

(258–260) Proposals to eliminate contradiction between Articles 11.7 and 11.8 and to equate non-fossil with fossil names of dinophytes for purposes of priority

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The purpose of naming organisms is to provide a means of reference to enable exchange of information about those organisms. A universally understood, precise and stable system of naming is therefore essential for effective scientific communication. Principle III and IV of the *Shenzhen Code* (“Code”: Turland & al. in *Regnum Veg.* 159. 2018) state that “the nomenclature of a taxonomic group is based upon priority of publication” and that there is “only one correct name, the earliest that is in accordance with the rules, except in specified cases”. Only few exceptions are made from these Principles, such as separate names for different organs of fossil-taxa (Art. 11.1).

The *Code* distinguishes between the two categories “non-fossil” and “fossil” and has developed different rules and provisions regarding starting-points (Art. 13) or priority (Art. 11). Primarily, Art. 11.7 and 11.8 of the *Code* regulate the priority of scientific names considering non-fossil taxa and fossil-taxa. The genesis of their contemporary wording is intricate. In the *Tokyo Code* (Greuter & al. in *Regnum Veg.* 131. 1994), there was only an equivalent to the current Art. 11.8 and in the *Saint Louis Code* (Greuter & al. in *Regnum Veg.* 138. 2000), there was only an equivalent to the current Art. 11.7 (and the Art. 11.8 equivalent became a Note, i.e. not binding rule in itself). In the *Tokyo Code*, also the term “algae” was restricted to “diatoms” and in the *Vienna Code* (McNeill & al. in *Regnum Veg.* 146. 2006), both Art. 11.7 and 11.8 were established. We found that the polyphasic changes have resulted in contradicting statements in these Articles (see below).

Many microalgae such as the dinophytes are characterized by different, morphologically distinct developmental stages during their life history. It frequently includes a flagellated, motile stage and a coccoid stage broadly interpreted as a resting and/or dormancy cell (“cyst”: Stein, *Organism. Infusionsthiere* 3(2). 1883; Stosch in *Brit. Phycol. J.* 8: 105–134. 1973; Dale in Fryxell, *Survival Strategies of Algae*: 69–136. 1983; Pfiester & Anderson in Taylor, *Biology of Dinoflagellates*: 611–648. 1987; Fensome & al., *Classification of Living and Fossil Dinoflagellates*. 1993; Bravo & Figueroa in *Microorganisms* 2: 11–32. 2014). Some of these coccoid cells can be embedded into sediments and eventually fossilize there. It is worthy to note that flagellated cells of dinophytes are

usually, though not necessarily, associated with the non-fossil category and coccoid cells usually, though not necessarily, with the fossil category.

The different habitats in which flagellated and coccoid cells of dinophytes occur (and the fact that flagellated cells of dinophytes usually do not fossilize) make it not always easy to recognize the link between different life-history stages of the same species (so called “cyst-motile” relationships). However, many such relations have been clarified in the past (e.g. †*Calciadinellum operosum* Deflandre: Montresor & al. in *J. Phycol.* 33: 122–131. 1997; †*Posoniella tricarineloides* (G. Versteegh) Streng & al.: Gu & al. in *Protist* 164: 583–597. 2013; †*Dapsilidinium pastielsii* (R.J. Davey & G.L. Williams) J.P. Bujak & al.: Mertens & al. in *Geology* 42: 531–534. 2014), and more will be elucidated in future by ongoing research. Therefore, there is no reason to express independence between flagellated and coccoid stages taxonomically and nomenclaturally as well. We propose here to treat dinophytes like the diatoms with respect to priority of those names published first, irrespective of the non-fossil or the fossil category, with the following changes to the *Code*.

