measurements or from several pictures from different taxonomical databases or literature.

Various taxa are quite variable in appearance. Thus, few species sometimes can be rather spherical, in other cases rather elliptical. Moreover, different stages within the life cycle (e.g. cysts) may have various forms. In addition, amoeboid taxa exist. In the following taxon-list, the assignments of a geometry have been made according to the common appearance of the vegetative form. If a corresponding taxon in the sample to be analysed shows a different shape deviating from the list, an appropriate geometrical shape will have to be selected according to Annex A.

If taxa are analysed on a higher taxonomical level than genus (e.g. family, order, class, etc.) a well-fitting shape according to Annex A will have to be assigned.

Table D.1 — Assigned geometrical shapes and correction factors to taxa (* for the explanation of the dimensions see Annex A).

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Acanthoceras H.Honigmann, 1909	cell	elliptic cylinder	$d_2=0,50\times d_1$
Acanthochloris Pascher, 1930	cell	sphere	
Acanthocorbis S.Hara & E.Takahashi, 1984	cell	spheroid	
Acanthoeca W.Ellis	cell	spheroid	
Acanthogonyaulax (Kofoid) Graham, 1942	cell	spheroid	
Acanthoica Lohmann, 1903	cell	spheroid	
Acanthosphaera Lemmermann, 1899	cell	sphere	
Achnantheiopsis Lange-Bertalot, 1997	cell	elliptic cylinder	
Achnanthes Bory de Saint-Vincent, 1822	cell	elliptic cylinder	$d_2=0,65\times d_1$; $h=0,65\times d_2$
Achnanthes amoena (Hustedt) Bukhtiyarova, 1999	cell	elliptic cylinder × 0,9	
Achnanthes bremeyeri Lange-Bertalot, 1989	cell	elliptic cylinder	$h=1,00\times d_2$
Achnanthes brevipes C.Agardh, 1824	cell	elliptic cylinder	$d_2=0,35\times d_1$; $h=1,15\times d_2$
Achnanthes caledonica Lange-Bertalot	cell	cuboid × 0,9	
Achnanthes lanceolata subsp. *frequentissima* (Lange-Bertalot) Round & L.Bukhtiyarova, 1996	cell	elliptic cylinder × 0,9	
Achnanthes longipes C.Agardh, 1824	cell	elliptic cylinder	$d_2=0,25\times d_1$; $h=1,50\times d_2$
Achnanthes taeniata Grunow, 1880	cell	elliptic cylinder	$d_2=0,29\times d_1$; $h=0,84\times d_2$
Achnanthes trinodis (W.Smith) Grunow, 1880	cell	elliptic cylinder	
Achnanthes ventralis (Krasske) Lange-Bertalot, 1989	cell	elliptic cylinder	$h=1,00\times d_2$
Achnanthes ziegleri Lange-Bertalot, 1993	cell	elliptic cylinder	
Achradina Lohmann, 1902	cell	spheroid	
Achroonema Skuja, 1948	filament	cylinder	
Actidesmium Reinsch, 1875	cell	spindle	
Actinastrum Lagerheim, 1882	cell	spindle	
Actinastrum aciculare Playfair	cell	cone with half sphere	
Actinastrum gracillimum Smith	cell	cylinder	
Actinella F.W.Lewis, 1864	cell	cuboid	
Actiniscus Ehrenberg, 1841	cell	spheroid	$h=0,80\times d$
Actinochloris Korshikov, 1953	cell	spheroid	
Actinocyclus Ehrenberg, 1837	cell	cylinder	$h=0,50\times d$
Actinomonas Kent, 1880	cell	spheroid	
Actinophaenia Shadbolt, 1854	cell	cylinder	$h=0,25\times d$
Actinoptychus Ehrenberg, 1843	cell	cylinder	$h=0,50\times d$
Actinoptychus splendens (Shadbolt) Ralfs ex Pritchard, 1861	cell	cylinder	$h=0,25\times d$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Actinotaenium (Nägeli) Teiling, 1954	cell	spheroid	
Acutodesmus (Hegewald) Tsarenko, 2001	cell	spindle	
Adenoides Balech, 1956	cell	ellipsoid	
Adlafia Gerd Moser, Lange-Bertalot & Metzeltin, 1998	cell	elliptic cylinder	$h=1,00\times d_2$
Adlafia aquaeductae (Krasske) Gerd Moser, Lange-Bertalot & D.Metzeltin, 1998	cell	cuboid × 0,85	$c=1,00\times b$
Adlafia minuscula (Grunow) Lange-Bertalot, 1999	cell	lanceolate cylinder	$h=1,00\times d_2$
Adoneis G.W.Andrews & P.Rivera, 1987	cell	rhombic prism	
Akashiwo G.Hansen & Moestrup, 2000	cell	ellipsoid	$d_2=0,67\times d_1$
Akashiwo sanguinea (K.Hirasaka) G.Hansen & Ø.Moestrup, 2000	cell	ellipsoid	$d_2=0,50\times d_1$
Alexandrium Halim, 1960	cell	spheroid	
Alexandrium catenella (Whedon & Kofoid) Balech, 1985	cell	ellipsoid	
Alexandrium leei Balech, 1985	cell	sphere	
Alexandrium margalefii Balech, 1994	cell	sphere	
Algirosphaera Schlauder, 1945	cell	spheroid	
Algirosphaera robusta (Lohmann) R.E.Norris, 1984	cell	sphere	
Alisphaera Heimdal, 1973	cell	sphere	
Ammatoidea West & G.S.West, 1897	filament	cylinder	
Amoebophrya Koeppen, 1894	cell	sphere	
Amoenoscapa	cell	spheroid	
Amphicampa (Ehrenberg) Ralfs, 1861	cell	elliptic cylinder × 1,03	$r_2=0,50\times h$; $h=2,00\times r_2$
Amphichrysis Korshikov, 1929	cell	spheroid	
Amphidiniopsis Woloszynska, 1928	cell	ellipsoid	
Amphidinium Claperède & Lachmann, 1859	cell	ellipsoid	$d_2=0,70\times d_1$
Amphidinium acutissimum Schiller, 1933	cell	double cone	
Amphidinium crassum Lohmann, 1908	cell	ellipsoid	$d_2=0,72\times d_1$
Amphidinium longum Lohmann, 1908	cell	ellipsoid	$d_2=0,67\times d_1$
Amphidinium sphenoides Wülff, 1916	cell	double cone	
Amphidoma Stein, 1883	cell	cone with half sphere	
Amphikrikos Korshikov, 1953	cell	cylinder	
Amphikrikos nanus (Fott & Heynig) Hindák, 1977	cell	spheroid	
Amphipleura Kützing, 1844	cell	elliptic cylinder	
Amphipleura pellucida (Kützing) Kützing, 1844	cell	lanceolate cylinder	
Amphiprora Ehrenberg, 1843	cell	elliptic cylinder	$d_2=0,15\times d_1$; $h=0,67\times d_1$
Amphirhiza Skuja, 1948	cell	sphere	
Amphisolenia Stein, 1883	cell	spindle	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Amphora Ehrenberg ex Kützing, 1844	cell	elliptic cylinder × 0,65	$d_2=0,50\times h$; $h=2,00\times d_2$
Amylax Meunier, 1910	cell	cone with half sphere × 0,75	$h=1,50\times d$
Anabaena Bory de Saint-Vincent ex Bornet & Flahault, 1886	cell	sphere	
Anabaena cylindrica Lemmermann, 1896	cell	cylinder	
Anabaena elliptica Lemmermann, 1898	cell	spheroid	
Anabaena pseudoscillatoria Bory de Saint-Vincent, 1822	cell	spheroid	
Anabaena smithii (Komárek) M.Watanabe	cell	spheroid	
Anabaena sphaerica Bornet & Flahault, 1888	cell	spheroid	
Anabaena tenericaulis Nygaard	cell	spheroid	
Anabaena utermohli (Utermöhl) Geitler, 1925	cell	spheroid	
Anabaenopsis V.V.Miller, 1923	cell	spheroid	
Anacystis Meneghini, 1837	cell	spheroid	
Anathece (Komárek & Anagnostidis) Komárek, Kaštovský & Jezberová, 2011	cell	spheroid	
Anaulus Ehrenberg, 1844	cell	elliptic cylinder	$d_2=0,60\times d_1$
Aneumastus D.G.Mann & A.J.Stickle, 1990	cell	elliptic cylinder	$h=1,00\times d_2$
Aneumastus tuscula (Ehrenberg) D.G.Mann & A.J.Stickle, 1990	cell	elliptic cylinder × 0,9	$h=1,00\times d_2$
Anisonema Dujardin, 1841	cell	ellipsoid	
Ankistrodesmus Corda, 1838	cell	spindle	
Ankyra Fott, 1957	cell	spindle	
Anomoeoneis E.Pfitzer, 1871	cell	elliptic cylinder	$h=1,00\times d_2$
Anoplosolenia Deflandre, 1952	cell	spindle	
Anorthoneis Grunow, 1868	cell	elliptic cylinder	
Anthophysa Bory de Saint-Vincent, 1822	cell	cone with half sphere	
Anthosphaera Kamptner, 1936	cell	sphere	
Apatococcus F.Brand, 1925	cell	spheroid	
Apedinella Throndsen, 1971	cell	sphere	
Aphanizomenon A.Morren ex Bornet & Flahault, 1888	filament	cylinder	
Aphanocapsa Nägeli, 1849	cell	sphere	
Aphanothece Nägeli, 1849	cell	spheroid	
Aphanothece paralleliformis G. Cronberg, 2003	cell	cylinder	
Apiocystis Nägeli, 1849	cell	sphere	
Apodochloris Komárek, 1959	cell	ellipsoid	
Arachnochloris Pascher, 1930	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Arachnoidiscus H.Deane ex G.Shadbolt, 1852	cell	cylinder	
Archaeperidinium Jörgensen, 1912	cell	sphere × 0,8	
Arcocellulus G.R.Hasle, H.A.von Stosch & E.E.Syvertsen, 1983	cell	elliptic cylinder	
Ardissonea De Notaris, 1870	cell	elliptic cylinder	
Arthronema J.Komárek & J.Lukavský, 1988	filament	cylinder	
Arthrospira Sitzenberger ex Gomont, 1892	filament	cylinder	
Astartiella A.Witkowski, Lange-Bertalot & D.Metzeltin, 1998	cell	elliptic cylinder	
Astasia Dujardin, 1841	cell	ellipsoid	
Asterionella Hassall, 1850	cell	cuboid	$b=1,00\times c$
Asterionella ralfsii var. *hustedtiana* Körner, 1970	cell	elliptic cylinder × 0,9	
Asterionellopsis Round, 1990	cell	pyramid × 0,9	$l_1=0,75\times l_2$
Asterococcus Scherffel, 1908	cell	spheroid	
Asterolampra Ehrenberg, 1844	cell	cylinder	
Asteromonas A.Artari, 1913	cell	spheroid	
Asteromphalus Ehrenberg, 1844	cell	cylinder	
Asteroplanus C.Gardner & R.M.Crawford, 1997	cell	elliptic cylinder	$d_2=0,14\times d_1$
Astrosiga W.S.Kent	cell	spheroid	
Attheya T.West, 1860	cell	elliptic cylinder	$d_2=0,50\times d_1$
Attheya longicornis R.M.Crawford & C.Gardner, 1994	cell	elliptic cylinder	$d_2=0,80\times d_1$
Attheya septentrionalis (Østrup) R.M.Crawford, 1994	cell	elliptic cylinder	$d_2=0,80\times d_1$
Aulacodiscus C.G.Ehrenberg, 1844	cell	cylinder	$h=0,50\times d$
Aulacomonas Skuja, 1939	cell	ellipsoid	
Aulacoseira Thwaites, 1848	cell	cylinder	
Aulacoseira karelica (Molder) Simonsen	cell	elliptic cylinder	
Auliscus Ehrenberg, 1843	cell	elliptic cylinder	$h=0,50\times d_2$
Aulomonas Lackey, 1942	cell	spheroid	
Aulosira Kirchner ex Bornet & Flahault, 1886	cell	spheroid	
Aureococcus Hargraves & Sieburth, 1988	cell	sphere	
Aureodinium Dodge, 1967	cell	ellipsoid	
Auricula Castracane, 1873	cell	elliptic cylinder × 0,65	$d_2=0,50\times h$; $h=2,00\times d_2$
Auxenochlorella (I.Shihira & R.W.Krauss) T.Kalina & M.Puncochárová, 1987	cell	spheroid	
Azadinium Elbrächter & Tillmann, 2009	cell	spheroid	
Azpeitia M.Peragallo, 1912	cell	cylinder	
Bacillaria J.F.Gmelin, 1791	cell	cuboid × 0,95	$b=1,00\times c$; $c=1,00\times b$
Bacteriastrum Shadbolt, 1854	cell	cylinder	$h=1,00\times d$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Bacterosira Gran, 1900	cell	cylinder	
Bacularia Borzì, 1905	cell	spheroid	
Balaniger Thomsen & Oates, 1978	cell	spheroid	
Balechina Loeblich Jr. & Loeblich III, 1968	cell	spheroid	
Bambusina Kützing ex Kützing, 1849	cell	cylinder × 0,8	
Basicladia W.E.Hoffmann & Tilden, 1930	filament	cylinder	
Bathycoccus W.Eikrem & J.Throndsen, 1990	cell	spheroid	
Beggiatoa V.B.A.Trevisan, 1845	filament	cylinder	
Bellerochea Van Heurck, 1885	cell	triangular prism (equilateral)	$m=0{,}50\times\sqrt{(3)}\times l$; $h=0{,}35\times l$
Belonastrum (Lemmermann) Round & N.I.Maidana, 2001	cell	elliptic cylinder	$d_2=1{,}00\times h$; $h=1{,}00\times d_2$
Berkeleya Greville, 1827	cell	elliptic cylinder	
Bernardinium Chodat, 1923	cell	ellipsoid	
Biceratium Vanhöffen, 1896	cell	cone with half sphere × 0,65	
Bicosoeca H.J.Clark, 1866	cell	spheroid	
Bicosta B.S.C.Leadbeater, 1978	cell	spheroid	
Biddulphia S.F.Gray, 1821	cell	elliptic cylinder	$d_2=0{,}50\times d_1$
Biddulphia antediluviana (Ehrenberg) Van Heurck, 1885	cell	cuboid × 0,9	$b=1{,}00\times a$; $c=1{,}40\times a$
Biddulphia biddulphiana (J.E.Smith) Boyer, 1900	cell	elliptic cylinder	$d_2=0{,}80\times d_1$
Biddulphia rhombus (Ehrenberg) W.Smith, 1854	cell	rhombic prism	$d_2=0{,}60\times d_1$; $h=1{,}00\times d_2$
Biddulphiopsis von Stosch & R.Simonsen, 1984	cell	elliptic cylinder	
Biecheleria Moestrup, Lindberg & Daugbjerg, 2009	cell	ellipsoid	
Binuclearia Wittrock, 1886	cell	cylinder	
Biremis D.G.Mann & E.J.Cox, 1990	cell	elliptic cylinder	
Bitrichia Woloszynska, 1914	cell	spheroid	
Bleakeleya Round, 1990	cell	cuboid	
Blennothrix Kützing ex Anagnostidis & Komárek, 1988	filament	cylinder	
Blepharocysta Ehrenberg, 1873	cell	spheroid	
Bodo Ehrenberg, 1832	cell	spheroid	
Boreadinium Dodge & Hermes, 1981	cell	ellipsoid	
Borghiella Moestrup, G.Hansen & Daugberg, 2008	cell	ellipsoid	
Borzia Cohn ex Gomont, 1892	filament	cylinder	
Botrydiopsis Borzì, 1889	cell	sphere	
Botrydium Wallroth, 1815	cell	ellipsoid	
Botryochloris Pascher, 1930	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Botryococcus Kützing, 1849	cell	spheroid	
Botryosphaerella P.C.Silva, 1970	cell	sphere	
Braarudosphaera Deflandre, 1947	cell	sphere	
Brachiomonas Bohlin, 1897	cell	spheroid	
Brachysira Kützing, 1836	cell	rhombic prism	
Brachysira aponina Kützing, 1836	cell	lanceolate cylinder	
Brachysira brebissonii R.Ross, 1986	cell	lanceolate cylinder	
Brachysira calcicola Lange-Bertalot, 1994	cell	elliptic cylinder	
Brachysira calcicola subsp. *pfisteri* H.Lange-Bertalot, 2004	cell	elliptic cylinder	
Brachysira follis (Ehrenberg) R.Ross, 1986	cell	elliptic cylinder × 0,8	$h=0,33\times d_2$
Brachysira hofmanniae Lange-Bertalot, 1994	cell	elliptic cylinder × 0,9	
Brachysira procera Lange-Bertalot & Gerd Moser, 1994	cell	lanceolate cylinder	
Brachysira serians (Brébisson) Round & D.G.Mann, 1981	cell	lanceolate cylinder	
Brachysira styriaca (Grunow) R.Ross, 1986	cell	lanceolate cylinder	
Brachysira vitrea (Grunow) R.Ross, 1986	cell	elliptic cylinder	
Brachysira zellensis (Grunow) Cleve	cell	elliptic cylinder	
Brebissonia Grunow, 1860	cell	rhombic prism	$h=0,50\times d_2$
Brevisira Krammer	cell	cylinder × 0,9	
Brockmanniella Hasle, Stosch & Syvertsen, 1983	cell	elliptic cylinder	$d_2=0,40\times d_1$
Bulbochaete C.Agardh, 1817	filament	cylinder	
Bumilleria Borzì, 1889	cell	cylinder	
Bumilleriopsis Printz, 1914	cell	cylinder	
Cachonina Loeblich III, 1968	cell	ellipsoid	$d_2=0,75\times d_1$
Caecitellus D.J.Patterson, K.Nygaard, G.Steinberg & Turley, 1993	cell	spheroid	
Cafeteria T.Fenchel & D.J.Patterson, 1988	cell	spheroid	
Calcidiscus Kamptner, 1950	cell	sphere	
Calciopappus Gaarder & Ramsfjell, 1954	cell	cone	$z=\sqrt{(s^2-0,25\times d^2)}$
Calciosolenia Gran, 1912	cell	spindle	
Calliacantha B.S.C.Leadbeater, 1978	cell	spheroid	
Caloneis P.Cleve, 1894	cell	elliptic cylinder	$d_2=1,50\times h$; $h=0,67\times d_2$
Caloneis amphisbaena (Bory de Saint Vincent) Cleve, 1894	cell	elliptic cylinder × 0,95	$h=0,75\times d_2$
Caloneis amphisbaena var. *subsalina* (Donkin) Cleve, 1894	cell	elliptic cylinder × 0,9	$h=0,75\times d_2$
Caloneis leptosoma (Grunow) Krammer, 1985	cell	elliptic cylinder × 0,9	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Caloneis limosa (Kützing) R.M.Patrick, 1966	cell	cuboid	
Caloneis macedonica Hustedt, 1945	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Caloneis permagna (J.W.Bailey) Cleve, 1894	cell	lanceolate cylinder	
Caloneis tenuis (W.Gregory) Krammer in Krammer & Lange-Bertalot, 1985	cell	cuboid × 0,85	
Caloneis undulata (Gregory) Krammer, 1985	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Calothrix C.Agardh ex Bornet & Flahault, 1886	filament	cylinder	
Calycomonas Lohmann, 1908	cell	spheroid	
Calyptrolithina Heimdal, 1982	cell	spheroid	
Calyptrolithophora Heimdal, 1980	cell	spheroid	
Calyptrosphaera Lohmann, 1902	cell	sphere	
Camptothrix West & G.S.West, 1897	filament	cylinder	
Camptylonemopsis T.V.Desikachary, 1948	filament	cylinder	
Campylodiscus Ehrenberg ex Kützing, 1844	cell	elliptic cylinder	$d_2=0{,}90\times d_1$; $h=0{,}40\times d_2$
Campylomonas Hill, 1991	cell	spheroid	
Campyloneis Grunow, 1862	cell	elliptic cylinder	
Campylopyxis L.K.Medlin, 1985	cell	elliptic cylinder	
Campylosira Grunow ex Van Heurck, 1885	cell	elliptic cylinder	$h=0{,}75\times r_2$
Caneosphaera Gaarder, 1977	cell	sphere	
Capartogramma Kufferath, 1956	cell	elliptic cylinder × 0,9	
Capsosira Kützing ex Bornet & Flahault, 1886	filament	cylinder	
Carteria Diesing, 1866	cell	sphere	
Carteria klebsii (P.A.Dangeard) Francé, 1921	cell	spheroid	
Carteria marina Diesing, 1866	cell	spheroid	
Catacombas D.M.Williams & Round, 1986	cell	cuboid × 0,8	
Catella G.Ålvik, 1934	cell	cylinder	
Catena Chodat, 1900	filament	cylinder	
Catenochrysis Perman, 1955	cell	spheroid	
Catenula Mereschkowsky, 1903	cell	elliptic cylinder	
Cavinula D.G.Mann & A.J.Stickle, 1990	cell	elliptic cylinder	$h=1{,}00\times d_2$
Cavinula lacustris (W.Gregory) D.G.Mann & Stickle, 1990	cell	lanceolate cylinder	$d_2=1{,}50\times h$; $h=0{,}67\times d_2$
Cecidochloris Skuja, 1948	cell	spheroid	
Centritractus E.Lemmermann, 1900	cell	cylinder × 0,85	
Centrodinium Kofoid, 1907	cell	cone with half sphere	
Centronella Max Voigt, 1902	cell part	cuboid	$c=1{,}00\times b$
Cerataulina H.Peragallo ex Schütt, 1896	cell	cylinder	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Cerataulus Ehrenberg, 1844	cell	cylinder	$h=0{,}67×d$
Cerataulus smithii Ralfs ex Pritchard, 1861	cell	cylinder × 0,75	$h=0{,}60×d$
Ceratium Schrank, 1793	cell	Ceratium - girdle diameter (see Annex A)	
Ceratium brachyceros Daday, 1907	cell	cone with half sphere × 0,65	
Ceratium carolinianum (Bailey) E.G.Jörgensen, 1911	cell	cone with half sphere × 0,65	
Ceratium cornutum (Ehrenberg) Claparède & J.Lachmann, 1859	cell	cone with half sphere × 0,65	
Ceratium furcoides (Levander) Langhans, 1925	cell	cone with half sphere × 0,65	
Ceratium massiliense (Gourret) Karsten, 1906	cell	cone with half sphere × 0,65	
Ceratium platycorne Daday, 1888	cell	cone with half sphere × 0,65	
Ceratium rhomvoides Hickel, 1987	cell	cone with half sphere × 0,65	
Ceratocorys Stein, 1883	cell	ellipsoid	
Ceratolithus Kamptner, 1950	cell	sphere	
Cercaria O.F.Müller, 1773	cell	Ceratium - girdle diameter (see Annex A)	
Chaetoceros Ehrenberg, 1844	cell	elliptic cylinder	$d_2=0{,}74×d_1$
Chaetoceros affinis Lauder, 1864	cell	elliptic cylinder	$d_2=0{,}80×d_1$
Chaetoceros anastomosans Grunow, 1882	cell	elliptic cylinder	$d_2=0{,}67×d_1$
Chaetoceros anastomosans var. *externus* (Gran) Cleve-Euler	cell	elliptic cylinder	$d_2=0{,}67×d_1$
Chaetoceros atlanticus Cleve, 1873	cell	elliptic cylinder	$d_2=0{,}67×d_1$
Chaetoceros borealis J.W.Bailey, 1854	cell	elliptic cylinder	$d_2=0{,}85×d_1$
Chaetoceros brevis F.Schütt, 1895	cell	elliptic cylinder	$d_2=0{,}83×d_1$
Chaetoceros calcitrans (Paulsen) Takano, 1968	cell	elliptic cylinder	$d_2=0{,}82×d_1$
Chaetoceros calcitrans f. *pumilus* Takano	cell	elliptic cylinder	$d_2=0{,}82×d_1$
Chaetoceros castracanei Karsten, 1905	cell	elliptic cylinder	$d_2=0{,}75×d_1$
Chaetoceros ceratosporus Ostenfeld, 1910	cell	elliptic cylinder	$d_2=0{,}82×d_1$; $h=1{,}60×d_2$
Chaetoceros circinalis (Meunier) K.G. Jensen & Moestrup	cell	elliptic cylinder	$d_2=0{,}85×d_1$
Chaetoceros compressus Lauder, 1864	cell	elliptic cylinder	$d_2=0{,}85×d_1$
Chaetoceros concavicornis Mangin, 1917	cell	elliptic cylinder	$d_2=0{,}60×d_1$; $h=1{,}75×d_2$
Chaetoceros constrictus Gran, 1897	cell	elliptic cylinder	$d_2=0{,}80×d_1$
Chaetoceros convolutus Castracane, 1886	cell	elliptic cylinder	$d_2=0{,}60×d_1$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Chaetoceros coronatus Gran, 1897	cell	elliptic cylinder	$d_2=0,81\times d_1$
Chaetoceros costatus Pavillard, 1911	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros crinitus F.Schütt, 1895	cell	elliptic cylinder	$d_2=0,80\times d_1$
Chaetoceros curvisetus Cleve, 1889	cell	elliptic cylinder	$d_2=0,50\times d_1$
Chaetoceros danicus Cleve, 1889	cell	elliptic cylinder	$d_2=0,75\times d_1$; $h=1,25\times d_2$
Chaetoceros debilis Cleve, 1894	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros decipiens Cleve, 1873	cell	elliptic cylinder	$d_2=0,77\times d_1$
Chaetoceros densus (Cleve) Cleve, 1899	cell	elliptic cylinder	$d_2=0,63\times d_1$
Chaetoceros diadema (Ehrenberg) Gran, 1897	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros didymus Ehrenberg, 1845	cell	elliptic cylinder	$d_2=0,50\times d_1$
Chaetoceros eibenii Grunow, 1882	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros externus Gran, 1897	cell	elliptic cylinder	$d_2=0,67\times d_1$
Chaetoceros galvestonensis Collier & Murphy	cell	elliptic cylinder	$d_2=0,67\times d_1$
Chaetoceros gracilis Pantocsek, 1892	cell	elliptic cylinder	$d_2=0,80\times d_1$; $h=1,70\times d_2$
Chaetoceros holsaticus F.Schütt, 1895	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros ingolfianus Ostenfeld, 1902	cell	elliptic cylinder	$d_2=0,70\times d_1$
Chaetoceros laciniosus F.Schütt, 1895	cell	elliptic cylinder	$d_2=0,85\times d_1$
Chaetoceros lauderi Ralfs, 1864	cell	elliptic cylinder	$d_2=0,90\times d_1$
Chaetoceros lorenzianus Grunow, 1863	cell	elliptic cylinder	$d_2=0,59\times d_1$
Chaetoceros minimus (Levander) D.Marino, G.Giuffre, M.Montresor & A.Zingone, 1991	cell	cylinder	
Chaetoceros muelleri Lemmermann, 1898	cell	elliptic cylinder	$d_2=0,86\times d_1$; $h=1,50\times d_2$
Chaetoceros neogracile S.L.VanLandingham, 1968	cell	elliptic cylinder	$d_2=0,67\times d_1$
Chaetoceros orientale Schiller	cell	elliptic cylinder	$d_2=0,55\times d_1$
Chaetoceros perpusillus Cleve, 1897	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros peruvianus Brightwell, 1856	cell	elliptic cylinder	$d_2=0,67\times d_1$
Chaetoceros protuberans H.S.Lauder, 1864	cell	elliptic cylinder	$d_2=0,50\times d_1$
Chaetoceros pseudocrinitus Ostenfeld, 1901	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros radicans F.Schütt, 1895	cell	elliptic cylinder	$d_2=0,67\times d_1$
Chaetoceros salsugineus Takano, 1983	cell	elliptic cylinder	$d_2=0,81\times d_1$
Chaetoceros seiracanthus Gran, 1897	cell	elliptic cylinder	$d_2=0,76\times d_1$
Chaetoceros seriacanthus Gran	cell	elliptic cylinder	$d_2=0,75\times d_1$
Chaetoceros similis Cleve, 1896	cell	elliptic cylinder	$d_2=0,70\times d_1$
Chaetoceros simplex Ostenfeld, 1901	cell	elliptic cylinder	$d_2=0,85\times d_1$; $h=1,60\times d_2$
Chaetoceros socialis H.S.Lauder, 1864	cell	elliptic cylinder	$d_2=0,50\times d_1$
Chaetoceros socialis f. *radians* (F.Schütt) A.I.Proshkina-Lavrenko, 1963	cell	elliptic cylinder	$d_2=0,50\times d_1$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Chaetoceros subsecundus (Grunow ex Van Heurck) Hustedt, 1927	cell	elliptic cylinder	d_2=0,67×d_1
Chaetoceros subtilis Cleve, 1896	cell	elliptic cylinder	d_2=0,85×d_1
Chaetoceros tenuissimus Meunier, 1913	cell	elliptic cylinder	d_2=0,87×d_1; h=1,40×d_2
Chaetoceros teres Cleve, 1896	cell	elliptic cylinder	d_2=0,85×d_1
Chaetoceros throndsenii (Marino, Montresor & Zingone) Marino, Montresor & Zingone, 1991	cell	elliptic cylinder	d_2=0,87×d_1
Chaetoceros tortissimus Gran, 1900	cell	elliptic cylinder	d_2=0,50×d_1
Chaetoceros willei Grunow, 1897	cell	elliptic cylinder	d_2=0,67×d_1
Chaetonema Filipjev, 1927	filament	cylinder	
Chaetopeltis Berthold, 1878	cell	spheroid	
Chaetophora Schrank, 1783	filament	cylinder	
Chaetosphaeridium Klebahn, 1892	cell	sphere	
Chamaecalyx Komárek & Anagnostidis, 1986	cell group	spheroid	
Chamaepinnularia Lange-Bertalot & Krammer, 1996	cell	elliptic cylinder	h=1,00×d_2
Chamaepinnularia krookiformis (K.Krammer) Lange-Bertalot & K.Krammer in H.Lange-Bertalot & S.I.Genkal, 1999	cell	cuboid × 0,9	b=1,11×c; c=0,90×b
Chamaepinnularia witkowskii (H.Lange-Bertalot & D.Metzeltin) M.Kulikovskiy & H.Lange-Bertalot, 2010	cell	lanceolate cylinder	h=1,00×d_2
Chamaesiphon A.Braun, 1864	filament	cylinder	
Characiopsis Borzì, 1895	cell	spindle	
Characium Braun ex Kützing, 1849	cell	spindle	
Chattonella B.Biecheler, 1936	cell	spheroid	
Chilomonas Ehrenberg ex Ralfs, 1831	cell	ellipsoid	d_2=0,80×d_1
Chlainomonas H.R.Christen, 1959	cell	spheroid	
Chlamydocapsa Fott, 1972	cell	spheroid	
Chlamydocapsa planctonica (West & G.S.West) Fott	cell	sphere	
Chlamydomonas Ehrenberg, 1833	cell	spheroid	
Chlamydomonas gloeocystiformis (O.Dill) A.Nakazawa, 2001	cell	sphere	
Chlamydomonas tetragama (Bohlin) Wille, 1909	cell	spindle	
Chlorallanthus Pascher, 1930	cell	ellipsoid	
Chlorangiella De Toni, 1889	cell	ellipsoid	
Chlorangiopsis Korshikov, 1932	cell	spheroid	
Chlorella M.Beijerinck, 1890	cell	spheroid	
Chlorella vulgaris Beyerinck [Beijerinck], 1890	cell	sphere	
Chlorhormidium B.Fott, 1960	filament	cylinder	
Chloridella Pascher, 1932	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Chlorobotrys Bohlin, 1901	cell	sphere	
Chlorochytrium Cohn, 1872	cell	spheroid	
Chlorocloster Pascher, 1925	cell	spheroid	
Chlorococcum Meneghini, 1842	cell	spheroid	
Chlorococcum wimmeri (F.W.Hilse) Rabenhorst, 1868	cell	sphere	
Chlorodesmos F.W.Phillips, 1882	cell	spheroid	
Chlorogibba Geitler, 1928	cell	sphere	
Chlorogloea Wille, 1900	cell	spheroid	
Chlorogonium Ehrenberg, 1837	cell	spindle	
Chloroidium Nadson, 1906	cell	spheroid	
Chlorolobion Korshikov, 1953	cell	spindle	
Chloromonas Gobi, 1899-1900	cell	spheroid	
Chlorotetraedron F.J.MacEntee, H.C.Bold & P.A.Archibald, 1978	cell	cuboid	$c=0,67\times b$
Chlorothecium Borzì, 1885	cell	spindle	
Chlorotylium Kützing, 1843	cell	cylinder	
Chodatella Lemmermann, 1898	cell	spheroid	
Chondrocystis Lemmermann, 1899	cell	sphere	
Choricystis (Skuja) Fott, 1976	cell	spheroid	
Chromophysomonas H.R.Preisig & D.J.Hibberd, 1982	cell	sphere	
Chromulina L.Cienkowsky, 1870	cell	spheroid	
Chroococcidiopsis Geitler, 1933	cell	sphere	
Chroococcidium Geitler, 1933	cell	spheroid	
Chroococcopsis Geitler, 1925	cell	spheroid	
Chroococcus Nägeli, 1849	cell	spheroid	
Chroococcus aphanocapsoides Skuja, 1964	cell	sphere	
Chroococcus cumulatus Bachmann, 1921	cell	sphere	
Chroococcus dispersus (Keissler) Lemmermann, 1904	cell	sphere	
Chroococcus distans (G.M.Smith) Komárková-Legnerová & Cronberg, 1993	cell	sphere	
Chroococcus microscopicus J.Komárková-Legnerová & G.Cronberg, 1994	cell	sphere	
Chroococcus minimus (Keissler) Lemmermann, 1904	cell	sphere	
Chroococcus minor (Kützing) Nägeli, 1849	cell	sphere	
Chroococcus minutus (Kützing) Nägeli, 1849	cell	sphere	
Chroococcus turgidus (Kützing) Nägeli, 1849	cell	sphere	
Chroomonas Hansgirg, 1885	cell	ellipsoid	$d_2=0,80\times d_1$
Chroomonas caudata (L.Geitler) D.R.A.Hill, 1991	cell	cone with half sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Chrysamoeba G.A.Klebs, 1892	cell	sphere	
Chrysanthemodiscus A.Mann, 1925	cell	cylinder × 0,9	
Chrysapsis Pascher, 1910	cell	spheroid	
Chrysastrella Chodat, 1922	cell	sphere	
Chrysidiastrum Lauterborn, 1913	cell	spheroid	
Chrysocapsa Pascher, 1913	cell	sphere	
Chrysocapsella Bourrelly, 1957	cell	spheroid	
Chrysochromulina Lackey, 1939	cell	spheroid	
Chrysochromulina parva Lackey, 1939	cell	ellipsoid	$d_2=0,60×d_1$
Chrysococcus G.A.Klebs, 1892	cell	sphere	
Chrysodendron Pascher, 1927	cell	spheroid	
Chrysolykos B.Mack, 1951	cell	spheroid	
Chrysomonas F.Stein, 1878	cell	sphere	
Chrysopora Pascher, 1925	cell	spheroid	
Chrysopyxis F.Stein, 1878	cell	sphere	
Chrysosaccus Pascher, 1925	cell	sphere	
Chrysosphaera Pascher, 1914	cell	spheroid	
Chrysosphaerella Lauterborn, 1896	cell	spheroid	
Chrysostephanosphaera Scherffel, 1911	cell	sphere	
Chrysotilos Pascher, 1931	cell	spheroid	
Chrysoxys Skuja, 1948	cell	spheroid	
Ciliophrys Cienkowski, 1876	cell	sphere	
Citharistes Stein, 1883	cell	ellipsoid	
Cladopyxis Stein, 1883	cell	sphere	
Clastidium Kirchner, 1880	cell	cylinder	
Clastidium setigerum Kirchner, 1880	cell	spindle	
Climacodium Grunow, 1868	cell	elliptic cylinder	
Closteriopsis Lemmermann, 1899	cell	spindle	
Closterium Nitzsch ex Ralfs, 1848	cell	spindle	
Closterium closterioides var. *intermedium* (J.Roy & Bisset) Ruzicka, 1973	cell	spindle × 1,2	
Closterium directum W.Archer, 1862	cell	cylinder	
Closterium navicula (Brébisson) Lütkemüller, 1905	cell	spindle × 1,2	
Closterium praelongum Brébisson, 1856	cell	cylinder	
Closterium praelongum var. *brevius* (Nordstedt) Willi Krieger, 1935	cell	cylinder	
Coccolithus E.H.L.Schwarz, 1894	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Coccomonas Stein, 1878	cell	spheroid	
Coccomyxa Léger & Hesse, 1907	cell	spheroid	
Cocconeis Ehrenberg, 1837	cell	elliptic cylinder	$h=0,35\times d_2$
Cocconeis pediculus Ehrenberg, 1838	cell	elliptic cylinder	$h=0,33\times d_2$
Cocconeis placentula var. *placentula* Ehrenberg	cell	elliptic cylinder	$h=0,30\times d_2$
Cocconeis scutellum var. *scutellum* Ehrenberg, 1838	cell	elliptic cylinder	$h=0,10\times d_2$
Coccopedia Troickaja, 1922	cell	spheroid	
Cochlodinium Schütt, 1896	cell	ellipsoid	$d_2=0,80\times d_1$
Cochlodinium achromaticum Lebour, 1925	cell	spheroid	
Cochlodinium brandtii Wulff, 1916	cell	spheroid	
Cochlodinium pulchellum Lebour, 1917	cell	spindle	
Cochlodinium vinctum Kofoid & Swezy, 1921	cell	spheroid	
Codomonas Lackey, 1939	cell	spheroid	
Codonomonas van Goor, 1925	cell	spheroid	
Codonosigopsis (Rabin) Senn	cell	spheroid	
Codosiga H.J.Clark, 1866	cell	spheroid	
Coelastrum Nägeli, 1849	cell	sphere	
Coelastrum pseudomicroporum Korshikov, 1953	cell	spheroid	
Coelomoron Buell, 1938	cell	spheroid	
Coelosphaerium Nägeli, 1849	cell	sphere	
Coenochloris Korshikov, 1953	cell	sphere	
Coenococcus Korshikov, 1953	cell	sphere	
Coenocystis Korshikov, 1953	cell	spheroid	
Colacium Ehrenberg, 1834	cell	spheroid	
Coleochaete Brébisson, 1844	colony	cylinder	
Coleochlamys Korshikov, 1953	cell	spheroid	
Coleodesmium Borzì ex Geitler, 1942	filament	cylinder	
Coleofasciculus Siegesmund, J.R.Johansen & Friedl, 2008	filament	cylinder	
Collodictyon H.J.Carter, 1865	cell	spheroid	
Comasiella E.Hegewald, M.Wolf, A.Keller, Friedl & Krienitz, 2010	cell	spheroid	
Commation Thomsen & Larsen, 1993	cell	cone	$z=\sqrt{(s^2-0,25\times d^2)}$
Conradiella Pascher, 1925	cell	spheroid	
Conradocystis A.Hollande, 1952	cell	spheroid	
Conticribra K.Stachura-Suchoples & D.M.Williams, 2009	cell	cylinder	$h=0,80\times d$
Coolia Meunier, 1919	cell	ellipsoid	$d_2=0,90\times d_1$

