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A SYSTEMATIC SURVEY OF THE PALEOZOIC AND MESOZOIC GASTROPODA AND PALEOZOIC BIVALVIA FROM JAPAN

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A Systematic Survey of the Paleozoic and Mesozoic Gastropoda and Paleozoic Bivalvia from Japan

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INTRODUCTION

This is a companion paper to "A Systematic Survey of the Mesozoic Bivalvia from Japan" (*Univ. Mus., Univ. Tokyo, Bull.*, no. 10, 1975). The purpose of investigation and the principles of classification are essentially the same as were noted in that article, and the systematic catalogues herein also give various basic information about the hitherto described taxa of the Paleozoic and Mesozoic Gastropoda and Paleozoic Bivalvia from Japan and its adjacent areas.

For the post-Cretaceous gastropods and bivalves, similar handbooks have already been published. Hatai and Nisiyama (1952) compiled "Checklist of Japanese Tertiary Marine Mollusca" and Masuda and Noda (1976) recently published "Checklist and Bibliography of the Tertiary and Quaternary Mollusca of Japan, 1950–1974." Oyama, Mizuno and Sakamoto's (1960) "Illustrated Handbook of Japanese Paleogene Molluscs" is another useful volume. Although the object, format and contents of this volume are different from those of these previous publications, we hope that it will complement them and will provide a basis for understanding the present status of the classification of Japanese fossil gastropods and bivalves.

In the case of Mesozoic Bivalvia from Japan and its adjacent areas, one of us (I. H.) prepared the systematic catalogue as a taxonomic conclusion which was reached on the basis of a large number of published works on particular families and genera and on nearly completed faunal studies. In the case of the Paleozoic–Mesozoic gastropods and Paleozoic bivalves, the circumstances, and especially the stage of investigation, are quite different. The taxa which have been described are only a portion of the total number presumed to have existed, and faunal studies are not completed. Most species, once named, have not been critically studied. Neither biostratigraphers nor paleontologists have paid much attention to these groups, because they are only rarely useful as index fossils and also because they are imperfectly preserved except in a few special cases. Many of the species have been described as "garnishings" in faunal studies rather than the "main dishes" of professional taxonomic studies, notwithstanding the fact that there are many interesting genera and species which seem to be important for the general consideration of molluscan phylogeny and classification.

The described species, about 105 Paleozoic gastropods, 165 Mesozoic gastropods and 120 Paleozoic bivalves, seem to represent only a minor fraction of the actual fossil records in the surveyed areas. The present state of taxonomic studies on these groups is also far from ideal. Thus, the present article is nothing but a preliminary steppingstone for future investigation and improvement.

This article consists of two parts. The first part is concerned with hitherto described taxa of Paleozoic and Mesozoic Gastropoda, and the second part with those of Paleozoic Bivalvia. Two of us are responsible for Part I, while Part II was mostly prepared by one of us (I. H.). Paleozoic gastropods and bivalves from Korea and Cretaceous gastropods

from Korea, Saghalin and Taiwan are also subjected to study, since most of their type specimens are now preserved in Japanese institutions.

The format and abbreviations adopted in the present catalogues conform to those in the preceding article on the Mesozoic Bivalvia. The subject under investigation is, however, somewhat extended. Described or illustrated specimens with only generic names were omitted in the preceding article but are included in the present catalogues.

Taxonomic names.—Revised taxonomic names are written in bold-faced letters. A question mark is placed after a generic name, if the generic reference is doubtful. "cf." and "aff." indicate the occurrence of comparable specimen(s) with the next coming taxon and the occurrence of not identical but morphologically similar specimen(s), respectively. Comparable specimen(s) with domestic taxa are commonly listed in synonymies with the prefix "compare." Names of taxa higher than subgeneric are systematically arranged (in many cases in accordance with the *Treatise on Invertebrate Paleontology*, Parts I and N), and those of species within a genus (or a subgenus) are arranged alphabetically.

Synonymies.—An attempt has been made to provide complete synonyms which appear in descriptive works. Omitted are synonyms from other countries and those in faunal lists containing neither description nor illustration and in various unscientific accounts. For brevity, references are indicated only by author name and date in the text: the full references, of course, will be found in the bibliography. The name of the author of the original publication, if it is the same as the author of the taxon, is not repeated. "*sic*" means the exact spelling of a taxonomic name is grammatically incorrect. Typographical or other errors are corrected in accordance with the *International Code of Zoological Nomenclature.*

Type.—Only information about primary type specimen(s) is given. The categories of types, namely, holotype (by original designation unless otherwise stated), syntype and lectotype, are distinguished. Information about the valid designation of lectotype and the figure number, depository, register number and locality of the type-specimen(s) are also given. If only one of the syntype specimens was illustrated in the original description, it is usually designated here as the lectotype; in other cases, however, new designation of lectotype is not made, because such a procedure ideally should be accompanied by particular study on the taxon. The place names of type localities are modernized in accordance with the present administrative division.

Depository.—The following abbreviations are used to indicate the institutions where the type-specimen(s) are actually (or said to be) preserved:

GMH: Department of Geology and Mineralogy, Faculty of Science, Hokkaido University, Sapporo

IGPS: Institute of Geology and Palaeontology, Faculty of Science, Tohoku University, Sendai

UMUT: University Museum, University of Tokyo, Tokyo

NSM: Department of Zoology, National Science Museum, Tokyo

GIYU: Geological Institute, Faculty of Education, Yokohama National University, Yokohama

UK: Geological and Mineralogical Institute, Faculty of Science, Kyoto University, Kyoto

ASM: Akiyoshidai Museum of Natural History [Akiyoshidai Science Museum], Shuho-cho, Yamaguchi Prefecture

GF: Department of Geology, Fukuoka University of Education [Fukuoka Gakugei University], Munakata-cho, Fukuoka Prefecture

GK: Department of Geology, Faculty of Science, Kyushu University, Fukuoka

GS: Department of Geology, Faculty of Education, Saga University, Saga

Age.—Age or stratigraphic range of each taxon in Japan and its adjacent areas is indicated primarily by means of international (or Tethyan) stage names. The ages of non-marine and brackish-water species are inevitably shown with less precision.

Distribution.—Stratigraphic and geographic distribution of each taxon is indicated by the names of strata and areas, though many taxa have been recorded only from the type localities. Distribution in other countries is only briefly noted. The data were derived mainly from previous descriptive studies cited in the synonymies but were partly supplemented by other undescribed materials newly examined. The geographic position of the Paleozoic and Mesozoic areas in question is indicated in the annexed index maps (Figs. 1, 2).

Illustrations.—Although it is not the purpose of the present article to be directly used for taxonomic identification, 80 selected specimens of Paleozoic and Mesozoic gastropods and 29 of Paleozoic bivalves are illustrated in the annexed plates. Most of them are primary type specimens (holotype, syntype or lectotype) of important species, covering the type-species on which new genera or subgenera were proposed by Japanese authors. Photographs were newly prepared except for several reproduced from existing illustrations (sources shown in the explanation of plates).

PART I. PALEOZOIC AND MESOZOIC GASTROPODA

GENERAL COMMENTS

From Japan and its adjacent areas (North and South Korea, Saghalin and Taiwan) approximately 80 Paleozoic and 110 Mesozoic gastropods have been described and named in more than 70 scientific papers prior to 1976 (Tables 1, 2). This number is small in comparison with that of the bivalve species (771 Mesozoic and 66 Paleozoic species in more than 260 papers) from the contemporary strata of the same surveyed areas. Provided that the average longevity of species is nearly equal between gastropods and bivalves and that the specific diversities of the two classes are roughly proportional to those in modern seas, our knowledge about the pre-Tertiary gastropod species in this region remains less than 5 percent as complete as that about the bivalves. Investigation of Paleozoic and Mesozoic gastropods is lagging far behind that of bivalves.

This marked contrast, we presume, is primarily due to technical difficulties in obtaining the material for study rather than to differences in fossil records. Generally speaking, gastropods as well as other orgnisms have been well known from calcareous sediments. For example, in the Cambro-Ordovician limestones in Korea, the Permian Akasaka limestone in central Honshu, the calcareous sediments of the Lower Cretaceous Miyako Group in north Honshu and the calcareous concretions of the Upper Cretaceous groups in Hokkaido, many well-preserved gastropods have been described, and the number of known species therefrom sometimes surpasses that of the bivalves. In contrast, molluscan shells are rather difficult to remove from non-calcareous consolidated rocks, since the tests are, if preserved, much weaker and more fragile than the clastic matrix. In many cases fossils are represented by internal and external moulds. Taxonomic investi-

Table 1. Number of descriptive works on Paleozoic and Mesozoic Gastropoda from Japan and its adjacent areas (number of newly proposed specific and infraspecific names in parentheses)

Date	Paleozoic	Mesozoic	Total
1870–1879	0	1 (3)	1 (3)
1880–1889	0	0	0
1890–1899	0	3 (3)	3 (3)
1900–1909	0	0	0
1910–1919	0	0	0
1920–1929	1 (0)	6 (9)	7 (9)
1930–1939	8 (43)	9 (59)	17 (102)
1940–1949	1 (10)	3 (11)	4 (21)
1950–1959	5 (7)	6 (3)	11 (10)
1960–1969	8 (14)	17 (8)	25 (22)
1970–1976	4 (2)	8 (17)	12 (19)
Total	27 (76)	53 (113)	80 (189)

Table 2. Number of valid described species of Paleozoic and Mesozoic Gastropoda from Japan and its adjacent areas

Age	Named species	Unnamed species	Total
Cretaceous	82	41	123
Jurassic	24	5	29
Triassic	3	10	13
Permian	22	13	35
Carboniferous	6	3	9
Devonian	0	0	0
Silurian	0	0	0
Ordovician	47	7	54
Cambrian	8	0	8
Total	192	79	271

gation of gastropods in such a state of preservation, particularly species of Small size, is much more difficult than investigation of bivalves, because the apertural and other important three-dimensional characters are hard to recognize. Although some recent attempts have proved that the artificial casting from natural moulds by means of latex or silicone rubber is quite effective for taxonomic studies, almost nothing has been done on the description of gastropod faunas from the widely distributed non-calcareous strata in the Paleozoic and Mesozoic terrains of Japan. The numbers of described gastropod species in different periods (Table 2), which appear to be much biased, may also reflect this circumstance.

HISTORICAL REVIEW

1) Cambrian and Ordovician Gastropoda

As the earliest fossiliferous strata so far known in the Japanese islands are Silurian, all the Cambrian and Ordovician gastropods reviewed in the present article are from the Chosen Group in Korea. In the Korean peninsula this group is distributed in two sedimentary areas: one is the "Heinan geosyncline" in North Korea, and the other is the "Yokusen geosyncline" in South Korea. Some 60 Cambro-Ordovician Gastropoda and Monoplacophora were described in several faunal studies together with the rich trilobites, nautiloids, brachiopods and other fossils.

Of these molluscs, several Lower and Middle Cambrian species from the Chunghwa area of Pyongan-namdo in North Korea (Saito, 1936, Kobayashi, 1958b) and from the Mungyong (Bunkei) area of Kyongsang-bukdo in South Korea (Kobayashi, 1935) attract our special attention, because they represent such early primitive genera as *Coreospira*, *Helcionella* and *Hampilina*, which seem to be important for the consideration of the early history of molluscs.

Lower and Middle Ordovician gastropods occur more abundantly in the two sedimentary areas. Particularly in the Shorin, Bantatsu and Unkaku beds in Pyongan-namdo and Huanghae-do and the Chikunsan and Tsuibon beds of Kangwon-do, the Bellerophontacea, Macluritacea, Euomphalacea and Pleurotomariacea are represented by many species (Kobayashi, 1930, 1931, 1934a, b, 1958b, etc.). According to Kobayashi, some

of the gastropods are common or closely allied to the contemporaneous faunas in northeast and middle-south China, and further comparative studies are desired. Almost all the type specimens of these Cambro-Ordovician gastropods are preserved in the University Museum, University of Tokyo. Since each nominal species is represented by a relatively small number of specimens, we cannot always confirm the distinction between closely related species, but the scientific importance of this material must be emphasized.

2) Silurian and Devonian Gastropoda

In the Japanese islands the distribution of Silurian and Devonian sediments is restricted to a few narrow areas. Though some "bellerophontids," "pleurotomariids" and "murchisoniids" were reported to occur from the Silurian of west Shikoku and from the Devonian of north Honshu, no gastropods have ever been formally described.

3) Carboniferous and Permian Gastropoda

Carboniferous and Permian formations are widely distributed in many areas of Honshu, Shikoku and Kyushu. They commonly occur together and bear large limestone bodies at many places which sometimes yield well-preserved molluscan fossils. The most famous gastropod fauna comes from the Middle Permian Akasaka Limestone in central Honshu, where giant species of *Bellerophon*, *Pleurotomaria* [*Bathrotomaria*?], *Naticopsis*, *Trachydomia* [*Trachyspira*] and *Murchisonia* [*Raha*?] are known to have occurred at some quarries of Kinshozan.* We owe their description and a number of fine drawing illustrations to Hayasaka (1938, 1939, 1943), who is a pioneer of Paleozoic molluscan paleontology in this country. The unusually large size of the constituents of the Akasaka fauna was later discussed by Hayasaka and Hayasaka (1953), although there are also many other described or undescribed gastropods of small size at the same localities. While most of the type specimens of Akasaka gastropods are now believed to be preserved at the Taipei University of Taiwan (oral communication of Prof. M. Murata and Dr. T. Ozawa), some topotype specimens are at various museums and institutions in Japan. Besides, Hayasaka (1953) described a large specimen of *Euconospira* with original color pattern from the Middle Permian Nabeyama Limestone in Kwanto.

The Carboniferous-Permian Akiyoshi Limestone in west Honshu, which is also famous for its overturned geologic structure and exemplary fusulinacean zonation, bears some well-preserved gastropods, mainly in the lower part. Shikama and Nishida (1968) and Nishida (1968) recorded several interesting species belonging to *Straparollus*, *Mourlonia* and *Turbonitella*, which are almost the only described Carboniferous gastropods in this country. Furthermore, Nishida (1969) described a Middle Permian gastropod fauna from the Ohirayama Limestone in south Shikoku, which contained the genus *Shikokuspira* of the Neritopsidae and the subgenus *Sorobanobaca* of the Bellerophontidae. The secondarily silicified material of the Ohirayama fossils attracts our attention, suggesting the possibility of further ambitious investigation.

Many Carboniferous and Permian gastropod faunas from non-calcareous rocks seem to remain undescribed, since a considerable number of species have been listed in stratigraphic papers. Only Murata (1969) described *Euphemitopsis*, *Bellerophon*, *Straparollus*,

* In this historical review revised generic names are shown in brackets immediately after the original names.


SAGHALIN
HOKKAIDO
KOREA
HONSHU
SHIKOKU
KYUSYU
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● PERMIAN, CARBONIFEROUS
▲ ORDOVICIAN, CAMBRIAN

Fig. 1

Fig. 1. Map showing the distributed areas of Paleozoic formations bearing fossil gastropods and bivalves in Japan and Korea.

1. Miyamori area in Iwate Pref. (Mid. Permian Hiryuyama Formation)
2. Sumita area in Iwate Pref. (Low. Permian Sakamotozawa Formation)
3. Ofunato area in Iwate Pref. (Low. Carboniferous)
4. Yahagi area in Iwate Pref. (Mid. Permian Kanokura Formation)
5. Kesennuma area in Miyagi Pref. (Low. Permian Sakamotozawa Formation/Mid. Permian Kanokura Formation)
6. Karakuwa area in Miyagi Pref. (Up. Permian Kowaragi Formation)
7. Fujisawa area in Miyagi Pref. (Up. Permian Toyoma Formation)
8. Maiya area in Miyagi Pref. (Low. Permian Sakamotozawa Formation)
9. Towa area in Miyagi Pref. (Mid. Permian Tenjinnoki and Rodai Formations)
10. Toyoma area in Miyagi Pref. (Up. Permian Toyoma Formation)
11. Ogachi are a in Miyagi Pref. (Up. Permian Toyoma Formation)
12. Yotsukura area in Fukushima Pref. (Permian Takakurayama Group)
13. Nabeyama area in Tochigi Pref. (Mid. Permian Nabeyama Limestone)
14. Itsukaichi area in Tokyo Pref. (Low. Carboniferous Mitsuzawa Limestone)
15. Omi area in Niigata Pref. (Carboniferous-Permian Omi Limestone)
16. Akasaka area in Gifu Pref. (Permian Akasaka Limestone)
17. Mikata area in Fukui Pref. (Up. Permian Maizuru Group)
18. Maizuru area in Kyoto Pref. (Up. Permian Maizuru Group)
19. Oe area in Kyoto Pref. (Up. Permian Gujo Formation)
20. Ayabe area in Kyoto Pref. (Up. Permian Maizuru Group)
21. Akiyoshi area in Yamaguchi Pref. (Carboniferous-Permian Akiyoshi limestone Group)
22. Isa area in Yamaguchi Pref. (Carboniferous-Permian Akiyoshi limestone Group)
23. Sakawa area in Kochi Pref. (Up.? Permian Katsura Formation/Mid. Permian Ohirayama Limestone of Takaoka Formation)
24. Mifune area in Kumamoto Pref. (Mid. Permian Mizukoshi Formation)
25. Kokai (Kanggyi) area in Heian-hoku-do (Pyongan-bukdo) (Low. Cambrian *Protolenus* shale)
26. Bantatsu (Mandalsan) area in Heian-nan-do (Pyongan-namdo) (Mid. Ordovician Unkaku beds of Chosen Group)
27. Chuwa (Chunghwa) area in Heian-nan-do (Pyongan-namdo) (Low. to Mid. Cambrian Manto shale of Chosen Group)
28. Kenjiho (Keomipeo) area in Heian-nan-do (Pyongan-namdo) (Low. Ordovician Shorin beds of Chosen group)
29. Koshu (Hwangju) area in Heian-nan-do (Pyongan-namdo) (Low. to Mid. Cambrian Manto shale of Chosen Group/Low. Ordovician Shorin beds of Chosen Group)
30. Hukumen (Buk-myeon) area in Kogen-do (Kangwon-do) (Mid. Cambrian Machari formation of Chosen Group)
31. Sanchoku (Sam-ch'eok) area in Kogen-do (Kangwon-do) (Mid. Ordovician Tsuibon beds of Chosen Group)
32. Heisho (P'yeong-ch'ang) area in Kogen-do (Kangwon-do) (Low.? Permian Jido Group)
33. Neietsu (Yeong-weol) area in Kogen-do (Kangwon-do) (Low. Ordovician *Clarkella* zone of Chosen Group)
34. Taihakusan (Taebaeksan) area in Kogen-do (Kangwon-do) (Mid. Cambrian to Mid. Ordovician beds of Chosen Group)
35. Bunkei (Mun'g-yeong) area in Keisho-hoku-do (Kyongsang-bukdo) (Cambrian Eiko Formation of Chosen Group/Mid. Ordovician Chikunsan beds and Todon Formation of Chosen Group)


SAGHALIN
HOKKAIDO
HONSHU
SHIKOKU
KYUSYU
KOREA
CRETACEOUS
JURASSIC
TRIASSIC

Fig. 2

Fig. 2. Map showing the distributed areas of Mesozoic formations bearing fossil gastropods in Saghalin, Japan and Korea.

1. Cape Khoi area in north Saghalin (Up. Cretaceous Cape Khoi beds)
2. Alexandrovsk area in north Saghalin (Up. Cretaceous)
3. Shiska area in south Saghalin (Up. Cretaceous Upper Yezo Group)
4. Kawakami colliery area in south Saghalin (Up. Cretaceous Upper Yezo Group)
5. Toyohara area in south Saghalin (Up. Cretaceous Upper Yezo Group)
6. Notoro area in south Saghalin (Up. Cretaceous Upper Yezo Group)
7. Soya (Wakkanai) area in Kitami Prov., Hokkaido (Up. Cretaceous Upper Yezo Group and Hakobuchi Group)
8. Sarufutsu area in Kitami Prov., Hokkaido (Up. Cretaceous Upper Yezo Group)
9. Nakagawa area in Teshio Prov., Hokkaido (Up. Cretaceous Upper Yezo Group)
10. Tappu area in Teshio Prov., Hokkaido (Up. Cretaceous Upper Yezo Group)
11. Uryu area in Ishikari Prov., Hokkaido (Up. Cretaceous Upper Yezo Group)
12. Ikushumbetsu (Mikasa) area in Ishikari Prov., Hokkaido (Up. Cretaceous Middle Yezo Group and Upper Yezo Group)
13. Poronai area in Ishikari Prov., Hokkaido (Up. Cretaceous Middle Yezo Group)
14. Miruto area in Ishikari Prov., Hokkaido (Up. Cretaceous Middle Yezo Group)
15. Manji area in Ishikari Prov., Hokkaido (Up. Cretaceous Middle Yezo Group)
16. Yubari area in Ishikari Prov., Hokkaido (Up. Cretaceous Upper Yezo Group and Middle Yezo Group)
17. Hidaka area in Hidaka Prov., Hokkaido (Up. Cretaceous Upper Yezo Group)
18. Kamihobetsu area in Iburi Prov., Hokkaido (Up. Cretaceous Upper Yezo Group)
19. Hobetsu area in Iburi Prov., Hokkaido (Up. Cretaceous Upper Yezo Group and Hakobuchi Group)
20. Hetonai (Tomiuchi) area in Iburi Prov., Hokkaido (Up. Cretaceous Hakobuchi Group)
21. Urakawa area in Hidaka Prov., Hokkaido (Up. Cretaceous Middle Yezo Group and Upper Yezo Group)
22. Erimo seamount, ca. 300 km east off the east coast of north Honshu
23. Tanohata area in Iwate Pref. (Low. Cretaceous Miyako Group)
24. Omoto (Iwaizumi) area in Iwate Pref. (Low. Cretaceous Miyako Group)
25. Miyako area in Iwate Pref. (Low. Cretaceous Miyako Group)
26. Omine-mine area in Iwate Pref. (Low. Cretaceous Kamihei Group)
27. Oshima area in Miyagi Pref. (Low. Cretaceous Oshima Formation)
28. Ojika area in Miyagi Pref. (Mid.-Up. Jurassic Ojika Group)
29. Shiogama (Rifu) area in Miyagi Pref. (Mid. Triassic Rifu Formation)
30. Kashima (Soma) area in Fukushima Pref. (Up. Jurassic Soma Group)
31. Futaba area in Fukushima Pref. (Up. Cretaceous Futaba Group)
32. Nakaminato area in Ibaraki Pref. (Up. Cretaceous Nakaminato Formation)
33. Choshi area in Chiba Pref. (Low. Cretaceous Choshi Group)
34. Nakazato area in Gumma Pref. (Low. Cretaceous Ishido and Sebayashi Formations)
35. Ohinata area in Nagano Pref. (Low. Cretaceous "Shiroi" and Ishido Formations)
36. Ueno area in Gumma Pref. (Low. Triassic Shionosawa Limestone/Low. Cretaceous "Shiroi Formation")
37. Itsukaichi area in Tokyo Pref. (Mid. or Up. Triassic Arai Formation/Up. Triassic "*Entomonotis* beds")
38. Furukawa area in Gifu Pref. (Up. Jurassic to Low. Cretaceous Tetori Group)
39. Shokawa area in Gifu Pref. (Up. Jurassic to Low. Cretaceous Tetori Group)
40. Kuzuryu (Izumi) area in Fukui Pref. (Up. Jurassic to Low. Cretaceous Tetori Group)
41. Yakuno area in Kyoto Pref. (Low.-Mid. Triassic Yakuno Group)
42. Nariwa area in Okayama Pref. (Up. Triassic Nariwa Group)
43. Awaji area in Hyogo Pref. (Up. Cretaceous Izumi Group)
44. Nagato area in Yamaguchi Pref. (Low. Cretaceous Kwanmon Group)
45. Takibe area in Yamaguchi Pref. (Low. Cretaceous Kwanmon Group)

46. Toyoda area in Yamaguchi Pref. (Low. Jurassic Toyora Group)
47. Asa area in Yamaguchi Pref. (Low. Cretaceous Kwanmon Group)
48. Yoshimo (Shimonoseki) area in Yamaguchi Pref. (Low. Cretaceous Yoshimo Formation and Kwanmon Group)
49. Dogo-himezuka area in Ehime Pref. (Up. Cretaceous Izumi Group)
50. Monobe area in Kochi Pref. (Low. Cretaceous Monobegawa Group)
51. Kahoku area in Kochi Pref. (Low. Cretaceous Monobegawa Group)
52. Nangoku area in Kochi Pref. (Low. Triassic Kurotaki Limestone)
53. Kochi area in Kochi Pref. (Low. Cretaceous Monobegawa Group)
54. Sakawa area in Kochi Pref. (Up. Jurassic Torinosu Group/Low. Cretaceous Ryoseki Formation)
55. Uonashi area in Ehime Pref. (Mid. Triassic "*Ussurites* beds")
56. Uwajima area in Ehime Pref. (Up. Cretaceous Uwajima Group)
57. Moji area in Fukuoka Pref. (Low. Cretaceous Kwanmon Group)
58. Kokura-Yahata area in Fukuoka Pref. (Low. Cretaceous Kwanmon Group)
59. Miyata area in Fukuoka Pref. (Low. Cretaceous Kwanmon Group)
60. Kotake area in Fukuoka Pref. (Low. Cretaceous Kwanmon Group)
61. Wakino area in Fukuoka Pref. (Low. Cretaceous Kwanmon Group)
62. Takachiho area in Miyazaki Pref. (Low. Triassic Kamura Formation)
63. Mifune area in Kumamoto Pref. (Up. Cretaceous Mifune Group)
64. Yatsushiro area in Kumamoto Pref. (Low. Cretaceous Kawaguchi Formation)
65. Hinagu area in Kumamoto Pref. (Up. Jurassic Sakamoto Formation/Low. Cretaceous Kawaguchi Formation)
66. Tanoura area in Kumamoto Pref. (Up. Jurassic Sakamoto Formation)
67. Gumizaki area in Kagoshima Pref. (Low. Cretaceous Gumizaki Formation)
68. Goshonoura island in Kumamoto Pref. (Low. to Up. Cretaceous Goshonoura Group)
69. Koshiki islands in Kagoshima Pref. (Up. Cretaceous Himenoura Group)
70. Keishu area in Keisho-hoku-do (Kyongsang-bukdo) (Cretaceous Shiragi Group)
71. Eisen area in Keisho-hoku-do (Kyongsang-bukdo) (Cretaceous Shiragi Group)
72. Shikkoku area in Keisho-hoku-do (Kyongsang-bukdo) (Cretaceous Naktong Group)
73. Shinshu area in Keisho-nan-do (Kyongsang-namdo) (Cretaceous Naktong Group)
74. Kato area in Keisho-nan-do (Kyongsang-namdo) (Cretaceous Naktong Group)

Glabrocingulum and a few other gastropods from the Upper Permian Toyoma Formation of north Honshu.

4) Triassic and Jurassic Gastropoda

In spite of a large number of described bivalve species from the Triassic and Jurassic of Japan, studies on the gastropod faunas are few and quite sporadic. The Upper Jurassic limestones of Torinosu type in north Honshu (Abukuma mountains), south Shikoku and middle Kyushu yield some nerineaceans. While a species and a subspecies of *Nerinea* were treated by Sugiyama and Asao (1942), most Jurassic nerineaceans, including *Nerinea*, *Cossmannea*, *Ptygmatis*, *Cryptoplocus*, *Bactroptyxis*, *Itieria* and *Phaneroptyxis* in addition to the genus, *Heteroptygmatis*, were described by Shikama and Yui (1973) together with some Lower Cretaceous species. Their classification of this superfamily seems to follow Pcelincev and Korobkov's scheme in Orlov (1960, ed.), which is considered controversial by other authors.

We are aware of the presence of many undescribed gastropods in the Triassic and Jurassic non-calcareous marine sediments, but only a few species were paleontologically described except for some pleurotomariaceans from the Middle Triassic Rifu Formation

of north Honshu (Hayasaka, 1966) and some *Neritopsis* species from the Lower Jurassic Toyora Group in west Honshu (Hayami, 1960). From the lower and middle parts of the Tetori Group in central Honshu (Hida mountains), which is mainly Jurassic but possibly Lower Cretaceous in part, Kobayashi and Suzuki (1937) described *Pila* [*Ampullaria*?] and some other non-marine forms.

5) Cretaceous Gastropoda

The Upper Cretaceous deposits of Saghalin and Hokkaido contain numerous well-preserved molluscan fossils, offering world-famous fossil records (Matsumoto, 1954, etc.). Pioneer studies on the gastropod faunas in this region as well as the rich ammonites and inoceramids date back to the last century. Schmidt (1873) first described a huge patelliform species of *Helcion* ["*Capulus*"] together with two species of *Trachytriton* [*Serrifusus*?] from the environs of Alexandrovsk in north Saghalin. Yokoyama's (1890) and Jimbo's (1894) papers on many Cretaceous fossils mainly from Hokkaido and Neumayr's study in Naumann and Neumayr (1890) on Jurassic and Lower Cretaceous fossils from Shikoku and Kyushu also include descriptions of some gastropods. All the plates in these classical monographs were later reproduced with revised taxonomic remarks (Matsumoto, Hayami and Asano, 1963; Matsumoto, 1963; Hayami, Matsumoto and Asano, 1963).

During the 1920's and 1930's, Yabe and Nagao greatly contributed to the descriptions of Cretaceous bivalve and gastropod faunas in the Japanese islands. Yabe and Nagao (1925, 1928) reported many representative gastropods from the Upper Cretaceous of Saghalin and Hokkaido, and these works were followed by those by Nagao (1932, 1939) and Nagao and Otatume (1938). During the course of descriptive studies, Nagao proposed two interesting genera, *Pseudogaleodea* and *Pseudoperissitys*. Other common and characteristic genera of this epoch are *Aporrhais* (*Tessarolax*) and *Pugnellus* of the Strombacea and *Serrifusus* of the Buccinacea, which indicate some relation to the contemporaneous faunas of North America. Yabe and Nagao *in* Yabe, Nagao and Shimizu (1926) described *Natica* (*Amauropsis*) [*Tylostoma*?] and two other small gastropods from the Lower Cretaceous formations of the Kwanto mountains in central Honshu. Summarizing the Cretaceous stratigraphy of the Japanese islands, Yabe (1927) illustrated some Lower Cretaceous specimens of *Purpuroidea*, *Tylostoma* and *Glauconia* [*Cassiope*], introducing new specific names for them. Although no description was given in that paper, the names are regarded as available, because they were proposed before 1930. Furthermore, some indigenous Albian-Cenomanian gastropods from the Amakusa islands of Kyushu were described by Nagao (1930) and Matsumoto (1938).

Nagao (1934) made an intensive study on the Aptian (partly Albian) gastropods from the Miyako Group in north Honshu. Indeed, this material seems to represent one of the most prolific gastropod faunas of this stage in the world. He described 28 species belonging to 22 genera, e.g., *Ataphrus*, *Desmieria* [*Otostoma*], *Pseudomelania*, *Trajanella*, *Tylostoma*, *Cerithium* [*Cirsocerithium*, *Cimolithium*, *Metacerithium*], *Bathraspira*, *Vanikoroa* [*Gyrodes*], *Avellana* and *Nerinea*. Twenty-two of these species are entirely new, and subsequently Allison (1955) compared some specimens from the Albian of Baja California of Mexico with the Miyako species. One of us (T. K.) is now engaging in a further study on the Miyako fauna and has already distinguished more than 20 unde-

scribed gastropods. Since the preservation of the material is exceptional, taxonomic and other studies on these gastropods may be significant beyond the description of a local fauna. Most of Yabe and Nagao's type specimens of the Cretaceous gastropods are now preserved in the Institute of Geology and Paleontology, Tohoku University, and the Department of Geology and Mineralogy, Hokkaido University, and were observed by us for the preparation of this catalogue.

In contrast with marine deposits, the distribution of Cretaceous non-marine formations with fossil gastropods is almost restricted to the Inner Zone of Southwest Japan and the southern part of South Korea. Since Kobayashi and Suzuki (1936) described non-marine molluscs including a new species of *Brotia* [*Brotiopsis*], a number of fresh-water and brackish-water gastropods belonging to Cyclophoracea, Rissoacea and Cerithiacea have been described from the Toyonishi and Kwanmon Groups in west Honshu and north Kyushu and from the Naktong and Shiragi Groups in Kyongsang-namdo and Kyongsang-bukdo of South Korea (Kobayashi and Suzuki, 1939; Suzuki, 1940, 1943; etc.). Although many subsequent Japanese stratigraphers and paleontologists have been more interested in some peculiarly ornamented unionoid bivalves rather than gastropods, there are such interesting indigenous genera as *Itomelania*, *Brotiopsis* and *Siragimelania*. Unfortunately, many of the original specimens treated by Suzuki were lost during the Second World War. After the war Ota (1960) and Hase (1960) additionally described non-marine gastropod faunas of the Kwanmon Group in west Honshu and north Kyushu and the Kawaguchi Formation in middle Kyushu. The former author proposed *Yoshimonia* and *Kumania* as two new subgenera of *Melanoides*.

Nakazawa and Murata (1966) described a new molluscan fauna including some species of gastropods from the Lower Cretaceous (probably Neocomian) Kamihei Group of north Honshu (Kitakami mountains).

In addition to Nagao's (1934) description of a species of *Nerinea* from the Miyako Group, Fukada (1953) described another large nerineacean from the Lower Cretaceous Lower Yezo Group of Hokkaido, and Tsuchi and Kagami (1967) reported the occurrence of valuable specimens of "*Nerinea*", which were dredged from the top of Seamount Erimo off the southern coast of Hokkaido. As noted before, Shikama and Yui (1973) accomplished a comprehensive study on the nerineaceans from Japan, in which some species of *Nerinea* and *Phaneroptyxis* from the Neocomian Oshima Formation in north Honshu (Kitakami mountains) were described together with the above-mentioned Miyako and Lower Yezo species. Another unique and special taxonomic study was recently completed by Kanie (1975), in which five patelliform gastropods were collectively redescribed on the basis of many specimens from Japan and Saghalin. He regarded these species as belonging to the genus *Anisomyon* and proposed the Anisomyonidae as a new family of the Calyptraeacea, transferring the genus from the Basommatophora to the Mesogastropoda. The presence of such large capulid gastropods is quite notable, though the generic assignment is, we think, still controversial.

NOTES ON THE CLASSIFICATION

As briefly reviewed above, studies on the pre-Tertiary gastropods from Japan and its adjacent areas still remain no more than descriptions of local fauna. Little investigation has been made of the paleoecology and phylogeny. Taxonomic criteria have almost been restricted to the shell morphology at the individual level, and little attention has been paid to the intra- and interpopulational variation, stratigraphical and geographic distribution and mode of occurrence. In the case of Mesozoic bivalves, one of us (I. H.) was worried about the difficulty in allowing variously split nominal species to come near real ones. Much deficiency of taxonomic data was also noted in Paleozoic and Mesozoic gastropods during the preparation of this volume. However, descriptive works on the present group are quite sporadic, and oversplitting of species is not so conspicuous, except in a few cases. Most of hitherto proposed species of Paleozoic and Mesozoic gastropods, though they still remain only nominal, seem to be valid at least nomenclaturally. Therefore, only a few changes are made here as to the specific discrimination and identification. On the other hand, with hitherto proposed infraspecific names (i.e., subspecies, varieties and formae), we have adjusted them as far as possible in accordance with the International Code of Zoological Nomenclature.

In preparing the present taxonomic catalogue, we faced two more difficult problems. One was the generic and subgeneric assignment of the gastropod species; they are often not typical of hitherto established genera and subgenera, which were mainly based on European and American species. Consequently, we were often driven to add a question mark after a generic (or subgeneric) name, even if the material is well preserved and was precisely described. As the taxonomic studies on this group progress in the future, a considerable number of new generic or subgeneric names will be required; in the present catalogue no attempt is made to provide such new names.

The other problem is attributable to the unsettled major subdivisions of this class. Various classification systems of gastropods have been presented by many authorities (e.g., Pelseneer, 1906; Thiele, 1929-1931; Wenz, 1938–1944; Pcelincev et al., 1960; Knight et al., 1960; Taylor and Sohl, 1962; Golikov and Starobogatov, 1975), primarily for the Prosobranchia. They often differ considerably, not only in the names of higher taxa but also in the taxobasis and contents. It is often difficult to determine the taxonomic position of Paleozoic and Mesozoic extinct groups (e.g., Murchisoniacea and Nerineacea). Moreover, homoeomorphism does not seem to be rare.

One of the standard and reliable classification systems is found in the *Treatise on Invertebrate Paleontology*, Part I (Knight et al., 1960), in which all the hitherto described genera and subgenera are taxonomically arranged. Yet, this volume treats only the taxa belonging to the Archaeogastropoda and Paleozoic and a few Mesozoic groups of the Caenogastropoda and Opisthobranchia. The volume (Part J) treating most families of the Caenogastropoda and Opisthobranchia has not been published. Very recently Golikov and Starobogatov (1975) have presented a new but somewhat controversial classification of the Prosobranchia which proposes many higher taxa. Since we are not in a position to present a more adequate scheme of major classification, the systematic ordering adopted in the present catalogue is mainly in accordance with that of Knight et al. (1960) for the

Archaeogastropoda and with that of Zilch (1959–1960) for the Opisthobranchia and Pulmonata. For the classification of the Caenogastropoda we owe much to the comprehensive survey of Wenz (1938–1944), but a few rearrangements are made here on the basis of recent taxonomic studies. For example, the Heterogastropoda (Epitoniacea and Architectonicacea) are separated from the Mesogastropoda as a distinct order, and the Nerineacea are regarded as belonging to the Opisthobranchia.

Palaeacmaea and some other Lower Paleozoic patelliform genera and *Hyolithes* are now generally excluded from the Gastropoda and regarded as constituting distinct classes, the Monoplacophora and the Hyolitha, respectively. Some representative species from the Cambro-Ordovician of Korea are listed in the present catalogue, since they were originally described as gastropods. It has been suggested in some recent studies that the suborder Bellerophontina wholly or partly belongs to the class Monoplacophora. In the present catalogue, however, the representatives of this suborder are listed as gastropods, since more evidence seems to be needed.

SYSTEMATIC CATALOGUE

Class GASTROPODA Cuvier, 1797
Subclass PROSOBRANCHIA Milne Edwards, 1848
Order ARCHAEOGASTROPODA Thiele, 1925
Suborder BELLEROPHONTINA Ulrich and Scofield, 1897
Superfamily HELCIONELLACEA Wenz, 1938
Family HELCIONELLIDAE Wenz, 1938
Subfamily HELCIONELLINAE Wenz, 1938
Genus ***Helcionella*** Grabau and Shimer, 1909

Helcionella acuticosta pacifica Saito [Pl. 1, Figs. 1a, b]

1936. *Helcionella acuticosta pacifica* Saito, p. 358, pl. 3, figs. 1–5.

Type.—Holotype (UMUT PM1468, Saito, 1936, pl. 3, figs. 1–3) from the "Manto shale" of the Chosen Group at loc. F17 near Chunghwa, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Late Lower Cambrian to early Middle Cambrian. *Ptychoparia* bed and Upper *Redlichia* shale in Chunghwa–Taktong area of North Korea.

Helcionella coreanica Kobayashi [Pl. 1, Fig. 2]

1958b. *Helcionella coreanica* Kobayashi, p. 114, pl. 8, figs. 4a–d, 5a, b, text-figs. 1a, b.

Type.—Syntypes (UMUT PM2316, 2317, two specimens) from the small limestone lens of the Chosen Group at loc. 4, north of Chunghwa, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Cambrian (stage unknown). Known only from the type locality.

Subfamily HAMPILININAE Kobayashi, 1958
Genus ***Hampilina*** Kobayashi, 1958

Hampilina goniospira Kobaysahi [Pl. 1, Figs. 3a,b]

1958b. *Hampilina goniospira* Kobayshi, p. 116, pl. 8, figs. 1a–c, 2.—1961. *Hampilina goniospira* Kobayashi: Kobayashi, p. 118, pl. 12, figs. 23a, b.

Type.—Holotype (UMUT PM2318, Kobaysahi, 1958b, pl. 8, figs. 1a–c) from a limestone boulder at Teibonsan cliff (Ma 32), probably derived from the Division 2 of the Eiko Formation of the Chosen Group in Bunkei area, Kyongsang-bukdo (Keisho-hoku-do), South Korea.

Age and distribution.—Cambrian (stage unknown). Known only from the type locality.

Hampilina alta Kobayashi

1958b. *Hampilina alta* Kobayashi, p. 116, pl. 8, figs. 3a, b.

Type.—Holotype by monotypy (UMUT PM2320, Kobayashi, 1958b, pl. 8, figs. 3a, b) from a limestone lens of the Chosen Group at loc. 4, north of Chunghwa, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Cambrian (stage unknown). Known only from the type locality.

Family COREOSPIRIDAE Knight, 1947

Genus ***Coreospira*** Saito, 1936

Coreospira rugosa Saito [Pl. 1, Figs. 4a,b]

1936. *Coreospira rugosa* Saito, p. 360, pl. 3, figs. 6–12. —1941. *Coreospira rugosa* Saito: Knight, p. 86, pl. 5, figs. 4a–d [reproduction of original figures]. —1952. *Coreospira rugosa* Saito: Shikama, p. 78, pl. 1, fig. 3 [reproduction of an original figure]. —1960. *Coreospira rugosa* Saito: Knight et al., p. I172, fig. 89–4a, b.

Type.—Holotype (UMUT PM1473, Saito, 1936, pl. 3, figs. 6, 7) from the "Upper *Redlichia* shale" of the Chosen Group at loc. D3, southern slope of Oknobong hill, 0.8 km northeast of Chunghwa, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Late Lower Cambrian. Known only from the type locality.

Superfamily BELLEROPHONTACEA M'Coy, 1851

Family SINUITIDAE Dall *in* Zittel-Eastman, 1913

Subfamily SINUITINAE Dall *in* Zittel-Eastman, 1913

Genus ***Sinuites*** Koken, 1896

Subgenus ***Sinuitopsis*** Perner, 1903

Sinuites (Sinuitopsis) kochiriensis (Kobayashi)

1934. *Sinuitopsis kochiriensis* Kobayashi, p. 360, pl. 5, figs. 1–4.

Type.—Syntypes (UMUT PM0570, 0571, two specimens) from the Chikunsan beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Subfamily EUPHEMITINAE Knight, 1956

Genus ***Euphemitopsis*** Yochelson, 1960

Euphemitopsis kitakamiensis Murata [pl. 1, Fig. 5]

1969. *Euphemitopsis kitakamiensis* Murata, p. 11, pl. 1, figs. 1a–d, 2a–c, 3a–c, 4a, b, 5a, b, 6, 7a–c. —1976a. *Euphemitopsis kitakamiensis* Murata: Murata, pl. P-19, figs. 5a, b, 6, 7.

Type.—Holotype (IGPS no. 91360, Murata, 1969, pl. 1, figs. 1a–d) from the middle part of the Toyoma Formation at Kitazawa, Toyoma-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Upper Permian (Tartarian). Toyoma Formation of the Maiya Group in Toyoma, Towa and Karakuwa areas of Miyagi Prefecture and in Fujisawa area of Iwate Prefecture.

Genus ***Warthia*** Waagen, 1880

Warthia sp.

1969. *Warthia* sp.: Murata, p. 12, pl. 2, figs. 2, 3, 4a–c.

Age and distribution.—Upper Permian (Tartarian). Toyoma Formation of the Maiya Group in Toyoma, Towa, Ogachi and Karakuwa areas of Miyagi Prefecture.

Family BELLEROPHONTIDAE M'Coy, 1851
Subfamily TROPIDODISCINAE Knight, 1956
Genus ***Tropidodiscus*** Meek and Worthen, 1866

Tropidodiscus? sigmoidalis (Kobayashi)

1934a. *Oxynodiscus sigmoidalis* Kobayashi [? error of *Oxydiscus*], p. 361, pl. 5, figs. 8, 9. —1958a. *Joleandella sigmoidalis* (Kobayashi) [typographical error of *Joleaudella*]: Kobayashi, p. 85.

Type.—Holotype (UMUT PM0572, Kobayashi, 1934, pl. 5, figs. 8, 9) from the Chikunsan shale of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Subfamily BUCANIINAE Ulrich and Scofield, 1897
Genus ***Bucania*** Hall, 1847

Bucania katoi Kobayashi [Pl. 1, Figs. 8a, b]

1930. *Bucania katoi* Kobayashi, p. 87, pl. 8, figs. 6a–c. —1958a. *Loxobucania katoi* (Kobayashi): Kobayashi, p. 86.

Type.—Holotype (UMUT PM0061, Kobayashi, 1930, pl. 8, figs. 6a–c) from the Unkaku beds of the Chosen Group at Taisei-ri, Bantatsu area, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Subfamily CARINAROPSINAE Ulrich and Scofield, 1897
Genus ***Bucanopsis*** Ulrich in Ulrich and Scofield, 1897

Bucanopsis tsuibonensis Kobayashi

1934a. *Bucanopsis tsuibonensis* Kobayashi, p. 361, pl. 6, figs. 1–8. —1952. *Bucanopsis tsubonensis* Kobayashi [typographical error of *tsuibonensis*]: Shikama, p. 82, pl. 3, fig. 5 [reproduction of an original figure].

