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An evaluated list of Cenozic-Recent radiolarian species names (Polycystinea), based on those used in the DSDP, ODP and IODP deep-sea drilling programs

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Abstract

A first reasonably comprehensive evaluated list of radiolarian names in current use is presented, covering Cenozoic fossil to Recent species of the primary fossilising subgroup Polycystinea. It is based on those species names that have appeared in the literature of the Deep Sea Drilling Project and its successor programs, the Ocean Drilling Program and Integrated Ocean Drilling Program, plus additional information from the published literature, and several unpublished taxonomic database projects. 1192 names are recognised as valid, and several hundred additional names including synonyms and mispellings are given as well. A brief list of valid names is provided in the main paper, while the full list, with synonyms, author, year of publication, family assignment, geologic age interval and notes is provided as a SOM spreadsheet table.

Key words: plankton, microfossil, taxonomy, protist

Introduction and past work

Radiolarians (as used in this paper, only the Order Polycystinea) are one of the major groups of marine microfossils, with an extensive fossil record extending from the basal Paleozoic to the Recent. The occurrences of different species of radiolarians are extensively used for research in biostratigraphy, paleoceanography and paleobiology (De Wever *et al.*, 2001). Progress in radiolarian research depends fundamentally on improved taxonomy. Inadequate or incomplete species level taxonomy limits all aspects of research, while higher level taxonomy and systematics are essential frameworks for many studies in evolution. Radiolarian taxonomy is still relatively poorly developed in comparison to many other groups of both macro- and microfossils. In comparison to much larger numbers of specialists for foraminifera, coccolithophores, diatoms or dinoflagellates, the radiolarian community is small, and in particular, the number of workers specialising in Cenozoic to Recent (e.g. living) radiolarians has been insufficient to support the development of reasonably comprehensive taxonomic catalogs or checklists of valid species. Lack of taxonomic synthesis, together with the extensive use of radiolarians for biostratigraphic and paleoceanographic studies, has led to an accumulation of radiolarian names in the published Cenozoic literature whose meaning is difficult to assess, increasingly hindering researchers using radiolarians in their work.

While substantial, if incomplete, published taxonomic databases exist for at least some time intervals of the Mesozoic (Baumgartner *et al.* 1995 for mid-Mesozoic low latitude radiolarian species; O'Dogherty *et al.* 2009 for Mesozoic radiolarian genera), for Cenozoic to Recent faunas the situation is less satisfactory. For living species, a major new comprehensive database of radiolarian ecology was recently published (WoRaD, Boltovskoy *et al.*

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2010) although due to remaining uncertainties about species boundaries a significant number of the published living species had to be lumped into groups in order to provide units stable enough to synthesise ecologic data (WoRaD uses ca 300 single species or groups). For fossil Cenozoic forms, published works to date are limited to a catalog of common low-latitude Miocene species (Nigrini and Lombari 1984), and a catalog of tropical Cenozoic stratigraphic marker species (Nigrini and Sanfilippo 2001). There has also been a volunteer effort to build a public catalog of radiolarian species online at the community website, www.radiolaria.org, run by Dolven (Dolven & Skjerpen, 2006). This site currently has over 600 taxa including synonym information, although progress has been uneven, there are some conflicting records, and the effort is not formally reviewed.

In contrast to the somewhat meagre available published resources, several large unpublished database efforts have been under development for several years, two of which are of particular importance. Radworld (2006) is a database that is attempting to capture basic information for all radiolarian names ever published. It was begun in the 1990s by Nigrini, Caulet and Sanfilippo with the very oldest literature, and has been gradually incorporating ever more recent literature. Radworld, although holding information for 15,000 species, is still incomplete, with irregular coverage of the post 19th Century literature, and has only limited information on synonyms or other revisions. Currently Radworld is only being actively developed by a single person (Caulet) on a part-time basis, and only information on genera are available from this database online, at http://geologie.mnhn.fr/radgen/radworldsite. Paleotax is a taxonomic database application (Löser 2004) which can be used to develop databases for different groups of organisms. It has been employed by Suzuki over a period of many years to compile information about radiolarian taxonomy. Like Radworld, the (unnamed) Suzuki database holds information on thousands of species (nearly 14,000 as of December 2014) but coverage of the literature still is incomplete. Unlike Radworld, which provides only limited information about synonymy, the Paleotax application enforces a rigid synonym rule—any entry with a newer publication date that alters a genus' status, or a species assignment, is automatically applied to all taxa and subordinate taxa regardless of whether expert users would agree with the taxonomic opinion entered, and in particular the application to all subordinate taxa. There are thus sometimes substantial differences in name combinations and taxa lists between the Suzuki database and names in common use.

By far the largest single source of Cenozoic radiolarian names in current use comes from the deep-sea drilling programs (DSDP, ODP and IODP) which have, over a period of nearly 40 years, recovered hundreds of kilometers of highly fossiliferous deep-sea sediments, primarily of Cenozoic age. These programs have sponsored or inspired ca 200 publications on these sediment core's radiolarian content (DSDP Initial Reports chapters, ODP Science Results chapters, and other papers in the professional literature). Radiolarian names from initial studies done by these authors while on ship (but only partially also from subsequent studies done on shore) have been captured routinely and stored in these organisations' central databases. Unlike Radworld or the Suzuki database, the DSDP-IODP name lists include various forms of names, including informal or open nomenclature usages, misspellings, and even, albeit rarely, non-radiolarian taxa names. This style of data capture is driven by these institutions' mandate to faithfully record the labels given to the data on taxonomic occurrences by the participating scientists, rather than to attempt to correct/interpret the data. Names captured during the early phases of deep-sea drilling by DSDP were recorded without any source information (author-year of species or of current combination, or where the name was used in the program's own publications). Names captured by the ODP include this source information. Deep-sea drilling name databases contain the names (including mispellings etc) that are linked to crucial stratigraphic and geographic distributional data. However, in conformance to institutional mandates, they do not include evaluative data such as synonym information or other information needed to effectively integrate or synthesize the primary data for research purposes.

Derived from the primary data of the deep-sea drilling programs, the Neptune database (Lazarus 1994; Spencer-Cervato 1999) contains occurrence data from hundreds of deep-sea drilled sections for several microfossil groups including radiolarians, and has been used in numerous scientific studies e.g. plankton evolution (Spencer-Cervato 1999; Lazarus 2002; Finkel *et al.* 2005; Allen and Gillooly 2006; Kucera and Schönfeld 2007; Liow *et al.* 2010; Lazarus *et al.* 2014). The current version of this database is NSB (for Neptune Sandbox Berlin: www.nsb-mfn-berlin.de). The radiolarian names contained in Neptune are based on the earlier DSDP lists, although limited numbers of additional names have been added over the years. The names in Neptune, following their source from DSDP, mostly do not have taxonomic source info (author-year) but, as calculations of diversity etc. require this, are mostly annotated to indicate synonym or valid species status.

Radiolarian names for living faunas have not benefited from similar large institutional sponsors. However, in addition to the radiolarian community's own WoRaD effort, the recent increase in support for biodiversity research has led to more interest in taxonomic syntheses for all groups of organisms, including radiolarians. This had led to the capture of some radiolarian species names in general biodiversity initiatives' online catalogs, although these often represented only small extracts from the total literature, and had not been vetted by taxonomic experts.

As the above review makes clear, despite several efforts to compile and interpret the species level radiolarian taxonomy literature, no reasonably comprehensive result has been achieved. In addition to incompleteness, different efforts have emphasised different items of information (author-year source info, synonymy status, etc) so that essential information is scattered between diverse compilation efforts. Worse, the individual efforts use very different strategies and tools to compile their data, thus creating additional problems of data correlation and integration.

History of project

The current radiolarian list is the result of two separate institutional initiatives. A meeting was hosted by IODP in the fall of 2006, which led to a long-term strategy for managing deep-sea drilling paleontology information, including a specific project to create common, annotated taxonomic name lists (TNLs) for all the major microfossil groups used by deep-sea drilling scientists. Each TNL should include all names used by deep-sea drilling workers (DSDP, ODP, IODP) and any additional names needed to provide a complete listing of valid names for these. The radiolarian TNL was created by Lazarus and Suzuki, with technical support by Diver, between fall 2008 and spring 2011. This project is described below. Independently, the Encyclopedia of Life project (www.eol.org) hosted a workshop, held in the fall of 2008, to discuss how to compile a reasonably complete list of living radiolarian species names. Subsequent cooperation between the participating radiolarian taxonomists (Lazarus, Dolven and Sanfilippo; with input by D. Boltovskoy from the complementary WoRaD effort) eventually yielded a list, with 421 valid species names and nearly 200 synonyms (including misspellings), which was placed online in 2010 at the World Register of Marine Species (WoRMS, www.marinespecies.org).

The radiolarian TNL authors decided to merge all the major existing lists for radiolarian names (IODP, Neptune, Radworld, Suzuki database) as well as the EOL list. All radiolarian names that had appeared in any of the drilling program databases, or in Neptune, would be edited for author-year and synonymy status. This would cover the large majority of Cenozoic names in common use by radiolarian specialists, while avoiding a large number of frankly dubious names, mostly by early workers such as Haeckel (Lazarus, 2014), which are present in data sources such as Radworld but which have seen little or no use by modern workers. The relatively infrequent recovery of well preserved Mesozoic radiolarian-bearing material by deep-sea drilling has resulted in a similarly modest number of radiolarian taxonomic names in these institutions' databases. Integration of the TNL project results with more comprehensive efforts to synthesise Mesozoic radiolarian taxonomy (e.g. O'Dogherty *et al.,* 2009) was decided to be more appropriate than separate publication. This paper thus reports only the TNL records of Cenozoic-Recent age. Lastly, and again to enhance the value for research purposes, all edited Cenozoic names were assigned to family level categories. These are the purely morphologic family level concepts long used by Cenozoic workers (Riedel, 1971), as very few molecular studies of polycystine radiolarians exist, and have yet to yield significant information on the specific taxonomy of the group.

In addition to the specific data management goals set by IODP, we also needed to define the goals of the project relative to current knowledge of radiolarian taxonomy, as it is significantly less well developed than for any of the other fossil groups. Achieving a similar degree of completeness and accuracy to, e.g. the planktonic foraminifera TNL would not be realistically possible for the radiolarian TNL. We decided in this project to primarily link together all names that refer to the same species concept, and to prefer, in most cases, the name most frequently used in recent literature, regardless of whether this led to coherent usage of generic concepts. Generic nomenclature for Cenozoic radiolarians is still in a rather confused state (see below) and revising generic concepts would have been far more work than managable. Such revisions also should be done, with full documentation and discussion, in the formal taxonomic literature and not in a listing as in this paper.

Steps in creating the TNL

Initial evaluation. An initial compilation of data from Neptune, IODP's Janus database, Radworld and the Suzuki database created a list of over 17,000 names, including names from all geologic age intervals (e.g. also Paleozoic), and both modern and historic literature. Initial comparisons between the Chronos Neptune and Janus data records yielded 2105 names present only in the Neptune database, 559 names only in the Janus database, and 1310 names present in both. Thus, although both deep-sea drilling lists were generated by scientists working on similar material, less than one third of the 3974 names could even be matched between databases, and approximately half of the names (ca 2,000) had no resolved taxonomic status. Furthermore, although it was hoped that most names in the deep-sea drilling sources (Janus and Neptune) could be matched to complementary data (e.g. author-year) in the more formally compiled Radworld and Suzuki databases, only 1347 names from Neptune could be matched to records either Radworld or the Suzuki database, and only 671 names from Janus (e.g. 1402 from a total of 3974 names). Many of the names in Neptune and Janus are clearly informal—open nomenclature names or questionable identifications (treated as separate names by database systems as the text string is not identical). Eventually ca. one third of the names in the Neptune and Janus databases would be so classified. Nonetheless, more than 1,000 formally correct names present in the deep-sea drilling databases could not be matched to records in Radworld or the Suzuki database. A few (ca. 100) were subsequently identified as misspellings, but the rest needed to be evaluated by direct comparison to original information from the primary literature. Further, nearly 700 of these were found only in the Neptune database (primarily of DSDP origin) and thus (unlike the Janus names) had no author, year or other source information to indicate which literature sources should be consulted.

The above analyses made clear the neccessity of extensive editing of data records based on the ability to rapidly search the primary literature for taxonomic name usage, despite there being no reasonably comprehensive catalogs or other reference lists to use as a starting point. Also, it became apparent that the work would need to be divided into reasonably self-contained modules to allow each worker to proceed without encountering coordination problems with other project members in the daily work.

Age assignment. Although for other groups of organisms expertise is often by taxonomic sub-grouping (reptiles within vertebrates), among radiolarian workers expertise is more often by geologic age interval, and in particular between Cenozoic and Mesozoic specialists (as there is a major evolutionary turnover in radiolarians in the very basal Cenozoic), or between those who work with living/late Neogene vs older Cenozoic materials. It was therefore decided to assign each name needing some form of editing to a broad age category (Neogene-Recent; Paleogene; Mesozoic (or Cretaceous, Jurassic, Triassic, if possible) or Paleozoic. Age information was extracted from the age and comment fields in the source databases, and for species with occurrences in the Neptune database, from the age ranges of these data. Ages of ca 1/4 the entries needed however to be manually assigned, either using the ages of genera (particularly Mesozic), or determined individually. The records were then assigned to either Lazarus (Neogene-Recent) or Suzuki (Paleogene and Mesozoic) for further editing.

Genus and family assignment. Genus names are a problem in Cenozoic radiolarian taxonomy due primarily to the creation of a great number (ca 1,200) of overly split or otherwise artificial genus names by Haeckel (1887) (Lazarus, 2014). For many groups of radiolarians no significant revisions exist; of those that have been revised, some have been done in brief notes within in relatively obscure publications, which are then often not made use of by subsequent workers. Lastly, the meaning of older generic concepts has often been unresolvable as no type material was available for examination. Publications have recently provided major re-descriptions of original materials from older authors (Aita *et al.,* 2009; Lazarus and Suzuki, 2009; Ogane *et al.,* 2009; Sakai *et al.,* 2009; Suzuki, 2009; Suzuki *et al.,* 2009a, b; Bjørklund *et al.,* 2014; Dolven *et al.,* 2014), and have resolved the previously uncertain status of other old collections (many were determined to have been lost in WWII: Lazarus, 2014). It is hoped that this new information, the lack of which has hindered taxonomic revision, together with the list of species provided here, will make it easier to revise Cenozoic radiolarian generic taxonomy in the future. Until then, we use, as stated previously, the most common name in the literature, even if it is likely that the generic assignment needs revision. A further complication comes from subgenera, which were created in great numbers by Haeckel, but which are only used by a few authors in the modern literature. For the purposes of this project, subgeneric names were treated simply as spelling variants of the species name, with the simple genus-species form being accepted as the valid one. Future studies may be able to include subgenus concepts in a more structured way. Also not clear yet are the numbers, names and scope of family categories. This problem also goes back to the highly

artificial supra-generic classification for radiolarians developed by Haeckel (1887) and is only gradually being replaced by more modern concepts. This confusion about family and generic names makes assigning genera to families a non-trivial task. At present there are two basic proposals for family level taxa for Cenozoic radiolarians. That of Riedel (1971) is based on the overall bauplan or geometric topology of the skeletons, of which many different ones exist in radiolarians. This system has been very widely accepted by radiolarian workers and is the one employed in the vast majority of Cenozoic-Recent literature to date, and is also the one used at other important websites (www.radiolaria.org and WoRMS). A more recent family level classification (De Wever *et al.,* 2001) covering all Phanerozoic radiolarians is based in part also on claimed homologous details of structure in the innermost part of many radiolarian skeletons, and implicitly is based on Haeckel's biogenetic law. It is assumed by these authors that the innermost part of the skeleton is the first part secreted during ontogeny, and thus, under the biogenetic law, that these morphological elements are most informative for higher level classification. Until the various aspects of this new system are adequately tested (homology, ontogenetic position of skeletal elements, validity of the biogenetic law for this group) we prefer to use the established system of Riedel (1971). This affects the placement of a few genera, e.g. *Joergensenium*, which we place here within the Actinommidae, although in the De Wever *et al.* (2001) system it would be in a different family.

Creating a searchable literature archive. The existing radiolarian literature is widely scattered, and no single library accessible to us held more than a fraction of the literature needed. It was decided to create searchable digital versions of as much of the key primary taxonomic literature as possible, including both older works, e.g. major monographs by Haeckel (1887) as well as more recent taxonomic literature (often available in searchable pdf form from journal publishers). A fairly comprehensive library of radiolarian literature up to ca 1980, with some younger publications as well, had been made available in earlier years in the form of microfiche by Riedel and Sanfilippo. A particular feature of this fiche library is the inclusion of translations of many important Russian papers into English. Microfiche however is not easy to rapidly handle, it is not digitally searchable or easy to OCR with good quality, and, for most of the fiche pages, the quality of the plate images is unacceptably poor. Over 1,000 other radiolarian taxonomy publications had already been scanned from print by Suzuki and his students, and were made available for this project. Fortunately, most of the remaining, not yet digitized original primary literature, including the original (high quality, IBM Selectric) typescript pages of the Riedel and Sanfilippo Russian literature translations, were archived recently at the Natural History Museum London. High priority literature and translations were loaned from London, other literature (older German) from libraries in Berlin. Both were scanned and transformed into searchable pdfs by OCR. The final archive of searchable taxonomic literature from all these sources, including other author pdf file contributions, comprising >5,000 papers, was automatically indexed and made searchable via standard software (Spotlight in Apple's OS X, or similar software for Windows).

