

Nannoplankton taxonomy and the *International Code of Nomenclature for algae, fungi, and plants (ICN)*

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Manuscript received 2nd June, 2015; revised manuscript accepted 1st July, 2015

Abstract In 2012, the *International Code of Nomenclature for algae, fungi, and plants* was published, which has ramifications for nannoplankton workers. The main changes that are relevant to us are: 1) certain forms of electronic publication are now acceptable, 2) English instead of Latin may now be used in descriptions and diagnoses of extant organisms, and 3) the morphotaxon concept for fossil plants and algae has been abandoned. Furthermore, names of genera based on extant types now have priority over those based on fossil types. This may cause a potential problem in the future for at least four genera with fossil types: *Cruciplacolithus* and *Reticulofenestra* (nannoplankton) and *Dictyocha* and *Stephanocha* (silicoflagellates). Herein, some of the rules and recommendations are explained, with nannoplankton and silicoflagellate examples.

Keywords nannoplankton, nannofossils, silicoflagellates, taxonomy, *ICBN*, *ICN*

1. Introduction

Explanatory notes on the rules and recommendations of previous versions of the *International Code of Botanical Nomenclature (ICBN)*, and how they relate to nannoplankton research, were published in the *International Nannoplankton Association (INA) Newsletter* and its successor, the *Journal of Nannoplankton Research (JNR)*, as a series of fourteen papers (van Heck, 1990-1996) that were indexed by Burnett (1997). Since then, numerous changes to these rules have been made at subsequent meetings of the International Botanical Congress. In this paper, the most relevant articles and recommendations that affect nannoplankton nomenclature are shown below *ad verbatim* from McNeill *et al.* (2012), and are annotated with examples of nannoplankton nomenclatural problems. Some of the more important parts of the *ICN* articles and recommendations have been enboldened, in order to emphasise the key points – *i.e.* the bold type does not appear in the original text. In addition, it should be noted that not all of the articles and recommendations cited in the copied text are reproduced here, so where necessary, please consult the *ICN*. Unlike the *ICN* and the van Heck papers, the articles and recommendations have been organised under similar themes, in the hope of making the rules easier to understand.

2.1 General

Preface. Like other international codes of nomenclature **the *ICN* has no legal status and is dependent on the voluntary acceptance of its rules by authors, editors, and other users of names that it governs.**

Art. 56.1. Any name that would cause a disadvantageous nomenclatural change (Art. 14.1) may be proposed for rejection. **A name thus rejected, or its basionym if it has one, is placed on a list of nomina utique rejicienda** (suppressed names, App. V). **Along with each listed**

name, all names for which it is the basionym are similarly rejected, and none is to be used (see Rec. 50E.2).

56.2. The list of nomina utique rejicienda (suppressed names) will remain permanently open for additions and changes. Any proposal for rejection of a name must be accompanied by a detailed statement of the cases both for and against its rejection, including considerations of typification. **Such proposals must be submitted to the General Committee** (see Div. III), **which will refer them for examination to the committees for the various taxonomic groups** (see also Art. 14.12 and 34.1).

56.4. When a proposal for the rejection of a name under Art. 56 has been approved by the General Committee after study by the Committee for the taxonomic group concerned, rejection of that name is authorized subject to the decision of a later International Botanical Congress (see also Art. 14.16 and 34.2).

Recommendation 56A.1. When a proposal for the rejection of a name under Art. 56 has been referred to the appropriate Committee for study, **authors should follow existing usage of names as far as possible pending the General Committee's recommendation on the proposal** (see also Rec. 14A and 34A).

Proposals for changes to the *Code* are first considered by a number of nomenclature committees, established by the International Association for Plant Taxonomy (in our case, the one for algae or the one for fossils). Modifications to the rulings and wordings of the *ICN*, as with previous *ICBN* editions, can only be decided upon at the plenary session of an International Botanical Congress, which is held every four years. Few nannoplankton workers have ever sat on a nomenclature committee. This means that, if we want to change a ruling or reject/conservate a name, we

must publish our proposal in a journal such as *Taxon*, and ask the relevant committee to consider it at the next Congress. There is no guarantee of success. This is emphasised by the case where a proposal submitted by Hay (1967) was rejected by the Committee for Algae (Silva, 1975). Although we could ignore this set of rules and do as we please, the result will ultimately be nomenclatural chaos.

It should be noted that there also have been some successes in the past. Notably, there was the conservation of Isochrysidaceae Bourrelly and the rejection of Ruttneraceae Geitler in the *ICBN* (see Nicolson, 1993a). In the *International Code of Zoological Nomenclature*, Braarud *et al.* (1964) proposed the conservation of Coccolithidae Poche (now written as Coccolithaceae Poche) and *Coccolithus* Schwarz, with *Coccosphaera pelagica* Wallich conserved over *C. oceanicus* Schwarz, and the suppression of the genera *Cyatholithus* Huxley and *Rhabdolithes* Schmidt, the latter in favour of *Rhabdosphaera*. This proposal was approved three years later (Evans & China, 1967).

Preamble 14. This edition of the *Code* supersedes all previous editions.

This means we should follow the most up-to-date *Code*, and not use older *Codes* for guidance. Hence, while most of the rules in the van Heck (1990-1996) papers are still relevant today, subtle changes to the wordings have occurred in subsequent *ICBN* editions, as well as some old rules having been replaced, and new rules having been introduced. At the time this article was written, the current *Code* is the *Melbourne Code* (McNeill *et al.*, 2012). For the first time, algae, fungi and plants were included in the title of the *Code*. Thus, there is no longer a current *International Code of Botanical Nomenclature (ICBN)*, rather the official name and abbreviation is the *International Code of Nomenclature for algae, fungi, and plants (ICN)*.

Principle I. The nomenclature of algae, fungi, and plants is independent of zoological and bacteriological nomenclature. This *Code* applies **equally** to names of taxonomic groups treated as algae, fungi, or plants, **whether or not these groups were originally so treated** (see Pre. 8).

Principle VI. The rules of nomenclature are retroactive unless expressly limited.

In the *Code*, some rules have time limitations, such as the use of Latin diagnoses. However, some changes can be made using the new *Code* that weren't possible before with older *Codes*, and I will deal with these problems later on.

2.2 Ranks

3.1. The principal ranks of taxa in descending sequence are: kingdom (regnum), division or phylum (divisio or phylum), class (classis), order (ordo), family (familia), genus (genus), and species (species). Thus, each species is assignable to a genus, each genus to a family, etc.

