Paleontological Contributions

Number 4

A Synoptical Classification of the Bivalvia (Mollusca)

Cover illustration: *Exogyra costata* Say, 1820, left valve, University of North Carolina 8264; Upper Cretaceous, Peedee Formation, milepost 49, near Donohoe Landing, Cape Fear River, North Carolina; maximum shell length (left to right) = 6.1 cm (new).
PREFACE

Joseph G. Carter, Cristian R. Altaba, David C. Campbell, Peter J. Harries, and Peter Skelton

The following classification summarizes the suprageneric taxonomy of the Bivalvia for the upcoming revision of the Bivalvia volumes of the Treatise on Invertebrate Paleontology, Part N. The development of this classification began with Carter (1990a), Campbell, Hoekstra, and Carter (1995, 1998), Campbell (2000, 2003), and Carter, Campbell, and Campbell (2000, 2006), who, with assistance from the United States National Science Foundation, conducted large-scale morphological phylogenetic analyses of mostly Paleozoic bivalves, as well as molecular phylogenetic analyses of living bivalves. During the past several years, their initial phylogenetic framework has been revised and greatly expanded through collaboration with many students of bivalve biology and paleontology, many of whom are coauthors. During this process, all available sources of phylogenetic information, including molecular, anatomical, shell morphological, shell microstructural, bio- and paleobiogeographic as well as stratigraphic, have been integrated into the classification. The more recent sources of phylogenetic information include, but are not limited to, Carter (1990a), Malchus (1990), J. Schneider (1995, 1998a, 1998b, 2002), T. Waller (1998), Hautmann (1999, 2001a, 2001b), Giribet and Wheeler (2002), Giribet and Distel (2003), Dreyer, Steiner, and Harper (2003), Matsumoto (2003), Harper, Dreyer, and Steiner (2006), Kappner and Bieler (2006), Mikkelsen and others (2006), Neulinger and others (2006), Taylor and Glover (2006), Kiříč (2007), B. Morton (2007), Taylor, Williams, and Glover (2007), Taylor and others (2007), Giribet (2008), and Kirkendale, Taylor, & Coan (2010). However, Chen Jin-hua (2009) summarize evidence that Trigoniodoida was derived instead from the superfamily Trigonioida. Arguments for these alternatives appear equally strong, so we presently list the Trigoniodoida, with question, under both the Trigoniida and Unionida, with the contents of the superfamily indicated under the Trigoniida.

Typified Versus Descriptive Names

The present classification gives preference to typified names over descriptive names above the family-group, following the recommendation by Stys and Kerzhner (1975) and Starobogatov (1991). Typified names are more useful than descriptive names, because their
root indicates taxonomic affiliation and their suffix can be modified to reflect taxonomic rank. Descriptive names can be advantageous for indicating a key morphological feature, but this feature may not characterize all members of the group (e.g., the Palaeotaxodonta), and descriptive names indicate nothing about the phylogenetic placement of the taxon.

We agree with Dubois (2005) that adoption of a descriptive name should be guided by the spirit of priority and adherence to original definition. The term original definition is presently interpreted in a phylogenetic sense to mean the monophyletic clade defined by the original members of the taxon, their common ancestor, and all of its descendants. We have, therefore, not formally adopted the terms Palaeoheterodonta and Heterodonta, the original definitions of which have no useful phylogenetic equivalent in the present classification. These descriptive names, as well as the phylogenetically more useful Euheterodonta and Nepiomorpha, are, however, placed in the classification in bold-face type after their synonymous, or approximately synonymous, typed name. The descriptive names Autobranchia, Protobranchia, Pteriomorpha, and Heteroconchia are presently formally adopted. Grobben’s (1894) Autolamellibranchiata is herein replaced with the shorter, more euphonious Autobranchia, following C. M. Kolesnikov (1977), T. Waller (1978), Naumov (2006), and Bieler, Carter, and Coan (2010).

**Authorship and Priority of Nomina above the Family-Group**

The ICZN (1999) Code does not regulate taxonomic names above the family-group. Previous workers have used various guidelines to determine the composition, authorship, and priority of such names. Some have based these names on the oldest valid and available included family-group name in the group, or the first publication to define the group in a modern sense, or the oldest valid and available typed name above the family-group. We have adopted the latter guideline, with separate authorship and priority for names above and within the family-group. For example, the hypodermy name Antipleuroidei Krčí, 2007, is presently adopted, even though it contains the superfAMILY Dualinoidea Conrath, 1887, because order Antipleuroidea Krčí, 2007 is the oldest valid and available typed name above the family-group for this clade. Similarly, Hippuritida Newell, 1965, is adopted for an order that includes some families established as early as 1847 and 1848. In cases where a new name above the family-group is needed, but an appropriate typed root name above the family-group is not available, the earliest valid and available typed name in the family-group is used as the root, but with a new publication date. Separate priority for names above and within the family-group is preferred because it allows for the retention of a number of widely used but otherwise lesser priority names above the family-group, such as order Hippuritida.

Typified names above the family-group, which are based on a junior generic synonym or homonym, are presently regarded as unavailable and are disregarded for purposes of priority. This is a departure from the ICZN (1999) Code rules for family-group names. For example, Anatina Lamarck, 1818, is a junior homonym of Anatina Schumacher, 1817. Consequently, the suborder Anatinacea P. Fischer, 1887, based on Anatina Lamarck, 1818, is not available and has no bearing on the priority of any other typed name above the family-group. Also, the suborder Saxicavoidea Morrites, 1949, is unavailable because it is based on Saxicava Fleuriau de Bellevue, 1802, a junior synonym of Hiatella Bosc ex Daudin MS, 1801, and the suborder Saxicavoidea has no bearing on the priority of the presently adopted order Hiatellida. However, typified names above the family-group are not presently regarded as unavailable on the basis that their nominal family-group name is a junior synonym of another family-group name. For example, the suborder Leptonidina Dall, 1889, is available despite the fact that its nominal family-group name, Leptonidae J. Gray, 1847b, is now a junior synonym of Lasaeidae J. Gray, 1842.

Priority is presently given to the higher ranking of two or more simultaneously published typified or descriptive names above the family-group. This is an extension of Article 24.1 of the ICZN (1999) Code for family-group names. For example, order Pectinacea J. Gray, 1854a, has priority over the simultaneously established (unspecified rank above family-group but below suborder) Anomiaina J. Gray, 1854a. Changes in the rank, spelling, and/or taxonomic composition of a descriptive name are not presently considered to be a valid basis for changing the author and date of the descriptive name.

**Paraphyletic and polyphyletic taxa.** Paraphyletic higher taxa are unavoidable in a classification that includes ancestors and descendants. This is illustrated by J. Schneider’s (1995, 1998a, 1998b, 2002) revision of the superfamily Cardioidea. Schneider reduced superfamily Tridacnoidea to subfamily Tridacninae within Cardiidae to eliminate paraphyly of Cardioidea with respect to Tridacnoidea. However, this reduction in rank merely shifted paraphyly from Cardioidea to its subfamily Cerastodermatinae, the ancestral stock group for Tridacninae. Building a taxonomy that includes living and extinct taxa presents a dilemma: choosing between explicitly recognizing paraphyletic taxa or multiplying supraspecific taxa beyond reasonable bounds (Cela-Conde & Altaba, 2002; Altaba, 2009). We favor an evolutionary classification that, being based upon cladistic analysis, does not dismiss evidence and reflects ancestor-descendant relationships. Paraphyletic taxa are indicated in the classification by an exclamation point (!) after the name.

Polyphyletic taxa are avoided in the classification, except in rare instances where the polyphyly is limited to descendants of the same genus, originating at about the same time. For example, the subfamily Lymnocardiinae is believed to contain more than one tribe derived, in the Miocene, from Cerastoderma of the subfamily Cerastodermatinae. In this case, Lymnocardiinae is also paraphyletic because it does not include Cerastoderma, the common ancestor of all its members.

**Linnean Ranks and Suffixes for Names above the Family-Group**

The present classification utilizes an increased number of Linnean ranks to adequately portray phylogenetic relationships. The number of Linnean ranks reflects a substantial increase in suprageneric taxa described over the past 50 years, and the fact that morphological and molecular phylogenetics have made possible a detailed phylogenetic framework for the Bivalvia. In order to minimize the number of Linnean ranks, we have not ranked the clade Eubivalvia and certain clades in more intensively studied groups, such as the Pectinoidea, Radiolitoidea, and Cardioidea. Those preferring a simpler classification can achieve this by disregarding some of the less familiar ranks, such as subcohort, infrasubcohort, megaorder, hypodermy, minorder, epifamily, and series. Such condensation of the classification will hide some phylogenetic relationships, but it might be better suited for some summary and discussion purposes. The present
Linnean synopsis does not show ancestor-descendant relationships, but these are identified in the phylogenetic classification under preparation for the revised Bivalvia Treatise.

There is currently no consensus on suffixes for typified names above the family-group. The proposal by Rohdendorf (1977) for general zoology is compared in Table 1 with the classifications of the Bivalvia by Cox and others (1969, 1971), Starobogatov (1984, 1992), Waterhouse (2008), and that herein.

The suffix -ia is commonly used for bivalve subclasses and infraclases, e.g., Protobranchia, Autobranchia, Pteriomorphia, and Heteroconchia (T. Waller, 1978; Amier, 1999). The suffix -ata was used by Blainville (1825, 1827) and by Grobben (1894) for orders (Lamellibranchiata and Autolamellibranchiata, respectively), and by Grobben (1892), Keen (1963), and Pojeta (1978) for subclasses (Protobranchiata, Anomalodesmata, and Lucinata, respectively).

Cohort and subcohort are generally inserted between class-group and ordinal-group names, although cohort has been used below the ordinal level for dinosaurs (e.g., Benton, 2005). The ranks subcohort, megaorder, hyporder, minorder, epifamily, and series have not been used before for the Bivalvia. Megaorder, hyporder, and minorder have been used for tetrapods, although at varying ranks in the case of hyporder and minorder (cf. Novacek, 1986; Sereno, 1986, 1999; E. Gaffney & Meylan, 1988; van Valen, 1994; McKenna & Bell, 1997; Benton, 2005).

Waterhouse (2000, 2001, 2008) suggested using -idina for suborders rather than the -ina of some earlier authors, because -ina is reserved for subtribes by Article 29.2 of the ICZN (1999) Code. The subordinal suffix -oidina, advocated by Waller in T. Waller and Stanley (2005, p. 8), is presently rejected because -idina is more consistent with the -ida ordinal ending adopted by Scarlato and Starobogatov (1969, 1979a), Waterhouse (2008), and Bieler, Carter, and Coan (2010). The suffix -oid, as in nuculoid and pterioid, is retained for informal reference to orders, to avoid confusion with informal references to families, such as nuculids and pterids.

The rank epifamily, with the suffix -oidei, has been used between superfamilies and family for reptiles (Bour & Dubois, 1984; de la Fuente, 2003; van der Meijden & others, 2005) and for insects (M. Engel, 2005). The term series has been used between superfamily and family for Lepidoptera.

**New Taxa**

New taxon names are formally proposed in Appendices 1 and 2 (p. 19–27 herein). This excludes rank and/or spelling changes of previously established suprageneric taxa, which will be documented in the Introduction volume to the revised Bivalvia Treatise.

**CLASSIFICATION FORMAT**

The present classification of the Bivalvia differs from previous ones in its uniform priority basis for determining names above the family-group, more consistent use of typified rather than descriptive names above the family-group, and labelling of paraphyletic taxa. Details of the classification format are described below.

**Taxon Order**

The nominotypical family, subfamily, or tribe is listed first within each superfamily, family, or subfamily, respectively. This is followed by the remaining members of the group in alphabetical order. At higher taxonomic ranks, simpler clades are generally listed before more complex clades.

**Paraphyletic Taxa**

Paraphyletic taxa are indicated by an exclamation point after the name, e.g., Grade Euproptobranchial.

**Extinct Taxa**

Extinct taxa are indicated by the symbol • before the name, e.g., •Family Actinodontidae.

**Taxonomically Isolated Plesions and Paraphyletic Taxa**

Some plesions and some paraphyletic taxa are taxonomically isolated in the sense that they lack membership in one or more expected, immediately higher Linnean ranks, e.g., the family Palaeocardiidae placed within the suborder Cardiida within without an intervening hyporder, minorder, or superfamily. Such isolated plesions and paraphyletic taxa are presently labelled plesions and paraphlesions, respectively, to emphasize their deviation from the normal Linnean hierarchy.

**Taxon Dates and References**

Where two references are given for a taxon, e.g., Glycymerididae Dall, 1908 (Leach in J. Gray, 1847a), the second one indicates the source of date priority. See Bouchet and Rocroi (2010) for documentation.

**Informal Descriptive Names**

Commonly used descriptive names that are not presently formally adopted but have exact phylogenetic equivalents in the present classification are placed in bold face type after their correlative typified name, e.g., Eupteriomorphia, Foliobranchia, Euheterodontae, Neoheterodontae, Nepiomorphia, Palaeotaxodonta. Commonly used descriptive names that are not presently formally adopted and have no exact phylogenetic equivalent in the present classification (as determined by their original composition) are placed in bold-face type and *italics* after their most compatible typified name, e.g., Palaeoheterodontae, Heterodontae. The taxonomically widely dispersed taxa formerly assigned to the Anomalodesmata are indicated by *underlining*.  

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**Table 1. Suffixes for taxonomic ranks.**

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ABSTRACT OF CLASSIFICATION

To more clearly illustrate the major structure of the classification, the following abstract includes only the higher taxonomic ranks and their higher ranking paraplesions. A more detailed abstract, which includes all taxa at or above the rank of superfamily, plus all plesions and paraplesions, is provided in Appendix 3 (p. 27 herein). Symbols: • = extinct; ! = paraphyletic; underlining = former members of Anomalodesmata; ? = taxonomic placement uncertain.

Class Bivalvia Linnaeus, 1758 in 1758–1759

• Grade Euprotobranchia! Nevesskaja, 2009
  • Order Fordillida! Pojeta, 1975
  • Order Tuarangiida MacKinnon, 1982

Clade Eubivalvia Carter, nov.

Subclass Protobranchia Pelseneer, 1889 (=Palaeotaxodonta Korobkov, 1954)

Superorder Nuculiformii! Dall, 1889 (=Foliobranchia Ménégaux, 1889)
  Order Nuculida! Dall, 1889
  Order Solemyida Dall, 1889

Superorder Nuculaniformii Carter, Campbell, & Campbell, 2000
  Order Nuculanida Carter, Campbell, & Campbell, 2000
  • Order Afghanodesmatida! Carter, nov.

Subclass Autobranchia Grobben, 1894

Infraclass Pteriomorphia Beurlen, 1944

Cohort Mytilomorphi! Férussac, 1822 in 1821–1822
  Order Mytilida! Férussac, 1822 in 1821–1822
  • Order Colpomyida Carter, nov.