Data editing. Most required missing information in the Neogene or Paleogene lists could be simply entered in the appropriate field or cell in a tabular editor (e.g. spreadsheet), based on each specialist's knowledge, supported by rapid retrieval of relevant literature via the searchable literature archive. Synonym information by contrast is more complicated. The structure used by the TNL, inherited from the Neptune system, is to keep all names in a single table and to indicate relationships between records with a status (pointer) field holding the record number that the current record is related to. Thus if species 2 is a synonym of species 1, the status field for species two would have the code 'S' (for synonym) and the pointer field would have the number '1'. If species 1 is a valid name the status field would hold 'V' and the pointer field would be empty. This structure is simple yet very flexible and can accomodate various types of relationships between names (valid, synonym, subspecies, questionable identification, etc). The downside is that in order to enter a value in the pointer field, the target record must be found in order to determine its record number, requiring frequent scrolling of the table and adding significantly to the complexity of data editing when done in a spreadsheet environment. It was found to be more practical to do the editing in a multi-windowed database editor (pgAdmin III and Navicat, using a Postgres database server) where appropriate subsets of records could be listed via sql queries in multiple open windows. Occasionally only an older synonym, but not the current valid form of a name was present in the list, and for these ca. 200 new data records were added. Duplicate records, created during the initial merge of sources, typically due to different proposed author-year values, were identified, the correct form chosen, and incorrect duplicate deleted from the final listing. The edited TNL was compared to the list of living taxa from WoRMS. Approximately 100 additional taxa listed at WoRMS but not present in the TNL were added, and the age category for these changed to Recent. A similar comparison was made between the TNL and all radiolarian names at www.radiolaria.org, and ca 100 names at

radiolaria.org not present in the TNL were individually evaluated and added to the TNL. Lastly, a comparsion of taxonomic status as given by Lazarus for Neogene names, and Suzuki for Paleogene names was done to identify conflicting opinions between these two workers on the status of names. Nearly 200 such differences were identified and resolved.

Several categories were used in the TNL taxonomic status field, e. g. V for valid, S for synonym, B for subspecies etc. Each of these is given, together with the criteria for assignment, in the SOM Appendix.

The entire evaluated Cenozoic portion of the TNL list has been uploaded into the NSB database.This database is maintained by the senior author at the Museum für Naturkunde Berlin, who should be contacted for access. All future upgrades to the TNL will be synchronised, with this database maintaining the master version.

Results

The TNL is provided in three forms. A basic listing of valid Cenozoic species names by family, with author and year is given as Table 1 in this paper. A full list of evaluated Cenozoic taxa, including synonyms, subspecies (i.e. V, S and B names) and comments on most names (such as usage of name in literature, reasons for decision on taxon status) is provided in a larger SOM spreadsheet. Lastly, the full list of Cenozoic evaluated names, including open nomenclature names etc, can be searched at the NSB database website. We do not provide a traditional, space-consuming list of references to the primary literature in this paper as the citations can be quickly retrieved by searching existing online reference lists of radiolarian taxonomic papers such as the one provided by www.radiolaria.org.

TABLE 1. List of accepted Cenozoic-Recent species and subspecies names, with original and revised author names and year of publication. Arranged by Order (Spumellaria and Nassellaria) and Family, as discussed in text. A more detailed listing is given as SOM Table 1. Minor differences in counts between this and Figure 1 reflect handling of subspecies and minor updates to the database during the publication process.

SPUMELLARIA

Actinommidae
Acanthosphaera Ehrenberg 1858
Acanthosphaera actinota Haeckel 1860
Acanthosphaera castanea Haeckel 1887
Acanthosphaera dodecastyla Mast 1910
Acanthosphaera pinchuda Boltovskoy 1980
Acanthosphaera tenuis Haeckel 1887
Actinomma Haeckel 1860
Actinomma antarcticum (Haeckel) Nigrini 1967
Actinomma arcadophorum Haeckel 1887
Actinomma beroes (Ehrenberg) Petrushevskaya 1975
Actinomma boreale Cleve 1899
Actinomma buspinigerum (Hays) Petrushevskaya 1975
Actinomma campylacantha Caulet 1991
Actinomma capillaceum Haeckel 1887
Actinomma delicatulum (Dogiel) in Dogiel and Reshetnyak 1952
Actinomma golownini Petrushevskaya 1975
Actinomma haysi Bjørklund 1976
Actinomma henningsmoeni Goll and Bjørklund 1989
Actinomma holtedahli Bjørklund 1976
Actinomma kerguelenensis Caulet 1991
Actinomma leptoderma longispina Cortese and Bjørklund 1998
Actinomma leptodermum (Jørgensen) Nigrini and Moore 1979
Actinomma livae Goll and Bjørklund 1989
Actinomma magnifenestra Lazarus 1992
Actinomma medianum Nigrini 1967
Actinomma mediterranensis Hollande 1960
Actinomma medusa (Ehrenberg) 1844
Actinomma mirabile Goll and Bjørklund 1989
Actinomma plasticum Goll and Bjørklund 1989
Actinomma popofskii (Petrushevskaya) Caulet 1986
Actinomma sol Cleve 1900
Actinomma trinacria (Haeckel) Cortese and Bjørklund 1998
Actinomma yosii Nakaseko 1959
Actinosphaera Hollande and Enjumet 1960
Actinosphaera capillacea (Haeckel) Hollande and Enjumet 1960
Actinosphaera haackei (Dreyer) Dumitricia 1972
Actinosphaera tenella (Haeckel) Hollande and Enjumet 1960
Amphisphaera Haeckel 1881
Amphisphaera aotea Hollis 1993
Amphisphaera cristata Carnevale 1908
Amphisphaera goruna (Sanfilippo and Riedel) 1973
Amphisphaera spinosa Carnevale 1908
Amphisphaera spinulosa (Ehrenberg) Petrushevskaya 1974
Amphistylus Haeckel 1881
Amphistylus angelinus (Campbell and Clark) Chen 1975
Anomalacantha Loeblich and Tappan 1961
Anomalacantha dentata Mast 1910
Arachnosphaera Haeckel 1860
Arachnosphaera dichotoma Jørgensen 1900
Arachnosphaera myriacantha Haeckel 1860
Astrosphaera Haeckel 1887
Astrosphaera hexagonalis Haeckel 1887
Axoprunum Haeckel 1887
Axoprunum euterpe (Haeckel) Caulet 1986

.....continued on the next page

TABLE 1. (Continued)

Axoprunum liostylum (Ehrenberg) Petrushevskaya and Kozlova 1972
Axoprunum losbanosensis (Clark and Campbell) 1945
Axoprunum monostylum Caulet 1986
Axoprunum pierinae (Clark and Campbell) 1942
Axoprunum stauraxonium Haeckel 1887
Carposphaera Haeckel 1881
Carposphaera acanthophora (Popofsky) Benson 1966
Carposphaera capillacea Haeckel 1887
Carposphaera magnaporylosa Clark and Campbell 1942
Carposphaera modesta (Stöhr) Haeckel 1887
Carposphaera subbotinae Borisenko 1958
Cenosphaera Ehrenberg 1854
Cenosphaera aspera Stöhr 1880
Cenosphaera coronata Haeckel 1887
Cenosphaera coronataformis Shilov 1995
Cenosphaera cristata Haeckel 1887
Cenosphaera eocenica Clark and Campbell 1945
Cenosphaera favosa Haeckel 1887
Cenosphaera megachile Clark and Campbell 1945
Cenosphaera oceanica Clark and Campbell 1945
Cenosphaera perforata Haeckel 1887
Centracontium Popofsky 1912
Centracontium hexacontarium Popofsky 1912
Centrocubus Haeckel 1887
Centrocubus cladostylus Haeckel 1887
Centrocubus octostylus Haeckel 1887
Centrolonche Popofsky 1912
Centrolonche hexalonche Popofsky 1912
Cladococcus Mueller 1857
Cladococcus (?) nakasekoi Nishimura 1992
Cladococcus abietinus Haeckel 1887
Cladococcus cervicornis Haeckel 1860
Cladococcus megaceros Boltovskoy and Riedel 1980
Cladococcus pinetum Haeckel 1887
Cladococcus scoparius Haeckel 1887
Cladococcus stalactites Haeckel 1887
Cladococcus viminalis Haeckel 1860
Conoactinomma Gorbunov 1979
Conoactinomma undosa undosa (Kozlova) Gobrunov 1979
Conocaryomma Lipman 1969
Conocaryomma lentis Lipman 1969
Cromyatractus Haeckel 1887
Cromyatractus elegans Petrushevskaya 1969
Cromydruppocarpus Campbell and Clark 1944
Cromydruppocarpus esterae Campell and Clark 1944
Cromyechinus Haeckel 1881
Cromyechinus icosacanthus Haeckel 1887
Cromyechinus pycnopora Nishimura 1992
Cromyomma Haeckel 1862
Cromyomma circumtextum Haeckel 1887
Cromyomma riedeli Nishimura 1992
Cromyomma villosum Haeckel 1887
Cyrtidosphaera Haeckel 1860
Cyrtidosphaera reticulata Haeckel 1860
Diploplegma Hinde 1890
Diploplegma somphum Sanfilippo and Riedel 1973
Druppatractus Haeckel 1887
Druppatractus hastatus Blueford 1982
Druppatractus irregularis Popofsky 1912
Druppatractus pyriformis (Bailey) McMillan and Casey 1978
Druppatractus variabilis Dumitrica 1973
Drymosphaera Haeckel 1881
Drymosphaera dendrophora Haeckel 1887
Drymyomma Jørgensen 1900
Drymyomma elegans Jørgensen 1900
Elatomma Haeckel 1887
Elatomma penicillus Haeckel 1887
Ellipsoxiphium Haeckel 1887
Ellipsoxiphium palliatum Haecker 1908
Entapium Sanfilippo and Riedel 1973
Entapium chaenapium Sanfilippo and Riedel 1973
Entapium regulare Sanfilippo and Riedel 1973
Gonosphaera Jørgensen 1905
Gonosphaera primordialis Jørgensen 1905
Haeckeliella Hollande and Enjumet 1960
Haeckeliella inconstans Dumitrica 1973
Haeckeliella macrodoras (Haeckel) Hollande and Enjumet 1960
Haliomma Ehrenberg 1838
Haliomma castanea Haeckel 1860
Haliomma erinaceum Haeckel 1860
Haliomma glisifra Renz 1976
Haliommetta Haeckel 1887
Haliommetta miocenica (Campbell and Clark) Petrushevskaya and Kozlova 1972
Heliaster Hollande and Enjumet 1960
Heliaster hexagonium Hollande and Enjumet 1960
Heliosestilla Haeckel 1887
Heliosestilla spicata (Haeckel) Petrushevskaya and Kozlova 1972
Heliosphaera Haeckel 1860
Heliosphaera radiata Popofsky 1912
Heterosestrum Clark and Campbell 1945
Heterosestrum sexispinatum rotundum Clark and Campbell 1945
Hexacontium Haeckel 1881
Hexacontium arachnoidale Hollande 1960
Hexacontium aristarchi (Haeckel) Boltovskoy and Riedel 1980
Hexacontium armatum/hostile group
Hexacontium axotrias Haeckel 1887
Hexacontium enthacanthum Jørgensen 1900
Hexacontium gigantheum Cortese and Bjørklund 1998
Hexacontium heracliti (Haeckel) Nishimura and Yamauchi 1984
Hexacontium hexactis (Stöhr) Dumitrica 1978
Hexacontium hootsi Campbell and Clark 1944
Hexacontium hystricina (Haeckel) Takahashi 1991
Hexacontium laevigatum Haeckel 1887
Hexacontium melpomene (Haeckel) Van de Paverd 1995
Hexacontium pachydermum Jørgensen 1900
Hexacontium palaeocenicum Sanfilippo and Riedel 1973
Hexacromyum Haeckel 1881
Hexacromyum elegans Haeckel 1887
Hexacromyum rara (Carnevale) Petrushevskaya 1975
Hexalonche Haeckel 1881
Hexalonche ? nakasekoi Petrushevskaya and Kozlova 1979
Hexalonche amphisiphon Haeckel 1887
Hexalonche esmarki Goll and Bjørklund 1989
Hexalonche heteracantha Popofsky 1912
Hexalonche philosophica Haeckel 1887

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TABLE 1. (Continued)

Hexastylus Haeckel 1881
Hexastylus dimensivus Haeckel 1887
Hexastylus triaxonius Haeckel 1887
Joergensenium Bjørklund 2008
Joergensenium rotatile Bjørklund 2008
Leptosphaera Haeckel 1887
Leptosphaera minuta Popofsky 1912
Liosphaera Haeckel 1887
Liosphaera antarctica Nakaseko 1959
Lithatractus Haeckel 1887
Lithatractus timmsi Campbell and Clark 1944
Lithomespilus Haeckel 1881
Lithomespilus mendosa (Krasheninnikov) 1960
Lonchosphaera Popofsky 1908
Lonchosphaera spicata Popofsky 1908
Lychnosphaera Haeckel 1881
Lychnosphaera regina Haeckel 1887
Octodendron Haeckel 1887
Octodendron cubocentron Haeckel 1887
Pentactinosphaera Nagata and Nishimura 1983
Pentactinosphaera hokurikuensis (Nakaseko) Nakaseko 1983
Peritiviator Pessagno 1976
Peritiviator (?) dumitricai Nishimura 1992
Plegmosphaera Haeckel 1881
Plegmosphaera coelopila Haeckel 1887
Plegmosphaera entodictyon Haeckel 1887
Plegmosphaera exodictyon Haeckel 1887
Plegmosphaera lepticali Renz 1976
Plegmosphaera oblonga Takahashi 1991
Plegmosphaera pachypila Haeckel 1887
Plegmosphaera pachyplegma Haeckel 1887
Prunopyle Dreyer 1889
Prunopyle hayesi Chen 1975
Prunopyle monikae (Petrushevskaya) 1975
Prunopyle tetrapila Hays 1965
Prunopyle titan Campbell and Clark 1944
Prunopyle trypopyrena Caulet 1991
Rhizoplegma Haeckel 1881
Rhizoplegma boreale Popofsky 1908
Rhizoplegma densum Blueford 1982
Saturnalis Haeckel 1881
Saturnalis circularis Haeckel 1887
Sphaeropyle Dreyer 1889
Sphaeropyle antarctica (Dreyer) 1880
Sphaeropyle langii Dreyer 1889
Sphaeropyle mespilus Dreyer 1889
Sphaeropyle robusta Kling 1973
Spongatractus Haeckel 1887
Spongatractus balbis Sanfilippo and Riedel 1973
Spongatractus pachystylus (Ehrenberg) 1873
Spongodictyon Haeckel 1887
Spongodictyon spongiosum (Mueller) 1858
Spongodrymus Haeckel 1881
Spongodrymus elaphococcus Haeckel 1887
Spongoplegma Haeckel 1881
Spongoplegma rugosa Hollande 1960
Spongoplegma variabile Nakaseko 1971
Spongosphaera Ehrenberg 1847
Spongosphaera helioides Haeckel 1862
Spongosphaera streptacantha Haeckel 1860
Stauroxiphos Haeckel 1887
Stauroxiphos communis Carnevale 1908
Stigmosphaera Haeckel 1887
Stigmosphaera cruciata Hollande and Enjumet 1960
Stylacontarium Popofsky 1912
Stylacontarium acquilonium (Hays) Kling 1973
Stylacontarium bispiculum Popofsky 1912
Stylatractus Haeckel 1887
Stylatractus coronatus (Ehrenberg) 1847
Stylatractus fragilis Haeckel 1887
Stylatractus giganteus Haeckel 1887
Stylatractus neptunus Haeckel 1887
Stylatractus ostracion (Haeckel) 1887
Stylatractus pluto (Haeckel) 1887
Stylatractus santaennae (Campbell and Clark) Petrushevskaya and Kozlova 1972
Stylatractus transparum Lazarus 1990
Stylatractus universus Hays 1970
Stylosphaera Ehrenberg 1847
Stylosphaera coronata coronata Ehrenberg 1873
Stylosphaera coronata macrosphaera Nishimura 1992
Stylosphaera coronata sabaca Sanfilippo and Riedel 1973
Stylosphaera dixyphos (Ehrenberg) Haeckel 1887
Stylosphaera hexaxyphophora (Campbell and Clark) Blueford 1988
Stylosphaera hispida Ehrenberg 1854
Stylosphaera laevis Ehrenberg 1873
Stylosphaera minor (Clark and Campbell) Sanfilippo and Riedel 1973
Stylosphaera radiosa Ehrenberg 1875
Styptosphaera Haeckel 1881
Styptosphaera spongiacea Haeckel 1887
Styptosphaera spumacea Haeckel 1887
Thecosphaera Haeckel 1881
Thecosphaera akitaensis Nakaseko 1971
Thecosphaera inermis (Haeckel) Haeckel 1887
Thecosphaera japonica Nakaseko 1971
Thecosphaera larnacium Sanfilippo and Riedel 1973
Thecosphaera miocenica Nakaseko 1955
Thecosphaera pseudojaponica Nakaseko 1971
Thecosphaera radians Hollande 1960
Thecosphaera sanfilippoae Blueford 1982
Thecosphaerella Haeckel 1887
Thecosphaerella agdaraensis (Mamedov) Sanfilippo and Riedel 1973
Thecosphaerella glebulenta Sanfilippo and Riedel 1973
Thecosphaerella ptomatus Sanfilippo and Riedel 1973
Thecosphaerella rotunda (Borisenko) Sanfilippo and Riedel 1973

Trilobatum Popofsky 1912
Trilobatum acuferum Popofsky 1912
Xiphatractus Haeckel 1887
Xiphatractus brevispina Carnevale 1908
Xiphatractus spumeus Dumitrica 1973
Xiphosphaera Haeckel 1881
Xiphosphaera gaea Haeckel 1887
Xiphosphaera tesseractis Dreyer 1913