4.2. If a greater number of ranks of taxa is desired, the terms for these are made by adding the prefix “sub-” to the terms denoting the principal or secondary ranks. An organism may thus be assigned to taxa of the following ranks (in descending sequence): kingdom (regnum), subkingdom (subregnum), division or phylum (divisio or phylum), subdivision or subphylum (subdivisio or subphylum), class (classis), subclass (subclassis), order (ordo), suborder (subordo), family (familia), subfamily (subfamilia), tribe (tribus), subtribe (subtribus), genus (genus), subgenus (subgenus), section (sectio), subsection (subsectio), series (series), subseries (subseries), **species (species), subspecies (subspecies), variety (varietas), subvariety (subvarietas), form (forma), and subform (subforma).**

5.1. The relative order of the ranks specified in Art. 3 and 4 **must not be altered** (see Art. 37.6 and 37.9).

11.2. A name has no priority outside the rank in which it is published (but see Art. 53.4).

Article 4.2 outlines the order of the ranks, particularly those of subspecific taxa. Although many authors consider the ranks of subspecies, variety and form to be interchangeable, others consider that they have different meanings and priority in ranking order (see Hamilton & Reichard, 1992, for a discussion). This seemingly chaotic situation is not just restricted to higher plants, but is also evident in nannoplankton taxonomy. However, it could be minimised by adopting the following approach:

subspecies – for those that slightly differ at the genetic level (or with one life-cycle phase different from the type, but with a cryptic alternate phase)

variety – for those that are morphologically different (*i.e.* not part of the natural variation of the type variety), without evidence of life-cycle phases

form – for different phases of a life-cycle (*e.g.* haploid and diploid phases of the same species).

Subspecies and varieties may be separated in time and space, whereas forms are likely to be found in the same sample or samples in different seasons, but from the same locality. In the case of fossil coccoliths, variety would be the most appropriate choice, since life-cycle phases are rarely (if ever) known.

Although a species is the sum of all its subordinate taxa (see Art. 25.1, below), it is probably better if we do not create varieties that are significantly older than the type variety – to avoid something akin to the chicken and egg paradox. This becomes relevant when the prefix *prae-* is used to indicate a similar taxon occurring in older sediments (inferring it is ancestral), but where it is younger than some of the varieties of the species it resembles.

25.1. For nomenclatural purposes, **a species or any taxon below the rank of species is regarded as the sum of its subordinate taxa, if any.**

2.3 Type definitions

9.1. A holotype of a name of a species or infraspecific taxon is the one specimen or illustration (but see Art. 40.4) used by the author, or designated by the author as the nomenclatural type. As long as the holotype is extant, it fixes the application of the name concerned (but see Art. 9.15).

Art. 9, Note 1. Any designation made by the original author, if definitely expressed at the time of the original publication of the name of the taxon, is **final** (but see Art. 9.11 and 9.15)...

9.2. A lectotype is a specimen or illustration designated from the original material as the nomenclatural type, in conformity with Art. 9.11 and 9.12, **if no holotype was indicated at the time of publication, or if the holotype is missing, or if a type is found to belong to more than one taxon** (see also Art. 9.14). For sanctioned names, a lectotype may be selected from among elements associated with either or both the protologue and the sanctioning treatment (Art. 9.10).

9.12. In lectotype designation, an isotype must be chosen if such exists, or otherwise a syntype if such exists. **If no isotype, syntype or isosyntype (duplicate of syntype) is extant, the lectotype must be chosen from among the paratypes if such exist.** If no cited specimens exist, **the lectotype must be chosen from among the uncited specimens and cited and uncited illustrations that comprise the remaining original material, if such exist.**

9.4. An isotype is any duplicate of the holotype; it is always a specimen.

9.5. A syntype is any specimen cited in the protologue when there is no holotype, or any one of two or more specimens simultaneously designated in the protologue as types (see also Art. 40 Note 1). Reference to an entire gathering, or a part thereof, is considered citation of the included specimens.

9.6. A paratype is any specimen cited in the protologue that is neither the holotype nor an isotype, nor one of the syntypes if in the protologue two or more specimens were simultaneously designated as types.

9.7. A neotype is a specimen or illustration selected to serve as nomenclatural type if no original material is extant, or as long as it is missing (see also Art. 9.16).

9.11. If no holotype was indicated by the author of a name of a species or infraspecific taxon, or when the holotype or previously designated lectotype has been lost or destroyed, or when the material designated as type is found to belong to more than one taxon, a lectotype

or, if permissible (Art. 9.7), a neotype as a substitute for it may be designated.

9.13. If no original material is extant, or as long as it is missing, a neotype may be selected. **A lectotype always takes precedence over a neotype,** except as provided by Art. 9.16.

9.8. An epitype is a specimen or illustration selected to serve as an interpretative type when the holotype, lectotype, or previously designated neotype, or all original material associated with a validly published name, is demonstrably ambiguous and cannot be critically identified for purposes of the precise application of the name to a taxon. Designation of an epitype is not effected unless the holotype, lectotype, or neotype that the epitype supports is explicitly cited (see Art. 9.20).

In most modern papers, we designate a holotype when describing new taxa, but for those species that were named decades, or over a century, ago, the situation may be quite different. It is recommended that, when there is no holotype, scientists make every effort to locate the original material. It is easy to designate a neotype from recently collected material, rather than searching for old samples in museum collections, but it should be realised that the discovery of the original material or permanent slides could lead to the neotype being superseded. Of course, it is mandatory (since 1st January, 1990; see Art. 40.7) that original material (as well as holotypes, isotypes, *etc.*) be deposited in a recognised museum or herbarium. It is important to note that private collections held in university or company laboratories are unlikely to be maintained or curated after the retirement or death of the scientist.

8.1. The type (holotype, lectotype, or neotype) of a name of a species or infraspecific taxon is **either a single specimen conserved in one herbarium or other collection or institution, or an illustration*** (but see Art. 8.5; see also Art. 40.4 and 40.5). [*Here and elsewhere in this *Code*, the term “illustration” designates a work of art or a photograph depicting a feature or features of an organism, e.g. a picture of a herbarium specimen or a scanning electron micrograph.]

8.5. The type, epitypes (Art. 9.8) excepted, of the name of a fossil-taxon of the rank of species or below is **always a specimen** (see Art. 9.15). One whole specimen is to be considered as the nomenclatural type (see Rec. 8A.3).

Recommendation 8A.1. When a holotype, a lectotype, or a neotype is an illustration, **the specimen or specimens upon which that illustration is based should be used to help determine the application of the name** (see also Art. 9.15).

Recommendation 8A.2. When an illustration is designated as the type of a name under Art. 40.5, **the collection data of the illustrated material should be given** (see also Rec. 38D.2).

40.5. For the purpose of Art. 40, the type of a name of a new species or infraspecific taxon of microscopic algae or microfungi (fossils excepted: see Art. 8.5) **may be an effectively published illustration** if there are technical difficulties of preservation or if it is impossible to preserve a specimen that would show the features attributed to the taxon by the author of the name.

These days, it is often acceptable to use an image taken by the scanning electron microscope (SEM) as the holotype of a new living taxon, because SEM stubs and filter papers are not easy to conserve. However, SEM stubs and filter papers should still be conserved, if possible, and along with negatives or digital images, should be deposited in a recognisable institution (see Rec. 7A.1, below).