Cohort Ostreomorphi Férussac, 1822 in 1821–1822

Subcohort Arzicioni J. Gray, 1854a
  • Order Cyrtodontida! Scarlato & Starobogatov in Nevesskaja & others, 1971
    • Suborder Cyrtodontidina! Scarlato & Starobogatov in Nevesskaja & others, 1971
  • Suborder Praecardiidina Newell, 1965 (=Nepiomorphia Kříž, 2007)
    • Hyporder Praecardioidei Newell, 1965
    • Hyporder Antipleuroidei Kříž, 2007

Order Arcida J. Gray, 1854a

Subcohort Ostreioni Férussac, 1822 in 1821–1822
  • Megaorder Myalinata H. Paul, 1939
    • Order Myalinida H. Paul, 1939

Megaorder Ostreata Férussac, 1822 in 1821–1822

Superorder Ostreiformii Férussac, 1822 in 1821–1822 (=Eupteriomorphia Boss, 1982)
  Order Ostreida Férussac, 1822 in 1821–1822
    Suborder Ostreidina Férussac, 1822 in 1821–1822
    Suborder Malleidina! J. Gray, 1854a
  Order Pectinida! Krasilova, 1959
    • Suborder Pectinidina J. Gray, 1854a
    • Suborder Anomiidina J. Gray, 1854a
    Hyporder Anomiioidei J. Gray, 1854a
      • (paraplesion) Superfamily Leiopectinoidea! Krasilova, 1959
        Suborder Pectinidina J. Gray, 1854a
        Suborder Anomiidina J. Gray, 1854a

Infraclass Heteroconchia Hertwig, 1895

Cohort Unionomorphi J. Gray, 1854a (=Palaeobeheterodonta of authors)

Subcohort Unioni J. Gray, 1854a
  (paraplesion) Superfamily Lyrodesmatoida! P. Fischer, 1886

Megaorder Unioniata J. Gray, 1854a
  Order Trigoniid! Dall, 1889
  Order Unionida J. Gray, 1854a
    Suborder Unionidina J. Gray, 1854a
    Suborder Hyriidina Hoeh & others, 2009
      • Suborder Silesunionidina! Skawina & Dzik, 2011

Cohort Cardiomorphi Férussac, 1822 in 1821–1822 (=Heterodonta of authors)

Subcohort Carditioni Dall, 1889
  • Order Actinodontida! Deschaseaux, 1952

Order Carditida Dall, 1889

Subcohort Cardionid! Férussac, 1822 in 1821–1822 (=Euheterodonta Giribet & Distel, 2003)
Infrasubcohort Lucinidia J. Gray, 1854a
(paraplesion) • Superfamily Babinkoidea! Horný, 1960
Order Lucinida J. Gray, 1854a

Infrasubcohort Cardiidia Férussac, 1822 in 1821–1822
(paraplesion) • Superfamily Grammysoidea! S. A. Miller, 1877
Megaorder Cardiata Férussac, 1822 in 1821–1822 (=Neoheterodonte! Taylor & others, 2007)
Superorder Pholadiformii J. Gray, 1854a
Order Pholadida J. Gray, 1854a
Order Cardiida Férussac, 1822 in 1821–1822
(paraplesion) • Superfamily Kalenteroidea! Marwick, 1953
Suborder Cardiidiina Férussac, 1822 in 1821–1822
(paraplesion) • Family Palaoncardiidae! Chavan, 1969b
Hyperorder Veneroidei J. Gray, 1854a
Minorder Veneroitei J. Gray, 1854a
Order Diplostephanidae R. Moore, 1967
Order Cardiida Férussac, 1822 in 1821–1822
(paraplesion) • Superfamily Kalenteroidea! Marwick, 1953
Suborder Cardiidiina Férussac, 1822 in 1821–1822
(paraplesion) • Family Palaoncardiidae! Chavan, 1969b
Hyperorder Veneroidei J. Gray, 1854a
Minorder Veneroitei J. Gray, 1854a

Superorder Cardiiformii Férussac, 1822 in 1821–1822
• Order Mediomorphida! Newell, 1969c
• Order Megalodontida Starobogatov, 1992
• Order Hhippuritida Newell, 1965
Order Cardiida Férussac, 1822 in 1821–1822
(paraplesion) • Superfamily Kalenteroidea! Marwick, 1953
Suborder Cardiidiina Férussac, 1822 in 1821–1822
(paraplesion) • Family Palaoncardiidae! Chavan, 1969b
Hyperorder Veneroidei J. Gray, 1854a
Minorder Veneroitei J. Gray, 1854a
Minorder Dreissenotei R. Moore in Moore, Lalicker, & Fischer, 1952
Suborder Gastrochaenidae! Morretes, 1949
• Suborder Anthracosididae Silantiev & Carter, 2011
Suborder Leptonididae! R. Stewart, 1930
Order Pholadida J. Gray, 1854a
Order Cardiida Férussac, 1822 in 1821–1822
(paraplesion) • Superfamily Kalenteroidea! Marwick, 1953
Suborder Cardiidiina Férussac, 1822 in 1821–1822
(paraplesion) • Family Palaoncardiidae! Chavan, 1969b
Hyperorder Veneroidei J. Gray, 1854a
Minorder Veneroitei J. Gray, 1854a

Megaorder Poromya! Ridewood, 1903
Order Poromyida! Ridewood, 1903
Order Pandorida R. Stewart, 1930
Order Pholadomyida! Newell, 1965
Order Thracidae! Carter, nov.

Megaorder Solenata! Dall, 1889
Order Solenida! Dall, 1889
Order Hiattellidae! Carter, nov.

DETAILED CLASSIFICATION

Class Bivalvia Linnaeus, 1758 in 1758–1759
• Grade Euprotobranchia! Nevekaia, 2009
  • Order Fordillida! Pojeta, 1975
    • Superfamily Fordilloidea! Pojeta, 1975
    • Family Fordilliidae! Pojeta, 1975
    • Family Camyidae! Hinz-Schallreuter, 2000
  • Order Tuaronididae! McAlester, 1969
    • Subfamily Tuaronidinae! McAlester, 1969
    • Subfamily Conacavonidae! Sanchez, 1999
    • Superfamily Pristiglomoidea! Sanders & Allen, 1973
    • Family Pristiglomidae! Sanders & Allen, 1973
    • Family Pristiglomidae! Sanders & Allen, 1973
  • Order Solenida! Dall, 1889
    • Superfamily Solenoidae! J. Gray, 1824
      • Family Solenidae! J. Gray, 1824
    • Subfamily Soleninae! J. Gray, 1840b
    • Subfamily Soleninae! J. Gray, 1840b
    • Subfamily Solenidae! Pojeta, 1988
    • Subfamily Solenidae! Pojeta, 1988
    • Family Clinopisthidae! Pojeta, 1988
    • Family Ovatoconchidae! Carter, nov.
    • Family Ovatoconchidae! Carter, 1999
    • Family Manzanellidae Chronic, 1952
    • Family Manzanellidae! Chronic, 1952
    • Superorder Nuculaniformii Carret, Campbell, & Campbell, 2000
•Order Afghanodesmatida! Carter, nov.
  •Superfamily Tironuculoidea Babin in Babin & others, 1982
    •Family Tironuculidae Babin in Babin & others, 1982
      •Subfamily Tironuculinae! Babin in Babin & others, 1982
    •Subfamily Natasiinae Sánchez, 1997
    •Family Nucularcidae Pojeta & Stott, 2007
  •Superfamily Afghanodesmatidae Scarlato & Starobogatov, 1979a
  •Family Afghanodesmatidae Scarlato & Starobogatov, 1979a
•Family Eritropidae! Cope, 2000

Order Nuculanida Carter, Campbell, & Campbell, 2000
Superfamily Malletterioidea! H. Adams & A. Adams, 1858 (d'Orbigny, 1846)
  Family Malletteriidae! H. Adams & A. Adams, 1858 (d'Orbigny, 1846)
    •Family Cucullellidae! P. Fischer, 1886
      •Subfamily Cucullellinae P. Fischer, 1886
    •Family Pseudocyrtodontidae Maillieux, 1939
    •Family Strabidae Prantl & Růžička, 1954
      Family Tindariidae Verrill & Bush, 1897
        Subfamily Tindarininae! Verrill & Bush, 1897
    •Subfamily Nelloliniinae Schileyko, 1989

Superfamily Nuculanidae H. Adams & A. Adams, 1858 (J. Gray, 1854a)
  .Family Nuculanidae! H. Adams & A. Adams, 1858 (J. Gray, 1854a)
  •Family Isoarcidae Keen, 1969b
  .Family Zealedidae Scarlato & Starobogatov in Nevesskaja & others, 1971
    .Subfamily Phaseolinae Scarlato & Starobogatov in Nevesskaja & others, 1971
    .Subfamily Siliculininae! J. A. Allen & Sanders, 1973
  •Family Polidevciidae! Kumpera, Prantl, & Růžička, 1960
  .Family Sareptidae Stoliczka, 1870 in 1870–1871
    .Subfamily Sareptinae Stoliczka, 1870 in 1870–1871
    .Subfamily Yoldiellinae J. A. Allen & Hannah, 1986
      .Subfamily Yoldiinae Dall, 1908
  .Family Zealedidae Scarlato & Starobogatov, 1979a
    .Subfamily Zealedinae Scarlato & Starobogatov, 1979a
    .Subfamily Paraizolininae Filatova & Schileyko, 1984

Subclass Autobranchia Grobben, 1894
Infraclass Pteriomorpha Beurlen, 1944
  Cohort Mytilomorph! Fréussac, 1822 in 1821–1822
  .Order Mytilida! Fréussac, 1822 in 1821–1822
    •Superfamily Modiolopsidea! P. Fischer, 1886
      •Family Modiolopsidea! P. Fischer, 1886
      •Family Goniophrinidae Sánchez, 2006
    .Superfamily Mytiloidea Rafinesque, 1815
      .Family Mytilidae! Rafinesque, 1815
        .Subfamily Mytilinae Rafinesque, 1815
          .Tribe Mytilini! Rafinesque, 1815
            .Tribe Adulinia Scarlato & Starobogatov, 1979b
            .Tribe Aulacomyini Carter, nov.
          .Subfamily Arcuatiellinae Scarlato & Starobogatov, 1979b
          .Subfamily Bathymodiolinae Kenk & Wilson, 1985
          .Subfamily Lithophagininae H. Adams & A. Adams, 1857 (J. Gray, 1854a)
            .Tribe Lithophagini H. Adams & A. Adams, 1857 (J. Gray, 1854a)
            .Tribe Botulini Scarlato & Starobogatov, 1979b
          .Subfamily Modiolinae! G. Termier & H. Termier, 1950
            •Subfamily Xenomytilinae Squares & Saul, 2006
          .Family Crenellidae J. Gray, 1840b
            .Subfamily Crenellinae J. Gray, 1840b
              .Tribe Crenellini! J. Gray, 1840b
              .Tribe Dacrydiini Ockelmann, 1983
            .Subfamily Musculinae Iredale, 1939
          .Family Septiferidae Scarlato & Starobogatov, 1979b
            .Subfamily Septiferinae Scarlato & Starobogatov, 1979b
            .Subfamily Limnoperninae Scarlato & Starobogatov, 1979b
  •Order Colpomyida Carter, nov.
    •Superfamily Colpomyoidea Pojeta & Gilbert-Tomlinsin, 1977
      •Family Colpomyidae! Pojeta & Gilbert-Tomlinsin, 1977
      •Family Evyanidae Carter, Campbell, & Campbell, 2000
Cohort Ostreomorphi Férussac, 1822 in 1821–1822

(plesion) • Family Matheriidae Scarlato & Starobogatov, 1979a
(plesion) • Family Ichyrodontidae Scarlato & Starobogatov, 1979a

Subcohort Arcioni! J. Gray, 1854a

• Order Cyrtodontida! Scarlato & Starobogatov in Nevesskaja & others, 1971
  • Suborder Cyrtodontinida! Scarlato & Starobogatov in Nevesskaja & others, 1971
    • Superfamily Cyrtodontotoidea Ulrich in Ulrich & Scofield, 1894
      • Family Cyrtodontidae Ulrich in Ulrich & Scofield, 1894
    • Superfamily Falcotodontinidea Cope, 1996
      • Family Falcotodontidae Cope, 1996
    • Superfamily Pichlerioidea Scarlato & Starobogatov, 1979a
      • Family Pichleriidae Scarlato & Starobogatov, 1979a
  • Suborder Praecardiidina Newell, 1965 (= Nepiomorpha Kříž, 2007)
    • Hyporder Praecardioidei Newell, 1965
      • Superfamily Praecardioida Cope, 1996
        • Family Praecardiidae R. Hoernes, 1884
        • Family Buchiolidae Grimm, 1998
      • Superfamily Cardioloidea R. Hoernes, 1884
        • Family Cardiolidae R. Hoernes, 1884
        • Family Slavidae Kříž, 1982
    • Hyporder Antipleuroidei Kříž, 2007
      • Superfamily Dualinoidea Conrath, 1887
        • Family Dualinidae Conrath, 1887
          • Subfamily Dualininae Conrath, 1887
          • Subfamily Loxopteriinae Nagel-Myers, Amler, & Becker, 2009
        • Family Praelucinidae Conrath, 1887
        • Family Stolidotidae Starobogatov, 1977
        • Family Spanilidae Kříž, 2007
  • Order Arcida J. Gray, 1854a
    • Superfamily Glyptarcoidea Cope, 1996
      • Family Glyptarcidae Cope, 1996
    • Superfamily Arcoidea Lamarck, 1809
      • Family Arcidae Lamarck, 1809
        • Subfamily Arcinae Lamarck, 1809
        • Subfamily Anarinae Reinhardt, 1935
        • Subfamily Noetiinae R. Stewart, 1930
          • Tribe Noettini R. Stewart, 1930
          • Tribe Striarcini MacNeil, 1937
          • Tribe Tritucni MacNeil, 1937
        • Family Catamarcaiidae Cope, 2000
          • Family Cucullaeidae R. Stewart, 1930
          • Family Frejudae Ratter & Cope, 1998
          • Family Glycymeridae Dall, 1908 (Leach in J. Gray, 1847a)
            • Subfamily Glycymeridinae Dall, 1908 (Leach in J. Gray, 1847a)
              • Subfamily Arcullaeinae Newell, 1969a
          • Family Parallelocardiidae Dall, 1898
            • Subfamily Parallelocardiinae Dall, 1898
              • Subfamily Grammatodontinae L. Stephenson, 1941
                • Tribe Grammatodontini L. Stephenson, 1941
                • Tribe Carcellini Scarlato & Starobogatov, 1979b
                • Tribe Nemodomini L. Stephenson et MacNeil MS, 1941
    • Superfamily Limopsoidea Dall, 1895a
      • Family Limopsidae Dall, 1895a
      • Superfamily Philobryoidea Félix Bernard, 1897
        • Family Philobryidae Félix Bernard, 1897
    • Subcohort Ostreioni Férussac, 1822 in 1821–1822
      • Megaorder Myalinata H. Paul, 1939
        • Order Myalinida H. Paul, 1939
          • Superfamily Alatoconchoidea H. Termier, Termier, & Lapparent, 1974
            • Family Alatoconchidinae H. Termier, Termier, & Lapparent, 1974
            • Family Saikraconchidinae H. Termier, Termier, & Lapparent, 1974
            • Family Lunulacardiidae P. Fischer, 1887
• Subfamily Lunulacardiinae P. Fischer, 1887
• Subfamily Pterochaeniinae Fang & Ding, 1993
• Family Monopteriidae Newell, 1969
• Family Mysidiellidae Cox, 1964
• Family Myalinidae Frech, 1891
• Family Ramonalinidae Yancey, Wilson, & Mione, 2009
• Superfamily Inoceramoidea C. Giebel, 1852
  • Family Inoceramidae C. Giebel, 1852
    • Subfamily Inoceraminae C. Giebel, 1852
    • Subfamily Coloniceraminae Pochialaynen, 1985
    • Subfamily Sachalinoceraminae Zonova, 1984
  • Family Atomodesmatidae Waterhouse, 1976
  • Subfamily Atomodesmatinae Waterhouse, 1976
  • Subfamily Malimanininae Waterhouse, 2001
  • Subfamily Permoceraminae Waterhouse, 2008
• Family Kolymiidae V. Kuznetsov, 1973
• Family Retroceramidae Koschelkina, 1980
• Superfamily Prokopievskioidea H. Vokes, 1967
  • Family Prokopievskiidae H. Vokes, 1967
    • Subfamily Prokopievskiinae H. Vokes, 1967
    • Subfamily Abellininae Starobogatov, 1970
    • Subfamily Concilininae Silantiev, nov.
    • Subfamily Kinerkailinae Scarlato & Starobogatov, 1979a
  • Family Anadontellidae Silantiev, nov.
  • Family Naiaditidae Scarlato & Starobogatov, 1979a