(258) Delete Art. 11.7:

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

Generally this Article is superfluous because priority is clearly regulated in the *Code*, which means that if only fossil names are available, they compete with each other. Due to the various changes of the *Code* over the decades, the phrasings of Art. 11.7 and 11.8 have also become contradictory. If (Art. 11.8) “names of organisms [...] based on a non-fossil type are treated as having priority over names [...] based on a fossil type [...]” is true, then (Art. 11.7) “names of fossil-taxa [...] compete only with names based on a fossil type [for purposes of priority]” cannot be true at the same time (with the emphasis on “only” – without that word, Art. 11.7 would be a matter of course). Therefore, the two phrasings are mutually exclusive. In order to avoid contradicting rules in the *Code* and redundancy with, for example, the Principles and Art. 11.1, we propose to delete Art. 11.7 including

both Examples (Ex. 29 and 30) and without replacement, returning to the concept of the *Tokyo Code*.

(259) Delete Ex. 30 from Art. 11:

~~“Ex. 30. Reid (in Nova Hedwigia 29: 429–462. 1977) indicated that his new fossil species *Votadinium calvum* was the resting cyst of the non-fossil dinoflagellate *Peridinium oblongum* (Auriv.) Cleve (in Kongl. Svenska Vetensk. Acad. Handl., n.s., 32(8): 20. 1900). *Votadinium calvum* can be used as the correct name for the cyst fossil species because it has a fossil type and therefore does not compete for priority with *P. oblongum*.”~~

The example of *Votadinium calvum* P.C. Reid (in Nova Hedwigia 29: 444. 1977) is unfortunate. The type of the name is a coccoid cell from recent sediments and it is therefore a non-fossil taxon, not fossil as claimed by Head & al. (in Taxon 65: 902–903. 2016). Even if this would be a case of doubtful stratigraphic relations, provisions for non-fossil taxa apply (Art. 13.3) and therefore non-fossil *V. calvum* competes with non-fossil *Peridinium oblongum* (Auriv.) Cleve for purposes of priority (Principles III and IV, Art. 11.1, 11.3 and 11.4). Moreover, the valid publication of the name *V. calvum* is controversial. Lentin & Williams (in Contr. Ser. Amer. Assoc. Stratigr. Palynologists 28: 666. 1993) and Fensome & Williams (in Contr. Ser. Amer. Assoc. Stratigr. Palynologists 42: 681. 2004) considered the name superfluous (and to be rejected) based on Art. 52.1(e) (and we agree), whereas Head & al. (l.c.) did not see the need to adopt the older name. Controversial Examples should be avoided in the *Code*, and the given Example is proposed for deletion here (irrespective of the Article being proposed for deletion, see Prop. 258).

Some of the present authors are of the opinion that the zoologically connoted term “dinoflagellate” (as used in the present Example) should be removed from the *Code*. The equivalent botanical terms are “*Dinophyta*” or “*Dinophyceae*”, so “dinophyte” would be the preferred term to use in the *Code*. We consider submitting a future proposal to amend the *Code*, depending on the outcome of Prop. 180–183 (Woelkerling & Moestrup in Taxon 71: 1337–1338. 2022) at the Madrid Congress.

(260) Amend Art. 11.8, its Ex. 35, and the caption of Art. 13.1(f) as follows (new text in bold, deleted text in strikethrough):

“11.8. Names of organisms (diatoms **and dinoflagellates** excepted) based on a non-fossil type are treated as having priority over names at the same rank based on a fossil type where these names are treated as synonyms for a non-fossil taxon.”

“Ex. 35. The non-fossil species *Gonyaulax ellegaardiae* K. N. Mertens & al. (in J. Phycol. 51: 563. 2015) was indicated in the protologue to produce a cyst corresponding to the fossil-species *Spiniferites pachydermus* (M. Rossignol) P. C. Reid (in Nova Hedwigia 25: 607. 1974). Both names were correct because Mertens & al. (l.c.) did not treat them as synonyms. However, if these names are treated as synonyms ~~for the non-fossil species, *S. pachydermus*, based on a fossil type, *G. ellegaardiae* is treated as having~~ **has priority because Art. 11.8 excepts dinoflagellates even though it is antedated by *S. pachydermus*.**”

“13.1. [...] Fossil organisms (diatoms **and dinoflagellates** excepted):”