Recommendation 7A.1. It is strongly recommended that the material on which the name of a taxon is based, especially the holotype, be deposited in a public herbarium or other public collection with a policy of giving bona fide researchers access to deposited material, and that it be scrupulously conserved.

2.4 Higher taxa

Most of us probably don't worry about higher levels of taxonomy, but we know or assume that the haptophytes are monophyletic (*e.g.* see Hackett *et al.*, 2007). However, surprisingly, there are a lot of competing names out there – but which ones are right? Some of the early history was discussed by Green & Jordan (1994) and Silva *et al.* (2007), so I will only give a brief summary here with an update on the current status.

10.7. The principle of typification does not apply to names of taxa above the rank of family, except for names that are automatically typified by being based on generic names (see Art. 16), the type of which is the same as that of the generic name.

16.1. The name of a taxon above the rank of family is treated as a noun in the plural and is written with an initial capital letter. Such names may be either (a) **automatically typified names** (Art. 10.7), formed from the name of an included genus in the same way as family names (Art. 18.1, but see Art. 16.4) by adding the appropriate rank-denoting termination (Art. 16.3 and 17.1), preceded by the connecting vowel *-o-* if the termination begins with a consonant; or (b) **descriptive names**, not so formed, which may be used unchanged at different ranks.

These two articles state that typification is not essential above the rank of family. Thus, the division Haptophyta, which is a descriptive name not based on an existing genus, is valid and does not need to be replaced by a typified name like the Prymnesiophyta. Descriptive names, unlike typified names, remain unchanged when they change rank. For example, the Haptophyta has been used as a kingdom (Cavalier-Smith, 1978), infrakingdom (Cavalier-Smith,

1998), phylum (Whittaker & Margulis, 1978) and division (Hibberd, 1972). However, all were invalidly published, until Edvardsen *et al.* (2000) validated the Haptophyta as a division.

16.2. For automatically typified names, the name of the subdivision or subphylum that includes the type of the adopted name of a division or phylum, the name of the subclass that includes the type of the adopted name of a class, and the name of the suborder that includes the type of the adopted name of an order **are to be based on the same generic name...** as the corresponding higher-ranked name.

For example, since Hibberd (1976) had validated the class name Prymnesiophyceae (as the earlier name proposed by Casper, 1972 was invalid), Cavalier-Smith (1986) had to use the typified name based on the genus *Prymnesium* Massart when creating the subclass Prymnesiophycidae (orth. emend. of Prymnesidae by Jordan & Green, 1994). See also the rule on autonyms.

16.3. Automatically typified names end as follows: the name of a division or phylum ends in *-phyta...*; the name of a class in the algae ends in *-phyceae*, and of a subclass in *-phycidae...* **Automatically typified names not in accordance with these terminations... are to be corrected, without change of the author citation or date of publication...** However, if such names are published with a non-Latin termination they are not validly published.

18.4. When a name of a family has been published with an improper Latin termination, the termination must be changed to conform with Art. 18.1, **without change of the author citation or date** (see Art. 32.2). However, if such a name is published with a non-Latin termination, it is not validly published.

Over the years, a number of higher taxa have been described using non-Latin terminations. As stated above (and for a subfamily – Art. 19.7), these would be deemed invalid at the time of publication. While other taxa were introduced using the termination for the wrong rank, these can be validated later on, using the correct ending. However, when orthographically emending the endings, no change to date or author is needed.

Hence, when Haeckel (1894) proposed the families Coccospaeralen and Rhabdosphaeralen using German terminations, they were both invalid. Equally, when Conrad (1926) introduced the Prymnésiaceés, with French spelling, it was invalid. Ostenfeld (1899) incorrectly utilised the Latin ending for an order when he proposed his family Rhabdosphaerales. The latter was validated by Lemmermann (1908) when he created the Rhabdosphaeraaceae, and it should be written as Rhabdosphaeraaceae Ostenfeld, 1899. Schmidt (1931) described the Prymnesiaceae with the Latin ending, so this family should be written as Prymnesiaceae Schmidt, 1931, not as Prymne-

siaceae Conrad (see Example 10 of Art. 18.4).

Haeckel (1889) erected the order Calcocyteae to include discoliths and cyatholiths (= placoliths). Later, he confusingly called the Calcocyteae a class and gave an alternative name to the class, Coccospaerales (Haeckel, 1894). All of them have the wrong endings for the rank they were intended for; they should have been written as the order Calcocytales, the class Calcocytophyceae and the class Coccolithophorophyceae. The latter would be illegitimate because it is based on the illegitimate genus *Coccolithophora*, while the Calcocyteae had dropped out of use by the end of the 19th Century. The Calcocyteae would become valid if the correct ending was applied to it – although it would be a junior synonym (in part) of a number of earlier validated taxa.

16.4 Note 2. The principle of priority does not apply above the rank of family (Art. 11.10; but see Rec. 16A).

Recommendation 16A.1. In choosing among typified names for a taxon above the rank of family, authors should generally follow the principle of priority.

18.3. A name of a family based on an illegitimate generic name is illegitimate unless and until it or the generic name upon which it is based is conserved.

When Lohmann (1902) described *Coccolithophora*, he included the valid genus *Coccolithus* as a synonym, thus making the former superfluous, but also illegitimate. Thus, his family Coccolithophoridae (= Coccolithophoraceae in botanical nomenclature) and subfamily Coccolithophorineae (= Coccolithophoroideae) were also illegitimate, while his subfamily Syracosphaerinae (= Syracosphaeroideae) is valid. Lemmermann (1908) elevated them to the orders Syracosphaerales and Coccolithophorales, although for the same reasons as above, the latter is illegitimate.

38.1. In order to be validly published, a name of a new taxon (see Art. 6.9) must (a) be accompanied by a description or diagnosis of the taxon or, if none is provided in the protologue, by a reference to a previously and effectively published description or diagnosis (except as provided in Art. 38.7, 38.8, and H.9; see also Art. 14.9 and 14.15); and (b) comply with the relevant provisions of Art. 32–45.

Rothmaler (1951) proposed the class Coccolithophyceae but did not provide a description. Silva *et al.* (2007) assumed that the earlier description of the Coccolithophoraceae by Lohmann (1902) could be used as a reference. Of course, the latter is considered an illegitimate family (see above), so it is debatable whether it validates the former, which is at a different rank.

39.1. In order to be validly published, a name of a new taxon (algae and fossils excepted) published between 1 January 1935 and 31 Decem-

ber 2011, inclusive, must be accompanied by a Latin description or diagnosis or by a reference (see Art. 38.13) to a previously and effectively published Latin description or diagnosis (but see Art. H.9; for fossils see Art. 43.1; for algae see Art. 44.1).