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Corethron Castracane, 1886	cell	cylinder × 0,86	
Corisphaera Kamptner, 1936	cell	sphere	
Coronastrum R.H.Thompson, 1938	cell	spheroid	
Coronosphaera Gaarder, 1977	cell	sphere	
Corymbellus J.C.Green, 1976	cell	spheroid	
Corythodinium Loeblich Jr. & Loeblich III, 1966	cell	spindle	
Coscinodiscus Ehrenberg, 1839	cell	cylinder	*h=0,52×d*
Coscinodiscus asteromphalus Ehrenberg, 1844	cell	cylinder	*h=0,47×d*
Coscinodiscus centralis Ehrenberg, 1844	cell	cylinder	*h=0,30×d*
Coscinodiscus commutatus Grunow, 1884	cell	cylinder	*h=0,48×d*
Coscinodiscus concinnus W.Smith, 1856	cell	cylinder	*h=0,39×d*
Coscinodiscus jonesianus (Greville) Ostenfeld, 1915	cell	cylinder × 0,9	
Coscinodiscus radiatus Ehrenberg, 1840	cell	cylinder	*h=0,40×d*
Coscinodiscus wailesii Gran & Angst, 1931	cell	cylinder	*h=0,71×d*
Coscinosira Gran, 1900	cell	cylinder	*h=0,38×d*
Cosmarium Corda ex Ralfs, 1848	half-cell	ellipsoid	d_2=0,60×d_1
Cosmioneis D.G.Mann & Stickle, 1990	cell	elliptic cylinder × 0,9	*h=0,75×*d_2
Cosmocladium Brébisson, 1856	half-cell	spheroid	
Cosmoeca Thomsen, 1984	cell	spheroid	
Craspedostauros E.J.Cox, 1999	cell	elliptic cylinder	
Craticula Grunow, 1867	cell	elliptic cylinder	*h=0,75×*d_2
Craticula accomoda (Hustedt) D.G.Mann, 1990	cell	elliptic cylinder × 0,9	
Craticula acidoclinata Lange-Bertalot & Metzeltin, 1996	cell	rhombic prism	*h=0,75×*d_2
Craticula ambigua (Ehrenberg) D.G.Mann, 1990	cell	elliptic cylinder × 0,9	*h=0,75×*d_2
Craticula buderi (Hustedt) Lange-Bertalot, 2000	cell	lanceolate cylinder × 0,9	
Craticula cuspidata (Kutzing) D.G.Mann, 1990	cell	lanceolate cylinder	*h=0,75×*d_2
Craticula dissociata (E.Reichardt) E.Reichardt, 1997	cell	lanceolate cylinder	*h=1,00×*d_2
Craticula halophila (Grunow) D.G.Mann, 1990	cell	lanceolate cylinder	*h=1,00×*d_2
Craticula minusculoides (Hustedt) Lange-Bertalot, 2001	cell	elliptic cylinder	*h=1,00×*d_2
Craticula molestiformis (Hustedt) Mayama, 1999	cell	elliptic cylinder	*h=1,00×*d_2
Craticula riparia (Hustedt) Lange-Bertalot, 1993	cell	lanceolate cylinder	*h=1,00×*d_2
Craticula submolesta (Hustedt) Lange-Bertalot, 1996	cell	elliptic cylinder	*h=1,00×*d_2
Crenalithus P.H.Roth, 1973	cell	sphere	
Cricosphaera Braarud, 1960	cell	sphere	
Crinalium Crow, 1927	filament	cylinder	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Crinolina H.A.Thomsen, 1976	cell	spheroid	
Crucigenia Morren, 1830	cell	spheroid	
Crucigenia fenestrata (Schmidle) Schmidle, 1900	cell	trapezoid prism	$l_2=0,6\times l_1$; $h=1,00\times l_1$
Crucigenia lauterbornii (Schmidle) Schmidle, 1900	cell	ellipsoid	$d_2=0,90\times d_1$
Crucigenia mucronata (G.M.Smith) J.Komárek	cell	ellipsoid	$d_2=0,90\times d_1$
Crucigenia quadrata Morren, 1830	cell	sphere	
Crucigenia quadrata var. *secta* Playfair	cell	ellipsoid	$d_2=0,90\times d_1$
Crucigenia tetrapedia (Kirchner) Kuntze, 1898	cell	tetrahedron	
Cruciplacolithus W.Hay & Mohler, 1967	cell	sphere	
Crucispina Espeland & Throndsen, 1986	cell	spheroid	
Cryothecomonas Thomsen Buck, Bolt & Garrison, 1991	cell	spheroid	
Cryptaulax Skuja, 1948	cell	ellipsoid	$d_2=0,80\times d_1$
Crypthecodinium Biecheler, 1938	cell	spheroid	
Cryptoglena Ehrenberg, 1831	cell	spheroid	
Cryptoglena skujae Marin & Melkonian, 2003	cell	ellipsoid	$d_2=0,85\times d_1$
Cryptomonas Ehrenberg, 1831	cell	ellipsoid	$d_2=0,80\times d_1$
Crystallolithus Gaarder & Markali, 1957	cell	sphere	
Ctenophora (Grunow) D.M.Williams & Round, 1986	cell	elliptic cylinder	$d_2=0,15\times d_1$; $h=1,00\times d_2$
Cuspidothrix Rajaniemi, Komárek, Willame, Hrouzek, Ka, 2005	filament	cylinder	
Cyanarcus Pascher, 1914	filament	elliptic cylinder	
Cyanobacterium Rippka & Cohen-Bazire, 1983	cell	spheroid	
Cyanobium Rippka & Cohen-Bazire, 1983	cell	spheroid	
Cyanocatena Hindák, 1975	cell	cylinder	
Cyanocystis Borzì, 1882	cell	spheroid	
Cyanodermatium Geitler, 1933	cell	spheroid	
Cyanodictyon Pascher, 1914	cell	sphere	
Cyanodictyon balticum Cronberg	cell	cylinder	
Cyanodictyon iac G.Cronberg & J.Komárek, 1994	cell	spheroid	
Cyanodictyon planctonicum B.A.Mayer, 1994	cell	spheroid	
Cyanodictyon tubiforme Cronberg, 1988	cell	spheroid	
Cyanogranis Hindák, 1982	cell	sphere	
Cyanokybus Schiller, 1956	cell	spheroid	
Cyanonephron Hickel, 1985	cell	spheroid	
Cyanophanon Geitler, 1955	filament	cylinder	
Cyanosaccus Lukas & Golubic, 1981	cell	spheroid	
Cyanosarcina Kovácik, 1988	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Cyanostylon Geitler, 1928	cell	spheroid	
Cyanothece Komárek, 1976	cell	spheroid	
Cyathomonas Fromentel, 1874	cell	ellipsoid	
Cyclidiopsis Korshikov, 1917	cell	spindle	
Cyclonexis A.Stokes, 1886	cell	spheroid	
Cyclophora Castracane, 1878	cell	elliptic cylinder	
Cyclostephanos Round ex Theriot, Hakansson, Kociolek, Round & Stoermer, 1987	cell	cylinder	*h=0,60×d*
Cyclotella (Kützing) Brébisson, 1838	cell	cylinder	*h=0,61×d*
Cyclotella atomus Hustedt, 1937	cell	cylinder	*h=0,50×d*
Cyclotella austriaca (M.Peragallo, Handmann & Schiedler) Hustedt, 1948	cell	elliptic cylinder	
Cyclotella choctawhatcheeana Prasad, 1990	cell	cylinder	*h=0,62×d*
Cyclotella meneghiniana Kützing, 1844	cell	cylinder	*h=0,86×d*
Cyclotella radiosa (Grunow) Lemmermann, 1900	cell	cylinder	*h=0,47×d*
Cylindrocapsa Reinsch, 1867	cell	cylinder	
Cylindrocystis Meneghini ex De Bary, 1858	cell	cylinder × 0,88	
Cylindrospermopsis G.Seenayya & N.Subba Raju, 1972	filament	cylinder	
Cylindrospermum Kützing ex Bornet & Flahault, 1886	cell	cylinder	
Cylindrotheca Rabenhorst, 1859	cell	spindle	
Cymatoneis Cleve, 1894	cell	rhombic prism	
Cymatopleura W.Smith, 1851	cell	elliptic cylinder	$h=0{,}75\times d_2$
Cymatopleura elliptica (Brébisson) W.Smith, 1851	cell	elliptic cylinder	$h=0{,}50\times d_2$
Cymatopleura elliptica var. *hibernica* (W.Smith) Hustedt	cell	elliptic cylinder	$h=0{,}50\times d_2$
Cymatosira Grunow, 1862	cell	elliptic cylinder	$d_2=0{,}33\times d_1$; $h=1{,}00\times d_2$
Cymbella C.Agardh, 1830	cell	elliptic cylinder × 0,8	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Cymbella cymbiformis C.Agardh, 1830	cell	lanceolate cylinder × 0,8	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Cymbella excisa Kützing, 1844	cell	lanceolate cylinder × 0,8	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Cymbella excisa var. *procera* Krammer, 2002	cell	lanceolate cylinder × 0,8	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Cymbella excisiformis Krammer, 2002	cell	lanceolate cylinder × 0,8	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Cymbella laevis Nägeli, 1849	cell	lanceolate cylinder × 0,8	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Cymbella lanceolata (C.Agardh) C.Agardh, 1830	cell	lanceolate cylinder × 0,65	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Cymbella lancettula (Krammer) Krammer, 2002	cell	lanceolate cylinder ×	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
		0,8	
Cymbella lange-bertalotii Krammer, 2002	cell	lanceolate cylinder × 0,8	*d_2=0,83×h; h=1,20×d_2*
Cymbella parva (W.Smith) Kirchner, 1878	cell	lanceolate cylinder × 0,8	*d_2=0,83×h; h=1,20×d_2*
Cymbella subhelvetica Krammer, 2002	cell	lanceolate cylinder × 0,8	*d_2=0,83×h; h=1,20×d_2*
Cymbellafalsa H.Lange-Bertalot & D.Metzeltin, 2009	cell	elliptic cylinder	
Cymbellonitzschia Hustedt, 1924	cell	elliptic cylinder	
Cymbodinium J.Cachon & M.Cachon, 1967	cell	sphere	
Cymbomonas J.Schiller, 1913	cell	spheroid	
Cymbopleura (K.Krammer) K.Krammer, 1999	cell	elliptic cylinder	
Cymbopleura amphicephala (Nägeli) Krammer, 2003	cell	elliptic cylinder × 0,9	
Cymbopleura anglica (Lagerstedt) Krammer, 2003	cell	elliptic cylinder × 0,9	
Cymbopleura angustata (W.Smith) Krammer, 2003	cell	elliptic cylinder × 0,9	
Cymbopleura apiculata Krammer, 2003	cell	elliptic cylinder × 0,9	
Cymbopleura cuspidata (Kützing) Krammer, 2003	cell	elliptic cylinder × 0,8	*d_2=0,83×h; h=1,20×d_2*
Cyrtosphaera A.Kleijne, 1992	cell	spheroid	
Cystodinedria Pascher, 1944	cell	ellipsoid	
Cystodinium Klebs, 1912	cell	ellipsoid	
Cystomonas Ettl & Gaertner, 1987	cell	ellipsoid	
Cystopleura Brébisson ex O.Kuntze, 1891	cell	elliptic cylinder × 0,65	*d_2=0,83×h; h=1*,20×d_2
Dactyliosolen Castracane, 1886	cell	cylinder	
Dactylococcopsis Hansgirg	cell	spindle	
Dactylosphaerium Steinecke, 1916	cell	sphere	
Daktylethra Gartner, 1969	cell	spheroid	
Dasygloea Thwaites ex Gomont, 1892	filament	cylinder	
Decussata (Patrick) Lange-Bertalot & Metzeltin, 2000	cell	elliptic cylinder	*h=1,00×d_2*
Delicata K.Krammer, 2003	cell	elliptic cylinder	
Delphineis G.W.Andrews, 1977	cell	elliptic cylinder	*d_2=0,40×d_1; h=0,60×d_2*
Dendromonas F.Stein, 1878	cell	spheroid	
Denticella C.G.Ehrenberg, 1838	cell	elliptic cylinder	*d_2=0,50×d_1*
Denticula Kützing, 1844	cell	elliptic cylinder	*h=0,50×d_2*
Derepyxis A.Stokes, 1885	cell	spheroid	
Dermocarpella Lemmermann, 1907	cell	sphere	
Desmarella W.S.Kent, 1878	cell	spheroid	
Desmatractum West & G.S West, 1902	cell	spheroid	
Desmidium C.Agardh ex Ralfs, 1848	cell	cylinder	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Desmidium swartzii C.Agardh ex Ralfs, 1848	cell	triangular prism (equilateral)	*m=0,50×√(3)×l;*
Desmidium swartzii var. *amblyodon* (Itzigsohn) Rabenhorst, 1863	cell	triangular prism (equilateral)	*m=0,50×√(3)×l;*
Desmidium swartzii var. *gotlandicum* R.L.Grönblad	cell	triangular prism (equilateral)	*m=0,50×√(3)×l;*
Desmococcus F.Brand, 1925	cell	sphere	
Desmodesmus (R.Chodat) S.S.An, T.Friedl & E.Hegewald, 1999	cell	spheroid	
Desmomastix Pascher, 1914	cell	ellipsoid	
Desmosiphon Borzì, 1907	filament	cylinder	
Detonula F.Schütt ex De Toni, 1894	cell	cylinder	*h=0,80×d*
Detonula confervacea (Cleve) Gran, 1900	cell	cylinder	
Deutschlandia Lohmann, 1912	cell	sphere	
Diachros Pascher, 1937	cell	sphere	
Diacronema Prauser, 1958	cell	spheroid	
Diadesmis Kützing, 1844	cell	elliptic cylinder	$h=1,00\times d_2$
Diadesmis biceps G.A.Arnott	cell	cuboid × 0,85	
Diadesmis contenta (Grunow ex Van Heurck) D.G.Mann, 1990	cell	cuboid × 0,95	*c=1,00×b*
Diadesmis contenta var. *biceps* (Grunow) P.B.Hamilton, 1992	cell	cuboid	
Diaphanoeca W.Ellis, 1930	cell	spheroid	
Diatoma Bory de Saint-Vincent, 1824	cell	elliptic cylinder	$d_2=0,50\times d_1$
Diatoma constricta (Grunow) Williams	cell	cuboid	*b=1,00×c; c=1,00×b*
Diatoma gracillima Hantzsch, 1861	cell	cuboid	*b=1,00×c; c=1,00×b*
Diatoma hiemalis (Roth) Heiberg, 1863	cell	cuboid	
Diatoma moniliformis Kützing, 1833	cell	cuboid × 0,9	
Diatoma tenuis C.Agardh, 1812	cell	cuboid	*b=1,00×c; c=1,00×b*
Diatoma vulgaris Bory de Saint-Vincent, 1824	cell	elliptic cylinder	$d_2=0,25\times d_1$; $h=0,50\times d_1$
Diatomella Greville, 1855	cell	elliptic cylinder	
Dicellula Svirenko, 1926	cell	spheroid	
Dichothrix Zanardini ex Bornet & Flahault, 1886	filament	cylinder	
Dichotomococcus Korshikov, 1928	cell	cone with half sphere	
Dickieia Berkeley ex Kützing, 1844	cell	elliptic cylinder	
Dicloster C.-C.Jao, Y.S.Wei & H.C.Hu, 1976	cell	spindle	
Dicranochaete Hieronymus, 1890	filament	cylinder	
Dicrateria Parke, 1949	cell	sphere	
Dicroerisma F.J.R.Taylor & S.A.Cattell, 1970	cell	cone × 0,5	$z=\sqrt{(s^2-0,25\times d^2)}$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Dictyocha Ehrenberg, 1837	cell	sphere × 0,5	
Dictyochlorella P.C.Silva, 1959	cell	spheroid	
Dictyococcus Gerneck, 1907	cell	sphere	
Dictyoneis Cleve, 1890	cell	elliptic cylinder	
Dictyosphaerium Nägeli, 1849	cell	spheroid	
Didymocystis Korshikov, 1953	cell	spheroid	
Didymoeca Doweld, 2003	cell	spheroid	
Didymogenes Schmidle, 1905	cell	spheroid	
Didymosphenia M.Schmidt, 1899	cell	elliptic cylinder × 0,9	
Dimeregramma Ralfs, 1861	cell	elliptic cylinder	$d_2=0,45\times d_1$; $h=1,00\times d_2$
Dimorphococcus Braun, 1855	cell	spheroid	
Dinema Perty, 1852	cell	spheroid	
Dinematomonas P.C.Silva, 1960	cell	spheroid	
Dinobryon Ehrenberg, 1834	cell	spheroid	
Dinococcus Fott, 1960	cell	ellipsoid	
Dinophysis Ehrenberg, 1839	cell	ellipsoid	$d_2=0,45\times d_1$
Dinophysis acuminata Claparède & Lachmann, 1859	cell	ellipsoid	$d_2=0,50\times d_1$
Dinophysis acuta Ehrenberg, 1839	cell	ellipsoid	$d_2=0,50\times d_1$
Dinophysis caudata Saville-Kent, 1881	cell	ellipsoid × 1,05	$d_2=0,60\times d_1$
Dinophysis contracta (Kofoid & Skogsberg) Balech, 1973	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis dens Pavillard, 1915	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis groenlandica (Schiller) Balech	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis hastata Stein, 1883	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis mucronata (Kofoid & Skogsberg) Sournia, 1973	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis nasuta (Stein) Parke & Dixon, 1968	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis norvegica Claparède & Lachmann, 1859	cell	ellipsoid	$d_2=0,49\times d_1$
Dinophysis odiosa (Pavillard) Tai & Skogsberg, 1934	cell	ellipsoid	$d_2=0,50\times d_1$
Dinophysis ovata Claparède & Lachmann, 1859	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis pulchella (Lebour) Balech, 1967	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis punctata Jörgensen, 1923	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis recurva Kofoid & Skogsberg, 1928	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis ruudii (Braarud) Balech, 1967	cell	ellipsoid	$d_2=0,70\times d_1$
Dinophysis tripos Gourret, 1883	cell	ellipsoid	$d_2=0,60\times d_1$
Dinoporella Halim, 1960	cell	spheroid	$h=0,60\times d$
Dinosphaera Kofoid & Michener, 1912	cell	ellipsoid	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Diplochloris Korshikov, 1939	cell	spindle	
Diplochloris hortobagyi B.Fott	cell	spheroid	
Diplochloris lunata (Fott) Fott, 1979	cell	spheroid	
Diploeca W.N.Ellis	cell	spheroid	
Diplomenora K.L.Blazé, 1984	cell	elliptic cylinder	
Diplomitella P.C.Silva, 1960	cell	spheroid	
Diploneis Ehrenberg ex Cleve, 1894	cell	elliptic cylinder	d_2=0,45×d_1; h=0,60×d_2
Diploneis crabro (Ehrenberg) Ehrenberg, 1854	cell	elliptic cylinder	h=0,75×d_2
Diploneis didyma (Ehrenberg) Ehrenberg, 1845	cell	elliptic cylinder	h=0,63×d_2
Diploneis elliptica (Kützing) Cleve, 1894	cell	elliptic cylinder	d_2=0,57×d_1; h=0,70×d_2
Diploneis incurvata (Gregory) Cleve, 1894	cell	elliptic cylinder	h=0,75×d_2
Diploneis interrupta (Kützing) Cleve, 1894	cell	elliptic cylinder	h=1,00×d_2
Diplopelta Stein ex Jörgensen, 1912	cell	spheroid	*h=0,80×d*
Diplopsalis Bergh, 1881	cell	spheroid	
Diplopsalis acuta (Apstein) Entz, 1904	cell	ellipsoid	d_2=0,90×d_1
Diplopsalopsis Meunier, 1910	cell	sphere	
Diplopsalopsis bomba (Stein ex Jörgensen) J.D.Dodge & S.Toriumi, 1993	cell	spheroid	*h=0,80×d*
Diplosiga Frenzel, 1891	cell	spheroid	
Diplostauron A.A.Korschikov, 1925	cell	spheroid	
Discocelis Ehrenberg, 1836	cell	sphere	
Discolithina A.R.Loeblich Jr. & Tappan, 1963	cell	sphere	
Discoplastis Triemer, 2006	cell	spindle	
Discosphaera Haeckel, 1894	cell	sphere	
Discostella Houk & Klee, 2004	cell	cylinder	*h=0,65×d*
Dispora H.Printz, 1913	cell	spheroid	
Dissodinium pseudocalani (Gonnert) Drebes ex Elbrachter & Drebes, 1978	spore	sphere	
Dissodium T.H.Abé, 1941	cell	spheroid	*h=0,80×d*
Distephanus E.Stöhr, 1880	cell	sphere × 0,5	
Distigma Ehrenberg, 1831	cell	spindle	
Distigma gracile E.G.Pringsheim, 1942	cell	cone with half sphere	
Ditylum J.W.Bailey, 1861	cell	triangular prism (equilateral)	$m=0{,}50\times\sqrt{(3)}\times l$
Docidium Brébisson ex Ralfs, 1848	cell	cylinder	
Dolichomastix Manton, 1977	cell	spheroid	
Dolichospermum (Ralfs ex Bornet & Flahault) P.Wacklin, L.Hoffmann & J.Komárek, 2009	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Dolichospermum fuscum (H.Hill) P.Wacklin, L.Hoffmann & J.Komárek, 1976	cell	spheroid	
Dolichospermum planctonicum (Brunnth.) Wacklin, L.Hoffm. & Komárek, 2009	cell	spheroid	
Dolichospermum smithii (Komárek) Wacklin L.Hoffm. & Komárek, 2009	cell	spheroid	
Donkinia Ralfs, 1861	cell	elliptic cylinder	
Draparnaldia Bory de Saint-Vincent, 1808	filament	cylinder	
Druridgea De Toni, 1894	cell	cylinder × 0,95	
Ducellieria Teilling, 1957	cell	spheroid	
Dunaliella Teodoresco, 1905	cell	spheroid	
Durinskia S.Carty & E.R.Cox, 1986	cell	sphere	
Durinskia baltica (K.M.Levander) S.Carty & E.R.Cox, 1986	cell	sphere × 0,8	
Dysmorphococcus Takeda, 1916	cell	spheroid	
Dzensia Voronichin, 1929	cell	spheroid	
Ebria Borgert, 1891	cell	sphere × 0,35	
Ecballocystis Bohlin, 1897	cell	spheroid	
Echinocoleum C.-C.Jao & K.T.Lee, 1947	cell	spheroid	
Echinosphaerella G.M.Smith, 1920	cell	sphere	
Ehrenbergiulva A.Witkowski, Lange-Bertalot & D.Metzeltin, 2004	cell	cylinder	
Elakatothrix Wille, 1898	cell	spindle	
Ellerbeckia R.M.Crawford, 1988	cell	cylinder	
Ellipsoidion Pascher, 1937	cell	sphere	
Emergosphaera W.W.Miller, 1921	cell	spheroid	
Emiliania W.W.Hay & H.P.Mohler, 1967	cell	sphere	
Enallax Pascher, 1943	cell	spindle	
Enallax costatus (Schmidle) Pascher, 1943	cell	spheroid	
Encyonema Kützing, 1834	cell	elliptic cylinder × 0,65	d_2=0,83×h; h=1,20×d_2
Encyonema alpinum (Grunow) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema brehmii (Hustedt) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema caespitosum Kützing, 1849	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema elginense (Krammer) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema gaeumannii (Meister) E.Y.Haworth & M.G.Kelly, 1998	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema hebridicum Grunow ex Cleve, 1891	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema minutum (Hilse) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema norvegica (Grunow) Bukhtiyarova, 1995	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Encyonema obscurum (Krasske) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema paucistriatum (Cleve-Euler) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema perpusillum (A.Cleve) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema prostratum (Berkeley) Kützing, 1844	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema reichardtii (Krammer) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema silesiacum (Bleisch) D.G.Mann, 1990	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonema ventricosum (C.Agardh) Grunow in A.Schmidt et al., 1885	cell	elliptic cylinder × 0,8	d_2=0,83×h; h=1,20×d_2
Encyonopsis K.Krammer, 1997	cell	elliptic cylinder	
Encyonopsis cesatii (Rabenhorst) K.Krammer, 1997	cell	lanceolate cylinder × 1,15	
Encyonopsis cesatii var. *geitleri* Krammer	cell	rhombic prism	
Encyonopsis descripta (Hustedt) Krammer	cell	elliptic cylinder × 0,9	
Encyonopsis descripta var. *asymmetrica* Krammer	cell	elliptic cylinder × 0,9	
Encyonopsis microcephala (Grunow) Krammer, 1997	cell	elliptic cylinder × 0,9	
Encyonopsis subminuta Krammer & E.Reichardt	cell	elliptic cylinder × 0,9	
Endictya Ehrenberg, 1845	cell	cylinder	
Endoderma Lagerheim, 1883	cell	spheroid	
Endodinium Hovasse, 1922	cell	ellipsoid	
Ensiculifera Balech, 1967	cell	cone with half sphere	
Entocladia Reinke, 1879	cell	spheroid	
Entomoneis Ehrenberg, 1845	cell	elliptic cylinder	d_2=0,20×d_1
Entomoneis ornata (J.W.Bailey) R.M.Patrick &, 1975	cell	elliptic cylinder	d_2=0,15×d_1; h=0,67×d_1
Entophysalis Kützing, 1843	cell	spheroid	
Entosiphon Stein, 1878	cell	ellipsoid	
Eolimna Lange-Bertalot & W.Schiller, 1997	cell	elliptic cylinder	h=1,00×d_2
Epicystis Pascher, 1930	cell	sphere	
Epigloeosphaera Komárková-Legnerová, 1991	cell	spheroid	
Epilithia Ercegovic, 1932	cell	spheroid	
Epipyxis Ehrenberg, 1838	cell	spheroid	
Epithemia Kützing, 1844	cell	elliptic cylinder × 0,65	d_2=0,83×h; h=1,20×d_2
Ercegovicia De Toni, 1936	cell	spheroid	
Eremosphaera De Bary, 1858	cell	spheroid	
Ericiolus H.A.Thomsen, 1995	cell	spheroid	
Erkenia Skuja, 1948	cell	sphere	
Erythropsidinium P.C.Silva, 1960	cell	ellipsoid	
Ethmodiscus Castracane, 1886	cell	cylinder × 0,9	h=0,50×d