The argument made by Chaloner & al. (in Taxon 47: 907–910. 1998) for the exception from precedence of a name with a non-fossil type over that with a fossil type to be restricted to diatom names was to prevent names of fossil algae displacing junior non-fossil names considered to belong to the same biological taxon. However, in a group

such as the dinophytes, the change can lead to long-established names based on a fossil type being displaced by names more recently published for flagellated stages that might be comparatively little known, which seems nomenclaturally disruptive. Therefore, by exempting dinophytes from this provision, we propose to return to the concept of the *Tokyo Code* and to expand the priority rules again also to dinophytes with a rich fossil record and a large body of established names both non-fossil and fossil (Fensome & al., l.c. 1993). Furthermore, if non-fossil and fossil dinophytes are treated equally regarding priority, then it is logical to exclude dinophytes from the later starting-point of fossils.

The acceptance of our proposals would make fossil names of dinophytes more important in contemporary nomenclature. For the frequently encountered example of *Gonyaulax* Diesing (in Sitzungsber. Kaiserl. Akad. Wiss., Wien, Math.-Naturwiss. Cl., Abt. I, 52: 305, 382. 1866) and †*Spiniferites* Mantell (Pict. Atlas Foss. Remains: 191[. 207]. 1850), the latter fossil name would have priority (again) over the younger non-fossil name, if both are considered synonyms of a non-fossil taxon. Moreover, newly published non-fossil names for “living fossils” currently have priority over well-established fossil names (Art. 11.8). We think this is a serious threat to nomenclatural stability, because numerous (superfluous) new names of non-fossil species could be created for already existing and established names of fossil-species. If the categories “non-fossil” and “fossil” were treated equally for the purpose of priority, then this would also approach the harmonization of the *Code* and the *International Code of Zoological Nomenclature* (Ride & al., Int. Code Zool. Nomencl., ed. 4. 1999; <https://www.iczn.org/the-code/the-code-online/>), which has particular importance for ambiregnal taxa such as dinophytes but also, for example, euglenophytes.

Explicitly, the harmonization between diatoms and dinophytes proposed here refers only to the priority of names, not to a complete equation of rules as per Art. 1.2. The latter would create clear disadvantages for dinophyte fossil-taxa described between 1958 and 2012, in accordance with the special provisions for fossil algae (see Art. 39.1 and 43.1): names of dinophyte fossil-taxa published during this period and lacking a Latin description or diagnosis would become retroactively not validly published under Art. 44.1, if now considered non-fossil algae (but see Prop. 181 by Woelkerling & Moestrup, l.c.). Disadvantages may also occur for “names” of dinophyte fossil-taxa published between 1912 and 1957 but lacking the validating illustration required by Art. 43.2, which would nevertheless now become validly published under Art. 44.2 if considered non-fossil. If these proposals are accepted, no disadvantages are anticipated with respect to the other *Code* provisions relating to fossil algae (see Art. 7 Note 1 and Art. 8.5, Rec. 8A.3 and Art. 9.15).

Disadvantages of the present proposals are minor. The most heard counter-arguments are name stability and inability to read older literature with expired names. However, name changes are an inevitable result of increasing taxonomic progress since the dawn of scientific naming. In particular, a few names of non-fossil dinophyte taxa in current use may need to be put into the synonymy of fossil names. If this is not desirable, then conservation or rejection proposals under Art. 14 or 56 can be considered in such cases. This may also impact suprageneric names, although Art. 11.10 indicates that the principle of priority does not apply to names above the rank of family. Name changes are usually the result of revisionary work in taxonomy, and the desired nomenclatural stability remains elusive in the microscopy domain, irrespective of whether non-fossil or fossil names or both are assessed. Application of scientific names is a

hypothesis inferred from a phylogenetic tree, and this is the best representation we have to date of the real Tree of Life. Fensome & al. (in Contr. Ser. Amer. Assoc. Stratigr. Palynologists 50: 13. 2019) and the online database system DINOFLAJ3 (http://dinoflaj.smu.ca/dinoflaj3/index.php/Main_Page) provide an easy means to obtain accepted names to synonyms and vice versa.