39.2. In order to be validly published, a name of a new taxon published on or after 1 January 2012 must be accompanied by a Latin or English description or diagnosis or by a reference (see Art. 38.13) to a previously and effectively published Latin or English description or diagnosis (for fossils see also Art. 43.1).

43.1. In order to be validly published, a name of a new fossil-taxon published on or after 1 January 1996 must be accompanied by a Latin or English description or diagnosis or by a reference (see Art. 38.13) to a previously and effectively published Latin or English description or diagnosis.

Note 1. As Art. 39.1 does not apply to names of fossil-taxa, a validating description or diagnosis (see Art. 38) in any language is acceptable for them prior to 1996.

44.1. In order to be validly published, a name of a new taxon of non-fossil algae published between 1 January 1958 and 31 December 2011, inclusive, must be accompanied by a Latin description or diagnosis or by a reference (see Art. 38.13) to a previously and effectively published Latin description or diagnosis.

Note 1. As Art. 39.1 does not apply to names of algal taxa, a validating description or diagnosis (see Art. 38) in any language is acceptable for them prior to 1958.

Article 39.2 means that, from 2012, Latin descriptions are no longer mandatory for new algal taxa. However, Article 44.1 states that algal descriptions written between 1958–2011 must be written in Latin, but those of fossil-taxa written on or after 1 January 1996 must be in Latin or English (before 1958 for algae, and before 1996 for fossils, any language could be used). Thus, validation of the Haptophyceae by Silva (1980) was needed, because Christensen (1962) supplied only a Danish description.

The subclass Calcihaptophycidae was described in Latin by de Vargas *et al.* (2007) and has since continued in sporadic use (*e.g.* Frada *et al.*, 2010; Liu *et al.*, 2010). It was erected to include the four modern orders (Isochrysidales, Syracosphaerales, Zygodiscales and Coccolithales), as well as all the extinct orders that either have a calcified stage in their life-cycle or belong in the same group as those that do. The phylogenetic tree of Edvardsen & Medlin (2007) placed *Chrysochromulina parkeae* Green & Leadbeater in the Isochrysidaceae. However, new data suggest that the alternate life-cycle phase of *C. parkeae* is *Braarudosphaera bigelowii* (Gran & Braarud) Deflandre, with both appearing close to *Prymnesium* Massart and *Haptolina* Edvardsen & Eikrem in clade B1 (Thomp-

son *et al.*, 2012). If the latter is correct, then a calcifying haptophyte would lie outside the Calcihaptophycidae, and thus, the Calcihaptophycidae would seem to be superfluous, since the older subclass name Prymnesiophycidae Cavalier-Smith encompasses all haptophytes, apart from those included in the Pavlovophycidae Cavalier-Smith (see Jordan & Green, 1994 for orthographic emendations), and therefore has priority.

2.5 Fossil genera

1.2. A taxon (diatom taxa excepted) the name of which is based on a fossil type is a fossil-taxon. A fossil-taxon comprises the remains of one or more parts of the parent organism, or one or more of their life history stages, in one or more preservational states, as indicated in the original or any subsequent description or diagnosis of the taxon (see also Art. 11.1 and 13.3).

13.3. For nomenclatural purposes, a name is treated as pertaining to a non-fossil taxon unless its type is fossil in origin (Art. 1.2). Fossil material is distinguished from non-fossil material by stratigraphic relations at the site of original occurrence. In cases of doubtful stratigraphic relations, and for all diatoms, provisions for non-fossil taxa apply.

11.7. For purposes of priority, names of fossil-taxa (diatom taxa excepted) compete only with names based on a fossil type.

11.8. Names of organisms (diatoms excepted) based on a non-fossil type are treated as having priority over names of the same rank based on a fossil type.

Article 11.8 is particularly relevant to INA, because at least four genera with fossil types and living representatives are presently affected: the nanoplankton genera *Cruciplacolithus* Hay & Mohler and *Reticulofenestra* Hay *et al.*, and the silicoflagellate genera *Dictyocha* Ehrenberg and *Stephanocha* McCartney & Jordan. Of course, this only becomes a problem when a new genus is created for the living representatives (*i.e.* with a non-fossil type) and then the two genera are later synonymised. Since the genus with the non-fossil type takes priority over the one with a fossil type, the latter would have to be conserved to prevent all the species in it from being transferred to the new genus. Another possibility is to emend the ICN article so that it lists nanoplankton and silicoflagellates alongside diatoms as exceptions. However, conservation and/or emendation of an article would require writing a proposal to a journal like *Taxon* and receiving favourable decisions by the relevant committees at the next International Botanical Congress. However, a decision could take four years, although still with the possibility of rejection.

It should be noted that Aubry & Bord (2009) have already described *Stauronertha* as a new genus for *Cruciplacolithus neohelis* (McIntyre & Bé) Reinhardt. So the above scenario is one step nearer. Potentially, anyone syn-

onymising *Stauronertha* and *Cruciplacolithus* could transfer all *Cruciplacolithus* species to *Stauronertha*. Such a transfer would be valid under Art. 11.8.

Crenalithus Roth is often cited as a junior synonym of *Reticulofenestra*, with most *Crenalithus* taxa transferred to *Reticulofenestra*. However, the type species of *Crenalithus* is *C. daronicoides* (Black & Barnes) Roth, a species described from South Atlantic surface-sediments, and presumed to be a proximal shield of *Gephyrocapsa oceanica* Kamptner. Despite this, it should be noted that *Crenalithus* remains a validly published genus. So, if *C. daronicoides* is considered to be extant and a separate species from *G. oceanica*, the transfer of *Reticulofenestra* taxa to *Crenalithus* would be valid, given the ruling in Art. 11.8.

Recently, Hagino *et al.* (2015) rediscovered the living species *Tergestiella adriatica* Kamptner (the type species of the genus) and showed that it is almost identical, morphologically, to fossil species of the genus *Cyclagelosphaera* Noël. They further noted that the two genera should be considered synonyms, with *Tergestiella* having priority over *Cyclagelosphaera*. This opens the door to the transfer of all *Cyclagelosphaera* taxa to *Tergestiella*. While this example does not invoke Art. 11.8, it does suggest that future discoveries of 'living fossils' may need to do so.

2.6 Homonyms

53.1. A name of a family, genus, or species, unless conserved (Art. 14) or sanctioned (Art. 15), is illegitimate if it is a later homonym, that is, if it is spelled exactly like a name based on a different type that was previously and validly published for a taxon of the same rank (see also Art. 53.2 and 53.4).

Art. 53 Note 1. A validly published earlier homonym, even if illegitimate or otherwise generally treated as a synonym, causes rejection of any later homonym that is not conserved or sanctioned (but see Art. 53.2).

The silicoflagellate genus *Distephanus* Stöhr is a junior homonym of a plant genus *Distephanus* Cassini, and so must be treated as illegitimate. Jordan & McCartney (2015) proposed *Stephanocha* as a replacement name for the former name.