Type.—Holotype (UMUT PM0574, Kobayashi, 1934, pl. 6, figs. 1–3) from the Tsuibon beds of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Subfamily BELLEROPHONTINAE M'Coy, 1851
Genus ***Bellerophon*** Montfort, 1808
Subgenus ***Bellerophon*** Montfort, 1808

Bellerophon (Bellerophon) hiulciformis Hayasaka

1943. *Bellerophon jonesianus* de Koninck var. *hiulciformis* Hayasaka, p. 27, pl. 1, figs. 3a–c.

Type.—Holotype (Taipei University, not registered, Hayasaka, 1943, pl. 1, figs. 3a–c) from the *Neoschwagerina* zone of Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Bellerophon (Bellerophon) jonesianus de Koninck [Pl. 2, Fig. 1]

1943. *Bellerophon jonesianus* de Koninck: Hayasaka, p. 24, pl. 1, figs. 1a, b, 2a–c. —1952. *Bellerophon jonesianus* de Koninck: Shikama, p. 180, pl. 52, figs. 1a, b [reproduction of Hayasaka's figures]. —1953. *Bellerophon jonesianus* de Kon.: Hayasaka and Hayasaka, p. 39, pl. 5, fig. 1. —1966. *Bellerophon jonesianus* de Koninck: Masutomi and Hamada, p. 67, 71, pl. 34, figs. 5a, b, pl. 36, fig. 5. —1970. *Bellerophon jonesianus* de Koninck: Shikama, p. 98, pl. 26, figs. 1, 2a, b [reproduction of Hayasaka's figures].

Age and distribution.—Middle Permian (Kazanian). *Neoschwagerina* zone of the Akasaka Limestone in Akasaka area of Gifu Prefecture. This species was described from the Permian of India.

Bellerophon (Bellerophon) kitakamiensis Murata

1971. *Bellerophon (Bellerophon) kitakamiensis* Murata, p. 105, pl. 13, figs. 1a–c, 2a, b, 3.

Type.—Holotype (IGPS no. 91389, Murata, 1971, pl. 13, figs. 1a–c) from the lower part of the Motoiwazawa sandstone member of the Sakamotozawa Formation at Motoiwazawa, southwest of Kawaguchi, Sumita-cho, Kesen-gun, Iwate Prefecture.

Age and distribution.—Lower to Middle Permian (Sakmarian–Kazanian). Upper part of the Sakamotozawa Formation in Sumita area of Iwate Prefecture, lower part of the Kanokura Formation in Kesennuma area and Tenjinnoki Formation in Towa area of Miyagi Prefecture.

Bellerophon (Bellerophon?) yabei Murata [Pl. 1, Figs. 6a, b]

1969. *Bellerophon (Bellerophon?) yabei* Murata, p. 12, pl. 1, figs. 8a–d, 9a–d, 10a–c. —1976b. *Bellerophon (Bellerophon) yabei* Murata: Murata, pl. P-19, figs. 8a–d.

Type.—Holotype (IGPS no. 91364, Murata, 1969, pl. 1, figs. 8a–d) from the basal part of the middle member of the Toyoma Formation at Kitazawa, Toyoma-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Upper Permian (Tartarian). Known only from the type locality.

Bellerophon (Bellerophon) sp.

1969. *Bellerophon (Bellerophon)* sp.: Murata, p. 12, pl. 2, figs. 1a, b.

Age and distribution.—Upper Permian (Tartarian). Lower and middle parts of the Toyoma Formation in Toyoma area of Miyagi Prefecture.

Bellerophon (Bellerophon) sp.

1969. *Bellerophon* (*Bellerophon*) sp.: Nishida, p. 83, pl. 2, fig. 1.

Age and distribution.—Middle Permian (Kazanian). *Neoschwagerina* zone of the Ohirayama limestone of the Takaoka Formation in Sakawa area of Kochi Prefecture.

Bellerophon (Bellerophon) sp. cf. **B. (B.) asiaticus** Wirth

1926. *Bellerophon* sp.: Matsushita, p. 423. — 1971. *Bellerophon* (*Bellerophon*) cf. *asiaticus* Wirth: Nakazawa, p. 128, pl. 25, figs. 9–11.

Age and distribution.—Lower Triassic (Scythian). Kurotaki Limestone in Nangoku area of Kochi Prefecture.

Subgenus uncertain

Bellerophon sp.

1934a. *Bellerophon* sp.: Kobayashi, p. 361, pl. 6, figs. 9, 10.

Age and distribution.—Middle Ordovician (Caradocian). Tsuibon beds of the Chosen Group in Taebaeksan (Taihakusan) area of Kangwon-do (Kogen-do), South Korea.

Subgenus ***Sorobanobaca*** Nishida, 1969

Bellerophon (Sorobanobaca) matsumotoi Nishida [Pl. 1, Figs. 7a, b]

1969. *Bellerophon* (*Sorobanobaca*) *matsumotoi* Nishida, p. 84, pl. 1, figs. 1a–d, 2a–d, 3a, b, 4, 5, 6a, b, 7a–c, 8–10, 11a, b, 12a, b.

Type.—Holotype (GS D54, Nishida, 1969, pl. 1, figs. 1a–d) from *Neoschwagerina* zone of the Ohirayama Limestone of the Takaoka Formation at Ohirayama mine of the Tosa Limestone Co., 1 km southeast of Sakawa JNR station, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Genus uncertain

Bellerophon? aotii Kobayashi

1958. "*Bellerophon*" *aotii* Kobayashi, p. 86, pl. 5, figs. 1a, b.

Type.—Holotype by monotypy (UMUT PM2300, Kobayashi, 1958a, pl. 5, figs. 1a, b) from dolomitic limestone of the Todon Formation of the Chosen Group at Kan on a hill northeast of Tot'am-ni, Kaun-myon, Mun'gyong-kun, Kyongsang-bukto (Keisho-hoku-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Subfamily KNIGHTITINAE Knight, 1956

Genus ***Knightites*** Moore, 1941

Subgenus ***Retispira*** Knight, 1945

Knightites (Retispira?) hanzawai Murata

1971. *Knightites* (*Retispira*?) *hanzawai* Murata, p. 106, pl. 13, figs. 4a–e, 5a, b, 6.

Type.—Holotype (IGPS no. 91391, Murata, 1971, pl. 13, figs. 4a–e) from the lower part of the Motoiwazawa sandstone member of the Sakamotozawa Formation at Motoiwazawa, southwest of Kawaguchi, Sumita-cho, Kesen-gun, Iwate Prefecture.

Age and distribution.—Lower Permian (Sakmarian). Known only from the type locality.

Suborder MACLURITINA Cox and Knight, 1960
Superfamily MACLURITACEA Fischer, 1885
Family ONYCHOCHILIDAE Koken, 1925
Subfamily SCAEVOGYRINAE Wenz, 1938
Genus ***Kobayashiella*** Endo, 1937

Kobayashiella? masariensis Kobayashi

1962. *"Kobayashiella" masariensis* Kobayashi, p. 16, pl. 3, figs. 4a, b.

Type.—Holotype by monotypy (UMUT PM3991, Kobayashi, 1962, pl. 3, figs. 4a, b) from the *Eochuangia* zone of the Machari Formation of the Chosen Group at loc. Ita-7, Song-ch'i, 1.45 km northeast of Machari, north of Nol-tari, Puk-myon, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Cambrian. Known only from the type locality.

Family MACLURITIDAE Fischer, 1885
Genus ***Maclurites*** Lesueur, 1818

Maclurites tofangoensis (Kobayashi) [Pl. 1, Figs. 9a–c]

1930. *Maclurea tofangoense* Kobayashi [*sic*], p. 96, pl. 9, figs. 1a–c, 2, 3, pl. 10, fig. 2, pl. 11, fig. 7, text-fig.

Type.—Syntypes (UMUT PM0083, 0085, two specimens) from the Toufangkou Limestone at Toufangkou, Niu-hsin-tai area, northeast China. Syntypes (UMUT PM0084 (operculum), 0086, two specimens) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea. Thus, the type locality of this species is not yet decided, but the lectotype is desirably selected from the Tou-fang-kou material, since the specific name was given after the place name.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the above localities.

Genus ***Protoscaevogyra*** Kobayashi, 1939

Remarks.—Kobayashi (1962, p. 17) introduced a new familial name, Protoscaevogyridae, for this genus, stressing its similarity to *Maclurites* rather than to *Pelagiella*. Since his proposal of this new family was not accompanied by any statement of diagnostic characters, *Protoscaevogyra* is now, though tentatively, referred to the Macluritidae.

Protoscaevogyra reversa (Kobayashi) [Pl. 2, Figs. 2a–c]

1935. *Pelagiella* (?) *reversa* Kobayashi, p. 72, pl. 11, figs. 4–6. —1939. [*Protoscaevogyra reversa* (Kobayashi)]: Kobayashi, p. 286. —1962. *Proscaevogyra reversa* (Kobayashi) [typographical error of *Protoscaevogyra*]: Kobayashi, p. 17, text-figs. 1a, b [reproduction of original figures].

Type.—Holotype (UMUT PM0944, Kobayashi, 1935, pl. 11, figs. 4–6) from the *Drepanura* zone of the Seison slate of the Chosen Group at Kasetsu-ji, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Late Middle Cambrian. Known only from the type locality.

Superfamily EUOMPHALACEA de Koninck, 1881
Family HELICOTOMIDAE Wenz, 1938
Genus ***Helicotoma*** Salter, 1859

Helicotoma amanoi Kobayashi [Pl. 2, Figs. 4a, b]

1958a. *Helicotoma amanoi* Kobayashi, p. 87, pl. 5, figs. 5a, b, 6a, b.

Type.—Holotype (UMUT PM2304, Kobayashi, 1958a, pl. 5, figs. 6a, b) from the Todon Formation of the Chosen Group at Kan on a small hill, northeast of Tot'am-ni, Kaunmyon, Mun'gyong-kun, Kyongsang-bukdo (Keisho-hoku-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Helicotoma kanekoi Kobayashi

1931. *Helicotoma kanekoi* Kobayashi, p. 35, pl. 1, figs. 8a–c, pl. 2, figs. 3a–c.

Type.—Holotype (UMUT PM0189, Kobayashi, 1931, pl. 2, figs. 3a–c) from the Shorin beds of the Chosen Group at Chundong near Kenjiho, Koshu-gun, Huanghae-do, (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenignian or Llanvirnian). Known only from the type locality.

Helicotoma keizanensis (Kobayashi)

1934a. *Raphistoma keizanense* Kobayashi, p. 372, pl. 7, figs. 1–3, 14. —1952. *Raphistoma keizanense* Kobayashi: Shikama, p. 82, pl. 3, figs. 8a, b [reproduction of an original figure]. —1958a. *Palaeomphalus keizanensis* (Kobayashi): Kobayashi, p. 88, pl. 5, figs. 8a, b, 9a, b.

Type.—Holotype (UMUT PM0599, Kobayashi, 1934, pl. 7, figs. 1–3) from the Tsuibon beds of the Chosen Group at Keizan-son, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Tsuibon beds of the Chosen Group in Taebaeksan (Taihakusan) area of South Korea.

Helicotoma tamurai Kobayashi

1930. *Helicotoma tamurai* Kobayashi, p. 95, pl. 11, figs. 4a, b.

Type.—Holotype (UMUT PM0081, Kobayashi, 1930, pl. 11, figs. 4a, b) from the Unkaku beds of the Chosen Group at Taisei-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Helicotoma yabei Kobayashi [Pl. 2, Figs. 5a, b]

1930. *Helicotoma yabei* Kobayashi, p. 95, pl. 11, figs. 5a–c.

Type.—Holotype (UMUT PM0080, Kobayashi, 1930, pl. 11, figs. 5a–c) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Helicotoma sp.

1934a. *Helicotoma* sp.: Kobayashi, p. 371, pl. 4, figs. 23, 24.

Age and distribution.—Middle Ordovician (Llandeilian). Chikun-san beds of the Chosen Group in Bunkei area of Kyongsang-bukto (Keisho-hoku-do), South Korea.

Genus ***Ophiletina*** Ulrich and Scofield, 1897

Ophiletina? shokoriensis Kobayashi

1930. *Ophiletina* (?) *shokoriense* Kobayashi [*sic*], p. 94, pl. 11, figs. 1a, b.

Type.—Holotype by monotypy (UMUT PM0078, Kobayashi, 1930, pl. 11, figs. 1a, b) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Ophiletina? sp.

1930. *Ophiletina* sp.: Kobayashi, p. 93, pl. 11, figs. 6a, b.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo (Heian-nan-do), North Korea.

Family EUOMPHALIDAE de Koninck, 1881

Genus ***Ecculiomphalus*** Portlock, 1843

Ecculiomphalus? kushanensis (Grabau)

1930. *Eccyliopterus kushanensis* Grabau: Kobayashi, p. 94, pl. 10, figs. 3a, b.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo (Heian-nan-do), North Korea. This species was originally described from the Machiakou Limestone of Chihli, north China.

Ecculiomphalus? sp.

1934a. *Eccyliopterus* (?) sp.: Kobayashi, p. 370.

Age and distribution.—Middle Ordovician (? Caradocian). Tsuibon beds (?) of the Chosen Group in Sanchoku area of Kangwon-do (Kogen-do), South Korea.

Genus ***Lesueurilla*** Koken, 1898

Lesueurilla minima (Kobayashi)

1934a. *Eccyliopterus minimus* Kobayashi, p. 370, pl. 4, figs. 5, 6.

Type.—Holotype by monotypy (UMUT PM0595, Kobayashi, 1934, pl. 4, figs. 5, 6) from the Tsuibon beds of the Chosen Group at Kochiri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Lesueurilla shirakii (Kobayashi) [Pl. 2, Figs. 3a, b]

1934a. *Eccyliopterus shirakii* Kobayashi, p. 369, pl. 7, figs. 4–6, 9–11.

Type.—Syntypes (UMUT PM0593, 0594, two specimens) from the Tsuibon beds of

the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Genus ***Straparollus*** de Montfort, 1810

Subgenus ***Straparollus*** de Montfort, 1810

Straparollus (Straparollus) otai Nishida

1968. *Straparollus* (*Straparollus*) *otai* Nishida, p. 234, pl. 23, figs. 3a–c, 4a, b, 5. —1970. *Straparollus otai* Nishida: Shikama, p. 212, pl. 83, fig. 1 [reproduction of an original figure].

Type.—Holotype (ASM 5025, Nishida, 1968, pl. 23, figs. 3a–c) from the *Millerella* sp. α Zone of the Akiyoshi limestone Group at the eastern slope of the Ryugoho, Akiyoshi, Shuho-cho, Mine-gun, Yamaguchi Prefecture.

Age and distribution.—Lower or Upper Carboniferous (Viséan or Namurian). Known only from the type locality.

Subgenus ***Euomphalus*** Sowerby, 1814

Straparollus (Euomphalus) uedai Murata

1967. *Phymatifer* aff. *nodocarinatus* (Wanner): Hayasaka, p. 145, text-figs. 2a–c. —1969. *Straparollus* (*Euomphalus*) *uedai* Murata, p. 14, pl. 2, figs. 5a–c, 6a–c, 7a–c. —1976b. *Straparollus* (*Euomphalus*) *uedai* Murata: Murata, pl. P-19, figs. 11a, b, 12.

Type.—Holotype (IGPS no. 91368, Murata, 1969, pl. 2, figs. 5a–c, 6a–c) from the upper part of the Toyoma Formation at Senmatsu, Fujisawa-cho, Higashiiwai-gun, Iwate Prefecture.

Age and distribution.—Upper Permian (Tartarian). Toyoma Formation in Fujisawa area of Iwate Prefecture and Toyoma area of Miyagi Prefecture.

Genus uncertain

Straparollus? shirakii Kobayashi

1931. *Straparollus shirakii* Kobayashi, p. 34, pl. 2, figs. 6a, b.

Type.—Holotype by monotypy (UMUT PM0186, Kobayashi, 1931, pl. 2, figs. 6a, b) from the Shorin beds of the Chosen Group at Keiho-ri near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Straparollus? sp.

1951. *Straparollus*? sp.: Ichikawa, p. 319, pl. 1, figs. 11a, b [no written description].

Age and distribution.—Upper? Permian (stage unknown). Katsura Formation in Sakawa area of Kochi Prefecture.

Suborder PLEUROTOMARIINA Cox and Knight, 1960
Superfamily PLEUROTOMARIACEA Swainson, 1840
Family RAPHISTOMATIDAE Koken, 1896
Subfamily OPHILETINAE Knight, 1956
Genus ***Euconia*** Ulrich, 1897

Euconia? shohakuensis (Kobayashi)

1934a. *Liospira shohakuensis* Kobayashi, p. 368, pl. 7, figs. 12, 13, 15, 16. —1958a. *Liospira shohakuensis* Kobayashi: Kobayashi, p. 89, pl. 5, figs. 2a–c.

Type.—Holotype (UMUT PM0591, Kobayashi, 1934a, pl. 7, figs. 12, 13) from the Tsuibon beds of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Euconia? taihakuensis (Kobayashi)

1934a. *Liospira taihakuensis* Kobayashi, p. 368, pl. 7, figs. 7, 8.

Type.—Holotype (UMUT PM0590, Kobayashi, 1934, pl. 7, figs. 7, 8) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type area.

Genus ***Ophileta*** Vanuxem, 1842

Ophileta alta Kobayashi

1934b. *Ophileta alta* Kobayashi, p. 533, pl. 2, figs. 4–6.

Type.—Syntypes (UMUT PM0813, 0814, two specimens) from the *Protopliomerops* zone of the Chosen Group at Makkol, *Clarkella* zone of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Lower Ordovician. Known only from the above localities.

Ophileta ichimurai (Kobayashi) [Pl. 2, Figs. 8a, b]

1931. *Raphistoma ichimurai* Kobayashi, p. 34, pl. 2, figs. 4a–c.

Type.—Holotype (UMUT PM0187, Kobayashi, 1931, pl. 2, figs. 4a–c) from the Shorin beds of the Chosen Group at Shorin-ri near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Ophileta plana Kobayashi

1934b. *Ophileta plana* Kobayashi, p. 534, pl. 2, figs. 7–10.

Type.—Syntypes (UMUT PM0815, 0816, 0817, three specimens) from the *Clarkella* zone of the Chosen Group at Saisho-ri and Makkol in Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Lower Ordovician. Known only from the above localities.

Subfamily RAPHISTOMATINAE Koken, 1896
Genus ***Scalites*** Emmons, 1842

Scalites irregularis Kobayashi [Pl. 2, Figs. 6a, b]

1958a. *Scalites irregulare* Kobayashi [*sic*], p. 87, pl. 5, figs. 7a, b.

Type.—Holotype by monotypy (UMUT PM2302, Kobayashi, 1958a, pl. 5, figs. 7a, b) from the Todon Formation of the Chosen Group at Kan on a small hill northeast of Tot'ami-ni, Kaun-myon, Mun'gyong-kun, Kyongsang-bukto (Keisho-hoku-do), South Korea.

Age and distribution.—Upper Ordovician. Known only from the type locality.

Scalites katoi (Kobayashi) [Pl. 2, Figs. 7a, b]

1934a. *Raphistoma katoi* Kobayashi, p. 373, pl. 8, figs. 4–16. —1958a. *Scalites katoi* (Kobayashi): Kobayashi, p. 87, pl. 5, figs. 4a, b.

Type.—Holotype (UMUT PM0602, Kobayashi, 1934a, pl. 8, figs. 7–9) from the Tsuibon beds of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age ane distribution.—Middle Ordovician (Caradocian). Tsuibon beds of the Chosen Group in Taebaeksan area and Todon Formation of the same group in Bunkei area, South Korea.

Genus ***Raphistoma*** Hall, 1847

Raphistoma coreanicum Kobayashi

1934a. *Raphistoma coreanicum* Kobayashi, p. 371, pl. 8, figs. 1–3, 10, 11.

Type.—Holotype (UMUT PM0598, Kobayashi, 1934a, pl. 8, figs. 10, 11) from the Tsuibon beds of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Subfamily LIOSPIRINAE Knight, 1956
Genus ***Liospira*** Ulrich and Scofield, 1897

Liospira barbouri Grabau

1930. *Liospira barbouri* Grabau: Kobayashi, p. 93.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area, Pyongan-namdo (Heian-nan-do), North Korea.

Liospira kawasakii Kobayashi

1930. *Liospira kawasakii* Kobayashi, p. 92, pl. 9, figs. 10a, b. —1931. *Liospira kawasakii* Kobayashi: Kobayashi, p. 33, pl. 1, figs. 9a–c, 10a, b.

Type.—Holotype by monotypy (UMUT PM0075, Kobayashi, 1930, pl. 9, figs. 10a, b) probably from the Toufang Group at Shih-tao-kou, Pen-hsi-hu, northeast China.

Age and distribution.—Lower to Middle Ordovician (Arenigian or Llanvirnian to Llandeilian or Caradocian). Shorin beds of the Chosen Group in Kenjiho area, North Korea. This species was originally described from the Toufang Group of northeast China.

Liospira lenticularis Kobayashi [Pl. 3, Figs. 2a, b]

1931. *Liospira lenticularis* Kobayashi, p. 33, pl. 1, fig. 11, pl. 2, figs. 5a, b, 7a, b.

Type.—Holotype (UMUT PM0184, Kobayashi, 1931, pl. 2, figs. 5a, b) from the Shorin beds of the Chosen Group at Shorin-ri near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Arenigian). Known only from the type locality.

Genus ***Angyomphalus*** Cossmann, 1916

Angyomphalus hashimotoi Shikama and Nishida

1968. *Angyomphalus hashimotoi* Shikama and Nishida, p. 214, pl. 25, figs. 1a–d, 2a–c, 3a, b, 4a–c. —1970. *Angyomphalus hashimotoi* Shikama and Nishida: Shikama, p. 212, pl. 83, fig. 2 [reproduction of an original figure].

Type.—Holotype (ASM 5015, Shikama and Nishida, 1968, pl. 25, figs. 1a–c) from the *Fusulinella biconica* Zone of the Akiyoshi limestone Group at the entrance of Shuchikujo, Akiyoshi, Isamachi, Mine City, Yamaguchi Prefecture.

Age and distribution.—Upper Carboniferous (Moscovian). Known only from the type locality.

Angyomphalus? okafujii Shikama and Nishida

1968. *Angyomphalus* (?) *okafujii* Shikama and Nishida, p. 216, pl. 25, figs. 5a–d.

Type.—Holotype (ASM 5020, Shikama and Nishida, pl. 25, figs. 5a–d) from the *Fusulinella biconica* Zone of the Akiyoshi Limestone Group at the entrance of Shuchikujo, Akiyoshi, Isa-machi, Mine City, Yamaguchi Prefecture.

Age and distribution.—Upper Carboniferous (Moscovian). Known only from the type locality.

Subfamily OMOSPIRINAE Wenz, 1938

Genus ***Sisenna*** Koken, 1896

Sisenna? japonica Kobayashi and Ichikawa

1952a. *Sisenna* (?) *japonica* Kobayashi and Ichikawa, p. 79, pl. 2, figs. 7a, b, 8, 9.

Type.—Holotype (UMUT MM5408a, Kobayashi and Ichikawa, 1952a, pl. 2, figs. 7a, b) from the Oyugo Formation(?) of the Yakuno Group at the roadside about 1.5 km WNW of Nukata, Yakuno-cho, Amada-gun, Kyoto Prefecture.

Age and distribution.—Middle Triassic (Anisian). Known only from the type locality.

Family EOTOMARIIDAE Wenz, 1938

Subfamily EOTOMARIINAE Wenz, 1938

Genus ***Eotomaria*** Ulrich and Scofield, 1897

Eotomaria concava Kobayashi [Pl. 3, Figs. 1a, b]

1930. *Eotomaria concava* Kobayashi, p. 93, pl. 10, figs. 4a, b.

Type.—Holotype (UMUT PM0076, Kobayashi, 1930, pl. 10, figs. 4a, b) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Genus ***Mourlonia*** de Koninck, 1883
Subgenus ***Mourlonia*** de Koninck, 1883

Mourlonia (Mourlonia) hayasakai Shikama and Nishida

1968. *Mourlonia* (*Mourlonia*) *hayasakai* Shikama and Nishida, p. 212, pl. 24, figs. 1a–c, 2a, b, 3, 4, 5a, b, 6a, b, text-fig. 2. —1970. *Mourlonia hayasakai* Shikama and Nishida: Shikama, p. 212, pl. 83, fig. 3 [reproduction of an original figure]. —1973. *Mourlonia* (*Mourlonia*) *hayasakai* Shikama and Nishida: Sakagami, p. 96, text-fig. 2 (1–5). —1975. *Mourlonia* (*M.*) *hayasakai* Shikama and Nishida: Ota *in* Takahashi et al., pl. 2E-2, fig. 8 [reproduction of an original figure].

Type.—Holotype (ASM 5001, Shikama and Nishida, 1968, pl. 24, figs. 1a–c) from the *Fusulinella biconica* Zone of the Akiyoshi limestone Group at 20 m west of the entrance of Shuchikujo, Isa-machi, Mine City, Yamaguchi Prefecture.

Age and distribution.—Lower to Upper Carboniferous (Viséan to Moscovian). *Millerella* sp. α Zone to *Fusulinella biconica* Zone of the Akiyoshi limestone Group in Akiyoshi area of Yamaguchi Prefecture, and a limestone of Mitsusawa in Itsukaichi area of Tokyo Prefecture.

Mourlonia sp. cf. **M. carinata** (Sowerby)

1924b. *Pleurotomaria* cfr. *carinata* Sowerby: Hayasaka, p. 58, pl. 7, figs. 13, 14 [erroneously written as "figs. 10, 11" in text and explanation of plate].

Age and distribution.—Carboniferous (stage unknown). Omi Limestone in Omi area of Niigata Prefecture.

Remarks.—This form is possibly conspecific with the preceding species, *Mourlonia* (*Mourlonia*) *hayasakai.*

Genus ***Euconospira*** Ulrich *in* Ulrich and Scofield, 1897

Euconospira nipponica Hayasaka [Pl. 3, Fig. 5]

1953. *Euconospira nipponica* Hayasaka, p. 350, pl. 20, figs. 1, 2. —1970. *Euconospira nipponica* Hayasaka: Shikama, p. 98, pl. 26, fig. 3 [reproduction of an original figure].

Type.—Holotype by monotypy (GMH, not registered, Hayasaka, 1953, pl. 20, figs. 1, 2) from the Nabeyama Limestone at Kadosawa limestone quarry, Nabeyama, Tochigi City, Tochigi Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kungurian). Known only from the type locality.

Remarks.—As described by Hayasaka (1953), this holotype reveals clear original color pattern.

Genus ***Spiroscala*** Knight, 1945

Spiroscala sp.

1969. *Spiroscala* sp.: Murata, p. 16, pl. 2, figs. 8, 9a–c. —1976b. *Spiroscala* sp.: Murata, pl. P-19, fig. 10.

Age and distribution.—Upper Permian (Tartarian). Toyoma Formation in Fujisawa area of Iwate Prefecture and Towa area of Miyagi Prefecture.

Genus ***Glabrocingulum*** Thomas, 1940
Subgenus ***Glabrocingulum*** Thomas, 1940

Glabrocingulum (Glabrocingulum) toyomense (Murata)

1969. *Mourlonia* (*Mourlonia*) *toyomensis* Murata, p. 15, pl. 2, figs. 10a, b, 11a, b, 12, 13, 14a, b, 15a, b, 16a, b, 17a, b, 18a, b, 19. —1976b. *Glabrocingulum* (*Glabrocingulum*) *toyomensis* Murata [*sic*]: Murata, pl. P-19, figs. 9a–d.

Type.—Holotype (IGPS no. 91371, Murata, 1969, pl. 2, figs. 10a, b) from the lower part of the Toyoma Formation at Kitazawa, Toyoma-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Upper Permian (Tartarian). Toyoma Formation in Toyoma, O-gachi and Karakuwa areas of Miyagi Prefecture.

Subgenus ***Ananias*** Knight, 1945

Glabrocingulum (Ananias?) shikamai Nishida

1969. *Glabrocingulum* (*Ananias*) *shikamai* Nishida, p. 86, pl. 2, figs. 2a, b, 3a, b, 4a, b, 5a, b, 6a, b.

Type.—Holotype (GS D73, Nishida, 1969, pl. 2, figs. 2a, b) from the *Neoschwagerina* zone of the Ohirayama Limestone of the Takaoka Formation at Ohirayama mine of the Tosa Limestone Co., 1 km southeast of Sakawa JNR station, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Family LOPHOSPIRIDAE Wenz, 1938
Subfamily LOPHOSPIRINAE Wenz, 1938
Genus ***Loxoplocus*** Fischer, 1885
Subgenus ***Lophospira*** Whitfield, 1886

Loxoplocus (Lophospira) acutus (Grabau) [Pl. 3, Fig. 4]

1930. *Lophospira acuta* Grabau: Kobayashi, p. 89, pl. 8, fig. 7.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo (Heian-nan-do), North Korea. This species was originally described from the Tou-fang-kou Limestone of Niu-hsin-tai area, northeast China.

Loxoplocus (Lophospira) bantatsuensis (Kobayashi)

1930. *Lophospira bantatsuense* Kobayashi [*sic*], p. 88, pl. 8, fig. 8, pl. 9, fig. 4. —1930. *Lophospira bantatsuense* Kobayashi var. [*sic*]: Kobayashi, p. 88, pl. 9, fig. 5. — compare 1958a. *Lophospira* cfr. *bantatsuensis* Kobayashi: Kobayashi, p. 88, pl. 5, fig. 3.

Type.—Holotype (UMUT PM0063, Kobayashi, 1930, pl. 8, fig. 8) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea. Although Kobayashi (1930) did not give the type designation in the explanation of plate, the measurements of the holotype in his text agree well with this illustrated specimen.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo, North Korea. Comparable specimens are known from the Todon Formation in Bunkei area of Kyonsang-bukdo (Keisho-hoku-do), South Korea.

Loxoplocus (Lophospira) endoi (Kobayashi)

1934a. *Lophospira endoi* Kobayashi, p. 366, pl. 9, figs. 1–4.

Type.—Holotype (UMUT PM0586, Kobayashi, 1934a, pl. 9, figs. 1–4) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Loxoplocus (Lophospira) gerardi (Grabau)

1930. *Lophospira gerardi* Grabau: Kobayashi, p. 90, pl. 10, fig. 6a.

Age and distribution.—Middle Ordocivian (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo (Heian-nan-do), North Korea. This species was originally described from the Tou-fang-kou Limestone in Tou-fang-kou area of northeast China.

Loxoplocus (Lophospira) kinosakii (Kobayashi)

1934a. *Lophospira kinosakii* Kobayashi, p. 367, pl. 9, figs. 27, 28.

Type.—Holotype (UMUT PM0587, Kobayashi, 1934a, pl. 9, figs. 27, 28) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Loxoplocus (Lophospira?) kodairai (Kobayashi)

1930. *Lophospira kodairai* Kobayashi, p. 89, pl. 8, fig. 10.

Type.—Holotype (UMUT PM0068, Kobayashi, 1930, pl. 8, fig. 10) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Loxoplocus (Lophospira) konnoi (Kobayashi)

1930. *Lophospira konnoi* Kobayashi, p. 88, pl. 8, figs. 12a, b.

Type.—Holotype (UMUT PM0066, Kobayashi, 1930, pl. 8, figs. 12a, b) from the Unkaku beds of the Chosen Group at Unkaku-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Loxoplocus (Lophospira?) morrisi (Grabau)

1930. *Lophospira morrisi* Grabau: Kobayashi, p. 87, pl. 9, fig. 6.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo (Heian-nan-do), North Korea. This species was originally described from the Tou-fang-kou Limestone in Tou-fang-kou and Wu-hu-tsui areas of northeast China.

Loxoplocus (Lophospira) pagoda (Salter)

1934a. *Lophospira pagoda* (Salter): Kobyashi, p. 365, pl. 9, figs. 8–21. —1934a. *Lophospira pagoda* (Salter) var.: Kobayashi, p. 366, pl. 9, figs. 22–25. —1952. *Lophospira pagoda* (Salter): Shikama, p. 82, pl. 3, figs. 10a, b [reproduction of Kobayashi's figures].

Age and distribution.—Middle Ordovician (Llandeilian). Chikunsan beds of the Chosen Group in Taebaeksan (Taihakusan) area of Kangwon-do (Kogen-do), South Korea. This species was originally described from the Himalayas.

Loxoplocus (Lophospira) subpulchellus (Kobayashi)

1930. *Lophospira subpulchella* Kobayashi, p. 90, pl. 8, fig. 9.

Type.—Holotype by monotypy (UMUT PM0070, Kobayashi, 1930, pl. 8, fig. 9) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Loxoplocus (Lophospira) tateiwai (Kobayashi) [Pl. 3, Fig. 3]

1934a. *Lophospira tateiwai* Kobayashi, p. 367, pl. 9, figs. 5–7.

Type.—Holotype (UMUT PM0588, Kobayashi, 1934, pl. 9, figs. 5–7) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taihakusan area, Kogen-do, South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Loxoplocus (Lophospira?) trochiformis (Grabau)

1930. *Lophospira trochiformis* Grabau: Kobayashi, p. 89, pl. 8, fig. 11.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo (Heian-nan-do), North Korea. This species was originally described from the Tou-fang-kou Limestone in Niu-hsin-tai area, northeast China.

Loxoplocus (Lophospira) sp. aff. **L. (L.) pagoda** (Salter)

1934a. *Lophospira* aff. *pagoda* (Salter): Kobayashi, p. 366, pl. 4, figs. 25, 26.

Age and distribution.—Middle Ordocivian (Llandeilian). Chikunsan beds of the Chosen Group in Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Loxoplocus (Lophospira?) sp.

1934a. *Lophospira* sp.: Kobayashi, p. 368, pl. 9, fig. 26.

Age and distribution.—Middle Ordovician (Llandeilian). Chikunsan beds of the Chosen Group in Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Subgenus ***Donaldiella*** Cossmann, 1903

Loxoplocus (Donaldiella) tetracarina (Kobayashi)

1930. *Pagodispira tetracarina* Kobayashi, p. 92, pl. 9, fig. 9.

Type.—Holotype (UMUT PM0074, Kobayashi, 1930, pl. 9, fig. 9) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Unkaku beds of the Chosen Group in Bantatsu area of Pyongan-namdo, North Korea, and Toufangkou limestone in Toufangkou area of northeast China.

Family PHYMATOPLEURIDAE Batten, 1956
Genus ***Eymarella*** Cossmann, 1897

Eymarella? sp.

1966. *Pleurotomaria* (*Eymarella*?) sp. (aff. *praebaucis* Krumbeck): Hayasaka, p. 27, pl. 1, figs. 1–3. —1970. *Eymarella* (?) aff. *praebaucis* Krumbeck: Shikama, p. 212, pl. 83, fig. 4 [reproduction of Hayasaka's figure]. —1976c. *Pleurotomaria* (*Eymarella*?) sp.: Murata, pl. Tr-11, figs. 8a, b, 9a–c, 10.

Age and distribution.—Middle Triassic (Ladinian). Rifu Formation in Shiogama area of Miyagi Prefecture.

Family PLEUROTOMARIIDAE Swainson, 1840
Genus ***Mellarium*** Waterhouse, 1960

Mellarium? sp.

1966. *Mellarium* n? sp. (aff. *nodulosum* Waterhouse): Hayasaka, p. 26, pl. 1, figs. 6–8. —1970. *Mellarium* (?) aff. *nodulorsum* Waterhouse [error of *nodulosum*]: Shikama, p. 212, pl. 83, fig. 5 [reproduction of Hayasaka's figure].—1976c. *Mellarium* ? sp.: Murata, pl. Tr-11, figs. 11a–c.

Age and distribution.—Middle Triassic (Ladinian). Rifu Formation in Shiogama area of Miyagi Prefecture.

Genus ***Bathrotomaria*** Cox, 1956

Bathrotomaria? yokoyamai (Hayasaka) [Pl. 3, Figs. 6, 7]

1943. *Pleurotomaria Yokoyamai* Hayasaka, p. 28, pl. 2, fig. 1, text-fig. 1.—1952. *Pleurotomaria yokoyamai* Hayasaka: Shikama, p. 180, pl. 52, fig. 2 [reproduction of original figure]. —1953. *Pleurotomaria Yokoyamai* Hysk.: Hayasaka and Hayasaka, p. 39.—1966. "*Pleurotomaria*" *yokoyamai* Hayasaka: Masutomi and Hamada, p. 71, pl. 36, fig. 4.—1970. *Pleurotomaria yokoyamai* Hayasaka: Shikama, p. 98, pl. 26, fig. 5 [reproduction of original figure].

Type.—Holotype (Taipei University, Hayasaka, 1943, pl. 2, fig. 1) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Bathrotomaria? sp.

1943. *Pleurotomaria* aff. *multicarinata* Mansuy: Hayasaka, p. 27, pl. 1, fig. 4.—1952. *Pleurotomaria* aff. *multicarinata* Mansuy: Shikama, p. 180, pl. 52, fig. 3 [reproduction of Hayasaka's figure].—1953. *Pleurotomaria* aff. *multicarinata* Mansuy: Hayasaka and Hayasaka, p. 39.—1970. *Pleurotomaria* aff. *multicarinata* Mansuy: Shikama. p. 98, pl. 26, fig. 4 [reproduction of Hayasaka's figure].

Age and distribution.—Middle Permian (Kazanian). *Neoschwagerina* zone of the Akasaka Limestone in Akasaka area of Gifu Prefecture.

Genus ***Perotrochus*** Fischer, 1885

Perotrochus fausta (Kanie and Habe)

1973. *Pleurotomaria* (s. l.) *fausta* Kanie and Habe, p. 19, pl. 2, figs. 1–5, text-fig. 2.

Type.—Holotype (NSM PM100, Kanie and Habe, pl. 2, figs. 1–5) from the Omisaki Formation of the Hakobuchi Group at Sennai near Cape Soya, Wakkanai City, Hokkaido.

Age and distribution.—Upper Cretaceous (Campanian). Known only from the type locality.

Perotrochus? sp.

1938. *Solariun*? sp.: Nagao and Otatume, p. 50, pl. 1, figs. 10, 10a.

Age and distribution.—Upper Cretaceous (Campanian or Maastrichtian). Lower part of the Hakobuchi Group in Hetonai area of Iburi Province, Hokkaido.

Family uncertain (? PLEUROTOMARIIDAE)

Pleurotomaria? sp.

1967. "*Pleurotomaria*" sp.: Yanagisawa, p. 82, pl. 3, fig. 14 [no written description].

Age and distribution.—Middle Permian. Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Pleurotomaria? sp.

1954. *Pleurotomaria* (?) sp.: Ichikawa, p. 66, pl. 7, figs. 18a–c.

Age and distribution.—Upper Triassic (Norian). "*Entomonotis* bed" in Hinode area of Tokyo Prefecture.

Superfamily TROCHONEMATACEA Zittel, 1895
Family TROCHONEMATIDAE Zittel, 1895
Genus ***Trochonema*** Salter, 1859

Trochonema ozawai Kobayashi [Pl. 3, Figs. 8a, b]

1930. *Trochonema ozawai* Kobayashi, p. 98, pl. 11, figs. 2a, b.—1930. *Trochonema ozawai* var. *depressa* Kobayashi, p. 99, pl. 11, figs. 3a, b.

Type.—Holotype (UMUT PM0090, Kobayashi, 1930, pl. 11, figs. 2a, b) from the Unkaku beds of the Chosen Group at Shoko-ri, Bantatsu-men, Koto-gun, Pyongan-namdo (Heian-nan-do), North Korea. Holotype of *T. ozawai* var. *depressa* (UMUT PM0091, Kobayashi, 1930, pl. 11, figs. 3a, b) from the same locality.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Suborder TROCHINA Cox and Knight, 1960
Superfamily PLATYCERATACEA Hall, 1859
Family HOLOPEIDAE Wenz, 1938
Genus ***Holopea*** Hall, 1847

Holopea tateiwai Kobayashi [Pl. 3, Fig. 9]

1931. *Holopea tateiwai* Kobayashi, p. 36, pl. 2, fig. 8.

Type.—Holotype (UMUT PM0191, Kobayashi, 1931, pl. 2, fig. 8) from the Shorin beds of the Chosen Group at Shorin-ri near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Family PLATYCERATIDAE Hall, 1859
Genus ***Cyclonema*** Hall, 1852

Cyclonema? sonrinensis Kobayashi

1931. *Cyclonema* (?) *sonrinensis* Kobayashi, p. 36, pl. 2, fig. 9.

Type.—**Lectotype** here designated (UMUT PM0190, Kobayashi, 1931, pl. 2, fig. 9) from the Shorin beds of the Chosen Group at Shorin-ri near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Superfamily TROCHACEA Rafinesque, 1815
Family TROCHIDAE Rafinesque, 1815
Subfamily PROCONULINAE Cox, 1960
Genus ***Trypanotrochus*** Cossmann, 1918

Trypanotrochus rikuchuensis (Nagao)

1934. *Cerithium* (*Metacerithium*) *rikuchuense* Nagao, p. 256, pl. 35, figs. 4, 5, 5a, b, 6, 6a, b, 7.—1952. *Cerithium* (*Metacerithium*) *rikuchuense* Nagao: Shikama, p. 128, pl. 26, fig. 16 [reproduction of an original figure].—1970. *Cerithium* (*Metacerithium*) *rikuchuense* Nagao: Shikama, p. 104, pl. 29, fig. 7 [reproduction of an original figure].

Type.—Holotype (GMH? missing, Nagao, 1934, pl. 35, fig. 7, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Genus ***Discotectus*** Favre, 1913

Discotectus crassus (Nagao) [Pl. 4, Figs. 1a, b]

1934. *Tectus crassus* Nagao, p. 236, pl. 39, figs. 9, 9a.—1970. *Tectus crassus* Nagao: Shikama, p. 98, pl. 26, fig. 23 [reproduction of an original figure].

Type.—Holotype by monotypy (GMH no. 6785, Nagao, 1934, pl. 39, figs. 9, 9a) from the Hiraiga Formation of the Miyako Group at the southern coast of Hiraiga inlet, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Known only from the type locality.

Subfamily MARGARITINAE Stoliczka, 1868
Genus ***Atira*** Stewart, 1926

Atira depressa (Nagao) [Pl. 4, Figs. 2a, b]

1939. *Margarites* (*Atira*) *depressus* Nagao, p. 217, pl. 20, figs. 15, 15a, b.—1970. *Margarites depressus* Nagao: Shikama, p. 98, pl. 26, fig. 13 [reproduction of an original figure].

Type.—Holotype by monotypy (GMH no. 8334, Nagao, 1939, pl. 20, figs. 15, 15a, b) from the Upper Yezo Group ("Upper ammonite bed") at Takinosawa, Toyohara-gun, south Saghalin.
Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Genus ***Margarites*** Gray, 1847

Margarites funiculatus (Yokoyama)

1890. *Margarita funiculata* Yokoyama, p. 197, pl. 20, figs. 13a–d.—1963. *Margarites funiculatus* (Yokoyama): Matsumoto, Hayami and Asano, p. 30, pl. 46, figs. 13a–d [reproduction of original figures].

Type.—Holotype by monotypy (Bayerische Staatsammlung für Palöontologie und Historische Geologie, München, Germany; Yokoyama, 1890, pl. 20, figs. 13a–d). As discussed by Matsumoto, Hayami and Asano (1963, p. 30), it probably came from the Mikasa Formation of the Middle Yezo Group near Poronai, Ishikari Province, Hokkaido.
Age and distribution.—Upper Cretaceous (Cenomanian or Turonian). Known only from the type locality.

Margarites ornatus Nagao

1939. *Margarites sachalinensis ornatus* Nagao, p. 217, pl. 20, fig. 10.

Type.—Holotype by monotypy (GMH no. 8326, Nagao, 1939, pl. 20, fig. 10) from the Upper Yezo Group ("Upper ammonite bed") at Nishiho-gawa near Kawakami colliery, Toyohara-gun, south Saghalin.
Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Margarites sachalinensis Nagao [Pl. 4, Figs. 3a, b]

1939. *Margarites sachalinensis* Nagao, p. 216, pl. 20, figs. 11, 11a, b, 12, 13, 13a.

Type.—Syntypes (GMH no. 8325, 8335, at least three specimens) from the Upper Yezo Group ("Upper ammonite bed") at Nishiho-gawa near Kawakami colliery, Toyohara-gun, south Saghalin.
Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Margarites? sp.

1972. *Margarites* (?) sp. aff. *M. sachalinensis* Nagao: Shikama and Suzuki, pl. 6, fig. 16.
Age and distribution.—Lower Cretaceous (Aptian if not Barremian). Ashikajima Formation of the Choshi Group in Choshi area of Chiba Prefecture.

Margarites? sp.

1972. *Margarites* (?) sp.: Shikama and Suzuki, pl. 6, fig. 15.
Age and distribution.—Lower Cretaceous (Aptian if not Barremian). Ashikajima Formation of the Choshi Group in Choshi area of Chiba Prefecture.

Margarites? sp.