Megaorder Ostreata Férussac, 1822 in 1821–1822
(plesion) • Family Myodakryotidae Tunnicliff, 1987
Superorder Ostreiformii Férussac, 1822 in 1821–1822 (=Eupteriomorpha Boss, 1982)
Order Ostreida Férussac, 1822 in 1821–1822
Suborder Ostreidina Férussac, 1822 in 1821–1822
  Superfamily Ostreidea Rafinesque, 1815
    Family Ostreidae Rafinesque, 1815
      • Subfamily Ostreinae Rafinesque, 1815
        • Tribe Ostreini Rafinesque, 1815
        • Tribe Pustulostreini Harry, 1985
        • Tribe Undulostreini Harry, 1985
      • Subfamily Lophinae Vialov, 1936
        • Tribe Lopha ni Vialov, 1936
        • Tribe Myrakeenini Harry, 1985
      • Family Arctostreidae Vialov, 1983
        • Subfamily Arctostreinae Vialov, 1983
        • Subfamily Palaeolophinae Malchus, 1990
      • Family Eligmiidae T. Gill, 1871
    Family Flemingostreidae Stenzel, 1971
      • Subfamily Flemingostreinae Stenzel, 1971
        • Tribe Flemingostreini Stenzel, 1971
        • Tribe Ambigostreini Malchus, 1990
        • Tribe Curvostreini Malchus, 1990
      • Subfamily Crassostreinae Scarlato & Starobogatov, 1979a
        • Tribe Crassostreini Scarlato & Starobogatov, 1979a
        • Tribe Striostreini Harry, 1985
        • Tribe Turkostreini Malchus, 1990
      • Subfamily Liostreinae Vialov, 1983
    Family Gryphaeidae Vialov, 1936
      • Subfamily Gryphaeinae Vialov, 1936
      • Subfamily Exogyrinae Vialov, 1936
        • Tribe Exogyrinini Vialov, 1936
        • Tribe Amphidonteini Vialov, 1983
      • Subfamily Gryphaeostreinae Stenzel, 1971
      • Subfamily Pycnodonteinae Stenzel, 1959
      • Tribe Pycnodonteini Stenzel, 1959
        • Tribe Hyotissini Scarlato & Starobogatov, 1979b
        • Tribe Neopycnodonteini Harry, 1985
    Suborder Malleidina J. Gray, 1854a
      (paraplesion) • Family Pterineidae F. Meek, 1864b
      Superfamily Pinnoidae Leach, 1819
        Family Pinnidae Leach, 1819
• Superfamily Posidonioidea Neumayr, 1891
  • Family Posidonidae! Neumayr, 1891
  • Family Aulacomyellidae! Ichikawa, 1958
    • Subfamily Aulacomyellinae Ichikawa, 1958
    • Subfamily Bostrinidae! Waterhouse, 2008
  • Family Daonellidae Neumayr, 1891
  • Family Halobiidae Kirtl, 1912

Superfamily Pterioidea! J. Gray, 1847b (Goldfuss, 1820)
Family Pteriidae J. Gray, 1847b (Goldfuss, 1820)
  • Subfamily Dattinae M. Healey, 1908
  • Family Bakevellidae! W. King, 1850
  • Family Cassianellidae Ichikawa, 1958
  • Family Kochiidae Frech, 1891

Family Malleidae Lamarck, 1818
  • Subfamily Malleinae Lamarck, 1818
  • Subfamily Isognomonidae! Woodring, 1925 (J. Fleming, 1828)
  • Subfamily Pulvinitorinae L. Stephenson, 1941
  • Family Pergamidiidae Cox, 1964
    • Subfamily Pergamidiinae Cox, 1964
    • Subfamily Oretiinae Waterhouse, 2008
  • Family Vlastidae! Neumayr, 1891
  • Subfamily Vlastinae Neumayr, 1891
  • Subfamily Praeostreinae! Kříž, 1966

Superfamily Rhombopterioidea! Korobkov in Eberzin, 1960
• Family Rhombopteridae! Korobkov in Eberzin, 1960
• Family Umburridae! P. A. Johnston, 1991

Order Pectinida J. Gray, 1854a
(paraplesion) • Superfamily Leiopectinoidea! Krasilova, 1959
  • Family Leiopectinidae! Krasilova, 1959

Suborder Pectinidina J. Gray, 1854a
Superfamily Pectinoidea Rafinesque, 1815
 Epifamily Pectinoidea Rafinesque, 1815
  • Family Pectinidae! Rafinesque, 1815
    • Subfamily Pectininae Rafinesque, 1815
      • Tribe Pectinini Rafinesque, 1815
      • Tribe Aequsipectinini! Nordsieck, 1969
      • Tribe Austrochlamydini Jonkers, 2003
      • Tribe Decatopectinini T. Waller, 1986
    • Subfamily Camptonectinae Habe, 1977
    • Subfamily Palliolinae Korobkov in Eberzin, 1960
    • Tribe Palliolini Korobkov in Eberzin, 1960
    • Tribe Adamussiini Habe, 1977
      • Tribe Eburneopectinini T. Waller, 2006
      • Tribe Mesopeplini T. Waller, 2006
      • Tribe Pseudentoliini T. Waller, 2006
      • Tribe Serripectinini T. Waller, 2006
    • Subfamily Pedinae! Bronn, 1862
      • Tribe Pedini Bronn, 1862
      • Tribe Chlamydiini! Teppner, 1922
      • Tribe Crassadomini T. Waller, 1993
      • Tribe Fortripectinini K. Masuda, 1963
        • Subtribe Fortripectinina K. Masuda, 1963
        • Subtribe Patiniopectinina Habe, 1977
      • Tribe Mimachlamydini! T. Waller, 1993
        • Subfamily Pseudopectininae! Kasum-Zade, 2003
        • Subfamily Weylinae Kasum-Zade, 2003
  • Family Pleuronectitidae! Hautmann, nov.
    • Family Spondylidae J. Gray, 1826
      • Subfamily Spondylinae J. Gray, 1826
        • Subfamily Spondylopectininae! Kasum-Zade & Romanov, 1987
  • Epifamily Neitheoidae Sobetski, 1960
  • Family Neithidae Sobetski, 1960
  • Family Tosapectinidae! Trushchelev, 1984

Suborder Anomiidina J. Gray, 1854a
Hyporder Anomioidei J. Gray, 1854a
•(plesion) Family Saharopteriidae G. Termier & H. Termier in Pareyn, Termier, & Termier, 1972
•(paraplesion) Superfamily Pseudomonotoidea! Newell, 1938
•Family Pseudomonotidae! Newell, 1938

Minorder Anomioitei J. Gray, 1854a
Superfamily Anomioidea Rafinesque, 1815
Family Anomidae! Rafinesque, 1815
Subfamily Anominae! Rafinesque, 1815
Subfamily Heteranomiinae Scarlato & Starobogatov, 1979a
•Family Permanomiidae Carter, 1990a
•Family Placunidae Rafinesque, 1815

Minorder Dimyoitei Ridewood, 1903
Superfamily Dimyioidea P. Fischer, 1886
Family Dimyidae P. Fischer, 1886
Superfamily Plicatuloidea J. Gray, 1854b
Family Plicatulidae! J. Gray, 1854b
•Family Chondrodontidae Freneix, 1960
•Superfamily Prospodyloidea! Pchelintseva, 1960
•Family Prospodylidae! Pchelintseva, 1960
•Subfamily Prospodylineae! Pchelintseva, 1960
•Subfamily Pegnaivalvulinae! Waterhouse, 2008

Hyporder Aviculopectinoidei! Starobogatov, 1992
•Superfamily Aviculopectinoidea! F. Meek & Hayden, 1865
•Family Aviculopectinidae! F. Meek & Hayden, 1865
•Subfamily Aviculopectininae! F. Meek & Hayden, 1865
•Subfamily Echiniferipectininae Waterhouse, 2008
•Subfamily Hayasakpectininae! Boyd & Newell, 2000
•Subfamily Spyridpectininae Waterhouse, 2008
•Family Deltopectinidae Dickins, 1957
•Subfamily Deltopectininae! Dickins, 1957
•Subfamily Cytorostrinae Newell & Boyd, 1995
•Subfamily Squamuliferipectininae Waterhouse, 2008
•Family Limatulinidae! Waterhouse, 2001
•Superfamily Chaenocardioidea S. A. Miller, 1889
•Family Chaenocardidae! S. A. Miller, 1889
•Family Streblochondriidae Newell, 1938
•Subfamily Streblochondriinae Newell, 1938
•Subfamily Guizhoupectininae M. Astafieva, 1994
•Subfamily Orbiculopectininae Waterhouse, 2001
•Tribe Orbiculopectinini Waterhouse, 2001
•Tribe Eocamptonectini Waterhouse, 2001
•Subfamily Saturnopectininae D. Campbell, nov.
•Subfamily Eocamptonectini Waterhouse, 2001
•Subfamily Acanthopectininae Waterhouse, 2008
•Family Limipectinidae Newell & Boyd, 1990
•Subfamily Limipectininae! Beurlen, 1954
•Subfamily Heteropectininae! Beurlen, 1954
•Subfamily Cassianoidinae Newell & Boyd, 1995
•Subfamily Etheripectininae! Waterhouse, 1982
•Subfamily Girtypectininae Waterhouse, 2008
•Family Annuliconchidae Astafieva, 1995
•Family Antijaniridae Hautmann, nov.
•Family Hunanopectinidae! Yin Hong-fu, 1985
•Subfamily Hunanopectininae Yin Hong-fu, 1985
•Tribe Hunanopectiniini Yin Hong-fu, 1985
•Tribe Furcatiini Waterhouse, 2001
•Subfamily Aselloinae! Begg & Campbell, 1986
•Family Limipectinidae Newell & Boyd, 1990
•Subfamily Limipectininae! Newell & Boyd, 1990
•Subfamily Acanthopectininae Newell & Boyd, 1995
•Tribe Acanthopectiniini Newell & Boyd, 1995
•Tribe Costatopicatini Waterhouse, 2008
•Tribe Lamnipectinini Waterhouse, 2008
•Family Ornithopectinidae Hautmann, nov.
•Superfamily Pterinopectinoidea! Newell, 1938
•Family Pterinopectinidae! Newell, 1938
•Subfamily Pterinopectininae! Newell, 1938
•Subfamily Pterinopectinellinae Waterhouse, 2008
• Subfamily Tessariinae Waterhouse, 2008
• Family Claraiidae Gavrilova, 1996
  • Subfamily Claraiinae! Gavrilova, 1996
  • Subfamily Chuluariinae Waterhouse, 2008
• Family Natalissimidae! Waterhouse, 2008
  • Subfamily Natalissiminia! Waterhouse, 2008
  • Subfamily Pseudaviculopectininae! Waterhouse, 2008

Hyponder Limoidei R. Moore in Moore, Lalicker, & Fischer, 1952
Superfamily Limoidea Rafinesque, 1815
  • Family Limidae! Rafinesque, 1815
    • Subfamily Liminae Rafinesque, 1815
      • Subfamily Ctenostreoninae Kasum-Zade, 2003
      • Subfamily Limatulinae! Kasum-Zade, 2003
        • Tribe Limatulini! Kasum-Zade, 2003
        • Tribe Calcicaniculariini Waterhouse, 2008
      • Subfamily Plagiostominiae Kasum-Zade, 2003
  • Family Isolimeidae Kasum-Zade, 2003
  • Hyporder Monotoidei Waterhouse, 2001
    • Superfamily Buchioidae! Cox, 1953 (P. Fischer, 1886)
      • Family Buchiidae Cox, 1953 (P. Fischer, 1886)
      • Family Dolpionellidae Waterhouse, 2001
      • Family Monotidae! P. Fischer, 1886
        • Subfamily Monotinae P. Fischer, 1886
        • Subfamily Otapiriinae! Waterhouse, 1982
    • Superfamily Eurydesmatoidae! Reed, 1932
    • Family Eurydesmatidae! Reed, 1932
    • Family Manticulidae Waterhouse, 2008
    • Superfamily Oxytomoidea Ichikawa, 1958
    • Family Oxytomidae Ichikawa, 1958
      • Subfamily Oxytominia! Ichikawa, 1958
      • Subfamily Maccouellinae Waterhouse, 2008

Suborder Entoliidida! Hautmann, nov.
Superfamily Entolioidae! Teppner, 1922
  • Family Entoliidae Teppner, 1922
    • Subfamily Entoliinae Teppner, 1922
    • Subfamily Palaeoentoliinae! Romanow, 1985
      • Subfamily Syncyclonematinae! T. Waller, 1978
      • Family Entoloidesidae Kasum-Zade, 2003
        • Subfamily Entoloidesinae! Kasum-Zade, 2003
        • Subfamily Calvaentoliinae Kasum-Zade, 2003
        • Family Pernopectinidae! Newell, 1938
        • Family Propeamussiidae Abbott, 1954
      • Superfamily Euchondrioidea! Newell, 1938
      • Family Euchondriidae! Newell, 1938
      • Family Euchondriidae! Newell, 1938
      • Superfamily Entolioida! Hautmann, nov.