53.3. When two or more names of genera or species based on different types are so similar that they are likely to be confused (because they are applied to related taxa or for any other reason) they are to be treated as homonyms (see also Art. 61.5). If established practice has been to treat two similar names as homonyms, this practice is to be continued if it is in the interest of nomenclatural stability.

Art. 53 Ex.10. *Acanthoica* Lohmann (1902) and *Acanthoeca* W.N. Ellis (1930) both designating flagellates, are sufficiently alike to be considered homonyms (Taxon 22: 313. 1973).

Parkinson (1986) proposed that Ex.10 should be treated as a parahomonym, but this was not accepted by the committee, who voted unanimously to uphold the previous decision, that the two generic names are so similar as to cause confusion (Nicolson, 1993a). Given the example above, one could consider the genera *Calyptrolithina* Heimdal and *Calyptrolithophora* Heimdal or *Calyptrorphaera* Lohmann and *Sphaerocalyptra* Deflandre as sufficiently similar to be treated as homonyms. However, we have never treated them as such, so in the interest of nomenclatural stability, we should continue to retain them. Luckily, in the case of Art. 53 Ex. 10 (see above), the nanoplankton genus had priority, but we may not be so lucky next time. So, we should be careful to avoid creating similar names in the future.

Art. 24 Note 2. Names of infraspecific taxa within the same species, even if they differ in rank, are homonyms if they have the same final epithet but are based on different types (Art. 53.4), the rank-denoting term not being part of the name.

53.4. The names of two subdivisions of the same genus, or of two infraspecific taxa within the same species, even if they are of different rank, **are homonyms if they are not based on the same type and have the same final epithet**, or are treated as homonyms if they have a confusingly similar final epithet. **The later name is illegitimate.**

The silicoflagellates *Distephanus crux* (Ehrenberg) Haeckel f. *crux* and *Distephanus crux* var. *bispinosus* Dumitrică f. *crux* Locker & Martini (now in *Distephanopsis* Dumitrică, so not transferred to *Stephanocha*) belong to the same species, but the two forms have different type specimens. However, they have the same final epithet and the same rank and so the latter is a homonym of the former.

2.7 Autonyms

6.8. Autonyms are such names as can be **established automatically** under Art. 22.3 and 26.3, **whether or not they actually appear in the publication** in which they are created (see Art. 32.3, Rec. 22B.1 and 26B.1).

7.6. **The type of an autonym is the same as that of the name from which it is derived.**

32.3. Autonyms (Art. 6.8) are accepted as **validly published names, dating from the publication in which they were established** (see Art. 22.3 and 26.3), whether or not they actually appear in that publication.

22.3. **The first instance of valid publication of a name of a subdivision** of a genus under a legitimate generic name **automatically establishes the corresponding autonym** (see also Art. 11.6 and 32.3).

11.6. **An autonym is treated as having priority over the name or names of the same date and rank that established it.**

Recommendation 22B.1. When publishing a name of a subdivision of a genus that will also establish an autonym, **the author should mention this autonym in the publication.**

26.1. **The name of any infraspecific taxon that includes the type of the adopted, legitimate name of the species to which it is assigned is to repeat the specific epithet unaltered as its final epithet, not followed by an author citation** (see Art. 46). Such names are autonyms (Art. 6.8; see also Art. 7.6).

In general, autonyms automatically occur when creating new subspecific taxa (if they do not exist already); however, creating new subdivisions of genera will also produce autonyms. It is recommended that autonyms are mentioned in the paper at this time. It should be remembered that an autonym does not bear an authority or date. Hence, *Emiliana huxleyi* var. *huxleyi* is written as *Emiliana huxleyi* (Lohmann) Hay & Mohler var. *huxleyi*. No mention is made of the first time or by whom a second variety was added to *E. huxleyi*. Surprisingly, there are many published examples of authorities incorrectly being added to autonyms.

2.8 Replacement names

6.11. A replacement name (avowed substitute, nomen novum, nom. nov.) is a new name based on a legitimate or illegitimate, previously published name, which is its replaced synonym. The replaced synonym, when legitimate, does not provide the final epithet, name, or stem of the replacement name (see also Art. 58.1).

7.4. A replacement name (Art. 6.11) is **typified by the type of the replaced synonym** even though it may have been applied erroneously to a taxon now considered not to include that type (but see Art. 41 Note 3 and 48.1).

When Jordan & McCartney (2015) replaced the illegitimate silicoflagellate genus *Distephanus* with *Stephanocha*, they had to use the type species of the former (*i.e.* *D. rotundus* Stöhr) as the type of the replacement genus, even though *D. rotundus* is considered to be a synonym of *D. speculum* (Ehrenberg) Haeckel and based on a double skeleton.

2.9 Effective publication

29.1. Publication is effected, under this *Code*, by **distribution of printed matter** (through sale, exchange, or gift) **to the general public or at least to scientific institutions with generally accessible libraries.** Publication is also effected by distribution on or after 1 January 2012 of electronic material in Portable Document

Format (PDF; see also Art. 29.3 and Rec. 29A.1) **in an online publication with an International Standard Serial Number (ISSN) or an International Standard Book Number (ISBN).**

Art. 29 Note 1. The distribution before 1 January 2012 of electronic material does not constitute effective publication.

29.2. For the purpose of Art. 29.1, “online” is defined as accessible electronically via the World Wide Web.

29.3. Should Portable Document Format (PDF) be succeeded, a successor international standard format communicated by the General Committee (see Div. III) is acceptable.

Recommendation 29A.1. Publication electronically in Portable Document Format (PDF) **should comply with the PDF/A archival standard** (ISO 19005).

Rec. 29A.2. Authors of electronic material should give preference to publications that are archived and curated, satisfying the following criteria as far as is practical (see also Rec. 29A.1):

(a) The material **should be placed in multiple trusted online digital repositories**, e.g. an ISO-certified repository.

(b) Digital repositories **should be in more than one area of the world and preferably on different continents.**

(c) **Deposition of printed copies in libraries in more than one area of the world and preferably on different continents is also advisable** (but see Rec. 30A.2).

30.3. The content of a particular electronic publication **must not be altered after it is effectively published.** Any such alterations are not themselves effectively published. Corrections or revisions must be issued separately to be effectively published.

30.8. Publication on or after 1 January 1953 of an independent non-serial work stated to be a thesis submitted to a university or other institute of education for the purpose of obtaining a degree **does not constitute effective publication unless the work includes an explicit statement** (referring to the requirements of the *Code* for effective publication) **or other internal evidence that it is regarded as an effective publication by its author or publisher.**

Recommendation 30A.3. To aid availability through time and place, authors publishing nomenclatural novelties should give preference to periodicals that regularly publish taxonomic articles, or else they should send a copy of a publication (printed or electronic) to an indexing centre appropriate to the taxonomic group. When such publications exist only as printed matter, they **should be deposited in at least ten, but preferably more, generally accessible libraries**

throughout the world.