1962. *Margarites* cfr. *inornatus* (Gabb): Saito, p. 73, pl. 2, figs. 18, 19.

Age and distribution.—Upper Cretaceous (Campanian or Maastrichtian). Nakaminato Formation in Nakaminato area of Ibaraki Prefecture.

Family ATAPHRIDAE Cossmann, 1918
Genus ***Ataphrus*** Gabb, 1869
Subgenus ***Ataphrus*** Gabb, 1869

Ataphrus (Ataphrus) yokoyamai Nagao [Pl. 4, Figs. 4a, b]

1934. *Ataphrus yokoyamai* Nagao, p. 234, pl. 35, figs. 2, 2a, 3, 3a–c.—1934. *Ataphrus kitakamiensis* Nagao, p. 235, pl. 39, figs. 7, 7a, 10, 10a–c.

Type.—Holotype (GMH no. 7088, Nagao, 1934, pl. 35, figs. 3, 3a–c, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture. **Lectotype** of *Ataphrus kitakamiensis* Nagao, 1934, here designated (GMH no. 6804, Nagao, 1934, pl. 39, figs. 7, 7a) from the same locality.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata and Miyako areas of Iwate Prefecture.

Family uncertain (? ATAPHRIDAE)

Ataphrus? tesioensis Nagao

1939. *Ataphrus tesioensis* Nagao, p. 214, pl. 20, figs. 14, 14a, b.

Type.—Holotype by monotypy (GMH no. 8290, Nagao, 1939, pl. 20, figs. 14, 14a, b) from the Upper Yezo Group ("Upper ammonite bed") at a tributary of the Abeshinai near the postal service station, Nakagawa-cho, Teshio Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Suborder NERITOPSINA Cox and Knight, 1960
Superfamily NERITACEA Rafinesque, 1815
Family NERITOPSIDAE Gray, 1847
Subfamily NATICOPSINAE Miller, 1889
Genus ***Naticopsis*** M'Coy, 1844
Subgenus ***Naticopsis*** M'Coy, 1844

Naticopsis (Naticopsis) fasciata Hayasaka

1943. *Naticopsis fasciata* Hayasaka, p. 39, pl. 4, figs. 4a, b.—1952. *Naticopsis fasciata* Hayasaka: Shikama, p. 180, pl. 52, fig. 9 [reproduction of an original figure].—1953. *Naticopsis fasciata* Hysk.: Hayasaka and Hayasaka, p. 39.—1970. *Naticopsis fasciata* Hayasaka: Shikama, p. 100, pl. 27, fig. 9 [reproduction of an original figure].

Type.—Holotype (Taipei University, Hayasaka, 1943, pl. 4, figs. 4a, b) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Naticopsis (Naticopsis) minoensis Hayasaka

1943. *Naticopsis minoensis* Hayasaka, p. 38, pl. 4, figs. 3a, b.—1952. *Naticopsis minoensis* Hayasaka: Shikama, p. 180, pl. 52, fig. 7 [reproduction of an original figure].—1953. *Naticopsis minoensis* Hysk.: Hayasaka and Hayasaka, p. 39.—1970. *Naticopsis minoensis* Hayasaka: Shikama, p. 100, pl. 27, fig. 10 [reproduction of an original figure].

Type.—Holotype (Taipei University, Hayasaka, 1943, pl. 4, figs. 3a, b) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Naticopsis (Naticopsis) wakimizui Hayasaka [Pl. 4, Figs. 5, 6]

1943. *Naticopsis Wakimizui* Hayasaka, p. 37, pl. 3, figs. 1a, b, 2, 3a, b.—1952. *Naticopsis wakimizui* Hayasaka: Shikama, p. 180, pl. 52, fig. 8 [reproduction of an original figure].—1953. *Naticopsis Wakimizui* Hysk.: Hayasaka and Hayasaka, p. 39.—1966. *Naticopsis wakimizui* Hayasaka: Masutomi and Hamada, p. 67, pl. 34, fig. 2.—1970. *Naticopsis wakimizui* Hayasaka: Shikama, p. 100, pl. 27, fig. 11 [reproduction of an original figure].

Type.—Holotype (Taipei University, Hayasaka, 1943, pl. 3, figs. 1a, b) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Naticopsis (Naticopsis) sp. cf. **N. (N.) praealta** Wanner

1943. *Naticopsis* cf. *praealta* Wanner: Hayasaka, p. 40, pl. 4, figs. 5a–c.—1952. *Naticopsis* cf. *praealta* Wanner: Shikama, p. 180, pl. 52, fig. 6 [reproduction of an original figure].—1953. *Naticopsis* cf. *praealta* Wanner: Hayasaka and Hayasaka, p. 39.—1970. *Naticopsis* cf. *peraealta* Wanner [error of *praealta*]: Shikama, p. 100, pl. 27, fig. 8 [reproduction of an original figure].

Age and distribution.—Middle Permian (Kazanian). *Neoschwagerina* zone of the Akasaka Limestone in Akasaka area of Gifu Prefecture. *Naticopsis praealta* Wanner was originally described from the Permian of Timor.

Naticopsis (Naticopsis) sp.

1925. *Naticopsis* sp. indet.: Matsushita, pl. 8, fig. 9.—1956. *Naticopsis* spp.: Yabe, p. 290, pl. 17, figs. 13 (?), 15 (non 14).—1971. *Naticopsis* (*Naticopsis*) sp.: Nakazawa, p. 128, pl. 25, figs. 6–8.

Age and distribution.—Lower Triassic (Scythian). Kurotaki Limestone in Nangoku area of Kochi Prefecture and Shionosawa Limestone in Ueno area of Gumma Prefecture.

Subgenus uncertain

Naticopsis sp.

1952b. *Naticopsis* (s. l.) sp., aff. *Natica klipsteini* Hernes: Kobayashi and Ichikawa, p. 271, pl. 10, figs. 5, 6.

Age and distribution.—Upper Triassic (Norian). Upper division of the Nariwa Group in Nariwa area of Okayama Prefecture.

Naticopsis sp.

1969. *Naticopsis* (*Naticopsis*) sp. indet.: Nishida, p. 90, pl. 3, figs. 17a–c, 18a, b, 19a, b, 20a, b, 21.

Age and distribution.—Middle Permian (Kazanian). *Neoschwagerina* zone of the Ohirayama Limestone of the Takaoka Formation in Sakawa area of Kochi Prefecture.

Naticopsis sp.

1924b. *Naticopsis* cfr. *variata* Phillips: Hayasaka, p. 60, pl. 7, fig. 12 [erroneously written as "fig. 13" in text and explanation].

Age and distribution.—Carboniferous (stage unknown). "Horizon V" of the Omi Limestone in Omi area of Niigata Prefecture.

Naticopsis sp.

1924b. *Naticopsis* indet. sp.: Hayasaka, p. 60, pl. 7, fig. 11 [erroneously written as "fig. 12" in text and explanation of plate].

Age and distribution.—Carboniferous (stage unknown). Omi Limestone in Omi area of Niigata Prefecture.

Subfamily NERITOPSINAE Gray, 1847

Genus ***Shikokuspira*** Nishida, 1969

Shikokuspira hamadai Nishida [Pl. 4, Figs. 8a, b]

1969. *Shikokuspira hamadai* Nishida, p. 88, pl. 3, figs. 1a–c, 2a–c, 3a, b, 4a, b, 5a, b, 6a, b, 7a, b, 8a, b, 9–16.

Type.—Holotype (GS D80, Nishida, 1969, pl. 3, figs. 1a–c) from the *Neoschwagerina* zone of the Ohirayama Limestone of the Takaoka Formation at Ohirayama mine of the Tosa Limestone Co., about 1 km southeast of Sakawa JNR station, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Genus ***Turbonitella*** de Koninck, 1881

Turbonitella ryugohoensis Nishida

1968. *Turbonitella ryugohoensis* Nishida, p. 236, pl. 23, figs. 10a, b.

Type.—Holotype (ASM 5030, Nishida, 1968, pl. 23, figs. 10a, b) from the *Millerella* sp. α Zone of the Akiyoshi limestone Group on the eastern slope of the Ryugoho, Akiyoshi, Shuho-cho, Mine-gun, Yamaguchi Prefecture.

Age and distribution.—Lower Carboniferous (Viséan). Known only from the type locality.

Turbonitella yanagidai Nishida

1968. *Turbonitella yanagidai* Nishida: p. 235, pl. 23, figs. 6a–c, 7a–c, 8a–c, 9a–c.

Type.—Holotype (ASM 5020, Nishida, 1968, pl. 23, figs. 6a–c) from the *Millerella* sp. α Zone of the Akiyoshi limestone Group at Uzura limestone quarry, 1200 m east of Yobara, Ofuku, Mine City, Yamaguchi Prefecture.

Age and distribution.—Lower Carboniferous (Viséan). Known only from the type locality.

Genus ***Trachydomia*** Meek and Worthen, 1866

Trachydomia sp. cf. **T. nodulosa** Worthen

1938. *Trachydomia* cfr. *nodulosum* Worthen: Hayasaka, p. 6, pl. 1, fig. 3.

Age and distribution.—Lower Permian (Sakmarian). *Fusulina* limestone of the Sakamotozawa Formation in Maiya area of Miyagi Prefecture.

Genus ***Trachyspira*** Gemmellaro, 1889

Trachyspira conica (Hayasaka) [Pl. 4, Fig. 7]

1943. *Trachydomia conica* Hayasaka, p. 43, pl. 2, figs. 4, 5.—1952. *Trachydomia conica* Hayasaka: Shikama, p. 180, pl. 52, fig. 4 [reproduction of an original figure].—1966. *Trachydomia conica* Hayasaka: Masutomi and Hamada, p. 67, pl. 34, fig. 4.—1970. *Trachydomia conica* Hayasaka: Shikama, p. 100, pl. 27, fig. 7 [reproduction of an original figure].

Type.—Holotype (Taipei University, Hayasaka, pl. 2, fig. 4) from the *Neoschwagerina* zone of Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Trachyspira magna (Hayasaka)

1938. *Trachydomia magna* Hayasaka, p. 2, pl. 1, figs. 1, 2.

Type.—Syntypes (Taipei University, two specimens) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Genus ***Neritopsis*** Grateloup, 1832

Subgenus ***Neritopsis*** Grateloup, 1832

Neritopsis (Neritopsis?) elegans Hayami [Pl. 4, Fig. 9]

1960a. *Neritopsis elegans* Hayami, p. 102, pl. 9, figs. 6a, b, 7, 8.—1970. *Neritopsis elegans* Hayami: Shikama, p. 212, pl. 83, fig. 13 [reproduction of an original figure].—1975. *Neritopsis elegans* Hayami: Takahashi and Mikami *in* Takahashi et al., pl. 3B-3, fig. 3 [reproduction of an original figure].

Type.—Holotype (UMUT MM3667, Hayami, 1960a, pl. 9, figs. 6a, b) from the *Cardinia toriyamai* bed of the Higashinagano Formation of the Toyora Group at the southeast of Higashinagano, Toyoda-cho, Toyora-gun, Yamaguchi Prefecture.

Age and distribution.—Lower Jurassic (Sinemurian). Known only from the type locality.

Neritopsis (Neritopsis) mutabilis Hayami [Pl. 4, Figs. 10a, b]

1960a. *Neritopsis mutabilis* Hayami, p. 101, pl. 9, figs. 10a–c, 11–13.—1970. *Neritopsis mutabilis* Hayami: Shikama, p. 212, pl. 83, fig. 12 [reproduction of an original figure].—1975. *Neritopsis mutabilis* Hayami: Takahashi and Mikami *in* Takahashi et al., pl. 3B-3, fig. 2 [reproduction of an original figure].

Type.—Holotype (UMUT MM3663, Hayami, 1960a, pl. 9, figs. 10a–c) from the *Cardinia toriyamai* bed of the Higashinagano Formation of the Toyora Group at the southeast of Higashinagano, Toyoda-cho, Toyora-gun, Yamaguchi Prefecture.

Age and distribution.—Lower Jurassic (Sinemurian). Known only from the type locality.

Neritopsis (Neritopsis) sp.

1968. *Neritopsis* n. sp.: Hanai, Obata and Hayami, pl. 4, fig. 3 [no written description].

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Family NERITIDAE Rafinesque, 1815
Genus ***Otostoma*** d'Archiac, 1859

Otostoma japonicum (Nagao) [Pl. 5, Figs. 1a–c]

1934. *Desmieria japonica* Nagao, p. 237, pl. 36, figs. 19, 21, 21a–d, 22, 23 (non 20, 20a, b).—
1968. *Otostoma japonicum* (Nagao): Hanai, Obata and Hayami, pl. 4, fig. 2.

Type.—Holotype (GMH no. 6763, Nagao, 1934, pl. 36, figs. 21, 21a–d, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Known only from the type area.

Remarks.—Nagao (1934) regarded a small individual (pl. 36, figs. 20, 20a, b) from Haipe near Hiraiga as "a smooth specimen referable to *Desmieria japonica*," but it certainly belongs to an unnamed species of the Neritidae.

Order uncertain (? ARCHAEOGASTROPODA)
Superfamily MURCHISONIACEA Koken, 1896
Family MURCHISONIIDAE Koken, 1896
Genus ***Murchisonia*** d'Archiac and de Verneuil, 1841

Murchisonia? sp.

1971. "*Murchisonia*" n. sp.: Murata, p. 107, pl. 13, figs. 7–10.

Age and distribution.—Lower Permian (Sakmarian). Upper part of the Sakamotozawa Formation in Sumita area of Iwate Prefecture.

Murchisonia? spp.

1966. "*Murchisonia*" sp.: Masutomi and Hamada, p. 67, pl. 34, fig. 1 [no written description].

Age and distribution.—Middle Permian (Kazanian). "Kuro zone" of the Akasaka Limestone in Akasaka area of Gifu Prefecture.

Remarks.—Four specimens illustrated by Masutomi and Hamada (1966) seem to be separable into two different species: the 1st and 3rd specimens from the left may belong to one species and the 2nd and 4th ones to another. The upper position of selenizone on the whorl is strange for *Murchisonia* and other genera of the Murchisoniidae.

Superfamily CLISOSPIRACEA Miller, 1889
Family CLISOSPIRIDAE Miller, 1889
Subfamily CLISOSPIRINAE Miller, 1889
Genus ***Clisospira*** Billings, 1865

Clisospira? chundongensis Kobayashi

1931. *Clisospira* (?) *chundongensis* Kobayashi, p. 37, pl. 1, figs. 12a, b.

Type.—Holotype by monotypy (UMUT PM0193, Kobayashi, 1931, pl. 1, figs. 12a, b) from the Shorin beds of the Chosen Group at Chundong near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Clisospira shorinensis Kobayashi

1931. *Clisospira shorinensis* Kobayashi, p. 37, pl. 2, figs. 10a–c.

Type.—Holotype (UMUT PM0192, Kobayashi, 1931, pl. 2, figs. 10a–c) from the Shorin beds of the Chosen Group at Chundong near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Superfamily CRASPEDOSTOMATACEA Wenz, 1938
Family CRASPEDOSTOMATIDAE Wenz, 1938
Genus ***Natiria*** de Koninck, 1881

Natiria? infrequens (Kobayashi and Ichikawa)

1952b. *Naticella* (?) *infrequens* Kobayashi and Ichikawa, p. 271, pl. 10, figs. 1–4

Type.—Holotype (UMUT MM5403a, Kobayashi and Ichikawa, 1952b, pl. 10, figs. 1, 2) from the upper division of the Nariwa Group at Yamamoto, Nariwa-cho, Kawakami-gun, Okayama Prefecture.

Age and distribution.—Upper Triassic (Norian). Known only from the type locality.

Natiria? japonica (Hayasaka)

1943. *Naticella japonica* Hayasaka, p. 41, pl. 4, fig. 6.—1952. *Naticella japonica* Hayasaka: Shikama, p. 180, pl. 52, fig. 10 [reproduction of original figure].—1953. *Naticella japonica* Hysk.: Hayasaka and Hayasaka, p. 39.—1970. *Naticella japonica* Hayasaka: Shikama, p. 100, pl. 27, fig. 12 [reproduction of original figure].

Type.—Holotype by monotypy (Taipei University, Hayasaka, 1943, pl. 4, fig. 6) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Natiria? sp.

1954. *Naticella* (?) sp.: Ichikawa, p. 64, pl. 7, fig. 13.

Age and distribution.—Middle or Upper Triassic (stage unknown). Arai Formation in Hinode area of Tokyo Prefecture.

Superfamily PALAEOTROCHACEA Knight, 1956
Family PARATURBINIDAE Cossmann, 1916
Genus ***Paraturbo*** Cossmann, 1907

Paraturbo kumasoana (Matsumoto) [Pl. 5, Fig. 3]

1938. *Astraea* (s. l.) *kumasoana* Matsumoto, p. 19, pl. 2, fig. 9.

Type.—**Lectotype** here designated (UMUT MM7743, Matsumoto, 1938, pl. 2, fig. 9) from the upper part of the Goshonoura Group at loc. G-125, Hokigahana, Goshonoura island, Amakusa-gun, Kumamoto Prefecture.

Age and distribution.—Upper Cretaceous (Cenomanian). Known only from the type locality.

Superfamily AMBERLEYACEA Wenz, 1938
Family PLATYACRIDAE Wenz, 1938
Genus ***Lepidotrochus*** Koken, 1894

Lepidotrochus? hataii Hayasaka [Pl. 5, Fig. 2]

1966. *Lepidotrochus* (?) *hataii* Hayasaka, p. 29, pl. 1, figs. 4, 5.—1970. *Lepidotrochus* (?) *hataii* Hayasaka: Shikama, p. 212, pl. 83, fig. 8 [reproduction of an original figure].—1976c. *Lepidotrochus*? *hataii* Hayasaka: Murata, pl. Tr-11, fig. 5.

Type.—Syntypes (IGPS no. 87303, two specimens) from the Rifu Formation at about 1 km northwest of Hamada JNR station, Shiogama City, Miyagi Prefecture.

Age and distribution.—Middle Triassic (Ladinian). Known only from the type locality.

Family NODODELPHINULIDAE Cox, 1960
Genus ***Nododelphinula*** Cossmann, 1916

Nododelphinula elegans Nagao [Pl. 5, Figs. 4a–c]

1934. *Nododelphinula elegans* Nagao, p. 232, pl. 33, figs. 1, 1a–c, 2, 2a–c, 8.—1952. *Nododelphinula elegans* Nagao: Shikama, p. 128, pl. 26, figs. 12a, b [reproduction of original figures].—1966. *Nododelphinura elegans* Nagao [typographical error of *Nododelphinula*]: Masutomi and Hamada, p. 143, pl. 72, fig. 2.—1968. "*Nododelphinula*" *elegans* Nagao: Hanai, Obata and Hayami, pl. 4, fig. 6.—1970. *Nododelphinula elegans* Nagao: Shikama, p. 100, pl. 27, figs. 6a, b [reproduction of original figures].—1972. *Nododelphinula elegans* Nagao: Hashimoto, Hayami and Noda, pl. 10, figs. 8a, b.

Type.—Holotype (GMH? missing, Nagao, 1934, pl. 33, figs. 1, 1a–c, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Haipe near Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Nododelphinula sp. aff. **N. elegans** Nagao

1972. *Nododelphinula* sp. aff. *N. elegans* Nagao: Hashimoto, Hayami and Noda, pl. 10, fig. 7 [no written description].

Age and distribution.—Lower Cretaceous (stage unknown). Gumizaki Formation in Gumizaki area of Kagoshima Prefecture.

Order CAENOGASTROPODA Cox, 1959
Suborder MESOGASTROPODA Thiele, 1925
Superfamily LOXONEMATACEA Koken, 1889
Family PSEUDOZYGOPLEURIDAE Knight, 1930
Genus ***Spiromphalus*** Hayasaka, 1939

Spiromphalus yabei Hayasaka [Pl. 5, Fig. 5]

1939. *Spiromphalus Yabei* Hayasaka, p. 22, pl. 3, figs. 1–9.—1953. *Spiromphalus Yabei* Hysk.: Hayasaka and Hayasaka, p. 39.—1960. *Spiromphalus yabei* Hayasaka: Knight et al., p. I315, fig. 208–10.

Type.—Syntypes (Taipei University?, at least four specimens) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Family COELOSTYLINIDAE Cossmann, 1909
Genus ***Coelostylina*** Kittl, 1894
Subgenus ***Coelostylina*** Kittl, 1894

Coelostylina (Coelostylina) sp. aff. **C. (C.) abbreviata** Koken

1966. *Coelostylina* (*Coelostylina*?) sp. (aff. *abbreviata* Koken): Hayasaka, p. 30, pl. 1, figs. 9, 10.

Age and distribution.—Middle Triassic (Ladinian). Rifu Formation in Shiogama area of Miyagi Prefecture.

Subgenus uncertain

Coelostylina sp.

1964. *Coelostylina* sp.: Nakazawa, p. 17, pl. 2, fig. 11.

Age and distribution.—Middle Triassic (Anisian). "*Ussurites* bed" in Uonashi area of Ehime Prefecture.

Family uncertain (? ZYGOPLEURIDAE)
Genus ***Raha*** Marwick, 1953

Raha? yabei (Hayasaka) [Pl. 5, Fig. 6]

1943. *Murchisonia Yabei* Hayasaka, p. 32, pl. 2, figs. 2, 3, pl. 4, figs. 1, 2, pl. 5, text-fig. 2.—1952. *Murchisonia yabei* Hayasaka: Shikama, p. 180, pl. 52, fig. 5 [reproduction of an original figure].—1953. *Murchisonia Yabei* Hysk.: Hayasaka and Hayasaka, p. 39.—1966. "*Murchisonia*" *yabei* Hayasaka: Masutomi and Hamada, p. 70, pl. 35, fig. 2.—1970. *Murchisonia yabei* Hayasaka: Shikama, p. 100, pl. 27, fig. 16 [reproduction of an original figure].

Type.—Syntypes (Taipei University, at least ten specimens) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Genus ***Allocosmia*** Cossmann, 1897

Allocosmia? multicostata (Hayasaka)

1943. *Solenospira multicostata* Hayasaka, p. 35, pl. 1, figs. 5a, b.—1952. *Solenospira multicostata* Hayasaka: Shikama, p. 180, pl. 52, fig. 11 [reproduction of an original figure].—1953. *Solenopsis multicostata* Hysk. [? error of *Solenospira*]: Hayasaka and Hayasaka, p. 39.—1970. *Ectomaria* (=*Solenospira*) *multicostata* Hayasaka: Shikama, p. 100, pl. 27, fig. 15 [reproduction of an original figure].

Type.—Holotype (Taipei University, Hayasaka, 1943, pl. 1, figs. 5, 6) from the *Neoschwagerina* zone of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Superfamily SUBULITACEA Lindström, 1884
Family SUBULITIDAE Lindström, 1884
Subfamily SUBULITINAE Lindström, 1884
Genus ***Subulites*** Emmons, 1842
Subgenus ***Fusispira*** Hall, 1872

Subulites (Fusispira?) sp.

1934. *Fusispira* sp.: Kobayashi, p. 373, pl. 5, fig. 7.

Age and distribution.—Middle Ordovician (Caradocian). Tsuibon beds of the Chosen Group in Taebaeksan (Taihakusan) area of Kangwon-do (Kogen-do), South Korea.

Family PSEUDOMELANIIDAE Fischer, 1885
Subfamily PSEUDOMELANIINAE Fischer, 1885
Genus ***Pseudomelania*** Pictet and Campiche, 1862
Subgenus ***Pseudomelania*** Pictet and Campiche, 1862

Pseudomelania (Pseudomelania) elegantula Nagao [Pl. 5, Figs. 7, 8]

1934. *Pseudomelania elegantula* Nagao, p. 238, pl. 37, figs. 1, 2, 2a, b, 3, 3a, 4–9, 10, 10a, b.—1952. *Pseudomelania elegantula* Nagao: Shikama, p. 128, pl. 26, fig. 18 [reproduction of an original figure].—1966. *Pseudomelania elegantula* Nagao: Masutomi and Hamada, p. 143, pl. 72, fig. 1.—1968. *Pseudomelania elegantula* Nagao: Hanai, Obata and Hayami, pl. 4, fig. 8.—1970. *Pseudomelania elegantula* Nagao: Shikama, p. 104, pl. 29, fig. 15 [reproduction of an original figure].

Type.—Syntypes (GMH nos. 7062, 7083, at least ten specimens) from the Hiraiga Formation of the Miyako Group at Hiraiga and Haipe, Tanohata-mura, at Moshi, Iwaizumi-cho, Shimohei-gun and at Hideshima, Miyako City, Iwate Prefecture, and the Aketo Formation of the same group at Aketo, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian–Albian). Hiraiga and Aketo Formations of the Miyako Group in Tanohata, Iwaizumi and Miyako areas of Iwate Prefecture.

Pseudomelania? sp.

1960. *Pseudomelania* (?) sp.: Hayami, p. 100, pl. 9, fig. 9.

Age and distribution.—Lower Jurassic (Sinemurian). Higashinagano Formation of the Toyora Group in Toyoda area of Yamaguchi Prefecture.

Pseudomelania? sp.

1974. *Pseudomelania* sp.: Hirata, p. 60, pl. 9, fig. 12 [no written description].

Age and distribution.—Lower Cretaceous (Aptian or Albian). Upper part of the Monobegawa Group in Kahoku area of Kochi Prefecture.

Subfamily TRAJANELLINAE Pcelincev, 1953
Genus ***Trajanella*** Popovici-Hatzeg, 1899

Trajanella japonica Nagao [Pl. 6, Fig. 1]

1934. *Trajanella japonica* Nagao, p. 239, pl. 39, figs. 1, 1a, 2, 4, 5, 5a, b.—1952. *Trajanella japonica* Nagao: Shikama, p. 128, pl. 26, fig. 20 [reproduction of an original figure].—1968.

Trajanella japonica Nagao: Hanai, Obata and Hayami, pl. 4, fig. 7.—1970. *Trajanella japonica* Nagao: Shikama, p. 104, pl. 29, fig. 16 [reproduction of an original figure].

Type.—Holotype (GMH no. 7077, Nagao, pl. 39, figs. 5, 5a, b, originally described as "type") from the Hiraiga Formation of the Miyako Group at Haipe near Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian–Albian). Tanohata, Hiraiga and Aketo Formations of the Miyako Group in Tanohata and Iwaizumi areas of Iwate Prefecture.

Superfamily CYCLOPHORACEA Gray, 1847
Family VIVIPARIDAE Gray, 1847
Subfamily VIVIPARINAE Gray, 1847
Genus ***Viviparus*** Montfort, 1810
Subgenus ***Sinotaia*** Haas, 1939

Viviparus? (Sinotaia?) keishoensis Suzuki

1943. *Viviparus* (*Sinotaia*?) *keishoensis* Suzuki, p. 199, pl. 14, figs. 1a, b, 2a, b, 3a, b, 4, 5, 6a, b, 7, 8a, b, 10a, b, 11, 12a, b, 13a, b, 14a, b, 15a, b, 16.

Type.—Holotype (destroyed during the 2nd World War; Suzuki, 1943, pl. 14, figs. 1a, b) from the Kinbu Formation of the Naktong Group at Butsumendo, Gyokuso-men, Kato-gun, Kyongsang-namdo (Keisho-nan-do), South Korea.

Age and distribution.—Lower Cretaceous (stage unknown). Kinbu Formation of the Naktong Group in various areas of Kyongsang-namdo and Kyongsang-bukdo, South Korea.

Family AMPULLARIIDAE Gray, 1847
Genus ***Ampullaria*** Lamarck, 1799

Ampullaria? nipponica (Kobayashi and Suzuki)

1937. *Pila* (*Turbinicola*?) *nipponica* Kobayashi and Suzuki, p. 49, pl. 5, figs. 14–17.—1952. *Pila* (*Turbinicola*?) *nipponica* Kobayashi and Suzuki: Shikama, p. 114, pl. 19, fig. 27 [reproduction of an original figure].

Type.—Holotype (UMUT MM4236, missing, Kobayashi and Suzuki, 1937, pl. 5, fig. 14) from the Tetori Group at Kurouti [=Kurouchi], Furukawa-cho, Yoshiki-gun, Gifu Prefecture.

Age and distribution.—Upper Jurassic (stage unknown). Itoshiro Subgroup of the Tetori Group in Furukawa area of Gifu Prefecture and Kuzuryu area of Fukui Prefecture.

Superfamily LITTORINACEA Gray, 1840
Family PURPURINIDAE Zittel, 1895
Genus ***Purpuroidea*** Lycett, 1848

Purpuroidea japonica Nagao [*in* Yabe]

1890. *Purpuroidea* (?) sp.: Naumann and Neumayr, p. 35, pl. 4, fig. 6.—1927. *Purpuroidea japonica* Nagao *in* Yabe, pl. 3, figs. 6a, b.—1963. *Purpuroidea* (?) *japonica* Nagao: Hayami, Matsumoto and Asano, p. 34, pl. 52, fig. 6.—1970. *Purpuroidea japonica* Nagao: Shikama, p. 104, pl. 29, fig. 14 [reproduction of Yabe's figure].

Type.—Holotype (IGPS no. 35157, missing, Yabe, 1927, pl. 3, figs. 6a, b) from the

"Ryoseki Series" (probably Kawaguchi Formation) at Hinagu, Hinagu-cho, Ashikita-gun, Kumamoto Prefecture.

Age and distribution.—Lower Cretaceous (Neocomian but precisely unknown). Known only from the type area.

Remarks.—The specific name of *Purpuroidea japonica* Nagao was first introduced by Yabe (1927) in the explanation of plate, although neither written description nor indication of Neumayr's description was given. Because the proposal was made before 1930, the specific name is regarded as available and valid in accordance with the International Code of Zoological Nomenclature.

Superfamily RISSOACEA Gray, 1847
Family HYDROBIIDAE Troschel, 1857
Subfamily HYDROBIINAE Troschel, 1857
Genus ***Hydrobia*** Hartmann, 1821

Hydrobia (Pachydrobia) gyokusoensis Suzuki

1943. *Hydrobia* (*Pachydrobia*) *gyokusoensis* Suzuki, p. 201, pl. 14, figs. 17–20.

Type.—Holotype (destroyed during the 2nd World War at the Shigenkagaku-kenkyusho; Suzuki, 1943, pl. 14, fig. 17) from the Kinbu Formation of the Naktong Group at Butumendo, Gyokuso-men, Kato-gun, Kyongsang-namdo (Keisho-nan-do), South Korea.

Age and distribution.—Lower Cretaceous (stage unknown). Known only from the type locality.

Family BITHYNIIDAE Gray, 1857
[=BULIMIDAE]
Genus ***Bulimus*** Scopoli, 1777

Bulimus? rakutoensis Suzuki

1943. *Bulimus rakutoensis* Suzuki, p. 202, pl. 14, figs. 21–23.

Type.—Holotype (destroyed during the 2nd World War at the Shigenkagaku-kenkyusho; Suzuki, 1943, pl. 14, fig. 23) from the Kinbu Formation of the Naktong Group at about 1 km northeast of Syoryu-do, Wakwan-yu, Sikkoku-gun, Kyongsang-bukdo (Keisho-hoku-do), South Korea.

Age and distribution.—Lower Cretaceous (stage unknown). Kinbu and Kasando Formations of the Naktong Group in Kyongsang-bukdo and Kyongsang-namdo, South Korea.

Family MICROMELANIIDAE Wenz, 1938
Subfamily MICROMELANIINAE Wenz, 1938
Genus ***Micromelania*** Brusina, 1874

Micromelania? katoensis Suzuki

1943. *Micromelania? katoensis* Suzuki, p. 204, pl. 14, figs. 27–30.

Type.—Holotype (destroyed during the 2nd World War at the Shigenkagaku-kenkyusho; Suzuki, 1943, pl. 14, fig. 27) from the Kinbu Formation of the Naktong Group at Butsumendo, Gyokuso-men, Kato-gun, Kyongsang-namdo (Keisho-nan-do), South Korea.

Age and distribution.—Lower Cretaceous (stage unknown). Kinbu Formation of the Naktong Group in Gyokuso area of Kyongsang-namdo and Wakwan area of Kyongsang-bukdo, South Korea.

Genus ***Itomelania*** Suzuki, 1943

Itomelania basicordata Suzuki [Pl. 6, Fig. 4]

1943. *Itomelania basicordata* Suzuki, p. 203, pl. 14, figs. 24–26, pl. 16, fig. 10.

Type.—Holotype (destroyed during the 2nd World War at the Shigenkagaku-kenkyusho; Suzuki, 1943, pl. 14, figs. 24 (right), 26 (left)) from the Shinshu Formation of the Naktong Group at 400 m north of Umatoge, Todo-men, Shinshu-gun, Kyongsang-namdo (Keisho-nan-do), South Korea. On a slab illustrated by Suzuki (1943, pl. 14, fig. 26) as the holotype are impressed three individuals. Judging from his measurements, the largest individual seems to agree with the holotype in his text (p. 203).

Age and distribution.—Lower Cretaceous (stage unknown). Known only from the type locality.

Superfamily CERITHIACEA Férussac, 1819
Family TURRITELLIDAE Woodward, 1851
Genus ***Mesalia*** Gray, 1842

Mesalia? goshorana (Matsumoto)

1938. *Turritella* (*Zaria*) *goshorana* Matsumoto, p. 20, pl. 2, fig. 6.

Type.—Holotype by monotypy (UMUT MM7742, Matsumoto, 1938, pl. 2, fig. 6) from the upper part of the Goshonoura Group at loc. G-125, Hōkigahana, Goshonoura island, Amakusa-gun, Kumamoto Prefecture.

Age and distribution.—Upper Cretaceous (Cenomanian). Known only from the type locality.

Genus ***Turritella*** Lamarck, 1799
Subgenus uncertain

Turritella soratiensis Nagao [Pl. 6, Fig. 3]

1939. *Turritella saratiensis* Nagao [typographical error of *soratiensis*], p. 222, pl. 21, figs. 6, 6a, b.

Type.—Holotype by monotypy (GMH no. 8343, Nagao, 1939, pl. 21, figs. 6, 6a, b) probably from the Mikasa Formation of the Middle Yezo Group at Tomatsu-zawa, a tributary of the Ikushumbetsu, Mikasa City, Ishikari Province, Hokkaido.

Age and distribution.—Upper Cretaceous (? Cenomanian or Turonian). Known only from the type locality.

Turritella yaegashii Nagao [Pl. 6, Fig. 2]

1934. *Turritelia Yaegashii* Nagao, p. 249, pl. 36, figs. 11, 11a.

Type.—**Lectotype** here designated (GMH no. 6802, Nagao, 1934, pl. 36, figs. 11, 11a) from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Known only from the type area.

Turritella? sp.

1938. *Turritella* sp. α: Matsumoto, p. 20, text-fig. 21.

Age and distribution.—Upper Cretaceous (Cenomanian). Middle and upper parts of the Goshonoura Group in Goshonoura island of Kumamoto Prefecture.

Turritella? sp.

1934. *Turritella* (?) sp.: Nagao, p. 250, pl. 33, figs. 6, 7.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Family MATHILDIDAE Dall, 1889

Genus ***Promathilda*** Andreae, 1887

Promathilda sp.

1960a. *Promathildia* sp. ex gr. *turritella* (Dunker) [error of *Promathilda*]: Hayami, p. 103, pl. 9, figs. 4, 5.

Age and distribution.—Lower Jurassic (Sinemurian). Higashinagano Formation of Toyora Group in Toyoda area of Yamaguchi Prefecture.

Family GLAUCONIIDAE Pcelincev, 1953

Genus ***Cassiope*** Coquand, 1862

Cassiope neumayri (Nagao) [in Yabe]

1890. *Turritella* sp.: Naumann and Neumayr, p. 35, pl. 4, fig. 5.—1927. *Glauconia neumayri* Nagao *in* Yabe, pl. 3, figs. 7a, b.—1939. *Glauconia* (?) *neumayri* (Nagao) Yabe: Kobayashi and Suzuki, p. 223, pl. 13, figs. 8–10.—1939. *Glauconia* (?) *neumayri* forma *angusta* Kobayashi and Suzuki, p. 223, pl. 13, figs. 1–7.—1952. *Glauconia neymayri* Nagao [typographical error of *neumayri*]: Shikama, p. 126, pl. 25, figs. 19a, b [reproduction of Yabe's figures].—1963. *Glauconia* (?) *neumayri* Nagao: Hayami, Matsumoto and Asano, p. 34, pl. 52, fig. 5 [reproduction of Naumann and Neumayr's figure].—compare 1966. *Craginia* sp. cf. *C. neumayri* (Nagao): Nakazawa and Murata, p. 321, pl. 6, figs. 9a–c.—1970. *Glauconia neymayri* Nagao [typographical error of *neumayri*]: Shikama, p. 100, pl. 27, figs. 19–21 [reproduction of Yabe's and Kobayashi and Suzuki's figures].—1975. *Glauconia*? *neumayri* forma *angusta* Kob. and Suz.: Takahashi et al., pl. 3B-3, fig. 9 [reproduction of Kobayashi and Suzuki's figure].

Type.—Holotype by monotypy (IGPS no. 35156, missing, Yabe, 1927, pl. 3, figs. 7a, b) from the Ryoseki Series (probably Kawaguchi Formation) at Hinagu, Hinagu-cho, Ashikita-gun, Kumamoto Prefecture. Syntypes of *Glauconia* (?) *neumayri* forma *angusta* (UMUT MM7900–7902, three specimens) from the Yoshimo Formation of the Toyonishi Group at Yoshimo, Shimonoseki City, Yamaguchi Prefecture. Syntypes of the same forma (UMUT MM7903, 7904, two specimens) from the Ryoseki Group at Takenouchi pass, southwest of Hinagu, Hinagu-cho, Ashikita-gun, Kumamoto Prefecture. Syntype of the same forma (UMUT MM7905, one specimen) from the same group at Hatato, southwest of Hinagu, Hinagu-cho, Ashikita-gun, Kumamoto Prefecture.

Age and distribution.—Lower Cretaceous (stage unknown). Kawaguchi Formation in Hinagu area of Kumamoto Prefecture, Ryoseki Group in Sakawa area of Kochi Prefecture, and Yoshimo Formation of the Toyonishi Group in Shimonoseki area of Yamaguchi

Prefecture. Comparable specimens occurred from the Kamihei Group in Omine mine area of Iwate Prefecture.

Remarks.—The specific name of *Glauconia neumayri* Nagao was first introduced by Yabe (1927) in the explanation of plate. Although neither written description nor indication of Neumayr's description was given by Yabe, the specific name is here regarded as available and valid in accordance with the International Code of Zoological Nomenclature.

Cassiope sp. aff. **C. neumayri** (Nagao)

1926. *Glauconia* sp. indet.: Yabe, Nagao and Shimizu, p. 65, pl. 13, figs. 51, 52.

Age and distribution.—Lower Cretaceous (Aptian or Albian). Sebayashi Formation (formerly called Shiroi Group) in Nakazato area of Gumma Prefecture.

Cassiope sp.

1930. *Glauconia* (?) sp. indet.: Nagao, p. 24, pl. 2, fig. 9.

Age and distribution.—Lower or Upper Cretaceous (Albian or Cenomanian). Goshonoura Group in Goshonoura island of Kumamoto Prefecture.

Cassiope? sp.

1939. *Glauconia* (*Gymnentome*) sp. indet.: Nagao, p. 223, pl. 20, fig. 9.

Age and distribution.—Upper Cretaceous (Cenomanian or Turonian). Mikasa Formation of the Middle Yezo Group in Mikasa area of Hokkaido.

Family THIARIDAE Preston, 1915

Genus ***Brotiopsis*** Suzuki, 1943

Brotiopsis kobayashii kobayashii Suzuki

1943. *Brotiopsis kobayashii* Suzuki, p. 207, pl. 17, figs. 10a, b, 11(B).—1960. *Brotiopsis kobayashii* Suzuki: Ota, p. 6, pl. 1, figs. 24–35.—1960. *Brotiopsis kobayashii kobayashii* Suzuki: Hase, p. 307, pl. 35, figs. 17–25, text-figs. 3c1, 3c2.—1969. *Brotiopsis kobayashii kobayashii* Suzuki: Nakano and Hase, pl. Cr-6, figs. 1–3.

Type.—Lectotype designated by Hase (1960, p. 307) (destroyed during the 2nd World War at the Shigenkagaku-kenkyusho; Suzuki, 1943, pl. 17, fig. 11 (B)) from the Kinbu Formation of the Naktong Group at Ryohori, Kinyo-men, Kato-gun, Kyongsang-namdo (Keisho-nan-do), South Korea.

Age and distribution.—Lower Cretaceous (stage unknown). Kinbu Formation of the Naktong Group in Kato area of Kyongsang-namdo and in Shikkoku area of Kyongsang-bukdo, South Korea. Sengoku Formation of the Kwanmon Group in Kotake area, Nyodaira Formation of the same group in Kokura-Yahata and Moji areas, and Wakamiya Formation of the same group in Kokura-Yahata and Nogata areas of Fukuoka Prefecture. Wakamiya Formation in Shimonoseki and Asa areas of Yamaguchi Prefecture.

Brotiopsis kobayashii sinsyuensis Suzuki

1943. *Brotiopsis kobayashii sinsyuensis* Suzuki, p. 208, pl. 16, figs. 11–13.—? 1960. *Brotiopsis kobayashii sinsyuensis* Suzuki: Ota, p. 6, pl. 2, figs. 1, 2.— ? 1960. *Brotiopsis kobayashii sinsyuensis* Suzuki: Hase, p. 309, pl. 35, figs. 26–31, 32a, b, 33a, b, text-figs. 3d1, 3d2.—? 1969. *Brotiopsis kobayashii sinsyuensis* Suzuki: Nakano and Hase, pl. Cr-6, figs. 4a, b, 5a, b.

Type.—Syntypes (destroyed during the 2nd World War at the Shigenkagaku-kenkyusho,

at least 30 specimens) from the Sinsyu Formation of the Naktong Group at about 0.5–1 km north of Kokusan-ri, Nado-men, at Hozantyo, at about 400 m north of Umatoge, Todo-men, at about 300 m northwest of the 134.3 m hill, Gyokuhotyo, all in Sinshu-gun, Kyongsang-namdo (Keisho-nan-do), South Korea.

Age and distribution.—Lower Cretaceous (stage unknown). Sinsyu Formation of the Naktong Group in Sinshyu area of Kyongsang-namdo. Morphologically similar specimens from the Wakamiya Formation of the Kwanmon Group in Yorino and Kokura-Yahata areas of Fukuoka Prefecture and in Asa area of Yamaguchi Prefecture.

Remarks.—The infraspecific classification of Japanese specimens of *Brotiopsis kobayashii* seems to be quite doubtful, because their subspecific distinctions have been chiefly based on morphological resemblance without considering the geographic and stratigraphic distribution.

Brotiopsis wakinoensis (Kobayashi and Suzuki) [Pl. 6, Fig. 5]

1936. *Brotia wakinoensis* Kobayashi and Suzuki, p. 256, pl. 29, figs. 14, 15.—1943. *Brotiopsis wakinoensis* (Kobayashi and Suzuki): Suzuki, p. 206, pl. 15.—1943. *Brotiopsis wakinoensis ryohoriensis* Suzuki, p. 206, pl. 17, fig. 11 (except A, B).—1952. *Brotia wakinoensis* Kobayashi and Suzuki: Shikama, p. 114, pl. 19, fig. 24 [reproduction of an original figure].—1960. *Brotiopsis wakinoensis* (Kobayashi and Suzuki): Ota, p. 2, pl. 1, figs. 1–23, text-fig. 1.—1960. *Brotiopsis wakinoensis* (Kobayashi and Suzuki): Hase, p. 305, pl. 35, figs. 7–16, text-figs. 3a1–3a4. —1970. *Brotiopsis wakinoensis* (Kobayashi and Suzuki): Shikama, p. 104, pl. 29, fig. 10 [reproduction of an original figure].

Type.—Holotype (UMUT MM7940, Kobayashi and Suzuki, 1936, pl. 29, fig. 14a) from the Naktong Group at Ryohori, Kinyo-men, Kato-gun, Kyongsang-namdo (Keisho-nan-do), South Korea. Holotype of *Brotiopsis wakinoensis ryohoriensis* (destroyed during the 2nd World War at the Shigenkagaku-kenkyusho; Suzuki, 1943, pl. 17, fig. 11 (except A, B)) from the same locality.

Age and distribution.—Lower Cretaceous (stage unknown). Naktong Group in Kato area of Kyongsang-namdo, South Korea. Sengoku Formation of the Kwanmon Group in Wakino and Kokura-Yahata areas, and Wakamiya Formation of the same group in Wakino area of Fukuoka Prefecture.

Brotiopsis sp. aff. **B. wakinoensis** (Kobayashi and Suzuki)

1960. *Brotiopsis* aff. *wakinoensis* (Kobayashi and Suzuki): Hase, p. 307, pl. 36, fig. 14, text-fig. 3b.

Age and distribution.—Lower Cretaceous (stage unknown). Sengoku Formation of the Kwanmon Group in Miyata area of Fukuoka Prefecture.