Infraclass Heterocochnia Hertwig, 1895
Cohort Unioniomorphia J. Gray, 1854a (=Palaeoheterodonta of authors)
  • Family Thoraliidae N. Morris, 1980
Subcohort Unioni J. Gray, 1854a
  • Family Lyrodesmatidae! P. Fischer, 1886
    • Subfamily Lyrodesmatinae! P. Fischer, 1886
    • Family Pseudarcidae Scarlato & Starobogatov, 1979a
Megaorder Unionida J. Gray, 1854a
Order Trigoniida! Dall, 1889
Superfamily Trigonioida! Lamarck, 1819
  • Family Trigoniidae! Lamarck, 1819
    • Subfamily Trigoniinae Lamarck, 1819
      • Subfamily Minetrigoniinae T. Kobayashi, 1954
      • Subfamily Nototrigoniinae Skwarko, 1963
      • Subfamily Pleurotrigoniinae van Hoepen, 1929
      • Subfamily Neugoniinae H. Leanza, 1993
      • Subfamily Psilotrigoniinae C. Fleming, 1987
      • Family Eoschizodidae Newell & Boyd, 1975
      • Family Groeberellidae Pérez, Reyes, & Damborenea, 1995
      • Family Myophoriidae! Bronn, 1849 in 1848–1849
      • Family Prosogyrotrigoniidae T. Kobayashi, 1954
        • Subfamily Prosogyotrigoniinae T. Kobayashi, 1954
        • Subfamily Praegoniinae C. Fleming, 1962
• Family Scaphellinidae Newell & Giracks, 1962
• Family Schizoididae Newell & Boyd, 1975
  • Subfamily Schizodinae Newell & Boyd, 1975
  • Subfamily Eocastaritinae Newell & Boyd, 1975
  • Subfamily Sinodorinae Pojeta & Zhang, 1984
• Superfamily Myophorelloidea T. Kobayashi, 1954
• Epifamily Myophorelloidae T. Kobayashi, 1954
• Family Myophorellidae T. Kobayashi, 1954
  • Subfamily Myophorellinae T. Kobayashi, 1954
  • Tribe Myophorellini T. Kobayashi, 1954
  • Tribe Steinmanellini M. Cooper, 1991
  • Subfamily Vaugoniinae T. Kobayashi, 1954
  • Tribe Vaugonini T. Kobayashi, 1954
  • Tribe Quadratotrignorniini Saveliev, 1958
• Family Buchotrignoniidae H. Leanza, 1993
  • Subfamily Buchotrignoniinae H. Leanza, 1993
  • Subfamily Syrotrignoniinae Perez & Reyes, 1997
• Family Laevitrigoniidae Saveliev, 1958
  • Subfamily Buchotrignoniinae Saveliev, 1958
  • Subfamily Frenguelliellinae Nakano, 1960
• Epifamily Megatrigonioidae van Hoepen, 1929
  • Series Megatrigoniitae van Hoepen, 1929
  • Family Megatrigoniidae van Hoepen, 1929
  • Subfamily Megatrigoniinae van Hoepen, 1929
    • Tribe Megatrigoniini van Hoepen, 1929
    • Tribe Apiotrigoniini Tashiro, 1979
    • Subtribe Apiotrigoniini Tashiro, 1979
    • Subtribe Heterotrigoniini M. Cooper, 1991
  • Subfamily Pterotrignoniinae van Hoepen, 1929
    • Tribe Pterotrignini van Hoepen, 1929
    • Tribe Scabrotrigoniini M. Cooper, 1989
• Family Iotrigoniidae Saveliev, 1958
  • Series Rutitrigoniitae van Hoepen, 1929
• Superfamily Pseudocardinioidea Martinson, 1961
• Family Pseudocardiniidae Martinson, 1961
• Family Utschamiellidae C. M. Kolesnikov, 1977
• Superfamily Trigoniodoidea Cox, 1952 (or in Unionida?)
  • Family Trigonidiidae Cox, 1952
    • Subfamily Trigonidiinae Cox, 1952
    • Subfamily Peregrinoconchinae Gu Zhi-wei & others in Ma & others, 1976
• Family Nakamuranaiadidae Guo, 1981
• Family Nippononaiadidae Chen Jin-hua, 1987
  • Subfamily Nippononaiinae Chen Jin-hua, 1987
  • Subfamily Sinonaiinae Chen Jin-hua, 1987
• Family Plicatounionidae Chen Jin-hua, 1987
• Superfamily Trigoniodoidea Modell, 1942
• Family Trigonidiidae Modell, 1942
• Family Desetrellidae Dechaseaux, 1947

Order Unioinida J. Gray, 1854a
Suborder Unioinidina J. Gray, 1854a
Superfamily Unionioidea Rafinesque, 1820
  • Family Unionidae Rafinesque, 1820
    • Subfamily Unioninae Rafinesque, 1820
      • Tribe Unionini Rafinesque, 1820
      • Tribe Anodontini Rafinesque, 1820
    • Subfamily Ambleminae Rafinesque, 1820
      • Tribe Amblemmini Rafinesque, 1820
      • Tribe Lampisilini Ihering, 1901
      • Tribe Pleurobemini Hannibal, 1912
      • Tribe Quadrulinini Ihering, 1901
    • Subfamily Gonideinae Ortmann, 1916
    • Subfamily Modellinaiinae Brandt, 1974
    • Subfamily Parreysiinae Henderson, 1935
    • Subfamily Qiyangiinae Chen Jin-hua, 1983
    • Subfamily Rectidentinae Modell, 1942
Family Margaritiferidae Henderson, 1929
  •Family Sancticarolitidae Simone & Mezzalira, 1997
Superfamily Mulleroidea Deshayes, 1832a
  Family Mulleriidae Deshayes, 1832a
    Subfamily Mulleriinae Deshayes, 1832a
    Subfamily Leilinae Morretes, 1949
    Subfamily Monocondylacinae Modell, 1942
    Subfamily Myctopodinae J. Gray, 1840b
  Family Etheriidae Deshayes, 1832a
  Family Iridinidae Swainson, 1840
    Subfamily Iridininae Swainson, 1840
    Subfamily Aspathariinae Modell, 1942
    •Superfamily Trigoniooidoidea Cox, 1952 (or in Trigoniida, which see)
Suborder Hyriidina Hoch & others, 2009
Superfamily Hyrioidea Swainson, 1840
  Family Hyriidae Swainson, 1840
    Subfamily Hyriinae Swainson, 1840
      Tribe Hyriini Swainson, 1840
      Tribe Castalliini Morretes, 1949
      Tribe Cucumerunionini Iredale, 1934
      Tribe Diplodontini Ihering, 1901
      Tribe Hyridellini McMichael & Hiscock, 1958 (Iredale, 1934)
    Subfamily Velesunioninae Iredale, 1934
    •Suborder Silesunionidina! Skawina & Dzik, 2011
    •Superfamily Silesunionoidea! Skawina & Dzik, 2011
      Family Silesunionidae! Skawina & Dzik, 2011
      Family Unionellidae Skawina & Dzik, 2011
    •Order Silesunionidae S. A. Miller, 1877
      Family Lipanellidae Sánchez, 2005
Subcohort Carditioni Dall, 1889
  •Order Actinodontida! Deshayes, 1832
    •Superfamily Anodontopsidae! S. A. Miller, 1889
      Family Anodontopsidae! S. A. Miller, 1889
      Family Actinodontidae! Davies, 1933
      Family Baidiostracidae Fang & Cope, 2008
      Family Cycloconchidae! Ulrich in Ulrich & Scofield, 1894
        •Subfamily Cycloconchinae! Ulrich in Ulrich & Scofield, 1894
        •Subfamily Taselasmodinae Fang & Cope, 2008
      Family Intihuarellidae! Sánchez in Sánchez & Vaccari, 2003
      •Family Redonidae! Babin, 1966
      •Superfamily Nyassoida! S. A. Miller, 1877
        •Family Nyassidae! S. A. Miller, 1877
      •Superfamily Palaeomutelidea! Lahusen, 1897
        •Family Palaeomutelidae! Lahusen, 1897
        •Superfamily Aenigmoconchidae Betekhtina in Betekhtina & Soukhov, 1968
        •Family Astartidae! d'Orbigny, 1844 in 1844–1848 (J. Gray, 1840b)
          •Subfamily Astartinae! d'Orbigny, 1844 in 1844–1848 (J. Gray, 1840b)
          •Subfamily Astartellinae! Boyd & Newell, 1968
          •Subfamily Eriphylinae Chavan, 1952b
          •Subfamily Opinae! Chavan, 1952b
          •Subfamily Pinzonellinae Beurlen, 1954
          •Subfamily Terrainae Scarlato & Starobogatov, 1979a
Order Cardiida Dall, 1889
(plesion) •Family Archaeocardia! Khlafin, 1940
(paraplesion) •Family Eodonidae! Carter, Campbell, & Campbell, 2000
Superfamily Crassatelloidea Férussac, 1822 in 1821–1822
  Family Crassatellidae Férussac, 1822 in 1821–1822
    Subfamily Crassatellinae! Férussac, 1822 in 1821–1822
      •Subfamily Psychomyinae Keen, 1969b
      Subfamily Scambulinae Chavan, 1952a
    •Superfamily Amnigenioidea Betekhtina in Betekhtina & Soukhov, 1968
      Family Astaridae! d’Orbigny, 1844 in 1844–1848 (J. Gray, 1840b)
        •Subfamily Astartinae! d’Orbigny, 1844 in 1844–1848 (J. Gray, 1840b)
          •Subfamily Astartellinae! Boyd & Newell, 1968
          •Subfamily Eriphylinae Chavan, 1952b
          •Subfamily Opinae! Chavan, 1952b
          •Subfamily Pinzonellinae Beurlen, 1954
          •Subfamily Terrainae Scarlato & Starobogatov, 1979a
Subfamily Trigonopinae R. N. Gardner & Campbell, 2002
Family Cardiniidae Zittel, 1881
Subfamily Carditinae Férussac, 1822 in 1821–1822
Subfamily Carditamerinae! Chavan, 1969b
Subfamily Carditesinae! Chavan, 1969b
Subfamily Thecaliinae Dall, 1903
Subfamily Venericardiinae Chavan, 1969b
Family Condylocardiidae Félix Bernard, 1896
Subfamily Condylocardiinae Félix Bernard, 1896
Subfamily Cuninae Chavan, 1969b
• Family Myophoricardiidae Chavan in Cox & Chavan, 1969
Subcohort Cardioni Férussac, 1822 in 1821–1822 (=Euheterodonta Giribet & Distel, 2003)
Infrasubcohort Lucinidia J. Gray, 1854a
(paraplesion) • Superfamily Babinkoidea! Horný, 1960
• Family Babinkidae! Horný, 1960
• Family Coxiconchiidae Babin, 1977
Order Lucinida J. Gray, 1854a
Superfamily Lucinoidea! J. Fleming, 1828
Family Lucinidae J. Fleming, 1828
Subfamily Lucinae J. Fleming, 1828
Subfamily Fimbriinae Nicol, 1950 (Stoliczka, 1870 in 1870–1871)
• Subfamily Ilioniinae! Scarlato & Starobogatov, 1979a
Subfamily Milthiniae! Chavan, 1969a
Subfamily Myrteinae Chavan, 1969a
• Family Mactromyidae Cox, 1929 (P. Fischer, 1887)
• Family Paracyclidae! P. A. Johnston, 1993
Superfamily Thyasiroidea Dall, 1900 (Dall, 1895a)
Family Thyasiridae Dall, 1900 (Dall, 1895a)
Subfamily Thyasirinae! Dall, 1900 (Dall, 1895a)
Subfamily Axinopsidinae Frank Bernard, 1983
Infrasubcohort Cardidi Férussac, 1822 in 1821–1822
(paraplesion) • Superfamily Grammysioidea! S. A. Miller, 1877
• Family Grammysiidae! S. A. Miller, 1877
• Subfamily Grammysiniae S. A. Miller, 1877
• Subfamily Cuncamvirae! N. Morris, Dickins, & Astafieva-Urbajtis, 1991
• Family Sanguinolitidae S. A. Miller, 1877
• Subfamily Sanguinolithae S. A. Miller, 1877
• Subfamily Alulinae N. Morris, Dickins, & Astafieva-Urbajtis, 1991
• Subfamily Paleodorinae Carter, nov.
• Subfamily Undulomyinae Astafieva-Urbajtis, 1983
Megaorder Cardiata Férussac, 1822 in 1821–1822 (=Neoheterodontae Taylor & others, 2007)
Superorder Cardiiformis Férussac, 1822 in 1821–1822
• Order Modiomorphida! Newell, 1969c
• Superfamily Modiomorphoidea! S. A. Miller, 1877
• Family Modiomorphidae! S. A. Miller, 1877
• Subfamily Modiomorphinae S. A. Miller, 1877
• Subfamily Butoviciellinae Krží, 1965
• Subfamily Healevinae! Hautmann, 2008
• Subfamily Joannininae Carter, nov.
• Family Cypricardiniidae Ulrich in Ulrich & Scofield, 1894
• Family Hippopodiniidae Cox in Cox & LaRocque, 1969
• Family Palaeopharidae Marwick, 1953
• Family Tusayanidae Scarlato & Starobogatov, 1979a
• Order Megalodontida! Starobogatov, 1992
• Superfamily Megalodontoidae! Haffer, 1959
• Family Mecnodontidae! Haffer, 1959
• Family Bichuanidae Liu Xie-zhang & Gu in Hou Hong-fei, Wan, & Xian, 1988
• Family Congerichomorphidae Saul, 1976
• Family Plerthocardiidae Scarlato & Starobogatov, 1979a
• Family Prosocoelidae! Karczewski, 1992
• Order Megalodontidea! Mecnodontidea! Haffer, 1959
• Family Mecnodontidea! Haffer, 1959
• Family Beichuaniidae Liu Xie-zhang & Gu in Hou Hong-fei, Wan, & Xian, 1988
• Family Congerichomorphidea Saul, 1976
• Family Plerthocardiidea Scarlato & Starobogatov, 1979a
• Family Prosocoelidea! Karczewski, 1992
• Superfamily Megalodontoididea! J. Morris & Lycett, 1853
• Family Megalodontidae! J. Morris & Lycett, 1853
• Family Ceratomyopsidae Cox, 1964
• Family Dicerocardiidea! Kurta, 1934
Order Hippuritida Newell, 1965
• Superfamily Requienioidea Kutassy, 1934
  • Subfamily Requeniidae Kutassy, 1934
  • Subfamily Matheroniinae R. Scott & others, 2010
  • Family Epidiceratidae Rengarten, 1950

Superfamily Radiolitoidea d’Orbigny, 1847b
• Family Radiolitidae d’Orbigny, 1847b
• ?Family Antillocaprinidae Mac Gillavry, 1937
• Family Caprinidae d’Orbigny, 1847b
  • Subfamily Caprininae d’Orbigny, 1847b
  • Subfamily Caprinuloideinae Damestoy, 1971
• Family Caprinulidae Yanin, 1990
• Family Caprotnidae J. Gray, 1848
• Family Diceratidae Dall, 1895a
• Family Hippuritidae J. Gray, 1848
• Family Ichthyosarcolitidae Douvillé, 1887 (T. Gill, 1871)
• Family Monopleuridae Munier-Chalmas, 1873
• Family Plagioptychidae Douvillé, 1888
• Family Polyconitidae Mac Gillavry, 1937
• ?Family Trechmannellidae Cox, 1934

Order Cardiida Férussac, 1822 in 1821–1822
(paraplesion) • Superfamily Kalenteroidea Marwick, 1953
  • Family Kalenteridae Marwick, 1953
  • Subfamily Kalenterinae Marwick, 1953
  • Subfamily Myoconchinae Newell, 1957
Suborder Cardiidina Férussac, 1822 in 1821–1822
(paraplesion) • Family Palaeocarditidae Chavan, 1969b

Hyporder Cardiodei Férussac, 1822 in 1821–1822
Superfamily Cardioidea Lamarck, 1809
• Family Pterocarditidae Scarlato & Starobogatov, 1979a
• Subfamily Pterocarditinae Scarlato & Starobogatov, 1979a
• Subfamily Tulongocarditinae J. Schneider, 1995

Family Cardiidae Lamarck, 1809
• Subfamily Lahillinae Finlay & Marwick, 1937
• Subfamily Protocarditinae Reuss, 1846 in 1845–1846

Clade Neocardiids J. Carter, Hylleberg, & Popov, nov.
  • Subfamily Laevicardiinae Keen, 1951
  • Subfamily Pleurocardiinae J. Schneider, 1995