Rec. 30A.4. Authors and editors are encouraged to mention nomenclatural novelties in the summary or abstract, or list them in an index in the publication.

31.1. The date of effective publication is **the date on which the printed matter or electronic material became available** as defined in Art. 29 and 30. In the absence of proof establishing some other date, the one appearing in the printed matter or electronic material must be accepted as correct.

Recommendation 31A.1. The **date on which the publisher or publisher’s agent delivers printed matter to one of the usual carriers for distribution to the public should be accepted** as its date of effective publication.

These new Articles explain the changes to what constitutes effective publication, with electronic publications in PDF being acceptable for the first time (effective from 2012, but not before). This major change reflects the growth in online journals, and the policy of many journals of publishing papers online before printing and distributing hard copies.

2.10 Validation of publication

35.1. A name of a taxon below the rank of genus is **not validly published unless the name of the genus or species to which it is assigned is validly published at the same time or was validly published previously** (but see Art. 13.4).

36.1. A name is not validly published (a) when it is **not accepted by the author in the original publication**; (b) when it is merely proposed in anticipation of the future acceptance of the taxon concerned, or of a particular circumscription, position, or rank of the taxon (so-called provisional name); (c) when it is merely cited as a synonym; or (d) by the mere mention of the subordinate taxa included in the taxon concerned. **Art. 36.1(a) does not apply to names published with a question mark or other indication of taxonomic doubt, yet accepted by their author.**

37.1. A name published on or after 1 January 1953 **without a clear indication of the rank of the taxon concerned is not validly published.**

37.3. A name published before 1 January 1953 **without a clear indication of its rank is validly published provided that all other requirements for valid publication are fulfilled; it is, however, inoperative in questions of priority except for homonymy** (see Art. 53.4). If it is the name of a new taxon, it may serve as a basionym or replaced synonym for subsequent new combinations, names at new ranks, or replacement names in definite ranks.

In a number of papers, particularly those in Deep Sea Drilling Project and Ocean Drilling Program volumes, the names of subspecific taxa have been described without giving an indication of the rank. These names are invalidly published. Effective publication can be made by re-describing the taxon with the rank indicated. The authority and publication date should be accredited to the paper in which effective validation was achieved, not the one in which the rank was omitted.

38.8. The name of a new species or infraspecific taxon published before 1 January 1908 may be validly published even if only accompanied by an illustration with analysis (see Art. 38.9 and 38.10).

39.2. In order to be validly published, a name of a new taxon published on or after 1 January 2012 must be accompanied by a Latin or English description or diagnosis or by a reference (see Art. 38.13) to a previously and effectively published Latin or English description or diagnosis (for fossils see also Art. 43.1).

40.1. Publication on or after 1 January 1958 of the name of a new taxon of the rank of genus or below is **valid only when the type of the name is indicated** (see Art. 7–10; but see Art. H.9 Note 1 for the names of certain hybrids).

40.4. For the purpose of Art. 40, the type of a name of a new species or infraspecific taxon (fossils excepted: see Art. 8.5) **may be an illustration** prior to 1 January 2007; on or after that date, the type must be a specimen (except as provided in Art. 40.5).

40.5. For the purpose of Art. 40, the type of a name of a new species or infraspecific taxon of microscopic algae or microfungi (fossils excepted: see Art. 8.5) **may be an effectively published illustration if there are technical difficulties of preservation or if it is impossible to preserve a specimen** that would show the features attributed to the taxon by the author of the name.

40.7. For the name of a new species or infraspecific taxon published on or after 1 January 1990 of which the type is a specimen or unpublished illustration, the single herbarium or collection or institution in which the type is conserved must be specified (see also Rec. 40A.3 and 40A.4).

Recommendation 40A.3. Specification of the herbarium or collection or institution of deposition (see Art. 40 Note 4) should be followed by any available number permanently identifying the holotype specimen (see also Rec. 9D.1).

Rec. 40A.4. Citation of the herbarium or collection or institution of deposition should use one of the standards mentioned in Art. 40 Note 4.

Although Loeblich & Tappan (1966) considered *Discolithus* Huxley and *Cyatholithus* Huxley (Huxley, 1868)

to be valid, Huxley thought they were not organisms and, thus, they must be treated as invalid. One could cite Art. 36.1 for this, although there does not seem to be a rule for this exact situation. In reality, the genera were not intended as algal, fungal or plant names, so they are not covered by the rules in the *ICN* and are, thus, invalid in botanical nomenclature.

41.1. In order to be validly published, a new combination, name at new rank, or replacement name (see Art. 6.10 and 6.11), **must be accompanied by a reference to the basionym or replaced synonym.**

41.3. Before 1 January 1953 an indirect reference (see Art. 38.14) to a basionym or replaced synonym **is sufficient for valid publication** of a new combination, name at new rank, or replacement name. Thus, errors in the citation of the basionym or replaced synonym, or in author citation (Art. 46), do not affect valid publication of such names.

41.4. If, for a name of a genus or taxon of lower rank published before 1 January 1953, no reference to a basionym is given but the conditions for its valid publication as the name of a new taxon or replacement name are fulfilled, that name is nevertheless treated as a new combination or name at new rank when this was the author's presumed intent and a potential basionym (Art. 6.10) applying to the same taxon exists.

41.5. On or after 1 January 1953, a new combination, name at new rank, or replacement name is not validly published unless its basionym or replaced synonym is clearly indicated and **a full and direct reference given to its author and place of publication, with page or plate reference and date** (but see Art. 41.6 and 41.8). On or after 1 January 2007, a new combination, name at new rank, or replacement name is not validly published unless its basionym or replaced synonym is cited.

41.6. For names published on or after 1 January 1953, **errors in the citation of the basionym or replaced synonym, including incorrect author citation (Art. 46), but not omissions (Art. 41.5) do not preclude valid publication** of a new combination, name at new rank, or replacement name.

In many papers, when describing new combinations or taxa at new ranks, a fully cited basionym is often missing, which invalidates the transfer or promotion/demotion to a new rank. These changes can be subsequently validated by providing a full citation to the basionym or replaced synonym. When Dumitrică (1978) described his new silicoflagellate genus *Distephanopsis*, and included a number of new combinations, the basionyms of the type species and another taxon were missing. Validation of these transfers was carried out by Desikachary & Prema (1996). Remember, errors in the basionym citation do not effect valida-

tion and can be corrected later on, without change to the authority and date. However, omission of the basionym results in invalidation, thus subsequent validation of the taxon should be accredited to the later authority, using the date of the later publication.

2.11 Citations

Art. 46 Note 1. When authorship of a name differs from authorship of the publication in which it was validly published, both are sometimes cited, connected by the word “in”. In such a case, “in” and what follows are part of a bibliographic citation and are better omitted unless the place of publication is being cited.