Subfamily THIARINAE Preston, 1915

Genus ***Siragimelania*** Suzuki, 1940

Siragimelania japonica (Matsumoto)

1938. *Pyrgulifera* (?) *japonica* Matsumoto, p. 21, text-fig. 23.—1940. *Thiara* (*Siragimelania*) *japonica* (Matsumoto): Suzuki, p. 227, text-figs. 17a–c.

Type.—Holotype by monotypy (UMUT MM7722, Matsumoto, 1938, text-fig. 23) from the horizon Ib of the Goshonoura Group at Aradachi, Goshonoura island, Amakusa-gun, Kumamoto Prefecture.

Age and distribution.—Lower Cretaceous (Albian). Known only from the type locality.

Siragimelania tateiwai acuticostata (Suzuki)

1940. *Thiara* (*Siragimelania*) *tateiwai acuticostata* Suzuki, p. 226, pl. 23, figs. 1–32.

Type.—Holotype (UMUT MM6355, Suzuki, 1940, pl. 2, figs. 3a–c) from the Kansenri Formation of the Siragi Group at the northwest of Kunkoku-ri, Sei-men, Keishu-gun, Kyongsang-bukdo (Keisho-hoku-do), South Korea.

Age and distribution.—Cretaceous (stage unknown, but probably lower Upper Cretaceous). Kansenri Formation of the Shiragi Group in Keishu area and Taikyu Formation of the same group in Eisen area of Kyongsang-bukdo, South Korea. Lower part of the Mifune Group in Mifune area of Kumamoto Prefecture.

Siragimelania tateiwai tateiwai (Suzuki) [Pl. 6, Figs. 6a–c]

1940. *Thiara* (*Siragimelania*) *tateiwai* Suzuki, p. 224, pl. 22, figs. 1–23, text-figs. 2–16.—1970. *Thiara* (*Siragimelania*) *tateiwai* Suzuki: Shikama, p. 104, pl. 29, figs. 13a, b [reproduction of original figures].

Type.—Holotype (UMUT MM6315, Suzuki, 1940, pl. 22, figs. 1a–c) from the middle fossil layer of the Taikyu Formation at Hyakuan-do, Hokuan-men, Eisen-gun, Kyongsang-bukdo (Keisho-hoku-do), South Korea.

Age and distribution.—Cretaceous (stage unknown). Known only from the type locality.

Siragimelania sp. cf. **S. tateiwai** (Suzuki)

1960. *Thiara* (*Siragimelania*) cf. *tateiwai* Suzuki: Hase, p. 312, pl. 36, fig. 13.

Age and distribution.—Lower Cretaceous (stage unknown). Sengoku Formation of the Kwanmon Group in Yorimo area of Fukuoka Prefecture.

Genus ***Melanoides*** Oliver, 1804

Subgenus ***Yoshimonia*** Ota, 1960

Melanoides (Yoshimonia) katukiensis Ota

1960. *Melanoides* (*Yoshimonia*) *katukiensis* Ota, p. 9, pl. 2, figs. 16, 17, text-fig. 4.—1960. *Melanoides* (*Yoshimonia*) *katukiensis* Ota: Hase, p. 310, pl. 36, figs. 7, 8, text-fig. 3g.

Type.—Holotype (GF K811, Ota, 1960, pl. 2, fig. 16) from the lower part of the Wakamiya Formation of the Kwanmon Group at about 1 km south of Hata-reservoir, Katsuki-machi, Yahata City, Fukuoka Prefecture.

Age and distribution.—Lower Cretaceous (stage unknown). Wakamiya Formation of the Kwanmon Group in Kokura-Yahata area of Fukuoka Prefecture.

Melanoides (Yoshimonia) kokurensis Hase

1960. *Melanoides* (*Yoshimonia*) *kokurensis* Hase, p. 310, pl. 36, figs. 9a, b, 10a, b, 11, 12, text-figs. 3h1. 3h2.—1970. *Melanoides* (*Yoshimonia*) *kokurensis* Hase, Shikama, p. 104, pl. 29, fig. 12 [reproduction of an original figure].

Type.—Holotype (GK H6072, Hase, 1960, pl. 36, figs. 9a, b) from the Sengoku Formation of the Kwanmon Group at about 400 m west of Shingetsu along the path from Shingetsu to Sugao, Kokura City, Fukuoka Prefecture.

Age and distribution.—Lower Cretaceous (stage unknown). Known only from the type locality.

Melanoides (Yoshimonia) yoshimoensis Ota [Pl. 6, Fig. 7]

1939. *Semisulcospira* (?) sp.: Kobayashi and Suzuki, p. 224,—1960. *Melanoides* (*Yoshimonia*) *yoshimoensis* Ota, p. 7, pl. 2, figs. 12–15, text-fig. 3.

Type.—Holotype (GF Y682 (a), Ota, 1960, pl. 2, fig. 15a) from the Yoshimo Formation of the Toyonishi Group at the coast of Yoshimo, Shimonoseki City, Yamaguchi Prefecture.

Age and distribution.—Lower Cretaceous (stage unknown). Known only from the type locality.

Melanoides (Yoshimonia) aff. **yoshimoensis** Ota

1960. *Melanoides* (*Yoshimonia*) aff. *yoshimoensis* Ota: Ota, p. 8, pl. 2, figs. 3–11.—1970. *Melanoides* (*Yoshimonia*) aff. *yoshimoensis* Ota: Shikama, p. 104, pl. 29, fig. 11 [reproduction of an original figure].

Age and distribution.—Lower Cretaceous (stage unknown). Yoshimo Formation of the Toyonishi Group in Shimonoseki area of Yamaguchi Prefecture.

Subgenus ***Kumania*** Ota, 1960

Melanoides (Kumania) kawaguchiensis Ota [Pl. 6, Fig. 8]

1960. *Melanoides* (*Kumania*) *kawaguchiensis* Ota [titled erroneously as "*Kumania kawaguchiensis*"], p. 10, pl. 2, figs. 18–24, text-fig. 5.

Type.—Holotype (GF K711a, Ota, 1960, pl. 2, fig. 18) from the upper member of the Kawaguchi Formation in Shimomatsukuma-mura, Yatsushiro-gun, Kumamoto Prefecture.

Age and distribution.—Lower Cretaceous (stage unknown). Known only from the type locality.

Subfamily uncertain (? THIARINAE)

Melanoides? minima Kobayashi and Suzuki

1937. *Melanoides vulgaris minima* Kobayashi and Suzuki, p. 51, pl. 5, figs. 18–21.—1952. *Melanoises vulgaris minima* Kobayashi and Suzuki: Shikama, p. 114, pl. 19, fig. 25 [reproduction of an original figure].

Type.—Holotype (UMUT MM7024, Kobayashi and Suzuki, pl. 5, figs. 18a, b) from the Izuki Formation of the Tetori Group at Izuki, Izumi-mura, Ono-gun, Fukui Prefecture.

Age and distribution.—Upper Jurassic and ? Lower Cretaceous (stage unknown). Izuki Formation of the Tetori Group in Izumi area of Fukui Prefecture, Numamachi Formation of the same group in Furukawa area of Gifu Prefecture, and Ushimaru Formation of the same group in Shokawa area of Gifu Prefecture.

Melanoides? vulgaris Kobayashi and Suzuki

1937. *Melanoides vulgaris* Kobayashi and Suzuki, p. 50, pl. 5, figs. 22a, b.

Type.—Holotype (UMUT MM7023, Kobayashi and Suzuki, 1937, pl. 5, figs. 22a, b) from the Izuki Formation of the Tetori Group at Izuki, Izumi-mura, Ono-gun, Fukui Prefecture.

Age and distribution.—Upper Jurassic or Lower Cretaceous (stage unknown). Known only from the type locality.

Family uncertain (? THIARIDAE)

Pachychilus? reticancellata (Kobayashi and Suzuki)

1926. *Melania cancellata* Yabe and Nagao *in* Yabe, Nagao and Shimizu, p. 66, pl. 13, figs. 43, 44 [non *Melania cancellata* Benson, 1833].—1939. *Semisulcospira reticancellata* Kobayashi and Suzuki, p. 224.

Type.—Syntypes of *Melania cancellata* Yabe and Nagao (IGPS no. 22444, several specimens) from the "Shiroi Group" at Bomeki, Ohinata-mura, Minamisaku-gun, Nagano Prefecture.

Age and distribution.—Lower Cretaceous (Neocomian). Known only from the type locality.

Family PROCERITHIIDAE Cossmann, 1905
Subfamily PROCERITHIINAE Cossmann, 1905
Genus ***Procerithium*** Cossmann, 1902

Procerithium sp.

1966. *Procerithium* sp.: Nakazawa and Murata, p. 323, pl. 6, figs. 12a, b, 13, 14.

Age and distribution.—Lower Cretaceous (probably Neocomian). Kamihei Group in Omine area near Kamaishi of Iwate Prefecture.

Subfamily PARACERITHIINAE Cossmann, 1906
Genus ***Cirsocerithium*** Cossmann, 1906

Cirsocerithium reticulatum (Nagao) [Pl. 6, Fig. 9]

1934. *Cerithium* (*Cirsocerithium*) *reticulatum* Nagao, p. 253, pl. 39, figs. 11, 11a, b.

Type.—Lectotype designated by Hanzawa, Asano and Takai (1961, p. 147) (GMH no. 6814, Nagao, 1934, pl. 39, figs. 11, 11a, b) from the Hiraiga Formation of the Miyako Group at Haipe near Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture. This specimen was regarded as "holotype" by Hanzawa, Asano and Takai, but "a few incomplete specimens" were treated in Nagao's original description.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Subfamily METACERITHIINAE Cossmann, 1906
Genus ***Bathraspira*** Cossmann, 1906

Bathraspira excavata Nagao [Pl. 6, Fig. 10]

1934. *Bathraspira excavata* Nagao, p. 258, pl. 34, figs. 5, 5a, b, 8.

Type.—Holotype (GMH no. 7080, Nagao, 1934, pl. 34, figs. 5, 5a, b, originally designated as "type") from the Hiraiga Formation ("*Orbitolina* sandstone") of the Miyako Group at the northern coast of Raga inlet, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Genus ***Metacerithium*** Cossmann, 1906

Metacerithium? sp.

1974. *Cerithium* cfr. *rikuchuensis* Nagao [*sic*]: Hirata, p. 63, pl. 7, figs. 8, 9.

Age and distribution.—Lower Cretaceous (Neocomian but precisely unknown). Lower Monobegawa Group in Monobe area of Kochi Prefecture.

Genus ***Cimolithium*** Cossmann, 1906

Cimolithium miyakoense (Nagao) [Pl. 6, Fig. 11]

1934. *Cerithium* (*Cimocerithium*?) *miyakoense* Nagao [error of *Cimolithium*], p. 254, pl. 36, figs. 1, 2, 2a, 3, 4, 4a, 5–10 [non fig. 24].—1952. *Cerithium* (*Cimocerithium*) *miyakoense* Nagao [error of *Cimolithium*]: Shikama, p. 128, pl. 26, fig. 17 [reproduction of an original figure].—1970. *Cerithium* (*Cimocerithium*) *miyakoense* Nagao [error of *Cimolithium*]: Shikama, p. 104, pl. 29, fig. 8 [reproduction of an original figure].

Type.—Holotype (GMH no. 6803, Nagao, 1934, pl. 36, fig. 1, originally designated as "type") from the Hiraiga Formation of the Miyako Group at the southern coast of Hiraiga inlet, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian–Albian). Hiraiga and Aketo Formations of the Miyako Group in Tanohata area of Iwate Prefecture.

Family POTAMIDIDAE Troschel, 1857
Subfamily POTAMIDINAE Troschel, 1857
Genus ***Potamides*** Brongniart, 1810

Potamides? sp.

1934. *Potamides*? (*Exechestoma*?) sp.: Nagao, p. 260, pl. 39, fig. 8.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Genus ***Pyrazus*** Montfort, 1810

Pyrazus? scalariformis Nagao [Pl. 6, Figs. 12a, b]

1934. *Pyrazus scalariformis* Nagao, p. 257, pl. 35, fig. 10, 10a, b, pl. 36, fig. 24.—1934. *Cerithium* (*Cimoceritkium*) *miyakoense* Nagao [error of *Pyrazus scalariformis*]: Nagao, pl. 36, fig. 24 [non pl. 36, figs. 1–10].—1968. *Cimocerithium* (?) *miyakoense* (Nagao): Hanai, Obata and Hayami, pl. 4, fig. 4.—1970. *Cerithium* (*Cimocerithium*) *miyakoense* Nagao: Shikama, p. 104, pl. 29, fig. 8 [reproduction of an original figure].

Type.—Holotype by monotypy (GMH no. 7084, Nagao, 1934, pl. 35, fig. 10, 10a, b, pl. 36, fig. 24) from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Known only from the type locality.

Remarks.—Confusion of the specific name by some of above authors evidently arose from Nagao's error in the explanation of the specimen in pl. 36, fig. 24, which is actually the holotype of this species.

Family uncertain (? CERITHIIDAE)

Cerithium? sanchuense Yabe and Nagao

1926. *Cerithium sanchuense* Yabe and Nagao *in* Yabe, Nagao and Shimizu, p. 66, pl. 14, figs. 12, 12a, 13, 13a, 14 [erroneously written as "*Cerithium ishidoense* Yabe and Nagao" in the explanation of plate for pl. 14, figs. 13, 14].

Type.—Syntypes (IGPS nos. 22487, 22545, three specimens) from the Ishido Formation at Ishido, Ohinata-mura, Minamisaku-gun, Nagano Prefecture.
Age and distribution.—Lower Cretaceous (Barremian or thereabout). Known only from the type locality.

Cerithium? isikarense Nagao

1939. *Cerithium* (s. l.) *ishikarense* Nagao, p. 224, pl. 21, fig. 4.

Type.—Holotype by monotypy (GMH? missing, Nagao, 1939, pl. 21, fig. 4) from the top of the Mikasa Formation ("*Trigonia* sandstone") or the basal part of the Upper Yezo Group ("Upper ammonite bed") at Asahi-machi, Yubari City, Ishikari Province, Hokkaido.
Age and distribution.—Upper Cretaceous (Turonian or Coniacian). Known only from the type locality.

Cerithium? sp.

1934. *Cerithium* (?) sp.: Nagao, p. 252, pl. 34, figs. 4, 4a, b.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Superfamily CALYPTRAEACEA Lamarck, 1809
Family CAPULIDAE Fleming, 1822
Genus unnamed

Remarks.—Several species of irregular patelliform gastropods commonly occur in the Cretaceous of Japan and Saghalin. "*Capulus*," "*Helcion*" or "*Brunonia*" has been used for their generic name. Recently, Kanie (1975) assigned them to the genus *Anisomyon* Meek and Hayden, 1860, and proposed a new family Anisomyonidae. We agree with him in considering that these species belong to the Calyptraeacea of Mesogastropoda, but it seems quite doubtful if *Anisomyon* actually belongs to this superfamily instead of to the Siphonariacea of Basommatophora. Although a new generic name is needed for the following species, in this catalogue they are provisionally referred to "*Capulus*."

"Capulus" annulatus Yokoyama

1890. *Capulus annulatus* Yokoyama, p. 200, pl. 25, figs. 17a, b [erroneously written as "*C. cassidarius*" in the explanation of plate].—1926. *Capulus*(?) *annulatus* Yokoyama: Yabe, Nagao and Shimizu, p. 66.—1963. *Brunonia* (?) *annulata* (Yokoyama): Matsumoto, Hayami and Asano, p. 32, pl. 51, figs. 17a, b [reproduction of original figures].—1975. *Anisomyon annulatus* (Yokoyama): Kanie, p. 27, pl. 19, figs. 3, 4a, b.

Type.—Lectotype designated by Matsumoto, Hayami and Asano (1963, p. 32) (Bayerische Staatsammlung für Paläontologie und Historische Geologie, München, Germany; Yokoyama, 1890, pl. 25, figs. 17a, b) probably from the Ishido Formation at the south of Kagahara, Nakazato-mura, Tano-gun, Gumma Prefecture.
Age and distribution.—Lower Cretaceous (Barremian or thereabout). Known only from the type area.

"Capulus" cassidarius Yokoyama

1890. *Capulus cassidarius* Yokoyama, p. 177, pl. 18, figs. 10a, b, 11a, b [non pl. 25, fig. 17].—

1963. *Brunonia* (?) *cassidaria* (Yokoyama): Matsumoto, Hayami and Asano, p. 29, pl. 44, figs. 10a, b, 11a, b [reproduction of original figures].—1975. *Anisomyon cassidarius* (Yokoyama): Kanie, p. 17, pl. 3, figs. 1, 2, 3a, b, 4a, b, 5.

Type.—Lectotype designated by Kanie (1975, p. 17) (Bayerische Staatsammlung für Paläontologie und Historische Geologie, München, Germany; Yokoyama, 1890, pl. 18, figs. 11a, b) from Urakawa, Hidaka Province, Hokkaido [horizon and locality precisely unknown].

Age and distribution.—Upper Cretaceous (Turonian–Santonian). Upper Yezo Group in Ikushumbetsu, Tappu, Yubari, Urakawa and Soya areas of Hokkaido. Uwajima Group in Uwajima area of Ehime Prefecture.

"Capulus" giganteus (Schmidt)

1873. *Helcion giganteus* Schmidt, p. 19, pl. 2, figs. 17, 18, pl. 3, figs. 1–10, pl. 8, figs. 2–5.—1894. *Helcion* cf. *giganteus* Schmidt: Jimbo, p. 41, pl. 9, fig. 5 [non figs. 4, 4a].—1927. *Helcion giganteus* Schmidt: Yabe, pl. 6, fig. 6.—1952. *Helcion giganteus* Schmidt: Shikama, p. 136, pl. 30, fig. 10 [reproduction of an original figure].—1963. *Helcion* cf. *giganteus* Schmidt: Matsumoto, p. 46, pl. 68, fig. 5 [non figs. 4, 4a] [reproduction of Jimbo's figure].—1966. *Helcion* cf. *giganteus* Schmidt: Abe, pl. 12, fig. 73-1.—1966. *Helcion gigantea* Schmidt [*sic*]: Masutomi and Hamada, p. 122, pl. 61, fig. 3.—1970. *Helcion gigantea* Schmidt [*sic*]: Shikama, p. 98, pl. 26, fig. 11 [reproduction of an original figure].—1975. *Anisomyon giganteus* (Schmidt): Kanie, p. 23, pl. 5, figs. 1a, b, 2, pl. 6, figs. 1, 2a, b, pl. 7, fig. 1, pl. 8, figs. 1a, b, pl. 9, figs. 1a, b, pl. 10, figs. 1a, b, pl. 11, figs. 1a, b, pl. 12, figs. 1a, b, pl. 13, fig. 1, pl. 14, figs. 1a, b, 2a, b, pl. 15, figs. 1a, b, 2, pl. 16, figs. 1, 2, pl. 17, fig. 1, pl. 18, fig. 1, pl. 19, fig. 5.

Type.—Lectotype designated by Kanie (1975, p. 23) (depository unknown for us; Schmidt, 1873, pl. 2, fig. 17) from Cape Dui near Alexandrovsk, north Saghalin. Kanie (1975, p. 23) designated this figure as "holotype" but this procedure is here regarded as constituting valid lectotype designation.

Age and distribution.—Upper Cretaceous (Campanian). Campanian beds in Jon Quiere area of north Saghalin. Upper part of the Upper Yezo Group in Urakawa, Nakagawa (Abeshinai), Soya, Sarufutsu and Chisaka areas of Hokkaido, Campanian beds in Dogo-Himezuka area of Ehime Prefecture and upper part of the Himenoura Group in Koshiki island of Kagoshima Prefecture. This species occurs also from the Chichina and Matanusca Formations of Alaska.

Remarks.—In the original description of this species Schmidt (1873) classified the material into four varieties, namely, var. *α depressa*, var. *β nasuta*, var. *γ retracta* and var. *δ centralis*. The shell morphology of this species is quite variable, as is known from the specimens from Hokkaido (Kanie, 1975), and none of these varieties seems to constitute an infraspecific taxon. The present species is unusually large for the Capulidae, but its symbiotic life mode is strongly suggested by the specimen (UMUT MM5535), which is actually adhered on the surface of a giant individual of *Inoceramus* (*Sphenoceramus*) *schmidti*.

"Capulus" problematicus (Nagao and Otatume)

1938. *Helcion*? *problomaticus* Nagao and Otatume [typographical error of *problematicus*], p. 51, pl. 4, figs. 1, 1a, 2.—1975. *Anisomyon problemaicus* (Nagao and Otatume) [typographical error of *problematicus*]: Kanie, p. 26, pl. 19, figs. 1, 2, pl. 20, fig. 1.

Type.—Holotype (GMH? missing, Nagao and Otatume, 1938, pl. 4, figs. 1, 1a) from the lower sandy shale of the Hakobuchi Group at Hetonai, Tomiuchi-cho, Iburi Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Maastrichtian). Hakobuchi Group in Tomiuchi area of Hokkaido and Minato shale of the Izumi Group in Awaji island of Hyogo Prefecture.

"Capulus" transformis Dundo

1894. *Helcion* cf. *giganteus* Fr. Schmidt: Jimbo, p. 41, pl. 9, figs. 4, 4a.—1963. *Helcion* cf. *giganteus* Schmidt: Matsumoto, p. 46, pl. 68, figs. 4, 4a [reproduction of Jimbo's figures].—1975. *Anisomyon transformis* Dundo: Kanie, p. 20, pl. 3, figs. 6a, b, 7a, b, 8a, b, 9a, b.

Age and distribution.—Upper Cretaceous (Campanian). Upper Yezo Group in Urakawa, Chisaka, Nakagawa (Abeshinai) and Soya areas of Hokkaido, and in Kawakami colliery and Naibuchi areas of south Saghalin. This species was originally described by Dundo (1974) from the Upper Baruikovskaya Formation in Koryak highland of Kamchatka.

Superfamily STROMBACEA Rafinesque, 1815
Family APORRHAIDAE Adams, 1858
Genus ***Drepanocheilus*** Meek, 1864

Drepanocheilus elongatodigitatus Nagao

1934. *Drepanochilus elongatodigitatus* Nagao [error of *Drepanocheilus*], p. 261, pl. 25, fig. 12, pl. 33, figs. 5, 5a.—1952. *Drepanochilus elongatodigitatus* Nagao [error of *Drepanocheilus*]: Shikama, p. 128, pl. 26, fig. 15 [reproduction of an original figure].—1970. *Drepanochilus elongatodigitatus* Nagao [error of *Drepanocheilus*]: Shikama, p. 106, pl. 30, fig. 2 [reproduction of an original figure].

Type.—**Lectotype** here designated (GMH? missing, Nagao, 1934, pl. 25, fig. 12, pl. 33, figs. 5, 5a) from the Hiraiga Formation of the Miyako Group at Haipe near Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga formation of the Miyako group in Tanohata area of Iwate Prefecture.

Genus ***Aporrhais*** da Costa, 1778
Subgenus ***Tessarolax*** Gabb, 1864

Aporrhais (Tessarolax) acutimarginatus (Nagao) [Pl. 6, Figs. 14a, b]

1932. *Tessarolax acutimarginatus* Nagao, p. 43, pl. 6, figs. 10, 10a, 15, 15a.—compare 1939. *Tessarolax* cf. *acuticalinatus* Nagao [error of *acutimarginatus*]: Nagao, p. 225, pl. 22, fig. 9.

Type.—Syntype (IGPS no. 51254) from the Upper Ammonite bed (Upper Yezo Group) at the vicinity of Kawakami colliery, Toyohara-gun, south Saghalin. Syntype (GMH no. 4555) from the Upper Yezo Group at Nigorikawa, a tributary of the Abeshinai, Teshio Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Kawakami area of south Saghalin and in Abeshinai area of Hokkaido. A comparable specimen from the top of the "*Trigonia* sandstone" or the base of the Upper Ammonite bed (upper part of the Mikasa Formation or lower part of the Upper Yezo Group) in Yubari area of Hokkaido.

Aporrhais (Tessarolax) japonicus (Yabe and Nagao) [Pl. 6, Figs. 13a, b]

1928. *Tessarolax japonicus* Yabe and Nagao, p. 94, pl. 17, figs. 9, 9a, 10, 10a, b.—1932. *Tessarolax japonicus* Yabe and Nagao: Nagao, p. 42, pl. 6, figs. 11, 11a.—1952. *Tessarolax japonica* Yabe and Nagao [*sic*]: Shikama, p. 136, pl. 30, fig. 8 [reproduction of an original figure].—1970. *Tessarolax japonica* Yabe and Nagao [*sic*]: Shikama, p. 106, pl. 30, fig. 3 [reproduction of an original figure].

Type.—Holotype (IGPS no. 22636, Yabe and Nagao, 1928, pl. 17, figs. 10, 10a, b) from the Upper Ammonite bed (Upper Yezo Group) at the upper course of the Ikushumbetsu, Sorachi-gun, Ishikari Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Ikushumbetsu, Yubari and Abeshinai areas of Hokkaido.

Subgenus ***Cuphosolenus*** Piette, 1876

Aporrhais (Cuphosolenus?) sp.

1965. *Aporrhais* (*Cuphosolenus?*) sp.: Matsumoto, Hayami and Hashimoto, p. 14, pl. 2, fig. 9.

Age and distribution.—Lower Cretaceous (Aptian). Buried Cretaceous formation in Peikan area of west Taiwan.

Genus ***Anchura*** Conrad, 1860

Subgenus ***Perissoptera*** Tate, 1865

Anchura (Perissoptera?) sp.

1939. *Dicroloma* (*Perissoptera*) sp.: Nagao, p. 225, pl. 21, fig. 2.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Abeshinai area of Hokkaido.

Genus uncertain

Anchura? sp.

1932. *Anchura* (?) sp.: Nagao, p. 45, pl. 7, figs. 4, 4a.

Age and distribution.—Upper Cretaceous (Cenomanian or Turonian). Mikasa Formation of the Middle Yezo Group in Ikushumbetsu area of Hokkaido.

Genus ***Harpagodes*** Gill, 1870

Harpagodes? sachalinensis Yabe and Nagao [Pl. 7, Fig. 1]

1925. *Harpagodes sachalinensis* Yabe and Nagao, p. 122, pl. 29, figs. 11, 11a, 11b, 12.—1970. *Harpagodes sachalinensis* Yabe and Nagao: Shikama, p. 106, pl. 30, fig. 4 [reproduction of an original figure].

Type.—Syntype (IGPS no. 8557) from the Cape de la Jonquière Group at the south of Cape Khoinji near Rogatyi, north Saghalin. Syntype (IGPS no. 8558) from the Upper Ammonite bed (Upper Yezo Group) near Kawakami colliery, Toyohara-gun, south Saghalin.

Age and distribution.—Upper Cretaceous (stage unknown but primarily Coniacian or Santonian). Cape de la Jonquière Group in Alexandrovsk area, north Saghalin and Upper Yezo Group in Kawakami area, south Saghalin.

Family COLOMBELLINIDAE Fischer, 1884
Genus ***Colombellina*** d'Orbigny, 1842
Subgenus ***Columbellaria*** Rolle, 1861

Colombellina (Columbellaria) brevisiphonata Nagao [Pl. 7, Fig. 3]

1934. *Columbellina brevisiphonata* Nagao [error of *Colombellina*], p. 260, pl. 39, figs. 6, 6a.

Type.—Lectotype designated by Hanzawa, Asano and Takai (1961, p. 150) (GMH no. 7086, Nagao, pl. 39, figs. 6, 6a) from the Hiraiga Formation of the Miyako Group at Haipe near Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture. Hanzazwa, Asano and Takai regarded this specimen as "holotype," but Nagao (1934) stated the original material was collected from the Hiraiga sandstone at two localities, "Haipe and Hiraiga." Hanzawa, Asano and Takai's treatment is here regarded as constituting valid lectotype designation.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Family STROMBIDAE Rafinesque, 1815
Genus ***Tibia*** Röding, 1798

Tibia japonica (Nagao) [Pl. 7, Fig. 4]

1932. *Rostellaria japonica* Nagao, p. 44, pl. 7, figs. 1-3, 3a, b, 5, 6.

Type.—Syntypes (GMH no. 4554, several specimens) from the Upper Ammonite bed (Upper Yezo Group) at the vicinity of Kawakami colliery, Toyohara-gun, south Saghalin and at the Omoshiro-shibetsu, a tributary of the Abeshinai in Teshio Province, Hokkaido. Syntypes (IGPS no. 22625, eleven specimens) from the *Inoceramus schmidti* Zone of the Cape de la Jonquière Group at Cape de la Jonquirère near Alexandrovsk, north Saghalin.

Age and distribution.—Upper Cretaceous (Coniacian–Campanian). Upper Yezo Group in Kawakami area of south Saghalin and Abeshinai area of Hokkaido, and Cape de la Jonquière Group in Alexandrovsk area of north Saghalin.

Genus ***Pugnellus*** Conrad, 1860
Subgenus ***Gymnarus*** Gabb, 1868

Pugnellus (Gymnarus) yabei Nagao [Pl. 7, Fig. 2]

1928. *Pugnellus* sp.: Yabe and Nagao, p. 95, pl. 17, figs. 17, 17a.—1939. *Pugnellus* (*Gymnarus*) *yabei* Nagao, p. 226, pl. 20, figs. 1–4, 5, 5a, b, 6–8.

Type.—Syntypes (GMH 6152, at least one hundred specimens) from the *Trigonia* sandstone (correlative to the Mikasa Formation of the Middle Yezo Group) at the upper course of the Tinomigawa near Urakawa.

Age and distribution.—Upper Cretaceous (Cenomanian or Turonian). Middle Yezo Group in Urakawa and Ikushumbetsu areas of Hokkaido.

Family uncertain

"Rostellaria" sp.

1962. *Rostellaria* sp. indet.: Saito, pl. 2, figs. 16, 17 [no written description].

Age and distribution.—Upper Cretaceous (Campanian). Isoai member of the Nakaminato Formation in Nakaminato area of Ibaraki Prefecture.

Superfamily NATICACEA Forbes, 1838
Family NATICIDAE Forbes, 1838
Subfamily GYRODINAE Wenz, 1941
Genus ***Gyrodes*** Conrad, 1860

Gyrodes japonicus (Nagao) [Pl. 7, Figs. 11a, b]

1934. *Vanicoroa japonica* Nagao, p. 245, p. 38, figs. 3, 3a, 4, 4a–c, 5 [non figs. 6, 6a–d].—1952. *Vanicoro japonica* Nagao: Shikama, p. 128, pl. 26, fig. 13 [reproduction of an original figure].—1970. *Vanicoro japonica* (Nagao): Shikama, p. 106, pl. 30, fig. 19 [reproduction of an original figure].

Type.—Holotype (GMH no. 7082, Nagao, 1934, pl. 38, figs. 3, 3a, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Haipe near Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Gyrodes sp.

1961. *Polinices* sp.: Saito, pl. 2, fig. 15 [no written description].

Age and distribution.—Upper Cretaceous (Coniacian). Ashizawa Formation of the Futaba Group in Futaba area of Fukushima Prefecture.

Gyrodes sp.

1957. *Gyrodes* sp.: Amano, p. 63, pl. 1, figs. 12, 13.

Age and distribution.—Upper Cretaceous (Campanian). Imuta Formation of the Himenoura Group in Shimokoshiki island of Kagoshima Prefecture.

Subfamily GLOBULARIINAE Wenz, 1941
Genus ***Pictavia*** Cossmann, 1925

Pictavia toyorana Hayami [Pl. 7, Fig. 6]

1960a. *Pictavia toyorana* Hayami, p. 104, pl. 9, figs. 1–3.

Type.—Holotype (UMUT MM3672, Hayami, 1960a, pl. 9, fig. 2) from the *Cardinia toriyamai* bed of the Higashinagano Formation of the Toyora Group at the southeast of Higashinagano, Toyoda-cho, Toyora-gun, Yamaguchi Prefecture.

Age and distribtuion.—Lower Jurassic (Sinemurian). Known only from the type locality.

Genus ***Globularia*** Swainson, 1840

Globularia? denselineata (Nagao) [Pl. 7, Fig. 5]

1939. *Natica* (*Lunatia*) *denselineata* Nagao, p. 220, pl. 20, figs. 16, 16a.

Type.—Holotype (GMH no. 8323, Nagao, 1939, pl. 20, figs. 16, 16a) from "the Upper Ammonite bed" (Upper Yezo Group) at Kawakami colliery, Toyohara-gun, south Saghalin.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Kawakami area of south Saghalin and in Abeshinai area of Hokkaido.

Genus ***Tylostoma*** Sharpe, 1849

Tylostoma? amaxense (Matsumoto)

1938. *Pterodonta amaxensis* Matsumoto, p. 20, text-fig. 20, pl. 2, fig. 3.

Type.—Holotype (UMUT MM7741, Matsumoto, 1938, pl. 2, fig. 3) from the IIIa member of the Goshonoura Group at Hokigahana, Goshonoura island, Amakusa-gun, Kumamoto Prefecture.
Age and distribution.—Upper Cretaceous (Cenomanian). Known only from the type locality.

Tylostoma miyakoense Nagao [in Yabe] [Pl. 7, Figs. 7a, b]

1927. *Tylostoma miyakoensis* Nagao [*sic*]: Yabe, pl. 5, fig. 3 [no written description].—1934. *Tylostoma miyakoensis* Nagao [*sic*]: Nagao, p. 247, pl. 34, figs. 1, 1a, 2, 2a, 3, 3a, 6, 6a, b, 7, 7a, pl. 35, figs. 1, 1a–c, pl. 39, fig. 3.—1952. *Tylostoma miyakoensis* Nagao [*sic*]: Shikama, p. 128, pl. 26, figs. 14a, b [reproduction of Nagao's figures].—1966. *Tylostoma miyakoense* Nagao: Masutomi and Hamada, p. 143, pl. 72, fig. 3.—1968. *Tylostoma miyakoense* Nagao: Hanai, Obata and Hayami, pl. 4, fig. 1 [no written description].—1970. *Tylostoma miyakoensis* Nagao [*sic*]: Shikama, p. 106, pl. 30, fig. 13 [reproduction of Nagao's figure].—compare 1974. *Tylostoma miyakoensis* Nagao [*sic*]: Hirata, p. 49, pl. 12, figs. 3, 4 [no written description].

Type.—Lectotype designated as "type" by Nagao (1934, explanation of plate 35) (IGPS no. 7129, Nagao, pl. 35, figs. 1, 1a–c) from the Hiraiga Formation of the Miyako Group at the southern coast of Hiraiga inlet, Tanohata-mura, Shimohei-gun, Iwate Prefecture.
Age and distribution.—Lower Cretaceous (Aptian). Tanohata and Hiraiga Formations of the Miyako Group in Tanohata, Iwaizumi (Moshi) and Miyako areas of Iwate Prefecture.
Remarks.—The specific name of *Tylostoma miyakoensis* Nagao was first introduced by Yabe (1927) in the explanation of plate. Although the verbal description of this species with valid lectotype designation (designated as "type") was first made by Nagao (1934), the specific name seems to be available since 1927 according the International Code of Zoological Nomenclature. The lectotype is actually a different individual from the illustrated specimen in Yabe (1927), which is here regarded as paralectotype. It is evident that the lectotype specimen was also used in his study, because the same register number was given.

Tylostoma? sanchuense (Yabe and Nagao) [Pl. 7, Fig. 8]

1926. *Natica* (*Amauropsis*) *sanchuensis* Yabe and Nagao *in* Yabe, Nagao and Shimizu, p. 64, pl. 13, figs. 31, 31a, 32, 32a, 48–50.

Type.—Holotype (IGPS no. 22508, Yabe, Nagao and Shimizu, 1926, pl. 13, figs. 31, 31a) from the "Shiroi Group" (Sebayashi Formation) at Hachimanzawa, south of Kagahara, Nakazato-mura, Tano-gun, Gumma Prefecture. Yabe, Nagao and Shimizu (1926) did not give any type indication in the explanation of plate, but this specimen seems to agree well with the holotype in their text.
Age and distribution.—Lower Cretaceous (Neocomian?, Aptian–Albian). Sebayashi Formation in Nakazato area of Gumma Prefecture and "Shiroi Group" in Ueno area of the same prefecture and in Ohinata area of Nagano Prefecture.

Subfamily POLINICINAE Gray, 1847
Genus ***Lunatia*** Gray, 1847

Lunatia alta (Nagao)

1939. *Natica* (*Lunatia*) *ainuana alta* Nagao, p. 220, pl. 21, figs. 9, 9a, 10.

Type.—Syntypes (GMH no. 8299, two specimens) from the Upper Ammonite bed (Upper Yezo Group) at Aton, Shisuka-gun, south Saghalin.
Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Lunatia? ezoana (Yabe and Nagao) [Pl. 7, Figs. 10a, b]

1928. *Natica* (*Lunatia*) *ezoana* Yabe and Nagao, p. 93, pl. 17, figs. 18, 18a.

Type.—Syntype (IGPS no. 22621, more than two specimens) from the *Trigonia* sandstone (Mikasa Formation of the Middle Yezo Group) along the Futamatanosawa near Miruto, Sorachi-gun, Ishikari Province, Hokkaido.
Age and distribution.—Upper Cretaceous (Cenomanian or Turonian). Known only from the type locality.

Lunatia importuna (Nagao) [Pl. 7, Fig. 9]

1934. *Natica importuna* Nagao, p. 244, pl. 35, figs. 8, 8a, b, 9, 9a, b, 15, 15a.

Type.—Holotype (GMH? missing, Nagao, 1934, pl. 35, fig. 8, designated as "type") from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.
Age and distribution.—Lower Cretaceous (Aptian). Known only from the type area.

Lunatia? sp.

1939. *Natica* (*Lunatia*?) sp.: Nagao, p. 221.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Toyohara and Shisuka areas of south Saghalin.

Subfamily NATICINAE Forbes, 1838
Genus ***Euspira*** Agassiz, 1838

Euspira? sp.

1957. *Euspira* sp.: Amano, p. 62, pl. 1, figs. 23–26.

Age and distribution.—Upper Cretaceous (Campanian). Imuta Formation of the Himenoura Group in Shimokoshiki-jima of Kagoshima Prefecture.

Family VANIKOROIDAE Gray, 1840
Genus ***Vanikoropsis*** Meek, 1876

Vanikoropsis ainuana (Nagao) [Pl. 7, Figs. 12a, b]

1939. *Natica* (*Lunatia*) *ainuana* Nagao, p. 219, pl. 21, figs. 11, 11a–c.—1970. *Lunatia ainuana* (Nagao): Shikama, p. 106, pl. 30, fig. 16 [reproduction of an original figure].

Type.—Holotype (GMH no. 8324, Nagao, 1939, pl. 21, figs. 11, 11a–c) from the Upper Ammonite bed (Upper Yezo Group) at Kawakami colliery, Toyohara-gun, south Saghalin.
Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Toyohara area of south Saghalin and in Abeshinai and Uryu areas of Hokkaido.

Suborder NEOGASTROPODA Wenz, 1938
Superfamily BUCCINACEA Rafinesque, 1815
Family FASCIOLARIIDAE Gray, 1853
Genus ***Serrifusus*** Meek, 1876

Serrifusus? duiensis (Schmidt)

1873. *Trachytriton duiensis* Schmidt, p. 18, pl. 4, figs. 2a–c.

Type.—Syntypes (depository unknown, more than three specimens) from Cape Dui near Alexandrovsk, north Saghalin.

Age and distribution.—Upper Cretaceous (Campanian or thereabout). Known only from the type locality.

Serrifusus? sachalinensis (Schmidt)

1873. *Trachytriton sachalinensis* Schmidt, p. 17, pl. 4, figs. 1a, b, pl. 8, fig. 1.

Type.—Syntypes (depository unknown, three specimens) from Cape Dui near Alexandrovsk, north Saghalin.

Age and distribution.—Upper Cretaceous (Campanian or thereabout). Known only from the type locality.

Serrifusus sachalinensis (Nagao) [non Schmidt, 1873] [Pl. 8, Figs. 1a, b]

1932. *Semifusus* (*Mayeria*?) *sachalinensis* Nagao, p. 47, pl. 8, figs. 8. 9, 9a, 10.—1939. *Semifusus* (*Trochofusus*) *schalinensis* Nagao [typographical error of *sachalinensis*]: Nagao, p. 229, pl. 21, figs. 1, 1a.

Type.—Syntypes (IGPS no. 51248, eight specimens) from the Upper Ammonite bed (Upper Yezo Group) at Oku-kawakami along the Suzuya, Toyohara-gun, south Saghalin. Hanzawa, Asano and Takai (1961, p. 187) introduced the term "holotype" for another specimen (GMH no. 4577) which was not illustrated by Nagao (1932), but Nagao did not designate the type specimen of this species.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Toyohara and Shisuka areas of south Saghalin.

Remarks.—This is possibly a subjective homonym of *Trachytriton sachalinensis* Schmidt, 1873, which may be referable to *Serrifusus*. But it seems desirable to examine Schmidt's type or some topotype specimens of that species, before proposing a new name for the present species.

Serrifusus tuberculatus (Nagao) [Pl. 7, Fig. 13]

1939. *Semifusus* (*Trochofusus*) *tuberculatus* Nagao, p. 230, pl. 22, figs. 1, 1a, b, 2, 2a–d, 3, 3a, 4.—1970. *Fusinus* (*Serrifusus*) *tuberculatus* (Nagao): Shikama, p. 110, pl. 32, fig. 31 [reproduction of an original figure].

Type.—Syntypes (GMH nos. 8340–8342, six specimens) from the Upper Ammonite bed (Upper Yezo Group) at Nakayama near Kawakami colliery and Oku-kawakami along the Suzuya, Toyohara-gun, south Saghalin, and at Kamihobetsu, Yufutsu-gun, Iburi Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Toyohara area of south Saghalin and Hobetsu area of Hokkaido.

Genus ***Graphidula*** Stephenson, 1941

Graphidula laevigata (Nagao) [Pl. 8, Fig. 7]

1939. *Piestochilus laevigatus* Nagao, p. 234, pl. 20, figs. 17, 17a.—1970. *Piestochilus laevigatus* Nagao: Shikama, p. 112, pl. 33, fig. 16 [reproduction of an original figure].

Type.—Holotype by monotypy (GMH no. 8345, Nagao, 1939, pl. 20, figs. 17, 17a) from the Upper Ammonite bed (Upper Yezo Group) at Kawakami, Toyohara-gun, south Saghalin.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Family uncertain (? FASCIOLARIIDAE)

Fusinus? sp.

1957. *Fusinus* sp.: Amano, p. 64, pl. 1, fig. 29.

Age and distribution.—Upper Cretaceous (Campanian). Imuta Formation of the Himenoura Group in Shimokoshiki island of Kagoshima Prefecture.

Family uncertain (? GALEODIDAE)

Genus ***Rhombopsis*** Gardner, 1916

Rhombopsis? kawakamiensis (Nagao) [Pl. 8, Figs. 2a, b]

1939. *Pyrifusus* (*Neptunella*) *kawakamiensis* Nagao, p. 232, pl. 21, figs. 7, 7a.

Type.—Holotype by monotypy (GMH no. 8346, Nagao, 1939, pl. 21, figs. 7, 7a) from the Upper Ammonite bed (Upper Yezo Group) at Kawakami, Toyohara-gun, south Saghalin.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Genus ***Pseudogaleodea*** Nagao, 1932

Pseudogaleodea tricarinata Nagao [Pl. 8, Figs. 4, 5]

1932. *Pseudogaleodea tricarinata* Nagao, p. 46, pl. 8, figs. 1, 2, 3, 3a–c, 4, 5, 6, 6a, 7.—1939. *Pseudogaleodea tricarinata* Nagao: Nagao, p. 227.—1941. *Pseudogaleodea tricarinata* Nagao: Wenz, p. 1046, fig. 2997 [reproduction of an original figure].

Type.—Syntypes (GMH no. 4591, IGPS no. 51249, eight specimens) from the Upper Ammonite bed (Upper Yezo Group) at Kawakami colliery, Toyohara-gun, south Saghalin.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Toyohara area of south Saghalin and in Urakawa area of Hokkaido.

Remarks.—The taxonomic position of *Pseudogaleodea* is not yet determined. It is possible that the present genus belongs to the Strombacea, since a small flange is produced from the lower part of the outer lip in one of the syntype specimens (Pl. 8, Fig. 5).

Family uncertain (? BUCCINIDAE)

"Fusus" volutodermoides Nagao [Pl. 8, Fig. 6]

1939. *Fusus* (s. l.) *volutodermoides* Nagao, p. 231, pl. 22, fig. 5.

Type.—Holotype by monotypy (GMH no. 8338, Nagao, 1939, pl. 22, fig. 5) from the

Upper Ammonite bed (Upper Yezo Group) at Ososhinai-zawa, a tributary of the Abeshinai, Nakagawa-cho, Teshio Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Superfamily VOLUTACEA Rafinesque, 1815
Family VASIDAE Adams and Adams, 1853
Genus ***Tudicla*** Röding, 1798
Subgenus ***Perissitys*** Stewart, 1927

Tudicla (Perissitys) sp.

1939. *Pyropsis* sp.: Nagao, p. 228, pl. 21, figs. 5, 5a, b.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Ammonite bed (Upper Yezo Group) in Abeshinai area of Hokkaido.

Subgenus uncertain

Tudicla? sp.

1957. *Tudicla* (?) sp.: Amano, p. 63, pl. 1, figs. 27, 28.