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TABLE 1. (Continued)

Coccodiscidae
Cypassis Haeckel 1887
Cypassis irregularis Nigrini 1968
Diartus Sanfilippo and Riedel 1980
Diartus hughesi (Campbell and Clark) Sanfilippo *et al.* 1985
Diartus petterssoni (Riedel and Sanfilippo) Sanfilippo *et al.* 1985

Diartus sp. Lazarus 1992
Didymocyrtis Haeckel 1860
Didymocyrtis antepenultima (Riedel and Sanfilippo) Sanfilippo *et al.* 1985
Didymocyrtis avita (Riedel) Sanfilippo and Riedel 1980
Didymocyrtis bassanii (Carnevale) Sanfilippo and Riedel 1980
Didymocyrtis didymus (Ehrenberg) Sanfilippo and Riedel 1980
Didymocyrtis laticonus (Riedel) Sanfilippo and Riedel 1980
Didymocyrtis mammifera (Haeckel) Sanfilippo and Riedel 1980
Didymocyrtis penultima (Riedel) Sanfilippo and Riedel 1980
Didymocyrtis prismatica (Haeckel) 1887
Didymocyrtis tetrathalamus (Haeckel) Sanfilippo and Riedel 1980
Didymocyrtis tubaria (Haeckel) Sanfilippo and Riedel 1980
Didymocyrtis violina (Haeckel) Sanfilippo and Riedel 1980
Lithocyclia Ehrenberg 1847
Lithocyclia angusta (Riedel) 1959
Lithocyclia aristotelis (Ehrenberg) 1847
Lithocyclia crux Moore 1971
Lithocyclia ocellus Ehrenberg 1854
Periphaena Ehrenberg 1873
Periphaena decora Ehrenberg 1873
Periphaena delta Sanfilippo and Riedel 1973
Periphaena dupla (Kozlova) Petrushevskaya and Kozlova 1972
Periphaena heliastericus (Clark and Campbell) 1942
Periphaena triactis (Ehrenberg) Sanfilippo and Riedel 1973
Periphaena tripyramis (Haeckel) 1887
Periphaena tripyramis triangula (Sutton) 1896
Periphaena tripyramis tripyramis (Haeckel) 1887
Phacodiscus Haeckel 1881
Phacodiscus testatus Kozlova 1966
Phacostaurus Haeckel 1881
Phacostaurus (?) quadratus Nishimura 1992
Sethodiscus Haeckel 1881
Sethodiscus macrococcus Haeckel 1887
Spongoliva Haeckel 1887
Spongoliva ellipsoides Popofsky 1912
Stylocyclia Ehrenberg 1847
Stylocyclia dimidiata Ehrenberg 1873
Trigonocyclia Haeckel 1887
Trigonocyclia prima Petrushevskaya 1972

Heliodiscidae
Astrophacus Haeckel 1881
Astrophacus inca (Clark and Campbell) 1942
Astrophacus linckiaformis (Clark and Campbell) Caulet 1986
Heliodiscus Haeckel 1862
Heliodiscus asteriscus Haeckel 1887
Heliodiscus echiniscus Haeckel 1887
Heliodiscus hexastericus Clark and Campbell 1942
Heliodiscus tunicatus O'Connor 1997

Litheliidae
Discopyle Haeckel 1887
Discopyle elliptica Haeckel 1887 ***Larcopyle*** Dreyer 1889
Larcopyle augusti Lazarus *et al.* 2005
Larcopyle buetschlii Dreyer 1889
Larcopyle eccentricum Lazarus *et al.* 2005
Larcopyle frakesi (Chen) Lazarus *et al.* 2005
Larcopyle hayesi (Chen) Lazarus *et al.* 2005
Larcopyle hayesi hayesi (Chen) Lazarus *et al.* 2005
Larcopyle hayesi irregularis Lazarus *et al.* 2005
Larcopyle labryinthusa Lazarus *et al.* 2005
Larcopyle nebulum Lazarus *et al.* 2005
Larcopyle peregrinator Lazarus *et al.* 2005
Larcopyle polyacantha (Campbell and Clark) Lazarus *et al.* 2005
Larcopyle polyacantha amplissima Lazarus *et al.* 2005
Larcopyle polyacantha polyacantha (Campbell and Clark) Lazarus *et al.* 2005
Larcopyle polyacantha titan Lazarus *et al.* 2005
Larcopyle pylomaticus (Riedel) Lazarus *et al.* 2005
Larcopyle titan (Campbell and Clark) Lazarus *et al.* 2005
Larcopyle weddellium Lazarus *et al.* 2005
Lithelius Haeckel 1860
Lithelius foremanae Sanfilippo 1973
Lithelius minor Jørgensen 1900
Lithelius nautiloides Popofsky 1908
Lithelius spiralis Haeckel 1860
Lithocarpium Stöhr 1880
Lithocarpium fragilis (Stöhr) Petrushevskaya 1975
Pylospira Haeckel 1887
Pylospira octopyle Haeckel 1887

Orosphaeridae
Oroscena Haeckel 1887
Oroscena carolae Friend 1967

Pyloniidae
Dipylissa Dumitrica 1988
Dipylissa bensoni Dumitrica 1988
Hexapyle Haeckel 1881
Hexapyle dodecantha Haeckel 1887
Histiastrum Ehrenberg 1847
Histiastrum quaternarium Ehrenberg 1873
Larcospira Haeckel 1887
Larcospira bulbosa Goll and Bjørklund 1989
Larcospira moschkovskii Kruglikova 1978
Larcospira quadrangula Haeckel 1887
Octopyle Haeckel 1881
Octopyle stenozona Haeckel 1887
Phorticium Haeckel 1881
Phorticium clevei (Jørgensen) Petrushevskaya 1967
Phorticium pylonium Haeckel 1887
Pylolena Haeckel 1887
Pylolena armata Haeckel 1887
Spirema Haeckel 1887
Spirema circularis Nakaseko in Nakaseko and Sugano 1973
Spirema melonia Haeckel 1887
Stomatosphaera Dreyer 1889
Stomatosphaera haackei (Dreyer) 1889
Streblacantha Haeckel 1887

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TABLE 1. (Continued)

Streblacantha circumtexta (Jørgensen) Jørgensen 1905
Tetrapyle Mueller 1858
Tetrapyle octacantha Mueller 1858
Tholospira Haeckel 1887
Tholospira cervicornis Haeckel 1887
Tholospira dendrophora Haeckel 1887
Sphaerozoidae
Rhaphidozoum Haeckel 1862
Rhaphidozoum pandora Haeckel 1887

Spongodiscidae
Amphicraspedum Haeckel 1881
Amphicraspedum murrayanum Haeckel 1887
Amphicraspedum prolixum Sanfilippo and Riedel 1973
Amphirhopalum Haeckel 1881
Amphirhopalum straussii (Haeckel) Johnson and Nigrini 1980
Amphirhopalum virchowii (Haeckel) Dumitricia 1973
Amphirhopalum ypsilon Haeckel 1887
Amphymenium Haeckel 1881
Amphymenium amphistylium Haeckel 1887
Amphymenium challengerae Weaver 1983
Amphymenium splendiarmatum Clark 1942
Circodiscus Kozlova 1972
Circodiscus circularis Clark and Campbell 1942
Circodiscus ellipticus (Stöhr) Petrushevskaya 1975
Circodiscus microporus (Stöhr) Petrushevskaya and Kozlova 1972
Coccolarcus Haeckel 1887
Coccolarcus oviformis Clark and Campbell 1945
Dictyocoryne Ehrenberg 1860
Dictyocoryne euclidis (Haeckel) 1887
Dictyocoryne gibsoni O'Connor 1994
Dictyocoryne ontongensis Riedel and Sanfilippo 1971
Dictyocoryne profunda Ehrenberg 1872
Dictyocoryne truncatum (Ehrenberg) Nigrini and Moore 1979
Euchitonia Ehrenberg 1860
Euchitonia elegans/furcata group
Ommatodiscus Stöhr 1880
Ommatodiscus murrayi Dreyer 1889
Ommatogramma Ehrenberg 1860
Ommatogramma dumitricai Petrushevskaya 1975
Perichlamydium Ehrenberg 1847
Perichlamydium limbatum (Ehrenberg) Ehrenberg 1847
Perichlamydium praetextum (Ehrenberg) Ehrenberg 1847
Plectodiscus Kozlova 1972
Plectodiscus bergontianus (Carnevale) Petrushevskaya and Kozlova 1972
Porodiscus Haeckel 1881
Porodiscus concentricus (Ehrenberg) Haeckel 1887
Rhopalastrum Ehrenberg 1847
Rhopalastrum abyssorum (Ehrenberg) Petrushevskaya 1972
Rhopalastrum angulatum (Ehrenberg) Petrushevskaya and Kozlova 1972
Rhopalastrum oraculibrachium Caulet 1986
Schizodiscus Dogel 1952
Schizodiscus codrant Petrushevskaya 1975
Schizodiscus disymmetricus Dogel 1952
Schizodiscus favus (Ehrenberg) Petrushevskaya 1975
Schizodiscus favus maxima (Popofsky) Petrushevskaya 1975
Spongaster Ehrenberg 1860
Spongaster berminghami (Campbell and Clark) Riedel and Sanfilippo 1978
Spongaster pentas Riedel and Sanfilippo 1970
Spongaster tetras Ehrenberg 1860
Spongaster tetras irregularis Nigrini, 1967
Spongaster tetras tetras Ehrenberg 1860
Spongasteriscus Haeckel 1862
Spongasteriscus marylandicus Martin 1904
Spongobrachium Haeckel 1881
Spongobrachium ellipticum Haeckel 1862
Spongodiscus Ehrenberg 1854
Spongodiscus ambus Sanfilippo 1974
Spongodiscus biconcavus Haeckel 1887
Spongodiscus craticulatus (Stöhr) Petrushevskaya 1975
Spongodiscus cruciferus (Clark and Campbell) 1942
Spongodiscus gigas Campbell and Clark 1944
Spongodiscus klingi Caulet 1986
Spongodiscus osculosus (Dreyer) 1889
Spongodiscus phrix Sanfilippo and Riedel 1973
Spongodiscus pulcher Clark and Campbell 1945
Spongodiscus quartus (Borisenko) Sanfilippo and Riedel 1973
Spongodiscus quartus bosoculus Sanfilippo and Riedel 1973
Spongodiscus quartus quartus (Borisenko) 1958
Spongodiscus resurgens Ehrenberg 1854
Spongodiscus rhabdostylus (Ehrenberg) 1873
Spongodiscus setosus (Dreyer) Petrushevskaya 1967
Spongopyle Dreyer 1889
Spongopyle osculosa Dreyer 1889
Spongotrochus Haeckel 1860
Spongotrochus americanus Kozlova and Gorbovets 1966
Spongotrochus glacialis Popofsky 1908
Spongotrochus longispinus Haeckel 1860
Spongotrochus vitabilis Goll and Bjørklund 1989
Spongurus Haeckel 1860
Spongurus (?) irregularis Nishimura 1992
Spongurus bilobatus Clark and Campbell 1942
Spongurus cauleti Goll and Bjørklund 1989
Spongurus cylindricus Haeckel 1860
Spongurus pylomaticus Riedel 1958
Spongurus sp. cf. elliptica (Ehrenberg) 1873
Spongurus spatulaeformis Clark 1942
Stylochlamydium Haeckel 1881
Stylochlamydium asteriscus Haeckel 1887
Stylochlamydium venustum (Bailey) Haeckel 1887
Stylodictya Ehrenberg 1847
Stylodictya aculeata Jørgensen 1905
Stylodictya gracilis Ehrenberg 1854
Stylodictya hastata Ehrenberg 1873
Stylodictya inaequalispina Clark 1942
Stylodictya multispina Haeckel 1860
Stylodictya ocellata Ehrenberg 1875
Stylodictya orbiculata (Haeckel) Petrushevskaya and Kozlova 1972
Stylodictya rosella Petrushevskaya 1972
Stylodictya stellata Bailey 1856
Stylodictya tainemplekta Caulet 1991
Stylodictya targaeformis (Clark and Campbell) 1942
Stylodictya tenuispina Jørgensen 1905

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TABLE 1. (Continued)

Stylospongia Haeckel 1862
Stylospongia huxleyi Haeckel 1862
Stylotrochus Haeckel 1862
Stylotrochus alveatus Sanfilippo and Riedel 1973
Stylotrochus charlestonensis (Campbell and Clark) 1945
Stylotrochus nitidus Sanfilippo and Riedel 1973
Stylotrochus quadribrachiatus Sanfilippo and Riedel 1973
Stylotrochus quadribrachiatus multibrachiatus Sanfilippo and Riedel 1973
Stylotrochus quadribrachiatus quadribrachiatus Sanfilippo and Riedel 1973
Stylotrochus sol Campbell and Clark 1944
Tessarastrum Haeckel 1887
Tessarastrum thiedei Goll and Bjørklund 1989
Tholodiscus Kozlova 1972
Tholodiscus splendens (Ehrenberg) Petrushevskaya and Kozlova 1972
Trigonastrum Haeckel 1887
Trigonastrum regulare Haeckel 1887

Tholoniidae
Amphitholus Haeckel 1887
Amphitholus acanthometra Haeckel 1887
Cubotholus Haeckel 1887
Cubotholus octoceras Haeckel 1887
Tholoma Haeckel 1887
Tholoma metallasson Haeckel 1887

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Amphipyndacidae
Amphipternis Foreman 1973
Amphipternis clava (Ehrenberg) 1873

Archiphormididae
Arachnocalpis Haeckel 1881
Arachnocalpis ellipsoides Haeckel 1887
Arachnocalpis ovatiretalis Takahashi 1991

Artostrobiidae
Artostrobium Haeckel 1887
Artostrobium rhinoceros Sanfilippo 1974
Aspis Nishimura 1992
Aspis murus Nishimura 1992
Aspis velutochlamydosaurus Nishimura 1992
Botryostrobus Haeckel 1887
Botryostrobus aquilonaris (Bailey) Johnson 1974
Botryostrobus auritus-australis Ehrenberg 1844
Botryostrobus bramlettei Caulet 1979
Botryostrobus bramlettei bramlettei (Campbell and Clark 1944
Botryostrobus bramlettei costatus (Stöhr) 1880
Botryostrobus bramlettei pretumidulus Caulet 1979
Botryostrobus bramlettei reedi
Botryostrobus bramlettei seriatus (Jørgensen) 1905
Botryostrobus bramlettei tumidulus (Bailey) 1856
Botryostrobus hollisi O'Connor 1997
Botryostrobus joides Petrushevskaya 1975
Botryostrobus kerguelensis Caulet 1991
Botryostrobus miralestensis (Campbell and Clark) Petrushevskaya and Kozlova 1972
Botryostrobus rednosus Caulet 1991
Dictyoprora Haeckel 1881
Dictyoprora amphora Haeckel 1887
Dictyoprora armadillo (Ehrenberg) 1873
Dictyoprora mongolfieri (Ehrenberg) 1854
Dictyoprora ovata (Haeckel) Nigrini 1977
Dictyoprora physothorax Caulet 1991
Dictyoprora pirum (Ehrenberg) 1873
Dictyoprora urceolus Haeckel 1887
Lithomitra Bütschli 1882
Lithomitra micropore Shilov 1995
Phormostichoartus Campbell 1951
Phormostichoartus caryoforma (Caulet) Nigrini and Caulet 1992
Phormostichoartus corbula (Harting) Nigrini 1977
Phormostichoartus crustula (Caulet) Nigrini and Caulet 1992
Phormostichoartus doliolum Riedel and Sanfilippo 1971
Phormostichoartus fistula Nigrini 1977
Phormostichoartus furcaspiculata (Popofsky) Caulet 1986
Phormostichoartus marylandicus (Martin) 1904
Phormostichoartus multiseriatus (Ehrenberg) Caulet 1986
Phormostichoartus pitomorphus Caulet 1986
Phormostichoartus platycephala (Ehrenberg) Caulet 1986
Phormostichoartus schneideri Nigrini and Caulet 1992
Phormostichoartus strongi Hollis 1997
Plannapus O'Connor 1997
Plannapus hornibrooki O'Connor 1999
Plannapus mauricei O'Connor 1999
Plannapus microcephalus O'Connor 1999
Siphocampe Haeckel 1881
Siphocampe acephala (Ehrenberg) 1875
Siphocampe altamontensis (Campbell and Clark) 1944
Siphocampe arachnea (Ehrenberg) Nigrini 1977
Siphocampe bassilis (Foreman) Sanfilippo and Riedel 1985
Siphocampe elizabethae (Clark and Campbell) 1942
Siphocampe grantmackiei O'Connor 1997
Siphocampe imbricata (Ehrenberg) 1873
Siphocampe lineata (Ehrenberg) Nigrini 1977
Siphocampe minuta (Clark and Campbell) 1942
Siphocampe modeloensis (Campbell and Clark) Caulet 1985
Siphocampe nodosaria (Haeckel) 1887
Siphocampe pachyderma (Ehrenberg) 1873
Siphocampe quadrata Petrushevskaya and Kozlova 1972
Siphocampe septata (Petrushevskaya) 1979
Siphocampe stathmeporoides (Petrushevskaya) 1979
Siphostichartus Nigrini 1977
Siphostichartus corona (Haeckel) Nigrini 1977
Siphostichartus praecorona Nigrini 1977
Spirocyrtis Haeckel 1881
Spirocyrtis gyroscalaris Nigrini 1977
Spirocyrtis scalaris Haeckel 1887
Spirocyrtis subscalaris Nigrini 1977
Spirocyrtis subtilis Petrushevskaya 1972
Theocamptra Haeckel 1887
Theocamptra formaster Petrushevskaya 1972
Theocamptra spirocyrtis Petrushevskaya 1972