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Euastropsis Lagerheim, 1894	cell	double cone	
Euastrum Ehrenberg ex Ralfs, 1848	cell	ellipsoid	d_2=0,65×d_1
Eucampia Ehrenberg, 1839	cell	elliptic cylinder	d_2=0,40×d_1
Eucampia zodiacus Ehrenberg, 1839	cell	elliptic cylinder	d_2=0,44×d_1
Eucapsis Clements & Shantz, 1909	cell	sphere	
Eucocconeis Cleve ex F.Meister, 1912	cell	elliptic cylinder	
Eudorina Ehrenberg, 1832	cell	sphere	
Euglena Ehrenberg, 1830	cell	ellipsoid	d_2=0,80×d_1
Euglena acusformis J.Schiller	cell	spindle	
Euglena chlamydophora Mainx, 1927	cell	spindle	
Euglena fenestrata A.Elenkin	cell	cylinder	
Euglena geniculata Dujardin, 1841	cell	spindle	
Euglena granulata (Klebs) F.Schmitz, 1884	cell	spindle	
Euglena guentheri M.Gojdics, 1953	cell	spindle	
Euglena hemichromata Skuja, 1948	cell	spindle	
Euglena ignobilis L.P.Johnson, 1944	cell	cylinder	
Euglena limnophila Lemmermann, 1898	cell	spindle	
Euglena megalithus Skuja, 1939	cell	spindle	
Euglena mutabilis F.Schmitz, 1884	cell	cylinder	
Euglena nana L.P.Johnson, 1944	cell	spindle	
Euglena obtusa F.Schmitz, 1884	cell	spindle	
Euglena pascheri Swirenko, 1915	cell	spindle	
Euglena pisciformis Klebs, 1883	cell	spindle	
Euglena proxima P.A.Dangeard, 1901	cell	spindle	
Euglena retronata L.P.Johnson, 1944	cell	spindle	
Euglena rostrata (Schiller) Triemer, 2006	cell	spindle	
Euglena rostrifera L.P.Johnson, 1944	cell	spindle	
Euglena sociabilis P.A.Dangeard, 1901	cell	spindle	
Euglena texta (Dujardin) Hübner, 1886	cell	spheroid	
Euglena vagans Deflandre, 1932	cell	spindle	
Euglena viridis (O.F.Müller) Ehrenberg, 1830	cell	spindle	
Euglenaria	cell	spindle	
Euglenopsis Klebs, 1892	cell	spindle	
Eunotia Ehrenberg, 1837	cell	elliptic cylinder × 1,03	r_2=0,50×h; h=2,00×r_2
Eunotia zasuminensis (Cabejszekówana) Körner	cell	cuboid × 0,85	b=1,00×c; c=1,00×b
Eunotogramma J.F.Weisse, 1855	cell	elliptic cylinder	r_2=0,25×d_1
Eupodiscus J.W.Bailey, 1851	cell	cylinder	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Eutetramorus Walton, 1918	cell	sphere	
Eutreptia Perty, 1852	cell	spheroid	
Eutreptiella A.da Cunha, 1914	cell	spheroid	
Eutreptiella pomquetensis (McLachlan, Seguel & Fritz) Marin & Melkonian, 2003	cell	spindle	
Excentrosphaera G.T.Moore, 1901	cell	ellipsoid	
Extubocellulus Hasle, Stosch & Syvertsen, 1983	cell	elliptic cylinder	
Falcula M.Voight, 1960	cell	elliptic cylinder × 1,03	r_2=0,50×h; h=2,00×r_2
Fallacia Stickle & D.G.Mann, 1990	cell	elliptic cylinder	d_2=0,50×d_1; h=0,65×d_2
Fibrocapsa S.Toriumi & H.Takano, 1973	cell	spheroid	
Fischerella (Bornet & Flahault) Gomont, 1895	filament	cylinder	
Fistulifera Lange-Bertalot, 1997	cell	elliptic cylinder	h=1,00×d_2
Florenciella Mead & De Falla, 1965	cell	sphere	
Florisphaera H.Okada & S.Honjo, 1973	cell	spheroid	
Follicularia W.W.Miller, 1924	cell	sphere	
Fortiea De Toni, 1936	filament	cylinder	
Fortiella Pascher, 1927	cell	ellipsoid	
Fossula G.R.Hasle, E.E.Syvertsen & C.H.von Quillfeldt, 1996	cell	elliptic cylinder	
Fotterella R.Buck, 1978	cell	spheroid	
Fragilaria Lyngbye, 1819	cell	elliptic cylinder	d_2=1,12×h; h=0,89×d_2
Fragilaria crotonensis Kitton, 1869	cell	rhombic prism × 0,9	d_2=0,07×d_1
Fragilaria crotonensis var. *oregona* H.E.Sovereign, 1958	cell	rhombic prism	
Fragilaria gaillonii (Bory) Lange-Bertalot	cell	elliptic cylinder	d_2=0,05×d_1; h=2,00×d_2
Fragilaria heidenii Østrup, 1910	cell	elliptic cylinder	d_2=0,22×d_1
Fragilaria islandica Grunow ex Van Heurck, 1881	cell	elliptic cylinder	d_2=0,07×d_1
Fragilaria istvanffyi Pantocsek, 1902	cell	elliptic cylinder	d_2=0,24×d_1
Fragilaria reicheltii (Voigt) L-B, 1986	cell part	cuboid	c=1,00×b
Fragilariforma D.M.Williams & Round, 1988	cell	elliptic cylinder	d_2=1,00×h; h=1,00×d_2
Fragilariopsis Hustedt, 1913	cell	elliptic cylinder	
Fragilariopsis cylindriformis (Hasle) Hasle, 1993	cell	cuboid	
Fragilariopsis cylindrus (Grunow) Krieger, 1954	cell	cuboid × 0,9	b=1,00×c; c=1,00×b
Fragilidium Balech ex Loeblich III, 1965	cell	spheroid	
Franceia Lemmermann, 1898	cell	spheroid	
Frustulia Rabenhorst, 1853	cell	elliptic cylinder	
Frustulia crassinervia (Brébisson) Lange-Bertalot & Krammer, 1996	cell	elliptic cylinder × 0,9	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Frustulia erifuga Lange-Bertalot & Krammer, 1996	cell	lanceolate cylinder	
Frustulia krammeri Lange-Bertalot & Metzeltin, 1998	cell	lanceolate cylinder	
Frustulia pangaeopsis Lange-Bertalot, 2001	cell	lanceolate cylinder	
Frustulia quadrisinuata Lange-Bertalot, 1996	cell	lanceolate cylinder	
Frustulia rhomboides (Ehrenberg) De Toni, 1891	cell	rhombic prism	
Frustulia rhomboides var. *amphipleuroides* (Grunow) Cleve, 1894	cell	lanceolate cylinder	
Frustulia saxonica Rabenhorst, 1853	cell	lanceolate cylinder	
Frustulia septentrionalis Lange-Bertalot, 1996	cell	lanceolate cylinder	
Fusola Snow, 1903	cell	spindle	
Gambierdiscus Adachi & Fukuyo, 1979	cell	ellipsoid	
Gardnerula G.De Toni, 1936	filament	cylinder	
Geissleria Lange-Bertalot & Metzeltin, 1996	cell	elliptic cylinder	$h=1{,}00 \times d_2$
Geissleria decussis (Østrup) Lange-Bertalot & Metzeltin, 1996	cell	elliptic cylinder × 0,9	$h=0{,}75 \times d_2$
Geissleria ignota (Krasske) Lange-Bertalot & Metzeltin, 1996	cell	cuboid × 0,85	$c=1{,}00 \times b$
Geitleribactron Komárek, 1975	cell	cylinder	
Geitlerinema (Anagnostidis & Komárek) Anagnostidis, 1989	filament	cylinder	
Gemellicystis Teiling, 1946	cell	spheroid	
Geminella Turpin, 1828	cell	cylinder	
Geminigera D.R.A.Hill, 1991	cell	ellipsoid	
Genicularia De Bary, 1858	cell	cylinder	
Gephyria Arnott, 1858	cell	elliptic cylinder	
Gephyrocapsa Kamptner, 1943	cell	sphere	
Germainiella Lange-Bertalot & Metzeltin, 2005	cell	ellipsoid	
Glaucocystis Itzigsohn, 1866	cell	spheroid	
Glaucospira Lagerheim, 1892	filament	cylinder	
Glenodiniopsis Woloszynska, 1916	cell	ellipsoid	
Glenodinium Ehrenberg, 1836	cell	ellipsoid	$d_2=0{,}67 \times d_1$
Gliscolithus R.E.Norris, 1985	cell	spheroid	
Glochiococcus G.B.De Toni, 1888	cell	sphere	
Gloeoactinium G.M.Smith, 1926	cell	sphere	
Gloeobacter Rippka, Waterbury & Cohen-Bazire, 1974	cell	spheroid	
Gloeobotrys Pascher, 1930	cell	sphere	
Gloeocapsa Kützing, 1843	cell	sphere	
Gloeocapsa siderochlamys (Skuja) Starmach, 1966	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Gloeocapsopsis Geitler ex Komárek, 1993	cell	spheroid	
Gloeochaete Lagerheim, 1883	cell	sphere	
Gloeochloris Pascher, 1932	cell	spheroid	
Gloeochrysis Pascher, 1925	cell	spheroid	
Gloeococcus A.Braun, 1850	cell	spheroid	
Gloeocystis Nägeli, 1849	cell	spheroid	
Gloeocystis minuta J.Komárek, 1979	cell	sphere	
Gloeomonas Klebs, 1886	cell	spheroid	
Gloeoplax Schmidle, 1899	cell	spheroid	
Gloeopodium Pascher, 1939	cell	ellipsoid	
Gloeothece Nägeli, 1849	cell	cylinder	
Gloeotila Kützing, 1843	cell	cylinder	
Gloeotrichia J.Agardh ex Bornet & Flahault, 1886	filament	cylinder	
Glyphodesmis Greville, 1862	cell	elliptic cylinder	
Golenkinia Chodat, 1894	cell	sphere	
Golenkiniopsis Korshikov, 1953	cell	sphere	
Gomontiella Teodoresco, 1901	filament	elliptic cylinder × 0,5	
Gomphocymbella Otto Müller, 1905	cell	elliptic cylinder	
Gomphocymbellopsis K.Krammer, 2003	cell	elliptic cylinder	
Gomphoneis Cleve, 1894	cell	pyramid × 0,9	$l_1=0,75 \times l_2$; $l_2=1,33 \times l_1$
Gomphonema Ehrenberg, 1832	cell	pyramid × 0,9	$l_1=0,75 \times l_2$; $l_2=1,33 \times l_1$
Gomphonemopsis L.K.Medlin, 1986	cell	pyramid × 0,9	$l_1=0,75 \times l_2$; $l_2=1,33 \times l_1$
Gomphonitzschia Grunow, 1868	cell	pyramid × 0,9	$l_1=0,75 \times l_2$; $l_2=1,33 \times l_1$
Gomphoseptatum L.K.Medlin, 1986	cell	pyramid × 0,9	$l_1=0,75 \times l_2$; $l_2=1,33 \times l_1$
Gomphosphaeria Kützing, 1836	cell	spheroid	
Gomphosphenia Lange-Bertalot, 1995	cell	pyramid × 0,9	$l_1=0,75 \times l_2$; $l_2=1,33 \times l_1$
Gonatozygon de Bary, 1858	cell	cylinder	
Gongrosira Kützing, 1843	filament	cylinder	
Gonioceros H.Peragallo & M.Peragallo, 1907	cell	elliptic cylinder	$d_2=0,80 \times d_1$
Goniochloris Geitler, 1928	cell	triangular prism (equilateral) × 0,52	$m=0,50 \times \sqrt{(3)} \times l$; $h=0,30 \times l$
Goniodoma Stein, 1883	cell	sphere	
Goniodoma polyedricum (Pouchet) Jörgensen, 1899	cell	spheroid	
Goniomonas Stein, 1878	cell	ellipsoid	$d_2=0,80 \times d_1$
Gonium O.F.Müller, 1773	cell	spheroid	
Gonyaulax Diesing, 1866	cell	cone with half sphere	$h=1,30 \times d$
Gonyaulax alaskensis Kofoid, 1911	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Gonyaulax apiculata (Pénard) Entz, 1904	cell	spheroid	
Gonyaulax diegensis Kofoid, 1911	cell	spheroid	
Gonyaulax grindleyi Reinecke, 1967	cell	ellipsoid	d_2=0,90×d_1
Gonyaulax verior Sournia, 1973	cell	cone with half sphere × 0,75	
Gonyostomum K.Diesing, 1866	cell	ellipsoid	d_2=0,65×d_1
Gonyostomum semen (Ehrenberg) Diesing, 1866	cell	ellipsoid	d_2=0,33×d_1
Gossleriella Schütt, 1892	cell	cylinder	
Gotoius T.H.Abé ex Matsuoka, 1988	cell	spheroid	
Grammatophora Ehrenberg, 1840	cell	elliptic cylinder	d_2=0,20×d_1; h=0,40×d_1
Grammatophora marina (Lyngbye) Kützing, 1844	cell	elliptic cylinder	d_2=0,25×d_1; h=0,50×d_1
Grammatophora oceanica Ehrenberg, 1840	cell	elliptic cylinder	d_2=0,13×d_1; h=0,22×d_1
Grammatophora serpentina Ehrenberg, 1844	cell	elliptic cylinder	d_2=0,18×d_1; h=0,60×d_1
Grammonema C.Agardh, 1832	cell	elliptic cylinder	
Granulocystis Hindák, 1977	cell	spheroid	
Granulocystopsis Hindák, 1977	cell	spheroid	
Groenbladia Teiling, 1952	cell	cylinder	
Grunowia Rabenhorst, 1864	cell	elliptic cylinder	
Grunowia solgensis (Cleve-Euler) M.Aboal, 2003	cell	elliptic cylinder × 1,15	
Grunowia tabellaria (Grunow) Rabenhorst, 1864	cell	rhombic prism × 1,15	
Guillardia D.R.A.Hill & R.Wetherbee, 1990	cell	spheroid	
Guinardia H.Peragallo, 1892	cell	cylinder	
Gymnodinium Stein, 1878	cell	ellipsoid	d_2=0,67×d_1
Gymnodinium abbreviatum Kofoid & Swezy, 1921	cell	spheroid	
Gymnodinium corollarium A.M.Sundström, Kremp & Daugbjerg, 2009	cell	sphere	
Gymnodinium gracile Bergh, 1881	cell	ellipsoid	d_2=0,70×d_1
Gymnodinium helveticum Penard, 1891	cell	double cone	
Gymnodinium lantzschii Utermöhl, 1925	cell	cone with half sphere	h=0,67×d
Gymnodinium simplex (Lohmann) Kofoid & Swezy, 1921	cell	ellipsoid	d_2=0,70×d_1
Gymnodinium uberrimum (G.J.Allman) Kofoid & Swezy, 1921	cell	spheroid	
Gymnodinium vestificii Schütt, 1885	cell	double cone	
Gyrodinium Kofoid & Swezy, 1921	cell	ellipsoid	d_2=0,67×d_1
Gyrodinium britannicum Kofoid & Swezy, 1921	cell	spindle	
Gyrodinium fissum (Levander) Kofoid & Swezy, 1921	cell	spheroid	
Gyrodinium linguliferum Lebour, 1925	cell	cone with half sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Gyrodinium pingue (Schütt) Kofoid & Swezy, 1921	cell	spheroid	
Gyrodinium spirale (Bergh) Kofoid & Swezy, 1921	cell	double cone	
Gyromitus Skuja, 1939	cell	ellipsoid	
Gyrosigma Hassall, 1845	cell	elliptic cylinder	$h=1,00\times d_2$
Gyrosigma acuminatum (Kützing) Rabenhorst, 1853	cell	lanceolate cylinder	$h=0,71\times d_2$
Gyrosigma acuminatum var. *brebissonii* (Grunow) Cleve, 1894	cell	elliptic cylinder	
Gyrosigma attenuatum (Kützing) Rabenhorst, 1853	cell	lanceolate cylinder	$h=0,60\times d_2$
Gyrosigma balticum (Ehrenberg) Rabenhorst, 1853	cell	cuboid × 0,9	$c=1,28\times b$
Gyrosigma macrum (W.Smith) J.W.Griffith & Henfrey, 1856	cell	lanceolate cylinder	$h=1,00\times d_2$
Gyrosigma scalproides (Rabenhorst) Cleve, 1894	cell	elliptic cylinder	$h=0,75\times d_2$
Gyrosigma scalproides var. *eximia* (Thwaites) Cleve, 1894	cell	elliptic cylinder	$h=0,75\times d_2$
Gyrosigma sciotoense (W.S.Sullivant) Cleve	cell	elliptic cylinder	
Gyrosigma strigilis (W.Smith) J.W.Griffin & Henfrey, 1856	cell	elliptic cylinder	$h=0,86\times d_2$
Gyrosigma tenuissimum (W.Smith) Griffith & Henfrey, 1856	cell	elliptic cylinder	$h=0,75\times d_2$
Gyrosigma wansbeckii (Donkin) Cleve, 1894	cell	elliptic cylinder	$h=0,75\times d_2$
Haematococcus Flotow, 1844	cell	spheroid	
Hafniomonas Ettl & Moestrup, 1980	cell	spheroid	
Halamphora (Cleve) Levkov, 2009	cell	elliptic cylinder × 0,65	$d_2=0,50\times h$; $h=2,00\times d_2$
Halopappus Lohmann, 1912	cell	spheroid	
Halosphaera K.J.F.Schmitz, 1878	cell	sphere	
Hannaea R.M.Patrick, 1966	cell	elliptic cylinder × 1,03	$r_2=0,50\times h$; $h=2,00\times r_2$
Hantzschia Grunow, 1877	cell	cuboid × 0,85	$b=1,00\times c$; $c=1,00\times b$
Hanusia J.A.Deane, D.R.A.Hill, S.J.Brett & G.I.McFadden, 1998	cell	spheroid × 0,9	
Hapalosiphon Nägeli ex Bornet & Flahault, 1886	filament	cylinder	
Haplotaenium T.Bando, 1988	cell	cylinder	
Haptolina Edvardsen & Eikrem, 2011	cell	spheroid	
Haptolina hirta (Manton) Edvardsen & Eikrem, 2011	cell	ellipsoid	$d_2=0,85\times d_1$
Hariotina P.-A.Dangeard, 1889	cell	sphere	
Haslea Simonsen, 1974	cell	lanceolate cylinder	$h=0,75\times d_2$
Haslea ostrearia (Gaillon) Simonsen, 1974	cell	elliptic cylinder	
Haslea spicula (Hickie) Lange-Bertalot, 1997	cell	lanceolate cylinder	$h=1,00\times d_2$
Hassallia Berkeley ex Bornet & Flahault, 1887	filament	cylinder	
Hegewaldia T.Proschold, C.Bock, W.Luo & L.Krienitz,	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
2010			
Heimansia Coesel, 1993	half-cell	spheroid	
Helicopedinella Sekiguchi, Kawachi, Nakayama & Inouye, 2003	cell	sphere	
Helicosphaera Kamptner, 1954	cell	sphere	
Helicotheca Ricard, 1987	cell	cuboid	$b=0,09\times a$
Helladosphaera Kamptner, 1937	cell	spheroid	
Hemiaulus Heiberg, 1863	cell	elliptic cylinder	
Hemidinium Stein, 1878	cell	ellipsoid	
Hemidiscus Wallich, 1860	cell	elliptic cylinder × 0,65	$d_2=1,25\times h$; $h=0,80\times d_2$
Hemiselmis Parke, 1949	cell	cone with half sphere	
Hemitoma Skuja, 1939	cell	spheroid	
Herdmania Dodge, 1981	cell	spheroid	
Heterocapsa Stein, 1883	cell	ellipsoid	$d_2=0,75\times d_1$
Heterocapsa rotundata (Lohmann) G.Hansen, 1995	cell	cone with half sphere	
Heterocapsa triquetra (Ehrenberg) F.Stein, 1883	cell	double cone	
Heterochromonas Pascher, 1912	cell	spheroid	
Heterodesmus Ettl, 1956	cell	cone with half sphere	
Heterodinium Kofoid, 1906	cell	cone with half sphere	
Heterodinium murrayi Kofoid, 1906	cell	spheroid	
Heterogloea Pascher, 1930	cell	sphere	
Heteroleibleinia (Geitler) L.Hoffmann, 1905	filament	cylinder	
Heteronema hexagonum (Playfair) Skuja, 1948	cell	spheroid	
Heterosigma Y.Hada ex Y.Hara & M.Chihara, 1987	cell	spheroid	
Heterosigma akashiwo (Y.Hada) Y.Hada ex Y.Hara & M.Chihara, 1987	cell	sphere	
Heterothrix Pascher, 1932	cell	cylinder	
Heterotrichella H.Reisigl, 1964	cell	cylinder	
Hexamitus Dujardin	cell	ellipsoid	
Hillea Schiller, 1925	cell	cone with half sphere	
Hindakia C. Bock, Proschold & Krienitz, 2010	cell	spheroid	
Hindakochloris A.Comas, 1992	cell	sphere	
Hippodonta Lange-Bertalot, Witkowski & Metzeltin, 1996	cell	elliptic cylinder	$h=0,75\times d_2$
Hippodonta capitata (Ehrenberg) Lange-Bertalot, Metzeltin & Witkowski, 1996	cell	elliptic cylinder × 0,9	$h=0,75\times d_2$
Hippodonta costulata (Grunow) Lange-Bertalot, Metzeltin & Witkowski, 1996	cell	lanceolate cylinder	$h=1,00\times d_2$
Hippodonta costulatiformis Lange-Bertalot, Metzeltin &	cell	lanceolate cylinder	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Witkowski, 1996			
Hippodonta coxiae Lange-Bertalot, 2001	cell	elliptic cylinder × 0,9	$h=0{,}75 \times d_2$
Hippodonta lesmonensis (Hustedt) Lange-Bertalot, Metzeltin & Witkowski, 1996	cell	elliptic cylinder × 0,9	$h=0{,}75 \times d_2$
Hippodonta lueneburgensis (Grunow) Lange-Bertalot, Metzeltin & Witkowski, 1996	cell	lanceolate cylinder	$h=1{,}00 \times d_2$
Hippodonta subcostulata (Hustedt) Lange-Bertalot, Metzeltin & Witkowski, 1996	cell	elliptic cylinder	$h=1{,}00 \times d_2$
Histioneis Stein, 1883	cell	ellipsoid	
Holococcolithophora L.Cros & J.R.Young, 2005	cell	sphere	
Holopedia Lagerheim, 1893	cell	spheroid	
Homoeothrix (Thuret ex Bornet & Flahault) Kirchner, 1898	filament	cylinder	
Homozygosphaera Deflandre, 1952	cell	sphere	
Hormidium Kützing, 1843	cell	cylinder	
Hormoscilla K.Anagnostidis & J.Komárek, 1988	filament	cylinder	
Hormotila Borzì, 1883	cell	sphere	
Hortobagyiella L.Hajdu, 1975	cell	ellipsoid	
Hustedtiella Simonsen, 1960	cell	elliptic cylinder	
Hyalodiscus Ehrenberg, 1845	cell	cylinder × 0,83	
Hyalogonium Pascher, 1927	cell	spindle	
Hyaloraphidium Pascher & Korshikov, 1931	cell	spindle	
Hyalotheca Ehrenberg ex Ralfs, 1848	cell	cylinder	
Hydrianum Rabenhorst, 1868	cell	ellipsoid	
Hydrococcus Kützing, 1833	cell	spheroid	
Hydrocoleum Kützing Ex Gomont, 1892	filament	cylinder	
Hydrocoryne H.Schwabe ex Bornet & Flahault, 1886	filament	cylinder	
Hydrodictyon Roth, 1797	cell	cylinder	
Hydrosera G.C.Wallich, 1858	cell	triangular prism (equilateral) × 1,25	$m=0{,}50 \times \sqrt{(3)} \times l$; $h=1{,}00 \times l$
Hydrurus C.Agardh, 1824	cell	spheroid	
Hyella Bornet & Flahault, 1888	filament	cylinder	
Hygropetra Krammer & Lange-Bertalot, 2000	cell	elliptic cylinder	
Hymenomonas Stein, 1878	cell	spheroid	
Imantonia N.Reynolds, 1974	cell	sphere	
Isactis Thuret ex Bornet & Flahault, 1886	filament	cylinder	
Isochrysis Parke, 1949	cell	spheroid	
Isocystis Borzì ex Bornet & Flahault, 1888	filament	cylinder	
Isoselmis Butcher, 1967	cell	cone with half sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Isthmia C.Agardh, 1832	cell	elliptic cylinder	
Isthmochloron H.Skuja, 1948	half-cell	spheroid	
Jaaginema Anagnostidis & Komárek, 1988	filament	cylinder	
Johannesbaptistia G.De Toni, 1934	cell	spheroid	
Karayevia Round & L.Bukhtiyarova ex F.E.Round	cell	elliptic cylinder	
Karayevia amoena (Hustedt) Bukhtiyarova, 1999	cell	elliptic cylinder × 0,9	
Karayevia laterostrata (Hustedt) Bukhtiyarova, 1999	cell	elliptic cylinder × 0,9	
Karayevia ploenensis (Hustedt) J.C.Kingston, 2000	cell	elliptic cylinder × 0,9	
Karenia G.Hansen & Moestrup, 2000	cell	ellipsoid	$d_2=0,67×d_1$
Karenia mikimotoi (Miyake & Kominami ex Oda) G.Hansen & Ø.Moestrup, 2000	cell	ellipsoid	$d_2=0,75×d_1$
Karlodinium J.Larsen, 2000	cell	spheroid	
Karlodinium vitiligo (D.Ballantine) J.Larsen, 2000	cell	ellipsoid	
Katablepharis Skuja, 1939	cell	spheroid	
Katagnymene Lemmermann, 1899	filament	cylinder	
Katodinium Fott, 1857	cell	ellipsoid	$d_2=0,50×d_1$
Katodinium asymmetricum (Massart) Loeblich, 1965	cell	cone with half sphere × 0,5	
Katodinium fungiforme (Anissimova) A.R.Loeblich III, 1965	cell	spheroid	
Katodinium glaucum (Lebour) Loeblich III, 1965	cell	spindle × 0,5	
Kephyrion Pascher, 1911	cell	spheroid	
Kephyriopsis Pascher & Ruttner, 1913	cell	spheroid	
Keratococcus Pascher, 1915	cell	spindle	
Khawkinea Jahn & McKibben, 1937	cell	spindle	
Kirchneriella Schmidle, 1893	cell	spindle	
Kirchneriella aperta Teiling, 1912	cell	spheroid	
Kirchneriella arcuata G.M.Smith	cell	spheroid	
Kirchneriella contorta var. *elegans* (Playfair) Komárek, 1979	cell	cylinder	
Kirchneriella microscopica G.N.Nygaard, 1945	cell	cylinder	
Kirchneriella obesa (West) West & G.S.West, 1894	cell	spheroid × 0,9	$h=0,50×d$
Kirchneriella obesa var. *major* (Bernard) G.M.Smith	cell	spheroid × 0,9	$h=0,50×d$
Kirchneriella pinguis Hindák, 1977	cell	spheroid	
Klebsormidium P.C.Silva, K.Mattox & W.Blackwell, 1972	cell	cylinder	
Kobayasiella Lange-Bertalot, 1999	cell	elliptic cylinder × 0,9	$h=0,75×d_2$
Kobayasiella jaagii (Meister) Lange-Bertalot, 1999	cell	elliptic cylinder	$h=1,00×d_2$
Kofoidinium Pavillard, 1928	cell	ellipsoid	$d_2=0,25×d_1$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Kolbesia Round & L.Bukhtiyarova ex F.E.Round, 1998	cell	elliptic cylinder × 0,9	
Kolbesia gessneri (Hustedt) M.Aboal, 2003	cell	elliptic cylinder	
Kolbesia kolbei (Hustedt) F.E. Round & L. Bukhtiyarova ex Fourtanier & Kociolek, 1999	cell	elliptic cylinder	
Koliella Hindák, 1963	cell	spindle	
Kolkwitziella Lindemann, 1919	cell	cone with half sphere	
Komarekia Fott, 1981	cell	spheroid	
Komma D.R.A.Hill, 1991	cell	cone with half sphere	
Komvophoron Anagnostidis & Komárek, 1988	cell	cylinder	
Korshikoviella P.C.Silva, 1959	cell	spindle	
Krasskella R.Ross & P.A.Sims, 1978	cell	elliptic cylinder	
Kryptoperidinium Lindemann, 1924	cell	ellipsoid	$d_2=0,67 \times d_1$
Kryptoperidinium foliaceum (F.Stein) Lindemann, 1924	cell	ellipsoid	$d_2=0,50 \times d_1$
Kyrtuthrix Ercegovic, 1929	filament	cylinder	
Laboea Lohmann, 1908	cell	cone	$z=\sqrt{(s^2-0,25 \times d^2)}$
Lacunastrum H.A.McManus, 2011	colony	cylinder	
Lagerheimia R.Chodat, 1895	cell	spheroid	
Lagynion Pascher, 1912	cell	spheroid	
Lampriscus A.Schmidt, 1882	cell	triangular prism (equilateral)	$m=0,50 \times \sqrt{(3)} \times l$
Lanceola F.Hindák, 1988	cell	spindle	
Lauderia Cleve, 1873	cell	cylinder	$h=0,90 \times d$
Lauterborniella Schmidle, 1900	cell	spindle	
Leibleinia (Gomont) L.Hoffman, 1985	filament	cylinder	
Lemmermanniella Geitler, 1942	cell	cylinder	
Lemmermanniella flexa Hindák, 1985	cell	spheroid	
Lemnicola Round & P.W.Basson, 1977	cell	elliptic cylinder	$d_2=0,35 \times d_1$; $h=0,80 \times d_2$
Lennoxia Thomsen & Buck, 1993	cell	spindle	
Lepidodinium Watanabe, Suda, Inouye, Sawaguchi & Chihara, 1990	cell	ellipsoid	$d_2=0,75 \times d_1$
Lepochromulina Scherffel, 1911	cell	spheroid	
Lepocinclis Perty, 1849	cell	spheroid	
Lepocinclis acus (O.F.Müller) Marin & Melkonian, 2003	cell	spindle	
Lepocinclis fusca (Klebs) Kosmala & Zakrys, 2005	cell	spindle	
Lepocinclis helicoidea	cell	spindle	
Lepocinclis oxyuris (Schmarda) Marin & Melkonian, 2003	cell	ellipsoid	$d_2=0,50 \times d_1$
Lepocinclis spirogyroides Marin & Melkonian, 2003	cell	ellipsoid	$d_2=0,75 \times d_1$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Lepocinclis spiroides (Lemmermann) Marin & Melkonian, 2003	cell	spindle	
Lepocinclis tripteris (Dujardin) Marin & Melkonian, 2003	cell	ellipsoid	$d_2=0,75×d_1$
Leptocylindrus Cleve, 1889	cell	cylinder	
Leptodiscus Hertwig, 1877	cell	cylinder	
Leptolyngbya Anagnostidis & Komárek, 1988	filament	cylinder	
Leptothrix Kützing, 1843	filament	cylinder	
Lessardia J.F.Saldarriaga & F.J.R.Taylor, 2003	cell	spindle	
Leucocryptos Butcher, 1967	cell	cone with half sphere	
Leyanella G.R.Hasle, H.A.von Stosch & E.E.Syvertsen, 1983	cell	elliptic cylinder	
Licmophora C.Agardh, 1827	cell	pyramid × 0,9	$l_1=0,75×l_2$; $l_2=1,33×l_1$
Limnococcus (Komárek & Anagnostidis) Komárková, Jezberová, O.Komárek & Zapomelová, 2010	cell	spheroid	
Limnothrix Meffert, 1987	filament	cylinder	
Lingulodinium D.Wall, 1967	cell	cone with half sphere	$h=1,20×d$
Lissodinium Matzenauer, 1933	cell	ellipsoid	
Lithocapsa Ercegovic, 1925	cell	spheroid	
Lithodesmium Ehrenberg, 1839	cell	triangular prism (equilateral)	$m=0,50×\sqrt{(3)}×l$; $h=0,80×l$
Lobochlamys T.Pröschold, B.Marin, U.W.Schlösser & M.Melkonian, 2001	cell	spheroid	
Lobocystis R.H.Thompson, 1952	cell	spheroid	
Lobomonas P.-A.Dangeard, 1899	cell	spheroid	
Lophodinium Lemmermann, 1910	cell	double cone	
Lunella P.Snoeijs, 1996	cell	elliptic cylinder	
Lutherella Pascher, 1930	cell	sphere	
Luticola D.G.Mann, 1990	cell	elliptic cylinder	$h=1,00×d_2$
Luticola nivalis (Ehrenberg) D.G.Mann, 1990	cell	elliptic cylinder × 0,9	$h=0,75×d_2$
Luticola paramutica (Bock) D.G.Mann, 1990	cell	elliptic cylinder × 0,9	$h=0,75×d_2$
Luticola ventricosa (Kützing) D.G.Mann, 1990	cell	elliptic cylinder × 0,9	$h=0,75×d_2$
Lyngbya C.Agardh ex Gomont, 1892	filament	cylinder	
Lyngbyopsis N.L.Gardner, 1927	filament	cylinder	
Lyrella Karajeva, 1978	cell	elliptic cylinder	$h=0,75×d_2$
Macrospermum Komárek, 2008	filament	cylinder	
Mallomonas Perty, 1852	cell	ellipsoid	$d_2=0,80×d_1$
Mallomonas akrokomos Ruttner, 1913	cell	spindle	
Mallomonas caudata Ivanov, 1899	cell	cone with half sphere	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Mallomonas crassisquama (Asmund) Fott, 1962	cell	spheroid	
Mallomonas globosa Schiller	cell	sphere	
Mallomonas hirsuta Conrad	cell	spheroid	
Mallomonas punctifera Korshikov, 1941	cell	spheroid	
Mallomonas zellensis Fott, 1962	cell	spheroid	
Mamiella Ø.Moestrup, 1984	cell	spheroid	
Mantoniella T.V.Desikachary, 1972	cell	spheroid	
Martyana Round, 1990	cell	elliptic cylinder	$d_2=1,00\times h$; $h=1,00\times d_2$
Marvania F.Hindák, 1976	cell	sphere	
Mastigocoleus Lagerheim ex Bornet & Flahault, 1886	filament	cylinder	
Mastogloia Thwaites ex W.Smith, 1856	cell	elliptic cylinder	$h=0,75\times d_2$
Mastogloia baltica Grunow, 1880	cell	elliptic cylinder × 0,9	
Mastogloia smithii Thwaites ex W.Smith, 1856	cell	elliptic cylinder × 0,9	
Mayamaea Lange-Bertalot, 1997	cell	elliptic cylinder	$h=1,00\times d_2$
Mediopyxis L.K.Medlin & Kühn, 2006	cell	elliptic cylinder	$d_2=0,22\times d_1$
Medusa Loureiro, 1790	cell	sphere	
Melosira C.Agardh, 1824	cell	cylinder	
Melosira dubia C.G.Kützing	cell	cylinder × 0,9	
Membraneis Paddock, 1988	cell	elliptic cylinder	
Menoidium Perty, 1852	cell	ellipsoid	
Menoidium tortuosum (A.Stokes) Senn, 1900	cell	spindle	
Meridion C.Agardh, 1824	cell	pyramid × 0,9	$l_1=0,75\times l_2$; $l_2=1,33\times l_1$
Meringosphaera Lohmann, 1932	cell	sphere	
Merismopedia Meyen, 1839	cell	sphere	
Merismopedia elegans A.Braun ex Kützing, 1849	cell	spheroid	
Merotricha Mereschkowsky, 1877	cell	ellipsoid	
Mesocena Ehrenberg, 1843	cell	sphere	
Mesodinium von Stein, 1862	cell	spheroid	
Mesopedinella Daugbjerg, 1996	cell	sphere	
Mesoporos Lillick, 1937	cell	spheroid	$h=0,60\times d$
Mesotaenium Nägeli, 1849	cell	cylinder	
Meuniera P.C.Silva, 1996	cell	elliptic cylinder	$d_2=0,30\times d_1$
Michaelsarsia Gran, 1912	cell	spheroid	
Micracantha Korshikov, 1953	cell	ellipsoid	
Micracanthodinium Deflandre, 1937	cell	sphere	
Micractinium Fresinius, 1858	cell	sphere	
Micractinium belenophorum (Korshikov) T.Proschold,	cell	ellipsoid	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
C.Block, W.Luo & L.Kreinitz, 2010			
Micractinium pusillum Fresenius, 1858	coenobium	sphere	
Micrasterias C.Agardh ex Ralfs, 1848	cell	elliptic cylinder × 0,8	$h=0,30\times d_2$
Microchaete Thuret ex Bornet & Flahault, 1886	filament	cylinder	
Microcoleus Desmazières ex Gomont, 1892	filament	cylinder	
Microcostatus Johansen & Sray, 1998	cell	elliptic cylinder	$h=1,00\times d_2$
Microcostatus naumannii (Hustedt) Lange-Bertalot	cell	elliptic cylinder × 0,9	
Microcrocis Richter, 1892	cell	spheroid	
Microcystis Lemmermann, 1907	cell	sphere	
Microglena Ehrenberg, 1832	cell	spheroid	
Micromonas I.Manton & M.Parke, 1960	cell	spheroid	
Microsiphona C.I.Weber, 1970	cell	cylinder × 0,9	
Microspora Thuret, 1850	cell	cylinder	
Microtabella Round, 1990	cell	elliptic cylinder	
Microthamnion J.Agardh, 1892	filament	cylinder	
Minidiscus Hasle, 1973	cell	cylinder	
Minuscula Lebour, 1925	cell	cone × 0,5	$z=\sqrt{(s^2-0,25\times d^2)}$
Minutocellus Hasle, Stosch & Syvertsen, 1983	cell	elliptic cylinder	
Miosira K.Krammer, Lange-Bertalot & W.Schiller, 1997	cell	cylinder × 0,9	
Mischococcus Nägeli, 1849	cell	sphere	
Monactinus Corda, 1839	colony	cylinder	
Monactinus simplex (Meyen) Corda, 1839	cell	triangular prism × 0,67	$h=1,00\times l$
Monallantus Pascher, 1939	cell	spheroid	
Monas O.F.Müller, 1773	cell	sphere	
Monoceros A.C.J.Van Goor, 1924	cell	cylinder	
Monochrysis Skuja, 1948	cell	spheroid	
Monochrysis aphanaster Skuja, 1943	cell	ellipsoid	
Monocosta Thomsen, 1979	cell	spheroid	
Monodus Chodat, 1913	cell	spheroid	
Monomastix Scherffel, 1912	cell	ellipsoid	
Monomorphina Mereschkowsky, 1877	cell	ellipsoid	$d_2=0,43\times d_1$
Monoraphidium Komárková-Legnerová, 1969	cell	spindle	
Monoraphidium minutum (Nägeli) Komárková-Legnerová, 1969	cell	spheroid	
Monoraphidium nanum (Ettl) Hindák, 1980	cell	spheroid	
Monoraphidium skujae B.Fott	cell	cylinder	
Monosiga W.S.Kent, 1878	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Mougeotia C.Agardh, 1824	cell	cylinder	
Mougeotiopsis Palla, 1894	cell	cylinder	
Mucidosphaerium C.Bock, Proschold & Krienitz, 2011	cell	spheroid	
Muelleria (Frenguelli) Frenguelli, 1945	cell	elliptic cylinder	$h=1,00 \times d_2$
Muriella J.B.Petersen, 1932	cell	sphere	
Mychonastes P.D.Simpson & S.D.Van Valkenburg, 1978	cell	spheroid	
Mychonastes jurisii (Hindák) Krienitz, C.Bock, Dadheech & Proschold, 2011	cell	sphere	
Myochloris J.H.Belcher & Swale, 1961	cell	spheroid	
Myxobaktron Schmidle, 1904	cell	spheroid	
Myxohyella Geitler, 1925	cell	spheroid	
Myxosarcina Printz, 1921	cell	spheroid	
Nannochloris Naumann, 1921	cell	spheroid	
Nannochloropsis D.J.Hibberd, 1981	cell	sphere	
Nannoeca Thomsen, 1988	cell	spheroid	
Navicula Bory de Saint-Vincent, 1822	cell	elliptic cylinder	$h=0,85 \times d_2$
Navicula amphibola Cleve, 1891	cell	elliptic cylinder × 0,9	$h=0,75 \times d_2$
Navicula bourrellyivera Lange-Bertalot, A.Witkowski & K.Stachura, 1998	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula capitata var. *capitata*	cell	elliptic cylinder	$h=1,00 \times d_2$
Navicula capitatoradiata Germain, 1981	cell	lanceolate cylinder × 0,9	$h=0,75 \times d_2$
Navicula cataracta-rheni Lange-Bertalot, 1993	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula caterva Hohn & Hellermann, 1963	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula clementis Grunow, 1882	cell	elliptic cylinder × 0,9	$h=0,75 \times d_2$
Navicula cryptocephala Kützing, 1844	cell	lanceolate cylinder	$h=0,56 \times d_2$
Navicula cryptocephala var. *veneta* (Kützing) Rabenhorst, 1864	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula cryptofallax Lange-Bertalot & Hofmann, 1993	cell	rhombic prism	$d_2=1,00 \times h$; $h=1,00 \times d_2$
Navicula cryptotenella Lange-Bertalot, 1985	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula cryptotenelloides Lange-Bertalot, 1993	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula densilineolata (Lange-Bertalot) Lange-Bertalot, 1993	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula detenta Hustedt, 1943	cell	elliptic cylinder × 0,9	$h=0,75 \times d_2$
Navicula digitoradiata (Gregory) Ralfs, 1861	cell	elliptic cylinder	$h=0,83 \times d_2$
Navicula digito-radiata (Gregory) Ralfs, 1861	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula directa (W.Smith) Ralfs, 1861	cell	lanceolate cylinder	$h=1,00 \times d_2$
Navicula flanatica Grunow, 1860	cell	lanceolate cylinder	$h=1,00 \times d_2$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Navicula gregaria Donkin, 1861	cell	lanceolate cylinder × 0,9	*h=0,75×d₂*
Navicula halophiloides Hustedt, 1959	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula hanseatica Lange-Bertalot & Stachura, 1998	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula hasta Pantocsek, 1892	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula irmengardis Lange-Bertalot, 1996	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula iserentantii Lange-Bertalot & Witkowski, 2000	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula kohlmaieri Lange-Bertalot, 1998	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula kotschyi Grunow	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula kotschyi f. *kotschyi* Grunow	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula leptostriata Jörgensen, 1948	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula lucinensis (Hustedt) Mann, 1990	cell	elliptic cylinder	$d_2=0{,}50\times d_1$; $h=0{,}65\times d_2$
Navicula menisculus Schumann, 1867	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula monoculata var. *omissa* (Hustedt) D.G.Mann, 1990	cell	elliptic cylinder	$d_2=0{,}50\times d_1$; $h=0{,}65\times d_2$
Navicula mutica var. *ventricosa* (Kützing) D.G.Mann, 1990	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula notha Wallace, 1960	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula oahuensis (Hustedt) Krammer, 1985	cell	pyramid × 0,9	$l_1=0{,}75\times l_2$; $l_2=1{,}33\times l_1$
Navicula oligotraphenta Lange-Bertalot & Hofmann, 1993	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula oppugnata Hustedt, 1945	cell	rhombic prism	$d_2=1{,}00\times h$; $h=1{,}00\times d_2$
Navicula palpebralis Brébisson ex W.Smith, 1853	cell	elliptic cylinder	$h=0{,}89\times d_2$
Navicula peregrina (Ehrenberg) Kützing, 1844	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula peregrina var. *meniscus* (J.Schumann) Grunow, 1895	cell	rhombic prism	$d_2=1{,}00\times h$; $h=1{,}00\times d_2$
Navicula phyllepta Kützing, 1844	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula phylleptosoma Lange-Bertalot, 1999	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula platystoma Ehrenberg, 1838	cell	elliptic cylinder	$h=0{,}82\times d_2$
Navicula pseudanglica E.J.Cox, 1987	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula pseudolanceolata Lange-Bertalot, 1980	cell	rhombic prism	$d_2=1{,}00\times h$; $h=1{,}00\times d_2$
Navicula radiosa Kützing, 1844	cell	rhombic prism	$d_2=1{,}00\times h$; $h=1{,}00\times d_2$
Navicula reinhardtii (Grunow) Grunow, 1877	cell	elliptic cylinder	$h=0{,}83\times d_2$
Navicula rhynchocephala Kützing, 1844	cell	lanceolate cylinder × 0,9	$h=0{,}75\times d_2$
Navicula rhynchotella Lange-Bertalot, 1993	cell	lanceolate cylinder × 0,9	$h=0{,}75\times d_2$
Navicula ricardae Lange-Bertalot, 2001	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula salinarum Grunow, 1880	cell	lanceolate cylinder ×	$h=0{,}75\times d_2$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
		0,9	
Navicula salinarum var. *minima* R.Kolbe, 1927	cell	lanceolate cylinder × 0,9	*h=0,75×d₂*
Navicula salinarum var. *rostrata* (Hustedt) Lange-Bertalot, 2001	cell	lanceolate cylinder × 0,9	$h=0{,}75\times d_2$
Navicula salinarum var. *salinarum* Grunow, 1880	cell	lanceolate cylinder × 0,9	$h=0{,}75\times d_2$
Navicula schmassmannii Hustedt, 1943	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula sieminskiae Lange-Bertalot & Witkowski, 2001	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula streckerae Lange-Bertalot & Witkowski, 2000	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula subconcentrica Lange-Bertalot, 2001	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula sublucidula (Hustedt) Mann, 1990	cell	elliptic cylinder	$d_2=0{,}50\times d_1$; $h=0{,}65\times d_2$
Navicula subrhynchocephala Hustedt, 1935	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula supergregaria Rumrich & Lange-Bertalot, 2000	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula tenerrima (Hustedt) D.G.Mann, 1990	cell	elliptic cylinder	$d_2=0{,}50\times d_1$; $h=0{,}65\times d_2$
Navicula transitans Cleve, 1883	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula transitans var. *derasa* (Grunow) Cleve, 1883	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula transitans var. *derasa* f. *delicatula* Heimdal, 1970	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula tripunctata (O.F.Müller) Bory de Saint-Vincent, 1822	cell	elliptic cylinder	$h=1{,}00\times d_2$
Navicula trivialis Lange-Bertalot, 1980	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula vandamii Schoeman & Archibald, 1987	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula vaneei Lange-Bertalot, 1998	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula vanhoeffenii Gran, 1897	cell	lanceolate cylinder × 0,85	$h=1{,}00\times d_2$
Navicula viridula (Kützing) Ehrenberg, 1838	cell	elliptic cylinder	$h=0{,}50\times d_2$
Navicula viridula var. *germainii* (Wallace) Lange-Bertalot, 1993	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Navicula wellneri (Lange-Bertalot) Lange-Bertalot	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Navicula wildii Lange-Bertalot, 1993	cell	lanceolate cylinder	$h=1{,}00\times d_2$
Naviculadicta Lange-Bertalot, 1994	cell	elliptic cylinder	$h=1{,}00\times d_2$
Navicymbula K.Krammer, 2003	cell	elliptic cylinder × 0,8	$d_2=0{,}83\times h$; $h=1{,}20\times d_2$
Navigiolum Lange-Bertalot	cell	elliptic cylinder	$h=1{,}00\times d_2$
Neglectella Vodeničarov & Benderliev, 1971	cell	spheroid	
Neidiopsis Lange-Bertalot & Metzeltin, 1999	cell	cuboid × 0,85	$c=1{,}00\times b$
Neidium Pfitzer, 1871	cell	elliptic cylinder	$h=1{,}00\times d_2$
Neidium affine (Ehrenberg) Pfizer, 1871	cell	cuboid × 0,85	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Neidium bisulcatum (Lagerstedt) Cleve, 1894	cell	cuboid × 0,85	
Neidium hitchcockii (Ehrenberg) Cleve, 1894	cell	cuboid × 0,8	
Nematodinium Kofoid & Swezy, 1921	cell	ellipsoid	$d_2=0{,}90\times d_1$
Nematopsides Greuet, 1973	cell	ellipsoid	$d_2=0{,}90\times d_1$
Nematoradaisia Geitler, 1925	cell	spheroid	
Neocalyptrella D.U.Hernández-Becerril & M.E.Meave del Castillo, 1997	cell	double cone	
Neoceratium F.Gómez, D.Moreira & P.López-Garcia, 2010	cell	Ceratium - girdle diameter (see Annex A)	
Neoceratium arcticum (Ehrenberg) F.Gómez, D.Moreira & P.López-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium arietinum (Cleve) F.Gómez, D.Moreira & P.López-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium azoricum (Cleve) F.Gómez, D.Moreira & P.López-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium breve (Ostenfeld & Schmidt) F.Gómez, D.Moreira & P.López-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium candelabrum (Ehrenberg) F.Gómez, D.Moreira & P.López-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium carnegiei (Graham & Bronikowsky) F.Gómez, D.Moreira & P.López-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium compressum (Gran) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium deflexum (Kofoid) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium extensum (Gourret) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	double cone × 0,65	
Neoceratium fusus (Ehrenberg) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	double cone × 0,65	
Neoceratium gibberum (Gourret) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium gravidum (Gourret) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium hexacanthum (Gourret) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium inflatum (Kofoid) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	double cone × 0,65	
Neoceratium kofoidii (Jörgensen) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium longirostrum (Gourret) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	double cone × 0,65	
Neoceratium minutum (Jörgensen) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Neoceratium pentagonum (Gourret) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium petersii (Steemann Nielsen) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium setaceum (Jörgensen) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium symmetricum (Pavillard) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium teres (Kofoid) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neoceratium trichoceros (Ehrenberg) F.Gomez, D.Moreira & P.Lopez-Garcia, 2010	cell	cone with half sphere × 0,65	
Neochloris Starr, 1955	cell	sphere	
Neocystis F.Hindák, 1988	cell	spheroid	
Neodenticula Akiba & Yanagisawa, 1986	cell	elliptic cylinder	
Neodesmus F.Hindák, 1976	cell	spheroid	
Neonema Pascher, 1925	cell	cylinder	
Neosynedra D.M.Williams & Round, 1986	cell	elliptic cylinder	
Nephrochlamys Korshikov, 1953	cell	spheroid	
Nephrochlamys danica Komárek	cell	spindle	
Nephrocytium Nägeli, 1849	cell	spheroid	
Nephrocytium lunatum West, 1892	cell	spindle	
Nephrodiella Pascher, 1937	cell	spheroid	
Nephroselmis F.Stein, 1878	cell	ellipsoid	$d_2=0{,}50×d_1$
Netrium (Nägeli) Itzigsohn & Rothe, 1856	cell	spheroid	
Nitzschia Hassall, 1845	cell	rhombic prism × 1,15	$h=0{,}50×d_2$
Nitzschia abbreviata Hustedt	cell	elliptic cylinder × 1,15	$h=0{,}50×d_2$
Nitzschia acicularis (Kützing) W.Smith, 1853	cell	spindle	
Nitzschia acicularis var. *closterioides* Grunow	cell	spindle	
Nitzschia angustiforaminata Lange-Bertalot, 1980	cell	elliptic cylinder × 1,15	$h=0{,}50×d_2$
Nitzschia brevissima Grunow, 1881	cell	cuboid × 0,85	$c=0{,}50×b$
Nitzschia calida (Grunow) D.G.Mann, 1990	cell	cuboid × 0,8	$c=0{,}50×b$
Nitzschia clausii Hantzsch, 1860	cell	cuboid × 0,85	$c=0{,}50×b$
Nitzschia denticula Grunow, 1862	cell	elliptic cylinder	$h=0{,}50×d_2$
Nitzschia disputata J.R.Carter, 1971	cell	cuboid × 0,85	$c=0{,}50×b$
Nitzschia dissipata (Kützing) Grunow, 1862	cell	lanceolate cylinder	$h=0{,}50×d_2$
Nitzschia dubia W.Smith, 1853	cell	cuboid × 0,85	$c=0{,}50×b$
Nitzschia epithemoides Grunow, 1880	cell	elliptic cylinder	$h=0{,}50×d_2$
Nitzschia epithemoides var. *disputata* (J.R.Carter)	cell	elliptic cylinder	$h=0{,}50×d_2$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Lange-Bertalot, 1987			
Nitzschia flexa Schumann, 1862	cell	cuboid × 0,9	*c=0,50×b*
Nitzschia fonticola (Grunow) Grunow, 1881	cell	lanceolate cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia frigida Grunow, 1880	cell	lanceolate cylinder	$h=0{,}50 \times d_2$
Nitzschia frustulum (Kützing) Grunow, 1880	cell	elliptic cylinder	$h=0{,}50 \times d_2$
Nitzschia frustulum var. *bulnheimiana* (Rabenhorst) Grunow, 1881	cell	elliptic cylinder	$h=0{,}50 \times d_2$
Nitzschia frustulum var. *subsalina* Hustedt	cell	elliptic cylinder	$h=0{,}50 \times d_2$
Nitzschia fruticosa Hustedt	cell	lanceolate cylinder	$h=0{,}50 \times d_2$
Nitzschia heufleriana Grunow, 1862	cell	cuboid × 0,85	*c=0,50×b*
Nitzschia inconspicua Grunow, 1862	cell	elliptic cylinder	$h=0{,}50 \times d_2$
Nitzschia intermedia Hantzsch ex Cleve & Grunow, 1880	cell	spindle	
Nitzschia lanceola Grunow	cell	lanceolate cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia lanceola var. *minutula* Grunow	cell	lanceolate cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia lanceolata W.Smith	cell	lanceolate cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia lanceolata var. *lanceolata* W.Smith, 1853	cell	lanceolate cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia linearis (C.Agardh) W.Smith, 1853	cell	cuboid × 0,85	*c=0,50×b*
Nitzschia linearis var. *subtilis* (Grunow) Hustedt, 1923	cell	cuboid × 0,85	*c=0,50×b*
Nitzschia linearis var. *tenuis* (W.Smith) Grunow, 1880	cell	lanceolate cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia longissima (Brébisson) Ralfs, 1861	cell	spindle	
Nitzschia lorenziana Grunow, 1879	cell	lanceolate cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia microcephala Grunow, 1878	cell	elliptic cylinder × 0,9	
Nitzschia nana Grunow, 1881	cell	cuboid × 0,85	*c=0,50×b*
Nitzschia paleacea (Grunow) Grunow, 1881	cell	spindle	
Nitzschia parvula W.Smith, 1853	cell	cuboid × 0,85	*c=0,50×b*
Nitzschia perspicua Cholnoky, 1960	cell	elliptic cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia pseudocommunis Hustedt, 1939	cell	elliptic cylinder × 1,15	$h=0{,}50 \times d_2$
Nitzschia pusilla (Kützing) Grunow emend.Lange-Bertalot, 1976	cell	elliptic cylinder	$h=0{,}50 \times d_2$
Nitzschia recta Hantzsch ex Rabenhorst, 1862	cell	cuboid × 0,8	*c=0,50×b*
Nitzschia recta var. *robusta* Hustedt, 1950	cell	cuboid × 0,8	*c=0,50×b*
Nitzschia regula Hustedt	cell	cuboid × 0,9	*c=0,50×b*
Nitzschia scalpelliformis Grunow, 1880	cell	cuboid × 0,85	*c=0,50×b*