Age and distribution.—Upper Cretaceous (Campanian). Imuta Formation of the Himenoura Group in Shimokoshiki island of Kagoshima Prefecture.

Genus ***Pseudoperissitys*** Nagao and Otatume, 1938

Pseudoperissitys bicarinata Nagao and Otatume [Pl. 8, Fig. 3]

1938. *Pseudoperissitys bicarinata* Nagao and Otatume, p. 53, pl. 4, figs. 3, 3a, b, 4, 5, 5a.

Type.—Holotype (GMH no. 5981, Nagao and Otatume, 1938, pl. 4, figs. 3, 3a, b) from the Fukaushi sandstone of the Hakobuchi Group at Kiusu, Shimohobetsu, Hobetsu-cho, Iburi Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Campanian or Maastrichtian). Hakobuchi Group in Hobetsu area of Hokkaido.

Family VOLUTIDAE Rafinesque, 1815
Genus ***Volutoderma*** Gabb, 1877
Subgenus ***Rostellinda*** Dall, 1907

Volutoderma (Rostellinda) sp.

1928. *Volutoderma* (*Rostellinda*) sp.: Yabe and Nagao, p. 95, pl. 17, fig. 16.

Age and distribution.—Upper Cretaceous (Cenomanian or Turonian). Mikasa Formation of the Middle Yezo Group (?) in Horomui area of Hokkaido.

Volutoderma (Rostellinda?) sp.

1925. *Volutoderma* (*Rostellinda*) (?) sp.: Yabe and Nagao, p. 123, pl. 29, figs. 13, 13a, b.

Age and distribution.—Upper Cretaceous (stage unknown). Cape Khoi bed in Alexandrovsk area of north Saghalin.

Superfamily CONACEA Rafinesque, 1815
Family TURRIDAE Adams and Adams, 1855
Genus ***Surculites*** Conrad, 1865

Surculites? fusoides Nagao [Pl. 8, Figs. 8a, b]

1939. *Surculites fusoides* Nagao, p. 235, pl. 21, figs. 8, 8a.—1970. *Surculites fusoides* Nagao: Shikama, p. 114, pl. 34, fig. 7 [reproduction of an original figure].

Type.—Holotype by monotypy (GMH no. 8339, Nagao, 1939, pl. 21, figs. 8, 8a) from the Upper Ammonite bed (Upper Yezo Group) at the Omoshirushibetsu, a tributary of the Abeshinai, Nakagawa-cho, Teshio Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Family uncertain (? TURRIDAE)

Surcula? sp.

1926. *Surcula* sp.: Yabe, Nagao and Shimizu, p. 65, pl. 13, figs. 39–41.

Age and distribution.—Lower Cretaceous (Hauterivian or Barremian). Ishido and "Shiroi" Formations in Ohinata area of Nagano Prefecture and in Ueno area of Gumma Prefecture.

Suborder HETEROGASTROPODA
Superfamily EPITONIACEA Berry, 1910
Family EPITONIIDAE Berry, 1910
Genus ***Acirsa*** Mörch, 1857
Subgenus ***Hemiacirsa*** de Boury, 1890

Acirsa (Hemiacirsa) miyakoensis (Nagao) [Pl. 8, Fig. 11]

1934. *Scala miyakoensis* Nagao, p. 241, pl. 38, figs. 11, 12, 12a.

Type.—Holotype (IGPS no. 66428, Nagao, 1934, pl. 38, figs. 11, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Known only from the type area.

Genus ***Proscala*** Cossmann, 1912

Proscala? sp.

1939. *Epitonium*? sp.: Nagao, p. 215, pl. 21, fig. 3.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Toyohara area of south Saghalin.

Suborder uncertain (? HETEROGASTROPODA)
Superfamily uncertain (? ARCHITECTONICACEA)
Family uncertain (? ARCHITECTONICIDAE)
Genus ***Semisolarium*** Cossmann, 1915

Semisolarium incrassatum (Nagao) [Pl. 8, Figs. 9a, b]

1934. *Solarium incrassatum* Nagao, p. 242, pl. 35, figs. 11, 11a, 12, 12a, 13, 14.

Type.—Holotype (IGPS no. 66600, Nagao, 1934, pl. 35, figs. 12, 12a, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata and Miyako areas of Iwate Prefecture.

Semisolarium vistuloides (Yabe and Nagao) [Pl. 8, Figs. 10a, b]

1928. *Trochus vistuloides* Yabe and Nagao, p. 93, pl. 17, figs. 20, 20a–e, 21.

Type.—Holotype (IGPS no. 22631, Yabe and Nagao, 1928, pl. 17, figs. 20, 20a–e) from the Upper Yezo Group ("Upper Ammonite bed") at the upper course of the Ikushumbetsu, Mikasa City, Ishikari Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Ikushumbetsu and Yubari areas of Hokkaido.

Subclass OPISTHOBRANCHIA Milne Edward, 1848
Order CEPHALASPIDEA Fischer, 1883
Superfamily ACTEONACEA d'Orbigny, 1842
Family ACTEONIDAE d'Orbigny, 1842
Subfamily ACTEONINAE d'Orbigny, 1842
Genus ***Acteon*** Montfort, 1810

Acteon? sachalinensis Nagao

1939 *Actaeon sachalinensis* Nagao [*sic*], p. 236, pl. 22, figs. 6, 7, 7a, b.

Type.—Syntypes (GMH no. 8328, two specimens) from the Upper Ammonite bed (Upper Yezo Group) at the Nishihogawa near Kawakami colliery, Toyohara-gun, south Saghalin.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Known only from the type locality.

Genus ***Pirsila*** Stephenson, 1953

Pirsila sp.

1934. *Actaeon* (?) sp. [*sic*]: Nagao, p. 263, pl. 33, figs. 4, 4a.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata area of Iwate Prefecture.

Subfamily ACTEONININAE Pcelincev, 1960
Genus ***Colostracon*** Hamlin, 1884
Subgenus ***Ovactaeonina*** Cossmann, 1895

Colostracon (Ovactaeonina) yeharai (Nagao)

1934. *Actoeonina* (*Ovactaeonina*) *yeharai* Nagao [typographical error of *Actaeonina*], p. 263, pl. 33, figs. 3, 3a–c.—1970. *Colostracon* (*Ovactaeonina*) *yeharai* Nagao: Shikama, p. 116, pl. 35, fig. 1 [reproduction of an original figure].

Type.—**Lectotype** here designated (GMH? missing, Nagao, 1934, pl. 33, figs. 3, 3a–c) from the Hiraiga Formation of the Miyako Group at Matsushima islet near Moshi, Iwaizumi-cho, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Known only from the type locality.

Subfamily ACTEONELLINAE Pcelincev, 1954
Genus ***Trochactaeon*** Meek, 1863

Trochactaeon sp. aff. **T. crisimensis** Choffat

1966. *Trochactaeon* sp. aff. *T. crisimensis* Choffat: Nakazawa and Murata, p. 332, pl. 6, figs. 10, 11.

Age and distribution.—Lower Cretaceous (probably Neocomian). Kamihei Group at Omine mine area near Kamaishi, Iwate Prefecture.

Family RINGICULIDAE Meek, 1863
Genus ***Avellana*** d'Orbigny, 1842

Avellana minima Nagao [Pl. 6, Figs. 15a, b]

1934. *Avellana minima* Nagao, p. 265, pl. 36, figs. 12, 12a, b, 13–16, 17, 17a, b, 18, 18a, b.

Type.—Holotype (GMH no. 7071, Nagao, 1934, pl. 36, figs. 12, 12a, b, originally designated as "type") from the Hiraiga Formation of the Miyako Group at Haipe near Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata and Iwaizumi areas of Iwate Prefecture.

Avellana? problematica Nagao

1932. *Avellana problematica* Nagao, p. 50, pl. 7, figs. 7, 7a, b.—1939. *Avellana problematica* Nagao: Nagao, p. 237.

Type.—Holotype (GMH no. 8212, Nagao, 1932, pl. 7, figs. 7, 7a, b) from the Upper Ammonite bed (Upper Yezo Group) at the left bank of the Abeshinai, south of Shibinnai, Nakagawa-cho, Teshio Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Nakagawa (Abeshinai) and Ikushumbestu areas of Hokkaido.

Genus ***Cunulia*** Gray, 1847
Subgenus ***Oligoptycha*** Meek, 1876

Cunulia (Oligoptycha) sp. cf. **C. (O.) obliqua** (Gabb)

1939. *Oligoptycha* cf. *obliqua* (Gabb): Nagao, p. 237, pl. 22, figs. 8, 8a.

Age and distribution.—Upper Cretaceous (Coniacian or Santonian). Upper Yezo Group in Notoro area of south Saghalin.

Order ENTOMOTAENIATA Cossmann, 1896
Superfamily NERINEACEA Zittel, 1873
Family NERINEIDAE Zittel, 1873
Subfamily NERINEINAE Zittel, 1873
Genus ***Nerinea*** Defrance, 1825

Nerinea higoensis Shikama and Yui

1973. *Nerinea higoensis* Shikama and Yui, p. 23, pl. 3, figs. 1–5, text-fig. 5.

Type.—Syntypes (GIYU M-21–36, sixteen specimens) from the limestone lens in the upper part of the Sakamoto Formation of the Torinosu Group at Igomisaki, about 2 km north of Uminoura, Tanoura-cho, Ashikita-gun, and about 2 km north of Futami near Hinagu, Yatsushiro City, both in Kumamoto Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian or thereabout). Known only from the type area.

Nerinea koikensis Shikama and Yui

1973. *Nerinea koikensis* Shikama and Yui, p. 26, pl. 3, fig. 8.

Type.—Holotype (GIYU M-103, Shikama and Yui, 1973, pl. 3, fig. 8) from the Koike limestone member of the Nakanosawa Formation of the Soma Group at Koike, Kashima-machi, Soma City, Fukushima Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian). Known only from the type locality.

Nerinea naumanni Sugiyama and Asao

1942. *Nerinea* (s. str.) *naumanni* Sugiyama and Asao, p. 439, figs. 3–5.—1973. *Nerinea naumanni* Sugiyama and Asao: Shikama and Yui, p. 20, pl. 4, figs. 7, 8.

Type.—Syntype (IGPS no. 7023) from the limestone of the Torinosu Group at Torinosu, Sakawa-cho, Takaoka-gun, Kochi Prefecture. Syntype (IGPS no. 65283) from the limestone of the Torinosu Group at Hanabatake, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Upper Jurassic (Oxfordian or thereabout). Known only from the type area.

Nerinea rigida Nagao

1934. *Nerinea rigida* Nagao, p. 250, pl. 38, figs. 1, 1a, b, 2.—1952. *Nerinea rigida* Nagao: Shikama, p. 128, pl. 26, fig. 19 [reproduction of an original figure].—1968. *Nerinea rigida* Nagao: Hanai, Obata and Hayami, pl. 4, fig. 5 [no written description].—1970. *Nerinea japonica* Nagao [? error of *Nerinea rigida*]: Shikama, p. 104, pl. 29, fig. 27 [reproduction of an original figure].—1973. *Nerinea rigida* Nagao: Shikama and Yui, p. 28, pl. 4, figs. 4–6.

Type.—Holotype (GMH? missing, Nagao, 1934, pl. 38, figs. 1, 1a, b, originally designated as "type") from the Hiraiga Formation of the Miyako Group at the southern coast of Hiraiga, Tanohata-mura, Shimohei-gun, Iwate Prefecture.

Age and distribution.—Lower Cretaceous (Aptian). Known only from the type area.

Nerinea? ryofuae Tsuchi and Kagami

1967. *Nerinea ryofuae* Tsuchi and Kagami, p. 1, pl. 1.

Type.—Syntypes (G 205 001, several individuals on a boulder) from the top of Seamount Cbloeb (Erimo) at the junction of Japan and Kuril-Kamchatcha trenches.

Age and distribution.—Cretaceous (stage unknown). Known only from the type locality.

Nerinea shiidai Shikama and Yui

1973. *Nerinea shiidai* Shikama and Yui, p. 27, pl. 4, figs. 1–3.

Type.—Syntypes (GIYU M-44–49, six specimens) from the middle part of the Oshima Formation at the northern coast of Yokonuma, Oshima island, Kesennuma City, Miyagi Prefecture.

Age and distribution.—Lower Cretaceous (Hauterivian or Barremian). Known only from the type locality.

Nerinea somensis Shikama and Yui

1973. *Nerinea somensis* Shikama and Yui, p. 25, pl. 3, figs. 6, 7.

Type.—Syntypes (GIYU M-37–42, six specimens) from the Koike limestone of the Nakanosawa Formation of the Soma Group at Koike, Kashima-machi, Soma City, Fukushima Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian). Known only from the type locality.

Nerinea sugiyamai Shikama and Yui

1942. *Nerinea* (s. str.) *naumanni neumayri* Sugiyama and Asao, p. 439, figs. 1, 2 [non *Nerinea neumayri* di Stefano, 1883].—1973. *Nerinea sugiyamai* Shikama and Yui, p. 21, pl. 4, figs. 9–11.

Type.—Syntype (IGPS no. 7024) from the limestone of the Torinosu Group at Torinosu, Sakawa-cho, Takaoka-gun, Kochi Prefecture. Syntype (IGPS no. 65278) from the limestone of the Torinosu Group at Hanabatake, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Upper Jurassic (Oxfordian or thereabout). Known only from the type locality.

Nerinea sp.

1966. *Nerinea* (*Nerinea*) sp. indet.: Nakazawa and Murata, p. 320, pl. 4, figs. 8a–c.

Age and distribution.—Lower Cretaceous (probably Neocomian). Kamihei Group in Omine mine area near Kamaishi, Iwate Prefecture.

Nerinea sp.

1973. *Nerinea*? sp. indet.: Shikama and Yui, p. 29, pl. 5, fig. 1.

Age and distribution.—Upper Jurassic (Kimmeridgian or thereabout). Sakamoto Formation of the Torinosu Group in Tanoura area of Kumamoto Prefecture.

Nerinea? sp.

1930. *Nerinaea* sp. indet. [error of *Nerinea*]: Nagao, p. 23, pl. 3, figs. 1–3.

Age and distribution.—Lower or Upper Cretaceous (Albian or Cenomanian). Goshonoura Group in Shishijima island of Kagoshima Prefecture.

Nerinea? sp.

1974. *Nerinea* sp.: Hirata, p. 31, pl. 4, fig. 13.

Age and distribution.—Upper Jurassic (Oxfordian or thereabout). Torinosu Limestone of the Torinosu Group in Sakawa area of Kochi Prefecture.

Genus ***Cossmannea*** Pcelincev, 1931

Cossmannea tahoto Shikama and Yui

1973. *Cossmannea tahoto* Shikama and Yui, p. 30, pl. 6, fig. 1.

Type.—**Lectotype** here designated (GIYU M-41, Shikama and Yui, 1973, pl. 6, fig. 1) from the Koike Limestone of the Nakanosawa Fromation of the Soma Group at Koyamada, Kashima-machi, Soma City, Fukushima Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian). Known only from the type locality.

Cossmannea sp.

1973. *Cossmannea* sp. indet.: Shikama and Yui, p. 31, pl. 6, fig. 2.

Age and distribution.—Upper Jurassic (Kimmeridgian or thereabout). Sakamoto Formation of the Torinosu Group in Tanoura area of Kumamoto Prefecture.

Subfamily PTYGMATISINAE Pcelincev, 1931

Genus ***Ptygmatis*** Thurmann, 1832

Ptygmatis yabei Shikama and Yui

1973. *Ptygmatis yabei* Shikama and Yui, p. 32, pl. 7, figs. 1, 2, text-fig. 6.

Type.—Syntypes (GIYU M-62, 63, two specimens) from the limestone lens in the upper part of the Sakamoto Formation of the Torinosu Group at the east of Igomisaki, about 2 km north of Uminoura, Tanoura-cho, Ashikita-gun, Kumamoto Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian or thereabout). Known only from the type locality.

Genus ***Heteroptygmatis*** Shikama and Yui, 1973

Heteroptygmatis elegans Shikama and Yui

1973. *Heteroptygmatis elegans* Shikama and Yui, p. 37, pl. 7, figs. 9–11.

Type.—Syntypes (GIYU M-71–73, three specimens) from the Koike Limestone of the Nakanosawa Formation of the Soma Group at Koike, Kashima-machi, Soma City, Fukushima Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian). Known only from the type locality.

Subfamily CRYPTOPLOCINAE Pcelincev, 1931

Genus ***Cryptoplocus*** Pictet and Campiche, 1861

Cryptoplocus abukumensis Shikama and Yui

1973. *Cryptoplocus abukumensis* Shikama and Yui, p. 39, pl. 5, fig. 4, pl. 6, figs. 3–5.

Type.—Syntypes (GIYU M-45–58, Fourteen specimens) from the Koike limestone of the Nakanosawa Formation of the Soma Group at Koike, Koyamada and Tochikubo, Soma City, Fukushima Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian). Known only from the type area.

Cryptoplocus phalloides Shikama and Yui

1973. *Cryptoplocus phalloides* Shikama and Yui, p. 40, pl. 5, figs. 2–4, text-fig. 7.

Type.—Syntypes (GIYU M-59–61, three specimens) from the limestone lens in the upper part of the Sakamoto Formation of the Torinosu Group at the south of Igo-misaki, about 2 km north of Uminoura, Tanoura-cho, Ashikita-gun, Kumamoto Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian or thereabout). Known only from the type locality.

Subfamily ADIOZOPTYXISINAE Pcelincev, 1931
Genus ***Adiozoptyxis*** Dietrich, 1916

Adiozoptyxis hidakensis (Fukada)

1953. *Nerinea hidakensis* Fukada, p. 213, pl. 12, figs. 1–3, pl.13, figs. 1–3.—1970. *Nerinea hidakensis* Fukada: Shikama, p. 104, pl. 29, fig. 26 [reproduction of an original figure].—1973. *Diozoptyxis hidakensis* (Fukada): Shikama and Yui, p. 41, pl. 3, fig. 9.

Type.—Syntypes (GMH? missing, three specimens) from the Lower Yezo Group ("Lower Ammonite bed") at the upper course of the Soshubetsu, Shimepappu-mura, Yufutsu-gun, Hidaka Province, Hokkaido.

Age and distribution.—Lower Cretaceous (stage unknown). Known only from the type locality.

Subfamily NERINOIDINAE Pcelincev, 1931
Genus ***Bactroptyxis*** Cossmann, 1896

Bactroptyxis nobilis Shikama and Yui

1973. *Bactroptyxis nobilis* Shikama and Yui, p. 42, pl. 7, figs. 12, 13.

Type.—Syntypes (GIYU M-74, 75, two specimens) from the Koike Limestone of the Nakanosawa Formation of the Soma Group at Koike, Kashima-machi, Soma City, Fukushima Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian). Known only from the type locality.

Genus ***Nerinoides*** Wenz, 1938

Nerinoides sp.

1934. *Nerinella* sp.: Nagao, p. 251, pl. 38, figs. 8–10.

Age and distribution.—Lower Cretaceous (Aptian). Hiraiga Formation of the Miyako Group in Tanohata and Miyako areas of Iwate Prefecture.

Nerinoides? sp.

1974. *Nerinella* sp.: Hirata, p. 45, pl. 7, fig. 10.

Age and distribution.—Lower Cretaceous (upper Neocomian). Lower part of the Monobegawa Formation in Kochi area of Kochi Prefecture.

Genus uncertain

Nerineidae? gen. et sp. indet.

1938. *Cerithium* sp. aff. *C. arcotensis* Stol.: Matsumoto, p. 22, text-fig. 22.

Age and distribution.—Upper Cretaceous (Cenomanian). Horizon III of the Goshonoura Group in Goshonoura island of Kumamoto Prefecture.

Family ITIERIIDAE Cossmann, 1896
Genus ***Itieria*** Matheron, 1842

Itieria japonica Shikama and Yui

1973. *Itieria japonica* Shikama and Yui, p. 43, pl. 8, figs. 1–3, text-fig. 8.

Type.—Holotype (GIYU M-76, Shikama and Yui, 1973, pl. 8, fig. 1) from the limestone lens of the upper part of the Sakamoto Formation of the Torinosu Group at the south of Igo-misaki, about 2 km north of Uminoura, Tanoura-cho, Ashikita-gun, Kumamoto Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian or thereabout). Known only from the type locality.

Genus ***Phaneroptyxis*** Cossmann, 1896

Phaneroptyxis oshimensis Shikama and Yui

1973. *Phaneroptyxis oshimensis* Shikama and Yui, p. 45, pl. 8, figs. 4, 5.

Type.—Syntypes (GIYU M-81–85, five specimens) from the upper part of the Oshima Formation at Yokonuma, Oshima island, Kesennuma City, Miyagi Prefecture.

Age and distribution.—Lower Cretaceous (Hauterivian or Barremian). Known only from the type locality.

Phaneroptyxis sakamotoensis Shikama and Yui

1973. *Phaneroptyxis sakamotoensis* Shikama and Yui, p. 46, pl. 8, fig. 6, text-fig. 9.

Type.—Holotype by monotypy (GIYU M-86, Shikama and Yui, 1973, pl. 8, fig. 6) from a limestone lens in the upper part of the Sakamoto Formation of the Torinosu Group at the south of Igo-misaki, Uminoura, Tanoura-cho, Ashikita-gun, Kumamoto Prefecture.

Age and distribution.—Upper Jurassic (Kimmeridgian or thereabout). Known only from the type locality.

Genus ***Itruvia*** Stoliczka, 1867

Itruvia? uedai (Matsumoto)

1938. *Vernedia*(?) *uedai* Matsumoto, p. 21, text-figs. 25, 26.

Type.—**Lectotype** here designated (UMUT MM7774, Matsumoto, 1938, text-fig. 25) from the horizon III of the Goshonoura Group at Hōkigahana, Goshonoura island, Amakusa-gun, Kumamoto Prefecture.

Age and distribution.—Upper Cretaceous (Cenomanian). Known only from the type locality.

Family uncertain (? NERINEIDAE)

Genus ***Oligoptyxis*** Pcelincev, 1953

Oligoptyxis pyramidaeformis (Nagao) [Pl. 8, Fig. 12]

1930. *Cerishium pyramidaeforme* Nagao [typographical error of *Cerithium*], p. 23, pl. 3, figs. 4–8, 15.—1938. "*Cerithium*" *pyramidaeforme* Nagao: Matsumoto, p. 22, text-fig. 24.

Type.—Syntypes (IGPS nos. 44301, 44305, more than five specimens) from the Goshonoura Group at the east coast of Goshonoura island, Amakusa-gun, Kumamoto Prefecture.

Age and distribution.—Lower or Upper Cretaceous (Albian and/or Cenomanian). Known only from the type area.

Subclass PULMONATA Cuvier, 1817
Order BASOMMATOPHORA Keferstein, 1864
Superfamily SIPHONARIACEA Gray, 1840
Family SIPHONARIIDAE Gray, 1840
Genus ***Anisomyon*** Meek and Hayden, 1860

Anisomyon ezoensis Nagao and Otatume

1938. *Anisomyon ezoensis* Nagao and Otatume, p. 50, pl. 2, figs. 4, 4a, 9, 9a, b.

Type.—Holotype (GMH? missing, Nagao and Otatume, 1938, pl. 2, figs. 9, 9a, b) from the lower sandy shale of the Hakobuchi Group at Hetonai, Tomiuchi-cho, Iburi Province, Hokkaido.

Age and distribution.—Upper Cretaceous (Campanian or Maastrichtian). Known only from the type locality.

Superfamily LYMNAEACEA Broderip, 1839
Family PLANORBIDAE
Subfamily PLANORBINAE
Genus ***Gyraulus*** Carpenter, 1837

Gyraulus? sp.

1943. *Anisus* (*Gyraulus*?) sp.: Suzuki, p. 208, pl. 14, figs. 31–33.—1960. *Gyraulus* (?) n. sp. (?): Hase, p. 313, pl. 36, figs. 15–22.—1969. *Anisus* (*Gyraulus*)? sp.: Nakano and Hase, pl. Cr-6, figs. 6, 7.

Age and distribution.—Lower Cretaceous (stage unknown). Kinbu Formation of the Naktong Group in Suikoku area of Kyongsang-namdo (Keisho-nan-do), South Korea. Sengoku Formation of the Kwanmon Group in Wakino area of Fukuoka Prefecture, and Wakamiya Formation of the same group in Takibe area of Yamaguchi Prefecture.

UNIDENTIFIED GASTROPODA

Gastropod, genus and species indet.

1963. Gastropod, gen. et sp. indet.: Kambe, p. 53, pl. 6, figs. 7–11.

Age and distrobution.—Lower Triassic (Scythian). Kamura Formation in Takachiho area of Miyazaki Prefecture.

Gastropod, genus and species indet.

1969. Unidentified gastropods: Takahashi, pl. 12, figs. 4, 5 [no written description].

Age and distribution.—Middle Jurassic (Bajocian or thereabout). Samuraihama Formation of the Ojika Group in Ojika area of Miyagi Prefecture.

Class uncertain (? GASTROPODA)
Superfamily PELAGIELLACEA Knight, 1956
Family PELAGIELLIDAE Knight, 1956
Genus ***Pelagiella*** Matthew, 1895

Pelagiella hana Kobayashi

1935. *Pelagiella hana* Kobayashi, p. 72, pl. 2, figs. 15–18.

Type.—Holotype (UMUT PM0942, Kobayashi, pl. 2, figs. 15, 16) from the *Chuangia* zone of the Kasetsu Formation of the Chosen Group at Kasetsuji, Taebaeksan (Taihaku-san) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Upper Cambrian (Chaumitian). Known only from the type locality.

PALEOZOIC FOSSILS FORMERLY REGARDED AS GASTROPODA

Class MONOPLACOPHORA Wenz *in* Knight, 1952
Order TRYBLIDIOIDA Lemche, 1957
Superfamily TRYBLIDIACEA Pilsbry *in* Zittel-Eastman, 1899
Family TRYBLIDIIDAE Pilsbry *in* Zittel-Eastman, 1899
Subfamily PROPLININAE Knight and Yochelson, 1958
Genus ***Proplina*** Kobayashi, 1933

Proplina antiqua Kobayashi

1962. *Propilina antiqua* Kobayashi [error of *Proplina*], p. 15, pl. 2, figs. 20a, b, 21a, b.

Type.—Holotype (UMUT PM3990, Kobayashi, 1962, pl. 2, figs. 21a, b) from the *Eochuangia* zone of the Chosen Group at 1.25 km west of Kok-kol, Puk-myon, NNE of Chung-san, South Korea.

Age and distribution.—Middle Cambrian. Known only from the type locality.

Family PALAEACMAEIDAE Grabau and Shimer, 1909
Genus ***Scenella*** Billings, 1872

Scenella clotho Walcott

1936. *Scenella clotho* Walcott: Saito, p. 359, pl. 3, figs. 18, 19.

Age and distribution.—Lower Cambrian. Upper *Redlichia* shales of the Chosen Group in Chungwa area of Pyongan-namdo (Heian-nan-do), North Korea. This species was known also from the Middle Cambrian of Shan-tung, north China.

Genus ***Palaeacmaea*** Hall and Whitfield, 1872

Palaeacmaea hampakuensis Kobayashi

1934. *Palaeacmaea hampakuensis* Kobayashi, p. 359, pl. 4, figs. 1–4, pl. 5, figs. 10–12.

Type.—Holotype (UMUT PM0566, Kobayashi, 1934, pl. 4, figs. 3, 4) from the Tsuibon beds of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type area.

Palaeacmaea sohsanensis Kobayashi

1934. *Palaeacmaea sohsanensis* Kobayashi, p. 359, pl. 5, figs. 5, 6.

Type.—Holotype (UMUT PM0569, Kobayashi, 1934, pl. 5, figs. 5, 6) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian or Caradocian). Known only from the type locality.

Palaeacmaea? sp.

1960. *Palaeacmaea* (?) sp.: Kobayashi, p. 229, pl. 14, fig. 4.

Age and distribution.—Lower Ordovician. *Clarkella* zone of the Chosen Group in Neietsu area of Kangwon-do (Kogen-do), South Korea.

Phylum uncertain
Class HYOLITHA Marek, 1963
Family HYOLITHIDAE Nicholson, 1872
Genus ***Hyolithes*** Eichwald, 1840

Hyolithes cybele Walcott

1962. *Hyolithes cybele* Walcott: Kobayashi, p. 18, pl. 3, fig. 5.

Age and distribution.—Middle Cambrian. *Eochuangia* zone of the Chosen Group in Taebaeksan (Taihakusan) area of Kangwon-do (Kogen-do), South Korea. This species was originally described from the Mapanian and Taitzuan Formations of Shantung and Liaotung, China.

Hyolithes globiger Saito

1936. *Hyolithus globiger* Saito [*sic*], p. 361, pl. 3, figs. 13–17.

Type.—Holotype (UMUT PM1482, Saito, 1936, pl. 3, figs. 16, 17) from the limestone near the base of the *Ptychoparia* beds at the south slope of Ch'ongnyongsan hill, 1.3 km ENE of Chunghwa, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Cambrian. Known only from the type locality.

Hyolithes katoi Saito

1936. *Hyolithus katoi* Saito [*sic*], p. 361, pl. 3, figs. 20–23.

Type.—Holotype (UMUT PM1477, Saito, 1936, pl. 3, figs. 20–22) from the limestone near the base of the *Ptychoparia* beds of the Chosen Group at the south slope of Ch'ongnyongan hill, 1.3 km ENE of Chunghwa, Pyongan-namdo (Heian-nan-do), North Korea.

Age and distribution.—Middle Cambrian. Known only from the type locality.

Hyolithes subcarinatus Kobayashi

1935. *Hyolithes subcarinatus* Kobayashi, p. 73, pl. 3, figs. 19–22.—1952. *Hyolithes subcarinatus* Kobayashi: Shikama, p. 80, pl. 2, fig. 18 [reproduction of an original figure].

Type.—Syntypes (UMUT PM0945–0947, three specimens) from the *Chuangia* zone of the Kasetsu Formation of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Upper Cambrian (Chaumitian). Known only from the type locality.

Hyolithes teretapex Saito

1936. *Hyolithus teretapex* Saito [*sic*], p. 362, pl. 3, figs. 24–31.

Type.—Holotype (UMUT PM1485, Saito, 1936, pl. 3, figs. 26, 27) from the *Protolenus* shale, at rail-way cutting immediately south of the tunnel under Kuhyonch'i pass, 2.0 km north of Heukkyo, Koshu area, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Cambrian. Known only from the type locality.

Hyolithes sp.

1935. *Hyolithes* a sp.: Kobayashi, p. 73, pl. 2, figs. 8, 9 [only opercula].

Age and distribution.—Lower or Middle Cambrian. *Solenoparia* zone of the Taiki Formation of the Chosen Group in Doten area, South Korea.

Hyolithes sp.

1935. *Hyolithes* b sp.: Kobayashi, p. 74, pl. 2, fig. 7 [only operculum].

Age and distribution.—Lower or Middle Cambrian. *Solenoparia* zone of the Taiki Formation of the Chosen Group in Doten area, South Korea.

Hyolithes sp.

1934. *Hyolithes* sp.: Kobayashi, p. 374, pl. 44, figs. 7, 8.

Age and distribution.—Middle Ordovician (Caradocian). Tsuibon beds of the Chosen Group in Taebaeksan (Taihakusan) area of Kwangwon-do (Kogen-do), South Korea.

Hyolithes? sp.

1960. *Hyolithes*(?) sp. indet.: Kobayashi, p. 229, pl. 13, figs. 22a, b.

Age and distribution.—Lower Ordovician. Bunkoku Formation of the Chosen Group in Puk area, South Korea.

PART II. PALEOZOIC BIVALVIA

GENERAL COMMENTS

In this part 66 named and 56 specifically unnamed Paleozoic Bivalvia which have been described or illustrated prior to 1976 on the basis of materials from Japan and Korea (Tables 3 and 4) are taxonomically treated. They are mostly Ordovician and Permian species, whose distribution seems to be restricted to this region. No descriptive studies have been attempted on Silurian and Devonian bivalves. Described Carboniferous bivalves are exceedingly few, though we are aware of the occurrence of a considerable number of species through various stratigraphic papers. As is clear from the marked difference in the numbers of descriptive works, research on Paleozoic bivalves is lagging far behind that on Mesozoic and Cenozoic ones.

Table 3. Number of descriptive works on Paleozoic and Mesozoic Bivalvia from Japan and its adjacent areas (number of newly proposed specific and infraspecific names in parentheses)

Date	Paleozoic	Mesozoic	Total
1870–1879	0 (0)	1 (1)	1 (1)
1880–1889	0 (0)	1 (2)	1 (2)
1890–1899	0 (0)	5 (14)	5 (14)
1900–1909	0 (0)	1 (5)	1 (5)
1910–1919	0 (0)	4 (10)	4 (10)
1920–1929	5 (12)	17 (64)	22 (76)
1930–1939	4 (20)	18 (85)	22 (105)
1940–1949	2 (0)	16 (52)	18 (52)
1950–1959	3 (6)	99 (328)	101 (334)
1960–1969	11 (28)	74 (158)	82 (186)
1970–1976	1 (1)	29 (52)	30 (53)
Total	26 (66)	265 (771)	287 (837)

Table 4. Number of valid described species of Paleozoic Bivalvia from Japan and its adiacent areas

Age	Named species	Unnamed species	Total
Permian	46	53	99
Carboniferous	1	1	2
Devonian	0	0	0
Silurian	0	0	0
Ordovician	19	2	21
Cambrian	0	0	0
Total	66	56	122

We owe our present knowledge about the Ordovician bivalves from Korea almost entirely to Kobayashi's (1931, 1934a, b) faunal studies. About 20 species were reported therein from the Chosen Group located mainly in the Taebaeksan area of South Korea. Most of them were referred to *Ctenodonta* and *Modiolopsis*, while *Cyrtodonta*?, *Pterinea*? and *Goniophora* were represented by one species each. It is worthy of note that three species of the Rostroconchia were described therefrom. These species are interesting in connection with the consideration of the major classification and early phylogeny of molluscs together with the Wanwanian species (Kobayashi, 1933) from northeast China, which were recently revised by Pojeta and Runnegar (1976). The main object of Kobayashi's studies on the Cambro-Ordovician faunas of Korea, however, seems to have been the description of the trilobites and nautiloids, which are more abundant and stratigraphically more important than the bivalves. Almost all of his described specimens of bivalves are now preserved in the University Museum, University of Tokyo, offering important data on the early history of this class. Yet, each nominal species is represented by only one or a few specimens, and regrettably we cannot always confirm the distinction between closely related species from the same localities. Only generic assignment of a few nominal species is altered, and the category and status of the type specimens are clarified in the present revision.

Research on Permian bivalve faunas in Japan was begun by Hayasaka in the 1920's. After describing several species from the Permian of the Kitakami mountains (north Honshu) in some short papers, Hayasaka (1925) published a monograph on one Carboniferous and 12 Permian bivalves from the clastic rocks of Kitakami and the Akasaka Limestone of Mino mountains (central Honshu). Specimens of *Parallelodon*, *Aviculopecten* [*Hayasakapecten*], *Myophoria* [*Schizodus*] and *Solenomorpha* [*Alula*] from Akasaka are exceptionally well preserved, cutting brilliant figures among Paleozoic molluscan fossils from Japan together with some associated giant gastropods. Ichikawa (1951) described a peculiar bivalve fauna from the Upper Permian Katsura Formation in south Shikoku. Among others the newly proposed genus *Actinodontophora* [type-species: *A. katsurensis* Ichikawa, 1951] seems to be quite important, because it was taken as the type genus of the family Actinodontophoridae Newell *in* Cox et al., 1969, and also because its hinge structure is informative about the phylogeny and hinge development of the subclass Praeheterodonta.

In recent years notable progress in research on Permian bivalves from this country has been achieved mainly through the efforts of Murata, Nakazawa and Newell. Nakazawa (1959, 1960) described some species of *Bakevellia* and the Myophoriidae from the Upper Permian Gujo Formation in the Oe area of central Honshu, together with many Lower Triassic species. Murata (1964) accomplished the description of the Middle Permian Aviculopectinidae from Kitakami, which show considerably greater specific diversity. Nakazawa and Newell (1968) surveyed all the hitherto known species of Permian bivalves from Japan and described 58 species belonging to 39 genera on the basis of the newly obtained material from Kitakami and the Maizuru zone of central Honshu. The up-to-date classification of this class adopted in their paper is important, since it seems to add some information to the system of *the Treatise* which was published almost simultaneously. They proposed five new genera, namely, *Towapteria* [type-species: *T. nipponica* Nakazawa and Newell, 1968], *Tambanella* [type-species: *T. gujoensis*

Nakazawa and Newell, 1968], *Ensipteria* [type-species: *E. onukii* Nakazawa and Newell, 1968], *Hayasakapecten* [type-species: *H. shimizui* Nakazawa and Newell, 1968] and *Gujocardia* [type-species: *G. oviformis* Nakazawa and Newell, 1968], and also one new subgenus, *Permoperna* [type-species: *Waagenoperna* (*Permoperna*) *hayamii* Nakazawa and Newell, 1968]. As noted by them, the Late Permian Gujo fauna seems to contain some Mesozoic elements, and the Permian bivalve fauna from Japan may offer significant data for the consideration of the Permian–Triassic transition as well as the inferred mass extinction of this age (Kanmera and Nakazawa, 1973; Nakazawa and Runnegar, 1973). Murata (1969, 1971) described some bivalves from the Upper Permian Toyoma Formation and the Lower Permian Sakamotozawa Formation of the Kitakami mountains, proposing a new genus, *Pseudoactinodontophora* [type-species: *P. yabei* Murata, 1971] from the latter formation.

Thus as many as 100 Permian bivalve species including many characteristic taxa have been described from Japan. Except for several species from the Akasaka Limestone, most specimens are external and internal moulds without original tests. Nevertheless, recent technical advancement of silicone rubber casting seems to have provided great facility for taxonomic studies and actually enabled us to examine the external and internal characters of the shells in detail.

SYSTEMATIC CATALOGUE

Class BIVALVIA Linné, 1758
Subclass PALAEOTAXODONTA Korobkov, 1954
Order NUCULOIDA Dall, 1889
Superfamily CTENODONTACEA Wöhrmann, 1893
Family CTENODONTIDAE Wöhrmann, 1893
Genus ***Ctenodonta*** Salter, 1852

Ctenodonta corbuliformis Kobayashi

1934a. *Ctenodonta corbuliformis* Kobayashi, p. 349, pl. 3, figs. 7, 22, 23.

Type.—Syntypes (UMUT PM0546–PM0548, three specimens) from the Chikunsan beds of the Chosen Group at Makkol and Tsuibon bed of the same group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordocivian (Llandeilian–Caradocian). Known only from the type area.

Ctenodonta coreanica Kobayashi

1934a. *Ctenodonta coreanica* Kobayashi, p. 347, pl. 3, figs. 16, 17, pl. 4, fig. 17.

Type.—Holotype (UMUT PM0540, Kobayashi, 1934a, pl. 3, fig. 16) from the Chikunsan beds of the Chosen Group at Makkol, and Tsuibon beds of the same group at Saisho-ri and Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian–Caradocian). Known only from the type area.

Ctenodonta dotensis Kobayashi

1934a. *Ctenodonta dotenensis* Kobayashi, p. 347, pl. 4, fig. 18.

Type.—Holotype by monotypy (UMUT PM0539, Kobayashi, 1934a, pl. 4, fig. 18) from the Tsuibon beds of the Chosen Group at Doten-ri, Taebaeksan (Taikahusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Ctenodonta nasutaformis Kobayashi

1934a. *Ctenodonta nasutaformis* Kobayashi, p. 346, pl. 4, figs. 13–15.

Type.—Holotype (UMUT PM0537, Kobayashi, 1934a, pl. 4, figs. 13, 14) from the Tsuibon beds of the Chosen Group at Keizan-son, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type area.

Ctenodonta nipponica Kobayashi [Pl. 9, Figs. 1a, b]

1934a. *Ctenodonta nipponica* Kobayashi, p. 345, pl. 3, figs. 1–3, pl. 4, fig. 16.

Type.—Holotype (UMUT PM0535, Kobayashi, 1934a, pl. 3, figs. 1–3) from the Chikunsan beds of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Ctenodonta oblongata Kobayashi

1934a. *Ctenodonta oblongata* Kobayashi, p. 350, pl. 3, fig. 21, pl. 4, fig. 12.

Type.—Holotype (UMUT PM0549, Kobayashi, 1934a, pl. 4, fig. 12) from the Chikunsan beds of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Ctenodonta? striata Kobayashi

1934a. *Ctenodonta* (?) *striata* Kobayashi, p. 351, pl. 4, fig. 11

Type.—**Lectotype** here designated (UMUT PM0550, Kobayashi, 1934a, pl. 4, fig. 11) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Ctenodonta? sp.

1934a. *Ctenodonta* (?) sp.: Kobayashi, p. 352, pl. 4, fig. 19.

Age and distribution.—Middle Ordovician (Llandeilian). Chikunsan beds of the Chosen Group in Taebaeksan (Taihakusan) area of Kangwon-do (Kogen-do), South Korea.

Superfamily NUCULACEA Gray, 1824
Family PRAENUCULIDAE McAlester, 1969
Genus ***Palaeoconcha*** Miller, 1889

Palaeoconcha? samenoha (Kobayashi) [Pl. 9, Fig. 6]

1934a. *Ctenodonta samenoha* Kobayashi, p. 348, pl. 3, figs. 10, 11.

Type.—Syntypes (UMUT PM0544, 0545, two specimens) from the Chikunsan beds of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Palaeoconcha? subsymmetrica (Kobayashi)

1934a. *Ctenodonta subsymmetrica* Kobayashi, p. 348, pl. 4, figs. 7, 8.

Type.—Holotype (UMUT PM0543, Kobayashi, 1934a, pl. 4, figs. 7, 8) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Family NUCULIDAE Gray, 1824
Genus ***Nuculopsis*** Girty, 1911
Subgenus ***Nuculopsis*** Girty, 1911

Nuculopsis (Nuculopsis) orientalis Ichikawa

1951. *Nuculopsis* (*Palaeonucula*) *orientalis* Ichikawa, p. 322, pl. 1, fig. 1.—1967. *Nuculopsis* (*Nuculopsis*) *orientalis* Ichikawa: Nakazawa, p. 167.

Type.—Holotype (UMUT PM5311, Ichikawa, 1951, pl. 1, fig. 1) from the Katsura Formation at Katsura, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Nuculopsis (Nuculopsis) sp.

1951. *Nuculopsis* (*Palaeonucula*) α sp.: Ichikawa, p. 323, pl. 1, fig. 2.—1967. *Nuculopsis* (*Nuculopsis*) sp.: Nakazawa, p. 167.

Age and distribution.—Upper Permian (stage unknown). Katsura Formation in Sakawa area of Kochi Prefecture.

Subgenus ***Nuculanella*** Tasch, 1953

Nuculopsis (Nuculanella) sp.

1951. "*Nucula*" sp.: Ichikawa, p. 321, pl. 1, fig. 14.—1967. *Nuculopsis* (*Nuculanella*) sp.: Nakazawa, p. 167.

Age and distribution.—Upper Permian (stage unknown). Katsura Formation in Sakawa area of Kochi Prefecture.

Family uncertain (? NUCULIDAE)

Nucula? sp.

1934a. *Nucula* (?) sp.: Kobayashi, p. 351.

Age and distribution.—Middle Ordovician (Caradocian). Tsuibon beds of the Chosen Group in Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Nucula? sp.

1967. *Nucula* aff. *subnuda* d'Orbigny: Yanagisawa, p. 93, pl. 1, fig. 14.

Age and distribution.—Middle Permian (Kazanian or thereabout). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Nucula? sp.

1967. *Nucula* sp.: Yanagisawa, p. 93, pl. 2, fig. 4.

Age and distribution.—Middle Permian (Kazanian or thereabout). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Superfamily NUCULANACEA Adams and Adams, 1858
Family MALLETIIDAE Adams and Adams, 1858
Genus ***Nuculites*** Conrad, 1841

Nuculites ichikawai Nakazawa and Newell

1968. *Nuculites ichikawai* Nakazawa and Newell, p. 35, pl. 1, figs. 1, 2.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 1, fig. 1) from the Katsura Formation at Katsura, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Nuculites kimurai Hayasaka

1924. *Nuculites kimurai* Hayasaka, p. 49, pl. 6, figs. 4–7.

Type.—Holotype by monotypy (IGPS no. 22418, Hayasaka, 1924, pl. 6, figs. 4–7) from the Toyoma Formation at Myojinyama, Ogachi-cho, Monoo-gun, Miyagi Prefecture. This specimen was once regarded as a "syntype" by Hanzawa, Asano and Takai (1961, p. 264), but it is clear that Hayasaka originally described this species on the basis of a solitary specimen.

Age and distribution.—Upper Permian (Tartarian). Known only from the type locality.

Nuculites? suboblongatus Kobayashi

1934a. *Nuculites* (?) *suboblongatus* Kobayashi, p. 351, pl. 4, fig. 20.

Type.—Holotype (UMUT PM0551, Kobayashi, pl. 4, fig. 20) from the Chikunsan beds of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Genus ***Palaeoneilo*** Hall and Whitfield, 1869

Palaeoneilo ogachiensis Hayasaka

1924. *Palaeoneilo ogachiensis* Hayasaka, p. 49, pl. 6, figs. 8–12.