Clade Eucardiids J. Schneider, 1995
Subfamily Cardiinae Lamarck, 1809
  • Tribe Cardini Lamark, 1809
  • Tribe Vepricardiini Kafanov & Starobogatov in Kafanov & Popov, 1977
Subfamily Cerastodermatinae Nordseeck, 1969
  • Tribe Cerastodermatin K. Nordseeck, 1969
  • Tribe Chokrakini S. V. Popov in Nevesskaja, Paramonova, & Popov, 2001
  • Tribe Parvicardiini Kafanov & Starobogatov in Kafanov & S. V. Popov, 1977
Subfamily Clinocarditinae Kafanov, 1975
Subfamily Fragnitae R. Stewart, 1930
  • Tribe Fragnii R. Stewart, 1930
  • Tribe Goniocarditini Scarlato & Starobogatov, 1979a
Subfamily Lymnocardiinae Stoliczka, 1870 in 1878–1871
  • Tribe Lymnocardiini Stoliczka, 1870 in 1878–1871
  • Tribe Acobaecardiini Paramonova in Nevesskaja & others, 1986
  • Tribe Adacnini T. Gill, 1871
  • Tribe Arcicardiini Neveskaja in Neveskaja & others, 1986
  • Tribe Aticardiini S. V. Popov in Kafanov & S. V. Popov, 1977
  • Tribe Aviculoardiini Paramonova in Neveskaja, Paramonova, & Popov, 2001
  • Tribe Limnopappini Schlickum, 1962
  • Tribe Merklinardiini S. V. Popov in Neveskaja, Paramonova, & Popov, 2001
  • Tribe Obsoletiformini Paramonova in Neveskaja, Paramonova, & Popov, 2001
  • Tribe Pachydacnini Andreescu, 1975
  • Tribe Paradacnini Eberzin, 1967
  • Tribe Phyllocardiini Neveskaja in Neveskaja & others, 1986
  • Tribe Planacardiini Paramonova in Neveskaja, Paramonova, & Popov, 2001
• Tribe Plicatiformini! Paramonova in Nevesskaja, Paramonova, & Popov, 2001
• Tribe Pontalmyrini! Taktaqishvili, 1987
• Tribe Prosodacnini Keen, 1937
• Tribe Pseudocarditini Keen, 1969b
Subfamily Orthocardinae J. Schneider, 2002
• Subfamily Profraginae Badve, 1977
• Subfamily Trapenicardinae Kanjilal & Srinivasan, 2002
Subfamily Tridacninae Lamarck, 1819

Superfamily Tellinoidea Blainville, 1814
Family Tellinidae Blainville, 1814
• Family Donacidae J. Fleming, 1828
• Family Icanotiidae R. Casey, 1961
• Family Psammobiidae J. Fleming, 1828
• Family Quenstedtiidae Cox, 1929
Family Semelidae Stoliczka, 1870 in 1870–1871 (Latreille, 1825)
• Subfamily Semelinae! Stoliczka, 1870 in 1870–1871 (Latreille, 1825)
Subfamily Erviliinae Dall, 1895b
Subfamily Scrobiculariinae H. Adams & A. Adams, 1856
Family Solencurtidae d’Orbigny, 1846
• Family Sowerbyidae Cox, 1929
• Family Tancrediidae F. Meek, 1864a
• Family Unicardiopsidae Chavan, 1969c

Hyporder Veneroidei J. Gray, 1854a
Minorder Veneroitei J. Gray, 1854a
Superfamily Arcticoidea! R. Newton, 1891 (d’Orbigny, 1844 in 1844–1848)
• Family Arcticidae! R. Newton, 1891 (d’Orbigny, 1844 in 1844–1848)
• Family Euloxidae J. A. Gardner, 1944
• Family Pollicidae L. Stephenson, 1953
• Family Trapezidae Lamy, 1920 (Dall, 1895a)
• Family Veniellidae Dall, 1895a
Superfamily Chamoidea Lamarck, 1809
• Family Chamidae Lamarck, 1809
Superfamily Cyrenoidea J. Gray, 1840b
• Family Cyrenidae! J. Gray, 1840b
• Family Cyrenoididae H. Adams & A. Adams, 1857 (J. Gray, 1853)
• Family Glauconomidae J. Gray, 1853
Superfamily Gaimardioidae Hedley, 1916
• Family Gaimardiidae Hedley, 1916
Superfamily Glossoidea J. Gray, 1847b (J. Gray, 1840b)
• Family Glossidae J. Gray, 1847b (J. Gray, 1840b)
• Family Kelliellidae P. Fischer, 1887
• Family Vesicomyidae Dall & Simpson, 1901
Superfamily Hemidontocadioidea Scarlato & Starobogatov in Nevesskaja & others, 1971
• Family Hemidontocaidae Scarlato & Starobogatov in Nevesskaja & others, 1971
Superfamily Mactroidea Lamarck, 1809
• Family Mactridae! Lamarck, 1809
  • Subfamily Mactrinae! Lamarck, 1809
  • Subfamily Darininae Signorelli, nov.
  • Subfamily Kymatoxinae Stenzel & Krause in Stenzel, Krause, & Twining, 1957
  • Subfamily Lutrariae J. Gray, 1853
  • Subfamily Tanysiphoninae Scarlato & Starobogatov in Nevesskaja & others, 1971
• Family Anatinellidae Deshayes in J. Gray, 1853
  • Family Cardiliidae P. Fischer, 1887
  • Family Mesodesmatidae J. Gray, 1840b
    • Subfamily Mesodesmatinae! J. Gray, 1840b
    • Subfamily Davilinae Dall, 1895b
Superfamily Ungulinoidea J. Gray, 1854b
• Family Unguliniidae J. Gray, 1854b
Superfamily Veneroidea Rafinesque, 1815
• Family Isocyprinidae! R. N. Gardner, 2005
• Family Veneridae! Rafinesque, 1815
  • Subfamily Venerinae Rafinesque, 1815
  • Tribe Venerini Rafinesque, 1815
  • Tribe Venerina Rafinesque, 1815
  • Tribe Chionina Frizzell, 1936
  • Tribe Dosiniini Deshayes, 1853
  • Tribe Tapetini! J. Gray, 1851
Subfamily Meretricinae J. Gray, 1847b (J. Gray, 1838)
Carter & others—Synoptical Classification of the Bivalvia (Mollusca)

Tribes:
- Meretricini J. Gray, 1847b (J. Gray, 1838)
  - Subtribe Meretricina J. Gray, 1847b (J. Gray, 1838)
  - Subtribe Callocardiina Dall, 1895a
  - Subtribe Clementiina Frizzell, 1936
  - Subtribe Cyclinina Frizzell, 1936
  - Subtribe Gemmina Dall, 1895a
  - Subtribe Petricolina d’Orbigny, 1840
  - Subtribe Samarangiina Keen, 1969c
  - Subtribe Sunettina Stoliczka, 1870 in 1870–1871
  - Subtribe Turtoniina W. Clark, 1855
- Gouldiini R. Stewart, 1930
  - Subtribe Gouldiina R. Stewart, 1930
- Lioconchina Habe, 1977

Superfamily:
- Dreissenoida J. Gray, 1840a
  - Family Dreissenidae J. Gray, 1840a
    - Subfamily Dreisseninae J. Gray, 1840a
      - Subfamily Dreissenomyinae Babak, 1983
  - Family Sphaeriidae Deshayes, 1855b (Rafinesque, 1820)
    - Subfamily Sphaeriinae Deshayes, 1855b (Rafinesque, 1820)
    - Subfamily Euperinae Heard, 1965
    - Subfamily Pisidiinae J. Gray, 1857

Suborders:
- Gastrochaenidina Morretes, 1949
  - Superfamily Gastrochaenoidea J. Gray, 1840b
    - Family Gastrochaenidae J. Gray, 1840b
      - Subfamily Gastrochaeninae J. Gray, 1840b
        - Subfamily Eufistulaninae Carter, nov.
        - Subfamily Spengleriinae Carter, nov.
  - Suborder Anthracosidina Silantiev & Carter, 2011
    - Superfamily Anthracosioidea Amalitzky, 1892
      - Family Anthracosididae Amalitzky, 1892
        - Family Ferganocochididae Martinson, 1961
        - Family Shainxiconchididae Liu Ben-pei in Liu Ben-pei & Li, 1980
        - Superfamily Palaeanodontoida Modell, 1964
        - Family Palaeanodontidae Modell, 1964
        - Superfamily Priliklielloidea Starobogatov, 1970
          - Family Prilikliellidae Starobogatov, 1970
          - Family Senderzoniellidae Betekhtina, Starobogatov, & Jatsuk, 1987
  - Suborder Leptonidina Dall, 1889
    - Superfamily Cyamioida G. O. Sars, 1878
      - Family Cyamiidae G. O. Sars, 1878
      - Family Basterotiidae Cossmann in Cossmann & Peyrot, 1909
      - Family Galatheavalvaidae Knudsen, 1970
      - Family Sportellidae Dall, 1899
    - Superfamily Galeommatoida J. Gray, 1840b
      - Family Galeommatidae J. Gray, 1840b
      - Family Lasaeidae J. Gray, 1842
  - Superorder Pholadiformis J. Gray, 1854a
    - Order Pholadida J. Gray, 1854a
      - Superfamily Pholadoidea Lamarck, 1809
        - Family Pholadidae Lamarck, 1809
          - Subfamily Pholadinae Lamarck, 1809
            - Tribe Pholadini! Lamarck, 1809
              - Tribe Euxinibarneini Zhgenti, 1991
              - Subfamily Jouannetiinae Tryon, 1862b
              - Subfamily Martesiinae U. Grant & Gale, 1931
              - Subfamily Xylophaginae! Purchon, 1941
            - Family Terecididae Rafinesque, 1815
              - Subfamily Terecininae Rafinesque, 1815
              - Tribe Terecidini Rafinesque, 1815
              - Tribe Bankiini Turner, 1966
              - Subfamily Kuphinae Tryon, 1862b
                - Superfamily Pleuromyoida! Zittel, 1895
                  - Family Pleuromyidae! Zittel, 1895
• Family Ceratomyidae | Arkell, 1934
  • Subfamily Ceratomyinae | Arkell, 1934
  • Subfamily Myopholadinae | Cox, 1964
• Family Vaccumellidae | Astafieva-Urbajtis, 1973

Superfamily Myoidea Lamarck, 1809
Family Myidae Lamarck, 1809
  • Subfamily Myinae Lamarck, 1809
  • Subfamily Cryptomyinae Habe, 1977
  • Subfamily Spheniinae | Frank Bernard, 1983

Family Corbulidae | Lamarck, 1818
  • Subfamily Corbulinae | Lamarck, 1818
  • Subfamily Caestocorbulinae H. Vokes, 1945
  • Subfamily Caryocorbulinae H. Vokes, 1945
  • Subfamily Erodoninae Winckworth, 1932
  • Subfamily Pachydontinae H. Vokes, 1945
• Family Pleurodesmatidae Cossmann in Cossmann & Peyrot, 1909
• Family Raetomyidae R. Newton, 1919

Megaorder Poromyata Ridewood, 1903
Order Poromyidae Ridewood, 1903
  • Superfamily Poromycidae | Dall, 1886
  • Family Poromyidae | Dall, 1886
  • Family Cetoconchidae Ridewood, 1903
  • Superfamily Cuspidarioidea | Dall, 1886
  • Family Cuspidariidae | Dall, 1886
  • Family Halonymphidae Scarlato & Starobogatov, 1983
  • Family Protuscipulidae | Scarlato & Starobogatov, 1983
  • ? Family Spheniopsis J. A. Gardner, 1928
• Family Parilimyoidae | B. Morton, 1981
  • Family Parilimyidae | B. Morton, 1981
• Superfamily Verticordioidea | Stoliczka, 1870 in 1870–1871
  • Family Verticordiidae | Stoliczka, 1870 in 1870–1871
  • Family Luciroidea Dall, 1895a
  • Family Lyonsiidae | Dall, 1895a

Order Pholadomida Newell, 1965
Superfamily Pholadomyoidae | W. King, 1844
  • Family Pholadomyidae | W. King, 1844
  • Subfamily Pholadomyinae | W. King, 1844
  • Subfamily Charenomyinae | Waterhouse, 1966
• Family Arenigomidae Carter, nov.
• Family Margaritariidae H. Vokes, 1964
• Family Ucumaridae Sánchez in Sánchez & Vaccari, 2003

Order Pandorida R. Stewart, 1930
Superfamily Pandoroidae Rafinesque, 1815
  • Family Pandoridace Rafinesque, 1815
  • Family Laternulidae | Hedley, 1918 (J. Gray, 1840b)
  • Family Lyonsiidae | P. Fischer, 1887
Superfamily Clagellatoidea | d’Orbigny, 1844 in 1844–1848
  • Family Clagellidae | d’Orbigny, 1844 in 1844–1848
  • Family Penicillidae | J. Gray, 1858

Order Thracidae Carter, nov.
Superfamily Thracioidea | Stoliczka, 1870 in 1870–1871 (Couthouy, 1839)
  • Family Thracidae | Stoliczka, 1870 in 1870–1871 (Couthouy, 1839)
  • Family Burmeisridae M. Healey, 1908
  • Family Cleidothaeridae | Hedley, 1918 (Stoliczka, 1870 in 1870–1871)
  • Family Myochamiidae | P. P. Carpenter, 1861
  • Family Periplomatidae | Dall, 1895a

Megaorder Solenata Dall, 1889
Order Solenida Dall, 1889
  • Superfamily Orthonotoidea | S. A. Miller, 1877
    • Family Orthonoritidae | S. A. Miller, 1877
    • Family Konduritidae | Sánchez in Sánchez & Benedetto, 2007
    • Family Prothyridae | S. A. Miller, 1889
    • Family Solenomorphidae Cockerell, 1915
      • Subfamily Solenomorphinae Cockerell, 1915
      • Subfamily Promacrinae | Scarlato & Starobogatov, 1979a
Superfamily Solenoidea Lamarck, 1809
  • Family Solenidae Lamarck, 1809
  • Family Pharidae | H. Adams & A. Adams, 1856
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APPENDIX 1. NEW SUPRAGENERIC TAXA AND UNRANKED CLADE NAMES

Abbreviations: CL, simple crossed lamellar; CCL, complex crossed lamellar; ISP, irregular simple prismatic; RSP, regular simple prismatic.


Anadontellidae Silantiev, herein, fam. nov. Type genus, *Anadontella* Betekhtina in Betekhtina, Starobogatov, & Jatsuk, 1987, p. 41. Family diagnosis: members of the superfamily Prokopievskioidea with relatively thin, elongate, subtriangular (*Anhroconuata*-like) or subrectangular, equivale or slightly inequivalve shells, with an edentulous hinge, distinctly multilayered shells with fine, commarginal growth lines, and no radial microsculpture. Some forms (e.g., *Synjaella*) are strongly tapered posteroventrally and have a sinus-like concavity on the posterior and ventral margins. Ligament opisthodetic, possibly submersed, with single, narrow ligament groove appearing on internal molds, possibly representing secondarily simplified duplivincular ligament. Outer shell layer calcitic irregular simple prismatic or fibrous prismatic, middle and inner shell layers nacreous, except immediately internal to ISP pallial myostracum, where irregular CCL is developed. Nonmarine. Anadontellidae resembles Naiaditidae but differs from Prokopievskiidae in lacking radial microsculpture. At least Anadontella differs from some Prokopievskiidae and Naiaditidae in having a distinct sublayer of irregular CCL between the pallial myostracum and the nacreous inner part of the inner shell layer. Anadontellidae differs from Naiaditidae in having a single, narrow, opisthodetic ligament groove instead of an amphidetic, duplivincular ligament. This family also contains *Soanellina* Betekhtina, 1990, and *Synjaella* Kanev, 1993.