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Nitzschia sigmoidea (Nitzsch) W.Smith, 1853	cell	cuboid × 0,9	*c=0,50×b*
Nitzschia sinuata var. *sinuata* (Thwaites ex W.Smith) Grunow, 1880	cell	elliptic cylinder	$h=0{,}50\times d_2$
Nitzschia sublinearis Hustedt, 1930	cell	cuboid × 0,8	*c=0,50×b*
Nitzschia tenuis (W.Smith) Grunow, 1880	cell	lanceolate cylinder × 1,15	$h=0{,}50\times d_2$
Nitzschia tryblionella Hantzsch, 1860	cell	lanceolate cylinder × 1,15	$h=0{,}50\times d_2$
Nitzschia tubicola Grunow, 1880	cell	cuboid × 0,8	*c=0,50×b*
Nitzschia valdestriata Aleem & Hustedt, 1951	cell	elliptic cylinder	$h=0{,}50\times d_2$
Nitzschia vermicularis (Kützing) Hantzsch, 1860	cell	cuboid × 0,9	*c=0,50×b*
Nitzschia vitrea G.Norman, 1861	cell	cuboid × 0,9	*c=0,50×b*
Noctiluca Suriray, 1836	cell	sphere	
Nodosilinea Perkerson & Casamatta, 2011	filament	cylinder	
Nodularia Mertens ex Bornet & Flahault, 1886	filament	cylinder	
Nostoc Vaucher ex Bornet & Flahault, 1886	cell	cylinder	
Notosolenus Stokes, 1884	cell	ellipsoid	
Nupela Vyverman & Compère, 1991	cell	elliptic cylinder	$h=1{,}00\times d_2$
Nupela impexiformis (Lange-Bertalot) Lange-Bertalot, 1999	cell	elliptic cylinder × 0,9	
Nupela wellneri (Lange-Bertalot) Lange-Bertalot	cell	elliptic cylinder × 0,9	$h=0{,}75\times d_2$
Oblea Balech ex Loeblich Jr. & Loeblich III, 1966	cell	sphere × 0,9	
Ochromonas Vysotskii [Wissotsky], 1887	cell	spheroid	
Ochrosphaera Schussnig, 1930	cell	sphere	
Octacanthium (Hansgirg) P.Compère, 1996	half-cell	spheroid	
Octactis J.Schiller, 1925	cell	sphere	
Odontella C.Agardh, 1832	cell	elliptic cylinder	$d_2=0{,}50\times d_1$
Odontella laevis (Ehrenberg) Kützing	cell	cylinder	*h=1,25×d*
Odontella longicruris (Greville) Hoban, 1983	cell	cylinder	
Odontella rhombus f. *trigona* (Cleve ex Van Heurck) R.Ross	cell	triangular prism (equilateral)	$m=0{,}50\times\sqrt{(3)}\times l$; $h=1{,}00\times l$
Odontella sinensis (Greville) Grunow, 1884	cell	elliptic cylinder	$d_2=0{,}40\times d_1$
Odontella turgida (Ehrenberg) Kützing, 1844	cell	elliptic cylinder × 0,87	$d_2=0{,}70\times d_1$
Oedogonium Link ex Hirn, 1900	filament	cylinder	
Oestrupia Heiden ex Hustedt, 1935	cell	cuboid × 0,85	
Okellya Leliaert & Rueness, 2009	filament	cylinder	
Olisthodiscus N.Carter, 1937	cell	spheroid	
Ollicola Vørs, 1992	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Oltmannsia Schiller, 1925	cell	spheroid	
Oltmannsiella Zimmermann, 1930	cell	spheroid	
Oltmannsiellopsis M.Chihara & I.Inouye, 1986	cell	spheroid	
Onkonema Geitler, 1933	cell	spheroid	
Oocardium Nägeli, 1849	cell	spheroid	
Oocystis Nägeli ex A.Braun, 1855	cell	spheroid	
Oodinium Chatton, 1912	cell	ellipsoid	
Oolithotus Reinhardt, 1968	cell	sphere	
Oonephris Fott, 1964	cell	spheroid	
Opephora P.Petit, 1889	cell	elliptic cylinder	$h=0,75\times d_2$
Ophiaster Gran, 1912	cell	sphere	
Ophiocytium Nägeli, 1849	cell	cylinder	
Opisthoaulax Calado, 2011	cell	ellipsoid	
Ornithocercus Stein, 1883	cell	sphere	
Orthoseira Thwaites, 1848	cell	cylinder	
Oscillatoria Vaucher ex Gomont, 1892	filament	cylinder	
Ostreococcus C.Courties & M.-J.Chrétiennot-Dinet, 1995	cell	spheroid	
Ostreopsis J.Schmidt, 1901	cell	ellipsoid	$d_2=0,90\times d_1$
Oxyneis Round, 1990	cell	elliptic cylinder × 0,85	$d_2=0,33\times h$; $h=3,00\times d_2$
Oxyrrhis Dujardin, 1841	cell	ellipsoid	$d_2=0,67\times d_1$
Oxytoxum Stein, 1883	cell	spindle	
Oxytoxum criophilum Balech, 1965	cell	double cone	
Oxytoxum gracile Schiller, 1937	cell	double cone	
Oxytoxum laticeps Schiller, 1937	cell	spheroid	
Oxytoxum sphaeroideum Stein, 1883	cell	spheroid	
Pachysoeca Ellis, 1933	cell	spheroid	
Pachysphaera Ostenfeld, 1899	cell	sphere × 0,8	
Palaeophalacroma Schiller, 1928	cell	spheroid	
Palatinus S.C.Craveiro, A.J.Calado, N.Daugbjerg & Moestrup, 2009	cell	ellipsoid	
Palatinus pseudolaevis (M.Lefèvre) S.C.Craveiro, A.J.Calado, N.Daugbjerg & Ø.Moestrup, 2009	cell	spheroid	
Palikiella G.Claus, 1962	filament	cylinder	
Palmella Lyngbye, 1819	cell	spheroid	
Palmellopsis Korshikov, 1953	cell	sphere	
Palmeria Greville, 1865	cell	elliptic cylinder × 0,6	$d_2=1,43\times h$; $h=0,70\times d_2$
Palmodictyon Kützing, 1845	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Palusphaera Lecal, 1966	cell	sphere	
Pandorina Bory de Saint-Vincent, 1824	cell	cone with half sphere	
Pannus B.Hickel, 1991	cell	sphere	
Papenfussiomonas Desikachary, 1972	cell	spheroid	
Papiliocellulus G.R.Hasle, H.A.von Stosch & E.E.Syvertsen, 1983	cell	elliptic cylinder	
Pappomonas I.Manton & K.Oates, 1975	cell	sphere	
Papposphaera K.Tangen, 1972	cell	spheroid	
Paracapsa Naumann, 1924	cell	spheroid	
Parachrysidalis Hulbert, 1965	cell	spheroid	
Paradoxia Svirenko, 1928	cell	spindle	
Paralia Heiberg, 1863	cell	cylinder	
Paramastix Skuja, 1948	cell	spheroid	
Parapediastrum E.Hegewald, 2005	cell	cuboid × 0,67	$c=1,00\times b$
Parapediastrum biradiatum (Meyen) E.Hegewald, 2005	cell	cuboid × 0,67	$c=1,00\times b$
Parapedinella S.M.Pedersen, P.L.Beech & H.A.Thomsen, 1986	cell	sphere	
Paraphysomonas De Saedeleer, 1930	cell	sphere	
Parlibellus E.J.Cox, 1988	cell	elliptic cylinder	$h=1,00\times d_2$
Parlibellus rhombicus (Gregory) E.J.Cox	cell	rhombic prism	
Parvicorbicula Deflandre, 1960	cell	spheroid	
Pascherina P.C.SIlva, 1959	cell	spheroid	
Pascherinema De Toni, 1936	filament	cylinder	
Pauliella F.E.Round & P.W.Basson, 1997	cell	elliptic cylinder	
Paulinella Lauterborn, 1895	cell	spheroid	
Paulschulzia Skuja, 1948	cell	sphere	
Pavlova Butcher, 1952	cell	ellipsoid	$d_2=0,67\times d_1$
Pectinodesmus Hegewald, Wolf, Keller, Friedl & Krienitz, 2010	cell	spheroid	
Pediastrum Meyen, 1829	cell	cuboid × 0,67	$c=1,00\times b$
Pediastrum simplex var. *biwaense* Fukushima	cell	triangular prism × 0,67	$h=1,00\times l$
Pedinella Vysotskij, 1887	cell	sphere	
Pedinomonas Korshikov, 1923	cell	ellipsoid	
Pelagococcus R.E.Norris, 1977	cell	sphere	
Penium Brébisson ex Ralfs, 1848	cell	cylinder	
Pentapharsodinium Indelicato & Loeblich III, 1986	cell	cone with half sphere	
Peranema Dujardin, 1841	cell	ellipsoid	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Peranemopsis Lackey, 1940	cell	spheroid	
Peridiniella Kofoid & Michener, 1911	cell	ellipsoid	d_2=0,67×d_1
Peridiniella catenata (Levander) Balech, 1977	cell	sphere × 0,5	
Peridiniopsis Lemmermann, 1904	cell	ellipsoid	d_2=0,75×d_1
Peridiniopsis cunningtonii Lemmermann, 1907	cell	cone with half sphere	
Peridinium Ehrenberg, 1832	cell	cone with half sphere	*h=1,20×d*
Peridinium aciculiferum Lemmermann, 1900	cell	cone with half sphere × 0,9	
Peridinium aciculiferum f. *inerme* J.Woloszynska	cell	cone with half sphere × 0,9	
Peridinium africanum Lemmermann, 1907	cell	ellipsoid	
Peridinium bipes F.Stein, 1883	cell	cone × 0,5	$z=\sqrt{(s^2-0,25\times d^2)}$
Peridinium cinctum (O.F.Müller) Ehrenberg, 1832	cell	sphere	
Peridinium gatunense Nygaard, 1925	cell	spheroid	
Peridinium lomnickii Woloszynska, 1916	cell	ellipsoid	
Peridinium lomnickii var. *wierzejskii* (Woloszynska) Lindemann, 1928	cell	spheroid	
Peridinium morzinense Lefèvre, 1928	cell	ellipsoid	
Peridinium quinquecorne Abé, 1927	cell	cone with half sphere	*h=1,22×d*
Peridinium steinii f. *pyriformis* O.W.Paulsen	cell	cone with half sphere	*h=1,35×d*
Peridinium umbonatum F.Stein, 1883	cell	ellipsoid	d_2=0,65×d_1
Peridinium umbonatum var. *goslaviense* (Wolszynska) J.Popovsky & L.Pfeister, 1986	cell	ellipsoid	
Peridinium willei Huitfeldt-Kaas, 1900	cell	ellipsoid	d_2=0,85×d_1
Periphyllophora Kamptner, 1936	cell	sphere	
Perone Pascher, 1932	cell	spheroid	
Peronia Fleming, 1822	cell	pyramid × 0,9	l_1=0,75×l_2; l_2=1,33×l_1
Peroniella Gobi, 1887	cell	sphere	
Petalomonas F.Stein, 1859	cell	ellipsoid	d_2=0,80×d_1
Petalonema Berkeley ex Kirchner, 1898	filament	cylinder	
Petrodictyon D.G.Mann, 1990	cell	elliptic cylinder	d_2=1,00×*h*; *h*=1,00×d_2
Petroneis A.J.Stickle & D.G.Mann, 1990	cell	elliptic cylinder	*h*=0,50×d_2
Pfiesteria K.A.Steidinger & J.M.Burkholder, 1996	cell	sphere	
Phacotus Perty, 1852	cell	ellipsoid	d_2=0,65×d_1
Phacotus glaber Playfair	cell	spheroid	
Phacus Dujardin, 1841	cell	ellipsoid	d_2=0,30×d_1
Phacus longicauda (Ehrenberg) Dujardin, 1841	cell	ellipsoid	d_2=0,17×d_1
Phacus pleuronectes (O.F.Müller) Nitzsch ex Dujardin,	cell	ellipsoid	d_2=0,14×d_1