Type.—Syntypes (IGPS, not registered, two specimens) from the Toyoma Formation at Myojinyama, Ogachi-cho, Monoo-gun, Miyagi Prefecture.

Age and distribution.—Upper Permian (Tartarian). Known only from the type locality.

Palaeoneilo sp.

1951. *Palaeoneilo* sp.: Ichikawa, p. 320, pl. 1, figs. 3a, b.

Age and distribution.—Upper Permian (stage unknown). Katsura Formation in Sakawa area of Kochi Prefecture.

Palaeoneilo? sp.

1968. *Palaeoneilo*? sp.: Nakazawa and Newell, p. 36, pl. 1, fig. 3.

Age and distribution.—Upper Permian (Tartarian). Middle part of the Maizuru Group in Maizuru area of Kyoto Prefecture.

Family NUCULANIDAE Adams and Adams, 1858
Genus ***Phestia*** Chernyshev, 1951
Subgenus ***Polidevcia*** Chernyshev, 1951

Phestia? (Polidevcia?) sp.

1968. ?*Phestia* (*Polidevcia*) sp.: Nakazawa and Newell, p. 38, pl. 1, figs. 4a, b.

Age and distribution.—Upper Permian (Tartarian). Middle part of the Maizuru Group in Maizuru area of Kyoto Prefecture.

Subclass PTERIOMORPHIA Beurlen, 1944
Order ARCOIDA Stoliczka, 1871
Superfamily CYRTODONTACEA Ulrich, 1894
Family CYRTODONTIDAE Ulrich, 1894
Genus ***Cyrtodonta*** Billings, 1858

Cyrtodonta? prima Kobayashi

1934b. *Cyrtodonta* (?) *prima* Kobayashi, p. 532, pl. 7, fig. 10.

Type.—Holotype (UMUT PM0812, Kobayashi, 1934b, pl. 7, fig. 10) from the *Clarkella* zone of the Chiktong Limestone of the Chosen Group at Doten, Taebaeksan (Taihaku-san) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Superfamily ARCACEA Lamarck, 1809
Family PARALLELODONTIDAE Dall, 1898
Subfamily PARALLELODONTINAE Dall, 1898
Genus ***Parallelodon*** Meek and Worthen, 1866
Subgenus ***Parallelodon*** Meek and Worthen, 1866

Parallelodon (Parallelodon) obsoletiformis Hayasaka [Pl. 9, Figs. 11a, b]

1925. *Parallelodon obsoletiformis* Hayasaka, p. 18, pl. 8, figs. 15, 16, 16a.—1953. *Parallelodon obsoletiformis* Hysk.: Hayasaka and Hayasaka, p. 39.—1970. *Parallelodon obsoletiformis* Hayasaka: Shikama, p. 118, pl. 36, fig. 3 [reproduction of an original figure].

Type.—Lectotype designated by Hanzawa, Asano and Takai (1961, p. 269) (IGPS no. 22392, pl. 8, figs. 15, 16, 16a) from the "Kuro zone" (i.e., *Yabeina globosa* zone) of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture. Hayasaka (1925) illustrated only one specimen, but noted the presence of two specimens in the

text. Hanzawa, Asano and Takai (1961) listed this illustrated specimen as "holotype," and their treatment is here regarded as constituting lectotype designation.
Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Parallelodon (Parallelodon) sp. cf. **P. (P.) multistiriatus** Girty

1968. *Parallelodon* cf. *multistriatus* Girty: Nakazawa and Newell, p. 47, pl. 2, fig. 1.

Age and distribution.—Middle Permian (Kazanian or thereabout). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Parallelodon (Parallelodon) cf. **P. (P.) tenuistriatus** (Meek and Worthen)

1968. *Parallelodon* cf. *tenuistriatus* (Meek and Worthen): Nakazawa and Newell, p. 48, pl. 2, fig. 2.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Order MYTILOIDA Férussac, 1822
Superfamily MYTILACEA Rafinesque, 1815
Family MYTILIDAE Rafinesque, 1815
Subfamily MODIOLINAE Keen, 1958
Genus ***Promytilus*** Newell, 1942

Promytilus maiyensis Nakazawa and Newell

1968. *Promytilus maiyensis* Nakazawa and Newell, p. 49, pl. 2, figs. 5, 6.—compare 1968. ? *Promytilus maiyensis* Nakazawa and Newell: Nakazawa and Newell, p. 51, pl. 2, fig. 9.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 2, fig. 5) from the Tenjinnoki Formation of the Maiya Group at Tenjinnoki, Towa-cho, Tome-gun, Miyagi Prefecture.
Age and distribution.—Middle Permian (Kazanian). Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture. Similar specimens from the Gujo Formation in Oe area of Kyoto Prefecture.

Promytilus sp.

1968. *Promytilus* sp. a: Nakazawa and Newell, p. 50, pl. 2, figs. 7, 8.

Age and distribution.—Upper Permian (stage unknown). Gujo Formation in Oe area of Kyoto Prefecture.

Promytilus sp.

1968. *Promytilus* sp. b: Nakazawa and Newell, p. 52, pl. 2, fig. 10.

Age and distribution.—Middle Permian (Artinskian). Rodai Formation of the Maiya Group in Towa area of Miyagi Prefecture.

Superfamily PINNACEA Leach, 1819
Family PINNIDAE Leach, 1819
Genus ***Aviculopinna*** Meek, 1864

Aviculopinna rectangularis (Hayasaka)

1920. *Conularia rectangularis* Hayasaka, p. 87, text-figs. 1–3.—1923. *Conularia rectangularis* Hayasaka: Hayasaka, p. 111, pl. 15, figs. 9–11.—1942. *Neoconularia rectangularis* (Haya-

saka): Sugiyama, p. 391, pl. 15, figs. 2, 2a–c.—1963. *Neoconularia rectangularis* (Hayasaka): Hayasaka, p. 476, text-figs. 1a–d.—compare 1968. *Aviculopinna* cf. *rectangularis* (Hayasaka): Nakazawa and Newell, p. 54, pl. 3, fig. 2.

Type.—Holotype by monotypy (IGPS, not registered, Hayasaka, 1920, text-figs. 1–3) from the lower part of the Kanokura Formation at Imo, Yahagi-cho, Kesen-gun, Iwate Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Yahagi area of Iwate Prefecture and in Kesennuma area of Miyagi Prefecture.

Remarks.—This species was originally regarded as a member of the conulariids but, as treated by Nakazawa and Newell (1968), is referable to *Aviculopinna*. *Neoconularia* Sugiyama (1942) is regarded as synonymous with *Aviculopinna*.

Aviculopinna sp.

1963. *Neoconularia* sp.: Hayasaka, p. 476, text-figs. 2a–c.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Aviculopinna sp.

1968. *Aviculopinna* sp.: Nakazawa and Newell, p. 53, pl. 3, fig. 1.

Age and distribution.—Upper Permian (stage unknown). Gujo Formation in Oe area of Kyoto Prefecture.

Order PTERIOIDA Newell, 1965
Suborder PTERIINA Newell, 1965
Superfamily AMBONYCHIACEA Miller, 1877
Family AMBONYCHIIDAE Miller, 1877
Genus ***Cleionychia*** Ulrich, 1892

Cleionychia oviformis Kobayashi [Pl. 9, Fig. 3]

1934a. *Clionychia oviformis* Kobayashi [error of *Cleionychia*], p. 352, pl. 3, fig. 14.

Type.—Holotype (UMUT PM0553, Kobayashi, 1934a, pl. 3, fig. 14) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Family MYALINIDAE Frech, 1891
Genus ***Myalina*** de Koninck, 1842
Subgenus ***Myalina*** de Koninck, 1842

Myalina (Myalina) sp.

1968. *Myalina* (*Myalina*) sp.: Nakazawa and Newell, p. 54, pl. 2, fig. 4.

Age and distribution.—Upper Permian (Tartarian). Toyoma Formation in Toyoma area of Miyagi Prefecture.

Genus ***Septimyalina*** Newell, 1942

Septimyalina sp.

1968. *Septimyalina* sp.: Nakazawa and Newell, p. 55, pl. 2, fig. 3.

Age and distribution.—Upper Permian (stage unknown). Gujo Formation in Oe area of Kyoto Prefecture.

Genus ***Anthraconaia*** Trueman and Weir, 1946

Anthraconaia sp.

1942. *Anthracomya* sp. nov.: Kobayashi and Hisakoshi, p. 195, text-fig. 1.

Age and distribution.—Upper Carboniferous (Moscovian or thereabout). Basal shale of the Koten Group in Kokai area of Huanghae-do (Kokai-do), North Korea.

Family uncertain

Myalina? sp.

1951. *Myalina*? sp.: Ichikawa, p. 331, pl. 1, fig. 10.

Age and distribution.—Upper Permian (stage unknown). Katsura Formation in Sakawa area of Kochi Prefecture.

Superfamily PTERIACEA Gray, 1847
Family PTERINEIDAE Miller, 1877
Genus ***Pterinea*** Goldfuss, 1826

Pterinea? subasperula Kobayashi

1931. *Pterinea* (?) *subasperula* Kobayashi, p. 32, pl. 1, figs. 1a, b.

Type.—Holotype by monotypy (UMUT PM0180, missing, Kobayashi, 1931, pl. 1, figs. 1a, b) from the Shorin beds of the Chosen Group at Shorin-ri near Kenjiho, Koshu-gun, Huanghae-do (Kokai-do), North Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Genus ***Leptodesma*** Hall, 1883
Subgenus ***Leiopteria*** Hall, 1883

Leptodesma (Leiopteria) sp.

1968. *Leptodesma* (*Leiopteria*) sp.: Nakazawa and Newell, p. 56, pl. 3, figs. 3, 4.

Age and distribution.—Middle Permian (Kazanian). Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture.

Subgenus uncertain

Leptodesma sp.

1968. *Leptodesma* sp.: Nakazawa and Newell, p. 56.

Age and distribution.—Middle Permain (Artinskian). Rodai Formation of the Maiya Group in Towa area of Miyagi Prefecture.

Family PTERIIDAE Gray, 1847
Genus ***Ensipteria*** Nakazawa and Newell, 1968

Ensipteria onukii Nakazawa and Newell [Pl. 11, Figs. 1, 2]

1968. *Ensipteria onukii* Nakazawa and Newell, p. 65, pl. 3, figs. 12a, b, 13, 14.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 3, figs. 12a, b) from the Tenjinnoki Formation of the Maiya Group at Tenjinnoki, Towa-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Family BAKEVELLIIDAE King, 1850
Genus ***Bakevellia*** King, 1848
Subgenus ***Bakevellia*** King, 1848

Bakevellia (Bakevellia) gujoensis Nakazawa

1959. *Bakevellia* (*Bakevellia*) *gujoensis* Nakazawa, p. 198, pl. 3, figs. 5a, b, 6–8, text-fig. 3.

Type.—Holotype (UK JP10044, Nakazawa, 1959, pl. 3, figs. 5a, b) from the upper part of the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Bakevellia (Bakevellia) sp.

1959. *Bakevellia* (*Bakevellia*) n. sp.: Nakazawa, p. 199, pl. 3, figs. 9a–c.

Age and distribution.—Upper Permian (stage unknown). Upper part of the Gujo Formation in Oe area of Kyoto Prefecture.

Genus ***Towapteria*** Nakazawa and Newell, 1968

Towapteria nipponica Nakazawa and Newell [Pl. 11, Figs. 3, 4]

1959. *Pteria* sp.: Nakazawa, p. 196, text-fig. 1.—1968. *Towapteria nipponica* Nakazawa and Newell, p. 59, pl. 3, figs. 5–8.—1971. *Towapteria nipponica* Nakazawa and Newell: Murata, p. 109, pl. 14, figs. 5a–c, 6a, b, 7, 8a, b.

Type.—Holotype (UK, not registered, Nakazawa and Newell, pl. 3, fig. 8) from the Tenjinnoki Formation of the Maiya Group at Tenjinnoki, Towa-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Lower to Upper Permian (Sakmarian–? Tartarian). Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture, lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture, Gujo Formation in Oe area of Kyoto Prefecture, and upper part of the Sakamotozawa Formation in Sumita area of Iwate Prefecture.

Family ISOGNOMONIDAE Woodring, 1925
Genus ***Waagenoperna*** Tokuyama, 1959
Subgenus ***Permoperna*** Nakazawa and Newell, 1968

Waagenoperna (Permoperna) hayamii Nakazawa and Newell [Pl. 11, Fig. 7]

1925. *Liebea sinensis* Frech: Hayasaka, p. 14, pl. 8, figs. 11–13 [non Frech, 1911].—1952. *Liebea sinensis* Frech: Shikama, p. 100, pl. 12, fig. 10 [reproduction of Hayasaka's figure].—1953. *Liebea sinensis* Frech: Hayasaka and Hayasaka, p. 39.—1960b. "*Isognomon*" n. sp.:

Hayami, p. 327, text-fig. 6.—1967. *Waagenoperna hayamii* Nakazawa and Newell [nom. nud.]: Nakazawa, p. 168, pl. 6, fig. 2 [reproduction of Hayami's figure], fig. 3.—1968. *Waagenoperna* (*Permoperna*) *hayamii* Nakazawa and Newell, p. 62, pl. 3, figs. 9–11.—1971. *Waagenoperna* (*Permoperna*) *hayamii* Nakazawa and Newell: Murata, p. 109, pl. 14, figs. 9, 11a, b.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 3, fig. 11) from the Tenjinnoki Formation of the Maiya Group at Tenjinnoki, Towa-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Lower and Middle Permian (Sakmarian–Kazanian). Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture, "Kuro zone" of the Akasaka Limestone in Akasaka area of Gifu Prefecture, lower part of the Kanokura Formation in Yahagi area of Iwate Prefecture and in Kesennuma area of Miyagi Prefecture, and upper part of the Sakamotozawa Formation in Sumita area of Iwate Prefecture.

Genus ***Tambanella*** Nakazawa and Newell, 1968

Tambanella gujoensis Nakazawa and Newell [Pl. 11, Fig. 5]

1968. *Tambanella gujoensis* Nakazawa and Newell, p. 64, pl. 4, figs. 4–9.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 4, figs. 7, 8) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Family uncertain

Waagenoperna? sp.

1967. *Liebea* aff. *mapingensis* Grabau: Yanagisawa, p. 94, pl. 2, fig. 5.

Age and distribution.—Lower or Middle Permian (Sakmarian or Artinskian). Motomura Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Superfamily PECTINACEA Rafinesque, 1815
Family AVICULOPECTINIDAE Meek and Hayden, 1864
Subfamily AVICULOPECTININAE Meek and Hayden, 1864
Genus ***Aviculopecten*** M'Coy, 1851

Aviculopecten hataii Murata [Pl. 10, Fig. 2]

1964. *Aviculopecten hataii* Murata, p. 221, pl. 34, figs. 10a–d.—compare 1967. *Aviculopecten* cf. *hataii* Murata: Yanagisawa, p. 95, pl. 2, fig. 13.—compare 1968. *Aviculopecten* cf. *hataii* Murata: Nakazawa and Newell, p. 68, pl. 5, figs. 1–3.—1976a. *Aviculopecten hataii* Murata, pl. P-17, figs. 10a, b.

Type.—Holotype (IGPS no. 85732, Murata, 1964, pl. 34, figs. 10a–d) from the Shigejizawa member of the Kanokura Formation at Toyazawa, Kamishishiori, Kesennuma City, Miyagi Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture. Comparable specimens from the Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture and from the Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture.

Aviculopecten hiemalis Salter

1967a. *Aviculopecten* (*Deltopecten*) *hiemalis* Salter: Hayasaka, p. 378, text-figs. 1a, b.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture. This species was originally described from the Permian (*Productus* shale) of Pakistan.

Aviculopecten? onukii Murata [Pl. 9, Fig. 7]

1969. *Aviculopecten? onukii* Murata, p. 17, pl. 3, figs. 1a–d, 2a, b, 3a, b, 4, 5.

Type.—Holotype (IGPS no. 91380, pl. 3, Murata, 1969, figs. 1a–d, 2a, b) from the upper part of the Toyoma Formation at Senmatsu, Fujisawa-cho, Higashiiwai-gun, Iwate Prefecture.

Age and distribution.—Upper Permian (Tartarian). Known only from the type area.

Aviculopecten shiroshitai Nakazawa and Newell

1968. *Aviculopecten shiroshitai* Nakazawa and Newell, p. 66, pl. 4, figs. 1–3.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 4, figs. 1, 2) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Aviculopecten sp.

1968. *Aviculopecten* sp. a: Nakazawa and Newell, p. 68, pl. 5, fig. 5.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Aviculopecten sp.

1968. *Aviculopecten* sp. b: Nakazawa and Newell, p. 69, pl. 5, fig. 4.

Age and distribution.—Upper Permian (Tartarian). Toyoma Formation in Toyoma area of Miyagi Prefecture.

Aviculopecten sp.

1971. *Aviculopecten* sp.: Murata, p. 110, pl. 14, figs. 12a, b.

Age and distribution.—Lower Permian (Sakmarian). Upper part of the Sakamotozawa Formation in Sumita area of Iwate Prefecture.

Aviculopecten? sp.

1971. *Aviculopecten?* sp.: Murata, p. 111, pl. 14, fig. 10.

Age and distribution.—Lower Permian (Sakmarian). Upper part of the Sakamotozawa Formation in Sumita area of Iwate Prefecture.

Genus ***Hayasakapecten*** Nakazawa and Newell, 1968

Hayasakapecten minoensis (Hayasaka) [Pl. 9, Fig. 10]

1925. *Aviculopecten minöensis* Hayasaka, p. 5, pl. 8, fig. 1.—1952. *Aviculopecten minoensis* Hayasaka: Shikama, p. 98, pl. 11, fig. 10 [reproduction of original figure].—1967. *Hayasakapecten minoensis* (Hayasaka): Nakazawa, p. 167 [without generic diagnosis], pl. 6, fig. 7 [reproduction of original figure].—1970. *Aviculopecten minoensis* Hayasaka: Shikama, p.122, pl. 38, fig. 29 [reproduction of original figure].

Type.—Lectotype designated by Nakazawa (1967, p. 174) (IGPS no. 8204, Hayasaka, 1925, pl. 8, fig. 1) from the "Upper Dairi zone" of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture. Nakazawa regarded this specimen as "holotype," but Hayasaka (1925) proposed the present species on the basis of several specimens. Nakazawa's treatment is here regarded as constituting valid lectotype designation.
Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Hayasakapecten reticularis (Hayasaka) [Pl. 9, Fig. 9]

1925. *Aviculopecten reticularis* Hayasaka, p. 6, pl. 8, fig. 2.—1967. *Hayasakapecten reticularis* (Hayasaka): Nakazawa, p. 167 [without generic diagnosis], pl. 6, fig. 6 [reproduction of original figure].

Type.—Holotype by monotypy (IGPS no. 22227, Hayasaka, 1925, pl. 8, fig. 2) from the "Upper Dairi zone" of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.
Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Hayasakapecten sasakii (Murata)

1964. *Aviculopecten sasakii* Murata, p. 218, pl. 34, figs. 1a, b, 2a, b.—1967. *Hayasakapecten sasahii* (Murata): Nakazawa, p. 167 [without generic diagnosis], pl. 6, figs. 4a, b, 5.—1968. *Hayasakapecten sasakii* (Murata): Nakazawa and Newell, p. 72, pl. 5, figs. 7, 10.—1976a. *Hayasakapecten sasakii* (Murata): Murata, pl. P-17, fig. 1.

Type.—Holotype (IGPS no. 85730, Murata, 1964, pl. 34, figs. 1a, b) from the lower part of the Kanokura Formation at the upper course of the Shigejizawa, Kamiyasse, Kesennuma City, Miyagi Prefecture.
Age and distribution.—Middle Permian (Artinskian or Kazanian). Known only from the type area.

Hayasakapecten shimizui Nakazawa and Newell

1968. *Hayasakapecten shimizui* Nakazawa and Newell, p. 70, pl. 5, figs. 6, 8, 9.—1976a. *Hayasakapecten shimizui* Nakazawa and Newell: Murata, pl. P-17, figs. 2, 3.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 5, fig. 8) from the Tenjinnoki Formation of the Maiya Group at Tenjinnoki, Towa-cho, Tome-gun, Miyagi Prefecture.
Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Genus ***Acanthopecten*** Girty, 1903

Acanthopecten onukii Murata [Pl. 10, Fig. 4]

1964. *Acanthopecten onukii* Murata, p. 222, pl. 35, figs. 1a, b, 2a, b, 3a, b, 4a, b, 5a, b, 6, 7a, b, 8, 9a, b.—1976a. *Acanthopecten onukii* Murata: Murata, pl. P-17, figs. 7, 8.

Type.—Holotype (IGPS no. 85745, Murata, 1964, pl. 35, figs. 1a, b) from the lower part of the Kanokura Formation at Shigejizawa, Kamiyasse, Kesennuma City, Miyagi Prefecture.
Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture and in Yahagi area of Iwate Prefecture.

Acanthopecten spinosus Hayasaka [Pl. 10, Fig. 3]

1925. *Acanthopecten spinosus* Hayasaka, p. 10, pl. 8, fig. 6 [non fig. 7].—1952. *Acanthopecten spinosus* Hayasaka: Shikama, p. 100, pl. 12, fig. 11 [reproduction of an original figure].—1964. *Acanthopecten spinosus* Hayasaka: Murata, p. 225, pl. 35, figs. 10a, b.—1970. *Acanthopecten spinosus* Hayasaka: Shikama, p. 124, pl. 39, fig. 17 [reproduction of an original figure].—1976a. *Acanthopecten spinosus* Hayasaka: Murata, pl. P-17, figs. 9a, b.

Type.—Lectotype designated by Murata (1964, p. 232) (IGPS no. 22378, Hayasaka, 1925, pl. 8, fig. 6; Murata, 1964, pl. 35, figs. 10a, b) from the lower part of the Kanokura Formation at Imo, Yahagi-cho, Kesen-gun, Iwate Prefecture. Murata (1964) regarded this specimen as "holotype," but Hayasaka proposed the present species on the basis of two specimens (IGPS nos. 22378, 22408) without any designation of the type. Murata's treatment is here regarded as constituting valid lectotype designation.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Known only from the type area.

Acanthopecten sp. cf. **A. coloradoensis** (Newberry)

1925. *Acanthopecten spinosus* Hayasaka, p. 10 (*pars*), pl. 8, fig. 7 (non fig. 6).—1964. *Acanthopecten* cf. *coloradoensis* (Newberry): Murata, p. 225, pl. 35, figs. 11a, b, 12, 13a, b.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Yahagi area of Iwate Prefecture.

Genus ***Annuliconcha*** Newell, 1938

Annuliconcha kitakamiensis Murata [Pl. 10, Fig. 1]

1925. *Pleuronectites interlineatus* Meek and Worthen: Hayasaka, p. 12, pl. 8, figs. 9, 9a.—1964. *Annuliconcha kitakamiensis* Murata, p. 227, pl. 34, figs. 11a–c, 12a, b.—1970. *Annuliconcha interlineatus* (Meek and Worthen) [*sic*]: Shikama, p. 122, pl. 38, fig. 28 [reproduction of Hayasaka's figure].—1976a. *Annuliconcha kitakamiensis* Murata: Murata, pl. P-17, fig. 6.

Type.—Holotype (IGPS no. 22389, Murata, 1964, pl. 34, figs. 12a, b) from the lower part of the Kanokura Formation at Imo, Yahagi-cho, Kesen-gun, Iwate Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Yahagi area of Iwate Prefecture and in Kesennuma area of Miyagi Prefecture.

Genus ***Etheripecten*** Waterhouse, 1963

Etheripecten? hayasakai (Murata)

1925. *Aviculopecten interstitialis* Phillips: Hayasaka, p. 7, pl. 8, figs. 3–5.—1964. *Aviculopecten hayasakai* Murata, p. 219, pl. 34, figs. 3, 4a, b, 5, 6a, b, 7, 8a, b, 9.—1967. "*Etheripecten*" *hayasakai* (Murata): Nakazawa, p. 168, pl. 6 fig. 8 [reproduction of Murata's figure].—1968. *Etheripecten? hayasakai* (Murata): Nakazawa and Newell, p. 72, pl. 6, figs. 1a–c.—1976a. *Etheripecten? hayasakai* (Murata): Murata, pl. P-17, figs. 11–14.

Type.—Holotype (IGPS no. 85737, Murata, 1964, pl. 34, figs. 4a, b) from the Shigejizawa member of the Kanokura Formation at the upper course of Toyazawa, Kamishishiori, Kesennuma City, Miyagi Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the

Kanokura Formation in Kesennuma area of Miyagi Prefecture and in Yahagi area of Iwate Prefecture.

Genus *Guizhoupecten* Chen, 1962

Guizhoupecten miyamoriensis (Murata) [Pl. 10, Fig. 6]

1964. *Streblochondria miyamoriensis* Murata, p. 229, pl. 35, figs. 14a, b.—1967. *Guizhopecten miyamoriensis* (Murata) [typographical error of *Guizhoupecten*]: Nakazawa, p. 168, pl. 6, fig. 9.—1968. *Guizhoupecten miyamoriensis* (Murata): Nakazawa and Newell, p. 76.—1976a. *Guizhoupecten miyamoriensis* (Murata): Murata, pl. P-17, fig. 15.

Type.—Holotype (IGPS no. 85733, Murata, 1964, pl. 35, figs. 14a, b) from the Hiryuyama Formation at the southeastern slope of Mt. Hiryuyama, Miyamori-mura, Kamihei-gun, Iwate Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Known only from the type locality.

Guizhoupecten sp.

1968. *Guizhoupecten* sp.: Nakazawa and Newell, p. 77, pl. 6, fig. 9.

Age and distribution.—Upper Permian (Tartarian). Upper part of the Maizuru Group in Mikata area of Kyoto Prefecture.

Genus *Limipecten* Girty, 1904

Limipecten bandoi Murata [Pl. 9, Fig. 8]

1969. *Limipecten bandoi* Murata, p. 18, pl. 4, figs. 1a–c.

Type.—Holotype (IGPS no. 91384, Murata, 1969, pl. 4, figs. 1a–c) from the lower part of the Toyoma Formation at Nagahata, Towa-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Upper Permian (Tartarian). Known only from the type locality.

Genus *Leptochondria* Bittner, 1891

Leptochondria? sp.

1968. *Leptochondria*? sp. a: Nakazawa and Newell, p. 73, pl. 6, figs. 4–7.

Age and distribution.—Upper Permian (stage unknown). Gujo Formation in Oe area of Kyoto Prefecture.

Leptochondria? sp.

1968. *Leptocondria*? sp. b: Nakazawa and Newell, p. 74, pl. 6, fig. 8.

Age and distribution.—Upper Permian (stage unknown). Gujo Formation in Oe area of Kyoto Prefecture.

Subfamily STREBLOCHONDRIINAE Newell, 1938

Genus *Streblopteria* M'Coy, 1851

Streblopteria sp.

1968. *Streblopteria* sp. a: Nakazawa and Newell, p. 78, pl. 6, figs. 2, 3.—1976a. *Streblopteria* sp.: Murata, pl. P-17, figs. 4, 5.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Streblopteria? sp.

1968. *Streblopteria*? sp. b: Nakazawa and Newell, p. 79, pl. 6, fig. 10.

Age and distribution.—Middle Permian (Kazanian). Shigejizawa member of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Subfamily EUCHONDRIINAE Newell, 1938

Genus ***Euchondria*** Meek, 1874

Euchondria sp.

1968. *Euchondria* sp.: Nakazawa and Newell, p. 80, pl. 11, figs. 1, 2.

Age and distribution.—Middle Permian (Kazanian or thereabout). Upper member of the Mizukoshi Formation in Mifune area of Kumamoto Prefecture.

Euchondria? kesenensis (Hayasaka) [Pl. 10, Fig. 5]

1925. *Cenipecten kesenensis* Hayasaka [typographical error of *Crenipecten*], p. 11, pl. 8, figs. 8, 8a.

Type.—Holotype by monotypy (IGPS no. 22383, Hayasaka, 1925, pl. 8, figs. 8, 8a) from the lower part of the Kanokura Formation at Imo, Yahagi-cho, Kesen-gun, Iwate Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Known only from the type locality.

Family OXYTOMIDAE Ichikawa, 1958

Genus ***Cyrtorostra*** Branson, 1930

Cyrtorostra sp. cf. **C. lunwalensis** (Reed)

1968. *Cyrtorostra* cf. *lunwalensis* (Reed): Nakazawa and Newell, p. 79, pl. 5, fig. 11.

Age and distribution.—Middle Permian (Kazanian). Shigejizawa member of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Superfamily uncertain [? Pectinacea]

Aviculopecten? sp.

1967. *Acanthopecten* cf. *carboniferous* Stevens: Yanagisawa, p. 96, pl. 2, fig. 17.

Age and distribution.—Middle Permian (stage unknown). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Aviculopecten? sp.

1967. *Limipecten* cf. *burnettensis* Maxwell: Yanagisawa, p. 95, pl. 2, figs. 14, 15.

Age and distribution.—Middle Permian (stage unknown). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Aviculopecten? sp.

1967. *Streblochondria* aff. *stantonensis* Newell: Yanagisawa, p. 96, pl. 2, fig. 8.

Age and distribution.—Middle Permian (stage unknown). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Suborder OSTREINA Férussac, 1822
Superfamily OSTREACEA Rafinesque, 1815
Family OSTREIDAE Rafinesque, 1815
Subfamily LOPHINAE Vyalov, 1936
Genus ***Lopha*** Röding, 1798

Lopha? murakamii Nakazawa and Newell [Pl. 11, Fig. 8]

1968. *Lapha? murakamii* Nakazawa and Newell [typographical error of *Lopha*], p. 82, pl. 7, figs. 1, 2, 3a, b, 4, 6, 7, 8a, b.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 7, figs. 8a, b) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Lopha? teranosawensis Nakazawa and Newell

1968. *Lopha? teranosawensis* Nakazawa and Newell, p. 83, pl. 7, figs. 5, 9.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 7, fig. 9) from the Tenjinnoki Formation of the Maiya Group at Teranosawa, Towa-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Middle Permian (Artinskian–Kazanian). Tenjinnoki and Rodai Formations of the Maiya Group in Towa area of Miyagi Prefecture.

Subclass PALAEOHETERODONTA Newell, 1965
Order MODIOMORPHOIDA Newell, 1969
Superfamily MODIOMORPHACEA Miller, 1877
Family MODIOMORPHIDAE Miller, 1877
Genus ***Goniophora*** Phillips, 1848
Subgenus ***Cosmogoniophora*** McLearn, 1918

Goniophora (Cosmogoniophora) orientalis Kobayashi [Pl. 9, Fig. 12]

1934a. *Goniophora orientalis* Kobayashi, p. 357, pl. 3, figs. 4, 5.

Type.—Holotype (UMUT PM0562, Kobayashi, 1934a, pl. 3, fig. 4) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Genus ***Modiolopsis*** Hall, 1847

Modiolopsis elongata Kobayashi

1934a. *Modiolopsis elongata* Kobayashi, p. 356, pl. 4, figs. 9, 10.

Type.—Holotype (UMUT PM0559, Kobayashi, 1934a, pl. 4, figs. 9, 10) from the Chikunsan beds of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Modiolopsis hinomotoensis Kobayashi

1934a. *Modiolopsis hinomotoensis* Kobayashi, p. 356, pl. 3, figs. 12, 13.

Type.—Holotype (UMUT PM0560, Kobayashi, 1934a, pl. 3, figs. 12, 13) from the Chikunsan beds of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Modiolopsis kogenensis Kobayashi [Pl. 9, Figs. 4, 5]

1934a. *Modiolopsis kogenensis* Kobayashi, p. 354, pl. 3, figs. 6, 18–20.

Type.—Holotype (UMUT PM0556, Kobayashi, p. 354, pl. 3, figs. 18,19) from the Chikunsan beds of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type area.

Modiolopsis reedi Kobayashi

1934a. *Modiolopsis reedi* Kobayashi, p. 355, pl. 4, fig. 21.

Type.—Holotype (UMUT PM0558, Kobayashi, pl. 4, fig. 21) from the Chikunsan beds of the Chosen Group at Makkol, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Modiolopsis rugosa Kobayashi

1934a. *Modiolopsis rugosa* Kobayashi, p. 357, pl. 4, fig. 22.

Type.—Holotype (UMUT PM0561, Kobayashi, 1934a, pl. 4, fig. 22) from the Chikunsan beds of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Llandeilian). Known only from the type locality.

Order UNIONOIDA Stoliczka, 1871
Superfamily ANTHRACOSIACEA Amalitsky, 1892
Family ANTHRACOSIIDAE Amalitsky, 1892
Genus ***Anthracosia*** King, 1856

Anthracosia? jidoensis (Kobayashi)

1933. *Anthracomya* (?) *jidoensis* Kobayashi, p. 176, pl. 16, fig. 4.

Type.—Syntypes (UMUT PM0432, two individuals on a slab) from the Jido Group at Ritzuji-ri, Bitan-men, Heisho-gun, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Lower? Permian (stage unknown). Known only from the type locality.

Superfamily uncertain [? UNIONACEA]
Family ACTINODONTOPHORIDAE Newell, 1969
Genus ***Actinodontophora*** Ichikawa, 1951

Actinodontophora katsurensis Ichikawa [Pl. 10, Fig. 7]

1951. *Actinodontophora katsurenais* Ichikawa [typographical error of *katsurensis*]: p. 327, pl. 1, figs. 15, 16, 17a, b, 18a, b.—1968. *Actinodontophora katsurensis* Ichikawa: Nakazawa and Newell, p. 97, pl. 10, figs. 8, 9.—1969. *Actinodontophora katsurensis* Ichikawa: Cox et al., p. N470, figs. D60-4a–c.

Type.—Holotype (UMUT PM5306, Ichikawa, 1951, pl. 1, figs. 17a, b) from the Katsura Formation at Katsura, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Middle and Upper Permian (? Artinskian, Kazanian–Tartarian). Katsura Formation in Sakawa area of Kochi Prefecture and lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Genus ***Pseudoactinodontophora*** Murata, 1971

Pseudoactinodontophora yabei Murata [Pl. 9, Figs. 2a, b]

1971. *Pseudoactinodontophora yabei* Murata, p. 112, pl. 14, figs. 1a, b, 2, 3a, b, 4.

Type.—Holotype (IGPS no. 86885, Murata, 1971, pl. 14, figs. 1a, b, 4) from the lower part of the Motoiwazawa sandstone member of the Sakamotozawa Formation at Motoiwazawa, southwest of Kawaguchi, Sumita-cho, Kesen-gun, Iwate Prefecture.

Age and distribution.—Lower Permian (Sakmarian). Known only from the type locality.

Order TRIGONIOIDA Dall, 1889
Superfamily TRIGONIACEA Lamarck, 1819
Family MYOPHORIIDAE Bronn, 1849
Genus ***Costatoria*** Waagen, 1906

Costatoria katsurensis Ichikawa

1951. *Schizodus? radiatus* Ichikawa, p. 326, pl. 1, fig. 7 [non *Costatoria radiata* (Loczy, 1899)].—1967. *Costatoria katsurensis* Nakazawa, p. 169 [proposal of a new name], pl. 6, fig. 11 [reproduction of original figure].—1968. *Costatoria katsurensis* Nakazawa: Nakazawa and Newell, p. 88, pl. 8, figs. 1a–c.

Type.—Holotype (UMUT PM5320, Ichikawa, 1951, pl. 1, fig. 7) from the Katsura Formation at Katsura, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Costatoria kobayashii (Kambe)

1951. *Myophoria goldfussi* v. Alberti var. *kobayashii* Kambe, p. 54, pl. 4, figs. 7a, b.—1960. *Costatoria kobayashii* (Kambe): Nakazawa, p. 52, pl. 6, figs. 10–20.—1975. *Costatoria kobayashii* (Kambe): Hayami, p. 99.

Type.—Lectotype designated by Hayami (1975, p. 99) (UMUT MM6477, Kambe, 1951, pl. 4, figs. 7a, b) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality. This species was originally regarded as Triassic.

Genus ***Schizodus*** de Verneuil and Murchison, 1844

Schizodus japonicus (Hayasaka) [Pl. 10, Fig. 9]

1925. *Myophoria japonica* Hayasaka, p. 16, pl. 8, fig. 14, text-figs. 1, 2.—1953. *Myophoria japonica* Hysk.: Hayasaka and Hayasaka, p. 39.—1967. *Schizodus japonicus* (Hayasaka): Nakazawa, p. 169, 171, pl. 6, figs. 13, 14 [reproduction of original figures], 15–18.

Type.—Lectotype designated by Hanzawa, Asano and Takai (1961, p. 259) (IGPS no. 22422, Hayasaka, 1925, pl. 8, fig. 14) from the "Kuro zone" (i.e., *Yabeina globosa* zone) of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture. Hanzawa, Asano and Takai regarded this specimen as "holotype," and their treatment seems to constitute valid lectotype designation. Nakazawa (1967) restudied this species and assigned Hayasaka's original figures (1925, text-figs. 1, 2) as "holotype, here designated." Nakazawa's designation, however, is invalid, because Hayasaka's text-figures were evidently based on a different speicmen from the aforementioned lectotype.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Schizodus tobai (Hayasaka) [Pl. 10, Fig. 8]

1923. *Myophoria sub-elegans* Waagen var. *tobai* Hayasaka, p. 109, pl. 15, figs. 4–8.—1925. *Myophoria sub-elegans* Waagen var. *tobai* Hayasaka: Hayasaka, p. 17.—1967. *Schizodus tobai* (Hayasaka): Nakazawa, p. 169, pl. 6, fig. 12 [reproduction of an original figure].—1968. *Schizodus tobai* (Hayasaka): Nakazawa and Newell, p. 89, pl. 8, figs. 2, 3.

Type.—Syntypes (IGPS nos. 8403–8407, five specimens) from the lower part of the Kanokura Formation at Imo, Yahagi-cho, Kesen-gun, Iwate Prefecture.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Yahagi area of Iwate Prefecture and in Kesennuma area of Miyagi Prefecture.

Genus ***Neoschizodus*** Giebel, 1855

Subgenus ***Neoschizodus*** Giebel, 1855

Neoschizodus (Neoschizodus) kitakamiensis Nakazawa and Newell

1968. *Neoschizodus* (*Neoschizodus*) *kitakamiensis* Nakazawa and Newell, p. 87, pl. 8, figs. 4, 5a, b, 6.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 8, figs. 5a, b) from the Tenjinnoki Formation of the Maiya Group at Teranosawa, Maiya, Towa-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Neoschizodus (Neoschizodus) kobayashii (Ichikawa)

1951. *Schizodus kobayashii* Ichikawa, p. 325, pl. 1, figs. 4–6.—1967. *Neoschizodus kobayashii* (Ichikawa): Nakazawa, p. 169, pl. 6, fig. 10 [reproduction of original figure].

Type.—Holotype (UMUT PM5317, Ichikawa, 1951, pl. 1, fig. 4) from the Katsura Formation at Katsura, Sakawa-cho, Takaoka-gun, Kochi Prefecture.

Age and distribution.—Upper? Permian (stage unknown). Known only from the type locality.

Neoschizodus (Neoschizodus) permicus Nakazawa

1960. *Neoschizodus permicus* Nakazawa, p. 55, pl. 6, figs. 4–8, 9a, b.

Type.—Holotype (UK JP10001, Nakazawa, 1960, pl. 6, fig. 5) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.
Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Subclass HETERODONTA Neumayr, 1884
Order VENEROIDA Adams and Adams, 1856
Superfamily CARDITACEA Fleming, 1820
Family PERMOPHORIDAE van de Poel, 1959 (1895)
Subfamily PERMOPHORINAE van de Poel, 1959 (1895)
Genus ***Permophorus*** Chavan, 1954

Permophorus tenuistriatus Nakazawa and Newell [Pl. 11, Fig. 9]

1968. *Permophorus tenuistriatus* Nakazawa and Newell, p. 92, pl. 9, figs. 7–9.

Type.—Syntypes (UK, not registered, at least two specimens) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.
Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Genus ***Netschajewia*** Yakovlev, 1925

Netschajewia sp. cf. **N. elongata** (Netschajew)

1968. *Netschajewia* cf. *elongata* (Netschajew): Nakazawa and Newell, p. 95, pl. 11, figs. 5, 6.

Age and distribution.—Upper Permian (Tartarian or thereabout). Toyoma Formation in Towa area of Miyagi Prefecture.

Genus ***Pseudopermophorus*** Ciriacks, 1963

Pseudopermophorus uedai Nakazawa and Newell

1968. *Pseudopermophorus uedai* Nakazawa and Newell, p. 94, pl. 9, figs. 10, 11.—1976b. *Pseudopermophorus uedai* Nakazawa et Newell: Murata, pl. P-19, figs. 1, 2, 3a, b, 4.

Type.—Syntypes (UK, not registered, seven specimens) from the Toyoma Formation at Nagahata, Towa-cho, and at Kitazawa, Toyoma-cho, Tome-gun, Miyagi Prefecture.
Age and distribution.—Upper Permian (Tartarian or thereabout). Toyoma Formation in Towa and Toyoma areas of Miyagi Prefecture.

Subfamily MYOCONCHINAE Newell, 1957
Genus ***Stutchburia*** Etheridge, Jr., 1900

Stutchburia? sp.

1968. *Stutchburia*? sp.: Nakazawa and Newell, p. 96, pl. 10, fig. 2.

Age and distribution.—Middle Permian (Kazanian). Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture.

Subfamily uncertain

Myoconcha? sp.

1967. *Myoconcha* sp.: Hayasaka, p. 519, text-figs. 2a–d.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Family CARDITIDAE Fleming, 1828
Subfamily PALAEOCARDITINAE Chavan, 1969
Genus ***Gujocardia*** Nakazawa and Newell, 1968

Gujocardia oviformis Nakazawa and Newell [Pl. 11, Figs. 10, 11]

1968. *Gujocardia oviformis* Nakazawa and Newell, p. 91, pl. 9, figs. 1–3, 4a, b, 5, 6.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 9, fig. 1) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Superfamily CRASSATELLACEA Férussac, 1822
Family ASTARTIDAE d'Orbigny, 1844
Subfamily ASTARTINAE d'Orbigny, 1844
Genus ***Astartella*** Hall, 1858

Astartella toyomensis Nakazawa and Newell [Pl. 11, Fig. 12]

1968. *Astartella toyomensis* Nakazawa and Newell, p. 98, pl. 10, figs. 3, 4a–c, 5.—1969. *Astartella toyomensis* Nakazawa and Newell: Murata, p. 19, pl. 4, figs. 9–11, 12a, b, 13, 14a, b, 15a, b, 16a, b, 17a, b.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 10, fig. 3) from the Toyoma Formation at Kitazawa, Toyoma-cho, Tome-gun, Miyagi Prefecture.

Age and distribution.—Upper Permian (Tartarian or thereabout). Toyoma Formation in Toyoma and Towa areas of Miyagi Prefecture, and Kowaragi Formation in Karakuwa area of the same prefecture.

Astartella sp.

1968. *Astartella* sp. a: Nakazawa and Newell, p. 99.

Age and distribution.—Upper Permian (Tartarian or thereabout). Upper part of the Maizuru Group in Oe area of Kyoto Prefecture.

Astartella sp.

1968. *Astartella* sp. b: Nakazawa and Newell, p. 100, pl. 11, fig. 9.

Age and distribution.—Middle Permian (Kazanian or thereabout). Upper part of the Mizukoshi Formation in Mifune area of Kumamoto Prefecture.

Astartella sp.

1968. *Astartella* sp. c: Nakazawa and Newell, p. 101, pl. 11, fig. 8.

Age and distribution.—Upper Permian (Tartarian or thereabout). Upper part of the Maizuru Group in Oe area of Kyoto Prefecture.

Astartella? sp.

1968. *Astartella?* sp. d: Nakazawa and Newell, p. 101, pl. 11, fig. 10.

Age and distribution.—Middle Permian (Kazanian). Shigejizawa member of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Astartella? sp.

1967. *Astertella* cf. *permocarbonica* Tschernyschew [typographical error of *Astartella*]: Yanagisawa, p. 97, pl. 3, figs. 10, 15.

Age and distribution.—Middle Permian (stage unknown). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Subclass ANOMALODESMATA Dall, 1889
Order PHOLADOMYOIDA Newell, 1965
Superfamily EDMONDIACEA King, 1850
Family EDMONDIIDAE King, 1850
Genus ***Edmondia*** de Koninck, 1841

Edmondia sp.

1967a. *Edmondia* sp.: Hayasaka, p. 380, text-figs. 2a, b, 3a, b, 4a–c.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Edmondia sp.

1968. *Edmondia* sp. a: Nakazawa and Newell, p. 39, pl. 1, figs. 6a, b.

Age and distribution.—Upper Permian (stage unknown). Gujo Formation in Oe area of Kyoto Prefecture.

Edmondia sp.

1968. *Edmondia* sp. b: Nakazawa and Newell, p. 40, pl. 11, fig. 7.

Age and distribution.—Upper Permian (stage unknown). Gujo Formation in Oe area of Kyoto Prefecture and (?) upper part of the Maizuru Group in Ayabe area of the same prefecture.