Thus, for example, *Sphenolithus abies* Deflandre is preferred, but *Sphenolithus abies* Deflandre in Deflandre & Fert, 1954 is also acceptable, as long as Deflandre & Fert (1954) is cited in the references. But it cannot be cited as *Sphenolithus abies* Deflandre, 1954.

Art. 46 Note 3. A name or its validating description or diagnosis is treated as though ascribed to the author(s) of the publication (as defined in Art. 46.6) when there is no ascription to or unequivocal association with a different author or different authors.

46.5. A name of a new taxon is attributed to the author(s) of the publication in which it appears when the name was ascribed to a different author or different authors but the validating description or diagnosis was neither ascribed to nor unequivocally associated with that author or those authors. A new combination, name at new rank, or replacement name is attributed to the author(s) of the publication in which it appears, although it was ascribed to a different author or different authors, when no separate statement was made that one or more of those authors contributed in some way to that publication. **However, in both cases authorship as ascribed, followed by “ex”, may be inserted before the name(s) of the publishing author(s).**

46.10. Authors publishing nomenclatural novelties and wishing other persons’ names followed by “ex” to precede theirs in authorship citation may adopt the “ex” citation in the protologue.

Recommendation 46C.1. After a name published jointly by two authors, both authors should be cited, linked by the word “et” or by an ampersand (&).

Thus, the word ‘and’ is not recommended when a name is jointly published by two authors.

Recommendation 46C.2. After a name published jointly by more than two authors, the citation should be restricted to the first author followed by “et al.” or “& al.”, except in the original publication.

Recommendation 46D.1. Authors should cite themselves by name after each nomenclatural novelty they publish rather than refer to themselves by expressions such as “nobis” (nob.) or “mihi” (m.).

Most of these are common sense and are being followed by the majority of authors, however, note that it is recommended that all authors are cited after a new name in the original publication, but in subsequent publications it should be simplified to ‘et al.’ or ‘& al.’. If no authorities are included after the new taxon, then the authorities are the same as the authorship of the publication, and in the same order; if you wish to change the order or name(s) of the authority, then it must be indicated after the new taxon’s name. In the 19th Century, it was usual to add ‘nobis’ or ‘mihi’ after new taxa, but no one does this any more. It should be remembered that the use of ‘ex’ is not mandatory, and thus the preceding author does not need to be cited if deemed unnecessary. For instance, the authority for the Prymnesiaceae can be cited as Conrad *ex* Schmidt or merely Schmidt, depending on whether the contribution made by Conrad is deemed worthy or not. According to Art. 18.4, Conrad’s family name in French is invalid.

2.12 Naming your new taxon

20.2. The name of a genus may not coincide with a Latin technical term in use in morphology at the time of publication unless it was published before 1 January 1912 and was accompanied by a species name published in accordance with the binary system of Linnaeus.

20.3. The name of a genus may not consist of two words, unless these words are joined by a hyphen.

21.3. The epithet in the name of a subdivision of a genus is not to be formed from the name of the genus to which it belongs by adding the prefix *Eu-* (see also Art. 22.2).

Since *Eu-discoaster* Tan was described as a genus, it does not conflict with the above article. However, it cannot be used as a subgenus of the genus *Discoaster* Tan. Note that the genus should be written as *Eudiscoaster* to conform with Art. 60.9.

60.4. The letters w and y, foreign to classical Latin, and k, rare in that language, are permissible in scientific names (see Art. 32.1(b)). Other letters and ligatures foreign to classical Latin that may appear in scientific names, such as the German ß (double s), are to be transcribed.

60.6. Diacritical signs are not used in scientific names. When names (either new or old) are drawn from words in which such signs appear, the signs are to be suppressed with the necessary transcription of the letters so modified; for example ä, ö, ü become, respectively, ae, oe,

ue; *é*, *è*, *ê* become *e*; *ñ* becomes *n*; *ø* becomes *oe*; *å* becomes *ao*. **The diaeresis, indicating that a vowel is to be pronounced separately from the preceding vowel (as in *Cephaëlis*, *Isoëtes*), is a phonetic device that is not considered to alter the spelling; as such, its use is optional.** The ligatures *-æ-* and *-œ-*, indicating that the letters are pronounced together, are to be replaced by the separate letters *-ae-* and *-oe-*.

In nannoplankton nomenclature, there are only a few examples of transcription, such as in *Gephyrocapsa muelerae* Bréhéret (after Carla Müller). When Jerkovič (1970) described the genus *Noëlaerhabdus* and the family Noëlaerhabdaceae (after Denise Noël), the diaeresis (ë) was used in the name. Although its use is optional, it is perhaps better to exclude it, and use the plain forms *Noelaerhabdus* and *Noelaerhabdaceae*. In that way, it is not mistaken for an umlaut, which is not allowed in an epithet of a taxon, and must be transcribed.

60.8. Adjectival epithets that combine elements derived from two or more Greek or Latin words but are not formed in accordance with Rec. 60G.1(a) **are to be corrected** to conform with it, unless Rec. 60G.1(b) or (c) applies. In particular, the use, in pseudocompounding, of the genitive singular of Latin first-declension nouns (Rec. 60G.1(c)) instead of a regular compound (Rec. 60G.1(a)) is treated as an error to be corrected unless it serves to make an etymological distinction.

60.9. The use of a hyphen in a compound epithet is treated as an error to be corrected by deletion of the hyphen. **A hyphen is permitted only when the epithet is formed of words that usually stand independently, or when the letters before and after the hyphen are the same** (see also Art. 23.1 and 23.3).

The specific epithet of *Cylindralithus? van-nieliae* Burnett, named after Brigitta van Niel, is allowed because the two letters before and after the hyphen are the same. Equally, *Ceratolithoides self-trailiae* Burnett is permitted because the two words separated by the hyphen stand independently in the surname of Jean Self-Trail, who is honoured in this epithet. The same could be said of *Lithraphidites moray-firthensis* Jakubowski and the two words of the geographic location (Moray Firth) they honour. However, the hyphens in the generic names *Eu-discoaster* Tan, *Helio-discoaster* Tan and *Hemi-discoaster* Tan should be removed (as done in various publications), without change to the authority and date.

60.10. The use of an apostrophe in an epithet is treated as an error to be corrected by deletion of the apostrophe. The use of a full stop (period) in an epithet that is derived from a personal or geographical name that contains this full stop is treated as an error to be corrected by deletion of the full stop.

Rec. 60B.1. When a new generic name, or epithet in a new name of a subdivision of a genus, is taken from the name of a person, it should be formed as follows (see Rec. 20A.1(i)):

(a) **When the name of the person ends with a vowel, the letter -a is added** (thus *Ottoa* after Otto; *Sloanea* after Sloane), **except when the name ends with -a, when -ea is added** (e.g. *Collaea* after Colla), **or with -ea** (as *Correa*), **when no letter is added.**

(b) **When the name of the person ends with a consonant, the letters -ia are added, but when the name ends with -er, either of the terminations -ia and -a is appropriate** (e.g. *Sesleria* after Sesler and *Kerneria* after Kerner).