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(261–266) Proposals to amend the *Code* to update regulations of the nomenclature of fossils

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These initiatives consist of a few specific, mostly editorial amendments of the provisions of the *International Code of Nomenclature for algae, fungi, and plants (ICN)*; Turland & al. in Regnum Veg. 159. 2018) in order to reflect the historical development of palaeobotanical nomenclature.

Because the former outdated notions such as “organo-genus”, “forma-species” and others have been eliminated in the newest revisions of the *ICN*, it is necessary to formally fix their correspondence with modern notions of the *ICN*, thereby allowing their correct treatment in the functioning indexing centres. However, the *ICN* should also have additional operational notions for how to proceed with another category of artificial binary “names”, which have been applied to fossil spore, pollen and other microfossil taxa (algal and fungal in nature). These proposals formally outline the distinction between fossil-taxa and these artificial designations and will significantly help indexing centres correctly interpret nomenclatural difficulties found in the old palaeobotanical literature.

The International Fossil Plant Names Index (IFPNI; <http://ifpni.org/>) has recorded numerous fossil “names” generated in the early years of palaeopalynology (1930s–1960s), which were formed as binary designations, but unlike fossil-species names (formed as a combination of a generic name and a specific epithet) these designations were associated with the artificial “names” of non-generic groups or subgroups of fossil spore, pollen or other microfossils. These designations, substituting at generic level in artificial systems of classification, were initially developed in the artificial system of classifications of fossil spores and pollen. The most influential authority of such a classification approach, Russian palaeopalynologist Sofia Naumova (in Trudy XVII Sess. Mezhdunar. Geol. Kongr. 1937(1): 357. 1940 [“1939”]), explicitly stated that “in the description of the spores and pollen a binary nomenclature is adopted: the «generic» names are given to the author’s subgroups; and the names of «families», to groups”. “*Leiotriletes*” (Naumova, l.c.: 357. 1940) was published as

a name of a subgroup of fossil spores in the artificial classification of microfossils (“Group *Azonotriletes* Luber of Class *Irrimales* Naumova”). “*Leiotriletes*” is not therefore a fossil-generic name, although it was used in binary combinations such as “*L. minutissimus*” (Naumova in Izv. Akad. Nauk S.S.S.R., Ser. Geol. 1949(4): 52. 1949). As a fossil-generic name, *Leiotriletes* was later validly published based on different fossil spore materials by various researchers nearly simultaneously and independently: *Leiotriletes* Naumova (in Trudy Inst. Geol. Nauk Akad. Nauk S.S.S.R. 143: 20, 17 [rank]. 27 Oct 1953) and *Leiotriletes* Naumova ex R. Potonié & Kremp (in Geol. Jahrb. 69: 120. 31 Mar 1954).

Such an approach forming artificial fossil spore/pollen designations eliminated the potential nomenclatural conflict if the fossil spore/pollen genus or species would be found and described earlier than its fossil plant, because the spore/pollen designations would not then compete with the fossil-genus names established on other organs of the plant. However, later in palaeopalynology another option was chosen to form the so-called “form-genera” or “organ-genera” in plant classification (which formally existed in former editions of the *Code* from Stockholm [Lanjouw & al. in Regnum Veg. 3. 1952] to Tokyo [Greuter & al. in Regnum Veg. 131. 1994], superseded by “morphogenus” from Saint Louis [Greuter & al. in Regnum Veg. 138. 2000] to Melbourne [McNeill & al. in Regnum Veg. 154. 2012], and all at least now eliminated from the *ICN* after Melbourne). Nevertheless, fossil spore taxa designations, formed as artificial binary combinations, persisted and were actively used in palaeopalynology up to the 1990s (!). In addition, as IFPNI has recorded, it was a usual practice to recombine species of these artificial designations into exact fossil spore or pollen genera, and vice versa: fossil species of exact fossil spore or pollen genera might be recombined under these artificial designations. For example, the fossil spore species *Selaginella hirta* Bolchovitina (in Trudy Inst. Geol. Nauk Akad. Nauk S.S.S.R. 145: 33. 1953), validly published under the generic