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
1841			
Phaeaster Scherffel, 1927	cell	ellipsoid	
Phaeobotrys H.Ettl, 1966	cell	sphere	
Phaeocystis Lagerheim, 1893	cell	sphere	
Phaeocystis globosa Scherffel, 1899	cell	sphere × 0,9	
Phaeodactylum Bohlin, 1897	cell	spindle	
Phaeodermatium Hansgirg, 1889	cell	spheroid	
Phaeoplaca Chodat, 1926	cell	spheroid	
Phaeoschizochlamys Lemmermann, 1898	cell	spheroid	
Phalacroma Stein, 1883	cell	ellipsoid	$d_2=0,28\times d_1$
Pheopolykrikos Chatton, 1933	colony	cylinder	
Phormidiochaete Komárek, 2001	filament	cylinder	
Phormidium Kützing ex Gomont, 1892	filament	cylinder	
Phyllomitus Stein	cell	spheroid	
Phytodinium Klebs, 1912	cell	spheroid	
Picochlorum W.J.Henley, J.L.Hironaka, L.Guillou, M.A.Buchheim, J.A.Buchheim, M.W.Fawley & K.P.Fawley, 2004	cell	spheroid	
Pilgeria Schmidle, 1901	cell	spheroid	
Pinnularia Ehrenberg, 1843	cell	cuboid × 0,9	$b=1,11\times c; c=0,90\times b$
Pinnularia balfouriana (Grunow ex Cleve) Krammer & Lange-Bertalot, 2000	cell	elliptic cylinder	
Pinnularia bertrandii K.Krammer, 2000	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia bullacostae K.Krammer & Lange-Bertalot, 1999	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia clevei R.M.Patrick, 1945	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia clevei var. *minor* (Hustedt) K.Krammer, 2000	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia crucifera Cleve-Euler, 1934	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia divergens var. *sublinearis* Cleve, 1895	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia elegans (W.Smith) K.Krammer, 1992	cell	elliptic cylinder	$d_2=1,11\times h; h=0,90\times d_2$
Pinnularia ivaloensis K.Krammer, 2000	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia krammeri Metzeltin, 1996	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia lange-bertalotii K.Krammer, 1992	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia leptosoma (Grunow) Krammer, 1985	cell	elliptic cylinder × 0,9	
Pinnularia lokana Krammer, 2000	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia polaris H.Heiden	cell	cuboid	$b=1,11\times c; c=0,90\times b$
Pinnularia polyonca (Brébisson) W.Smith, 1856	cell	elliptic cylinder × 0,9	
Pinnularia septentrionalis K.Krammer, 2000	cell	cuboid	$b=1,11\times c; c=0,90\times b$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Pinnularia tirolensis var. *julma* Krammer, 2000	cell	cuboid	*b=1,11×c; c=0,90×b*
Pinnunavis H.Okuno, 1975	cell	elliptic cylinder × 1,15	d_2*=1,11×h; h=0,90×*d_2
Pinnunavis genustriata (Hustedt) Lange-Bertalot & K.Krammer	cell	rhombic prism × 1,15	d_2*=1,11×h; h=0,90×*d_2
Placoma Schousboe ex Bornet & Thuret, 1876	cell	spheroid	
Placoneis Mereschkowsky, 1903	cell	elliptic cylinder × 0,9	*h=0,75×*d_2
Placoneis abiskoensis (Hustedt) Lange-Bertalot & D.Metzeltin, 1996	cell	cuboid × 0,85	*c=1,00×b*
Placoneis gastrum (Ehrenberg) Mereschkovsky, 1903	cell	elliptic cylinder	*h=1,00×*d_2
Plagiodiscus Grunow & Eulenstein, 1867	cell	elliptic cylinder	
Plagiogramma Greville, 1859	cell	elliptic cylinder	d_2*=0,40×*d_1
Plagiogrammopsis Hasle, von Stosch & Syvertsen, 1983	cell	rhombic prism × 0,9	d_2*=0,20×*d_1
Plagioselmis Butcher ex G.Novarino, I.A.N.Lucas & S.Morrall, 1994	cell	cone with half sphere	
Plagiotropis Pfitzer, 1871	cell	rhombic prism × 1,15	
Planctococcus Korshikov, 1953	cell	sphere	
Planctomyces	cell	spheroid	
Planctonema Schmidle, 1903	cell	cylinder × 0,9	
Planktolyngbya Anagnostidis & Komárek, 1988	filament	cylinder	
Planktoniella F.Schütt, 1892	cell	cylinder	*h=0,80×d*
Planktosphaeria G.M.Smith, 1918	cell	sphere	
Planktothrix Anagnostidis & Komárek, 1988	filament	cylinder	
Planonephros Christensen, 1978	cell	spheroid	
Planophila Gerneck, 1907	cell	cone with half sphere	
Planothidium Round & L.Bukhtiyarova, 1996	cell	elliptic cylinder	
Planothidium dubium (Grunow) Round & Bukhtiyarova, 1996	cell	elliptic cylinder × 0,9	
Planothidium haynaldii (Schaarschmidt) Lange-Bertalot, 1999	cell	elliptic cylinder × 0,9	
Planothidium peragalloi (J.Brun & Héribaud-Joseph) Round & L.Bukhtiyarova, 1996	cell	elliptic cylinder × 0,9	
Planothidium rostratum (Oestrup) Lange-Bertalot, 1999	cell	elliptic cylinder × 0,9	
Platessa Lange-Bertalot, 2004	cell	elliptic cylinder	
Plectonema Thuret ex Gomont, 1892	filament	cylinder	
Pleodorina W.R.Shaw, 1894	cell	sphere	
Pleromonas Pascher, 1914	cell	spheroid	
Pleurasiga J.Schiller, 1925	cell	spheroid	
Pleurocapsa Thuret, 1885	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Pleurochloris Pascher, 1925	cell	sphere	
Pleurochrysis Pringsheim, 1955	cell	sphere	
Pleurosigma W.Smith, 1852	cell	rhombic prism	$h=0,75×d_2$
Pleurosira (Meneghini) Trevisan, 1848	cell	elliptic cylinder	$d_2=0,85×d_1$; $h=1,00×d_2$
Pleurosira laevis f. *polymorpha* (Kützing) Compère, 1982	cell	cylinder	
Pleurotaenium Nägeli, 1849	cell	cylinder	
Podocapsa Ercegovic, 1931	cell	spheroid	
Podocystis J.W.Bailey, 1854	cell	elliptic cylinder	
Podohedra Düringer, 1958	cell	spindle	
Podolampas Stein, 1883	cell	cone with half sphere	
Podosira Ehrenberg, 1840	cell	cylinder × 0,83	
Polyblepharides P.-A.Dangeard, 1888	cell	spheroid	
Polyedriella Pascher, 1930	cell	sphere	
Polyedriopsis Schmidle, 1899	cell	tetrahedron	
Polyfibula Manton & Bremer, 1981	cell	spheroid	
Polygoniochloris Ettl, 1977	cell	cuboid × 0,52	$c=0,50×a$
Polygoniochloris circularis (Bourrelly & Georges) H.Ettl, 1965	cell	cylinder × 0,52	$h=0,50×d$
Polykrikos Bütschli, 1873	colony	spheroid	
Polykrikos lebourae Herdman, 1924	colony	ellipsoid	$d_2=0,50×d_1$
Polylepidomonas Preisig & D.J.Hibberd, 1983	cell	sphere	
Polyoeca Kent, 1880	cell	spheroid	
Polytoma Ehrenberg, 1831	cell	spheroid	
Polytomella Aragão, 1910	cell	spheroid	
Pomatodinium J.Cachon & Cachon-Enjumet, 1966	cell	sphere	
Pontosphaera Lohmann, 1902	cell	sphere	
Porosira Jörgensen, 1905	cell	cylinder	$h=0,60×d$
Porotheca P.C.Silva, 1960	cell	spheroid	$h=0,60×d$
Porphyrosiphon Kützing ex Gomont, 1892	filament	cylinder	
Prasinocladus Kuckuck, 1894	cell	spheroid	
Preperidinium Mangin, 1913	cell	ellipsoid	$d_2=0,90×d_1$
Proboscia Sundström, 1986	cell	cylinder	
Prochlorothrix T.Burger-Wiersma, L.J.Stal & L.R.Mur, 1989	filament	cylinder	
Prodinophysis Balech, 1944	cell	ellipsoid	$d_2=0,28×d_1$
Progonoia H.-J.Schrader, 1969	cell	elliptic cylinder	
Pronoctiluca Fabre-Domergue, 1889	cell	ellipsoid	$d_2=0,85×d_1$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Pronoctiluca phaeocysticola (Scherffel) Pavillard, 1922	cell	spindle	
Properidinium Meunier, 1919	cell	double cone	
Prorocentrum Ehrenberg, 1834	cell	ellipsoid	$d_2=0,50\times d_1$
Prorocentrum aporum (Schiller) Dodge, 1975	cell	ellipsoid	$d_2=0,70\times d_1$
Prorocentrum balticum (Lohmann) Loeblich, 1970	cell	sphere × 0,9	
Prorocentrum cassubicum (Woloszynska) Dodge, 1975	cell	ellipsoid	$d_2=0,70\times d_1$
Prorocentrum cordatum (Ostenfeld) Dodge, 1975	cell	ellipsoid	$d_2=0,65\times d_1$
Prorocentrum dentatum Stein, 1883	cell	ellipsoid	$d_2=0,70\times d_1$
Prorocentrum gracile Schütt, 1895	cell	ellipsoid	$d_2=0,70\times d_1$
Prorocentrum lima (Ehrenberg) F.Stein, 1878	cell	ellipsoid	$d_2=0,70\times d_1$
Prorocentrum nanum J.Schiller, 1918	cell	spheroid	
Prorocentrum scutellum Schröder, 1900	cell	ellipsoid	$d_2=0,70\times d_1$
Proschkinia N.I.Karajeva, 1978	cell	elliptic cylinder × 1,15	$h=1,00\times d_2$
Proschkinia complanatula (Hust ex Simonsen) Mann, 1990	cell	rhombic prism × 1,15	$d_2=1,00\times h$; $h=1,00\times d_2$
Prosoaulax (F.Stein) Calado & Moestrup, 2005	cell	ellipsoid	
Protaspis Skuja, 1939	cell	ellipsoid	
Proterendothrix West & G.S.West, 1897	filament	cylinder	
Proterospongia Kent, 1882	cell	spheroid	
Proterythropsis Kofoid & Swezy, 1920	cell	ellipsoid	$d_2=0,90\times d_1$
Protoceratium Bergh, 1881	cell	sphere × 0,9	
Protoderma Kützing, 1843	cell	spheroid	
Protodinium Lohmann, 198.	cell	ellipsoid	$d_2=0,75\times d_1$
Protoperidinium Bergh, 1882	cell	cone with half sphere	$h=1,20\times d$
Protoperidinium achromaticum (Levander) Balech, 1974	cell	sphere × 0,9	
Protoperidinium avellana (Meunier) Balech, 1974	cell	ellipsoid	
Protoperidinium bipes (Paulsen) Balech, 1974	cell	cone × 0,5	$z=\sqrt{(s^2-0,25\times d^2)}$
Protoperidinium breve Paulsen	cell	sphere × 0,9	
Protoperidinium brochii (Kofoid & Swezy) Balech	cell	double cone	
Protoperidinium cerasus (Paulsen) Balech, 1973	cell	cone with half sphere	$h=1,00\times d$
Protoperidinium claudicans (Paulsen) Balech, 1974	cell	ellipsoid	$d_2=0,65\times d_1$
Protoperidinium crassipes (Kofoid) Balech, 1974	cell	double cone × 0,7	
Protoperidinium curtipes (Jörgensen) Balech, 1974	cell	double cone × 0,7	
Protoperidinium curvipes (Ostenfeld) Balech, 1974	cell	cone with half sphere	$h=1,00\times d$
Protoperidinium decipiens (Jörgensen) Parke & Dodge, 1976	cell	spheroid	$h=0,60\times d$
Protoperidinium defectum (Balech) Balech, 1974	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Protoperidinium denticulatum (Gran & Braarud) Balech, 1974	cell	ellipsoid × 0,8	$d_2=0,75×d_1$
Protoperidinium depressum (Bailey) Balech, 1974	cell	cone with half sphere × 0,8	*h=1,10×d*
Protoperidinium divergens (Ehrenberg) Balech, 1974	cell	cone with half sphere × 0,8	*h=1,20×d*
Protoperidinium excentricum (Paulsen) Balech, 1974	cell	double cone	
Protoperidinium globulus (Stein, 1883) Balech, 1974	cell	sphere	
Protoperidinium granii (Ostenfeld) Balech, 1974	cell	cone with half sphere × 0,8	*h=1,00×d*
Protoperidinium islandicum (Paulsen) Balech, 1973	cell	spheroid	
Protoperidinium laticeps (Grontved & Seidenfaden) Balech, 1974	cell	cone with half sphere × 0,8	
Protoperidinium leonis (Pavillard) Balech, 1974	cell	double cone × 0,7	
Protoperidinium longispinum (Kofoid) Balech, 1974	cell	cone with half sphere × 0,8	*h=1,20×d*
Protoperidinium marie-lebouriae (Paulsen) Balech, 1974	cell	double cone × 0,7	
Protoperidinium mite (Pavillard) Balech, 1974	cell	cone with half sphere	*h=1,00×d*
Protoperidinium oblongum (Aurivillius) Parke & Dodge, 1976	cell	cone with half sphere × 0,8	*h=1,40×d*
Protoperidinium oceanicum (VanHöffen) Balech, 1974	cell	cone with half sphere × 0,8	*h=1,45×d*
Protoperidinium ovatum Pouchet, 1883	cell	ellipsoid	$d_2=0,85×d_1$; $h=0,80×d_1$
Protoperidinium pallidum (Ostenfeld) Balech, 1973	cell	cone with half sphere × 0,8	*h=1,33×d*
Protoperidinium pentagonum (Gran) Balech, 1974	cell	double cone × 0,7	
Protoperidinium punctulatum (Paulsen) Balech, 1974	cell	cone with half sphere × 0,75	*h=1,05×d*
Protoperidinium pyriforme (Paulsen) Balech, 1974	cell	cone with half sphere	*h=1,25×d*
Protoperidinium quarnerense (Schröder) Balech, 1974	cell	ellipsoid	
Protoperidinium roseum (Paulsen) Balech, 1974	cell	spheroid	
Protoperidinium steinii (Jörgensen) Balech, 1974	cell	cone with half sphere × 0,75	*h=1,35×d*
Protoperidinium subcurvipes (Lebour) Balech, 1974	cell	ellipsoid	
Protoperidinium subinerme (Paulsen) Loeblich III, 1969	cell	cone with half sphere × 0,75	*h=0,90×d*
Protoperidinium thorianum (Paulsen) Balech, 1974	cell	spheroid × 0,8	
Protoperidinium thulesense (Balech) Balech, 1974	cell	cone with half sphere	*h=0,80×d*
Protopsis Kofoid & Swezy, 1921	cell	spheroid	
Provasoliella A.R.Loeblich III, 1967	cell	spheroid	
Prymnesium Massart, 1920	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Psammodictyon D.G.Mann, 1990	cell	elliptic cylinder	
Psammodiscus Round & D.G.Mann, 1980	cell	cylinder	
Psammothidium L.Buhtkiyarova & Round, 1996	cell	elliptic cylinder	
Pseudanabaena Lauterborn, 1915	filament	cylinder	
Pseudendoclonium Wille, 1901	filament	cylinder	
Pseudoactiniscus Bursa, 1969	cell	sphere	
Pseudobodo Greissmann, 1913	cell	spheroid	
Pseudocapsa Ercegovic, 1925	cell	spheroid	
Pseudocarteria H.Ettl, 1958	cell	spheroid	
Pseudocharaciopsis K.W.Lee & Bold, 1973	cell	spindle	
Pseudocharacium Korshikov, 1953	cell	spindle	
Pseudochattonella (Y.Hara & Chihara) Hosoi-Tanabe, Honda, Fukaya, Inagaki & Sako, 2007	cell	spheroid × 0,88	
Pseudochattonella verruculosa (Y.Hara & M.Chihara) S.Tanabe-Hosoi, D.Honda, S.Fukaya, Y.Inagaki & Y.Sako, 2007	cell	ellipsoid	$d_2=0,85×d_1$
Pseudococcomyxa Korshikov, 1953	cell	spheroid	
Pseudodictyosphaerium jurisii (Hindák) Krienitz, C.Bock, Dadheech & Proschold, 2011	cell	sphere	
Pseudodidymocystis Hegewald & Deason, 1989	cell	spheroid	
Pseudogomphonema L.K.Medlin, 1986	cell	pyramid × 0,9	$l_1=0,75×l_2$; $l_2=1,33×l_1$
Pseudogoniochloris L.Krienitz, E.Hegewald, O.L.Reymond & T.Peschke, 1993	cell part	cuboid × 0,67	$c=1,00×b$
Pseudoguinardia von Stosch, 1986	cell	cylinder	
Pseudohimantidium Hustedt & Krasske, 1941	cell	elliptic cylinder × 0,65	$d_2=1,00×h$; $h=1,00×d_2$
Pseudokephyrion Pascher, 1913	cell	spheroid	
Pseudokirchneriella contorta (Schmidle) F.Hindák, 1990	cell	cylinder	
Pseudoncobyrsa Geitler, 1925	cell	spheroid	
Pseudo-nitzschia H.Peragallo, 1900	cell	rhombic prism × 0,7	$d_2=1,33×h$; $h=0,75×d_2$
Pseudopediastrum E.Hegewald, 2005	cell	cuboid × 0,67	$c=1,00×b$
Pseudopedinella N.Carter, 1937	cell	sphere	
Pseudopedinella erkensis Skuja, 1948	cell	cylinder × 0,8	
Pseudopfiesteria Litaker, Steidinger, Mason, Shields & Tester, 2005	cell	sphere	
Pseudophormidium (Forti) Anagnostidis & Komárek, 1988	filament	cylinder	
Pseudopodosira A.P.Jousé, 1949	cell	spheroid	$h=0,80×d$
Pseudopolyedriopsis Gollerbach, 1962	half-cell	tetrahedron	
Pseudoquadrigula E.N.Lacoste de Díaz, 1973	cell	spindle	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Pseudoschroederia Hegewald & Schnepf, 1986	cell	spindle	
Pseudoscourfieldia I.Manton, 1975	cell	ellipsoid	$d_2=0,90\times d_1$
Pseudoscytonema Elenkin, 1949	filament	cylinder	
Pseudosolenia B.G.Sundström, 1986	cell	cylinder	
Pseudosphaerocystis Woronichin, 1931	cell	spheroid	
Pseudostaurastrum R.Chodat, 1921	half-cell	tetrahedron	
Pseudostaurosira D.M.Williams & Round, 1988	cell	elliptic cylinder	$d_2=1,00\times h$; $h=1,00\times d_2$
Pseudotetraedriella Hedgewald, Padisak & Friedl, 2007	cell	tetrahedron	
Pseudotetrastrum Hindák, 1977	cell	cone with half sphere	
Pseudotriceratium Grunow, 1884	cell	triangular prism (equilateral)	$m=0,50\times\sqrt{(3)}\times l$;
Pteridomonas Penard, 1889	cell	sphere	
Pteromonas Seligo, 1887	cell	ellipsoid	$d_2=0,75\times d_1$
Pteroncola R.W.Holmes & D.A.Croll, 1984	cell	elliptic cylinder	
Pterosperma Pochet, 1893	cell	sphere	
Ptychodiscus Stein, 1883	cell	ellipsoid	
Pulchella Krammer, 2000	cell	elliptic cylinder	
Pulvinularia Borzì, 1916	cell	cylinder	
Punctastriata D.M.Williams & Round, 1988	cell	elliptic cylinder	
Puncticulata H.Håkansson	cell	cylinder	
Pycnococcus R.R.L.Guillard, 1991	cell	sphere	
Pyramichlamys H.Ettl & O.Ettl, 1959	cell	ellipsoid	
Pyramidochrysis Pascher, 1909	cell	cone with half sphere	
Pyramimonas Schmarda, 1849	cell	spheroid	
Pyramimonas longicauda L.Van Meel, 1969	cell	cone	$z=\sqrt{(s^2-0,25\times d^2)}$
Pyramimonas tertrarhynchus Schmarda	cell	cone	$z=\sqrt{(s^2-0,25\times d^2)}$
Pyrobotrys Arnoldi, 1916	cell	spheroid × 0,88	
Pyrocystis J.Murray ex Haeckel, 1890	cell	ellipsoid	$d_2=0,90\times d_1$
Pyrocystis fusiformis (Wyville Thomson ex Haeckel) Blackman, 1902	cell	spindle	
Pyrocystis lunula (J.Schütt) J.Schütt, 1896	sporangium	spindle	
Pyrocystis noctiluca Murray ex Haeckel, 1890	sporangium	spindle	
Pyrodinium Plate, 1906	cell	ellipsoid	
Pyrophacus Stein, 1883	cell	ellipsoid × 0,8	$d_2=0,95\times d_1$; $h=0,53\times d_2$
Quadrichloris Fott, 1959	cell	spheroid	
Quadricoccus Fott, 1948	cell	spheroid	
Quadrigula Printz, 1916	cell	spindle	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Raciborskiella S.Wislouch, 1924	cell	spheroid	
Radaisia Sauvageau, 1895	cell	spheroid	
Radaisiella Geitler, 1925	cell	spheroid	
Radiococcus Schmidle, 1902	cell	sphere	
Radiocystis Skuja, 1948	cell	sphere	
Radiocystis geminata Skuja, 1948	cell	spheroid	
Radiofilum Schmidle, 1894	cell	sphere	
Radiosphaera J.Snow, 1918	cell	sphere	
Raphidiopsis F.E.Fritsch & F.Rich, 1929	filament	cylinder	
Raphidocelis Hindák, 1977	cell	spindle	
Raphidonema Lagerheim, 1892	cell	spindle	
Raphidosphaera (Pascher) P.C.Silva, 1979	cell	sphere	
Rayssiella Edelstein & Prescott, 1964	cell	ellipsoid	
Rebecca J.C.Green, 2000	cell	ellipsoid	$d_2=0,67 \times d_1$
Reimeria J.P.Kociolek & E.F.Stoermer, 1987	cell	elliptic cylinder	
Resultor Moestrup, 1991	cell	sphere	
Rhabdoderma Schmidle & Lauterborn, 1900	cell	cylinder	
Rhabdogloea Schröder, 1917	cell	cylinder	
Rhabdolithes O.Schmidt, 1870	cell	sphere	
Rhabdomonas Fresenius, 1858	cell	spheroid	
Rhabdomonas costata (Korsikov) Pringsheim, 1942	cell	spindle	
Rhabdonema Kützing, 1844	cell	elliptic cylinder	
Rhaphoneis Ehrenberg, 1844	cell	elliptic cylinder	$h=0,33 \times d_2$
Rhinomonas D.R.A.Hill & Wetherbee, 1988	cell	ellipsoid	
Rhipidodendron F.Stein, 1878	cell	sphere	
Rhizochloris Pascher, 1917	cell	miscellaneous (amoeboid)	
Rhizochrysis Pascher, 1913	cell	spheroid	
Rhizoclonium Kützing, 1843	filament	cylinder	
Rhizosolenia Brightwell, 1858	cell	cylinder	
Rhizosolenia imbricata Brightwell, 1858	cell	cylinder × 0,9	
Rhizosolenia longiseta O.Zacharias, 1893	cell	elliptic cylinder	$d_2=0,90 \times d_1$
Rhodomonas Karsten, 1898	cell	ellipsoid	$d_2=0,90 \times d_1$
Rhodomonas baltica Karsten, 1898	cell	cone with half sphere	
Rhodomonas lacustris Pascher & Ruttner, 1913	cell	cone with half sphere	$h=0,90 \times d$
Rhodomonas marina (P.A.Dangeard) Lemmermann, 1899	cell	cone with half sphere	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Rhodomonas salina (Wislouch) D.R.A.Hill & R.Wetherbee, 1989	cell	cone with half sphere	
Rhodoplax Schmidle & Wellheim, 1901	cell	spheroid	
Rhodostichus Geitler & Pascher, 1931	cell	spheroid	
Rhoicosphenia Grunow, 1860	cell	pyramid × 0,9	l_1=0,75×l_2; l_2=1,33×l_1
Rhoicosphenia abbreviata (C.Agardh) Lange-Bertalot, 1980	cell	elliptic cylinder	d_2=0,75×h; h=1,33×d_2
Rhoikoneis Grunow, 1863	cell	elliptic cylinder	
Rhopalodia Otto Müller, 1895	cell	elliptic cylinder × 0,65	d_2=0,40×h; h=2,50×d_2
Rhynchomonas Klebs, 1892	cell	spheroid	
Richelia J.Schmidt, 1901	filament	cylinder	
Rivularia C.Agardh ex Bornet & Flahault, 1886	filament	cylinder	
Romeria Koczwara, 1932	cell	cylinder	
Roperia Grunow ex Pelletan, 1889	cell	cylinder	*h=0,50×d*
Roscoffia Balech, 1956	cell	ellipsoid	
Rosenvingiella P.C.Silva, 1957	filament	cylinder	
Rossithidium Round & L.Bukhtiyarova, 1996	cell	elliptic cylinder	
Roya West & G.S.West, 1896	cell	cylinder	
Rutilaria Greville, 1863	cell	rhombic prism	
Saccochrysis Korshikov, 1941	cell	spheroid	
Sacconema Borzì ex Bornet & Flahault, 1886	filament	cylinder	
Saepicula Leadbeater, 1980	cell	spheroid	
Salpingoeca H.J.Clark, 1866	cell	spheroid	
Sarcinochrysis Geitler, 1930	cell	sphere	
Saroeca H.A.Thomsen, 1979	cell	spheroid	
Savillea (W.N. Ellis) Loeblich III, 1967	cell	spheroid	
Scenedesmus Meyen, 1829	cell	spheroid	
Scenedesmus acutus f. *tetradesmiformis* (Wolosz.) Uherkovich	cell	spindle	
Scenedesmus producto-capitatus Schmula, 1909	cell	spindle	
Scenedesmus raciborskii Woloszynska, 1914	cell	spindle	
Scherffelia Pascher, 1911	cell	spheroid	
Schilleriella Pascher, 1932	cell	cylinder	
Schizochlamys Braun ex Kützing, 1849	cell	sphere	
Schizomeris Kützing, 1843	filament	cylinder	
Schizothrix Kützing ex Gomont, 1892	filament	cylinder	
Schroederella Pavillard, 1913	cell	cylinder	*h=0,80×d*
Schroederia Lemmermann, 1898	cell	spindle	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Schroederiella Woloszynska, 1914	cell	ellipsoid	
Schuettiella Balech, 1988	cell	double cone	
Sclerodinium Dodge, 1982	cell	ellipsoid	d_2=0,67×d_1
Scoliopleura Grunow, 1860	cell	elliptic cylinder	
Scoliotropis P.T.Cleve, 1894	cell	cuboid × 0,85	
Scotiella Fritsch, 1912	cell	spheroid	
Scotiellopsis Vinatzer, 1975	cell	spheroid	
Scotinosphaera Klebs, 1881	cell	ellipsoid	
Scourfieldia G.S.West, 1912	cell	ellipsoid	
Scrippsiella Balech ex A.R.Loeblich III, 1965	cell	spheroid	
Scrippsiella mexicana Indelicato & Loeblich III, 1986	cell	cone with half sphere	
Scrippsiella trochoidea (Stein) Balech ex Loeblich III, 1965	cell	cone with half sphere	*h=1,50×d*
Scyphosphaera Lohmann, 1902	cell	sphere	
Scytonema C.Agardh ex Bornet & Flahault, 1886	filament	cylinder	
Scytonematopsis E.I.Kiseleva, 1930	filament	cylinder	
Selenastrum Reinsch, 1867	cell	spindle	
Selenochloris Pascher, 1927	cell	spindle	
Selenoderma K.Bohlin, 1897	cell	spindle	
Sellaphora Mereschowsky, 1902	cell	elliptic cylinder	h=1,00×d_2
Sellaphora bacillum (Ehrenberg) D.G.Mann, 1989	cell	cuboid	
Sellaphora mutata (Krasske) Lange-Bertalot, 1996	cell	elliptic cylinder × 0,85	h=1,00×d_2
Sellaphora nana (Hustedt) Lange-Bertalot, Cavacini, Tagliaventi & Alfinito, 2003	cell	elliptic cylinder	h=0,75×d_2
Sellaphora pupula (Kützing) Mereschkovsky, 1902	cell	cuboid × 0,85	
Seminavis D.G.Mann, 1990	cell	elliptic cylinder × 0,65	d_2=0,50×h; h=2,00×d_2
Semiorbis R.M.Patrick, 1966	cell	elliptic cylinder × 1,03	r_2=0,50×h; h=2,00×r_2
Sheshukovia Z.I.Glezer [S.I.Gleser], 1975	cell	triangular prism (equilateral)	$m=0,50\times\sqrt{(3)}\times l$;
Shionodiscus A.J.Alverson, S.H.Kang & E.C.Theriot, 2006	cell	cylinder	*h=0,50×d*
Siderocelis (Naumann) Fott, 1934	cell	spheroid	
Siderocystopsis Swale, 1964	cell	spheroid	
Sieminskia D.Metzeltin & Lange-Bertalot, 1998	cell	elliptic cylinder	h=1,00×d_2
Simonsenia Lange-Bertalot, 1979	cell	elliptic cylinder	
Sinaiella L.Gruia, 1965	filament	cylinder	
Sinophysis Nie & C.Wang, 1944	cell	ellipsoid	
Siphonema Geitler	filament	cylinder	
Siphononema Geitler, 1925	cell	spheroid	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Sirocoleum Kützing ex Gomont, 1892	filament	cylinder	
Skeletonema Greville, 1865	cell	cylinder × 0,9	
Snowella Elenkin, 1938	cell	sphere	
Snowella fennica J.Komárek & J.Komárková-Legnerová, 1992	cell	spheroid	
Snowella lacustris (Chodat) Komárek & Hindák, 1988	cell	spheroid	
Sokolovia Elenkin, 1926	filament	cylinder	
Solentia Ercegovic, 1927	cell	spheroid	
Sorastrum Kützing, 1845	cell	tetrahedron	
Spatulodinium J.Cachon & M.Cachon, 1976	cell	ellipsoid	$d_2=0,67 \times d_1$
Spermatozopsis Korshikov, 1913	cell	spindle	
Sphaeraspis J.Schiller, 1954	cell	spheroid	
Sphaerellocystis Ettl, 1960	cell	spheroid	
Sphaerellopsis fluviatilis (F.Stein) Pascher, 1927	cell	spheroid × 0,88	
Sphaerellopsis gloeocystiformis (Dill) Gerloff, 1940	cell	ellipsoid	$d_2=0,90 \times d_1$
Sphaerobotrys Butcher, 1932	cell	sphere	
Sphaerocalyptra Deflandre, 1952	cell	sphere	
Sphaerocystis R.Chodat, 1897	cell	sphere	
Sphaerodinium Woloszynska, 1916	cell	ellipsoid	$d_2=0,75 \times d_1$
Sphaeroeca Lauterborn, 1894	cell	spheroid	
Sphaeroneocystis I.Kostikov, T.Darienko, A.Lukešová & L.Hoffmann	cell	sphere	
Sphaeroplea C.Agardh, 1824	filament	cylinder	
Sphaerospermopsis Zapomělová, Jezberová, Hrouzek, Hisem, Řeháková & Komárková, 2010	cell	sphere	
Sphaerozosma Corda ex Ralfs, 1848	half-cell	spheroid	
Sphaleromantis Pascher, 1910	cell	ellipsoid	
Sphenomonas Stein, 1878	cell	spindle	
Spiniferomonas E.Takahashi, 1973	cell	sphere	
Spiraulax Kofoid, 1911	cell	double cone	
Spirodinium Schütt, 1896	cell	spindle × 0,5	
Spirogyra Link, 1820	cell	cylinder	
Spiromonas Dujardin, 1841	cell	ellipsoid	
Spirotaenia Brébisson, 1848	cell	spheroid	
Spirulina Turpin ex Gomont, 1892	filament	cylinder	
Spondylomorum Ehrenberg, 1848	cell	spheroid	
Spondylosium Brébisson ex Kützing, 1849	half-cell	spheroid	
Spongiococcum Deason, 1959	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Spongomonas Stein, 1878	cell	spheroid	
Sporotetras Butcher, 1932	cell	spheroid	
Spumella Cienkowsky, 1870	cell	cone with half sphere	
Stanieria Komárek & Anagnostidis, 1986	cell	sphere	
Starria N.J.Lang, 1977	filament	elliptic cylinder	
Staurastrum Meyen ex Ralfs, 1848	half-cell	tetrahedron	
Stauridium Corda, 1839	cell	cuboid × 0,67	$c=1,00×b$
Staurodesmus Teiling, 1948	half-cell	tetrahedron	
Staurodesmus brevispina (Brébisson) Croasdale, 1957	half-cell	spheroid	
Staurodesmus convergens (Ehrenberg ex Ralfs) S.Lilleroth, 1950	half-cell	spheroid	
Staurodesmus crassus (West & G.S.West) M.-B.Florin, 1957	half-cell	spheroid	
Staurodesmus extensus (Borge) Teiling, 1948	half-cell	spheroid	
Staurodesmus extensus var. *isthmosus* (Heimerl) Coesel, 1993	half-cell	spheroid	
Staurodesmus extensus var. *joshuae* (Gutwinski) Teiling, 1967	half-cell	spheroid	
Staurodesmus incus (Hassal ex Ralfs) Teiling, 1967	half-cell	spheroid	
Staurodesmus incus var. *ralfsii* (West) Teiling, 1967	half-cell	spheroid	
Staurodesmus indentatus (West & G.S.West) Teiling, 1948	half-cell	spheroid	
Staurodesmus patens (Nordstedt) Croasdale, 1957	half-cell	spheroid	
Staurodesmus patens var. *maximus* Teiling, 1967	half-cell	spheroid	
Staurodesmus subtriangularis (O.Borge) Teiling, 1967	half-cell	spheroid	
Staurodesmus triangularis (Lagerheim) Teiling, 1948	half-cell	spheroid	
Stauroforma R.Flower, V.Jones & Round	cell	elliptic cylinder	$d_2=1,00×h$; $h=1,00×d_2$
Stauroneis Ehrenberg, 1843	cell	elliptic cylinder	$h=0,75×d_2$
Stauroneis acidoclinata Lange-Bertalot & Werum in Werum & Lange-Bertalot, 2004	cell	elliptic cylinder × 0,9	
Stauroneis acuta W.Smith, 1853	cell	rhombic prism	
Stauroneis agrestis J.B.Petersen, 1915	cell	elliptic cylinder × 0,9	
Stauroneis anceps Ehrenberg, 1843	cell	elliptic cylinder × 0,9	
Stauroneis anceps f. *gracilis* Rabenhorst, 1864	cell	elliptic cylinder × 0,9	
Stauroneis anceps var. *anceps* Ehrenberg, 1843	cell	elliptic cylinder × 0,9	
Stauroneis anceps var. *hyalina* Peragallo & Brun	cell	elliptic cylinder × 0,9	
Stauroneis anceps var. *siberica* Grunow, 1880	cell	elliptic cylinder × 0,9	
Stauroneis gracilior E.Reichardt	cell	lanceolate cylinder	$h=0,75×d_2$
Stauroneis gracilis Ehrenberg, 1843	cell	lanceolate cylinder	$h=0,75×d_2$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Stauroneis lauenburgiana Hustedt, 1950	cell	elliptic cylinder × 0,9	
Stauroneis neohyalina LB nov.stat., 1996	cell	elliptic cylinder × 0,9	
Stauroneis phoenicenteron (Nitzsch) Ehrenberg, 1843	cell	lanceolate cylinder	$h=0,75×d_2$
Stauroneis pseudagrestis Lange-Bertalot & Werum in Werum & Lange-Bertalot, 2004	cell	elliptic cylinder × 0,9	
Stauroneis reichardtii Lange-Bertalot	cell	elliptic cylinder × 0,9	
Stauroneis siberica (Grunow) Lange-Bertalot & Krammer	cell	elliptic cylinder × 0,9	
Stauroneis smithii Grunow, 1860	cell	lanceolate cylinder	$h=0,75×d_2$
Stauroneis smithii var. *smithii* Grunow, 1860	cell	lanceolate cylinder	$h=0,75×d_2$
Stauronella Mereschkowsky, 1901	cell	elliptic cylinder	
Staurophora Mereschkowsky, 1903	cell	elliptic cylinder	
Staurophora salina (W.Smith) Mereschkowsky, 1903	cell	lanceolate cylinder	$h=0,75×d_2$
Staurosira Ehrenberg, 1843	cell	elliptic cylinder	$h=0,75×d_2$
Staurosira construens Ehrenberg, 1843	cell	elliptic cylinder × 0,85	$h=0,50×d_2$
Staurosira construens var. *binodis* (Ehrenberg) P.B.Hamilton, 1992	cell	elliptic cylinder	$h=1,00×d_2$
Staurosira construens var. *exigua* (W.Smith) H.Kobayasi, 2002	cell	triangular prism (equilateral) × 0,65	$m=0,50×\sqrt{(3)}×l;$
Staurosira venter (Ehrenberg) H.Kobayasi, 2002	cell	elliptic cylinder	$d_2=1,00×h; h=1,00×d_2$
Staurosirella D.M.Williams & Round, 1988	cell	elliptic cylinder	$d_2=1,00×h; h=1,00×d_2$
Staurosirella leptostauron (Ehrenberg) D.M.Williams & Round, 1987	cell	elliptic cylinder × 0,8	$h=0,33×d_2$
Stelexomonas Lackey, 1942	cell	spheroid	
Stellarima Hasle & P.A.Sims, 1986	cell	cylinder × 0,85	$h=0,65×d$
Stellarima stellaris (Roper) G.R.Hasle & P.A.Sims, 1986	cell	cylinder	$h=0,50×d$
Stenokalyx J.Schiller, 1926	cell	spheroid	
Stenopterobia Brébisson ex Van Heurck, 1896	cell	cuboid × 0,85	
Stenopterobia delicatissima (F.W.Lewis) Brébisson ex van Heurck, 1896	cell	rhombic prism × 1,15	
Stephanocodon Pascher, 1942	cell	spheroid	
Stephanocostis Genkal & Kuzmina, 1985	cell	cylinder	$h=0,60×d$
Stephanodiscus Ehrenberg, 1845	cell	cylinder	$h=0,60×d$
Stephanodiscus astraea (Ehrenberg) Grunow, 1880	cell	cylinder	$h=0,65×d$
Stephanodiscus binderanus (Kützing) Krieger, 1927	cell	cylinder	$h=1,50×d$
Stephanodiscus hantzschii Grunow, 1880	cell	cylinder	$h=0,77×d$
Stephanodiscus hantzschii f. *tenuis* (Hustedt) H.Håkansson & E.F.Stoermer, 1984	cell	cylinder	$h=0,77×d$
Stephanodiscus minutulus (Kützing) Cleve & Möller, 1882	cell	cylinder	$h=0,88×d$