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TABLE 1. (Continued)

Tricolocampe Haeckel 1881
Tricolocampe vitrea Krasheninnikov 1960
Cannobotryidae
Acrobotrissa Haeckel 1887
Acrobotrissa cribrosa Popofsky 1913
Acrobotrys Haeckel 1881
Acrobotrys chelinobotrys Takahashi 1991
Acrobotrys disolenia Haeckel 1887
Acrobotrys sphaerothorax (Haeckel) Petrushevskaya and Kozlova 1972
Acrobotrys teralans Renz 1976
Acrobotrys tessarolobon Takahashi 1991
Acrobotrys tritubus Riedel 1957
Amphimelissa Jørgensen 1905
Amphimelissa setosa (Cleve) Bernstein 1934
Bisphaerocephalina Petrushevskaya 1965
Bisphaerocephalina armata Petrushevskaya 1965
Botryocampe Ehrenberg 1860
Botryocampe inflata Bailey 1856
Botryocella Haeckel 1887
Botryocella appenninica Vinassa de Regny 1900
Botryocella multicellaris Haeckel 1887
Botryocyrtis Ehrenberg 1860
Botryocyrtis elongatum Takahashi 1991
Botryocyrtis quinaria Ehrenberg 1872
Botryocyrtis scutum (Harting) Nigrini 1967
Botryometra Petrushevskaya 1975
Botryometra poljanskii Petrushevskaya 1975
Botryometra spongiosa Petrushevskaya 1975
Botryopyle Haeckel 1881
Botryopyle cribrosa (Ehrenberg) Haeckel 1887
Botryopyle dictyocephalus Haeckel 1887
Botryopyle dionisi Petrushevskaya 1975
Centrobotrys Petrushevskaya 1965
Centrobotrys gravida Moore 1971
Centrobotrys petrushevskayae Sanfilippo and Riedel 1973
Centrobotrys thermophila Petrushevskaya 1965
Lithobotrys Ehrenberg 1844
Lithobotrys galea Ehrenberg 1844
Neobotrys Popofsky 1913
Neobotrys quadrituberosa Popofsky 1913
Saccospyris Haecker 1907
Saccospyris antarctica Haecker 1907
Saccospyris conithorax Petrushevskaya 1965
Saccospyris preantarctica Petrushevskaya 1975

Carpocaniidae
Artobotrys Petrushevskaya 1971
Artobotrys auriculaleporis (Clark and Campbell) 1942
Artobotrys biaurita (Ehrenberg) 1873
Artobotrys borealis (Cleve) Petrushevskaya 1971
Carpocanarium Haeckel 1887
Carpocanarium papillosum (Ehrenberg) 1872
Carpocanistrum Haeckel 1887
Carpocanistrum acutidentatum Takahashi 1991
Carpocanistrum brevispina Vinassa de Regny 1900
Carpocanistrum cephalum Haeckel 1887
Carpocanistrum coronatum (Ehrenberg) Takahashi 1991
Carpocanistrum favosum (Haeckel) Takahashi 1991
Carpocanistrum flosculum Haeckel 1887
Carpocanistrum odysseus (Haeckel) Dumitricia 1973
Carpocanistrum pulchrum (Carnevale) Petrushevskaya and Kozlova 1972
Carpocanium Ehrenberg 1847
Carpocanium kinugasense Nishimura 1990
Carpocanobium Haeckel 1887
Carpocanobium setosa (Ehrenberg) Haeckel 1887
Carpocanopsis Riedel and Sanfilippo 1971
Carpocanopsis bramlettei Riedel 1971
Carpocanopsis cingulata Riedel and Sanfilippo 1971
Carpocanopsis cristata (Carnevale) Sanfilippo and Riedel 1971
Carpocanopsis favosa (Haeckel) Kruglivkova 1978
Cystophormis Haeckel 1887
Cystophormis ob Petrushevskaya 1975
Lophocorys Haeckel 1881
Lophocorys norvegiensis (Bjørklund and Kellog) Bjørklund 1976

Tricolocapsa Haeckel 1881
Tricolocapsa bergontiana (Ehrenberg) Petrushevskaya and Kozlova 1972

Collosphaeridae
Acrosphaera Haeckel 1881
Acrosphaera arktios (Nigrini) 1970
Acrosphaera australis Lazarus 1990
Acrosphaera collina Haeckel 1887
Acrosphaera cyrtodon (Haeckel) Strelkov and Reshetnyak 1971
Acrosphaera flammabunda (Haeckel) Johnson and Nigrini 1980
Acrosphaera hamospina Caulet 1986
Acrosphaera labrata Lazarus 1992
Acrosphaera lappacea (Haeckel) Johnson and Nigrini 1980
Acrosphaera mercurius Lazarus 1992
Acrosphaera murrayana (Haeckel) Hilmers 1906
Acrosphaera pseudarktios Caulet 1986
Acrosphaera spinosa Caulet 1986
Acrosphaera spinosa echinoides (Haeckel) Bjørklund and Goll 1979
Acrosphaera trepanata (Haeckel) Goll 1980
Buccinosphaera Haeckel 1887
Buccinosphaera invaginata Haeckel 1887
Clathrosphaera Haeckel 1881
Clathrosphaera arachnoides Haeckel 1887
Collosphaera Mueller 1855
Collosphaera armata Brandt 1905
Collosphaera confossa Takahashi 1991
Collosphaera huxleyi Mueller 1855
Collosphaera macropora Popofsky 1917
Collosphaera orthoconus (Haeckel) Bjørklund and Goll 1979
Collosphaera polygona Haeckel 1887
Collosphaera pyloma Reynolds 1980
Collosphaera tuberosa Haeckel 1887
Disolenia Ehrenberg 1860
Disolenia quadrata (Ehrenberg) Nigrini 1967
Otosphaera Haeckel 1887
Otosphaera annikae Petrushevskaya 1972
Otosphaera auriculata Haeckel 1887
Otosphaera tenuissima Takahashi 1991

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TABLE 1. (Continued)

Siphonosphaera Mueller 1858
Siphonosphaera cyathina Haeckel 1887
Siphonosphaera hyalina Caulet 1986
Siphonosphaera magnisphaera Takahashi 1991
Siphonosphaera martensi Brandt 1905
Siphonosphaera polysiphonia Haeckel 1887
Siphonosphaera socialis Haeckel 1887
Siphonosphaera tenera Brandt 1885
Siphonosphaera vesuvius Lazarus 1992
Solenosphaera Haeckel 1887
Solenosphaera omnitubus Riedel and Sanfilippo 1971
Solenosphaera omnitubus omnitubus Riedel and Sanfilippo 1971
Solenosphaera omnitubus procera Sanfilippo and Riedel 1974
Solenosphaera polysolenia Strelkov 1971
Solenosphaera zanguebarica Brandt 1905
Sphaerozoum Meyen 1834
Sphaerozoum crassus Goll 1980
Sphaerozoum punctatum Mueller 1858
Tribonosphaera Haeckel 1881
Tribonosphaera centripetalis Haeckel 1887
Trisolenia Ehrenberg 1860
Trisolenia megalactis megalactis Ehrenberg 1873

Myelastridae
Myelastrum Haeckel 1881
Myelastrum quadrifolium Takahashi 1991
Myelastrum trinibrachium Takahashi 1991

Plagiacanthidae
Amphiplecta Haeckel 1881
Amphiplecta acrostoma Haeckel 1887
Amphiplecta cylindrocephala Dumitrica 1973
Antarctissa Petrushevskaya 1967
Antarctissa capitata (Popofsky) Petrushevskaya 1975
Antarctissa clausa (Popofsky) Petrushevskaya 1975
Antarctissa cylindrica Petrushevskaya 1975
Antarctissa deflandrei (Petrushevskaya) Nigrini and Lombari 1984
Antarctissa denticulata (Ehrenberg) Petrushevskaya 1967
Antarctissa longa (Popofsky) Petrushevskaya 1967
Antarctissa robusta Petrushevskaya 1975
Antarctissa strelkovi Petrushevskaya 1967
Antarctissa whitei Bjørklund 1976
Arachnocorallium Haeckel 1887
Arachnocorallium calvata Petrushevskaya 1971
Arachnocorys Haeckel 1860
Arachnocorys circumtexta Haeckel 1860
Arachnocorys umbellifera Haeckel 1860
Archipilium Haeckel 1881
Archipilium macropus (Haeckel) Petrushevskaya and Kozlova 1972
Archipilium quasimacropum Wang and Yang 1992
Archiscenium Haeckel 1881
Archiscenium quadrispinum Haeckel 1887
Botryopera Haeckel 1887
Botryopera (?) pseudoantarctissa Petrushevskaya 1979
Botryopera boldyrae (Petrushevskaya) Petrushevskaya 1975
Botryopera chlamida Petrushevskaya 1975
Botryopera oceanica (Ehrenberg) Petrushevskaya 1975
Botryopera triloba (Ehrenberg) Haeckel 1887
Callimitra Haeckel 1881
Callimitra atavia Goll 1979
Callimitra carolotae Haeckel 1887
Callimitra simplex Popofsky 1913
Callimitra solocicribrata Takahashi 1991
Ceratocyrtis Bütschli 1882
Ceratocyrtis amplus (Popofsky) 1908
Ceratocyrtis broeggeri Goll and Bjørklund 1989
Ceratocyrtis cucullaris (Ehrenberg) Bütschli 1882
Ceratocyrtis erosa (Cleve) Petrushevskaya 1971
Ceratocyrtis galeus (Cleve) Bjørklund 1976
Ceratocyrtis histricosa (Jørgensen) Petrushevskaya 1971
Ceratocyrtis manumi Goll and Bjørklund 1989
Ceratocyrtis mashae Bjørklund 1976
Ceratocyrtis robustus Bjørklund 1976
Ceratocyrtis sinuosa Petrushevskaya 1971
Ceratocyrtis stigi (Bjørklund) 1976
Ceratocyrtis stoermeri Goll and Bjørklund 1989
Cladoscenium Haeckel 1881
Cladoscenium limbatum Jørgensen 1905
Cladoscenium tricolpium (Haeckel) Jørgensen 1900
Clathrocanium Ehrenberg 1860
Clathrocanium coarctatum Ehrenberg 1872
Clathrocanium diadema Haeckel 1887
Clathrocanium sphaerocephalum Haeckel 1887
Clathrocorona Haeckel 1881
Clathrocorona atreta Sanfilippo 1973
Clathrocorys Haeckel 1881
Clathrocorys giltschii Haeckel 1887
Clathrocorys gracilis Wang 2005
Clathrocorys murrayi Haeckel 1887
Clathrocorys teuscheri Haeckel 1887
Clathromitra Haeckel 1881
Clathromitra pentacantha Haeckel 1887
Clathromitra pterophormis Haeckel 1887
Enneaphormis Haeckel 1881
Enneaphormis rotula Haeckel 1887
Euscenarium Haeckel 1887
Euscenarium joergenseni Sugiyama 1994
Euscenium Haeckel 1887
Euscenium corynephorum Jørgensen 1900
Helotholus Jørgensen 1905
Helotholus haysi Lazarus 1992
Helotholus praevema Weaver 1983
Lamprotripus Haeckel 1881
Lamprotripus mawsoni (Riedel) Petrushevskaya and Kozlova 1972
Lithomelissa Ehrenberg 1847
Lithomelissa challengerae Chen 1975
Lithomelissa cheni Caulet 1991
Lithomelissa dupliphysa Caulet 1991
Lithomelissa ehrenbergii Bütschli 1882
Lithomelissa gelasinus O'Connor 1997
Lithomelissa haeckeli Bütschli 1882
Lithomelissa hystrix Jørgensen 1900

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TABLE 1. (Continued)

Lithomelissa laticeps Jørgensen 1905
Lithomelissa maureenae O'Connor 1997
Lithomelissa mitra Bütschli 1882
Lithomelissa pentacantha (Popofsky) Petrushevskaya 1971
Lithomelissa robusta Campbell and Clark 1944
Lithomelissa setosa Jørgensen 1905
Lithomelissa sphaerocephalis Chen 1975
Lithomelissa thoracites Haeckel 1860
Lithomelissa tricornis Chen 1975
Lithomelissa ultima Caulet 1979
Lithomelissa? aitai Hollis 1997
Lithopilium Popofsky 1913
Lithopilium reticulatum Popofsky 1913
Lithopilium sphaerocephalum Popofsky 1913
Lophophaena Ehrenberg 1847
Lophophaena buetschlii (Haeckel) Petrushevskaya 1971
Lophophaena capito Ehrenberg 1873
Lophophaena circumtexta Haeckel 1887
Lophophaena clevei Petrushevskaya 1971
Lophophaena cylindrica (Cleve) Petrushevskaya 1971
Lophophaena decacantha Takahashi 1991
Lophophaena hispida (Ehrenberg) Petrushevskaya 1971
Lophophaena macrencephala Clark and Campbell 1945
Lophophaena nadezdae Petrushevskaya 1971
Lophophaena rioplatensis Boltovskoy 2003
Lophophaena tekopua O'Connor 1997
Lophophaena thaumasia Caulet 1991
Lophophaena variabilis (Popofsky) Petrushevskaya 1971
Lophophaena witjazii (Petrushevskaya) Van de Paverd 1995
Lophophaenoma Haeckel 1887
Lophophaenoma radians (Ehrenberg) 1873
Mitrocalpis Haeckel 1881
Mitrocalpis araneafera Popofsky 1908
Neosemantis Popofsky 1913
Neosemantis bjoerklundi Goll 1979
Neosemantis bjoerklundi mimicus Goll 1979
Neosemantis cladophora Goll 1979
Neosemantis distephanus Goll 1979
Neosemantis distephanus distephanus Goll 1979
Neosemantis hofferti Goll 1980
Peridium Haeckel 1887
Peridium longispinum Jørgensen 1900
Peridium spinipes Haeckel 1887
Peromelissa Haeckel 1881
Peromelissa phalacra Haeckel 1887
Phormacantha Jørgensen 1905
Phormacantha hystrix (Jørgensen) Jørgensen 1905
Plagiacantha Mueller 1857
Plagiacantha arachnoides Claparede 1856
Plagiacantha panarium Dumitrica 1973
Plectacantha Jørgensen 1905
Plectacantha cremastoplegma Nigrini 1968
Plectacantha oikiskos Jørgensen 1905
Plectacantha trichoides Jørgensen 1905
Plectagonidium Cachon and Cachon 1969
Plectagonidium deflandrei Cachon and Cachon 1969
Pleuropodium Haeckel 1881
Pleuropodium (?) tortuosum Nishimura 1992
Protoscenium Jørgensen 1905
Protoscenium simplex Jørgensen 1905
Pseudocubus Haeckel 1887
Pseudocubus obeliscus Haeckel 1887
Pseudocubus octostylus Haeckel 1887
Pseudocubus vema (Hays) Petrushevskaya 1971
Pseudocubus warreni Goll 1980
Pseudodictyophimus Petrushevskaya 1971
Pseudodictyophimus amundseni Goll and Bjørklund 1989
Pseudodictyophimus callosus (Petrushevskaya) Caulet 1986
Pseudodictyophimus galeatus Caulet 1991
Pseudodictyophimus gracilipes Caulet 1979
Pseudodictyophimus gracilipes tetracanthus (Popofsky) 1913
Pseudodictyophimus horrida Petrushevskaya 1975
Pseudodictyophimus platycephalus (Haeckel) 1887
Pseudodictyophimus tanythorax Funakawa 1994
Pteropilium Haeckel 1881
Pteropilium stratiotes Haeckel 1887
Pteroscenium Haeckel 1881
Pteroscenium pinnatum Haeckel 1887
Rhabdolithis Ehrenberg 1847
Rhabdolithis ellida Sanfilippo and Riedel 1973
Rhabdolithis pipa Ehrenberg 1854
Sethophormis Haeckel 1887
Sethophormis aurelia Haeckel 1887
Spongomelissa Haeckel 1887
Spongomelissa adunca Sanfilippo and Riedel 1973
Spongomelissa cucumella Sanfilippo and Riedel 1973
Spongomelissa dilli Chen 1975
Tetraphormis Haeckel 1881
Tetraphormis dodecaster (Haeckel) Takahashi 1991
Tetraplecta Haeckel 1881
Tetraplecta pinigera Haeckel 1887
Tetraplecta plectaniscus Takahashi 1991
Tripilidium Haeckel 1881
Tripilidium clavipes Clark and Campbell 1942
Tripilidium clavipes advena Clark and Campbell 1945
Tripocalpis Haeckel 1881
Tripocalpis cassidus Nishimura 1992
Tripocalpis simplex Nishimura 1992
Tripodiscinus Haeckel 1887
Tripodiscinus tumulosus (Kozlova) Petrushevskaya and Kozlova 1979
Tripophaenoscenium Campbell and Clark 1944
Tripophaenoscenium laimingi Campbell and Clark 1944
Trisulcus Popofsky 1913
Trisulcus nana (Popofsky) Petrushevskaya 1971
Trisulcus triacanthus Popofsky 1913
Velicucullus Riedel and Campbell 1952
Velicucullus altus Abelmann 1990
Velicucullus magnificum (Clark and Campbell) Caulet 1986
Velicucullus oddgurneri Bjørklund 1976
Velicucullus palaeocenica Nishimura 1992

Pterocorythidae
Androcyclas Jørgensen 1905
Androcyclas gamphonycha (Jørgensen) Jørgensen 1905

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TABLE 1. (Continued)