(c) **In latinized personal names ending with -us this termination is dropped before applying the procedure described under (a) and (b)** (e.g. *Dillenia* after Dillenius).

Hence, *Emiliana* Hay & Mohler was named after Cesar Emiliani and *Gaarderia* Kleijne was named after Karen Gaarder. It should be noted that words ending in *-a* are supposed to use the termination *-ea*, as in *Gorkaea* Varol & Girgis (after Hanna Górká). However, leaving generic names unchanged is unusual, but permissible under Art. 20.1 (see below). In nannoplankton taxonomy, there is one such case, *Rebecca* J.C. Green (named after his daughter). Since Rebecca is from Hebrew, and the spelling in Latin is unchanged, using Rebecca as a genus is not incorrect, despite conflicting with Rec. 60B.1(a). After all, it is merely a recommendation, not a rule.

The following suffixes are commonly used for generic and specific epithets:

-ensis (e.g. *adenensis*, *brasiliensis*), *-(a)nus*, *-inus* or *-icus* (e.g. *adriaticus*, *caribbeanica*, *japonica*) used in combination with place names means ‘originating in’ or ‘typical of’ or ‘characteristic of’ (see Rec. 60D).

-ius means ‘characteristic of’ or ‘connected with’. However, when used in combination with a person’s name, as in *Prinsius* Hay & Mohler (after Ben Prins) or *Toweius* Hay & Mohler (after Kenneth Towe), it is contrary to Rec. 20A.1(i), which recommends a feminine form for all generic names commemorating people (regardless of whether they are male or female) and so, under Rec. 60B.1(b), the examples above would be *Prinsia* and *Toweia*. But these are only recommendations and so *Prinsius* and *Toweius* are not to be rejected merely because they are contrary to *Code* recommendations.

-fer, *-fera*, *-ferus* (e.g. *cancellifer*, *papillifera*, *ponticuliferus*), *-phora* (e.g. *Periphyllophora* Kamptner), or *-ocha* (e.g. *Dictyocha*, *Stephanocha*) means ‘to carry’ or ‘bear’.

-opsis (e.g. *calceolariopsis*) means ‘resembling’. However, this suffix has been attached to personal names in disregard of its classical meaning (see David, 2003).

-ella (e.g. *Quaternariella* Thomsen) means ‘small’ or

'diminutive'. However, for a long time now, authors have attached the suffix to personal names in disregard of its classical meaning (see Steyskal, 1970).

Occasionally, some odd combinations have been published, which commemorate people, such as *Gleserocha* McCartney *et al.*, which would literally mean 'carrying Dr. Gleser', or *Perchnielsenella* Watkins, which would mean 'a small Katharina Perch-Nielsen'. In fact, many genera in various algal groups have been erected using the suffix *-ella* in combination with personal names. If another genus name already existed that commemorated the same person, then using *-iella* or *-ella* for the second genus, as a diminutive form of the other genus, would be appropriate. However, using this suffix merely to honour a person is not to be recommended. But such names are not to be rejected because of this incorrect usage.

20.1. The name of a genus is a noun in the nominative singular, or a word treated as such, and is written with an initial capital letter (see Art. 60.2). It may be taken from any source whatever, and may even be composed in an absolutely arbitrary manner, but it must not end in *-virus*.

Recommendation 20A.1. Authors forming generic names should comply with the following:

- (a) **Use Latin terminations** insofar as possible.
- (b) **Avoid names not readily adaptable to the Latin language.**
- (c) **Not make names that are very long or difficult to pronounce in Latin.**
- (d) **Not make names by combining words from different languages.**
- (e) Indicate, if possible, by the formation or ending of the name the affinities or analogies of the genus.
- (f) Avoid adjectives used as nouns.
- (g) **Not use a name similar to or derived from the epithet in the name of one of the species of the genus.**
- (h) **Not dedicate genera to persons quite unconnected with botany, mycology, phyecology, or natural science in general.**
- (i) Give a feminine form to all personal generic names, whether they commemorate a man or a woman (see Rec. 60B; see also Rec. 62A.1).
- (j) Not form generic names by combining parts of two existing generic names, because such names are likely to be confused with nothogeneric names (see Art. H.6).

Recommendation 23A.3. In forming specific epithets, authors should comply also with the following:...

- (d) Avoid those formed of two or more hyphenated words.
- (e) Avoid those that have the same meaning as the generic name (pleonasm).
- (f) Avoid those that express a character common to all or nearly all the species of a genus.
- (g) Avoid in the same genus those that are very much alike, especially those which dif-

fer only in their last letters or in the arrangement of two letters.

(h) Avoid those that have been used before in any closely allied genus.

(i) Not adopt epithets from unpublished names found in correspondence, travellers' notes, herbarium labels, or similar sources, attributing them to their authors, unless these authors have approved publication (see Rec. 50G).

(j) Avoid using the names of little-known or very restricted localities unless the species is quite local.

The holococcolithophore *Poritectolithus poritectum* (Heimdal) Kleijne, following its transfer from *Helladosphaera* Kamptner, would now appear to conflict with Rec. 23A.3(e), since the generic and specific epithets have almost identical meanings.

While these are merely recommendations, they do serve as a general guide for giving new taxa sensible names. However, some are rather vague. For instance, Rec. 23A.3(j) does not provide any examples of how small is small. So does Disko Bay in Greenland (used in the name *Trigonaspis diskoensis* Thomsen) constitute a very restricted locality and is it little-known?

3. Conclusions

The new rulings of the *ICN* (McNeill *et al.*, 2012) affect nannoplankton and silicoflagellate nomenclature. In particular, the priority of non-fossil (= extant) types over fossil-types (Art. 11.8) will cause some problems in the future, especially if more 'living fossils' are found and given new generic names. On the other hand, and to the relief of many taxonomists, the newly introduced Art. 39.2 allows, for the first time, the use of English (instead of Latin) in the descriptions of new non-fossil taxa. Also, with the rise in online journals, effective publication can now be achieved by electronic material in PDF (Art. 29.1).

Thus, it is essential that we collaborate with nomenclature committee members to ensure that existing articles and recommendations can be emended, and names conserved or rejected, where necessary. Also, we should follow these rules as closely as possible to avoid creating orthographically incorrect taxon names and chaotic classification schemes for our algal groups.

Acknowledgments

I would like to thank the two reviewers, Laurel Bybell and Lucy Edwards, as well as Jamie Shamrock (Editor) and Jean Self-Trail (Guest Editor) for improving the text. This paper would not have been submitted without the encouragement and enthusiasm of Jean, who invited me to explain the new *ICN* rules to a wider audience using nannoplankton examples. I am also grateful to John McNeill, for answering my queries on some of the *ICN* rules.

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