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Stephanodiscus parvus Stoermer & Håkansson, 1984	cell	cylinder	*h=0,88×d*
Stephanodiscus tenuis Hustedt, 1939	cell	cylinder	*h=0,77×d*
Stephanoeca W.Ellis, 1930	cell	spheroid	
Stephanoporos W.Conrad & Pascher, 1940	cell	spheroid	
Stephanopyxis (Ehrenberg) Ehrenberg, 1845	cell	cylinder × 0,87	
Stichococcus Nägeli, 1849	cell	cylinder	
Stichogloea Chodat, 1897	cell	sphere	
Stichosiphon Geitler, 1931	filament	cylinder	
Stictocyclus A.Mann, 1925	cell	cylinder	
Stictodiscus Greville, 1861	cell	cylinder	
Stigeoclonium Kützing, 1843	filament	cylinder	
Stigonema C.Agardh ex Bornet & Flahault, 1886	filament	cylinder	
Stipitochrysis Korshikov, 1941	cell	spheroid	
Stipitococcus West & G.S.West, 1898	cell	spheroid	
Stokesiella Lemmermann, 1908	cell	spheroid	
Storeatula Hill, 1991	cell	spheroid	
Striatella C.Agardh, 1832	cell	elliptic cylinder	$d_2=0,33\times d_1$
Strombomonas Deflandre, 1930	cell	spheroid	
Stylochrysalis F.Stein, 1878	cell	spheroid	
Stylodinium Klebs, 1912	cell	spheroid	
Stylosphaeridium Geitler & Gimesi, 1925	cell	spheroid	
Subsilicea H.A.von Stosch & B.E.F.Reimann, 1970	cell	elliptic cylinder	$d_2=1,00\times h$
Surirella Turpin, 1828	cell	elliptic cylinder	$d_2=1,12\times h; h=0,89\times d_2$
Surirella angusta Kützing, 1844	cell	cuboid × 0,85	*b=1,33×c; c=0,75×b*
Surirella biseriata Brébisson, 1835	cell	elliptic cylinder	$d_2=1,23\times h; h=0,81\times d_2$
Surirella capronii Brébisson ex F.Kitton	cell	elliptic cylinder × 0,7	$d_2=1,10\times h; h=0,91\times d_2$
Surirella crumena Brébisson ex Kützing, 1849	cell	elliptic cylinder	$d_2=1,52\times h; h=0,66\times d_2$
Surirella linearis W.Smith, 1853	cell	cuboid × 0,85	*b=1,33×c; c=0,75×b*
Surirella minuta Brébisson, 1849	cell	elliptic cylinder	$d_2=1,00\times h; h=1,00\times d_2$
Surirella robusta Ehrenberg	cell	elliptic cylinder	$d_2=1,41\times h; h=0,71\times d_2$
Symbiodinium Freudenthal, 1962	cell	sphere	
Symploca Kützing ex Gomont, 1892	filament	cylinder	
Symplocastrum (Gomont) Kirchner, 1898	filament	cylinder	
Syncrypta Ehrenberg	cell	spheroid	
Syndendrium Ehrenberg, 1845	spore	spheroid	
Synechococcus Nägeli, 1849	cell	spheroid	
Synechocystis Sauvageau, 1892	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Synedra Ehrenberg, 1830	cell	elliptic cylinder	$d_2=1{,}00×h;\ h=1{,}00×d_2$
Synedra nana F.Meister, 1912	cell	elliptic cylinder	
Synedrella F.E.Round & N.I.Maidana, 2001	cell	elliptic cylinder	
Synedropsis G.R.Hasle, L.K.Medlin & E.E.Syvertsen, 1994	cell	elliptic cylinder	
Synedrosphenia (H.Peragallo) Azpeitia Moros, 1911	cell	pyramid × 0,9	$l_1=0{,}75×l_2;\ l_2=1{,}33×l_1$
Synura Ehrenberg, 1834	cell	cone with half sphere	
Synura globosa (Schiller) Starmach	cell	spheroid × 0,88	
Synura splendida Korshikov, 1942	cell	spheroid × 0,88	
Synuropsis J.Schiller, 1929	cell	spheroid × 0,88	
Syracolithus (Kamptner) Deflandre, 1952	cell	sphere	
Syracosphaera Lohmann, 1902	cell	sphere	
Tabellaria Ehrenberg ex Kützing, 1844	cell	cuboid	$b=0{,}50×c$
Tabellaria binalis var. *elliptica* R.J.Flower	cell	elliptic cylinder × 0,85	$d_2=0{,}33×h;\ h=3{,}00×d_2$
Tabellaria fenestrata (Lyngbye) Kützing, 1844	cell	cuboid	$b=0{,}10×a;\ c=0{,}33×a$
Tabularia (Kützing) D.M.Williams & Round, 1986	cell	elliptic cylinder	$d_2=1{,}00×h;\ h=1{,}00×d_2$
Tabularia gaillonii (Bory de Saint-Vincent) Bukhtiyarova, 1995	cell	cuboid × 0,8	
Talaroneis W.H.C.F.Kooistra & M.De Stefano, 2004	cell	elliptic cylinder	
Tapinothrix Sauvageau, 1892	filament	cylinder	
Tasmanites E.T.Newton, 1875	cell	sphere	
Teilingia Bourrelly, 1964	half-cell	spheroid	
Teleaulax Hill, 1991	cell	cone with half sphere	
Telonema Griessmann, 1913	cell	cone with half sphere	
Terpsinoe Ehrenberg, 1843	cell	elliptic cylinder	
Tessellaria Playfair, 1918	cell	sphere	
Tetmemorus Ralfs ex Ralfs, 1848	cell	ellipsoid	
Tetrabaena Fromentel	cell	spheroid	
Tetrablepharis Senn ex Wille, 1909	cell	ellipsoid	
Tetrachlorella Korshikov, 1939	cell	spheroid	
Tetracyclus Ralfs, 1843	cell	elliptic cylinder	
Tetracyclus emarginatus (Ehrenberg) W.Smith, 1856	cell	elliptic cylinder × 0,75	
Tetracyclus glans (Ehrenberg) Mills, 1935	cell	elliptic cylinder × 0,85	$h=0{,}50×d_2$
Tetracystis R.M.Brown, Jr & Bold, 1964	cell	sphere	
Tetradesmus G.M.Smith, 1913	cell	spindle	
Tetradinium Klebs, 1912	cell	triangular prism (equilateral)	$m=0{,}50×\sqrt{(3)}×l;$
Tetraedriella Pascher, 1930	cell	tetrahedron	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Tetraedron Kützing, 1845	cell	tetrahedron	
Tetraedron caudatum (Corda) Hansgirg, 1888	cell	cuboid × 0,75	*c=0,67×b*
Tetraedron incus (Teiling) G.M.Smith, 1926	cell	cuboid	*c=0,67×b*
Tetraedron lunula (Reinsch) Hansgirg, 1889	cell	spindle	
Tetraedron minimum (A.Braun) Hansgirg, 1888	cell	cuboid	*c=0,67×b*
Tetraedron minimum var. *scrobiculatum* Lagerheim, 1888	cell	elliptic cylinder	
Tetraedron minimum var. *tetralobulatum* Reinsch	cell	elliptic cylinder	
Tetraedron triangulare Korshikov	cell	triangular prism (equilateral) × 0,52	*m=0,50×√(3)×l; h=0,50×l*
Tetrallantos Teiling, 1916	cell	spindle	
Tetramitus Perty, 1852	cell	miscellaneous	
Tetranephris C.R.Leite & C.E.M.Bicudo, 1977	cell	spheroid	
Tetraplektron Fott, 1957	cell	tetrahedron	
Tetrarcus H.Skuja, 1934	cell	spheroid	
Tetraselmis F.Stein, 1878	cell	spheroid	
Tetraspora Link ex Desvaux, 1818	cell	sphere	
Tetrasporopsis Lemmermann ex Schmidle, 1902	cell	sphere	
Tetrastrum Chodat, 1895	cell	cone with half sphere	
Tetrastrum elegans Playfair, 1917	cell	sphere	
Tetrastrum glabrum (Y.V.Roll) Ahlstrom & Tiffany	cell	sphere	
Tetrastrum staurogeniiforme (Schröder) Lemmermann, 1900	cell	sphere	
Tetrastrum triangulare (Chodat) Komárek, 1974	cell	sphere	
Tetratoma Buetschli, 1884	cell	spheroid	
Thalassiocyclus Håkansson & Mahood	cell	cylinder	
Thalassioneis Round, 1990	cell	elliptic cylinder	
Thalassionema Grunow ex Mereschkowsky, 1902	cell	cuboid	*b=1,00×c; c=1,00×b*
Thalassionema bacillare (Heiden) Kolbe, 1955	cell	elliptic cylinder	
Thalassionema frauenfeldii (Grunow) Hallegraeff, 1986	cell	cuboid × 0,89	*b=1,00×c; c=1,00×b*
Thalassionema nitzschioides (Grunow) Mereschkowsky, 1902	cell	cuboid × 0,89	*b=1,00×c; c=1,00×b*
Thalassionema pseudonitzschioides (G.Schuette & H.Schrader) G.R.Hasle	cell	elliptic cylinder	
Thalassiophysa P.S.Conger, 1954	cell	elliptic cylinder	
Thalassiosira Cleve, 1873	cell	cylinder	*h=0,49×d*
Thalassiosira angulata (W.Gregory) Hasle, 1978	cell	cylinder	*h=0,48×d*
Thalassiosira anguste-lineata (A.Schmidt) G.Fryxell & Hasle, 1977	cell	cylinder	*h=0,38×d*