Anthocyrtidium Haeckel 1881
Anthocyrtidium angulare Nigrini 1971
Anthocyrtidium ehrenbergi (Stöhr) Haeckel 1887
Anthocyrtidium euryclathrum Nigrini and Caulet 1988
Anthocyrtidium jenghisi Streeter 1988
Anthocyrtidium marieae O'Connor 1997
Anthocyrtidium michelinae Caulet 1979
Anthocyrtidium nosicaae Caulet 1979
Anthocyrtidium ophirense (Ehrenberg) Petrushevskaya 1968
Anthocyrtidium pliocenica (Seguenza) Nigrini and Caulet 1988
Anthocyrtidium prolatum Nigrini and Caulet 1988
Anthocyrtidium zanguebaricum (Ehrenberg) Haeckel 1887
Calocycletta Haeckel 1887
Calocycletta acanthocephala (Ehrenberg) Petrushevskaya and Kozlova 1972
Calocycletta caepa Moore 1972
Calocycletta cladara Sanfilippo and Riedel 1992
Calocycletta costata (Riedel) Riedel and Sanfilippo 1970
Calocycletta parva Moore 1972
Calocycletta robusta Moore 1971
Calocycletta serrata Moore 1972
Calocycletta virginis Haeckel 1887
Cryptocarpium Sanfilippo and Riedel 1992
Cryptocarpium azyx (Sanfilippo and Riedel) 1973
Cryptocarpium ornatum (Ehrenberg) 1873
Lamprocyclas Haeckel 1881
Lamprocyclas aegles Ehrenberg 1854
Lamprocyclas hadros Nigrini and Caulet 1992
Lamprocyclas hannai (Campbell and Clark) Sanfilippo *et al.* 1985
Lamprocyclas inexpectata Caulet 1991
Lamprocyclas junonis (Haeckel) Petrushevskaya and Kozlova 1972
Lamprocyclas margatensis (Campbell and Clark) Caulet 1986
Lamprocyclas maritalis Haeckel 1887
Lamprocyclas maritalis maritalis Haeckel 1887
Lamprocyclas maritalis polypora Nigrini 1967
Lamprocyclas maritalis ventricosa Nigrini 1968
Lamprocyclas matakohe O'Connor 1997
Lamprocyclas prionotocodon Caulet 1991
Lamprocyclas rhinoceros (Haeckel) Petrushevskaya and Kozlova 1972
Lamprocyrtis Kling 1973
Lamprocyrtis daniellae Caulet 1986
Lamprocyrtis heteroporos (Hays) Kling 1973
Lamprocyrtis neoheteroporos Kling 1973
Lamprocyrtis nigriniae (Caulet) Kling 1973
Podocyrtis Ehrenberg 1847
Podocyrtis acalles Sanfilippo and Riedel 1992
Podocyrtis ampla (Ehrenberg) Nigrini 1974
Podocyrtis ampla ampla
Podocyrtis apeza Sanfilippo and Riedel 1992
Podocyrtis aphorma Riedel 1970
Podocyrtis argulus Ehrenberg 1873
Podocyrtis chalara Riedel 1970
Podocyrtis coronatus (Ehrenberg) Petrushevskaya and Kozlova 1972
Podocyrtis diamesa Riedel 1970
Podocyrtis dorus Sanfilippo 1973
Podocyrtis fasciolata (Nigrini) 1974
Podocyrtis goetheana (Haeckel) 1887 *Podocyrtis helenae* Nigrini 1974
Podocyrtis mitra Ehrenberg 1854
Podocyrtis mitrella Ehrenberg 1873
Podocyrtis papalis Ehrenberg 1847
Podocyrtis phyxis Sanfilippo 1973
Podocyrtis platypus Sanfilippo 1973
Podocyrtis sinuosa Ehrenberg 1873
Podocyrtis trachodes Riedel 1970
Pterocorys Haeckel 1881
Pterocorys campanula Haeckel 1887
Pterocorys campanula variabilis Caulet 1979
Pterocorys clausus (Popofsky) Petrushevskaya and Kozlova 1972
Pterocorys hertwigii (Haeckel) Petrushevskaya 1971
Pterocorys longicollis Caulet 1986
Pterocorys macroceras (Popofsky) Petrushevskaya 1971
Pterocorys minythorax (Nigrini) Nigrini and Moore 1979
Pterocorys sabae (Ehrenberg) Haeckel 1887
Pterocorys zancleus (Mueller) Nigrini and Moore 1979
Tetracorethra Haeckel 1881
Tetracorethra tetracorethra Haeckel 1887
Theocorythium Haeckel 1887
Theocorythium trachelium (Ehrenberg) Nigrini 1967
Theocorythium trachelium dianae (Haeckel) 1887
Theocorythium trachelium trachelium (Ehrenberg) 1872
Theocorythium vetulum Nigrini 1971
Theocyrtis Haeckel 1887
Theocyrtis annosa (Riedel) 1959
Theocyrtis diabloensis Clark 1942
Theocyrtis litos (Clark and Campbell) 1945
Theocyrtis robusta (Clark andCampbell) Caulet 1991
Theocyrtis tuberosa Riedel 1959

Theoperidae
Anthocorys Haeckel 1881
Anthocorys akitaensis Nakaseko 1959
Anthocyrtella Haeckel 1887
Anthocyrtella callopisma Caulet 1986
Anthocyrtella mespilus (Ehrenberg) 1847
Anthocyrtella spatiosa (Ehrenberg) 1873
Anthocyrtoma Haeckel 1887
Anthocyrtoma (?) frizzelli Nishimura 1992
Aphetocyrtis Sanfilippo and Caulet 1998
Aphetocyrtis gnomabax Sanfilippo and Caulet 1998
Artophormis Haeckel 1881
Artophormis barbadensis (Ehrenberg) 1873
Artophormis dominasinensis (Ehrenberg) Riedel and Sanfilippo 1970
Artophormis gracilis Riedel 1959
Artopilium Haeckel 1881
Artopilium elegans Haeckel 1887
Artopilium undulatum Popofsky 1913
Artostrobus Haeckel 1887
Artostrobus annulatus (Bailey) Haeckel 1887
Artostrobus elegans (Ehrenberg) Caulet 1986
Artostrobus Jørgenseni Petrushevskaya 1967
Artostrobus pretabulatus Petrushevskaya 1975

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Artostrobus quadriporus Bjørklund 1976
Bathropyramis Haeckel 1881
Bathropyramis aeshna Petrushevskaya 1972
Bathropyramis ramosa Haeckel 1887
Bathropyramis scalaris (Ehrenberg) Petrushevskaya and Kozlova 1972
Bathropyramis spongiosa (Haeckel) Petrushevskaya and Kozlova 1972
Bathropyramis woodringi Campbell and Clark 1944
Bekoma Riedel and Sanfilippo 1971
Bekoma (?) demissa demissa
Bekoma (?) demissa robusta Nishimura 1992
Bekoma (?) oliva Nishimura 1992
Bekoma bidartensis Riedel and Sanfilippo 1971
Bekoma campechensis Foreman 1973
Bekoma demissa Foreman 1973
Bekoma divaricata Foreman 1973
Bekoma helenae Nishimura 1992
Bekomiforma Sanfilippo and Riedel 1974
Bekomiforma mynx Sanfilippo and Riedel 1974
Buryella Foreman 1973
Buryella clinata Foreman 1973
Buryella foremanae Petrushevskaya 1977
Buryella granulata Petrushevskaya 1977
Buryella pentadica Foreman 1973
Buryella tetradica Foreman 1973
Calocyclas Ehrenberg 1847
Calocyclas bandyca (Mato and Theyer) 1980
Calocyclas disparidens Chen 1975
Calocyclas extensa Clark 1942
Calocyclas fragilis (Carnevale) Petrushevskaya 1975
Calocyclas hispida (Ehrenberg) 1873
Calocyclas monumentum Haeckel 1887
Calocyclas talwanii Bjørklund 1972
Calocyclas turris Ehrenberg 1873
Calocyclas? nakasekoi Takemura and Ling 1998
Calocycloma Haeckel 1887
Calocycloma ampulla (Ehrenberg) 1854
Calocycloma castum (Haeckel) 1887
Cassideus Pessagno 1969
Cassideus mariae Nishimura 1992
Clathrocyclas Haeckel 1881
Clathrocyclas alcmenae Haeckel 1887
Clathrocyclas aurelia Clark and Campbell 1945
Clathrocyclas australis Hollis 1997
Clathrocyclas cassiopeiae Haeckel 1887
Clathrocyclas semeles Haeckel 1887
Clathrocyclas universa Clark 1942
Clathrocyclas universa nova Clark and Campbell 1945
Clathrocycloma Haeckel 1887
Clathrocycloma (?) catherinea Nishimura 1992
Clathrocycloma capitaneum Foreman 1973
Clathrocycloma parcum Foreman 1973
Clathropyrgus Haeckel 1881
Clathropyrgus (?) grandifenestra Nishimura 1992
Clinorhabdus Sanfilippo and Caulet 1998
Clinorhabdus longithorax (Abelmann) Sanfilippo and Caulet 1998
Clinorhabdus robusta (Abelmann) Sanfilippo and Caulet 1998
Conarachnium Haeckel 1881
Conarachnium facetum (Haeckel) Takahashi 1991
Conarachnium parabolicum (Popofsky) Takahashi 1991
Conicavus Takahashi 1991
Conicavus tipiopsis Takahashi 1991
Cornutella Ehrenberg 1838
Cornutella clava Petrushevskaya 1972
Cornutella profunda Ehrenberg 1856
Cornutella stiligera Ehrenberg 1854
Cycladophora Ehrenberg 1847
Cycladophora bicornis (Popofsky) Lombari and Lazarus 1988
Cycladophora bicornis amphora Lombari and Lazarus 1988
Cycladophora bicornis bicornis (Popofsky) Lombari and Lazarus 1988
Cycladophora bicornis helios Lombari and Lazarus 1988
Cycladophora cabrilloensis (Campbell and Clark) Lombari and Lazarus 1988
Cycladophora cabrilloensis subhumerus Lombari and Lazarus 1988
Cycladophora campanula Haeckel 1887
Cycladophora conica Lombari and Lazarus 1988
Cycladophora cosma Lombari and Lazarus 1988
Cycladophora cosma cosma Lombari and Lazarus 1988
Cycladophora davisiana Ehrenberg 1861
Cycladophora golli (Chen) Lombari and Lazarus 1988
Cycladophora golli golli (Chen) 1975
Cycladophora golli regipileus (Chen) Lombari and Lazarus 1988
Cycladophora humerus (Petrushevskaya) Lombari and Lazarus 1988
Cycladophora pliocenica (Hays) Lombari and Lazarus 1988
Cycladophora robusta Lombari and Lazarus 1988
Cycladophora sakaii Motoyama 1996
Cycladophora spongothorax (Chen) Lombari and Lazarus 1988
Cycladophora tetracantha (Bjørklund and Kellogg) Lazarus and Pallant 1989
Cymaetron Caulet 1991
Cymaetron sinolampas Caulet 1991
Cyrtocapsella Haeckel 1887
Cyrtocapsella ampullacea Goll and Bjørklund 1989
Cyrtocapsella cornuta Haeckel 1887
Cyrtocapsella eldholmi Bjørklund 1976
Cyrtocapsella elongata (Nakaseko) Sanfilippo and Riedel 1970
Cyrtocapsella japonica Tochilina 1985
Cyrtocapsella kladaros Goll and Bjørklund 1989
Cyrtocapsella tetrapera Haeckel 1887
Cyrtolagena Haeckel 1887
Cyrtolagena aglaolampa Takahashi 1991
Cyrtolagena laguncula Haeckel 1887
Dictyocephalus Ehrenberg 1860
Dictyocephalus middouri Nishimura 1992
Dictyocodon Haeckel 1881
Dictyocodon palladius Haeckel 1887
Dictyomitra Zittel 1876
Dictyomitra amygdala Shilov 1995
Dictyophimus Ehrenberg 1847
Dictyophimus (?) constrictus Nishimura 1992
Dictyophimus (?) okadai Nishimura 1992
Dictyophimus archipilium Petrushevskaya 1975

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Dictyophimus bicornis (Ehrenberg) Petrushevskaya 1967
Dictyophimus bullatus Morley and Nigrini 1995
Dictyophimus caia Foreman 1973
Dictyophimus craticula Ehrenberg 1873
Dictyophimus crisiae Ehrenberg 1854
Dictyophimus hirundo (Haeckel) Petrushevskaya 1975
Dictyophimus histricosus Jørgensen 1905
Dictyophimus infabricatus Nigrini 1968
Dictyophimus killmari (Renz) 1974
Dictyophimus macropterus (Ehrenberg) Takahashi 1991
Dictyophimus pocillum Ehrenberg 1873
Dictyophimus splendens Clark 1942
Dictyopodium Ehrenberg 1847
Dictyopodium oxylophus Ehrenberg 1873
Diplocyclas Haeckel 1881
Diplocyclas pseudobicorona Nishimura 1992
Diplocyclas pseudobicorona pseudobicorona Nishimura 1992
Diplocyclas pseudobicorona teres Nishimura 1992
Eucecryphalus Haeckel 1860
Eucecryphalus cervus (Ehrenberg) Petrushevskaya 1971
Eucecryphalus clinatus Takahashi 1991
Eucecryphalus craspedota (Jørgensen) Petrushevskaya and Bjørklund 1974
Eucecryphalus emmae (Haeckel) 1887
Eucecryphalus europae (Haeckel) Takahashi 1991
Eucecryphalus gegenbauri Haeckel 1860
Eucecryphalus petrushevskaae Caulet 1979
Eucecryphalus sestrodiscus (Haeckel) Takahashi 1991
Eucecryphalus tricostatus (Haeckel) Takahashi 1991
Eucyrtidium Ehrenberg 1847
Eucyrtidium acuminatum (Ehrenberg) Ehrenberg 1847
Eucyrtidium aderces Nigrini and Caulet 1992
Eucyrtidium anniae Caulet 1986
Eucyrtidium annulatum (Popofsky) 1913
Eucyrtidium anomalum (Haeckel) Haeckel 1862
Eucyrtidium antiquum Caulet 1991
Eucyrtidium asanoi Sakai 1980
Eucyrtidium biconicum (Vinassa de Regny) Caulet 1991
Eucyrtidium calvertense Martin 1904
Eucyrtidium cheni Takemura 1992
Eucyrtidium cienkowskii Haeckel 1887
Eucyrtidium diaphanes Sanfilippo 1973
Eucyrtidium dictyopodium (Haeckel) Takahashi 1991
Eucyrtidium dufresni Caulet 1979
Eucyrtidium erythromystax Nigrini and Caulet 1992
Eucyrtidium heptacolum (Haeckel) Petrushevskaya 1971
Eucyrtidium hexacolum (Haeckel) Petrushevskaya 1971
Eucyrtidium hexagonatum Haeckel 1887
Eucyrtidium hexastichum Haeckel 1887
Eucyrtidium indiensis Caulet 1979
Eucyrtidium inflatum Kling 1973
Eucyrtidium infundibulum (Haeckel) Benson 1983
Eucyrtidium mariae Caulet 1991
Eucyrtidium matuyamai Hays 1970
Eucyrtidium montiparum Ehrenberg 1873
Eucyrtidium octocolum (Haeckel) Petrushevskaya 1971
Eucyrtidium pseudoinflatum Weaver 1983
Eucyrtidium punctatum (Ehrenberg) Ehrenberg 1847
Eucyrtidium saccoi (Vinassa de Regny) Goll and Bjørklund 1989
Eucyrtidium spinosum Haeckel 1887
Eucyrtidium teuscheri Haeckel 1887
Eucyrtidium teuscheri orthoporus Caulet 1985
Eucyrtidium teuscheri teuscheri Caulet 1985
Eucyrtidium yatsuoense Nakaseko 1955
Eurystomoskevos Caulet 1991
Eurystomoskevos petrushevskaae Caulet 1991
Eusyringium Haeckel 1881
Eusyringium fistuligerum (Ehrenberg) 1873
Eusyringium lagena (Ehrenberg) 1873
Eusyringium tubulus (Ehrenberg) Petrushevskaya and Kozlova 1972
Gondwanaria Petrushevskaya and Kozlova 1975
Gondwanaria campanulaeformis (Campbell and Clark) 1945
Gondwanaria deflandrei Petrushevskaya 1975
Gondwanaria dogieli Petrushevskaya 1979
Gondwanaria hister Petrushevskaya 1975
Gondwanaria japonica (Nakaseko) 1963
Gondwanaria japonica kiaeri Goll and Bjørklund 1989
Gondwanaria reshetnjakae (Petrushevskaya) Petrushevskaya and Kozlova 1979
Lampromitra Haeckel 1881
Lampromitra coronata Haeckel 1887
Lampromitra cracenta Takahashi 1991
Lampromitra danaes (Haeckel) 1887
Lampromitra parabolica Popofsky 1913
Lampromitra pentalactis (Haeckel) 1887
Lampromitra quadricuspis Haeckel 1887
Lampromitra schultzei (Haeckel) Takahashi 1991
Lampromitra spinosiretis Takahashi 1991
Lampromitra tiara Dumitrica 1973
Lamptonium Haeckel 1887
Lamptonium colymbus Foreman 1973
Lamptonium fabaeforme Riedel 1970
Lamptonium fabaeforme chaunothorax Riedel and Sanfilippo 1970
Lamptonium fabaeforme constrictum Riedel and Sanfilippo 1970
Lamptonium fabaeforme fabaeforme (Krasheninnikov) 1960
Lamptonium incohatum Foreman 1973
Lamptonium obelix Sanfilippo 1979
Lamptonium pennatum Foreman 1973
Lamptonium sanfilippoae Foreman 1973
Lipmanella Loeblich and Tappan 1961
Lipmanella acanthica (Jørgensen) Petrushevskaya and Kozlova 1979
Lipmanella bombus Haeckel 1887
Lipmanella dictyoceras (Haeckel) Kling 1973
Lipmanella insectum Haeckel 1887
Lipmanella irregularis (Cleve) Loeblich and Tappan 1961
Lipmanella tribranchiata Dumitrica 1973
Lipmanella xiphephorum Jørgensen 1899
Lithapium Haeckel 1887
Lithapium anoectum Riedel 1970
Lithapium mitra (Ehrenberg) Riedel and Sanfilippo 1970
Lithapium plegmacantha Riedel 1970
Litharachnium Haeckel 1860
Litharachnium eupilium Takahashi 1991
Litharachnium tentorium Haeckel 1860