Edmondia sp.

1968. *Edmondia* sp. c: Nakazawa and Newell, p. 41, pl. 1, figs. 7, 8.

Age and distribution.—Middle Permian (Kazanian). Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture.

Edmondia? sp.

1951. *Edmondia*? a sp.: Ichikawa, p. 324, pl. 1, fig. 9.

Age and distribution.—Upper Permian (stage unknown). Katsura Formation in Sakawa area of Kochi Prefecture.

Edmondia? sp.

1951. *Edmondia*? b sp.: Ichikawa, p. 324, pl. 1, fig. 8.

Age and distribution.—Upper Permian (stage unknown). Katsura Formation in Sakawa area of Kochi Prefecture.

Superfamily PHOLADOMYACEA Gray, 1847
Family GRAMMYSIIDAE Miller, 1877
Genus ***Sanguinolites*** M'Coy, 1844

Sanguinolites? bisectus Hayasaka

1925. *Sanguinolites bisectus* Hayasaka, p. 13, pl. 8, fig. 10.

Type.—Holotype by monotypy (IGPS no. 22414, Hayasaka, 1925, pl. 8, fig. 10) from the Lower Carboniferous at Hikoroichi, Ofunato City, Iwate Prefecture.
Age and distribution.—Lower Carboniferous (Viséan or thereabout). Known only from the type locality.

Sanguinolites kamiyassensis Nakazawa and Newell

1968. *Sanguinolites kamiyassensis* Nakazawa and Newell, p. 42, pl. 11, figs. 3, 4.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 11, fig. 3) from the Shigejizawa member of the Kanokura Formation at Kamiyasse, Kesennuma City, Miyagi Prefecture.
Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Sanguinolites sp.

1968. *Sanguinolites* sp.: Nakazawa and Newell, p. 42.

Age and distribution.—Middle Permian (Kazanian). Shigejizawa member of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Sanguinolites? sp.

1968. *Sanguinolites?* sp.: Nakazawa and Newell, p. 43, pl. 1, fig. 11.

Age and distribution.—Middle Permian (Kazanian). Tenjinnoki Formation of the Maiya Group in Towa area of Miyagi Prefecture.

Genus ***Alula*** Girty, 1912

Alula elegantissima (Hayasaka) [Pl. 10, Fig. 10]

1925. *Solenomorpha elegantissima* Hayasaka, p. 21, pl. 9, figs. 1, 1a, 2, 2a, 3–7.—1952. *Solenomorpha elegantissima* Hayasaka: Shikama, p. 98, pl. 11, fig. 9 [reproduction of an original figure].—1953. *Solenomorpha elegantissima* Hysk.: Hayasaka and Hayasaka, p. 39.—1970. *Solenomorpha elegantissima* Hayasaka: Shikama, p. 116, pl. 35, fig. 20 [reproduction of an original figure].

Type.—Syntypes (IGPS no. 8203, at least seven specimens) from the "Kuro zone" (i.e., *Yabeina globosa* zone) of the Akasaka Limestone at Kinshozan, Akasaka-cho, Fuwa-gun, Gifu Prefecture.
Age and distribution.—Middle Permian (Kazanian). Known only from the type locality.

Family MEGADESMIDAE Vokes, 1967

Genus ***Pyramus*** Dana, 1847

Pyramus planus Nakazawa and Newell

1968. *Pyramus planus* Nakazawa and Newell, p. 45, pl. 1, figs. 5, 9, 10.

Type.—Holotype (UK, not registered, Nakazawa and Newell, 1968, pl. 1, fig. 5) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.
Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Family PHOLADOMYIDAE Gray, 1847
Genus ***Wilkingia*** Wilson, 1959

Wilkingia sp.

1967b. *Allorisma* sp.: Hayasaka, p. 517, text-figs. 1a–d.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower part of the Kanokura Formation in Kesennuma area of Miyagi Prefecture.

Wilkingia sp.

1968. *Wilkingia* sp.: Nakazawa and Newell, p. 44, pl. 10, fig. 6.

Age and distribution.—Middle Permian (Artinskian or Kazanian). Lower? part of the Kanokura Formation in Yahagi area of Iwate Prefecture.

Genus ***Chaenomya*** Meek, 1864
Subgenus ***Vacunella*** Waterhouse, 1956

Chaenomya (Vacunella) rostrata Nakazawa and Newell

1968. *Chaenomya* (*Vacunella*) *rostrata* Nakazawa and Newell, p. 102, pl. 10, fig. 7.

Type.—**Lectotype** here designated (UK, not registered, Nakazawa and Newell, pl. 10, fig. 7) from the Gujo Formation at Gujo, Oe-cho, Kasa-gun, Kyoto Prefecture.

Age and distribution.—Upper Permian (stage unknown). Known only from the type locality.

Class uncertain (? BIVALVIA)

Lima? sp.

1967. *Lima* cf. *retifera* Shumard: Yanagisawa, p. 97, pl. 2, fig. 9.

Age and distribution.—Middle Permian (stage unknown). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Conocardium? sp.

1967. *Conocardium kansuensis* Chao [*sic*]: Yanagisawa, p. 94, pl. 3, fig. 9.

Age and distribution.—Middle Permian (stage unknown). Kashiwadaira Formation of the Takakurayama Group in Yotsukura area of Fukushima Prefecture.

Posidonia? sp.

1924b. *Posidoniella* cfr. *pyriformis* Hind: Hayasaka, p. 57, pl. 7, fig. 10 (erroneously written as fig. 9 in text and explanation).

Age and distribution.—Carboniferous (stage unknown). Ōmi Limestone in Ōmi area of Niigata Prefecture.

Class ROSTROCONCHIA Pojeta, Runnegar, Morris and Newell, 1972
Order RIBEIROIDA Kobayashi, 1933
Family RIBEIRIIDAE Kobayashi, 1933
Genus ***Technophorus*** Miller, 1889

Technophorus coreanicus (Kobayashi)

1934b. *Ribeiria* (?) *coreanica* Kobayashi, p. 576, pl. 4, fig. 18.—1976. *Technophorus coreanica* Kobayashi [*sic*]: Pojeta and Runnegar, p. 58, pl. 11, fig. 14.

Type.—Holotype by monotypy (UMUT PA0900, Kobayashi, 1934b, pl. 4, fig. 14; Pojeta and Runnegar, 1976, pl. 11, fig. 14) from the *Clarkella* zone of the Chiktong Limestone of the Chosen Group at Saisho-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Lower Ordovician (Arenigian or Llanvirnian). Known only from the type locality.

Order CONOCARDIOIDA Neumayr, 1891
Superfamily EOPTERIACEA Miller, 1889
Family EOPTERIIDAE Miller, 1889
Genus ***Eopteria*** Billings, 1865

Eopteria? trilobata Kobayashi

1934a. *Eopteria* (?) *trilobata* Kobayashi, p. 493, pl. 44, figs. 9, 10.

Type.—Holotype by monotypy (UMUT PA0784, Kobayashi, 1934a, pl. 44, figs. 9, 10) from the Tsuibon beds of the Chosen Group at Kochi-ri, Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

Age and distribution.—Middle Ordovician (Caradocian). Known only from the type locality.

Superfamily CONOCARDIACEA Miller, 1889
Family CONOCARDIIDAE Miller, 1889
Genus ***Conocardium*** Bronn, 1835

Conocardium japonicum Nishida

1968. *Conocardium* (*Conocardium*) *japonicum* Nishida, p. 208, pl. 23, figs. 1, 2.

Type.—Holotype (ASM no. 5501, Nishida, 1968, pl. 23, fig. 1) from the *Fusulinella biconica* Zone of the Akiyoshi Limestone Group at the entrance of Shuchikujo, Isa-machi, Mine City, Yamaguchi Prefecture.

Age and distribution.—Upper Carboniferous (Moscovian). Known only from the type locality.

Conocardium sp.

1934a. *Conocardium* sp.: Kobayashi, p. 353, pl. 3, figs. 8, 9.

Age and distribution.—Middle Ordovician (Caradocian). Tsuibon beds of the Chosen Group in Taebaeksan (Taihakusan) area, Kangwon-do (Kogen-do), South Korea.

APPENDIX: REGISTERED SPECIMENS PRESERVED IN THE UNIVERSITY MUSEUM, UNIVERSITY OF TOKYO

All the described specimens of Paleozoic and Mesozoic gastropods and Paleozoic bivalves which are registered and preserved in the University Museum, University of Tokyo, are listed by author (with date) and also by species in agreement with the present systematic catalogues. The following abbreviations are used for the indication of the category of type specimens; H: holotype, P: paratype, S: syntype, L: lectotype, PL: paralectotype.

1) Registered specimens by author and date

Hayami (1960a): UMUT MM3662–3674
Hayami (1960b): UMUT PM3612
Ichikawa (1951): UMUT PM5306–5309, PM5311–5322, PM5325–5329
Ichikawa (1954): UMUT MM5435, 5436
Jimbo (1894): UMUT MM7485, 7486
Kambe (1951): UMUT MM6477
Kanie (1975): UMUT MM5533–5535
Kobayashi (1930): UMUT PM0061–0091
Kobayashi (1931): UMUT PM0180–0193
Kobayashi (1933): UMUT PM0432
Kobayashi (1934a): UMUT PM0535–0606, PA0784
Kobayashi (1934b): UMUT PM0812–0817
Kobayashi (1935): UMUT PM0942–0950
Kobayashi (1958a): UMUT PM2300–2308
Kobayashi (1958b): UMUT PM2316–2320
Kobayashi (1960): UMUT PM2362, 2363, PA2417
Kobayashi (1961): UMUT PM2499
Kobayashi (1962): UMUT PM3989–3992
Kobayashi and Hisakoshi (1942): PM1908, 1909
Kobayashi and Ichikawa (1952a): MM5408
Kobayashi and Ichikawa (1952b): MM5402, 5403
Kobayashi and Suzuki (1936): MM4233
Kobayashi and Suzuki (1937): MM4236, 4237, MM7022–7030
Kobayashi and Suzuki (1939): MM7900–7909
Matsumoto (1938): UMUT MM7741–7743, MM7756–7781
Matsumoto (1963): UMUT MM7485, 7486
Saito (1936): UMUT PM1468–1489
Suzuki (1940): UMUT MM6315–6385

2) Registered specimens by species

Paleozoic and Mesozoic gastropods

Helcionella acuticosta pacifica Saito: PM1468(H), 1469(P), 1470(P)

Helcionella coreanica Kobayashi: PM2316(S), 2317(S)
Hampilina goniospira Kobayashi: PM2318(H), 2319(P), 2499
Hampilina alta Kobayashi: PM2320(H)
Coreospira rugosa Saito: PM1473(H), 1474(P), 1475(P), 1476(P)
Sinuites (*Sinuitopsis*) *kochiriensis* (Kobayashi): PM0570(S), 0571(S)
Tropidodiscus? *sigmoidalis* (Kobayashi): PM0572(H)
Bucania katoi Kobayashi: PM0061(H)
Bucanopsis tsuibonenesis Kobayashi: PM0574(H), 0575(P), 0576(P), 0577(P)
Bellerophon sp. [Kobayashi, 1934a]: PM0573
Bellerophon? *aotii* Kobayashi: PM2300(H)
Kobayashiella? *masariensis* Kobayashi: PM3991(H)
Maclurites tofangoensis (Kobayashi): PM0083(S), 0084(S), 0085(S), 0086(S)
Protoscaevogyra reversa (Kobayashi): PM0944(H)
Helicotoma amanoi Kobayashi: PM2304(H), 2303(P)
Helicotoma kanekoi Kobayashi: PM0189(H), 0188(P)
Helicotoma keizanensis (Kobayashi): PM0599(H), 0600(P), 2305, 2306
Helicotoma tamurai Kobayashi: PM0081(H)
Helicotoma yabei Kobayashi: PM0080(H)
Helicotoma sp. [Kobayashi, 1934a]: PM0596
Ophiletina? *shokoriensis* Kobayashi: PM0078(H)
Ophiletina? sp. [Kobayashi, 1930]: PM0077
Ecculiomphalus? *kushanensis* (Grabau): PM0079
Lesueurilla minima (Kobayashi): PM0595(H)
Lesueurilla shirakii (Kobayashi): PM0593(S), 0594(S)
Straparollus? *shirakii* Kobayashi: PM0186(H)
Straparollus? sp. [Ichikawa, 1951]: PM5322
Euconia? *shohakuensis* (Kobayashi): PM0591(H), 0592(P), 2308
Euconia? *taihakuensis* (Kobayashi): PM0590(H)
Ophileta alta Kobayashi: PM0813(S), 0814(S)
Ophileta ichimurai (Kobayashi): PM0187(H)
Ophileta plana Kobayashi: PM0815(S), 0816(S), 0817(S)
Scalites irregularis Kobayashi: PM2302(H)
Scalites katoi (Kobayashi): PM0602(H), 0601(P), 0603(P), 0604(P), 2301
Raphistoma coreanicum Kobayashi: PM0598(H), 0597(P)
Liospira kawasakii Kobayashi: PM0075(H), 0181, 0182
Liospira lenticularis Kobayashi: PM0184(H), 0183(P), 0185(P)
Sisenna? *japonica* Kobayashi and Ichikawa: MM5408a(H)
Eotomaria concava Kobayashi: PM0076(H)
Loxoplocus (*Lophospira*) *acutus* (Grabau): PM0069
Loxoplocus (*Lophospira*) *bantatsuensis* (Kobayashi): PM0063(H), 0064(P), 0065(P)
Loxoplocus (*Lophospira*) cf. *bantatsuensis* Kobayashi: PM2307
Loxoplocus (*Lophospira*) *endoi* (Kobayashi): PM0586(H)
Loxoplocus (*Lophospira*) *gerardi* (Grabau): PM0071
Loxoplocus (*Lophospira*) *kinosakii* (Kobayashi): PM0587(H)
Loxoplocus (*Lophospira*?) *kodairai* (Kobayashi): PM0068(H)
Loxoplocus (*Lophospira*) *konnoi* (Kobayashi): PM0066(H)
Loxoplocus (*Lophospira*?) *morrisi* (Grabau): PM0062
Loxoplocus (*Lophospira*) *pagoda* (Salter): PM0578–0583
Loxoplocus (*Lophospira*) aff. *pagoda* (Salter): PM0584

Loxoplocus (*Lophospira*) *subpulchellus* (Kobayashi): PM0070(H)
Loxoplocus (*Lophospira*) *tateiwai* (Kobayashi): PM0588(H)
Loxoplocus (*Lophospira*) *trochiformis* (Grabau): PM0067
Loxoplocus (*Lophospira*?) sp. [Kobayashi, 1934a]: PM0589
Loxoplocus (*Donaldiella*) *tetracarina* (Kobayashi): PM0074(H)
Pleurotomaria? sp. [Ichikawa, 1954]: MM5436
Trochonema ozawai Kobayashi: PM0090(H), 0091(H of *T. ozawai* var. *depressa*)
Holopea tateiwai Kobayashi: PM0191(H)
Cyclonema? *sonrinensis* Kobayashi: PM0190(L)
Naticopsis sp. [Kobayashi and Ichikawa, 1952b]: MM5402
Neritopsis (*Neritopsis*?) *elegans* Hayami: MM3667(H), 3668(P), 3669(P)
Neritopsis (*Neritopsis*) *mutabilis* Hayami: MM3663(H), 3664(P), 3665(P), 3666(P)
Clisospira? *chundongensis* Kobayashi: PM0193(H)
Clisospira shorinensis Kobayashi: PM0192(H)
Natiria? *infrequens* (Kobayashi and Ichikawa): MM5403a(H)
Natiria? sp. [Ichikawa, 1954]: MM5435
Paraturbo kumasoana (Matsumoto): MM7743(L), 7756(PL)
Subulites (*Fusispira*?) sp. [Kobayashi, 1934a]: PM0605
Pseudomelania? sp. [Hayami, 1960a]: MM3662
Ampullaria? *nipponica* (Kobayashi and Suzuki): MM4236(H), 4237(P)
Mesalia? *goshorana* (Matsumoto): MM7742(H)
Turritella? sp. [Matsumoto, 1938]: MM7761, 7762
Promathilda sp. [Hayami, 1960a]: MM 3670, 3671
Cassiope neumayri (Nagao): MM7900–7905(S of *Glauconia*? *neumayri* forma *angusta*), 7906–7909
Brotiopsis wakinoensis (Kobayashi and Suzuki): MM7940 (plaster cast of H)
Siragimelania japonica (Matsumoto): MM7722(H)
Siragimelania tateiwai acuticostata (Suzuki): MM6355(H), 6353(P), 6354(P), 6356–6384(P)
Siragimelania tateiwai tateiwai (Suzuki): MM6315(H), 6316–6352(P)
Melanoides? *minima* Kobayashi and Suzuki: MM7024(H), 7025–7027(P)
Melanoides? *vulgaris* Kobayashi and Suzuki: MM7023(H)
"*Capulus*" *giganteus* (Schmidt): MM5533–5535
Pictavia toyorana Hayami: MM3672(H), 3673(P), 3674(P)
Tylostoma? *amaxense* (Matsumoto): MM7741(H), 7760(P)
Oligoptyxis pyramidaeformis (Nagao): MM7781
Itruvia? *uedai* (Matsumoto): MM7774a(L), 7774b(PL)
Pelagiella hana Kobayashi: PM0942(H), 0943(P)

[Paleozoic species formerly described as gastropods]
Proplina antiqua Kobayashi: PM3990(H), 3989(P)
Scenella clotho Walcott: PM1471, 1472
Palaeacmaea hampakuensis Kobayashi: PM0566(H), 0565(P), 0567(P), 0568(P)
Palaeacmaea sohsanensis Kobayashi: PM0569(H)
Palaeacmaea (?) sp. [Kobayashi, 1960]: PM2362
Hyolithes cybele Walcott: PM3992
Hyolithes globiger Saito: PM1482(H), 1479–1481(P)
Hyolithes katoi Saito: PM1477(H), 1478(P)
Hyolithes subcarinatus Kobayashi: PM0945–0947(S)

Hyolithes teretapex Saito: PM1485(H), 1483(P), 1484(P)
Hyolithes sp. [Kobayashi, 1935]: PM0948, 0949
Hyolithes sp. [Kobayashi, 1935]: PM0950
Hyolithes sp. [Kobayashi, 1934a]: PM0606
Hyolithes? sp. [Kobayashi, 1960]: PM2363

Paleozoic bivalves

Ctenodonta corbuliformis Kobayashi: PM0546–0548(S)
Ctenodonta coreanica Kobayashi: PM0540(H), 0541(P), 0542(P)
Ctenodonta dotensis Kobayashi: PM0539(H)
Ctenodonta nasutaformis Kobayashi: PM0537(H), 0538(P)
Ctenodonta nipponica Kobayashi: PM0535(H), 0536(P)
Ctenodonta oblongata Kobayashi: PM0549(H)
Ctenodonta? *striata* Kobayashi: PM0550(L)
Ctenodonta? sp. [Kobayashi, 1934a]: PM0552
Palaeoconcha? *samenoha* (Kobayashi): PM0544(S), 0545(S)
Palaeoconcha? *subsymmetrica* Kobayashi: PM0543(H)
Nuculopsis (*Nuculopsis*) *orientalis* Ichikawa: PM5311(H)
Nuculopsis (*Nuculopsis*) sp. [Ichikawa, 1951]: PM5312
Nuculopsis (*Nuculanella*) sp. [Ichikawa, 1951]: PM5313
Nuculites? *suboblongatus* Kobayashi: PM0551(H)
Palaeoneilo sp. [Ichikawa, 1951]: PM5314
Cyrtodonta? *prima* Kobayashi: PM0812(H)
Cleionychia oviformis Kobayashi: PM0553(H)
Anthraconaia sp. [Kobayashi and Hisakoshi, 1942]: PM1908, 1909
Myalina? sp. [Ichikawa, 1951]: PM5321
Pterinea? *subasperula* Kobayashi: PM0180(H)
Waagenoperna (*Permoperna*) *hayamii* Nakazawa and Newell: PM3612
Goniophora (*Cosmogoniophora*) *orientalis* Kobayashi: PM0562(H), 0563(P)
Modiolopsis elongata Kobayashi: PM0559(H)
Modiolopsis hinomotoensis Kobayashi: PM0560(H)
Modiolopsis kogenensis Kobayashi: PM0556(H), 0555(P), 0557(P)
Modiolopsis reedi Kobayashi: PM0558(H)
Modiolopsis rugosa Kobayashi: PM0561(H)
Anthracosia? *jidoensis* (Kobayashi): PM0432(S)
Actinodontophora katsurensis Ichikawa: PM5306(H), 5307–5310(P)
Costatoria kobayashii (Kambe): MM6477(L)
Neoschizodus (*Neoschizodus*) *kobayashii* (Ichikawa): PM5317(H), 5318(P), 5319(P)
Edmondia? sp. [Ichikawa, 1951]: PM5315
Edmondia? sp. [Ichikawa, 1951]: PM5316

[Paleozoic species formerly described as bivalves]
Technophorus coreanicus Kobayashi: PA0900(H)
Conocardium sp. [Kobayashi, 1934a]: PM0554

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ERRATA

For Hayami: A systematic survey of the Mesozoic Bivalvia from Japan. *Univ. Mus., Univ. Tokyo, Bull.*, no. 10

Page	Line	Read	For
22	14	**tenelliformis**	**telliniformis**
27	8	**Parallelodon**	**Paralleldon**
27	25	**Parallelodon**	**Paralleldon**
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39	36	**gyliakiana**	**gyliakina**
39	37	*gyliakiana*	*gyliakina*
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82	10	MM 5209	MM 5210
101	21	*Myophoriopis*	*Myophoriopsis*
108	16	and	*and*
134	26	**Integricardium?**	**Intergricardium?**
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INDEX

Generic and specific names adopted in the present taxonomic study are indicated in italic type, and other cited names in roman type. Adopted familial names are distinguished by the use of full capitals.

PALEOZOIC AND MESOZOIC GASTROPODA

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S

PALEOZOIC BIVALVIA

HAYAMI and KASE: PALEOZOIC AND MESOZOIC GASTROPODA AND PALEOZOIC BIVALVIA FROM JAPAN

PLATES 1–11

Explanation of Plate 1

Fig. 1. *Helcionella acuticosta pacifica* Saito. Holotype (UMUT PM1468). Right side view (1a) and anterior side view (1b), ×12. Reproduced from Saito, 1936, pl. 3, figs. 1, 2. Loc. Chungwa, Pyongan-namdo (Lower or Middle Cambrian, Manto shale of the Chosen Group).

Fig. 2. *Helcionella coreanica* Kobayashi. Syntype (UMUT PM2317). Right side view, ×1.5. Loc. Chungwa, Pyongan-namdo (Cambrian, Chosen Group).

Fig. 3. *Hampilina goniospira* Kobayashi: type-species of genus *Hampilina*. Holotype (UMUT PM2320). Left side view (3a) and posterior side view (3b), ×2. Loc. Mungyong, Kyongsang-bukdo (Cambrian, Eiko Formation of the Chosen Group).

Fig. 4. *Coreospira rugosa* Saito: type-species of genus *Coreospira*. Holotype (UMUT PM1473). Right side view (4a) and adapertural view (4b), × 10. Reproduced from Saito, 1936, pl. 3, figs. 6, 7. Loc. Chungwa, Pyongan-namdo (Lower Cambrian, "Upper *Redlichia* shale" of the Chosen Group).

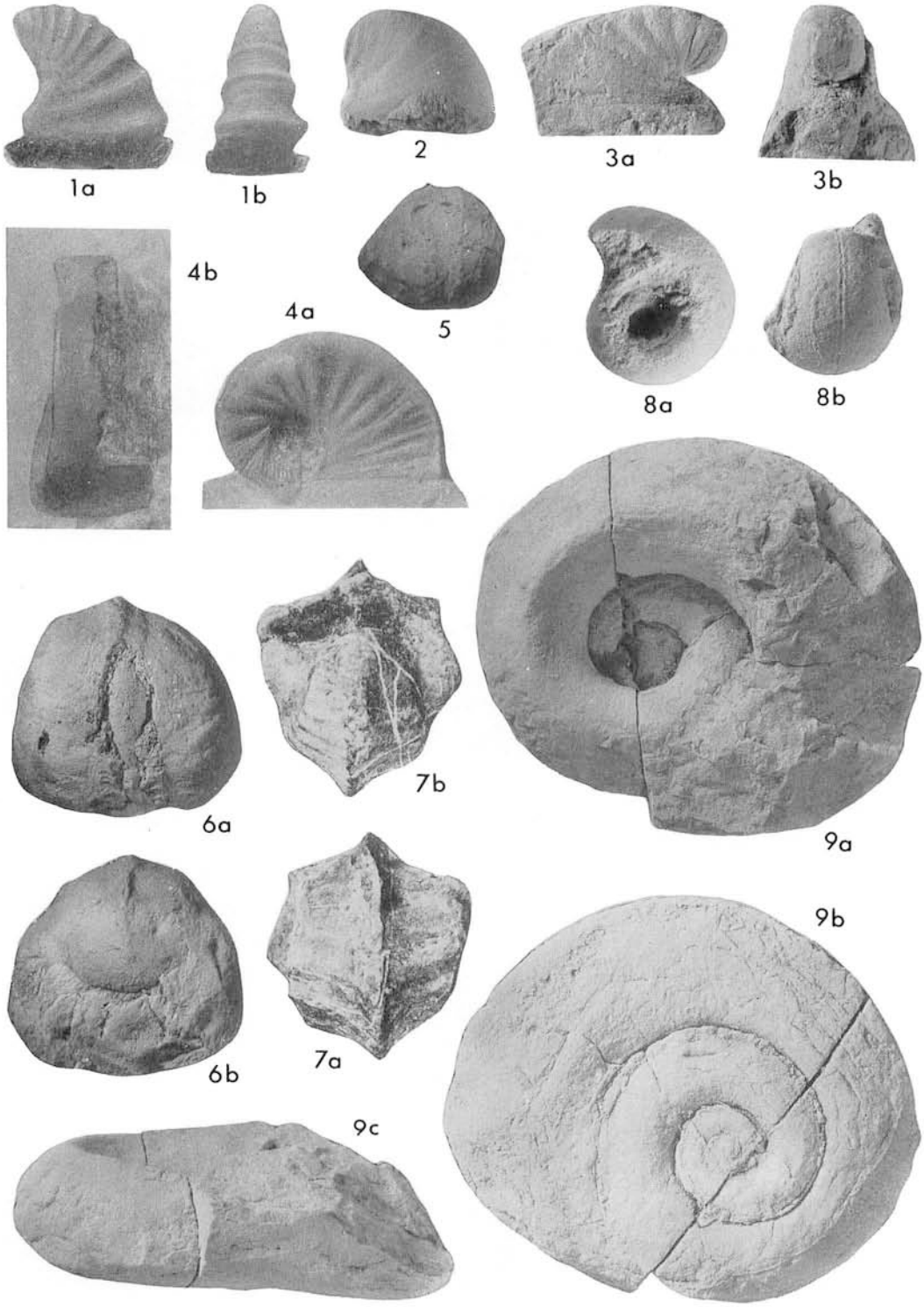
Fig. 5. *Euphemitopsis kitakamiensis* Murata. Holotype (IGPS no. 91360). Adapertural view, × 2. Loc. Kitazawa, Miyagi Pref. (Upper Permian, Toyoma Formation).

Fig. 6. *Bellerophon* (*Bellerophon*?) *yabei* Murata. Holotype (IGPS no. 91364). Adapertural view (6a) and apertural view (6b), × 2. Loc. Kitazawa, Miyagi Pref. (Upper Permian, Toyoma Formation).

Fig. 7. *Bellerophon* (*Sorobanobaca*) *matsumotoi* Nishida: type-species of subgenus *Sorobanobaca*. Holotype (GS D54). Adapertural view (7a) and apertural view (7b), × 2. Loc. Ohirayama, Kochi Pref. (Middle Permian, Takaoaka Formation).

Fig. 8. *Bucania katoi* Kobayashi. Holotype (UMUT PM0061). Apertural view (8a) and left side view (8b), × 2. Loc. Taisei-ri, Pyongan-namdo (Middle Ordovician, Unkaku beds of the Chosen Group).

Fig. 9. *Maclurites tofangoensis* (Kobayashi). Syntype (UMUT PM 0083). Upper side view (9a), lower side view (9b) and apertural view (9c), × 1. Loc. Toufangkou, northeast China (Middle Ordovician, Toufangkou Limestone).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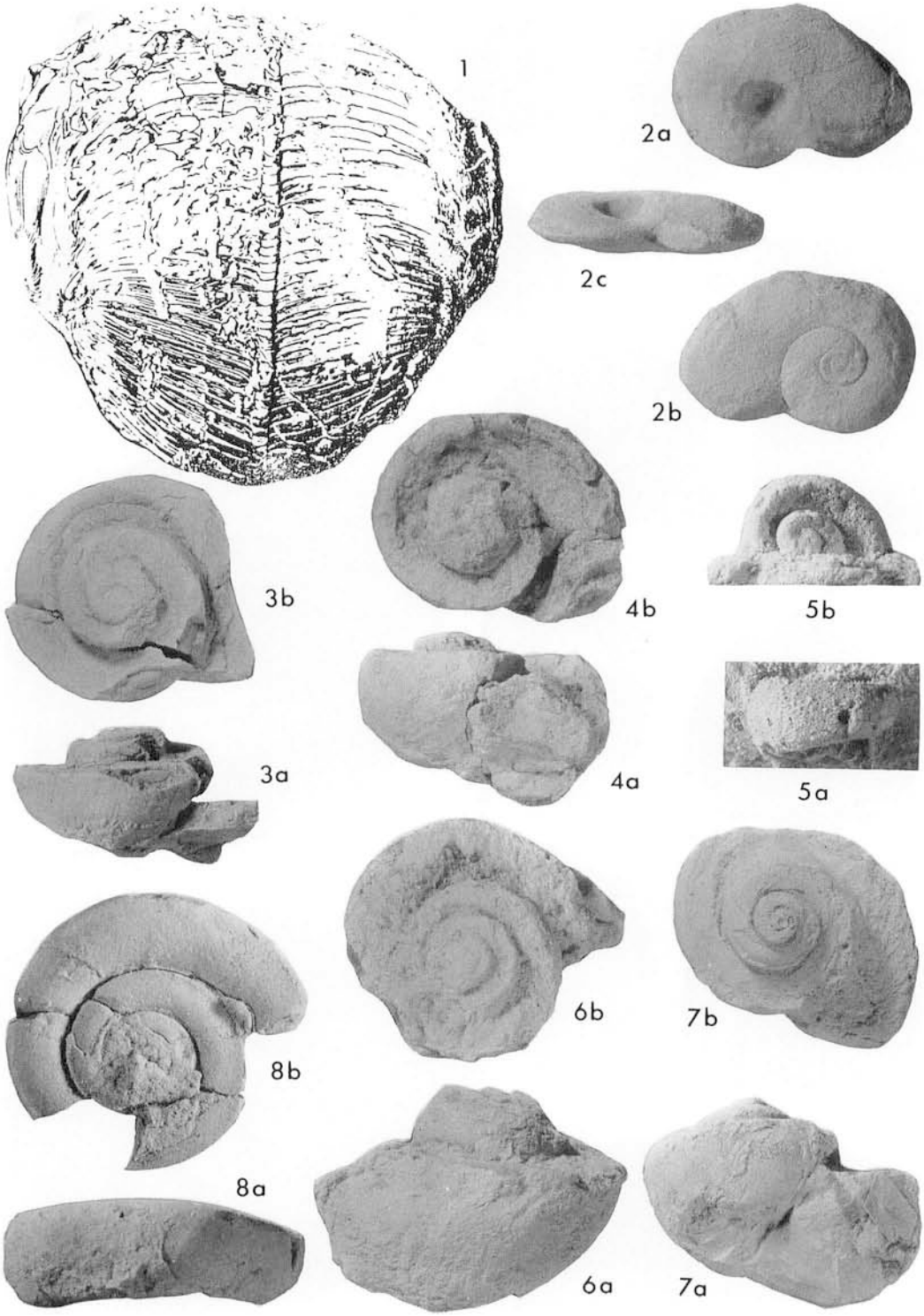
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Explanation of Plate 2

Fig. 1. *Bellerophon* (*Bellerophon*) *jonesianus* de Koninck. Adapertural view, × 0.8. Reproduced from Hayasaka, 1943, pl. 1, fig. 1. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 2. *Protoscaevogyra reversa* (Kobayashi): type-species of genus *Protoscaevogyra*. Holotype (UMUT PM0944). Upper side view (2a), lower side view (2b) and apertural view (2c), × 2. Loc. Kasetsuji, Kangwon-do (Middle Cambrian, Seison slate of the Chosen Group).

Fig. 3. *Lesueurilla shirakii* (Kobayashi). Syntype (UMUT PM0593). Apertural view (3a) and upper side view (3b), × 1. Loc. Kochi-ri, Kangwon-do (Middle Ordovician, Tsuibon beds of the Chosen Group).

Fig. 4. *Helicotoma amanoi* Kobayashi. Holotype (UMUT PM2304). Apertural view (4a) and upper side view (4b), × 1. Loc. Kan, Kyongsang-bukdo (Middle Ordovician, Todon Formation of the Chosen Group).

Fig. 5. *Helicotoma yabei* Kobayashi. Holotype (UMUT PM0080). Adapertural view (5a) and upper side view (5b), × 2. Loc. Shoko-ri, Pyongan-namdo (Middle Ordovician, Unkaku beds of the Chosen Group).

Fig. 6. *Scalites irregularis* Kobayashi. Holotype (UMUT PM2302). Adapertural view (6a) and upper side view (6b), × 1. Loc. Kan, Kyongsang-bukdo (Middle Ordovician, Todon Formation of the Chosen Group).

Fig. 7. *Scalites katoi* (Kobayashi). Holotype (UMUT PM0602). Apertural view (7a) and upper side view (7b), × 1.5. Loc. Saisho-ri, Kangwon-do (Middle Ordovician, Tsuibon beds of the Chosen Group).

Fig. 8. *Ophileta ichimurai* (Kobayashi). Holotype (UMUT PM0187). Adapertural view (8a) and upper side view (8b), × 1.5. Loc. Shorin-ri, Huanghae-do (Lower Ordovician, Shorin beds of the Chosen Group).

Explanation of Plate 3

Fig. 1. *Eotomaria concava* Kobayashi. Holotype (UMUT PM0076). Adapertural view (1a) and lower side view (1b), × 2. Loc. Shoko-ri, Pyongan-namdo (Middle Ordovician, Unkaku beds of the Chosen Group).

Fig. 2. *Liospira lenticularis* Kobayashi. Holotype (UMUT PM0184) Apertural view (2a) and upper side view (2b), × 1.5 Loc. Shorin-ri, Huanghae-do (Middle Ordovician, Shorin beds of the Chosen Group).

Fig. 3. *Loxoplocus* (*Lophospira*) *tateiwai* (Kobayashi). Holotype (UMUT PM0588). Adapertural view, × 2. Loc. Kochi-ri, Kangwon-do (Middle Ordovician, Tsuibon beds of the Chosen Group).

Fig. 4. *Loxoplocus* (*Lophospira*) *acutus* (Grabau). Apertural view, ×2. Loc. Shoko-ri, Pyongan-namdo (Middle Ordovician, Unkaku beds of the Chosen Group).

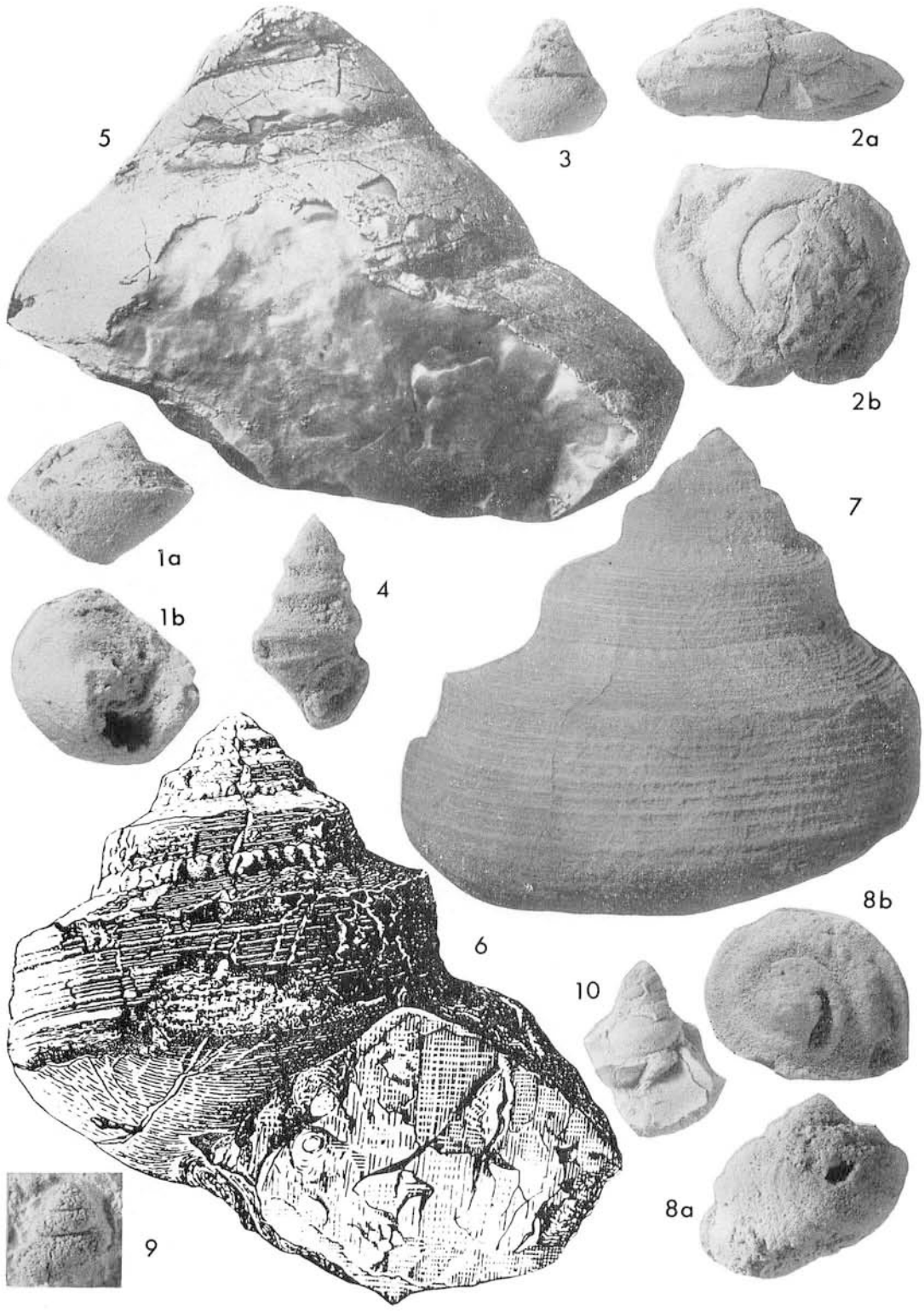
Fig. 5. *Euconospira nipponica* Hayasaka. Holotype (GMH). Apertural view, × 1. Loc. Nabeyama, Tochigi Pref. (Middle Permian, Nabeyama Limestone).

Fig. 6. *Bathrotomaria*? *yokoyamai* (Hayasaka). Holotype (Taipei Univ.). Apertural view, × 0.8. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 7. The same species. Topotype (Kyushu Univ.). Adapertural view, × 0.6. Loc. ditto.

Fig. 8. *Trochonema ozawai* Kobayashi. Holotype (UMUT PM0090). Adapertural view (8a) and upper side view (8b), × 2. Loc. Shoko-ri, Pyongan-namdo (Middle Ordovician, Unkaku beds of the Chosen Group).

Fig. 9. *Holopea tateiwai* Kobayashi. Holotype (UMUT PM0191). Adapertural view, × 2. Loc. Shorin-ri, Huanghae-do (Shorin beds of the Chosen Group).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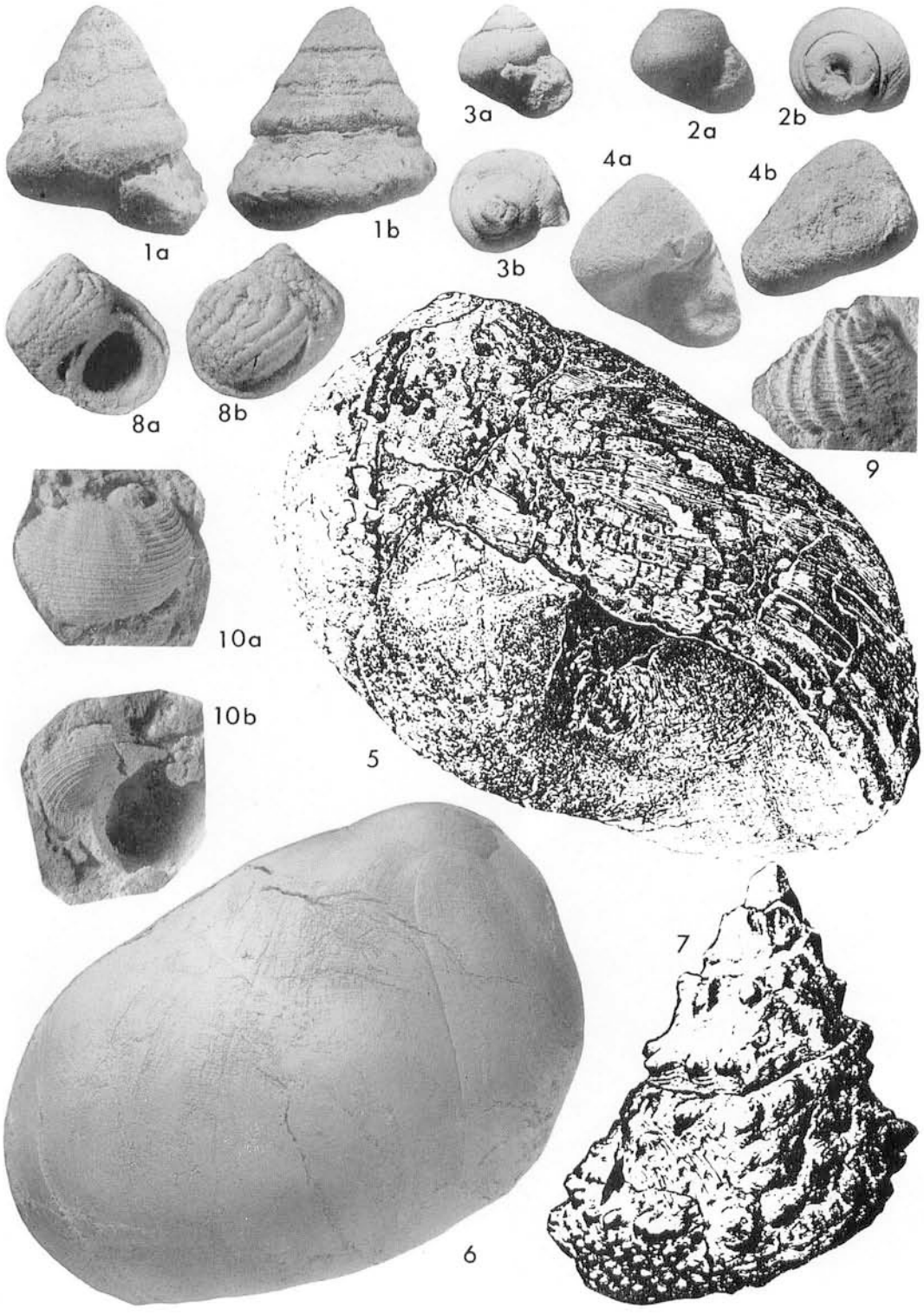
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Explanation of Plate 4

Fig. 1. *Discotectus crassus* (Nagao). Holotype (GMH no. 6785). Apertural view (1a) and adapertural view (1b), × 1.5. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 2. *Atira depressa* (Nagao). Holotype (GMH no. 8334). Apertural view (2a) and upper side view (2b), × 2. Loc. Takinosawa, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 3. *Margarites sachalinensis* Nagao. Syntype (GMH no. 8325). Apertural view (3a) and upper side view (3b), × 2. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 4. *Ataphrus* (*Ataphrus*) *yokoyamai* Nagao. Holotype (GMH no. 7088). Apertural view (4a) and adapertural view (4b), × 2. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 5. *Naticopsis* (*Naticopsis*) *wakimizui* Hayasaka. Holotype (Taipei Univ.). Apertural view, × 0.8. Reproduced from Hayasaka, 1943, pl. 3, fig. 1a. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 6. The same species. Topotype (UMUT). Adapertural view, × 0.6. Loc. ditto.

Fig. 7. *Trachyspira conica* (Hayasaka). Holotype (Taipei Univ.). Adapertural view, × 0.8. Reproduced from Hayasaka, 1943, pl. 2, fig. 4b. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 8. *Shikokuspira hamadai* Nishida: type-species of genus *Shikokuspira*. Holotype (GS D80). Apertural view (8a) and adapertural view (8b), × 3. Loc. Ohirayama, Kochi Pref. (Middle Permian, Takaoka Formation).