Antijaniridae Hautmann, herein, fam. nov. Type genus, *Antijanira* Bittner, 1901, p. 49. Family diagnosis: small shells with well-developed radial ribs occasionally bearing spines; ribs either equal in strength or intercalated in two or more ranks; discs circular to slightly retrocrescent, biconvex or with right disc flatter; dorsal margin straight and relatively short; beaks located close to midpoint of dorsal margin; byssal notch well developed; ctenolium not observed; ligament alivincular-areate, with centrally or slightly posteriorly located resilifer; shell with calcitic outer shell layer, regular simple prismatic in right valve and predominantly homogeneous in left valve, plus aragonitic crossed lamellar middle and inner shell layers. Comparisons: the ligament system indicates affinity with taxa presently classified with Aviculopectinoidea or Heteropectinoidea, contrary to Hertlein's (1969, p. 355) placement of the “Antijanira group” in Pectinidae. The style of ornamentation in Antijaniridae is not observed in other Triassic Aviculopectinoidea or Heteropectinoidea, except for *Ornithopecten* (Ornithopectinoidea), which differs in having a broad right posterior wing and a delicate right anterior auricle. This family also contains *Amphijanira* Bittner, 1901, and *Oxypteria* Waagen, 1907. The affinity of *Oxypteria* to this group was first recognized by Allasinaz (1972, p. 266).

Arenigomyidae Carter, herein, fam. nov. Type genus, *Arenigomya* Cope, 1996, p. 1017. Cope (1996, p. 1017) gave the following diagnosis for *Arenigomya*, which is also the present family diagnosis: “Equivalve, edentulous, trapezoidal bivalve with length one-and-a-half times greater than height. Surface with fine concentric undulose ornament, radial striae and anteriorly prominent commarginal rugae. Surface detail of finely granulose ornament. Strong carina runs from posterior side of umbo to postero-ventral margin of valves. Each valve with subumbonal articulation device.” This family is monogenic.

Aulacomynini Carter, herein, tribe nov. Type genus, *Aulacomyna* Möörch, 1853 in 1852–1853, p. 53. This new tribe is proposed because *Perninnae* Scarlato & Starobogatov, 1979b, p. 24, is invalid;
its type genus was given without author or date but is inferred from the context to be *Perna* Philipsson in Retzius, 1788. This *Perninae* is a junior homonym of *Pernaeae* J. Fleming, 1828 (spelling corrected by Zittel, 1895, to *Pernidae*, the latter based on *Perna* Brugiére, 1789, in Brugiére, Lamarck, & Deshayes, 1789–1832, a junior synonym of *Isognomon* Lightfoot, 1786). Tribe Aulacomyini diagnosis: smooth or radially ribbed, mytiliform members of *Mytilinidae* in which the anterior adductor muscle is present only in the juvenile stage. Other than the type genus, this tribe contains *Ischadium* Jukes-Browne, 1905, *Perna* Philipsson in Retzius, 1788, and *Choromytilus* T. Soot-Ryen, 1952.


**Concinellinae Silantiev, herein, subfam. nov.** Type genus, *Concinella* Betekhtina, 1966, p. 108, 198. Subfamily diagnosis: members of family Prokopieviidae with thin, subcircular to subtriangular, inequivalve or equivelar, edentulous shells, probably an opisthodontic, possibly submerged ligament with a single, narrow ligament groove appearing on internal molds, possibly representing a secondarily simplified, duplivinicular ligament. Ornamentation of regularly imbricated growth lines and fine radial striae. Outer shell layer calcitic irregular simple prismatic; middle and inner shell layers nacreous. Nonmarine. This subfamily is monogenic.

**Crassatellopsidae Carter, herein, fam. nov.** Type genus, *Crassatellopsis* Beushausen, 1895, p. 146. The following family diagnosis is modified from the description of *Crassatellopsis* by P. A. Johnston (1993): two cardinal teeth in right valve, one anterior and one central, the latter bordered posteriorly by a narrow shelf; two cardinal teeth in left valve, left cardinal tooth immediately posterior to left pival cardinal is slender and directed posteriorly; right cardinal tooth anterior to right pival cardinal tooth is slender and directed posteriorly; no lateral teeth and no shell marginal teeth. Shell shape similar to *Astarte*, trigonally suboval or subcircular; umbos pointed, prosogyrate; shell margins broadly concave immediately anterior to umbos, convex elsewhere; lunule and escutcheon absent; exterior ornament of commarginal ribs, rugae, and growth lines; ribs generally prominent and regularly spaced in early growth stages, in some cases diminishing gradually throughout ontogeny. Hinge plate narrow or broad. Anterior adductor muscle scar reniform or moderately elongate; posterior adductor muscle scar larger. Anterior pedal retractor scar positioned above and separate from anterior adductor scar; above this scar 2 to possibly 4 subumbonal muscle scars are positioned at the junction of hinge plate and the shell interior, with the dorsalmost of these scars most prominent and usually positioned directly below the left or right principal cardinal tooth or its socket in the opposite valve. Posterior internal radial ridge present immediately anterior to posterior adductor muscle scar. Pallial line continuous, nonsinuate, relatively close to shell margin ventrally. Lamellar sublayer of ligament inserting into opisthodontic, narrow, submarginal fossa, but fibrous sublayer of ligament inserting within a strongly oblique, short resilifer; ligament sublayers separated by indistinct ridge on posterior margin of resilifer. This family is monogenic.

**Darinae Signorelli, herein, subfam. nov.** Type genus, *Darina* J. Gray, 1853, p. 42. Subfamily diagnosis: members of *Mactridae* with thin, fragile, oval to subcircular, elongate, anteriorly and posteriorly gaping shells, nearly median umbos, a rudimentary, external ligament, a large resilium on a ventrally to posteroven turally strongly projecting chondrophore, a subduced posterior umbonal ridge, and hinge dentition that is concentrated on the central part of the hinge. This subfamily also contains *Daricina* B. Clark & Durham, 1946. Darinae differs from Mactridae in having a more elongate shell shape, thinner, more pellucid valves, and more medially concentrated hinge dentition. It differs from *Kymatoxinae* in having a more elongate, more nearly equilateral shell shape, anterior as well as posterior gapes, less prominent sculpture, and stronger anterior lateral teeth. It differs from *Lutriinae* in having a more projecting chondrophore and more median umbos.

**Entoliidina Hautmann, herein, subord. nov., nom. transl. et correct.** M. Hautmann, herein, *ex* Entoliidae Teppner, 1922, p. 89. A suborder proposed for the superfamilies Euchondrioidea and Entolioida, as indicated above.

**Eubivalvia Carter, herein, unranked clade nov.** A descriptive clade name proposed for the subclasses Protopoecia and Autobranchia.

**Eufistulaninae Carter, herein, subfam. nov.** Type genus, *Eufistula* Eames, 1951, p. 445. Subfamily diagnosis: oblate tube-dwelling *Gastrochaenidae* with long, straight-sided tubes; long, largely fused siphons *sensu strictum*; rare, minute siphonal papillae on incumbent but not excurrent siphonal aperture; anterior pedal retractor muscles passing around visceral mass as they approach the foot; the ventral surface of the foot elongate-ovate in the lateral direction. This subfamily differs from Spengleriinae and Gastrochaeniidae in having tube-dwelling life habits in which the tube is very elongate and straight sided, lacking papillae on the excurrent siphon, and in having a laterally expanded instead of round to anteroposteriorly elongate ventral pedal surface. This family also contains *Kummemia* L. Stephenson, 1937.

**Hiatellida Carter, herein, ord. nov., nom. transl. et correct.** Carter, herein, *ex* Hyatellaceae J. Gray, 1824, based on *Hyatella*, an incorrect subsequent spelling of *Hiatella* Bosc *ex* Daudin MS, 1801; =suborder Saxicavoidea Morretes, 1949, p. 47, invalid, based on the junior synonym *Saxicava* Fleuri la de Belleveu, 1802 (=Hiatella Bosc *ex* Daudin MS, 1801). Taxonomic content indicated above.

**Joannininae Carter, herein, subfam. nov.** Type genus, *Joannina* Waagen, 1907, p. 94. Subfamily diagnosis: edentulous members of *Mactromorphidae* differing from sister superfamilies *Mactromorphinae* and *Healeyinae* in having more dorsally projecting umbos, better defined anterior auricles, a narrower hinge plate, and, with the exception of *Leidaponocona*, a shorter, more external ligament nymph and growth lines not continuing from a lunule onto the subumbonal hinge plate. This subfamily also contains *Protopis* Kittl, 1904, *Waijiaoella* Stiller & Chen, 2006, *Qingyaniola* Stiller & Chen, 2006, and *Leidaponocona* Stiller & Chen, 2006.

**Neocardidi Carter, Hylleberg, & Popov, herein, unranked clade nov.** A descriptive name proposed for the clade of *Laevicardinidae* + *Fleuriocardiidae* + “eucardids” *sensu* J. Schneider (1995, 1998a).

**Ornithopectinidae Hautmann, herein, fam. nov.** Type genus, *Ornithopectes* Cox, 1962, p. 596. Family diagnosis: discs inequilater al, retrocrescent, posteriorly slightly expanded; beaks located well in front of midpoint of dorsal margin; right anterior auricle delicate, with narrow subauricular byssal notch; right posterior wing broad, poorly differentiated but distally pointed; left anterior auricle poorly
differentiated, with indistinct auricular sinus; ornament with radial ribs usually intercalated in different ranks, superimposed by regularly spaced commarginal ribs. Comparisons: Ornithopectinidae differs from the closely related Antijaniridae chiefly in the anteriorly positioned beaks, retroventrally expanded shells, and broad posterior wing. This family is monogenic.

**Ovatoconchidae Carter, herein, fam. nov.** Type genus, Ovatocona Cope, 1996, p. 988. Family diagnosis: members of superfamily Solemyoidea with anteriorly produced shell, as in Ctenodontitidae and Solemyidae, but lacking paravincular nymphs and possibly also lacking palaeotaxodont hinge teeth in adult shell. This family is monogenic.

**Paleodorinae Carter, herein, subfam. nov.** Type genus, Paleodora C. Fleming, 1957, p. 943. Subfamily diagnosis: members of family Sanguinolitidae with elongate, subrectangular, slightly sickle-shaped shell with anterior end short and rounded, posterior end longer; posteriorly rounded and dorsoposteriorly truncate; ornament of low, commarginal ribs, replaced by fine growth lines on the relatively flat, dorsoposterior area; hinge unknown, possibly lacking distinct teeth; sharply elevated, internal shell lamellae radiating from area below beaks anterogradely and toward the posterior. This subfamily is monogenic.

**Pleuronectitidae Hautmann, herein, fam. nov.** Type genus, Pleuronectites Schlotheim, 1820, p. 217. Family diagnosis: discs procurent, height of valves greater than length, left valve more convex than right; shell exterior smooth or with radial ribs; right anterior auricle with auricular scroll and deep byssal notch; ctenolium present; right posterior auricle obtuse but well delimited, not projecting above hinge margin; auricles of left valve lacking auricular sinuses and dorsally levelling with hinge margin; ligament alivincularitate, small bourrelets may be present; hinge lacking residual teeth; shell interior without buttresses; shell with thin, calcitic outer shell layer, divided into radial sectors with irregular foliated to radially irregular spherulitic prismatic to radially fibrous prismatic structure; aragonitic middle and inner shell layers with evidence of linear to slightly branching crossed lamellar structure. Comparisons and comment: Pleuronectitidae differs from other families of Pectinoidea (as defined by the presence of both an alivincular-alate ligament and a ctenolium, thus excluding the Entolioidea) in having procurent discs, a flat right valve, a well-developed right anterior auricular scroll, and in lacking teeth and internal buttresses. This family tentatively also contains Lower and Middle Triassic Periclaritas Li Jin-hua & Ding, 1981.


**Similodontidae Carter & Pojeta, herein, fam. nov.** Type genus, Similodonta H. Soot-Ryen, 1964, p. 498. Family diagnosis: members of superfamily Triconduloidea with low hinge angle (65–100°) and only slightly, if at all, anteroventrally expanded shell. Increased anterior shell gape achieved by orienting ligament axis more nearly perpendicular to the anterovenetal shell margins. Anterior hinge teeth convexodont to orthomorphodont and inclined. Posterior hinge teeth convexodont in most genera, to orthomorphodont and inclined. Anterior and posterior tooth rows generally form continuous series below the beaks, but posterior tooth row may overlap anterior tooth row below beaks. Anterior and posterior tooth rows typically nearly equal in length, but the posterior tooth row may be slightly shorter. This family also contains Austraralnucula Sánchez, 1989, Trigononconcha Sánchez, 1999, Villicumia Sánchez, 1999, and doubtfully Upper Ordovician Paleonoeconcha S. A. Miller, 1889.

**Spenglerinae Carter, herein, subfam. nov.** Type genus, Spengleria Tryon, 1862a, p. 472, 485. Subfamily diagnosis: obligate endolithic Gastrochaenidae with short to long, entirely separated siphons sensu stricto, and with little or no extension of ctenidia and mantle cavity posterior to shell margins. Beaks slightly to moderately anterior, never far anterior or terminal. Numerous, minute siphonal papillae surround each siphonal aperture. Anterior pedal retractor muscles pass around visceral mass as they approach the sole of the foot; ventral surface of foot nearly circular to elongate-ovate in anteroposterior direction. This subfamily differs from Gastrochaeninae in having siphons sensu stricto that are entirely separated, and by having little or no extension of the ctenidia and mantle cavity posterior to the shell margins. It differs from Eufustulinae in having entirely separated siphons sensu stricto, and in having obligate endolithic instead of obligate tube dwelling habits. This family also contains Gastrochaenopsis Chavan, 1952c, and Spengleriachaena Carter, gen. nov.


**APPENDIX 2. NEW GENERA AND SPECIES**

Superfamily Gastrochaenoidea J. Gray, 1840b

- **Family Gastrochaenidae J. Gray, 1840b**
  - **Subfamily Gastrochaeninae J. Gray, 1840b**
    - **Stenochaena Carter, herein, gen. nov.**
      
      Figure 1

      **Type species.**—Gastrochaena lactea Belokryls, 1991, p. 10.

      **Discussion.**—The genus *Stenochaena* is presently proposed for Middle Eocene *Gastrochaena lactea* Belokryls, 1991 (p. 10, pl. 1,1–3, fig. 1a, 2), from the Dnepropetrovsk region of Ukraine. The name *Stenochaena* derives from the Greek *stenos* for narrow, and from a variation of *chenikos* for the upturned prow of a boat, as in *Gastrochaena*. The new genus name is feminine. The name *Stenochaena* reflects the extremely small pedal gape and boatlike shape of the united valves. In addition to *Stenochaena lactea*, this genus includes Upper Jurassic *Gastrochaena zitteli* Boehm, 1883, from Stramberk, Czech Republic, and Jurassic *Gastrochaena valfinensis* de Loriol, 1888, in de Loriol & Bourgeat, 1886–1888, from Valfin, eastern France (possibly a juvenile of *Stenochaena zitteli*).