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TABLE 1. (Continued)

Lithocampana Clark and Campbell 1942
Lithocampana lithoconella Clark and Campbell 1942
Lithochytris Ehrenberg 1847
Lithochytris archaea Riedel and Sanfilippo 1970
Lithochytris triconiscus (Haeckel) Petrushevskaya 1981
Lithochytris ventricosa (Ehrenberg) Petrushevskaya and Kozlova 1972
Lithochytris vespertilio Ehrenberg 1873
Lithomitrissa Haeckel 1887
Lithomitrissa conica Vituchin 1993
Lithopera Ehrenberg 1847
Lithopera bacca Ehrenberg 1872
Lithopera baueri Sanfilippo 1970
Lithopera neotera Sanfilippo 1970
Lithopera renzae Sanfilippo 1970
Lithopera thornburgi Sanfilippo 1970
Lithostrobus Bütschli 1882
Lithostrobus cuspidatus Haeckel 1887
Lithostrobus hexagonalis Haeckel 1887
Lithostrobus microporus (Ehrenberg) Bütschli 1882
Lithostrobus undulatus (Popofsky) De Wever *et al.* 1990
Lophoconus Haeckel 1887
Lophoconus titanothericeraos Clark and Campbell 1942
Lophocorys polyacantha Popofsky 1913
Lophocyrtis Haeckel 1887
Lophocyrtis (?) pseudojacchia Nishimura 1992
Lophocyrtis andriashevi (Petrushevskaya) Hull 1979
Lophocyrtis aspera (Ehrenberg) Sanfilippo and Caulet 1998
Lophocyrtis brachythorax (Sanfilippo and Riedel) Sanfilippo 1990
Lophocyrtis dumitricai Sanfilippo 1990
Lophocyrtis galenum Sanfilippo 1990
Lophocyrtis hadra (Riedel and Sanfilippo) 1986
Lophocyrtis inaequalis O'Connor 1997
Lophocyrtis jacchia (Ehrenberg) 1873
Lophocyrtis leptetrum (Sanfilippo and Riedel) Sanfilippo 1990
Lophocyrtis longiventer (Chen) 1975
Lophocyrtis milowi (Riedel and Sanfilippo) 1971
Lophocyrtis neatum (Sanfilippo and Riedel) Sanfilippo 1990
Lophocyrtis pegetrum (Sanfilippo and Riedel) Sanfilippo 1990
Lophocyrtis semipolita (Campbell and Clark) Sanfilippo and Caulet 1998
Lophocyrtis tanythorax (Sanfilippo and Riedel) Sanfilippo 1990
Lychnocanium Ehrenberg 1847
Lychnocanium carinatum Ehrenberg 1873
Lychnocanium conicum Clark 1942
Lychnocanium hirundo Ehrenberg 1875
Lychnocanium neptunei O'Connor 1997
Lychnocanoma Haeckel 1887
Lychnocanoma (?) costata Nishimura 1992
Lychnocanoma (?) pileus Nishimura 1992
Lychnocanoma amphitrite Foreman 1973
Lychnocanoma anacolum Foreman 1973
Lychnocanoma auxilla Foreman 1973
Lychnocanoma bajunensis Renz 1984
Lychnocanoma bellum (Clark and Campbell) 1942
Lychnocanoma elongata (Vinassa de Regny) 1900
Lychnocanoma grande Campbell and Clark 1944
Lychnocanoma grande rugosum
Lychnocanoma nipponica Sakai 1980
Lychnocanoma nipponica magnacornuta Sakai 1980
Lychnocanoma nipponica nipponica (Nakaseko) 1963
Lychnocanoma nipponica sakaii Morley and Nigrini 1995
Lychnocanoma parallelipes Motoyama 1996
Lychnocanoma trifolium (Riedel and Sanfilippo 1971
Lychnocanoma turgidum (Ehrenberg) 1872
Orbula Foreman 1973
Orbula comitata Foreman 1973
Orbula discipulus Foreman 1973
Orbula ducalis Foreman 1973
Peripyramis Haeckel 1881
Peripyramis circumtexta Haeckel 1887
Peripyramis magnifica (Clark and Campbell) 1942
Phormocyrtis Haeckel 1887
Phormocyrtis alexandrae O'Connor 1997
Phormocyrtis cubensis (Riedel and Sanfilippo) 1971
Phormocyrtis embolum Ehrenberg 1873
Phormocyrtis proxima Clark and Campbell 1942
Phormocyrtis striata Wetzel 1935
Phormocyrtis striata exquisita (Kozlova, in Kozlova and Gorbovetz) 1966
Phormocyrtis striata praexquisita Nishimura 1992
Phormocyrtis striata striata Brandt in Wetzel 1935
Phormocyrtis turgida (Krasheninnikov) 1960
Phrenocodon Haeckel 1887
Phrenocodon clathrostomium Haeckel 1887
Plectopyramis Haeckel 1881
Plectopyramis dodecomma Haeckel 1887
Podocyrtis schomburgkii var. Bury 1862
Pterocanium Ehrenberg 1847
Pterocanium (?) gigas Nishimura 1992
Pterocanium (?) procerum Nishimura 1992
Pterocanium audax (Riedel) 1953
Pterocanium auritum Nigrini and Caulet 1992
Pterocanium charybdeum Mueller 1858
Pterocanium charybdeum trilobum (Haeckel) 1860
Pterocanium contiguum Ehrenberg 1873
Pterocanium grandiporus Nigrini 1968
Pterocanium korotnevi (Dogel) in Dogel and Reshetnyak 1952
Pterocanium orcinum Haeckel 1887
Pterocanium praetextum (Ehrenberg) Haeckel 1887
Pterocanium praetextum eucolpum Haeckel 1887
Pterocanium praetextum praetextum (Ehrenberg) 1872
Pterocanium prismatium Riedel 1957
Pterocanium satelles (Kozlova) Petrushevskaya 1975
Pterocodon Ehrenberg 1847
Pterocodon ampla (Brandt) 1935
Pterocodon anteclinata Foreman 1975
Pterocodon campana Ehrenberg 1847
Pterocodon lex Sanfilippo 1979
Pterocodon tenellus Foreman 1973
Pterocyrtidium Bütschli 1882
Pterocyrtidium (?) borisenkoi Nishimura 1992
Pterocyrtidium genriettae Nishimura 1992
Rhopalocanium Ehrenberg 1847
Rhopalocanium ornatum Ehrenberg 1847
Sethochytris Haeckel 1881
Sethochytris babylonis (Clark and Campbell) Riedel and Sanfilippo 1970
Sethochytris cavipodis O'Connor 1999

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TABLE 1. (Continued)

Sethoconus Haeckel 1887
Sethoconus myxobrachia Strelkov 1959
Sethoconus tabulatus Haeckel 1887
Stichocampe Haeckel 1881
Stichocampe (?) magnacornus Nishimura 1992
Stichocampe bironec Renz 1976
Stichocorys Haeckel 1881
Stichocorys armata (Haeckel) Riedel and Sanfilippo 1971
Stichocorys delmontensis (Campbell and Clark) Sanfilippo and Riedel 1970
Stichocorys diploconus (Haeckel) Sanfilippo and Riedel 1970
Stichocorys greeni O'Connor 1994
Stichocorys johnsoni Caulet 1986
Stichocorys negripontensis O'Connor 1997
Stichocorys peregrina (Riedel) 1953
Stichocorys wolffii Haeckel 1887
Stichopilidium Haeckel 1887
Stichopilidium columba (Haeckel) 1887
Stichopilidium kruegeri (Popofsky) Nishimura and Yamauchi 1984
Stichopilidium sphinx (Ehrenberg) Petrushevskaya and Kozlova 1972
Stichopilium Haeckel 1881
Stichopilium bicorne Haeckel 1887
Stichopilium variabilis Popofsky 1908
Theocorys Haeckel 1881
Theocorys acroria Foreman 1973
Theocorys anaclasta Riedel 1970
Theocorys anapographa Riedel 1970
Theocorys cretica (Ehrenberg) Haeckel 1887
Theocorys phyzella Foreman 1973
Theocorys puriri O'Connor 1997
Theocorys redondoensis (Campbell and Clark) Kling 1973
Theocorys saginata Takemura and Ling 1998
Theocorys spongoconus Kling 1971
Theocorys veneris Haeckel 1887
Theocotyle Riedel and Sanfilippo 1970
Theocotyle conica Foreman 1973
Theocotyle cryptocephala (Ehrenberg) Sanfilippo and Riedel 1970
Theocotyle nigriniae Riedel and Sanfilippo 1970
Theocotyle venezuelensis Riedel and Sanfilippo 1970
Theocotylissa Foreman 1973
Theocotylissa alpha Foreman 1973
Theocotylissa auctor Foreman 1973
Theocotylissa ficus (Ehrenberg) 1873
Theocotylissa fimbria Foreman 1973
Theopilium Haeckel 1881
Theopilium tricostatum Haeckel 1887
Thyrsocyrtis Ehrenberg 1847
Thyrsocyrtis bromia Ehrenberg 1873
Thyrsocyrtis clausa Chen 1975
Thyrsocyrtis hirsuta (Krasheninnikov) Riedel and Sanfilippo 1970
Thyrsocyrtis lochites Sanfilippo 1982
Thyrsocyrtis rhizodon Ehrenberg 1873
Thyrsocyrtis robusta Riedel and Sanfilippo 1970
Thyrsocyrtis schomburgkii (Ehrenberg) 1873
Thyrsocyrtis tarsipes Foreman 1973
Thyrsocyrtis tensa Foreman 1973
Thyrsocyrtis tetracantha (Ehrenberg) 1873
Thyrsocyrtis triacantha (Ehrenberg) 1873
Udan Renz 1976
Udan undulata Renz 1976
Valkyria O'Connor 1997
Valkyria pukapuka O'Connor 1997

Trissocyclidae
Acanthodesmia Mueller 1857
Acanthodesmia circumflexa (Goll) Petrushevskaya 1971
Acanthodesmia micropora (Popofsky) Petrushevskaya 1971
Acanthodesmia viniculata (Mueller) Mueller 1858
Acrocubus Haeckel 1881
Acrocubus octopylus Haeckel 1887
Acrospyris Haeckel 1881
Acrospyris lingi Shilov 1995
Amphispyris Haeckel 1881
Amphispyris roggentheni Goll 1980
Androspyris Haeckel 1887
Androspyris anthropiscus Haeckel 1887
Androspyris fenestrata (Haeckel) Goll 1980
Androspyris huxleyi (Haeckel) Goll 1980
Androspyris ramosa (Haeckel) Takahashi 1991
Androspyris reticulidisca Takahashi 1991
Cantharospyris Haeckel 1887
Cantharospyris platybursa Haeckel 1887
Cephalospyris Haeckel 1881
Cephalospyris cancellata Haeckel 1887
Ceratospyris Ehrenberg 1847
Ceratospyris articulata Ehrenberg 1873
Ceratospyris borealis Bailey 1856
Ceratospyris clavata Bütschli 1882
Ceratospyris echinus Ehrenberg 1873
Ceratospyris hyperborea Jørgensen 1905
Clathrospyris Haeckel 1881
Clathrospyris sandellae Goll 1978
Clathrospyris vogti Goll and Bjørklund 1989
Corythospyris Haeckel 1881
Corythospyris fiscella Goll 1978
Corythospyris hispida Goll and Bjørklund 1989
Corythospyris jubata Goll 1978
Corythospyris jubata sverdrupi Goll and Bjørklund 1989
Corythospyris palmipodiscus (Petrushevskaya) Hull 1996
Corythospyris reuschi Goll and Bjørklund 1989
Corythospyris stapedius (Haeckel) Goll 1978
Dendrospyris Haeckel 1881
Dendrospyris acuta Goll 1968
Dendrospyris anthocyrtoides (Bütschli) Haeckel 1887
Dendrospyris binapertonis Goll 1968
Dendrospyris bursa Sanfilippo 1973
Dendrospyris damaecornis (Haeckel) 1887
Dendrospyris fragoides Sanfilippo and Riedel 1973
Dendrospyris golli Nishimura 1992
Dendrospyris inferispina Goll 1968
Dendrospyris megalocephalis Chen 1975
Dendrospyris pannosa Goll 1968
Dendrospyris pododendros (Carnevale) Goll 1968
Dendrospyris stabilis Goll 1968

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TABLE 1. (Continued)

Dendrospyris stylophora (Ehrenberg) Haeckel 1887
Dendrospyris turriturcica Sanfilippo and Riedel 1973
Dendrospyris turriturcica dasyotus Sanfilippo and Riedel 1973
Dendrospyris turriturcica turriturcica Sanfilippo and Riedel 1973
Desmospyris Haeckel 1881
Desmospyris mamillata Haeckel 1887
Desmospyris rhodospyroides Petrushevskaya 1975
Desmospyris spongiosa Hays 1965
Desmospyris stabiloides Petrushevskaya 1972
Dictyospyris Ehrenberg 1847
Dictyospyris discus Sanfilippo and Riedel 1973
Dictyospyris gigas Ehrenberg 1873
Dictyospyris melissium Sanfilippo and Riedel 1973
Dictyospyris sphaera Bütschli 1882
Dorcadospyris Haeckel 1881
Dorcadospyris alata (Riedel) Riedel and Sanfilippo 1970
Dorcadospyris argisca (Ehrenberg) 1873
Dorcadospyris ateuchus (Ehrenberg) 1873
Dorcadospyris circulus (Haeckel) Moore 1971
Dorcadospyris confluens (Ehrenberg) Goll 1969
Dorcadospyris costatescens Goll 1969
Dorcadospyris dentata Haeckel 1887
Dorcadospyris forcipata (Haeckel) 1887
Dorcadospyris mahurangi O'Connor 1997
Dorcadospyris papilio (Riedel) 1959
Dorcadospyris platyacantha (Ehrenberg) 1873
Dorcadospyris praeforcipata Moore 1971
Dorcadospyris pseudopapilio Moore 1971
Dorcadospyris quadripes Moore 1971
Dorcadospyris riedeli Moore 1971
Dorcadospyris simplex (Riedel) Riedel and Sanfilippo 1970
Dorcadospyris spinosa Moore 1971
Dorcadospyris triceros Ehrenberg 1873
Eucoronis Haeckel 1881
Eucoronis fridtjofnanseni Goll and Bjørklund 1980
Eucoronis hertwigii (Bütschli) Petrushevskaya and Kovlova 1972
Giraffospyris Haeckel 1881
Giraffospyris annulispina Goll 1969
Giraffospyris cyrillium Sanfilippo and Riedel 1973
Giraffospyris didiceros (Ehrenberg) Goll 1969
Giraffospyris haeckelii (Bütschli) Goll 1969
Giraffospyris lata Goll 1969
Giraffospyris laterispina Goll 1969
Gorgospyris Haeckel 1881
Gorgospyris hemisphaerica Clark 1942
Gorgospyris perizostra Sanfilippo 1973
Gorgospyris schizopodia Haeckel 1887
Lamprospyris Haeckel 1881
Lamprospyris hookeri Haeckel 1887
Liriospyris Haeckel 1881
Liriospyris clathrata (Ehrenberg) Haeckel 1887
Liriospyris cricus Westberg-Smith and Riedel 1884
Liriospyris elevata Goll 1968
Liriospyris geniculosa Goll 1968
Liriospyris globosa Goll 1968
Liriospyris hexapoda Haeckel 1887
Liriospyris longicornuta Goll 1968
Liriospyris mutuaria Goll 1968
Liriospyris ovalis Goll 1968
Liriospyris parkerae Riedel and Sanfilippo 1971
Liriospyris reticulata (Ehrenberg) Goll 1968
Liriospyris spinulosa (Ehrenberg) Goll 1968
Liriospyris stauropora (Haeckel) Goll 1968
Lithocircus Mueller 1857
Lithocircus rhombus Pantanelli 1880
Lithocircus toxaria (Haeckel) Goll 1968
Lithotympanum Haeckel 1887
Lithotympanum tuberosum Haeckel 1887
Lophospyris Haeckel 1881
Lophospyris cheni Goll 1976
Lophospyris pentagona (Ehrenberg) Petrushevskaya 1971
Lophospyris pentagona hyperborea (Jørgensen) Goll 1969
Lophospyris pentagona pentagona (Ehrenberg) 1872
Lophospyris pentagona quadriforis (Haeckel) 1887
Nephrospyris Haeckel 1887
Nephrospyris knutheieri Goll and Bjørklund 1985
Nephrospyris pervia (Haeckel) Goll and Bjørklund 1985
Nephrospyris pervia (perforate type) (Haeckel) Goll and Bjørklund 1985
Nephrospyris pervia (trellis-type) (Haeckel) Goll and Bjørklund 1985
Nephrospyris renilla Haeckel 1887
Nephrospyris renilla lana
Nephrospyris renilla renilla Haeckel 1887
Paradictyum Haeckel 1881
Paradictyum paradoxum Haeckel 1887
Petalospyris Ehrenberg 1847
Petalospyris diaboliscus Ehrenberg 1847
Petalospyris foveolata Ehrenberg 1854
Petalospyris pentas Ehrenberg 1873
Phormospyris Haeckel 1881
Phormospyris thespios Goll and Bjørklund 1989
Phormospyris tricostata Haeckel 1887
Platybursa Haeckel 1881
Platybursa clathrobursa (Haeckel) Petrushevskaya 1971
Psychospyris Riedel and Sanfilippo 1971
Psychospyris grandis Riedel and Sanfilippo 1971
Psychospyris intermedia Riedel and Sanfilippo 1971
Psychospyris parva Riedel and Sanfilippo 1971
Rhodospyris Haeckel 1881
Rhodospyris anthocyrtis (Haeckel) Petrushevskaya and Kozlova 1972
Rhodospyris tricornis Haeckel 1887
Semantis Haeckel 1887
Semantis gracilis Popofsky 1908
Tholospyris Haeckel 1881
Tholospyris anthophora (Haeckel) 1887
Tholospyris baconiana Goll 1972
Tholospyris baconiana baconiana Goll 1972
Tholospyris baconiana variabilis Goll 1972
Tholospyris capoi (Goll) De Wever *et al.* 1990
Tholospyris cortinisca (Haeckel) Goll 1972
Tholospyris devexa Goll 1969
Tholospyris devexa devexa
Tholospyris devexa finalis
Tholospyris fornicata Popofsky 1913
Tholospyris gephyristes Huelsemann 1963