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Thalassiosira baltica (Grunow) Ostenfeld, 1901	cell	cylinder	*h=0,42×d*
Thalassiosira constricta Gaardner, 1938	cell	cylinder	*h=1,00×d*
Thalassiosira delicatula Ostenfeld, 1908	cell	cylinder	*h=1,00×d*
Thalassiosira eccentrica (Ehrenberg) Cleve, 1903	cell	cylinder	*h=0,38×d*
Thalassiosira gravida Cleve, 1896	cell	cylinder	*h=0,40×d*
Thalassiosira hyalina (Grunow) Gran, 1897	cell	cylinder	*h=0,60×d*
Thalassiosira hyperborea (Grunow) Hasle	cell	cylinder	*h=0,40×d*
Thalassiosira hyperborea var. *pelagica* (Cleve-Euler) G.R.Hasle	cell	cylinder	*h=0,40×d*
Thalassiosira lacustris (Grunow) Hasle, 1977	cell	cylinder	*h=0,54×d*
Thalassiosira levanderi van Goor, 1924	cell	cylinder	*h=0,60×d*
Thalassiosira minima Gaarder, 1951	cell	cylinder	*h=0,50×d*
Thalassiosira nordenskioeldii Cleve, 1873	cell	cylinder	*h=0,61×d*
Thalassiosira proschkinae Makarova, 1979	cell	cylinder	*h=0,50×d*
Thalassiosira pseudonana Hasle & Heimdal, 1970	cell	cylinder	*h=0,65×d*
Thalassiosira punctigera (Castracane) Hasle, 1983	cell	cylinder	*h=0,50×d*
Thalassiosira rotula Meunier, 1910	cell	cylinder	*h=0,44×d*
Thalassiothrix Cleve & Grunow, 1880	cell	cuboid	*b=1,00×c; c=1,00×b*
Thaumatomastix Lauterborn, 1899	cell	spheroid	
Thecadinium Kofoid & Skogsberg, 1928	cell	ellipsoid	
Thelesphaera Pascher, 1943	cell	sphere	
Thompsodinium Bourrelly, 1970	cell	spheroid	
Thoracomonas Korshikov, 1925	cell	ellipsoid	
Thorakochloris Pascher, 1932	cell	sphere	
Thorosphaera Ostenfeld, 1910	cell	sphere	
Togula Flo Jorgensen, Murray & Daugbjerg, 2004	cell	ellipsoid	
Tolypothrix Kützing ex Bornet & Flahault, 1886	filament	cylinder	
Torodinium Kofoid & Swezy, 1921	cell	ellipsoid	$d_2=0,90×d_1$
Torodinium teredo (Pouchet) Kofoid & Swezy, 1921	cell	ellipsoid	$d_2=0,76×d_1$
Tovellia Moestrup, K.Lindberg & N.Daugberg, 2005	cell	spheroid	
Tovellia leopoliensis (Wolosz.) Moestrup, Lindberg & Daugbjerg, 2005	cell	ellipsoid	
Toxonidea Donkin, 1858	cell	elliptic cylinder	
Trachelomonas Ehrenberg, 1835	cell	spheroid	
Trachelomonas rugulosa F.Stein ex Deflandre, 1926	cell	sphere	
Trachelomonas volvocina (Ehrenberg) Ehrenberg, 1834	cell	sphere	
Trachelomonas volvocinopsis Svirenko, 1914	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Trachelophyllum Claparède & Lachmann, 1859	cell	spindle	
Trachychloron Pascher, 1939	cell	spheroid	
Trachydiscus Ettl, 1964	cell	spheroid	
Trachyneis P.T.Cleve, 1894	cell	elliptic cylinder	d_2=0,80×h; h=1,25×d_2
Trachysphenia Petit, 1877	cell	elliptic cylinder	
Trebouxia Puymaly, 1924	cell	sphere	
Trepomonas Dujardin, 1841	cell	spheroid	
Treubaria C.Bernard, 1908	cell	sphere	
Treubaria crassispina G.M.Smith, 1926	cell	tetrahedron	
Treubaria quadrispina (G.M.Smith) Fott & Kovácik, 1975	cell	cuboid	
Treubaria setigera (Archer) G.M.Smith, 1933	cell	triangular prism	
Tribonema Derbès & Solier, 1851	cell	cylinder	
Triceratium Ehrenberg, 1839	cell	triangular prism (equilateral)	*m=0,50×√(3)×l; h=0,50×l*
Trichocoleus Anagnostidis, 2001	filament	cylinder	
Trichodesmium Ehrenberg ex Gomont, 1892	filament	cylinder	
Trichormus (Ralfs ex Bornet & Flahault) Komárek & Anagnostidis, 1989	cell	cylinder	
Trichotoxon F.M.H.Reid & Round, 1988	cell	cuboid	*b=1,00×c; c=1,00×b*
Trigonaspis H.A.Thomsen, 1980	cell	spheroid	
Trigonium Cleve, 1867	cell	triangular prism (equilateral)	*m=0,50×√(3)×l; h=1,00×l*
Trigonomonas Klebs, 1892	cell	spheroid	
Triparma B.C.Booth & H.J.Marchant, 1987	cell	sphere	
Triploceras J.W.Bailey, 1851	cell	cylinder	
Trochiscia Kützing, 1834	cell	sphere	
Tropidoneis Cleve, 1891	cell	rhombic prism	
Tryblionella W.Smith, 1853	cell	elliptic cylinder × 1,15	h=0,75×d_2
Tryblionella aerophila (Hustedt) D.G.Mann, 1990	cell	cuboid × 0,8	*c=0,75×b*
Tryblionella angustata W.Smith, 1853	cell	elliptic cylinder × 0,8	h=0,75×d_2
Tryblionella apiculata Gregory, 1857	cell	cuboid × 0,8	*c=0,75×b*
Tryblionella calida (Grunow) D.G.Mann, 1990	cell	cuboid × 0,8	*c=0,75×b*
Tryblionella compressa (J.W.Bailey) M.Poulin, 1990	cell	elliptic cylinder	h=0,75×d_2
Tryblionella debilis Arnott ex O'Meara, 1873	cell	elliptic cylinder × 0,8	h=0,75×d_2
Tryblionella divergens (Hustedt) D.G.Mann, 1990	cell	rhombic prism × 1,15	
Tryblionella hungarica (Grunow) Frenguelli, 1942	cell	cuboid × 0,8	*c=0,75×b*
Tryblionella marginulata (Grunow) D.G.Mann, 1990	cell	elliptic cylinder × 1,15	h=0,50×d_2