Fig. 9. *Neritopsis* (*Neritopsis*?) *elegans* Hayami. Holotype (UMUT MM3667). Rubber cast. Adapertural view, × 1.5. Loc. Higashinagano, Yamaguchi Pref. (Lower Jurassic, Higashinagano Formation of the Toyora Group).

Fig. 10. *Neritopsis* (*Neritopsis*) *mutabilis* Hayami. Holotype (UMUT MM3663). Rubber cast. Adapertural view (10a) and apertural view (10b), × 1. Loc. Higashinagano, Yamaguchi Pref. (Lower Jurassic, Higashinagano Formation of the Toyora Group).

Explanation of Plate 5

Fig. 1. *Otostoma japonicum* (Nagao). Holotype (GMH no. 6763). Apertural view (1a), adapertural view (1b), upper side view (1c), × 1.5. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 2. *Lepidotrochus hataii*(Hayasaka). Syntype (IGPS no. 87303). Adapertural view, × 1. Loc. Hamada, Miyagi Pref. (Middle Triassic, Rifu Formation).

Fig. 3. *Paraturbo kumasoana* (Matsumoto). Lectotype (UMUT MM 7743). Adapertural view, × 1. Loc. Goshonoura island, Kumamoto Pref. (Upper Cretaceous, Goshonoura Group).

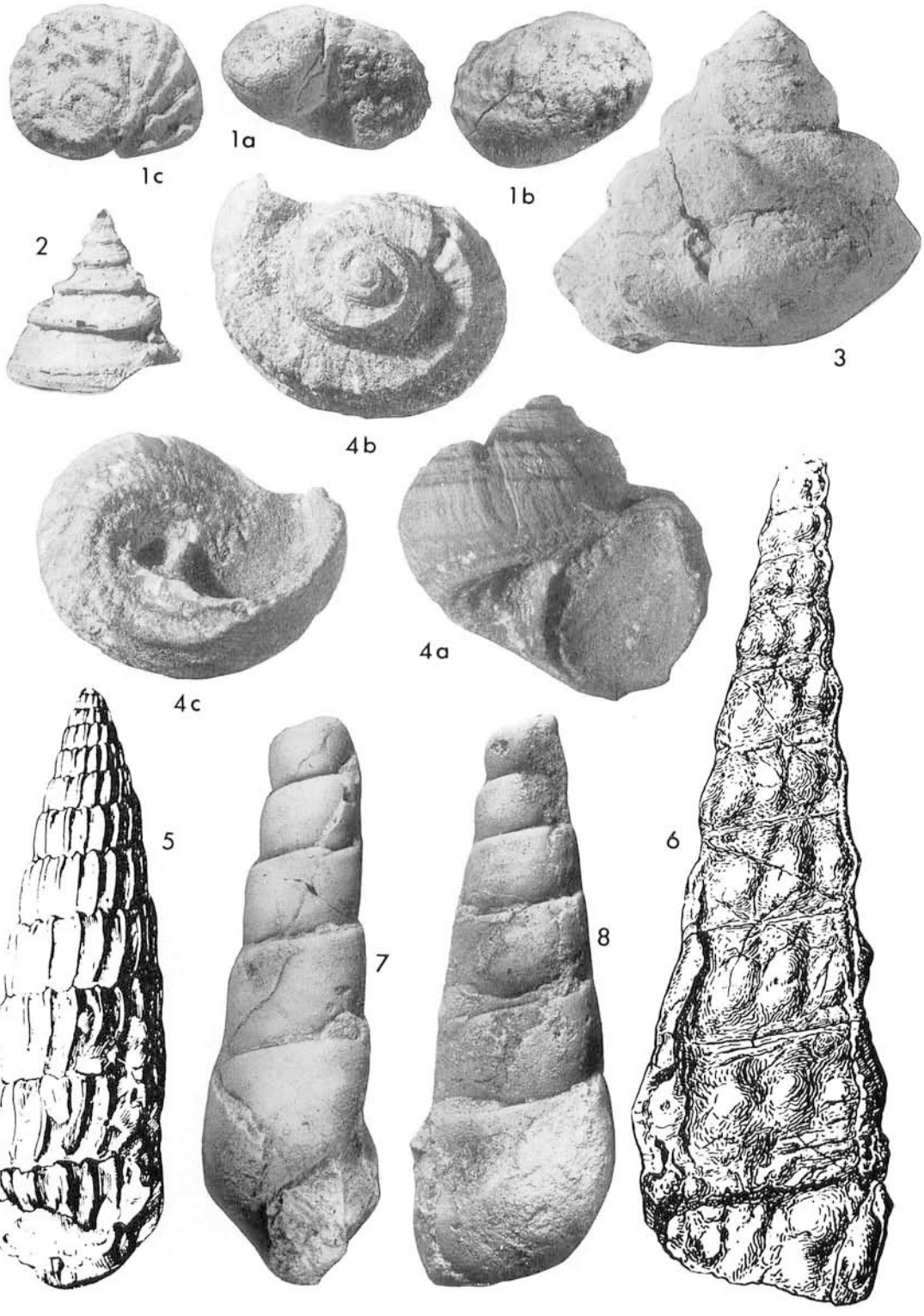
Fig. 4. *Nododelphinula elegans* Nagao. Apertural view (4a), upper side view (4b) and lower side view (4c), × 1. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 5. *Spiromphalus yabei* Hayasaka: type-species of genus *Spiromphalus*. Syntype (Taipei Univ.?). Adapertural view, × 6. Reproduced from Hayasaka, 1939, pl. 3, fig. 3. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 6. *Raha? yabei* (Hayasaka). Syntype (Taipei Univ.). Reproduced from Hayasaka, 1943, pl. 4, fig. 2. × 0.8. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 7. *Pseudomelania* (*Pseudomelania*) *elegantula* Nagao. Syntype (GMH no. 7062). Apertural view (internal mould), × 1. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 8. The same species. Another syntype (GMH no. 7062). Adapertural view (internal mould), × 1. Loc. ditto.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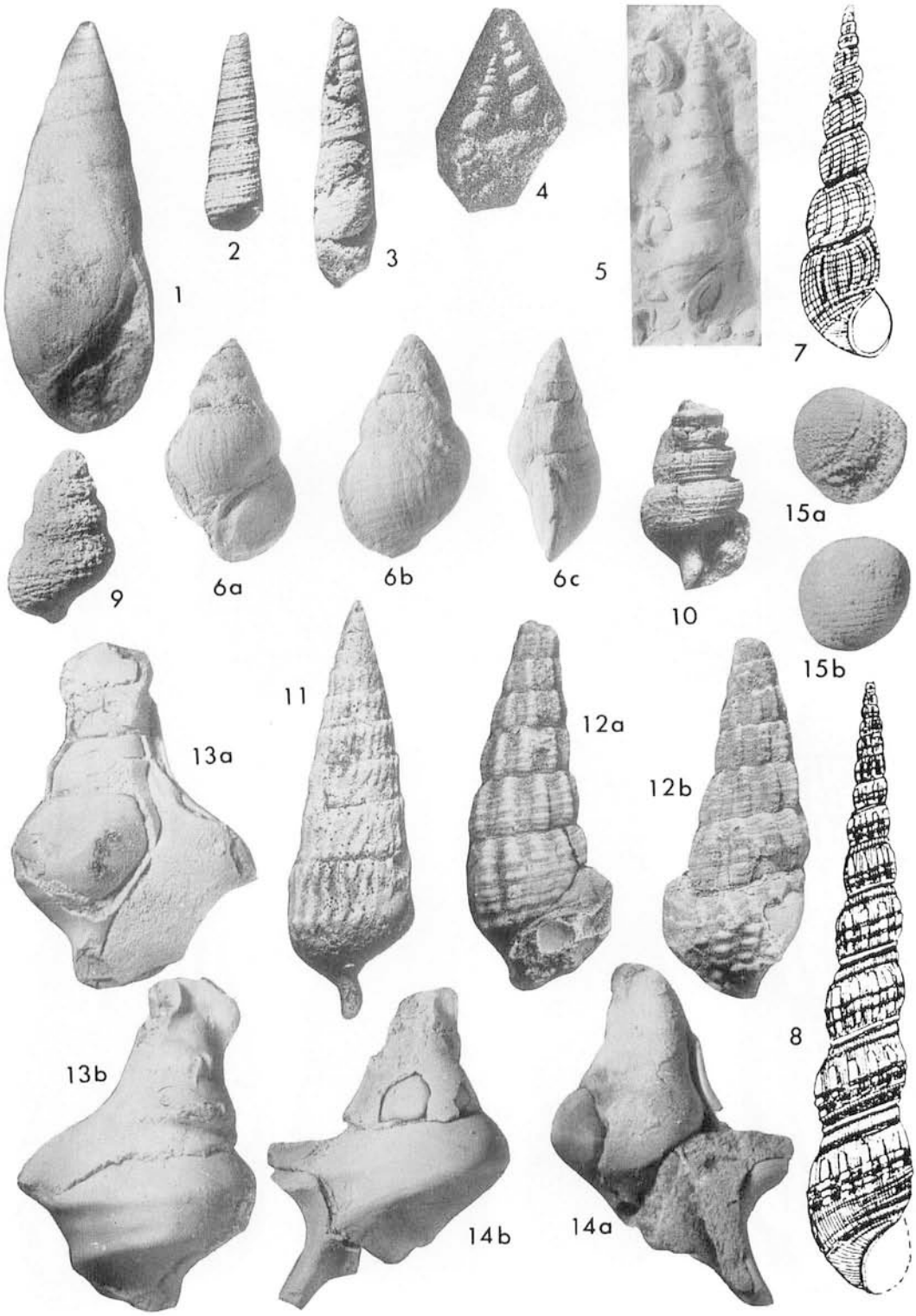
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Explanation of Plate 6

Fig. 1. *Trajanella japonica* Nagao. Holotype (GMH no. 7077). Apertural view, × 1. Loc. Haipe, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 2. *Turritella yaegashii* Nagao. Lectotype (GMH no. 6802). Apertural view, × 2. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 3. *Turritella soratiensis* Nagao. Holotype (GMH no. 8343). Adapertural view, × 2.5. Loc. Tomatsu-zawa, Hokkaido (Upper Cretaceous, Mikasa Formation of the Middle Yezo Group).

Fig. 4. *Itomelania basicordata* Suzuki: type-species of genus *Itomelania*. Holotype (left). Adapertural view, × 2. Loc. Umatoge, Kyongsang-namdo (Lower Cretaceous, Shinshu Formation of the Naktong Group).

Fig. 5. *Brotiopsis wakinoensis* (Kobayashi and Suzuki): type-species of genus *Brotiopsis*. Plaster cast of holotype (UMUT MM7940). Apertural view, × 1.2. Loc. Ryohori, Kyongsang-namdo (Lower Cretaceous, Naktong Group).

Fig. 6. *Siragimelania tateiwai tateiwai* (Suzuki): nominate subspecies of the type-species of genus *Siragimelania*. Holotype (UMUT MM6315). Apertural view (1a) and adapertural views (1b, c), × 2. Loc. Hyakuan-do, Kyongsang-bukdo (Cretaceous, Taikyu Formation of the Siragi Group).

Fig. 7. *Melanoides* (*Yoshimonia*) *yoshimoensis* Ota: type-species of subgenus *Yoshimonia*. Apertural view, × 2. Reproduced from Ota, 1960, p. 8, fig. 3. Loc. Yoshimo, Yamaguchi Pref. (Lower Cretaceous, Yoshimo Formation of the Toyonishi Group).

Fig. 8. *Melanoides* (*Kumania*) *kawaguchiensis* Ota: type-species of subgenus *Kumania*. Apertural view, × 1.5. Reproduced from Ota, 1960, p. 11, fig. 5. Loc. Shimomatsukuma, Kumamoto Pref. (Lower Cretaceous, Kawaguchi Formation).

Fig. 9. *Cirsocerithium reticulatum* (Nagao). Lectotype (GMH no. 6814). Adapertural view, × 3. Loc. Haipe, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 10. *Bathraspira excavata* Nagao. Holotype (GMH no. 7080). Apertural view, × 1.5. Loc. Raga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 11. *Cimolithium miyakoense* (Nagao). Holotype (GMH no. 6803). Adapertural view, × 1. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 12. *Pyrazus? scalariformis* Nagao. Holotype (GMH no. 7084). Apertural view (12a) and adapertural view (12b), × 1. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 13. *Aporrhais* (*Tessarolax*) *japonicus* (Yabe and Nagao). Holotype (IGPS no. 22636). Apertural view (13a) and adapertural view (13b), × 1.5. Loc. Ikushumbetsu river, Hokkaido (Upper Cretaceous, Upper Yezo Group).

Fig. 14. *Aporrhais* (*Tessarolax*) *acutimarginatus* (Nagao). Syntype (IGPS no. 51254). Apertural view (14a) and adapertural view (14b), × 1.5. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 15. *Avellana minima* Nagao. Holotype (GMH no. 7071). Apertural view, × 4. Loc. Haipe, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Explanation of Plate 7

Fig. 1. *Harpagodes? sachalinensis* Yabe and Nagao. Syntype (IGPS no. 8557). Adapertural view, × 1. Loc. Cape Khoinji, north Saghalin (Upper Cretaceous, Cape de la Jonquière Group).

Fig. 2. *Pugnellus* (*Gymnarus*) *yabei* Nagao. Syntype (GMH no. 6152). Adapertural view, × 1.5. Loc. Tinomigawa, Hokkaido (Upper Cretaceous, Mikasa Formation of the Middle Yezo Group).

Fig. 3. *Colombellina* (*Columbellaria*) *brevisiphonata* Nagao. Lectotype (GMH no. 7086). Apertural view, × 2. Loc. Haipe, Iwate Pref. Apertural view, × 2. Loc. Haipe, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 4. *Tibia japonica* (Nagao). Syntype (GMH no. 4554). Adapertural view, × 1. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 5. *Globularia? denselineata* (Nagao). Holotype (GMH no. 8323). Apertural view, × 1.5. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 6. *Pictavia toyorana* Hayami. Holotype (UMUT MM3672). Apertural view (rubber cast), × 2. Loc. Higashinagano, Yamaguchi Pref. (Lower Jurassic, Higashinagano Formation of the Toyora Group).

Fig. 7. *Tylostoma miyakoense* Nagao. Lectotype (IGPS no. 7129). Apertural view (7a) and adapertural view (7b), × 1. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 8. *Tylostoma? sanchuense* (Yabe and Nagao). Holotype (IGPS no. 22508). Apertural view, × 1.2. Loc. Hachimanzawa, Gumma Pref. (Lower Cretaceous, Sebayashi Formation).

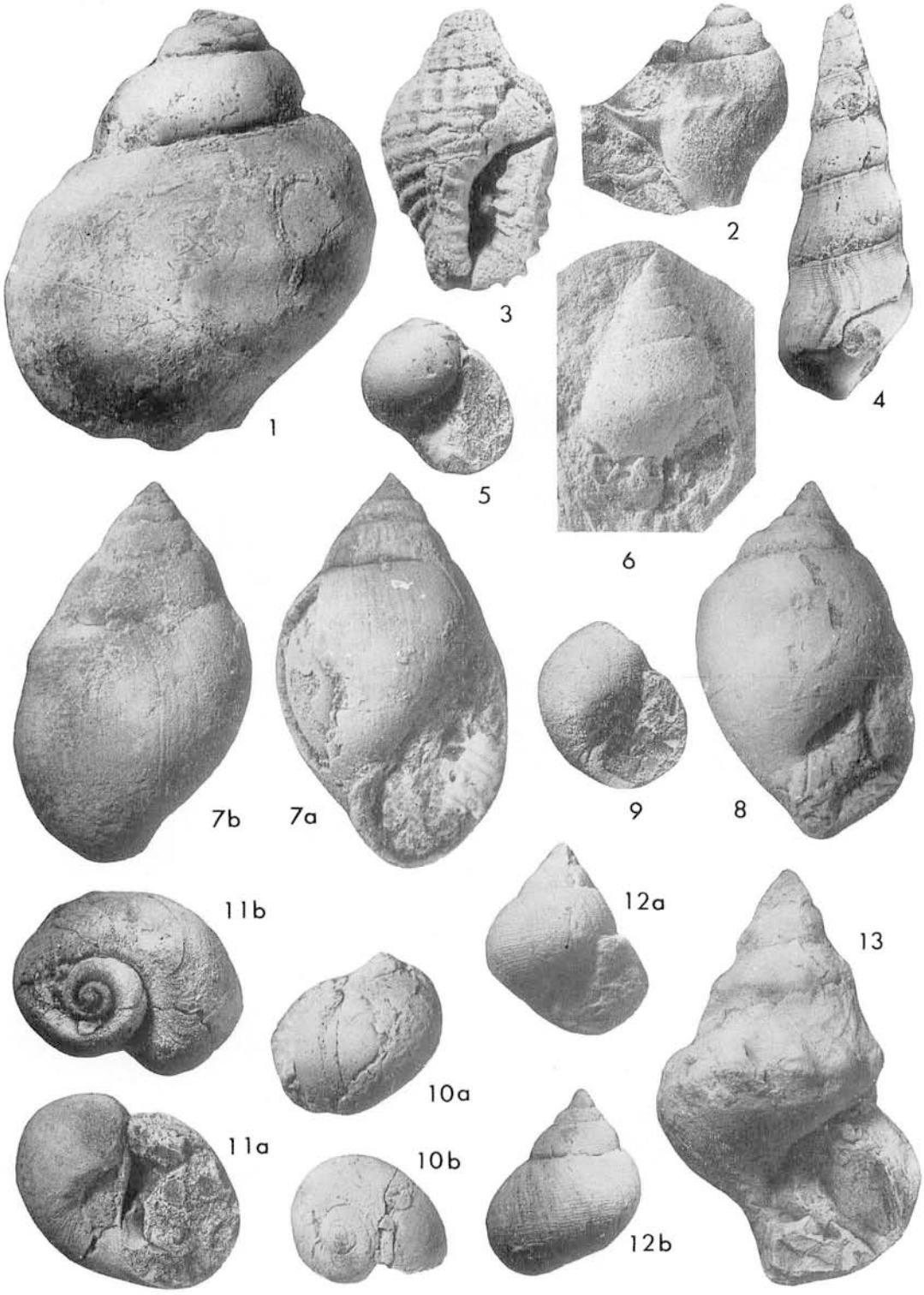
Fig. 9. *Lunatia importuna* (Nagao). Paratype (GMH no. 7070). Apertural view, × 2. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 10. *Lunatia? ezoana* (Yabe and Nagao). Syntype (IGPS no. 22621). Adapertural view (10a) and upper side view (10b), × 1.5. Loc. Futamatanosawa, Hokkaido (Upper Cretaceous, Mikasa Formation of the Middle Yezo Group).

Fig. 11. *Gyrodes japonicus* (Nagao). Holotype (GMH no. 7082). Apertural view (11a) and upper side view (11b), × 1.3. Loc. Haipe, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 12. *Vanikoropsis ainuana* (Nagao). Holotype (GMH no. 8324). Apertural view (12a) and adapertural view (12b), × 1.5. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 13. *Serrifusus tuberculatus* (Nagao). Syntype (GMH no. 8340). Apertural view, × 1. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).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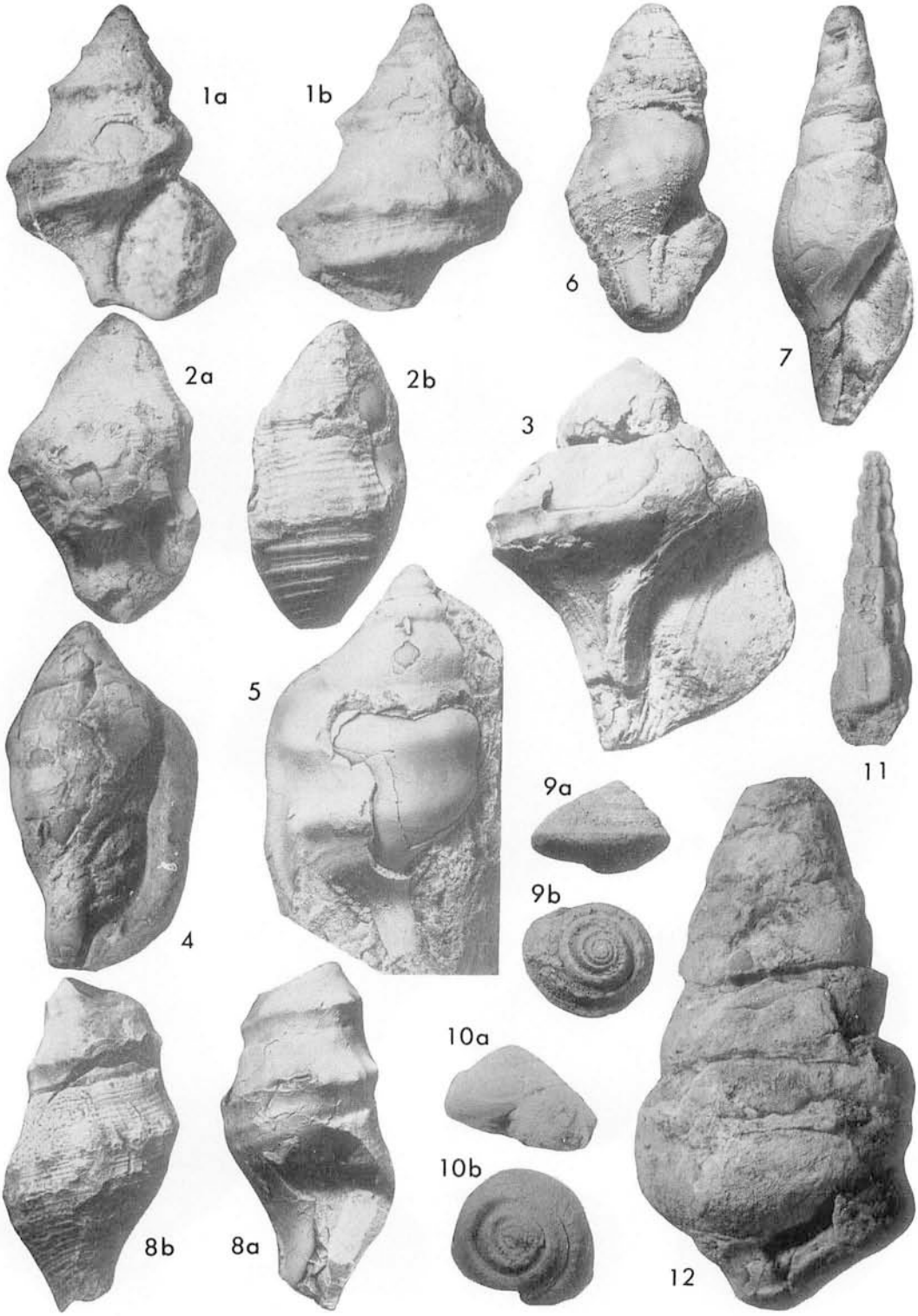
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Explanation of Plate 8

Fig. 1. *Serrifusus sachalinensis* (Nagao) [non Schmidt, 1873]. Syntype (IGPS no. 51248). Apertural view (1a) and adapertural view (1b), × 1. Loc. Oku-kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 2. *Rhombopsis? kawakamiensis* (Nagao). Holotype (GMH no. 8346). Apertural view (2a) and adapertural view (2b), × 1.2. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 3. *Pseudoperissitys bicarinata* Nagao and Otatume: type-species of genus *Pseudoperissitys*. Holotype (GMH no. 5981). Apertural view, × 1. Loc. Kiusu, Hokkaido (Upper Cretaceous, Fukaushi sandstone of the Hakobuchi Group).

Fig. 4. *Pseudogaleodea tricarianata* Nagao: type-species of genus *Pseudogaleodea*. Syntype (IGPS no. 51249). Apertural view, × 1. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 5. The same species. Syntype (GMH no. 4591). Adapertural view, × 1. Loc. ditto.

Fig. 6. "*Fusus*" *volutodermoides* Nagao. Holotype (GMH no. 8338). Apertural view, × 1.5. Loc. Ososhinai-zawa, Hokkaido (Upper Cretaceous, Upper Yezo Group).

Fig. 7. *Graphidula laevigata* (Nagao), Holotype (GMH no. 8345). Apertural view, × 1. Loc. Kawakami, south Saghalin (Upper Cretaceous, Upper Yezo Group).

Fig. 8. *Surculites? fusoides* Nagao. Holotype (GMH no. 8339). Apertural view (8a) and adapertural view (8b), × 1. Loc. Omoshirushibetsu, Hokkaido (Upper Cretaceous, Upper Yezo Group).

Fig. 9. *Semisolarium incrassatum* (Nagao). Holotype (IGPS no. 66600). Adapertural view, (9a) and upper side view (9b), × 2. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 10. *Semisolarium vistuloides* (Yabe and Nagao). Holotype (IGPS no. 22631). Apertural view (10a) and upper side view (10b), × 2. Loc. upper course of the Ikushumbetsu, Hokkaido (Upper Cretaceous, Upper Yezo Group).

Fig. 11. *Acirsa* (*Hemiacirsa*) *miyakoensis* (Nagao). Holotype (IGPS no. 66428). Apertural view, × 2. Loc. Hiraiga, Iwate Pref. (Lower Cretaceous, Hiraiga Formation of the Miyako Group).

Fig. 12. *Oligoptyxis pyramidaeformis* (Nagao). Syntype (IGPS no. 44305). Apertural view, × 1. Loc. Goshonoura island, Kumamoto Pref. (Lower or Upper Cretaceous, Goshonoura Group).

Explanation of Plate 9

Fig. 1. *Ctenodonta nipponica* Kobayashi. Holotype (UMUT PM0535). Left internal mould (1a) and upper side view of the same specimen (1b), × 1.5. Loc. Makkol. Kangwon-do (Middle Ordovician, Chikunsan beds of the Chosen Group).

Fig. 2. *Pseudoactinodontophora yabei* Murata: type-species of genus *Pseudoactinodontophora*. Holotype (IGPS no. 86885). Rubber cast of right internal mould (2a) and left internal mould of the same individual (2b), × 1. Reproduced from Murata, 1971, pl. 14, figs. 4, 1a. Loc. Motoiwazawa, Iwate Pref. (Lower Permian, Sakamotozawa Formation).

Fig. 3. *Cleionychia oviformis* Kobayashi. Holotype (UMUT PM0553). Left valve, × 3. Loc. Kochi-ri, Kangwon-do (Middle Ordovician, Tsuibon beds of the Chosen Group).

Fig. 4. *Modiolopsis kogenensis* Kobayashi. Paratype (UMUT PM0557). Left valve, × 3. Loc. Saisho-ri, Kangwon-do (Middle Ordovician, Chikunsan beds of the Chosen Group).

Fig. 5. The same species. Holotype (UMUT PM0556). Right valve, × 3. Loc. Makkol, Kangwon-do (Middle Ordovician, Chikunsan beds of the Chosen Group).

Fig. 6. *Palaeoconcha? samenoha* (Kobayashi). Syntype (UMUT PM0544). Right(?) internal mould, × 3. Loc. Makkol, Kangwon-do (Middle Ordovician, Chikunsan beds of the Chosen Group).

Fig. 7. *Aviculopecten? onukii* Murata. Holotype (IGPS no. 91380). Rubber cast of left external mould, × 1.2. Loc. Senmatsu, Iwate Pref. (Upper Permian, Toyoma Formation).

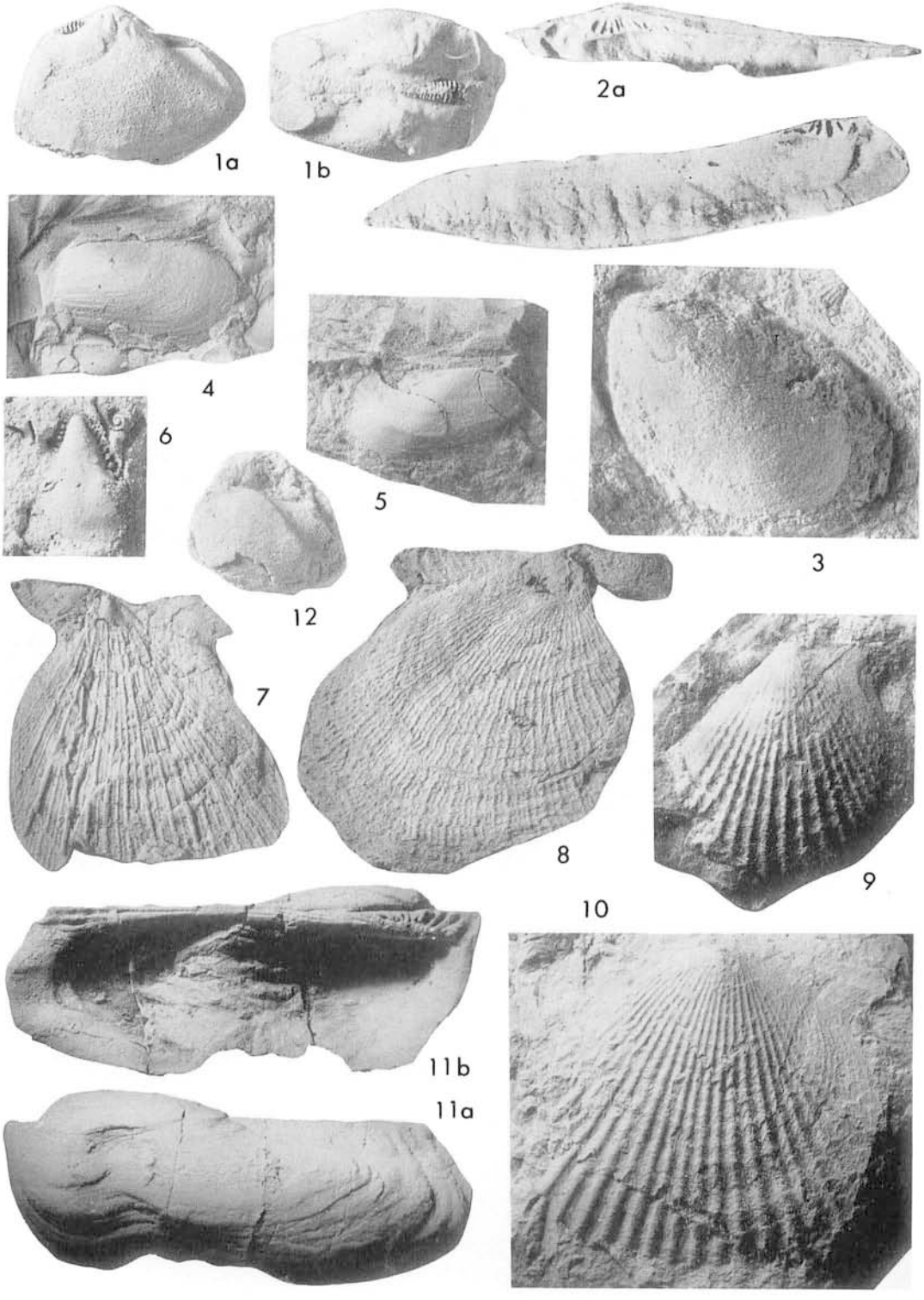
Fig. 8. *Limipecten bandoi* Murata. Holotype (IGPS no. 91384). Rubber cast of right external mould, × 1. Loc. Nagahata, Miyagi Pref. (Upper Permian, Toyoma Formation).

Fig. 9. *Hayasakapecten reticularis* (Hayasaka). Holotype (IGPS no. 22227). Left valve, × 1.5. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 10. *Hayasakapecten minoensis* (Hayasaka). Lectotype (IGPS no. 8204). Left valve, × 1.2. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 11. *Parallelodon* (*Parallelodon*) *obsoletiformis* Hayasaka. Lectotype (IGPS no. 22392). External view (11a) and internal view (11b) of left valve, × 1.5. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 12. *Goniophora* (*Cosmogoniophora*) *orientalis* Kobayashi. Holotype (UMUT PM0562). Left valve, × 3. Loc. Kochi-ri, Kangwon-do (Middle Ordovician, Tsuibon beds of the Chosen Group).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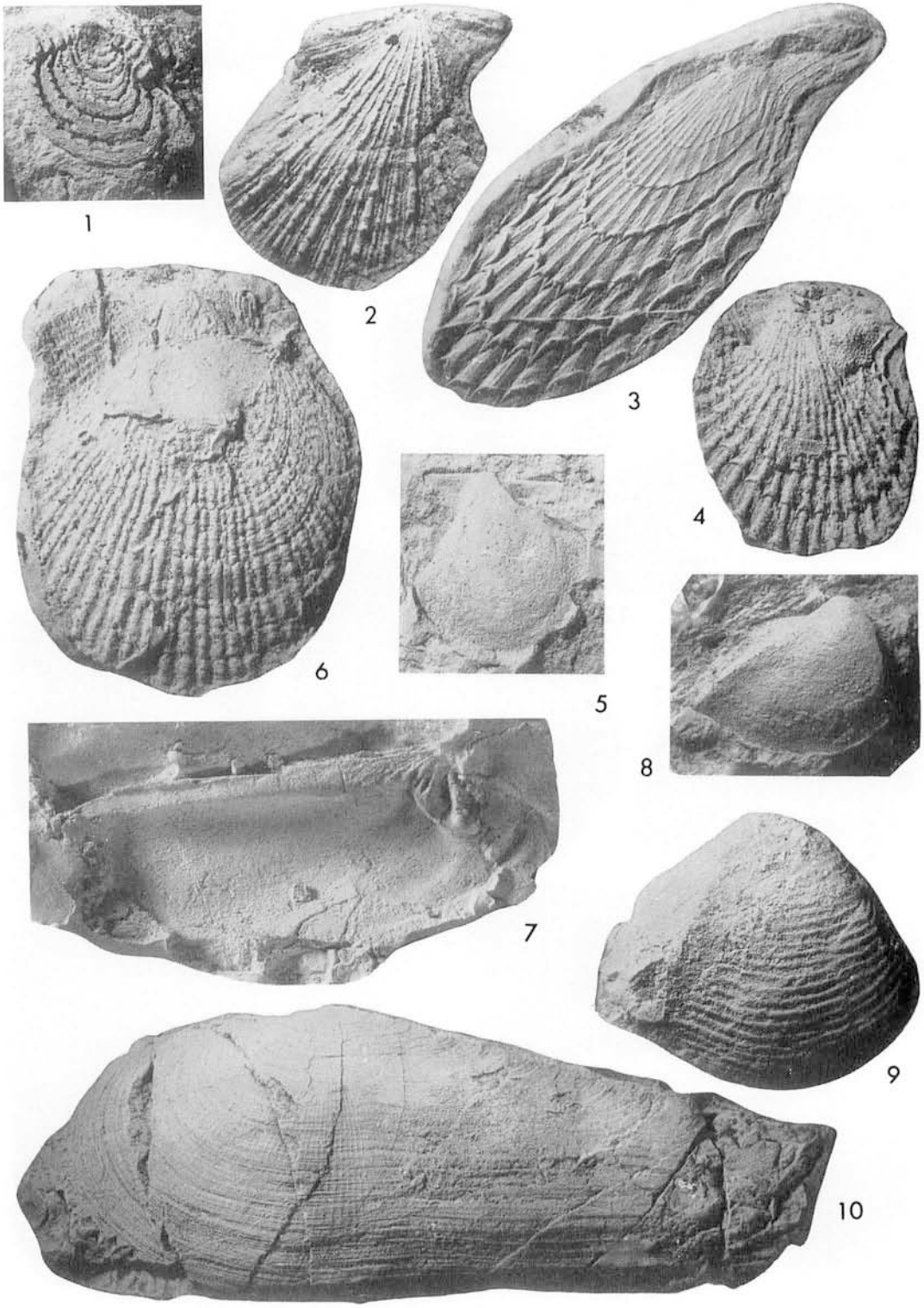
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Explanation of Plate 10

Fig. 1. *Annuliconcha kitakamiensis* Murata. Holotype (IGPS no. 22389). Left external mould, × 1.5. Loc. Imo, Iwate Pref. (Middle Permian, Kanokura Formation).

Fig. 2. *Aviculopecten hataii* Murata. Holotype (IGPS no. 85732). Rubber cast from left external mould, × 1.5. Loc. Toyazawa, Miyagi Pref. (Middle Permian, Kanokura Formation).

Fig. 3. *Acanthopecten spinosus* Hayasaka. Lectotype (IGPS no. 22378). Rubber cast from left external mould, × 1.5. Loc. Imo, Iwate Pref. (Middle Permian, Kanokura Formation).

Fig. 4. *Acanthopecten onukii* Murata. Holotype (IGPS no. 85745). Rubber cast from left external mould, × 1.5. Loc. Shigejizawa, Miyagi Pref. (Middle Permian, Kanokura Formation).

Fig. 5. *Euchondria? kesenensis* (Hayasaka). Holotype (IGPS no. 22383). Right internal mould, × 1.5. Loc. Imo, Iwate Pref. (Middle Permian, Kanokura Formation).

Fig. 6. *Guizhoupecten miyamoriensis* (Murata). Holotype (IGPS no. 85733). Rubber cast from left external mould, × 1.5. Loc. Mt. Hiryuyama, Iwate Pref. (Middle Permian, Hiryuyama Formation).

Fig. 7. *Actinodontophora katsurensis* Ichikawa: type-species of genus *Actinodontophora*. Holotype (UMUT PM5306). Rubber cast from left internal mould, × 1.5. Loc. Katsura, Kochi Pref. (Upper Permian, Katsura Formation).

Fig. 8. *Schizodus tobai* (Hayasaka). Syntype (IGPS no. 8406). Right internal mould, × 1.5. Loc. Imo, Iwate Pref. (Middle Permian, Kanokura Formation).

Fig. 9. *Schizodus japonicus* (Hayasaka). Lectotype (IGPS no. 22422). Right valve, × 1.2. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Fig. 10. *Alula elegantissima* (Hayasaka). Syntype (IGPS no. 8203). Left valve, × 0.55. Loc. Kinshozan, Gifu Pref. (Middle Permian, Akasaka Limestone).

Explanation of Plate 11

Fig. 1. *Ensipteria onukii* Nakazawa and Newell: type-species of genus *Ensipteria*. Holotype (UK). Latex cast from left internal mould, × 3. Reproduced from Nakazawa and Newell, 1968, pl. 3, fig. 12b. Loc. Tenjinnoki, Miyagi Pref. (Middle Permian, Tenjinnoki Formation).

Fig. 2. The same species. Paratype (UK). Latex cast from right external mould, × 2. Reproduced from Nakazawa and Newell, 1968, pl. 3, fig. 13. Loc. ditto.

Fig. 3. *Towapteria nipponica* Nakazawa and Newell: type-species of genus *Towapteria*. Paratype (UK). Left internal mould, × 4. Reproduced from Nakazawa and Newell, 1968, pl. 3, fig. 7. Loc. Tenjinnoki, Miyagi Pref. (Middle Permian, Tenjinnoki Formation).

Fig. 4. The same species. Holotype (UK). Latex cast of left external mould, × 3. Reproduced from Nakazawa and Newell, 1968, pl. 3, fig. 8. Loc. ditto.

Fig. 5. *Tambanella gujoensis* Nakazawa and Newell: type-species of genus *Tambanella*. Holotype (UK). Latex cast from right internal mould, × 2. Reproduced from Nakazawa and Newell, 1968, pl. 4, fig. 8. Loc. Gujo, Kyoto Pref. (Upper Permian, Gujo Formation).

Fig. 6. The same species. Paratype (UK). Left internal mould, × 4. Reproduced from Nakazawa and Newell, 1968, pl. 4, fig. 5. Loc. ditto.

Fig. 7. *Waagenoperna* (*Permoperna*) *hayamii* Nakazawa and Newell: type-species of subgenus *Permoperna*. Holotype (UK). Right internal mould, × 3. Reproduced from Nakazawa and Newell, 1968, pl. 3, fig. 11. Loc. Tenjinnoki, Miyagi Pref. (Middle Permian Tenjinnoki Formation).

Fig. 8. *Lopha*? *murakamii* Nakazawa and Newell. Holotype (UK). Latex cast from left (?) external mould, × 2. Reproduced from Nakazawa and Newell, 1968, pl. 7, fig. 8b. Loc. Gujo, Kyoto Pref. (Upper Permian, Gujo Formation).

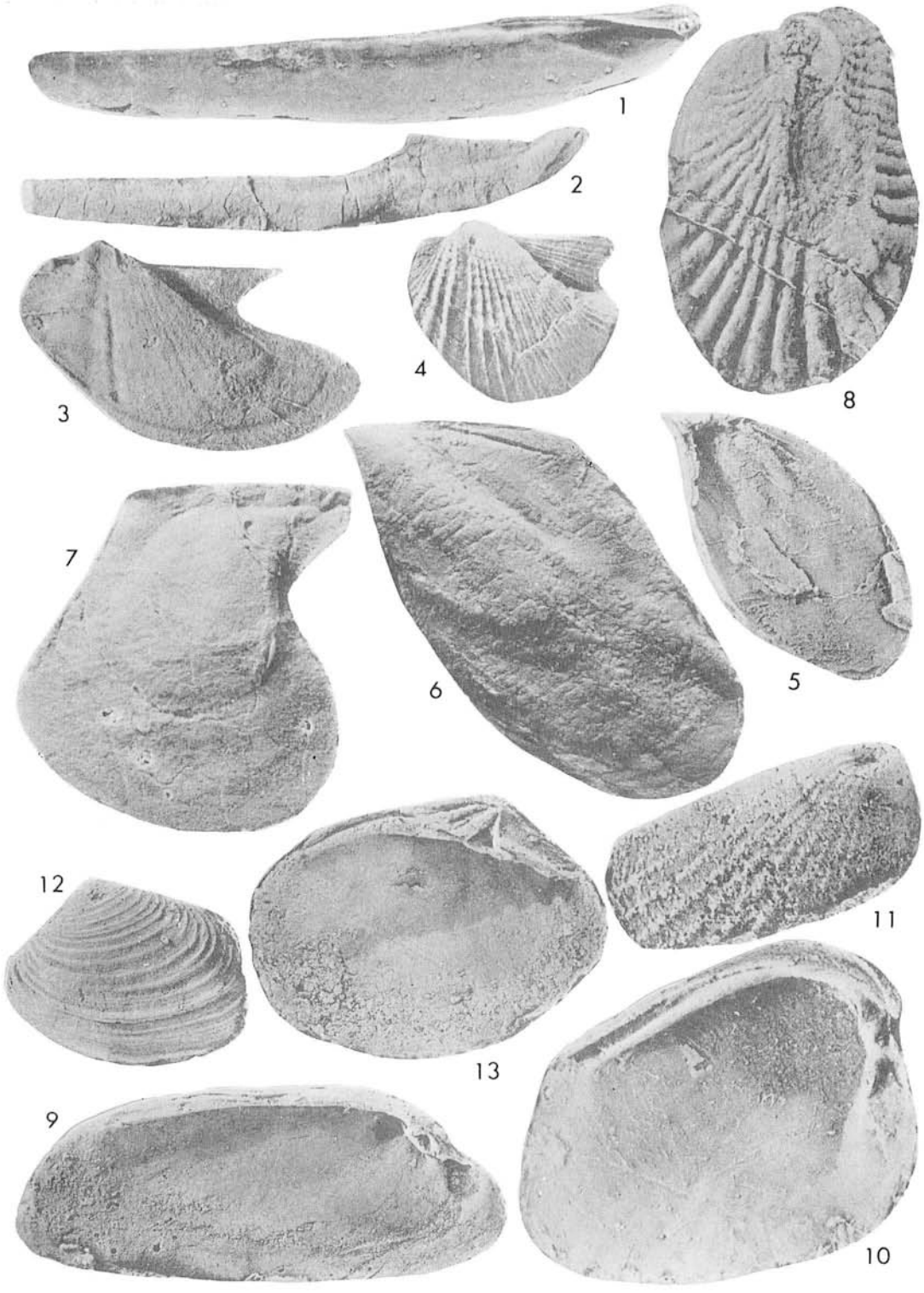
Fig. 9. *Permophorus tenuistriatus* Nakazawa and Newell. Syntype (UK). Latex cast from left internal mould, × 2. Reproduced from Nakazawa and Newell, 1968, pl. 9, fig. 8. Loc. Gujo, Kyoto Pref. (Upper Permian, Gujo Formation).

Fig. 10. *Gujocardia oviformis* Nakazawa and Newell: type-species of genus *Gujocardia*. Holotype (UK). Latex cast from left internal mould, × 5. Reproduced from Nakazawa and Newell, 1968, pl. 9, fig. 1. Loc. Gujo, Kyoto Pref. (Upper Permian, Gujo Formation).

Fig. 11. The same species. Paratype (UK). Latex cast from right external mould, × 4. Reproduced from Nakazawa and Newell, 1968, pl. 9, fig. 4a. Loc. ditto.

Fig. 12. *Astartella toyomensis* Nakazawa and Newell. Paratype (UK). Latex cast from left external mould, × 2. Reproduced from Nakazawa and Newell, 1968, pl. 10, fig. 5. Loc. Kitazawa, Miyagi Pref. (Upper Permian, Toyoma Formation).

Fig. 13. The same species. Holotype (UK). Latex cast from left internal mould, × 2. Reproduced from Nakazawa and Newell, 1968, pl. 10, fig. 3. Loc. ditto.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