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TABLE 1. (Continued)

Tholospyris infericosta Goll 1969	***Tympanidium*** Haeckel 1887
Tholospyris kantiana (Haeckel) Goll 1969	*Tympanidium foliosum* Haeckel 1887
Tholospyris macropora Takahashi 1991	***Tympanomma*** Haeckel 1887
Tholospyris mammillaris (Haeckel) 1887	*Tympanomma binoctonum* Haeckel 1887
Tholospyris procera Goll 1969	***Zygocircus*** Bütschli 1882
Tholospyris rhombus Goll 1972	*Zygocircus buetschli* Haeckel 1887
Tholospyris scaphipes (Haeckel) Goll 1969	*Zygocircus cimelium* Petrushevskaya 1972
Tholospyris tripodiscus Haeckel 1887	*Zygocircus piscicaudatus* Popofsky 1913
Triceraspyris Haeckel 1881	*Zygocircus productus* (Hertwig) Haeckel 1887
Triceraspyris antarctica (Haecker) Haecker 1908	*Zygocircus productus capulosus* (Popofsky) Goll 1979
Triceraspyris coronata Weaver 1976	*Zygocircus productus tricarinatus* Goll 1979
Triceraspyris pacifica Campbell and Clark 1944	***Zygospyris*** Haeckel 1887
Tricolospyris Haeckel 1881	*Zygospyris brevispina* Carnevale 1908
Tricolospyris leibnitziana Haeckel 1887	
Tricolospyris newtoniana Haeckel 1887	**Unknown**
Tristylospyris Haeckel 1881	***Tepka*** Sanfilippo and Riedel 1973
Tristylospyris palmipes Haeckel 1887	*Tepka perforata* Sanfilippo and Riedel 1973

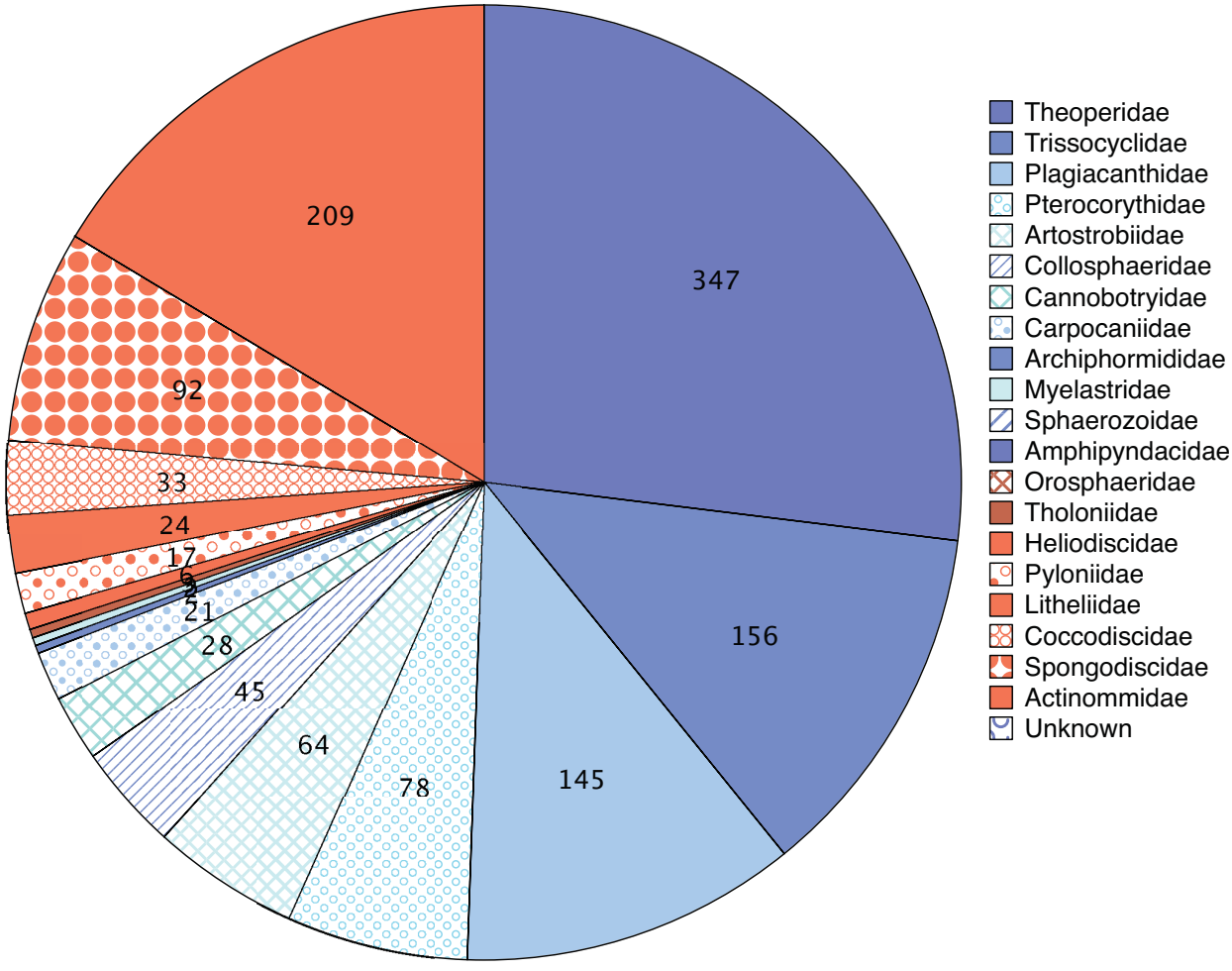

FIGURE 1. Species diversity in families of radiolarians, grouped into the two living orders Nassellaria and Spumellaria and sorted by diversity rank within order. Spumellarian families are sorted anticlockwise from the top to the left, Nassellarian families clockwise from the top to the right. The legend runs clockwise from the top.

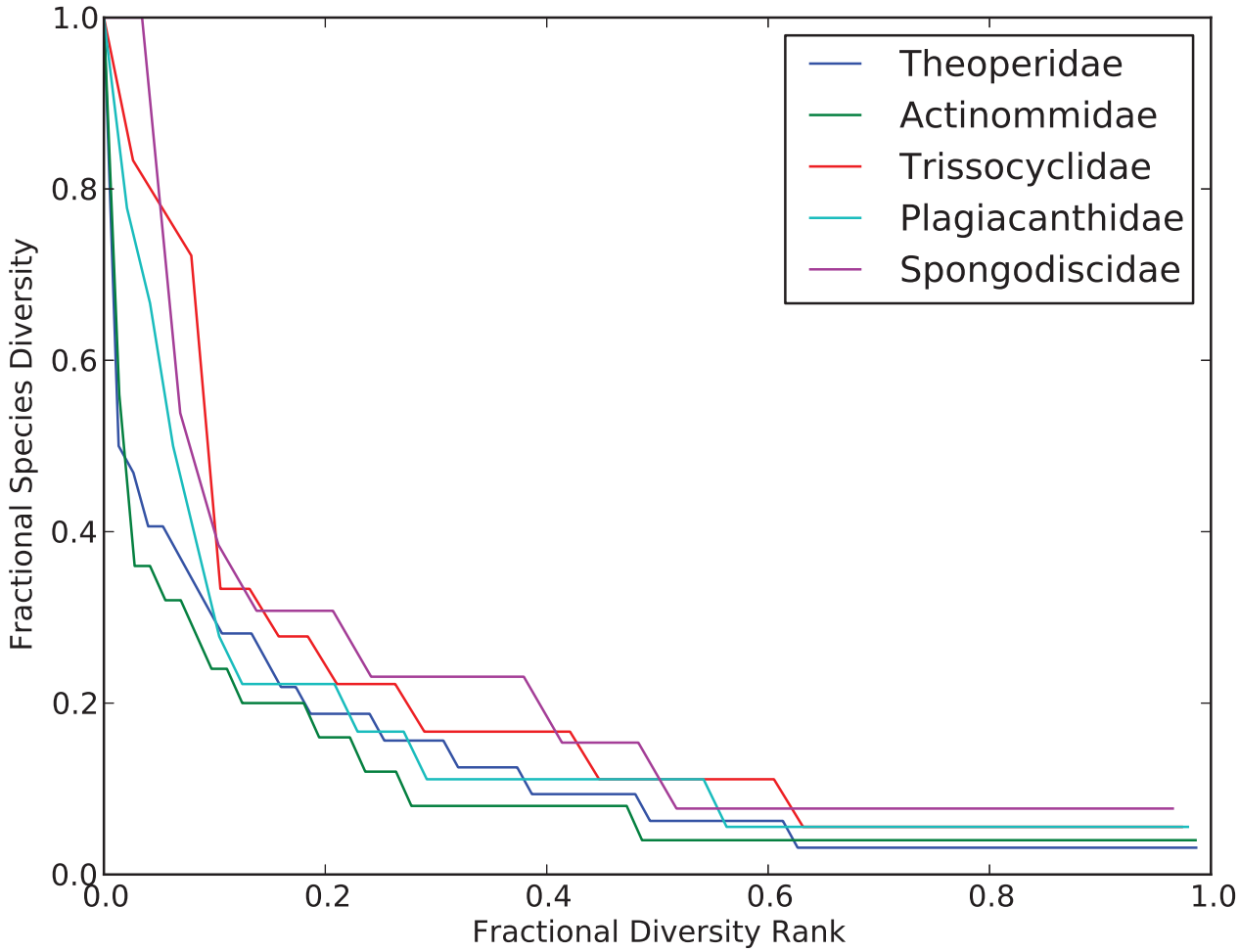

FIGURE 2. Ranked relative species diversity for genera in representative radiolarian families. Curves are scaled to unit height and width, i.e. the most abundant species in each family is scaled to 1 on the y-axis, the last-ranked species (=diversity of family) to 1 on the x-axis. Due to unequal total species richness between families, step sizes in normalised data are not equal between curves.

The evaluated Cenozoic list in this paper contains 2037 entries: 1192 valid names, 83 additional valid subspecies names, and 762 synonyms. A comparison of our result to the old list of radiolarian names in Neptune makes clear the extent of change. The final radiolarian TNL contains over 17,000 names or name variants, and nearly 4,200 evaluated names, of which ca 1,600 are accepted as valid. This is an increase of nearly 1,000 evaluated names, and of nearly 40% in the number of valid species names in comparison to those in the Neptune database. Of this 40%, ca. 15% have come from resolving the status of names previously in the Neptune database, while the remaining 25% are new names, coming from the Janus database, the WoRMS list, or other sources. More than half of the taxa given as unknown in Neptune have been taxonomically resolved (the remainder are mostly truely indeterminate, eg. of the form 'Genus? sp.', etc.) The number of names identified as synonyms and generic level assignments (identified as 'sp.' or other non-specific forms) have increased substantially, in part due to first time evaluation of names from the Janus database. A total of 39 names were identified as not being polycystine radiolarians (vs. only 2 so identified in the original sources). Most of these are for species of rarely preserved phaeodarians, which are often included in the informal category 'radiolarians' and thus are legitimately included in deep-sea drilling databases. Only 4 records were identified as truely incorrect. Lastly, many 'double-valid' names were identified and synonymised in the Neptune data, where the same species was considered valid but under different generic names. This last activity is not indicated, indeed, works against, the apparent magnitude of changes as suggested by the increase in the total of valid names. Of the 2037 records in this paper, 1639 match names in the old Neptune while 398 are new. Of the names that match, the taxonomic status of 326 was changed. Of those 1313 names whose taxonomic status was not changed, 479 records have new or altered author/year

information, while additional comments are given for 770 records. Only 359 names of the 2037 in this paper are given with essentially unaltered Neptune information, and even for these, age group and family assignments have been added. It is also worth examining which types of status change were most common among the 326 names whose status was altered. 110 unknown status names were resolved (72 as valid species, 37 as synonyms for other species, and one as 'questionably' related to another name). 56 names, some previously given as valid, were given subspecies status to other names, and 19 names given as synonyms were changed to valid species. The largest category however were 135 names listed originally as valid that were identified as synonyms for other taxa. A few were subjective decisions but mostly reflect objective synonyms, due, as already noted, to the confused nature of Cenozoic 'Haeckelian' genus-level taxonomy, from which the same taxon is assigned to multiple genera by different workers.

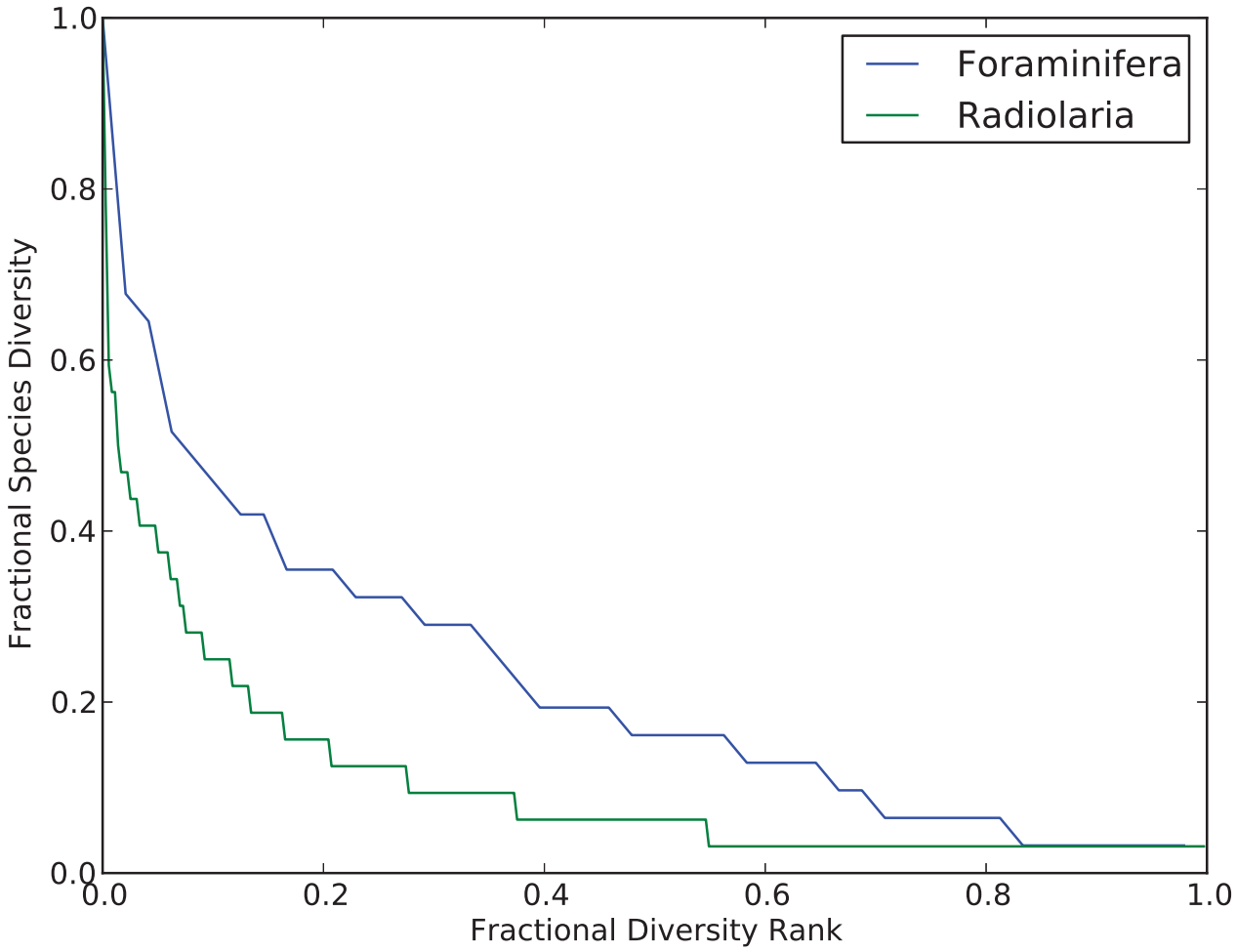

FIGURE 3. Comparison of ranked relative species diversity for genera of radiolarians and planktonic foraminifera, using same conventions as Figure 1. Foraminifera data from Aze *et al.*, 2011 (SOM Appendix S5, table 'AM' which provides a taxonomy using conventions most similar to those used in radiolarian work).