      **Generic diagnosis and description.**—Members of Gastrochaeninae with a greatly posteriorly elongated, small- to medium-sized shell (9.5–38 mm long), with far anterior but not terminal beaks, a very small, anteriorly restricted pedal gape (comprising less than 12% of shell length), and pedal gape margins oriented at a high angle (over 60°) relative to the hinge axis. The shell’s posterior is narrowly ovate
and ornamented with regularly spaced, erect, commarginal lamellae (*Stenochaena zitteli*) or irregularly spaced growth lines (*Stenochaena lacera*). There are no mineralized periostracal spikes or spines cemented to the shell. The boring’s shell chamber is subcylindrical, tapering far anteriorly and far posteriorly to conform with the shell’s shape. The anterior half of the siphonal boring appears like a slightly narrower extension of the shell chamber, without a strong constriction in boring width at the base of the siphons. The posterior half of the siphonal boring is divided into incurrent and excurrent areas that diverge at an angle of 20°–25°. The hinge is thin, edentulous, and lacks myophores. Posterior to the beaks, the hinge is slightly convex and nearly parallel with the ventral shell margin; anterior to the beaks, it is very short, dorsally slightly deflected, and laterally strongly deflected (about 60°) from the subumbonal hinge axis. This lateral deflection frames a distinct, triangular opening between the dorsoanterior shell margins. The ligament is opisthodetic and parivincular, with very thin, not strongly dorsally projecting nymphs. The anterior adductor muscle scar is positioned immediately adjacent to the deflected dorsoanterior shell margin. Other muscle scars are not visible, despite excellent preservation of the aragonitic shells.

**Comparisons.**—No other member of Gastrochaenidae approaches *Stenochaena* in its combination of a very anteriorly restricted, high-angle pedal gape and greatly posteriorly extended, nearly cylindrical shell shape.

**Distribution.**—*Stenochaena* is known only from the Upper Jurassic and Middle Eocene of Europe.

**Ecology.**—Specimens of *Stenochaena lacera* from Belokrys (1991) came from borings in the dome-shaped coral *Astraeopora sphaeroidalis* (Mich.). Belokrys speculated that juveniles of this species bored through living coral tissue. Although this cannot be certain, the borings are sometimes partially overgrown by coral, indicating close proximity to living coral tissue at the time of settlement. Calcareous laminae are sometimes present in the anterior of the boring’s shell chamber, indicating that the bivalves sometimes bored in a posterior direction to keep pace with coral growth.

Boehm’s (1883) specimen of *Stenochaena zitteli* came from an Upper Jurassic limestone at Stramberk, Czech Republic (Boehm, 1883, p. 495, pl. 53,6–7). Boehm indicated that his specimen occupied a calcareous tube that is anteriorly thin walled and posteriorly rather thick walled. This putative tube is probably the calcareous lining of
a boring, thickened posteriorly to conform with the shell’s shape, as in modern endolithic gastrochaenids. The British Museum has in its collections an upper Tithonian, Upper Jurassic specimen of S. zitteli, also from Stramberk (British Museum Geology Department L23855), with impressions of a coral substratum on the exterior of its boring cast.

Superfamily Gastrochaenoidea J. Gray, 1840b
Family Gastrochaenidae J. Gray, 1840b
Subfamily Spengleriinae Carter, herein, subfam. nov.

Spenglerichaena Carter, herein, gen. nov.

Figure 2

Type species.—Gastrochaena apertissima Deshayes, 1855a, p. 326.
Discussion.—The genus Spenglerichaena is presently proposed for Recent, Indo-Pacific Gastrochaena apertissima Deshayes, 1855a, the type species. The name derives from Spengleria and Gastrochaena, in recognition of anatomical similarities with Spengleria and shell similarities, especially the lack of a raised posterior triangular area, with Gastrochaena. The new genus name is feminine.

Generic diagnosis and description.—Members of Spengleriinae with anteriorly strongly laterally inflated shells, moderately anterior umbo, completely divided, relatively long siphons sensu stricto, little or no extension of the ctenidia and posterior mantle cavity posterior to the shell margins, no raised, posterior triangular area, and no distinct umbalonal-posteroventral sulcus. The shell posterior has irregular, commarginal growth lamellae and a thin, nonmineralized periostracum. The ctenidia are nonplicate, the pedal probing organ is spatulate, and the calcareous boring linings lack an annular septum and spiny baffles at the base of the siphonal boring.

Comparisons.—Spenglerichaena resembles Spengleria in its completely separated siphons sensu stricto and anterior pedal retractor muscles that pass around the visceral mass as they approach the foot. However, Spenglerichaena lacks the raised posterior triangular area, aragonitic periostracal spikes, distinct umbonal-posteroventral sulcus, pointed calcareous baffles in the boring lining at the base of the siphons, plicate ctenidia, and more medially positioned umbo of Spengleria. Its nonplicate ctenidia, spatulate pedal probing organ, lack of a raised, posterior triangular area, and lack of mineralized periostracal spines are more typical of Gastrochaena and Rocellaria, but in those genera, the siphons sensu stricto and sensu lato are largely fused, and the ctenidia and mantle cavity are extended at least slightly into the siphonal part of the boring, posterior to the shell margins. Spenglerichaena differs from Gastrochaenopsis in having a wider, longer pedal gape, no raised posterior triangular area, and greater lateral inflation of the shell.

Distribution.—Borings similar to those made by Spenglerichaena are known from the Lutetian, Middle Eocene near Verona, Italy, but the associated shells are unknown (Savazzi, 1980). Spenglerichaena is therefore definitely known only from the Recent tropical Indo-West Pacific Region.
Ecology.—Spenglerichaena bores primarily into thicker coral substrata that are less subject to breakage.

Superfamily Modiomorphoidea S. A. Miller, 1877
Family Modiomorphidae S. A. Miller, 1877
Subfamily Modiomorphinae S. A. Miller, 1877

Goniomorpha Carter, herein, gen. nov.

Type species.—Goniophora hamiltonensis J. Hall & Whitfield, 1869, p. 36.

Discussion.—The genus Goniophora is presently proposed for sharply carinate, posteriorly obliquely truncate, subumbonally irregularly dentate modiomorphids formerly classified as Megalodon J. de C. Sowerby, 1827, in James Sowerby, 1812–1845, or Goniopora J. Phillips, 1848. The type species is presently designated as Middle Devonian Goniophora hamiltonensis J. Hall & Whitfield, 1869. The name Goniomorpha derives from Goni- (from Goniopora Phillips, 1848) and morpha (from Modiomorpha J. Hall & Whitfield, 1869). Johnston (1993, p. 76) was aware that “Goniophora hamiltonensis is “almost certainly not congeneric” with Goniopora J. Phillips, 1848, and he pointed out that it differs from true Goniopora in having a depressed, striated lunule, the growth lines of which continue onto the subumbonal hinge plate, as in Modiomorpha concentrica (Conrad, 1838) (see J. Hall, 1884 in 1883–1884, pl. 43,18–19; Bailey, 1983, fig. 47; Carter, 1990a, fig. 50A). Carter (1990a, p. 266) indicated that “Goniophora hamiltonensis belongs in Modiomorphidae, noting that it is microstructurally similar to M. concentrica, and Johnston (1993) also assigned “Goniophora hamiltonensis to Modiomorphidae.

True Goniophora is a mecyodontid based on upper Silurian Goniophora cymbaeformis Sowerby in Murchison, 1839. This mecyodontid resembles Goniomorpha in having an equivelar, strongly inequilateral, posteriorly elongate shell with simple, commarginal ornament, and a sharp, angular carina extending from the beak to the posterodorsal shell margin. However, it differs from Goniomorpha in having prominent anterior and posterior internal ridges (Johnston, 1993, p. 74–76; Liljedahl, 1994, p. 74, fig. 521). The hinge and ligament of Goniophora cymbaeformis are unknown, but other species of this genus differ from Goniomorpha in having a narrower hinge plate, largely restricted to the subumbonal area, with finer, more regularly shaped cardinal teeth, an opisthocid, parivincular ligament with shorter, more external nymphs, no strong growth lines on the subumbonal hinge plate, and no deeply impressed lunule (Liljedahl, 1994, p. 74).

Goniomorpha hamiltonensis was described and illustrated by J. Hall (1885, p. 296, pl. 43,8–15, 17–21), Carter and Tevesz (1978), Carter (1990a, p. 266–268, fig. 50), Carter, Lutz, and Tevesz (1990, p. 391), and Johnston (1993, p. 76). Other species presently included in Goniomorpha lack posterior lateral teeth, and they all have at least one, weakly to strongly developed, irregular but more or less triangular cardinal tooth in the left valve. A second, weaker cardinal tooth may be present posterior to the principal cardinal tooth in the left valve, e.g., in Lower Devonian Goniomorpha stuartzi (Beuhauser, 1895) (see Maillieux, 1937, p. 136), or a large, rounded cardinal tooth may be present in the right valve, anterior to the right, principal cardinal socket, as in Lower Devonian Goniomorpha cognata (Drevermann, 1902) (see Drevermann, 1902, p. 88, pl. 10,15–16).

Carter (1990a, p. 266) incorrectly indicated that “Goniophora hamiltonensis has a very weak left posterior lateral tooth overlapping a weak right posterior lateral tooth. This was based on a misinterpretation of a shallow flexure near the base of the posterior hinge plate in an isolated left valve. Subsequent sections through united valves from the Hamilton Group near Morrisville, New York, along with the observations by C. F. Römer (1844) and Maillieux (1937), indicate a lack of lateral hinge teeth in this genus.

Generic diagnosis and description.—Goniomorpha encompasses members of subfamily Modiomorphinae with a sharply defined, umbonal-posteroventral carina, an angular, rostrate posterior, and no posterior lateral hinge teeth. Like other Modiomorphinae, the shell is equivalved, posteriorly elongate, and strongly inequilateral, with low umbos, a deeply impressed, growth-lined lunule with growth lines extending from the lunule onto a wide, subumbonal hinge plate, a weakly or more strongly developed, irregular, more or less triangular, left cardinal tooth, a flat, wide, posterior hinge plate, and slightly subemerged, elongate, parivincular ligament nymphs. In some species, a second, smaller, more posterior, left cardinal tooth is also present, or a rounded cardinal tooth is present in front of the principal cardinal socket in the right valve. The adductors are heteromyarian, the anterior one deeply impressed and positioned just below the hinge, and bounded posteriorly by a low, umbonal ridge or buttress. The posterior adductor muscle scar is more shallowly impressed. The anterior pedal retractor scar is separated from...
the anterior adductor scar, but the posterior pedal retractor scar is partially confluent with the posterior adductor scar. The pallial line is unknown for the type species, but it was probably integripalliate, judging from other members of Modiomorphinae. The shell mineralogy and microstructure resemble Modiomorpha concentrica, except that mineralized periostracal spikes are fused to the shell's exterior anteriorly (see Carter, 1990a, p. 268).

Comparisons.—Goniomorpha resembles Modiomorpha in having a crudely shaped cardinal tooth in the left valve, but Goniomorpha has a more sharply defined posterior carina, a more sharply truncate posterior, a more variable subumbonal dentition, and no posterior lateral teeth. A posterior lateral tooth is variably developed in Modiomorpha (see Carter, 1990a, p. 266).


Paleoecology.—Goniomorpha hamiltonensis occurs in the Middle Devonian Hamilton Group of central New York State in clay-rich sandstones also containing a high diversity of other marine invertebrates, especially the bivalves Pychopteria (Pterideidae), rare pectinoïds, and the gastropods Palaeozyglopleura and Bembexia. Goniomorpha hamiltonensis is not usually found in large concentrations. The strongly and sharply truncate, elongate posterior and pectinoids, and the gastropods

Superfamily Ostreoidea Rafinesque, 1815
Family Arctostreidae Vialov, 1983
Subfamily Palaeolophinae Malchus, 1990

Nacrolopha Carter & Malchus, herein, gen. nov.

Figure 4

Type species.—Nacrolopha carolae Carter & Malchus, herein, gen. et sp. nov.

The new genus Nacrolopha is presently proposed for the new species, Carnian, Upper Triassic Nacrolopha carolae Carter & Malchus (Fig. 4), with the holotype of the latter being a well-preserved left valve from Alpe di Specie, Cassiano Formation (alt. 1900–2000 m), Italy (UNC 13497b). The holotype was described and illustrated as an unknown genus and species by Carter (1990a, p. 217–220, fig. 32). The genus name derives from the nacreous microstructure and Lophus-like shape of the type species. The species is dedicated to Carol Elizabeth Via Carter. The holotype, which has been sectioned for microstructural analysis, is deposited in the paleontological collection of the Yale University Peabody Museum of Natural History, New Haven, Connecticut.

Generic and species diagnosis.—Nacrolopha is characterized by a posteriorly instead of posterodorsally positioned posterior adductor scar, a posterior pedal retractor scar that is partially confluent with the posterior adductor scar, a minute, anterior adductor scar, and a nacrsmorphitric left valve that lacks foliated structure, structural chambering, and chalky deposits. This diagnosis applies to the genus and to its type species.

Generic and species description.—The following description of N. carolae is based on left valve UNC 13497b. The beak is prosogyrate in the juvenile stage and orthogyrate in the adult stage. The hinge is slightly arched and smooth except for 9 shallow pits (possible preparation artifacts) posterior and ventral to the cardinal area. There are no chomata. The ventral and lateral internal shell margins vary from nearly smooth to slightly radially costate. The exterior has about 25 coarse, radial costae immediately adjacent to the attachment area; these increase to about 30 at the shell margins through intercalation and branching, but mostly through intercalation. A pallial line is not visible, but this could be covered by an attached brachiopod and adherent sediment. The posterior adductor muscle scar (5.1 × 3.5 mm) is ovate, higher than wide, and much larger than the anterior adductor muscle scar (1.4 × 0.8 mm); both scars are positioned near their respective shell margins, and both are elevated by a shelly buttress, that supporting the anterior adductor being more prominent by virtue of its position on a more steeply inclined shell surface. The posterior pedal retractor muscle scar measures 1.2 × 1.0 mm, and its center is 40% from the ventral shell margin toward the dorsal end of the shell. The ligament insertion area is acutely triangular and alivincular-arcuate, with the fibrous attachment area distinctly impressed below narrow, distinct, anterior and posterior bourrelets. The “incipient” crura that Carter (1990a, p. 219) described for this specimen are actually the flanks of the alivincular-arcuate ligament (Hautmann, 2004, 2006). The ligament insertion area is covered by a very thin aragonitic ligament of nearly vertical irregular simple prisms (ISP) and steeply dipping fibrous prisms. The underlying hinge is nacreous. The outer shell layer is very thin and varies from ISP to regular simple prismatic to homogeneous mosaic, with prisms 6–10 μm wide. The middle shell layer is nacreous and closely approaches the shell margins. Where marginal radial folds are present, the nacreous laminae are strongly reflected outward. The adductor mysotrasum is finely ISP. The inner shell layer is aragonitic and mostly coarsely textured ISP, with minor nacreous lensatic sublayers.