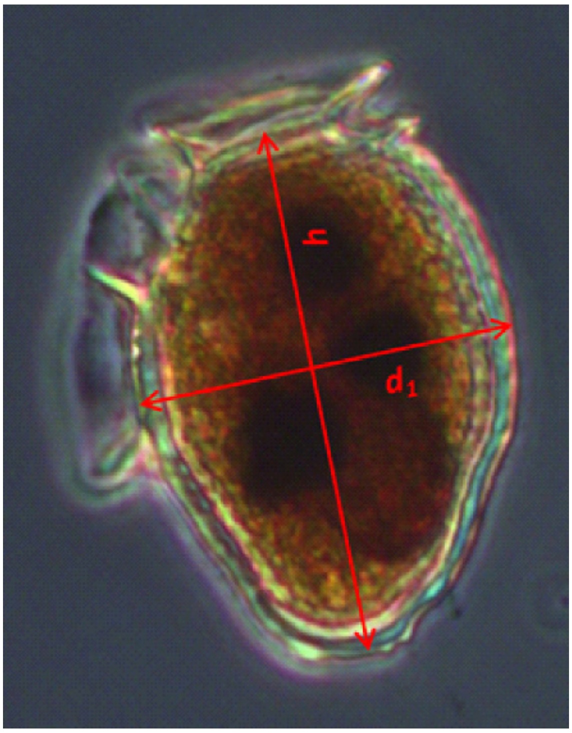
Taxon (genus, species, subspecies, variety, forma)	Geometrical shape unit	Geometrical shape (× correction factor)	Hidden dimension estimation*
Tryblionella navicularis (Brébisson) Ralfs, 1861	cell	elliptic cylinder × 0,8	$h=0,75 \times d_2$
Tryblionella plana (W.Smith) Pelletan, 1889	cell	cuboid	$c=0,75 \times b$
Tryblionella salinarum (Grunow) Pantocsek, 1901	cell	cuboid	$c=0,75 \times b$
Tryblionella scalaris (Ehrenberg) P.Siver & P.B.Hamilton, 2005	cell	cuboid × 0,9	$c=0,75 \times b$
Tubiella Hollerbach, 1935	cell	spheroid	
Turrisphaera I.Manton, J.Sutherland & K.Oates, 1976	cell	spheroid	
Tychonema Anagnostidis & Komárek, 1988	filament	cylinder	
Tyrannodinium A.J.Calado, S.C.Craveiro, N.Daugbjerg & Ø.Moestrup, 2009	cell	ellipsoid	
Ulnaria (Kutzing) P.Compère, 2001	cell	elliptic cylinder	$d_2=1,00 \times h$; $h=1,00 \times d_2$
Ulnaria acus (Kützing) M.Aboal, 2003	cell	lanceolate cylinder	$d_2=1,00 \times h$; $h=1,00 \times d_2$
Ulnaria capitata (Ehrenberg) P.Compère, 2001	cell	cuboid	
Ulnaria danica (Kützing) Compère & Bukhtiyarova, 2006	cell	cuboid	
Ulnaria delicatissima (W.Smith) M.Aboal & P.C.Silva, 2004	cell	rhombic prism	
Ulnaria delicatissima var. *angustissima* (Grunow) M.Aboal & P.C.Silva, 2004	cell	rhombic prism	
Ulothrix Kützing, 1833	cell	cylinder	
Umbellosphaera Paasche, 1955	cell	sphere	
Umbilicosphaera Lohmann, 1902	cell	sphere	
Undatella Paddock & P.A.Sims, 1980	cell	elliptic cylinder	
Urceolus C.von Mereschkowsky, 1879	cell	spheroid	
Uroglena Ehrenberg, 1834	cell	spheroid	
Uroglenopsis Lemmermann, 1899	cell	spheroid	
Uronema Lagerheim, 1887	filament	cylinder	
Urosolenia Round & R.M.Crawford, 1990	cell	cylinder	
Vacuolaria Cienkowski, 1870	cell	ellipsoid	
Vaucheria A.P.de Candolle, 1801	filament	cylinder	
Vischeria Pascher, 1938	cell	sphere	
Vitreochlamys Batko, 1970	cell	spheroid	
Vitreochlamys fluviatilis (Stein) Batko, 1970	cell	spheroid × 0,88	
Vitreochlamys gloeocystiformis (O.Dill) A.Nakazawa in Nakazawa Krienitz & Nozaki, 2001	cell	sphere	
Volvox Linnaeus, 1758	cell	sphere	
Volvulina Playfair, 1915	cell	spheroid	
Warnowia Lindemann, 1928	cell	spheroid	
Westella De Wildermann, 1897	cell	sphere	

Taxon (genus, species, subspecies, variety, forma)	**Geometrical shape unit**	**Geometrical shape (× correction factor)**	**Hidden dimension estimation***
Westellopsis C.-C.Jao, 1959	cell	sphere	
Wigwamma I.Manton, J.Sutherland & K.Oates, 1977	cell	spheroid	
Willea Schmidle, 1900	cell	spheroid	
Wollea Bornet & Flahault, 1886	filament	cylinder	
Woloszynskia R.H.Thompson, 1951	cell	ellipsoid	$d_2=0,75×d_1$
Woloszynskia coronata (Woloszynska) Moestrup, Lindberg & Daugbjerg, 2005	cell	spheroid	
Woloszynskia halophila (Biecheler) M.Elbrächter & A.Kremp, 2005	cell	spheroid	
Wolskyella Claus, 1963	cell	cylinder	
Woronichinia Elenkin, 1933	cell	spheroid	
Xanthidium Ehrenberg ex Ralfs, 1848	half-cell	spheroid	
Xanthonema P.C.Silva, 1979	cell	cylinder	
Xenococcus Thuret, 1880	cell	spheroid	
Xenotholos M.Gold-Morgan, G.Montejano & J.Komárek, 1994	cell	spheroid	
Zygnema C.Agardh, 1817	cell	cylinder	
Zygnemopsis (Skuja) Transeau, 1934	cell	cylinder	
Zygoceros C.G.Ehrenberg, 1839	cell	miscellaneous	
Zygogonium Kützing, 1843	cell	cylinder	
Zygosphaera Kamptner, 1937	cell	sphere	

Annex E
(informative)

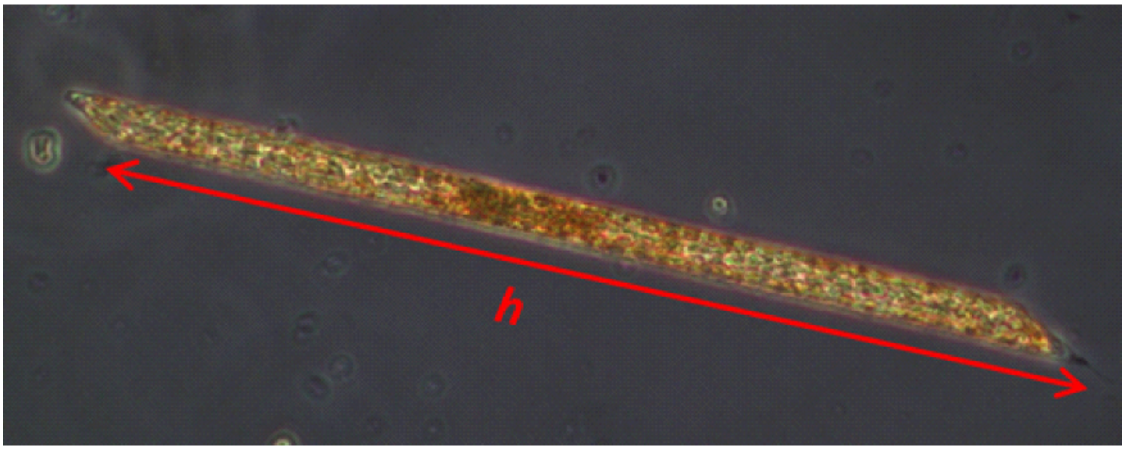
Example: Genus-specific instruction for measurement of dimensions

Figures E.1 to E.6 show examples for some well-chosen taxa to measure the necessary dimensions.



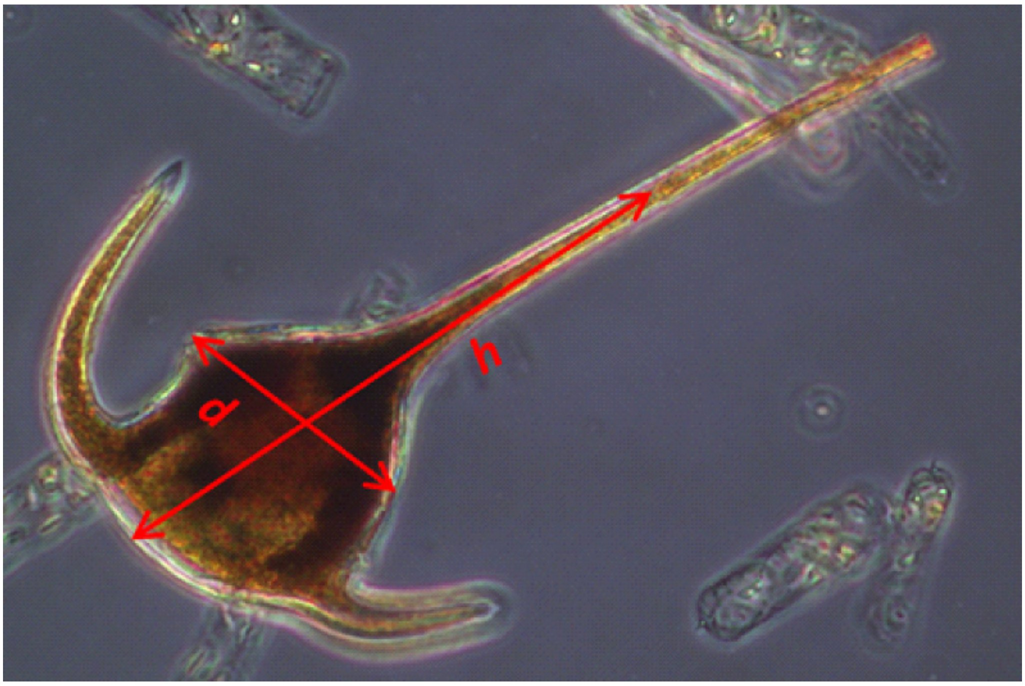
NOTE The necessary dimensions large diameter (d_1) and height (h) of the "ellipsoid" are both measured without the cell "wings".

Figure E.1 — *Dinophysis*



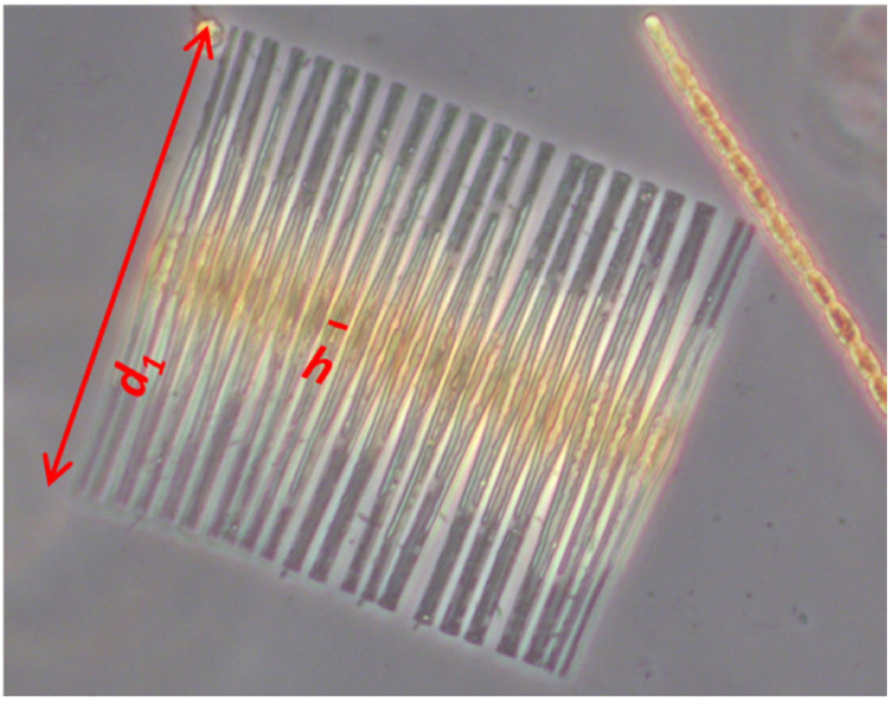
NOTE The height (h) of the "cylinder" is measured on one side from the tip to the beginning of the inclination at the other end. Thus, the unmeasured tip on one side replaces the missing piece on the other side.

Figure E.2 — *Rhizosolenia*



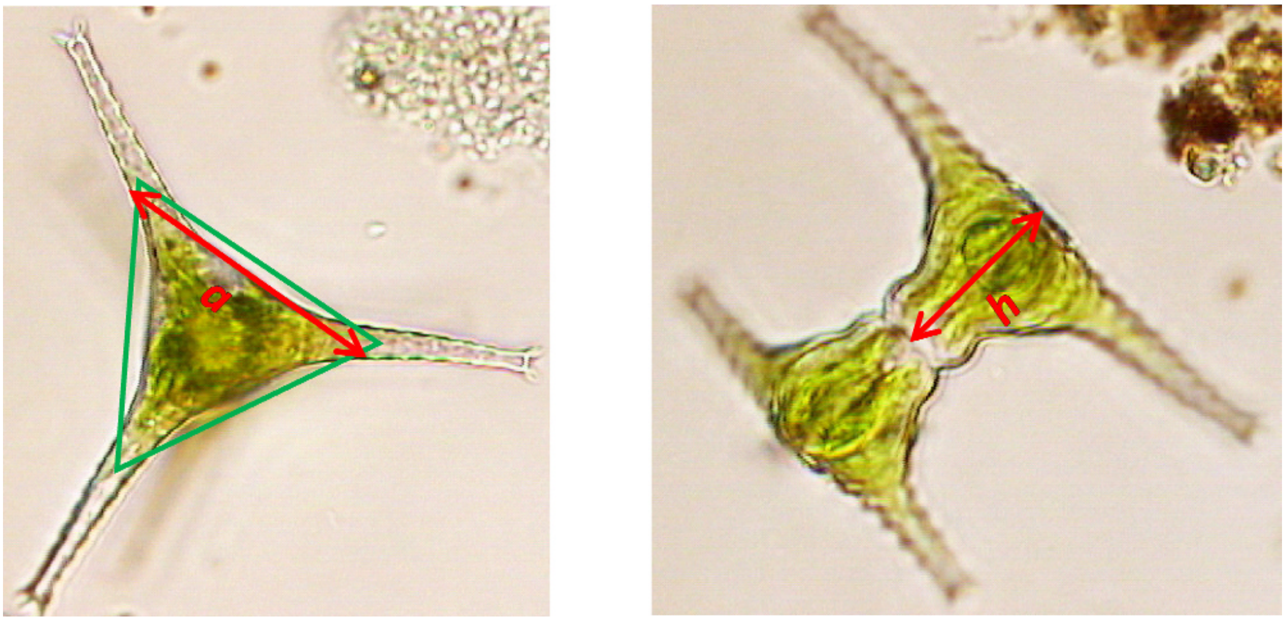
NOTE For those species, for which the volume can be expressed as the special Ceratium-shape (see Annex A) the girdle-diameter (*d*) is sufficient for calculation. For other species that are assigned as "cone with half sphere" additionally the height (*h*) is necessary, which can be measured approximately up to half of the horn length. Thus, the unrecognized horns and parts of the "half sphere" compensate the resulting overestimation of the cone. The flattening of the whole cell is addressed by the additional use of a correction factor.

Figure E.3 — *Ceratium*



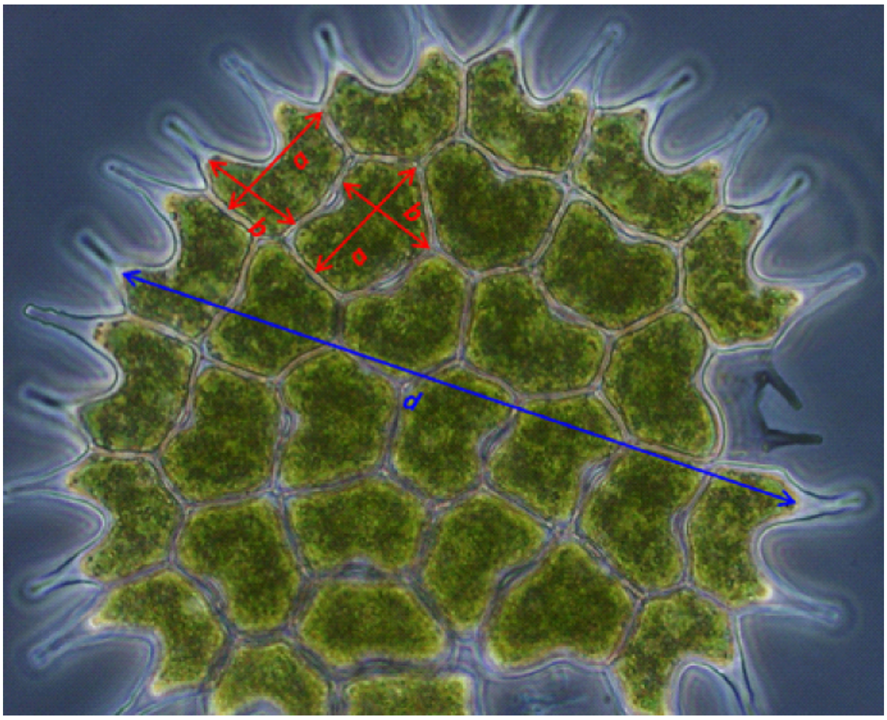
NOTE For that genus, which species can be a "cuboid", an "elliptic cylinder", or a "rhombic prism" the height (*h*) is measured in the middle of the cell. In cases where cells are narrowed towards the apical poles, this is taken into account by using a correction factor.

Figure E.4 — *Fragilaria*



NOTE The shape for this genus is a "tetrahedron" on half-cell basis. The edge length (*a*) of the basic triangle (left figure) should be measured between the opposite edges of the "arms" after the eyepiece scale has been applied to one cell edge (*a*). The resulting slight overestimation of this basis is compensated by the "arms" and the underestimation in the area of the upper part of the "tetrahedron". In the appropriate position, the height (*h*) can be measured between the basis and the isthmus axis.

Figure E.5 — Staurastrum



NOTE If applying a "cylinder" on coenobium basis it is easy to measure the diameter (*d*). For the geometrical shape correction factor for the "cuboid" and the hidden dimension factors see Annex D.

Figure E.6 — Pediastrum

If in Figure E.6, the "cuboid" is used on cell basis the length (*a*) and width (*b*) should be measured at the widest positions.

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