One benefit of having a reasonably complete listing of taxonomic names is the ability to examine taxonomic structure. Figure 1 gives the species diversity of Spumellaria and Nassellaria, grouped by family. There are more than twice as many valid species of Nassellaria as Spumellaria. The majority of all species are found in just three Nassellarian families: Theoperidae, Trissocyclidae and Plagiacanthidae; while the two most diverse Spumellarian familes (Actinommidae and Spongodiscidae) contribute nearly another quarter of the total diversity. Such uneven distributions are ubiquitous in many types of ranked data, both natural and man-made. It is not clear given the present state of radiolarian taxonomic knowledge if these highly diverse families reflect mostly biologic diversity structure or inadequate knowledge of higher level divisions. De Wever *et al.* (2001) subdivide these, and other families into several separate groups, although as explained above we do not believe the biologic basis for doing so

is as yet reliably established. Table 2 gives a breakdown, by family, of the number of species in genera. From this table it is clear that only a relatively few genera in each family hold the majority of species names. There are also many genera with only one or two species in them. When the effect of unequal totals for genera and species numbers are removed, the similarity in distributions for representative radiolarian families is even more apparent (Figure 2). For comparison, we plot the relative frequencies of radiolarian generic species richness for all radiolarians (all families grouped) to the equivalent curve for Cenozoic planktonic foraminifera (Figure 3). Planktonic foraminifera are also members of the Rhizarian clade of protists, are ecologically similar to radiolarians and also have an excellent Cenozoic fossil record. Unlike radiolarians, planktonic foraminifera have been much more extensively studied and the taxonomy is relatively mature (Aze *et al.,* 2011). One might expect therefore that in principle, the two groups should show a similar taxonomic structure. As shown in Figure 3, they do not. Planktonic foraminifera have a significantly more equal distribution of species within genera, with relatively few genera being either extremely speciose or nearly monospecific. This difference, if real, would be biologically interesting and possibly suggest significant, fundamental differences in the style or even mechanisms of diversification between the two groups (see review in Hendericks *et al.,* 2014). It is more likely however that the differences seen are primarily due to the different degree of maturity in taxonomic knowledge. In our taxonomic list we have not attempted to formally revise generic name use and have simply accepted the name forms that are in most common modern use. As already noted, the confused nature of Cenozoic generic taxonomy, and the inconsistent use even of attempted revisions means that many taxa are assigned in our list to low diversity genera that are likely to become synonyms with further taxonomic work. Equally, some highly speciose genera may well become subdivided as the result of further taxonomic work—a phenomenon seen for example in recent decades in taxonomic work on diatoms. Both these effects of taxonomic revision would tend to alter the radiolarian genera relative species richness curve in ways making it more similar to the one for planktonic foraminifera. A biologically meaningful comparison of the taxonomic structure of the two groups will only be possible when radiolarian supra-specific taxonomy matures to levels comparable to that of the planktonic foraminifera.

TABLE 2. List of genera with 3 or more species, by order and family, ranked by species diversity. Genera with only 1 or 2 species not listed individually but totals provided.

Genus	N Valid Species	Cum. %
Spumellaria		
Actinommidae		
Actinomma	25	12.2
Hexacontium	14	19.0
Cenosphaera	9	23.4
Stylatractus	9	27.8
Cladococcus	8	31.7
Thecosphaera	8	35.6
Plegmosphaera	7	39.0
Axoprunum	6	42.0
Stylosphaera	6	44.9
Acanthosphaera	5	47.3
Amphisphaera	5	49.8
Carposphaera	5	52.2
Hexalonche	5	54.6
Prunopyle	5	57.1
Druppatractus	4	59.0
Sphaeropyle	4	61.0
Thecosphaerella	4	62.9
Actinosphaera	3	64.4

.....continued on the next page

TABLE 2. (Continiued)

Genus	N Valid Species	Cum. %
Cromyomma	3	65.9
Haliomma	3	67.3
(15 genera)	@ 2	82.0
(37 genera)	@ 1	100.0
Totals: 72 genera	205 species	
Coccodiscidae		
Didymocyrtis	11	35.5
Periphaena	6	54.8
Lithocyclia	4	67.7
Diartus	3	77.4
(7 genera)	@ 1	100.0
Totals: 11 genera	31 species	
Heliodiscidae		
Heliodiscus	4	40.0
Astrophacus	2	100.0
Totals: 2 genera	6 species	
Litheliidae		
Larcopyle	12	63.2
Lithelius	4	84.2
(3 genera)	@ 1	100.0
Totals: 5 genera	19 species	
Myelastridae		
Myelastrum	2	100.0
Totals: 1 genus	2 species	
Orosphaeridae		
Oroscena	1	100.0
Totals: 1 genus	1 species	
Pyloniidae		
Larcospira	3	17.6
(3 genera)	@ 2	52.9
(8 genera)	@ 1	100.0
Totals: 12 genera	17 species	
Spongodiscidae		
Spongodiscus	13	15.3
Stylodictya	13	30.6
Spongurus	7	38.8
Stylotrochus	5	44.7
Dictyocoryne	4	49.4
Rhopalastrum	4	54.1
Spongotrochus	4	58.8
Amphirhopalum	3	62.4
Amphymenium	3	65.9

.....continued on the next page

TABLE 2. (Continiued)

Genus	N Valid Species	Cum. %
Circodiscus	3	69.4
Schizodiscus	3	72.9
Spongaster	3	76.5
(3 genera)	@ 2	83.5
(14 genera)	@ 1	100.0
Totals: 29 genera	85 species	
Tholoniidae		
(3 genera)	@ 1	100.0
Totals: 3 genera	3 species	
Nassellaria		
Amphipyndacidae		
Amphipternis	1	100.0
Totals: 1 genus	1 species	
Archiphormididae		
Arachnocalpis	2	100.0
Totals: 1 genus	2 species	
Artostrobiidae		
Siphocampe	15	25.9
Phormostichoartus	12	46.6
Botryostrobus	8	60.3
Dictyoprora	7	72.4
Spirocyrtis	4	79.3
Plannapus	3	84.5
(3 genera)	@ 2	94.8
(3 genera)	@ 1	100.0
Totals: 12 genera	58 species	
Cannobotryidae		
Acrobotrys	6	21.4
Botryocyrtis	3	32.1
Botryopyle	3	42.9
Centrobotrys	3	53.6
Saccospyris	3	64.3
(2 genera)	@ 2	78.6
(6 genera)	@ 1	100.0
Totals: 13 genera	28 species	
Carpocaniidae		
Carpocanistrum	8	38.1
Carpocanopsis	4	57.1
Artobotrys	3	71.4
(6 genera)	@ 1	100.0
Totals: 9 genera	21 species	
Collosphaeridae		

.....continued on the next page

TABLE 2. (Continiued)

Genus	N Valid Species	Cum. %
Acrosphaera	13	31.0
Collosphaera	8	50.0
Siphonosphaera	8	69.0
Otosphaera	3	76.2
Solenosphaera	3	83.3
Sphaerozoum	2	88.1
(5 genera)	@ 1	100.0
Totals: 11 genera	42 species	
Plagiacanthidae		
Lithomelissa	18	12.8
Lophophaena	14	22.7
Ceratocyrtis	12	31.2
Antarctissa	9	37.6
Pseudodictyophimus	7	42.6
Botryopera	5	46.1
Callimitra	4	48.9
Clathrocorys	4	51.8
Neosemantis	4	54.6
Pseudocubus	4	57.4
Velicucullus	4	60.3
Clathrocanium	3	62.4
Plectacantha	3	64.5
Spongomelissa	3	66.7
(13 genera)	@ 2	85.1
(21 genera)	@ 1	100.0
Totals: 48 genera	141 species	
Pterocorythidae		
Podocyrtis	19	26.8
Anthocyrtidium	11	42.3
Lamprocyclas	10	56.3
Calocycletta	8	67.6
Pterocorys	8	78.9
Theocyrtis	5	85.9
Lamprocyrtis	4	91.5
(2 genera)	@ 2	97.2
(2 genera)	@ 1	100.0
Totals: 11 genera	71 species	
Sphaerozoidae		
Rhaphidozoum	1	100.0
Totals: 1 genus	1 species	

.....continued on the next page

TABLE 2. (Continiued)

Genus	N Valid Species	Cum. %
Theoperidae		
Eucyrtidium	32	10.1
Lophocyrtis	16	15.1
Dictyophimus	15	19.8
Cycladophora	13	23.9
Lychnocanoma	13	28.0
Pterocanium	12	31.8
Thyrsocyrtis	11	35.2
Theocorys	10	38.4
Calocyclas	9	41.2
Eucecryphalus	9	44.0
Lampromitra	9	46.9
Stichocorys	8	49.4
Cyrtocapsella	7	51.6
Lipmanella	7	53.8
Bekoma	6	55.7
Clathrocyclas	6	57.5
Gondwanaria	6	59.4
Lamptonium	6	61.3
Phormocyrtis	6	63.2
Artostrobus	5	64.8
Bathropyramis	5	66.4
Buryella	5	67.9
Lithopera	5	69.5
Pterocodon	5	71.1
Lithochytris	4	72.3
Lithostrobus	4	73.6
Lychnocanium	4	74.8
Theocotyle	4	76.1
Theocotylissa	4	77.4
Anthocyrtella	3	78.3
Artophormis	3	79.2
Clathrocycloma	3	80.2
Cornutella	3	81.1
Eusyringium	3	82.1
Lithapium	3	83.0
Orbula	3	84.0
Stichopilidium	3	84.9
(10 genera)	@ 2	91.2
(28 genera)	@ 1	100.0
Totals: 75 genera	318 species	

.....continued on the next page

TABLE 2. (Continiued)

Genus	N Valid Species	Cum. %
Trissocyclidae		
Dorcadospyris	18	12.9
Tholospyris	15	23.6
Dendrospyris	14	33.6
Liriospyris	13	42.9
Corythospyris	6	47.1
Giraffospyris	6	51.4
Androspyris	5	55.0
Ceratospyris	5	58.6
Desmospyris	4	61.4
Dictyospyris	4	64.3
Zygocircus	4	67.1
Acanthodesmia	3	69.3
Gorgospyris	3	71.4
Nephrospyris	3	73.6
Petalospyris	3	75.7
Psychospyris	3	77.9
Triceraspyris	3	80.0
(7 genera)	@ 2	90.0
(14 genera)	@ 1	100.0
Totals: 38 genera	140 species	
Unknown		
Tepka	1	100.0

Conclusions and Future work

The radiolarian taxonomic name list presented here is the first reasonably comprehensive listing of Cenozoic to Recent radiolarian species names in actual use, as well as the first to provide taxonomic status, source information and synonymy for such a large number of species. It is however by no means complete. Many of the missing names (which contribute substantially to the original total merged list of >17,000 names) are for nomen dubia, e.g. names introduced by early authors such as Haeckel without adequate description or illustration. Some of the older species names that had been placed in synonymy by authors before the start of the deep-sea drilling project (DSDP) are not included in our list of evaluated names, as only names used as valid by authors in the drilling program were evaluated—names listed in these publications but only as synonyms are not included. Nor are more recently published species names used to date only outside of the deep-sea drilling programs' own official 'Initial Reports' publications (DSDP Initial Reports, ODP Initial Reports, but not ODP Science Results, or IODP publications) or outside of the plankton literature sources used to create the living taxa listing at WoRMS. There are probably several hundred of these newer names, most of which are presumably valid. Future revision should make an effort to capture these more recent names, and to the extent possible, correctly identify known synonyms in older names. Minor corrections and revision to the existing evaluated records should also be done as errors are identified, or changes are introduced in the taxonomic literature.

Equally important is the dissemination of these results so that they can be used effectively to assist managers of taxonomic databases in the correlation and synthesis of taxonomic data. The list here is available via the online tabular version as a static archive. A regularly maintained community list would be a better solution. Lastly, proper use of a name list is only possible if sufficient information is available for each taxon to allow proper determination

of specimens during daily work. Thus, while an important step forwards, full catalog records for each species are still needed, including descriptions, images, differential diagnoses etc. The community catalog at www.radiolaria.org, and other similar projects are essential and need completion if the full potential of the Cenozoic radiolarian record is to be used.

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APPENDIX/SOM

1. Explanations of fields and values in full table
2. SOM full table with all synonyms, notes
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SOM Appendix Explanation of fields and abbreviations

The table in this appendix gives a full listing of the Cenozoic names evaluated in the TNL project which are considered to be valid, synonyms or subspecies. Additional names were evaluated and assigned to other categories. All names are available at the NSB database: www.nsb-mfn-berlin.de.

radorg_family_name—the radiolarian family to which the species belongs. These families, as explained in the main text, are largely those of Riedel (1971). This column is the main sort field for the list.
valid_name—the species name chosen as the preferred name, for species with synonyms, or the species name without subspecies, for those subspecies considered as valid.

taxon_name—the name as it appears in the databases and source literature

author and publ_yr—the author and year of publication of the species name. Only given consistently for the valid name

taxon_status—our evaluation of the name. In this SOM list we give V, S and B but the full TNL lists also G, Q, I and U. The categories and rules for assignment are given here:

V—valid species. The primary goal of the TNL, and our Cenzoic extract from it, is to link together various names that refer to the same taxonomic entity, not to enforce a particular taxonomic opinion on the 'true' correct name. Nonetheless one name does need to be chosen in the database to provide the name for each entity, here designated as 'V'. The name chosen is based primarily on what appears to the dominant recent community usage, rather than rigidly following whichever is the latest proposed revision. For most taxa, the current name in common use does respect prior taxonomic revision work. For a few taxa no clear dominant usage exists in the community, and the choice of name for 'V' designation was somewhat arbitrary. For living taxa it was in some cases possible to compare different proposed combinations with the illustrations of the type species for the different genera and from this pick a clearly preferred genus name, thus identifying the others as junior objective synonyms.

S—synonym. The majority of synonyms determined here are objective synonyms (same original species description, different proposed generic assignments). Less common are subjective synonyms (different original species descriptions, thought to be of the same taxonomic entity), with this judgement generally based on published synonymy lists. Only rarely did we ourselves create a subjective synonym, instead preferring only to make a note that the name might be a subjective synonym for another name in the list. Also included here are the all too frequent misspellings. Some of these are clearly only typos, but some appear to be persistent errors in usage, which we could clarify only by re-examination of the original publications. Listing mispelled names as synonyms is important since primary observational data is linked to this misspelled name, and non-specialists are unlikely to note the spelling error.

B—subspecies. A code 'B' indicates that the subspecies is only a subset of the parent. Other trinomial names whose relationship to the parent name were less clear were treated as ''S', to indicate either that the proposed subspecies is not thought to have any biologic validity, being most likely simple within species variation, or, if pointing to a different named species, to indicate synonym relationship. This most frequently occurred between taxa originally proposed as subspecies which have subsequently been elevated to species rank, e.g. *Cycladophora bicornis spongothorax* Chen is a synonym of the currently accepted name *Cycladophora spongothorax* (Chen) Lazarus.

G—genus level identification, e.g. open nomenclature. These names included those without a species name e.g. sp., and many names where a species name was given but a qualifier such as cf. made clear that the specimens being referred to were not conspecific with the name given. (database only)

Q—questionable identification names. These were mostly indicated in the original publication by a '?', i.e. genus species? and transcribed into drilling program databases by database staff as 'genus species (Q)'. There are probably a few cases in which names of the form 'genus? species', which indicate a conspecific identification but with an added taxonomic comment on the correctness of the genus assignment, were incorrectly transcribed as genus species (Q) but we were not able to check the original literature usage to identify and correct such instances. There are also ambiguous uses of the '?', e.g. '?Genus species', which both drilling program workers and we have treated as 'genus species?' (database only)

I—for names that do not belong to Polycystinea, primarily for Phaeodarian taxa. (database only)

U—for names whose taxonomic status could not be resolved, such as genus? sp. or names which could not be located in our literature database. (database only)

age_group—estimated age for the species, as explained in the main text. Consistently given only for valid species

match_code—N: name listed only in the Neptune database (mostly DSDP-era names); J: name listed only in the ODP Janus database; B—name listed in both the Neptune and Janus databases. Blank means name was added during the editing process after initial merge of the source databases.

comments—a compilation of the comment fields from the various source databases. Although considerable effort has been made to edit these to make them more comprehensible they still largely retain the flavor of the source database systems, and tend to be informal and terse, with many abbreviations. The latter characteristic reflects both the convenience to the original enterer in using abbreviations in typing and the short maximum number of characters available for comments in some of the early database systems (often between 128-255 characters). The four main sources for comments are—N: Neptune database; J: Janus database of ODP; No: Nori Suzuki database and/or additional comments added by this author during data processing for the TNL; RW_age: comments on the geologic age from the Radworld database. Several authors contributed comments over the years to the Neptune database but most are either by Nigrini and Caulet who did the initial list editing (N&C) or Lazarus (dl or dbl). Janus comments usually include the initials of the database editor who entered/validated the Janus record, mostly R. Goll (RMG). Numeric codes preceded by 'added by' in the Janus comment refer to the ID number of scientists in the Janus people names table. Taxonomic names are frequently abbreviated but within the context of the individual record are clear. For example, the taxon_name Pterocyrtidium barbadense, with valid_name Lophocyrtis barbadense has as part of the Neptune comment ' n.comb. L.b. in Sanfilippo and Caulet 1998'—here L.b. is an abbreviation of Lophocyrtis barbadense. Because so many of the literature sources are from the deep-sea drilling projects several abbreviations are used including Lnn (where nn is a number) for the Leg e.g. L14, BB or blue book for DSDP Intitial Report volume; IR for ODP or IODP Initial Reports volume, SR for Scientific Results volume. Other abbreviations—comb.: combination; lit: literature; orig: originally; rad: radiolarian; radorg: www.radiolaria.org; rec: recent; ref: reference; strat: stratigraphic; syn: synonym xref: cross-reference; xfer: transfer. Some well known radiolarian taxonomic papers are abbreviated to the first letters of the author name with year, e.g. Pet71 for Petrushevskaya 1971.