Comparisons.—Nacrolopha carolae differs from all other presently known members of Palaeolophinae in having nacre, an anterior adductor muscle scar, and a posterior pedal retractor scar. Because these features are internal, the composition of the genus is poorly known. Palaeolophia montiscaprilis (Klipstein, 1843) (Klipstein, 1843, p. 247, pl. 16, 5) appears externally similar to N. carolae (see also Wöhrmann, 1889, p. 200, pl. 6, 1–3), but illustrations of that species do not show an anterior adductor or posterior pedal retractor muscle scar. Possible congeners of Nacrolopha include certain other species assigned by Malchus (1990) to Palaeolophia, such as Carnian, Upper Triassic Palaeolophia mediocostata (Wöhrmann, 1889), and Palaeolophia calcoformis (Broilli, 1904). However, these species are unknown both microstructurally and in the details of their muscle scars.
Figure 4. *Nacrolopha carolae* Carter & Malchus, *gen. et sp. nov.*, holotype, left valve, University of North Carolina 13497b; Carnian, Upper Triassic, Cassiano Formation, Alpe di Specie, altitude 1900–2000 m, Dolomitic Alps, northeast of Cortina d’Ampezzo, Italy: 1, interior of left valve, showing alivincular-arcuate ligament insertion area, muscle scars for posterior adductor (*PA*), anterior adductor (*AA*, supported by a slight buttress), and posterior (Continued on facing page.)
The presence of ISP and homogeneous mosaic structure in the outer shell layer of the left valve of *N. carolae* resembles some Triassic bakevelliids and gryphaeids, e.g., the Middle Triassic bakevellid *Hoerneis socialis* (Schlotheim, 1823 in 1822–1823) (Carter, 1990b, p. 337) and the Upper Triassic gryphaeid *Gryphaea nevadensis* McRoberts, 1992 (McRoberts & Carter, 1994). Some Jurassic gryphaeids retained homogeneous mosaic structure in their outer shell layer, typically between an RSP outermost sublayer and the foliated middle shell layer, e.g., in Jurassic *Gryphaea arcuata* (Lamarck, 1801) and in *Prasoctyga hebridica* (Forbes, 1851) (Carter, 1990c, p. 356–359).

The dorsally rounded posterior adductor muscle scar in *N. carolae* resembles Gryphaeidae and differs from the dorsally flattened or concave posterior adductor scar in Ostreidae (Harry, 1985).

*Nacrolopha carolae* resembles Norian–Rhaetian, Upper Triassic *Umbrostrea emamii* Hautmann, 2001b, from the Nayband Formation of Iran, in having some calcitic RSP in its outer shell layer and nacre in its inner shell layers. However, *U. emamii* differs in having a regularly to irregularly foliated instead of nacreous middle shell layer. In *U. emamii*, the outer layer of the right valve is RSP to slightly ISP, whereas that of the left valve is coarsely ISP (Hautmann, 2001b, pl. 7; 2006). Structural chambers are lacking in the foliated layer. *Umbrostrea* lacks an adult anterior adductor muscle scar and adult posterior pedal retractor muscle scars (Hautmann, 2001b).

**Distribution.**—*Nacrolopha carolae* is presently known only from the Carnian, Upper Triassic, Cassiano Formation at Alpe di Specie, Italy.

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**APPENDIX 3. CLASSIFICATION ABOVE FAMILY RANK**

The following abstract includes all taxa at or above the rank of superfamily (superfamilies are listed in alphabetical order), plus all pleons and parapleons. Taxa above the rank of order are highlighted with bold face type. Symbols: • = extinct; ! = paraplectic.

**Class Bivalvia Linnaeus, 1758 in 1758–1759**

*Grade Euprotobranchia! Nevesskaja, 2009*

• Order Fordilliida! Pojeta, 1975: •Superfamily Fordillioidea! Pojeta, 1975

• Order Tuarangiida MacKinnon, 1982

**Clad Eubivalvia Carter, nov.**

Subclass Protobranchia Pelseneer, 1889 (=Palaeotaxodonta Korobkov, 1954)

**Superorder Nuculiformii! Dall, 1889 (=Foliobranchia Ménégaux, 1889)**

Order Nuculida! Dall, 1889: Superfamily Nuculoidea! J. Gray, 1824; Superfamily Pristiglomoidea Sanders & Allen, 1973

Order Solenomyida Dall, 1889: Superfamily Manzanelloidea Chronic, 1952; Superfamily Solemyoidea! J. Gray, 1840b

**Superorder Nuculaniformii Carter, Campbell, & Campbell, 2000**

• Order Afghanodesmata! Carter, nov.: •Superfamily Afghanodesmatoidea! Scarlato & Starobogatov, 1979a; •Superfamily Tironuculoidea Babin in Babin & others, 1982


**Subclass Autobranchia Grobben, 1894**

**Infraclasse Pteriomorphia Beurlen, 1944**

**Cohort Mytilomorphi! Férussac, 1822 in 1821–1822**

Order Mytilida! Férussac, 1822 in 1821–1822; •Superfamily Modiolopoidea! P. Fischer, 1886; Superfamily Mytiloidea Rafinesque, 1815

• Order Colpomyida Carter, nov.: •Superfamily Colpomyoidea Pojeta & Gilbert–Tomlinson, 1977

**Cohort Ostreomorphi! Férussac, 1822 in 1821–1822**

(plession) •Family Matheriidae Scarlato & Starobogatov, 1979a

(plesion) •Family Matheriidae Scarlato & Starobogatov, 1979a

**Subcohort Arcoinii! J. Gray, 1854a**

• Order Cephalorganida! Scarlato & Starobogatov in Nevesskaja & others, 1971

• Suborder Cephalorganida! Scarlato & Starobogatov in Nevesskaja & others, 1971: •Superfamily Cephalorganida! Ulrich in Ulrich & Schofield, 1894; •Superfamily Falcatacondontaidea Cope, 1996; •Superfamily Pachylopoidea Scarlato & Starobogatov, 1979a

• Suborder Praecardiida Newell, 1965 (=Nepiomorphia Kříž, 2007)

• Hyporder Praecardiidei Newell, 1965: •Superfamily Cardioloidea R. Hoernes, 1884; •Superfamily Praecardioida R. Hoernes, 1884

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Figure 4 (continued from facing page).

pedal retractor (PPR); a brachiopod (Brach) is cemented to shell’s interior; 2, horizontal acetate peel through aragonitic ISP inner shell layer also visible in view 3, scale bar = 100 μm; 3, anterior-posterior, vertical acetate peel showing nacreous middle shell layer (above, darker layer) and the underlying aragonitic ISP inner shell layer, scale bar = 0.5 mm; 4, SEM, vertical fracture through nacreous middle shell layer (barely visible at extreme top of figure) and the aragonitic ISP inner shell layer, scale bar = 25 μm; 5, vertical fracture through the nacreous middle shell layer and aragonitic ISP adductor myostracum, scale bar = 5 μm; calcitic outer shell layer does not appear in any of these figures (new).
Paleontological Contributions

- Hyporder Antipleuroidei Kříž, 2007: •Superfamily Dualinoidea Conrath, 1887
- Order Arcida J. Gray, 1854a: Superfamily Arcoidea Lamarck, 1809; •Superfamily Glyptarcoidea Cope, 1996; Superfamily Limospoidea Dall, 1895a; Superfamily Philobyroidea Félix Bernard, 1897

Subcohort Ostreioni Férussac, 1822 in 1821–1822
• Megaorder Myalinata H. Paul, 1939
  - Order Myalina H. Paul, 1939: •Superfamily Alatoconchoidea H. Termier, Termier, & Lapparent, 1974; •Superfamily Ambonychioidea! S. A. Miller, 1877; •Superfamily Inoceramoidea C. Giebel, 1852; •Superfamily Prokopievskioidea H. Vokes, 1967

Megaorder Ostreata Férussac, 1822 in 1821–1822
(plesion) •Family Myodakryotidae Tunnicliff, 1987

Superorder Ostreiformii Férussac, 1822 in 1821–1822 (=Eupteriomorphia Boss, 1982)
- Order Ostreida Férussac, 1822 in 1821–1822
- Suborder Ostreidina Férussac, 1822 in 1821–1822: Superfamily Ostreoidea Rafinesque, 1815
- Suborder Malleidina! J. Gray, 1854a
  (paraplesion) •Family Pterineidae! F. Meek, 1864b
- Superfamily Pinnoidea Leach, 1819; •Superfamily Posidonioidea Neumayr, 1891; Superfamily Pterioidea! J. Gray, 1847b (Goldfuss, 1820); •Superfamily Rhombopterioidea! Korobkov in Eberzin, 1960
- Order Pectinida J. Gray, 1854a
  (paraplesion) •Superfamily Leiopectinoidea! Krasilova, 1959
- Suborder Pectinidina J. Gray, 1854a: Superfamily Pectinoidea Rafinesque, 1815
- Suborder Anomiidina J. Gray, 1854a
  Hyporder Anomioidei J. Gray, 1854a
    •(plesion) ?Family Saharopteriidae G. Termier & H. Termier in Pareyn, Termier, & Termier, 1972
    •(paraplesion) Superfamily Pseudomonotoidea! Newell, 1938
- Minorder Anomioitei J. Gray, 1854a: Superfamily Anomioidea Rafinesque, 1815
- Minorder Dimyoitei Ridewood, 1903: Superfamily Dimyoidea P. Fischer, 1886; Superfamily Plicatuloidea J. Gray, 1854b; •Superfamily Pterinopseusoidea! P. Fischer, 1886
- Hyporder Monotoidei R. Moore in Moore, Lalicker, & Fischer, 1952: Superfamily Limoidae J. Gray, 1854a
  - Suborder Entoliidina! Hautmann, nov.: Superfamily Entolioidea! T eppner, 1922; •Superfamily Euchondrioidea! Newell, 1938

Infraclasse Heteroconchia Hertwig, 1895
Cohort Unionomorphi J. Gray, 1854a (=Palaeobrachyconia “of authors”)
(plesion) •Family Thoraliidae N. Morris, 1980

Subcohort Unioni J. Gray, 1854a
(paraplesion) •Superfamily Lyrodesmatoidea! P. Fischer, 1886

Megaorder Unionatata J. Gray, 1854a
- Order Trigonida! Dall, 1889: •Superfamily Myophorelloidea T. Kobayashi, 1954; •Superfamily Pseudocardinclioidea Martinson, 1961; Superfamily Trigonioidea Lamarck, 1819; •Superfamily Trigonioidoidea! Cox, 1952 (or in Unionida?); •Superfamily Trigonodoidea! Modell, 1942
- Order Unionida J. Gray, 1854a
  Suborder Unioidea! H. Termier & H. Termier in Pareyn, Termier, & Termier, 1972
  •Superfamily Trigonooidea! P. Fischer, 1886
- Suborder Myolidae Dall, 1889: Superfamily Mulleroidea Deshayes, 1832a; •Superfamily Trigonioidoidea! Cox, 1952 (or in Trigonida?); Superfamily Unioidea Rafinesque, 1820
- Suborder Hyridinae Hoch & others, 2009: Superfamily Hyrioidae Swainson, 1840

Cohort Cardiomorphi Férussac, 1822 in 1821–1822 (=Heterodonta “of authors”)
(plesion) •Family Lipanellidae Sánchez, 2005

Subcohort Carditioni Dall, 1889
•Order Actinodonta! Deschaseaux, 1954; •Superfamily Amnigenioidea Khalifin, 1949; •Superfamily Anodontopsida! S. A. Miller, 1889; •Superfamily Nyassoidea! S. A. Miller, 1877; •Superfamily Oriocrassatoidea Boyd & Newell, 1968; •Superfamily Palaemuteloidea Lahusen, 1897
- Order Cardidida Dall, 1889
  (paraplesion) •Family Actinopoidea! Khalifin, 1940
  (paraplesion) •Family Eodonidae! Carter, Campbell, & Campbell, 2000
Superfamily Crassatelloidea Férussac, 1822 in 1821–1822

Subcohort Cardioni Férussac, 1822 in 1821–1822 (=Euheterodonta Giribet & Distel, 2003)

Infra subcohort Lucinidia J. Gray, 1854a
(paraplesion) •Superfamily Babinkoidea! Horný, 1960
Order Lucinida J. Gray, 1854a: Superfamily Lucinoidea! J. Fleming, 1828; Superfamily Thyasiroidea Dall, 1900 (Dall, 1895a)

Infra subcohort Cardiidia Férussac, 1822 in 1821–1822
(paraplesion) •Superfamily Grammysioidea! S. A. Miller, 1877

Megaorder Cardiata Férussac, 1822 in 1821–1822

Superorder Cardiiformii Férussac, 1822 in 1821–1822

•Order Modiomorphida! Newell, 1969c: •Superfamily Modiomorphoidea! S. A. Miller, 1877

•Order Megalodontida! Starobogatov, 1992: •Superfamily Megynodontoidae! Haffer, 1959; •Superfamily Megalodontoidae! J. Morris & Lycett, 1853

•Order Hippuritida Newell, 1965: •Superfamily Radiolitoidea d’Orbigny, 1847b; •Superfamily Requienioidea Kutassy, 1934

Order Cardiida Férussac, 1822 in 1821–1822 (paraplesion) •Superfamily Kalenteroidea! Marwick, 1953

Suborder Cardiidina Férussac, 1822 in 1821–1822
(paraplesion) •Family Palaeocarditidae! Chavan, 1969b

Hyporder Cardioidei Férussac, 1822 in 1821–1822: Superfamily Cardioidea Lamarck, 1809; Superfamily Tellinoidea Blainville, 1814

Hyporder Veneroidei Férussac, 1822 in 1821–1822

Minorder Veneroitei J. Gray, 1854a

•Superfamily Arcticaidea! R. Newton, 1891 (d’Orbigny, 1844 in 1844–1848); Superfamily Chamaeidea Lamarck, 1809; Superfamily Cyrenoida J. Gray, 1840b; Superfamily Gaimardioida Hedley, 1916; Superfamily Glossidea J. Gray, 1847b (J. Gray, 1840b); Superfamily Hemidonacoidea Scarlato & Starobogatov in Neveskaja & others, 1971; Superfamily Macroidea Lamarck, 1809; Superfamily Ungulinoidea J. Gray, 1854b; Superfamily Veneroidea Rafinesque, 1815

Minorder Dreissenoida R. Moore in Moore, Lalicker, & Fischer, 1952: Superfamily Dreissenoidae J. Gray, 1840a; Superfamily Sphaerioidae! Deshayes, 1855b (Rafinesque, 1820)

Suborder Gastrochaenidina Morretes, 1949: Superfamily Gastrochaenoidea J. Gray, 1840b

•Suborder Anthracosidina Silantiev & Carter, 2011: •Superfamily Anthracosoiidea Amalitzky, 1892; •Superfamily Palaeoidea Modell, 1964; •Superfamily Prilukielloidea Starobogatov, 1970

Suborder Leptonidina Dall, 1889: Superfamily Cyamioidea! G. O. Sars, 1878; Superfamily Galeommatoidea J. Gray, 1840b

Superorder Pholadiformii J. Gray, 1854a

Order Pholadida J. Gray, 1854a: Superfamily Myoidea Lamarck, 1809; Superfamily Pholadoidea Lamarck, 1809; •Superfamily Pleuroideoidea! Zittel, 1895

Megaorder Poromyata Ridewood, 1903

Order Poromyida Ridewood, 1903: Superfamily Cupispariaria Dall, 1886; Superfamily Parilimoidea! B. Morton, 1981; Superfamily Poromyoidea Dall, 1886; Superfamily Verticordioidea! Stoliczka, 1870 in 1870–1871

Order Pholadomyida! Newell, 1965: Superfamily Pholadomyoidea! W. King, 1844

Order Pandorida R. Stewart, 1930: Superfamily Clavagelloidea d’Orbigny, 1844 in 1844–1847; Superfamily Pandoroidea! Rafinesque, 1815

Order Thracidea Carter, nov.: Superfamily Thracioidea! Stoliczka, 1870 in 1870–1871 (Couthouy, 1839)

Megaorder Solenata Dall, 1889.

Order Solenida Dall, 1889: •Superfamily Orthonotoidea! S. A. Miller, 1877; Superfamily Solenoidea Lamarck, 1809

Order Hiastellida Carter, nov.: •Superfamily Edmondioidea! W. King, 1850; Superfamily Hiastelloidea J. Gray, 1824

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